WARNING

This Information Manual may be used for general information purposes only.

This Information Manual is not kept current. It must not be used as a substitute for the official FAA approved Pilot's Operating Handbook required for operation of the airplane.

Piper™

SEMINOLE

PA-44-180

SN 4496174, 4496224 AND UP

INFORMATION MANUAL

MANUAL PART NUMBER 767-049

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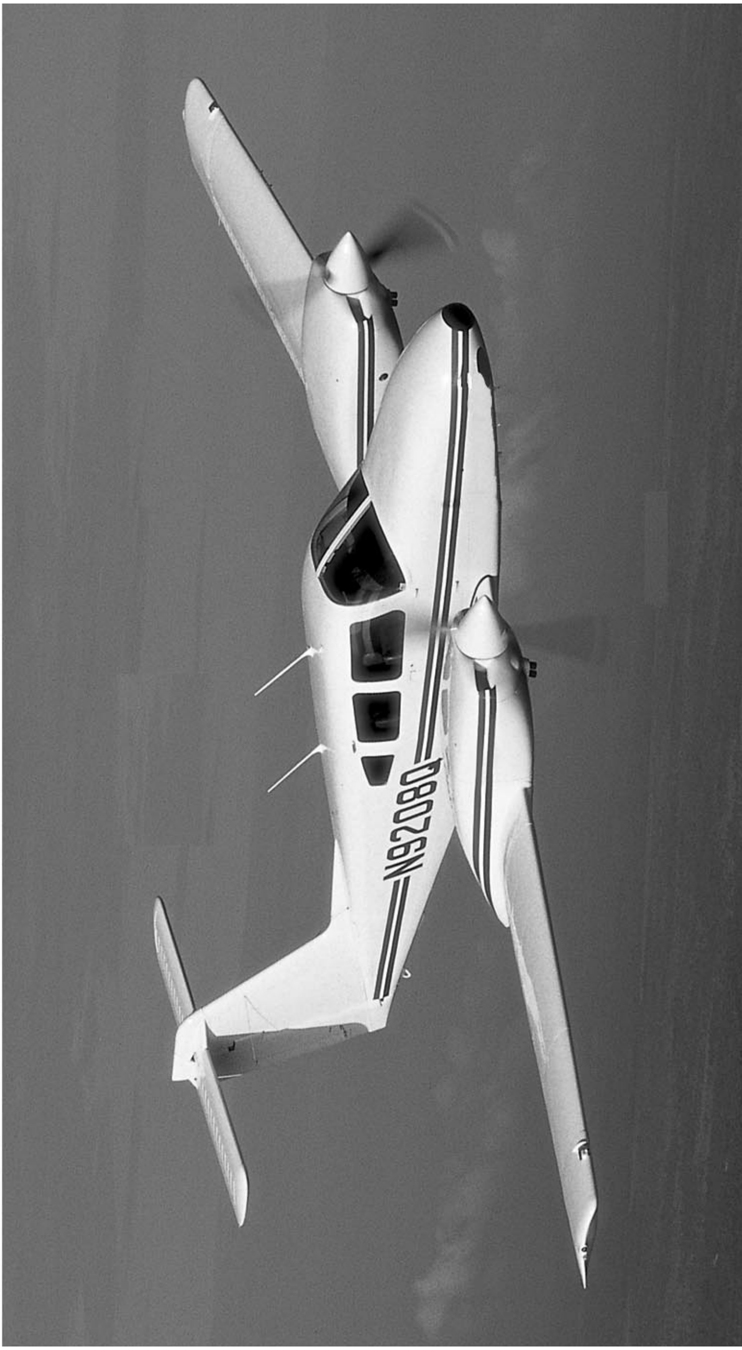
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APPLICABILITY

Application of this handbook is limited to the specific Piper PA-44-180 model airplane designated by serial number and registration number on the face of the title page of this handbook.

WARNING

EXTREME CARE MUST BE EXERCISED TO LIMIT THE USE OF THIS HANDBOOK TO APPLICABLE AIRCRAFT. THIS HANDBOOK IS VALID FOR USE WITH THE AIRPLANE IDENTIFIED ON THE FACE OF THE TITLE PAGE. SUBSEQUENT REVISIONS SUPPLIED BY PIPER MUST BE PROPERLY INSERTED.

WARNING

THIS HANDBOOK CANNOT BE USED FOR OPERATIONAL PURPOSES UNLESS KEPT IN A CURRENT STATUS.

WARNING

INSPECTION, MAINTENANCE AND PARTS REQUIREMENTS FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS HANDBOOK. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE INSPECTION PROGRAM PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, PIPER PROVIDED INSPECTION CRITERIA MAY NOT BE VALID FOR AIRPLANES WITH NON-PIPER APPROVED STC INSTALLATIONS.

REVISIONS

The Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, with the exception of the equipment list, is kept current by revisions which are distributed to the registered airplane owners. The equipment list was current at the time the airplane was licensed by the manufacturer and thereafter must be maintained by the owner.

Revision material will consist of information necessary to add, update or correct the text of the present handbook and/or to add supplemental information to cover added airplane equipment.

I. Identifying Revised Material

Each handbook page is dated at the bottom of the page showing both the date of original issue and the date of the latest revision. Revised text and illustrations are indicated by a black vertical line located along the outside margin of each revised page opposite the revised, added, or deleted information. A vertical line next to the page number indicates that an entire page has been changed or added.

Vertical black lines indicate current revisions only. Correction of typographical or grammatical errors or the physical relocation of information on a page will not be indicated by a symbol.

II. Revision Procedure

Revisions will be distributed whenever necessary as complete page replacements or additions and shall be inserted into the handbook in accordance with the instructions given below.

1. Revision pages will replace only pages with the same page number.
2. Insert all additional pages in proper numerical order within each section. Discard old page.
3. Insert page numbers followed by a small letter in direct sequence with the same commonly numbered page.

ORIGINAL PAGES ISSUED

The original pages issued for this handbook prior to revision are given below:

Title, ii through viii, 1-i, 1-ii, 1-1 through 1-12, 2-i, 2-ii, 2-1 through 2-14, 3-i through 3-vi, 3-1 through 3-52, 4-i through 4-iv, 4-1 through 4-48, 5-i, 5-ii, 5-1 through 5-30, 6-i, 6-ii, 6-1 through 6-18, 7-i, 7-ii, 7-1 through 7-54, 8-i, 8-ii, 8-1 through 8-22, 9-i, 9-ii, 9-1 through 9-24, 10-i, 10-ii, 10-1 through 10-4.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-44-180, SEMINOLE Pilot's Operating Handbook, REPORT: VB-1942 issued May 26, 2006.

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date

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TABLE OF CONTENTS

SECTION 1

GENERAL

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SECTION 1
GENERAL

1.1 INTRODUCTION

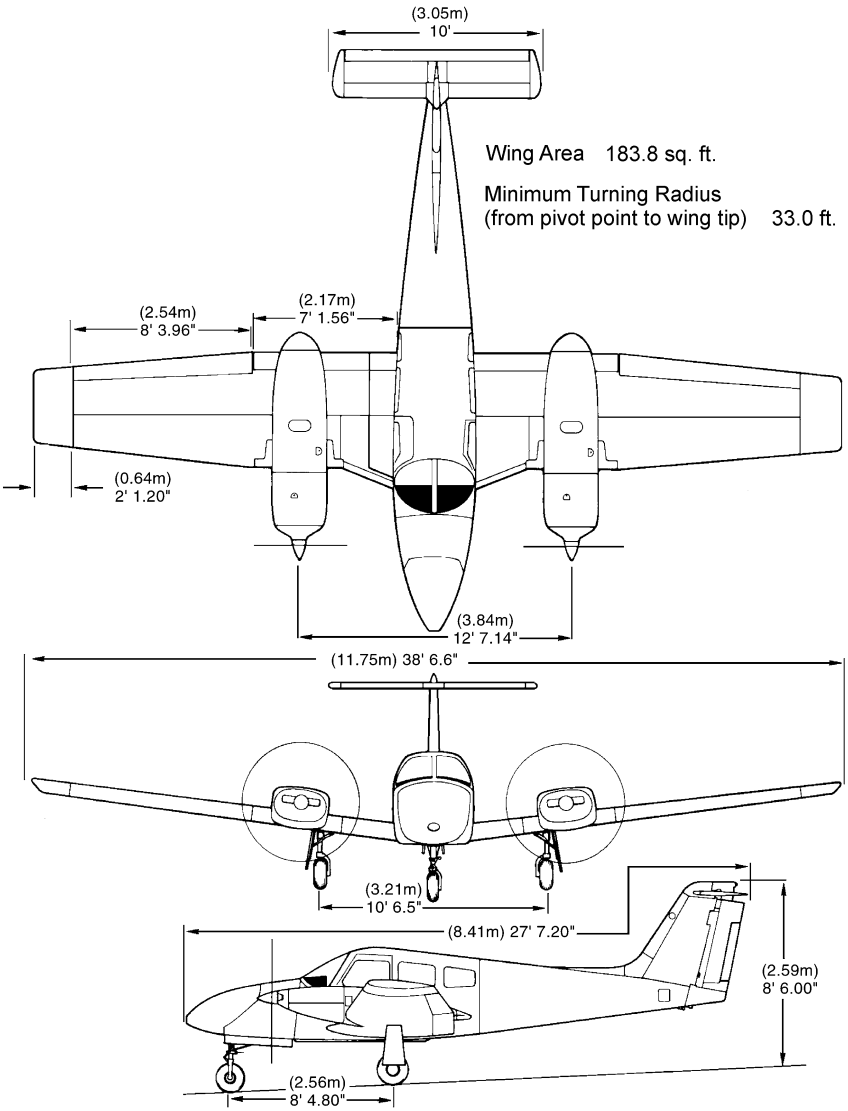
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by the Federal Aviation Regulations and additional information provided by the manufacturer and constitutes the FAA Approved Airplane Flight Manual.

This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status.

Assurance that the airplane is in an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by instrument markings, placards, and this handbook.

Although the arrangement of this handbook is intended to increase its in-flight capabilities, it should not be used solely as an occasional operating reference. The pilot should study the entire handbook to become familiar with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

The handbook has been divided into numbered (arabic) sections, each provided with a finger-tip tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide easier access to information that may be required in flight. The Emergency Procedures Section has been furnished with a red tab divider to present an instant reference to the section. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally left blank.



THREE VIEW
Figure 1-1

1.3 ENGINE

(a)	Number of Engines	2
(b)	Engine Manufacturer	Lycoming
(c)	Engine Model Number	
	Left	0-360-A1H6
	Right	L0-360-A1H6
(d)	Rated Horsepower	180
(e)	Rated Speed (rpm)	2700
(f)	Bore (in.)	5.125
(g)	Stroke (in.)	4.375
(h)	Displacement (cu. in.)	361
(i)	Compression Ratio	8.5:1
(j)	Engine Type	Four Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

1.5 PROPELLER

(a)	Number of Propellers	2
(b)	Propeller Manufacturer	Hartzell
(c)	Blade Model	
	Left	HC-C2Y(K,R)-2CEUF/ FC7666A-2R
	Right	HC-C2Y(K,R)-2CLEUF/ FJC7666A-2R
(d)	Number of Blades	2
(e)	Propeller Diameter (inches)	
	(1) Maximum	74
	(2) Minimum	72
(f)	Propeller Type	Constant Speed, Hydraulically Actuated, Full Feathering

1.7 FUEL

AVGAS ONLY

(a) Fuel Capacity (U.S. gal.) (total)	110
(b) Usable Fuel (U.S. gal.) (total)	108
(c) Fuel	
(1) Minimum Grade	100 Green or 100LL Blue Aviation Grade
(2) Alternate Fuels	Refer to latest revision of Lycoming Service Instruction 1070, except alcohol is ***not*** approved for use in this airplane.

1.9 OIL

(a) Oil Capacity (U.S. qts.) (per engine)	8
(b) Oil Specification	Refer to latest revision of Lycoming Service Instruction 1014.

(c) Oil Viscosity per Average Ambient Temperature for Starting.

Average Ambient Temperature All Temperatures	MIL-L-6082B SAE Grade	MIL-L-22851 Ashless Dispersant SAE Grades 15W-50 or 20W-50
Above 80°F	60	60
Above 60°F	50	40 or 50
30°F to 90°F	40	40
0°F to 70°F	30	30, 40 or 20W-40
0°F to 90°F	20W50	20W50 or 15W50
Below 10°F	20	30 or 20W-30

When operating temperatures overlap indicated ranges, use the lighter grade oil.

NOTE

Refer to the latest issue of Lycoming Service Instruction 1014 (Lubricating Oil Recommendations) for further information.

1.11 MAXIMUM WEIGHTS

(a) Maximum Ramp Weight (lb)	3816
(b) Maximum Takeoff Weight (lb)	3800
(c) Maximum Landing Weight (lb)	3800
(d) Maximum Weights in Baggage Compartment (lb)	200

1.13 STANDARD AIRPLANE WEIGHTS

Refer to Figure 6-5 for the Standard Empty Weight and the Useful Load.

1.15 BAGGAGE SPACE AND ENTRY DIMENSIONS

(a) Compartment Volume (cu. ft.)	24
(b) Entry Dimensions (in.)	
(1) Entry Width (in.)	22
(2) Entry Height(in.)	20

1.17 SPECIFIC LOADING

(a) Wing Loading (lbs. per sq. ft.)	21.1
(b) Power Loading (lbs. per hp)	10.55

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1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following definitions are of symbols, abbreviations and terminology used throughout the handbook and those which may be of added operational significance to the pilot.

(a) General Airspeed Terminology and Symbols

CAS	Calibrated Airspeed means 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 airspeed of an airplane as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in Knots.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
KTAS	True Airspeed expressed in Knots.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an airplane can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{MCA}	Air Minimum Control Speed is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling, not more than a 5° bank towards the operative engine, takeoff power on operative engine, landing gear up, flaps in takeoff position, and most rearward C.G.
V_{NE}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

V_{SSE} Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.

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

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

(b) Meteorological Terminology

ISA International Standard Atmosphere in which:

(1) The air is a dry perfect gas;
(2) The temperature at sea level is 15° Centigrade (59° Fahrenheit);
(3) The pressure at sea level is 29.92 inches Hg (1013.2 mb)
(4) The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003564°F) per foot and zero above that altitude.

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

Indicated Pressure Altitude The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 millibars).

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.
Wind	'The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

(c) Power Terminology

Takeoff Power	Maximum power permissible for takeoff.
Maximum Continuous Power	Maximum power permissible continuously during flight.
Maximum Climb Power	Maximum power permissible during climb.
Maximum Cruise Power	Maximum power permissible during cruise.

(d) Engine Instruments

CHT	Cylinder Head Temperature
EGT	Exhaust Gas Temperature

(e) Airplane Performance and Flight Planning Terminology

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

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

Demonstrated Crosswind Velocity	The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests.
Accelerate-stop Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.
Route Segment	A part of a route. Each end of that part is identified by (1) a geographical location or (2) a point at which a definite radio fix can be established.

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance in inches from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.
Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run-up fuel).
Maximum Takeoff Weight	Maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

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SECTION 2

LIMITATIONS

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SECTION 2
LIMITATIONS

2.1 GENERAL

This section provides the FAA Approved operating limitations, instrument markings, color coding and basic placards necessary for the safe operation of the airplane and its systems.

Limitations associated with those optional systems and equipment which require handbook supplements can be found in Section 9 (Supplements).

2.3 AIRSPEED LIMITATIONS

SPEED	KIAS	KCAS
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation.	202	194
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	169	165
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
At 3800 lb Gross Weight	135	133
At 2700 lb Gross Weight	112	112

CAUTION

Maneuvering speed decreases at lighter weight as the effects of aerodynamic forces become more pronounced. Linear interpolation may be used for intermediate gross weights. Maneuvering speed should not be exceeded while operating in rough air.

2.3 AIRSPEED LIMITATIONS (Continued)

SPEED	KIAS	KCAS
Maximum Landing Gear Extended Speed (V_{LE}) -Do not exceed this speed with landing gear extended.	140	138
Maximum Landing Gear Extension Speed (V_{LO}) - Do not exceed this speed when extending the landing gear.	140	138
Maximum Landing Gear Retraction Speed (V_{LO}) - Do not exceed this speed when retracting the landing gear.	109	109
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with the flaps extended.	111	109
One Engine Inoperative Best Rate of Climb Speed.	88	90
Air Minimum Control Speed (V_{MCA}) - Lowest airspeed at which airplane is controllable with one engine operating and no flaps. **Note**: This is a stalled condition.	56	63

2.5 AIRSPEED INDICATOR MARKINGS

(Avidyne PFD and Standby Airspeed Indicator)

MARKING	IAS
Red Radial Line (Never Exceed)	202 KTS
Yellow Arc (Caution Range - Smooth Air Only)	169 KTS to 202 KTS
Green Arc (Normal Operating Range)	57 KTS to 169 KTS
White Arc (Flaps Down)	55 KTS to 111 KTS
Blue Radial Line (One Engine Inoperative Best Rate of Climb Speed)	88 KTS
Red Radial Line (One Engine Inoperative Air Minimum Control Speed)	56 KTS

2.7 POWER PLANT LIMITATIONS

(a)	Number of Engines	2
(b)	Engine Manufacturer	Lycoming
(c)	Engine Model No.	
	Left	0-360-A1H6
	Right	L0-360-A1H6
(d)	Engine Operating Limits	
	(1) Maximum Horsepower	180
	(2) Maximum Rotation Speed (RPM)	2700
	(3) Maximum Manifold Pressure	Full Throttle
	(4) Maximum Cylinder Head Temperature	500°F
	(5) Maximum Oil Temperature	245°F
(e)	Oil Pressure	
	Minimum	25 PSI
	Maximum	115 PSI
(f)	Fuel Pressure	
	Normal Operating Range (green arc)	0.5 PSI to 8 PSI
	Minimum (red line)	0.5 PSI
	Maximum (red line)	8 PSI
(g)	Fuel (AVGAS ONLY)	
	(minimum grade)	100 or 100LL Aviation Grade
(h)	Number of Propellers	2
(i)	Propeller Manufacturer	Hartzell
(j)	Propeller Hub and Blade Models	
	Left	HC-C2Y(K,R)-2CEUF/ FC7666A-2R
	Right	HC-C2Y(K,R)-2CLEUF/ FJC7666A-2R
(k)	Propeller Diameter (inches)	
	Maximum	74 IN.
	Minimum	72 IN.

2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer

Green Arc (Normal Operating Range)	500 to 2700 RPM
Red Line (Maximum)	2700 RPM

(b) Oil Temperature

Green Arc (Normal Operating Range)	75°F to 245°F
Red Line (Maximum)	245°F

(c) Oil Pressure

Green Arc (Normal Operating Range)	55 PSI to 95 PSI
Yellow Arc (Caution Range) (Idle)	25 PSI to 55 PSI
Yellow Arc (Warm Up, Taxi & Takeoff)	95 PSI to 115 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	115 PSI

(d) Cylinder Head Temperature

Green Arc (Normal Range)	200°F to 500°F
Red Line (Maximum)	500°F

2.11 WEIGHT LIMITS

(a)	Maximum Ramp Weight	3816 lb
(b)	Maximum Takeoff Weight	3800 lb
(c)	Maximum Landing Weight	3800 lb
(d)	Maximum Weight in Baggage Compartment	200 lb

NOTE

Refer to Section 5 (Performance) for maximum weight as limited by performance.

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
2800	84.0	93.0
3400	85.0	93.0
3800	89.0	93.0

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at wing station 106.

It is the responsibility of the airplane owner and the pilot to ensure that the airplane is properly loaded. See Section 6 (Weight and Balance) for proper loading instructions.

2.15 MANEUVER LIMITS

All intentional acrobatic maneuvers (including spins) are prohibited. Avoid abrupt maneuvers.

2.17 FLIGHT LOAD FACTORS

(a) Positive Load Factor (Maximum)
  (1) Flaps Up — 3.8 G
  (2) Flaps Down — 2.0 G

(b) Negative Load Factor (Maximum) — No inverted maneuvers approved

2.19 TYPES OF OPERATION

The airplane is approved for the following operations when equipped in accordance with FAR 91 or FAR 135.

(a) Day V.F.R.
(b) Night V.F.R.
(c) Day I.F.R.
(d) Night I.F.R.
(e) Non Icing

2.21 FUEL LIMITATIONS

(a)	Minimum Aviation Fuel Grade	100LL or 100
(b)	Total Capacity	110 U.S. GAL.
(c)	Unusable Fuel The unusable fuel for this airplane has been determined as 1.0 gallon in each nacelle in critical flight attitudes.	2 U.S. GAL.
(d)	Usable Fuel The usable fuel in this airplane has been determined as 54 gallons in each nacelle or a total of 108 gallons.	108 U.S. GAL.

2.23 MAXIMUM SEATING CONFIGURATION

The maximum seating capacity is 4 persons.

2.25 AVIDYNE PFD LIMITATIONS

1. IFR flight is prohibited when the PFD or any standby instrument is inoperative (altimeter, airspeed indicator, artificial horizon, or whiskey compass).
2. IFR flight is prohibited upon aircraft total loss of essential engine parameter display (manifold pressure, tachometer, fuel flow).
3. The Avidyne FlightMax Entegra series Primary Flight Display Pilot's Guide, p/n 600-00104-003, latest revision, must be available to the pilot during all flight operations.
4. If a VLOC is displayed on the HSI and GPSS mode is engaged on the autopilot, the autopilot will track the active flight plan in the GPS corresponding to the selected VLOC (i.e. GPS1 for VLOC1 or GPS2 for VLOC2). This configuration is potentially confusing and must be avoided.
5. GPSS mode must not be used on the final approach segment of a VLOC approach (ILS, LOC or non-GPS-overlay VOR). GPSS mode must be deselected (i.e., NAV mode selected) prior to the turn onto the final approach course.

NOTE

The PFD integrates with separately approved sensor and flight control installations. Adherence to limitations in appropriate installation AFM supplements is mandatory.

2.27 AVIDYNE MFD LIMITATIONS

1. The Avidyne moving map display provides visual advisory of the airplane's GPS position against a moving map. This information supplements CDI course deviation and information presented on the GPS navigator. The moving map display must not be used as the primary navigation instrument.
2. Use of Map page during IFR flight requires an IFR approved GPS receiver and installation, operated in accordance with its applicable limitations.
3. The Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00105-000, latest revision, must be available to the pilot during all flight operations.
4. Aircraft dispatch is prohibited when the MFD is inoperative.

NOTE

The MFD integrates with separately approved sensor and flight control installations. Adherence to limitations in appropriate installation AFM supplements is mandatory.

CAUTION

Traffic information shown on the Map page display is provided to the pilot as an aid to visually acquiring traffic. Pilot's should maneuver their aircraft based only on ATC guidance or positive visual acquisition of the conflicting traffic. Maneuvers should be consistent with ATC instructions. No maneuvers should be based only on a Traffic Advisory.

Terrain information shown on the Map page display is provided to the pilot as an aid to situational awareness. The Map page terrain color representations should not be used as a basis for terrain avoidance.

2.29 TRAFFIC INFORMATION

The pilot should not maneuver the aircraft based on the traffic display only. The traffic display is intended to assist in visually locating traffic. The traffic display lacks the resolution necessary for use in evasive maneuvering. Maneuvers should be consistent with ATC instructions.

2.31 CMAX CHART PAGE LIMITATIONS

The geographic referenced aircraft symbol must not be used for navigation.

NOTE

The aircraft symbol displayed provides supplemental aircraft situational awareness information. It is not intended as a means for navigation or flight guidance. The airplane symbol is not to be used for conducting instrument approaches or departures. Position accuracy, orientation, and related guidance must be assumed by other means or required navigation.

Operators with the optional CMax Chart Page must have back-up charts available. Do not rely upon CMax charts as your sole source of navigation information.

2.33 MID-CONTINENT ELECTRIC ATTITUDE INDICATOR LIMITATIONS

1. The emergency battery must be checked for proper operation prior to flight.
2. Should the RED TEST annunciator illuminate any time during the self test, this is an indication that the battery pack is in need of charging, or possible replacement. Flight in Instrument Meteorological Conditions (IMC) is prohibited.
3. Internal battery should be used for emergency use only.

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2.35 PLACARDS

On the side panel to the left of the pilot:

LIMITATIONS	INFORMATION
THE MARKINGS & PLACARDS INSTALLED IN THIS AIRPLANE CONTAIN OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THE NORMAL CATEGORY. OTHER OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THIS CATEGORY ARE CONTAINED IN THE AIRPLANE FLIGHT MANUAL. NO ACROBATIC MANEUVERS, INCLUDING SPINS, APPROVED. THIS AIRCRAFT APPROVED FOR V.F.R., I.F.R., DAY AND NIGHT NON-ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135. ONE ENGINE INOPERATIVE AIR MINIMUM CONTROL SPEED 56 KIAS. ONE ENGINE INOPERATIVE STALLS NOT RECOMMENDED. CAN CAUSE 300 FT. LOSS OF ALTITUDE AND 30° PITCH ANGLE.	OIL COOLER WINTERIZATION PLATE TO BE REMOVED WHEN AMBIENT TEMPERATURE EXCEEDS 50°F. **WARNING** TURN OFF STROBE LIGHTS WHEN IN CLOSE PROXIMITY TO GROUND OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE. 35669-142

On the instrument panel in full view of the pilot:

V_A 135 AT 3800 LBS
(SEE P.O.H.)
V_{LO} 140 DN, 109 UP
V_{LE} 140 MAX.
DEMO. X-WIND 17 KTS

In full view of the pilot and passengers:

NO SMOKING

On the landing gear warning mute switch:

GEAR
WARN
MUTE

2.35 PLACARDS (Continued)

On the storm window:

DO NOT OPEN ABOVE 129 KIAS

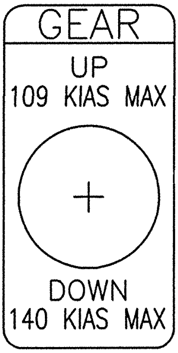
On the vertical window post between the first and second left side windows and close to the Emergency Exit release handle:

EMERGENCY EXIT
REMOVE COVER PANEL
PULL HANDLE FORWARD
PUSH WINDOW OUT

Near the emergency gear release:

EMERGENCY GEAR EXTENSION
PULL TO RELEASE. SEE AFM
BEFORE RE-ENGAGEMENT

Near the gear selector switch:



2.35 PLACARDS (Continued)

On the center post of the windshield in full view of the pilot:

CAUTION

COMPASS
CAL. MAY
BE IN ERROR
WITH ELECT.
EQUIPMENT
OTHER THAN
AVIONICS ON.

On the instrument panel near the elevator trim switch:

ELEV. TRIM

PUSH ON/OFF

On the instrument panel in full view of the pilot (stormscope equipped aircraft only):

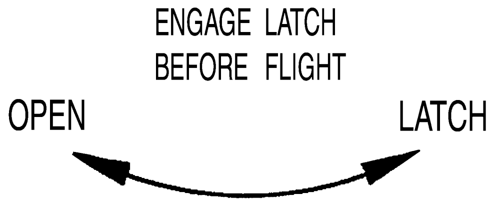
STORMSCOPE NOT TO BE USED FOR
THUNDERSTORM AREA PENETRATION

On the instrument panel above the alternate static source:

ALTERNATE STATIC SOURCE
ALL CABIN VENTS AND STORM WINDOW MUST BE CLOSED.
HEATER AND DEFROSTER MUST BE ON. PULL AFT TO OPEN

2.35 PLACARDS (Continued)

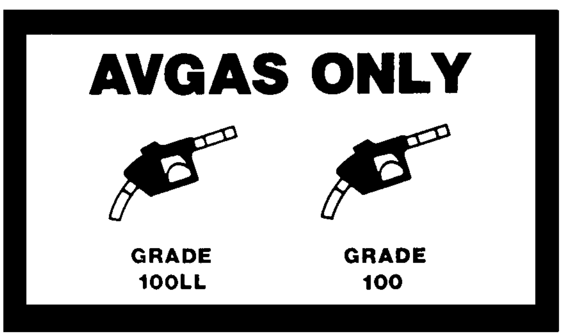
Adjacent to the upper door latch:



On the inside of the baggage compartment door:

BAGGAGE MAX 200 LBS

Adjacent to the fuel tank filler caps:



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SECTION 3
EMERGENCY PROCEDURES

3.1 GENERAL

This section provides the recommended procedures for coping with various emergency or critical situations. All of the emergency procedures required by the FAA as well as those necessary for operation of the airplane, as determined by its operating and design features, are presented.

Emergency procedures associated with optional systems and equipment which require handbook supplements are presented in Section 9, Supplements.

This section is divided into two basic parts. The first part contains the emergency procedures checklists. These checklists supply an immediate action sequence to be followed during critical situations with little emphasis on the operation of the systems. The numbers located in parentheses after each checklist heading indicate where the corresponding paragraph in the amplified procedures can be found.

The second part of the section provides amplified emergency procedures corresponding to the emergency procedures checklist items. These amplified emergency procedures contain additional information to provide the pilot with a more complete description of the procedures so they may be more easily understood. The numbers located in parentheses after each paragraph heading indicates the corresponding checklist paragraph.

Pilots must familiarize themselves with the procedures given in this section and must be prepared to take the appropriate action should any emergency situation arise. The procedures are offered as a course of action for coping with the particular situation or condition described.They are not a substitute for sound judgement and common sense.

Most basic emergency procedures are a normal part of pilot training. The information presented in this section is not intended to replace this training. This information is intended to provide a source of reference for the procedures which are applicable to this airplane. The pilot should review standard emergency procedures periodically to remain proficient in them.

3.3 AIRSPEEDS FOR EMERGENCY OPERATIONS

One engine inoperative air minimum control ....56 KIAS
One engine inoperative best rate of climb ....88 KIAS
One engine inoperative best angle of climb....................................82 KIAS
Maneuvering (3800 lb)..135 KIAS
Never exceed ....202 KIAS

3.5 EMERGENCY PROCEDURES CHECKLIST

3.5a Engine Inoperative Procedures (3.9)

IDENTIFYING DEAD ENGINE AND VERIFYING POWER LOSS (3.9a)

Loss of thrust.
Nose of aircraft will yaw in direction of dead engine.
Rudder pedal force will be required in the direction away from the dead engine to maintain straight flight.

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE) (3.9b)

Throttle ....RETARD TO VERIFY
Propeller ....FEATHER (950 RPM Min.)
Mixture ....IDLE CUT-OFF
Cowl Flap ....CLOSE
Alternator...OFF
Magneto Switches ....OFF
Electric fuel pump ....OFF
Fuel selector..OFF
Electrical load ....REDUCE
Crossfeed ....AS REQUIRED

3.5a Engine Inoperative Procedures (Continued)

ENGINE FAILURE DURING TAKEOFF (SPEED BELOW 75 KIAS OR GEAR DOWN) (3.9c)

If engine failure occurs during takeoff and 75 KIAS has not been attained:

Throttles ....IMMEDIATELY CLOSE
Brakes (or land and brake) ....AS REQUIRED
Stop straight ahead.

If insufficient runway remains for a complete stop:

Throttles ....IMMEDIATELY CLOSE
Mixtures..IDLE CUTOFF
Fuel Selectors ....OFF
Magneto Switches ....OFF
Electric Fuel Pumps..OFF
Battery Master Switch ....OFF
Brakes ....APPLY MAXIMUM BRAKING

Maintain directional control, maneuvering to avoid obstacles if necessary.

ENGINE FAILURE DURING TAKEOFF (SPEED ABOVE 75 KIAS) (3.9d)

If sufficient runway remains for a complete stop:

Directional Control ....MAINTAIN
Throttles ....IMMEDIATELY CLOSE
Land if airborne and stop straight ahead.

Brakes ....AS REQUIRED

3.5a Engine Inoperative Procedures (Continued)

ENGINE FAILURE DURING TAKEOFF (SPEED ABOVE 75 KIAS) (3.9d) (Continued)

If gear is in transit or up and the decision is made to continue:

WARNING

Negative climb performance may result from an engine failure occurring after liftoff and before the failed engine's propeller has been feathered, the gear has been retracted, the cowl flap on the failed engine is closed and a speed of 88 KIAS has been attained.

WARNING

In many combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to Climb Performance - One Engine Operating - Gear Up chart in Section 5.

Mixture controls ....FULL FORWARD
Propeller controls ....FULL FORWARD
Throttle controls ....FULL FORWARD
Directional control ....MAINTAIN
Flaps....................FULL UP
Landing Gear Selector ....CHECK UP
Inoperative Engine ....IDENTIFY and VERIFY
Throttle (Inop. Engine) ....CLOSE
Propeller (Inop. Engine)....................FEATHER
Mixture (Inop. Engine)....................IDLE CUT-OFF
Establish Bank ....2° to 3° INTO OPERATIVE ENGINE
Climb Speed ....88 KIAS
Trim....................ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 BALL SLIP INDICATED ON THE SKID/SLIP INDICATOR
Cowl Flap (Inop. Engine)....................CLOSE
Alternator Switch (Inop. Engine) ....OFF
Magneto Switches (Inop. Engine)....................OFF
Electric Fuel Pump (Inop. Engine)....................OFF
Fuel Selector (Inop. Engine) ....OFF

Land as soon as practical at the nearest suitable airport.

3.5a Engine Inoperative Procedures (Continued)

ENGINE FAILURE DURING CLIMB (3.9e)

Airspeed....................MAINTAIN 88 KIAS
Directional Control....................MAINTAIN
Power....................MAX. CONTINUOUS
Inoperative Engine....................IDENTIFY and VERIFY
Inoperative Engine....................Complete Engine Securing Procedure
Trim....................ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 BALL SLIP INDICATED ON THE SKID/SLIP INDICATOR
Cowl Flap (Operative Engine)....................AS REQUIRED
Land as soon as practical at the nearest suitable airport.

ENGINE FAILURE DURING FLIGHT (SPEED BELOW V_{MCA}) (3.9f)

Rudder....................APPLY AGAINST YAW (Operative Engine)
Throttles....................RETARD TO STOP TURN
Pitch Attitude....................LOWER NOSE TO ACCELERATE ABOVE V_{MCA} (56 KIAS)
Operative Engine....................INCREASE POWER AS AIRSPEED INCREASES ABOVE V_{MCA} (56 KIAS)

If altitude permits, a restart may be attempted.

If restart fails or if altitude does not permit restart:

Inoperative Engine....................Complete Engine Securing Procedure
Trim....................ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 BALL SLIP INDICATED ON THE SKID/SLIP INDICATOR
Cowl Flap (Operative Engine)....................AS REQUIRED

3.5a Engine Inoperative Procedures (Continued)

ENGINE FAILURE DURING FLIGHT (SPEED ABOVE V_{MCA}) (3.9g)

Inoperative Engine....................IDENTIFY
Operative Engine....................ADJUST POWER AS REQUIRED
Airspeed....................ATTAIN AND MAINTAIN AT LEAST 88 KIAS

Before securing inop. engine:

Electric Fuel Pump....................ON
Fuel Quantity....................CHECK
Oil Pressure and Temperature....................CHECK
Magneto Switches....................CHECK
Air Start....................ATTEMPT

If engine does not start, complete Engine Securing Procedure.

Power (Operative Engine)....................AS REQUIRED
Fuel Quantity (Operative Engine Tank)....................SUFFICIENT
Electric Fuel Pump (Operative Engine)....................AS REQUIRED
Cowl Flap (Operative Engine)....................AS REQUIRED
Trim....................ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 BALL SLIP INDICATED ON THE SKID/SLIP INDICATOR
Electrical Load....................DECREASE TO MIN. REQUIRED
Land as soon as practical at the nearest suitable airport.

3.5a Engine Inoperative Procedures (Continued)

ONE ENGINE INOPERATIVE LANDING (3.9h)

Inoperative Engine ....ENGINE SECURING PROCEDURE COMPLETE
Seat Belts/Harnesses...SECURE
Fuel Selector (Operative Engine)..ON
Electric Fuel Pump (Operative Engine)..ON
Mixture (Operative Engine) ....FULL RICH
Propeller Control (Operative Engine) ....FULL FORWARD
Cowl Flap (Operative Engine)..AS REQUIRED

Altitude & Airspeed..MAKE NORMAL APPROACH

When Landing is Assured:

Landing Gear ....DOWN
Wing Flaps...25° (2nd Notch)
Final Approach Speed ....90 KIAS
Power ....RETARD SLOWLY AND FLARE AIRPLANE
Trim ....AS POWER IS REDUCED (AIRPLANE WILL YAW IN DIRECTION OF OPERATIVE ENGINE)

WARNING

Negative climb performance may result from an engine failure occurring after liftoff and before the failed engine's propeller has been feathered, the gear has been retracted, the cowl flap on the failed engine is closed and a speed of 88 KIAS has been attained.

WARNING

Under many conditions of loading and density altitude a go-around may be impossible and in any event the sudden application of power during one engine inoperative operation makes control of the airplane more difficult.

NOTE

A one engine inoperative go-around should be avoided if at all possible.

3.5a Engine Inoperative Procedures (Continued)

ONE ENGINE INOPERATIVE GO-AROUND (Should be avoided if at all possible) (3.9i)

Mixture ....FORWARD
Propeller....................FORWARD
Throttle ....SMOOTHLY ADVANCE TO TAKEOFF POWER
Flaps....................RETRACT SLOWLY
Landing Gear ....RETRACT (AFTER POSITIVE CLIMB ACHIEVED)
Airspeed....................88 KIAS
Trim....................ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 BALL SLIP INDICATED ON THE SKID/SLIP INDICATOR
Cowl Flap (Operating Engine) ....AS REQUIRED

3.5b Air Starting Procedure (3.11)

UNFEATHERING PROCEDURE/ UNFEATHERING ACCUMULATOR FUNCTIONING (3.11a)

NOTE

With the propeller unfeathering system installed, the propeller will usually windmill automatically when the propeller control is moved forward.

Fuel Selector (Inoperative Engine) ....ON
Magneto Switches (Inoperative Engine)....................ON
Electric Fuel Pump (Inoperative Engine) ....ON
Mixture ....FULL RICH
Throttle ....Open 1/4 inch

3.5b Air Starting Procedure (3.11) (Continued)

Prop Control ....FULL FORWARD
Throttle ....Reduce power until engine is warm
Alternator ....ON

NOTE

Starter assist is required if the propeller is not windmilling freely within 5-7 seconds after the propeller control has been moved forward.

When propeller unfeathering occurs, it may be necessary to retard the prop control slightly so as to not overspeed the prop.

UNFEATHERING PROCEDURE/ STARTER ASSISTED (3.11b)

Fuel Selector (Inoperative Engine) ....ON
Magneto Switches (Inoperative Engine)..ON
Electric Fuel Pump (Inoperative Engine) ....ON
Mixture ....FULL RICH
Throttle ....Two full strokes and then open 1/4 inch
Prop Control ....FORWARD TO CRUISE
Starter...ENGAGE UNTIL PROP WINDMILLS
Throttle...REDUCE POWER until engine is warm

If engine does not start, prime as required.

Alternator ....ON

3.5c Engine Roughness (3.13)

NOTE

Partial carburetor heat may be worse than no heat at all, since it may melt part of the ice which will refreeze in the intake system. Therefore, when using carburetor heat always use full heat; and, when ice is removed, return the control to the full cold position.

Carburetor Heat .... ON

If roughness continues after one minute:

Carburetor Heat .... OFF
Mixture .... ADJUST for MAXIMUM SMOOTHNESS
Electric Fuel Pump .... ON
Engine Gauges .... CHECK
Magneto Switches .... CHECK

If operation is satisfactory on either magneto, continue on that magneto at reduced power and full RICH mixture to first airport.

3.5d Engine Overheat (3.15)

Cowl Flaps .... OPEN
Mixture .... ENRICHEN
Power .... REDUCE
Airspeed .... INCREASE (If altitude permits)

3.5e Loss of Oil Pressure (3.17)

Oil Pressure .... VERIFY LOSS & ENGINE AFFECTED
Engine .... SECURE per Engine Securing Procedure

3.5f Engine Fire (3.19)

ENGINE FIRE DURING START (3.19a)

If engine has not started:

Mixture ....IDLE CUT-OFF
Throttle ....FULL OPEN
Starter ....CONTINUE to Crank Engine

If engine has already started and is running, continue operating to try pulling the fire into the engine.

If fire continues:

Fuel Selectors ....OFF
Electric Fuel Pumps ....OFF
Mixtures ....IDLE CUT-OFF
Throttles ....FULL OPEN
External Fire Extinguisher ....USE
Airplane ....EVACUATE

NOTES

If fire continues, shut down both engines and evacuate.

If fire is on the ground, it may be possible to taxi away.

ENGINE FIRE IN FLIGHT (3.19b)

Fuel Selector (Affected Engine) ....OFF
Throttle (Affected Engine) ....IDLE
Propeller (Affected Engine) ....FEATHER
Mixture (Affected Engine) ....IDLE CUT-OFF
Cowl Flap (Affected Engine) ....OPEN
Affected Engine ....COMPLETE Engine Securing Procedure

If fire persists:

Airspeed ....INCREASE in attempt to blow out fire

Land as soon as possible at the nearest suitable airport.

3.5g Electrical Fire (3.21)

Flashlight (at night) ....LOCATE
Battery Master Switch ....OFF
Alternator Switches ....OFF
All Electrical Switches ....OFF
Radio Master Switch ....OFF
Vents ....CLOSED (To avoid drafts)
Cabin Heat ....OFF

If fire persists, locate and, if practical, extinguish with portable fire extinguisher located on the center console just aft of the 2 front seats.

Bus Circuit Breakers
- Main Bus 1 ....PULL
- Main Bus 2 ....PULL
- Non-Essential ....PULL
- Avionics Bus # 1 ....PULL
- Avionics Bus # 2 ....PULL
- L. Alternator ....PULL
- R. Alternator ....PULL

All Main Bus Circuit Breakers ....PULL
All Avionics Bus Circuit Breakers ....PULL

NOTE

At this point, the pilot must decide if the flight can be safely continued without electrical power. If so, land at the nearest airport and have the electrical system repaired.

If electrical power is required for safe continuation of flight, proceed as follows:

WARNING

The following procedure may reenergize the faulty system. Reset the circuit breakers one at a time. Allow a short time period between the resetting of each breaker. If the faulty system is reinstated, its corresponding circuit breaker must be immediately pulled.

3.5g Electrical Fire (3.21) (Continued)

NOTE

Refer to Power Distribution paragraph on page 7-22 and Figure 7-23 on page 7-23 for electrical power distribution information.

One (1) Main Bus Circuit Breaker ....IN
Battery Master Switch...ON
L. or R. Alternator Circuit Breaker ....IN

NOTE

Select the applicable Alternator Field circuit breaker and alternator switch corresponding to the Alternator circuit breaker pressed in.

Alternator Field Circuit Breaker...IN
Alternator Switch ....ON
Main Bus Circuit Breakers
    Landing Gear Control..IN
    Avionics Bus #1...IN
    Avionics Bus #2...IN
Radio Master Switch ....ON
    Audio Amp/Mkr ....IN
    Com #1 ....IN
    Nav/GPS #1 ....IN
Vents ....OPEN (When it is ascertained that fire is completely extinguished)
Land as soon as practical.

WARNING

The landing gear must be lowered using the emergency extension procedure.

3.5h Fuel Management During One Engine Inoperative Operation (3.23)

CRUISING (3.23a)

When using fuel from tank on the same side as the operating engine:

Fuel Selector (Operative Engine)..ON
Fuel Selector (Inoperative Engine)...OFF
Electric Fuel Pumps...OFF
(except in case of engine driven pump failure when electric fuel pump on operating engine side must be used)

When using fuel from tank on the side opposite the operating engine:

Fuel Selector (Operative Engine)...CROSSFEED
Fuel Selector (Inoperative Engine)...OFF
Electric Fuel Pumps...OFF
(except in case of engine driven pump failure, electric fuel pump on operating engine side must be used)

NOTE

Use crossfeed in level cruise flight only.

LANDING (3.23b)

Fuel Selector (Operative Engine)..ON
Fuel Selector (Inoperative Engine)...OFF

3.5i Engine Driven Fuel Pump Failure (3.25)

Electric Fuel Pump (Affected Engine)..ON

3.5j Landing Gear Unsafe Warnings (3.27)

Red gear warning annunciator light indicates gear in transit.
Recycle gear if indication continues.
Red gear warning annunciator light will illuminate and gear horn sounds when the gear is not down and locked if throttles are at low settings or wing flaps are in second or third notch position.

3.5k Landing Gear Malfunctions (3.29)

MANUAL EXTENSION OF LANDING GEAR

If emergency gear extension is required due to electrical power failure, the gear position indicator lights will not illuminate.

Check following before extending gear manually:

Day/Night Dimmer Switch (Daytime) ....DAY
Circuit Breakers...CHECK
Battery Master Switch...ON
Alternators ....CHECK

To extend, proceed as follows:

Airspeed ....REDUCE (100 KIAS max.)
Gear Selector ....GEAR DOWN
LOCKED position
Emerg. Gear Extend Knob..PULL
Indicator Lights ....3 GREEN
Leave emergency gear extension knob out.

WARNING

If the emergency gear extension knob has been pulled out to lower the gear due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gear hydraulic and electrical systems.

3.5m Gear Up Emergency Landing (3.31)

Approach and Landing ....NORMAL
Airspeed ....80 - 90 KIAS
Flaps..UP
Just prior to touchdown:
Throttles ....CLOSE
Battery Master Switch..OFF
Fuel Selectors ....OFF
Contact with surface should be made at the slowest possible airspeed.

3.5n Electrical Failures (3.33)

SINGLE ALTERNATOR FAILURE (Zero Amps or ALTernator Inop. Light Illuminated - Annunciator Panel). (3.33a)

NOTE

Anytime total tie bus voltage is below approximately 12.5 Vdc, the LOW BUS VOLTAGE annunciator will illuminate and the digital value will turn red.

Verify Failure ....CHECK AMMETERS
Electrical Load (If LOW BUS VOLTAGE
annunciator illuminated) ....REDUCE until total load
is LESS THAN 60 amps
& low bus voltage
annunciator EXTINGUISHED
Failed ALTR Switch ....OFF
Failed ALTR circuit breaker ....CHECK and RESET
AS REQUIRED
Failed ALTR Switch (After OFF at least 1 second) ....ON

If power not restored:

Failed ALTR Switch ....OFF
Ammeter ....MONITOR and MAINTAIN
BELOW 60 AMPS

One alternator will supply sufficient current for minimum required avionics and cockpit lighting. Under no circumstances may the total electrical load exceed 60 amps. The cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

3.5n Electrical Failures (3.33) (Continued)

DUAL ALTERNATOR FAILURE (Zero Amps Both Ammeters or Alternator Inop. Light Illuminated - Annunciator Panel). (3.33b)

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency gear extension procedure. The gear position lights will be inoperative.

NOTE

Anytime total tie bus voltage is below approximately 12.5 Vdc, the LOW BUS VOLTAGE annunciator will illuminate and the digital value will turn red.

Verify failure ....CHECK AMMETERS
Electrical Load ....REDUCE to MINIMUM
REQUIRED FOR SAFE FLIGHT
Alternator Switches ....OFF
Alternator Circuit Breakers..CHECK and RESET
AS REQUIRED
Alternator Switches (One at a time
after OFF at least 1 second)...ON

If only one alternator resets:

Operating Alternator Switch ....ON
Failed Alternator Switch...OFF
Electrical Load....................................... MAINTAIN LESS than 60 AMPS
Ammeter...MONITOR

3.5n Electrical Failures (3.33) (Continued)

If neither alternator resets:

Both Alternator Switches...OFF
Continue flight with reduced electrical load on battery power only.

NOTE

LOW BUS VOLTAGE annunciator will also be illuminated.

Land as soon as practical. Anticipate complete electrical failure. Duration of battery power available will be dependent on electrical load and battery condition prior to failure.

3.5o Avionics Systems Failures (3.35)
Failure of Primary Flight Display (PFD)
Indication: PFD Display goes blank.

Standby Attitude Indicator ....VERIFY ON and flag is pulled on indicator

Maintain attitude control using standby attitude indicator and establish the aircraft in straight and level unaccelerated flight.

If time and conditions permit:

PFD Brightness Control (BRT/DIM) ....Adjust to full bright
PFD Circuit Breaker ....PULL and RESET

If PFD Screen cannot be reinstated:

On aircraft equipped with the optional secondary Nav Indicator:
Secondary Nav Indicator ....Utilize for primary navigation
Engine Instruments..Refer to Engine page of MFD

NOTE

The Secondary Nav Indicator receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

Land as soon as practical.

3.5o Avionics Systems Failures (3.35) (Continued)

Loss of PFD Engine Data

Indication: Indicator needle removed from dial and digital readout replaced with white dashes.

Engine Instruments ....Refer to Engine page of MFD

Land as soon as practical.

Invalid Air Data

Indication: Airspeed, Altimeter, and Vertical Speed data replaced with Red X's.

Maintain aircraft airspeed and altitude by referring to the standby airspeed indicator and altimeter.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

If air data is still invalid:

Refer to standby airspeed indicator and altimeter.

Land as soon as practical.

Invalid Heading Data

Indication: Heading Bug and Heading Data removed and replaced with Red X's.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

Maintain heading control using magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

Land as soon as practical.

3.5o Avionics Systems Failures (3.35) (Continued)

Invalid Attitude and Heading Data

Indication: Attitude and Heading Data removed and replaced with Red X's.

Standby Attitude Indicator ....VERIFY ON and flag is pulled on indicator

Maintain attitude control using standby attitude indicator.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

If attitude and heading data is still invalid:

Maintain attitude control by using standby attitude indicator.

Maintain heading control by utilizing magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

Land as soon as practical.

NOTE

The EXP5000 PFD comes equipped with a self-check monitor. "Crosscheck Attitude" is displayed when this monitor detects a condition that does not warrant removal of data. When this message is displayed, scan all standby instruments to crosscheck the aircraft attitude. The warning message is removed automatically when the self-check monitor confirms the EXP5000 PFD attitude is valid.

3.5o Avionics Systems Failures (3.35) (Continued)

Failure of Air Data, Attitude and Heading Reference System (ADAHRS)

Indication: Airspeed, Attitude, Heading and Altitude replaced with Red X's.

Standby Attitude Indicator ....VERIFY ON and flag is pulled on indicator

Maintain attitude control using standby attitude indicator.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

If ADAHRS initialization does not occur:

On aircraft equipped with the optional secondary Nav Indicator:
Secondary Nav Indicator ....Utilize for primary navigation
Engine Instruments ....Refer to Engine page of MFD

NOTE

The Secondary Nav Indicator receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

Land as soon as practical.

3.5o Avionics Systems Failures (3.35) (Continued)

Total Loss of Engine Instruments

Indication: Indicator needle removed from dial, digital readout replaced with white dashes, and yellow alert message saying Engine Sensor Unit Not Communicating.

DAU Circuit Breaker ....PULL and RESET

If specific engine data is still invalid:

NOTE

The following engine message(s) will be displayed on the MFD for the invalid parameter:

- Check Oil Temp
- Check Oil Press
- Check CHT
- Check RPM
- Check Manifold Pressure

If failure occurs during takeoff:

Mixture ....Maintain Full Rich
Propeller Control ....Full Forward
Manifold Pressure ....As required

Return to airport for landing.

If failure occurs during climb or landing:

Mixture ....Maintain Full Rich
Propeller Control ....Full Forward
Manifold Pressure ....As required

Land as soon as practical.

If failure occurs after setting cruise power and mixture:

Power ....Maintain power setting

Land as soon as practical.

If failure occurs prior to or during descent:

Manifold Pressure ....Set for descent
Mixture ....Full Rich

3.5o Avionics Systems Failures (3.35) (Continued)

Complete Electrical Failure

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

Standby Attitude Indicator....................SELECT Standby (STBY) power button

CAUTION

The STBY PWR annunciator will rapidly flash for approximately one minute when aircraft power is lost. STBY PWR must be selected, otherwise the standby attitude indicator will auto shutdown after approximately one minute.

Standby Attitude Indicator ....VERIFY ON and flag is pulled on gyro

Maintain aircraft control with reference to the standby airspeed, altimeter, and attitude indicators.

Battery Master Switch ....OFF

Land as soon as possible.

3.5p Spin Recovery (Intentional Spins Prohibited) (3.37)

NOTE

Federal Aviation Administration Regulations do not require spin demonstration of multi-engine airplanes; spin tests have not been conducted. The recovery technique presented is based on the best available information.

Throttles ....RETARD to idle
Rudder..FULL OPPOSITE TO DIRECTION OF SPIN
Control wheel ....FULL FORWARD
Ailerons ....NEUTRAL
Rudder ....NEUTRALIZE when rotation stops
Control wheel ....SMOOTH BACK PRESSURE to recover from dive

3.5q Open Door (Entry door only) (3.39)

If both top and side latches are open, the door will trail slightly open and airspeeds will be reduced slightly.

To close the door in flight:

Airspeed ....Slow to 82 KIAS.
Cabin Vents ....CLOSE
Storm Window..OPEN

If Top Latch is Open ....LATCH

If Side Latch is Open..PULL on armrest WHILE MOVING LATCH HANDLE to latched position

If Both Latches are Open ....LATCH SIDE latch THEN TOP latch

3.5r Propeller Overspeed (3.41)

Throttle (Affected Engine)..RETARD
Oil pressure (Affected Engine) ....CHECK
Prop control (Affected Engine) ....FULL DECREASE RPM
THEN SET if any
control available
Airspeed ....REDUCE
Throttle (Affected Engine)..................................AS REQUIRED to remain
below 2700 rpm

3.5s Emergency Descent (3.43)

Carburetor Heat...ON
Throttles...CLOSED
Prop Controls...FORWARD
Mixtures...AS REQUIRED
Landing Gear ....EXTEND 140 KIAS MAX.
Airspeed...140 KIAS

3.5t Emergency Exit (3.45)

Thermoplastic Cover ....REMOVE
Emergency Exit Handle..PULL FORWARD
Window ....PUSH OUT

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3.7 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of the recommended course of action and probable cause of an emergency situation.

3.9 ENGINE INOPERATIVE PROCEDURES (3.5)

3.9a Identifying Dead Engine and Verifying Power Loss (3.5a)

If it is suspected that an engine has lost power, the faulty engine must be identified, and its power loss verified. Rudder pressure required to maintain directional control will be on the side of the operative engine - in short, A DEAD FOOT INDICATES A DEAD ENGINE. Engine indications such as EGT and oil pressure may help confirm the dead engine.

3.9b Engine Securing Procedure (Feathering Procedure) (3.5a)

The engine securing procedure should always be accomplished in a sequential order according to the nature of the engine failure.

Begin the securing procedure by moving the throttle of the inoperative engine towards IDLE. If no changes are noted, the correct identification of the dead engine is confirmed. Move the propeller control to FEATHER (fully aft) before the propeller speed drops below 950 RPM. The propellers can be feathered only while the engine is rotating above 950 RPM. Loss of centrifugal force due to slowing rpm will actuate a stop pin that keeps the propeller from feathering each time the engine is stopped on the ground. One engine inoperative performance will decrease significantly if the propeller of the inoperative engine is not feathered.

The inoperative engine's mixture control should be moved fully aft to the IDLE CUTOFF position. Close its cowl flap to reduce drag. Turn off the alternator switch, magneto switches and the electric fuel pump, move the inoperative engine's fuel selector to the off position. Complete the procedure by reducing the electrical load and considering the use of the fuel crossfeed if the fuel quantity dictates.

NOTE

When an engine is feathered, the OIL PRESSURE and ALTERNATOR INOP annunciator warning lights will remain illuminated.

3.9c Engine Failure During Takeoff (Speed Below 75 KIAS or Gear Down) (3.5a)

Determination of runway length, single engine climb rate, and accelerate/stop distance will aid in determining the best course of action in the event of an engine failure during takeoff. If engine failure occurs during the takeoff roll, the takeoff MUST be aborted. If failure occurs after liftoff but before 75 KIAS is achieved or before the gear is retracted, the takeoff should also be aborted. Immediately close the throttles, land if airborne, apply brakes as required and stop straight ahead.

If an engine failure occurs below 75 KIAS and there is not adequate runway remaining for landing, deceleration and stop, immediately retard the throttle and mixture levers fully aft. Move the fuel selectors to the off position. Turn off the magneto switches followed by the master switch.

During these procedures maintain directional control and if necessary, maneuver to avoid obstacles.

3.9d Engine Failure During Takeoff (Speed Above 75 KIAS) (3.5a)

If engine failure occurs after liftoff with the gear still down and 75 KIAS has been attained the course of action to be taken will depend on the runway remaining and aircraft configuration. Also the pilot's decision must be based on a personal judgement, taking into consideration such factors as obstacles, the type of terrain beyond the runway, altitude and temperature, weight and loading, weather, airplane condition, and the pilot's own proficiency and capability.

WARNING

> In many combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to Climb Performance - One Engine Operating - Gear Up chart in Section 5.

If adequate runway remains, maintain heading. Close both throttles immediately, land if airborne, apply brakes as required and stop straight ahead.

3.9d Engine Failure During Takeoff (Speed Above 75 KIAS) (3.5a) (Continued)

If the runway remaining is inadequate for stopping or the gear is in-transit or up, the pilot must decide whether to abort or to continue the takeoff and climb on a single engine.

If a decision is made to continue the takeoff, the airplane will tend to turn in the direction of the inoperative engine, since one engine will be inoperative and the other will be at maximum power. Rudder pressure force on the side of the operative engine will be necessary to maintain directional control.

Verify the throttle, propeller and mixture controls are fully forward. Remember, keep in mind that the One Engine Inoperative Air Minimum Control speed (VMCA) is 56 KIAS and the One Engine Inoperative Best Rate of Climb speed (VYSE) is 88 KIAS. Verify that the flaps and landing gear are up.

Once the faulty engine is identified and its power loss verified, feather its propeller. Move the mixture to the IDLE CUT-OFF position. Establish a bank of 2° to 3° into the operative engine. Maintain 88 KIAS (VYSE). Trim the aircraft for 2° to 3° bank toward the operative engine with approximately 1/2 ball slip indicated on the skid/slip indicator. Close the cowl flap on the inoperative engine.

After the aircraft is trimmed, the alternator switch, magneto switches, electric fuel pump and fuel selector of the inoperative engine can be turned OFF. Close the cowl flap of the operative engine as much as possible without exceeding engine temperature limits.

Land as soon as practical at the nearest suitable airport.

3.9e Engine Failure During Climb (3.5a)

If engine failure occurs during climb, a minimum airspeed of 88 KIAS (V_{YSE}) should be maintained. Since one engine will be inoperative and the other will be at maximum power, the airplane will have a tendency to turn in the direction of the inoperative engine. Rudder pedal force on the side of the operative engine will be necessary to maintain directional control.

After the faulty engine has been identified and power loss has been verified, complete the Engine Securing Procedure. Continue a straight ahead climb until sufficient altitude (minimum of 1000 feet above ground elevation) is reached to execute the normal Single Engine Landing procedure at the nearest suitable airport.

For maximum climb performance in single engine flight, sideslip must be minimized by banking towards the operating engine 2° to 3°. The ball of the skid/slip indicator will be approximately 1/2 diameter out of center towards the operating engine for straight flight and should remain so displaced during any maneuvering necessary.

During this climb, engine temperatures must remain at or below specific limits set by the engine manufacturer. Use of full open cowl flaps on the operating engine will ensure that the established temperature limitations will not be exceeded on a day where air temperatures are 100°F at sea level decreasing from that point by 3.5°F per 1000 feet of altitude.

Land as soon as practical at the nearest suitable airport.

3.9f Engine Failure During Flight (Speed Below V_{MCA})(3.5a)

Should an engine fail during flight at an airspeed below V_{MCA} (56 KIAS) apply rudder towards the operative engine to minimize the yawing motion. The throttles should be retarded to stop the yaw towards the inoperative engine. Lower the nose of the aircraft to accelerate above 56 KIAS and increase the power on the operative engine as the airspeed exceeds 56 KIAS. The airplane should be banked 5° towards the operating engine during this recovery to maximize control effectiveness.

After an airspeed of at least 82 KIAS (V_{XSE}) has been established, an engine restart attempt may be made if altitude permits. If the restart has failed, or altitude does not permit, the engine should be secured. Move the propeller control of the inoperative engine to FEATHER and complete the engine securing procedure. Adjust the trim to a 2° to 3° bank into the operative engine with approximately 1/2 ball slip indicated on the skid/slip indicator. The cowl flap on the operative engine should be adjusted as required to maintain engine temperatures within allowable limits.

3.9g Engine Failure During Flight (Speed Above V_{MCA})(3.5a)

If an engine fails during flight at an airspeed above V_{MCA} (56 KIAS), begin corrective response by identifying the inoperative engine. The operative engine should be adjusted as required after loss of power has been verified. Attain and maintain an airspeed of at least 88 KIAS (V_{YSE}).

Once the inoperative engine has been identified and the operative engine adjusted properly, an engine restart may be attempted if altitude permits. Prior to securing the inoperative engine, turn on the electric fuel pump. The cause of engine failure may be the failure of the engine driven fuel pump. Check the oil pressure and oil temperature and ensure that the magneto switches are on.

If the engine fails to start, it should be secured using the engine securing procedure. After the inoperative engine has been secured, power should be maintained as required. Check the fuel supply and turn on the emergency fuel pump if necessary. The cowl flap on the operative engine should be adjusted as required to maintain engine temperatures within allowable limits. Adjust the trim for a 2° to 3° bank toward the operating engine with approximately 1/2 ball slip indicated on the skid/slip indicator. The electrical load should be decreased to a required minimum.

Land as soon as practical at the nearest suitable airport.

3.9h One Engine Inoperative Landing (3.5a)

Complete the Engine Securing Procedure. The landing gear should not be extended and the wing flaps should not be lowered until certain of making the field.

Maintain a normal approach keeping in mind that the landing should be made right the first time and that a go-around should be avoided if at all possible.

A final approach speed of 90 KIAS and the use of 25° rather than full wing flaps will place the airplane in the best configuration for a go-around should this be necessary.

WARNING

Negative climb performance may result from an engine failure occurring after liftoff and before the failed engine's propeller has been feathered, the gear has been retracted, the cowl flap on the failed engine is closed and a speed of 88 KIAS has been attained.

3.9i One Engine Inoperative Go-Around (Should be avoided if at all possible) (3.5a)

NOTE

A one engine inoperative go-around should be avoided if at all possible.

To execute a one engine inoperative go-around, smoothly advance the throttle and verify the mixture and propeller levers are forward. Retract the flaps and landing gear. Maintain airspeed at the one engine inoperative best rate of climb speed of 88 KIAS (V_{YSE}). Set the trim and cowl flaps as required.

3.9j Summary of Factors Affecting Single Engine Operations.

Significant climb performance penalties can result from landing gear, flap, or windmilling propeller drag. These penalties are approximately as listed below:

Landing gear extended/Flaps Up ....- 250 ft./min.
Flaps extended 25°/Gear Down ....- 490 ft./min.
Flaps extended fully/Gear Down......................................- 525 ft./min.
Inoperative engine propeller windmilling
(Gear and Flaps Up) ....-200 ft./min.

WARNING

The propeller on the inoperative engine must be feathered, the landing gear retracted, and the wing flaps retracted for continued flight.

The following general facts should be used as a guide if an engine failure occurs:

1. **Discontinuing a takeoff upon engine failure is advisable under most circumstances. Continuing the takeoff, if engine failure occurs prior to reaching obstacle speed and gear retraction, is not advisable.**

2. Altitude is more valuable to safety after takeoff than is airspeed in excess of the best single-engine climb speed.

3. A windmilling propeller and extended landing gear cause a severe drag penalty and, therefore, **climb or continued level flight is improbable**, depending on weight, altitude and temperature. Prompt retraction of the landing gear, identification of the inoperative engine, and feathering of the propeller is of utmost importance if the takeoff is to be continued.

4. In no case should airspeed be allowed to fall below V_{XSE} (82 KIAS) unless touchdown is imminent even though altitude is lost, since any lesser speed will result in significantly reduced climb performance.

3.9j Summary of Factors Affecting Single Engine Operations. (Continued)

5. If the requirement for an immediate climb is not present, allow the airplane to accelerate to the single-engine best rate-of-climb airspeed since this speed will always provide the best chance of climb or least altitude loss in a given time.
6. To maximize controllability during recovery following an inflight engine loss near or below VMC, the airplane should be banked approximately 5° into the operative engine and the rudder used to maintain straight flight. This will result in the ball of the skid/slip indicator being displaced 1/2 to 3/4 diameter towards the operating engine.
7. To maximize climb performance after airplane is under control of the pilot and failed engine is secured, the airplane should be trimmed in a 2° to 3° bank towards the operating engine with the rudder used as needed for straight flight. This will result in approximately 1/2 ball displacement towards the operating engine. This ball displacement should be maintained during any necessary maneuvering to maintain best possible climb margins.

3.11 AIR STARTING PROCEDURE (3.5b)

3.11a Unfeathering Procedure/ Unfeathering Accumulator Functioning (3.5b)

Move the fuel selector for the inoperative engine to the ON position and check to make sure the electric fuel pump for that engine is ON. The mixture should be set RICH. Open the throttle 1/4 inch and turn ON the magneto switches.

Push the propeller control to the full forward position. If the propeller does not windmill freely within 5 - 7 seconds after the propeller control has been moved full forward, engage the starter for 1 - 2 seconds. The throttle should be set at reduced power until the engine is warm. The alternator switch should be turned ON after restart.

NOTE

When propeller unfeathering occurs, it may be necessary to retard the prop control slightly so as to not overspeed the prop.

3.11 AIR STARTING PROCEDURE (3.5c) (Continued)

3.11b Unfeathering Procedure/ Starter Assisted (3.5b)

Move the fuel selector for the inoperative engine to the ON position and check to make sure the electric fuel pump for that engine is ON. Push the propeller control forward to the cruise RPM position and the mixture should be set RICH. Push in full throttle twice and then open it 1/4 inch.

Turn ON the magneto switches and engage the starter until the propeller windmills. The throttle should be set at reduced power until the engine is warm. If the engine does not start, prime as necessary. The alternator switch should then be turned ON.

3.13 ENGINE ROUGHNESS (3.5c)

Engine roughness may be caused by induction system icing or ignition problems.

Under certain moist atmospheric conditions at temperatures of -5°C to 20°C, it is possible for ice to form in the induction system, even in summer weather. This is due to the high air velocity through the carburetor venturi and the absorption of heat from this air by vaporization of the fuel.

To avoid this, carburetor preheat is provided to replace the heat lost by vaporization. Carburetor heat should be full on when carburetor ice is encountered. Adjust mixture for maximum smoothness.

If roughness continues for more than one minute, close off all carburetor heat and adjust the mixture for maximum smoothness. The engine will run rough if the mixture is too rich or too lean. Turn ON the electric fuel pump.

Check the engine indications for abnormal readings. If any indications are abnormal proceed accordingly.

The magneto switches should then be checked one at a time. If operation is satisfactory on either magneto, proceed on that magneto at reduced power with full RICH mixture to a landing at the first available airport.

If roughness persists, prepare for a precautionary landing at pilot's discretion.

3.15 ENGINE OVERHEAT (3.5d)

A steady, rapid rise in oil temperature is a sign of trouble. An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a defective indicating system, or other causes. Watch the oil pressure indication for an accompanying loss of pressure.

Excessive cylinder head temperature may parallel excessive oil temperature. In any case, open the cowl flaps, enrich the mixture and / or reduce power, and increase airspeed if altitude permits. If the problem persists, land as soon as practical at an appropriate airport and have the cause investigated.

3.17 LOSS OF OIL PRESSURE (3.5e)

Loss of oil pressure may be either partial or complete. A partial loss of oil pressure usually indicates a malfunction in the oil pressure regulating system, and a landing should be made as soon as possible to investigate the cause and prevent engine damage.

A complete loss of oil pressure indication may signify oil exhaustion or may be the result of a faulty indication. In either case, continued operation of the engine could result in a serious emergency situation or severe engine damage.

Complete the Engine Securing Procedure (para. 3.5a) on the faulty engine.

If engine oil is depleted, the engine will seize and if feathering is not initiated before 950 RPM is reached, the propeller will not feather

3.19 ENGINE FIRE (3.5f)

3.19a Engine Fire During Start (3.5f)

The first attempt to extinguish the fire is to try to draw the fire back into the engine. If the engine has not started, move the mixture control to idle cut-off and open the throttle. Continue to crank the engine with the starter in an attempt to pull the fire into the engine.

If the engine has already started and is running, continue operating to try to pull the fire into the engine.

3.19 ENGINE FIRE (3.5f) (Continued)

3.19a Engine Fire During Start (3.5f) (Continued)

In either case (above), if the fire continues longer than a few seconds the fire should be extinguished by the best available external means.

If an external fire extinguishing method is to be applied move the fuel selector valves to OFF and the mixture to idle cut-off.

3.19b Engine Fire In Flight (3.5f)

The possibility of an engine fire in flight is extremely remote. The procedure given below is general and pilot judgment should be the deciding factor for action in such an emergency.

If an engine fire occurs in flight, place the fuel selector of the affected engine in the OFF position and close its throttle. Feather the propeller on the affected engine. Move the mixture control on the affected engine to idle cut-off. The cowl flap on the affected engine should be open. After completion of the Engine Securing Procedure (para. 3.5a) on the affected engine, and if the fire persists, increase airspeed as much as possible in an attempt to blow out the fire.

Land as soon as possible at the nearest suitable airport.

3.21 ELECTRICAL FIRE (3.5g)

The presence of smoke in the cabin or the distinctive odor of smoldering insulation are indications of an electrical fire. The first step in coping with an electrical fire is to turn the battery master switch OFF. During night flight, be sure that a flashlight is in hand <u>before</u> turning off the master switch. Check for open circuit breakers and turn OFF the Alternator switches, all electrical switches and the Radio Master switch. Proceed to close cabin vents and turn cabin heat OFF.

If the fire persists, locate and, if practical, extinguish with the portable extinguisher located between the front seats, aft of the center console. Then pull all circuit breakers, beginning with the Bus circuit breakers.

NOTE

At this point, the pilot must decide if the flight can be safely continued without electrical power. If so, land at the nearest airport and have the electrical system repaired.

3.21 ELECTRICAL FIRE (3.5g) (Continued)

If electrical power is required for safe continuation of flight, proceed as follows:

WARNING

The following procedure may reenergize the faulty system. Reset the circuit breakers one at a time. Allow a short time period between the resetting of each circuit breaker. If the faulty system is reinstated, its corresponding circuit breaker must be immediately pulled.

NOTE

Refer to Power Distribution paragraph on page 7-22 and Figure 7-23 on page 7-23 for electrical power distribution information.

At this time press IN one MAIN Bus circuit breaker. Turn ON the Battery Master switch and press in either the L or R Alternator circuit breaker applicable to the circuitry remaining operable.

NOTE

Select the applicable Alternator Field circuit breaker and Alternator switch corresponding to the Alternator circuit breaker pressed in.

Press IN the applicable Alternator Field circuit breaker and Alternator switch. Turn ON the Radio Master switch and press in the Main Bus circuit breakers for the noted units required for flight. The other circuit breakers should be left OFF for the remainder of the flight.

Land as soon as practical at the nearest suitable airport.

WARNING

The landing gear must be lowered using the emergency extension procedure.

3.23 FUEL MANAGEMENT DURING ONE ENGINE INOPERATIVE OPERATION (3.5h)

A crossfeed is provided to increase range during one engine inoperative operation. Use crossfeed in level flight only.

3.23a Cruising (3.5h)

When using fuel from the fuel tank on the same side as the operating engine, the fuel selector of the operating engine should be ON and the fuel selector for the inoperative engine should be OFF. The electric fuel pumps should be OFF except in the case of an engine-driven fuel pump failure. If an engine-driven fuel pump has failed, the electric fuel pump on the operating engine side must be ON.

Increased range is available by using fuel from the tank on the opposite side of the operating engine. For this configuration the fuel selector of the operating engine must be on X-FEED (crossfeed) and the fuel selector of the inoperative engine must be OFF. The electric fuel pumps should be OFF. Crossfeed is approved for level cruise flight only.

3.23b Landing (3.5h)

During the landing sequence, the fuel selector of the operating engine must be ON and the fuel selector of the inoperative engine OFF. The electric fuel pump of the operating engine should be ON.

3.25 ENGINE DRIVEN FUEL PUMP FAILURE (3.5i)

Loss of fuel flow and engine power can be an indication of failure of the engine-driven fuel pump. Should these occur and engine-driven fuel pump failure is suspected, turn ON the electric fuel pump.

CAUTION

If normal engine operation and fuel flow are not immediately re-established, the electric fuel pump should be turned off. The lack of a fuel flow indication while the electric fuel pump is ON could indicate a leak in the fuel system, or fuel exhaustion.

3.27 LANDING GEAR UNSAFE WARNINGS (3.5j)

The red landing gear warning annunciator light will illuminate when the landing gear is in transition between the full up position and the down-and-locked position The pilot should recycle the landing gear if continued illumination of the light occurs. Additionally, the red landing gear warning annunciator light will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked, and also when wing flaps are in the second or third notch position and the gear is not down and locked.

3.29 LANDING GEAR MALFUNCTIONS (3.5k)

Manual Extension of Landing Gear

Several items should be checked prior to extending the landing gear manually. Check for popped circuit breakers and ensure the master switch is ON. Then check the alternators. If it is daytime, select DAY on the day/night dimmer switch.

To execute a manual extension of the landing gear, power should be reduced to maintain airspeed below 100 KIAS. Place the landing gear selector switch in the GEAR DOWN position and pull the emergency gear extension knob. Check for 3 green indicator lights.

WARNING

If the emergency gear extension knob has been pulled out to lower the gear due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gear hydraulic and electrical systems.

3.31 GEAR-UP EMERGENCY LANDING (3.5m)

An approach should be made with power at a normal airspeed with the flaps up. The flaps are left up to reduce wing and flap damage. Close the throttles just before touchdown. Turn OFF the master and ignition switches and move the fuel selector valve controls to OFF. Contact to the surface should be made at a minimum airspeed.

3.33 ELECTRICAL FAILURES (3.5n)

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The green position lights will be inoperative.

3.33a Single Alternator Failure (Zero Amps or ALTernator Light Illuminated - Annunciator Panel) (3.5n)

If one ammeter shows zero output or the ALTernator annunciator light is illuminated, reduce electrical loads to a minimum, turn the inoperative alternator switch OFF and check its circuit breaker. Reset if required. After at least one second, turn the ALT switch ON. If the alternator remains inoperative, turn the ALT switch OFF, maintain an electrical load not to exceed 60 amps on the operating alternator and exercise judgment regarding continued flight. The cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

3.33b Dual Alternator Failure (Zero Amps Both Ammeters or ALTernator Light Illuminated - Annunciator Panel) (3.5n)

If both ammeters show zero output, reduce electrical loads to a minimum and turn both ALT switches OFF. Check both alternator circuit breakers and reset if required. After being OFF at least one second, turn ALT switches ON one at a time while observing the ammeters.

If only one alternator output can be restored, leave the operating ALTernator switch ON, turn the faulty ALTernator switch OFF, reduce electrical loads to less than 60 amps and monitor the ammeter.

If neither alternator output can be restored, turn both ALT switches OFF. Maintain a minimum electrical load (less than 60 amps) and land as soon as practical. The battery is the only remaining source of electrical power.

3.35 AVIONICS SYSTEMS FAILURES (3.5o)

Failure of Primary Flight Display (PFD)

Should the primary flight display (PFD) go blank, verify the standby attitude indicator is on and the flag is pulled on the indicator. Maintain attitude control using the standby attitude indicator and establish the aircraft in straight and level unaccelerated flight.

If time and conditions permit, adjust the PFD brightness control to full bright and, pull and reset the PFD circuit breaker.

If the PFD cannot be reinstated and the aircraft is equipped with the optional secondary nav indicator, use the secondary nav indicator for primary navigation.

NOTE

The Secondary Nav Indicator receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Monitor engine performance by referring to the engine page on the multi-function display (MFD).

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

3.35 AVIONICS SYSTEMS FAILURES (3.5o) (Continued)

Loss of PFD Engine Data

Should the indicator needle be removed from the dial and the digital readout be replaced with white dashes, refer to the engine page of the MFD for engine data, and land as soon as practical.

Invalid Air Data

Should the airspeed, altimeter, and vertical speed data be replaced with red X's, refer to the standby airspeed and altimeter instruments for aircraft airspeed and altimeter data.

If time and conditions permit, pull and reset the PFD circuit breaker.

If air data is still invalid, refer to the standby airspeed and altimeter indicators for aircraft airspeed and altimeter data, and land as soon as practical.

Invalid Heading Data

Should the heading bug and heading data be removed and replaced with red X's, if time and conditions permit, pull and reset the PFD circuit breaker.

Maintain heading control using the magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group) and land as soon as practical.

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

3.35 AVIONICS SYSTEMS FAILURES (3.5o) (Continued)

Invalid Attitude and Heading Data

Should the attitude and heading data be removed and replaced with red X's, verify the standby attitude indicator is on and the flag is pulled on the gyro. Maintain attitude control using the standby attitude indicator.

If time and conditions permit, pull and reset the PFD circuit breaker.

If attitude and heading data is still invalid, maintain attitude control by using the standby attitude indicator and maintain heading control using the magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group). Land as soon as practical.

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

3.35 AVIONICS SYSTEMS FAILURES (3.5o) (Continued)

Failure of Air Data, Attitude and Heading Reference System (ADAHRS)

Should airspeed, attitude, heading and altitude data be removed and replaced with red X's, verify the standby attitude indicator is on and the flag is pulled on the indicator. Maintain attitude control using the standby attitude indicator.

If time and conditions permit, pull and reset the PFD circuit breaker.

If ADAHRS initialization does not occur and the aircraft is equipped with the optional secondary nav indicator, use the secondary nav indicator for primary navigation.

NOTE

The Secondary Nav Indicator receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Monitor engine performance by referring to the engine page on the multi-function display (MFD).

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD Map page and/or GNS 430 Position page within NAV page group).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy.

3.35 AVIONICS SYSTEMS FAILURES (3.5o) (Continued)

Total Loss of Engine Instruments

Should the indicator needle be removed from the dial and the digital readout be replaced with white dashes and a yellow alert message saying Engine Sensor Unit Not Communicating, pull and reset the DAU circuit breaker.

If engine data is still invalid, the following engine message(s) will be displayed on the MFD for the invalid parameter: check oil temp, check oil pressure, check CHT, check RPM, check manifold pressure.

If failure occurs during takeoff, maintain the mixture at full rich, maintain full forward propeller control, adjust the manifold pressure as required, and return to the airport for landing.

If failure occurs during climb or landing, maintain the mixture at full rich, maintain full forward propeller control, adjust the manifold pressure as required, and land as soon as practical.

If failure occurs after setting the cruise power and mixture, maintain power setting and land as soon as practical.

If failure occurs prior to or during descent, set the manifold pressure for descent and move the mixture to the full rich position.

3.35 AVIONICS SYSTEMS FAILURES (3.5o) (Continued)

Complete Electrical Failure

Should there be a complete electrical failure, select the standby (STBY) power button on the standby attitude indicator.

CAUTION

The STBY PWR annunciator will rapidly flash for approximately one minute when aircraft power is lost. STBY PWR must be selected, otherwise the standby attitude indicator will auto shutdown after approximately one minute.

Verify the standby attitude indicator is on and the flag is pulled on the indicator. Maintain aircraft control with reference to the standby airspeed, altimeter, and attitude indicators. Turn the battery switch off, and if a ground clearance switch is installed, turn it on. Land as soon as practical.

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

3.37 SPIN RECOVERY (INTENTIONAL SPINS PROHIBITED) (3.5p)

NOTE

Federal Aviation Administration Regulations do not require spin demonstration of multi-engine airplanes; therefore, spin tests have not been conducted. The recovery technique presented is based on the best available information.

Intentional spins are prohibited in this airplane. In the event a spin is encountered unintentionally, immediate recovery actions must be taken.

To recover from an unintentional spin, immediately retard the throttles to the idle position. Apply full rudder opposite the direction of the spin rotation and immediately push the control wheel full forward. Keep the ailerons neutral. Maintain the controls in these positions until spin rotation stops, then neutralize the rudder. Recovery from the resultant dive should be with smooth back pressure on the control wheel. No abrupt control movement should be used during recovery from the dive, as the positive limit maneuvering load factor may be exceeded.

3.39 OPEN DOOR (ENTRY DOOR ONLY) (3.5q)

The cabin door is double latched, so the chances of its springing open in flight at both the top and side are remote. However, should you forget the upper latch, or not fully engage the side latch, the door may spring partially open. This will usually happen at takeoff or soon afterward. A partially open door will not affect normal flight characteristics, and a normal landing can be made with the door open.

If both upper and side latches are open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 82 KIAS, close the cabin vents and open the storm window. If the top latch is open, latch it. If the side latch is open, pull on the armrest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.41 PROPELLER OVERSPEED (3.5r)

Propeller overspeed is usually caused by a malfunction in the propeller governor which allows the propeller blades to rotate to full low pitch.

If propeller overspeed should occur, retard the throttle. The propeller control should be moved to full DECREASE rpm and then set if any control is available. Airspeed should be reduced and the throttle should be used to maintain 2700 RPM.

3.43 EMERGENCY DESCENT (3.5s)

In the event an emergency descent becomes necessary, move the carburetor heat to ON, CLOSE the throttles and move the propeller controls full FORWARD. Adjust the mixture as necessary to attain smooth operation. Extend the landing gear at 140 KIAS and maintain this airspeed.

3.45 EMERGENCY EXIT (3.5t)

The pilot's left side window is an emergency exit. This is to be used when emergency egress becomes necessary on the ground only. The emergency exit release handle is located beneath the thermoplastic cover on the vertical post between the 1st and 2nd left side windows. To exit the aircraft, remove the thermoplastic cover, push the release handle forward and then push the window out. The window then will fall free from the fuselage.

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SECTION 4
NORMAL PROCEDURES

4.1 GENERAL

This section provides the normal operating procedures for the PA-44-180, Seminole airplane. All of the normal operating procedures required by the FAA as well as those procedures which have been determined as necessary for the operation of the airplane, as determined by the operating and designed features of the airplane, are presented.

Normal operating procedures associated with optional systems and equipment which require handbook supplements are presented in Section 9, Supplements.

These procedures are provided to supply information on procedures which are not the same for all airplanes and as a source of reference and review. Pilots should familiarize themselves with these procedures to become proficient in the normal operation of the airplane.

This section is divided into two parts. The first part is a short form checklist supplying an action - reaction sequence for normal procedures with little emphasis on the operation of the systems. Numbers in parentheses after each checklist section indicate the paragraph where the corresponding amplified procedures can be found.

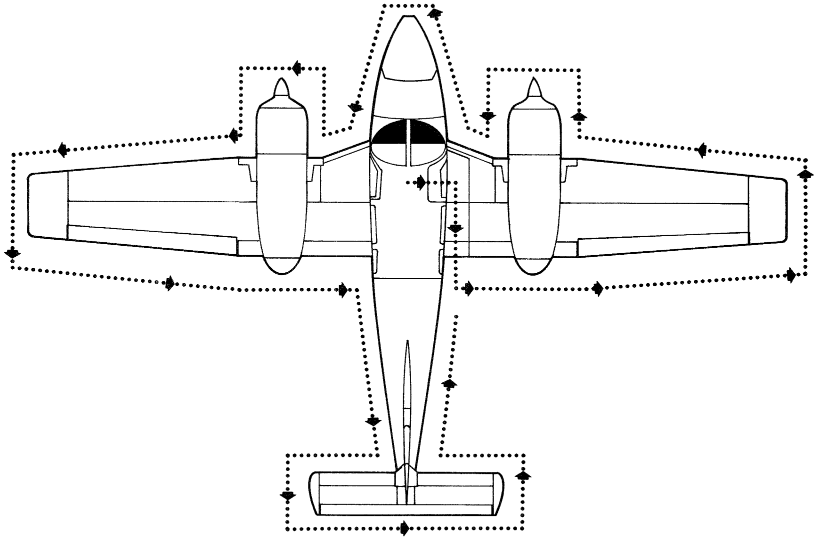
The second part of this section contains the amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an inflight reference due to the lengthy explanation. The short form checklists should be used on the ground and in flight. Numbers in parentheses after each paragraph title indicate where the corresponding checklist can be found.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the safe operation of the airplane. These figures are for standard airplanes flown at gross weight under standard conditions at sea level.

Performance for a specific airplane may vary from published figures depending upon the equipment installed, the condition of the engine, airplane and equipment, atmospheric conditions and piloting technique.

(a)	Best Rate of Climb Speed	88 KIAS
(b)	Best Angle of Climb Speed	82 KIAS
(c)	Turbulent Air Operating Speed (See Subsection 2.3)	135 KIAS
(d)	Maximum Flap Speed	111 KIAS
(e)	Landing Final Approach Speed (Flaps 40 degrees) Short Field Effort	75 KIAS
(f)	Intentional One Engine Inoperative Speed	82 KIAS
(g)	Maximum Demonstrated Crosswind Velocity	17 KIAS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

4.5a Preflight Checklists (4.9)

COCKPIT (4.9a)

Control Wheel....................release restraints
Static System....................DRAIN
Alternate Static Source....................NORMAL
Magneto Switches....................OFF
Parking Brake....................SET
Fuel Pump Switches....................OFF
Gear Selector....................DOWN
Throttles....................IDLE
Mixture Controls....................IDLE CUT-OFF
Cowl Flaps....................OPEN
Flight Controls....................PROPER OPERATION
Stabilator & Rudder Trim....................NEUTRAL
Fuel Selectors....................ON
Radio Master Switch....................OFF
All Electrical Switches....................OFF

4.5a Preflight Checklists (4.9) (Continued)

COCKPIT (4.9a)

Battery Master Switch...ON
Annunciator Panel ....PRESS-TO-TEST
Landing Gear Lights...3 GREEN
Battery Master Switch ....OFF
Emergency Exit ....CHECK
Flaps ....EXTEND
Windows...check CLEAN
Required Papers ....check ON BOARD
POH ....check ON BOARD
Baggage ....STOW PROPERLY - SECURE

RIGHT WING (4.9b)

Fuel Sump Drains..DRAIN
Surface Condition................................CLEAR of ICE, FROST & SNOW
Flap and Hinges...CHECK
Aileron, Hinges & Freedom of Movement......................................CHECK
Static Wicks...CHECK
Wing Tip and Lights...CHECK
Scupper Drain ....CLEAR
Fuel Tank Vent ....CLEAR
Tie Down ....REMOVE
Nacelle Fuel Filler Cap...CHECK & SECURE
Engine Oil & Cap ....CHECK & SECURE
Propeller & Spinner...CHECK
Air Inlets ....CLEAR
Cowl Flap Area...CHECK
Main Gear Strut ....PROPER INFLATION
(2.60 ± 0.25 in.)
Main Wheel Tire...CHECK
Brake, Block & Disc ....CHECK
Chock ....REMOVE

4.5a Preflight Checklists (4.9) (Continued)

NOSE SECTION (4.9c)

General Condition .... CHECK
Windshield .... CLEAN
Battery Vents .... CLEAR
Landing Lights .... CHECK
Heater Air Inlet .... CLEAR
Chock .... REMOVE
Nose Gear Strut .... PROPER INFLATION
(2.70 +/- 0.25 in.)
Nose Wheel Tire .... CHECK

LEFT WING (4.9d)

Surface Condition .... CLEAR of ICE, FROST & SNOW
Main Gear Strut .... PROPER INFLATION
(2.60 +/- 0.25 in.)
Main Wheel Tire .... CHECK
Brake, Block & Disc .... CHECK
Chock .... REMOVE
Cowl Flap Area .... CHECK
Nacelle Fuel Filler Cap .... CHECK & SECURE
Engine Oil & Cap .... CHECK & SECURE
Propeller & Spinner .... CHECK
Air Inlets .... CLEAR
Scupper Drain .... CLEAR
Fuel Tank Vent .... CLEAR
Tie Down .... REMOVE
OAT Probe .... CHECK
Stall Warning Vanes .... CHECK
Pitot/ Static Head .... CLEAR
Wing Tip and Lights .... CHECK
Aileron, Hinges & Freedom of Movement .... CHECK
Flap and Hinges .... CHECK
Static Wicks .... CHECK

4.5a Preflight Checklists (4.9) (Continued)

FUSELAGE (LEFT SIDE) (4.9e)

General Condition ....CHECK
Emergency Exit ....CHECK
Antennas ....CHECK
Fresh Air Inlet ....CLEAR

EMPENNAGE (4.9f)

Surface Condition.................................CLEAR of ICE, FROST & SNOW
Stabilator, Trim Tab & Freedom of Movement ....CHECK
Rudder, Trim Tab & Freedom of Movement ....CHECK
Static Wicks ....CHECK
Tie Down ....REMOVE

FUSELAGE (RIGHT SIDE) (4.9g)

General Condition ....CHECK
Baggage Door ....SECURE & LOCKED
Cabin Door ....CHECK

MISCELLANEOUS (4.9h)

Flaps ....RETRACT
Battery Master Switch...ON
Interior Lighting (Night Flight) ....ON & CHECK

CAUTION

Care should be taken when an operational check of the heated pitot head is being performed. The unit becomes very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

Pitot Heat Switch ....ON
Exterior Lighting Switches ....ON & CHECK
Pitot/Static Head...CHECK - WARM
All Lighting Switches...OFF
Pitot Heat Switch...OFF
Battery Master Switch ....OFF
Passengers ....BOARD

4.5b Before Starting Engine Checklists (4.11)

BEFORE STARTING ENGINE (4.11)

Preflight Check ....COMPLETED
Flight Planning..COMPLETED
Cabin Door ....CLOSE & SECURE
Seats ....ADJUSTED & LOCKED
Seatbelts and Harness ....FASTEN/ADJUST
CHECK INERTIA REEL
Empty Seats......................................SEAT BELTS SNUGLY FASTENED
Parking Brake ....SET
Gear Selector ....GEAR DOWN
Throttles ....IDLE
Propeller Controls...FULL FORWARD
Mixtures...IDLE CUT-OFF
Friction Control Handle..AS DESIRED
Carburetor Heat Controls ....OFF
Cowl Flaps..OPEN
Trim (Stabilator and Rudder) ....SET
Fuel Selectors...ON
Radio Master Switch ....OFF
Electrical Switches ....OFF
Heater Switch ....OFF
Circuit Breakers ....CHECK IN
Day/Night Switch ....VERIFY PROPER SETTING
For External Power Starts ....Proceed to appropriate checklist
Battery Master Switch...ON
Alternators...ON
Primary Flight Display (PFD) ....VERIFY CORRECT MODEL
Annunciator Panel ....CHECK LIGHTS & PRESS-TO-TEST
Initial Usable Fuel ....SET
Fuel Quantity/Imbalance ....CHECK

4.5c Engine Start Checklists (4.13)

ENGINE START - GENERAL (4.13)

NOTE

When starting at ambient temperatures +20°F and below, operate first engine started with alternator ON (at max charging rate not to exceed 1500 RPM) for 5 minutes minimum before initiating start on second engine.

NORMAL START - COLD ENGINE (4.13a)

Mixtures ....FULL RICH
Propeller Controls....................FULL FORWARD
Throttles ....1/4 inch OPEN
Landing Gear Lights....................3 GREEN
*Electric Fuel Pump....................ON
*Primer ....AS REQUIRED
*Propeller Area ....CLEAR
*Magneto Switches ....ON
*Starter....................ENGAGE
*Throttle ....ADJUST WHEN ENGINE STARTS TO 1000 RPM
*Oil Pressure ....CHECK

Repeat Above Procedure (*) for Second Engine Start

Voltmeter ....CHECK
Ammeters ....CHECK

NORMAL START - HOT ENGINE (4.13b)

Mixtures ....FULL RICH
Propeller Controls....................FULL FORWARD
Throttles ....1/2 inch OPEN
Landing Gear Lights....................3 GREEN
*Electric Fuel Pump....................ON
*Propeller Area ....CLEAR
*Magneto Switches ....ON
*Starter....................ENGAGE
*Throttle....................ADJUST to LOW RPM
*Oil Pressure ....CHECK

Repeat Above Procedure (*) for Second Engine Start

Voltmeter ....CHECK
Ammeters ....CHECK

4.5c Engine Start Checklists (4.13) (Continued)

ENGINE START - COLD WEATHER (BELOW 10°F) (4.13c)

CAUTION

Ensure magneto and master switches are OFF and mixture controls are in idle cut-off before turning propeller manually.

If available, preheat should be considered. Rotate each propeller through 10 blades manually during preflight inspection.

Battery Master Switch ....OFF
Alternators ....OFF
Magneto Switches ....OFF
External Power ....INSERT 14 VDC PLUG
Primary Flight Display ....VERIFY CORRECT MODEL
Annunciator Panel ....CHECK LIGHTS & PRESS-TO-TEST
Initial Usable Fuel ....SET
Fuel Quantity/Imbalance ....CHECK
Mixtures ....FULL RICH
Propeller Controls....................FULL FORWARD
Throttles ....1/4 inch OPEN
Landing Gear Lights....................3 GREEN
*Electric Fuel Pump....................ON
*Primer ....AS REQUIRED
*Propeller Area ....CLEAR
*Magneto Switches ....ON
*Starter....................ENGAGE
*Oil Pressure ....CHECK

If engine does not start, add prime and repeat above. When engine fires, prime as required until engine is running smoothly.

Repeat above procedure (*) for Second Engine Start

Throttles ....LOWEST POSSIBLE RPM
Battery Master Switch....................ON
Alternators....................ON

WARNING

Shut down the right engine when it is warmed prior to disconnecting the external power plug.

Right Engine ....SHUTDOWN
External Power ....DISCONNECT 14 VDC PLUG

4.5c Engine Start Checklists (4.13) (Continued)

ENGINE START - COLD WEATHER (BELOW 10°F) (4.13c) (continued)

Voltmeter ....CHECK
Ammeter (Operating Engine)..CHECK
Right Engine...NORMAL RESTART
Ammeters ....CHECK

ENGINE START WHEN FLOODED (4.13d)

Mixtures...IDLE CUT-OFF
Propeller Controls...FULL FORWARD
Throttles...FULL OPEN
Landing Gear Lights...3 GREEN
*Electric Fuel Pump ....OFF
*Propeller Area ....CLEAR
*Magneto Switches ....ON
*Starter...ENGAGE
*Mixture..ADVANCE
*Throttle ....RETARD to 1000 RPM
*Oil Pressure ....CHECK

Repeat Above Procedure (*) for Second Engine Start

Voltmeter ....CHECK
Ammeters ....CHECK

4.5c Engine Start Checklists (4.13) (Continued)

ENGINE START WITH EXTERNAL POWER SOURCE (4.13e)

CAUTION

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the battery master switch ON momentarily while the starter is engaged.

If cranking speed increases, the ship's battery is at a higher level than the external power supply. If the battery has been depleted by excessive cranking, it must be recharged before the second engine is started. All the alternator current will go to the low battery until it receives sufficient charge, and it may not start the other engine immediately.

NOTE

For all normal operations using an external power source, the battery master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the battery master switch ON. This will give longer cranking capabilities, but will not increase the amperage.

Battery Master Switch ....OFF
Alternators ....OFF
All Electrical Equipment ....OFF
External Power ....INSERT 14 VDC PLUG
Primary Flight Display ....VERIFY CORRECT MODEL
Annunciator Panel ....CHECK LIGHTS & PRESS-TO-TEST
Initial Usable Fuel ....SET
Fuel Quantity/Imbalance ....CHECK
Mixtures ....FULL RICH
Propeller Controls..FULL FORWARD
Throttles ....1/4 inch OPEN
Landing Gear Lights..3 GREEN
*Electric Fuel Pump (Left Engine)..ON
*Primer (Left Engine) ....AS REQUIRED
*Propeller Area ....CLEAR
*Magneto Switches (Left Engine) ....ON
*Starter (Left Engine)..ENGAGE
*Throttle (Left Engine)..ADJUST WHEN ENGINE STARTS TO 1000 RPM
*Oil Pressure (Left Engine) ....CHECK

4.5c Engine Start Checklists (4.13) (Continued)

ENGINE START WITH EXTERNAL POWER SOURCE (4.13e) (continued)

Battery Master Switch.......................................ON
Alternators.......................................ON
Voltmeter.......................................CHECK
Ammeter (Left Engine).......................................CHECK
Battery Charge Rate.......................................CHECK

NOTE

Run left engine for adequate time to charge battery.

WARNING

If right engine inadvertently started, shut down right engine before disconnecting external power plug.

External Power ....DISCONNECT 14 VDC PLUG

Repeat Above Procedure (*) for Right Engine Start

Ammeters ....CHECK

WARNING

Do not attempt flight if there is no indication of alternator output.

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4.5d Warm-Up Checklist (4.15)

WARM-UP (4.15a)

Battery Master Switch..ON
External Power Source Unit......................................REMOVE (if applied)
Throttles ....1000 to 1200 RPM

BEFORE TAXIING (4.15b)

Annunciator Panel ....CHECK LIGHTS & PRESS-TO-TEST
Radio Master Switch/Avionics ....ON/CHECK
Select Aux Page on MFD.........................VERIFY SET TO PROPER GPS
Lights ....AS REQUIRED
Heater and Defroster...AS DESIRED
Autopilot Master Switch..SELECT ON/VERIFY
SELF TEST COMPLETED
Electric Trim..CHECK
Manual Electric Trim Preflight Check ....PERFORM PER
PROCEDURE DEFINED
IN S-TEC SYSTEM 55X
AUTOPILOT SUPPLEMENT
(SEE SECTION 9)
Standby Attitude Indicator...................................VERIFY ON AND FLAG
IS PULLED ON GYRO
Standby Gyro Preflight Test.............................PERFORM AS FOLLOWS:

1. Apply aircraft power and allow the gyro to spin up for approximately 2 minutes.
2. Press and hold the STBY PWR button.
3. Verify that after several seconds the amber LED has started to flash. This indicates that the unit has latched into the Battery Test Mode. At this time the STBY PWR button can be released.
4. Verify that a green annunciator is illuminated under the word TEST.
5. Visually monitor the test lights until the amber LED stops flashing, signaling the end of the test.

4.5d Warm-Up Checklist (4.15) (Continued)

BEFORE TAXIING (4.15b) (continued)

NOTE

A green annunciator throughout the test indicates the standby battery is sufficiently charged and should be able to function under normal operation. The presence of a red annunciator at any time during the test is an indication the standby battery is in need of charging, or possibly replacement.

NOTE

The Standby Attitude Indicator will operate for approximately one hour with the internal battery, depending on battery condition at the time of power failure.

Altimeter/Standby Altimeter..SET
ADAHRS ....VERIFY INITIALIZED
Passenger Briefing ....COMPLETE
Parking Brake ....RELEASE

4.5e Taxiing Checklist (4.17)

TAXIING (4.17)

Taxi Area..CLEAR
Throttles...APPLY SLOWLY
Brakes ....CHECK
Steering..CHECK
Flight Instruments ....CHECK
Electric Fuel Pumps ....AS REQUIRED
Fuel Selectors...ON/CHECK CROSSFEED

4.5f Ground Check Checklist (4.19)

GROUND CHECK (4.19)

Parking Brake ....SET
Mixtures ....FULL RICH
Propeller Controls..FULL FORWARD
Engine Instruments..CHECK
Throttles..1500 RPM
Propeller Controls (Max. Drop - 500 RPM).............FEATHER - CHECK
Throttles..2000 RPM
Magnetos (Max. Drop - 175 RPM:
Max. Diff. - 50 RPM) ....CHECK
Propeller Controls (Max. Drop - 300 RPM) ....EXERCISE
Carburetor Heat ....CHECK
Alternator Output ....CHECK
Annunciator Panel Lights ..................EXTINGUISHED (except pitot heat)
Throttles (550 to 650 RPM) ....IDLE - CHECK
Throttles..1000 RPM
Friction Handle ....SET

4.5g Before Takeoff Checklist (4.21)

BEFORE TAKEOFF (4.21)

Flight Controls..CHECK
Flight Instruments ....CHECK
Engine Instruments..CHECK
Fuel Quantity/Imbalance ....CHECK
Battery Master Switch..ON
Alternators..ON
Electric Fuel Pumps ....ON
Pitot Heat..AS REQUIRED
Radio Master Switch..ON
Autopilot/FD ....Disengaged / “RDY”
Mixtures ....FULL RICH
Carburetor Heat ....OFF
Cowl Flaps..OPEN
Flaps ....CHECK & SET
Stabilator and Rudder Trims..SET
Fuel Selectors..ON

4.5g Before Takeoff Checklist (4.21) (Continued)

BEFORE TAKEOFF (4.21) (continued)

Transponder .... AS REQUIRED
Annunciator/MFD Messages .... CHECK
Door .... LATCHED
Parking Brake .... RELEASE

4.5h Takeoff Checklist (4.23)

CAUTION

Fast taxi turns immediately prior to takeoff should be avoided to prevent unporting fuel feed lines.

NOTE

Adjust mixture prior to takeoff at high elevations. Do not overheat engines. Adjust mixture only enough to obtain smooth engine operation.

NORMAL TAKEOFF (4.23a)

Flaps .... 0° to 10°
Stabilator and Rudder Trim .... CHECK SET
Power .... 2700 RPM, FULL THROTTLE
Rotate Speed .... 75 KIAS
Climb Speed .... 88 KIAS
Gear .... UP
Flaps .... UP

4.5h Takeoff Checklist (4.23) (Continued)

0° FLAP, SHORT FIELD PERFORMANCE TAKEOFF (4.23b)

Flaps..UP
Stabilator and Rudder Trim ....CHECK & SET
Brakes ....HOLD
Mixture...FULL RICH (or SET for ALTITUDE)
Power ....2700 RPM, FULL THROTTLE
Brakes ....RELEASE
Rotate Speed..70 KIAS
Obstacle Clearance Speed ....82 KIAS
Gear...UP
Climb Speed (after obstacles) ....88 KIAS

4.5i Climb Checklist (4.25)

MAXIMUM PERFORMANCE CLIMB (4.25a)

Best Rate (Flaps Up) ....88 KIAS
Best Angle (Flaps Up) ....82 KIAS
Cowl Flaps..OPEN
Electric Fuel Pumps ....ON

CRUISE CLIMB (4.25b)

Mixture ....FULL RICH
Power 75%
Climb Speed ....105 KIAS
Cowl Flaps ....As Required
Electric Fuel Pumps ....ON

4.5j Cruise Checklist (4.27)

CRUISING (4.27)

Reference performance charts and Avco-Lycoming Operator's Manual.
Power ....SET per Power Setting Chart
Electric Fuel Pumps...OFF
Mixture Controls ....ADJUST
Cowl Flaps ....CLOSED/As Required

4.5k Descent Checklist (4.29)

DESCENT (4.29)

Mixture Controls...ADJUST with Descent
Throttles ....As Required
Cowl Flaps ....As Required

4.5m Approach and Landing Checklist (4.31)

APPROACH AND LANDING (4.31)

Altimeter/Standby Altimeter..SET
Seat Backs ....ERECT
Seat Belts, Harnesses..ADJUSTED
Electric Fuel Pumps ....ON
Fuel Selectors..ON
Landing Gear (Below 140 KIAS) ....DOWN
Landing Gear Lights..3 GREEN
Nacelle Mirror..NOSE GEAR DOWN
Mixture Controls ....FULL RICH
Propeller Controls...FULL FORWARD
Carburetor Heat Controls ....AS REQUIRED
Autopilot...OFF
TAS ....AS REQUIRED
Toe Brakes ....DEPRESS TO CHECK

NORMAL LANDING (4.31a)

Flags (Below 111 KIAS) ....0° to FULL DOWN
Airspeed (Flaps Up)..80-90 KIAS
(Flaps Down)..75-85 KIAS
Trim ....AS REQUIRED
Throttles...AS REQUIRED
Touchdown ....MAIN WHEELS
Braking ....AS REQUIRED

SHORT FIELD PERFORMANCE LANDING (4.31b)

Flaps (Below 111 KIAS)...FULL DOWN
Airspeed (At Max. Weight)...75 KIAS
Trim ....AS REQUIRED
Throttles..IDLE
Touchdown ....MAIN WHEELS
Braking ....MAXIMUM without SKIDDING

4.5n Go-Around Checklist (4.33)

GO-AROUND (4.33)

Mixture Controls ....FULL FORWARD
Propeller Controls..FULL FORWARD
Throttle Controls ....FULL FORWARD
Control Wheel ....BACK PRESSURE TO OBTAIN
POSITIVE CLIMB ATTITUDE
Flaps..RETRACT SLOWLY
Gear..UP
Cowl Flaps...AS REQUIRED
Trim ....AS REQUIRED

4.5o After Landing Checklist (4.35)

AFTER LANDING (4.35)

Clear of runway.
Flaps...RETRACT
Cowl Flaps..FULL OPEN
Carburetor Heat Controls ....OFF
Electric Fuel Pumps...OFF
Strobe Lights ....AS REQUIRED
Landing and Taxi Lights..AS REQUIRED

4.5p Stopping Engine Checklist (4.37)

STOPPING ENGINE (4.37)

Heater (If ON) ....FAN - 2 MIN. THEN OFF
Radio Master Switch ....OFF
Electrical Equipment ....OFF
Throttles ....IDLE
Mixtures...IDLE CUTOFF
Magneto Switches ....OFF
Alternator Switches ....OFF
Panel Lights (At Night) ....OFF
Battery Master ....OFF

4.5q Mooring Checklist (4.39)

MOORING (4.39)

Parking Brake ....SET
Control Wheel..SECURED with belts
Flaps..FULL UP
Wheel Chocks ....IN PLACE
Tiedowns...SECURE

4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

The following paragraphs are provided to supply detailed information and the explanations of the normal procedures necessary for the safe operation of the airplane.

4.9 PREFLIGHT CHECK (4.5a)

The airplane should be given a thorough preflight and walk-around inspection. The preflight should include a check of the airplane's operational status, computation of weight and C.G. limits, takeoff distance and in-flight performance. A weather briefing should be obtained for the intended flight path, and any other factors relating to a safe flight should be checked before takeoff.

4.9a Cockpit (4.5a)

Upon entering the cockpit, release the seat belts securing the control wheel. Open the static system drain to remove any moisture that has accumulated in the lines. Verify that the alternate static system valve is in the normal position. Ensure that the magneto switches are OFF.

Set the parking brake by first depressing and holding the toe brake pedals and then pulling out the parking brake knob.

Check that the fuel pump switches are in the OFF position.

Check that the landing gear selector is in the DOWN position.

The throttles should be at IDLE and the mixture controls should be in IDLE CUT-OFF. Move the cowl flap controls to the full OPEN position.

Check the primary flight controls for proper operation and set the stabilator and rudder trim to neutral. Ensure that both fuel selectors are ON.

Verify the radio master switch and all electrical switches are in the OFF position. Turn battery master switch ON.

Check the fuel quantity gauges for adequate supply of fuel. Check the annunciator lights with the PRESS-TO-TEST button located to the left of the annunciator panel. Check that the three landing gear lights are ON. Turn OFF the battery master switch.

4.9a Cockpit (4.5a) (Continued)

CAUTION

If the emergency exit is unlatched in flight, it may separate and damage the exterior of the airplane.

Check that the emergency exit is in place and securely latched. Extend the flaps for the walk-around inspection. Check the windows for cleanliness. Check that the POH and all required papers are on board. Properly stow any baggage and secure.

4.9b Right Wing (4.5a)

After exiting the cockpit, the first items to check during the walk-around are the fuel sump drains. These drains are located on the right side of the fuselage just forward of the entrance step. Drain and check for water, foreign matter and proper fuel.

Check that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition. Check the wing tip and lights for damage.

Proceeding along the wing, verify that the scupper drain and fuel tank vent located on the underside of the wing, outboard of the nacelle, are clear of obstructions. Remove the tiedown.

Open the fuel cap and visually check the fuel quantity. The quantity should match the indication that was on the fuel quantity gauges. Replace cap securely.

Proceed forward to the engine cowling. Check its general condition; look for oil or fluid leakage and that the cowling is secure. Open the oil access door and check the oil quantity (four to eight quarts). Eight quarts are required for maximum range. Secure the access door.

The propeller and spinner should be checked for detrimental nicks, cracks, or other defects, and the air inlets are clear of obstructions. Move down to the cowl flap area. The cowl flaps should be open and secure.

4.9b Right Wing (4.5a) (Continued)

Next, complete a check of the landing gear. Check the main gear strut for proper inflation. There should be 2.60 +/- 0.25 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake, block and disc. Remove the chock.

4.9c Nose Section (4.5a)

Check the general condition of the nose section. The windshield should be clean, secure and free from cracks or distortion. Next check that the battery vents are clear of obstructions. Check the condition and security of the landing lights. The heater air inlet should be clear of obstructions. Next remove the chock and check the nose gear strut for proper inflation. There should be 2.70+/-0.25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation.

4.9d Left Wing (4.5a)

The wing surface should be clear of ice, frost, snow or other extraneous substances. Check the main gear strut for proper inflation. There should be 2.60 +/- 0.25 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake, block and disc. Remove the chock. Next, check the cowl flap area. The cowl flap should be open and secure.

Proceed to the fuel filler cap. Open the fuel cap and visually check the fuel quantity. The quantity should match the indication that was on the fuel quantity gauges. Replace cap securely.

Next, check the engine cowling. Check its general condition; look for oil or fluid leakage and that the cowling is secure. Open the oil access door and check the oil quantity (four to eight quarts). Eight quarts are required for maximum range. Secure the access door.

The propeller and spinner should be checked for detrimental nicks, cracks, or other defects, and the air inlets are clear of obstructions.

Next, verify that the scupper drain and fuel tank vent located on the underside of the wing, outboard of the nacelle, are clear of obstructions.

Remove the tiedown.

Check the outside air temperature (OAT) probe for damage and security.

4.9d Left Wing (4.5a) (Continued)

Proceed along the leading edge of the wing to the stall warning vanes. Check both vanes for damage and freedom of movement. A squat switch in the stall warning system does not allow the unit to be activated on the ground.

Check the pitot/ static head. If installed, remove the cover from the pitot head on the underside of the wing. Make sure the holes are open and clear of obstructions. Next, check the wingtip and lights for damage.

Check the aileron, flap and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition.

4.9e Fuselage (Left Side) (4.5a)

Check the general condition of the left side of the fuselage. The emergency exit should be secure and flush with the fuselage skin. All side windows should be clean and without defects. Antennas should be in place and securely attached. Check the fresh air inlet for any obstructions.

4.9f Empennage (4.5a)

Check that the empennage surfaces are clear of ice, frost, snow or other extraneous substances. All surfaces of the empennage should be examined for damage and operational interference. The stabilator and rudder should be operational and free from damage or interference of any type. Check the condition of the trim tabs and ensure that all hinges and push rods are sound and operational. Stabilator and rudder static wicks should be firmly attached and in good condition.

If the tail has been tied down, remove the tiedown rope.

4.9g Fuselage (Right Side) (4.5a)

Check the general condition of the right side of the fuselage. Check that the baggage door and cabin door attachments are secure and that the hinges are operational. Close and latch the baggage door.

4.9h Miscellaneous (4.5a)

Enter the cockpit and retract the flaps. Turn the battery master switch ON. Check the interior lights by turning ON the necessary switches. After the interior lights are checked, turn ON the pitot heat, and the exterior light switches. Next, perform a walk-around check of the exterior lights for proper operation, and the heated pitot head for proper heating.

CAUTION

Care should be taken when an operational check of the heated pitot head is being performed. The unit becomes very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

Reenter the cockpit and turn all switches OFF. At this time all passengers can be boarded.

4.11 BEFORE STARTING ENGINE (4.5b)

After preflight interior and exterior checks and flight planning have been completed and the airplane has been determined ready for flight, the cabin door should be secured. All seats should be adjusted and secured in position and seat belts and shoulder harnesses properly fastened.

NOTE

A pull test of the locking restraint feature should be performed on the inertial reel shoulder harness.

Set the parking brake by first depressing and holding the toe brake pedals, then pull back on the parking brake knob. Verify that the landing gear selector is in the DOWN position.

Check that the control levers move smoothly and place the throttles at IDLE, the propeller controls to FULL INCREASE and the mixture controls at IDLE CUTOFF. Adjust the friction control handle as desired.

Verify that the carburetor heat for each engine is OFF and the cowl flaps are OPEN.

Verify that both stabilator and rudder trim is set to NEUTRAL and that the fuel selectors are ON.

4.11 BEFORE STARTING ENGINE (4.5b) (Continued)

All other electrical switches, heater switch, and radio master switch should be OFF to avoid an electrical overload when the starter is engaged. Verify Day/Night selector switch is properly set. Check that all circuit breakers are in.

Turn the battery master switch ON and both alternator switches ON, and verify the correct aircraft model software is shown on the PFD Initialization page. Verify the Traffic Advisory System (TAS) is set to Standby. Check lights on annunciator panel illuminate by depressing the press-to-test switch which is located to the right of the annunciator panel. Input the total usable fuel on the Fuel Initialization page and press the appropriate key to exit to the Engine page. On the Engine page check the fuel quantity and imbalance.

4.13 ENGINE START (4.5c)

NOTE

When starting at ambient temperatures +20°F and below, operate first engine started with alternator ON (at max charging rate not to exceed 1500 RPM) for 5 minutes minimum before initiating start on second engine.

4.13a Normal Start - Cold Engine (4.5c)

Advance the mixture controls to FULL RICH, the propeller controls to FULL FORWARD, and the throttles to ¼ inch open. Check that the three green gear position lights are illuminated. Start one engine at a time using the following procedure.

Turn the electric fuel pump ON. Prime the engine as required. Verify the propeller area is clear, then turn ON the magneto switches. Engage the starter.

When the engine starts, adjust the throttle and monitor the oil pressure. If no oil pressure is indicated within 30 seconds, shut down the engine and have it checked. In cold weather it may take somewhat longer for an oil pressure indication.

Repeat the above procedure for the opposite engine. After the engines have started, check for proper bus voltage and check the alternators for sufficient output.

NOTE

To prevent starter damage, limit starter cranking to 30-second periods. If the engine does not start within that time, allow a cooling period of several minutes before engaging starter again. Do not engage the starter immediately after releasing it. This practice may damage the starter mechanism.

4.13b Normal Start - Hot Engine (4.5c)

Advance the mixture controls to FULL RICH, the propeller controls to FULL FORWARD, and the throttles to ½ inch open. Check that the three green gear position lights are illuminated. Start one engine at a time using the following procedure.

Turn the electric fuel pump on. Verify the propeller area is clear and turn magnetos on. Engage the starter. When the engine starts, adjust the throttle and monitor the oil pressure. If no oil pressure is indicated within 30 seconds, shut down the engine and have it checked.

Repeat the above procedure for the opposite engine. After the engines have started, confirm proper bus voltage and that the alternators are on by checking the ammeters for output.

4.13c Engine Start - Cold Weather (Below 10°F) (4.5c)

CAUTION

Ensure magneto and master switches are OFF and mixture controls are in idle cut-off before turning propeller manually.

If available, preheat should be considered. After checking that the battery master and magneto switches are OFF, and mixture controls are in idle cut-off, manually rotate each engine through 10 propeller blades during the preflight inspection. Refer to Section 4.13e before starting with external power.

Turn the battery master switch and alternator switches OFF. Verify the magneto switches are OFF and connect the external power. Verify the correct aircraft model software is shown on the PFD Initialization page. Check lights on the annunciator panel illuminate by depressing the press-to-test switch which is located to the right of the annunciator panel. Input the total usable fuel on the Fuel Initialization page and press the appropriate key to exit to the Engine page. On the Engine page check the fuel quantity and imbalance.

Move the mixture controls to FULL RICH, the propeller controls to FULL FORWARD and open the throttles ¼ inch. Check that the three green gear position lights are illuminated. Start one engine at a time using the following procedure.

Turn the electric fuel pump ON, prime as required, check that the propeller area is clear then turn on the magneto switches. Engage the starter.

4.13c Engine Start - Cold Weather (Below 10°F) (4.5c) (Continued)

When the engine starts, adjust the throttle and monitor the oil pressure. If engine does not start, add prime and repeat. When engine fires, prime as required until engine is running smoothly. Repeat the above procedure for the opposite engine.

After both engines have been started and warmed-up, reduce the throttles to the lowest possible RPM. The battery master switch and alternators should be turned ON so as to not lose power to the PFD and MFD when external power is disconnected.

WARNING

Shut down the right engine when it is warmed prior to disconnecting the external power plug.

Shut down the right engine and disconnect the external power plug. Check bus voltage and the alternators for sufficient output. Restart the right engine using a normal start.

4.13d Engine Start When Flooded (4.5c)

If an engine is flooded (by overpriming, for example), the mixture should be pulled to IDLE CUT-OFF. Advance the propeller control to FULL FORWARD and the throttle FULL OPEN. Check that the three green gear position lights are illuminated. Start one engine at a time using the following procedure.

Verify that the electric fuel pump is OFF. Verify the propeller area is clear, then turn the magneto switches ON. Engage the starter.

Advance the mixture control only after the engine has started, and retard the throttle lever to 1000 RPM. Monitor the oil pressure. Confirm proper bus voltage and that the alternators are on by checking the ammeters for output.

4.13e Engine Start With External Power Source (4.5c)

NOTE

For all normal operations using the PEP jumper cables, the master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the master switch ON. This will give longer cranking capabilities, but will not increase the amperage.

CAUTION

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply. If the battery has been depleted by excessive cranking, it must be recharged before the second engine is started. All the alternator current will go to the low battery until it receives sufficient charge, and it may not start the other engine immediately.

A feature called the Piper External Power (PEP) allows the operator to use an external battery to crank the engines without having to gain access to the airplane's battery.

Turn the battery master switch, alternators, and all electrical equipment OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 12-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the receptacle located on the right side of the nose. Note that when the plug is inserted, the electrical system is ON.

Verify the correct aircraft model software is shown on the PFD Initialization page. Check lights on the annunciator panel illuminate by depressing the press-to-test switch which is located to the right of the annunciator panel. For night flight, turn on and check interior lights. Input the total usable fuel on the Fuel Initialization page and press the appropriate key to exit to the Engine page. On the Engine page check the fuel quantity and imbalance.

4.13e Engine Start With External Power Source (4.5c) (Continued)

Move the mixture controls to FULL RICH, the propeller controls to FULL FORWARD and open the throttles ¼ inch. Check that the three green gear position lights are illuminated. Start the left engine first using the following procedure.

Turn the left engine electric fuel pump ON, prime as required, check that the propeller area is clear then turn on the left engine magneto switches. Engage the left engine starter.

When the engine starts, adjust the throttle and monitor the oil pressure. Turn the battery master switch and alternators ON to begin charging the battery. Check the bus voltage, left engine alternator output, and battery charge rate. After the battery has charged, remove external power and start the right engine. Check ammeters after both engines are started.

WARNING

Shut down the right engine when it is warmed prior to disconnecting the external power plug.

WARNING

Do not attempt flight if there is no indication of alternator output.

4.15 BEFORE TAXIING (4.5d)

4.15a. Warm-Up (4.5d)

Warm-up the engines at 1000 to 1200 RPM. Avoid prolonged idling at low RPM, as this practice may result in fouled spark plugs.

Takeoff may be made as soon as the ground checks are completed, provided that the throttles may be opened fully without backfiring or skipping and without a reduction in engine oil pressure.

Do not operate the engines at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.15b. Before Taxiing (4.5d)

If an External Power Source Unit has been used for starting, it should be disconnected and the battery master and radio master switches should be turned ON. Select Aux page on the MFD and verify that the proper GPS is selected. Lights and heater may be turned on as desired. Check the radios, and set them as desired. Check the autopilot (See Section 9) and turn ON and check the electric trim. Verify that the standby attitude indicator flag is pulled and perform standby attitude indicator (gyro) preflight test. Verify that the altimeter and standby altimeter are set. Verify that the ADAHRS is initialized.

Complete the passenger briefing. Release the parking brake by first depressing and holding the toe brake pedals and then pushing forward on the parking brake control.

4.17 TAXIING (4.5e)

Check to make sure the taxi area is clear. Always apply the throttles slowly. While taxiing, apply the brakes to determine their effectiveness. Make slight turns to check steering. During the taxi, check the instruments (turn indicator arrow, PFD heading indicator, skid/slip indicator & compass). Check the operation of the fuel management controls by moving each fuel selector to crossfeed for a short time, while the other selector is in the ON position. Return the selectors to the ON position.

4.19 GROUND CHECK (4.5f)

Set the parking brake. Advance mixture and propeller controls. Check engine instruments to see that they are functional and that readings are within limitations. Set the throttles to an engine speed of 1500 RPM. Retard the propeller controls aft to check feathering; however, do not allow a drop of more than 500 RPM.

Advance the throttles until engine speed reaches 2000 RPM. Check the magnetos on each engine by turning OFF, then ON, each of four magneto switches in turn. The maximum drop when a magneto is turned off is 175 RPM. The maximum differential between magnetos on one engine is 50 RPM. After checking one magneto, do not check the next until the engine speed returns to 2000 RPM. Operation of an engine on one magneto should be kept to a minimum.

Exercise the propeller levers through their range to check their operation. Response should be normal. Do not allow speed to drop more than 300 RPM . The governor can be checked by retarding the propeller control until a drop of 100 RPM to 200 RPM appears, then advancing the throttle to get a slight increase in manifold pressure. The propeller speed should stay the same when the throttle is advanced, indicating proper function of the governor. Carburetor heat should also be checked prior to takeoff to be sure the control is operating properly and to purge any ice which may have formed during taxiing. Avoid prolonged ground operation with carburetor heat ON as the air is unfiltered.

Check alternator output - alternator output readings should be about equal. All annunciator lights should be out, except PITOT HEAT. Retard the throttles to 550 to 650 RPM to check idling. Set the throttles at 1000 RPM, recheck the flight instruments, and reset them if necessary. Set the desired amount of friction on the engine control levers.

4.21 BEFORE TAKEOFF (4.5g)

Ensure proper flight control movement and response. Check that flight instruments are set and operational, and that all engine instruments are reading within limits. Check that the fuel quantity and imbalance is sufficient for the intended flight. Verify that the battery master and alternator switches are ON. Turn the electric fuel pumps ON for takeoff. Turn pitot heat ON if necessary. Set avionics as required. The autopilot servos should be disengaged (RDY prompt) or should be turned off entirely during takeoff.

Check that the mixture controls are full forward. Verify that the carburetor heat selectors are off and cowl flaps are open. Check the wing flaps for proper operation. Visually confirm that right and left wing flaps are equally extended. Set the flaps. Set the stabilator and rudder trims for takeoff. Ensure that the fuel selectors are on. Recheck alternator output. Set the direction indicator if necessary and set the transponder as required.

Check that no warning lights are illuminated. Verify that the cabin door is closed and latched. Release the parking brake.

4.23 TAKEOFF (4.5h)

CAUTION

Fast taxi turns immediately prior to takeoff should be avoided to prevent any possibility of fuel line unporting which could lead to engine stoppage on takeoff.

To maximize power availability for takeoffs from airports at higher elevations, the mixture should be leaned. Adjust mixture after takeoff power has been applied just enough to obtain smooth engine operation. Monitor engine temperatures to prevent overheating.

Takeoff should not be attempted with ice or frost on the wings. Takeoff distances and 50-foot obstacle clearance distances are shown on charts in the Performance Section of this Handbook. The performance shown on charts will be reduced by uphill gradient, tailwind component, or soft, wet, rough or grassy surface, or poor pilot technique.

4.23 TAKEOFF (4.5h) (Continued)

Avoid fast turns onto the runway followed by immediate takeoff, especially with a low fuel supply. As power is applied at the start of the takeoff roll, look at the engine instruments to see that the engines are operating properly and producing normal power and at the airspeed indicator to see that it is functioning. Apply throttles smoothly.

The flap setting for normal takeoff is 0° to 10°. For short fields or fields with soft surface conditions or adjacent obstacles, total takeoff distances can be reduced appreciably by lowering flaps to 25° for takeoff.

4.23a Normal Takeoff (4.5h)

When obstacle clearance is no problem, a normal takeoff technique may be used with flaps set to 0° or 10°. Set the stabilator trim indicator in the takeoff range. Accelerate to 75 KIAS and ease back on the control wheel enough to let the airplane lift off. After lift-off, accelerate to the best rate of climb speed, 88 KIAS, retracting the landing gear and flaps, if applicable, while accelerating.

4.23b 0° Flap, Short Field Performance Takeoff (4.5h)

When a short field effort is required, the safest short field technique to use is with the flaps up (0°). In the event of an engine failure, the airplane is in the best flight configuration to sustain altitude immediately after the gear is raised.

Set the stabilator trim indicator in the takeoff range. Set the brakes and bring the engines to full power before release. Accelerate to 70 KIAS and rotate the airplane firmly so that the airspeed is approximately 82 KIAS when passing through the obstacle height. The airplane should then be allowed to accelerate to the best rate of climb speed (88 KIAS) when obstacles are not a problem. The landing gear should be retracted when a positive climb is achieved.

NOTE

Gear warning horn will sound when landing gear is retracted with flaps extended beyond first notch.

When the shortest possible ground roll and the greatest clearance distance over a 50-foot obstacle is needed, a flap setting up to a maximum of 25° (second notch) may be used. Set the stabilator trim indicator slightly nose up from the takeoff range. When 25° of flaps are selected, procedures similar to those described for 0° flaps should be used with an obstacle speed no slower than 70 KIAS. Retract the gear when a gear-down landing is no longer possible on the runway. It should also be noted that when a 25-degree flap setting is used on the takeoff roll, an effort to hold the airplane on the runway too long may result in a wheelbarrowing tendency. This should be avoided.

This procedure should only be used when conditions truly require added performance. The pilot must be aware that this improved performance is achieved only at the expense of a reduction in safety margins. If an engine failure were to occur near the obstacle with the gear and flaps still down, the only choice available to the pilot is to reduce the remaining power to idle and make the best possible landing straight ahead since single engine performance under these conditions is non-existent.

Because of reduced safety margins associated with 25° flap, short field takeoffs, performance data is only provided for 0° flap, short field takeoffs. Takeoff distances to be achieved using these procedures are included in Section 5 of this Handbook.

4.25 CLIMB (4.5i)

4.25a Takeoff Climb (4.5i)

On climb-out after takeoff, it is recommended that the best rate of climb speed (88 KIAS) be maintained with full power on the engines until adequate terrain clearance is obtained. If obstacle clearance is a consideration, maintain best angle of climb speed (82 KIAS) until clear of all obstacles, then accelerate to best rate of climb speed (88 KIAS). The cowl flaps should be OPEN and electric fuel pumps should be ON until level-off is accomplished at desired cruise altitude.

4.25b Cruise Climb (4.5i)

At this point, engine power should be reduced to approximately 75% power for cruise climb. A cruise climb speed of 105 KIAS or higher is also recommended. This combination of reduced power and increased climb speed provides better engine cooling, less engine wear, reduced fuel consumption, lower cabin noise level, and better forward visibility.

When reducing engine power, the throttles should be retarded first, followed by the propeller controls. The mixture controls should remain at full rich during the climb. Cowl flaps should be adjusted to maintain cylinder head and oil temperatures within the normal ranges specified for the engine. The electric fuel pumps should be ON until level-off is accomplished at desired cruise altitude.

Consistent operational use of cruise climb power settings is strongly recommended since this practice will make a substantial contribution to fuel economy and increased engine life, and will reduce the incidence of premature engine overhauls.

4.27 CRUISE (4.5j)

When leveling off at cruise altitude, the pilot may reduce to a cruise power setting in accordance with the Power Setting Table in this Handbook.

For maximum service life, cylinder head temperature should be maintained below 435°F during high performance cruise operation and below 400°F during economy cruise operation. If cylinder head temperatures become too high during flight, reduce them by enriching the mixture, by opening cowl flaps, by reducing power, or by use of any combination of these methods.

Following level-off for cruise, the electric fuel pumps may be turned off, the cowl flaps should be closed or adjusted as necessary to maintain proper cylinder head temperatures, and the airplane should be trimmed to fly hands off.

4.27 CRUISE (4.5j) (Continued)

The pilot should monitor weather conditions while flying and should be alert to conditions which might lead to icing. If induction system icing is expected, place the carburetor heat control in the ON position.

WARNING

Flight in icing conditions is prohibited. If icing is encountered, immediate action should be taken to fly out of icing conditions. Icing is hazardous due to greatly reduced performance, loss of forward visibility, possible longitudinal control difficulties due to increased control sensitivity, and impaired power plant and fuel system operation.

The ammeters for the electrical system should be monitored during flight, especially during night or instrument flight, so that corrective measures can be taken in case of malfunction. The procedures for dealing with electrical failures are contained in the Emergency Procedure Section of this Handbook. The sooner a problem is recognized and corrective action taken, the greater is the chance of avoiding total electrical failure. Both alternator switches should be ON for normal operation. The two ammeters, shown on the MFD Engine page, continuously indicate the alternator outputs. Certain regulator failures can cause the alternator output voltage to increase uncontrollably. To prevent damage, overvoltage relays are installed to automatically shut off the alternator(s). The red alternator inoperative annunciator (ALTERNATOR INOP) on the annunciator panel will illuminate to warn of the tripped condition. Alternator outputs will vary with the electrical equipment in use and the state of charge of the battery. Alternator outputs should not exceed 60 amperes. The red low bus voltage annunciator (LOW BUS VOLTAGE) will warn of bus voltage below requirements.

It is not recommended to takeoff into IFR operation with a single alternator. During flight, electrical loads should be limited to 50 amperes for each alternator. Although the alternators are capable of 60 amperes output, limiting loads to 50 amperes will assure battery charging current.

Since the Seminole has one fuel tank per engine, it is advisable to feed the engines symmetrically during cruise so that approximately the same amount of fuel will be left in each side for the landing. A crossfeed is provided and can be used to even up the fuel quantities, if necessary.

4.27 CRUISE (4.5j) (Continued)

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauging systems are operating. Crosscheck your values with fuel totalizer information on the MFD Engine page.

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, the landing gear will free-fall to the gear down position. The true airspeed with gear down is approximately 75% of the gear retracted airspeed for any given power setting. Allowances for the reduction in airspeed and range should be made when planning extended flight between remote airfields or flight over water.

4.29 DESCENT (4.5k)

When power is reduced for descent, the mixtures should be enriched as altitude decreases. The propellers may be left at cruise setting; however, if the propeller speed is reduced, it should be done after the throttles have been retarded. Cowl flaps should normally be closed to keep the engines at the proper operating temperature.

4.31 APPROACH AND LANDING (4.5m)

Sometime during the approach for a landing, the throttle controls should be retarded to check the gear warning horn. Flying the airplane with the horn inoperative is not advisable. Doing so can lead to a gear up landing as it is easy to forget the landing gear, especially when approaching for a one engine inoperative landing, or when other equipment is inoperative, or when attention is drawn to events outside the cabin.

The red landing gear unsafe light (GEAR WARNING) will illuminate when the landing gear is in transition between the full up position and the down and locked position. Additionally, the light will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked and when flaps of 25° or 40° are selected and the gear is not down and locked.

The gear warning annunciator light is off when the landing gear is in either the full down and locked or full up positions.

The altimeter and standby altimeter should be set to the appropriate local barometric pressure.

4.31 APPROACH AND LANDING (4.5m) (Continued)

Prior to entering the traffic pattern, the aircraft should be slowed to approximately 100 KIAS, and this speed should be maintained on the downwind leg. The landing check should be made on the downwind leg. The seat backs should be erect, and the seat belts and shoulder harnesses should be fastened.

NOTE

A pull test of the inertia reel locking restraint feature should be performed.

Both fuel selectors should normally be ON, and the cowl flaps should be set as required. The electric fuel pumps should be ON. Select landing gear DOWN and check for three green lights on the panel and look for the nose wheel in the nose wheel mirror. The landing gear should be lowered at speeds below 140 KIAS and the flaps at speeds below 111 KIAS.

Maintain a traffic pattern speed of 100 KIAS and a final approach speed of 90 KIAS. If the aircraft is lightly loaded, the final approach speed may be reduced to 80 KIAS. Set the mixture controls to full rich.

When the power is reduced on close final approach, the propeller controls should be advanced to the full forward position to provide maximum power in the event of a go-around.

The landing gear position should be checked on the downwind leg and again on final approach by checking the three green indicator lights on the instrument panel and looking at the external mirror to check that the nose gear is extended. Remember that when the Day/Night switch is in the Night position, the green gear position lights are dimmed and are difficult to see in the daytime.

Operate the toe brakes to determine if there is sufficient pressure for normal braking and make sure that the parking brake is not set. Verify that the mixture and propeller controls are full forward. Carburetor heat should be used if induction icing is suspected. The autopilot should be OFF for landing.

4.31 APPROACH AND LANDING (4.5m) (Continued)

4.31a Normal Landing (4.5m)

Landing may be made with any flap setting. Normally full flaps are used. Full flaps will reduce stall speed during final approach and will permit contact with the runway at a slower speed.

Good pattern management includes a smooth, gradual reduction of power on final approach with the power fully off before the wheels touch the runway. This gives the gear warning horn a chance to blow if the gear is not locked down. Electric trim can be used to assist a smooth back pressure during flare-out. Hold the nose up as long as possible before and after contacting the ground with the main wheels.

Maximum braking after touch-down is achieved by retracting the flaps, applying back pressure to the wheel and applying pressure on the brakes. However, unless extra braking is needed or unless a strong crosswind or gusty air condition exists, it is best to wait until turning off the runway to retract the flaps. This will permit full attention to be given to the landing and landing roll and will also prevent the pilot from accidentally reaching for the gear handle instead of the flap handle.

If a crosswind or high-wind landing is necessary, approach with higher than normal speed and with zero to 25 degrees of flaps. Immediately after touch-down, raise the flaps. During a crosswind approach hold a crab angle into the wind until ready to flare out for the landing. Then lower the wing that is into the wind to eliminate the crab angle without drifting, and use the rudder to keep the wheels aligned with the runway. Avoid prolonged side slips with a low fuel indication.

The maximum demonstrated crosswind component for landing is 17 KTS.

4.31b Short Field Performance Landing (4.5m)

For landings on short runways of runways with adjacent obstructions, a short field landing technique should be used in accordance with the charts in Section 5. The airplane should be flown down final with full flaps at 75 KIAS (at maximum weight) so as to cross any obstructions with the throttles at idle. Immediately after touch-down, raise the flaps and apply back pressure to the control wheel as maximum braking is applied.

4.33 GO-AROUND (4.5n)

If a go-around from a normal approach with the airplane in the landing configuration becomes necessary, apply takeoff power to both engines by moving the mixture controls, propeller controls and throttle controls full forward. Establish a positive climb attitude, retract the flaps and landing gear and adjust the cowl flap for adequate engine cooling.

4.35 AFTER LANDING (4.5o)

When clear of the active runway, retract the flaps and open the cowl flaps. Test the toe brakes, a spongy pedal is often an indication that the brake fluid needs replenishing. The carburetor heat controls should be OFF. Turn both electric fuel pumps OFF and use the Landing/Taxi and Strobe lights as required.

4.37 STOPPING ENGINE (4.5p)

Prior to shutdown turn all radio and electrical equipment and external lights OFF. Move the throttle controls full aft to idle and the mixture controls to idle cut-off. Turn OFF the magneto, the alternator and battery master switches. Also, at night, turn OFF the panel lights.

NOTE

The flaps must be placed in the "UP" position for the flap step to support weight. Passengers should be cautioned accordingly.

4.39 MOORING (4.5q)

If necessary, the airplane should be moved on the ground with the aid of the optional nose wheel tow bar.

The parking brake should be set and the ailerons and stabilator should be secured by looping the seat belt through the control wheel and pulling it snug. The rudder need not be secured under normal conditions, as its connection to the nose wheel holds it in position. The flaps are locked when in the fully retracted position.

Wheel chocks should be positioned in place. Tie-down ropes may be attached to mooring rings under each wing and to the tail skid.

4.41 STALLS

The loss of altitude during a power off stall with the gear and flaps retracted may be as much as 300 feet.

NOTE

The stall warning system is inoperative with the master switch OFF.

During preflight, the stall warning system should be checked by turning the battery switch on and lightly lifting up on the stall warning vanes on the left wing to determine if the horn is actuated.

4.43 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, it is recommended that when turbulent air is encountered or expected, the airspeed be reduced to maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups which may occur as a result of the turbulence or of distractions caused by the conditions. (See Subsection 2.3)

4.45 V_{SSE} - INTENTIONAL ONE ENGINE INOPERATIVE SPEED

V_{SSE} is a speed selected by the aircraft manufacturer as a training aid for pilots in the handling of multi-engine aircraft. It is the minimum speed for intentionally rendering one engine inoperative in flight. This minimum speed provides the margin the manufacturer recommends for use when intentionally performing engine inoperative maneuvers during training in the particular airplane.

V_{SSE} is not a limitation. However, it is recommended that, except for training, demonstrations, takeoffs, and landings, the airplane should not be flown at a speed slower than V_{SSE}

The intentional one engine inoperative speed, V_{SSE}, for the PA-44-180 is 82 KIAS.

4.47 VMCA - AIR MINIMUM CONTROL SPEED

VMCA is the minimum flight speed at which a twin-engine airplane is directionally and/or laterally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling; not more than a 5° bank toward the operative engine; landing gear up; flaps in takeoff position; and most rearward center of gravity.

VMCA for the PA-44-180 has been determined to be 56 KIAS and is a stalled condition.

The VMCA demonstration, which may be required for the FAA flight test for the multi-engine rating, approaches an uncontrolled flight condition with power reduced on one engine. The demonstration and all intentional one engine operations should not be performed at an altitude of less than 4000 feet above the ground. The recommended procedure for VMCA demonstration is to reduce the power to idle on the simulated inoperative engine <u>at or above the intentional one engine inoperative speed, VSSE</u>, and slow down approximately one knot per second until the FAA Required Demonstration Speed, stall buffet or warning, rudder or ailerons at full travel, or VMCA (red line on the Airspeed Indicator) is reached.

VMCA DEMONSTRATION

(a) Landing Gear .... UP
(b) Flaps .... UP
(c) Airspeed .... at or above 82 KIAS (VSSE)
(d) Mixture .... FULL RICH
(e) Propeller Controls .... HIGH RPM
(f) Throttle (Simulated Inoperative Engine) .... IDLE
(g) Throttle (Other Engine) .... FULL FORWARD
(h) Airspeed .... Reduce approximately 1 knot per second until either STALL WARNING, FULL CONTROL TRAVEL or VMCA is obtained

4.47 VMCA - AIR MINIMUM CONTROL SPEED (Continued)

CAUTION

Use rudder to maintain directional control (heading) and ailerons to maintain 5° bank towards the operative engine (lateral attitude). At the first sign of either VMCA (airspeed indicator redline) or stall warning (which may be evidenced by: inability to maintain heading or bank attitude, aerodynamic stall buffet, or stall warning horn), immediately initiate recovery; reduce power to idle on the operative engine, and immediately lower the nose to regain VMCA and continue accelerating to VSSE.

CAUTION

One engine inoperative stalls are not recommended.

Under no circumstances should an attempt be made to fly at a speed below VMCA with only one engine operating.

4.49 PRACTICE ONE ENGINE INOPERATIVE FLIGHT

Simulated one engine inoperative flight can be practiced without actually shutting down one engine by setting the propeller rpm of an engine to approximate zero thrust. This is accomplished at typical training altitudes with the throttle adjusted to produce the appropriate engine speed shown below and the mixture full rich, or leaned as required for smooth low power operation.

Propeller rpm for Zero Thrust

KIAS	RPM
82 VSSE	1850
88 VYSE	2180
100	2510
110	2690

4.51 NOISE LEVEL

The corrected noise level of this aircraft is 74.7 dB(A) with the two blade propeller.

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

The above statement notwithstanding, the noise level stated above has been verified by and approved by the Federal Aviation Administration in noise level test flights conducted in accordance with FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

TABLE OF CONTENTS

SECTION 5

PERFORMANCE

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SECTION 5
PERFORMANCE

5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to this aircraft is provided by this section.

Performance information associated with those optional systems and equipment which require handbook supplements is provided by Section 9 (Supplements).

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

The performance information presented in this section is based on measured Flight Test Data corrected to I.C.A.O. standard day conditions and analytically expanded for the various parameters of weight, altitude, temperature, etc.

The performance charts are unfactored and do not make any allowance for varying degrees of pilot proficiency or mechanical deterioration of the aircraft. This performance, however, can be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow and quantity checks are recommended.

REMEMBER! To get chart performance, follow the chart procedures.

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING (Continued)

The information provided by paragraph 5.5 (Flight Planning Example) outlines a detailed flight plan using the performance charts in this section. Each chart includes its own example to show how it is used.

WARNING

Performance information derived by extrapolation beyond the limits shown on the charts should not be used for flight planning purposes.

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning a flight is to calculate the airplane weight and center of gravity by utilizing the information provided by Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as delivered from the factory has been entered in Figure 6-5. If any alterations to the airplane have been made affecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

Make use of the Weight and Balance Loading Form (Figure 6-11) and the C.G. Range and Weight graph (Figure 6-15) to determine the total weight of the airplane and the center of gravity position.

After proper utilization of the information provided, the following weights have been found for consideration in the flight planning example.

The landing weight cannot be determined until the weight of the fuel to be used has been established [refer to item (g)(1)].

(1)	Basic Empty Weight	2589 lb
(2)	Occupants (2 x 170 lb)	340 lb
(3)	Baggage and Cargo	21 lb
(4)	Fuel (6 lb./gal. x 80)	480 lb
(5)	Takeoff Weight (3800 lb. max. allowable)	3430 lb
(6)	Landing Weight (a)(5) minus (g)(1), (3430 lb minus 323 lb)	3107 lb

Takeoff and landing weights are below the maximums, and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

Now that the aircraft loading has been determined, all aspects of the takeoff and landing must be considered.

5.5 FLIGHT PLANNING EXAMPLE (Continued)

All of the existing conditions at the departure and destination airport must be acquired, evaluated and maintained throughout the flight.

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff performance graphs (Figures 5-13 and 5-15) to determine the length of runway necessary for the takeoff and/or the obstacle distance.

The landing distance calculations are performed in the same manner using the existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below. The takeoff and landing distances required for the example flight have fallen well below the available runway lengths.

	Departure Airport	Destination Airport
(1) Pressure Altitude	1250 ft.	680 ft.
(2) Temperature	8°C	8°C
(3) Wind Component (Headwind)	6 KTS	5 KTS
(4) Runway Length Available	7400 ft.	9000 ft.
(5) Runway Required (Short Field Effort)		
Takeoff	1520 ft.*	
Landing		1238 ft.**

NOTE

The remainder of the performance charts used in this flight plan example assume a no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

*reference Figure 5-15

**reference Figure 5-35

5.5 FLIGHT PLANNING EXAMPLE (Continued)

(c) Climb

The next step in the flight plan is to determine the necessary climb segment components.

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time and Distance to Climb graph (Figure 5-23). After the fuel, time and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-23). Now subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

The remaining values are the true fuel, time and distance components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in the flight planning example.

(1) Cruise Pressure Altitude	5500 ft.
(2) Cruise OAT	-2°C
(3) Fuel to Climb (2.6 gal. minus 0.4 gal.)	2.2 gal.*
(4) Time to Climb (4.5 min. minus 0.9 min.)	3.6 min.*
(5) Distance to Climb (7.3 naut. miles minus 1.4 naut. miles)	5.9 naut. miles*

*reference Figure 5-23

5.5 FLIGHT PLANNING EXAMPLE (Continued)

(d) Descent

The descent data will be determined prior to the cruise data to provide the descent distance for establishing the total cruise distance.

Utilizing the cruise pressure altitude and OAT determine the basic fuel, time and distance for descent (Figure 5-33). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time and distance values from the graph (Figure 5-33). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the flight plan.

The values obtained by proper utilization of the graphs for the descent segment of the example are shown below.

(1) Fuel to Descend (3 gal. minus 1 gal.)	2 gal.*
(2) Time to Descend (9 min. minus 2 min.)	7 min.*
(3) Distance to Descend (30 naut. miles minus 4 naut. miles)	26 naut. miles*

*reference Figure 5-33

5.5 FLIGHT PLANNING EXAMPLE (Continued)

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the appropriate Lycoming Operator's Manual and the Fuel and Power Setting Tables when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be utilized to determine the true airspeed from the Speed Power graph (Figure 5-27).

Calculate the cruise fuel for the cruise power setting from the information provided on Figure 5-27.

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel flow by the cruise time.

The cruise calculations established for the cruise segment of the flight planning example are as follows:

(1)	Total Distance	431 miles
(2)	Cruise Distance (e)(1) minus (c)(5) minus (d)(3), (431 naut. miles minus 5.9 naut. miles minus 26 naut. miles)	399 naut. miles
(3)	Cruise Power (Performance Cruise Mixture)	55% rated power
(4)	Cruise Speed	140 KTS TAS*
(5)	Cruise Fuel Consumption	17.4 GPH*
(6)	Cruise Time (e)(2) divided by (e)(4), (399 naut. miles divided by 140 KTS)	2.85 hrs.
(7)	Cruise Fuel (e)(5) multiplied by (e)(6), (17.4 GPH multiplied by 2.85 hrs.)	49.6 gal.

*reference Figure 5-27

5.5 FLIGHT PLANNING EXAMPLE (Continued)

(f) Total Flight Time

The total flight time is determined by adding the time to climb, the time to descend and the cruise time. Remember! The time values taken from the climb and descent graphs are in minutes and must be converted to hours before adding them to the cruise time.

The following flight time is required for the flight planning example.

(1) Total Flight Time
(c)(4) plus (d)(2) plus (e)(6),
(0.06 hrs. plus 0.12 hrs. plus 2.85 hrs.) 3.03 hrs.

(g) Total Fuel Required

Determine the total fuel required by adding the fuel to climb, the fuel to descend and the cruise fuel. When the total fuel (in gallons) is determined, multiply this value by 6 lb./ gal. to determine the total fuel weight used for the flight.

The total fuel calculations for the example flight plan are shown below.

(1) Total Fuel Required
(c)(3) plus (d)(1) plus (e)(7),
(2.2 gal. plus 2 gal. plus 49.6 gal.) 53.8 gal
(53.8 gal. multiplied by 6 lb./gal.) 323 lb

5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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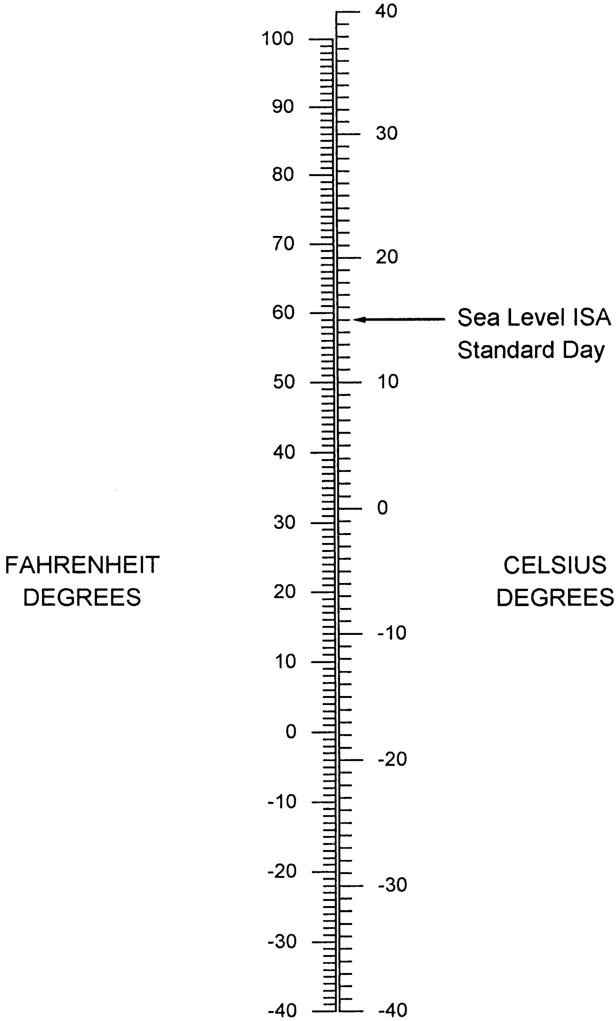
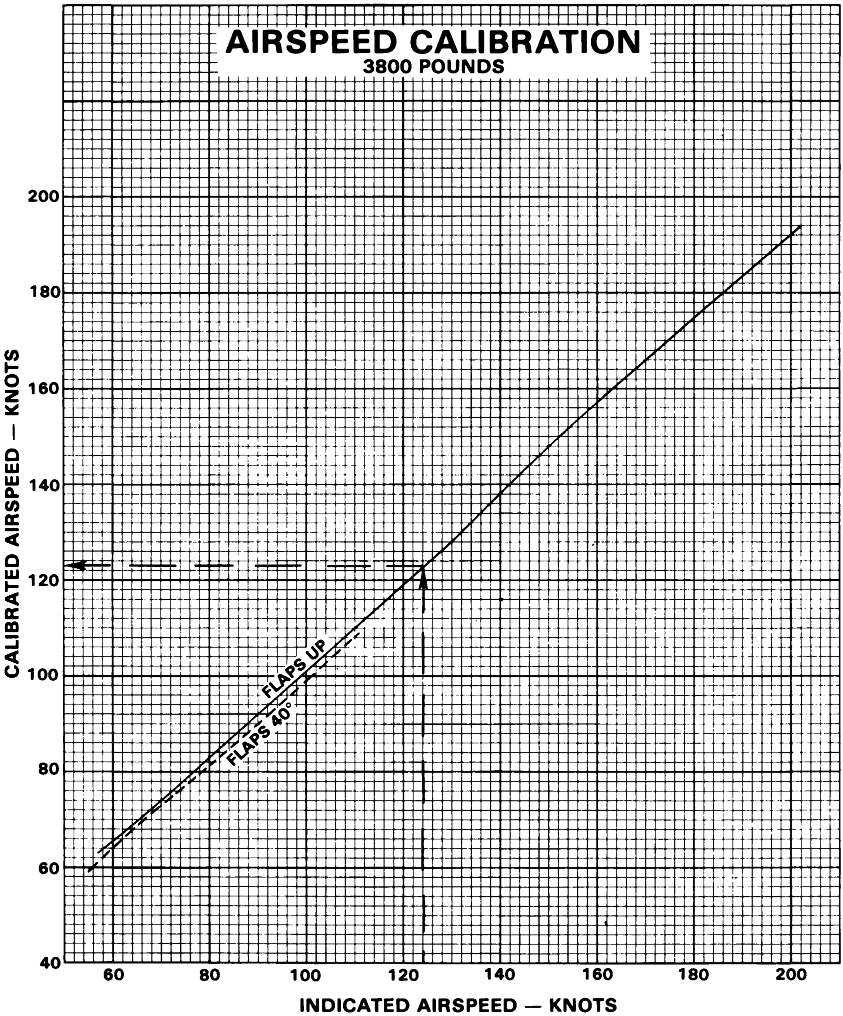
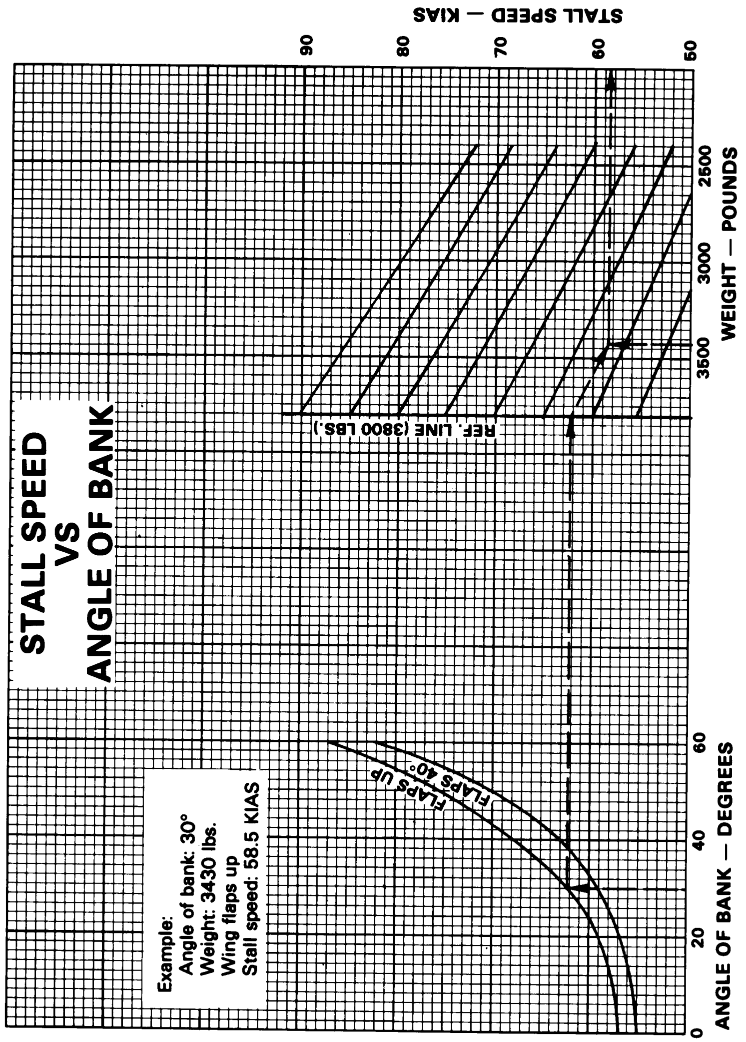


TEMPERATURE CONVERSION
Figure 5-1

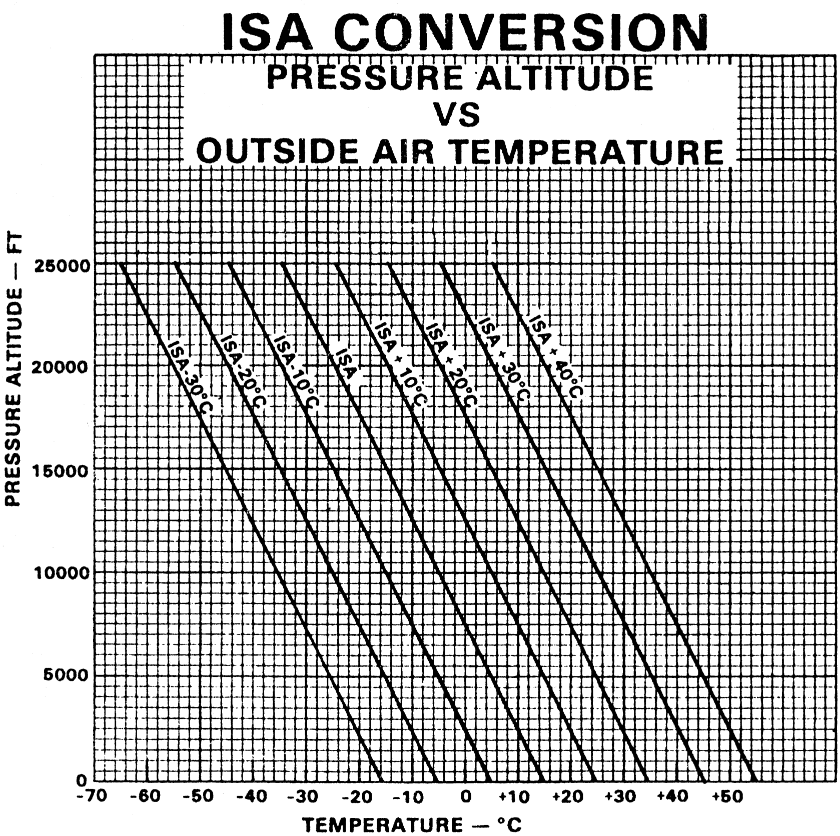


Example:
Indicated airspeed: 124 knots
Flaps up
Calibrated airspeed: 123 knots

AIRSPEED CALIBRATION
Figure 5-3



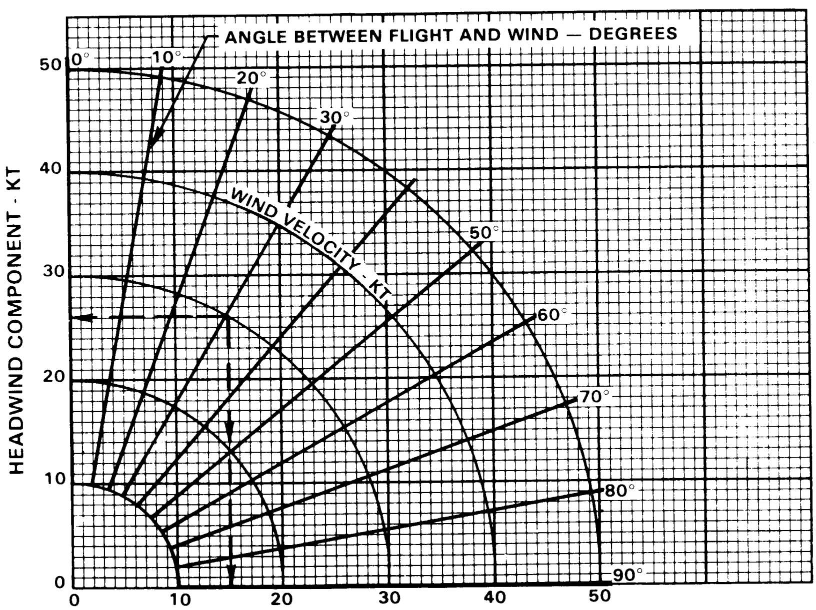
STALL SPEED VS. ANGLE OF BANK
Figure 5-5



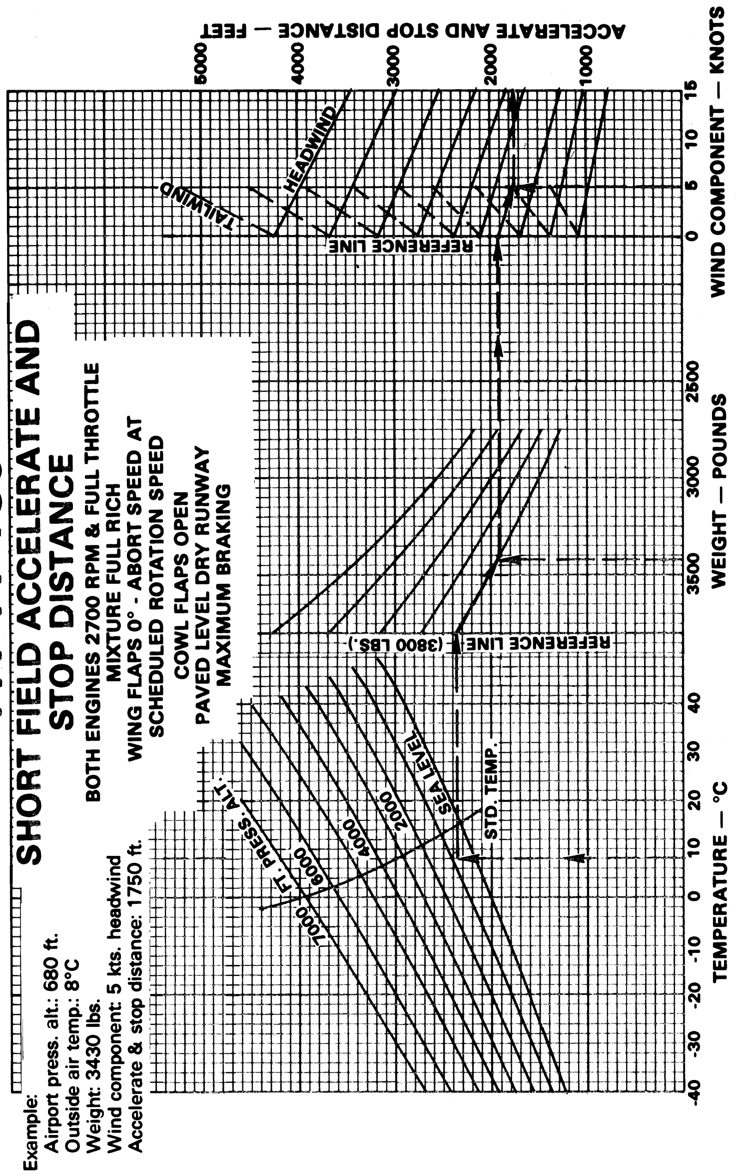
ISA CONVERSION
Figure 5-7

WIND COMPONENTS

Example:
Wind velocity: 30 KT
Angle between flight path and wind: 30°
Headwind: 26 KT
Crosswind component: 15 KT

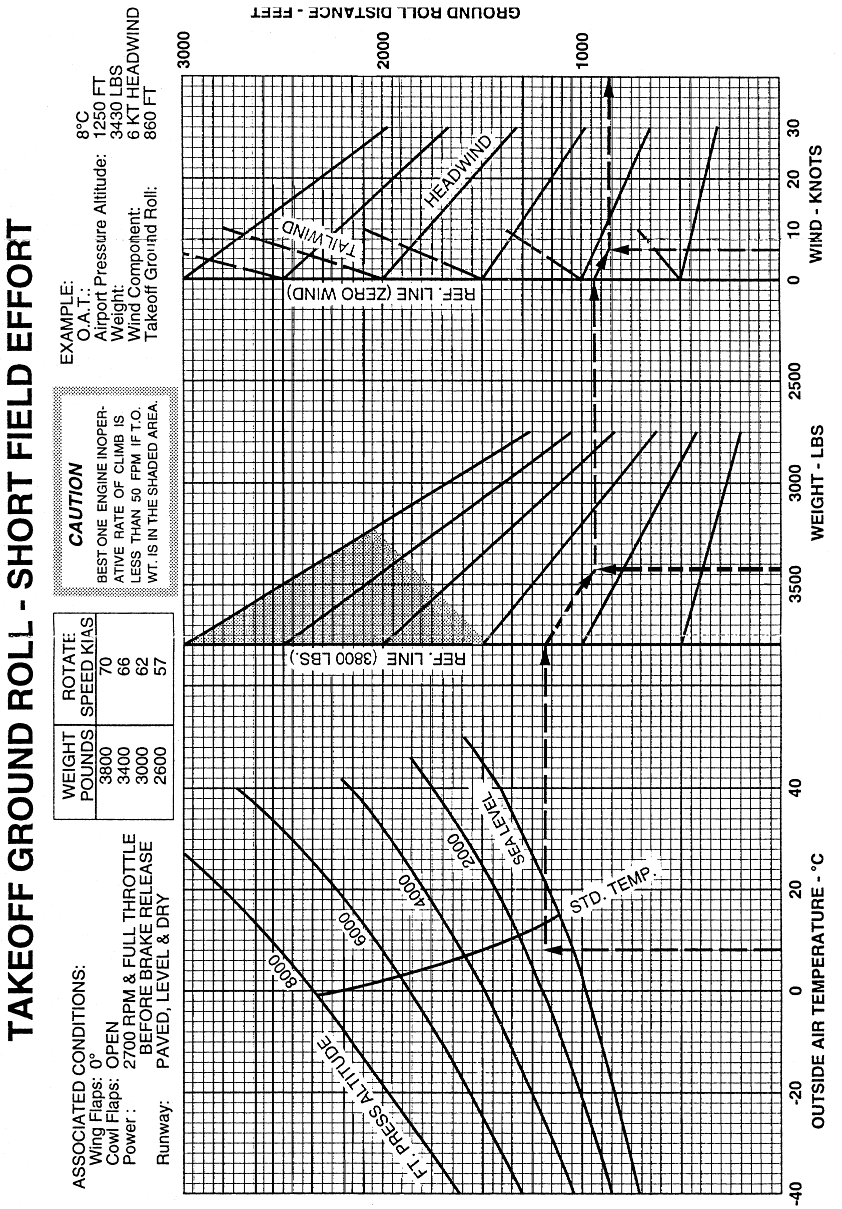


WIND COMPONENTS
Figure 5-9



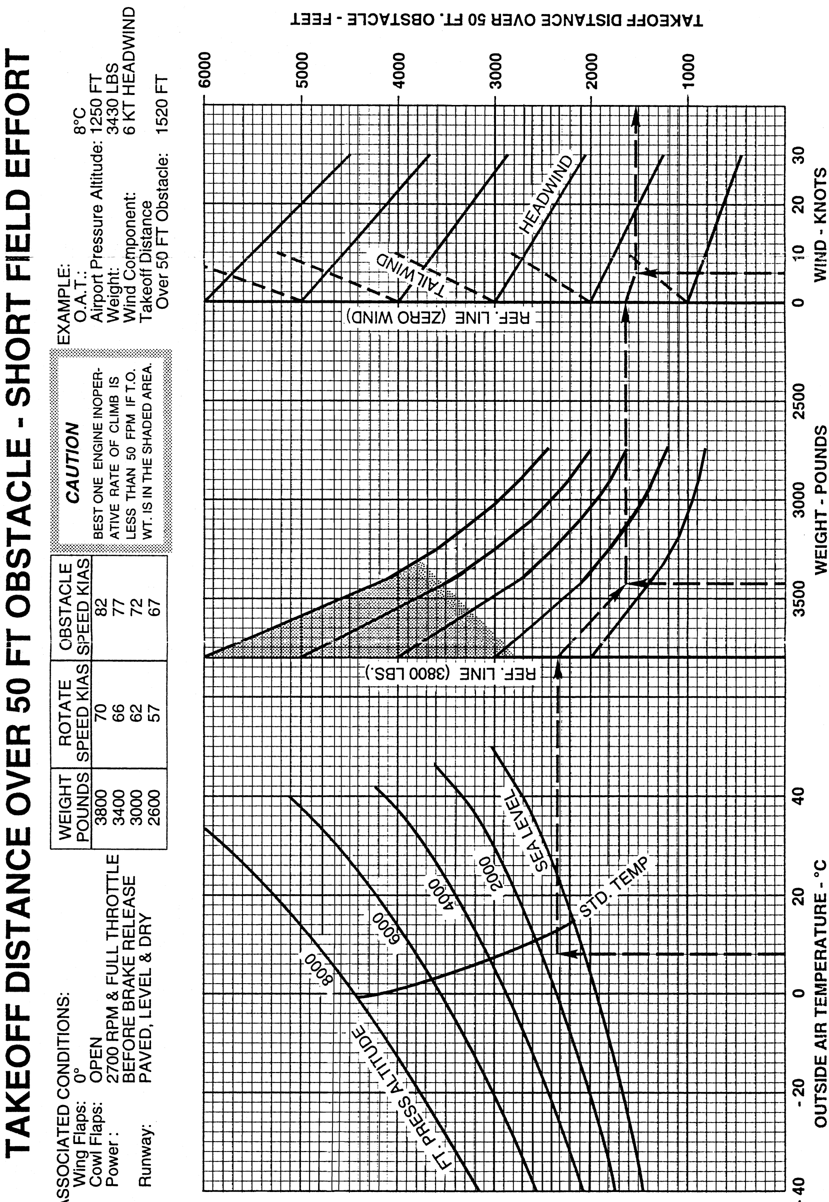
ACCELERATE AND STOP DISTANCE - SHORT FIELD EFFORT

Figure 5-11



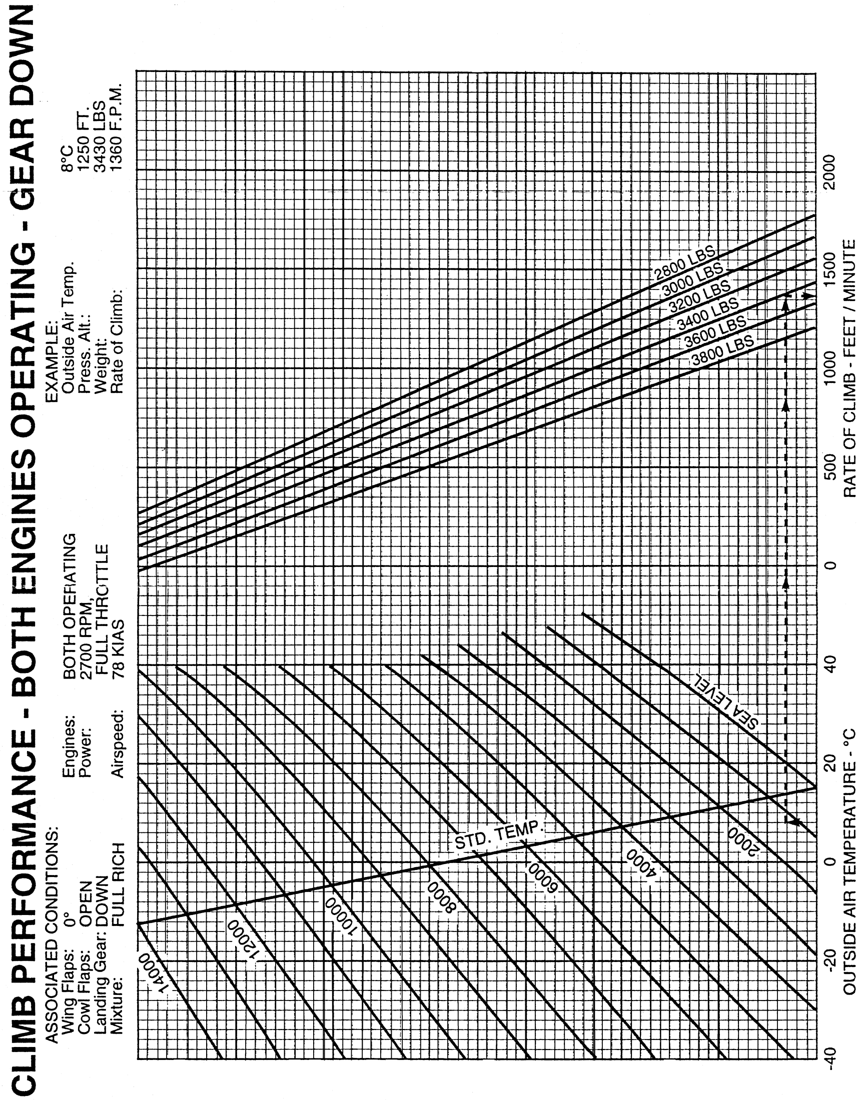
TAKEOFF GROUND ROLL - SHORT FIELD EFFORT

Figure 5-13



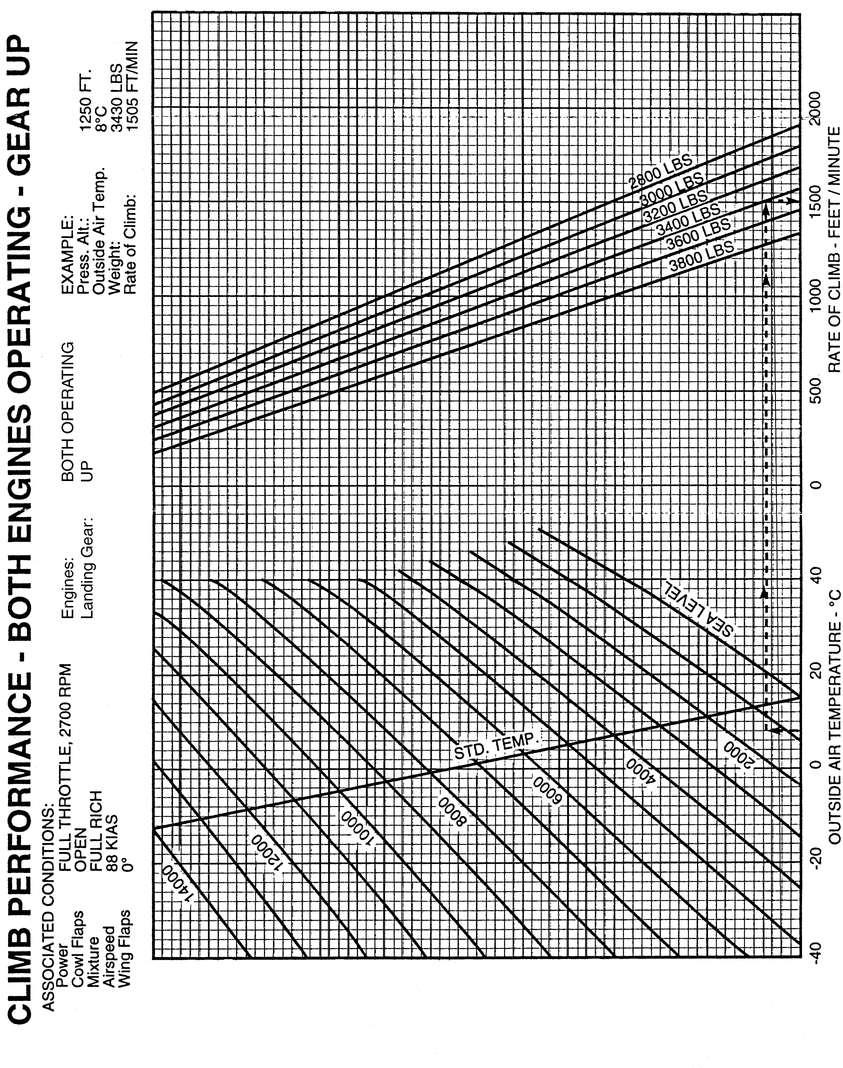
TAKEOFF DISTANCE OVER 50 FT. OBSTACLE - SHORT FIELD EFFORT

Figure 5-15



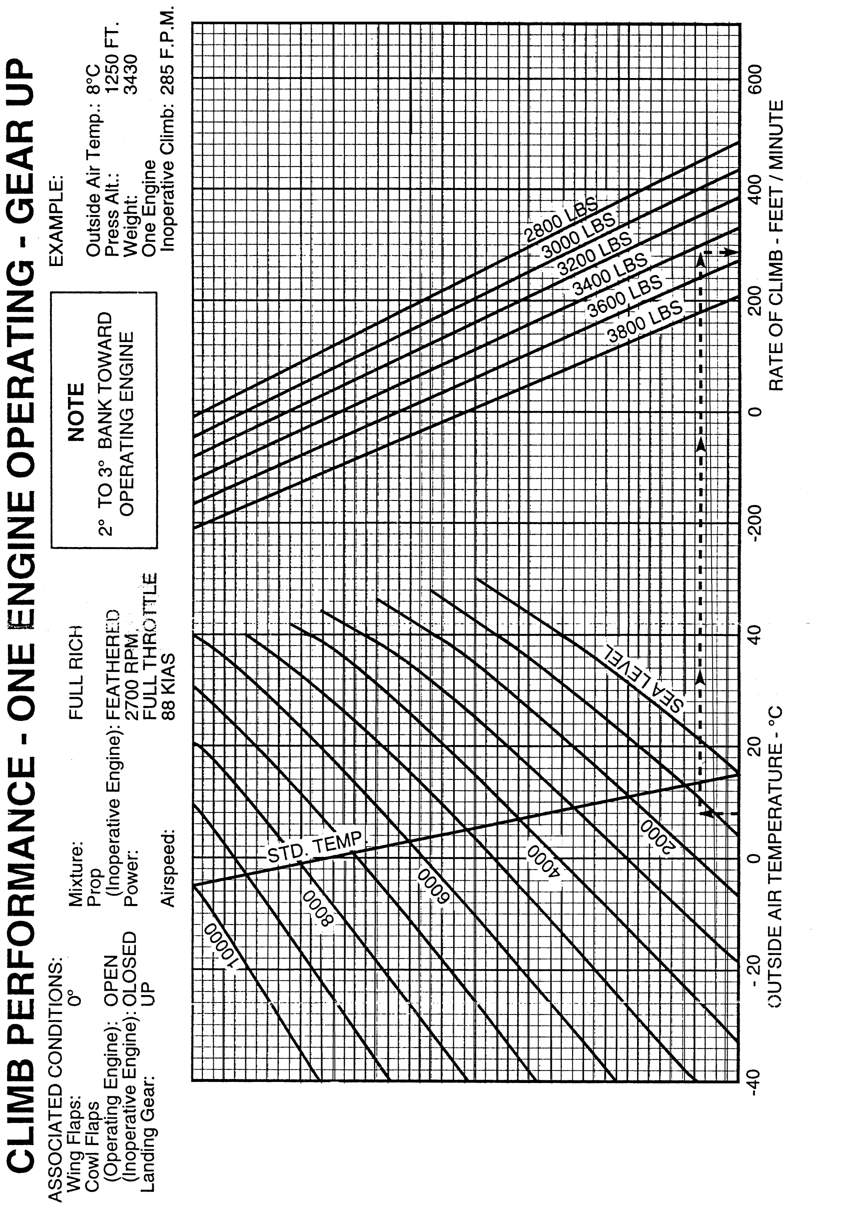
CLIMB PERFORMANCE - BOTH ENGINES OPERATING - GEAR DOWN

Figure 5-17

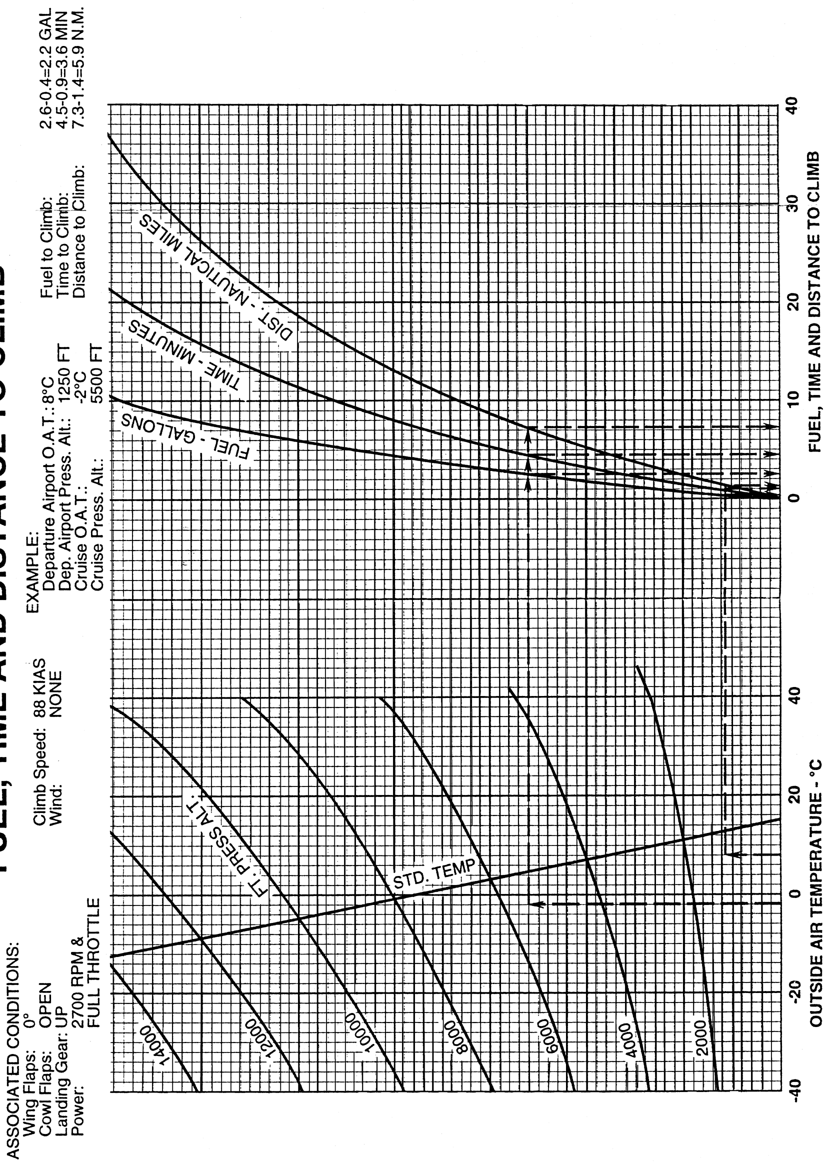


CLIMB PERFORMANCE - BOTH ENGINES OPERATING - GEAR UP

Figure 5-19



CLIMB PERFORMANCE - ONE ENGINE OPERATING - GEAR UP
Figure 5-21



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-23

FUEL AND POWER SETTING TABLE

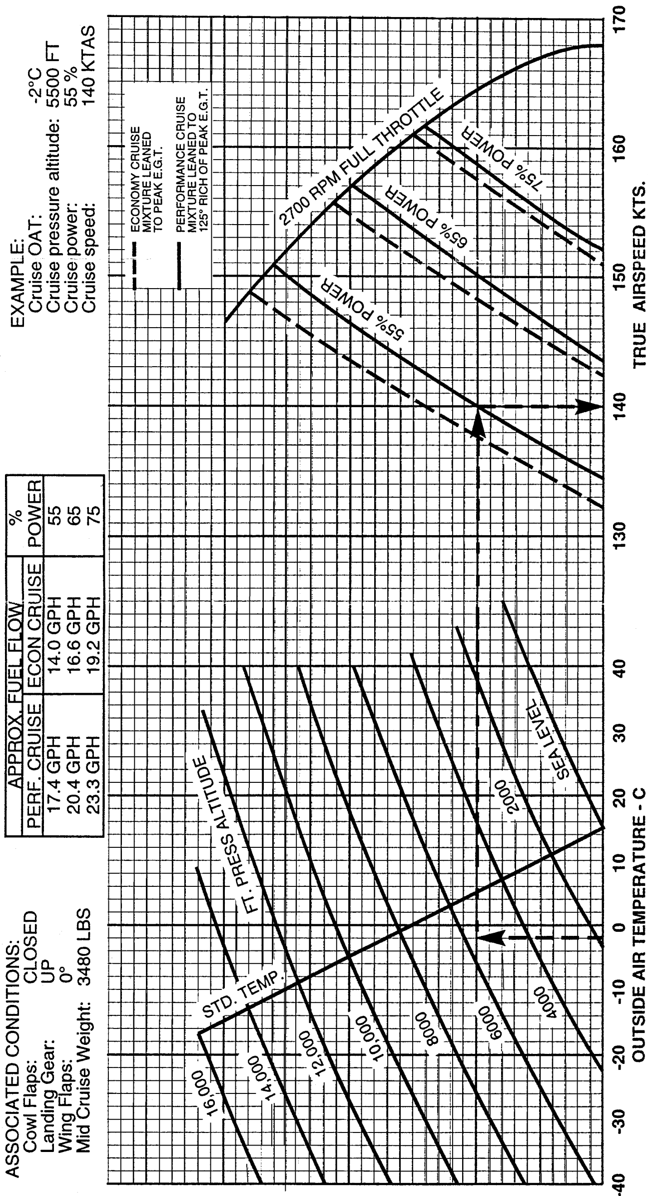
LYCOMING (L) O-360-A1H6 (PER ENGINE)

Press. Alt. Feet	Std. Alt. Temp. °C	99 BHP– 55% Rated Power Approx. Fuel Flow 8.7 G.P.H.* RPM AND MAN. PRESS.				117 BHP– 65% Rated Power Approx. Fuel Flow 10.2 G.P.H.* RPM AND MAN. PRESS.				135 BHP– 75% Rated Power Approx. Fuel Flow 11.7 G.P.H.* RPM AND MAN. PRESS.				Press. Alt. Feet
		2100	2200	2300	2400	2100	2200	2300	2400	2200	2300	2400	2500	
SL	15	22.3	21.7	21.1	20.6	24.9	24.2	23.5	22.9	26.7	26.0	25.2	24.6	SL
1000	13	22.0	21.3	20.8	20.3	24.6	23.8	23.2	22.6	26.3	25.6	24.9	24.3	1000
2000	11	21.7	21.0	20.5	20.0	24.2	23.5	22.9	22.3	25.9	25.3	24.6	24.0	2000
3000	9	21.3	20.7	20.2	19.8	23.9	23.2	22.6	22.0	25.6	25.0	24.4	23.7	3000
4000	7	21.1	20.5	20.0	19.5	23.5	22.8	22.3	21.8	FT	24.7	24.1	23.5	4000
5000	5	20.8	20.2	19.7	19.2	23.2	22.5	22.0	21.5	—	FT	23.8	23.2	5000
6000	3	20.5	19.9	19.4	19.0	22.9	22.2	21.7	21.3	—	—	FT	22.9	6000
7000	1	20.2	19.7	19.2	18.7	FT	21.9	21.5	21.0	—	—	—	FT	7000
8000	-1	20.0	19.4	18.9	18.5	—	FT	21.2	20.8					8000
9000	-3	19.7	19.1	18.7	18.2	—	—	FT	20.6					9000
10,000	-5	19.5	18.9	18.4	18.0	—	—	—	FT					10,000
11,000	-7	19.2	18.7	18.2	17.8									11,000
12,000	-9	FT	18.4	18.0	17.6									12,000
13,000	-11	—	FT	FT	17.4									13,000
14,000	-13	—	—	—	FT									14,000

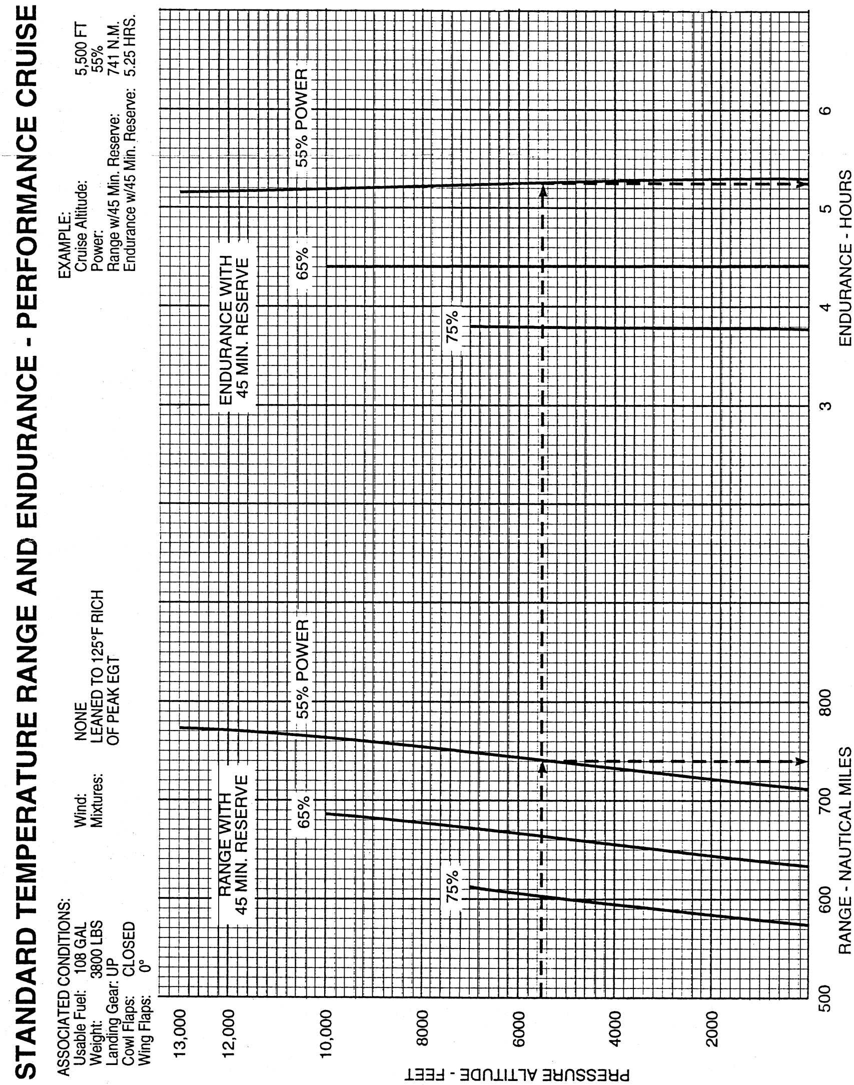
NOTE: To maintain constant power, add approximately 1% Manifold Pressure for each 8°C above standard. Subtract approximately 1% for each 8°C below standard.

*PERFORMANCE CRUISE POWER

FUEL AND POWER SETTING TABLE
Figure 5-25

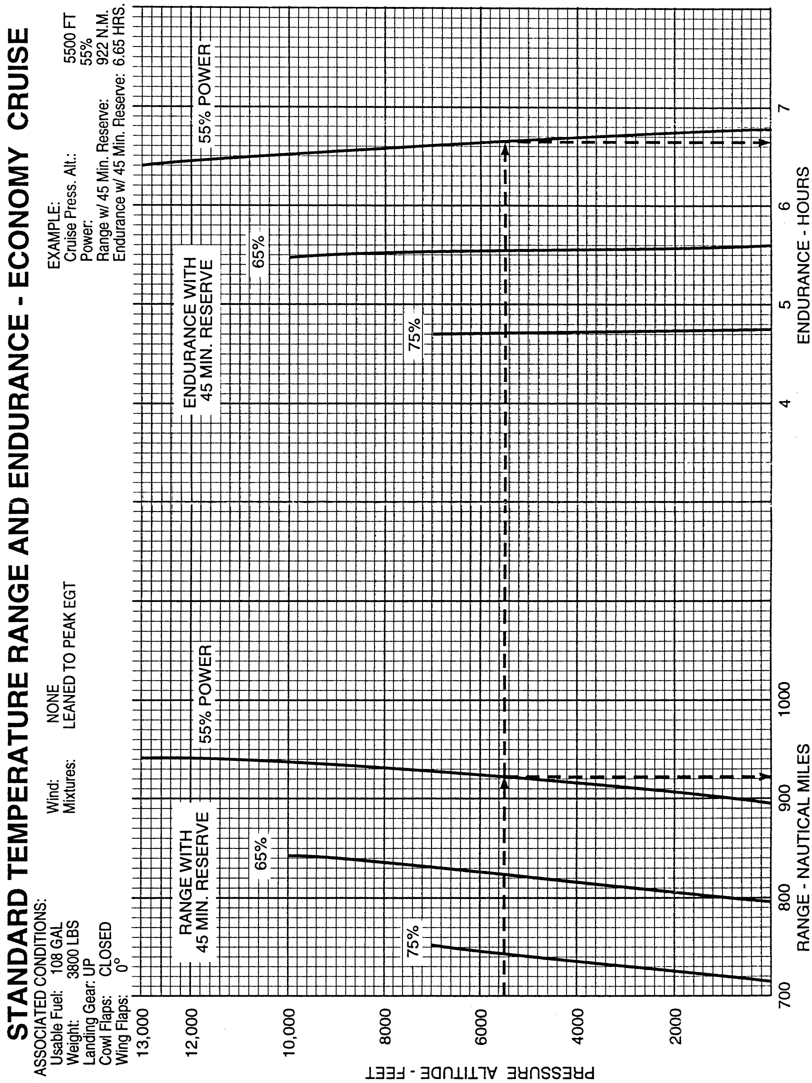


SPEED POWER
Figure 5-27

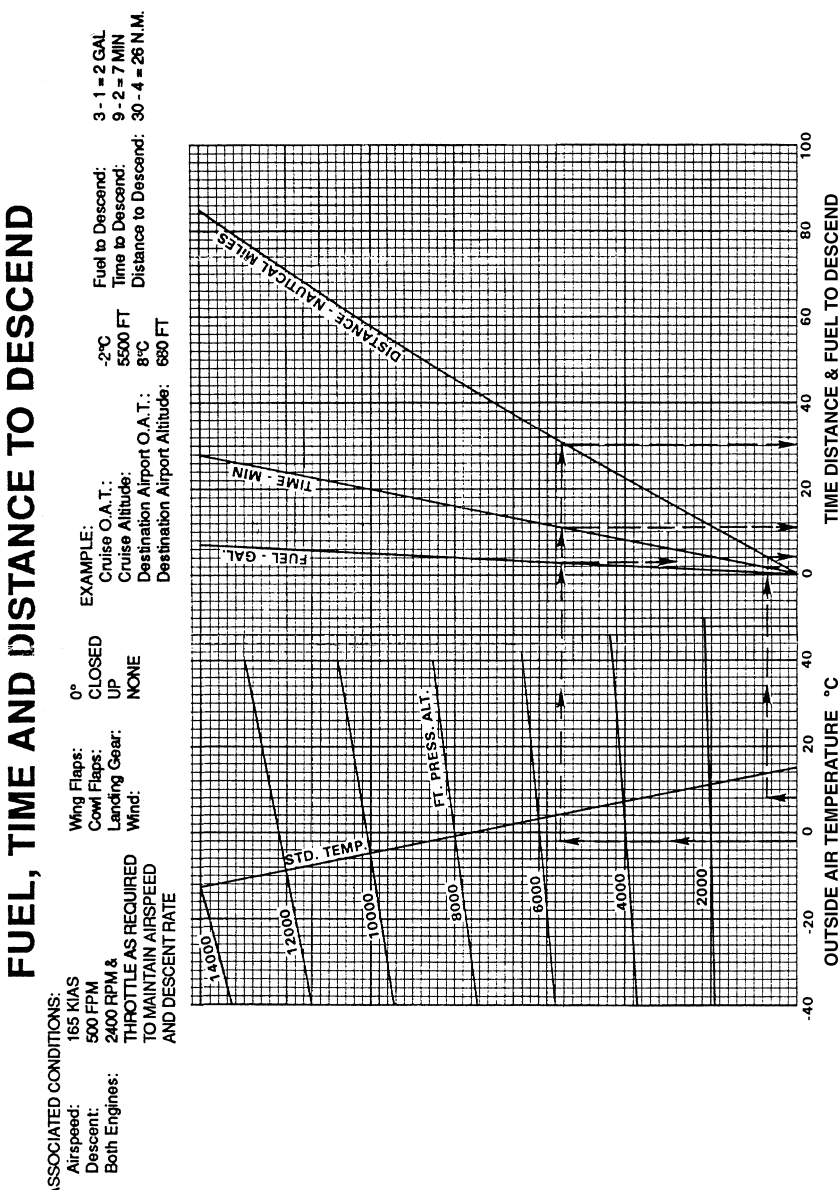


STANDARD TEMPERATURE RANGE AND ENDURANCE - PERFORMANCE CRUISE

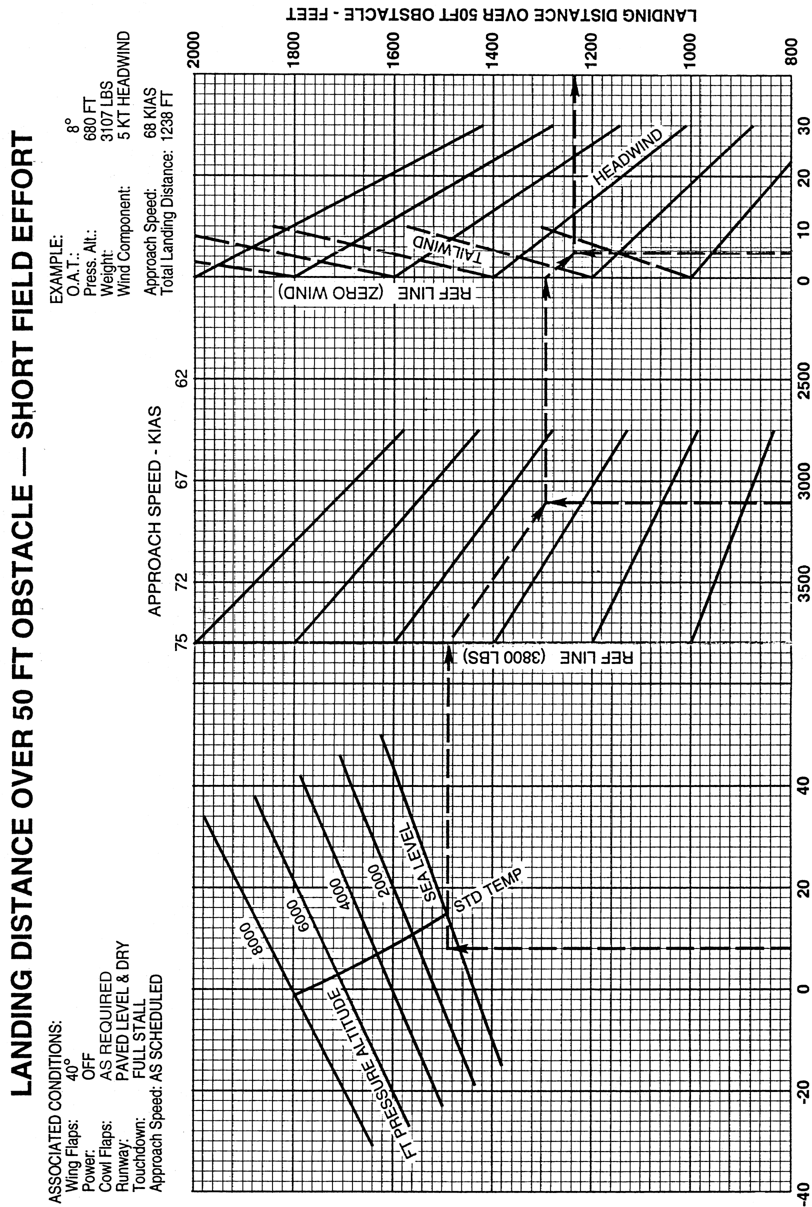
Figure 5-29



STANDARD TEMPERATURE RANGE AND ENDURANCE - ECONOMY CRUISE
Figure 5-31

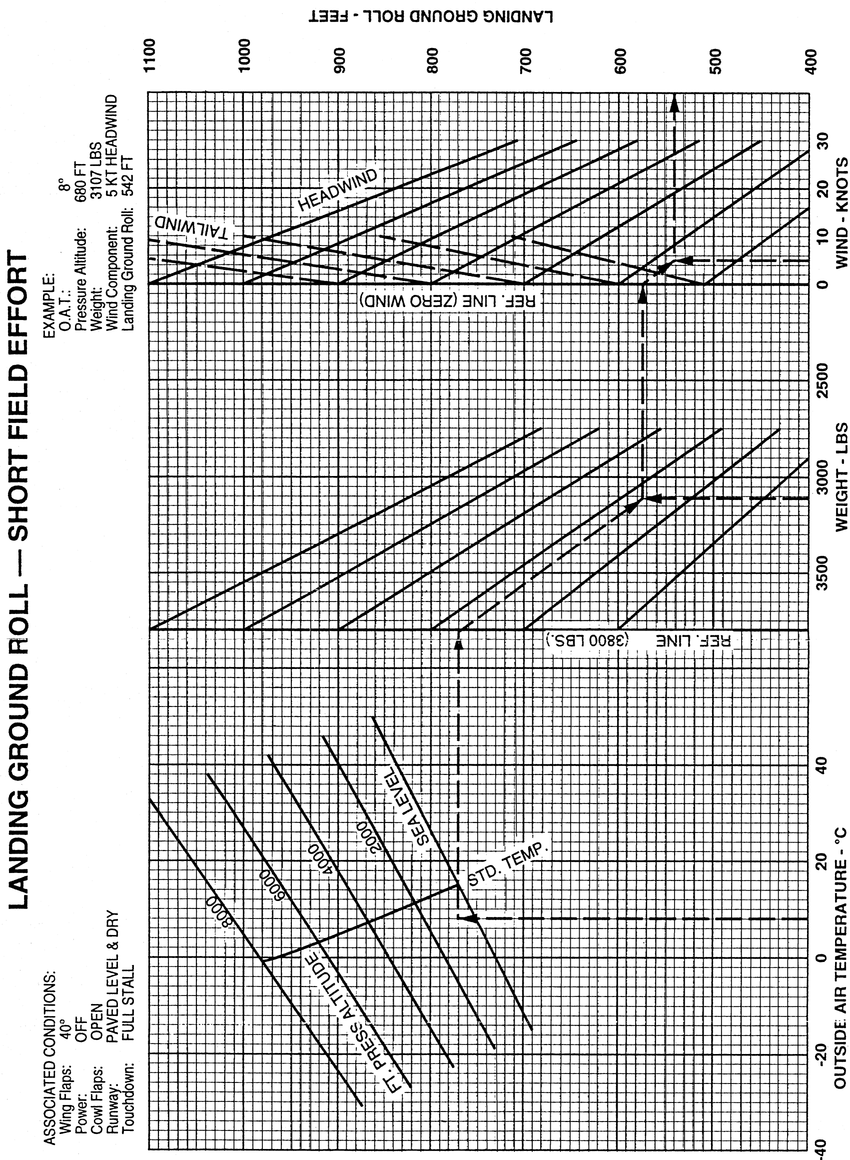


FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-33



LANDING DISTANCE OVER 50 FT. OBSTACLE - SHORT FIELD EFFORT

Figure 5-35



LANDING GROUND ROLL - SHORT FIELD EFFORT
Figure 5-37

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SECTION 6

WEIGHT AND BALANCE

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SECTION 6
WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must ensure that the airplane is loaded within the loading envelope before he makes a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended. This airplane is designed to provide performance within the flight envelope. Before the airplane is delivered, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

6.1 GENERAL (Continued)

The basic empty weight and C.G. location are recorded in the Weight and Balance Data Form (Figure 6-5) and the Weight and Balance Record (Figure 6-7). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be boarded so as to keep within allowable limits. Check calculations prior to adding fuel to ensure against overloading.

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

6.3 AIRPLANE WEIGHING PROCEDURE

At the time of licensing, provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-5.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.

(2) Remove excessive dirt, grease, moisture, and foreign items such as rags and tools, from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate each engine until all undrainable fuel is used and engine stops. Then add the unusable fuel (2.0 gallons total, 1.0 gallon each wing).

6.3 AIRPLANE WEIGHING PROCEDURE (Continued)

CAUTION

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engines for a minimum of 3 minutes at 1000 RPM on each tank to ensure no air exists in the fuel supply lines.

(4) Fill with oil to full capacity.

(5) Place pilot and copilot seats in fourth (4th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and entrance and baggage door closed.

(6) Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

(1) With airplane on scales, block main gear oleo pistons in the fully extended position.

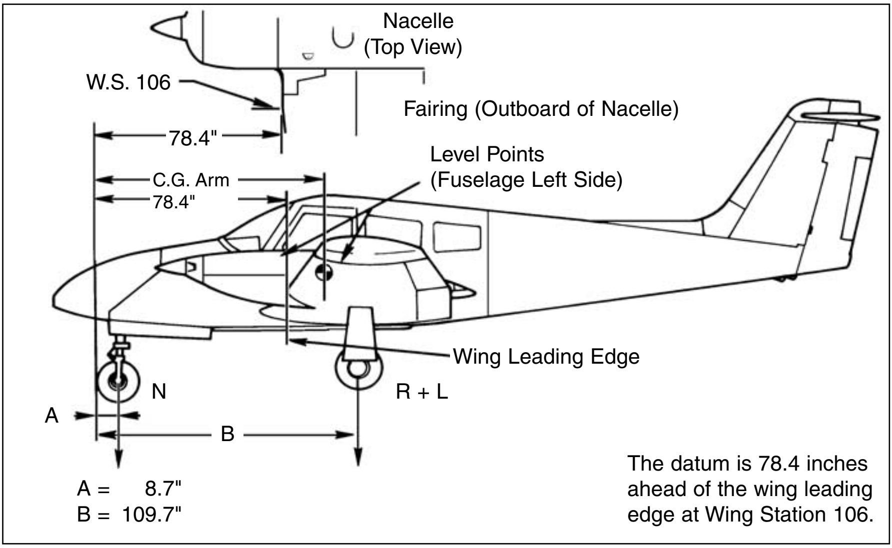
(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing- Airplane Basic Empty Weight

(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

Scale Position and Symbol	Scale Reading	Tare	Net Weight
Nose Wheel (N)			
Right Main Wheel (R)			
Left Main Wheel (L)			
Basic Empty Weight, (as Weighed) (T)			

WEIGHING FORM
Figure 6-1



LEVELING DIAGRAM
Figure 6-3

6.3 AIRPLANE WEIGHING PROCEDURE (Continued)

(d) Basic Empty Weight Center of Gravity

(1) The Leveling Diagram geometry (Figure 6-3) applies to the PA-44-180 airplane when it is level. Refer to Leveling paragraph 6.3 (b).

(2) The basic empty weight center of gravity (as weighed including optional equipment, full oil and unusable fuel) can be determined by the following formula:

$$\text{C.G. Arm} = \frac{N\,(A) + (R + L)\,(B)}{T} \quad \text{inches}$$

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useful Load listed. in Figure 6-5 are for the airplane as delivered from the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as delivered from the factory has been entered in the Weight and Balance Record (Figure 6-7). This form is provided to present the current status of the airplane basic empty weight and a complete history of previous modifications. Any change to the permanently installed equipment or modification which affects weight or moment must be entered in the Weight and Balance Record.

MODEL PA-44-180, SEMINOLE

Airplane Serial Number________________________

Registration Number __________________________

Date ______________________________________

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight (Lbs)	x C.G. Arm (Inches Aft of Datum)	= Moment (In-Lbs)
Standard Empty Weight* Actual / Computed			
Optional Equipment			
Basic Empty Weight			

*The standard empty weight includes full oil capacity and 2.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

(Gross Weight) - (Basic Empty Weight) = Useful Load

(3800 lbs.) - (lbs.) = lbs.

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS LICENSED AT THE FACTORY. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT AND BALANCE DATA FORM

Figure 6-5

PA-44-180		Serial Number		Registration Number			Page Number	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100
		As licensed						

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-44-180		Serial Number		Registration Number			Page Number	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100

WEIGHT AND BALANCE RECORD
Figure 6-7 (Continued)

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.

(b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.

(c) Add the moment of all items to be loaded to the basic empty weight moment.

(d) Divide the total moment by the total weight to determine the C.G. location.

(e) By using the figures of item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (Continued)

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger	340.0	80.5	27370
Passengers (Rear Seats)	340.0	118.1	40154
Fuel (108 Gallon Maximum Usable)		95.0	
Baggage (200 Lb. Limit)		142.8	
Ramp Weight (3816 Lbs. Max.)			
Fuel Allowance for Engine Start, Taxi & Runup	-16.0	95.0	-1520
Take-off Weight (3800 Lbs. Max.)			

The center of gravity (C.G.) for the take-off weight of this sample loading problem is at inches aft of the datum line. Locate this point ( ) on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Take-off Weight			
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.		95.0	
Landing Weight			

Locate the center of gravity of the landing weight on the C.G. range and weight graph. Since this point falls within the weight- C.G. envelope, the loading may be assumed acceptable for landing.

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO ENSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL TIMES.

SAMPLE LOADING PROBLEM
Figure 6-9

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (Continued)

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		80.5	
Passengers (Rear Seats)		118.1	
Fuel (108 Gallon Maximum Usable)		95.0	
Baggage (200 Lb. Limit)		142.8	
Ramp Weight (3816 Lbs. Max.)			
Fuel Allowance for Engine Start, Taxi & Runup	-16.0	95.0	-1520
Take-off Weight (3800 Lbs. Max.)			

The center of gravity (C.G.) for the take-off weight of this loading problem is at inches aft of the datum line. Locate this point ( ) on the C.G. range and weight graph. If this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Take-off Weight			
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.		95.0	
Landing Weight			

Locate the center of gravity of the landing weight on the C.G. range and weight graph. If this point falls within the weight- C.G. envelope, the loading may be assumed acceptable for landing.

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO ENSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL TIMES.

WEIGHT AND BALANCE LOADING FORM
Figure 6-11

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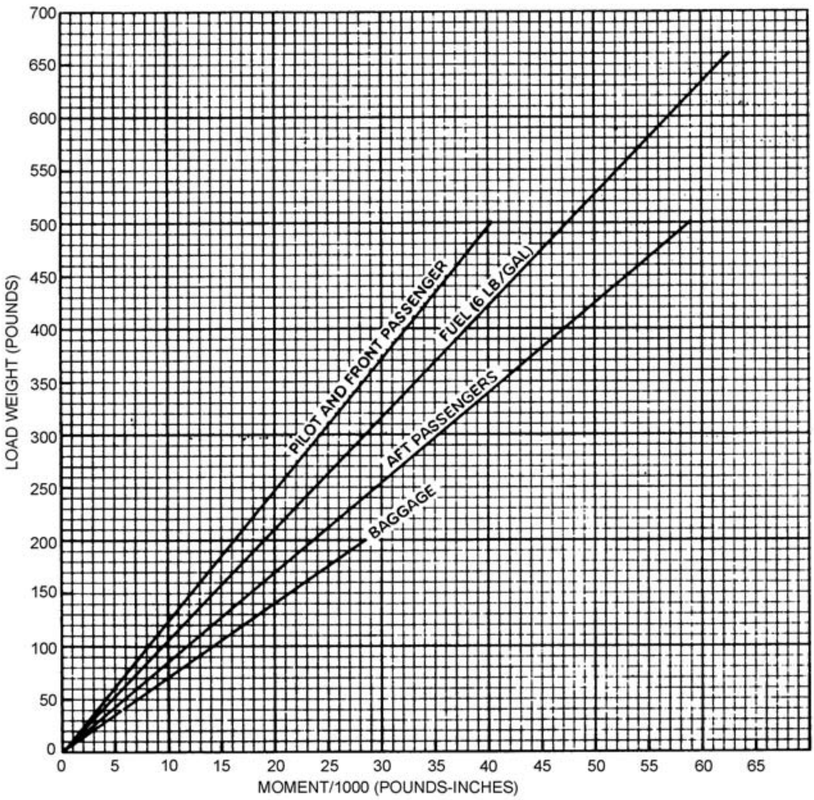
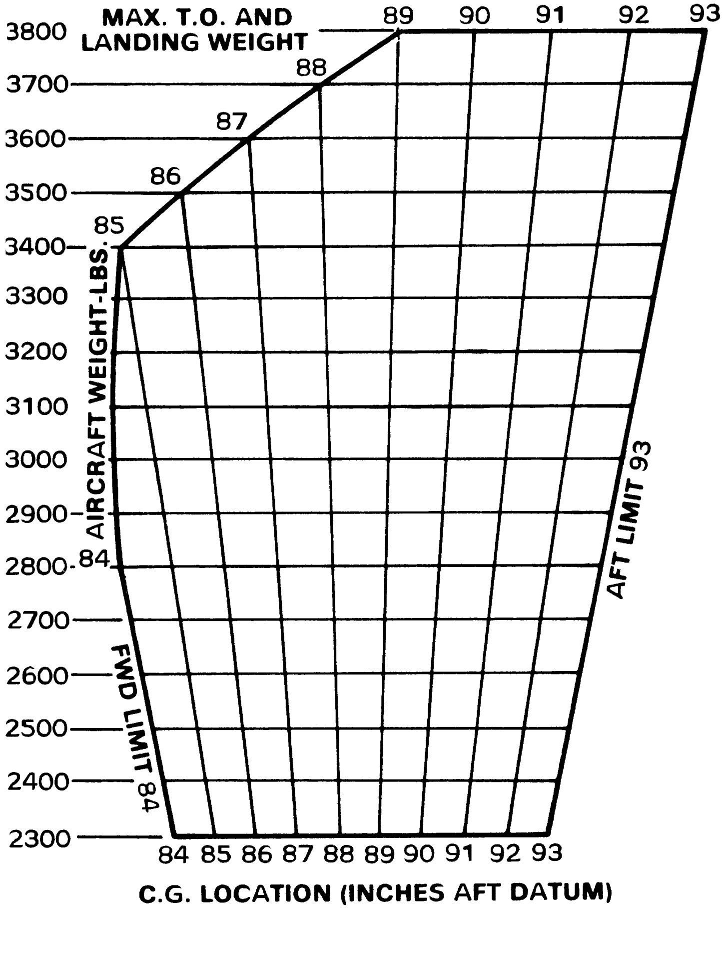


LOADING GRAPH
Figure 6-13



C.G. RANGE AND WEIGHT
Figure 6-15

6.9 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER

This plotter is provided to enable the pilot quickly and conveniently to:

(a) Determine the total weight and C.G. position.
(b) Decide how to change his load if his first loading is not within the allowable envelope.

Heat can warp or ruin the plotter if it is left in the sunlight. Replacement plotters may be purchased from Piper dealers and distributors.

When the airplane is delivered, the basic weight and basic C.G. will be recorded on the computer. These should be changed any time the basic weight or C.G. location is changed.

The plotter enables the user to add weights and corresponding moments graphically. The effect of adding or disposing of useful load can easily be seen. The plotter does not cover the situation where cargo is loaded in locations other than on the seats or in the baggage compartments.

Brief instructions are given on the plotter itself. To use it, first plot a point on the grid to locate the basic weight and C.G. location. This can be put on more or less permanently because it will not change until the airplane is modified. Next, position the zero weight end of any one of the loading slots over this point. Using a pencil, draw a line along the slot to the weight which will be carried in that location. Then position the zero weight end of the next slot over the end of this line and draw another line representing the weight which will be located in this second position. When all the loads have been drawn in this manner, the final end of the segmented line locates the total load and the C.G. position of the airplane for takeoff. If this point is not within the allowable envelope it will be necessary to remove fuel, baggage, or passengers and/or to rearrange baggage and passengers to get the final point to fall within the envelope.

Fuel burn-off and gear movement do not significantly affect the center of gravity.

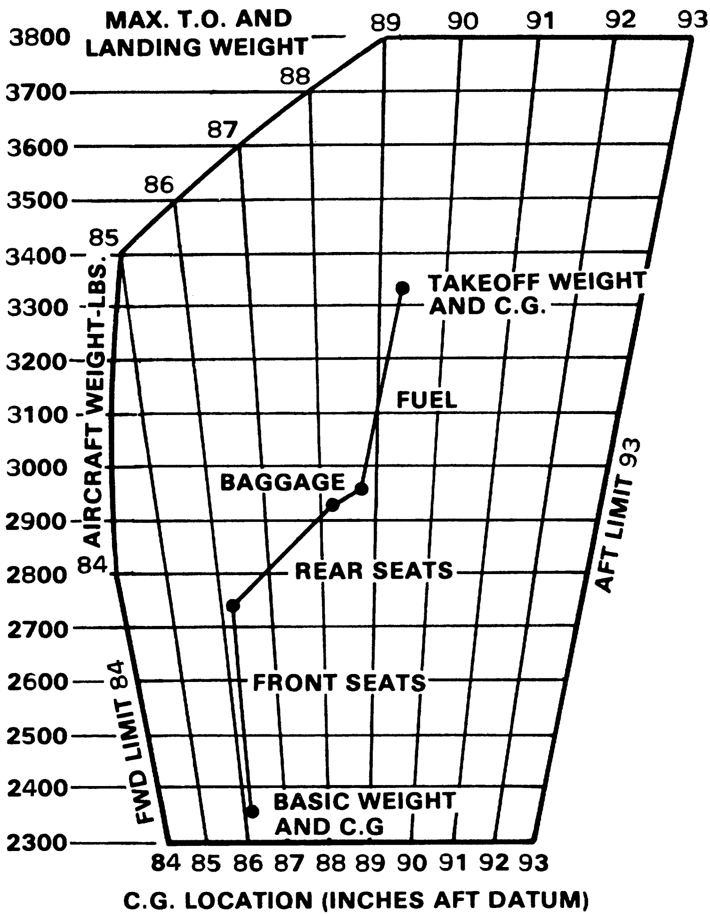
SAMPLE PROBLEM

A sample problem (Figure 6-17) will demonstrate the use of the weight and balance plotter.

Assume a basic weight and C.G. location of 2364 pounds at 86.14 inches respectively. We wish to carry a pilot and 3 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, and two children weighing 80 and 100 pounds will ride in the rear. Two suitcases weighing 25 pounds and 20 pounds respectively, will be carried in the rear compartment. We wish to carry 60 gallons of fuel. Will we be within the safe envelope?

(a) Place a dot on the plotter grid at 2364 pounds and 86.14 inches to represent the basic airplane. (See illustration.)
(b) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.
(c) Draw a line up the slot to the 380 pound position (180 + 200) and put a dot.
(d) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), baggage compartment (45), and fuel tanks (360).
(e) As can be seen from the illustration, the final dot shows the total weight to be 3329 pounds with the C.G. at 89.30. This is well within the envelope.
(f) There will be room for more fuel.

As fuel is burned off, the weight and C.G. will follow down the fuel line and stay within the envelope for landing.



SAMPLE PROBLEM
Figure 6-17

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TABLE OF CONTENTS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND IT'S SYSTEMS

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Seminole is a twin-engine, all metal, retractable landing gear, airplane. It has seating for up to four occupants and has a two hundred pound capacity luggage compartment.

7.3 AIRFRAME

With the exception of the steel engine mounts, the landing gear, the fiberglass nose cone, cowling nose bowls and tips of wings, and the ABS thermoplastic or fiberglass extremities (tail fin, rudder and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure with a passenger door on the forward right side, a cargo door on the aft right side with an emergency egress door on the forward left side.

The wing is of a semi-tapered design and employs a modified laminar flow NACA airfoil section. The main spar is located at approximately 40% of the chord. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the rear seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each nacelle contains one fuel tank.

7.3 AIRFRAME (Continued)

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator, which is mounted on top of the fin incorporates an anti-servo tab which provides longitudinal stability and trim. This tab moves in the same direction as the stabilator, but with increased travel. Rudder effectiveness is increased by an anti-servo tab on the rudder.

7.5 ENGINES AND PROPELLERS

ENGINES

The Seminole is powered by two Lycoming four-cylinder, direct drive, horizontally opposed engines, each rated at 180 horsepower @ 2700 RPM at sea level. The engines are air cooled and are equipped with oil coolers with low temperature bypass systems and engine-mounted oil filters. A winterization plate is provided to restrict air during winter operation. (See Winterization in Section 8.) Asymmetric thrust during takeoff and climb is eliminated by the counter-rotation of the engines: the left engine rotating in a clockwise direction when viewed from the cockpit, and the right engine rotating counterclockwise.

The engine oil dipstick is accessible through a door located on the upper cowl of each nacelle.

The engines are accessible through removable cowls. The upper cowl half is attached with quarter-turn fasteners and is removable. Engine mounts are constructed of steel tubing, and dynafocal engine mounts are provided to reduce vibration.

Induction Air System

The induction air box incorporates a manually operated two-way valve which allows the carburetor to receive either induction air which passes through the air filter or heated air which bypasses the filter. Carburetor heat selection provides heated air to the carburetor in the event of carburetor icing, and also allows selection of an alternate source of air in the event the induction air source or the air filter becomes blocked with ice, snow, freezing rain, etc. Carburetor heat selection provides air which is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

7.5 ENGINES AND PROPELLERS (Continued)

PROPELLERS

Counter-rotation of the propellers provides balanced thrust during takeoff and climb and eliminates the critical engine factor in single-engine flight.

Two blade, constant speed, controllable pitch and feathering Hartzell propellers are installed as standard equipment. The propellers mount directly to the engine crankshafts.

Pitch is controlled by oil and nitrogen pressure. Oil pressure sends a propeller toward the high RPM or unfeather position; nitrogen pressure and a large spring sends a propeller toward the low RPM or feather position and also prevents propeller overspeeding. The recommended nitrogen pressure to be used when charging the unit is listed on placards on the propeller domes and inside the spinners. This pressure varies with ambient temperature at the time of charging. Although dry nitrogen gas is recommended, compressed air may be used provided it contains no moisture. For more detailed instructions, see Propeller Service in Section 8 of this Handbook.

Governors, one on each engine, supply engine oil at various pressures through the propeller shafts to maintain constant RPM settings. A governor controls engine speed by varying the pitch of the propeller to match load torque to engine torque in response to changing flight conditions.

Each propeller is controlled by the propeller control levers located in the center of the power control quadrant. Feathering of a propeller is accomplished by moving the control fully aft through the low RPM detent, into the FEATHER position. Feathering takes place in approximately six seconds. Unfeathering is accomplished by moving the propeller control forward. This releases oil accumulated under pressure and moves the propeller out of the FEATHER position.

7.5 ENGINES AND PROPELLERS (Continued)

Unfeathering Accumulators

The propeller unfeathering system consists of increased capacity governors and gas charged accumulators.

The feathering governors are designed to operate in the conventional manner in addition to their accumulator unfeathering capability.

The accumulators store engine oil under pressure from the governors which is released back to the governors for propeller unfeathering when the propeller control lever is moved forward from the feathered position.

With this system installed the feathering time is 10 - 17 seconds and unfeathering times is 8 - 12 seconds depending on the oil temperature.

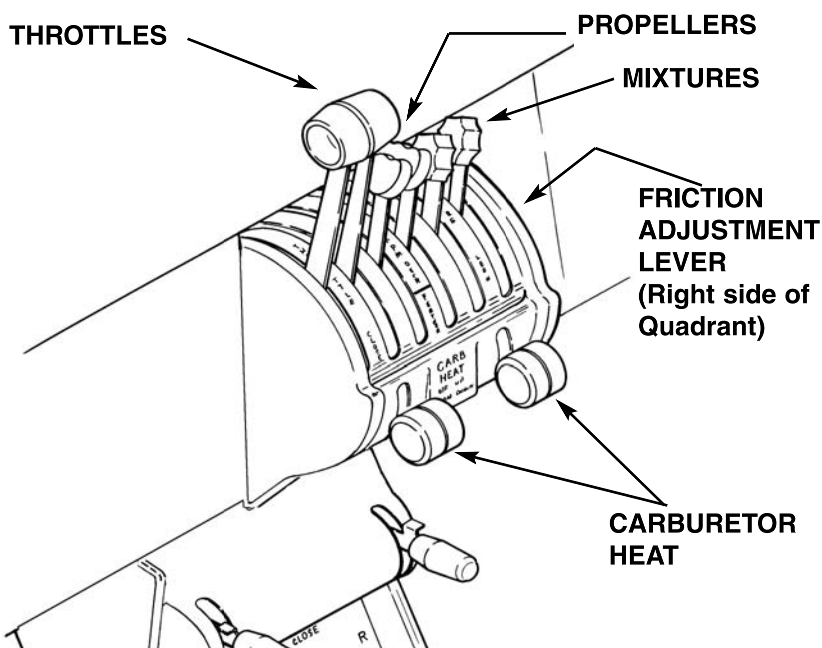
A feathering lock, operated by centrifugal force, prevents feathering during engine shutdown by making it impossible to feather any time the engine speed falls below 950 RPM. For this reason, when airborne, and the pilot wishes to feather a propeller to save an engine, he must be sure to move the propeller control into the FEATHER position before the engine speed drops below 950 RPM.

7.7 ENGINE CONTROLS

Engine controls consist of a throttle, a propeller control and a mixture control lever for each engine. These controls are located on the control quadrant on the lower center of the instrument panel where they are accessible to both the pilot and the copilot (Figure 7-1). The controls utilize teflon-lined control cables to reduce friction and binding.

The throttle levers are used to adjust the manifold pressure. Gear up warning horn micro-switches are incorporated and are activated by either or both throttles contacting the switches during the lower portion of throttle lever travel (approximately 14 in. Hg. MAP and below). If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a safety feature to warn the pilot of an inadvertent gear up landing.

All throttle operations should be made with a smooth, not too rapid movement to prevent unnecessary engine wear or damage to the engines.



CONTROL QUADRANT
Figure 7-1

7.7 ENGINE CONTROLS (continued)

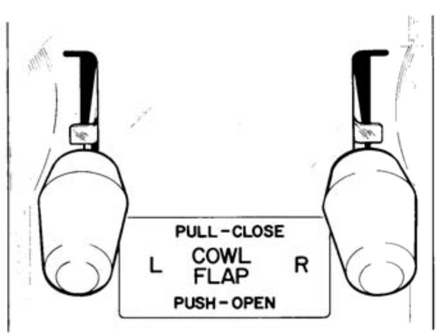
The propeller control levers are used to adjust the propeller speed from high RPM (low pitch) to feather (high pitch).

The mixture control levers are used to adjust the air to fuel ratio. An engine is shut down by the placing of the mixture control lever in the full lean (idle cut-off) position.

The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle, propeller, and mixture controls or to lock the controls in a selected position.

The carburetor heat controls are located on the control quadrant just below the engine control levers. When a carburetor heat lever is in the up, or OFF, position the engine is operating on filtered air; when the lever is in the down, or ON, position the engine is operating on unfiltered, heated air.

The cowl flap control levers (Figure 7-3), located below the control quadrant, are used to regulate cooling air for the engines. The levers have three positions: full open, full closed, and intermediate. A lock incorporated in each control lever locks the cowl flap in the selected position. To operate the cowl flaps, depress the lock and move the lever toward the desired setting. Release the lock after initial movement and continue movement of the lever. The control will stop and lock into place at the next setting. The lock must be depressed for each selection of a new cowl flap setting.



COWL FLAP CONTROLS
Figure 7-3

7.9 LANDING GEAR

The Seminole is equipped with hydraulically operated, fully retractable, tricycle landing gear. On takeoff, the gear should be retracted before an airspeed of 109 KIAS is exceeded. The landing gear may be lowered at any speed up to 140 KIAS.

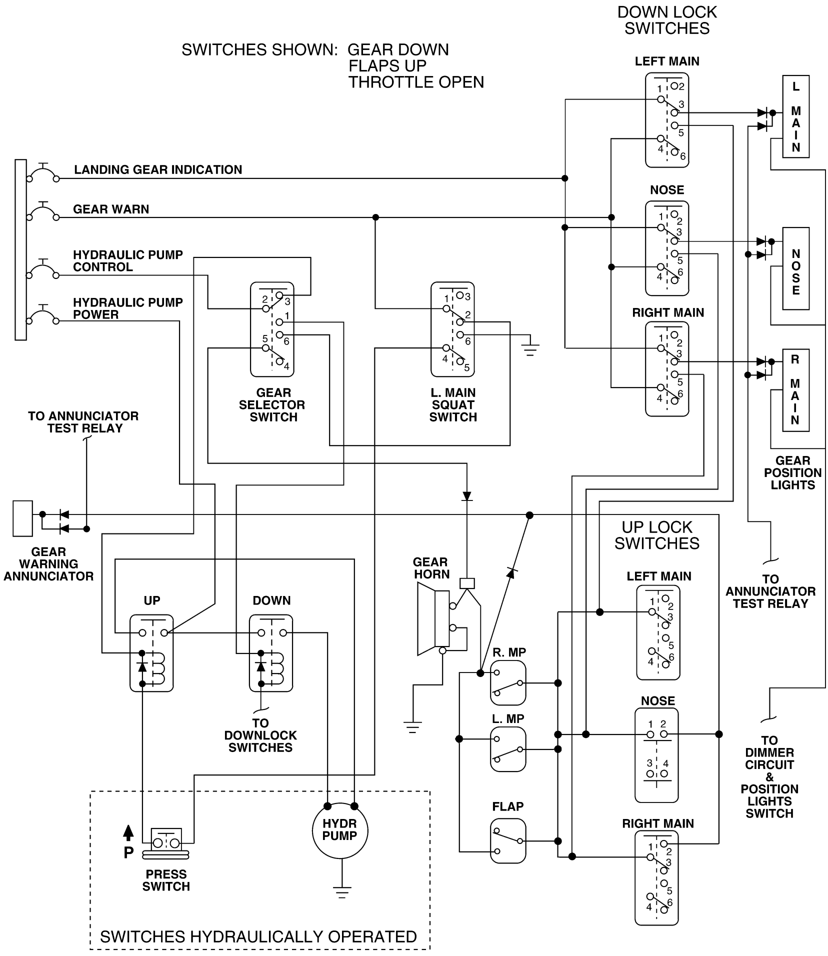
NORMAL OPERATION

Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-7 and 7-9). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-5). The gear selector switch which has a wheel-shaped knob must be pulled out before it is moved to the UP or DOWN position. When hydraulic pressure is exerted in one direction the gear is retracted; when it is exerted in the other direction the gear is extended. Gear extension or retraction normally takes six to seven seconds.

CAUTION

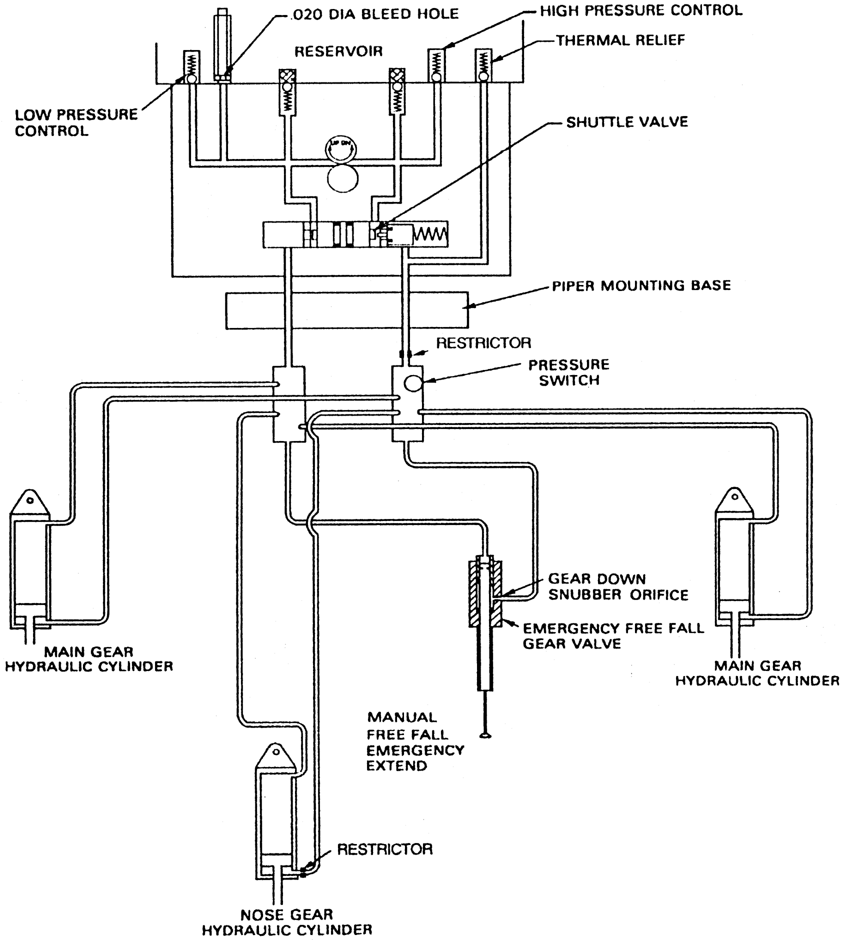
If the landing gear is in transit and the hydraulic pump is running it is NOT advisable to move the gear selector switch to the opposite position before the gear has reached its full travel limit. because a sudden reversal may damage the electric pump.

LANDING GEAR SELECTOR AND INDICATORS
Figure 7-5



LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC

Figure 7-7



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC

Figure 7-9

7.9 LANDING GEAR (continued)

When the gear is fully extended or fully retracted and the gear selector is in the corresponding position, electrical limit switches stop the flow of current to the motor of the hydraulic pump.

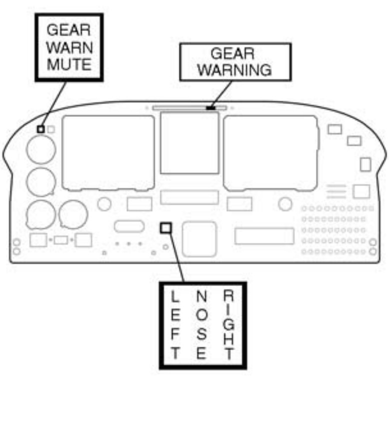
When the landing gear is retracted, the main wheels retract inboard into the wings and the nose wheel retracts aft into the nose section. Springs assist in gear extension and in locking the gear in the down position. After the gear are down and the downlock hooks engage, springs maintain force on each hook to keep it locked until it is released by hydraulic pressure.

A convex mirror on the left engine nacelle both serves as a taxiing aid and allows the pilot to visually confirm the condition of the nose gear.

ANNUNCIATOR LIGHTS

If the gear is in neither the full up nor the full down position, a red GEAR WARNING annunciator, located in the annunciator panel, (Figure 7-11) illuminates.

The three green lights (Figure 7-11) directly above the landing gear selector switch illuminate to indicate that each of the three landing gear are down and locked.



GEAR ANNUNCIATOR LIGHTS & MUTE SWITCH
Figure 7-11

7.9 LANDING GEAR (continued)

ANNUNCIATOR LIGHTS (Continued)

On aircraft equipped with a day/night dimmer switch, the switch must be in the DAY position to obtain full intensity of the gear position indicator lights during daytime flying. When the aircraft is operated at night, the day/night dimmer switch should be in the NIGHT position to dim the gear lights.

If one or two of the three green lights do not illuminate when the gear DOWN position has been selected, any of the following conditions could exist for each light that is out:

(a) The gear is not locked down.
(b) A bulb is burned out.
(c) There is a malfunction in the indicating system.

In order to check the bulbs, the square indicator lights can be pulled out and interchanged.

WARNING HORN

Should the throttle be placed in a low manifold pressure setting and/or the flaps are extended- as for a landing approach, while the gear is retracted, a warning horn sounds to alert the pilot that the gear is retracted. The gear warning horn emits a 90 cycles per minute beeping sound.

A gear up warning manifold pressure switch, mounted on each engine, activates the gear warning horn under the following conditions:

(a) The gear is not locked down and the manifold pressure has fallen below 14 inches on either one or both engines.
(b) The gear selector switch is in the UP position when the airplane is on the ground.
(c) The gear selector switch is in the UP position and wing flaps are extended to the second or third notch position.

WARNING HORN MUTE SWITCH

A gear warning mute switch is located directly above the standby airspeed indicator (Figure 7-11). Activating the mute switch will silence the gear warning horn only if the horn was triggered by power lever position. When activated, the mute switch will illuminate and the function may be cancelled by extending the landing gear or advancing the power lever(s).

7.9 LANDING GEAR (continued)

SAFETY SWITCH

To prevent inadvertent gear retraction should the gear selector be placed in the UP position when the airplane is on the ground, a squat switch located on the left main gear will prevent the hydraulic pump from actuating if the master switch is turned on. On takeoff, when the landing gear oleo strut drops to its full extension, the safety switch closes to complete the circuit which allows the hydraulic pump to be activated to raise the landing gear when the gear selector is moved to the UP position. During the preflight check, be sure the landing gear selector is in the DOWN position and that the three green gear indicator lights are illuminated.

EMERGENCY EXTENSION

The landing gear is designed to extend even in the event of hydraulic failure. Since the gear is held in the retracted position by hydraulic pressure, should the hydraulic system fail for any reason, gravity will allow the gear to extend. To extend and lock the gears in the event of hydraulic failure, it is necessary only to relieve the hydraulic pressure.

An emergency gear extension knob, located below and to the left of the gear selector switch is provided for this purpose. A guard across the knob prevents inadvertant movement. Moving the guard aside and pulling the emergency gear extension knob releases the hydraulic pressure holding the gear in the up position and allows the gear to fall free. Before pulling the emergency gear extension knob, place the landing gear selector switch in the DOWN position to prevent the pump from trying to raise the gear.

NOTE

If the emergency gear knob has been pulled out to lower the gear by gravity due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gear hydraulic and electrical systems. See the Maintenance Manual for proper landing gear system check out procedures.

7.9 LANDING GEAR (continued)

NOTE

If the airplane is being used for training purposes or a pilot check-out mission, and the emergency gear extension knob has been pulled out, it may be pushed in again when desired if there has not been any apparent malfunction of the landing gear system.

HYDRAULIC RESERVOIR

The hydraulic reservoir for landing gear operation is an integral part of the gear hydraulic pump. Access to the combination pump and reservoir is through a panel in the baggage compartment. For filling instructions, see the Maintenance Manual.

GROUND OPERATION

The nose gear is steerable through a 30 degree arc either side of center by use of a combination of full rudder pedal travel and brakes. A gear centering spring, incorporated in the nose gear steering system, prevents shimmy tendencies. A bungee assembly reduces ground steering effort and dampens shocks and bumps during taxiing. When the gear is retracted, the nose wheel centers as it enters the wheel well, and the steering linkage disengages to reduce pedal loads in flight.

TIRES

The main landing gear carries 6.00 x 6, 8-ply tires. The nose wheel has a 5.00 x 5, 6-ply tire. For information on servicing the tires, see TIRE INFLATION in Section 8 of this Handbook.

STRUTS

Struts for the landing gear are air-oil assemblies. Strut exposure should be checked during each preflight inspection. If a need for service or adjustment is indicated, refer to the instructions printed on the units. Should more detailed landing gear service information be required, refer to the Maintenance Manual.

7.11 BRAKE SYSTEM

NORMAL OPERATION

The brake system is designed to meet all normal braking needs. Two single-disc, double puck brake assemblies, one on each main gear, are actuated by toe brake pedals mounted on both the pilot's and copilot's rudder pedals. A brake system hydraulic reservoir, independent of the landing gear hydraulic reservoir, is located on the upper right side of the bulkhead in the nose compartment. Brake fluid should be maintained at the level marked on the reservoir. For further information see BRAKE SERVICE in Section 8 of this Handbook.

PARKING BRAKE

The parking brake is engaged by depressing the toe brake pedals and pulling out the parking brake knob located on the lower instrument panel below the left control column. The parking brake is released by depressing the toe brake pedals and pushing in the parking brake knob.

7.13 FLIGHT CONTROL SYSTEM

Dual flight controls are installed as standard equipment. The controls actuate the control surfaces through a cable system.

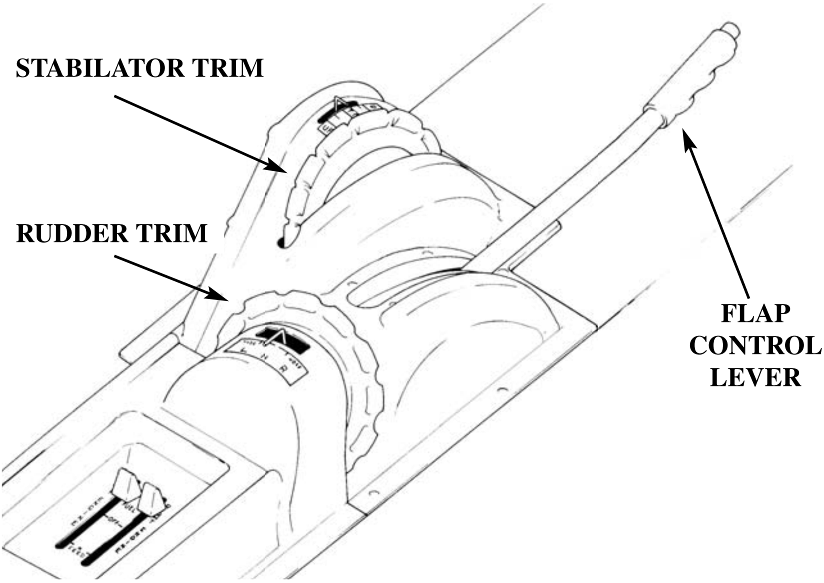
EMPENNAGE

The horizontal tail surface (stabilator) is of the all movable slab type with an anti-servo tab mounted on the trailing edge. This tab, actuated by a control mounted on the console between the front seats, also acts as a longitudinal trim tab (refer to Figure 7-13).

The vertical tail is fitted with a rudder which incorporates a combination rudder trim and anti-servo tab. The rudder trim control is located on the control console between the front seats.

FLAPS

The flaps are manually operated and spring loaded to return to the retracted (up) position. A four-position flap control handle (Figure 7-13) located on the console between the front seats adjusts the flaps for reduced landing speeds and glide path control.



FLAP AND TRIM CONTROLS
Figure 7-13

To extend the flaps, pull the handle up to the desired setting - 10, 25 or 40 degrees. To retract, depress the button on the end of the handle and lower the control.

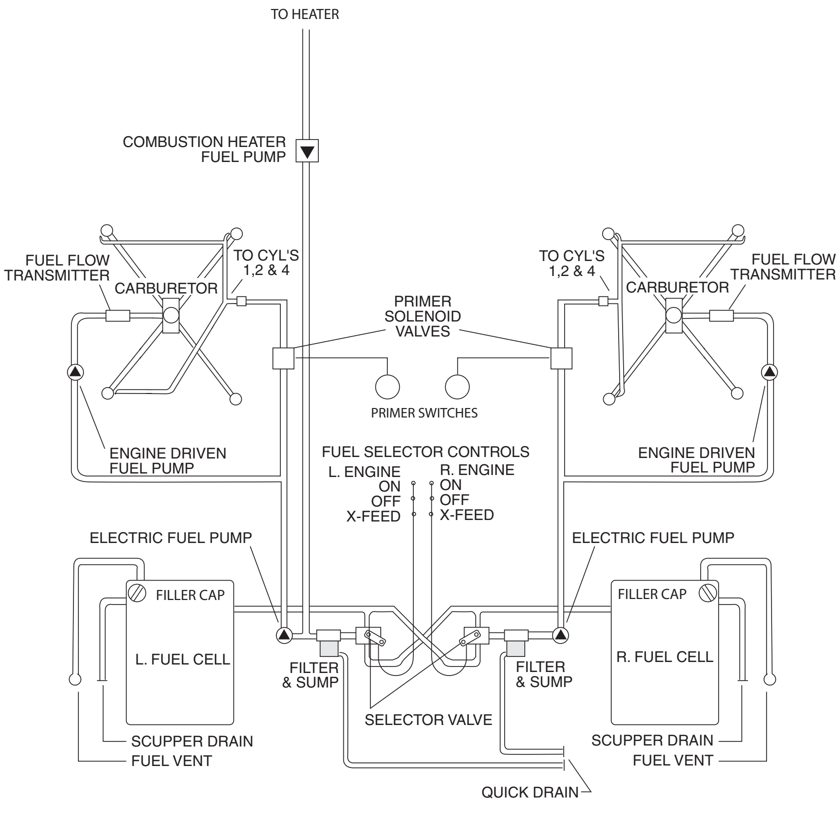
An over-center lock incorporated in the actuating linkage holds the right flap when it is in the retracted (up) position so that it may be used as a step.

NOTE

The right flap will support a load only in the fully retracted (up) position. When loading and unloading passengers, make sure the flaps are in the fully retracted (up) position.

7.15 FUEL SYSTEM

Fuel is stored in two 55 gallon fuel tanks, one in each nacelle (Figure 7-15). One gallon of fuel in each nacelle is unusable, giving a total of 108 usable gallons. The minimum fuel grade is 100 octane. The fuel tank vents, one installed under each wing, feature an anti-icing design to prevent ice formation from blocking the fuel tank vent lines.



FUEL SYSTEM SCHEMATIC
Figure 7-15

7.15 FUEL SYSTEM (continued)

FUEL PUMPS

Normally, fuel is supplied to the engines through engine-driven fuel pumps. Auxiliary electric fuel pumps serve as a back-up feature. The electric fuel pumps are controlled by rocker switches on the switch panel below and to the right of the pilot's control column. The electric fuel pumps should be ON during takeoffs and landings.

ELECTRIC PRIMER SYSTEM

The fuel primer system is used to provide fuel to the engine during start and makes use of electric pumps mounted in each wing and solenoid controlled primer valves. Left and Right primer switches are located on either side of the starter switch.

NOTE

The electric fuel pumps must be ON to operate the electric fuel primers.

With fuel pressure available, the primer button is depressed actuating the primer solenoid valve and allowing fuel to flow through the lines to the primer jets in the intake of the number 1, 2 and 4 cylinders.

FUEL QUANTITY AND FLOW

Fuel flow for each engine is digitally displayed on the MFD. There is a separate fuel quantity indication for each tank.

A calibrated fuel dipstick is provided with the airplane. To visually check the quantity of fuel in a tank, insert the dipstick to the bottom of the tank, close off the protruding end with a finger, withdraw the dipstick, and read the fuel level. The most accurate reading will be obtained with the airplane on level ground.

FUEL DRAINS

Before each flight, fuel must be drained from the low points in the fuel system to ensure that any accumulation of moisture or sediment is removed from the system. A fuel drain is provided for each half of the fuel system. The fuel drains are located on the right side of the fuselage just forward of the entrance step. (Refer to fuel draining procedure in paragraph 8.23, Fuel System.)

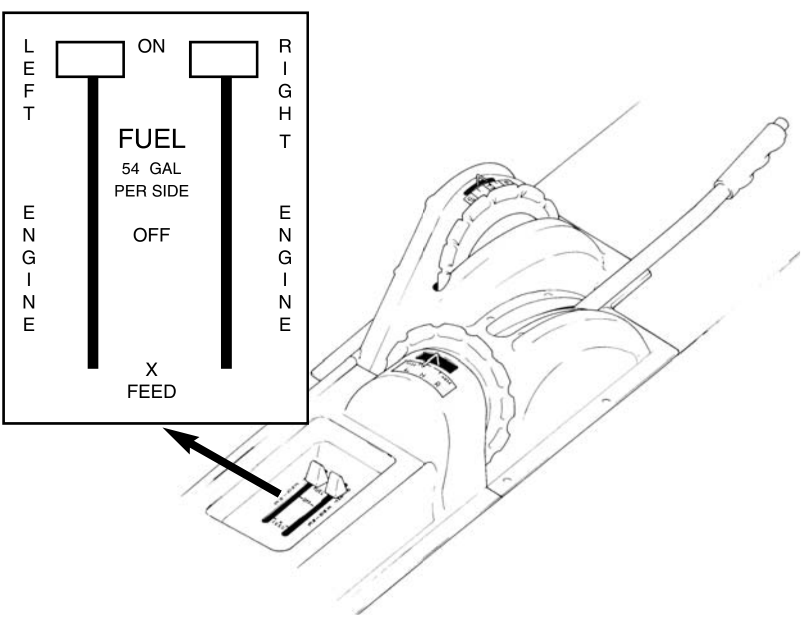
7.15 FUEL SYSTEM (continued)

FUEL CONTROLS

Fuel management controls are located on the console between the front seats (Figure 7-17). There is a control lever for each engine, and each is placarded ON - OFF - X-FEED. During normal operation, the levers are in the ON position, and each engine draws fuel from the tanks on the same side as the engine. When the X-FEED position is selected the engine will draw fuel from the tank on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. The OFF position shuts off the fuel flow to that engine.

NOTE

When one engine is inoperative and the fuel selector for the operating engine is on X-FEED the selector for the inoperative engine must be in the OFF position. Do not operate with both selectors on X-FEED. Do not take off or land with a selector on X-FEED.



FUEL SYSTEM CONTROLS
Figure 7-17

7.17 ELECTRICAL SYSTEM

The electrical system is a negative-ground, dual-fed, split-bus system capable of supplying sufficient current for complete night IFR equipment.

ALTERNATORS

The primary electrical power is supplied by two belt-driven 14 volt, 60 ampere alternators (Figure 7-23), one mounted on each engine. The alternator provides full electrical power output even at low engine rpm. This provides improved radio and electrical equipment operation and increases battery life by reducing battery load.

VOLTAGE REGULATORS

Each alternator is protected by an alternator control unit which incorporates a voltage regulator and an overvoltage relay. The regulators maintain effective load sharing while regulating electrical system bus voltage to 14-volts. An overvoltage relay in each alternator circuit prevents damage to electrical and avionics equipment by taking an alternator off the line if its output exceeds 17-volts. If this should occur, the ALTERNATOR INOP annunciator light will illuminate.

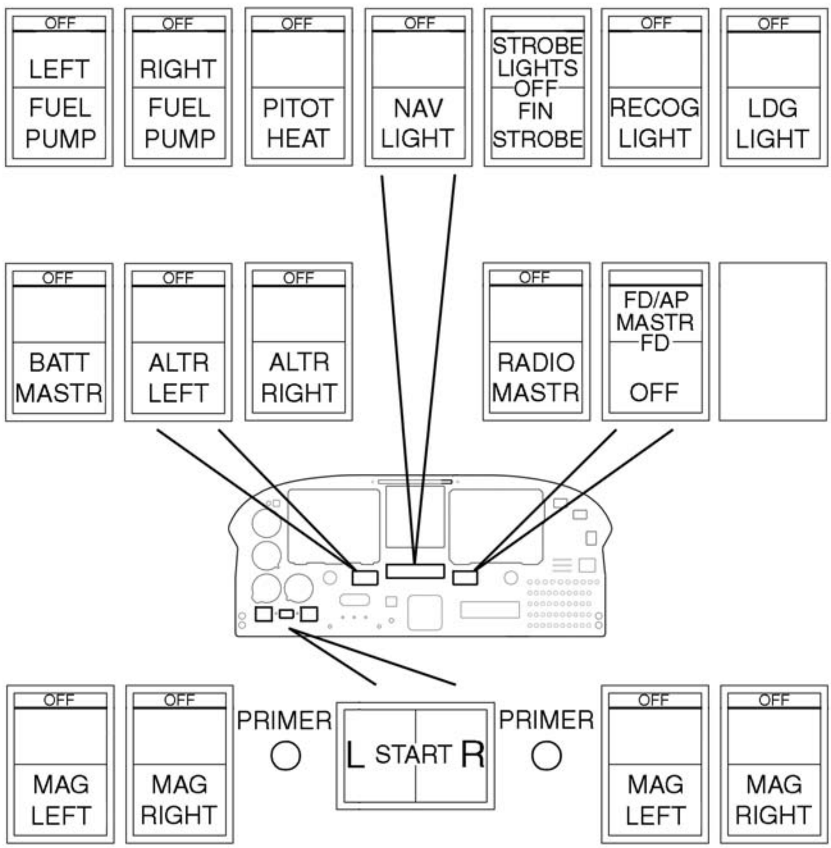
BATTERY

A 35 ampere-hour, 12-volt battery provides current for starting, for use of electrical equipment when the engines are not running, and for a source of stored electrical power to back up the alternator output. The battery, which is located in the nose section is normally kept charged by the alternators. If it becomes necessary to charge the battery, it should be removed from the airplane.

SWITCHES

Switches for operation of the fuel pumps, pitot heat, exterior lights, battery, alternators and avionics are located on the center of the instrument panel (Figure 7-19). The engine start, magneto and primer switches are located on the lower left instrument panel (Figure 7-19).

Switches for operation of the cabin environment are located on the right side of the instrument panel (Figure 7-31).

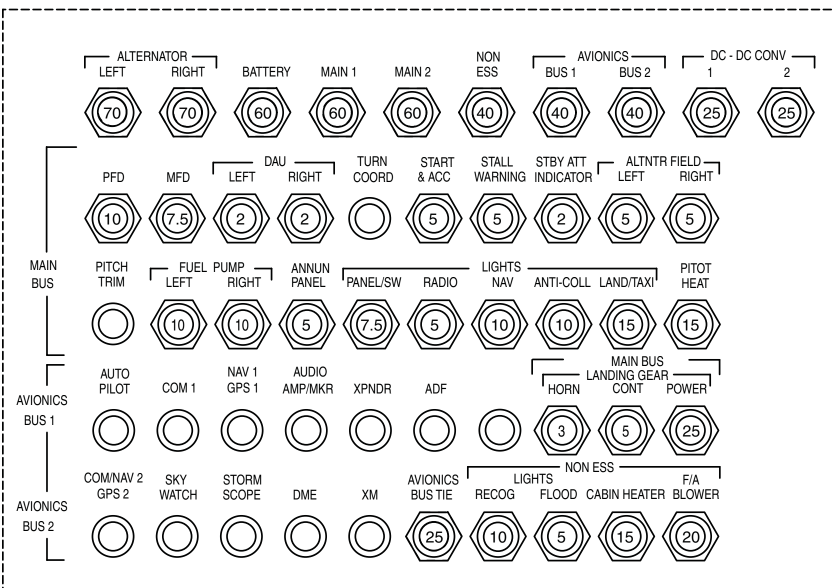


ELECTRICAL POWER SWITCHES
Figure 7-19

7.17 ELECTRICAL SYSTEM (continued)

CIRCUIT BREAKERS

The electrical system and equipment are protected by circuit breakers located on a circuit breaker panel on the lower right side of the instrument panel (Figure 7-21). In the event of equipment malfunctions or a sudden surge of current, a circuit breaker can trip automatically. The pilot can reset the breaker by pressing it in (preferably after a few minutes cooling period). The circuit breakers can be pulled out manually.



TYPICAL CIRCUIT BREAKER PANEL

Figure 7-21

7.17 ELECTRICAL SYSTEM (continued)

POWER DISTRIBUTION

A battery bus (Figure 7-23), located in the battery compartment, provides a continuous source of power to the engine hourmeter, the flight-time hourmeter and the heater hourmeter. Because the battery bus is connected directly to the battery, power is available even when the Battery Master switch is OFF. Fuses located on the battery bus are used to protect these circuits.

When the Battery Master switch is turned ON, the battery solenoid contactor closes, enabling current to flow from the battery to both the starter contactors and the tie bus. Tie bus overcurrent protection is provided by a 60 amp tie bus BATTERY circuit breaker. The tie bus, located on the left of the circuit breaker panel (Figure 7-21), distributes power to other systems through circuit breakers.

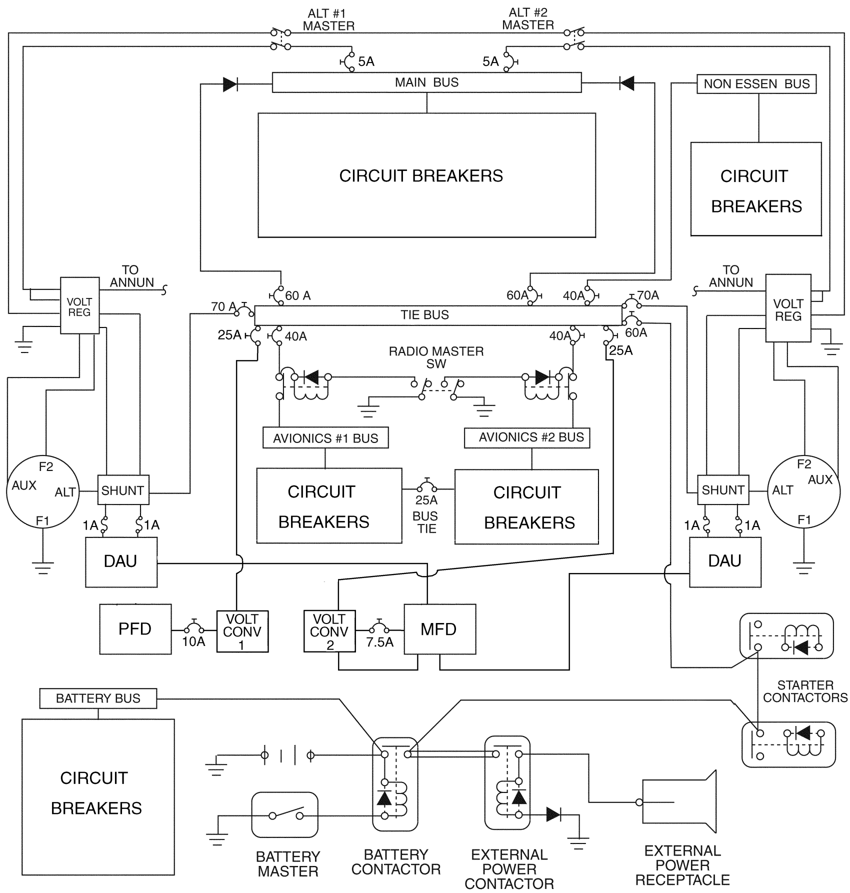
Each alternator system has an independent ON-OFF rocker switch and a solid state voltage regulator that automatically regulates alternator field current. When selected ON, the positive output of each alternator is fed through individual shunts to the tie bus. Overcurrent protection is provided by the 70 amp tie bus L ALT and R ALT circuit breakers.

A main bus, a non-essential bus and two avionics buses, with associated circuit breakers, are located at the circuit breaker panel. The two avionics buses are interconnected through the avionics bus 25 amp AVI BUS TIE circuit breaker.

Current is fed from the tie bus to the main bus by two conductors. In line diodes prevent reverse current flow to the tie bus. Two tie bus 60 amp MAIN BUS circuit breakers protect the main bus from an overload.

Current from the tie bus is fed to each avionics bus through independent solenoid contactors. When the Radio Master switch is selected ON, both solenoid contactors close, permitting current flow to both avionics busses. Avionics bus overload protection is provided by the 40 amp AVI BUS #1 and AVI BUS # 2 circuit breakers. Should the need arise, either avionics bus can be isolated by pulling out the avionics bus AVI BUS TIE circuit breaker and the appropriate tie bus avionics circuit breaker.

The non-essential bus is also fed from the tie bus. Overload protection is provided by the tie bus 40 amp NON ESS circuit breaker.



ELECTRICAL POWER DISTRIBUTION SYSTEM
Figure 7-23

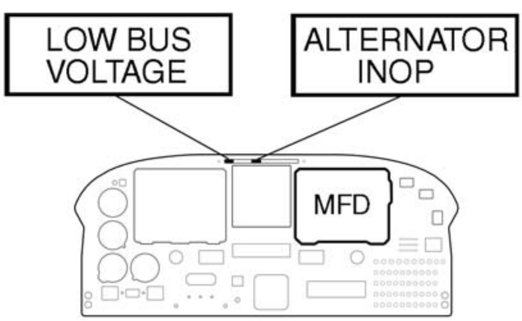
7.17 ELECTRICAL SYSTEM (continued)

SYSTEM MONITORS

The Engine page of the MFD contains the electrical system indications. Included are amperage indication from each alternator (L ALT R), bus voltage (BUS) and battery current charge/discharge (BATT). Additionally, the annunciator panel contains a red Alternator Inop light and a red Low Bus Voltage light (Figure 7-25).

Should an overvoltage condition occur in either alternator, its voltage regulator will shut off the voltage of that alternator. If this occurs or if either alternator fails or is manually selected off, the red Alternator Inop annunciator light will illuminate.

A low voltage monitor, also connected to the tie bus, will illuminate the red Low Bus Voltage annunciator light when the system drops from bus voltage (14 Vdc) to battery voltage (approx. 12.5 Vdc). Additionally, the bus voltage (BUS) indication on the MFD will turn red. A fuse provides overload protection for the voltage monitor.



SYSTEM MONITORS
Figure 7-25

7.17 ELECTRICAL SYSTEM (continued)

LIGHTS

Interior lighting consists of post lights and internally lighted avionics and switches. Radio, panel, and switch lights are controlled by rheostat switches located below the pilot's control column.

A floodlight, mounted in the overhead panel, provides additional instrument and cockpit lighting for night flying. The light is controlled by a rheostat switch located adjacent to the light. A map light window in the lens is actuated by an adjacent switch.

A cabin courtesy light is installed in the forward cabin adjacent to the dome light. This light is operated by a switch that is incorporated as part of the light assembly. The courtesy light can only be operated when the battery master switch is on.

WARNING

On aircraft equipped with a Day/Night Dimmer switch, the switch must be set to DAY to obtain gear lights full intensity during daytime flying. When the aircraft is operated at night and the Day/Night Dimmer switch is set to NIGHT, the gear lights will automatically dim.

Exterior lighting systems include landing/taxi lights, navigation lights, strobe/anti-collision lights, and recognition lights. The wing tip recognition light system consists of two lights; one in each wing tip.

WARNING

Anti-collision lights should not be operating when flying through cloud, fog or haze, since the reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground, such as during taxiing, takeoff or landing.

7.17 ELECTRICAL SYSTEM (continued)

EXTERNAL POWER RECEPTACLE

Should the airplane's battery be depleted, a receptacle located on the lower right side of the nose section permits using an external battery for engine start.

CAUTION

External power is supplied directly to the electrical bus. Turn off all electrical equipment before applying external power.

Turn the Battery Master switch and all electrical equipment OFF. Connect the power connector plug assembly to an appropriate external battery. Insert the plug into the external power receptacle. This completes a circuit which permits current to flow from the external power source directly to the starter contactors and the tie bus. Instructions on a placard located on the cover of the receptacle should be followed when starting with external power. For instructions on the use of the external power, refer to Starting Engines - Section 4.

7.18 AVIDYNE FLIGHTMAX ENTEGRA PRIMARY FLIGHT / MULTI-FUNCTION DISPLAYS

Due to the design of the Avidyne FlightMax Entegra Avionics System utilized on the Seminole, various avionics systems have become integrated.

This section provides a general description of the Avidyne FlightMax Entegra Series 700-00006-0XX-( ) PFD, its operation, and aircraft systems interfaces. For a detailed description of PFD operation, refer to the Avidyne FlightMax Entegra Series Primary Flight Display Pilot's Guide, p/n 600-00104-003, latest revision.

7.18a PFD SYSTEMS DESCRIPTION

The Entegra PFD start-up is automatic once power is applied via the battery master switch. The display presents the Initialization Display immediately after power is applied. Power-on default is 75% brightness. Typical alignment times are 3 minutes.

Air Data, Attitude and Heading Reference System (ADAHRS)

Air Data

The airspeed tape to the left of the PFD begins indicating at 20 Knots Indicated Airspeed (IAS) and is color coded in accordance with the model POH airspeeds for V_{SO}, V_{FE}, V_S, V_{YSE}, V_{MCA}, V_{NO}, and V_{NE}. An altitude tape is provided to the right of the PFD which also displays a symbol for the Altitude Preselect (Altitude Bug). The Vertical Speed Indicator (VSI) is displayed to the right of the altitude tape and also displays a symbol for the Vertical Speed Indicator (VSI bug). For vertical speed rates greater than the PFD displayed VSI scale, the indicator needle will peg just outside the scale and a digital readout of actual VSI up to 4000 FPM is then displayed. An additional data block is provided for display of Outside Air Temperature (OAT), True Airspeed (TAS), and Ground Speed (GS). Controls for selecting bug and barometric correction values are along the right side of the PFD. A wind indicator is also provided beneath the altitude tape.

Attitude Data

Attitude is depicted on the PFD using a combination of an aircraft reference symbol ("flying-delta") against a background of labeled pitch ladders for pitch and a bank angle pointer in the form of an arced scale along the top of the PFD for bank. A skid/slip indicator is attached to the bottom edge of the bank angle pointer.

7.18a PFD SYSTEMS DESCRIPTION (continued)

Air Data, Attitude and Heading Reference System (ADAHRS) (continued)

Heading Data

Magnetic heading is represented in a boxed digital form at the top of the compass rose. Heading rate (Rate of Turn Indicator) takes the form of a blue arcing arrow that begins behind the magnetic heading indicator and moves left or right accordingly. Graduations are provided on the rate of turn indicator scale to indicate ½ and full standard rate turns. A heading bug is also provided on the compass rose.

Navigation Data

Navigation data on the PFD takes several forms. A Course Deviation Indicator (CDI) is always provided on the HSI, provided that the primary nav source (Nav) has valid VLOC or GPS signals, and a bearing pointer can be optionally selected for display on the HSI by the pilot. Controls for selecting the source of navigation data, selecting the display format of the navigation data, and for selecting the type of compass rose and moving map to be displayed are along the left side of the PFD. The active flight plan contained in the GPS Nav/Comm unit selected as the primary navigation source (Nav) can be optionally selected for display on the HSI (View) as well as the desired range of the optionally selectable moving map display (Range). If a localizer or ILS frequency is tuned and captured in the GPS Nav/Comm selected as the Nav source, a Vertical Deviation Indicator (VDI) and Horizontal Deviation Indicator (HDI) are automatically displayed on the ADI.

NOTE

In the event glide slope or localizer signals are lost, the HDI and/or VDI will be displayed as red X's to indicate loss of signal. The red X'd indicator will only be removed if the signal is regained. In this case, the PFD Nav source should be set to GPS, or the GPS Nav/Comm should be tuned to another acceptable frequency. Appropriate action must be taken by the pilot if on an approach.

7.18a PFD SYSTEMS DESCRIPTION (continued)

Autopilot Integration

The Entegra PFD is fully integrated with the S-TEC System 55X Autopilot. Reference bugs for Heading, Altitude, and Vertical Speed are provided on the PFD to control the autopilot and aid pilot situational awareness. These bugs are displayed with solid or hollow symbology depending on the autopilot status. If the autopilot is engaged in that mode, the bug is solid to indicate the autopilot is coupled to that bug. A hollow bug indicates the autopilot is not engaged in that mode or is not coupled to that bug.

Autopilot mode annunciations are shown along the top of the PFD and on the S-TEC System 55X computer.

Flight director command bars on the PFD attitude indicator can be enabled by the pilot in two ways. When the autopilot is engaged in both lateral and vertical modes, the magenta colored flight director automatically displays the goals of the autopilot. When FD mode only is selected and the autopilot has lateral and vertical modes selected, the green colored flight director displays expected pilot inputs consistent with the lateral and vertical modes selected.

NOTE

A lateral autopilot mode must be engaged on the S-TEC System 55X Autopilot before a vertical mode can be engaged. The flight director command bars will only be displayed on the PFD when enabled by the pilot and when both lateral and vertical autopilot modes are engaged.

NOTE

When HDG mode is engaged, rotation of the heading bug greater than 180° will result in a reversal of turn direction.

CAUTION

If a VLOC is selected in NAV on the PFD and GPSS mode is engaged on the autopilot, the autopilot will track the active flight plan in GPS1 if VLOC1 is selected or GPS2 if VLOC2 is selected and not track VLOC1 or VLOC2 as the selected source in NAV on the PFD. Therefore, the course deviation on the PFD CDI and the course deviation flown by the autopilot can be different. This situation may be confusing and should be avoided.

7.18a PFD SYSTEMS DESCRIPTION (continued)

Autopilot Integration (continued)

The following autopilot modes are supported by the PFD:

1. HDG (Heading, using the heading bug)
2. NAV (Nav, using the course pointer and course deviation indicator)
3. GPSS (GPS Steering, using GPS course guidance)
4. APR (Approach, using the HDI and VDI, including automatic glide slope capture)
5. REV (Reverse sensing HDI approach)

Engine Instruments

Manifold Pressure -

Displays current engine manifold pressure in inches of mercury (In. - Hg). A numeric display below the manifold pressure analog indicator displays the manifold pressure value to the nearest 0.1 In. Hg. If the manifold pressure enters the warning (red) area, the analog indicator and the numeric readout will be displayed in the corresponding color.

Prop RPM -

Displays the current propeller RPM. A numeric display below the prop RPM analog indicator displays the prop RPM to the nearest 10 RPM. The prop RPM digital indication snaps to 2700 whenever the actual value is between 2660 and 2740 RPM. If the prop RPM enters the warning (red) area, the analog indicator and the numeric readout will be displayed in the corresponding color.

Fuel Flow -

Displays the current engine fuel flow as a numeric display, to the nearest 0.1 gallon per hour.

Oil Pressure -

Displays the current oil pressure during engine starting as a numeric display, to the nearest 1 psi. Oil pressure indication is removed 3 minutes after the final engine's oil pressure is outside the red range.

7.18b MFD SYSTEMS DESCRIPTION

NOTE

For a detailed description of the MFD, refer to the Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00105-000, latest revision.

Navigation

Data associated with the moving map is found on four pages: Map, Nearest, Trip, and Chart pages. The MFD contains a Jeppesen NavData database that is available for display on the Map page. In conjunction with GPS-supplied position information, an own-ship symbol is superimposed on the moving map and positioned relative to the NavData information. GPS can also supply the active flight plan for display on the moving map. Terrain data is provided by a USGS terrain database stored within the MFD and updated only on an as needed basis.

The Jeppesen Navigation Database provides data on airports, approaches, VOR's, NDB's, intersections, airspace definitions, and frequencies. North American and international databases are available. Database information can be updated via the USB port on the front face of the bezel.

The navigation data on the moving map display are based on databases that are updated periodically. Database updates are available on 28-day cycle subscriptions. Expired databases are clearly stated to the pilot via messages during system startup and on the Aux Main page. The warning can only be removed by updating the data.

NOAA man-made obstruction database information provides data on man-made obstacles over 200 feet AGL. This data is only available for North America and can be updated via the USB port on the front face of the bezel.

The obstacle data on the moving map display are based on databases that are updated periodically. Database updates are available from Avidyne on 56-day cycle subscriptions. Expired databases are clearly stated to the pilot via messages during system startup and on the Aux Main page. The warning can only be removed by updating the data.

7.18b MFD SYSTEMS DESCRIPTION (continued)

Navigation (continued)

Using the Jeppesen NavData data and the GPS-supplied present position, the MFD can provide the pilot with the nearest 25 airports or navaids, depending on pilot selection, within 100 nm. This information is presented on the Nearest page.

More detailed information on a particular airport is also generated from the Jeppesen NavData data and is available for pilot viewing on the Info page.

Flight plan data supplied by the GPS system provide the pilot with a tabular form of the remaining legs in the active GPS flight plan. This information is viewed on the Trip page and includes a CDI for added enroute navigation aiding.

Flight plan data is transmitted to the MFD from an external GPS navigator. Some installations do not support depictions of curved flight paths. In these cases, curved flight path segments will be depicted as straight lines. The GPS navigator and HSI are to be used during approach procedures. Reference the Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00105-000, latest revision, for more information.

Datalink

Datalink information is received by the MFD based upon installation provisions and a subscription service available through Avidyne (www.myavidyne.com). Data is presented on the Map, Trip, and Nearest pages. Datalink information is provided for strategic planning purposes only. Data aging and transport considerations make it unsuitable for tactical use. Reference the Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00105-000, latest revision, for more information.

Aux Page

The various soft keys, shown on the Aux Main page, allow the pilot to set user preferences for system operation. In addition to listing the software version identification information and database validity dates, the Aux page allows access to several pages for preference selection and provides a means to initiate self-tests of the traffic and lightning sensors.

7.18b MFD SYSTEMS DESCRIPTION (continued)

Aux Page (continued)

Airport Filter page provides selections for displaying airport type, runway surface type and minimum runway lengths on the moving map. **Declutter Setup** page allows the pilot to select settings for defining the base map detail when changing display range. **System Time** page provides an opportunity to select system time zone and Map page menu timeout options. **DataBlocks** page allows the pilot to select the data to be displayed in the datablock thumbnail windows on the Map page. **Datalink** page allows the pilot to select parameters for the datalink system, including update rate and range of weather data request. **Nav Src** page allows the pilot to select either GPS1 or GPS2 as the source of information, such as flight plan route, being displayed on the Map page.

Engine Instruments

The Engine page provides the pilot with engine parameters depicted on simulated gauges and electrical system parameters located in dedicated regions within the MFD display. An Engine Sensor Unit interfaces with engine-mounted sensors and provides data to the MFD for display.

Traffic Mode

An optional Skywatch Traffic Advisory System (TAS), model SKY497, from L-3 Avionics Systems is available. This system monitors the airspace around your aircraft and advises the flight crew where to look for transponder-equipped aircraft that may pose a collision threat. The traffic information includes the range, relative bearing and relative altitude of the intruder aircraft.

The MFD has pilot selectable interfaces to the Skywatch system, including a vertical mode display (ABOVE, BELOW, NORMAL, UNLIMITED, DISPLAY OFF) on the Map page and a Traffic STBY/TEST on the Aux page. When an intruder aircraft is present, and aural warning “TRAFFIC, TRAFFIC” is provided. When this happens, the MFD posts a message related to this intruder. If this message is acknowledged, the MFD will default to a Traffic page which encompasses the entire screen. To leave this screen and go back to the Map page, the pilot would select the Exit Traffic button. Refer to the Skywatch SKY497 Pilot’s Guide, p/n 009-10801-001, latest revision.

7.18b MFD SYSTEMS DESCRIPTION (continued)

Traffic Mode (continued)

Traffic Information Service (TIS) provides a graphic display of traffic advisory information overlaid on the MFD Map page. This feature is available on Mode S transponder equipped aircraft only and there are no pilot selectable features on the MFD, such as Test Mode, STBY, etc. TIS is a ground based service providing relative location of all ATCRBS Mode A and Mode C transponder equipped aircraft within a specified service volume. Aircraft without an operating transponder are invisible to TIS. If the ground based service is not available or the aircraft is out of range of an operating TIS Mode S site, an aural alert "Traffic Not Available" is provided.

If an aircraft has a transponder, but does not have altitude reporting, the TIS will depict it without the altitude information tag. If the depicted traffic is reporting altitude and is climbing or descending at a rate of at least 500 feet per minute, a trend arrow is displayed near the traffic symbol indicating that the aircraft is climbing or descending. If the intruder is not reporting altitude, the traffic symbol appears without an altitude tag or trend arrow. Traffic ground track is indicated by a "target track vector", a short line displayed in 45 degree increments.

The symbology displayed is as follows:

(1) Other Aircraft - An open cyan diamond indicates that an intruder's relative aircraft is greater than +/- 3000 feet, or its distance is beyond 7 nm range. It is not considered a threat.

(2) Proximity Intruder Traffic - A filled cyan diamond indicates that the intruder aircraft is within +/- 1200 feet, and within 7 nm range, but is still not considered a threat.

(3) Traffic Alert (TA) - A symbol changed to a filled amber circle indicates that the intruder aircraft is considered to be potentially hazardous. The condition which causes a traffic alert is defined on a course that will intercept a 0.5 nm radius and a relative altitude of +/- 500 feet within 34 seconds.

When a hazardous intruder aircraft is detected an annunciator will be displayed on the MFD with relative bearing, range and relative altitude along with the advisory voice message "TRAFFIC, TRAFFIC" heard through the audio system.

7.18b MFD SYSTEMS DESCRIPTION (continued)

Engine Page

All engine instruments consist of a combination of round dials and vertical tape readout design except for fuel flow which is digital readout only.

The FUEL FLOW indication displays fuel flow in gallons per hour. Readings are accurate at stabilized power settings.

The FUEL QUANTITY indicator is calibrated in gallons of fuel and accurately displays fuel remaining in the left and right tanks.

For additional description of the engine page features refer to the Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00105-000, latest revision.

7.19 STANDBY INSTRUMENTS

The standby instrument group includes an electric attitude indicator, an airspeed indicator, and a barometric altimeter mounted to the left side of the pilot's PFD. The standby airspeed and altimeter are of the traditional mechanical design. The standby electric attitude indicator is powered by a self-contained standby power source.

Mid-Continent 4300-4XX Series Standby Attitude Indicator

The standby attitude indicator provides backup display of aircraft attitude. It is located in the middle of the standby instrument group where it can be viewed easily by the pilot. It is powered by a self-contained standby power source so that it will remain powered for approximately 60 minutes after loss of the aircraft electrical system. In the event of a loss or interruption of the aircraft electrical power, the amber standby power light will start flashing, warning that the indicator has lost its main DC power source. Selecting the STBY PWR button located on the face of the instrument will power the indicator by means of the self-contained power source.

7.21 PITOT STATIC SYSTEM

The pitot static system (Figure 7-27) supplies both pitot and static pressure for the primary and standby airspeed indicators and static pressure for the primary and standby altimeter, vertical speed indicator and blind encoder. The autopilot has its own dedicated static pressure transducer. Pitot and static pressure are picked up by the pitot head on the bottom of the left wing.

The control valve for an alternate static source is located below the left side of the instrument panel. When the valve is set in the alternate position, the primary and standby altimeter, vertical speed indicator, blind encoder, and primary and standby airspeed indicator will be using cabin air for static pressure. The storm window and cabin vents must be closed and the cabin heater and defroster must be on during alternate static source operation. The altimeter error is less than 50 feet unless otherwise placarded.

To prevent bugs and water from entering the pitot and static pressure holes when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

NOTE

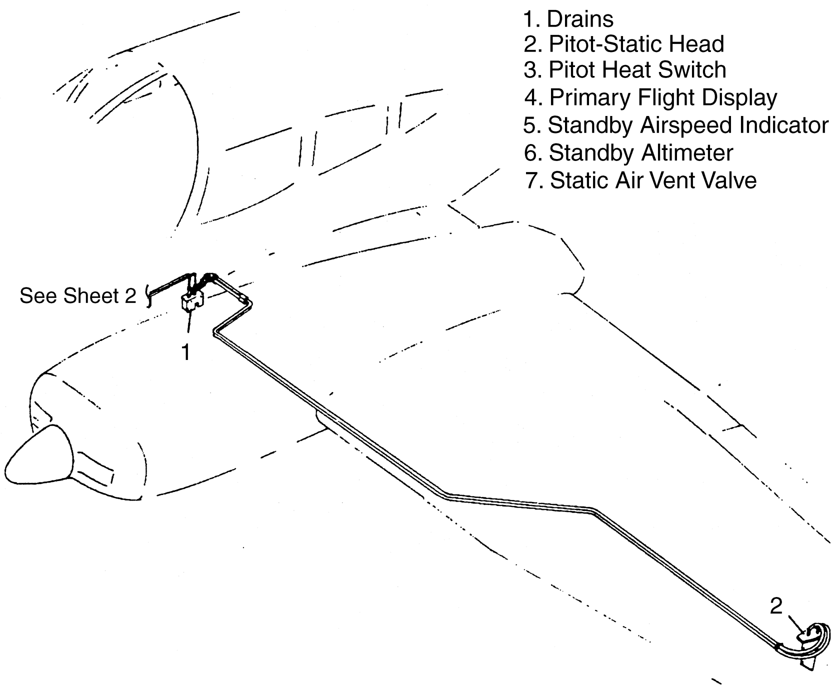
During preflight, check to make sure the pitot cover is removed.

Pitot and static lines can be drained through separate drain valves located on the lower left sidewall adjacent to the pilot.

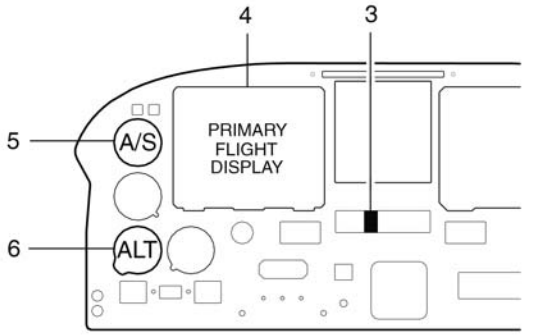
A heated pitot head installation alleviates problems with icing or heavy rain. The switch for pitot heat is located in the row of switches below the # 2 GNS 430. The pitot heat system has a separate circuit breaker located in the circuit breaker panel and labeled PITOT HEAT. The operational status of the pitot heat system should be included in the preflight check.

CAUTION

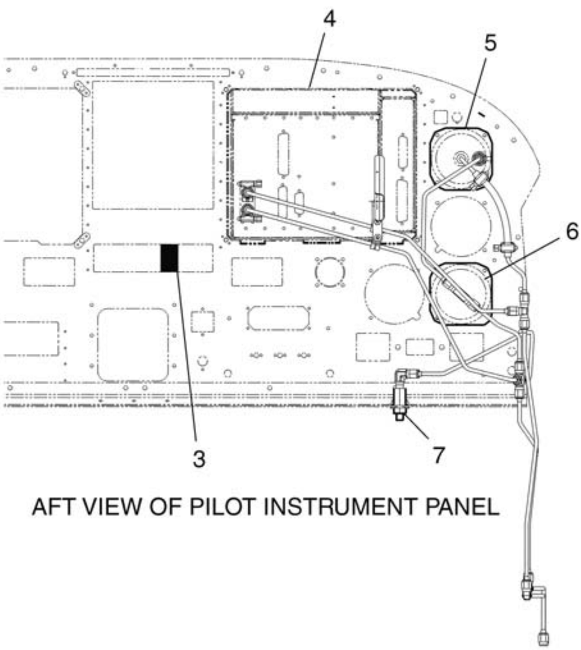
Care should be exercised when checking the operation of the heated pitot head. The unit becomes very hot. Ground operation of pitot heat should be limited to 3 minutes maximum to avoid damaging the heating units.



PITOT AND STATIC PRESSURE SYSTEM
Figure 7-27 (Sheet 1 of 2)



FRONT VIEW OF PILOT INSTRUMENT PANEL



AFT VIEW OF PILOT INSTRUMENT PANEL

PITOT AND STATIC PRESSURE SYSTEM
Figure 7-27 (Sheet 2 of 2)

7.23 HEATING, VENTILATING AND DEFROSTING SYSTEM

HEAT

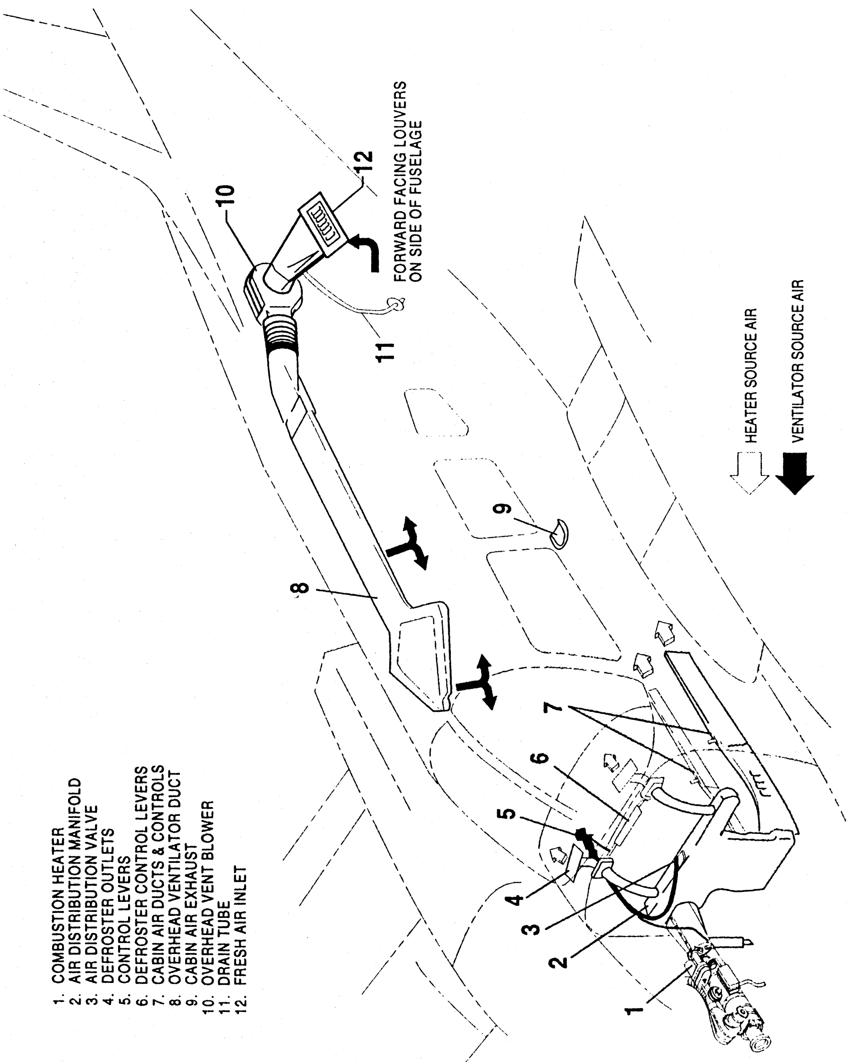
Heated air for cabin heat and windshield defrosting is provided by a Janitrol combustion heater located in the forward fuselage (Figure 7-29). Air from the heater is distributed by a manifold down through ducts along the cabin floor to outlets at each seat. Heated air from the manifold is also moved up through two ducts to the defroster outlets.

Operation of the combustion heater is controlled by a three-position switch located on the instrument panel (Figure 7-31) and labeled CABIN HEAT - FAN. Airflow and temperature are regulated by the three levers to the left of the switch. The upper lever regulates AIR INTAKE and the center lever regulates cabin TEMPerature. Cabin comfort can be maintained as desired through various combinations of lever positions. Passengers have secondary control over heat output by individually adjustable outlets at each seat location. The third lever on the instrument panel controls heated airflow to the windshield DEFrosters.

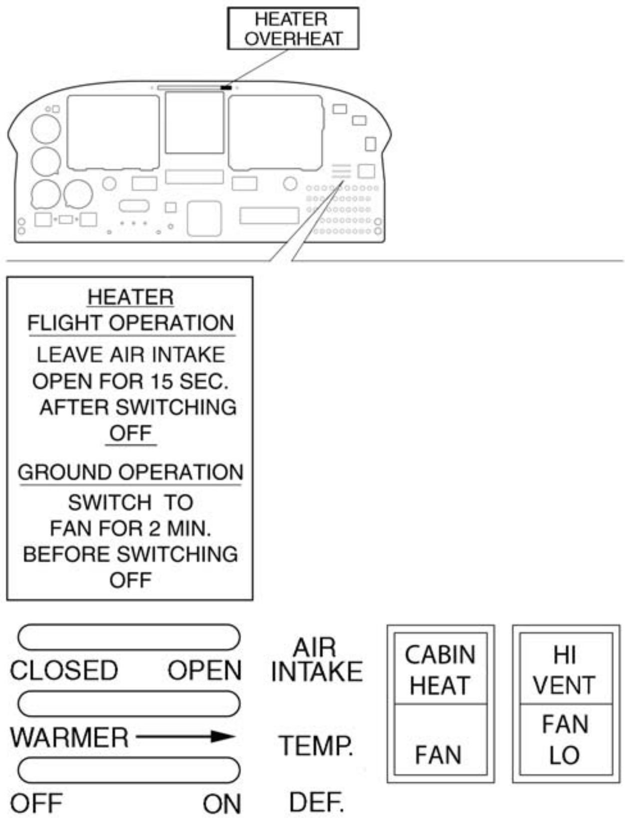
For cabin heat, the AIR INTAKE lever on the instrument panel must be partially or fully open and the three-position switch set to the CABIN HEAT position. This simultaneously starts fuel flow and ignites the heater. During ground operation, it also activates the ventilation blower which is an integral part of the combustion heater. With instant starting and no need for priming, heat should be felt within a few seconds. When cabin air reaches the temperature selected on the cabin TEMPerature lever, ignition of the heater cycles automatically to maintain the selected temperature.

The combustion heater uses fuel from the airplane fuel system. An electric fuel pump draws fuel from the left tank at a rate of approximately one-half gallon per hour. Fuel used for heater operation should be considered when planning for a flight.

Hours of combustion heater operation can be checked via an hourmeter mounted on the heater unit within the nose compartment.



ENVIRONMENTAL SYSTEM
Figure 7-29



ENVIRONMENTAL CONTROLS AND ANNUNCIATORS
Figure 7-31

7.23 HEATING, VENTILATING AND DEFROSTING SYSTEM (continued)

Safety Switches

Two safety switches activated by the air intake valve, located aft of the heater unit, prevent both fan and heater operation when the air intake lever is in the closed position. A micro switch, which actuates when the landing gear is retracted, turns off the ventilation blower so that in flight the cabin air is circulated by ram air pressure only.

Overheat Switch and Annunciator

An overheat switch located in the heater unit acts as a safety device to render the heater inoperative if a malfunction should occur. Should the switch deactivate the heater, the red HEATER OVERHEAT annunciator light on the instrument panel (Figure 7-31) will illuminate. The overheat switch is located on the aft inboard end of the heater vent jacket. A red reset button is located on the heater shroud in the nose cone compartment.

To prevent activation of the overheat switch upon normal heater shutdown during ground operation, turn the three-position switch to FAN for two minutes with the air intake lever in the open position before turning the cabin heat switch to OFF. During flight, leave the air intake lever open for a minimum of fifteen seconds after turning the cabin heat switch to OFF.

VENTILATION

When heat is not desired during ground operation, place the three-position switch in the FAN position and the ventilation fan will blow fresh air through the heater duct work for cabin ventilation and windshield defogging. To introduce fresh, unheated air into the cabin during flight, the air intake should be open and the heater off. Ram air enters the system and can be individually regulated at each floor outlet.

Overhead outlets also supply fresh air for cabin ventilation. The occupant of each seat can manually adjust an outlet in the ceiling to regulate the flow of fresh air to that seat area. A fresh air blower is installed in the overhead ventilation system to provide additional fresh air flow during ground operation. Operation of the fresh air blower is controlled by a three-position switch located on the instrument panel (Figure 7-31) and labeled HI VENT/FAN LO.

7.25 INSTRUMENT PANEL

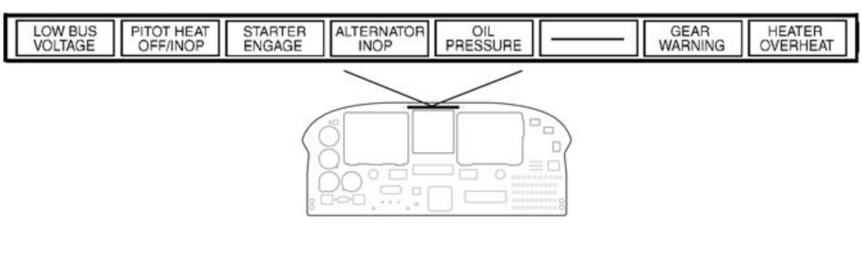
The instrument panel (Figure 7-35) is designed to accommodate the Avidyne FlightMax Entegra Primary Flight Display and the EX5000 Multi-Function Display. The panel is designed for glare-free use in all flight conditions.

An annunciator panel (Figure 7-33) incorporating a press-to-test feature, is mounted in the upper instrument panel to warn the pilot of a possible malfunction. Monitored functions include: LOW BUS VOLTAGE, PITOT HEAT OFF/INOP, STARTER ENGAGE, ALTERNATOR INOP, OIL PRESSURE, GEAR WARNING, and HEATER OVERHEAT.

Closely monitor instrument panel gauges to check the condition of a system whose corresponding light on the annunciator panel illuminates. During preflight, the operational status of the annunciator panel should be tested by use of the Press-to-Test button. When the button is depressed, all annunciator panel lights should illuminate.

NOTE

When an engine is feathered, the ALTERNATOR INOP and OIL PRESSURE annunciator lights will remain illuminated.



ANNUNCIATOR PANEL
Figure 7-33

7.25 INSTRUMENT PANEL (continued)

Electrical rocker-type switches are located in three cluster rows below the PFD, #2 GNS430 and MFD, respectively (Figure 7-19). The first row of switches includes the battery master, left alternator and right alternator. The second row of switches includes the left fuel pump, right fuel pump, pitot heat, navigation lights, strobe lights, recognition lights and landing light. The third row of switches includes the radio master and autopilot/flight director master.

Engine switches are located to the lower left of the pilot's control yoke. Switches include the left and right engine magnetos, which are protected by plastic covers, left and right engine primer push-button switches and the left and right engine starter spring-loaded, rocker-type switches.

The Primary Flight Display (PFD) is located directly in front of the pilot. The audio panel, autopilot and GPS Nav/Comms are located to the right of the PFD. The Multi-Function Display (MFD) is located to the right of the GPS Nav/Comms. To the left of the PFD, in a vertical arrangement, are the standby airspeed indicator, standby attitude indicator and standby altimeter. To the right of the standby altimeter is the optional Automatic Direction Finder (ADF) indicator. Above the standby instruments are the pitch trim master switch and the gear warning mute switch. To the right of the control quadrant are the transponder and the optional Automatic Direction Finder (ADF) receiver.

Instrument panel lighting is provided by post lights and internally lighted avionics and switches. Lighting can be adjusted by three rheostat dimming switches, labeled SWITCH, PANEL and AVIONICS, located below the pilot's control column. Additional cockpit flood lighting is located in the overhead panel and controlled by an adjacent switch. For night operations, a Day/Night dimmer switch, located to the left of the annunciator panel, controls lighting intensity of the 3 green gear down lights, the PFD and MFD bezel buttons and the annunciator panel lights.

WARNING

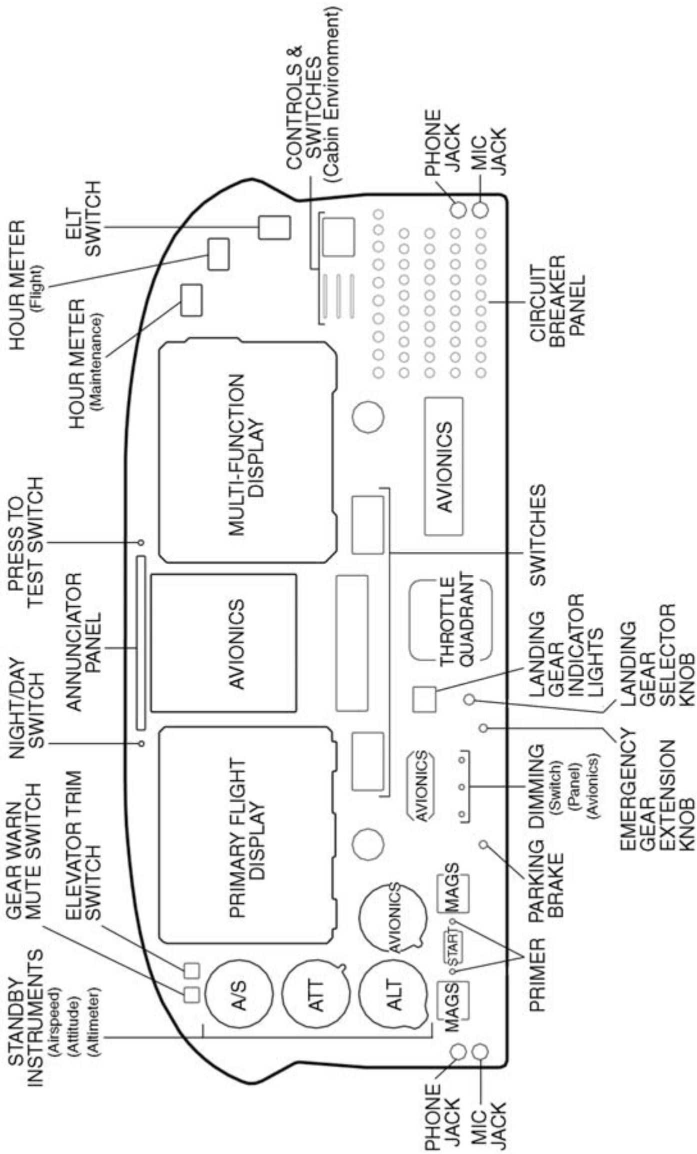
On aircraft equipped with a Day/Night Dimmer switch, the switch must be set to DAY to obtain gear lights full intensity during daytime flying. When the aircraft is operated at night and the Day/Night Dimmer switch is set to NIGHT, the gear lights will automatically dim.

7.25 INSTRUMENT PANEL (continued)

The parking brake handle (PARK BRAKE - PULL) is located below the light rheostats. Just to the left of the control quadrant are the optional DME indicator and the landing gear controls and indicators. The control quadrant - throttles and propeller and mixture controls - is in the center of the lower instrument panel. To the right of the control quadrant is the control friction lock.

Radios are mounted above the control quadrant. The radio master (RADIO MASTR) switch is located to the right of the control quadrant. It controls the power to all radios through the radio master contactor. When the battery master (BATT MASTR) switch is turned ON, power is supplied to the radio master switch relay, opening the contactors and preventing current flow to the radios. When the radio master (RADIO MASTR) switch is turned ON, power is removed from the radio master switch relay, allowing the contactors to spring closed and permitting current flow to the radios.

Switches and knobs for controlling cabin comfort and windshield defogging are located to the right of the copilot's control column. Directly below is the circuit breaker panel containing breakers of the AVIONICS BUS TIE, the MAIN BUS, the NON-ESSENTIAL BUS and two avionics busses (AVIONICS BUS 1 AND AVIONICS BUS 2).



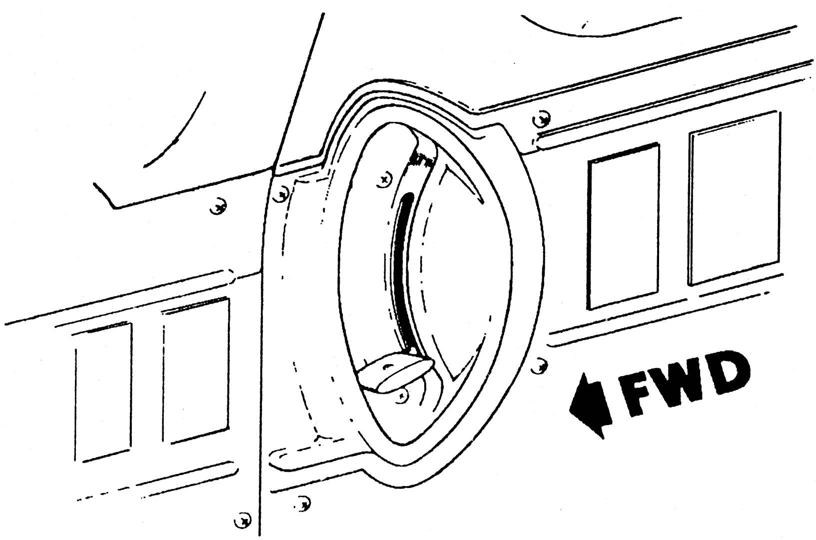
TYPICAL INSTRUMENT PANEL

Figure 7-35

7.27 CABIN FEATURES

Cabin entry is made through the cabin door on the right side. The cabin door is double latched. To close the cabin door, hold the door closed with the armrest while moving the side door latch (Figure 7-37) down to the LATCH position. Then engage the top latch to the LATCH position. Both latches must be secure before flight.

To exit the aircraft, move the top latch to the OPEN position followed by moving the side door latch to the OPEN position.



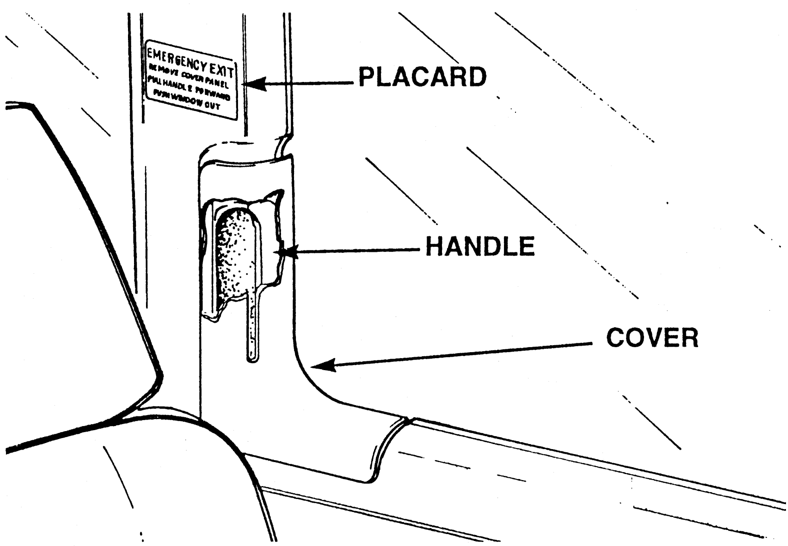
CABIN DOOR SIDE LATCH
Figure 7-37

7.27 CABIN FEATURES (continued)

The pilot's left side window is an emergency exit. The emergency exit release handle is located beneath the thermoplastic cover on the vertical post between the first and second left side windows (Figure 7-39).

CAUTION

The emergency exit is for ground use only. When released, the window will fall free from the fuselage.



EMERGENCY EXIT
Figure 7-39

7.27 CABIN FEATURES (continued)

STANDARD FEATURES

Standard front cabin features include cabin and baggage door locks, a pilot's storm window, map pockets, ashtrays, and sun visors. An armrest is located on the side panel adjacent to each front seat. Additional standard cabin items are pockets on the front seat backs, a portable fire extinguisher, a special cabin sound-proofing package, a coat hanger support bar and baggage restraint straps in the aft baggage area.

A worktable is available and can be attached to the rear of either the pilot or copilot seat. The worktable is stored along the left side in the baggage area. It is secured with a strap.

SEATS

All seat backs have three positions: normal, intermediate and recline. An adjusment lever is located at the base of each seat back on the outboard side.

The two front seats are adjustable fore, aft and vertically. The seats are adjustable fore and aft by lifting the bar below the seat front and moving to the desired position. Release the handle and move the seat until the locking pin engages. To raise the vertically adjustable pilot and copilot seats, push back on the pushbutton located at the lower right of each seat, relieve the weight from the seat and it will rise. To lower the seat, push the button and apply weight until the proper position is reached.

The rear seats are easily removed to provide room for bulky items. Rear seat installations incorporate leg retainers with latching mechanisms, which must be released before the rear seats can be removed. Releasing the retainers is accomplished by depressing the plunger behind each rear leg.

NOTE

To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.

7.27 CABIN FEATURES (continued)

SEAT BELTS AND SHOULDER HARNESSES

Seat belts and adjustable shoulder harnesses with inertial reels are standard on all four seats. The pilot should adjust this fixed seat belt strap so that all controls are accessible while maintaining adequate restraint for the occupant. The seat belt should be snugly fastened over each unoccupied seat.

The shoulder harness is routed over the shoulder adjacent to the window and attached to the seat belt in the general area of the occupant's inboard hip. A check of the inertial reel mechanism is made by pulling sharply on the strap. The reel should lock in place and prevent the strap from extending. For normal body movements, the strap will extend or retract as required. The lap belts and shoulder harnesses should be routinely worn during movement on the surface, takeoff, landing and whenever an in-flight emergency situation occurs.

FIRE EXTINGUISHER

A portable, handheld, fire extinguisher, containing Halon 1211, is mounted between the pilot and copilot seats, behind the fuel selector console. Read the instructions on the nameplate and become familiar with the unit before an emergency situation. It has a discharge rate of no less than 8 seconds and no more than 10 seconds. The original weight of the extinguisher is 4 pounds 14 ounces ± 2 ounces.

To operate, remove it from the quick-release bracket, hold it upright with the spray nozzle pointing forward. Slide the red safety catch down with the thumb, direct the nozzle towards the base of the fire source and squeeze the lever with the palm of the hand. Squeezing ejects an indicator disc from the rear of the operating head of the extinguisher, and extinguishant is released from the nozzle in a wide, flat pattern.

Maximum extinguishing effect is obtained by moving in towards base of the fire source as it is extinguished. Releasing the lever automatically stops further discharge, retaining part of the charge for further use. Ejection of the disc provides visual indication of partial or total discharge.

7.29 BAGGAGE AREA

The 24 cubic foot baggage compartment, located aft of the seats, has a weight capacity of 200 pounds. This compartment is loaded and unloaded through a separate 22 x 20 inch baggage door, and the compartment is accessible during flight. Tie-down straps are provided and they should be used at all times. The baggage compartment door and passenger door use the same key.

NOTE

It is the pilot's responsibility to be sure when baggage is loaded that the airplane C.G. falls within the allowable C.G. range. (See Weight and Balance Section.)

7.31 FINISH

The standard exterior finish is painted with acrylic enamel. To keep the finish attractive, economy size spray cans of touch-up paint are available from Piper Dealers.

7.33 STALL WARNING

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on the Stall Speed vs Angle of Bank graph in Section 5.

The stall warning indication consists of a continuous sounding horn located behind the instrument panel. The stall warning horn has a different sound from that of the gear warning horn which has a 90 cycles per minute beeping sound.

The stall warning horn is activated by two lift detectors on the leading edge of the left wing, outboard of the engine nacelle. The inboard detector activates the horn when the flaps are in the 25 and 40 degree positions, the outboard when the flaps are in positions of 10° or less. A squat switch in the stall warning system does not allow the units to be activated on the ground.

7.35 EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT) meets the requirements of FAR 91.52. It operates on self-contained batteries and is located in the aft fuselage section. It is accessible through a rectangular cover on the right hand side. A number 2 Phillips screwdriver is required to remove the cover.

A battery replacement date is marked on the transmitter. To comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

7.35 EMERGENCY LOCATOR TRANSMITTER (continued)

ARTEX 110-4 ELT OPERATION

On the ELT unit itself is a two position switch placarded ON and OFF. The OFF position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane.

A pilots remote switch, placarded ON and ARM is located on the copilots instrument panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in ARM position. Moving the switch to ON will activate the transmitter. A warning light located above the remote switch will alert you whenever the ELT is activated.

ARTEX 110-4 ELT OPERATION

Should the ELT be activated inadvertently it can be reset by either positioning the remote switch to the ON then immediately relocating it to the ARM position, or by setting the switch on the ELT to ON and then back to OFF.

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON and then immediately to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

NOTE

Three sweeps of the emergency tone and an illuminated warning light indicates a normally functioning unit. The warning light must illuminate during the first 3 second test period. If it does not illuminate, a problem is indicated such as a "G" switch failure.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane's ELT is probably transmitting. Setting the remote switch back to OFF will automatically reset the ELT and should stop the signal being received on 121.50 MHz.

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides guidelines relating to the handling, servicing and maintenance of the Seminole. For complete maintenance instructions, refer to the PA-44-180 Maintenance Manual.

WARNING

Inspection, maintenance and parts requirements for all non-PIPER approved STC installations are not included in this handbook. When a non-PIPER approved STC installation is incorporated on the airplane, those portions of the airplane affected by the installation must be inspected in accordance with the inspection program published by the owner of the STC. Since non-PIPER approved STC installations may change systems interface, operating characteristics and component loads or stresses on adjacent structures, PIPER provided inspection criteria may not be valid for airplanes with non-PIPER approved STC installations.

WARNING

Modifications must be approved in writing by PIPER prior to installation. Any and all other installations, whatsoever, of any kind will void this warranty in it's entirety.

8.1 GENERAL (CONTINUED)

WARNING

Use only genuine PIPER parts or PIPER approved parts obtained from PIPER approved sources, in connection with the maintenance and repair of PIPER airplanes.

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Additionally, reworked or salvaged parts or those parts obtained from non-PIPER approved sources, may have service histories which are unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or may have other hidden damage not discernible through routine visual or nondestructive testing. This may render the part, component or structural assembly, even though originally manufactured by PIPER, unsuitable and unsafe for airplane use.

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

8.1 GENERAL (CONTINUED)

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Service Department to obtain the latest information pertaining to their airplane, and to avail themselves of Piper's support systems.

Piper takes a continuing interest in having owners get the most efficient use from their airplane and keeping it in the best mechanical condition. Consequently, Piper, from time to time, issues service releases including Service Bulletins, Service Letters, Service Spares Letters, and others relating to the airplane.

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent directly to the latest FAA-registered owners in the United States (U.S.) and Piper Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Piper Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Service Centers and, if necessary, to the latest FAA-registered owners in the U.S. Owners should give careful attention to Service Letter information.

Piper Service Spares Letters offer improved parts, kits and optional equipment which were not available originally, and which may be of interest to the owner.

Piper offers a subscription service for Service Bulletins, Service Letters, and Service Spares Letters. This service is available to interested persons such as owners, pilots, and mechanics at a nominal fee, and may be obtained through an authorized Piper Service Center or Piper's Customer Service Department.

Maintenance manuals, parts catalogs, and revisions to both, are available from Piper Service Centers or Piper's Customer Service Department.

Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

8.3 AIRPLANE INSPECTION PERIODS

WARNING

All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., recommended by PIPER are solely based on the use of new, remanufactured or overhauled PIPER approved parts. If parts are designed, manufactured, remanufactured, overhauled and/or approved by entities other than PIPER, then the data in PIPER'S maintenance/service manuals and parts catalogs are no longer applicable and the purchaser is warned not to rely on such data for non-PIPER parts. All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., for such non-PIPER parts must be obtained from the manufacturer and/or seller of such non-PIPER parts.

Piper has developed inspection items and required inspection intervals (i.e.: 50, 100, 500, and 1000 hours) for the specific model aircraft. Approprate forms are contained in the applicable Piper Service/Maintenance Manual, and should be complied with by a properly trained, knowledgeable, and qualified mechanic at a Piper Authorized Service Center or a reputable repair shop. Piper cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed Inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continuous airworthiness is maintained. Complete details are available from all local distributors representing The New Piper Aircraft, Inc.

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

8.3 AIRPLANE INSPECTION PERIODS (Continued)

A spectrographic analysis of the engine oil is available from several sources. This inspection, if performed properly, provides a good check of the internal condition of the engine. To be accurate, induction air filters must be cleaned or changed regularly, and oil samples must be taken and sent in at regular intervals.

8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used to carry persons or property for hire. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance required on the airplane should be accomplished by appropriately licensed personnel.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
- (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
- (2) Aircraft Registration Certificate Form FAA-8050-3.
- (3) Aircraft Radio Station License if transmitters are installed.

(b) To be carried in the aircraft at all times:
- (1) Pilot's Operating Handbook.
- (2) Weight and Balance data.plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
- (3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

8.9 GROUND HANDLING

(a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly.

CAUTIONS

When towing with power equipment, do not turn the nose gear beyond its steering radius in either direction, as this will result in damage to the nose gear and steering mechanism.

Do not tow the airplane when the controls are secured.

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and / or tail by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures as well as taxi techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following checks should be performed:

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.

8.9 GROUND HANDLING (Continued)

(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.
(6) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

(c) Parking

When parking the airplane, be sure that it is sufficiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) To park the airplane, head it into the wind if possible.
(2) Set the parking brake by depressing the toe brakes and pulling out the parking brake control. To release the parking brake, depress the toe brakes and push in the parking brake control, then release the toe brakes.

CAUTION

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Block the wheels.

(5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.

NOTE

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

(6) Install a pitot head cover if available. Be sure to remove the pitot head cover before flight.
(7) Cabin and baggage doors should be locked when the airplane is unattended.

8.11 ENGINE INDUCTION AIR FILTERS

(a) Removing Induction Air Filter

(1) Remove the upper cowling to gain access to the air filter box.
(2) Turn the three studs and remove the air filter box cover.
(3) Lift the air filter from the filter box.

(b) Cleaning Induction Air Filters

The induction air filters must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

8.11 ENGINE INDUCTION AIR FILTERS (Continued)

To clean the filter:

(1) Tap filter gently to remove dirt particles. Do not use compressed air or cleaning solvents.

(2) Inspect filter. If paper element is torn or ruptured or gasket is damaged, the filter should be replaced. The usable life of the filter should be restricted to one year or 500 hours, whichever comes first.

(c) Installation of Induction Air Filters

After cleaning, place filter in air box and install cover. Secure cover by turning studs. Replace cowl.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. This should be checked periodically or at every 50-hour inspection and replenished when necessary. The brake reservoir is located in the forward maintenance area. Remove the four screws and rotate the fiberglass nose cone forward and down. The reservoir is located at the top rear of the compartment. Keep the fluid level at the level marked on the reservoir.

No adjustment of brake clearance is necessary. Refer to the Maintenance Manual for brake lining replacement instructions.

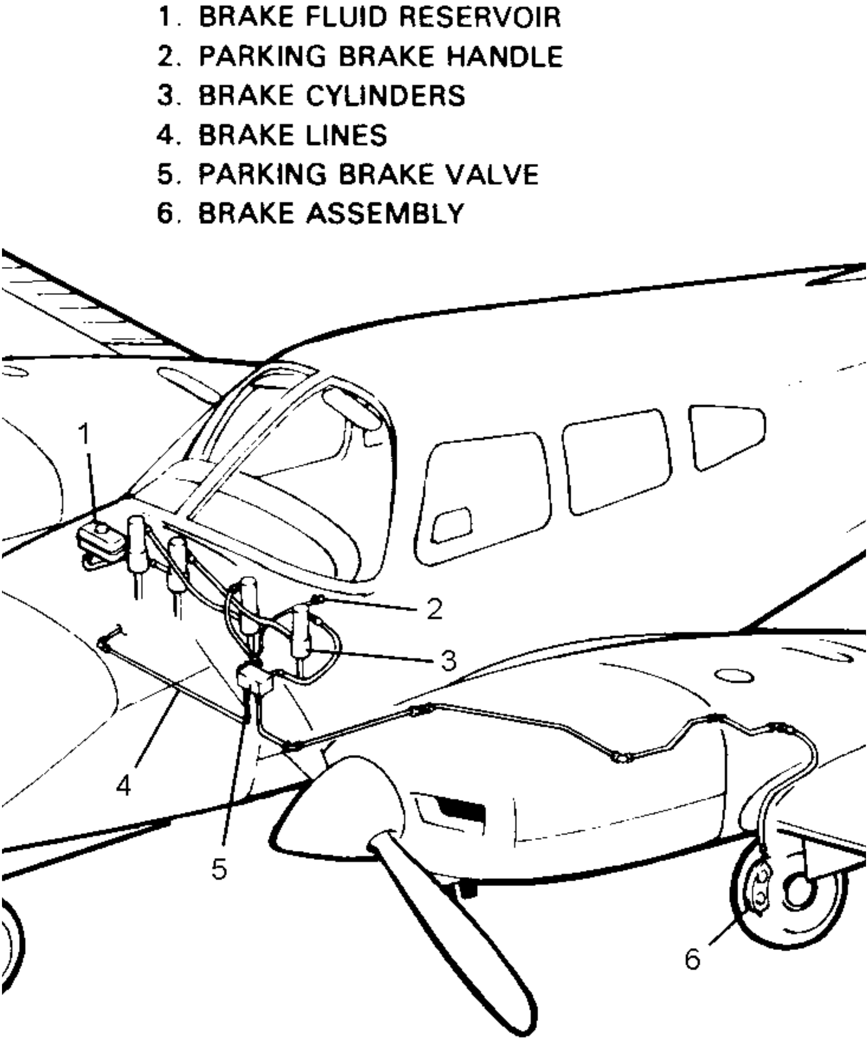
8.15 LANDING GEAR SERVICE

Two jack points are provided for jacking the aircraft for servicing. One is located outboard of each main landing gear. Before jacking, attach a tail support to the tail skid. Approximately 500 pounds of ballast should be placed on the tail support.

CAUTION

Be sure to apply sufficient support ballast; otherwise the airplane may tip forward, and the nose section could be damaged.

Landing gear oleos should be serviced according to instruction on the units. Under normal static load (empty weight of airplane plus full fuel and oil), main oleo struts should be exposed 2.60 inches and the nose oleo strut should be exposed 2.70 inches. Refer to the Maintenance Manual for complete information on servicing oleo struts.



BRAKE SYSTEM
Figure 8-1

8.17 HYDRAULIC SYSTEM SERVICE

The hydraulic landing gear system reservoir is an integral part of the electric hydraulic pump assembly. The combination pump and reservoir is accessible through a panel in the baggage compartment. Fill the reservoir with MIL-H-5606 hydraulic fluid. The fluid level should be checked periodically or every 50 hour inspection and replenished when necessary.

To check fluid level, remove the filler plug/dipstick and note fluid level on dipstick. The filler plug also incorporates a vent. When reinstalling filler plug, tighten to full tight then loosen 1 1/2 turns to allow proper venting. The instructions are also placarded on the pump reservoir.

8.19 PROPELLER SERVICE

The gas charge in the propeller cylinder should be kept at the pressure specified on the placard located in the spinner cap. The pressure in the cylinder will increase about one-third psi for every degree Fahrenheit increase in temperature. This effect should be considered when checking pressure. The charge maintained must be accurate and free of excessive moisture since moisture may freeze the piston during cold weather. Dry nitrogen gas is recommended.

CHAMBER PRESSURE REQUIREMENTS WITH
TEMPERATURE FOR COUNTERWEIGHT TYPE PROPELLERS

Temp. °F	Pressure (PSI)
	FOR PROPELLER HUBS: HC-C2Y(K,R)-2CEUF AND HC-C2Y(K,R)-2CLEUF
70 to 100	41 +/- 1
40 to 70	38 +/- 1
0 to 40	36 +/- 1
-30 to 0	33 +/- 1

NOTE: Do not check pressure or charge with propeller in feather position.

The gas charge in the unfeathering accumulators should be maintained at 90 - 100 PSI. It is important to use nitrogen only for this purpose since any moisture in the system may freeze and render it inoperative. Do not check this charge pressure while engine is running.

8.19 PROPELLER SERVICE (Continued)

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, or corrosion. If found, they should be repaired as soon as possible by a rated mechanic, since a nick or scratch causes an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, all surfaces should be cleaned and waxed periodically.

8.21 OIL REQUIREMENTS

The oil capacity of the Lycoming engines is 8 quarts per engine with a minimum safe quantity of 2 quarts per engine. It is necessary that oil be maintained at full for maximum endurance flights. It is recommended that engine oil be drained and renewed every 50 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The interval between oil and oil filter change is not to exceed four (4) months. Lycoming Service Bulletin No. 446 should be complied with each 50 hours, also. The following grades are required for temperatures:

Average Ambient Temperature All Temperatures	MIL-L-6082B SAE Grade --	MIL-L-22851 Ashless Dispersant SAE Grades 15W-50 or 20W-50
Above 80°F	60	60
Above 60°F	50	40 or 50
30°F to 90°F	40	40
0°F to 70°F	30	30, 40 or 20W-40
0°F to 90°F	20W50	20W50 or 15W50
Below 10°F	20	30 or 20W-30

When operating temperatures overlap indicated ranges, use the lighter grade oil.

NOTE

Refer to the latest issue of Lycoming Service Instruction 1014 (Lubricating Oil Recommendations) for further information.

8.23 FUEL SYSTEM

(a) Servicing Fuel System

The fuel screens in the strainers require cleaning at 50 hour or 90 day intervals, whichever occurs first. The fuel gascolator strainers are located in the fuselage under the rear seats. The fuel selector valves and the auxiliary pumps are in the wings adjacent to the nacelles.

(b) Fuel Requirements

The minimum aviation grade fuel for the PA-44-180 is 100. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes.

Refer to the latest issue of Lycoming Service Instruction No. 1070 for additional information.

A summary of current grades as well as the previous fuel designations is shown in the following chart:

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572E) Amendment No. 3		
Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* -Grade 100LL fuel in some overseas countries is currently colored green and designated as 100L.

** -Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

The operation of the aircraft is approved with an anti-icing additive in the fuel. When an anti-icing additive is used it must meet the specification MIL-1-27686, must be uniformly blended with the fuel while refueling, must not exceed 0.15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than 0.10% by volume. One and one half liquid ozs. per ten gallon of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

CAUTION

Assure that the additive is directed into the flowing fuel stream. The additive flow should start after and stop before the fuel flow. Do not permit the concentrated additive to come in contact with the aircraft painted surfaces or the interior surfaces of the fuel tanks.

CAUTIONS

Some fuels have anti-icing additives preblended in the fuel at the refinery, so no further blending should be performed.

Fuel additive can not be used as a substitute for preflight draining of the fuel system.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the fillers located inside the access cover aft of the engine cowling on the outboard side of the nacelles. Each nacelle tank holds a maximum of 55 U .S. gallons. When using less than the standard 110 gallon capacity, fuel should be distributed equally between each side.

8.23 FUEL SYSTEM (Continued)

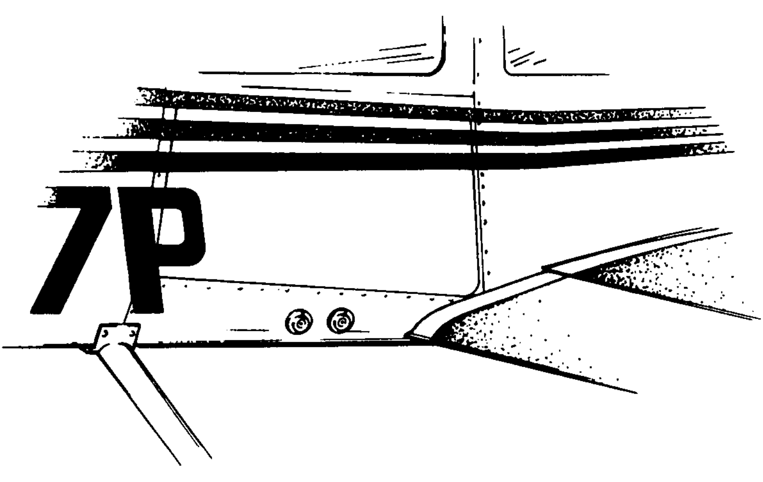
(d) Draining Fuel Strainers, Sumps and Lines

The aircraft is equipped with single point drains (Figure 8-3) which should be drained before the first flight of the day and after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each half of the fuel system can be drained from a single point which is located just forward of the entrance step. Fuel selectors should be in the ON position during draining. The fuel drained should be collected in a transparent container and examined for contamination.

CAUTION

When draining fuel, be sure that no fire hazard exists before starting the engines.



FUEL DRAINS
Figure 8-3

(e) Draining Fuel System

The fuel may be drained by opening the valves at the right hand side of the fuselage just forward of the entrance step or by siphoning. The remaining fuel in the lines may be drained through the gascolators.

8.25 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures. The main gear tires should be inflated to 55 psi and the nose gear should be inflated to 50 psi.

Interchange the tires on the main wheels, if necessary, to produce even wear. All wheels and tires are balanced before original installation, and the relationship of the tire, tube, and wheel should be maintained if at all possible. Unbalanced wheels can cause extreme vibration on takeoff. In the installation of new components, it may be necessary to rebalance the wheel with the tire mounted.

When checking the pressure, examine the tires for wear, cuts, bruises and slippage.

8.27 BATTERY SERVICE

Access to the 12-volt 35 ampere hour battery is gained through the fiberglass nose cone. The battery container has a plastic drain tube which is normally closed off. This tube should be opened occasionally to drain off any accumulation of liquid.

The battery fluid level must not be brought above the baffle plates. It should be checked every 30 days to determine that the fluid level is proper and the connections are tight and free of corrosion. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use distilled water only. A hydrometer check will determine the percent of charge in the battery.

If the battery is not properly charged, recharge it starting with a rate of 4 amperes and finishing with a rate of 2 amperes. Quick charges are not recommended.

8.27 BATTERY SERVICE (Continued)

The external power receptacle is located on the right side of the nose section. Be sure the Battery Master switch is OFF while inserting or removing a plug at this receptacle.

Refer to the Maintenance Manual for detailed procedures for cleaning and servicing the battery.

8.29 SERIAL NUMBER PLATES

The serial number plate is located on the left side of the fuselage near the aft end of the tail cone. The serial number should always be used when referring to the airplane on service or warranty matters.

8.31 LUBRICATION

Lubrication at regular intervals is an essential part of the maintenance of an airplane. For lubrication instructions and a chart showing lubrication points, types of lubricants to be used, lubrication methods and recommended frequencies, refer to the Maintenance Manual.

8.33 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.
(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

CAUTION

Do not spray solvent into the alternator, vacuum pump, starter, air intakes, or alternate air inlets.

(3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

CAUTION

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

(4) Remove the protective tape from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the Maintenance Manual.

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.
(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
(4) Remove the cover from the wheel and remove the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart in the Maintenance Manual.
(6) Caution: Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.

8.33 CLEANING (Continued)

(3) To remove exhaust stains, allow the solution to remain on the surface longer.
(4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff brush, and vacuum where necessary.
(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Carefully follow the manufacturer's instructions. Avoid soaking or harsh rubbing.

CAUTION

Solvent cleaners require adequate ventilation.

(3) Leather should be cleaned with saddle soap or a mild hand soap and water.

(f) Cleaning Carpets

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a non-inflammable dry cleaning fluid. Floor carpets may be removed and cleaned like any household carpet.

8.35 WINTERIZATION

For winter operation a winterization kit is installed on the inlet opening of the oil cooler outboard chamber of the plenum chamber. This kit should be installed whenever the ambient temperature is 50°F or less. When the kit is not being used it can be stowed in the nose cone compartment.

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SECTION 9

SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of Supplements which are necessary for efficient operation of the airplane when equipped with one or more of the various optional systems and equipment not approved with the standard airplane.

All of the supplements provided in this section are FAA Approved and consecutively numbered as a permanent part of this Handbook. The information contained in each Supplement applies only when the related equipment is installed in the airplane.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 1
FOR
GARMIN GNS 430 VHF COMMUNICATION TRANSCEIVER/VOR/ILS RECEIVER/GPS RECEIVER

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GNS 430 VHF Communication Transceiver/VOR/ILS Receiver/GPS Receiver is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:

LINDA J. DICKEN
DOA-510620-CE
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: May 26, 2006

SECTION 1 - GENERAL

The GNS 430 System is a fully integrated, panel mounted instrument, which contains a VHF Communications Transceiver, a VOR/ILS Receiver, and a Global Positioning System (GPS) Navigation computer. The system consists of a GPS Antenna, GPS Receiver, VHF VOR/LOC/GS Antenna, VOR/ILS Receiver, VHF COMM Antenna and a VHF Communications Transceiver. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the VOR/ILS Receiver portion of the equipment is to receive and demodulate VOR, Localizer, and Glide Slope signals. The primary function of the GPS portion of the system is to acquire signals from the GPS system satellites, recover orbital data, make range and Doppler measurements, and process this information in real- time to obtain the user's position, velocity, and time.

Provided the GARMIN GNS 430's GPS receiver is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications for:

- VFR/IFR enroute, terminal, and non-precision instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB- DME, RNAV) operation within the U.S. National Airspace System in accordance with AC 20-138.

- One of the approved sensors, for a single or dual GNS 430 installation, for North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace in accordance with AC 91-49 and AC 120- 33.

- The system meets RNP5 airspace (BRNAV) requirements of AC 90-96 and in accordance with AC 20-138, and JAA AMJ 20X2 Leaflet 2 Revision 1, provided it is receiving usable navigation information from the GPS receiver.

NOTE

Navigation is accomplished using the WGS-84 (NAD-83) coordinate reference datum. Navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of America.

SECTION 2 - LIMITATIONS

A. The GARMIN GNS 430 Pilot's Guide, p/n 190-00140-00, Rev. A, dated October 1998, or later appropriate revision, must be immediately available to the flight crew whenever navigation is predicated on the use of the system.

B. The GNS 430 must utilize the following or later FAA approved software versions:

Sub-System	Software Version
Main	2.00
GPS	2.00
Comm	1.22
VOR/LOC	1.25
G/S	2.00

The main software version is displayed on the GNS 430 self test page immediately after turn-on for 5 seconds. The remaining system software versions can be verified on the AUX group sub-page 2, "SOFTWARE/DATABASE VER".

SECTION 2 - LIMITATIONS (continued)

C. IFR enroute and terminal navigation predicated upon the GNS 430's GPS Receiver is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.

D. Instrument approach navigation predicated upon the GNS 430's GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the GPS equipment data base. The GPS equipment data base must incorporate the current update cycle.

E. Instrument approaches utilizing the GPS receiver must be conducted in the approach mode and Receiver Autonomous Integrity Monitoring (RAIM) must be available at the Final Approach Fix.

F. Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS or any other type of approach not approved for GPS overlay with the GNS 430's GPS receiver is not authorized.

G. Use of the GNS 430 VOR/ILS receiver to fly approaches not approved for GPS require VOR/ILS navigation data to be present on the external indicator.

H. When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation, the aircraft must have the operational equipment capable of using that navigation aid, and the required navigation aid must be operational.

I. VNAV information may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in normal position to land.

SECTION 2 - LIMITATIONS (continued)

J. If not previously defined, the following default settings must be made in the "SETUP 1" menu of the GNS 430 prior to operation (refer to Pilot's Guide for procedure if necessary):

1. dis, spd.........^{n}m ^{k}t (sets navigation units to "nautical miles" and "knots")
2. alt, vs...........ft fpm (sets altitude units to "feet" and "feet per minute")
3. map datum...WGS 84 (sets map datum to WGS-84, see note below)
4. posn.............deg-min (sets navigation grid units to decimal minutes)

NOTE

In some areas outside the United States, datums other than WGS-84 or NAD-83 may be used. If the GNS 430 is authorized for use by the appropriate Airworthiness authority, the required geodetic datum must be set in the GNS 430 prior to its use for navigation.

SECTION 3 - EMERGENCY PROCEDURES

ABNORMAL PROCEDURES

A. If GARMIN GNS 430 navigation information is not available or invalid, utilize remaining operational navigation equipment as required.

B. If “RAIM POSITION WARNING” message is displayed the system will flag and no longer provide GPS based navigational guidance. The crew should revert to the GNS 430 VOR/ILS receiver or an alternate means of navigation other than the GNS 430’s GPS receiver.

C. If “RAIM IS NOT AVAILABLE” message is displayed in the enroute, terminal, or initial approach phase of flight, continue to navigate using the GPS equipment or revert to an alternate means of navigation other than the GNS 430’s GPS receiver appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using the GNS 430’s VOR/ILS receiver or another IFR-approved navigation system.

D. If “RAIM IS NOT AVAILABLE” message is displayed while on the final approach segment, GPS based navigation will continue for up to 5 minutes with approach CDI sensitivity (0.3 nautical mile). After 5 minutes the system will flag and no longer provide course guidance with approach sensitivity. Missed approach course guidance may still be available with 1 nautical mile CDI sensitivity by executing the missed approach.

E. In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 Mhz into the “Active” frequency window.

SECTION 4 - NORMAL PROCEDURES

CAUTION

Familiarity with the enroute operation of the GNS 430 does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the GNS 430 approach feature.

A. DETAILED OPERATING PROCEDURES

Normal operating procedures are described in the GARMIN GNS 430 Pilot's Guide, p/n 190-00140-00, Rev. A, dated October 1998, or later appropriate revision.

B. CROSSFILL OPERATIONS

Crossfill capabilities exist between the GNS 430 systems. Refer to the Garmin GNS 430 Pilot's Guide for detailed crossfill operating instructions.

C. AUTOMATIC LOCALIZER COURSE CAPTURE

By default, the GNS 430 automatic localizer course capture feature is enabled. This feature provides a method for system navigation data present on the external indicator to be switched automatically from GPS guidance to localizer/glide slope guidance at the point of course intercept on a localizer at which GPS derived course deviation equals localizer derived course deviation. If an offset from the final approach course is being flown, it is possible that the automatic switch from GPS course guidance to localizer/glide slope course guidance will not occur. It is the pilot's responsibility to ensure correct system navigation data is present on the external indicator before continuing a localizer based approach beyond the final approach fix.

SECTION 5 - PERFORMANCE

No Change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the Equipment List attached to the Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

See the GNS 430 Pilot's Guide for a complete description of the GNS 430 system.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 2
FOR
GARMIN GTX 330/330D TRANSPONDER

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GTX 330/330D Transponder is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:
LINDA J. DICKEN
DOA-510620-CE
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: May 26, 2006

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the Garmin GTX 330/330D Transponder is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

A. Display of TIS traffic information is advisory only and does not relieve the pilot responsibility to "see and avoid" other aircraft. Aircraft maneuvers shall not be predicated on the TIS displayed information.

B. Display of TIS traffic information does not constitute a TCAS I or TCAS II collision avoidance system as required by 14 CFR Part 121 or Part 135.

C. Title 14 of the Code of Federal Regulations (14 CFR) states that "When an Air Traffic Control (ATC) clearance has been obtained, no pilot-in-command (PIC) may deviate from that clearance, except in an emergency, unless he obtains an amended clearance." Traffic information provided by the TIS up-link does not relieve the PIC of this responsibility.

D. The 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum) P/N 190-00140-13 Rev. A or later revision must be accessible to the flight crew during flight.

E. 400/500 Series Main Software 4.00 or later FAA approved software is required to operate the TIS interface and provide TIS functionality.

SECTION 3 - EMERGENCY PROCEDURES

To transmit an emergency signal:

- Mode Selection Key - ALT
- Code Selection - SELECT 7700

To transmit a signal representing loss of all communications:

- Mode Selection Key - ALT
- Code Selection - SELECT 7600

SECTION 4 - NORMAL PROCEDURES

BEFORE TAKEOFF:

To transmit Mode C (Altitude Reporting) code in flight:

- Mode Selection Key - ALT
- Code Selector Keys - SELECT assigned code.

To transmit Mode A (Aircraft Identification) code in flight:

- Mode Selector Key - ON
- Code Selector Keys - SELECT assigned code.

NOTE

During normal operation with the ON mode selected, the reply indicator “R” flashes, indicating transponder replies to interrogations.

NOTE

Mode A reply codes are transmitted in ALT also; however, Mode C codes only are suppressed when the Function Selector ON key is selected.

NOTE

GTX 330D Diversity Option is operational only with the No. 1 Transponder.

1. DETAILED TRANSPONDER OPERATING PROCEDURES

   Normal transponder operating procedures are described in the GARMIN GTX 330 Pilot’s Guide, P/N 190-00207-00, Rev. A, or later appropriate revision.

2. DISPLAY OF TRAFFIC INFORMATION SERVICE (TIS) DATA

   TIS surveillance data uplinked by Air Traffic Control (ATC) radar through the GTX 330 Mode S Transponder will appear on the interfaced display device (Garmin 400 or 500 series products). For detailed operating instructions and information regarding the TIS interface, refer to the 400/500 Series Garmin Display Interfaces (Pilot’s Guide Addendum) P/N 190-00140-13 Rev. A or later appropriate revision.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in section 6 of the Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION

See the 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum), P/N 190-00140-13, and GTX 330 Pilot's Guide, P/N 190-00207-00, for a complete description of the GTX 330 system.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 3
FOR
GARMIN GMA 340 AUDIO PANEL

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GMA 340 is installed per the Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

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SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the Garmin GMA 340 audio panel is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

AUDIO CONTROL SYSTEM OPERATION:

- Select the desired transmitter audio selector button (COM1, COM2, OR COM3) and verify that the buttons LED is illuminated.
- INTERCOM VOL Control (ICS) - Adjust to desired listening level.
- INTERCOM VOX (voice) Sensitivity Control - ROTATE CONTROL knob clockwise to the middle range and then adjust as required for desired voice activation or hot mic intercom.
- If desired, select the speaker function button. Selecting this button allows radio transmissions to be received over the cabin speaker.

NOTE

Audio level is controlled by the selected NAV radio volume control.

MARKER BEACON RECEIVER OPERATION:

- TEST Button - PRESS to verify all marker lights are operational.
- SENS Button - SELECT HI for airway flying for LO for ILS/LOC approaches.

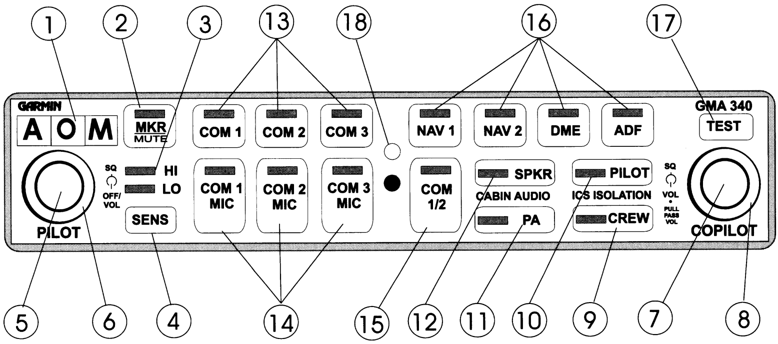
SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in section 6 of the Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION



1. Marker Beacon Lamps
2. Marker Beacon Receiver Audio Select/Mute Button
3. Marker Beacon Receiver Sensitivity Selection Indicator LED
4. Marker Beacon Receiver Sensitivity Selection Button
5. Unit On/Off, Pilot Intercom System (ICS) Volume
6. Pilot ICS Voice Activated (VOX) Intercom Squelch Level
7. Copilot and Passenger ICS Volume Control (Pull out for Passenger Volume)
8. Copilot/Passenger VOX Intercom Squelch Level
9. Crew Isolation Intercom Mode Button
10. Pilot Isolation Intercom Mode Button
11. Passenger Address (PA) Function Button
12. Speaker Function Button
13. Transceiver Audio Selector Buttons (COM1, COM2, COM3)
14. Transmitter (Audio/Mic) Selection Buttons
15. Split COM Button
16. Aircraft Radio Audio Selection Buttons (NAV1, NAV2, DME, ADF)
17. Annunciator Test Button
18. Photocell - Automatic Annunciator Dimming

SECTION 7 - DESCRIPTION AND OPERATION (continued)

ON/OFF, Pilot Intercom System (ICS) Volume Control

The GMA 340 is powered OFF when the left small knob (5) is rotated fully CCW into the detent. To turn the unit ON, rotate the knob clockwise past the click. The knob then functions as the pilot ICS volume control. A fail safe circuit connects the pilot's headset and microphone directly to COM1 in case power is interrupted or the unit is turned OFF.

Transceivers

Selection of either COM1, COM2, or COM3 for both MIC and audio source is accomplished by pressing either COM1, MIC, COM2 MIC, COM3 MIC (14). The activeCOM audio is always heard on the headphones.

Additionally, each audio source can be selected independently by pressing COM1, COM2, or COM3 (13). When selected this way, they remain active as audio sources regardless of which transceiver has been selected for microphone use.

When a microphone is keyed, the active transceiver's MIC button LED blinks approximately one per second to indicate that the radio is transmitting.

NOTE

Audio level is controlled by the selected COM radio volume controls.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Split COM

Pressing the COM 1/2 button (15) activates the split COM function. When this mode is active, COM1 is dedicated solely to the pilot for MIC/Audio while COM2 is dedicated to the copilot for MIC/Audio. The pilot and copilot can simultaneously transmit in this mode over separate radios. Both pilots can still listen to COM3, NAV1, NAV2, DME, ADF, and MRK as selected. The split COM mode is cancelled by pressing the COM 1/2 button a second time.

When in the split COM mode the copilot may make PA announcements while the pilot continues using COM1 independently. When the PA button is pressed after the split com mode is activated the copilot's mic is output over the cabin speaker when keyed. A second press of the PA button returns the copilot to normal split COM operation.

NOTE

It is possible that radio interference may occur in the split COM mode when the frequencies of the two communications radios are close together (normally less than one MHz). The extent of the interference is a function of the specific frequencies selected, transmitted power, antenna spacing, etc. No guarantee is made to the performance of the split COM feature on small aircraft.

Aircraft Radios and Navigation

Pressing NAV1, NAV2, DME, ADF (16) or MRK (2) selects each audio source. A second button press deselects the audio.

Speaker Output

Pressing the SPKR button (12) selects the aircraft radios over the cabin speaker. The speaker output is muted when a COM microphone is keyed.

PA Function

The PA mode is activated by pressing the PA button (11). Then, when either the pilot's or copilot's microphone is keyed, the corresponding mic audio is heard over the cabin speaker. If the SKR button is also active, then any selected speaker audio is muted while the microphone is keyed. The SPKR button does not have to be previously active in order to use the PA function.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Intercom System (ICS)

Intercom volume and squelch (VOX) are adjusted using the following front panel knobs:

- **Left Small Knob** - Unit ON/OFF power control and pilot's ICS volume. Full CCW detent position is OFF.
- **Left Large Knob** - Pilot ICS mic VOX squelch level. CW rotation increases the amount of mic audio (VOX level) required to break squelch. Full CCW is the "HOT MIC" position (no squelch).
- **Right Small Knob** - IN position: Copilot ICS volume. OUT position: Passenger ICS volume.
- **Right Large Knob** - Copilot and passenger mic VOX squelch level. CW rotation increases the amount of mic audio (VOX level) required to break squelch. Full CCW is the "HOT MIC" position.
- **PILOT Mode** - This mode isolates the pilot from everyone else and dedicates the aircraft radios to the pilot exclusively. The copilot and passengers share communications between themselves but cannot communicate with the pilot or hear the aircraft radios.
- **CREW Mode** - This mode places the pilot and copilot on a common ICS communication channel with the aircraft radios. The passengers are on their own intercom channel and can communicate with each other, but cannot communicate with the crew or hear the aircraft radios.

Marker Beacon Receiver

The GMA 340's marker beacon receiver controls are located on the left side of the front panel (1 - 4). The SENS button selects either high or low sensitivity as indicated by the HI or LO LED being lit. Low sensitivity is used on ILS approaches while high sensitivity allows operation over airway markers or to get an earlier indication of nearing the outer marker during an approach.

The marker audio is initially selected by pressing the MKR/Mute button (2). If no beacon signal is received, then a second button press will deselect the marker audio. This operation is similar to selecting any other audio source on the GMA 340. However, if the second button press occurs while a marker beacon signal is received, then the marker audio is muted but not deselected. The buttons LED will remain lit to indicate that the source is still selected. When the current marker signal is no longer received, the audio is automatically un-muted. While in the muted state, pressing the MKR/Mute button deselects the marker audio. The button's LED will extinguish to indicate that the marker audio is no longer selected.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 4
FOR
S-TEC SYSTEM 55X TWO AXIS
AUTOMATIC FLIGHT GUIDANCE SYSTEM

The FAA approved operational supplement for the S-TEC System 55X Autopilot, installed in accordance with STC SA09131AC-D, is required for operation of this system. S-TEC will be responsible to supply and revise the operational supplement. It is permitted to include the S-TEC supplement in this location of the Pilot’s Operating Handbook unless otherwise stated by S-TEC. The information contained in the S-TEC supplement may supersede or supplement the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual with respect to the operation of the S-TEC System 55X Autopilot. For limitations, procedures and performance information not contained in the S-TEC supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 5
FOR
S-TEC MANUAL ELECTRIC TRIM SYSTEM
WITH TRIM MONITOR

The FAA approved operational supplement for the S-TEC Manual Electric Trim System, installed in accordance with STC SA09139AC-D, is required for operation of this system. S-TEC will be responsible to supply and revise the operational supplement. It is permitted to include the S-TEC supplement in this location of the Pilot’s Operating Handbook unless otherwise stated by S-TEC. The information contained in the S-TEC supplement may supersede or supplement the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual with respect to the operation of the S-TEC Manual Electric Trim System. For limitations, procedures and performance information not contained in the S-TEC supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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SECTION 10

OPERATING TIPS

10.1 GENERAL

This section provides operating tips of particular value in the operation of the Piper Seminole.

10.3 OPERATING TIPS

(a) Learn to trim for takeoff so that only a very light back pressure on the wheel is required to lift the airplane off the ground.

(b) On takeoff, do not retract the gear prematurely. The airplane may settle and make contact with the ground because of lack of flying speed, atmospheric conditions, or rolling terrain.

(c) Flaps may be lowered at airspeeds up to 111 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the UP position before they will lock and support weight on the step.

(d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

(e) Always determine position of landing gear by checking the gear position lights.

(f) The shape of the nacelle fuel tanks is such that in certain maneuvers and with low fuel levels, the fuel may move away from the tank outlet. If the outlet is uncovered, the fuel flow will be interrupted and a temporary loss of power may result. Pilots can prevent inadvertent uncovering of the outlet by avoiding maneuvers which could result in uncovering the outlet.

10.3 OPERATING TIPS (Continued)

Extreme running turning takeoffs should be avoided.

Prolonged slips and skids which result in excess of 2000 feet of altitude loss, or other radical or extreme maneuvers which could cause uncovering of the fuel outlet must be avoided as fuel flow interruption may occur when the tank being used is not full.

(g) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of his feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

(h) Anti-collision lights should not be operating when flying through clouds, fog, or haze, since reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

(i) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications such as regulations, advisory circulars, Aviation News, AIM and safety aids.

(j) Pilots who fly above 10,000 feet should be aware of the need for special physiological training. Appropriate training is available at approximately twenty-three Air Force Bases throughout the United States for a small fee. The training is free at the NASA Center in Houston and at the FAA Aeronautical Center in Oklahoma.

Forms to be completed (Physiological Training Application and Agreement) for application for the training course may be obtained by writing to the following address:

Chief of Physiological Training, AAC-143
FAA Aeronautical Center
P. 0. Box 25082
Oklahoma City, Oklahoma 73125

It is recommended that all pilots who plan to fly above 10,000 feet take this training before flying this high and then take refresher training every two or three years.

10.3 OPERATING TIPS (Continued)

(k) Sluggish RPM control and propeller overspeed with poor RPM recovery after rapid throttle application are indications that nitrogen pressure in the propeller dome is low.

(l) Experience has shown that the training advantage gained by pulling a mixture control or turning off the fuel to simulate engine failure at low altitude is not worth the risk assumed, therefore it is recommended that instead of using either of these procedures to simulate loss of power at low altitude, the throttle be retarded slowly to idle position. Fast reduction of power may be harmful to the engine. See Section 4 for power settings which are recommended for simulated one engine operation.

(m) Before starting either engine, check that all radio switches, light switches and the pitot heat switch are in the OFF position so as not to create an overloaded condition when the starter is engaged.

(n) The airplane should not be flown in severe turbulence as damage to the airframe structure could result.

(o) The best speed for takeoff is about 75 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of an engine failure.

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