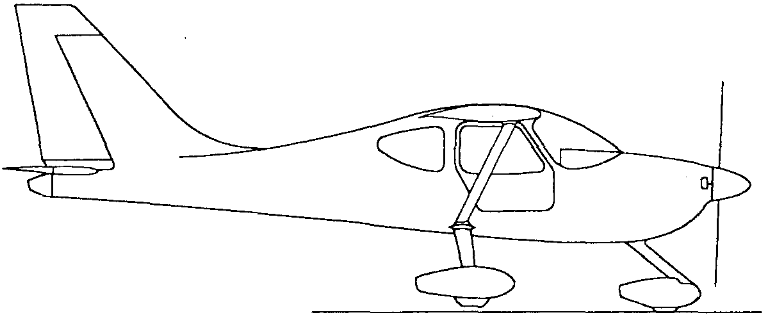
GlaStar

Model GS-1



TRICYCLE GEAR

OWNER'S MANUAL

Serial #__________

P/N 063-02001-01

Published by

STODDARD-HAMILTON AIRCRAFT, INC.
18701-58th Avenue NE
Arlington, WA 98223

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LIST OF REVISIONS

Revision	Date	Section	Page(s)
1	6/2006	W&B	22

~~NO REVISIONS TO DATE~~

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SECTION 1

GENERAL INFORMATION

Table of Contents

1-1 INTRODUCTION

The sole purpose of this manual is to explain the safe and efficient operation of your GlaStar aircraft. Section 1 provides basic aircraft specifications and performance data as well as general information on the use of the manual. It also contains definitions of symbols, abbreviations and terminology used throughout the manual.

1-2 APPLICABILITY AND PURPOSE

The information contained in this manual refers to the GlaStar aircraft (Model GS-1) built according to the *GlaStar Assembly Manual.* Any homebuilder modifications to the aircraft that deviate from the *Assembly Manual* may alter the applicability of this manual to your airplane.

This manual is not designed nor can it serve as a substitute for adequate and competent flight instruction. It is not intended to be a guide of basic flight instruction or a training manual.

This manual should be read thoroughly and carefully by the owner and/or operator in order to become familiar with the operation of the aircraft. It is intended to serve only as a guide under most circumstances, but cannot take the place of good, sound judgment during flight operations. Multiple emergencies, adverse weather, terrain, etc., may require deviation from the recommended procedures. Furthermore, this *Owner's Manual* does not provide a discussion of all possible dangerous situations an owner or operator may encounter.

Flying in itself is not inherently dangerous, but to an even greater extent than any other mode of travel, it is terribly unforgiving of any carelessness, incapacity or neglect. The builder/pilot is entirely responsible for the manufacture, inspection, maintenance, test flight and normal operation of the aircraft. Thorough, careful procedures, therefore, must be carried out in all these phases.

How well the plane is built, maintained and operated will determine how safely it performs. Maximum performance and safe operation can only be achieved by a skilled pilot and a good mechanic. Thorough, careful construction, continued maintenance and diligent practice during the early phases of flight familiarization are mandatory.

The performance data presented in this manual are estimates based on flight tests of Stoddard-Hamilton's own aircraft. Due to differences in the engine and propeller installed, quality of workmanship and many other variables, each airplane will vary somewhat in performance. Do not assume that your aircraft will have the same performance characteristics as presented in this manual.

1-3 FAA REGULATIONS

The owner and operator should be familiar with the Federal Aviation Regulations (FARs) applicable to the operation and maintenance of an airplane licensed in the experimental amateur-built category and with FAR Part 91, General Operating and Flight Rules. Further, the airplane must be operated and maintained in accordance with FAA Airworthiness Directives that may be issued against powerplants, propellers and any other parts of the aircraft not manufactured by Stoddard-Hamilton. Additionally, mandatory service bulletins issued by

Stoddard-Hamilton must be complied with.

The Federal Aviation Regulations place the responsibility for maintenance of this airplane on the owner and operator. All limits, procedures, safety practices, time limits, servicing and maintenance requirements contained in this manual are considered mandatory for continued safe airworthiness and to maintain the airplane in a condition equal to that of its original construction.

NOTE

References to the Federal Aviation Regulations throughout this manual refer, of course, to regulations issued by the Federal Aviation Administration (FAA) in the USA. Owners and operators of GlaStars in other countries must comply with the regulations issued by the controlling authorities in their own countries.

1-4 USE OF THE MANUAL

The *GlaStar Owner's Manual* is designed to maintain documents necessary for the safe and efficient operation of the aircraft. It is published in loose-leaf form for easy revision updates and in a convenient size for storage in the airplane. The manual is divided into nine major sections which are listed in the Table of Contents. Each section also has its own individual Table of Contents.

1-5 REVISIONS

Immediately following the Table of Contents page in the front of the manual is the "List of Revisions," which lists all revisions to the *Owner's Manual* by the revision letter, date issued, section and page number. When you receive a revision, remove and discard all the obsolete pages, and insert the revised pages.

1-6 WARNINGS, CAUTIONS AND NOTES

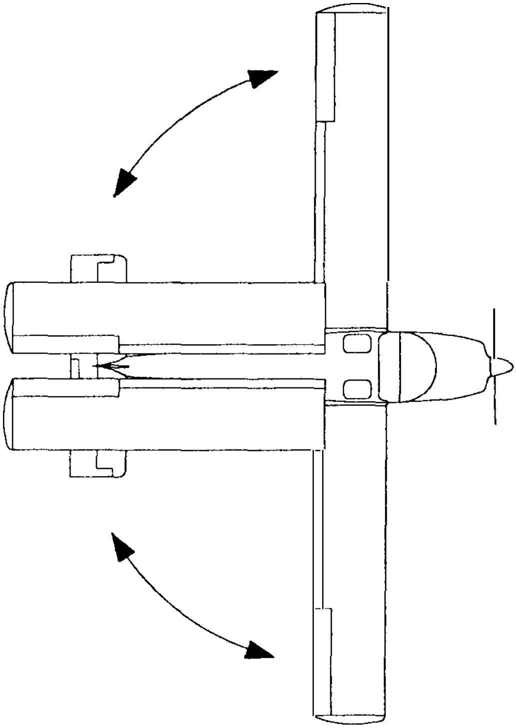
The following definitions apply to WARNINGS, CAUTIONS and NOTES used throughout this manual.

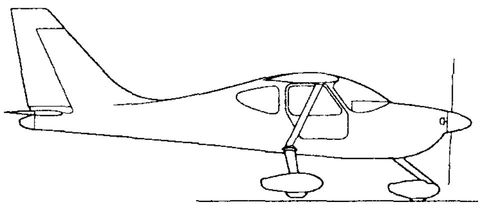
WARNING Procedures, practices, etc., which may result in personal injury or loss of life if not carefully followed.

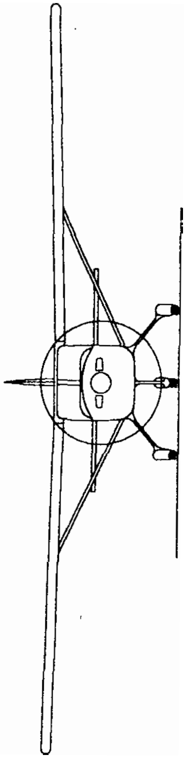
CAUTION Procedures, practices, etc., which if not strictly observed may result in damage to or destruction of equipment.

NOTE An operating procedure, condition, etc., which it is considered essential to emphasize.

1-7 AIRPLANE THREE-VIEW







1-8 SPECIFICATIONS

Wing Span	35.0 ft.
Wings Folded/Tail Removed	8.0 ft.
Wing Area	128.0 $ft.^2$
Wing Aspect Ratio	9.6
Fuselage Length:	
With Continental IO-240 Engine	22.3 ft.
Wings Folded (Continental engine)	24.5 ft.
With Lycoming Engine	22.8 ft.
Wings Folded (Lycoming engine)	25.0 ft.
Maximum Height	9.1 ft.
Wheel Base	5.7 ft.
Wheel Span (track)	7.2 ft.
Cabin Width at Hips	44.0 in.
At Shoulders	46.0 in.
Door Width	37.0 in.
Height	31.5 in.
Sill to Ground	33.0 in.
Baggage Space	32.0 $ft.^3$
Maximum Gross Weight:	1,960 lb.
Empty Weight (approx.)	1,200 lb.
Useful Load (approx.)	760 lb.

Baggage Capacity (max.) .... 250 lb.

Wing Loading, Gross .... 15.3 lb./ft.^{2}

Fuel Capacity (total):

Main Wing Tanks (standard) .... 30.6 gal.

Auxiliary Tanks (optional) .... 20 gal.

Fuel Capacity (usable):

Main Wing Tanks (standard) .... 27.6 gal.

Auxiliary Tanks (optional) .... 17.5 gal.

Seats 2

Tire Size:

Main Gear .... 5.00 × 5

Nose Gear .... 11 × 4.00-5

1-9 PERFORMANCE DATA

NOTE

Performance numbers are the actual data from Stoddard-Hamilton's prototype GlaStars. The 125 h.p. numbers are for an aircraft equipped with a Continental IO-240 engine with a Sensenich 72/57 fixed-pitch propeller. The 160 and 180 h.p. numbers are for aircraft equipped with Lycoming O-320 and O-360 engines, respectively, and Hartzell constant-speed propellers. The performance of a different airplane will vary depending on engine horsepower, propeller choice, aircraft weight, airframe construction and pilot ability.

Top Speed (sea level, TAS):

125 h.p. .... 136 kts./156 m.p.h.
160 h.p. .... 145 kts./167 m.p.h.
180 h.p. .... 149 kts./171 m.p.h.

Cruise Speed (75% power @ 8,000 ft., TAS):

125 h.p. .... 131 kts./151 m.p.h.
160 h.p. .... 140 kts./161 m.p.h.
180 h.p. .... 145 kts./167 m.p.h.

Cruise Speed (65% power @ 8,000 ft., TAS):

125 h.p. .... 122 kts./140 m.p.h.
160 h.p. .... 133 kts./153 m.p.h.
180 h.p. .... 138 kts./159 m.p.h.

Stall Speeds, Gross:
- No Flaps (Vs) .... 49 kts./56 m.p.h.
- Full Flaps (Vso) .... 43 kts./49 m.p.h.

Best Rate of Climb Speed (Vy) .... 78 kts./90 m.p.h.

Best Angle of Climb Speed (Vx) .... 65 kts./75 m.p.h.

Best Glide Speed .... 70 kts./81 m.p.h.

Maneuvering Speed (Va) .... 98 kts./113 m.p.h.

Maximum Structural Cruising Speed (Vno) .... 144 kts./166 m.p.h.

Rate of Climb, Solo:
- 125 h.p. .... 1,300 ft./min.
- 160 h.p. .... 2,075 ft./min.
- 180 h.p. .... 2,150 ft./min.

Rate of Climb, Gross:
- 125 h.p. .... 1,000 ft./min.
- 160 h.p. .... 1,390 ft./min.
- 180 h.p. .... 1,500 ft./min.

Structural Limit Loads, Gross
- Positive .... 3.8 Gs
- Negative .... 1.5 Gs

Fuel Consumption at 65% power:
- 125 h.p. .... 5.8 gal./hr.
- 160 h.p. .... 6.7 gal./hr.
- 180 h.p. .... 8.5 gal./hr.

Range at 65% power (no wind, VFR reserve):

125 h.p.	520 n.m./598 s.m.
125 h.p. with auxiliary tanks	888 n.m./1,021 s.m.
160 h.p.	481 n.m./553 s.m.
160 h.p. with auxiliary tanks	829 n.m./953 s.m.
180 h.p.	379 n.m./436 s.m.
180 h.p. with auxiliary tanks	663 n.m./762 s.m.

Service Ceiling (estimated):

125 h.p.	17,000 ft.
160 h.p.	20,000 ft.
180 h.p.	21,500 ft.

1-10 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

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

KCAS — Calibrated Airspeed expressed in knots.

GS — Ground Speed is the speed of an airplane relative to the ground.

IAS — Indicated Airspeed is the speed of an airplane as shown on the airspeed indicator when corrected for instrument error. IAS values published in this manual assume zero instrument error.

KIAS — Indicated Airspeed expressed in knots.

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

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

Vfe — Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

Vne — Never Exceed Speed is the speed limit that may not be exceeded at any time.

Vno — Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.

Vs — Stalling Speed or the minimum steady flight speed at which the airplane can maintain altitude.

Vso — Stalling Speed or the minimum steady flight speed in the landing configuration (i.e., full flaps).

Vx — Best Angle-of-Climb Speed is the airspeed that delivers the greatest gain of altitude in the shortest possible horizontal distance.

Vy — Best Rate-of-Climb Speed is the airspeed that delivers the greatest gain in altitude in the shortest possible time.

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SECTION 2

LIMITATIONS

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2-1 AIRSPEED LIMITATIONS

Vfe = 75 kts./86 m.p.h. (maximum flap extended speed)
Do not extend flaps or operate with flaps extended above this speed. If Vfe is inadvertently exceeded with the flaps extended, slow the aircraft to an airspeed below Vfe before retracting the flaps.

Va = 98 kts./113 m.p.h. (maneuvering speed)
Do not make full or abrupt control movements above this speed.

Vno = 144 kts./166 m.p.h. (maximum structural cruising speed)
Do not exceed this speed except in smooth air and then only with caution.

Vne = 162 kts./186 m.p.h. (never exceed speed)
Do not exceed this speed in any operation

NOTE

Definitions of these airspeeds are given in FAR Part 1, Paragraph 1.2. All airspeeds are calibrated airspeeds (CAS). During flight test, the airspeed indicator should be calibrated so as to distinguish indicated airspeeds (IAS) from CAS.

NOTE

Airspeed limitations for GlaStars operated on floats are different. These are published in GlaStar Service Letter 4.

2-2 AIRSPEED INDICATOR MARKINGS

*WHITE ARC .... 43–75 kts./49–86 m.p.h.
(full flap operating range)

*GREEN ARC .... 49–144 kts./56–166 m.p.h.
(normal operating range)

YELLOW ARC .... 144–162 kts./166–186 m.p.h.
(operate with caution; only in smooth air)

RED LINE .... 162 kts./186 m.p.h.
(maximum speed for all operations)

* Indicated gross weight stall speed with flaps for the white arc and indicated clean stall speed for the green arc are derived from tests of the Stoddard-Hamilton GlaStar prototype, N824G. Slight variations may be experienced in customer-built aircraft. Actual stall speeds should be determined from flight test of each individual aircraft, and the airspeed indicator markings should be adjusted appropriately.

2-3 CONTROL SURFACE TRAVEL LIMITS

Elevator Travel... 23° up and 20° down (±1°)

Rudder Travel... 25° left and right (±1°)

Aileron Travel ....22.5° up and 17.5° down (±1°)

2-4 POWERPLANT LIMITATIONS

2-4.1 SUPPORTED ENGINES

Engines supported by Stoddard-Hamilton for the GlaStar are:

1. Continental IO-240-B6B engine.
2. Lycoming O-320 A, B or C series engines with conical (flat) engine mounts.
3. Lycoming O-320 D or E series engines with 30° Type I Dynafocal engine mounts.
4. Lycoming O-360-A1A, -A1F6 or -A4M engines.

Other engines may be installed on the GlaStar, but the above listed engines are the only ones that have been tested by Stoddard-Hamilton and the only ones for which Stoddard-Hamilton supplies propellers, engine mounts, cowlings and other firewall-forward accessories and installations.

NOTE

For new engines and engines returned to service following cylinder replacement or top overhaul of one or more cylinders, cruising should be done at not less than 65% to 75% power until a total of 50 hours has accumulated or oil consumption has stabilized. This is to insure proper seating of the piston rings. Use straight mineral oil for the 50 hour break-in period. See Section 8-2 in "SECTION 8: FLIGHT TEST" for a further discussion of this subject.

NOTE

In the event of any discrepancy between the limitations given in this manual and those given in the engine manufacturer's operating manual, the latter shall be observed. The pilot should be thoroughly familiar with the engine operating manual, which may contain additional limitations not discussed below.

2-4.2 Oil Pressure

Continental IO-240:

Normal Operating .... 30–60 p.s.i.
Idling .... 10 p.s.i.
Start and Warm-up Maximum (red line) .... 100 p.s.i.
Green Arc .... 30–60 p.s.i.

Lycoming O-320 and O-360:

Normal Operating .... 60–90 p.s.i.
Idling .... 25 p.s.i
Start and Warm-up Maximum (red line) .... 100 p.s.i.
Green Arc .... 60–90 p.s.i.

2-4.3 Oil Temperature

Continental IO-240:

Cruise .... 77°–88°C/170°–190°F
Minimum for Takeoff .... 24°C/75°F
Maximum (red line) .... 110°C/240°F
Green Arc .... 71°–99°C/160°–210°F

Lycoming O-320 and O-360:

Recommended .... 82°C/180°F
Maximum (red line) .... 118°C/245°F
Green Arc .... 60°–104°C/140°–220°F
Yellow Arc .... 38°–60°C/100°–140°F

2-4.4 FUEL PRESSURE

Continental IO-240:

Idle (675 r.p.m.) .... 5.5–7.5 p.s.i.g
Takeoff (2,800 r.p.m.) .... 27.5–30.5 p.s.i.g

Lycoming O-320 and O-360 (at inlet to carburetor):

Maximum .... 8.0 p.s.i.
Recommended .... 3.0 p.s.i.
Minimum .... 0.5 p.s.i.

2-4.5 CYLINDER HEAD TEMPERATURE

Continental IO-240 (using bayonet-type probe):

Maximum (red line) .... 238°C/460°F
Normal Operating (green arc) .... 182°–210°C/360°–410°F

Lycoming O-320:

Maximum (red line) .... 260°C/500°F
Normal Operating (green arc) .... 66°–224°C/150°–435°F

Lycoming O-360:

Maximum (red line) .... 260°C/500°F
Normal Operating (green arc) .... 66°–204°C/150°–400°F

2-4.6 Engine Crankshaft Speed

Continental IO-240:

Maximum Continuous and Takeoff (red line)........................ 2,800 r.p.m.
Recommended Maximum Cruise.. 2,550 r.p.m.
Idle..675 ± 25 r.p.m.
Normal Operating (green arc).....................................675–2,800 r.p.m.

Lycoming O-320 and O-360:

Maximum (red line).. 2,700 r.p.m.
Normal Operating (green arc).....................................600–2,700 r.p.m.

NOTE

The **Lycoming O-360-A1A** has a restriction against continuous operation between **1,900 and 2,200 (± 50) r.p.m.** when fitted with a Hartzell constant-speed propeller. This restricted range is inferred from similar engine/propeller combinations but can only be established definitively by a vibrational survey, which has not yet been conducted at this writing. The **O-360-A1F6**, on the other hand, has crankshaft counterweights that permit use of the Hartzell prop throughout the engine's operating range without restriction. Both the **-A1A** and the **-A1F6** can also be used with a Sensenich fixed-pitch propeller, but both engines have a restriction against continuous operation between **2,150 and 2,350 r.p.m.** using the Sensenich prop. The **O-360-A4M** is a solid-crank engine that cannot be used with a constant-speed propeller, but has no r.p.m. restrictions for the Sensenich fixed-pitch propeller.

2-5 VACUUM PRESSURE

Operating Range .... 4.3–5.9 in. Hg

2-6 WEIGHT LIMITS

Maximum Gross Weight .... 1,960 lb.
Maximum Baggage Weight .... 250 lb.

WARNING

The weight limit figures depend on the airplane being within safe center of gravity limits. Do not fly the airplane if its flight CG falls outside of the published limits. Variables such as fuel, passenger and baggage weights will affect the CG location. Before each flight, calculate the CG to determine whether the aircraft is within safe CG limits.

NOTE

GlaStars operated on floats are subject to a higher allowable gross weight. See GlaStar Service Letter 4.

2-7 CENTER OF GRAVITY LIMITS

Forward Limit .... Station 95.6
Aft Limit .... Station 103.5

The reference datum is 58.0 in. forward of the cowling attach flange joggle. Stations are measured in inches from the datum. See "SECTION 5: WEIGHT AND BALANCE" for further information.

2-8 FLIGHT LOAD FACTORS

At the 1,960 lb. gross weight, the G limits are:

Positive .... 3.8 Gs
Negative .... 1.5 Gs

2-9 AEROBATIC MANEUVER LIMITATIONS

The GlaStar is a standard-category aircraft. **Aerobatic maneuvers are prohibited in the GlaStar.** Maneuvers required for pilot certification, such as stalls, steep turns, lazy eights and chandelles, can be performed in the GlaStar, however. Do not attempt any maneuver that could impose high loads on the airframe. In performing any maneuver, avoid excessive airspeed or abrupt control movements that could result in excessive loads.

2-10 INTENTIONAL SPINS

Due to many variables that affect spin recovery and our lack of control over these variables, Stoddard-Hamilton prohibits intentional spins in the GlaStar. Some of the variables are: pilot technique, the manner in which the spin is entered, slight differences in wing and horizontal stabilizer incidence angles, center of gravity location, number of turns into the spin, spin direction, aileron position, power carried and control rigging and adjustment.

2-11 FLIGHT IN ICING CONDITIONS

Flight in icing conditions is prohibited in the GlaStar. The GlaStar must not be exposed to icing encounters of any intensity. If the airplane is inadvertently flown into icing conditions, the pilot must make an immediate diversion by flying out of the area of visible moisture or going to an altitude where icing is not encountered. These precautions apply to any aircraft without operational anti-ice and/or deice equipment.

2-12 FLIGHT IN THE VICINITY OF THUNDERSTORMS

The FAR Part 23 airworthiness standards for normal, utility and acrobatic category airplanes require that the airplane's structure be protected from the catastrophic effects of lightning, and that the airplane's fuel system be designed to prevent the ignition of fuel vapor by lightning.

WARNING

The GlaStar, because of its composite fuselage, which is transparent to an electrical charge, does not comply with FAR Part 23 standards for lightning protection. For this reason, the GlaStar is prohibited from flight in conditions that would expose the airplane to the possibility of a lightning strike.

2-13 REQUIRED EQUIPMENT

Builders of experimental category aircraft must comply with Part 91.33 of the Federal Aviation Regulations, which specifies the minimum equipment and instrumentation that must be installed and operational for various flight conditions. Equipment is specified for both VFR and IFR flight and for both day and night conditions.

2-14 PLACARDS

Various placards are required or recommended for the GlaStar. All placards should be highly visible and easy to read. Passengers should be made aware of pertinent placards.

2-14.1 PLACARDS AND MARKINGS REQUIRED BY FAR

Placards and markings required for certification of an experimental amateur-built aircraft are:

1. The word "EXPERIMENTAL," in 2 in. high block letters, displayed near each entrance to the cabin. (On our factory GlaStars, this is located on the baggage compartment bulkhead.)
2. A permanently installed, fireproof identification plate that is permanently stamped or engraved with the information required by FAR 45.13. This information includes the name of the manufacturer (your name, **not** Stoddard-Hamilton), the aircraft type (GlaStar GS-1), and the serial number (your kit number). The data plate must be located on the exterior of the aircraft, either just aft of the entry door or on the fuselage near the tail surfaces and must be legible to a person standing on the ground.

3. A Passenger Warning Placard, permanently installed in the cockpit in full view of all the occupants with the words: "PASSENGER WARNING—THIS AIRCRAFT IS AMATEUR BUILT AND DOES NOT COMPLY WITH FEDERAL SAFETY REGULATIONS FOR STANDARD AIRCRAFT."

2-14.2 FUEL FILLER CAP PLACARDS

In addition to the required identification placard mentioned in Section 2-14.1, placards specifying the fuel type and quantity near each fuel filler cap are recommended. (A permanent engraving of these markings on the fuel caps is a good idea.)

2-14.3 BAGGAGE COMPARTMENT PLACARDS

The following placards are recommended for the baggage compartment:

1. A placard specifying the maximum allowable baggage capacity (250 lb.) as well as the maximum capacities for the forward and aft baggage zones as determined in Section 5-3.2 in "SECTION 5: WEIGHT AND BALANCE."
2. A placard such as, "Keep all articles securely stowed to avoid the possibility of interference with the control system."

2-14.4 FUEL VALVE MARKINGS

Clearly mark the ON (pointing forward) and OFF (pointing to the right) positions of the fuel valve.

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SECTION 3

EMERGENCY PROCEDURES

Table of Contents

Subject: Page:

3-1 INTRODUCTION

The emergency procedures described in this section are applicable to most aircraft including the GlaStar. Each procedure is suggested as the best course of action for coping with the particular situation described, but none are substitutes for sound judgment and common sense. Since emergencies happen rarely, they are usually unexpected, and the best corrective action may not always be obvious. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

The procedures recommended here for coping with emergency situations are the best techniques presently available, based on flight test results and operational experience. Multiple emergencies, weather, unusual conditions, etc., may require deviation from these procedures. Each pilot must make the final decision as to the correct procedure under the circumstances and is responsible for the consequences of that decision.

NOTE

In any emergency, maintaining control of the aircraft is **always** the highest priority.

3-2 AIRSPEEDS FOR EMERGENCY OPERATIONS

Maneuvering Speed .... 98 kts./113 m.p.h.
Maximum Glide Speed .... 70 kts./81 m.p.h.
Precautionary Landing Approach Speed:
With Engine Power, Full Flaps .... 65 kts./75 m.p.h.
Engine-Out Landing Approach Speed:
Full Flaps .... 65 kts./75 m.p.h.

3-3 EMERGENCY CHECK LISTS

3-3.1 ENGINE FAILURE

3-3.1.1 Engine Failure During the Takeoff Run

1. Throttle closed.
2. Apply brakes.
3. Retract wing flaps.
4. Mixture full lean.
5. Ignition switch OFF.
6. Master switch OFF.

3-3.1.2 Engine Failure Immediately After Takeoff

1. Airspeed: 65 kts./75 m.p.h. If flaps are on, do **not** retract them.
2. Mixture full lean.
3. Fuel valve OFF.
4. Ignition switch OFF.
5. Master switch OFF.
6. Wing flaps as required.

3-3.1.3 Engine Failure During Flight

1. Prop control full aft—coarse pitch (if applicable).
2. Establish best glide airspeed: 70 kts./81m.p.h.
3. Carburetor heat ON (if applicable).
4. Mixture RICH.
5. Fuel valve ON.
6. Ignition switch BOTH (or START if propeller has stopped).
7. If engine fails to restart, execute a forced landing.

3-3.2 FORCED LANDING WITHOUT ENGINE POWER

1. Establish final approach speed of 65 kts./75 m.p.h.
2. Extend flaps as appropriate to maintain desired glide path.
3. Transmit mayday on 121.5 MHz and/or other appropriate frequency.
4. Mixture full lean.
5. Fuel valve OFF.
6. Ignition switch OFF.
7. All electrical accessories OFF.
8. Alternator switch OFF.
9. Master switch OFF.
10. Seat belts and shoulder harnesses tight.
11. Extend full flaps on short final and bleed airspeed to touch down as slowly as possible.
12. Unlatch doors before touchdown.
13. Touch down slightly tail low.
14. Apply brakes heavily while holding full aft stick.

3-3.3 FIRE

3-3.3.1 Engine Fire During Start

1. Continue cranking engine.

If engine starts:

2. Run engine at 1,700 r.p.m. for a few minutes.
3. Shut down engine and inspect for damage.

If engine fails to start:

4. While still cranking engine:
   a) Mixture full lean.
   b) Throttle wide open.
   c) Fuel valve OFF.
5. Ignition switch OFF.
6. Master switch OFF.
7. Extinguish fire and inspect for damage.

3-3.3.2 In-Flight Engine Fire

1. Fuel valve OFF.
2. Mixture full lean.
3. Ignition switch OFF.
4. All electrical accessories OFF.
5. Alternator and master switches OFF.
6. Cabin heat OFF.
7. Open or close cabin air vents and/or crack open the doors, as necessary, to minimize smoke and fumes in the cockpit.
8. Execute a forced landing as soon as possible.

3-3.3.3 Electrical Fire on the Ground

1. All electrical accessories OFF.
2. Alternator switch OFF.
3. Master switch OFF.
3. Shut down the engine.
4. Evacuate the aircraft.
5. Extinguish the fire.

3-3.3.4 In-Flight Electrical Fire

1. All electrical accessories OFF.
2. Alternator switch OFF.
3. Master switch OFF.
4. Reduce speed.
5. Open air vents and/or cabin doors to provide fresh air.
6. Extinguish fire, if possible.
7. Land as soon as possible.

3-3.4 Spins and Spiral Dives

3-3.4.1 Spin Recovery

1. Power off.
2. Immediately apply full rudder opposite to the direction of rotation, while neutralizing the stick.

—as rotation stops—

3. Neutralize the rudder.
4. Pull out of the dive.

3-3.4.2 Spiral Dive Recovery

1. Reduce power and simultaneously...
2. Level the wings.
3. Pull out of the dive.

3-4 EXPLANATIONS OF EMERGENCY PROCEDURES

3-4.1 ENGINE FAILURE

The certified aircraft engines supported for the GlaStar are very reliable, and the probability of a catastrophic failure without some type of advance warning is quite low. Early indications of an engine failure are lowering oil pressure, increasing oil temperature, high cylinder head temperatures, excessive mechanical noise and so on. Pilot-induced failures, on the other hand, are far more common: carburetor ice, mixture set too lean, fuel starvation, etc. Keep these in mind if an engine problem or failure should arise.

3-4.1.1 Engine Failure During the Takeoff Run

If the engine fails before the aircraft has left the ground during takeoff, close the throttle and apply brakes to stop on the remaining runway. Retracting the wing flaps increases braking effectiveness. Secure the engine as you stop or after stopping: mixture to the idle cut-off position, ignition switch off, alternator and master switches off, fuel valve off. Determine the cause of the problem and remedy it before attempting another takeoff.

3-4.1.2 Engine Failure Immediately After Takeoff

If the engine fails shortly after the aircraft has left the ground on takeoff, lower the nose to maintain flying speed. Use the recommended airspeed for an engine-out landing: 65 kts./75 m.p.h. We recommend using full flaps, if you have time to extend them. If the flaps are extended when the engine fails, do **not** retract them.

Land on the remaining runway, if possible; otherwise, prepare to land straight ahead, making small turns to avoid obstacles. Only if enough altitude and airspeed are available can a 180° turn be made to return to the airfield. You are much more likely to survive an emergency straight-ahead forced landing of the plane than a stall and spin resulting from a steep, slow turn back to the field.

Only if there is time and you have maintained control of the aircraft should you attempt to restart the engine. Pull the carburetor heat on (if applicable) and make sure that the mixture control is in the full rich position, the fuel valve is on and the magneto switch is in the "BOTH" position.

3-4.1.3 Engine Failure During Flight

If loss of power occurs at altitude and if your GlaStar is equipped with a constant-speed propeller, immediately (while there is still enough oil pressure to operate the prop) pull the propeller control to the full aft (coarse pitch) position to reduce drag. Trim the aircraft for best gliding speed (70 kts./81 m.p.h.), and attempt to restart the engine by applying carburetor heat (if applicable), moving the mixture control to the full rich position and checking that the fuel valve is on and the magneto switch is in the "BOTH" position. If the engine fails to restart, prepare to execute a forced landing.

More common than a complete engine failure is engine roughness, which may be caused by a bad magneto, induction problems, improper leaning, plug fouling, fuel starvation, carburetor icing, water in the fuel, etc. If you encounter engine roughness or power loss in flight, check all engine gauges to verify that the pressures and temperatures fall within normal ranges. Also, check the mixture setting, carb heat, magnetos, etc. If none of these items alleviates the problem, make a precautionary landing at the nearest airport and troubleshoot the problem.

3-4.2 FORCED LANDING WITHOUT ENGINE POWER

As soon as you have determined that the engine will not restart after an engine failure, begin to look for a suitable landing field. If time permits, check your charts for airports in the immediate vicinity; it may be possible to land at one if you have sufficient altitude. If possible, notify air traffic control of your location, difficulty and intentions, or transmit a distress call on 121.5 MHz.

When you have located a suitable field, establish a spiral pattern around the field. Try to be at 1,000 feet above the field at the downwind position to make a normal approach. Even if you are forced to land away from an airport, it is best to fly a standard pattern with downwind, base and final legs. This will help you make correct altitude and approach-speed judgments for an unknown landing site.

Remember that the engine-out glide will be somewhat steeper than the engine-idle glide that you are used to. Always leave yourself enough altitude and airspeed to clear obstacles. We recommend leaving the flaps retracted until you are assured of making your intended landing spot. If you are too high on approach, however, extend flaps or slip the airplane. We recommend always using flaps for the final approach, if possible, to minimize the touchdown airspeed.

Throughout the approach, maintain the recommended airspeed for an engine-out landing: 65 kts./75 m.p.h. Bleed off the airspeed in the flare, however, so that the actual touchdown is made at the lowest possible airspeed.

CAUTION

> Keep the airspeed above 60 kts./69 m.p.h. until you are within a few feet of the ground during the approach. Slower airspeeds will result in an excessive descent rate that may be impossible to arrest without engine power.

Before landing, close the throttle completely, move the mixture control to the full lean position, turn the fuel valve off and switch off the ignition, alternator and master switches. Make sure that lap belts and shoulder harnesses are tight.

Touch down at the minimum controllable airspeed, being careful not to stall and drop the airplane in. Especially if forced to land in trees, allow the airplane to fly into the tree tops rather than stalling it and dropping to the ground through the trees.

In very rough terrain, try to fly the airplane so that the fuselage (passenger compartment) misses the larger objects, such as the biggest tree trunks and rocks. Sacrifice other parts of the airframe (wings, landing gear) to absorb the impact energy. As soon as the airplane comes to rest, evacuate it as quickly as possible to escape a possible post-crash fire.

3-4.3 FIRE

NOTE

We strongly recommend that all GlaStars be equipped with at least a 2 lb. Halon (or equivalent) fire extinguisher. The extinguisher should be located within easy reach of both pilot and passenger.

3-4.3.1 Engine Fire During Start

Engine fires during start-up are usually the result of over-priming or a stuck or contaminated carburetor float valve—excess fuel accumulates in the induction system and ignites. If such a fire occurs when on the ground, continue cranking the engine with the starter in an attempt to pull the fire back into the engine. If the engine starts, let it run at a moderate speed (1,700 r.p.m.) for a minute or so, and then shut the engine down and inspect for damage.

If the engine fails to start in a reasonable period of time, continue cranking the engine while pulling the mixture to the full lean, idle-cutoff position and opening the throttle fully, again in an attempt to pull the burning fuel back into the engine. Turn the fuel valve to the OFF position to stop the flow of fuel to the engine compartment, then shut off the ignition, alternator and master switches. Evacuate the airplane, extinguish the fire and inspect for damage.

3-4.3.2 In-Flight Engine Fire

Immediately shut off the fuel supply to the engine. Turn off all electrical accessories. Close the cabin heat valve to prevent smoke from entering the cabin. Execute an emergency landing as soon as possible.

Experiment with opening or closing the cabin vents and/or cracking open the doors to find a combination that minimizes smoke and fumes in the cockpit. Slipping the airplane may help keep smoke and flames away from the cabin and provide fresh air to the cabin vent inlet on one side. Another possible strategy is to dive to an airspeed at which the air flow through the cowling will extinguish the flames; if you try this, remember that Vne is 162 kts./186 m.p.h. Remember also that executing a safe forced landing is your highest priority.

3-4.3.3 Electrical Fire on the Ground

In the event of an electrical fire on the ground, turn all electrical systems off, including the master switch. Shut down the engine. Clear the aircraft and extinguish the fire. Resolve the problem and repair any damage before further flight.

3-4.3.4 In-Flight Electrical Fire

If an electrical fire occurs in the air, turn the alternator switch, master switch and all electrical equipment off. Reduce speed, open the air vents and/or crack open the doors to provide fresh air for breathing. Extinguish the fire, if possible. Land as soon as possible and remedy the problem before further flight.

3-4.4 SPINS AND SPIRAL DIVES

3-4.4.1 Spins

WARNING

Intentional spins in the GlaStar are prohibited.

Since the wing must be stalled for a spin to occur, inadvertent spins can be prevented by avoiding inadvertent stalls. The GlaStar's stall characteristics are so benign, however, that it would be very difficult to enter an inadvertent spin. Positive control can be maintained throughout the stall without departure—at low power settings the airplane is easily controlled with the stick held fully aft for any length of time.

To recover from a spin, first pull the throttle to the idle position. Simultaneously apply full rudder opposite to the direction of rotation, while neutralizing the stick. As the rotation stops, neutralize the rudder and pull out of the resulting dive.

3-4.4.2 Spiral Dives

A spiral dive is a situation that develops when the nose of the aircraft begins dropping out of a turn. (A spin, on the other hand, develops from excessive yaw during a stall.) In a spiral dive, speed builds rapidly as the nose drops and, if the pilot attempts to raise the nose by applying back pressure, the turn will tighten and G forces will begin to build. If allowed to continue, the aircraft will either strike the ground at high speed or will suffer in-flight structural failure from excessive G loads.

The proper recovery from a spiral dive is to first reduce power to prevent exceeding Vne. Simultaneously with the power reduction, level the wings and then apply gentle back-pressure to stop the dive. The wings must be leveled before pulling out of the dive to minimize G loads on the airframe.

A spiral dive is a common result (usually fatal) of flying into instrument conditions without proper training or proper instrumentation. For this reason, pilots who are not rated and current in IFR flight must avoid flight in conditions of reduced visibility.

Section 4

Normal Operating Procedures

Table of Contents

4-1 INTRODUCTION

This section describes the normal operating procedures for both ground and flight operations. All pilots should be thoroughly familiar with this section along with the Emergency Procedures, Operating Limitations and Flight Test sections before attempting any ground or flight operations. Pilots must also be familiar with the performance data in "SECTION 1: GENERAL INFORMATION."

4-2 PREFLIGHT CHECKLIST

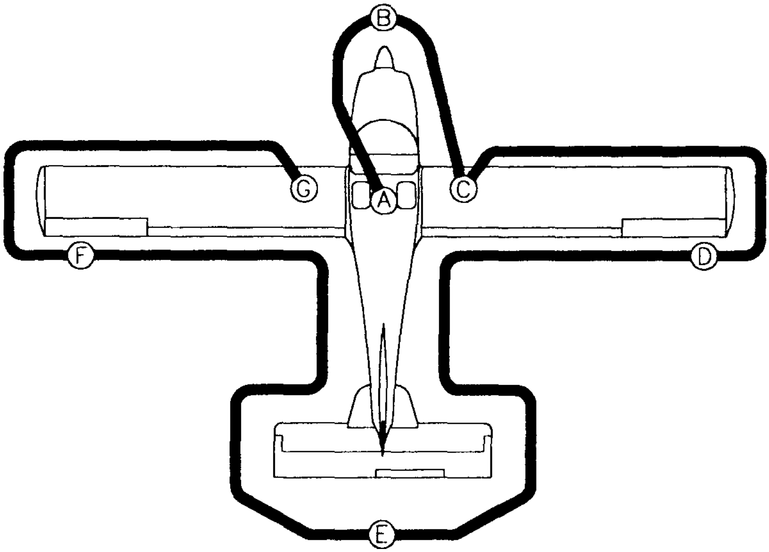

Figure 4-1: Preflight Walk-Around

Prior to any flight, inspect the exterior and interior of the aircraft for anything that looks suspicious or out of line. Use the following preflight walk-around checklist as a guide when inspecting the aircraft. Remedy any problems or defects before flight.

PREFLIGHT WALK-AROUND

A. CABIN:

1. Throttle out or closed.
2. Mixture full lean (idle cut-off).
3. Carb heat in (cold or off).
4. Magneto and master switches off.
5. Fuel valve on.
6. Check fuel quantity indicators for fuel level.
7. Check forward and aft wing spar attach hardware for security and integrity.
8. Remove any control locks.
9. Move flaps to the fully extended position.

B. NOSE GEAR, ENGINE, PROPELLER AND COWLING:

1. Check left-side static port for obstructions.
2. Fuel filter or gascolator: drain fuel into clear cup and check for water and debris. Drain until water or debris is gone.
3. Check nose gear:
   a) Security and integrity of strut;
   b) Tire condition and pressure;
   c) Condition and security of fairings.
3. Check propeller for nicks and cracks. Check spinner for security and integrity.
4. Check cowling fasteners for security.
5. Check engine cooling inlets for obstructions (bird nests, etc.).
6. Check alternator belt for condition and tension (Lycoming engines).

7. Check engine oil level. Fill if needed. Give inside of cowl a general inspection through oil access door.
8. Check exhaust pipe for security and integrity.
9. Check cowl flap for security and integrity.
10. Check induction air inlet for obstructions.
11. Check right-side static port for obstructions.

C. RIGHT-SIDE FUEL TANK AND WING LEADING EDGE:

1. Check fuel level visually for correspondence with gauge.
2. Check fuel cap for security.
3. Check wing leading-edge skins for cracks, dents and loose rivets.
4. Check security and integrity of delta wings.
5. Remove wingtip fuel vent plug, if present, and check vent line for other obstructions. (Use a length of 1/4" I.D. tubing to blow into vent.)
6. Check security and integrity of wingtip fairing and nav/strobe lights.

D. RIGHT WING TRAILING EDGE AND CONTROL SURFACES AND RIGHT MAIN LANDING GEAR:

1. Check aileron counterweight for security, integrity and freedom from obstruction (e.g., loose wires in wingtip).
2. Check aileron skins for cracks, dents and loose rivets.
3. Check aileron hinges for security, integrity and free movement.
4. Check aileron pushrod for security, integrity and freedom.
5. Check flap skins for cracks, dents and loose rivets.
6. Check flap tracks and flap track bearings for security, integrity and free movement.

7. Check flap pushrod for security, integrity and freedom.
8. Check upper and lower main wing skins for cracks, dents and loose rivets.
9. Check inspection hole covers for security.
10. Fuel sump: drain fuel into clear cup and check for water and debris. Drain until water or debris is gone.
11. Check wing strut integrity and security at both ends.
12. Right main gear:
    a) Check security and integrity of strut;
    b) Check tire condition and pressure;
    c) Check condition of brake disc and pads;
    d) Check for evidence of fluid leaks;
    e) Check condition and security of fairings.

E. REAR FUSELAGE AND EMPENNAGE:

1. Check right-side top-deck hatch for security.
2. Check pitot system low-point drain (if installed) for water.
3. Check right-side fuselage skins for stress cracks and fractures.
4. Check right-side stabilizer strake for security and integrity.
5. Check right-side stabilizer skins for cracks, dents and loose rivets.
6. Grasp stabilizer by the right tip and shake gently to check for secure attachment and structural integrity.
7. Check stabilizer and elevator right-side tip fairings for security and integrity.
8. Check elevator hinges for security and freedom of movement.
9. Check elevator pushrod for security, integrity and free movement.

10. Check elevator and trim tab skins for cracks, dents and loose rivets.
11. Check trim tab pushrod and counterweight for security and integrity.
12. Check tail cone for security and integrity.
13. Check fuselage bottom inspection-hole cover for security.
14. Check rudder skins for cracks, dents and loose rivets.
15. Check rudder hinges for secure attachment and free movement.
16. Check rudder base and tip fairings for security and integrity.
17. Grasp stabilizer by the left tip and shake gently to check for secure attachment and structural integrity.
18. Check stabilizer and elevator left-side tip fairings for security and integrity.
19. Check left-side stabilizer strake for security and integrity.
20. Check left-side fuselage skins for stress cracks and fractures.
21. Check baggage door for security.
22. Fuel system low-point drain: drain fuel into clear cup and check for water and debris. Drain until water or debris is gone.
23. Check left-side wing-fold hatch for security.
24. Check external antennae, if any, for security and integrity.

F. LEFT MAIN LANDING GEAR AND LEFT WING TRAILING EDGE AND CONTROL SURFACES:

1. Left main gear:
   a) Check security and integrity of strut;
   b) Check tire condition and pressure;

   c) Check condition of brake disc and pads;
   d) Check for evidence of fluid leaks;
   e) Check condition and security of fairings.
2. Check wing strut integrity and security at both ends.
3. Check inspection-hole covers for security.
4. Fuel sump: drain fuel into clear cup and check for water and debris. Drain until water or debris is gone.
5. Check upper and lower main wing skins for cracks, dents and loose rivets.
6. Check flap pushrod for security, integrity and freedom.
7. Check flap tracks and flap track bearings for security, integrity and free movement.
8. Check flap skins for cracks, dents and loose rivets.
9. Check aileron pushrod for security, integrity and freedom.
10. Check aileron hinges for security, integrity and free movement.
11. Check aileron skins for cracks, dents and loose rivets.
12. Check aileron counterweight for security, integrity and freedom from obstruction (e.g., loose wires in wingtip).

G. LEFT-SIDE WING LEADING EDGE AND FUEL TANK:

1. Check security and integrity of wingtip fairing and nav/strobe lights.
2. Remove wingtip fuel vent plug, if present, and check vent line for other obstructions. (Use a length of 1/4" I.D. tubing to blow into vent.)
3. Check security and integrity of delta wings.
4. Check wing leading-edge skins for cracks, dents and loose rivets.

5. Remove pitot tube cover, if present, and check pitot tube for security and obstructions. If a heated pitot tube is installed, be sure the drain hole is clear.
6. Check fuel level visually for correspondence with gauge.
7. Check fuel cap for security.

4-3 PRE-START AND ENGINE-START CHECKLIST

4-3.1 General

After the preflight check, the airplane can be boarded and the engine started. Prior to starting the engine you should:

1. Turn the fuel valve on.
2. Move the carb heat control to the off position (if applicable).
3. Turn master switches on.
4. Set the brakes.
5. Make sure the propeller is clear of all objects, people, etc. (shout, "Clear prop!")

Complete the normal start, cold start or hot start procedures as described below for the engine installed on your airplane. After the engine starts, check to see whether the oil pressure comes up into the green arc range after about 30 seconds of operation. If proper oil pressure does not develop, shut the engine down and determine the cause before proceeding. Let the engine warm up at about 1,000–1,200 r.p.m. before takeoff.

NOTE

Follow the starting procedures given in the engine manufacturer's operating manual if they differ from the procedures described here.

4-3.2 NORMAL START

4-3.2.1 Continental Engine

1. Crack throttle 1/8–1/4 in.
2. Move the mixture to the full rich position.
3. Turn electric boost pump on for a few seconds to prime the engine.
4. Turn boost pump off and pull mixture back to idle cut-off.
5. Engage the starter by rotating the magneto switch clockwise.
6. When the engine fires, release the starter switch and move the mixture to the full rich position. Advance throttle to desired setting. If the engine does not fire within 5–10 seconds, disengage starter switch and try again after a few seconds.

4-3.2.2 Lycoming Engine

1. Crack throttle 1/8 in.
2. Set mixture full rich.
3. Engage the starter by rotating the magneto switch clockwise.
4. When the engine fires, move the magneto switch to "BOTH" and advance throttle to desired setting. If the engine does not fire within 5–10 seconds, disengage starter switch and try again after a few seconds.

4-3.3 COLD START

In very cold weather, it's necessary to preheat the engine before attempting to start it. Especially if the engine has cold-soaked at temperatures below 25° F for more than two hours, use an engine pre-heater to apply hot air directly to the oil sump, the oil cooler, the external oil filter and oil lines, the cylinders and the air intake.

CAUTION

Starting an engine without proper preheat in cold weather can cause damage from lack of lubrication due to congealed oil in the system.

4-3.3.1 Continental Engine

Cold weather starting procedures for the Continental engine are the same as normal starting procedures, except that more priming may be required.

4-3.3.2 Lycoming Engine

1. Open throttle 1/4 in.
2. Set mixture full rich.
3. Prime as required (pump throttle if no primer is installed).
4. Engage starter.
5. When engine fires, advance throttle to desired setting. If the engine does not fire within 5–10 seconds, disengage starter switch and prime with one to three strokes of the primer (or throttle). Repeat starting procedure.

4-3.4 HOT START (CONTINENTAL ENGINE)

After a hot engine has been shut down, the fuel system will begin to heat up, causing fuel in the injection components to vaporize. During subsequent starting attempts, the fuel pump will initially be pumping some combination of fuel and fuel vapor. Until the entire fuel system becomes filled with liquid fuel, difficult starting and unstable engine operation can be expected. Restarting attempts will be the most difficult from 30 minutes to one hour after shut-down.

When the engine is hot, use the following starting procedures:

1. Throttle closed.
2. Pull mixture to the idle cut-off position.
3. Run the electric boost pump for 3–5 seconds. This will fill the fuel system with cool, liquid fuel and return any fuel vapor to the tanks.
4. Engage starter.
5. When engine fires, push mixture to the full rich position and advance throttle to desired setting. If the engine does not fire within 5–10 seconds, repeat starting procedure.

4-3.5 FLOODED START

Allow all fuel to drain from the intake system before attempting to start a flooded engine. Then:

1. Open the throttle fully.
2. Set mixture full lean.
3. Engage starter. When engine fires, advance the mixture control and move the throttle to desired setting.

4-4 RUN-UP AND PRE-TAKEOFF CHECKLIST ("CIGARS")

CONTROLS:

- Check full travel of stick in all directions while watching ailerons and elevator.
- Check full travel of rudder pedals.
- Make sure all control surfaces move freely and in the proper directions.

INSTRUMENTS:

- Check all switches and circuit breakers or fuses.
- Set altimeter and directional gyro.
- Set radios, GPS and transponder, as applicable.
- Turn autopilot off.
- Nav lights, landing light and strobes checked (check ammeter for increased current load) and switched on as required.
- Check pitot heat (if applicable).
- Check all instruments for normal readings.

GAS:

- Check fuel gauges. Enough fuel and reserve for planned flight?
- Fuel valve on.
- At high density altitude, lean mixture appropriately for best power during takeoff.
- Boost pump on (Continental IO-240 only).

ATTITUDE:

- Trim set at neutral position (for takeoff).
- Flaps checked for full travel and extended as appropriate for takeoff.

RUN-UP:

- Turn into wind; set brakes.
- Advance throttle to 1,800 r.p.m. for a Lycoming engine or 1,700 r.p.m. for the Continental.
- Check magnetos; r.p.m. drop should not exceed 175 r.p.m. and should not differ by more than 50 r.p.m. between magnetos.
- Cycle constant-speed prop (if applicable).
- Pull carburetor heat to full on (if installed) and check for a perceptible r.p.m. drop.
- Check all engine instruments for normal indications.
- Check ammeter and voltmeter for normal indications.
- Check suction gauge for normal indications.
- Reduce throttle to idle.

SEAT BELTS:

- Check that seat belts are snug and properly latched.
- Check that both doors are closed and latched.
- Passenger briefing completed.

NOTE

Do not overheat the engine by excessive ground run-up and taxi on hot days.

4-5 TAXIING

The tricycle landing gear configuration makes taxiing the GlaStar a simple matter. Visibility over the nose is excellent. Steering at slow taxi speeds is by differential braking. At any speed above a quick trot, the rudder begins to become effective for directional control. It is best to keep the speed well under control while taxiing and to taxi defensively when in the vicinity of other ground traffic.

In most conditions, taxi with the stick in the full aft (elevator up) position. This reduces the weight on the nose wheel and makes steering easier. Only in the instance of a very strong tail wind (i.e. a strong enough wind to move the aircraft itself) should the airplane be taxied with the stick forward. In very strong crosswinds, hold aileron into the wind while taxiing.

In warm weather, the GlaStar may be taxied with the cabin doors open. In wet weather, if the aircraft is not equipped with windshield defrost, cracking open either door slightly will help keep the inside of the windshield from fogging prior to takeoff. Keep the doors latched in gusty wind conditions or if taxiing through the prop wash of another airplane.

When possible, avoid stopping the aircraft with the nose wheel cocked significantly to one side or the other. From a standing start, a considerable amount of power and braking will be required to straightened a turned nose wheel, and this maximizes strain on the nose gear strut.

4-6 TAKEOFF

4-6.1 GENERAL

Before takeoff, all preflight, pre-start, engine start and run-up checklists must be properly complied with.

When applying power for takeoff, advance the throttle smoothly and slowly. Follow the throttle with right rudder, as necessary, to overcome the torque effects of the engine and propeller and to keep the airplane tracking straight down the runway.

Check the full-throttle operation of the engine during the early part of the takeoff roll. Abort the takeoff if there is any sign of engine roughness, if the engine doesn't seem to be developing full power or if proper oil pressure at full r.p.m. is not achieved. Correct any problems with the engine before attempting another takeoff.

4-6.2 NORMAL TAKEOFF

Make sure the doors are securely latched. Select the first notch of flaps. After making sure no other airplanes are landing, line the airplane up with the runway centerline. Advance the throttle smoothly and slowly until full power is achieved. At about 50 kts. (58 m.p.h.), ease the stick back to achieve a takeoff angle of attack and let the airplane fly itself off.

As the airplane accelerates after lift-off, ease the flaps up, making sure that they are completely retracted before reaching Vfe (75 kts./86 m.p.h.). Let the airplane accelerate to 78 kts. (90 m.p.h.) which is the best rate-of-climb airspeed.

4-6.3 SHORT-FIELD TAKEOFF

Full flaps are recommended for a short-field takeoff. After lining up on the runway, hold the brakes while advancing the power. Release the brakes after full power is reached. As the airplane passes through Vso (43 kts./49 m.p.h.), ease the stick back to rotate the wing to a takeoff angle of attack.

Once airborne, allow the airplane to accelerate to the best angle-of-climb airspeed (65 kts./75 m.p.h.). Establish a climb at this airspeed until obstacles are cleared. When all obstacles are cleared, ease the flaps off while accelerating to at least the best rate-of-climb airspeed (78 kts./90 m.p.h.).

WARNING

Because the GlaStar enjoys such remarkable controllability near and even below the stall speed, it is tempting to operate the aircraft closer to the margins than one might in another aircraft, especially in situations like a short-field departure with obstacles to clear. Flight at these extreme corners of the envelope carries risks, however. The GlaStar's ability to lift off and climb impressively at speeds only slightly higher than the stall speed does not exempt it from the effects of wind shear or turbulence. Encountering such conditions when at the edge of the performance envelope can lead to an accident.

4-6.4 HIGH DENSITY ALTITUDE TAKEOFF

At high density altitude (above 4,000 ft. MSL), lean the engine during run-up for best takeoff power. Follow the leaning procedures described in the operator's manual for your powerplant.

NOTE

Since every airplane is different, accurate high density altitude takeoff distances are difficult to predict. Many factors affect takeoff performance such as gross weight, temperature, relative humidity, type of propeller, altitude, engine horsepower, pilot ability, etc. We recommend that each builder determine high density altitude takeoff performance data for his own airplane.

4-7 CLIMB

After lift-off, let the airspeed rise to at least 65 kts. (75 m.p.h.) for best angle of climb when clearing obstacles. Once clear of obstacles, or if no obstacles are present, lower the nose and let the aircraft accelerate to at least the best-rate-of-climb airspeed of 78 kts. (90 m.p.h.).

Two important considerations may dictate a climb speed faster than the best-rate speed: engine cooling and visibility. Pay close attention to engine temperatures during climb; temperatures can exceed the normal ranges if the airspeed is too low on hot days. Therefore, a higher-than-normal climb speed might be required on hot days.

Additionally, at its best-rate-of-climb airspeed, the attitude of the

GlaStar remains rather nose-high. Over-the-nose visibility is obviously important at all times, but particularly in busy traffic areas, it may be prudent to climb at a faster speed to facilitate traffic scanning.

When clear of terrain and an adequate climb rate is established, you may reduce power for noise abatement or to avoid excessive fuel burn and high engine temperatures.

4-8 STALLS

4-8.1 GENERAL

The benign stall characteristics of the GlaStar are among the aircraft's most remarkable features. The GlaStar exhibits very little tendency to depart from controlled flight in a stall; positive, three-axis control can be maintained throughout even a fully developed stall. Stall recovery technique in the GlaStar is typical of most conventional aircraft—reduce the angle of attack and add power.

With the exception of aerobatic flight—for which the GlaStar is not approved in any case—stalls have no place in "normal operating procedures." Properly flown, there is no reason that a GlaStar should ever enter an inadvertent stall. However, stall and combination stall-spin accidents continue to be among the leading causes of general aviation accidents, and thus it is vital that the GlaStar pilot be proficient at identifying and recovering from both power-off and power-on stalls.

WARNING

While the GlaStar has been rightly praised for its outstanding slow-speed handling characteristics and benign stall behavior, it's important to remember that, just like any other airplane, the GlaStar *can* be stalled at any airspeed and in any attitude, and that any stall results in a loss of lift that *can* be critical, depending on the conditions under which it occurs. The GlaStar's outstanding controllability and stall recovery characteristics should be thought of as a resource to draw on in the event of an emergency, not a feature to be exploited in normal flight operations or a license for recklessness.

Familiarity with the GlaStar's stall characteristics can only be attained through practicing stalls. The following sections of this manual outline proper practice stall entry techniques, stall characteristics, and recovery techniques. Practice these stalls until you are thoroughly comfortable with them, and plan on recurrent practice throughout your GlaStar ownership. All stalls should be practiced at an altitude of at least 3,000 ft. AGL, and each stall should be preceded by a thorough clearing of the surrounding airspace. Also, be sure that any baggage is well secured before practicing stalls.

WARNING

Intentional spins are prohibited in the GlaStar. Be familiar with standard spin recovery procedures in the event of an inadvertent spin entry while practicing stalls.

4-8.2 Power-Off Stalls

The power-off stall simulates a stall during the approach to landing. Entry to this type of stall is best and most realistically accomplished by applying gently increasing amounts of back pressure on the stick in order to maintain altitude as the airspeed bleeds off. Power-off stalls should be practiced at each flap setting to get the feel of slight differences in the character of the stall with different flap settings.

Given a gentle stall entry as described above, the GlaStar exhibits virtually no defined stall break. As the wing stalls, the nose will fall very slightly and the aircraft will begin a "mushing" descent. The lowering of the nose will be slightly more pronounced in a clean stall than in a stall with flaps.

If the stick is held fully aft, the descent will stabilize at a rate of 700–800 ft./min. The aircraft will oscillate slightly in pitch, and the airspeed will settle at around 60 kts. (69 m.p.h.). In this configuration, the aircraft remains very controllable in all three axes. This controllability is naturally a very positive trait, but it makes it crucial that the pilot recognizes the aircraft's stalled condition. GlaStar pilots must learn to distinguish a conventional power-off glide from the mushing descent characteristic of a stabilized power-off stall.

Recovery from a power-off stall is easily accomplished by relaxing back pressure on the stick and applying power. Although full power should be used for any stall recovery, even partial power is sufficient to arrest the descent with virtually no altitude loss provided that the stick is neutralized. There is no need in the GlaStar as in some aircraft to push the stick forward to aggressively lower the nose; this procedure will only delay the achievement of a positive rate of climb.

The GlaStar climbs extremely well at any flap setting. Therefore, it is **not** recommended to change the flap setting in a stall until a positive rate of climb has been established. Once the aircraft is climbing, ease the flaps off prior to exceeding Vfe (75 kts./86 m.p.h.), just as you would on a normal takeoff.

4-8.3 POWER-ON STALLS

Power-on stalls simulate stalls that might occur during the departure phase of flight. In the GlaStar as in other aircraft, power-on stalls tend to be more aggressive than power-off stalls. The stall has a more defined break, and the torque effects of the engine and propeller induce rolling and yawing forces during the power-on stall that make a wing drop more likely to occur. These yawing forces make the development of the stall into a spin more likely in the power-on case than the power-off one. However, power-on stalls in the GlaStar are still extremely predictable and controllable.

Practice power-on stalls initially at moderate power settings and proceed to higher power settings gradually, only as you become completely comfortable with the GlaStar's characteristics and your recovery technique. At full power, the GlaStar will attain a truly exhilarating nose-high attitude before stalling—higher than would ever be prudent in normal operations. For this reason, full-power stall practice is not recommended.

Enter a power-on stall by establishing and holding a climb angle until the airspeed bleeds off to the stall speed. With any but the lowest power settings, this angle will need to be considerably nose high. The break of a power-on stall is preceded by a significant amount of airframe buffeting, which provides a clear 3–5 kt. warning period before the actual onset of the stall. Before attempting a full power-on stall, fly the aircraft into this buffet and become familiar with its feel.

Holding the nose-high attitude through the buffet will eventually cause the stall to break. The nose will drop decisively, although neither particularly abruptly nor very far. One wing or the other (typically the left wing) is likely to drop, but as with the nose drop, this occurs fairly slowly.

To recover from a power-on stall, release the back pressure on the stick to reduce the angle of attack and apply full power. If a wing has dropped, simultaneously apply "top" rudder—that is, rudder opposite the dropped wing. In any but the most extreme nose-high stalls, it is unnecessary to push the nose down actively to regain flying speed; mere relaxation of back pressure will suffice to arrest the stall with virtually no altitude loss.

WARNING

> As in power-off stalls, the GlaStar retains control authority in all three axes throughout a power-on stall. This makes it tempting to use aileron rather than rudder to pick up a low wing during a power-on stall. Although this will be effective in most cases, this technique is strongly discouraged, as it will be ineffective or worse in many other aircraft. Use of rudder only to arrest wing drop during a stall is a good, standard practice to cultivate regardless of the aircraft being flown.

4-8.4 ACCELERATED STALLS

An accelerated stall is a stall caused by the application of the flight controls in such a way as to rapidly increase the angle of attack beyond the critical angle for the airfoil. Because of this rapid change in angle of attack, accelerated stalls typically occur at airspeeds considerably higher than the published stall speeds for the aircraft.

Two situations account for the majority of inadvertent accelerated stall entries. First, any aircraft will stall at a progressively higher airspeed as the angle of bank in a turn is increased. As bank angles exceed 30°, the stall speed rises exponentially. Accelerated stalls of this type are very difficult to produce in the GlaStar without imposing excessive G loading on the airframe. In the unlikely event of such a stall, however, the recovery technique is the same as for any other stall: reduce the angle of attack. In most cases, a slight relaxation of back pressure and a reduction in the angle of bank will be all that is required.

The second common way that pilots get into accelerated stalls is by pulling the stick back too abruptly while recovering from an ordinary power-on or power-off stall. This is typically done to avoid altitude loss, but of course the so-called "secondary stall" caused by the over-enthusiastic pull-up only eats up more altitude. Because secondary stalls can occur at an airspeed considerably above Vs and because they tend to be more aggressive than unaccelerated stalls, pilots must be very disciplined in not pulling too hard too soon in effecting stall recoveries. In the event of a secondary stall in the GlaStar, recover just as you would from a power-on stall: relax back pressure and pick up the dropped wing with top rudder.

4-9 CRUISE

Hold the plane at the desired altitude, when it is reached, and throttle back to the desired cruise r.p.m. It takes a little while for the airplane to adjust to the cruise attitude after climb-out. Use the elevator trim to trim away stick pressure as the airplane increases in speed. Because of the wide speed range of the GlaStar, considerable trim change is required in transitioning from climb to cruise. An airplane in trim is a much easier airplane to handle.

4-10 CRUISE PERFORMANCE

The following figures are to be used as guides for determining the desired cruise power settings and speeds. Performance numbers are the actual data from Stoddard-Hamilton's prototype GlaStars. The 125 h.p. numbers are for an aircraft equipped with a Continental IO-240 engine and a Sensenich 72/57 fixed-pitch propeller. The 160 h.p. and 180 h.p. numbers are for aircraft equipped with Lycoming O-320 and O-360 engines, respectively, and Hartzell constant-speed propellers. Cruise performance will vary from plane to plane depending on many factors (such as propeller, engine horsepower, weight, etc.).

Cruise Speed (75% power @ 8,000 ft., TAS):

125 h.p. .... 131 kts./151 m.p.h.
160 h.p. .... 140 kts./161 m.p.h.
180 h.p. .... 145 kts./167 m.p.h.

Cruise Speed (65% power @ 8,000 ft., TAS):

125 h.p. .... 122 kts./140 m.p.h.
160 h.p. .... 133 kts./153 m.p.h.
180 h.p. .... 138 kts./159 m.p.h.

Fuel Consumption at 65% power:

125 h.p. .... 5.8 gal./hr.
160 h.p. .... 6.7 gal./hr.
180 h.p. .... 8.5 gal./hr.

Range at 65% power (no wind, VFR reserve):

125 h.p. .... 520 n.m./598 s.m.
125 h.p. with auxiliary tanks .... 888 n.m./1,021 s.m.
160 h.p. .... 481 n.m./553 s.m.
160 h.p. with auxiliary tanks .... 829 n.m./953 s.m.
180 h.p. .... 379 n.m./436 s.m.
180 h.p. with auxiliary tanks .... 663 n.m./762 s.m.

NOTE

If an EGT gauge is used, lean a Lycoming engine to 50° F rich of peak EGT (hottest cylinder) and a Continental engine to 25° F rich of peak EGT to obtain the optimum fuel consumption rate; or follow the recommendations in your engine operator's manual.

4-11 FUEL MANAGEMENT

Fuel management in the GlaStar is very simple, since both tanks feed simultaneously. However, the tanks will not necessarily drain at equal rates. Slight differences in vent pressures, uncoordinated flight and other factors cause fuel to be drawn from one tank more rapidly than the other. This is normal and no cause for concern.

Determine by careful experimentation what your airplane's fuel burn per hour is at various commonly used power settings such as 65% and 75% power. Plan your flights so that you always have, at a minimum, the legally required reserve on board for the type of flight you are conducting. Under most circumstances, maintaining a more generous fuel reserve than the legal minimum is strongly recommended. Always keep track of your fuel status in terms of flight time and fuel burn per hour; never rely on the fuel gauges.

NOTE

If your GlaStar is equipped with the optional auxiliary fuel tanks, you have an additional 17.5 gals. of usable fuel capacity. Each auxiliary tank is drained into its respective main tank by an electric transfer pump. The recommended procedure is to burn down the main tanks until less than 10 gals. total remain, and then to turn on the transfer pumps to refill the mains. Turning on the pumps with **more** than 10 gals. in the mains risks pumping fuel overboard through the vents. It takes the pumps approximately 20 minutes to drain the auxiliary tanks.

4-12 DESCENT

Never pull power off and dive down in cold air. The rapid cooling at idle and high velocity can be very hard on an engine. When descending keep a little power on and don't descend too fast.

Be sure your seat belts are fastened snugly when descending. Coming down from smooth air into turbulent air at high speed can be especially tough on you and the airframe. Maximum structural cruising speed (Vno) of the GlaStar is 144 kts. or 166 m.p.h. IAS.

Gradually push the mixture control rich during long descents.

4-13 APPROACH AND LANDING

4-13.1 PRE-LANDING CHECKLIST

A suggested pre-landing checklist has the acronym GUMP:

GAS:

- Fuel valve on.
- Throttle reduced as necessary.
- Boost pump on (Continental IO-240 only).

UNDERCARRIAGE:

- Down and welded!

MIXTURE:

- Push to full rich position (or to appropriate setting for high-altitude landings).

PROP:

- Move prop control (if installed) to high r.p.m., flat pitch (forward) position.

NOTE

We recommend completing the pre-landing checklist before entering the pattern so that the pilot's attention can be directed outside the airplane to clear for other traffic while in the pattern.

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4-13.2 Approach

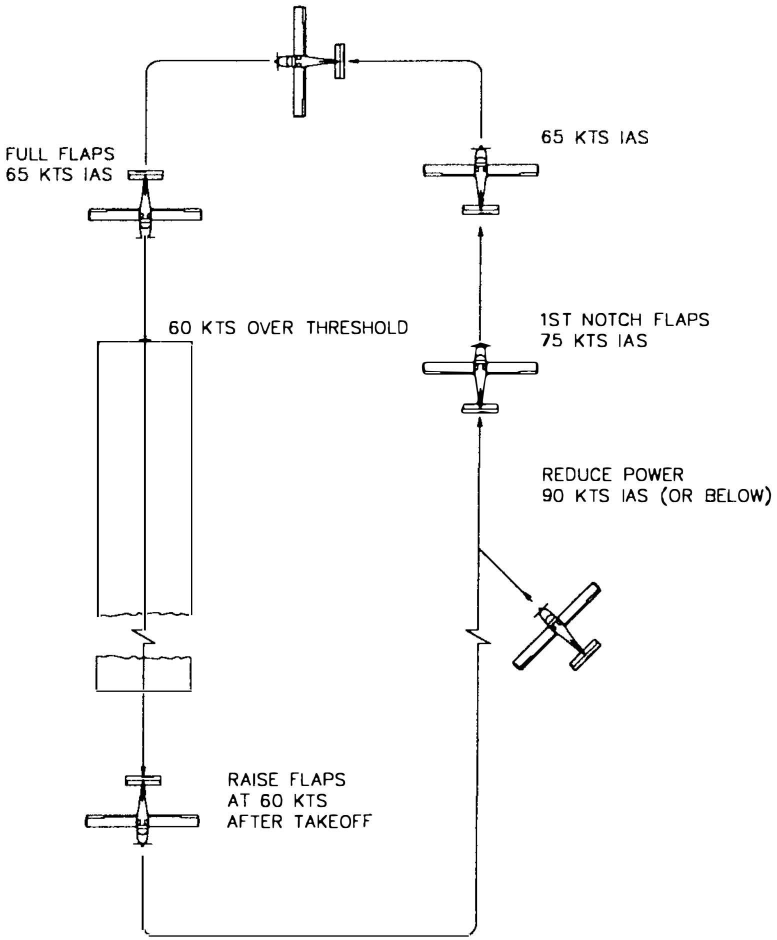

Figure 4-2: Landing Pattern

Enter the pattern on the 45° at about 90 kts. (103 m.p.h.). Pull the carb heat (if installed) for 15–30 seconds to check for ice. Push the mixture full rich (or enrich as appropriate for altitude), and move the prop control forward to the high r.p.m. (flat pitch) position (if applicable). Slow the airplane to 75 kts. (86 m.p.h.) abeam the numbers on downwind and extend the first notch of flaps.

NOTE

Because the GlaStar is very clean aerodynamically, speed changes in the pattern must be anticipated earlier and accompanied by greater changes in power setting than many pilots may be accustomed to.

Continue slowing the airplane to about 65 kts. (75 m.p.h.) on base leg. Throughout downwind, base and final, continue to trim the airplane as necessary. Maintain 65 kts. (75 m.p.h.) onto final approach, and add full flaps. Control altitude with power and airspeed with pitch.

NOTE

The GlaStar can be landed with no flaps, half flaps or full flaps, and the recommended pattern speeds remain the same regardless. However, full flaps will produce the best sight picture over the nose on final and will result in the slowest touchdown speed, so full-flap landings are recommended under most circumstances.

You should be at about 60 kts. (69 m.p.h.) over the threshold under normal conditions. Carry a little more airspeed if you are heavily loaded or in gusty or strong wind conditions.

WARNING

If you don't like the way you're set up for landing, don't be ashamed or too proud to go around and try it again. It is much better to go around than to damage the plane or yourself.

WARNING

When the GlaStar is flown at a normal approach speed of 60–65 kts. (69–75 m.p.h.) as described above, the airplane glides nicely to a gentle landing at a minimum descent rate and with plenty of elevator power for the flare. At slower airspeeds, the power-off sink rate increases rapidly, and considerable engine power is required to arrest the descent sufficiently to flare for landing.

4-13.3 Landing

Landing the tricycle gear GlaStar is similar to landing any other nose wheel airplane. Unlike many light airplanes, however, the GlaStar has very little tendency to float in ground effect. Spot landing tasks are therefore quite easy to accomplish in the GlaStar, but pilots accustomed to skimming the runway end lights and touching down a third of the way down the runway must be prepared for a somewhat different experience.

Touchdown should always be on the main wheels first, and the nose wheel should be held off as long as possible to take advantage of aerodynamic braking. However, the GlaStar lands best in a relatively level attitude. At standard landing speeds, anything approaching full-aft stick will produce an attitude that is far too nose-high.

Directional control on roll-out should pose minimal challenge in the GlaStar, as the large rudder is effective down to speeds not much above a walking pace. Be aware of crosswinds, however, and use the standard technique of applying upwind aileron to prevent loss of directional control. Apply brakes smoothly and evenly, and avoid hard braking unless absolutely necessary to complete a landing safely.

On a balked landing (go-around), add full power (applying right rudder as necessary), stabilize the plane in a best-rate climb, and ease the flaps off; raising the flaps abruptly will cause unnecessary pitch change and loss of lift.

4-13.4 SHORT-FIELD LANDING

The procedures described above in Sections 4-13.2 and 4-13.3 are suitable for the majority of approach and landing situations most GlaStar pilots will encounter. With a final approach speed of 65 kts. (75 m.p.h.), even a heavily loaded GlaStar can easily be brought to a stop without heavy braking within 700–800 ft. This equals or exceeds the "short-field" performance capabilities of most aircraft and certainly exceeds the requirements of any established airport.

However, the rugged construction, generous payload and exceptional slow-flight capabilities of the GlaStar invite its use under more demanding circumstances. Truly short-field landings of 400 ft. or less are possible with the proper technique.

As with any landing, the key to a successful short-field landing in the GlaStar is a stabilized approach—that is, an approach in which the proper power setting and attitude for the desired airspeed and descent rate are established early in the approach and held steady all the way to touchdown with only minimal adjustments. The slower the approach speed, the shorter the landing, but also the more power required to maintain manageable descent rates.

Pilots inexperienced in high-performance, bush-type flying should approach truly short-field work in the GlaStar gradually, slowing approach speeds incrementally from the recommended 65 kts. (75 m.p.h.). Approach speeds as low as 45 kts. (52 m.p.h.) can be flown, but such speeds leave little margin for unexpected gusts or wind shear.

Short-field landings should always be made with full flaps, but the flaps should be retracted immediately upon touchdown to increase the weight on the main wheels and thus the braking effectiveness.

4-13.5 Slips

The forward slip is a very useful technique in the GlaStar for losing altitude without gaining excessive airspeed. The GlaStar's Fowler flaps create more lift than drag and cannot be counted on to save a high approach. With its large, effective rudder and ailerons, however, the GlaStar slips marvelously. Easily controlled slipping descents exceeding 1,000 ft./min. can be achieved at typical 65 kt. (75 m.p.h.) approach speeds.

The GlaStar can safely be slipped with full, half or no flaps. In full- or half-flap slips, however, care must be taken to avoid exceeding Vfe (75 kts./86 m.p.h.).

WARNING

Full-flap slipping approaches should be attempted only after becoming thoroughly familiar and proficient with the normal handling characteristics of the GlaStar. Although the slip itself is very straightforward, rapid transition from the slip to a normal flare and touchdown requires confident handling of the aircraft

4-13.6 CROSSWINDS

Normal crosswind landing procedures for conventional aircraft apply to the GlaStar. Especially strong crosswinds require either a crab into the wind and straightening out just before touchdown or a side slip, or a combination of the two methods.

The maximum crosswind that can be handled in the GlaStar is highly dependent on pilot proficiency and technique. Therefore, although the GlaStar has been landed in extremely demanding crosswind conditions, no maximum demonstrated crosswind component is published for the aircraft. Each pilot is urged to practice crosswind landing tasks of progressive difficulty and to honestly assess his/her own capability along with that of the aircraft.

4-14 ENGINE SHUT-DOWN

1. Set the propeller control at minimum blade angle.
2. Idle until there is a decided decrease in cylinder head temperature.
3. Turn radios off.
4. Turn all accessory switches off.
5. Electric fuel boost pump off (Continental engine).
6. Set mixture to idle cut-off (full lean) and wait for the engine to stop.
7. Turn off ignition, alternator and master switches.

SECTION 5

WEIGHT AND BALANCE

Table of Contents

5-1 GENERAL DATA

WARNING

To operate the GlaStar safely, it must be flown within the specified center of gravity (CG) limits. These limits must be **strictly** observed. Flight in either a nose-heavy or a tail-heavy airplane is unsafe and can result in loss of control.

Because every GlaStar is different, you must determine the CG for **your** airplane in both empty and loaded configurations in order to establish safe loading criteria. What follows are some general definitions and data useful in calculating the CG of your airplane. The specific steps required are detailed below.

5-1.1 GENERAL DEFINITIONS

Arm (or Moment Arm) — the horizontal distance in inches from the datum to the center of gravity of a particular item.

Center of Gravity (CG) — the point at which an object would balance if suspended in space. The CG of a particular part of the airplane or its load is typically expressed as a horizontal distance from the datum, while the CG of the aircraft as a whole is expressed as a percentage of the mean aerodynamic chord (see below).

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

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

Datum — an imaginary vertical plane from which all moment arms are measured for weight and balance purposes. The datum is perpendicular to the waterline plane when the aircraft is in level-flight attitude.

Empty Weight — Weight of an airplane including full operating fluids, unusable fuel, full oil and optional equipment.

***Mean Aerodynamic Chord* (MAC)** — a chord is the straight-line distance from the leading edge to the trailing edge of an airfoil section. The MAC is the average chord across the entire wingspan. The MAC of a straight, constant-chord wing like the GlaStar's is the same as the actual chord at any point in the span. Aircraft CG locations are specified as percentages of MAC; these distances are measured from the leading edge of the wing.

Maximum Gross Weight — Maximum weight approved for flight operations.

Moment — the product of an item's weight multiplied by its arm.

Payload — Weight of occupants and baggage.

Station — a horizontal distance from the reference datum given in inches.

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

Useful Load — Difference between maximum gross weight and empty weight.

Waterline — A horizontal reference plane running longitudinally through the fuselage.

5-1.2 Weight and Balance Data

The following generic data are needed for the weight and balance calculations:

Datum ....58" forward of the cowling mounting flange joggle

Mean Aerodynamic Chord (MAC) .... 44"

Maximum Gross Weight.. 1,960 lb.

Maximum Baggage Weight.. 250 lb.

CG Limits:

Forward ....14.0% MAC (Station 95.6)

Aft ....32.0% MAC (Station 103.5)

Various Moment Arms:

Datum	Station	0.0
Cowling Mounting Flange Joggle	Station	58.0
Firewall	Station	60.5
Wing Leading Edge	Station	89.4
Pilot and Passenger	Station	101.0
Fuel	Station	108.0
Baggage, Forward Zone	Station	136.0
Baggage, Aft Zone	Station	160.0

NOTE

The dividing line between the forward and aft baggage zones is located **25" forward** of the baggage compartment bulkhead or just forward of the baggage door, as shown in Figure 5-1.

5-2 EMPTY WEIGHT CG CALCULATION

NOTE

If no changes have been made to your airplane, you may copy the data from Steps 217–220 in "SECTION X: FINAL ASSEMBLY" of your *GlaStar Assembly Manual* to the appropriate spaces in Sections 5-2 and 5-3 of this manual.

5-2.1 DETERMINE THE STATIONS OF THE LANDING GEAR

The empty weight CG of the airplane must be determined before any additional CG calculations can be made. The first step in determining the empty weight CG is to measure the distances from the datum to the landing gear. These distances will vary slightly among GlaStars.

First, with the airplane supported with the wings and the waterline level, use a plumb bob to mark the location of the cowling mounting flange joggle (the cowling/fuselage split line) on the floor.

NOTE

To level the tricycle gear GlaStar, position blocks under either the nose wheel or the main wheels (or partially deflate one or more of the tires). Use the permanent waterline marks recommended in Step 33 in "SECTION VIII: FUSELAGE ASSEMBLY" of your *GlaStar Assembly Manual* as a reference.

Measure forward 58" from the cowling joggle mark and mark a line on the floor at this point perpendicular to the longitudinal centerline of the airplane. This line represents the intersection of a plane in space with the floor. This plane is defined as the reference datum (Station 0.00) from which all moment arms are measured.

Measure and record the horizontal distances "X" and "Y" from the datum to the centers of the nose and main wheel axles respectively. See Figure 5-1. These distances represent the stations of the landing gear.

Enter the results of your measurements here:

NOSE WHEEL (X)____________

MAIN GEAR (Y)____________

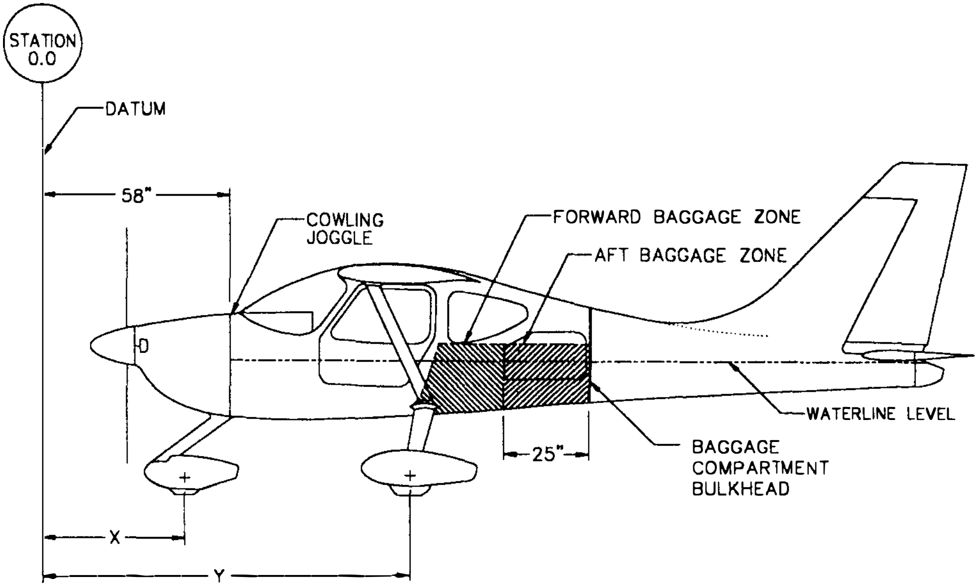

Figure 5-1: Measuring the Landing Gear Stations

5-2.2 Weigh the Aircraft

Now weigh the airplane, using three scales, one under each wheel. The scales should each be capable of handling about 600 lb. For this measurement, the fuel tanks should be empty, but the engine should be full of oil. While weighing the airplane, block up the wheels as necessary to bring the waterline and the wings level. Be sure to subtract the tare weight of any blocks or wheel chocks used from the scale readings.

NOTE

You need to record the weights registered by each scale individually, not just the total weight.

Enter the results of your initial weighing here:

	Scale reading	–	Tare weight	=	Weight
Left main gear	________	–	________	=	________
Right main gear	________	–	________	=	________
Nose gear	________	–	________	=	________
Total aircraft	________	–	________	=	________

5-2.3 CALCULATE THE STATION OF THE EMPTY WEIGHT CG

Use the following formula to calculate the empty weight CG station:

Empty Weight CG =

$$\frac{(\text{Nose Gear Weight})(X) + (\text{Right Main} + \text{Left Main Weight})(Y)}{\text{Airplane Total Weight}}$$

NOTE

"X" and "Y" in the above formula are the stations of the nose and main gear axles, respectively. Refer to Figure 5-1.

Following is a sample empty weight CG calculation, using the formula above and the data from the tricycle-geared GlaStar prototype. The prototype's empty weight with a Lycoming O-320, a prop extension and a Sensenich fixed-pitch metal propeller is 1,224 lb., as follows:

Nose Gear:.. 351 lb., Station 45.1
Left Main Gear: .... 437 lb., Station 113.3
Right Main Gear:... 436 lb., Station 113.3

Empty Weight CG =

$$\frac{(351\text{ lb.} \times 45.1\text{ in.}) + (437\text{ lb.} + 436\text{ lb.})(113.3\text{ in.})}{1{,}224\text{ lb.}}$$

$$= \frac{114{,}741\text{ in.-lb.}}{1{,}224\text{ lb.}} = \textbf{Station 93.7}$$

Enter the results of your empty weight CG calculations here:

EMPTY WEIGHT CG STATION__________

5-3 FLIGHT CG CALCULATIONS

Calculate the flight CG of your GlaStar in "worst-case" loading scenarios—extreme forward and extreme aft CG conditions—to see where your GlaStar's CG falls relative to the acceptable CG range. The results of these calculations will establish guidelines for safely loading your GlaStar for flight.

To perform the forward and rearward CG limit checks, tabulate the weights, stations and moments, as shown in the following examples. Add the weights and moments and divide the total moment by the total weight to obtain the station of the CG. Once you have that figure, use the following formula to calculate the CG as a percentage of MAC:

$$CG_{\%MAC} = \frac{\text{Station of the CG} - \text{Station of the Wing Leading Edge}}{\text{MAC}} \times 100$$

. . . in which the station of the wing leading edge is **89.4**, and the MAC is **44.0"**.

The following examples are based on the empty weight and empty-weight CG of the tricycle-geared GlaStar prototype; **your numbers will vary!**

NOTE

For all weight and balance calculations, note that gasoline weighs 6 pounds per gallon.

5-3.1 FORWARD CG LIMIT CHECK

The FARs specify that the forward limit check should be performed using the **maximum** weights of items located **forward** of the forward CG limit and the **minimum** weights of items located **aft** of the forward CG limit. In the GlaStar, all items of variable weight—pilot and passenger, fuel and baggage—are located aft of the forward CG limit (Station 95.6), so the forward limit check conditions are: **no passenger, minimum fuel** and **no baggage**.

The FAA standard pilot weighs **170 lb**. The standard formula for calculating minimum fuel is as follows:

$$\textbf{Minimum Fuel} = \frac{\textbf{Engine h.p.}}{\textbf{12}}$$

Thus, for our prototype with a 160 h.p. engine, the minimum fuel is **13.3 gal**. Calculate a minimum fuel figure for your GlaStar and enter the result here:

MINIMUM FUEL ____________

NOTE

If you weigh **less** than 170 lb., you have the **option** of using your own weight to perform the forward and rearward CG limit checks. However, the converse is **not** true; if you weigh more than 170 lb., you **must** use the 170 lb. standard weight.

ITEM	WEIGHT (LB.)	STATION (IN.)	MOMENT (IN.-LB.)
Empty GlaStar	1,224.0	93.7	114,741.0
Pilot	170.0	101.0	17,170.0
Passenger	0.0	101.0	0.0
Fuel (13.3 gal.)	79.8	108.0	8,618.4
Forward baggage	0.0	136.0	0.0
Aft baggage	0.0	160.0	0.0
TOTAL	**1,473.8**	**—**	**140,529.4**

Table 5-1: Sample Forward CG Limit Check

$$CG = \frac{\text{Total Moment}}{\text{Total Weight}} = \frac{140{,}529.4 \text{ in.-lb.}}{1{,}473.8 \text{ lb.}} = \text{Station } 95.4$$

$$CG_{\%MAC} = \frac{95.4 - 89.4}{44.0} \times 100 = 13.6\% \text{ MAC}$$

In this example, we can see that, although the total aircraft weight of 1,474 lb. is well below the maximum allowable gross, the CG at 13.6% MAC is slightly forward of the 14% MAC forward limit, and thus, the aircraft as loaded is not safe to fly.

ITEM	WEIGHT (LB.)	STATION (IN.)	MOMENT (IN.-LB.)
Empty GlaStar			
Pilot		101.0	
Passenger	0.0	101.0	0.0
Minimum Fuel		108.0	
Forward baggage	0.0	136.0	0.0
Aft baggage	0.0	160.0	0.0
TOTAL		—	

Table 5-2: Your Forward CG Limit Check

Using the sample forward CG limit check as a guide, enter the data for your GlaStar in Table 5-2 and perform your own forward limit check. Enter your result here:

FORWARD LIMIT CHECK — STATION ____________

If your forward limit check comes out beyond the forward CG limit, you have two options: 1) you can placard the airplane, prohibiting flight under loading conditions that would exceed the forward CG limit, or 2) you can shift the battery aft in an attempt to bring the forward-most CG aft of the forward limit. Option #2 is probably more attractive to most builders and is described in detail in Step 220 in "SECTION X: FINAL ASSEMBLY" of your *GlaStar Assembly Manual.*

WARNING

The preceding example illustrates that, as a result of the GlaStar's ability to carry so much baggage, its forward CG limit is somewhat more sensitive than in some other aircraft when the baggage compartment is empty, especially when equipped with a relatively heavy engine and prop. Be particularly aware of your weight and balance condition when you fly with little or no baggage and low fuel, especially if you are flying solo.

5-3.2 REARWARD CG LIMIT CHECK

The rearward limit check must be performed using the **minimum** weights of items located **forward** of the aft CG limit and the **maximum** weights of items located **aft** of the aft CG limit. The aft CG limit in the GlaStar is at Station 103.5, so the rearward limit check conditions are: **no passenger, maximum fuel** and **maximum baggage**.

Maximum standard fuel capacity in the GlaStar is **30.6 gal.**, and the maximum total baggage capacity is **250 lb**.

ITEM	WEIGHT (LB.)	STATION (IN.)	MOMENT (IN.-LB.)
Empty GlaStar	1,224.0	93.7	114,741.0
Pilot	170.0	101.0	17,170.0
Passenger	0.0	101.0	0.0
Fuel (30.6 gal.)	183.6	108.0	19,828.8
Forward baggage	0.0	136.0	0.0
Aft baggage	250.0	160.0	40,000.0
TOTAL	**1,827.6**	—	**191,739.8**

Table 5-3: Sample Rearward CG Limit Check

$$CG = \frac{\text{Total Moment}}{\text{Total Weight}} = \frac{191{,}739.8 \text{ in.-lb.}}{1{,}827.6 \text{ lb.}} = \text{Station } 104.9$$

$$CG_{\%MAC} = \frac{104.9 - 89.4}{44.0} \times 100 = 35.2\% \text{ MAC}$$

In this case, although the airplane is once again under maximum gross weight, the loading exceeds the aft CG limit. Of course, this is not surprising, since we're trying to load all 250 lb. of baggage allowance into the aft zone of the baggage compartment. The solution to this dilemma is to divide the baggage up between the two zones and recalculate. Trial-and-error revealed that, in our prototype, a load distribution of 110 lb. in the forward zone and 140 lb. in the aft zone brings the CG exactly to the aft limit. This loading represents the aft-most approved loading condition, and **the airplane should be placarded to indicate this.**

Using the sample rearward CG limit check as a guide, enter the data for your GlaStar in Table 5-4 and perform your own rearward limit check. Enter your result here:

REARWARD LIMIT CHECK — STATION __________

If your GlaStar exceeds the aft limit, as it most likely will, determine how the maximum baggage load must be redistributed to bring the CG within limits, and then placard the compartment with the results.

Baggage compartment restrictions — Forward zone __________

Aft zone __________

ITEM	WEIGHT (LB.)	STATION (IN.)	MOMENT (IN.-LB.)
Empty GlaStar			
Pilot		101.0	
Passenger	0.0	101.0	0.0
Maximum Fuel		108.0	
Forward baggage	0.0	136.0	0.0
Aft baggage	250.0	160.0	40,000.0
TOTAL		—	

Table 5-4: Your Rearward CG Limit Check

WARNING

Any future modifications to the aircraft that add, subtract or shift weight will change the location of the empty weight CG. If any such modifications are made, you must recalculate the empty weight CG and re-perform the forward and rearward limit checks.

The loaded aircraft weight and the station of the CG must fall within the shaded area of the graph shown in Figure 5-2.

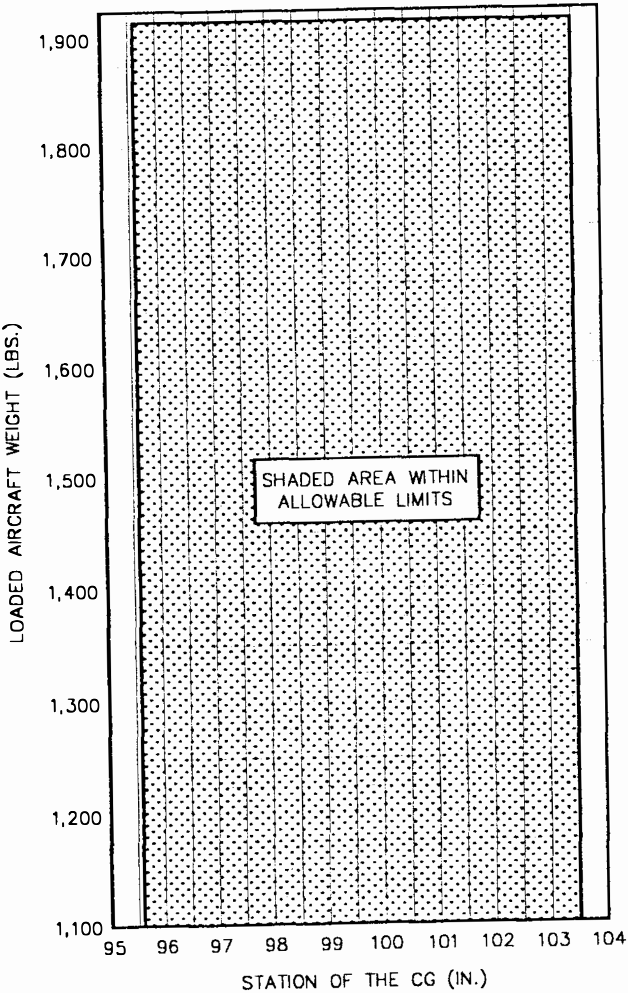

Figure 5-2: Center of Gravity Limits

5-3.3 LOADING PROBLEM

Rather than using the formulae shown in Sections 5-3.1 and 5-3.2 to calculate the flight CG, you can figure weight and balance by using the following Loading Problem, Loading Graph and Center of Gravity Moment Envelope. To use the Loading Problem, follow these three steps:

1. Take the basic empty weight and total moment data for your airplane from Section 5-2.3 and enter them in the columns titled "Your Airplane" in Table 5-5.

NOTE

The total moment must be divided by 1,000 and this value used as the moment/1,000 in the Loading Problem.

2. Use the Loading Graph (Figure 5-3) to determine the moment/1,000 for each additional item to be carried; then list these items in Table 5-5.

NOTE

Loading Graph information for the baggage is based on baggage loaded in the **centers** of the baggage areas shown in Figure 5-1. The dividing line between the forward and aft baggage zones is located **25" forward** of the baggage compartment bulkhead or just forward of the baggage door.

3. Total the weights and moments/1,000 in Table 5-5 and plot the resulting values on the Center of Gravity Moment Envelope (Figure 5-4). If the plotted point falls within the envelope, the loading is acceptable.

ITEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	WEIGHT (LB.)	MOMENT /1,000 (IN.-LB.)	WEIGHT (LB.)	MOMENT /1,000 (IN.-LB.)
Empty GlaStar	1,224.0	114.7		
Pilot	170.0	17.2		
Passenger	135.0	13.6		
Fuel (6 lb./gal.)	183.6	19.8		
Fwd baggage	100.0	13.6		
Aft baggage	40.0	6.4		
TOTAL	**1,852.6**	**185.3**		

Table 5-5: Loading Problem

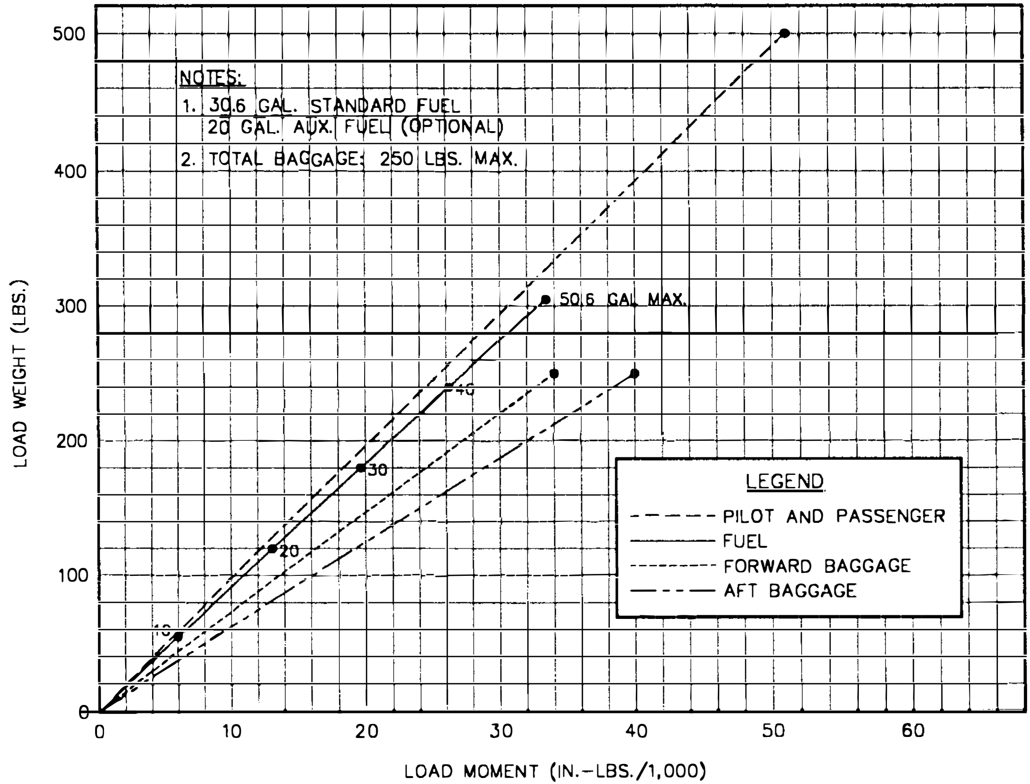

Figure 5-3: Loading Graph

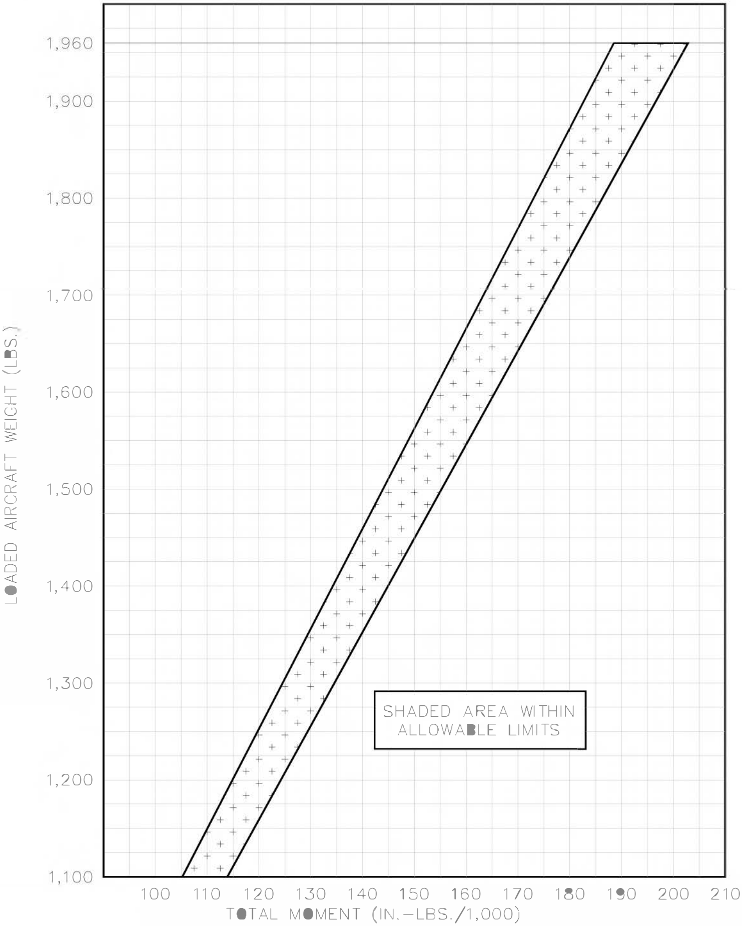

Figure 5-4: Center of Gravity Moment Envelope

SECTION 6

SYSTEMS DESCRIPTIONS

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6-1 POWERPLANT

Powerplants supported by Stoddard-Hamilton for the GlaStar are the Continental IO-240 (125 h.p.), the Lycoming O-320 (150 or 160 h.p., depending on the model) and the Lycoming O-360 (180 h.p.). See "SECTION 2: LIMITATIONS" for further details. Stoddard-Hamilton supplies engine mounts, exhaust systems, cowlings and other firewall-forward options for all of the supported engines.

If you didn't receive one with your engine, we recommend purchasing the operator's manual for the engine model installed in your airplane. Besides operating instructions and performance tables, these manuals have information concerning installation, maintenance and trouble-shooting.

6-2 PROPELLER/GOVERNOR

We recommend a Sensenich fixed-pitch, metal propeller for a Glastar equipped with a Continental IO-240 engine; either a Hartzell constant-speed propeller or a Sensenich fixed-pitch propeller can be used on a Lycoming engine-equipped GlaStar. We recommend a Woodward propeller governor for the Hartzell constant-speed propeller.

NOTE

Some **Lycoming O-360** engines equipped with either Hartzell constant-speed or Sensenich fixed-pitch propellers are restricted from continuous operation within certain r.p.m. ranges. See Section 2-4.6 of this manual for details.

6-3 FUEL SYSTEM

The standard GlaStar fuel system has two main fuel tanks, one in each wing. Standard capacities are 30.6 gallons total in the main tanks. All but 3 gallons of the fuel is usable. The main tanks are vented through 1/4" diameter tubing. The vent lines extend from the outboard ends of the tanks to the wingtips where they exit from the lower wing surface.

Auxiliary tanks are available as an option. These tanks hold 10 gallons each for a total of 20 gallons extra with 17.5 gallons usable. Total usable fuel with auxiliary tanks is 45.1 gallons. The auxiliary tanks feed directly into their respective main tanks via independently operated electric transfer pumps. Each auxiliary tank is vented to the wingtip.

The GlaStar fuel system is primarily gravity-fed. A mechanical fuel pump on the engine supplies fuel pressure to the carburetor for a Lycoming engine or the fuel injection system on the Continental. The IO-240 Continental requires a fuel return line from the fuel injector to the main fuel tank and also uses a supplementary electric boost pump for start-up, takeoff and landing operations.

A two-position fuel valve with positions for fuel OFF and fuel ON is used for fuel management. A fuel sump drain is mounted at the bottom of each main and auxiliary tank. Additionally, a low-point drain is located under the belly of the aircraft.

A fuel screen is fitted to the fuel pickup in each tank and a cartridge-type fuel filter or a gascolator is required at the low point of the fuel line forward of the firewall.

A carbureted engine can be primed with an optional hand-actuated essex pump located on the instrument panel.

6-4 OIL SYSTEM

The engine oil system uses a mechanical oil pump with a wet sump on the bottom of the engine. The preferred location for the oil cooler radiator is on the firewall with air ducted to it from an opening in the engine baffling.

Oil capacity is 6 quarts for the Continental engine and 8 quarts for Lycoming engines. Refer to your engine operator's manual for recommended oil types and viscosity.

6-5 LANDING GEAR

All three gear struts on the tricycle-gear GlaStar are of the Wittman tapered-rod design. The struts are made from heat-treated steel

5.00 × 5 wheels and brakes are used on the main gear. A 5.00 × 5 wheel, fitted with an 11 × 4.00-5 tire, is used on the nose gear.

The nose gear is free-castering, and steering is accomplished by differential braking. A compression-spring shimmy damper is incorporated on the nose gear.

Toe-in on the main gear is 1/32" measured at the end of the axle, or about 1/3°.

6-6 BRAKES

Hydraulic brakes and master cylinders are used, with toe pressure on the tops of the rudder pedals causing braking action. The brake fluid reservoir is mounted to the aft side of the firewall. Brake pedals on the pilot's side are standard equipment on the GlaStar; dual brake controls are available as an option.

6-7 COCKPIT

The GlaStar provides comfortable side-by-side seating for two passengers up to 6 ft. 7 in. tall and weighing up to 250 lb. Cabin width is approximately 44 in., which provides plenty of room for a fully equipped instrument panel if desired.

The GlaStar has two cabin doors; each door is secured by a four-point latch system actuated by a single handle. The doors open fully forward—an essential feature for float operations. The doors can be cracked open for ventilation during ground taxi, although we recommend securing them in gusty winds or when taxiing through the prop wash of another airplane.

Baggage is stored directly behind the seats and should be securely anchored down when in flight. A baggage door is provided on the left side of the aircraft just behind the pilot's door. Larger baggage can be loaded through the large cabin doors by folding the seat backs forward.

WARNING

Do not place any small loose articles in the baggage compartment. All baggage must be stowed in containers such as packs, suitcases or bags. A small article, if misplaced, could bind up a control linkage causing loss of control of the aircraft.

6-8 CONTROL SYSTEM

The primary controls on the GlaStar are of a conventional 3-axis design using dual stick controls for pitch and roll and dual rudder pedals for yaw. Positive travel stops are provided for all primary controls.

The large Fowler flaps are manually actuated by a lever mounted between the seats. A thumb-operated button releases a spring-loaded locking pin from a detent in a ratchet plate, allowing the lever to be moved to the desired position. The ratchet plate has three positions for flap extensions from 0° to 40°.

The elevator, aileron and flap control interconnections are by cables to bellcranks, with a pushrod connecting each bellcrank to its control surface. The rudder is controlled by cables directly to the rudder actuator yoke. The aileron and flap control cables are routed in such a way that they need not be disconnected when the wings are folded.

The GlaStar elevator trim system uses a large trim tab in the elevator. Standard elevator trim is manually operated by a cockpit-mounted trim wheel; electric trim is optional.

See Figures 6-1 through 6-4 for schematics of the control systems.

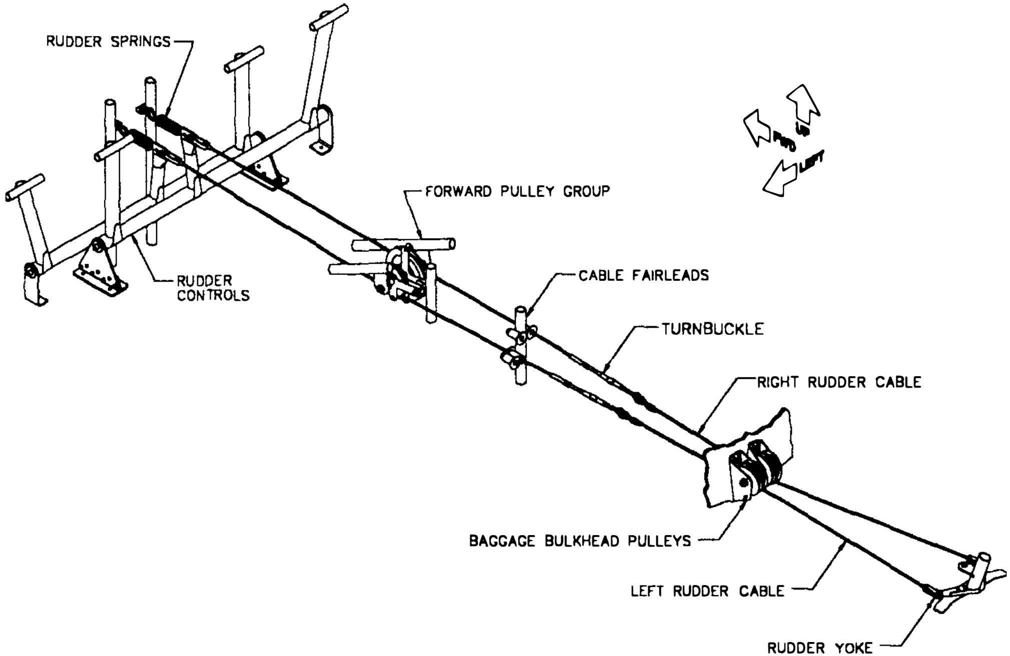

Figure 6-1: Rudder Control System

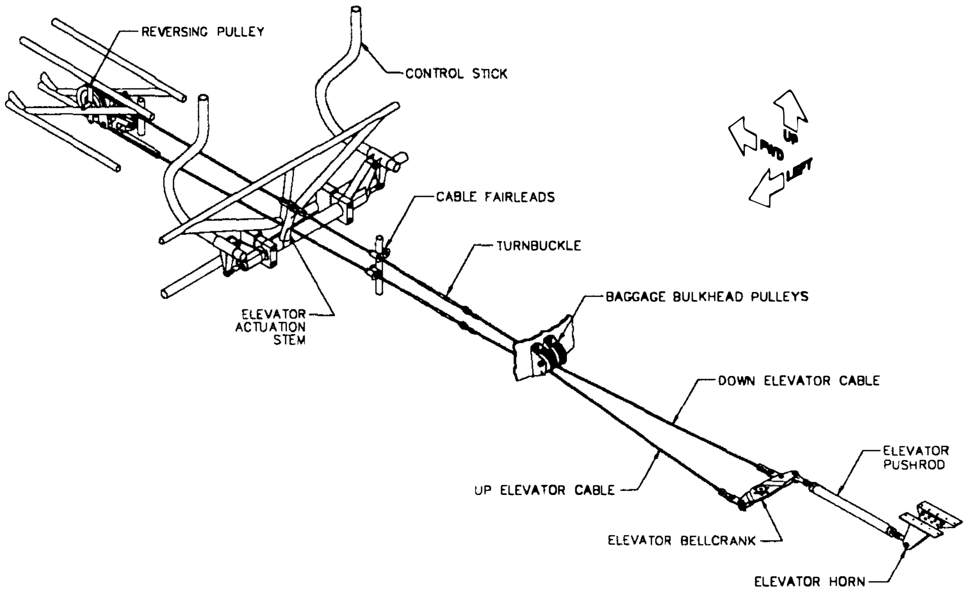

Figure 6-2: Elevator Control System

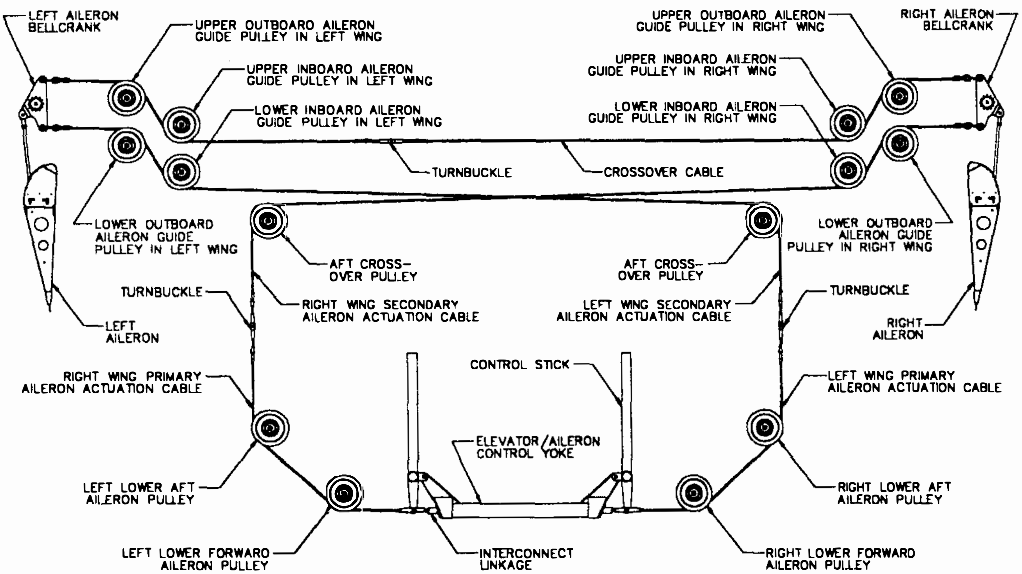

Figure 6-3: Aileron Control System

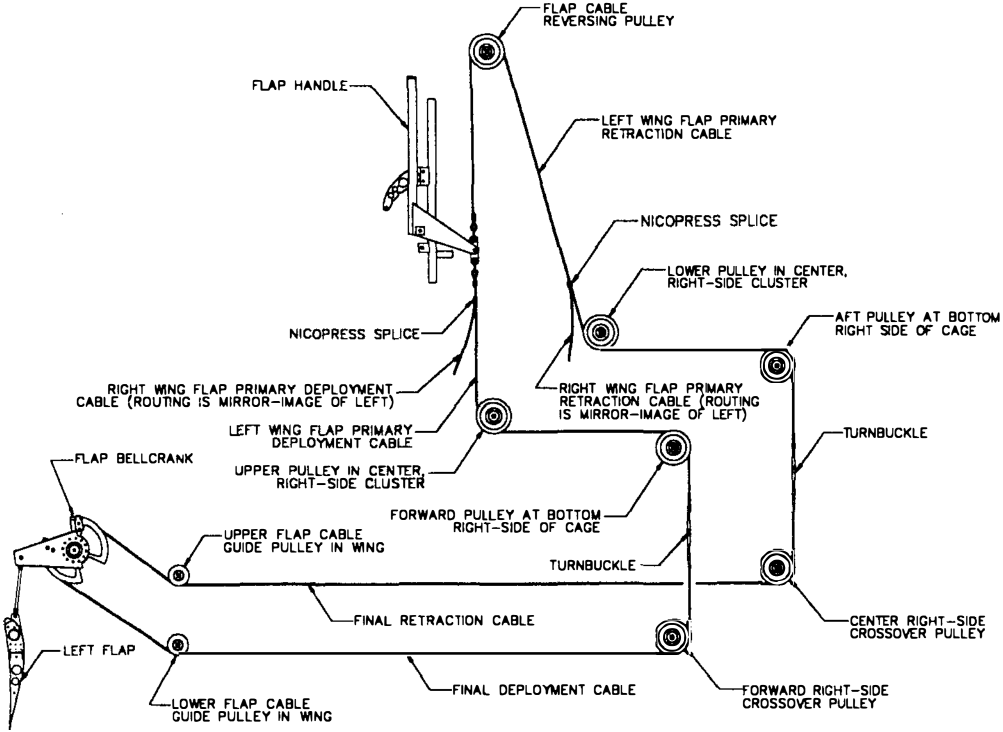

Figure 6-4: Flap Control System

6-9 WING-FOLD SYSTEM

The GlaStar features folding wings and a removable horizontal stabilizer to permit trailering the airplane to and from the airport and storing it in a garage or rental storage unit. With the wings folded, it's also possible for the GlaStar to share hangar space with another airplane. When folding the wings, there is no need to disconnect control cables, fuel lines, electrical wiring or the pitot line.

Optional support struts that fit between the wing forward spars (near the roots) and the lower ends of the wing struts are available to support the wings when folded. These struts help "unload" the spar pins, making the pins easier to remove, as well as holding the wing in the proper alignment so that the spar lines up properly with the cage when the wing is folded back into flight position. Another pair of optional struts installed between the wing rear spar (near the tip) and the vertical fin spar hold the wings in their fully folded positions to keep them from swinging back and forth.

Since the horizontal stabilizer is longer than the legal highway width, it must be removed for trailering. This is easily accomplished using simple hand tools to disconnect the elevator and trim controls and to unbolt the stabilizer from its support structure. Having an assistant simplifies the job, only because the stabilizer is somewhat unwieldy for one person to handle.

See Section 7-4 for a description of procedures to fold the wings and remove the stabilizer.

6-10 HEATING AND VENTILATION SYSTEMS

Optional cabin heat is provided by a heat exchanger mounted on the exhaust system, with a heat valve mounted on the firewall. A push-pull cable control opens and closes the cabin heat valve. If desired, the warm cabin air can be diverted to provide windshield defrosting as well as heating for the occupants.

Two optional cabin vents provide fresh air ventilation for the cockpit area. NACA-style inlet ducts on both sides of the fuselage feed air into boxes which incorporate "eyeball" vent valves to control the flow of ventilation air into the cockpit.

6-11 ELECTRICAL SYSTEM

The electrical system is optional in the GlaStar and, thus, will vary widely among individual GlaStars. The only difference between the GlaStar's electrical system and that of more conventional aircraft is that the composite aft fuselage structure on the GlaStar cannot be used as a ground. Instead, a negative (ground) lead as well as a positive (power) lead is required for any electrical equipment mounted aft of the fuselage cage. All circuits should be protected by appropriate circuit breakers, which can be either rocker-arm style or the standard push-pull type.

Optional navigation/strobe light units can be mounted to the wingtip fairings. The standard lower engine cowling has a molded recess for a landing light lens, so an optional landing light can be easily installed.

6-12 INSTRUMENTATION

The GlaStar instrument panel is required by the FARs to have at least the following instruments:

1. Airspeed indicator
2. Altimeter
3. Tachometer
4. Magnetic compass
5. Fuel quantity gauge for each main tank
6. Oil temperature gauge
7. Oil pressure gauge
8. Manifold pressure gauge (required for constant-speed propeller)

NOTE

Different engine instruments are required for liquid-cooled engines.

Do not fly your GlaStar without these instruments all working and calibrated properly. Refer to "SECTION 2: LIMITATIONS" for recommended instrument range markings.

Besides these instruments, FAR part 91.52 requires that an emergency locator transmitter (ELT) be installed for all flights beyond a 50 mile radius of the airport of departure. The ELT must have a remote actuation switch on the panel.

Instruments such as a directional gyro or artificial horizon, if used, are typically operated by vacuum pressure. We recommend using an electric turn and bank indicator if a vacuum system is used for the artificial horizon, so that a back-up system is available in the event of a vacuum system failure. If an electrical system is used, an ammeter should also be used in conjunction. All additional instruments, avionics, etc. are subject to the builder's preferences.

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SECTION 7

HANDLING, SERVICE AND MAINTENANCE

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7-1 GENERAL

The purpose of this section is to describe ground handling procedures for the GlaStar and also to outline the requirements for maintaining the aircraft in an airworthy condition. The Federal Aviation Regulations (FARs) place the responsibility for the maintenance of this airplane on the owner and operator, who must ensure that all maintenance is done in conformity with established airworthiness requirements.

The FAA, on request, will issue a repairman's certificate to the original builder of an experimental amateur-built aircraft. This certificate enables the builder to perform all the maintenance and overhaul work necessary to keep the aircraft in legal flying condition, and also enables the builder to conduct the annual condition inspection. The certificate applies only to the individual aircraft (not to others of the same model), and is non-transferable; if the airplane is sold, the new owner must have a licensed mechanic (or the original builder) perform maintenance and the annual inspection. Specific information regarding repairman certification can be found in AC 65-23, *Certification of Repairmen (Experimental Aircraft Builders)*.

All limits, procedures, safety practices, time limits, and servicing and maintenance requirements contained in this handbook are considered mandatory.

When testing a new experimental aircraft, inspection after each flight is **essential** for the first 25 hours. We cannot stress this enough. Any problems are most likely to occur during the initial hours of flight testing. For the second 25 hours, we recommend performing a major inspection after each 5 hours of flight or if anything appears out of the ordinary. After the first 50 hours of flight, we recommend another major inspection at 75 hours, and then at the 100 hour mark. The FARs require that a condition inspection of the airplane be completed and signed off every year. Review all items listed in the annual condition inspection checklist (Section 7-8) annually. If desired, the owner may also inspect the airplane at 100 hour intervals.

Inspection of your GlaStar is at your discretion (except for the annual inspection, which is required by law). The above suggestions are given as guidelines; each builder should devise a schedule of periodic inspections for his or her aircraft.

7-2 GROUND HANDLING

One person can move the airplane on a smooth, level surface using the optional tow bar. Insert the tow bar pins through the holes in the nose gear wheel fairing into the tow bar tube on the nose gear fork. Slide the nylon sleeve down the tow bar to lock it in place.

CAUTION

1. If you push or pull on the propeller blades to help move the airplane, grasp the blades near the hub and make sure that the magnetos are off, the throttle is closed and the mixture is in the idle cut-off position.
2. Do not exert force on the control surfaces.
3. Do not push or lift on the stabilizer strakes.
4. Do not force the nose gear beyond the pivot stops by attempting too tight a turn.

5. Do not push the airplane backwards unless the nose wheel is being steered by the tow bar; unless steered, the nose wheel will try to caster, which may result in damage to the pivot stops or the nose gear fork.

7-3 TIE-DOWN

It is best to secure the airplane with the nose into the wind. We recommend installing tie-down eyes at both outboard wing strut attach points and at the tail.

1. Secure the airplane at the three points, using nylon line or chain.
2. Chock the main wheels, fore and aft.
3. At least, use a lap belt to tie the control stick back to protect the ailerons and elevator from gusts. External gust locks, especially on the rudder, are also recommended.
4. If high winds are expected, prop the tail with a support and tie the nose wheel down.
5. Use a cabin cover to keep moisture and sunlight from entering the cockpit.
6. Make sure that all drain holes in the tail section are clear to prevent the collection of water in any part of the airframe.

7-4 FOLDING THE WINGS AND REMOVING THE STABILIZER

7-4.1 Folding the Wings

To fold the wings for storage or to prepare the airplane for trailering, follow these steps:

1. Chock the main wheels fore and aft so that forces exerted to fold the wings do not move the airplane.
2. When the wings are folded, the fuel tank vent line inlets are below the tops of the tanks, so plug the fuel tank vent lines to prevent fuel from overflowing.
3. Remove the top-deck hatches to provide space for the inboard ends of the flaps.
4. Install the support struts between the eye bolts at the forward spar roots and the bases of the wing struts (optional, but recommended).
5. Fasten the wing securing struts to their fittings on the wing aft spars, but just leave them hanging for now so they'll be ready to secure to the fittings on the vertical fin (optional).
6. Remove the safety clip and the spar pin on one side to disconnect the forward wing spar from the fuselage cage.

CAUTION

Hold onto the wing strut with one hand (or have an assistant hold onto the strut) when removing the pin, as the wing may start rotating aft once the forward spar is free of the cage.

7. Rotate the free wing back until it is parallel to the fuselage and (optional, but recommended) secure it to the vertical fin.
8. Repeat Steps 6 and 7 for the other wing.

NOTE

With one wing folded, the GlaStar's CG moves to a point very near the main gear, meaning the aircraft can easily be tipped onto its tail, where it will remain. With both wings folded, the CG is well aft of the gear, meaning the aircraft will definitely settle on its tail unless supported. Therefore, it is recommended either to support the tail before folding the second wing or to set the aircraft gently back on its tail after folding the first wing but prior to folding the second. With both wings folded, the aircraft can easily be moved on the ground "wheelbarrow fashion" by lifting on the wingtips.

If the airplane is to be trailered, instead of just stored at the airport, the support struts mentioned in Step 4 are **essential** to prevent structural damage caused by flexing when the trailer passes over bumps. Also for trailering, the quick-release pins at both ends of all four support struts should be replaced with AN3 bolts and nuts, and the ailerons should be padded and secured to prevent them from banging against the trailing edge support struts. For the greatest possible security, you may wish to use a ratchet-type loading strap around both wings and the fuselage to absolutely insure that the wings cannot unfold while the aircraft is being trailered.

CAUTION

The GlaStar is not intended to be towed for any significant distance or at any speed above a walking pace on its own gear. Neither the wheels and bearings nor the tires are designed for sustained highway speeds.

To extend the wings from the folded positions, the operations described above are simply reversed. The spar pins are visible from inside the cockpit so it is easy to verify that they are correctly installed and their safety clips are in place.

WARNING

Besides verifying the security of the spar pins and safety clips after extending the wings, make sure to remove the fuel tank vent line plugs before flight.

7-4.2 Removing the Horizontal Stabilizer

Since the horizontal stabilizer is longer than the legal highway width in most locales, it must be removed for trailering. Follow these steps to remove the stabilizer:

1. Remove the tail cone and the rudder base fairing.
2. Disconnect the elevator trim. For manual trim, this involves unbolting the end of the trim cable from the trim tab horn, removing the trim cable retainer clip from the underside of the elevator and, finally, snaking the trim cable out through the slots in the elevator skins. For the optional electric trim, it's necessary only

to unplug the trim-servo wiring harness.

3. Disconnect the elevator pushrod from the elevator control horns.
4. Remove the four bolts that secure the stabilizer aft attach brackets to the tail cone bulkhead.
5. Pull the stabilizer aft until the forward spar alignment pins are free of the bushings in the forward attach bracket.
6. Lift the stabilizer/elevator assembly free of the fuselage; this is most easily accomplished by two people, one at each tip.

To remount the stabilizer on the fuselage, reverse the operations described above. Again, it's best to have two people involved, especially to get the stabilizer in position with the spar pins properly seated in the forward attach bracket bushings.

7-5 JACKING THE AIRPLANE

The GlaStar must be jacked up and supported on jack stands for periodic landing gear maintenance and for annual inspections.

You have several options for jacking the GlaStar. If you have a hangar with a sturdy roof structure, you can simply hoist the airplane by the lifting eyes welded to the fuselage cage. If you have access to a pair of tall, Cessna-type airplane jacks, position them under the outboard wing strut mounting bolts that are visible near where the struts protrude from the wings. If these options aren't available, you can use a short bottle jack or scissors jack to lift the airplane by the main landing gear struts just inboard of the wheels. If you choose this option, you will need to devise some sort of adapter that either clamps to the strut or mounts on the jack to keep the strut from slipping off the jack. A final alternative, if you have plenty of help, is to have several helpers lift the airplane by one wing near the tip while you position a jack stand under the main gear strut. (The jack stand could consist of a simple 8–9" long 4 × 4 wooden block with the ends cut off square and a semi-circular notch cut in one end to cradle the axle.) Whatever method you use, it's necessary to lift the airplane only just enough for the tires to clear the floor by about 1".

To work on the nose gear, you can lever the nose wheel off the floor by pushing down on the tail. Support the tail of the airplane with a sturdy, padded sawhorse under the aft fuselage and place padded weights on top of the horizontal stabilizer (close to the vertical fin) to keep the airplane from tipping onto its nose. Again, it's necessary to lift the nose wheel tire off the ground by only about 1".

WARNING

No persons should be under the airplane while in the process of lifting it. Only after you have finished jacking and checked the airplane for security on its supports should you crawl under the aircraft.

7-6 OUT-OF-SERVICE CARE

7-6.1 GENERAL

The following guidelines are meant to help prevent deterioration of the aircraft during periods of non-use or limited use. These procedures are applicable for situations in which the airplane is not used for periods of time between 7 and 30 days.

NOTE

If the aircraft is to be stored for longer periods, consult your engine operator's manual for engine preservation recommendations.

7-6.2 MOORING

If a hangar is not available, secure the aircraft as described above in the section on tie-down (Section 7-3). To prevent oxidization of the finish, we recommend the use of light-colored slip covers over the composite fuselage during extended periods of outdoor tie-down.

7-6.3 ENGINE PREPARATION FOR STORAGE

Engines in airplanes that are flown only occasionally tend to exhibit much more cylinder wall corrosion than engines that are flown frequently. To prepare an engine for storage, check for correct oil level and add oil if necessary to bring the level to the full mark. Then, run the engine for at least five minutes at 1,200–1,500 r.p.m. with oil and cylinder head temperatures in the normal operating range. This procedure coats all of the bearing surfaces and cylinder walls with oil to prevent internal corrosion. Letting the engine reach normal operating temperatures during this procedure helps to drive condensed water and other corrosive combustion by-products out of the engine.

7-6.4 Fuel Tanks

Top up the fuel tanks to prevent condensation of water in the tanks.

7-6.5 Pitot Tube

Install cover.

7-6.6 Windshield and Doors

Make sure both cabin doors are securely closed. If the aircraft is stored outdoors, we recommend that covers be installed over the cabin area to keep out moisture and sunlight.

7-6.7 During Flyable Storage

Each seven days during flyable storage, rotate the propeller by hand. After rotating the engine six revolutions, stop the propeller 60° to 120° from its former position.

WARNING

Before rotating the propeller blades, make certain that the magneto/start switch is off, the throttle is closed and the mixture is in the idle cut-off position. Always stand in the clear when turning the propeller. There is always some danger that a cylinder will fire when the propeller is moved. The best procedure is to turn the propeller backwards, or counter-clockwise as viewed from the cabin, so the impulse coupling cam in the magneto cannot catch and fire a cylinder.

If, at the end of 30 days, the airplane will not be removed from storage, the engine should be started and run. The preferred method is to fly the airplane for 30 minutes.

7-6.8 PREPARATION FOR RETURN TO SERVICE

Remove all covers, gust locks, etc., and give the airplane a thorough inspection. Particularly check control openings and the cowl inlets and outlets for bird nests. Preflight the airplane following procedures in Section 4-2.

7-7 50 HOUR POWERPLANT INSPECTION

In addition to the daily preflight inspections, make the following engine maintenance inspection after every 50 hours of operation. This inspection is in accordance with the Lycoming engine *Operator's Manual.* Procedures for the Continental engine are similar.

7-7.1 GENERAL ENGINE COMPARTMENT

Check fuel and oil line connections and repair any leaks. Make sure that the cowling and baffling are in good condition and securely mounted. Any damaged or missing part of the cooling system must be replaced before the aircraft resumes operation. Inspect and service the air filter.

7-7.2 IGNITION SYSTEM

If spark plug fouling has been apparent, rotate the lower plugs to the upper position.

Examine the spark plug cable leads and the spark plug ceramics for corrosion and deposits. This condition is evidence of either leaking spark plugs or improper cleaning of the spark plug walls or connector ends. Where this condition is found, clean with alcohol or MEK. All parts should be clean and dry before reassembly.

Check the ignition harness for security of the mounting clamps and make sure all connections are tight and properly torqued at the spark plug and magneto terminals.

7-7.3 Fuel and Induction System

Check the primer lines (if installed) for leaks and security of clamps. Remove and clean the carburetor or injector fuel-inlet strainers. Check the mixture, throttle and carb heat control linkages for travel, freedom of movement and security of clamps; lubricate if necessary. Check the air intake duct (carb heat valve) for leaks and security.

Remove and inspect the air filter element. For the Brackett air filter used with our optional Lycoming induction system, replace the element after 200 hours of use or every 12 months or when it is difficult to see light through it due to foreign material. Clean with compressed air; do **not** wash and reuse. These filters are chemically treated to make them more effective.

7-7.4 Oil System

If your engine is due for an oil change (see NOTE below), drain the crankcase oil and then replace and safety-wire the drain plug. If the engine is equipped with an external, full-flow oil filter element, replace it. We recommend opening the old filter with an oil filter can cutter to inspect for metal particles that might indicate engine damage.

NOTE

For both Lycoming and Continental engines, intervals between oil changes can be increased by at least 100% on engines equipped with full-flow oil filters. This increase in oil change interval is recommended only if an air filter is also installed. For Lycoming engines, see Service Instruction 1319 B for further details. For Continental engines, refer to your engine *Maintenance Manual.* Also see Section 7-9.1 of this manual.

If the engine is not equipped with an external, full-flow oil filter, check the oil suction and oil pressure screens for metal particles. Check all oil lines for leaks, chafing, dents or cracks. Refill the engine with fresh oil.

7-7.5 EXHAUST SYSTEM

Check the attaching flanges at the exhaust ports on the cylinders for evidence of leakage. Examine the exhaust manifold for general condition. Inspect for cracks, especially in the cabin heat muff area. Soot on the inside surface of the heat muff shroud indicates the presence of cracks. Any cracks must be repaired by welding before further flight.

WARNING

Stainless steel exhaust systems must be repaired by qualified personnel using special methods to prevent contamination of the metal during welding, otherwise cracking may persist.

7-7.6 Cylinders

Check the rocker box covers for evidence of oil leaks. If leaks are found, replace the gaskets and tighten the screws to 50 inch-pounds.

Check the cylinders for cracked cooling fins and for excessive heat which is indicated by burned paint on the cylinder. Excessive heat is indicative of internal damage to the cylinder; if found, its cause must be determined and corrected before the aircraft resumes operation.

7-8 ANNUAL CONDITION INSPECTION

The service and inspection procedures described below must be performed annually in accordance with the scope and detail of Appendix D of FAR part 43. If the aircraft is found to be in a condition for safe operation, a proper entry must be made in the airplane's log book by an authorized person (the original builder or a licensed A&P mechanic), certifying the condition of the airplane.

The following checklist is intended as a guide and is not represented to be complete. It is the responsibility of the operator and repairman to inspect and maintain the entire aircraft in an airworthy condition.

7-8.1 Powerplant and Propeller

A. Engine Run-up: start the engine and warm it up thoroughly. Check the following:
   1. Oil pressure.
   2. Alternator output.
   3. Left magneto drop.

4. Right magneto drop.
5. Propeller control and governor action.
6. Suction gauge.
7. Static r.p.m.
8. Idle r.p.m.
9. Carburetor heat.
10. Magneto ground.
11. Mixture cut-off r.p.m. rise at idle.

B. Engine Inspection and Service:

1. Remove the engine cowling and check for leaks and stains.
2. Perform a compression check. Record the results in the engine log book.
3. Drain the oil; clean the screen or replace the filter.
4. Replace and safety-wire the screen or filter.
5. Refill the crankcase with fresh oil.
6. Clean and adjust the spark plugs; rotate upper and lower plugs.
7. Check the ignition harness for breaks; check the cigarettes and contact springs.

C. Magnetos

1. Lubricate the breaker cam follower.
2. Check the point gap and the condition of the points.
3. Check the P-leads for breaks, frays.
4. Check and adjust the magneto timing.

D. Engine Controls: check the following controls for security, full range of travel, chafing, safety. Lubricate if necessary.
   1. Throttle.
   2. Mixture.
   3. Prop pitch control.
   4. Carburetor heat.

E. Battery Inspection:
   1. Clean the battery terminals.
   2. Clean the battery box (if installed).
   3. Check the electrolyte level and top up.
   4. For an enclosed battery box, inspect the drain tube and vent lines for damage and obstructions.

F. General Engine Compartment and Engine Accessories:
   1. Inspect the alternator: mounting, wiring, terminals.
   2. Inspect the alternator belt and adjust its tension, if needed.
   3. Inspect the starter: wiring, terminals, brushes.
   4. Remove the cabin heat muff and check the exhaust system for cracks. (Soot on the inner surface of the heat muff indicates a crack.)
   5. Check the exhaust pipes, muffler, gaskets and shrouds for security and cracks.

NOTE

GlaStar Service Bulletins 32 and 32A or 33 prescribe specific inspection requirements for Stoddard-Hamilton exhaust systems installed on Lycoming engines with Dynafocal mounts.

6. Check the cylinder baffles for cracks and proper seal.
7. Check the engine mount for security, rust, chafing and condition of the rubber bushings.
8. Check the engine for loose nuts, bolts and screws.
9. Check the oil cooler and lines for security, chafing and obstructions.
10. Check the primer system for leaks, if installed.
11. Check all breather and overboard lines for security and obstructions.
12. Inspect the fuel filter element and replace if necessary. Safety-wire the fuel filter bowl.
13. Clean the carburetor or injector screens and check the fuel flow.
14. Inspect the carburetor or injector and the fuel lines for security and leaks.
15. Inspect the cabin heat muff, heat valve and hoses for security and leaks.
16. Inspect the carburetor heat box, damper and hoses for condition and operation.
17. Remove the propeller spinner and check the spinner, front plate and back plate for security and cracks.
18. Inspect the propeller track. Check the blades for nicks. Check torque of the mounting bolts. Re-safety the bolts. Grease the propeller hub, if applicable. Reinstall the spinner.
19. Inspect the induction air filter and clean with compressed air. Replace if it is difficult to see light through it due to foreign material or if it has been in service for 12 months or 200

hours since last replacement.

20. Inspect all engine compartment wiring for security, cracked or brittle insulation and chafing. Replace any nylon tie wraps or spiral wrap that is brittle or discolored.
21. Wash the engine and cowling, using a suitable solvent or engine degreaser.
22. Check the cowling for chafing, cracks or heat damage.
23. Check the engine for any loose hardware and tools that may have been left in the engine compartment during maintenance.

G. Ground Run-up Check:

1. Oil pressure.
2. Alternator output.
3. Left magneto drop.
4. Right magneto drop.
5. Prop control and governor action.
6. Suction gauge.
7. Static r.p.m.
8. Idle r.p.m.
9. Carburetor heat.
10. Magneto ground.
11. Mixture cut-off r.p.m. rise at idle.
12. After engine shut-down, check for oil leaks.
13. Reinstall the lower cowling and check the operation of the landing light.

7-8.2 CABIN, FUSELAGE AND EMPENNAGE

Remove the glare shield, forward and aft control cable covers, seat pans, baggage compartment bulkhead, baggage shelf, tail fairings, horizontal stabilizer and forward and aft inter-bulkhead shearwebs, as necessary. Inspect the following:

A. Inspect the control system cables, pulleys, pushrods and rod-end bearings for corrosion, safety, security and chafing. Lubricate all pivot points, bearing surfaces and pulleys as necessary. Check the following systems:
   1. Aileron system.
   2. Elevator system.
   3. Rudder system.
   4. Flap system.
   5. Trim system.

B. Inspect the rudder pedal weldments, control stick pivot brackets and aileron/elevator control yoke for excessive play. Tighten or replace any excessively loose bolts.

C. Check the operation of the fuel selector valve. Check the valve markings.

D. Check all fuel lines for leaks, security and chafing.

E. Drain the fuel tank sumps and check for contaminants. Remove and clean the fuel sump strainers (finger screens) if excessive contamination is apparent.

F. Check the instruments for security, legibility and markings.

G. Check the fuel tank gauges and senders, if applicable, for proper markings, indication and freedom of movement.

H. Check the compass for discoloration, fluid leaks and compass correction card displayed.

I. Check the circuit breakers and switches for security and condition.

J. Replace the vacuum air filter.

K. Check all instrument wiring and plumbing for security and chafing. Replace any nylon tie wraps or spiral wrap that is brittle or discolored.

L. Check radio equipment, wiring and antennas. Check the ELT battery for replacement date.

M. Check all Plexiglas for cracks.

N. Check the door hinges and latches. Lubricate as required.

O. Inspect the fuselage cage welds for cracks or stress marks.

P. Check the static ports and the pitot/static plumbing.

Q. Check the seat pans for cracks or stress marks.

R. Check the seat belts and shoulder harnesses for security and condition.

S. Check the brake master cylinders and brake line fittings for leaks. Check the brake lines for security.

T. Top up the brake fluid reservoir, leaving an air space for fluid expansion.

U. Check the stabilizer, elevator, rudder and trim tab for dents, cracks, corrosion and loose rivets. Check the security of the stabilizer alignment pins and the aft stabilizer attach bracket.

V. Check the empennage counterweights for cracks, security and chafing.

W. Check and lubricate the elevator, rudder and trim tab hinges. Verify that the hinges are properly safetied.

X. Check all aft-fuselage bulkheads for integrity. Check security of the forward stabilizer attach bracket and aft stabilizer attach nutplates. Check all aft-fuselage drain holes for obstructions.

Y. Reinstall the forward and aft inter-bulkhead shearwebs and the stabilizer. Reattach the elevator pushrod and the trim system.

Z. Check the elevator and the rudder for proper travel:
   1. Elevator: 23° up and 20° down (±1°).
   2. Rudder: 25° left and right (±1°).

7-8.3 LANDING GEAR

A. Remove the wheel pants. Clean the interiors of the pants of any accumulation of mud or other debris.

B. Check the wheel pant backing plates for cracks and security.

C. Check the landing gear struts for general condition.

D. Check the landing gear support structure for evidence of damage. Check the landing gear strut attach hardware for security and integrity.

E. Check the tires for cracks, wear and proper inflation.

F. Repack the wheel bearings and inspect the wheels for cracks and corrosion.

G. Check the brake mounting flanges for tightness and security. Replace attach bolts if worn. Replace flange weldment if holes are elongated.

H. Inspect the brake discs for excessive scoring, the brake lines for leaks or chafing and the brake pads for wear. Replace the brake pads, if necessary, using the procedures described in Section 7-9.5.1. Check the operation of the brakes and bleed them, if necessary, as described in Section 7-9.5.2.

I. Check and adjust the nose gear axle nut tension using the procedures described in Section 7-9.4.

J. Check for loose hardware and tools in the fuselage and tail areas.

K. Vacuum the cockpit area. Clean the windshield and the canopies.

L. Reinstall the interior panels, the tail fairings and the landing gear fairings.

7-8.4 Wings

A. Remove all inspection covers and the wingtip fairings.

B. Check the wing attach pins, bolts and fittings for security, integrity and safety.

C. Check the wing and control surface skins for cracks, dents, corrosion and loose rivets.

D. Check the wingtip fairings for cracks and stress marks.

E. Check all wiring and plumbing for chafing and security.

F. Check all aileron and flap control cables, pushrods, rod-ends, bellcranks and hinges for corrosion, safety, security and chafing. Lubricate pivot points and bearing surfaces as necessary.

G. Check the ailerons for proper travel: 22.5° up and 17.5° down (±1°).

H. Make sure the flap guide-arm bearings contact the ends of the flap track slots in the fully retracted and extended flap positions. Check the roller bearings for wear and replace if necessary.

I. Inspect the aileron counterweights for integrity, security and chafing. (Be sure any wiring in the wing tips cannot jam the aileron counterweights.)

J. Check the fuel tanks and fuel tank fittings for leaks. Check the fuel lines and vent lines for integrity and freedom from chafing.

K. Check the fuel filler caps for proper labeling.

L. Check the pitot tube for security. If a heated pitot tube is installed, make sure the drain hole is clear. Check the pitot line for integrity and freedom from chafing.

M. Check the navigation and anti-collision lights for secure mounting.

N. Check inside the wings for loose hardware and tools.

O. Reinstall the wingtip fairings and check the operation of the navigation and anti-collision lights.

P. Reinstall the inspection covers.

7-8.5 Paperwork

Make sure the following documents are present, current and properly displayed (if applicable):

A. Airworthiness certificate.
B. Registration certificate.
C. Operating limitations (issued by your airworthiness inspector).
D. Weight and balance.
E. Placards.
F. Radio station license (for international flight only).
G. This *Owner's Manual.*
H. Log book: make a log book entry, noting any discrepancies and other pertinent information. Sign off the annual condition inspection as required by the operating limitations imposed with your Experimental Airworthiness Certificate.

7-9 SERVICING

7-9.1 OIL SYSTEM

CAUTION

Oil consumption tends to be higher during break-in periods on new engines. Prolonged flights should be avoided and oil level monitored closely during this period. New or newly overhauled engines should be operated on straight mineral oil for a minimum of 50 hours or until oil consumption has stabilized. After this period, a change to an approved additive oil may be made.

Consult your engine operator's manual for the recommended grades of oil to be used.

The engine oil filler cap and dipstick are accessible through the access door on the right side of the upper engine cowling. Maximum oil sump capacity for the Continental engine is 6 quarts. Oil capacity of the Lycoming engines supported for the GlaStar is 8 quarts.

If a Lycoming engine is not equipped with an external full-flow oil filter, the oil should be changed and the oil suction and oil pressure screens cleaned and checked for metal particles every 50 hours. If a Lycoming engine is equipped with an external full-flow oil filter and also an air filter, the oil change intervals may be increased to every 100 hours as long as the oil filter element is replaced every 50 hours. See Lycoming Service Instruction 1319 B. If the engine does not have an air filter, change the oil every 50 hours.

The Continental IO-240 engine, if equipped with only an integral oil screen, must have its oil changed and the screen cleaned every 25 hours. If the engine is equipped with either a large (approximately 5.8" high) or a small (approximately 4.8" high) external full-flow oil filter, the interval between oil and filter changes can be increased: 100 hours between changes for the large filter and 50 hours for the small filter. For any filter configuration, the oil and filter must be changed at least every 6 months, regardless of how much time has accumulated on the engine.

To assure complete drainage of the old oil for an oil change, the engine should be run until it reaches normal operating temperature prior to the change.

We recommend keeping a record in the flight log of all oil added between changes. This practice monitors changes in oil consumption patterns that can serve as a warning of impending problems. An oil analysis performed at every oil change is another valuable tool for monitoring the engine's condition.

7-9.2 BATTERY

If an unsealed battery is used, check the electrolyte level after each 25 hours of engine operation. Add distilled water if necessary. Do not fill the battery cells above the bottom of the split ring. If the battery is filled when in a low state of charge, it will overflow when charged.

CAUTION

Excessive overcharging can cause heating and boiling.

Excessive water consumption may be an indication that the voltage regulator requires adjustment.

If an enclosed battery box is used, it must have a drain to eliminate liquids that might collect in the box and it must be vented overboard to dispose of hydrogen gas and electrolyte fumes that are discharged during normal operation. To ensure proper venting of the fumes and gas, inspect the vent tubes periodically for condition and obstructions. Also inspect the battery box drain tube.

7-9.3 TIRES

Tire Specifications:

Main Gear: 5.00 × 5, 6-ply rating
Nose Gear: 11 × 4.00-5, 8-ply rating

Maintain an inflation pressure of 35 to 50 p.s.i. in the main wheel tires. Inflate the nose wheel tire to 50 p.s.i. Inspect the tires for breaks and cuts when inflating.

7-9.4 NOSE GEAR SHIMMY DAMPER

Nose gear shimmy in the GlaStar is prevented by tightening the nose gear fork axle nut against the compression of a set of spring washers. Since normal wear reduces the compression applied to the spring washers, check the axle nut tightness periodically—at least every 50 hours or if shimmy is encountered during normal operations.

To check the shimmy damper tightness, use a fisherman's pocket spring scale attached to the end of the nose gear fork arm to measure the force needed to rotate the fork around the axle. This force must be between 15 and 20 pounds. If the force needed to rotate the fork is less than 15 pounds, tighten the pivot axle nut until the rotation force is within the desired range. Tighten the nut a little more, if necessary, to align the castellations in the nut with the hole in the pivot axle.

7-9.5 BRAKES

Check the brake hydraulic fluid level periodically and top it up if necessary.

There is no need to adjust the brakes since the brake pistons move to compensate for brake pad wear. Inspect the brake pads at every preflight, however, and replace them if worn excessively.

WARNING

The minimum brake lining thickness is 1/10". If the brake pads are excessively worn, the piston O-rings can protrude beyond the caliper housing, resulting in loss of hydraulic fluid and complete brake failure.

The brakes supplied with GlaStar kits use floating calipers, which are free to move from side to side, rather than being solidly attached to the torque plates. This provides for equal lining wear on both pieces of lining material. Periodically (at least at every annual condition inspection), check that the brake caliper assembly is free to float from side to side. Grasp the caliper and wiggle it back and forth (parallel to the wheel axle) to check for a little play. If no play is present, lubricate the caliper anchor pins and torque plate bushings with a dry lubricant such as silicon or graphite. If the anchor pins or torque plate bushings are dirty or corroded, disassemble the calipers, clean the anchor pins and bushings or remove corrosion with fine sandpaper, lubricate the anchor pins, and reassemble.

NOTE

Do **not** use any petroleum-based lubricants (oil, grease or WD-40) on the caliper anchor pins. Petroleum base lubricants are sticky and attract dust and dirt, which can impede the floating action of the calipers.

7-9.5.1 Brake Lining Replacement

There is no need to jack the aircraft, remove the wheels or disconnect the brake hydraulic lines to replace the brake linings.

You will need a brake lining installation tool and a new set of brake linings and rivets to fit your calipers. Brake linings are available in the *GlaStar Options Catalog.*

STEP 1: DISASSEMBLE THE BRAKES

Remove the safety wire and the two bolts that secure the back plate to the caliper housing.

NOTE

Do not confuse the caliper housing bolts with the anchor pin nuts. The caliper housing bolts are the farthest from the axle.

Remove the caliper back plate with its piece of lining material attached.

Slide the caliper housing away from the wheel in a direction parallel to the wheel axle until the anchor pins clear the torque plate bushings. Remove the pressure plate (the small metal plate with the other piece of brake lining material attached) by sliding it off the anchor pins of the brake caliper housing assembly.

Take the time now to push the caliper piston back into the caliper housing. The piston is the round piece that protrudes slightly from the caliper housing and is located under the pressure plate that was just removed. As the brake lining wears, the piston protrudes farther from the caliper housing. To accommodate the thickness of the new linings and permit assembly of the caliper to the brake disc, the piston must be pressed back into the housing. Hold the caliper housing in both hands and press the piston back in using both thumbs equally. Push the piston straight in to avoid unseating the piston O-rings. If the O-rings are unseated, loss of brake fluid or entry of air into the system may result.

NOTE

> Do not press on the brake pedal while the caliper is disassembled. This will push the piston completely out of the caliper, causing a mess and resulting in further work to refill and bleed the brake system. We recommend placing a small clamp or band around the caliper to prevent the piston from accidentally popping out.

Slide the caliper anchor pins back into the torque plate bushings temporarily to support the caliper housing while the new lining material is being installed.

STEP 2: STUDY THE BRAKE PAD ASSEMBLIES

Examine the pieces of lining material that are attached to the back plate and the pressure plate, noting the relationship of the pieces and the direction that the rivets are installed. Note that the head of the rivet fits into the counterbored side of the brake lining material and the tail of the rivet (the end that is formed during brake lining installation) fits into the counterbored side of the pressure plate or back plate.

STEP 3: REMOVE THE OLD BRAKE LININGS

Place the back plate or pressure plate on a vise with the lining material down and with the rivets positioned over the gap between the vise jaws. Use a hammer and the punch supplied with the lining installation tool to drive each rivet out. Hammering with the punch un-crimps the tail end of the rivet and pushes it out of the assembly.

STEP 4: INSTALL THE NEW BRAKE LININGS

Position the new lining material against the back plate or the pressure plate, making sure that the counterbores on both pieces are facing outward (away from each other) so that the rivets can be installed correctly.

Insert a rivet into each of the holes in the lining material with the head of the rivet fitting into the counterbore in the lining. Clamp the rivet installation fixture in a vise, and place the plate and lining into the installation fixture with the head of the rivet down against the bucking anvil of the tool. Insert the rivet setting mandrel into the fixture with the mandrel contacting the rivet tail. Refer to Figure 7-1.

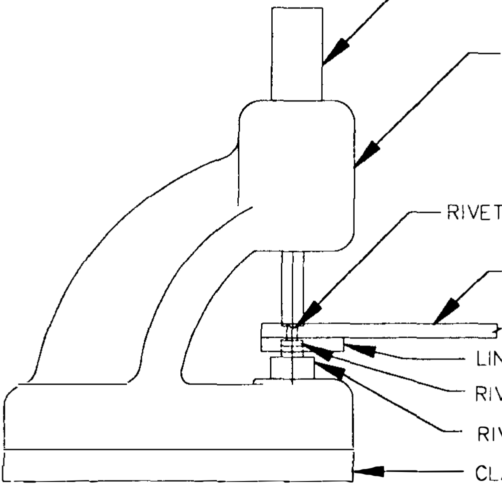

Figure 7-1: Brake Lining Installation

Support the plate and the lining in the installation fixture with one hand while tapping the mandrel with a hammer. Proceed slowly and rotate the assembly while driving the rivet so that the tail is evenly formed. Check the rivet frequently as you go to make sure it isn't splitting. Before setting the first rivet fully, start the other rivets to keep the lining aligned properly with the plate, and then set all the rivets fully. Check the security of the lining frequently while proceeding. Stop when the lining is firmly attached to the plate (there is no movement when wiggled by hand) but before the rivets or the lining begin to crack from over-driving. The brake plates are now ready for remounting to the caliper housing.

STEP 5: REINSTALL THE BRAKE PAD ASSEMBLIES

Slide the caliper housing off the torque plate where it was placed temporarily after disassembly. Make sure the piston is pushed all the way into the caliper housing, as mentioned previously.

Inspect the bores of the torque plate bushings for dirt or corrosion. Clean or use fine sandpaper to remove corrosion, if necessary. Do the same for the caliper housing anchor pins.

Lubricate the caliper housing anchor pins with silicon lubricant or with aerosol graphite spray. As mentioned previously, do **not** use a petroleum base lubricant.

Slide the pressure plate with its new lining material over the caliper housing anchor pins, with the pressure plate against the piston. Slide the caliper housing anchor pins into the torque plate bushings until the lining on the pressure plate contacts the brake disc.

Position the back plate with its new lining material against the other side of the disc and thread the two caliper housing bolts with their washers into the back plate from the opposite side of the caliper housing. Tighten the bolts to 90 inch-pounds. Safety-wire the bolts using standard procedures.

STEP 6: CHECK THE OPERATION OF THE BRAKES

Check the brakes for firm pedal pressure and bleed the system if either brake feels spongy. See Section 7-9.5.2 for brake bleeding instructions.

STEP 7: BREAK-IN THE BRAKE LININGS

The lining material used in the GlaStar brakes is an asbestos-based organic compound. To provide the maximum service life, the brake lining material must be properly broken-in by gently heat curing the resins, as described below. Excessive heat applied before curing will carburize the lining material, lowering the braking coefficient and reducing the service life of the linings.

To break-in the new brake lining material, perform a minimum of six stops from a speed of between 25 and 40 m.p.h., using light pedal effort and letting the brakes cool partially (about one minute) between stops. This procedure generates enough heat to cure the resins in the lining, yet will not carburize the material by heating excessively. Once the linings are properly cured, they will provide many hours of maintenance-free service.

7-9.5.2 Bleeding the Brakes

To bleed the brakes, use a fluid pump (such as an oil pump can) with a clear tube attached to the brake caliper bleeder fitting. Open the bleeder and pump fluid from the caliper through the master cylinder(s) to the reservoir until no air bubbles are evident in the reservoir; then, tighten the bleeder fitting. As the reservoir fills, siphon the fluid back down into the pump or some other container to prevent overflow. Repeat for both brake calipers until the brakes feel solid. Finally, drain the reservoir until it is about **7/8** full.

7-9.6 CONSTANT-SPEED PROPELLER

Instructions for constant-speed propeller operation, servicing and maintenance are contained in the propeller owner's manual furnished with the propeller.

WARNING

When servicing the propeller, always make sure that the magneto switch is off, the throttle is closed, the mixture is in the idle cut-off position and the engine has cooled completely. Stand in the clear when moving a propeller. There is always some danger of a cylinder firing when the propeller is moved. The best procedure is to turn the propeller backwards, or counter-clockwise as viewed from the cockpit, so the impulse coupling cam in the magneto cannot catch and fire a cylinder.

Daily Inspection

Inspect the blades for nicks, gouges and cracks. Inspect the spinner and the visible hub parts for damage or cracks. Repair prior to the next flight. See the propeller owner's manual for blade repair procedures.

Inspect for grease or oil leakage. Leaks would show up on the inside of the spinner or at the base of the blades next to the hub.

100 Hour Inspection

Remove the spinner and inspect the blades for nicks and gouges. Repair nicks and gouges using the procedures described in the propeller owner's manual. Always consider propeller balance when removing material from a blade.

Inspect the propeller hub parts for cracks or wear. Check all visible parts for wear and safety. Check the inside of the spinner and at the base of the blades next to the hub for evidence of oil and grease leaks. Grease the propeller hub through the zerk fittings.

CAUTION

Consult the propeller owner's manual for proper lubrication procedures. On some propellers, one of the zerk fittings must be removed to avoid pressurizing the hub.

Make an entry in the propeller log book verifying the 100 hour inspection and describing any maintenance performed.

7-9.7 Fixed-Pitch Propeller

As part of every preflight inspection, inspect the propeller for nicks, especially near the tips and on the leading edge. Such nicks cause stress concentrations that may result in cracks and should be dressed out with a fine file as soon as possible. Clean bug and grass stains off the propeller when you wash the rest of the airframe. Never use a harsh, corrosive cleaner on the propeller blades.

7-9.8 INDUCTION AIR FILTER

The Brackett air filter element used in the Lycoming induction system is treated with a wetting agent to capture dust and repel water. The element has also been treated with a fire retardant. Replace the element every 200 hours of use or every 12 months or when it is difficult to see light through it due to foreign material. Clean with compressed air. Since the filter's effectiveness depends on its chemical treatment, do **not** wash and reuse it.

When operating under severely dusty conditions, check the element **daily** and replace it when needed.

NOTE

Replacement Lycoming induction system filter elements are available from Stoddard-Hamilton; order P/N 620-0110-001.

7-9.9 AIRFRAME CARE

Care of the aluminum portions of the GlaStar airframe is the same as for any other aluminum airplane. We recommend washing the airframe by hand. Flush away loose dirt with clean water and then wash with a mild soap and water solution, using a soft cleaning cloth. Avoid the use of harsh or abrasive cleaners. Rinse thoroughly with clean water and then dry with a soft cloth or chamois. Applying a high-quality automotive wax will prevent painted surfaces from oxidizing and will help prevent unpainted surfaces from corroding. Unpainted aluminum surfaces can be polished, if desired, using any standard aircraft aluminum polish. Storing your GlaStar in a hangar rather than tying it down outside will greatly extend the airframe's life.

CAUTION

If high-pressure washing equipment is used to wash your GlaStar, keep the stream of water away from wheel bearings, propeller hub bearings, pitot-static ports, electrical and avionics equipment, etc. Avoid directing the stream toward the wings and tail surfaces from the rear where the water can more easily enter the structure.

The GlaStar's fiberglass composite fuselage structure is not subject to corrosion like the aluminum portions of the airframe, but extended exposure to the ultraviolet radiation in sunlight will cause the gel coat to oxidize, requiring buffing to restore the original gloss. If the airplane is to be tied down outside for an extended time, we recommend covering the fuselage with a protective slip cover to prevent gel coat oxidation.

Minor surface cracking of the composite fuselage is usually just a cosmetic concern and not a structural problem. If surface cracks appear in the finish in a high stress or vibration area, however, it may indicate damage to the underlying structure. Check the fiberglass structure below the finish by sanding down to the fiberglass laminate. **Do not sand into the laminate.** If the fiberglass structure is damaged, it will have a white-colored ridge or notch, indicating torn or compressed fibers. If no damage has occurred to the structure, the glass will be smooth and translucent. If damage has occurred, contact Stoddard-Hamilton for repair consultation.

Wash the fuselage in the same manner as the aluminum wings and tail surfaces, and then apply a high-quality automotive paste wax to help prevent gel coat oxidation. We recommend avoiding the use of waxes containing silicon. Silicon is very difficult to remove from a surface, even with solvents such as acetone, and its presence may inhibit a good bond in the event that airframe repair or gel coat touch-up is necessary.

7-9.10 WINDSHIELD AND WINDOWS

Keep the windshield and door window Plexiglas clean, and wax it with a Plexiglas polish such as Mirrorglaze. To prevent scratches, wash the windows carefully with plenty of mild soap and water solution, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used but only to carry water to the surface. Rinse thoroughly and then dry with a clean moist chamois. Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge which attracts dust particles in the air.

Remove oil and grease with a cloth moistened with isopropyl alcohol. Never use gasoline, benzene, alcohol, acetone, carbon tetrachloride, lacquer thinner or glass cleaner. These materials will soften the plastic and may cause it to craze.

After a thorough cleaning, wax the surface with a good grade of commercial wax (Mirrorglaze or similar). The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft flannel cloth. Do not use a power buffer; the heat generated by a buffing pad may soften the plastic.

7-9.11 ENGINE CLEANING

Use standard, parts-cleaning solvent to clean the engine. Spray or brush the fluid over the engine, rinse thoroughly with water, and allow to dry. Engine degreasers may be used cautiously and should always be properly neutralized after use.

CAUTION

Particular care should be given to electrical equipment before cleaning. Do not allow cleaning fluids to enter the magnetos, the starter, the alternator or the like. All other openings should be covered before cleaning.

Section 8

Flight Test

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8-1 INTRODUCTION

Flight testing should be approached in a frame of mind of absolute seriousness, yet also in a relaxed, non-rushed way. If there is any advice we could give an anxious and excited builder, soon to become a GlaStar pilot, it is this: **DO NOT BE IN A HURRY!** The first flight should be flown in an atmosphere of calm, not haste. You have too much time, money and life invested in this project to make a mistake at this point, so slow down and make each step a sure and calculated one.

It cannot be stressed enough at this time that the pilot be thoroughly familiar with all aspects of the GlaStar: the airframe, weight and balance, control systems, engine, electrical system, fuel system, normal operating procedures, emergency procedures and operating limitations. The pilot should have read and understood this entire *Owner's Manual.*

Aircraft homebuilders often concentrate all their time and effort on the completion of their project and let their flying skills get rusty. Obviously, this is not a good situation for someone about to test fly a new airplane. The GlaStar test pilot should have enough recent time in a comparable airplane to feel comfortable. Any nervousness or tension interferes with a pilot's ability to safely control the airplane under normal circumstances and inhibits appropriate reactions in an emergency.

Over half of all homebuilt accidents occur within the first 40 hours of operation. To help reduce the accident rate during the flight test period, Stoddard-Hamilton is proud to have participated in the development of FAA Advisory Circular 90-89, *Amateur Built Aircraft*

Flight Testing Handbook. We strongly recommend procuring and studying a copy of AC 90-89 before engaging in any test operations. It is available from:

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

8-2 GROUND TESTS

Before beginning taxi testing, run the engine without the engine cowling in place so that oil leaks, fuel leaks or vibration problems can be seen and remedied immediately. Run the engine at various power settings from idle to maximum static r.p.m.

CAUTION

Make sure the airplane is adequately secured and the area around the propeller is clear of stones and other foreign objects. Have someone stand by with a fire extinguisher during initial engine runs.

Run the engine for short periods of time and monitor temperature gauges to avoid overheating the engine. Have helpers observe the engine and related systems from outside while you control the engine and monitor the instruments from inside the cockpit.

During the initial engine runs, make sure that all the engine instruments and controls work properly. Check the oil pressure, the alternator output, left and right magneto drops and the r.p.m. drop with carburetor heat. Switch the magnetos off momentarily to check the magneto ground connections.

Adjust the idle r.p.m., and verify that, at higher power settings, leaning the mixture control produces a rise in exhaust gas temperature; otherwise, the mixture is too lean. Make sure there is a slight rise in r.p.m. when the mixture control is moved to the idle cut-off position.

After each engine run, check every system very closely and remedy defects if necessary. Check all wiring, hose ducting, fuel and oil lines, etc., for excessive vibration or chafing. Make sure all plumbing and wiring is securely fastened with nylon ties, hose clamps or the like.

Check the full-power engine operation before flight is attempted. Perform the full-power checks with the engine cowling and spinner installed. Point the airplane into the wind to assist engine cooling. Tie the airplane down securely and chock the wheels for the full-power tests. Verify that the engine runs smoothly and strongly at full power.

If your airplane has a new, remanufactured or overhauled engine, it should receive the same start, warm-up and preflight checks as any other engine. Using low power settings for cruise during the break-in period is **not** recommended. A good engine break-in requires that the oil film that lubricates the piston rings and cylinder wall break down slightly and allow some wear to occur. This wear, or "seating," of the rings with the cylinder wall will occur only when pressures inside the cylinder are great enough to cause expansion of the piston rings. Pressures inside the cylinder become great enough only when power settings above 65% are used. Full power for takeoff and climb is not harmful to a new or overhauled engine; it is beneficial. (Monitor engine temperatures closely, however, to ensure that overheating does not occur.) For cruise, it's best to use power settings of 70% to 75% of rated power for the first 50 hours, or until oil consumption stabilizes, to produce a good engine break-in.

Unfortunately, the initial ground checks of engine operation, as well as subsequent taxi tests, are characterized by relatively low power settings, which may not allow proper seating of the piston rings, and by reduced cooling flow, which may cause overheating and cylinder wall glazing. Piston rings that fail to seat and cylinder wall glazing can result in elevated cylinder head temperatures and excessive oil consumption. One solution to this dilemma is to have an overhaul shop break in your engine on a test stand before installing it in your GlaStar. This has the additional advantage of assuring you that the engine is sound before attempting flight. The ground tests described above will then verify that the engine functions properly as installed in the airframe.

CAUTION

Operate new or overhauled engines on straight mineral oil for a minimum of 50 hours or until oil consumption has stabilized. After this period, change to an approved additive oil if so desired.

8-3 TAXI TESTING

8-3.1 LOW-SPEED TAXI

After the static engine tests are complete and any defects have been remedied, low-speed taxi testing can begin. First, adjust your seating position in the cockpit. Position the seat back and adjust the seat cushion thickness so that you are comfortable, can move all the controls to their stops without interference or excessive reaching and have maximum visibility.

Take the time to become familiar enough with instrument and control locations so that you do not have to spend time hunting for them. Check the operation of all your flight and engine controls. Everything should work smoothly with no binding or interference.

Make sure that all air has been bled out of the brakes and they are working properly before starting the engine. If necessary, bleed the brakes using the procedures in Section 7-9.5.2. Low-speed taxiing may be done with the doors cracked open for cooling on hot days, but we recommend securing the doors in gusty wind conditions or when taxiing through the prop blast of another airplane. The pilot should use the lap belt and shoulder harness any time the airplane is moving.

The purpose of low-speed taxi testing is to give the pilot a feel for steering by differential braking and to reveal any defects in the landing gear before flight. The initial taxi testing should be done at no more than the speed of a fast walk to become familiar with the ground handling characteristics of the airplane and the space needed to maneuver.

Inspect the landing gear thoroughly between taxi tests, checking for such defects as loose wheel bearings or improper adjustment of the nose gear pivot axle nut.

8-3.2 High-Speed Taxi

As taxi testing continues, gradually increase the taxi speed as you feel confident and comfortable to do so. Wear your parachute for the high-speed taxi runs, not only to get used to wearing it, but also because of the possibility of a high-speed taxi test turning into an unintentional first flight. This is not an uncommon occurrence but, with careful planning, it should not happen. To avoid an unintentional first flight, do not exceed 30 knots (35 m.p.h.) during high-speed taxi tests. If you airspeed indicator does not register at such low speeds, slow down at the first sign of the ASI coming alive.

CAUTION

The problem with an unintentional first flight arises when the excited pilot tries to get the airplane back on the ground. If for some reason you do lift off, do not try to force the airplane back on the ground. Level off gently and ease the power off, allowing the airplane to settle back to the runway. Bleed off airspeed and flare to a normal, main-wheel-first landing.

High-speed taxi testing should be done on a long airport runway (at least 4,000–5,000 ft.). Practice steering by tracking the runway centerline.

NOTE

> Do not make large, jerky control inputs. The airplane responds better and you are less likely to get into trouble with smooth, steady, firm control pressures.

The aerodynamic controls begin to become effective almost immediately upon the application of full power—especially the rudder and elevator, which are in the prop wash. As the speed builds, try picking up the nose wheel to get a feel for the elevator control. Develop a smooth touch on the rudder pedals during the transition from low-speed steering (with brakes) to high-speed steering (aerodynamic rudder control) and back. Try runs with no flaps and with one notch of flaps to get a feel for the difference. Notice the rudder inputs necessary to counteract engine torque as power is applied.

CAUTION

> Monitor the engine gauges during taxi testing. Stop and let the engine cool if there is any sign of overheating. Keep an eye on all of the other aircraft components as testing continues, and remedy any problems that occur. Try to use the brakes as little as possible. **Prolonged taxi tests or heavy brake usage can glaze the brake pads or, worse, cause a fire.**

The most valuable thing you will have learned during high-speed taxi testing is how the airplane feels just prior to lift-off speed. You will have learned what kind of input is required on the rudder pedals for directional control and when the elevator becomes effective; you also will have gained a general confidence in your own ability to react and adjust to handling the GlaStar. When you feel confident in this area, you are almost ready for takeoff and have part of the landing technique under control.

NOTE

> Remove the engine cowling after the first hour of taxi testing and re-check the engine and all engine-related systems.

The FAA requires one hour of logged taxi time on the airplane before they will sign off the aircraft log book and issue a Limited Duration Experimental Airworthiness Certificate. We recommend breaking the hour into short segments to avoid overheating the engine or the brakes.

8-4 FINAL INSPECTION

After one hour of taxi testing has been logged on the aircraft, it is time to submit your "Application for Airworthiness Certificate" and request an inspection by the FAA.

So as not to waste the FAA inspector's time, you should be absolutely certain that the airplane is ready when you call for the inspection. We recommend having an independent inspection performed by a knowledgeable person, such as an EAA designee, before calling for the FAA inspector.

Often, builders are so familiar with their projects that they will overlook deficiencies that are obvious to an unbiased observer. Any such deficiencies should be remedied before the FAA inspector arrives, otherwise the Airworthiness Certificate could be denied. Keep in mind that the primary objective of the inspections is not only to verify compliance with the law but also to ensure safety.

In addition to inspecting for acceptable workmanship and construction practices, the inspector will check the airplane for the minimum required instrumentation (see FAR 91.33), instrument range markings, ELT installation, pilot and passenger restraints, properly marked N-number and the appropriate permanently installed placards. (See Section 2-14.1 of this *Owner's Manual* for a description of the placards required for certification of an experimental amateur-built aircraft.)

You should have the following documents ready for the inspector:

1. Application for Airworthiness Certificate, FAA form 8130-6.

2. Enough data (such as photographs or a 3-view drawing) to identify the aircraft.

3. An Aircraft Registration Certificate, AC Form 8050-3, or the pink copy of the Aircraft Registration Application, AC Form 8050-1.

4. A statement setting forth the purpose for which the aircraft is to be used; i.e. "Operating an amateur-built aircraft." The statement should include the estimated duration of the test period and the areas over which the test will take place.

5. A notarized statement that the applicant fabricated and assembled the major portion of the aircraft for education or recreation and

has the evidence to support the statement available to the FAA upon request. A construction log maintained by the builder, including photographs taken as major components are completed, will be acceptable verification that the builder constructed the major portion of the aircraft.

6. Weight and balance data.

7. An aircraft log book with evidence of inspections, such as log book entries signed by the builder describing all inspections conducted during construction of the aircraft. This will verify that the construction has been accomplished in accordance with acceptable workmanship methods, techniques and practices.

If no deficiencies are found in the aircraft and if all documentation is in order, you will be issued a Limited Duration Experimental Airworthiness Certificate and Operating Limitations that will permit you to begin flight testing.

For a complete discussion of the certification and operation of amateur-built aircraft, obtain a copy of FAA Advisory Circular 20-27D. To request a free copy of this advisory circular, write to:

U.S. Department of Transportation
Utilization and Storage Section M443.2
Washington, D.C. 20590

8-5 FIRST FLIGHT

IMPORTANT CONSIDERATIONS:

1. The pilot should be confident in a comparable aircraft, with at least 10 hours of recent flight time, and should feel comfortable with high-speed taxi in the GlaStar.
2. The weather should be calm and clear.
3. Emergency procedures should be memorized and rehearsed mentally. The pilot should be familiar with open areas in the flight test vicinity for use as possible emergency landing sites.
4. Don't let a crowd gather and make you nervous. On the other hand, don't test fly alone. Recruit a small ground crew, consisting of a friend or two with a hand-held radio, to provide immediate assistance in the event of an emergency, but don't make the mistake of letting everyone come. You'll be more relaxed and level-headed without the additional pressure of a large audience.
5. If you are at a controlled airfield, plan your first flight for a time when the airport is least busy. Early morning is usually best.
6. You should have 4,000 to 5,000 ft. of runway for the first flight.
7. Check oil and fuel quantities and perform a very thorough preflight inspection.
8. Carry ballast, if necessary, to position the CG in the middle of its allowed range. Make sure that any ballast is adequately secured.
9. Wear a parachute and practice getting out of the airplane quickly.

After you feel confident with your high-speed taxi tests and all systems look good, you are ready for your first takeoff and flight. Again, you should have good weather, no wind and clear skies.

NOTE

Your first few flights should be accomplished with about half fuel; 15 to 20 gallons is plenty. This is enough fuel to remain airborne for awhile, but not enough to add unnecessary weight to the airframe.

For the first takeoff, follow the normal takeoff procedures described in Section 4-6 of this manual. Align the airplane with the centerline of the runway, select the first notch of flaps and smoothly apply full power, adding right rudder as necessary to correct for engine torque effects. As the airplane accelerates through 50 knots (58 m.p.h.), ease in a little aft stick to raise the nose; the airplane will fly itself off when it is ready. Any serious control problems should be immediately evident as soon as the airplane is airborne. If anything seems amiss, reduce power and land on the remaining runway.

NOTE

The purpose of the first flight is to verify that the engine and primary control systems are functioning normally, to begin to establish a familiarity with the feel of the controls and to note any necessary changes in control rigging or trim.

If the airplane seems controllable at lift-off, allow the airplane to accelerate to at least 65 knots (75 m.p.h.). Continue to climb straight out until at least 500 ft. AGL is reached.

Retract the flaps when the climb is stabilized and the airplane is clear of all obstacles on initial climb-out. Make a gentle 180° turn to downwind and continue to climb out to 5,000 ft. AGL over the airfield. Once the first downwind turn is completed, trim the plane for a 78 knot (90 m.p.h.) climb. Keep monitoring the operating temperatures. Reduce power and level off if temperatures during climb-out become excessive. If temperatures continue to rise, return to the airfield and troubleshoot the problem.

NOTE

> Be alert to any peculiar engine noises, airframe vibrations or control system binding. Keep an eye on all engine gauges during these initial flights. Remember these first few flights are training sessions for the pilot and test flights for the aircraft. Investigate even the slightest unusual vibration, noise or deviation from normal. The airplane will be "talking" to you; be sure to listen.

When 5,000 ft. AGL is reached, level off while reducing power to hold altitude and maintain an easy cruise of about 95 knots (109 m.p.h.). Keep within gliding range of the airport. It's best to stay directly over the field so you can spiral down if necessary.

Try to trim the airplane for hands-off flying and note any tendency for the airplane to roll or skid. If necessary, install rudder and aileron trim tabs when on the ground after the first flight.

Once you begin to feel comfortable with the feel of the airplane at cruise airspeed and are satisfied with the engine operation and temperatures, gradually reduce power to idle and re-trim the airplane for the landing configuration. Set the airplane up for an imaginary 75 knot (86 m.p.h.) downwind leg at 5,000 ft., pull one notch of flaps and check carburetor heat. Trim the airplane for a 65 knot (75 m.p.h.) glide and try a few shallow turns to get a feel for the handling at low airspeeds. Add power, retract the flaps, and climb back to 5,000 ft. AGL.

Now, try a few gentle stalls. Make sure the area is clear of other traffic. Reduce power and hold altitude with gently increasing back pressure as the speed bleeds off. Watch the VSI as the stick comes back and note and record the airspeed at which full aft stick is no longer sufficient to keep the descent rate zeroed. In lieu of a decisive stall break, this speed is Vs. Recover by releasing back pressure and adding power. Catch any tendency for a wing to drop with top rudder. Stabilize the airplane in flight and repeat the stall procedure to verify the previous airspeed indication. Keep the minimum approach speed in the pattern between 1.3 and 1.4 times the indicated stall speed until completely comfortable with the GlaStar's low-speed handling characteristics.

The first flight should not exceed 15–20 minutes duration. After the indicated stall speed has been established, continue to practice slow flight maneuvers at different flap settings while descending to the airport. You must know the airplane's stall speed and be familiar with the slow-flight handling in order to make a confident approach and landing.

When back at the airport at pattern altitude, enter downwind and land, using the normal procedures described in Section 4-13. During the early flights and until the pilot becomes comfortable with the GlaStar's handling, it is advisable to use the high end of the normal speed ranges recommended for the landing pattern. It is best to use a high approach, keeping the runway within gliding range for safety in the event of a power problem.

After the first flight, remove the upper and lower engine cowling and all inspection cover plates. Give the entire aircraft a general inspection. Check the engine compartment for leaks, wiring problems, hot spots on the lower cowling near the exhaust, etc. Correct any problems.

Repeat this inspection procedure after each of the first 4 or 5 flights or until you are absolutely satisfied that no problems exist. We recommend that you remain within gliding distance of the field until you have a minimum of five hours on the airplane.

8-6 FURTHER FLIGHT TESTING

8-6.1 GENERAL

In subsequent test flights, as the pilot becomes more familiar with the airplane, more of the airplane's systems may be tested and the known performance envelope may be expanded. During the next couple of flights, the test pilot should continue to explore the handling characteristics at both low and high speeds and to make further trim adjustments if necessary. The pilot will also begin to become more comfortable with takeoffs and landings.

The purpose of the flight test period, in accordance with FAR 91.42(b), is to demonstrate that the airplane is controllable throughout its normal range of speeds and for all maneuvers to be executed, and has no hazardous operating characteristics or construction shortcomings.

Design and plan an organized flight test program to verify compliance with part 91.42(b).

8-6.2 Envelope Expansion

WARNING

> You are flight testing a brand new airplane and you should treat it as a one-of-a-kind first prototype. Do not assume that your airplane will have exactly the same characteristics as any of our prototypes or someone else's airplane. Minor builder modifications or slight variations could cause large differences in flight performance, handling, CG range, etc.

Approach this phase of flight testing very carefully and cautiously. The following conditions should be met before expanding the flight envelope of your airplane:

1. All control surfaces properly balanced to ensure against flutter.

2. Optional rudder and aileron trim tabs adjusted properly.

3. Pitot tube calibrated, if necessary.

Once the above conditions are met, the airplane's airspeed can be gradually increased. We recommend increasing the airspeed in 10 knot increments on each succeeding flight or until you feel absolutely comfortable with the trim and handling of your GlaStar. Do not push red line on your first flight.

As mentioned earlier, your initial flight testing should be done with about 15 to 20 gallons of fuel on board. Once you feel confident with your ability to handle the airplane, increase the amount of fuel carried until you are flying with full fuel. Also, ballast the airplane to shift the location of the CG fore and aft to gradually explore the handling of the airplane throughout the permitted range of CG locations.

WARNING

> If ballast is used to adjust the CG location, be absolutely certain that it is securely restrained so that it cannot shift and interfere with the controls.

You do not need to expand your CG limits right away on the first few flights. Take your time; you have a lot of required flight time to log before you can leave your designated 25-mile-radius test area. Make the best use of your time, learning as much about your plane as possible.

Explore the flap performance envelope. You should know your airplane's indicated stall speeds when clean and at each flap setting. Practice retracting the flaps smoothly and slowly while getting used to the pitch changes.

Do not feel obligated to expand your flight envelope to the limitations given in this handbook. The limitations given are those demonstrated by the designer; you may choose to restrict these limits as you determine, based on your own limitations and experience.

WARNING

Wear a currently repacked parachute for all flight testing, and know how to use it.

8-7 FINAL CERTIFICATION

After the flight testing period has been completed, the builder may submit an application for an unlimited-duration airworthiness certificate. The aircraft flight log, with a record of the completed flight testing, should be submitted along with Form 8130-6, Application for Airworthiness Certificate.

With the issuance of the unlimited duration airworthiness certificate, an operating limitation requiring a condition inspection at 12 month intervals is imposed. The aircraft builder can be certified as a repairman to enable him to perform the condition inspection. Specific information regarding repairman certification can be found in AC 65-23, *Certification of Repairmen (Experimental Aircraft Builders).*

SECTION 9

SAFETY INFORMATION

Table of Contents

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9-1 INTRODUCTION

Like any other airplane, the GlaStar can be operated efficiently and safely only in the hands of a skilled pilot. This safety information is provided to refresh the pilot's knowledge of a number of safety subjects. These subjects should be reviewed periodically.

Topics in this section and other safety-related issues are dealt with more fully in FAA Documents and other articles pertaining to the subject of safe flying. The safe pilot should be familiar with this literature.

The GlaStar is designed to provide many years of safe and efficient transportation. By maintaining and flying the airplane prudently, its fullest potential will be realized.

It is mandatory that you fully understand the contents of this manual; that FAA requirements for ratings, certifications and review be scrupulously complied with; and that you allow only persons who are properly licensed and rated and thoroughly familiar with the contents of this *Owner's Manual* to operate the aircraft.

9-2 GENERAL

As a pilot, you are responsible to yourself, those who fly with you, other pilots and their passengers, and people on the ground to fly wisely and safely.

The following material in this Safety Section covers several subjects in limited detail. Here are some General Do's and Don'ts:

DO

Be thoroughly familiar with your airplane; know its limitations and your own.

Be current in your airplane, or fly with a qualified instructor until you are current and proficient.

Pre-plan all aspects of your flight; obtain weather information and carry adequate fuel reserves.

Use services available—weather briefing, in-flight weather and Flight Service Stations.

Carefully preflight your airplane.

Use the checklists in this manual.

Have more than enough fuel for takeoff, the flight and an adequate reserve.

Be sure your weight loading and CG are within limits.

Pilot and passenger must use seat belts and shoulder harnesses at all times.

Be sure all loose articles and baggage are secured.

Check freedom of all controls during preflight inspection and before takeoff.

Maintain the prescribed airspeeds in takeoff, climb, descent and landing.

Avoid large airplane wake turbulence.

Practice emergency procedures at safe altitudes and airspeeds, preferably with a qualified instructor pilot, until the required action is instinctive.

Keep your airplane in good mechanical condition.

Stay informed and alert; fly in a sensible manner.

DON'T

Don't attempt takeoff with frost, ice or snow on the airframe.

Don't take off with less than minimum recommended fuel plus adequate reserves.

Don't fly in a reckless, show-off, careless manner.

Don't fly near thunderstorms or severe weather.

Don't fly in possible icing conditions.

Don't fly close to mountainous terrain.

Don't apply controls abruptly or with high forces that could exceed design loads of the airplane.

Don't carry passengers during the flight test period. It is illegal.

Don't fly into weather conditions that are beyond your ratings or current proficiency.

Don't attempt any takeoff or landing without using the checklist.

Don't fly when physically or mentally exhausted or below par.

Don't trust to luck.

9-3 GENERAL SOURCES OF INFORMATION

A wealth of information created for the sole purpose of making flying safer, easier and faster is available to the pilot. Take advantage of this information and be prepared for an emergency in the remote event that one should occur.

You, as a pilot, have responsibilities under government regulations. These are designed for your protection and the protection of your passengers. Compliance is mandatory.

9-3.1 RULES AND REGULATIONS

FAR Part 91, General Operating and Flight Rules, is a document of law governing operation of aircraft and the owner's and pilot's responsibilities. This document covers such subjects as:

- Responsibility and authority of the pilot-in-command
- Certificates required
- Alcohol and other drugs
- Flight plans
- Preflight action
- Fuel requirements
- Flight rules
- Maintenance, preventive maintenance, alterations, inspection and maintenance records

These are only some of the topics covered. The owner and the pilot are responsible for compliance with all requirements of FAR Part 91.

9-3.2 AIRWORTHINESS DIRECTIVES

FAR Part 39 specifies that no person may operate a product to which an airworthiness directive issued by the FAA applies, except in accordance with the requirements of that airworthiness directive. Since the GlaStar is an experimental airplane, no airworthiness directives apply to the airframe. The builder/pilot must comply, however, with any airworthiness directives that apply to certified engines, engine-related accessories or propellers.

9-3.3 AIRMAN INFORMATION, ADVISORIES AND NOTICES

Airman's Information Manual

The *Airman's Information Manual* (AIM) is designed to provide airmen with basic flight information and ATC procedures for use in the national airspace system of the United States. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms used in the Air Traffic Control System, information on safety, and accident and hazard reporting. It is revised at six month intervals and can be purchased locally or from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The subjects discussed in the AIM are:

- Controlled air space
- Services available to pilots
- Radio phraseology and technique
- Airport operations
- Clearances and separations

Preflight
IFR departures
IFR en route
IFR arrival
Emergency procedures
Weather and icing
Mountain flying
Wake turbulence, vortices
Medical facts for pilots
Bird hazards
Good operating practices
Airport location directory

All pilots must be thoroughly familiar with and use the information in the AIM.

Advisory Information

NOTAMS (Notices to Airmen) are documents that have information of a time-critical nature that would affect a pilot's decision to make a flight, such as an airport closed, terminal radar out of service, en route navigational aids out of service, etc.

Airmen can subscribe to services to obtain FAA NOTAMS and Airman Advisories, and these are also available at FAA Flight Service Stations.

FAA Advisory Circulars

The FAA issues advisory circulars to inform the aviation public of non-regulatory material of interest. Advisory Circulars contain information with which the prudent pilot should be familiar. A complete list of current FAA advisory circulars is published in Advisory Circular AC00-2, which lists advisory circulars for sale as well as those distributed free of charge and provides ordering information. Many advisory circulars which are for sale can be purchased locally in aviation bookstores or at FBOs.

FAA Advisory Circular 20-27D, which describes homebuilt aircraft certification and registration requirements and procedures, should be of particular interest to a GlaStar builder. AC 20-27D is available from:

US Department of Transportation
Utilization and Storage Section M443.2
Washington, DC 20590

Also highly recommended is AC 90-89, *Amateur-Built Aircraft Flight Testing Handbook*. AC 90-89 is available from:

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402.

FAA General Aviation News

FAA General Aviation News is published by the FAA in the interest of flight safety. The magazine is designed to promote safety in the air by calling the attention of general aviation airmen to current technical, regulatory and procedural matters affecting the safe operation of aircraft. FAA General Aviation News is sold on subscription by the Superintendent of Documents at the above address.

9-4 INFORMATION ON SPECIFIC TOPICS

9-4.1 FLIGHT PLANNING

FAR Part 91 requires that, before beginning a flight, each pilot in command familiarize himself with all available information concerning that flight.

Obtain a current and complete preflight briefing. This should consist of local, en route and destination weather, and en route navaid information. En route terrain and obstructions, alternate airports, airport runways active, length of runways and takeoff and landing distances required for expected conditions should be known.

The prudent pilot will review his planned en route track and stations and make a list for quick reference. It is strongly recommended that a flight plan be filed with Flight Service Stations, even for a VFR flight. Also, advise Flight Service Stations of changes or delays of one hour or more, and remember to close the flight plan at destination.

The pilot must be completely familiar with the performance of the airplane and performance data in the *Owner's Manual*. The resultant effect of temperature and pressure altitude must be taken into account in determining performance. This *Owner's Manual* should be aboard the airplane at all times.

9-4.2 MAINTENANCE INSPECTIONS

In addition to maintenance inspections and preflight information required by FAR Part 91, a complete preflight inspection is imperative. It is the responsibility of the owner and the operator to assure that the airplane is maintained in an airworthy condition and that proper maintenance records are kept.

This manual includes a checklist which should be followed for the preflight inspection.

9-4.3 FLIGHT OPERATIONS

General

The pilot must be thoroughly familiar with all information published by Stoddard-Hamilton concerning the airplane and must operate the aircraft in compliance with all limitations imposed by the *Owner's Manual.*

Turbulent Weather

A complete and current weather briefing is a requirement for a safe trip.

Updating of weather information en route is also essential. The wise pilot knows that weather conditions can change quickly and treats weather forecasting as professional advice, rather than absolute fact. He obtains all the advice he can, but stays alert to any sign or report of changing conditions.

Thunderstorms, squall lines and violent turbulence should be regarded as extremely dangerous and must be avoided. Hail and tornadic wind velocities encountered in thunderstorms can destroy any airplane, just as tornadoes destroy nearly everything in their path on the ground.

A roll cloud ahead of a squall line or thunderstorm is visible evidence of violent turbulence; the absence of a roll cloud, however, should not be interpreted as a sign that severe turbulence is not present.

Even though flight in severe turbulence must be avoided, flight in turbulent air may be encountered unexpectedly under certain conditions.

Observe the following recommendations for airplane operation in turbulent air:

1. Flying through turbulent air presents two basic problems, the solution to both of which is proper airspeed. On one hand, if you maintain an excessive airspeed, you run the risk of structural damage or failure; on the other hand, if your airspeed is too low, you may stall.
2. If moderate to severe turbulence is encountered, reduce speed to the maneuvering speed (98 kts./113 m.p.h.). This speed gives the best assurance of avoiding excessive structural loads and provides the proper margin against inadvertent stalls due to gusts.
3. Beware of over-controlling in attempting to correct for changes in attitude; applying control pressure abruptly will build up G-forces rapidly and could cause structural damage or even failure. You should particularly watch your angle of bank, making turns as wide and shallow as possible. Be equally cautious in applying forward or back pressure to keep the nose level. Maintain straight and level attitude in either up or down drafts. Use trim sparingly to avoid being grossly out of trim as the vertical air columns change velocity and direction.

4. Be sure that your seat belt and shoulder harnesses are snug. You will be unable to control the aircraft in turbulence unless you are firmly restrained in your seat.

Flight in Icing Conditions

Flight in icing conditions is prohibited in the GlaStar. The GlaStar must not be exposed to icing encounters of any intensity. If the airplane is inadvertently flown into icing conditions, the pilot must make an immediate diversion by flying out of the area of visible moisture or going to an altitude where icing is not encountered. These same precautions apply to any aircraft without operational anti-ice and/or deice equipment.

Flight in the Vicinity of Thunderstorms

The FAR Part 23 Airworthiness Standards for Normal, Utility and Acrobatic Category Airplanes require that the airplane's structure be protected from the catastrophic effects of lightning, and that the airplane's fuel system be designed to prevent the ignition of fuel vapor by lightning.

WARNING

The GlaStar, because of its composite fuselage which is transparent to an electrical charge, does not comply with FAR Part 23 Standards for lightning protection. For this reason, the GlaStar is prohibited from flight in conditions that would expose the airplane to the possibility of a lightning strike.

Mountain Flying

Pilots flying in mountainous areas should inform themselves of all aspects of mountain flying, including the effects of topographic features on weather conditions. Many good articles have been published and a synopsis of mountain flying operations is included in the FAA Airman's Information Manual, Part One.

Avoid flight at low altitude over mountainous terrain, particularly near the lee slopes. If the wind velocity near the level of the ridge is in excess of 25 knots and approximately perpendicular to the ridge, mountain wave conditions are likely over and near the lee slopes. If the wind velocity at the level of the ridge exceeds 50 knots, a strong mountain wave is probable with extreme up and down drafts and severe turbulence.

Standing lenticular clouds are visible signs that a mountain wave exists, but their presence is dependent on moisture. Mountain wave turbulence can, of course, occur in dry air and the absence of lenticular clouds should not be taken as any assurance that mountain wave turbulence will not be encountered.

The worst turbulence will be encountered in and below the rotor zone, which is usually 8 to 10 miles downwind from the ridge. This zone is sometimes characterized by the presence of "roll clouds," but only if sufficient moisture is present.

A mountain wave downdraft may exceed the climb capability of your airplane. Avoid mountain wave downdrafts.

Marginal VFR

If you are not instrument rated, do not attempt "VFR on top" or "Special VFR" flight. Being caught above a solid cloud layer when an emergency descent is required (or at destination) is an extremely hazardous position for the VFR pilot. Accepting a clearance out of certain airport control zones with no minimum ceiling and one mile visibility, as permitted with "Special VFR," is a foolish practice for the VFR pilot.

Avoid areas of low ceilings and restricted visibility unless you are instrument rated and proficient and have an instrument equipped airplane. Then proceed with caution and with planned alternates.

Night VFR

When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain a safe minimum altitude as dictated by terrain, obstacles such as TV towers or communities in the area flown. This is especially true in mountainous terrain, where there is usually very little ground reference. Minimum clearance is 2,000 feet above the highest obstacle en route.

Do not depend on your ability to see obstacles in time to miss them. Flight on dark nights over sparsely populated country can be the same as IFR, and must be avoided by inexperienced or non-IFR rated pilots.

Vertigo—Disorientation

Disorientation can occur in a variety of ways. During flight, inner ear balancing mechanisms are subjected to varied forces not normally experienced on the ground. This, combined with loss of outside visual reference, can cause vertigo. False interpretations (illusions) result, and may confuse the pilot's perception of the attitude and position of his airplane.

Under VFR conditions, the visual sense, using the horizon as a reference, can override the illusions. Under low-visibility conditions (night, fog, clouds, haze, etc.) the illusions predominate. Only through awareness of these illusions and proficiency in instrument flight procedures can an airplane be operated safely in a low visibility environment.

Flying in fog, dense haze or dust, cloud banks or very low visibility with strobe lights or rotating beacons turned on can contribute to vertigo. Strobe lights and beacons should be turned off in these conditions, particularly at night.

All pilots should check the weather and use good judgment in planning flights. The VFR pilot should use extra caution in avoiding low-visibility conditions.

Motion sickness often precedes or accompanies disorientation and may further jeopardize the flight.

Disorientation in low-visibility conditions is not limited to VFR pilots. Although IFR pilots are trained to use their instruments as an artificial visual reference in place of a visual horizon, they may still experience vertigo. This can happen when the pilot's physical condition will not permit him to concentrate on his instruments, when the pilot is not proficient in flying instrument conditions in the airplane he is flying or when the pilot's work load is increased by such factors as turbulence or equipment failure.

Even if you're instrument-rated, when you encounter instrument flight conditions either intentionally or unintentionally, you should ask yourself whether or not you are sufficiently alert and proficient in the airplane to fly under low-visibility conditions and in the turbulence anticipated or encountered. If any doubt exists, proceed to an area where visual flight conditions exist or discontinue the flight as soon as possible.

The result of vertigo is loss of control of the airplane. If the loss of control is sustained, it will result in an excessive speed accident. Excessive speed accidents occur in one of two manners: either as an in-flight airframe failure or as a high-speed ground impact. All pilots are susceptible to this form of accident.

Descent

In piston-powered airplanes, it is necessary to avoid prolonged descents with low power as this produces two problems:

1. Excessively cool cylinder head temperatures which cause premature engine wear, and
2. Excessively rich mixtures due to idle enrichment (and altitude) which cause soot and lead deposits on the spark plugs (fouling).

The second of these is the more serious consideration; the engine may not respond to the throttle when it is desired to discontinue the descent.

Both problems are amenable to one solution: maintain adequate power to keep cylinder head temperatures in the "green" range during descent, and lean to best power mixture (that is, progressively enrich the mixture from cruise only slightly as altitude decreases). This procedure will lengthen the descent, of course, and requires some advance planning.

If it is necessary to make a prolonged descent at or near idle, as in practicing forced landings, at least avoid the problem of fouled spark plugs by frequently advancing the throttle until the engine runs smoothly and by maintaining an appropriate mixture setting with altitude.

Vortices—Wake Turbulence

Every airplane generates wake turbulence while in flight. Part of this is from the propeller or jet engine and part from the wing tip vortices. The larger and heavier the airplane, the more pronounced and turbulent the wakes will be. Wingtip vortices from large, heavy airplanes are very severe at close range, degenerating with time, wind and distance. In tests, vortex velocities of 133 knots have been recorded.

Encountering the rolling effect of wing tip vortices within two minutes after passage of large airplanes is most hazardous to light airplanes. This roll effect can exceed the maximum counter-roll available in a light airplane. The turbulent areas may remain for as long as three minutes or more, depending on wind conditions, and may extend several miles behind the airplane. Plan to fly slightly above and to the windward side of the other airplane's flight path. Because of the wide variety of conditions that can be encountered, there is no set rule to follow to avoid wake turbulence in all situations. The *Airman's Information Manual* and Advisory Circular 90-23, *Aircraft Wake Turbulence*, provide a thorough discussion of the factors you should be aware of when wake turbulence may be encountered.

Takeoff and Landing Conditions

Avoid taking off on runways covered with wet snow or freezing slush. Snow or slush can accumulate inside the wheel pants and freeze the wheels in flight, causing a hazardous condition when landing.

Landing on runways covered by water or slush, which cause hydroplaning, or landing on snow- or ice-covered runways is hazardous because of reduced braking effectiveness and reduced directional control due to insufficient surface friction. The pilot should also be alert to the possibility of the brakes freezing when operating the airplane on snowy or slushy runways.

Use caution when taking off or landing during gusty wind conditions. In particular, be aware of the special wind conditions caused by buildings or other obstructions located near the runway in a crosswind pattern.

9-4.4 MEDICAL FACTS FOR PILOTS

General

When the pilot enters the airplane, he or she becomes an integral part of the flight system. The pilot is just as essential to a successful flight as the control surfaces. To ignore the pilot in preflight planning would be as senseless as failing to inspect the integrity of the control surfaces or any other vital part of the machine. The pilot has the sole responsibility for determining his or her own reliability prior to entering the airplane for flight. When piloting an airplane, an individual should be free of conditions that compromise alertness, reaction time or the ability to make correct decisions.

Fatigue

Fatigue generally slows reaction times and causes errors due to inattention. In addition to the most common cause of fatigue (insufficient rest and loss of sleep), recent illness, the pressures of business, financial worries and family problems can be important contributing factors. If you are tired, don't fly.

Hypoxia

Hypoxia is a lack of sufficient oxygen to keep the brain and other body tissues functioning properly. There is wide individual variation in susceptibility to hypoxia. In addition to progressively insufficient oxygen at higher altitudes, anything interfering with the supply of oxygen to the brain, such as anemia, atherosclerosis, high blood pressure, certain drugs and even postural changes (twisting the head, for example, can block blood supply to the brain) can contribute to hypoxia. Persons who have recently overindulged in alcohol, who are moderate to heavy smokers or who take certain drugs may be more susceptible to hypoxia. Susceptibility may also vary in the same individual from day to day or even morning to evening.

It is impossible to predict when or where hypoxia will occur during a given flight, or how it will manifest itself. Some of the common symptoms of hypoxia are increased breathing rate, a light-headed or dizzy sensation, tingling sensation, sweating, reduced visual field (tunnel vision), sleepiness, blue coloring of the skin, fingernails or lips (cyanosis), and behavior changes. Some people with hypoxia feel clammy and cold.

A particularly dangerous feature of hypoxia is an increased sense of well-being, called euphoria. It obscures a person's ability and desire to be critical of himself, slows reaction time and impairs thinking ability. Consequently, a hypoxic individual often believes things are getting progressively better as he nears total collapse.

The symptoms are slow but progressive, insidious in onset, and are most marked at altitudes starting above 10,000 ft. Night vision, however, can be impaired starting as low as 5,000 ft.

Use oxygen on flights above 10,000 ft. and at any time when symptoms appear. Should symptoms occur that cannot definitely be identified as either hypoxia or hyperventilation, try three or four deep breaths of oxygen. The symptoms should improve markedly if the condition was hypoxia (recovery from hypoxia is rapid).

Hyperventilation

Hyperventilation, or over-breathing, is a disturbance of respiration that may occur in individuals as a result of emotional tension or anxiety. Under conditions of emotional stress, fright or pain, breathing rate may increase, causing increased lung ventilation. Since there is no corresponding increase in the carbon dioxide output of the body cells, carbon dioxide is "washed out" of the blood.

The most common symptoms of hyperventilation are tingling sensations around the mouth followed by tingling of the hands, legs, and feet, dizziness, faintness, hot and cold sensations, muscle spasms, nausea, sleepiness and, finally, unconsciousness. If the symptoms persist, discontinue use of oxygen and consciously slow your breathing rate until symptoms clear, and then resume a normal breathing rate. Normal breathing can be aided by talking aloud.

Alcohol

Common sense and scientific evidence dictate that you must not fly while under the influence of alcohol. Even in small amounts, alcohol produces a dulling of critical judgment, a decreased sense of responsibility, diminished skill reactions and coordination, decreased speed and strength of muscular reflexes, decreases in efficiency of eye movements during reading, increased frequency of errors, constriction of visual fields, impaired night vision, loss of efficiency of sense of touch, decrease of memory and reasoning ability, increased susceptibility to fatigue and decreased attention span, decreased relevance of response and increased self-confidence with decreased insight into immediate capabilities.

Tests have shown that pilots commit major errors of judgment and procedure at blood alcohol levels substantially less than the minimum legal levels of intoxication for most states. These tests further show a continuation of impairment from alcohol up to as many as 14 hours after consumption. The body metabolizes ingested alcohol at a rate of about one-third of an ounce per hour. Even after the body completely destroys a moderate amount of alcohol, a pilot can still be severely impaired for many hours by hangover.

The effects of alcohol on the body are magnified at altitude, as 2 oz. of alcohol at 18,000 ft. produce the same adverse effects as 6 oz. at sea level. In other words, "the higher you get, the higher you get."

Because of the slow destruction of alcohol by the body, a pilot may still be under the influence eight hours after drinking a moderate amount of alcohol. Therefore, an excellent rule is to allow at least 12–24 hours between "bottle and throttle," depending on the amount of alcoholic beverage consumed. Even then, recent tests have shown that judgment and performance are affected after blood alcohol levels have returned to normal.

Drugs

Self-medication or taking medicine in any form when you are flying can be extremely hazardous. Even simple over-the-counter remedies and drugs, such as aspirin, antihistamines, cold tablets, cough mixtures, laxatives, tranquilizers and appetite suppressants, may seriously impair the judgment and coordination needed while flying. The safest rule is to take no medicine before or while flying, except after consultation with your Aviation Medical Examiner.

Scuba Diving

Flying shortly after any prolonged scuba diving could be dangerous. Under the increased pressure of the water, excess nitrogen is absorbed into your system. If sufficient time has not elapsed for your system to rid itself of this excess gas before takeoff, you may experience the bends at altitudes even under 10,000 ft. where most light planes fly.

Carbon Monoxide and Night Vision

The presence of carbon monoxide results in hypoxia which will affect night vision in the same manner and extent as hypoxia from high altitudes. Even small levels of carbon monoxide have the same effect as an altitude increase of 8,000 to 10,000 ft. Smoking several cigarettes can result in a carbon monoxide saturation sufficient to affect visual sensitivity equal to an increase of 8,000 ft. of altitude.