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 4496331 AND UP
WITH GARMIN G1000 SYSTEM

INFORMATION MANUAL

MANUAL PART NUMBER 767-090

Published by
TECHNICAL PUBLICATIONS
Piper Aircraft, Inc.
Issued: June 5, 2013
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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 certified 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, 1-1 through 1-14, 2-1 through 2-18, 3-1 through 3-44, 4-1 through 4-26, 5-1 through 5-34, 6-1 through 6-14, 7-1 through 7-78, 8-1 through 8-22, 9-1 through 9-30, 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-2307 issued June 5, 2013

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1 (PR140611)	i	Added EASA statement .	
	ii	Updated copyright.	
	v	Added Rev. 1 to L of R.	
	1-6	Revised Para. 1.18. Relocated text to page 1-7.	
	1-7	Added text from page 1-6.	
	2-9	Revised Para. 2.25(d).	
	2-10	Revised Para. 2.25(f).	
	2-13	Revised Para. 2.25 (l).	
	4-ii	Revised T.O.C.	Eric A. Wright
	4-26	Added Para. 4.5q.	June 11, 2014
Rev. 2 (PR141027)	i	Removed EASA statement.	
	ii	Corrected typo.	
	v	Added Rev. 2 to L of R.	
	vi	Added Rev. 2 and L of R .	
	vi-a	Added page.	
	vi-b	Added page.	
	vi-c	Added page.	
	vi-d	Added page.	
	1-11	Revised Para. 1.19.	
	2-i	Revised T of C.	
	2-7	Revised Para.'s 2.25 (a) & (b).	
	2-8	Revised Para. 2.25(c).	
	2-9	Revised Para. 2.25 (d).	
	2-10	Reviseed Paragraphs 2.25 (e) and 2.25(f).	
	2-11	Revised Paragraphs 2.25 (f).	
	2-12	Revised Para. 2.25(i).	
	2-13	Revised Para. 2.25 (l).	
	2-15	Added para. 2.26. Relocated text to page 2-16.	
	2-16	Added text from page 2-15.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 2 (Continued)	3-i	Revised T of C.	
	3-iii	Revised T of C.	
	3-2	Revised Para. 3.1.	
	3-3 to 3-5	Revised CAS messages.	
	3-6	Revised CAS Advisory Table.	
	3-14	Revised Para. 3.5a.	
	3-14a	Relocated text from 3-15. Revised Para. 3.5a.	
	3-14b	Relocated text from 3-15.	
	3-15	Relocated text to pages 3-14a and 3-14b.	
	3-25	Rev. Para. 3.5i.	
	3-27	Revised Para. 3.5j.	
	3-30	Revised Para. 3.5k.	
	3-31	Revised Para. 3.5k.	
	3-32	Revised Para. 3.5k.	
	3-33	Revised Para. 3.5k.	
	3-34	Revised Para. 3.5k.	
	3-38a thru 3-38f	Added pages.	
	3-39	Revised Para. 3.5k.	
	3-40	Revised Para. 3.5l.	
	4-ii	Revised T of C.	
	4-2	Revised Para. 4.3.	
	4-3	Removed Note from Para. 4.5.	
	4-10 thru 4-13	Revised Para. 4.5c.	
	4-14	Revised Para. 4.5d.	
	4-15	Revised Para. 4.5f.	
	4-16	Revised Para. 4.5g.	
	4-18	Revised Para. 4.5h.	

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Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 2 (Continued)	4-20	Revised Para. 4.5j.	
		Relocated text to page 4-21.	
	4-21	Added text from page 4-20.	
	4-24	Revised Para. 4.5m.	
	4-25	Added Note to Para. 4.5o.	
	4-26	Para. 4.5q Noise Level now Para. 4.5t. and moved to page 4-28.	
		Added new Para. 4.5q.	
	4-27	Added page.	
	4-28	Added page.	
	4-29	Added page.	
		Added Para. 4.5u.	
	4-30	Added page.	
	7-i	Revised T. O. C.	
	7-7	Revised Para. 7.9.	
	7-8	Revised Para. 7.9.	
	7-11	Revised Para. 7.9.	
	7-12	Revised Para. 7.9.	
	7-13	Revised Para. 7.9.	
	7-14	Revised Para. 7.9.	
	7-15	Revised Para. 7.9.	
		Added text from page 7-16.	
	7-16	Revised Para. 7.9.	
		Relocated text from page 7-15	
	7-18	Revised Para. 7.9.	
	7-19	Revised Note in Para. 7.9.	
	7-21	Revised Para. 7.9.	
	7-23	Revised Para. 7.9.	
	7-24	Revised Para. 7.9.	
	7-26 thru 7-29	Revised Para. 7.9.	
	7-31	Revised Para. 7.9.	
	7-33	Revised Para. 7.9.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 2 (Continued)	7-34	Revised Para. 7.9.	
	7-36 thru 7-38	Revised Para. 7.9.	
	7-39	Revised Para. 7.9. Added Para. 7.10.	
	7-39a thru 7-39d	Added pages.	
	7-40	Added Audio Panel text. Relocated text to page 7-41.	
	7-41	Added text from page 7-40. Relocated text to page 7-42.	
	7-42	Added text from page 7-41. Relocated text to page 7-43.	
	7-43	Added text from page 7-42.	
	7-46	Revised Para. 7.11.	
	7-47	Revised Figure 7-13.	
	7-57	Revised Figure 7-21.	
	7-58	Revised Figure 7-21.	
	7-70	Revised Figure 7-33.	
	7-71	Revised Figure 7-33.	
	9-11	Revised footer.	
	9-12	Added Para. 2.1 heading. Added Para. 2.2. Revised footer.	
	9-13	Revised footer.	
	9-14	Revised Section 3. Relocated text to page 9-15. Revised footer.	
	9-15	Revised Section 3. Added text from page 9-14. Relocated text to page 9-16. Revised footer.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 2 (Continued)	9-16	Added text from page 9-15. Relocated text to page 9-17. Revised footer.	
	9-17	Added text from page 9-16. Revised footer.	
	9-18 thru 9-22	Revised footer	
	9-23	Relocated text to page 9-24. Added Figures 2 and 3. Revised footer.	
	9-23a	Added page.	
	9-23b	Added page.	Eric A. Wright
	9-24	Revised footer.	October 27, 2014
Rev. 3 (PR141205)	vi-c	Added Rev. 3 to L of R.	
	7-75	Revised Para. 7.33.	Eric A. Wright December 5, 2014
Rev. 4 (PR150720)	ii	Updated copyright info.	
	vi-c	Added Rev. 4 to L of R.	
	3-iii	Revised T of C.	
	3-iv	Revised T of C.	
	3-43	Added 3.5q Emergency Descent Checklist and renumbered remaining checklists.	
	4-6	Revised Para. 4.5a.	
	7-68	Revised Para. 7.23.	Eric A. Wright July 20, 2015
Rev. 5 (PR170111)	i	Added EASA statement.	
	ii	Updated copyright info.	
	vi-c	Added Rev. 5 to L of R.	
	1-6	Revised Para. 1.18 to add ICAO RNAV classification.	Eric A. Wright January 11, 2017

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 6 (PR180702)	ii	Updated copyright info.	
	vi-d	Added Rev. 6 to L of R.	
	2-4	Revised Para. 2.10.	
	2-14	Revised Para. 2.25.	
	2-15, -16	Revised Para. 2.27.	
	3-21 - 3-22	Revised Para. 3.5e to amend Oil Press/Temp procedures.	
	3-22a	Added page. Relocated text from 3-22.	
	3-22b	Added page.	
	3-28	Typo.	
	4-8	Revised Para. 4.5b.	
	4-15	Revised Para. 4.5f.	
	4-15a, -b 4-16	Added pages. Relocated text from 4-15 and 4-16.	
	7-42	Revised Standby Instrument.	
	7-52	Revised Figure 7-17.	
	7-56	Revised Para. 7-19.	
	9-i	Revised T.O.C.	Eric A. Wright
	9-39, -40	Added Supplement 6.	July 2, 2018

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GENERAL

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SECTION 1

GENERAL

1.1 INTRODUCTION

This Pilot's Operating Handbook is designed as an operating guide for the pilot. It contains all of the information that must be provided in an Airplane Flight Manual (AFM) under Federal Aviation Regulation. Additional information is provided by the airplane manufacturer regarding the characteristics and operation of the airplane and its systems.

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

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.

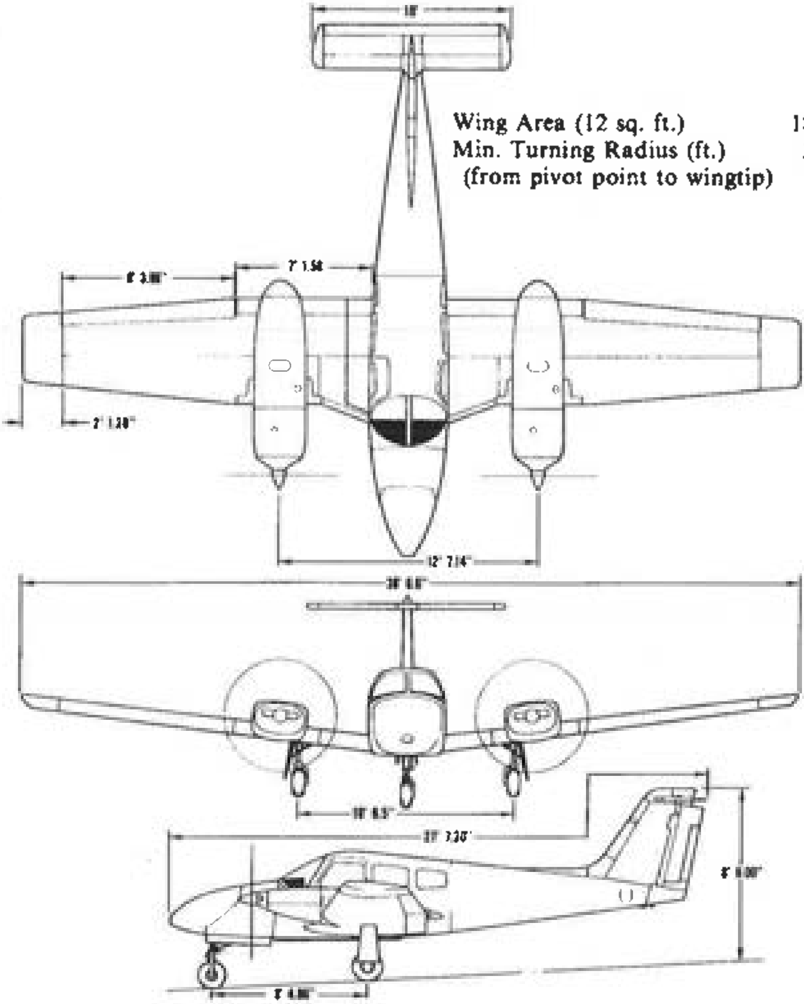
This handbook should not be used solely as an occasional operating reference. The pilot should study the entire handbook to become familiar with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

The handbook has been divided into numbered sections, each provided with a 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 for instant reference. 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 intentionally left blank.

NOTE

In countries other than the United States of America, FAA operating rules may not apply. Operators must ensure that the aircraft is operated in accordance with national operating rules.

Wing Area (12 sq. ft.)	183.8
Min. Turning Radius (ft.) (from pivot point to wingtip)	33.0



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

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	MIL-L-6082B SAE Grade	MIL-L-22851 Ashless Dispersant SAE Grades
All Temperatures	--	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

1.18 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS

The Garmin G1000 Integrated Avionics GNSS navigation system installed in this aircraft is a GPS system with a Satellite Based Augmentation System (SBAS) comprised of two ETSO-145/TSO-C145a Class 3 approved Garmin GIA 63Ws, ETSO-146/TSO-C146a Class 3 approved Garmin GDU 1040 Display Units, two GA36 GPS antennas (one is a GA37 if optional GDL 69A is installed), and GPS software version 3.2 or later approved version.

The Garmin G1000 Integrated Avionics GNSS navigation system as installed in this aircraft complies with AC 20-138C and has airworthiness approval for navigation using GPS and GPS/SBAS (within the coverage of a satellite-based augmentation system complying with ICAO Annex 10) for IFR enroute, terminal area, non-precision approach, operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV", within the U.S. National Airspace System.

For airplanes registered in the European Union member states and other states associated to EASA, the Garmin G1000 Integrated Avionics GNSS navigation system as installed in this aircraft complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for PRNAV (RNAV 1) operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No. 10 (JAA TGL-10 Rev 1). The G1000 Integrated Avionics GNSS navigation system as installed in this aircraft complies with the equipment requirements for PRNAV (RNAV 1) and BRNAV (RNAV 5) operations in accordance with AC 90-96A and JAA TGL- 10 Rev 1. The G1000 system as installed in this aircraft has also been evaluated and approved in accordance with AMC 20-27, AMC 20-28, and CRI-F-87 to perform approaches using Lateral Precision with Vertical guidance, (LPV) and RNAV-GNSS approach operations to LNAV/VNAV minima where angular VNAV guidance is provided by SBAS augmented GNSS. This does not constitute an operational approval.

The Garmin G1000 Integrated Avionics GNSS navigation system as installed in this aircraft complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures without RF (radius to fix) legs. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

1.18 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (Continued)

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin G1000 GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138C and FAA Order 8400.12C. The Garmin GNSS navigation system can be used without reliance on other long range navigation systems. This does not constitute an operational approval.

The Garmin G1000 Integrated Avionics GNSS navigation system as installed in this aircraft has been found to comply with the navigation requirements for primary means of Class II navigation in oceanic and remote navigation (RNP-4) in accordance with AC 20-138C and FAA Order 8400.33. The G1000 can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153A for database integrity, quality, and database management practices for the Navigation database. Flight crews and operators can view the LOA status at FlyGarmin.com then select "Type 2 LOA Status".

Navigation information is referenced to WGS-84 reference system.

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_O	Maximum Operating 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

IMC — Instrument Meterological Conditions.

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

EGT	Exhaust Gas Temperature
MAP	Manifold Pressure
RPM	Propeller Speed (revolutions per minute)
FFLOW	Fuel Flow
CHT	Cylinder Head 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.

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

(g) Avionics Terminology

MFD	Multifunction Display
PFD	Primary Flight Display
AHRS	Attitude Heading Reference System
ADC	Air Data Computer
GIA	Garmin Integrated Avionics Unit
GEA	Garmin Engine/Airframe Unit
GPS	Global Positioning System

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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 operation of the airplane and its systems.

This airplane must be operated as a normal or utility category airplane in compliance with the operating limitations stated in this section and the handbook.

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
Maximum Operating Maneuvering Speed (V_O) - Do not make full or abrupt control inputs above this speed.		
At 3800 lb Gross Weight	135	133
At 2870 lb Gross Weight	115	115

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 turbulent 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.	56	63

NOTE

Vmca for this airplane is defined by aerodynamic stall.

2.5 AIRSPEED INDICATOR MARKINGS

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 (Flap Down)	55 KTS to 111 KTS
Blue Radial Line (One Engine Inoperative Best Rate of Climb Speed)	88 KTS

2.5 AIRSPEED INDICATOR MARKINGS (Continued)

MARKING	IAS
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 (AVGAS ONLY) (minimum grade)	100 or 100LL Aviation Grade
(g) Number of Propellers	2
(h) Propeller Manufacturer	Hartzell
(i) Propeller Hub and Blade Models	
Left	HC-C2Y(K,R)-2CEUF/ FC7666A-2R
Right	HC-C2Y(K,R)-2CLEUF/ FJC7666A-2R
(j) Propeller Diameter (inches)	
Maximum	74 IN.
Minimum	72 IN.

2.9 POWERPLANT 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 & T.O.)	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
(e) Fuel Flow	
Green Arc (Normal Operating Range)	3.0 GPH to 25.0 GPH

2.10 SYSTEMS LIMITATIONS

a) Alternator	
1) Maximum Load Ground	60 AMPS
2) Maximum Load Flight	80 AMPS
b) Main Battery	
Minimum	25 VOLTS
Maximum	32 VOLTS
c) Emergency Battery	
Minimum	20 VOLTS
Minimum Required for Flight	23.3 VOLTS
Maximum	32 VOLTS

ISSUED: June 5, 2013
REVISED: July 2, 2018

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)	-1.5 G

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
2 U.S. GAL.
The unusable fuel for this airplane is 1.0 gallon in each nacelle in critical flight attitudes.
(d) Usable Fuel
108 U.S. GAL.
The usable fuel in this airplane is 54 gallons in each nacelle for a total of 108 gallons.

2.23 MAXIMUM SEATING CONFIGURATION

The maximum seating capacity is 4 persons.

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS

(a) Cockpit Reference & Pilot's Guide

The Garmin G1000 Cockpit Reference Guide for the PA-44-180 Seminole (Garmin P/N 190-01462-01 latest appropriate revision) provides operating instructions on the major features of the G1000 Integrated Flight Deck. This Cockpit Reference Guide (CRG) must be immediately available to the pilot while operating the airplane.

The Garmin G1000 Pilot's Guide for the PA-44-180 Seminole (Garmin P/N 190-01461-01), provides detailed operating procedures for the G1000 system.

(b) System Software Requirements.

The G1000 must utilize the following or later FAA approved software versions:

Component	Identification	Software Version
PFD	Primary Flight Display	13.01
MFD	Multifunction Flight Display	13.01
GMA	Audio Panel	4.04
GRS	Attitude and Heading Reference System	3.03
GDC	Air Data Computer	3.09
GIA	Integrated Avionics Unit	7.08
GEA	Engine Airframe Interface Unit	2.07
GPS	Global Positioning System	5.0
GMU	Magnetometer Unit	2.05

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (Continued)

(c) Databases

GPS/SBAS based IFR enroute, oceanic and terminal navigation predicated upon the Garmin G1000 GPS Receiver is prohibited unless the pilot uses a valid, compatible, and current Navigation database or verifies each selected waypoint for accuracy by reference to current data.

Instrument approach navigation predicated upon the Garmin G1000 GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the G1000 Navigation database. The G1000 Navigation database must incorporate the current update cycle and the approach must be retrievable by its procedure name.

(d) Flight Planning

In areas where GPS WAAS SBAS coverage is not available, the pilot must verify RAIM availability. Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, or the FAA's enroute and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station. Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home. For other areas, use the Garmin WFDE Prediction program. The route planning and WFDE Prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643, 'WFDE Prediction Program Instructions'.

For operations within the U.S. Nation Airspace System on RNP and RNAV procedures when GPS WAAS SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight should be delayed, canceled, or re-routed on a track where RAIM requirements can be met.

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (Continued)

(d) Flight Planning (continued)

For operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight should be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

When RAIM is required for GPS integrity (GPS WAAS SBAS not available) during instrument meteorological conditions (IMC), other non-GPS navigation equipment appropriate to the operation, must be available.

When using GPS WAAS at an alternate airport, flight planning must be based on the minimums associated with the RNAV (GPS) LNAV, circling, or GPS or conventional approach procedure with "or GPS" in the title. Upon arrival at the alternate, if the WAAS navigation equipment indicates LNAV/VNAV or LPV service is available, then the associated vertical guidance and minimums may be used.

When not using GPS WAAS, filing a GPS-based instrument approach at either the destination or alternate airport is acceptable, but not at both locations. The GPS receiver must have fault detection and exclusion (FDE) capability and the pilot must perform a preflight RAIM prediction at the airport where the RNAV (GPS) approach will be flown. For the alternate airport, flight planning must be based on the minimums associated with the LNAV or circling approach. LNAV/VNAV minimums may be used if equipped with and using approved baro-VNAV equipment and RNP 0.3 minimums may be used on an RNAV (RNP) instrument approach, if specifically authorized, using baro-VNAV equipment, and the pilot has verified RNP availability through an approved WFDE prediction program

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (Continued)

(e) Enroute

RNP and RNAV routes including Standard Instrument Departures (SIDs) and Obstacle Departure Procedures (ODPs) and Standard Terminal Arrival (STAR) must be loaded into the flight plan from the current database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Whenever possible, RNAV "Q" and RNAV "T" routes should be extracted from the database in their entirety, rather than loading RNAV route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

Navigation information is referenced to WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

(f) Approaches

RNAV approaches and RNP procedures must be retrievable by the procedures name from the current aircraft navigation database and must conform to the charted procedures. Manual entry of waypoints is prohibited.

(1) Vertical Guidance

Advisory vertical guidance deviation information is only an aid to help pilots comply with altitude restrictions. When using advisory vertical guidance, the pilot must use the primary barometric altimeter to ensure compliance with all altitude restrictions, particularly during instrument approach operations.

When GPS WAAS SBAS corrections are unavailable or if operating outside of GPS WAAS SBAS coverage, instrument approaches utilizing the GPS receiver will be conducted in the approach mode and Fault Detection and Exclusion mode. Loss of Integrity annunciations must not be displayed at the Final Approach Fix. Vertical guidance from GPS will not be available if GPS WAAS SBAS corrections are unavailable or if operating outside of GPS WAAS SBAS coverage. When outside or on the fringe of the SBAS coverage area, it may be desirable, although not recommended, to disable SBAS.

IFR non-precision approach with vertical guidance approval using the GPS/SBAS sensor is limited to published approaches within the U.S.

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (Continued)

(f) Approaches (continued)

(1) Vertical Guidance (continued)

and EASA Airspace Systems. Approaches to airports in other airspace are not approved unless authorized by the appropriate governing authority.

(2) GPS Approaches

See Section 1, paragraph 1.18. for approved GPS operations/approaches.

(3) Non GPS Approaches

The navigation equipment required to perform an instrument approach procedures is indicated by the title of the procedure and notes on the IAP chart. Use of the Garmin GPS/SBAS receivers to provide navigation guidance during the final approach segment of an ILS, LOC, LOC-BC, LDA, SDF, MLS or any other type of approach not approved for "or GPS" navigation is prohibited. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI.

(g) Attitude and Heading Reference System (AHRS)

(1) AHRS Operational Area

Operation in the following regions is not authorized due to unsuitability of the magnetic fields near the Earth's poles:

- North of 72° North latitude at all longitudes
- South of 70° South latitude at all longitudes
- North of 65° North latitude between longitude 75° W and 120° W. (Northern Canada)
- North of 70° North latitude between longitude 70° W and 128° W. (Northern Canada)
- North of 70° North latitude between longitude 85° E and 114° E. (Northern Russia)
- South of 55° South latitude between longitude 120° E and 165° E. (Region south of Australia and New Zealand)

Loss of the G1000 heading and attitude may occur near the poles, but this will not affect the GPS track.

NOTE

In dual GPS installations, only one GPS needs to be available for IFR operations.

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (Continued)

(h) Terrain and Obstacle Display

The G1000 terrain and obstacle information appears on the MFD display as red and yellow tiles or towers, and is depicted for advisory information only. Aircraft maneuvers and navigation must not be predicted upon the use of the terrain display.

Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. Coverage of the obstacle database includes the United States and Europe.

(i) Datalink Weather Display

XM weather data is provided by an optional GDL 69 interface. The weather information display on the MFD is limited to supplemental use only and may not be used in lieu of an official weather data source.

WARNING

Do not use data-linked weather as the sole means for negotiating a path through a thunderstorm area (tactical maneuvering). Avoid any thunderstorm identified as severe or giving an intense radar echo by at least 20 miles. This is especially true under the anvil of a large cumulonimbus.

(j) Traffic Display

Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

(k) Synthetic Vision System (SVS)

Use of the Synthetic Vision system display elements alone for aircraft control without reference to the G1000 primary flight instruments or the aircraft standby instrument is prohibited.

Use of the Synthetic Vision system alone for navigation, or obstacle/terrain avoidance is prohibited.

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (Continued)

(l) ChartView and SafeTaxi®

The G1000 Integrated Avionics System as installed in this aircraft supports approval of AC 20-173 Hardware Class 3, Software Type B Electronic Flight Bag (EFB) electronic aeronautical chart applications when using current FliteChart or ChartView data. For operations under 14 CFR Part 91, it is suggested that a secondary or back up source of aeronautical information necessary for the flight be available to the pilot in the aircraft. The secondary or backup information may be either traditional paper-based material or displayed electronically. If the source of aeronautical information is in electronic format, operators must determine non-interference with the G1000 system and existing aircraft systems for all flight phases.

Do not use SafeTaxi® or Chartview functions as the basis for ground maneuvering. SafeTaxi® and Chartview functions have not been qualified to be used as an Airport Moving Map Display (AMMD). SafeTaxi® and Chartview are intended to improve pilot situational awareness during ground operations and should only be used by the flight crew to orient themselves on the airport surface.

For EASA aircraft (aircraft in compliance with EASA type design TCDS IM.A.232) no EFB airworthiness approval has been obtained. Geo-referenced data (airplane symbol) presented on moving maps and electronic approach charts must be used for situational awareness only. Paper charts or other EASA approved electronically displayed information must be used as the primary source of aeronautical information. If the source of aeronautical information is electronically displayed, operators must determine noninterference with the G1000 system and existing aircraft systems for all flight phases. For EASA aircraft this limitation supersedes the first paragraph of chapter 2.25(l).

2.25 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (Continued)

(m) Minimum fully functional equipment required for flight operations:

Equipment	Number Installed	VFR	IFR
PFD	1	0 (1)	1
MFD	1	0 (2)	1
GEA	1	1	1
GIA	2	2	2
GPS	2	0	1
AHRS (GRS)	1	0	1
ADC (GDC)	1	0	1
Magnetometer (GMU)	1	0	1
Standby Instrument - Attitude	1	0	1
Standby Instrument - Airspeed	1	0 (3)	1
Standby Instrument - Altimeter	1	0 (3)	1
Standby Instrument - Heading	1	0 (3)	1

(1) If the PFD is inoperative during DAY or NIGHT VFR, the MFD must be operative.

(2) If the MFD is inoperative, the PFD must be operative for ALL flight operations.

(3) If this standby instrument indication is inoperative, the equivalent indication on the PFD must be operative.

NOTE

To be considered fully functional, there must be no active CAS Messages, System Annunciations or MFD and PFD Message Advisories related to the equipment required for flight operations. (see table above).

2.26 GFC 700 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

1. The autopilot must be disengaged during takeoff and landing.
2. Autopilot minimum engagement heights:
   a. 400 feet AGL during takeoff and subsequent climb operations.
   b. 1000 feet AGL during cruise and descent operations.
   c. 200 feet AGL during approach operations.
3. Autopilot minimum approved operating speed:

   On Approach - 90 KIAS
   Other than Approach - 80 KIAS
4. Autopilot maximum approved operating speed - 190 KIAS
5. Maximum fuel imbalance during autopilot operations - 10 gal.
6. Autopilot coupled go-around prohibited with one engine inoperative.
7. Maximum autopilot engagement limits:
   a. Pitch axis: +/-50°
   b. Roll axis: +/-75°
8. If the stall warning system is inoperative, Underspeed Protection (USP) will not activate in altitude critical modes (ALT, GS, GP, TO and GA).
9. Autopilot approved for Category 1 precision approaches and non-precision approaches only.

2.27 ASPEN STANDBY INSTRUMENT LIMITATIONS

1. Either the EFD1000 Pilot's Guide (Aspen P/N 091-00005-001 Revision D, or later appropriate revision); or Aspen Evolution Backup Display (EBD) Pilot's Guide (Aspen P/N 091-00027-001 Revision A, or later appropriate revision) must be immediately available to the flight crew.
2. Use of the EFD1000 for IFR operations within 750 nautical miles of the magnetic North or South Pole, is NOT AUTHORIZED.

NOTE

See Section 2.25 (m) for approved VFR and IFR operations when the EFD1000 has an invalid or failed function.

2.29 PLACARDS

In full view of the pilot:

> The markings and 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.

In full view of the pilot:

> ONE ENGINE INOPERATIVE
> AIR MINIMUM CONTROL SPEED 56 KIAS

In full view of the pilot:

> ONE ENGINE INOPERATIVE STALLS NOT RECOMMENDED. CAN CAUSE 300 FT. LOSS OF ALTITUDE AND 30° PITCH ANGLE.

In full view of the pilot:

> WARNING - TURN OFF STROBE LIGHTS WHEN IN CLOSE PROXIMITY TO GROUND, OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

2.29 PLACARDS (Continued)

On instrument panel in full view of the pilot:

Vo 135 AT 3800 LBS
Vo 115 AT 2870 LBS
VLo 140 DN, 109 UP
VLE 140 MAX.
DEMO. X-WIND 17 KTS

In full view of the pilot and passengers: (S/N 4496014 and up)

NO SMOKING

In full view of the pilot when the oil cooler winterization kit is installed:

OIL COOLER WINTERIZATION PLATE TO BE REMOVED WHEN AMBIENT TEMPERATURE EXCEEDS 50°F.

On 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 emergency gear release:

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

2.29 PLACARDS (Continued)

Near gear selector switch:

GEAR UP	109 KIAS MAX.
DOWN	140 KIAS MAX.

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

On inside of baggage compartment door:

BAGGAGE MAX 200 LBS

Adjacent to fuel tank filler caps:

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EMERGENCY PROCEDURES

ISSUED: June 5, 2013
REVISED: July 20, 2015

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 are presented, along with those procedures that are necessary for operation of the airplane.

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

Checklists within this section are divided into two distinct parts.

1. The Emergency Procedures Checklists, depicted within boxes, describe immediate action sequences that should be followed during critical situations.

2. When applicable, amplified procedures are provided immediately below the relevant Emergency Procedures Checklist, to enhance the pilot's understanding of the procedure.

Pilots must familiarize themselves with the procedures in this section and must be prepared to take the appropriate action should an emergency situation arise. These procedures provide one 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. In order to remain proficient, pilots should periodically review standard emergency procedures.

3.1 GENERAL (Continued)

Annunciations and Alerts

The G1000 System produces a number of annunciations and alerts by various means and methods. Some alerts are provided through visual indications, some are aural messages, and some are a combination of the two. The various methods of producing G1000 annunciations and alerts are described in Section 7 of this handbook.

Crew Alerting System (CAS) Messages

For quick reference all messages associated with the Crew Alerting System (Master Warning, Master Caution and Advisory) are provided in this section. A more detailed description of all CAS, System and Aural alerts is provided in Description and Operation Section 7.9 **GARMIN G1000 AVIONICS SYSTEM**

NOTE

A detailed description of the Crew Alerting System and other annunciations and system messages may be found in the Garmin G1000 Cockpit Reference Guide (Garmin P/N 190-1462-01) and the Garmin G1000 Pilot's Guide (Garmin P/N 190-01461-01).

The following tables show the color and significance of the Warning, Caution and Advisory messages which may appear on the Garmin G1000 displays.

3.1 GENERAL (Continued)

Crew Alerting System (CAS) Messages

Warnings – Red

Event	CAS Message	Checklist Page	Cause*
	CAS Warnings with Text Messages		
High Cylinder Head Temperature	L ENG CHT R ENG CHT	3-21	Left and/or right engine CHT exceeds 500 °F
Low Fuel Quantity	L FUEL QTY R FUEL QTY	3-22	Left or right fuel quantity is less than 5 GAL
Alternator Failure	L ALTR FAIL R ALTR FAIL	3-26 3-27	Left and/or right alternator is turned ON and has failed as determined by voltage regulator
Starter Engaged	L START ENGD R START ENGD	3-41	Left or right engine starter is engaged for greater than 30 seconds
Landing Gear Failure	GEAR SYS	3-25	Landing gear system malfunction while on the ground
Landing Gear Position Unsafe	CHECK GEAR	3-24	Landing gear selector is not in the down position when aircraft is less than 400 ft AGL with MAP less than 14 in Hg (mutable aural) or flaps greater than first "notch" (non-mutable aural). Landing gear is selected UP while on the ground.
High Heater Temperature	HTR OVRHEAT	3-43	Cabin heater has sensed an overheat condition and has shut down the heater
Underspeed Protection	USP ACTIVE	3-38c	The autopilot Underspeed Protection (USP) mode is actively preventing an under speed condition.

*CAS Messages/Alerts may have small time delays to avoid nuisance alarms.

3.1 GENERAL (Continued)

Crew Alerting System (CAS) Messages (Continued)

Warnings – Red (Continued)

Event	CAS Message	Checklist Page	Cause*
CAS Warnings with EIS Indications			
Propeller Overspeed	None	3-42	Propeller speed is greater than 2720 RPM for more than 5 seconds.
Oil Temperature Exceedance	None	3-21	Oil Temperature greater than 245°F.
Oil Pressure Exceedance	None	3-21	Oil Pressure less than 25 PSI or greater than 115 PSI.
Total Fuel Quantity Low	None	3-22	Total fuel quantity less than 10 gals.
Battery Voltage	None	NA	Primary battery voltage less than: 24 VOLTS when less than 1100 RPM or 25 VOLTS when greater than 1100 RPM Or Primary battery voltage greater than 32 VOLTS.
Alternator Amperage	None	3-26	Left and/or right alternator amperage is greater than 75 AMPS.
Emergency Battery Voltage	None	3-30	Emergency battery voltage less than 20 VOLTS or greater than 32 VOLTS.
Landing Gear Failure	None	3-25	Malfunction in any of the landing gear as indicated by a red circle on the landing gear display.

*CAS Messages/Alerts may have small time delays to avoid nuisance alarms.

3.1 GENERAL (Continued)

Crew Alerting System (CAS) Messages (Continued)

Cautions – Amber

CAS Event	CAS Message	Checklist Page	Cause*
CAS Cautions with Text Messages			
Low Fuel Quantity	L FUEL QTY R FUEL QTY	3-22	Left or right fuel quantity is less than 10 GAL
Landing Gear Failure	GEAR SYS	3-25	Landing gear system malfunction while in flight
Landing Gear Position Unsafe	CHECK GEAR	3-24	Landing gear selector is not in the down position when aircraft is greater than 400 ft AGL with MAP less than 14 in Hg (mutable aural) or flaps greater than first "notch" (non-mutable aural)
Hydraulic Pump	HYDR PUMP ON	3-40	Hydraulic pump has been running for greater than 16 seconds
Pitot Heat Fail	PITOT HEAT FAIL	3-39	Pitot heat is selected ON and is inoperative
Pitot Heat Off	PITOT HEAT OFF	3-39	Pitot heat is selected OFF (double chime is suppressed)
CAS Cautions with EIS Indications			
Oil Pressure Exceedance	None	3-21	Oil pressure between 26 PSI and 55 PSI when propeller speed is greater than 1100 RPM or oil pressure between 96 and 115 PSI.
Total Fuel Quantity Low	None	3-22	Total fuel quantity is less than 20 GAL.
Emergency Battery Voltage	None	NA	Emergency battery voltage is less than 23.3 VOLTS

3.1 GENERAL (Continued)

Crew Alerting System (CAS) Messages (Continued)

Advisories – White

CAS Event	CAS Message	Checklist Page	Cause*
CAS Advisory with Text Message			
Emergency Power In Use	EMERG BATT ON	3-29	Emergency battery is in use
Fuel Imbalance	FUEL IMBAL	NA	Left and right fuel quantities differ by greater than 10 GAL
PFD Fan Failure	PFD FAN FAIL	3-39	The PFD cooling fan has failed
MFD Fan Failure	MFD FAN FAIL	3-39	The MFD cooling fan has failed
Avionics Fan Failure	AV FAN FAIL	3-39	The avionics cooling fan has failed

Terminology

Many emergencies require some urgency in landing the aircraft. The degree of urgency varies with the emergency; therefore the terms "land as soon as possible" and "land as soon as practical" are employed. These terms are defined as follows:

Land as soon as possible - A landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, and ambient lighting.

Land as soon as practical - Emergency conditions are less urgent, and although the mission is to be terminated, the emergency is such that an immediate landing at the nearest suitable airfield may not be necessary.

3.3 AIRSPEEDS FOR SAFE 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 (115 KIAS @ 2870 LB)
Never exceed ....202 KIAS

3.5 EMERGENCY PROCEDURES CHECKLIST

3.5a Engine Inoperative Procedures

An inoperative engine can be identified by various means, including the fact that directional control is maintained by applying rudder pressure toward the operative engine (DEAD FOOT INDICATES DEAD ENGINE). Additionally, engine indications such as EGT and oil pressure may help in identifying an inoperative engine. After identification, verify complete power loss on that engine by retarding its throttle and noting the absence of engine or aircraft response.

Engine Securing Procedure (Feathering Procedure)

THROTTLE ....CLOSE
PROPELLER ....FEATHER (950 RPM Min.)
MIXTURE...CUT-OFF
COWL FLAP ....CLOSE
MAG LEFT/RIGHT Switches ....OFF
FUEL PUMP Switch..OFF
ALTR Switch ....OFF
FUEL selector ....OFF
Electrical load...REDUCE
XFEED ....AS REQUIRED

3.5a Engine Inoperative Procedures (Continued)

The engine securing procedure should always be accomplished in a sequential order on the inoperative engine. Move the throttle of the inoperative engine towards IDLE. If no changes are noted, the correct identification of the inoperative engine is confirmed. Move the propeller control to FEATHER (fully aft) before the propeller speed drops below 950 RPM, otherwise the propeller will not feather. **One engine inoperative performance will decrease significantly if the propeller of the inoperative engine is not feathered.**

Refer to Section 3.5b: Fuel Management During One Engine Inoperative Operation for proper operation of the fuel cross feed (XFEED) system.

Engine Failure During Takeoff (Speed Below 75 KIAS or Gear Down)

THROTTLES .... IMMEDIATELY CLOSE
Brakes (or land and brake) .... AS REQUIRED
Directional Control .... MAINTAIN

If insufficient runway remains for a complete stop:

Brakes .... APPLY MAXIMUM BRAKING
MIXTURES .... CUT-OFF
FUEL Selectors .... OFF
MAG LEFT/RIGHT Switches .... OFF
BATT MASTR Switch .... OFF
Directional Control .... MAINTAIN and AVOID OBSTACLES

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 landing gear is retracted, the takeoff should also be aborted.

3.5a Engine Inoperative Procedures (Continued)

Engine Failure During Takeoff (Speed Above 75 KIAS)

If sufficient runway remains for a complete stop:

GEAR .... VERIFY DOWN
LAND .... STRAIGHT AHEAD
Directional Control .... MAINTAIN
THROTTLES .... CLOSE
Brakes .... AS REQUIRED

If GEAR is in transit or UP and the decision is made to continue:

WARNING

In many combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to Climb Performance chart- One Engine Operating - Gear Up, Figure 5-19.

MIXTURES .... FULL RICH
PROPELLERS .... FULL INCREASE
THROTTLES .... FULL OPEN
FLAPS .... FULL UP
GEAR .... VERIFY UP
Inoperative Engine .... IDENTIFY and VERIFY
THROTTLE (Inop. Engine) .... CLOSE
PROPELLER (Inop. Engine) .... FEATHER
MIXTURE (Inop. Engine) .... CUT-OFF
Establish Bank .... 2° to 3° INTO OPERATING ENGINE
Climb Speed .... 88 KIAS
Trim .... ADJUST TO 2° to 3° BANK TOWARD OPERATING ENGINE WITH APPROXIMATELY 1/2 TRAPEZOID SLIP INDICATED ON THE TURN AND BANK INDICATOR
COWL FLAP (Operating Engine) .... AS REQUIRED
COWL FLAP (Inop. Engine) .... CLOSE
MAG LEFT/RIGHT Switches (Inop. Engine) .... OFF
FUEL PUMP (Inop. Engine) .... OFF
ALTR Switch (Inop. Engine) .... OFF
FUEL Selector (Inop. Engine) .... OFF

Land as soon as practical.

3.5a Engine Inoperative Procedures (Continued)

If engine failure occurs after liftoff with the gear still down and 75 KIAS has been attained, the best course of action 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.

Attempt to maintain the One Engine Inoperative Best Rate of Climb speed (VYSE: 88 KIAS). Do not allow airspeed to decrease below the One Engine Inoperative Air Minimum Control speed (VMCA: 56 KIAS).

An inoperative engine can be identified by various means, including the fact that directional control is maintained by applying rudder pressure toward the operative engine (DEAD FOOT INDICATES DEAD ENGINE). Additionally, engine indications such as EGT and oil pressure may help in identifying an inoperative engine. After identification, verify complete power loss on that engine by retarding its throttle and noting the absence of engine or aircraft response.

Once the aircraft is trimmed and the inoperative engine is secured, 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.

3.5a Engine Inoperative Procedures (Continued)

Engine Failure During Climb

Airspeed	MAINTAIN 88 KIAS
Directional Control	MAINTAIN
MIXTURE	FULL RICH
PROPELLERS	FULL INCREASE
THROTTLES	FULL OPEN
Inoperative Engine	IDENTIFY and VERIFY
THROTTLE (Inop. Engine)	CLOSE
PROPELLER (Inop. Engine)	FEATHER
MIXTURE (Inop. Engine)	CUT-OFF
Establish Bank	2° to 3° INTO OPERATING ENGINE
Climb Speed	88 KIAS
Trim	ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 TRAPEZOID SLIP INDICATED ON THE TURN AND BANK INDICATOR
COWL FLAP (Operating Engine)	AS REQUIRED
COWL FLAP (Inop. Engine)	CLOSE
MAG LEFT/RIGHT Switches (Inop. Engine)	OFF
FUEL PUMP (Inop. Engine)	OFF
ALTR Switch (Inop. Engine)	OFF
FUEL Selector (Inop. Engine)	OFF

Land as soon as practical.

An inoperative engine can be identified by various means, including the fact that directional control is maintained by applying rudder pressure toward the operative engine (DEAD FOOT INDICATES DEAD ENGINE). Additionally, engine indications such as EGT and oil pressure may help in identifying an inoperative engine. After identification, verify complete power loss on that engine by retarding its throttle and noting the absence of engine or aircraft response.

3.5a Engine Inoperative Procedures (Continued)

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 One Engine Inoperative Landing procedure at the nearest suitable airport.

Engine Failure During Flight (Speed Below V_{MCA})	
Rudder	APPLY AGAINST YAW
THROTTLES (Both Engines)	RETARD TO ARREST TURN/YAW
Pitch Attitude	LOWER NOSE TO ACCELERATE ABOVE V_{MCA} (56 KIAS)
Operating 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	IDENTIFY and VERIFY
PROPELLER (Inop. Engine)	FEATHER
MIXTURE (Inop. Engine)	CUT-OFF
Trim	ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 TRAPEZOID SLIP INDICATED ON THE TURN AND BANK INDICATOR
COWL FLAP (Operating Engine)	AS REQUIRED
COWL FLAP (Inop. Engine)	CLOSE
MAG LEFT/RIGHT Switches (Inop. Engine)	OFF
FUEL PUMP (Inop. Engine)	OFF
ALTR Switch (Inop. Engine)	OFF
FUEL Selector (Inop. Engine)	OFF

An inoperative engine can be identified by various means, including the fact that directional control is maintained by applying rudder pressure toward the operative engine (DEAD FOOT INDICATES DEAD ENGINE). Additionally, engine indications such as EGT and oil pressure may help in identifying an inoperative engine. After identification, verify complete power loss on that engine by retarding its throttle and noting the absence of engine or aircraft response.

3.5a Engine Inoperative Procedures (Continued)

In order to maximize control effectiveness during the recovery, bank the airplane 5° towards the operating engine.

Engine Failure During Flight (Speed Above VMCA)

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

Before securing inoperative engine:

FUEL PUMP ....ON
MIXTURE...FULL RICH
FUEL QTY... CHECK
CARB HEAT ....ON
OIL PSI .... CHECK
OIL °F.. CHECK
MAG LEFT/RIGHT Switches .... CHECK

If engine does not restart, complete Engine Securing Procedure.

Power (Operating Engine)..................................AS REQUIRED
FUEL QTY (Operating Engine Tank) .... SUFFICIENT
(XFEED AS REQUIRED)
FUEL PUMP (Operating Engine)...........................AS REQUIRED
COWL FLAP (Operating Engine) ....AS REQUIRED
Trim ....ADJUST TO 2° to 3° BANK
TOWARD OPERATIVE ENGINE
WITH APPROXIMATELY 1/2
TRAPEZIOD SLIP INDICATED ON
THE TURN AND BANK INDICATOR
Electrical Load ....DECREASE TO MIN. REQUIRED

Land as soon as practical.

If oil temperature is high and oil pressure is zero, suspect loss of oil and do not attempt to restart the engine.

3.5a Engine Inoperative Procedures (Continued)

One Engine Inoperative Landing

Inoperative Engine .... ENGINE SECURING PROCEDURE COMPLETE
Seat Belts/Harnesses .... SECURE
FUEL Selector (Operating Engine) .... ON
MIXTURE (Operating Engine) .... FULL RICH
PROPELLER Control (Operating Engine) .... FULL INCREASE
FUEL PUMP (Operating Engine) .... ON
COWL FLAP (Operating Engine) .... AS REQUIRED
Altitude & Airspeed .... MAKE NORMAL APPROACH

When Landing is Assured:

GEAR .... DOWN
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 OPERATING ENGINE)

WARNING

Under some conditions of loading and density altitude, aircraft single engine climb performance and obstacle clearance may make a one engine inoperative go-around impossible (See Section 5). Sudden application of power during one engine inoperative operation can make control of the airplane more difficult.

CAUTION

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

3.5a Engine Inoperative Procedures (Continued)

One Engine Inoperative Go-Around

MIXTURE (Operating Engine)..FULL RICH
PROPELLER (Operating Engine) .... FULL INCREASE
THROTTLES .... SMOOTHLY ADVANCE TO TAKEOFF POWER
FLAPS ....RETRACT INCREMENTALLY
GEAR ....UP
Airspeed...88 KIAS
Trim ....ADJUST TO 2° to 3° BANK
TOWARD OPERATIVE ENGINE
WITH APPROXIMATELY 1/2
TRAPEZOID SLIP INDICATED ON
THE TURN AND BANK INDICATOR
COWL FLAP (Operating Engine) ....AS REQUIRED

WARNING

Under some conditions of loading and density altitude, aircraft single engine climb performance and obstacle clearance may make a one engine inoperative go-around impossible (See Section 5). Sudden application of power during one engine inoperative operation can make control of the airplane more difficult.

WARNING

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

WARNING

Autopilot coupled go-around is not authorized during single engine operations.

CAUTION

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

3.5a Engine Inoperative Procedures (Continued)

Summary of Factors Affecting Single Engine Operations

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

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.

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3.5a Engine Inoperative Procedures (Continued)

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. 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.
3. Airspeed should not be allowed to fall below VXSE (82 KIAS) any lesser speed will result in significantly reduced climb performance.
4. Once obstacles and terrain are cleared, accelerate to the single-engine best rate-of-climb airspeed.
5. To maximize controllability during recovery following an 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 trapazoid of the turn and slip indicator being displaced 1/2 to 3/4 towards the operating engine.
6. 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 trapazoid displacement towards the operating engine. This trapazoid displacement should be maintained during any necessary maneuvering to maintain best possible climb margins

3.5b Fuel Management - One Engine Inoperative

Cruising - One Engine Inoperative

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

FUEL Selector (Operating Engine)..ON
FUEL Selector (Inoperative Engine) ....OFF
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 (Operating Engine)....................................XFEED
FUEL Selector (Inoperative Engine) ....OFF
FUEL PUMPS..OFF
(except in case of engine driven pump failure, electric fuel pump on operating engine side must be used)

NOTE

Use XFEED in level cruise flight only.

Landing - One Engine Inoperative

FUEL Selector (Operating Engine)..ON
FUEL Selector (Inoperative Engine) ....OFF

3.5c Air Starting Procedure

Unfeathering Procedure / Unfeathering Accumulator Functioning

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
MAG LEFT/RIGHT Switches (Inoperative Engine) .... ON
FUEL PUMP (Inoperative Engine) .... ON
MIXTURE (Inoperative Engine) .... FULL RICH
THROTTLE (Inoperative Engine) .... Open 1/4 inch
PROPELLER (Inoperative Engine) .... FULL INCREASE
THROTTLE .... Reduce power until engine is warm
ALTR .... ON (After restart)

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.

3.5c Air Starting Procedure (Continued)

Unfeathering Procedure/ Starter Assisted
FUEL Selector (Inoperative Engine) .... ON
MAG LEFT/RIGHT Switches (Inoperative Engine)........ ON
FUEL PUMP (Inoperative Engine)........ ON
MIXTURE (Inoperative Engine) .... FULL RICH
THROTTLE (Inoperative Engine) .... Two full strokes and then open 1/4 inch
PROPELLER (Inoperative Engine) .... INCREASE (to cruise setting)
ENG START (Inoperative Engine)........ ENGAGE UNTIL PROP WINDMILLS
ENG PRIMER (Inoperative Engine) .... AS REQUIRED
THROTTLE .... REDUCE POWER until engine is warm
ALTR .... ON (After restart)

3.5d Engine Roughness

Engine Roughness

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.

CARB HEAT .... ON

If roughness continues after one minute:

CARB HEAT .... OFF
MIXTURE .... ADJUST for MAXIMUM Smoothness
FUEL PUMP .... ON
Engine Gauges .... CHECK
MAG LEFT/RIGHT Switches .... CHECK (One at a time)

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

Engine roughness is usually due to carburetor icing which is indicated by a drop in RPM, and may be accompanied by a slight loss of airspeed or altitude. If too much ice is allowed to accumulate, restoration of full power may not be possible; therefore, prompt action is required. Upon completion of this checklist, if roughness persists, consider a precautionary landing.

3.5e Engine Indication System (EIS)

Oil Pressure

Indication: Master Warning, Triple Chime, Flashing Red Oil Pressure Indication

Affected Engine.. VERIFY

Low Oil Pressure:

THROTTLE (Affected Engine)..........................MINIMUM REQUIRED
PROPELLER (Affected Engine).. DECREASE

If accompanied by high oil temperature:

Affected Engine...................... Complete the Engine Securing Procedure
Land as soon as possible.

If accompanied by normal oil temperature:

Land as soon as practical.

High Oil Pressure:

THROTTLE (Affected Engine)..........................MINIMUM REQUIRED
PROPELLER (Affected Engine).. DECREASE

Land as soon as practical.

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. Oil temperature may be monitored to corroborate low oil pressure readings.

A complete loss of oil pressure may signify oil exhaustion. 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 above 950 RPM is the propeller will not feather.

3.5e Engine Indication System (EIS) (Continued)

High Oil / Cylinder Head Temperature

Indication: Master Warning, Triple Chime, Flashing Red Oil Temperature Indication

Or

Indication: Master Warning, Triple Chime, L ENG OHT / R ENG OHT

COWL FLAPS .... OPEN
MIXTURE .... ENRICHEN
Power .... REDUCE
Airspeed .... INCREASE
(If altitude permits)

Abnormally high oil temperature may be caused by low oil level. Monitor oil pressure gage for accompanying loss of pressure.

Excessive cylinder head temperature may parallel excessive oil temperature.

If the problem persists, land as soon as practical and have the cause investigated.

3.5e Engine Indication System (EIS) (Continued)

Loss of Fuel Flow
FUEL PUMP (Affected Engine)....................................ON

CAUTION

If normal engine operation is not immediately re-established, the FUEL PUMP should be turned off. The lack of engine response could indicate a leak in the fuel system. If a fuel leak is verified, switch the fuel selector to OFF and proceed with the Engine Securing Procedure.

Fuel Quantity
Indication: Master Warning, Triple Chime, L FUEL QTY / R FUEL QTY
Master Caution, Double Chime, L FUEL QTY / R FUEL QTY
If one tank has low fuel quantity:
Fuel Selector (engine with low fuel quantity) ....XFEED
Land as soon as practical.
If both tanks have low fuel quantity:
FUEL Selectors ....ON
Land as soon as possible.

The L FUEL QTY or R FUEL QTY warning CAS messages alert the pilot of low fuel quantity.

A Master Warning will trigger if the fuel quantity in either tank is 5 GAL or less, or if the Total Fuel Quantity is 10 GAL or less.

A Master Caution will trigger if the fuel quantity in either tank is 10 GAL or less, or if the total fuel quantity is 20 GAL or less.

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3.5f Engine Fire

Engine Fire During Start

If engine has not started:

MIXTURE .... CUT-OFF
THROTTLE .... FULL OPEN
ENG START .... 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
FUEL PUMPS .... OFF
MIXTURES .... CUT-OFF
THROTTLES .... FULL OPEN
External Fire Extinguisher .... USE
Airplane .... EVACUATE

NOTES

If fire continues, shut down both engines and evacuate.

Engine Fire in Flight

FUEL Selector (Affected Engine) .... OFF
THROTTLE (Affected Engine) .... CLOSE
PROPELLER (Affected Engine) .... FEATHER
MIXTURE (Affected Engine) .... 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.

3.5g Electrical Fire

Electrical Fire	
EMERG BATT	VERIFY ARM
BATT MASTR	OFF
ALTR LEFT/RIGHT Switches	OFF
Vents	CLOSED (To avoid drafts)
CABIN HEAT	OFF

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

Land as soon as possible.

Prior to landing:

GEAR .... Use Manual Extension of Landing Gear procedure

WARNING

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

3.5h Landing Gear Unsafe

Landing Gear Unsafe	
Indication: Master Warning, Aural Alert, CHECK GEAR	
GEAR	DOWN
Gear Position Indications	3 GREEN
Indication: Master Caution, Aural Alert, CHECK GEAR	
GEAR	DOWN (if desired)
Gear Position Indications	3 GREEN

The CHECK GEAR aural alert is activated to notify the pilot that the landing gear are not down and locked, when the aircraft is in a landing configuration. The alert is triggered when manifold pressure is less than 14 In. Hg. on either engine, or flaps are extended to the second or third notch.

3.5h Landing Gear Unsafe (Continued)

The CHECK GEAR Caution is triggered when above ~400 feet AGL and the Warning below ~400 feet AGL.

The CHECK GEAR aural that is triggered by low manifold pressure may be silenced by pressing the Master Warn Reset or Master Caution Reset switch as appropriate. The CHECK GEAR aural that is triggered by flap position, can only be silenced by retracting the flaps or extending the landing gear.

3.5i Landing Gear Malfunctions

Landing Gear Malfunction

Indication: Master Warning, Triple Chime, GEAR SYS

Indication: Master Caution, Double Chime, GEAR SYS

Indication: EIS Landing Gear Display

Check following before extending gear manually:

Circuit Breakers .... CHECK
BATT MASTR Switch .... ON
ALTR LEFT/RIGHT .... CHECK

Manual Extension of Landing Gear:

Airspeed .... REDUCE (100 KIAS max.)
GEAR .... DOWN
Emerg. Gear Extend Knob .... Move wire guard and PULL
Gear Position Indications .... 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.

3.5j Electrical Failures

CAUTION

The LEFT ALTR (Row 1, Column 15) and RIGHT ALTR (Row 1, Column 16) circuit breakers should not be opened manually when the alternators are functioning properly.

NOTE

Tripped circuit breakers should be reset only if the affected system/component is considered essential for safety of flight. Prior to resetting the circuit breaker, wait at least one minute and verify there is no smoke or "burning smell". If the circuit breaker opens a second time, leave the circuit breaker out. Have a maintenance inspection performed prior to resetting the circuit breaker. Do not reset any nonessential circuit breakers in flight.

Single Alternator Failure

Indication: Master Warning, Triple Chime, L ALTR FAIL or R ALTR FAIL

Verify Failure.................CHECK ALTR AMPS Indication
Electrical Load.................REDUCE less than 75 AMPS
(60 AMPS if on ground)
Failed ALTR Switch.................OFF
Failed Alternator Field Circuit Breaker.................RESET
L ALTR FIELD Circuit Breaker (Row 2, Col. 15)
R ALTR FIELD Circuit Breaker (Row 2, Col. 16)
Failed ALTR Switch.................ON

If alternator still failed:

Failed ALTR Switch.................OFF
ALTR AMPS Indication.................MONITOR
(MAINTAIN less than 75 AMPS)
(60 AMPS if on ground)

3.5j Electrical Failures (Continued)

Dual Alternator Failure

Indication: Master Warning, Triple Chime, L ALTR FAIL and R ALTR FAIL

CAUTION

Approximately 30 minutes of electrical power remains after a dual alternator failure. To ensure 30 minutes of battery power, complete the Load Shedding procedure below, within 3 minutes of dual alternator failure.

Verify Failure ....CHECK ALTR AMPS Indication

Attempt to reset alternators:

Failed ALTR Switches ....OFF
Failed Alternators Field Circuit Breaker ....RESET if tripped
L ALTR FIELD Circuit Breaker (Row 2, Col. 15)
R ALTR FIELD Circuit Breaker (Row 2, Col. 16)
Failed ALTR Switches ....ON

If only one alternator resets:

Operating ALTR Switch ....ON
Failed ALTR Switch ....OFF
Electrical Load ....MAINTAIN LESS than 75 AMPS
(60 AMPS on ground)
Ammeter ....MONITOR

If neither alternator resets:

Both Alternator Switches ....OFF
Electrical Load ....SHED in less than 3 minutes
NON ESS BUS Circuit Breaker (Row 1, Col. 1) ....PULL
LIGHTING BUS Circuit Breaker (Row 1, Col. 2) ....PULL
AVIONICS BUS Circuit Breaker (Row 1, Col. 3) ....PULL
AVION MASTER Switch ....OFF
EMER BATT ....VERIFY ARM

3.5j Electrical Failures (Continued)

↓

To ensure 30-minutes of battery life:

BATT AMPS..-20 AMPS Maximum
PITOT HEAT..15 Minutes Usage Maximum
Com Radio...3 Minutes Usage Maximum

If neither alternator resets, the main battery becomes the primary source of electrical power. As battery power is depleted, system voltage may be reduced to a level that is insufficient to support the required electrical load. If this occurs the emergency battery should activate automatically. Activation of the emergency battery may be verified by the CAS Advisory message EMER BATT ON, and by the VOLT indication changing to E VOLTS on the Engine Indicating System. If the emergency battery does not activate automatically (at approximately 20 VOLTS), the BATT MASTR, ALTR 1, and ALTR 2 switches should be turned OFF, thereby forcing the emergency battery to power the Essential Bus.

Refer to Complete Electrical Failure checklist if EMER BATT ON illuminates.

3.5j Electrical Failures (Continued)

Complete Electrical Failure

Indication: Single Chime, EMERG BATT ON

CAUTION

The emergency battery is designed to provide electrical power to all items on the emergency bus for a minimum of 30 minutes.

NOTE

The VOLTS indication on the EIS window automatically changes to the emergency bus voltage (E VOLTS) when operating on the emergency battery.

NOTE

Cooling air for the PFD is lost when operating on the emergency bus as indicated by the PFD FAN FAIL CAS Advisory message.

EMERG BATT Switch....................Verify ARM
Standby Flight Instrument....................Verify OPERATIONAL
Aircraft Control....................Use PFD and Standby Instrument
BATT MASTR Switch....................OFF
ALTR LEFT/RIGHT Switches....................OFF

Prior to landing:

Landing Light....................INOPERATIVE
GEAR....................Use Manual Extension of Landing Gear procedure

Approximately 30 minutes of electrical power is available.
Land as soon as possible.

The following equipment will operate while on the emergency bus:

- Primary Flight Display (reversionary mode)
- Engine Instruments
- Com 1
- Nav 1
- Standby Instrument
- Audio Panel
- Avionics Lighting/Dimming

3.5j Electrical Failures (Continued)

Emergency Battery Voltage

Indication: Master Warning, Triple Chime, Flashing Red E VOLTS Indication.

WARNING

Complete electrical failure is imminent.

Land as soon as possible.

3.5k Avionics System Failures

PFD Failure

Indication: PFD display goes blank.

Standby Instrument .... Verify OPERATIONAL
Aircraft Control .... Use standby instrument
DISPLAY BACKUP (red button on audio panel)........................PUSH (button extended)
Aircraft Control.................................Use MFD and Standby Instrument
COM 2...ACTIVATE and TUNE as necessary
NAV 2...ACTIVATE and TUNE as necessary
COM2/MIC...SELECT on Audio Panel
DME..................................SELECT NAV2 in DME TUNING Window
Exit and avoid IMC as soon as practical.

NOTE

If the PFD fails, the MFD will remain in normal display mode. Pushing the DISPLAY BACKUP button on the audio panel puts the MFD in reversionary mode, which depicts primary flight instruments, engine and systems information on a single display format. Certain map functions will be lost in reversionary mode.

3.5k Avionics System Failures (Continued)

NOTE

If the PFD failure occurs while operating on NAV1 DME, the NAV 1 DME information will still be available. If however, the pilot selects NAV2 DME, NAV1 DME may not be re-selected.

NOTE

The following features will become inoperative if the PFD fails:

- Com 1 (red x'd but 121.5 MHz remains available)
- Nav 1
- GPS 1
- Traffic
- GFC700 Autopilot (including ESP and USP)

Following a PFD failure, the autopilot computer will disconnect and not be available for use.

Attitude, heading, airspeed and altitude are available on the standby instrument and on the MFD after the DISPLAY BACKUP button is pressed. It is the pilot's responsibility to compare these parameters to verify accuracy.

GPS and VOR2 navigation, as well as flight planning are available via the inset map on the MFD. Weather products (if installed) that were displayed on the MFD prior to the PFD failure will still be presented on the inset map on the MFD in reversionary mode.

3.5k Avionics System Failures (Continued)

MFD Failure

Indication: MFD display goes blank.

DISPLAY BACKUP on audio panel..PUSH (button extended)

Exit and avoid IMC as soon as practical.

NOTE

The PFD will automatically revert to reversionary mode.

NOTE

The following features will become inoperative with MFD failure:

- Com 2 (red x'd but 121.5 MHz remains available)
- Nav 2
- GPS 2
- GDL 69 (Garmin Datalink - XM)
- DME
- ADF
- ESP

NOTE

If the GFC700 autopilot was engaged prior to MFD failure, it will remain engaged in its current lateral and vertical modes. The modes cannot be changed and if the autopilot is disengaged, it cannot be re-engaged.

Attitude, heading, airspeed and altitude indications are available on the standby instrument and on the PFD in reversionary mode. It is the pilot's responsibility to compare these parameters to verify accuracy.

After an MFD failure, the PFD should automatically revert to reversionary mode. However, pressing the DISPLAY BACKUP button ensures that the PFD reverts. Without automatic or manual reversion of the PFD, engine indications would not be available.

3.5k Avionics System Failures (Continued)

Attitude Heading Reference System (AHRS) Failures

AHRS Total Failure

On Ground:

Indication: Sky/Ground presentation removed, course pointer straight up, red-x's and amber text on all attitude and heading indications.

PFD Message Advisories (MSG Softkey) .... CONSIDER
AHRS Circuit Breaker (Row 2, Col. 8) .... RESET

If AHRS data still invalid:

IFR operations not authorized.

AHRS Total Failure

In Flight:

Indication: Sky/Ground presentation removed, course pointer straight up, red-x's and amber text on all attitude and heading indications.

Standby Instrument .... VERIFY NO FAILURE INDICATIONS
Attitude and Heading .... Use Standby Instrument

NOTE

The course pointer will point upwards at all times, but the CDI can still be used for navigating in GPS and VOR/LOC modes.

Course .... Set using CRS knob on PFD
PFD Message Advisories (MSG Softkey) .... CONSIDER
AHRS Circuit Breaker (Row 2, Col. 8) .... RESET

If AHRS data still invalid:

Exit and avoid flight in IMC

NOTE

The autopilot (including ESP and USP) will be inoperative if AHRS remains inoperative.

NOTE

Traffic (TAS) symbols will not be displayed on the moving map, however TAS information remains available on the TAS page.

NOTE

For partial AHRS failures, a red-x and amber text will appear over the affected indication(s).

3.5k Avionics System Failures (Continued)

Air Data Computer (ADC) Failures

ADC Total Failure

On Ground:

Indication: Red-x's and amber text on all Air Data indications.

PFD Message Advisories (MSG Softkey) ....CONSIDER
ADC Circuit Breaker (Row 2, Col. 7) ....RESET

If ADC data still invalid:

IFR operations not authorized.

In Flight:

Indication: Red-x's and amber text on all Air Data indications.

Standby Instrument .... VERIFY AIR DATA INDICATIONS
Airspeed, Altitude and Vertical Speed.................................. USE Standby Instrument
PFD Message Advisories (MSG Softkey) ....CONSIDER
ADC Circuit Breaker (Row 2, Col. 7) ....RESET

NOTE

During failure of ADC, Traffic Avoidance System (TAS) and GFC700 autopilot will be inoperative.

If ADC data still invalid:

Exit and avoid flight in IMC.

ISSUED: June 5, 2013
REVISED: October 27, 2014

3.5k Avionics System Failures (Continued)

Erroneous Indication or Loss of Engine and Fuel Displays

Indication: Red-x over affected engine indication or fuel display

NOTE

Erroneous information should be suspected when indications do not agree with other system information. Erroneous indications may be identified by comparing a display with other system information.

1. Set power based on throttle lever position, engine sound and speed.
2. Monitor other indications to determine the health of the engine.
3. Use known power settings from POH power setting tables for approximate fuel flow values.
4. Use other system information, such as annunciator messages, fuel totalizer quantity and flow, to safely complete the flight.

If indications for any of the following are invalid:

- All Engine Parameters
- VOLTS
- ALTR AMPS
- BATT AMPS
- FUEL QTY

GEA circuit breaker (Row 2, Col. 3)..RESET

If all engine parameters are still unavailable, *land as soon as practical.*

3.5k Avionics System Failures (Continued)

Erroneous or Loss of Warning/Caution CAS Messages

Indication: **Red-x is shown over the CAS message window or CAS message present when not expected or CAS message not present when expected.**

1. If a red-x is placed over the CAS message window, special attention should be placed on all engine and airframe related indications. The Master Warning and Master Caution indicators will not function, therefore a failure of a particular system can go undetected.

NOTE

See Section 3.1 of this handbook for a list of CAS Warning, Caution and Advisory messages that may be inoperative.

2. If a CAS message appears that is not expected, treat it as if the condition exists.
3. If an abnormal condition exists but the CAS system has not been activated, use other available information to confirm the condition exists. If it cannot be determined that the condition does not exist, treat the situation as if the condition does exist and take appropriate action.

NOTE

CAS messages are inhibited for many parameters on the engine information system display (EIS) of the MFD. The Master Warning and Master Caution indicators and associated chimes are still activated whenever any indicated parameter enters the red or amber color bands.

If a red-x appears over the CAS message window, ***land has soon as practical.***

3.5k Avionics System Failures (Continued)

Communications (COM1 and COM2) Failure

Indication: Inability to communicate/receive on COM1 and COM2.

NOTE

No matter what the cause of a Com failure, removing power from the audio panel actuates a fail-safe connection between the pilot's headset/ microphone and COM1.

AUDIO MKR circuit breaker (Row 2, Col. 9) .... PULL

Exit and avoid IMC as soon as practical.

Dual GPS Failure

Indication: Amber "DR" annunciation on HSI, Amber "DR" superimposed over airplane symbol on moving map.

Navigation .... Use alternate source of navigation (ILS, LOC, VOR, DME, ADF)

If no alternate navigation sources are available:

Dead Reckoning (DR) Mode - Is active when in Enroute mode (the airplane is greater than 30 NM from the destination airport in flight plan).

Navigation .... Use the airplane symbol and magenta course line on the MAP display and the amber CDI on the HSI.

WARNING

In DR mode, the estimated position becomes increasingly unreliable over time and should not be used as a sole means of navigation. In DR mode the CDI is initially displayed in amber, but is removed after 20 minutes.

3.5k Avionics System Failures (Continued)

WARNING

TAWS is Inoperative.

DR mode uses heading, airspeed and last known GPS position to estimate the airplanes current position. All maps with an airplane symbol show a ghosted airplane and a "DR" label.

NOTE

Traffic Information System (TIS) and Traffic Advisory System (TAS) are not dependent on GPS information. Therefore, the position of displayed traffic relative to the airplane symbol on the map is still accurate.

Loss of Integrity (LOI) Mode - Is active when GPS integrity is insufficient for the current phase of flight.

Navigation .... Crosscheck / use other navigation sources as required.

NOTE

All information derived from GPS or DR is removed from the displays.

The airplane symbol is removed from all maps. The map will remain centered at the last known position.

"NO GPS POSITION" is shown in the center of the map.

TAWS and TAS are inoperative.

3.5k Avionics System Failures (Continued)

Autopilot Malfunction

Indication: An unexpected roll or pitch deviation from the desired flight path, possible flight director command deviations from desired aircraft attitudes and possible autopilot disconnect with red AFCS annunciation, amber or red A/P annunciation on PFD.

Control Wheel .... GRASP FIRMLY
Attitude Indicators .... CROSSCHECK
A/P DISC Switch .... DEPRESS and HOLD
Pitch Trim .... RETRIM as necessary
AUTOPILOT Circuit Breaker (Row 3, Col. 2) .... PULL
Autopilot .... DO NOT RE-ENGAGE

Automatic Autopilot Disconnect

Indication: Flashing red and white A/P on PFD and aural disconnect tone

A/P DISC Switch .... DEPRESS and RELEASE
(cancels disconnect tone, and disconnects Autopilot)
Pitch Trim .... RETRIM as necessary

NOTE

The autopilot disconnect may be accompanied by a red boxed PTCH (pitch), ROLL, or PTRM annunciation on the PFD, indicating the axis which has failed. The autopilot cannot be re-engaged with any of these annunciations present.

3.5k Avionics System Failures (Continued)

Electric PitchTrim Failure

Indication: **Red boxed PTRM on PFD**

NOTE

Loss of the electric pitch trim servo will not cause the autopilot to disconnect. Monitor pitch attitude for unusual behavior. Be alert to possible autopilot out-of-trim conditions (see AUTOPILOT OUT OF TRIM procedure this section) and expect residual control forces upon disconnect. The autopilot will not re-engage after disconnect with failed pitch trim.

Autopilot .... DISCONNECT

Electric Pitch Trim Runaway

Indication: **An unexpected pitch deviation from the desired flight path and red PTRM annunciation**

NOTE

After the autopilot is disengaged, it can not be re-engaged until the electric pitch trim system regains functionality.

Control Wheel .... GRASP FIRMLY
Attitude Indicators .... CROSSCHECK
A/P DISC Switch .... DEPRESS and HOLD
PITCH TRIM Circuit Breaker (Row 3, Col. 1) .... PULL
Pitch Trim .... RETRIM MANUALLY

ISSUED: June 5, 2013
REVISED: October 27, 2014

3.5k Avionics System Failures (Continued)

Autopilot Overspeed Recovery

Indication: **MAXSPD** **annunciation at the top of the PFD airspeed tape**

This autopilot mode is active whenever the aircraft actual or projected airspeed exceeds V_{NE}.

THROTTLE..REDUCE POWER as required
Autopilot Pitch Reference ....RESET to slow the aircraft
Autopilot...DISCONNECT if required

NOTE

Overspeed recovery mode provides a pitch up command (to a maximum level flight altitude) to decelerate the airplane below V_{NE}. The autopilot must be engaged for it to follow the pitch-up commands of the flight director. Overspeed recovery is not active in altitude hold (ALT), glideslope (GS) or glidepath (GP) modes. The speed reference cannot be adjusted while in overspeed recovery mode.

Autopilot Underspeed Recovery

Indication: **MINSPD** **annunciation at the top of the PFD airspeed tape and** **USP ACTIVE** **annunciation on PFD**

This autopilot mode is active whenever the autopilot is engaged and the airspeed has decreased below a minimum threshold.

THROTTLE...INCREASE POWER as required
Flaps Position ....CONSIDER
Landing Gear Position...CONSIDER

3.5k Avionics System Failures (Continued)

Autopilot Out-Of-Trim

Indication: Amber, ← AIL, AIL →, ↑ ELE, or ↓ ELE on PFD

CAUTION

Do not attempt to overpower the autopilot in the event of a mistrim. The autopilot servos will oppose pilot input and will trim opposite the direction of pilot input (pitch axis only). This could lead to a significant out-of-trim condition. Disconnect the autopilot using the AP DISC / TRIM INTER switch if manual control is desired.

If AIL → or ← AIL annunciation .... Verify SLIP/SKID INDICATOR centered.
If ↑ ELE or ↓ ELE annunciation .... Suspect elevator trim issue
Control Wheel .... GRASP FIRMLY with both hands

CAUTION

Be prepared to apply a sustained control force in the direction of the annunciation arrow. For example, an arrow pointing to the right with AIL annunciation indicates that sustained right wing down control wheel force will be required upon autopilot disconnect.

AP DISC Switch .... DEPRESS
Affected trim system .... RETRIM
Autopilot .... RE-ENGAGE if available

If the mistrim indication re-occurs, disconnect the autopilot for the remainder of the flight or until the offending condition is resolved.

3.5k Avionics System Failures (Continued)

Abnormal Flight Director Mode Transitions

Indication: Flashing lateral or vertical mode annunciations on PFD

NOTE

Upon loss of a selected mode, the system will revert to the default mode for the affected axis, either ROL or PIT.

Loss of selected vertical mode

Autopilot Mode Controls............SELECT ANOTHER VERTICAL MODE

If on an instrument approach:
Autopilot...DISCONNECT (if coupled) and continue manually or execute missed approach

Loss of selected lateral mode

Autopilot Mode Controls............SELECT ANOTHER LATERAL MODE

If on an instrument approach:
Autopilot...DISCONNECT (if coupled) and continue manually or execute missed approach

Autopilot Preflight Test Failure

Indication: Red Boxed PFT on PFD

AUTOPILOT Circuit Breaker (Row 3, Col. 2)..............................PULL
PITCH TRIM Circuit Breaker (Row 3, Col. 1)..............................PULL
AUTOPILOT and PITCH TRIM Circuit Breakers..........................RESET simultaneously

NOTE

When the AUTOPILOT circuit breaker is pulled, the red PFT annunciation will be removed and the autopilot will be unavailable. One attempt at resetting the circuit breakers is allowed.

3.5k Avionics System Failures (Continued)

Loss Of Navigation Information

Indication: **Amber VOR, VAPP, GPS, BC, LOC or GS flashing on PFD**

NOTE

If a navigation signal is lost while the autopilot is tracking it, the autopilot will roll the aircraft wings level and default to roll mode (ROL).

Autopilot.......................................SELECT ANOTHER LATERAL MODE
Nav Source.......................................SELECT A VALID NAV SOURCE
Autopilot...SELECT NAV

If on an instrument approach at the time the navigation signal is lost:

Missed Approach...EXECUTE
(A second approach may be attempted using other navaids.)

3.5k Avionics System Failures (Continued)

Cooling Fan Failures

Indication: CAS Advisory, Single Chime, AV FAN FAIL / PFD FAN FAIL / MFD FAN FAIL

If failure occurs on ground:

Do not fly until issue is resolved.

If failure occurs in flight:

Fix issue prior to next flight.

When any of these CAS messages illuminate, it is possible to exceed the manufacturer's specified temperature limits for the affected equipment. The avionics fan (AV FAN FAIL advisory CAS message) supplies cooling air to the transponder and GIA. Displays may automatically dim if excessive temperatures are detected.

Pitot Heat

Indication: Master Caution, No Chime, PITOT HEAT OFF

PITOT HEAT Switch....................ON (If desired)

Indication: Master Caution, Double Chime, PITOT HEAT FAIL

PITOT HEAT Switch....................OFF
PITOT HEAT Circuit Breaker (Row 2, Col. 2) ....RESET
PITOT HEAT Switch....................ON

If Pitot Heat still inoperative:

Exit and Avoid Instrument Meteorological Conditions.

To aviod damage to the Pitot heating units, continuous ground operation should be limited to no longer than 3 minutes. See Section 7 for additional information

3.51 Hydraulic Pump Failures

Hydraulic Pump Failures

Hydraulic pump will not deactivate:

Indication: Master Caution, Double Chime, HYDR PUMP ON

GEAR PUMP Circuit Breaker (Row 2, Col. 12)........................PULL

Prior to landing:

GEAR PUMP Circuit Breaker (Row 2, Col. 12)........................PUSH

If GEAR PUMP Circuit Breaker Opens:

Complete Manual Extension of Landing Gear checklist

Hydraulic pump will not activate:

Indication: Gear Position Indications remain in current position

GEAR ....RETURN to Original Position
GEAR PUMP Circuit Breaker (Row 2, Col. 12)........................RESET
GEAR ....RESELECT

If landing gear remains up (prior to landing):

Complete Manual Extension of Landing Gear checklist

If landing gear remains down:

Airspeed ....REMAIN BELOW V_{LE} (140 KIAS)

3.5m Starter Engaged

Starter Engaged

Indication: Master Warning, Triple Chime, L START ENGD / R START ENGD

If on the ground:

THROTTLE...REDUCE
ENG START Circuit Breaker (Row 1, Col. 12)...................PULL
ENGINE...SHUTDOWN

If in flight:

THROTTLE...REDUCE
ENG START Circuit Breaker (Row 1, Col. 12)...................PULL

Land as soon as possible.

3.5n Spin Recovery (Intentional Spins Prohibited)

Spin Recovery

WARNING

Intentional Spins Prohibited.

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...CLOSED
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

3.5o Open Door

Open Door	
To close the door in flight:	
Airspeed	REDUCE to less than 82 KIAS
Cabin Vents	CLOSE
Storm Window	OPEN
Upper latch (if open)	CLOSE latch
Side latch (if open)	PULL on armrest while closing latch
If both latches open	CLOSE Side then top latch

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

3.5p Propeller Overspeed

Propeller Overspeed	
THROTTLE (Affected Engine)	RETARD
PROPELLER (Affected Engine)	DECREASE (do not feather)
OIL PSI (Affected Engine)	CHECK
Airspeed	REDUCE
THROTTLE (Affected Engine)	AS REQUIRED to remain below 2700 rpm

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

3.5q Emergency Descent

Emergency Descent	
CARB HEAT	ON
THROTTLES	CLOSED
PROPELLERS	FULL INCREASE
MIXTURES	AS REQUIRED
GEAR (Below 140 KIAS)	DOWN
Airspeed	140 KIAS

3.5r Emergency Exit

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

3.5s Heater Overheat

Heater Overheat	
Indication: Master Warning, Triple Chime, HTR OVRHEAT	
CABIN HEAT	OFF

An overheat switch in the heater unit deactivated the heater. See Section 7 for additional information.

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NORMAL PROCEDURES

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NORMAL PROCEDURES

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NORMAL PROCEDURES

4.1 GENERAL

This section provides the normal operating procedures for the PA-44-180, Seminole airplane. All normal operating procedures required by FAA regulation, as well as those deemed necessary for normal operation of the airplane are presented.

This section provides checklists for all normal operating procedures, using a simple action - reaction format, with little emphasis on system operation. These checklists should be used during normal ground and flight operations.

When appropriate, additional information is provided immediately below the checklist, providing more detailed information related to that procedure. In order to operate the airplane in a safe and efficient manner, pilots should familiarize themselves with the both the checklists and amplified procedures.

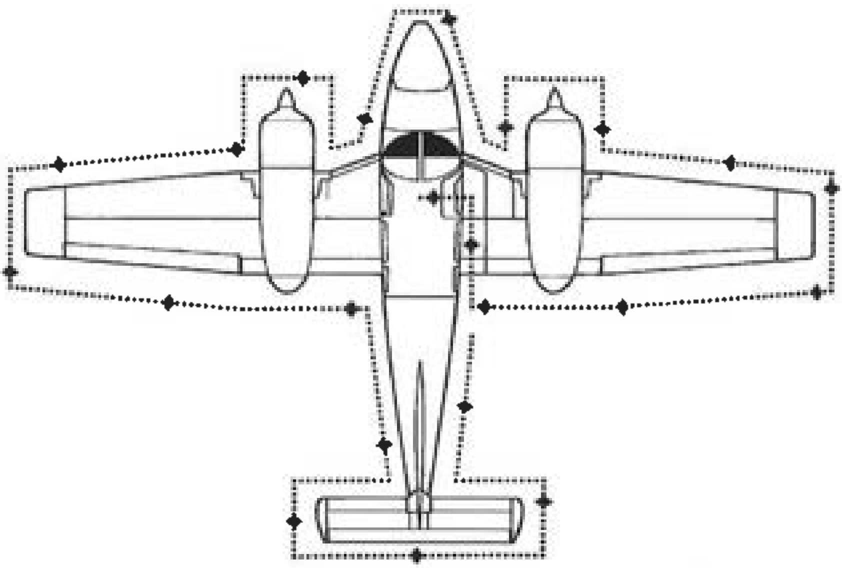
Normal operating procedures associated with optional systems and equipment, which require handbook supplements, are presented in Section 9, Supplements.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds 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 (Vy) .... 88 KIAS
(b) Best Angle of Climb Speed (Vx) .... 82 KIAS
(c) Maximum Operating Maneuvering
Speed (Vo) .... 135 KIAS (115 KIAS @ 2870 LB)
See Airspeed Limitations Section 2.3
(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 (V_{SSE}) .... 82 KIAS
(g) Maximum Demonstrated Crosswind Velocity .... 17 KIAS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

The airplane should be given a thorough preflight and walk-around check. 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.

4.5 NORMAL PROCEDURES CHECKLIST (Continued)

4.5a Preflight Checklists

COCKPIT

Control Wheel .... release restraints
Flight Controls .... FREE AND CORRECT
PARK BRAKE .... SET
Static System .... DRAIN
Alternate Static Source .... CLOSED
LEFT/RIGHT ENG MAG Switches .... OFF
LEFT/RIGHT FUEL PUMP Switches .... OFF
GEAR .... DOWN
THROTTLES .... IDLE
MIXTURES .... CUT-OFF
COWL FLAPS .... OPEN
Stabilator & Rudder Trim .... NEUTRAL
FUEL Selectors .... ON
All Electrical Switches .... OFF
BATT MASTR Switch .... ON
FUEL QTY Indications .... CHECK
Gear Position Indications .... 3 GREEN
BATT MASTR Switch .... OFF
Emergency Exit .... CHECK
FLAPS .... EXTEND
Windows .... check CLEAN
Required Papers .... check ON BOARD
POH .... check ON BOARD
Baggage .... STOW PROPERLY - SECURE

CAUTION

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

Set the parking brake by first depressing and holding the toe brake pedals and then pulling out the PARK BRAKE knob. The static drains are located on the lower left sidewall adjacent to the pilot.

4.5 NORMAL PROCEDURES CHECKLIST (Continued)

4.5a Preflight Checklists (Continued)

RIGHT WING

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

Eight quarts of oil are required for maximum range flights.

4.5a Preflight Checklists (Continued)

NOSE SECTION

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

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
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

Eight quarts of oil are required for maximum range flights.

4.5a Preflight Checklists (Continued)

FUSELAGE (LEFT SIDE)

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

EMPENNAGE

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)

General Condition .... CHECK
Baggage Door .... CLOSED AND LATCHED
Cabin Door .... CHECK

MISCELLANEOUS

FLAPS .... RETRACT
BATT MASTR Switch .... ON
Interior Lighting (Night Flight) .... ON & CHECK

CAUTION

Care should be taken when checking the heated pitot head. 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
PITOT HEAT Switch .... OFF
All Lighting Switches .... OFF
BATT MASTR Switch .... OFF
Passengers .... BOARD

4.5b Before Starting Engine Checklists

BEFORE STARTING ENGINE

Preflight Check	COMPLETED
Flight Planning	COMPLETED
Cabin Door	CLOSE & LATCH (Upper and Lower)
Seats	ADJUSTED & LOCKED
Seatbelts and Harness	FASTEN/ADJUST CHECK INERTIA REEL
PARK BRAKE	SET
GEAR	DOWN
THROTTLES	IDLE
PROPELLERS	FULL INCREASE
MIXTURES	CUT-OFF
Friction Handle	AS DESIRED
CARB HEAT	OFF
COWL FLAPS	OPEN
Stabilator & Rudder Trim	SET
FUEL Selectors	ON
LEFT/RIGHT ALTR Switches	ON
EMER BATT	ARM
E VOLTS Indication	23.3 VOLTS (minimum)
AVION MASTER Switch	OFF
DAY/NIGHT Switch.	As Required
STROBE LIGHTS	FIN STROBE
All Other Electrical Switches	OFF
CABIN HEAT Switch	OFF
Circuit Breakers	CHECK

NOTE

The EMERG BATT should remain ON after checking for proper bus operation, allowing the PFD to remain powered for engine start. Avoid delays between this check and engine starting to preserve emergency battery power.

If the E VOLTS indication is less than 23.3 VOLTS, the voltage should be checked again at the end of the GROUND CHECK checklist (after being charged for some time by the primary electrical system). If E VOLTS is still less than 23.3 volts, determine the cause and correct the issue prior to flight.

4.5c Engine Start Checklists

ENGINE START - GENERAL

WARNING

The L START ENGD or R START ENGD warning CAS message will illuminate after 30 seconds of continuous engine cranking. If the CAS message illuminates after the engine is running, stop the engine and determine the cause.

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.

NOTE

Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 20 second rest period between cranking attempts. Maximum of 6 start periods allowed. If a start is not achieved on sixth attempt allow starter to cool for 30 minutes before attempting additional starts. Do not engage the starter immediately after releasing it. This practice may damage the starter mechanism.

4.5c Engine Start Checklists

NORMAL START - COLD ENGINE

BATT MASTR Switch ....ON
Gear Position Indications .... 3 GREEN
THROTTLES .... 1/4 inch OPEN
PROPELLERS .... FULL INCREASE
MIXTURES .... FULL RICH
*FUEL PUMP ....ON
*MAG LEFT/RIGHT Switches ....ON
*ENG PRIMER .... AS REQUIRED
*Propeller Area ....CLEAR
*ENG START .... ENGAGE
*THROTTLE .... ADJUST WHEN ENGINE STARTS TO 1000 RPM
*OIL PSI .... CHECK

Repeat Above Procedure (*) for Second Engine Start
VOLTS .... CHECK
ALTR AMPS .... CHECK
FUEL PUMPS .... OFF

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.

4.5c Engine Start Checklists (Continued)

NORMAL START - HOT ENGINE

BATT MASTR Switch .... ON
Gear Position Indications .... 3 GREEN
THROTTLES .... 1/2 inch OPEN
PROPELLERS .... FULL INCREASE
*MIXTURE .... FULL RICH
*FUEL PUMP .... ON
*MAG LEFT/RIGHT Switches .... ON
*Propeller Area .... CLEAR
*ENG START .... ENGAGE
*THROTTLE .... ADJUST to LOW RPM
*OIL PSI .... CHECK

Repeat Above Procedure (*) for Second Engine Start
VOLTS .... CHECK
ALTR AMPS .... CHECK
FUEL PUMPS .... OFF

ENGINE START - COLD WEATHER (BELOW 10°F)

WARNING

Ensure all magneto (MAG LEFT/RIGHT) and master switches (BATT MASTR) are OFF and mixture controls are in cut-off before turning propeller manually.

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

BATT MASTR Switch .... OFF
LEFT/RIGHT ALTR Switches .... OFF
External Power .... CONNECTED (SEE STARTING ENGINES WITH EXTERNAL POWER)
THROTTLES .... 1/4 inch OPEN
PROPELLERS .... FULL INCREASE
MIXTURES .... FULL RICH
*FUEL PUMP .... ON
*MAG LEFT/RIGHT Switches .... ON
*ENG PRIMER .... AS REQUIRED

4.5c Engine Start Checklists (Continued)

ENGINE START - COLD WEATHER (BELOW 10°F) (Continued)

*Propeller Area .... CLEAR
*ENG START .... ENGAGE
*OIL PSI .... 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
External Power Plug .... DISCONNECT
BATT MASTR Switch .... ON
LEFT/RIGHT ALTR Switches .... ON
VOLTS .... CHECK
ALTR AMPS .... CHECK
FUEL PUMPS .... OFF

After engine start and the throttle is set as desired, the oil pressure should be checked for a positive indication. 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.

NOTE

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

ENGINE START WHEN FLOODED

BATT MASTR Switch .... ON
Gear Position Indications .... 3 GREEN
THROTTLES .... OPEN FULL
PROPELLERS .... FULL FORWARD

4.5c Engine Start Checklists (Continued)

ENGINE START WHEN FLOODED (Continued)

MIXTURES .... CUT-OFF
*FUEL PUMP .... OFF
*MAG LEFT/RIGHT Switches .... ON
*Propeller Area .... CLEAR
*ENG START .... ENGAGE
*MIXTURE .... ADVANCE
*THROTTLE .... RETARD
*OIL PSI .... CHECK

Repeat above procedure (*) for second engine start

VOLTS .... CHECK
ALTR AMPS .... CHECK
FUEL PUMPS .... OFF

ENGINE START WITH EXTERNAL POWER SOURCE

BATT MASTR Switch .... OFF
ALTR LEFT/RIGHT .... OFF

NOTE

The EMERG BATT switch may remain in ARM while using external power. The emergency bus does not receive power from external power.

External Power Plug .... INSERT in RECEPTACLE
GEAR Indications .... 3 GREEN
THROTTLES .... 1/4 inch OPEN
PROPELLERS .... FULL INCREASE
MIXTURES .... FULL RICH
*FUEL PUMP .... ON
*MAG LEFT/RIGHT Switches .... ON
*ENG PRIMER .... AS REQUIRED
*Propeller Area .... CLEAR
*ENG START .... ENGAGE
*THROTTLE .... ADJUST WHEN ENGINE STARTS TO 1000 RPM
*OIL PSI .... CHECK

Repeat Above Procedure (*) for Second Engine Start

4.5d Warm-Up Checklist

ENGINE START WITH EXTERNAL POWER SOURCE (Continued)

THROTTLES .... LOWEST POSSIBLE RPM
External Power Plug .... DISCONNECT from RECEPTACLE
BATT MASTR Switch .... ON
ALTR LEFT/RIGHT Switches .... ON
VOLTS .... CHECK
ALTR AMP .... CHECK
FUEL PUMPS .... OFF

WARM-UP

THROTTLES .... 1000 to 1200 RPM

BEFORE TAXIING

External Power Source .... VERIFY REMOVED
BATT MASTR Switch .... VERIFY ON
FUEL Selectors .... ON, BOTH X-FEED (30 SEC), ON
AVION MASTER Switch .... ON
MFD splash screen .... Verify Database Currency
FUEL Totalizer .... FOB SYNC or ENTER MANUALLY
CAS Messages .... Consider any illuminated
PFD Annunciations .... Consider any illuminated
System Messages (MSG Softkey) .... Consider
TRAFFIC (if installed) .... TEST
MASTER WARN and MASTER CAUTION RESET Switches .... TEST
Standby Flight Instrument .... VERIFY ON with no red X's or failure annunciations
Altimeters (Standby and PFD) .... SET
Lights .... AS REQUIRED
CABIN HEAT .... AS DESIRED
Radios .... CHECK & SET
Autopilot .... Verify Preflight Self-Test (PFT) completed and disconnect tone heard.

FUEL Selectors .... VERIFY ON
Passenger Briefing .... COMPLETE
PARK BRAKE .... RELEASE

4.5e Taxiing Checklist

TAXIING

Taxi Area...CLEAR
THROTTLES.. APPLY SLOWLY
Brakes...CHECK
Steering ....CHECK
Instruments..CHECK

NOTE

During taxi, if the VOLTS indication decreases into the warning range, increase engine RPM (if possible) to retain adequate battery charging.

4.5f Ground Check Checklist

GROUND CHECK

PARK BRAKE ....SET
MIXTURES ....FULL RICH
PROPELLERS ....FULL INCREASE
Engine Instruments ....CHECK
THROTTLES.. 1500 RPM
PROPELLERS (Max. Drop - 500 RPM) ....FEATHER - CHECK
THROTTLES.. 2000 RPM
LEFT/RIGHT MAG (Max. Drop - 175 RPM:
Max. Diff. - 50 RPM)...CHECK
PROPELLERS (Max. Drop - 300 RPM) ....EXERCISE
CARB HEAT ....CHECK
THROTTLES (550 to 650 RPM) ....IDLE - CHECK
FUEL PUMPS...ON
THROTTLES.. 1000 RPM
Friction Handle ....SET

If E VOLTS indication less than 23.3 VOLTS during BEFORE STARTING ENGINE checklist:

EMERG BATT Switch ....Verify ARM
AVION MASTER Switch ....OFF
ALTR LEFT / RIGHT Switches ....OFF
BATT MASTR Switch ....OFF
E VOLTS Indication ....23.3 VOLTS MINIMUM

4.5f Ground Check Checklist (Continued)

If E VOLTS less than 23.3 VOLTS, determine cause and correct issue prior to flight.

If E VOLTS greater than or equal to 23.3 VOLTS:

BATT MASTR Switch .... ON
ALTR LEFT / RIGHT Switches .... ON
AVION MASTER Switch .... ON

Operation of an engine on one magneto should be kept to a minimum. Avoid prolonged ground operation with carburetor heat ON as the air is unfiltered

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.

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4.5g Before Takeoff Checklist

BEFORE TAKEOFF

Flight Controls	FREE and CORRECT
Flight Instruments	CHECK
Engine Instruments	CHECK
FUEL QTY	SUFFICIENT
PROPELLERS	FULL INCREASE
MIXTURES	FULL RICH
CARB HEAT	OFF
COWL FLAPS	OPEN
FLAPS	CHECK & SET
Stabilator and Rudder Trims	SET
FUEL Selectors	ON
CAS Messages	Consider any illuminated
PFD Annunciations	Consider any illuminated
System Messages (MSG Softkey)	Consider
Transponder	AS REQUIRED
FUEL PUMPS	ON
PITOT HEAT	AS REQUIRED
STROBE LIGHTS	ON
Door	LATCHED (UPPER and LOWER)
PARK BRAKE	RELEASE

CAUTION

Prior to takeoff with autopilot on, verify that the autopilot servos are disengaged and that flight controls move freely.

4.5h Takeoff Checklist

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.

4.5h Takeoff Checklist (Continued)

NORMAL TAKEOFF

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

NOTE

TAS aural alerts will be muted when GPS altitude is lower than ~ 400 FT AGL.

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.

0° FLAP, SHORT FIELD PERFORMANCE TAKEOFF

FLAPS .... UP
Stabilator and Rudder Trim .... CHECK SET
Brakes .... HOLD
Power .... 2700 RPM, FULL THROTTLE
MIXTURE .... FULL RICH (or SET for ALTITUDE)
Brakes .... RELEASE
Rotate Speed .... 70 KIAS
Obstacle Clearance Speed .... 82 KIAS
GEAR (with positive rate of climb) .... UP
Climb Speed (past obstacles) .... 88 KIAS

NOTE

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

4.5h Takeoff Checklist (Continued)

0° FLAP, SHORT FIELD PERFORMANCE TAKEOFF (Continued)

When a short field effort is required, the safest technique is to use flaps up (0°). In the event of an engine failure, the airplane will be in the best configuration to maintain altitude immediately after the gear is raised. Refer to Section 5 of this handbook for short field performance data.

4.5i Climb Checklist

MAXIMUM PERFORMANCE CLIMB

Best Rate (Flaps Up) .... 88 KIAS
Best Angle (Flaps Up) .... 82 KIAS
COWL FLAPS .... OPEN
FUEL PUMPS .... ON

4.5i Climb Checklist (Continued)

CRUISE CLIMB (4.25b)

MIXTURE ....FULL RICH
Power 75%
Climb Speed ....105 KIAS
COWL FLAPS ....As Required
FUEL PUMPS ....ON

After attaining an altitude for adequate terrain and obstacle clearance, a cruise climb speed of 105 KIAS or higher is recommended. The 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. Consistent operational use of cruise climb power settings is strongly recommended since this practice will make a substantial contribution to fuel economy, increased engine life, and will reduce the incidence of premature engine overhauls.

4.5j Cruise Checklist

CRUISING

Reference performance charts and Avco-Lycoming Operator's Manual.
Power ....SET per Power Setting Chart
FUEL PUMPS ....OFF
MIXTURES ....ADJUST
COWL FLAPS ....As Required
TRIM ....As Required

WARNING

Flight in icing conditions is prohibited. If icing is encountered, take immediate action to exit icing conditions. Icing is hazardous due to greatly reduced performance, loss of forward visibility, possible longitudinal control difficulties and impaired power plant and fuel system operation.

4.5j Cruise Checklist (Continued)

CRUISING (Continued)

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes. The mixture should be leaned during cruising operation above 5000 ft. altitude and at pilot's discretion at lower altitudes when 75% power or less is being used. If any doubt exists as to the amount of power being used, the mixture should be in the full RICH position for all operations under 5000 feet. To lean the mixture, pull the mixture control aft.

Best economy mixture is obtained by moving the mixture control aft until peak EGT is reached. Best power mixture is obtained by leaning to peak EGT and then enrichening until the EGT is 100F rich of the peak value. Under some conditions of altitude and throttle position, the engine may exhibit roughness before peak EGT is reached. If this occurs, the EGT corresponding to the onset of engine roughness should be used as the peak reference value.

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.

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 CARB HEAT control in the ON position.

The LEFT ALTR amd RIGHT ALTR switches should be ON for normal operation. Certain regulator failures can cause the alternator output voltage to increase uncontrollably. To prevent damage, overvoltage relays will automatically shut off the alternator(s). The CAS Warning messages L ALTR FAIL and R ALTR FAIL will warn of this tipped condition.

Alternator outputs will vary with the electrical equipment in use and the state of charge of the battery. ALTR AMPS should not exceed 60 amperes on the ground or 75 amperes in flight. The VOLTS indication will flash red if bus voltage drops below minimum requirements.

IFR operation is not recommended with a single alternator.

4.5j Cruise Checklist (Continued)

CRUISING (Continued)

Since the Seminole has one fuel tank per engine, it is advisable to feed the engines symmetrically during cruise so that the same approximate amount of fuel will be left in each side for the landing. The crossfeed (XFEED) can **be used to balance FUEL QTY, if necessary.**

During flight, keep account of time and fuel used in connection with power settings to verify the accuracy of the fuel flow and fuel quantity gauging systems.

There are no mechanical uplocks in the landing gear system. If the hydraulic system malfunctions, the landing gear will free-fall to the gear down position. 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.

4.5k Descent Checklist

DESCENT

MIXTURE..ADJUST with Descent
THROTTLES..As Required
COWL FLAPS..As Required

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.

4.51 Approach and Landing Checklist

APPROACH AND LANDING

Seat Backs	ERECT
Seat Belts, Harnesses	ADJUSTED
FUEL PUMPS	ON
FUEL Selectors	ON
GEAR (Below 140 KIAS)	DOWN
Gear Position Indications	3 GREEN
Nacelle Mirror	CHECK NOSE GEAR DOWN
MIXTURES	FULL RICH
PROPELLERS	FULL INCREASE
CARB HEAT	AS REQUIRED
Autopilot	Disconnect (above 200 FT AGL)

NOTE

TAS aural alerts will be muted when GPS altitude is lower than ~ 400 FT AGL.

NOTE

The HSI will auto-slew during CDI transitions to LOC, LOC BC, LDA, or SDF approaches if the approach is activated in the G1000 system. The pilot should always double check the inbound course pointer prior to initiating a VHF NAV approach.

During the approach for a landing, the CHECK GEAR aural alert may sound. The mutable CHECK GEAR is triggered when the gear is not down and locked and manifold pressure(s) is less than 14 inHg. The non-mutable CHECK GEAR is triggered when the landing gear is not down and locked and flaps are extended beyond the first notch. The severity of the CHECK GEAR CAS message is determined by proximity to the ground. A Caution message is triggered when above ~400 feet AGL, and a Warning is triggered below ~400 feet AGL. See Section 7 for additional details.

The landing gear is down and locked when three solid green circles are indicated on the MFD. The mirror on the left engine nacelle may be used to visually verify the nose landing gear position.

Operate the toe brakes to verify sufficient pressure for normal braking. Verify the parking brake is not set.

4.51 Approach and Landing Checklist (Continued)

NORMAL LANDING

FLAPS .... 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

Landing may be made with any flap setting. Normally full flaps are used, which reduces stall speed and permits slower speed at contact. 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 maximum braking is needed or unless a strong crosswind or gusty 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 rollout.

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.

NOTE

The maximum demonstrated crosswind component during landing is 17 KTS.

4.5l Approach and Landing Checklist (Continued)

SHORT FIELD PERFORMANCE LANDING

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

For landings on short runways or 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.

4.5m Go-Around Checklist

GO-AROUND

MIXTURES........FULL RICH
PROPELLERS........FULL INCREASE
THROTTLES........FULL OPEN
Control Wheel........BACK PRESSURE TO OBTAIN POSITIVE CLIMB ATTITUDE
FLAPS........RETRACT INCREMENTALLY
GEAR........UP
COWL FLAPS........AS REQUIRED

WARNING

Autopilot coupled go-around is not authorized during single engine operations.

If the aircraft is equipped with optional Underspeed Protection (USP) and an autopilot coupled go-around is desired, press the TO/GA button on the throttle handle, followed immediately by the checklist shown above. Refer to Section 7 for additional details on the autopilot coupled go-around.

4.5n After Landing Checklist

AFTER LANDING

Clear of runway.
FLAPS .... RETRACT
COWL FLAPS .... FULL OPEN
CARB HEAT .... OFF
FUEL PUMPS .... OFF
LIGHTS .... AS REQUIRED
PITOT HEAT .... OFF

A spongy pedal during braking, is often an indication that the brake fluid needs replenishing.

4.5o Stopping Engine Checklist

STOPPING ENGINE

CABIN HEAT (If ON) .... FAN - 2 MIN. THEN OFF
VENT FAN .... OFF
AVION MASTER .... OFF
EMERG BATT .... OFF
LEFT/RIGHT ALTR .... OFF
LEFT/RIGHT FUEL PUMP .... OFF
All Other Electrical Equipment .... OFF
THROTTLES .... IDLE
MIXTURES .... CUT-OFF
LEFT/RIGHT ENG MAG Switches .... OFF
Panel Lights (At Night) .... OFF
BATT MASTR .... OFF
STANDBY INSTRUMENT .... VERIFY SHUTDOWN

NOTE

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

NOTE

In case the Aspen EFD-1000 standby instrument remains "ON" due to improper shutdown, the EFD-1000 switches to internal battery and depletes it. To turn off the EFD-1000, press the "SHUT DOWN" command from Main Menu page 6 or hold the red "REV" button for 20 seconds.

4.5p Mooring Checklist

MOORING

PARK BRAKE .... AS REQUIRED
Control Wheel .... SECURED with seat belts
FLAPS .... FULL UP
Wheel Chocks .... IN PLACE
Tiedowns .... SECURE

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

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, or the parking brake set. Tie-down ropes may be attached to mooring rings under each wing and to the tail skid

4.5q V_{SSE} - INTENTIONAL ONE ENGINE INOPERATIVE SPEED

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.

4.5r VMCA - AIR MINIMUM CONTROL SPEED

The VMCA demonstration, may be required for the FAA flight test for the multi-engine rating.

VMCA DEMONSTRATION

(a) Landing Gear .... UP
(b) Flaps .... UP
(c) Altitude .... at or above 4000 ft. AGL
(d) Airspeed .... at or above 82 KIAS (VSSE)
(e) Mixture .... FULL RICH
(f) Propeller Controls .... HIGH RPM
(g) Throttle (Simulated Inoperative Engine) .... IDLE
(h) Throttle (Other Engine) .... FULL FORWARD
(i) Airspeed .... Reduce approximately 1 knot per second until either STALL WARNING, FULL CONTROL TRAVEL or VMCA is obtained

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.

4.5s 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.

NOTE

A rapid reduction in power (full throttle to idle in less than 2 seconds) may be harmful to the engine.

Propeller rpm for Zero Thrust

KIAS	RPM
82 V_{SSE}	1850
88 V_{YSE}	2180
100	2510
110	2690

4.5t 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.

4.5u 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 Battery Master OFF

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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 in this section.

Performance information associated with those optional systems and equipment which require handbook supplements is provided in 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 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.

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING (Continued)

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

WARNING

Performance should not be extrapolated beyond the limits shown on the charts.

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 is entered in Figure 6-5. Any alterations to the airplane which affect weight and balance, should be recorded in the aircraft logbook and Weight and Balance Record (Figure 6-7). These alterations should be considered when determining the current basic empty weight of the airplane.

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

The following weights have been used in the flight planning example.

(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

* Fuel used must be established (refer to item (g)(1)) before the landing weight can be calculated.

The calculated takeoff and landing weights are below the maximum limits, and the weight and balance calculations show the C.G. position within the approved limits.

(b) Takeoff and Landing

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

5.5 FLIGHT PLANNING EXAMPLE (Continued)

The existing conditions at the departure airport and the forecast conditions at the destination airport must be acquired and evaluated. Actual, versus forecast conditions at the destination airport should be monitored throughout the flight.

Apply the departure airport conditions and takeoff weight to the appropriate takeoff performance graphs (Figures 5-11 and 5-13) to determine the necessary runway length for takeoff and/obstacle clearance.

Calculate the landing distance 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.

	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 5-13

**reference Figure 5-33

5.5 FLIGHT PLANNING EXAMPLE (Continued)

(c) Climb

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

First determine the Fuel, Time and Distance to Climb from sea level to the desired cruise altitude and OAT. Then determine the Fuel, Time and Distance to Climb from sea level to the departure field pressure altitude and OAT. Subtract the departure field values from the cruise values to get the true Time, Fuel and Distance to Climb for the flight. See the following example (reference Figure 5-21):

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 5-21

5.5 FLIGHT PLANNING EXAMPLE (Continued)

(d) Descent

Determine true descent time, fuel and distance similar to the method used for climb.

First determine the Fuel, Time and Distance to Descend from cruise altitude and OAT to sea level. Then determine the Fuel, Time and Distance to Descend from the destination field altitude and OAT to sea level. Then subtract the destination field values from the cruise values to get the true Time, Fuel and Distance to Descend for the flight. See the following example (reference Figure 5-31):

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 5-31

5.5 FLIGHT PLANNING EXAMPLE (Continued)

(c) Cruise

Starting with the total flight distance, subtract the previously determined distance to climb and distance to descend to obtain 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 5-25).

Calculate the cruise fuel for the cruise power setting from the information provided on Figure 5-25.

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 5-25

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. Keep in mind that the time values obtained 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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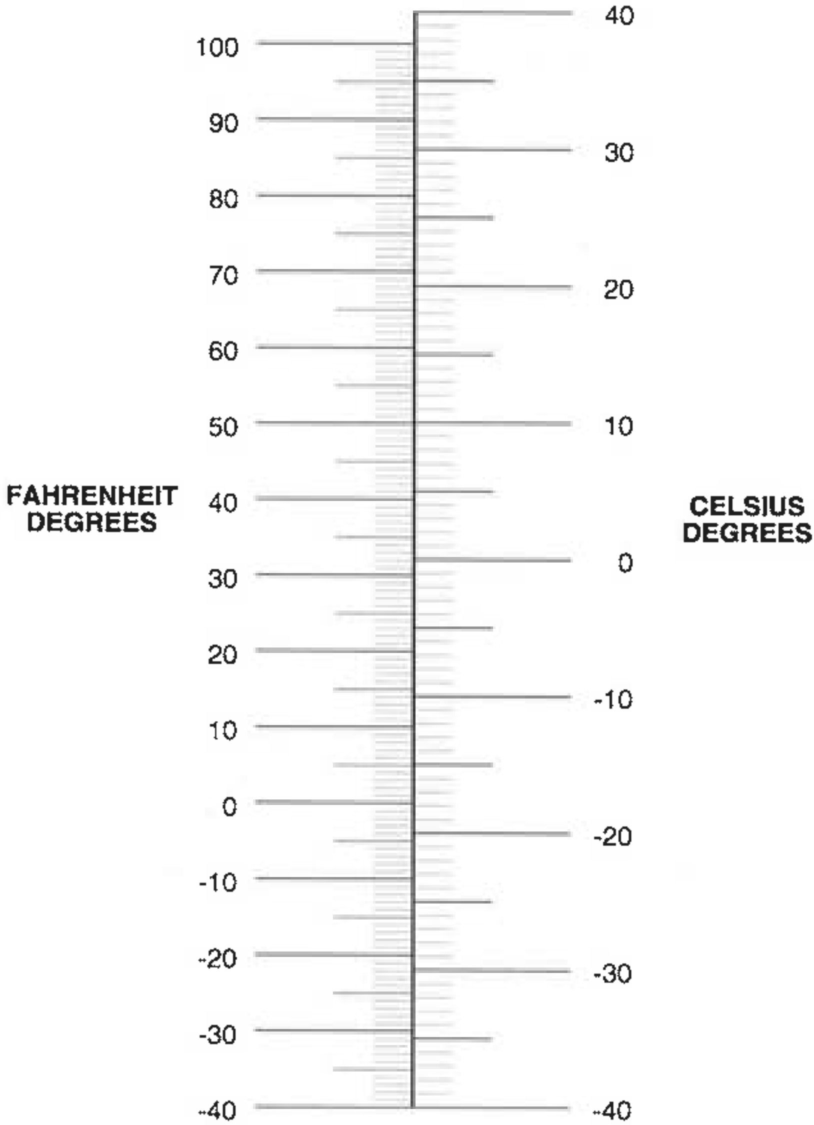
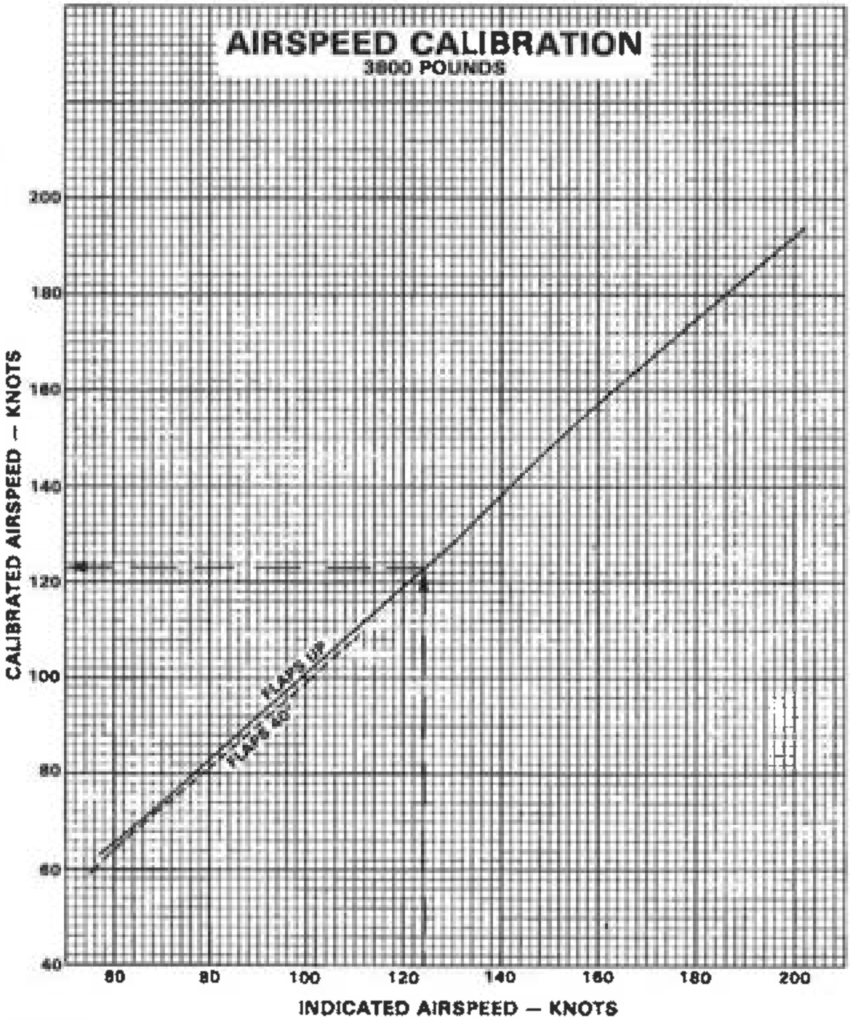
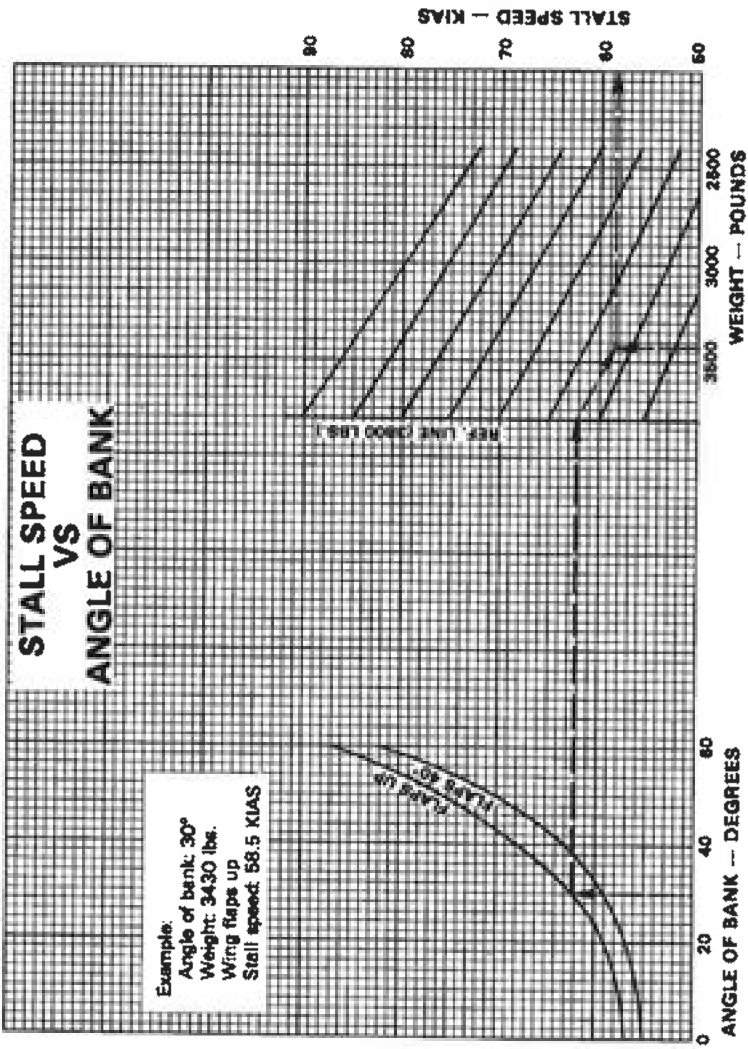


TEMPERATURE CONVERSION
Figure 5-1

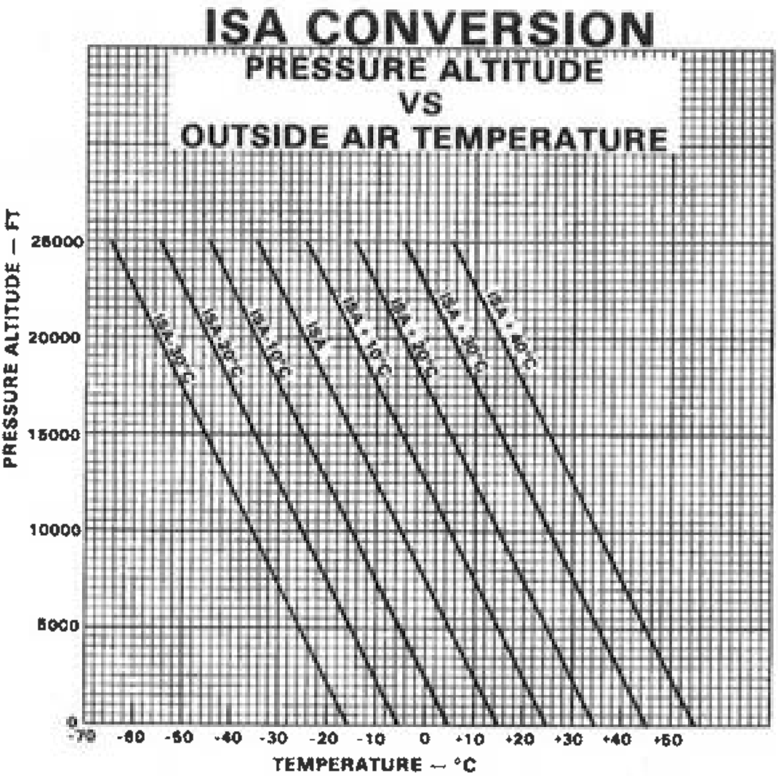


Example:
Indicated airspeed: 124 knots
Flaps up
Calibrated airspeed: 123 knots

AIRSPEED CALIBRATION
Figure 5-3



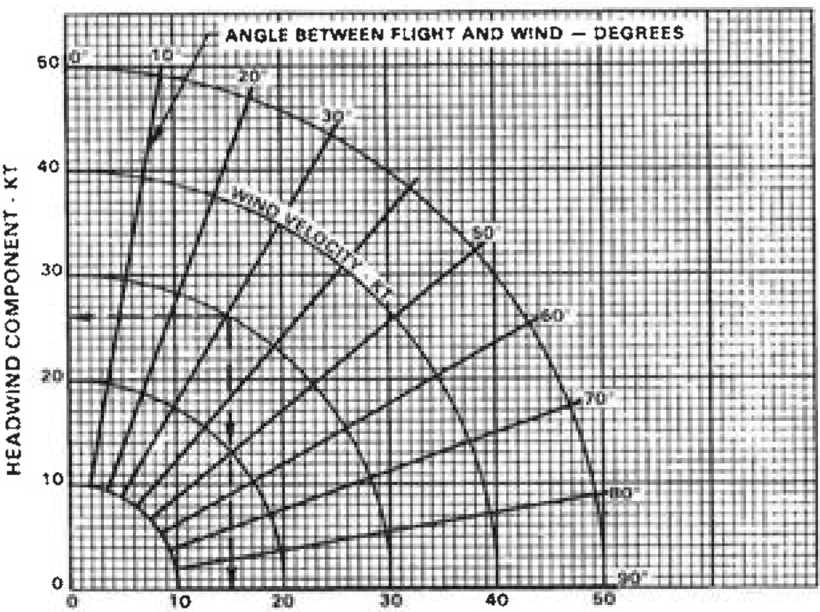
STALL SPEED VS. ANGLE OF BANK
Figure 5-5



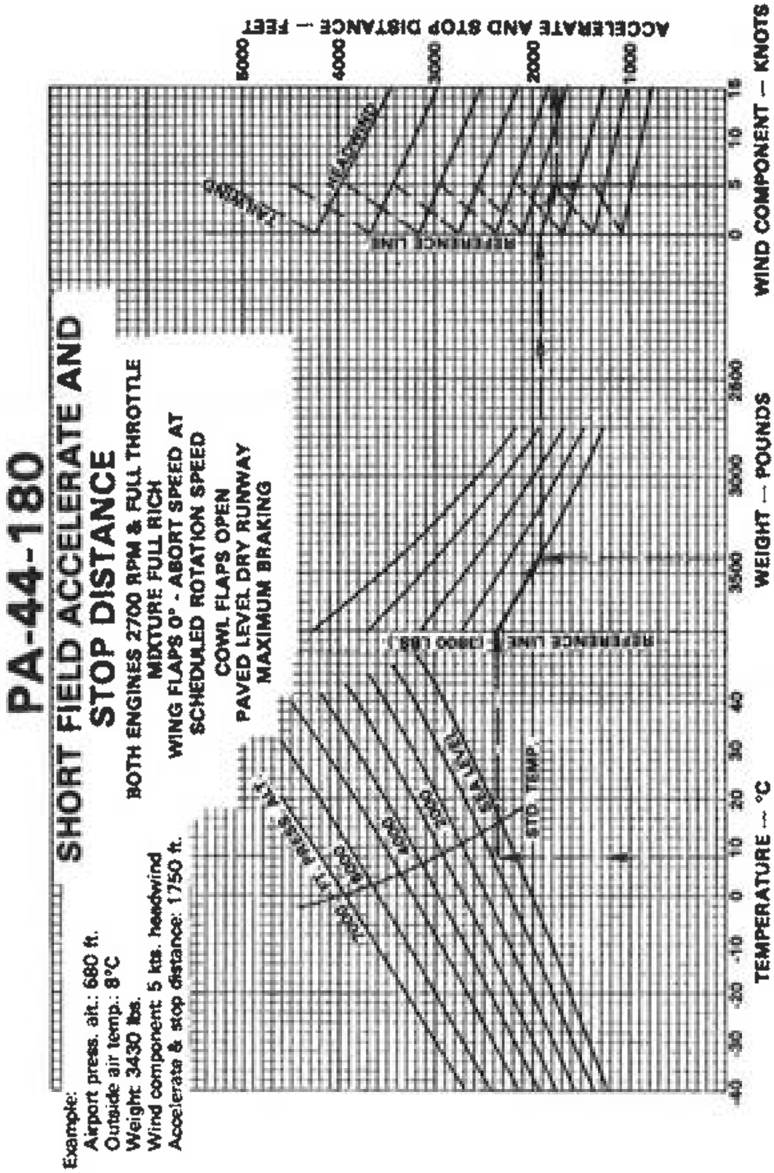
ISA CONVERSION
Figure 5-7

WIND COMPONENTS

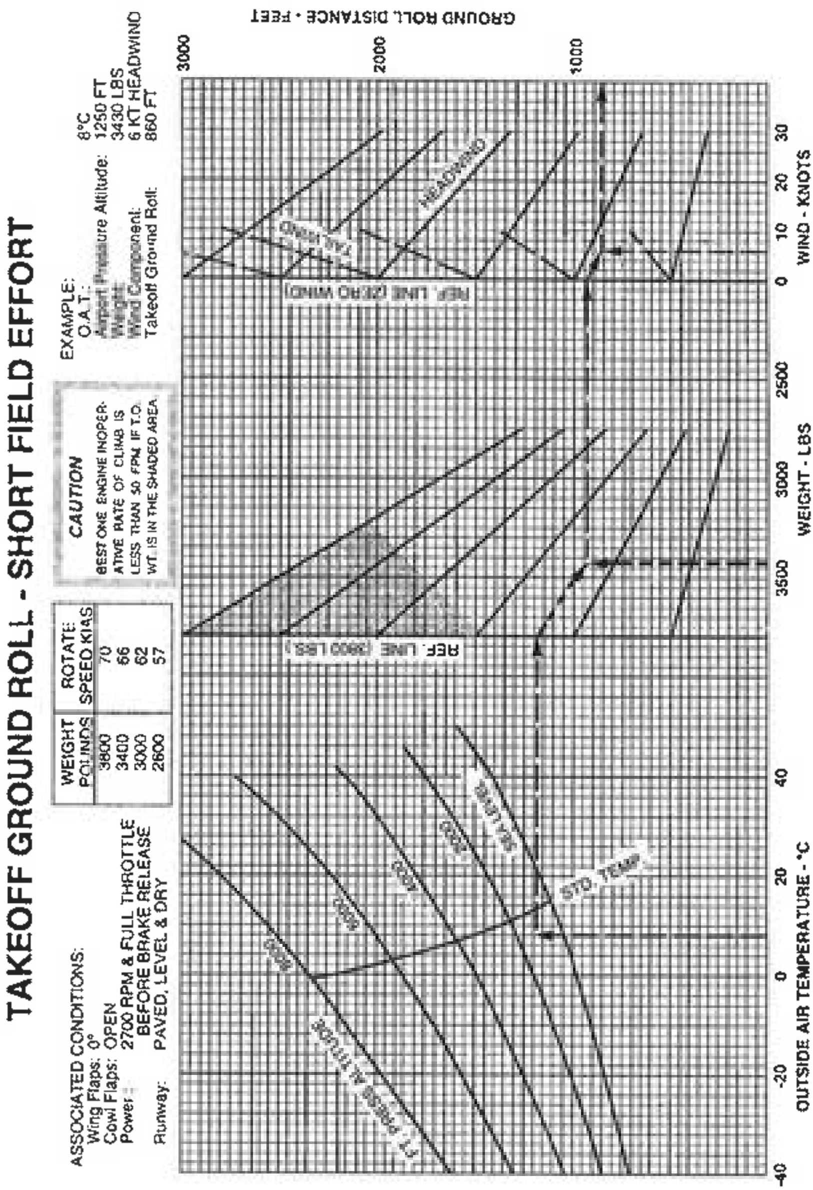
Example:
Wind velocity: 30 KT
Angle between flight path and wind: 30°
Headwind: 26 KT
Crosswind component: 15 KT



WIND COMPONENTS
Figure 5-9



ACCELERATE AND STOP DISTANCE - SHORT FIELD EFFORT
Figure 5-10



TAKEOFF GROUND ROLL - SHORT FIELD EFFORT
Figure 5-11

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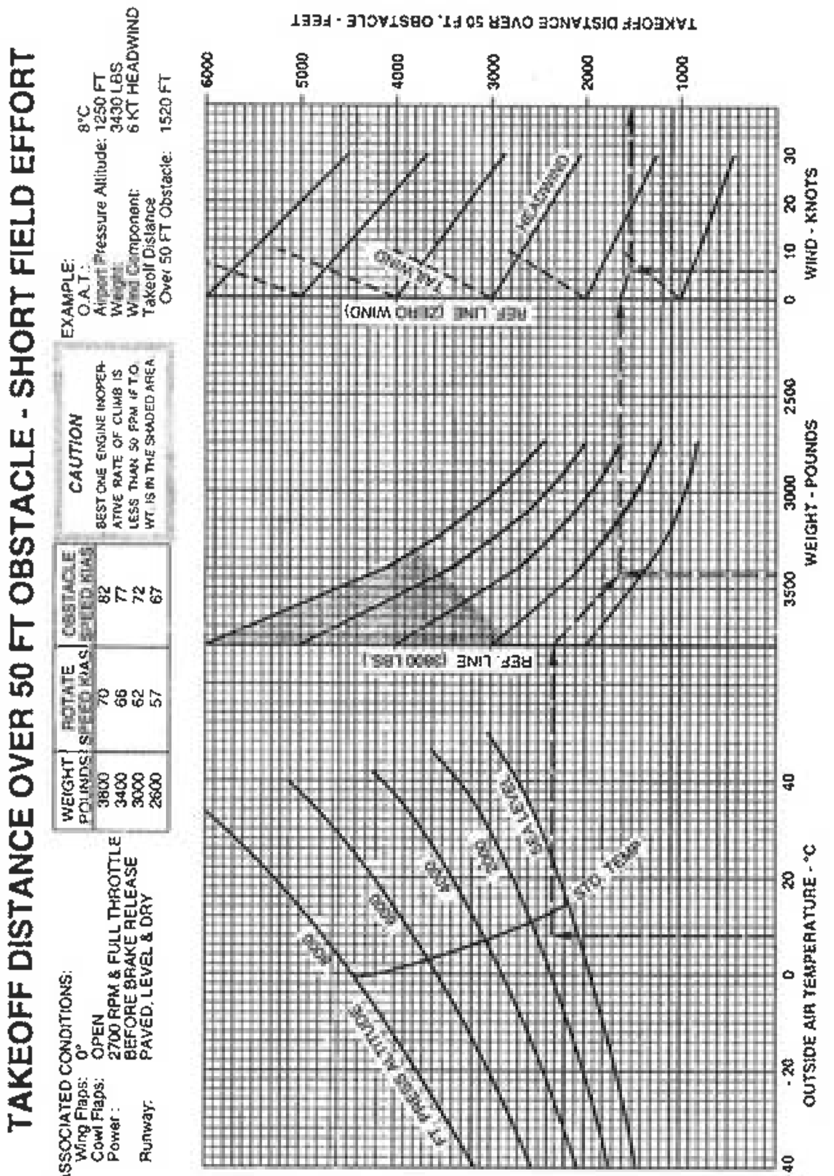

TAKEOFF DISTANCE OVER 50 FT. OBSTACLE - SHORT FIELD EFFORT
Figure 5-13

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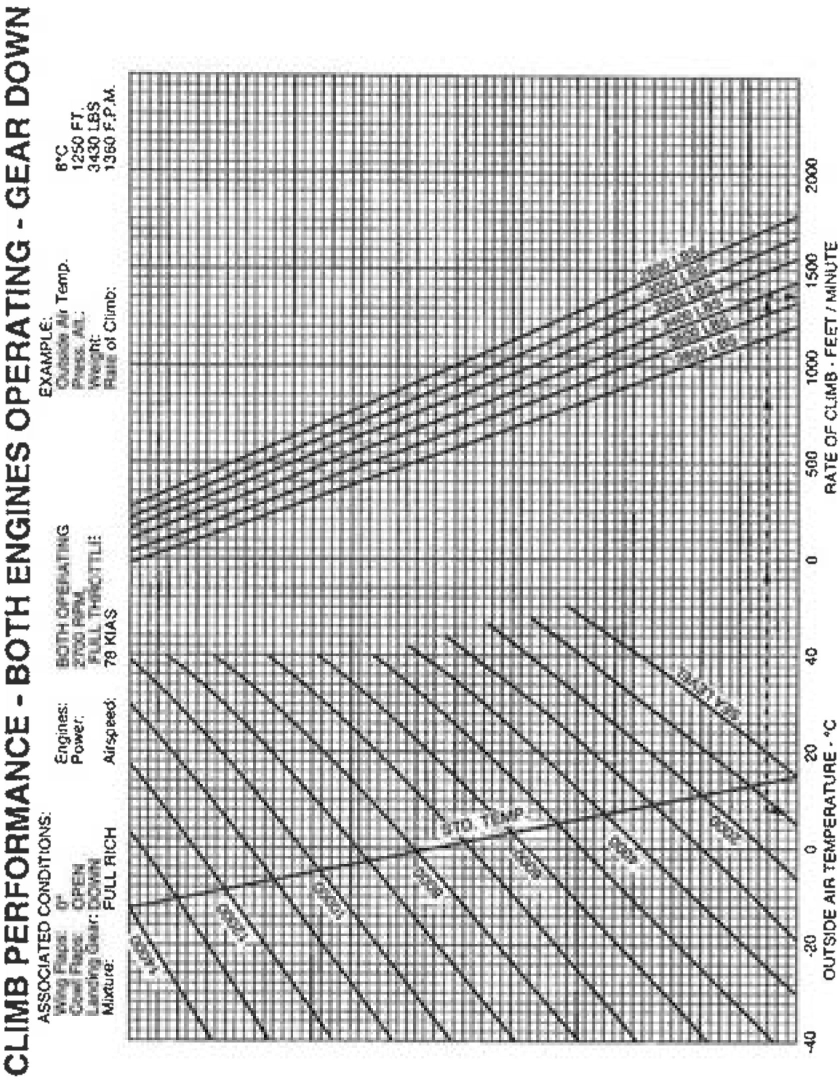

CLIMB PERFORMANCE - BOTH ENGINES OPERATING - GEAR DOWN
Figure 5-15

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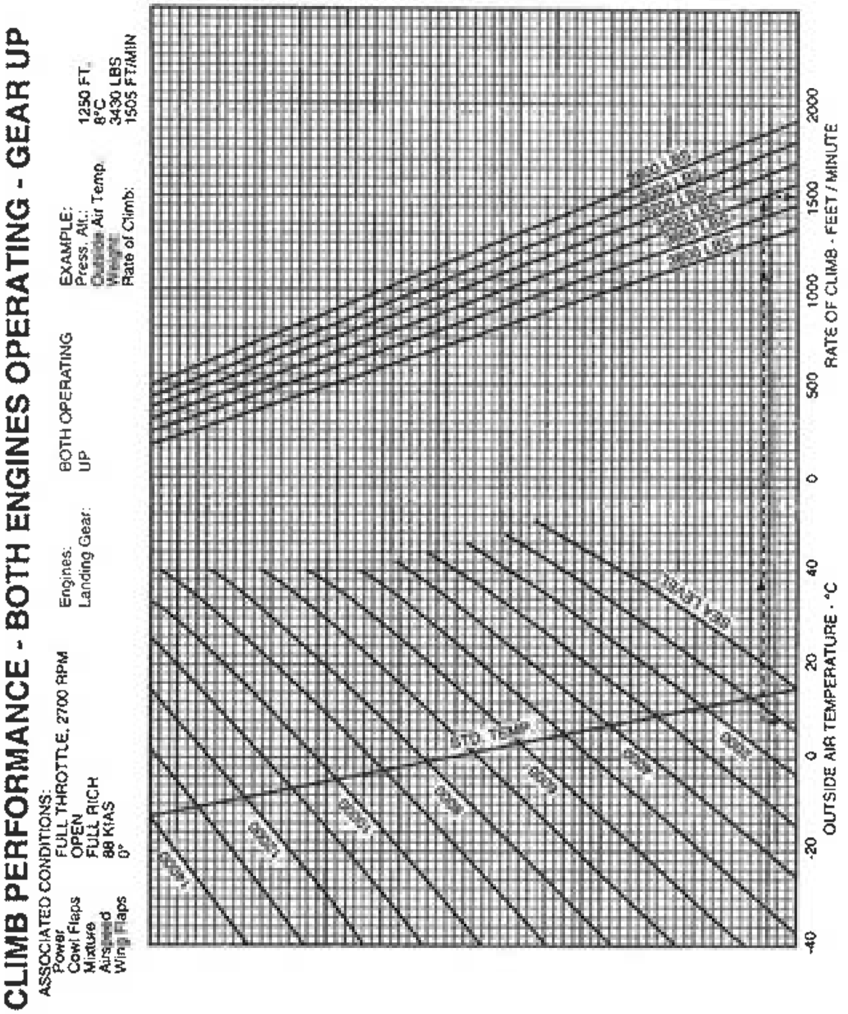
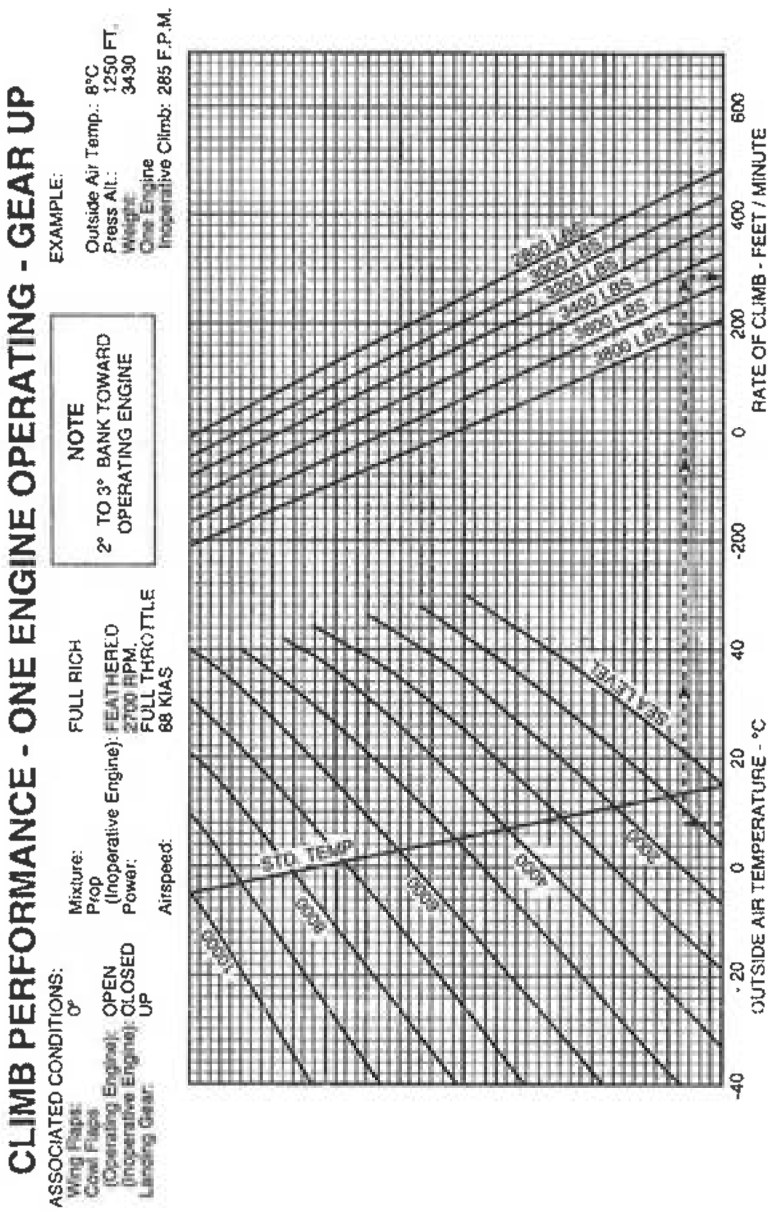
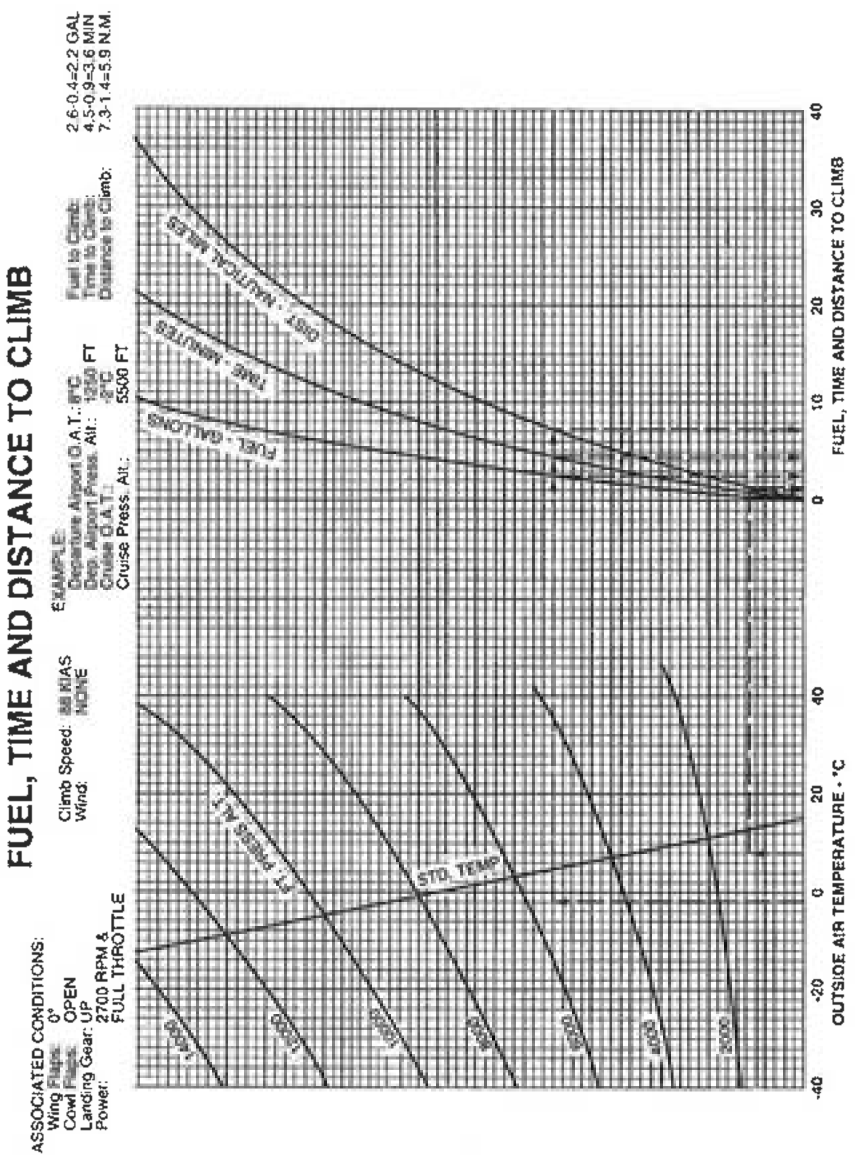


CLIMB PERFORMANCE - BOTH ENGINES OPERATING - GEAR UP
Figure 5-17



CLIMB PERFORMANCE - ONE ENGINE OPERATING - GEAR UP
Figure 5-19



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-21

FUEL AND POWER SETTING TABLE

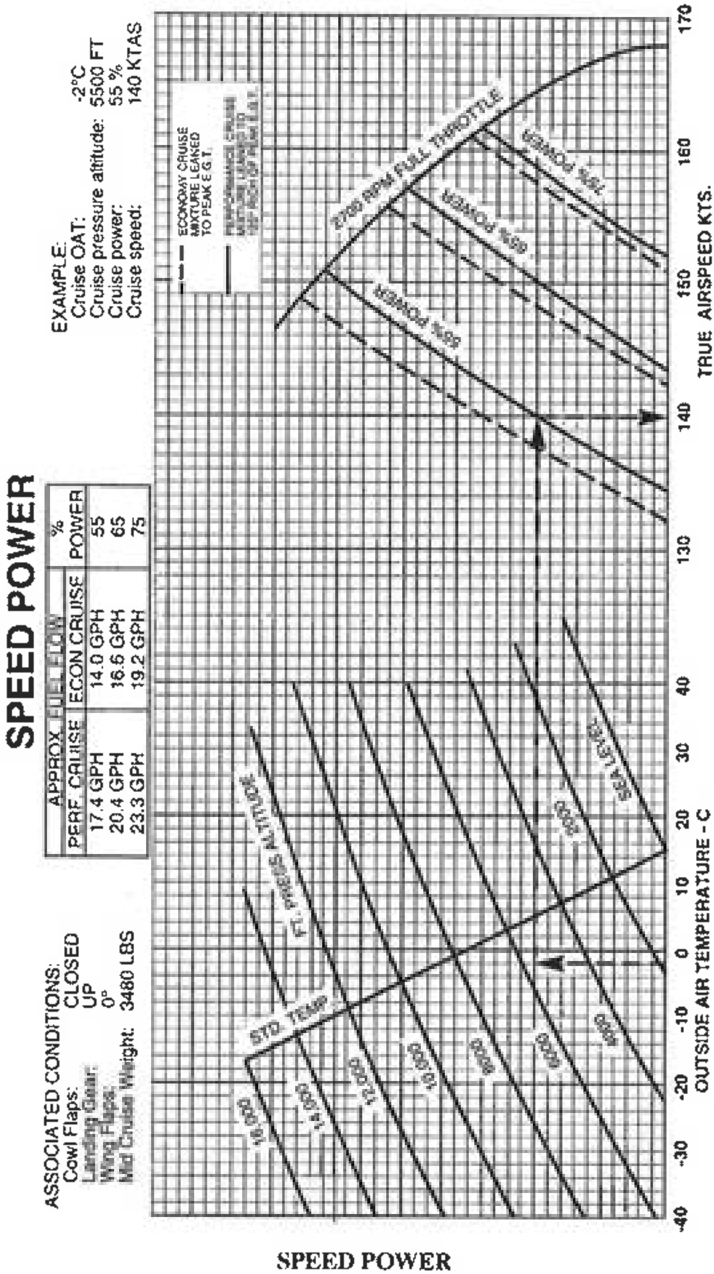
LYCOMING (L) O-360-A1H6 (PER ENGINE)

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 & POWER SETTING TABLE
Figure 5-23



SPEED POWER
Figure 5-25

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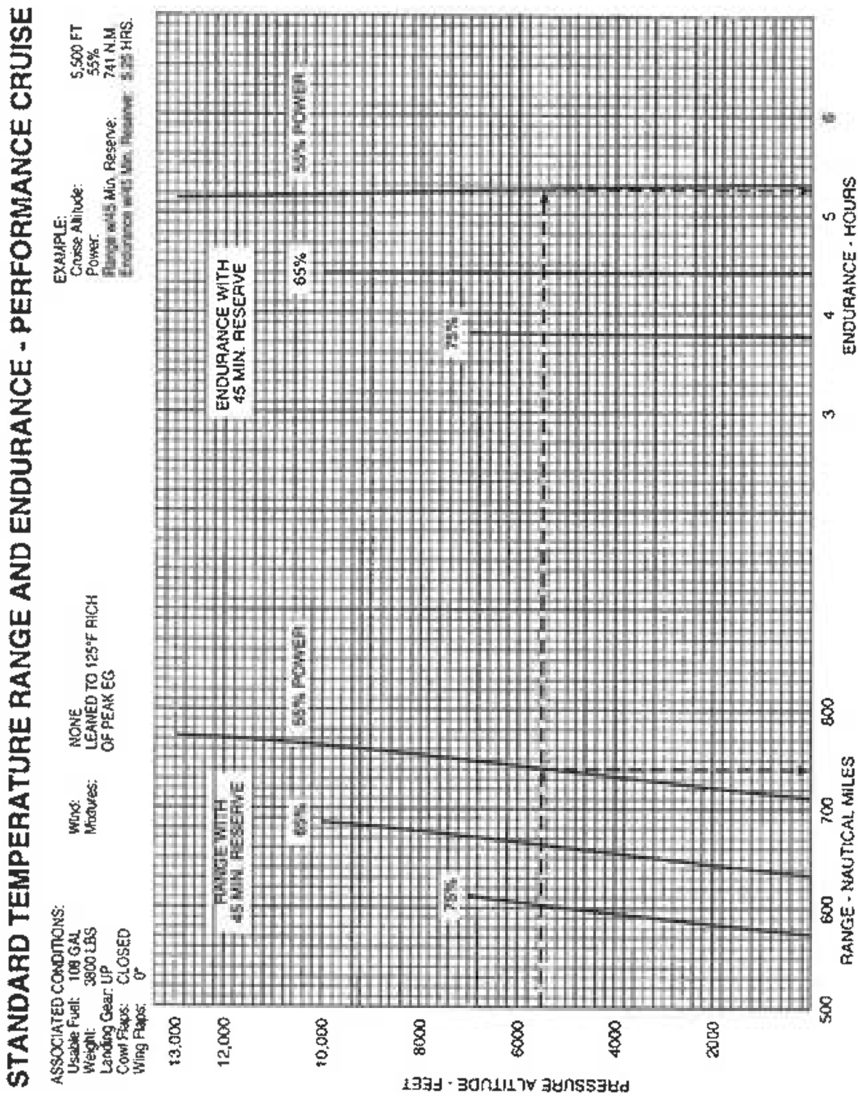

STANDARD TEMPERATURE RANGE AND ENDURANCE - PERFORMANCE CRUISE
Figure 5-27

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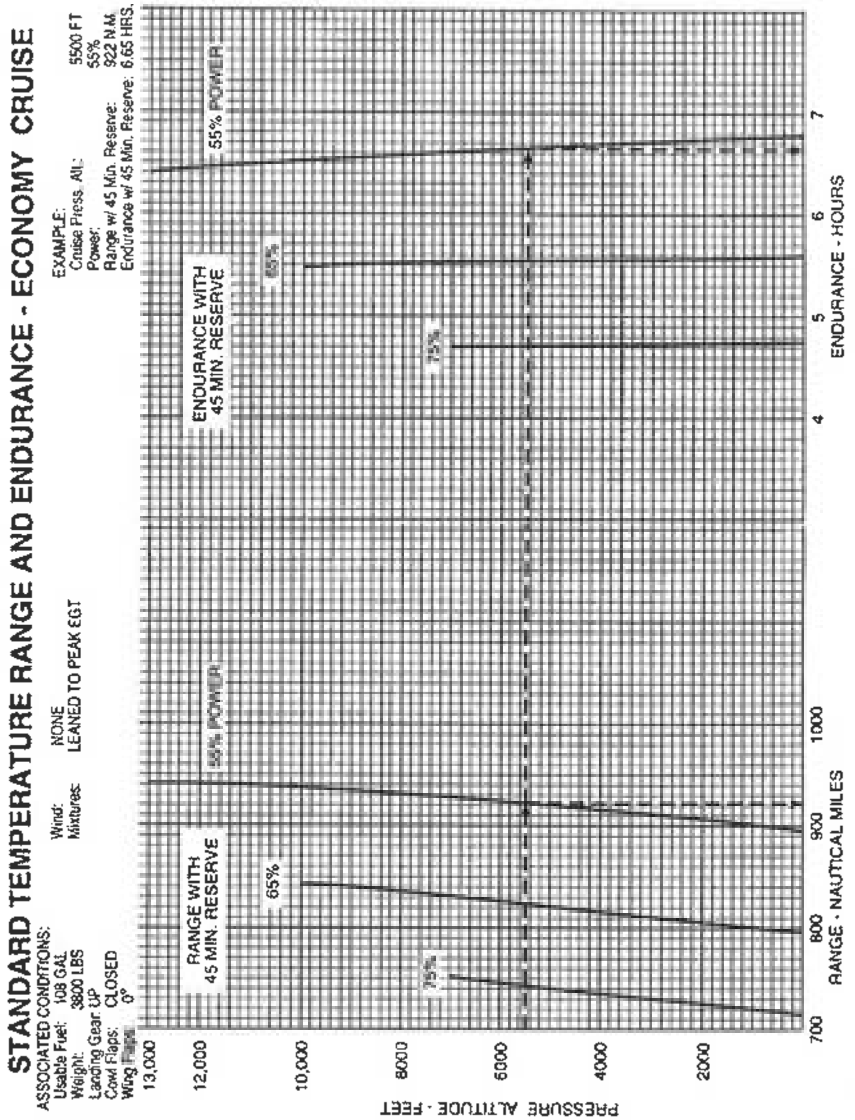
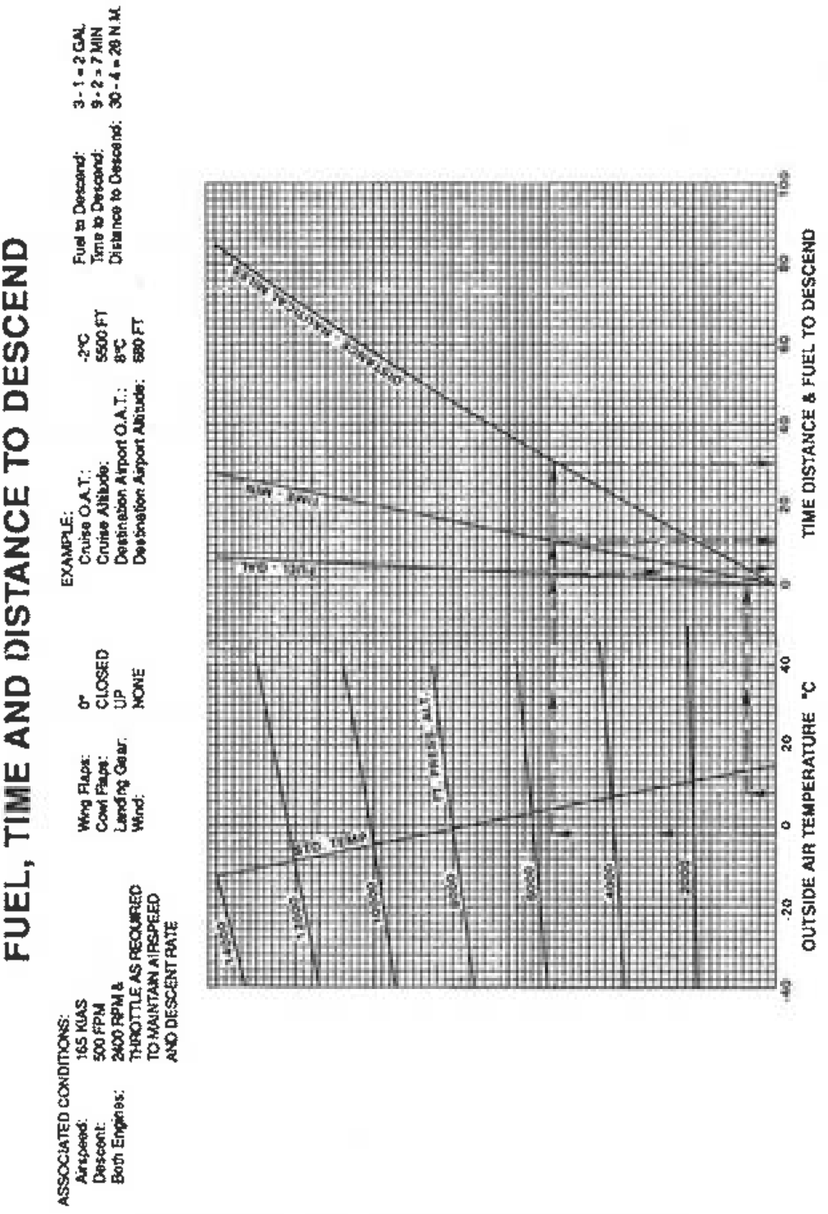
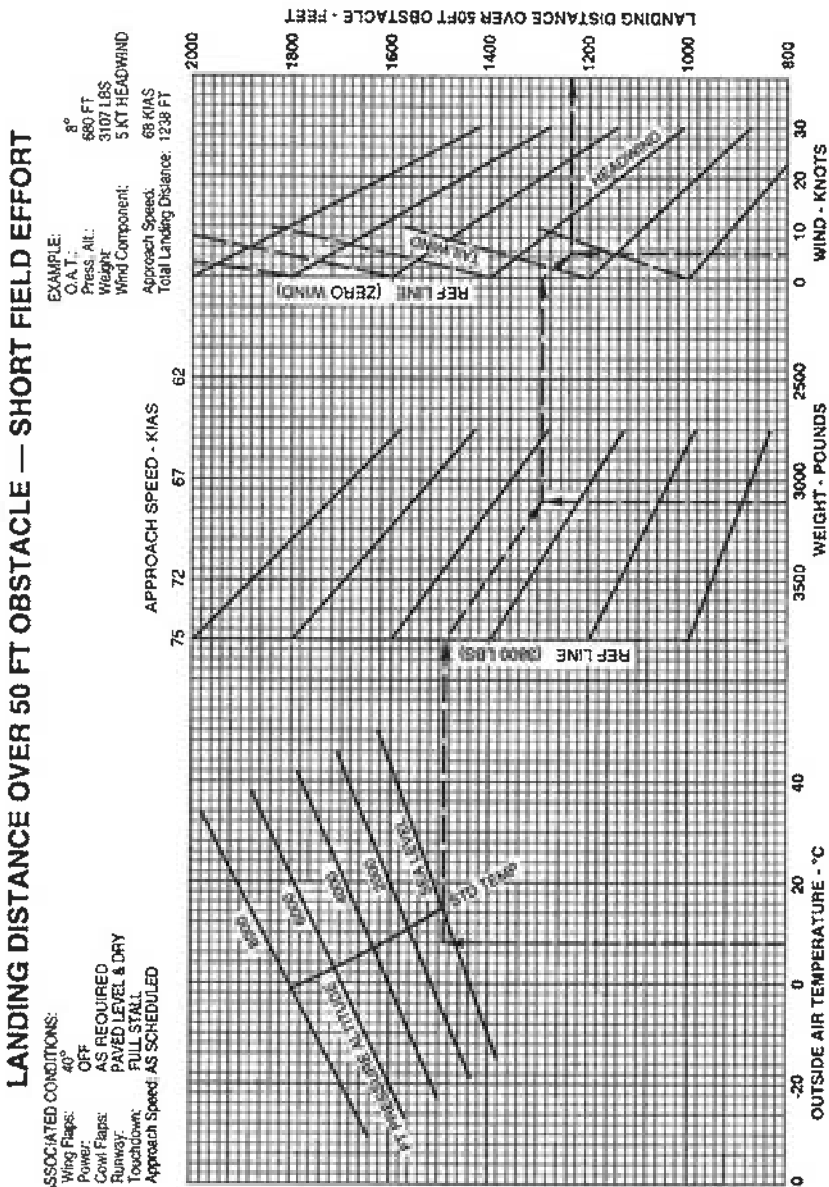


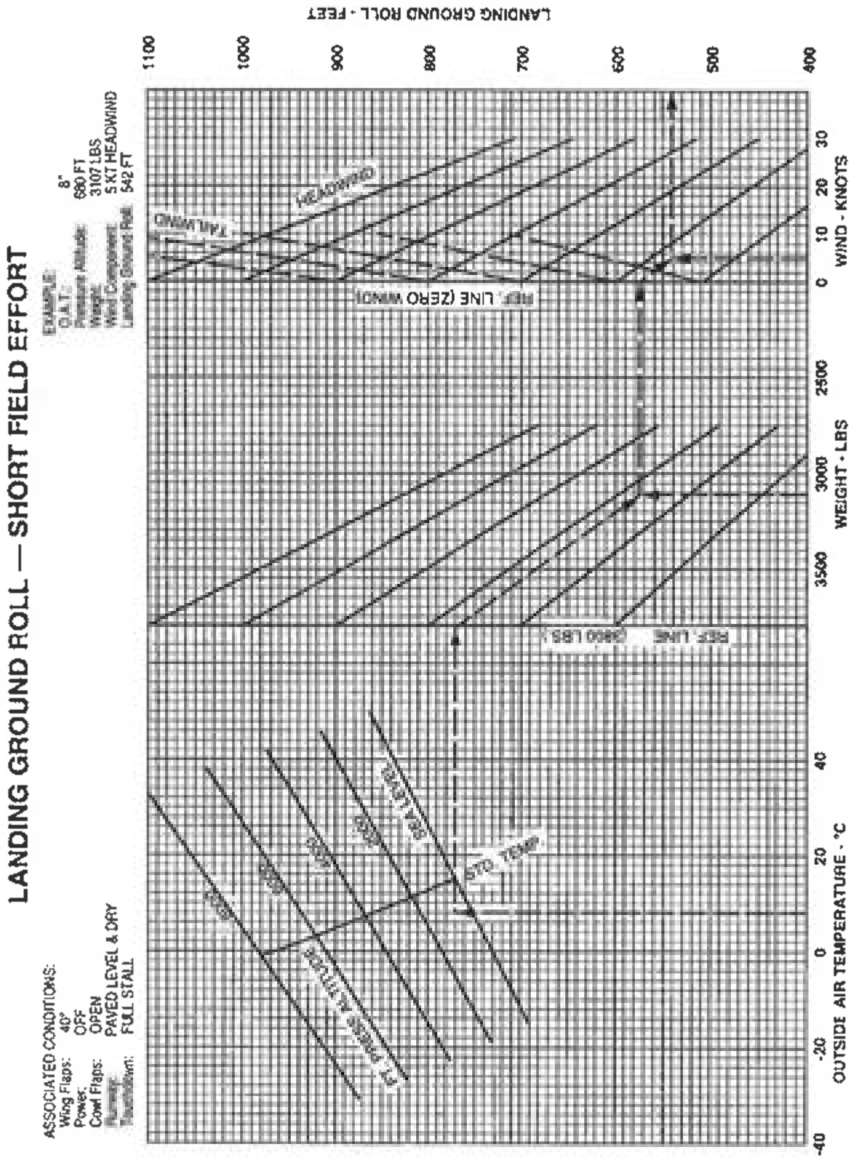
STANDARD TEMPERATURE RANGE AND ENDURANCE - ECONOMY CRUISE
Figure 5-29



FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-31



LANDING DISTANCE OVER 50 FT. OBSTACLE - SHORT FIELD EFFORT
Figure 5-33



LANDING GROUND ROLL - SHORT FIELD EFFORT
Figure 5-35

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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.

6.3 AIRPLANE WEIGHING PROCEDURE

Piper provides basic empty weight and center of gravity location for each airplane, when initial airworthiness is issued.

This data is provided on a **Weight and Balance Data Form (Figure 6-5) in Section 6 of the POH.**

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

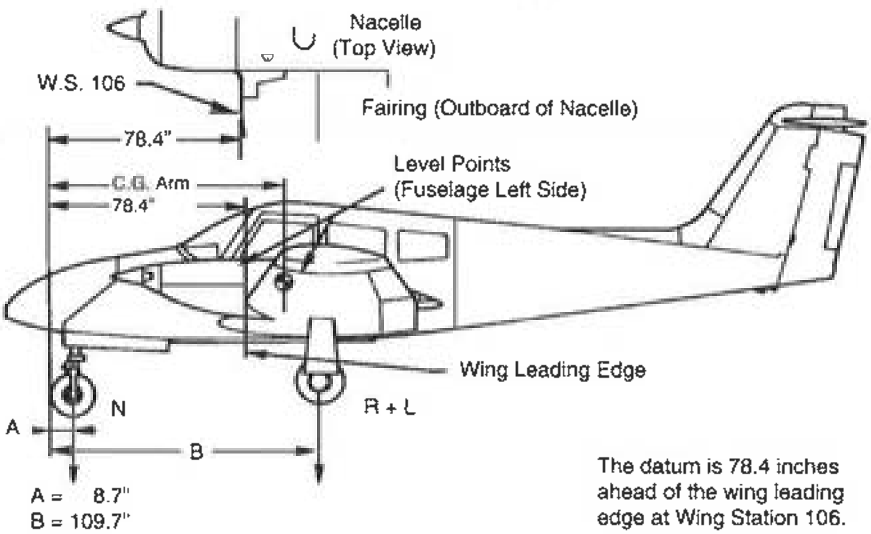
(1) With airplane on scales, block main gear oleo pistons in the fully extended position.
(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(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:

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

$$\text{Where: } T = N + R + L$$

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 CERTIFIED 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 Delivered						

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 (Continued)
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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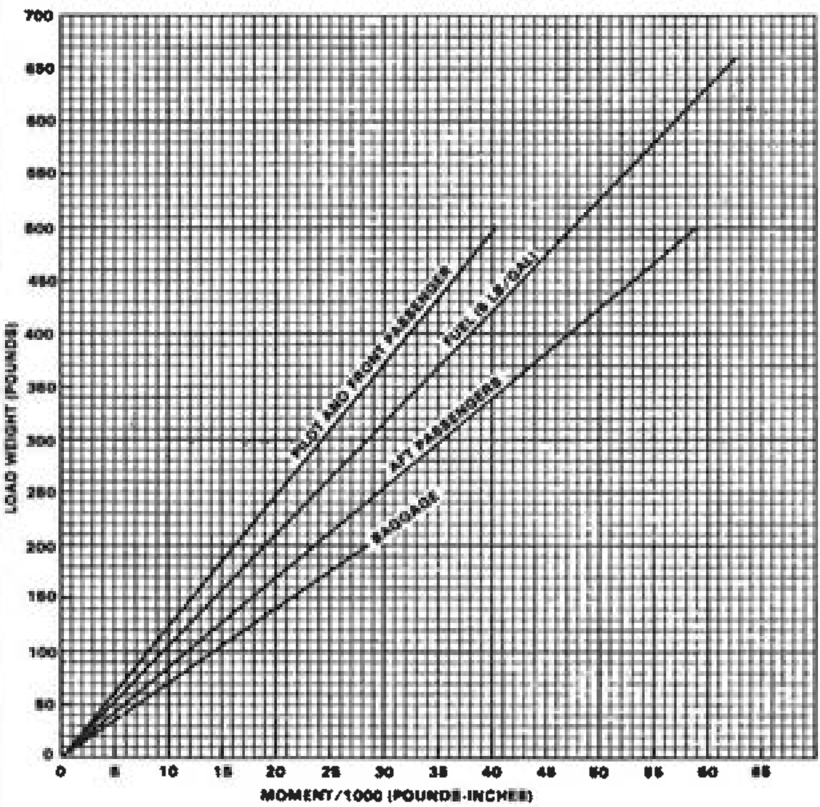
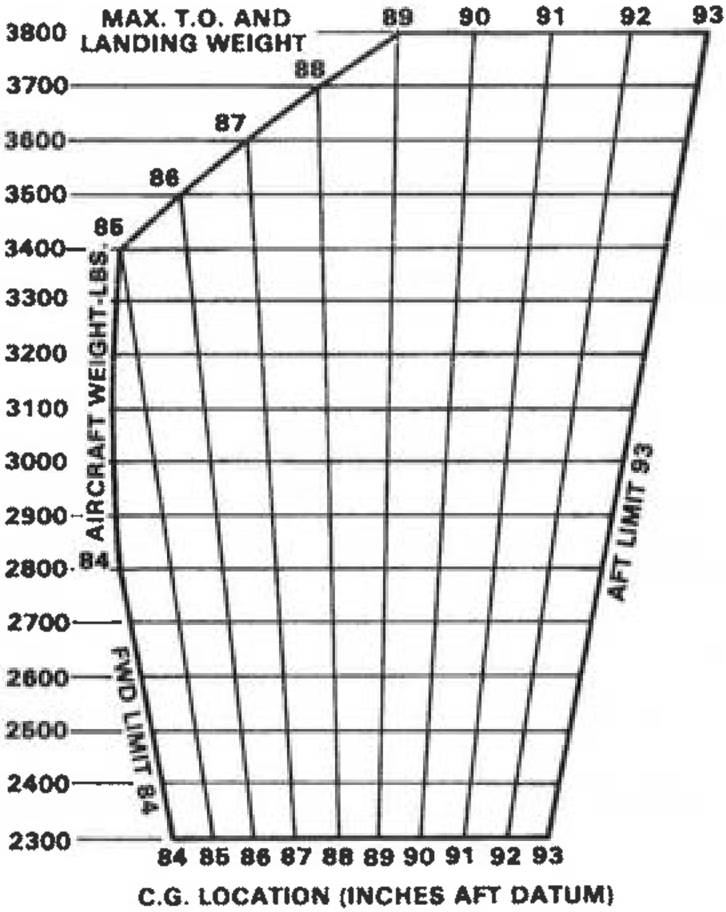


LOADING GRAPH
Figure 6-13



C.G. RANGE AND WEIGHT
Figure 6-15

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OF THE AIRPLANE AND IT'S SYSTEMS

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SECTION 7

DESCRIPTION AND OPERATION

OF THE AIRPLANE AND IT'S SYSTEMS

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

The basic airframe is constructed of aluminum alloy, with steel engine mounts, and landing gear, fiberglass nose cone, cowling nose bowls and wing tips, and ABS thermoplastic or fiberglass extremities (tail fin, rudder and stabilator). 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 a semi-tapered design and employs a modified laminar flow NACA airfoil section. The main spar, located at approximately 40% of the chord, is attached to the fuselage by inserting the butt ends of the spar into a spar box carry-through. Bolting the spar ends into the spar box carry-through structure, (located under the rear seats), effectively creates a continuous main spar. The wings are also attached by auxiliary front and rear spars. 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, is mounted on top of the vertical fin, and 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 rotates in a clockwise direction when viewed from the cockpit, and the right engine rotates 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. Engine mounts are constructed of steel tubing, with dynafocal isolators to reduce vibration.

Induction Air System

The induction air box incorporates a manually operated two-way valve, allowing either filtered induction air or unfiltered heated air into the carburetor. Selecting carburetor heat provides heated air to the carburetor in the event of carburetor icing, and also bypasses the air filter if it becomes blocked with ice, snow, freezing rain, etc. Since the air is unfiltered, carburetor heat should not be used during ground operation when dust or other contaminants might enter the system. The primary (filtered) induction source should always be used for takeoffs.

7.5 ENGINES AND PROPELLERS (Continued)

PROPELLERS

Counter-rotating propellers provides balanced thrust during takeoff and climb which 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 drives the propeller toward the high RPM or unfeather position; nitrogen pressure and a large spring drives the propeller toward the low RPM or feather position and also prevents propeller overspeeding. The recommended nitrogen pressure 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.

A propeller governor on each engine, supplies engine oil at various pressures through the propeller shaft to maintain constant RPM settings. The 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 a propeller is accomplished by moving the control fully aft through the low RPM detent, into the FEATHER position. 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

Unfeathering 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 out of the feathered position.

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 feathering a propeller in flight, the pilot must move the propeller control into the FEATHER position before the engine speed drops below 950 RPM.

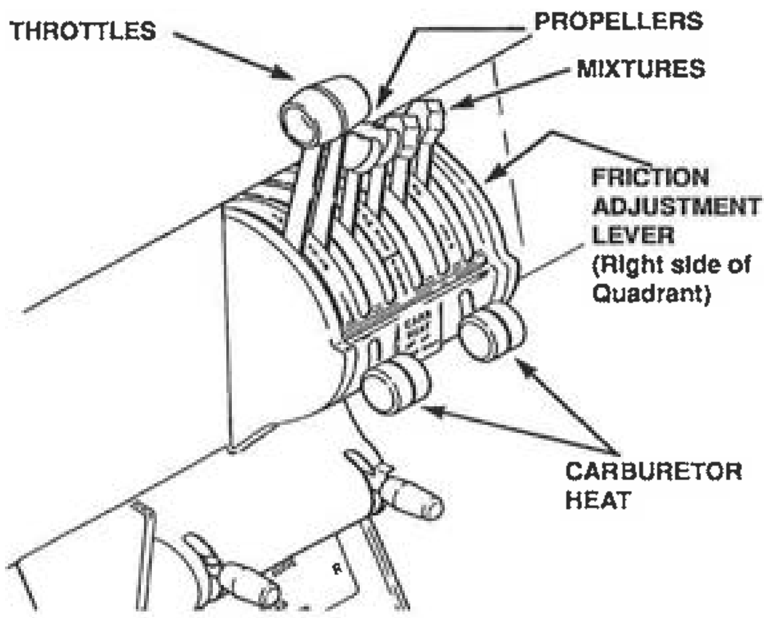
7.7 ENGINE CONTROLS

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 engine manifold pressure. A gear up warning system, triggered by low manifold pressure, is intended to alert the pilot of an impending gear up landing. When ever manifold pressure drops below 14 inHg with the landing gear not down and locked, a CHECK GEAR CAS message is activated along with a continuous CHECK GEAR aural alert. If the airplane is higher than approximately 400 feet AGL, the CAS CAUTION is triggered. Below 400 feet AGL, the CAS WARNING is triggered. Since this low manifold condition might be experienced during normal descent, the CHECK GEAR aural alert may be muted by pressing the appropriate MASTER RESET switch above the PFD. Once muted, the aural alert is silenced, but the associated CHECK GEAR CAS text message will remain present until manifold pressure is increased, or the gear is deployed.

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

7.7 ENGINE CONTROLS (Continued)



CONTROL QUADRANT
Figure 7-1

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

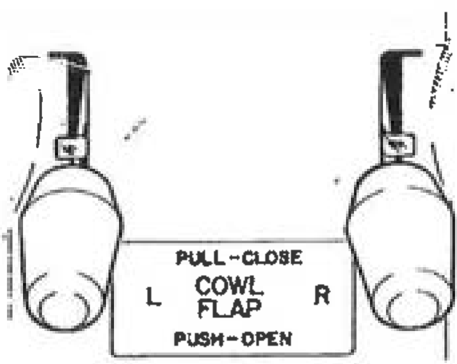
The mixture control levers are used to adjust the air to fuel ratio. An engine is shut down by the placing of the mixture control lever in the full lean (cut-off) position.

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.

7.7 ENGINE CONTROLS (Continued)

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 GARMIN G1000 AVIONICS SYSTEM

NOTE

Refer to the latest appropriate revision of the Garmin G1000 Pilot's Guide for the Piper PA-44 Seminole, (Garmin P/N 190-01461-01) for complete descriptions of the G1000 integrated avionics system and operating procedures.

The Garmin G1000 Integrated Avionics System consists of a Primary Flight Display (PFD), a Multi-Function Display (MFD), an Audio Panel, an Attitude and Heading Reference System (AHRS), an Air Data Computer (ADC), and the sensors and computers to process flight and engine information for display to the pilot. The system contains dual GPS WAAS receivers, dual VOR/ILS receivers, dual VHF communications transceivers, a transponder, and an integrated crew alerting system (CAS) to alert the pilot of advisory, caution and warning messages. The G1000 system also provides Message Advisories, which alert the pilot to abnormalities associated with the G1000 system. The G1000 system also has a terrain proximity system, Traffic Information Service (TIS) and FliteCharts. Optional avioncs equipment include ADF, DME, Class B TAWS, Traffic Advisory System (TAS), Jeppesen ChartView, Synthetic Vision, AOPA Facilities Directory, and the Garmin Datalink (GDL) for XM weather and music.

Primary Flight Display

The Primary Flight Display (PFD) displays airspeed, attitude, altitude, and heading information in a traditional format. Slip information is shown as a trapezoid under the bank pointer. One width of the trapezoid is equal to one ball width slip. Rate of turn information is shown on the scale above the rotating compass card; a standard rate turn is accomplished when the turn rate trend vector stops at the second tick mark (standard rate tick mark). OAT information is presented in the lower left corner of the PFD. The measured value of OAT is adjusted for probe recovery factor and ram air effects to indicate static air temperature.

7.9 GARMIN G1000 AVIONICS SYSTEM (Continued)

Primary Flight Display (Continued)

The primary function of the PFDs is to provide attitude and heading data from the Attitude and Heading Reference System, air data from the Air Data Computer, and navigation and alerting information. Synthetic Vision and Pathways may be utilized to increase situational awareness.

The following controls are available on the PFD (clockwise from top right):

- Communications frequency volume and squelch knob
- Communications frequency transfer button
- Communications frequency set knobs
- Altimeter (BARO) setting knob (large knob)
- Course knob (small knob)
- Map range knob and cursor control
- FMS control buttons and knob
- Flight planning buttons
- PFD softkey buttons
- Altitude reference set knob
- Heading bug control
- Navigation frequency set knobs
- Navigation frequency transfer button
- Navigation frequency volume and Identifier knob

The primary function of the VHF Communication portion of the G1000 is to enable external radio communication. The primary function of the VOR/ ILS Receiver portion of the equipment is to receive VOR, Localizer, and Glide Slope signals. The primary function of the GPS portion of the system is to acquire signals from the GPS and WAAS satellites and process this information in real-time to obtain the user's position, velocity, and time. This GPS WAAS is certified under TSO C146a and therefore is qualified as a primary navigation system.The PFD also displays autopilot status and mode annunciation, at the top, center of the display.

Primary Flight Display (continued)

Attitude and Heading Reference System (AHRS)

The AHRS uses rate sensors, air data, GPS data and magnetic variation, to calculate pitch, roll, heading and sideslip. The AHRS incorporates internal monitors to continually validate the information it sends to the flight displays. If a failure is detected, a red X will be displayed in place of the incorrect information. If the pilot suspects the validity of an indication that has not been invalidated by the internal monitors, he should cross check related indications on the PFD and the standby instrument to verify the suspect information

If the entire AHRS unit fails, an amber ATTITUDE FAIL is displayed over the attitude indicator and all invalid information is replaced with a red X. The AHRS may be re-set in-flight and will align while the airplane is in motion. Alignment will occur quicker if the wings are kept level during the alignment process. Note that if the AHRS fails, the course pointer on the HSI will point straight up. The CDI will still function properly and course may still be set using the digital window.

Air Data Computer (ADC)

The ADC provides airspeed, altitude, vertical speed, and air temperature to the display system, the traffic systems and the flight management system.

The ADC incorporates internal monitors to continually validate the information it sends to the flight displays. If a failure is detected, a red X will be displayed in place of the incorrect information. If the pilot suspects the validity of an indication that has not been invalidated by the internal monitors, he should cross check related indications on the PFD and the standby instrument to verify the suspect information.

If the entire ADC unit fails, amber AIRSPEED FAIL, ALTITUDE FAIL and VERT SPEED FAIL messages are displayed, along with the red X, over the appropriate area of the displays.

Primary Flight Display (continued)

Crew Alerting System (CAS) Messages

The Crew Alerting System (CAS) consists of Master Warning and Master Caution indicators operating in conjunction with CAS text messages and aural alerts. The Master Warning and Caution indicators (labeled MASTER WARN RESET and MASTER CAUTION RESET) are illuminated push-button switches, above the PFD. They are used to annunciate, and to acknowledge warning and caution alerts.

CAS text messages appear on the lower right side of the PFD during normal and reversionary mode operations. They are categorized as warning, caution or advisory and are prioritized in the following order:

Warning (Red) Messages - appear at the top of the message stack

Caution (Amber) Messages - appear in the middle of the stack

Advisory (White) Messages - appear at the bottom of the stack

Warning (Red) Messages

Warning conditions are conveyed via a flashing (red) Master Warning indicator, a repeating triple chime and either a flashing (inversely red on white) text message or a flashing EIS gage indication.

Warnings may be acknowledged by pressing the MASTER WARN RESET switch. When acknowledged, the Master Warning indicator will extinguish, and the aural chime will silence. If applicable, the text message will stop flashing and will revert to normal (red on black) text. Warning text messages persist until the initiating condition is removed.

A Warning is triggered whenever a gage on the Engine Indication System (EIS) exceeds a red line. In this event, the Master Warning indicator and triple chime are triggered (and acknowledged) normally, but without an accompanying Warning text message. Instead, the appropriate EIS gage will flash until the exceedance is removed.

Primary Flight Display (continued)

Crew Alerting System (CAS) Messages (continued)

Caution (Amber) Messages

Caution conditions are conveyed via a flashing (amber) Master Caution indicator, a non-repeating double chime and either an inverse (black on amber) text message or a flashing EIS gage indication.

Cautions may be acknowledged by pressing the MASTER CAUTION RESET switch. When acknowledged, the Master Caution indicator will extinguish, and if applicable, the text message will will revert to normal (amber on black) text. Caution text messages persist until the initiating condition is removed.

A Caution is triggered whenever a gage on the Engine Indication System (EIS) exceeds an amber line. In this event, the Master Caution indicator and double chime are triggered (and acknowledged) normally, but without an accompanying Caution text message. Instead, the appropriate EIS gage will flash until the exceedance is removed.

Advisory (White) Messages

Advisory messages are conveyed via a non-repeating singe chime and a (white on black) text message.

Advisory text messages do not require acknowledgment, and will persist until the initiating condition is removed.

System Annunciations

System Annunciations do not trigger Master Warning or Master Caution indications and do not require pilot action to acknowledge. These annunciations are typically divided into two categories.

- Hardware or functional failures, indicated graphically with text or red "x" over the failed display.
- Optional systems alerts such as those generated by terrain awareness or traffic avoidance systems. These annunciations and alerts are indicated in accordance with their system descriptions.

Primary Flight Display (continued)

Aural Alerts

The G1000 system generates the following aural alerts:

- Master Warning - Repeating triple chime.
- Master Caution - Non-repeating double chime.
- Advisory - Non-repeating single chime.
- Autopilot disconnect and preflight test complete (warble tone).
- Terrain cautions/warnings and various voice alerts.
- Traffic System various voice alerts.
- Airspeed greater than Vne - "Airspeed...Airspeed" voice alert.
- Low airspeed - Airspeed voice alert of an impending underspeed condition (if equipped with optional Underspeed Protection)
- Stall Warning - "Stall...Stall" voice alert.
- "Five-hundred" voice alert - when aircraft descends within 500 feet above the terrain or runway threshold.
- "Minimums..Minimums" voice alert - when the aircraft reaches MDA/DH if set by the pilot.
- "CHECK GEAR" voice alert - In flight when the manifold pressure is 14 inches of mercury or below and the landing gear selector is not in the DOWN position.
- "CHECK GEAR" voice alert - In flight when the flaps are extended more than 10° and the landing gear selector is not in the DOWN position.
- "CHECK GEAR" voice alert - On the ground when the landing gear selector is in the UP position.
- "Engaging Autopilot" voice alert when autopilot automatically engages in LVL mode.

Primary Flight Display (continued)

MFD & PFD Message Advisories

The G1000 system generates several MFD and PFD Message Advisories. These messages are annunciated by flashing the PFD lower right softkey label, and are accessed/hidden by depressing that softkey. For a complete list of these messages, see the Garmin G1000 Cockpit Reference Guide.

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Primary Flight Display (continued)

Reversionary Mode - PFD

If a failure is detected in the MFD, the G1000 automatically enters reversionary mode. In reversionary mode, critical flight instrumentation, autopilot annunciations, CAS display and the inset map are combined with engine instrumentation on a single display.

If an undetected display failure occurs, the pilot may manually activate reversionary display mode by depressing the red DISPLAY BACKUP button on the audio panel.

NOTE

See Reversionary Mode - MFD for description of reversionary mode following a PFD failure.

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Primary Flight Display (continued)

Synthetic Vision System (SVS) - Optional

The Synthetic Vision System (SVS) is a visual enhancement to the G1000. Terrain-SVS is displayed on the PFD as a forward-looking depiction of the topography immediately in front of the aircraft. The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and a database of terrain, obstacles, and other relevant information. The following SVS enhancements appear on the PFD:

- Pathways
- Flight Path Marker
- Horizon Heading Marks
- Traffic Displays
- Airport Signs
- Runway Displays
- Terrain Alerting
- Obstacle Alerting
- Water
- Zero-Pitch Line

Optional Terrain Awareness and Warning System - Class B (TAWS-B) or standard Terrain-SVS information is integrated within SVS to provide visual and audible alerts of terrain threats relative to the projected flight path. In addition to the standard TAWS or Terrain-SVS alerts, Terrain-SVS offers a three dimensional view of terrain and obstacles. Terrain and/ or obstacles that pose a threat to the aircraft are shaded yellow or red. SVS is activated from the PFD softkey located along the display bezel. -

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Multi-Function Display

The Multi-Function Display (MFD) is located in the center of the instrument panel, and displays the following:

- Engine parameters
- Aircraft system parameters
- Various map and system status pages for Navigation, Traffic Map, Weather Datalink, and TAWS-B

The MFD also displays waypoint information, auxiliary information, flight plan information, and nearest information.

All engine and systems indications necessary for control and monitoring are continuously displayed along the left edge of the MFD display. This area is called the Engine Indicating System (EIS) display. A dedicated Engine page is also provided on demand, showing all engine and systems indications in an expanded format (Figure 7.5).

MFD controls are identical to the PFD controls with the addition of GFC700 controls on the lower left bezel.

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Multi-Function Display (continued)

ENGINE PAGE
Figure 7-5

Multi-Function Display (continued)

Reversionary Mode - MFD

If the PFD becomes inoperative, the MFD will not automatically switch to reversionary mode. The pilot may elect to use the standby instrument for primary flight instruments, or may manually select the MFD to reversionary mode by pressing the red DISPLAY BACKUP button on the audio panel. In reversionary mode, critical flight instrumentation is combined with engine instrumentation on a single display.

If an undetected display failure occurs, the pilot may manually activate reversionary display mode by depressing the red DISPLAY BACKUP button on the audio panel.

NOTE

See Reversionary Mode - PFD for description of reversionary mode following an MFD failure.

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Multi-Function Display (continued)

Traffic Information Service (TIS)

NOTE

If the G1000 system is configured to use the optional Traffic Advisory System (TAS), TIS will not be available for use.

Traffic Information Service (TIS) provides a graphic display of traffic advisory information to the pilot. The G1000 system performs an automatic test of the TIS system upon power-up. If the TIS power-up test is passed, it will enter STANDBY mode while on the ground. If the TIS power-up test is failed, a failure annunciation will be indicated in the center of the Traffic Map page. The TIS will automatically switch to OPERATE mode once the aircraft is airborne and will provide a voice or tone audio output and a graphic display of traffic.

TIS uses the Mode S transponder for the traffic data link and is available only when the aircraft is within the service volume of a TIS-capable, ground based, terminal radar site. Updates are available to the pilot in 5 second intervals. Aircraft without a transponder are invisible to TIS and aircraft without altitude reporting capability are shown without altitude separation data or climb/descent indication.

Traffic Map Page

The Traffic Map page, located in the Map Group on the MFD, is selectable from 2 nm to 12 nm. The G1000 system can display up to eight traffic targets within a 7.5 nm radius, from 3000 feet below to 3500 feet above the requesting aircraft. The altitude difference between the requesting aircraft and other aircraft is displayed above/below the traffic symbol in hundreds of feet. If the traffic target is above the requesting aircraft, the altitude separating text appears above the traffic symbol; if below, the altitude separation text appears below the traffic symbol. An altitude trend up/down arrow is displayed to the right of the traffic target symbol when the relative climb or descent speeds are greater than 500 ft/min in either direction. TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°.

Multi-Function Display (continued)

Traffic Information Service (TIS) (continued)

Traffic Map Page (Continued)

Traffic is overlaid on the following pages:

- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page
- PFD Inset Map

TIS Alerts

Traffic is displayed according to TCAS symbology using four different symbols:

1. Non-Threat Traffic – An open white diamond with black center that indicates traffic is beyond a 5 nm range and greater than ±1200 feet from the requesting aircraft.
2. Traffic Advisory (TA) – A solid yellow circle that indicates that traffic has met the criteria for a traffic advisory.
3. Traffic Advisory Off Scale - On the Traffic Map page a half TA symbol indicating a traffic advisory (TA), which is detected but is outside the range of the map will be displayed at the edge of the scale on the azimuth of the detected traffic. On the map page the off-scale traffic advisory is provided in a text box located on the lower left corner of the map.

Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page or in a banner at the lower left corner of map pages other than the Traffic Map Page on which traffic can be displayed.

TIS customization options are available to the pilot by depressing the MENU key while on the Navigation Map Page, and then selecting "Map Setup" then "Traffic" Group. TIS traffic may also be displayed on the Navigation Map page by selecting the MAP softkey and then selecting the TRAFFIC softkey.

Multi-Function Display (continued)

Traffic Information Service (TIS) (continued)

TIS Alerts (continued)

Additional details on the Traffic Information Service (TIS) are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-44 Seminole, Garmin P/N 190-01462-01 and/or the Garmin G1000 Pilot's Guide for the PA-44 Seminole, Garmin P/N 190-01461-01.

Traffic Advisory System (TAS) – Optional

NOTE

If the G1000 system is configured to use the optional Traffic Advisory System (TAS), TIS will not be available for use.

Traffic Advisory System

The optional Garmin GTS 800 is a Traffic Advisory System (TAS). It enhances flight crew situation awareness by displaying traffic information from transponder-equipped aircraft. The system also provides visual and aural traffic alerts including voice announcements to assist in visually acquiring traffic.

The GTS 800 provides a system test mode to verify the TAS system is operating normally. The test must be initiated from STANDBY mode, and takes 10 seconds to complete. When the system test is initiated, a test pattern of traffic symbols appears on the Trafic Map page. If the system test passes, the system announces, "TAS System Test Passed". If the system test does not pass, the system announces "TAS System Test Failed." When the system test is complete, the traffic system enters STANDBY mode.

After power-up, the GTS 800 automatically enters STANDBY mode and no traffic depictions or alerts will be given. The GTS 800 must be in OPERATE mode for traffic to be displayed and for traffic advisories (TA) to be issued. The pilot can manually change the system between STANDBY mode and OPERATE mode at any time via softkeys on the Traffic Map page. If the pilot does not manually select a mode of operation, the system will automatically transition from STANDBY to OPERATE mode 8 seconds after becoming airborne and transition from OPERATE to STANDBY 24 seconds after landing. TAS aural alerts are muted when GPS altitude is less than 400 ft above ground level (AGL).

Multi-Function Display (continued)

Traffic Advisory System (TAS) - Optional (continued)

Traffic Map Page

The Traffic Map page, located in the Map Group on the MFD, is selectable from 2 nm to 12 nm. The GTS 800 is capable of tracking up to 45 intruding aircraft equipped with Mode A or C transponders, and up to 30 intruding aircraft equipped with Mode S transponders. A maximum of 30 aircraft with the highest threat potential can be displayed simultaneously over a range of 2 nm to 12 nm at altitudes of 10,000 feet below to 10,000 feet above the requesting aircraft. No TAS surveillance is provided for aircraft without operating transponders. The altitude difference between the requesting aircraft and other aircraft is displayed above/below the traffic symbol in hundreds of feet. If the traffic target is above the requesting aircraft, the altitude separating text is preceded by a "+" symbol and appears above the traffic symbol; if below, the altitude separation text is preceded by a "-" symbol and appears below the traffic symbol. An altitude trend up/down arrow is displayed to the right of the traffic target symbol when the relative climb or descent speeds are greater than 500 ft/min in either direction.

Traffic is overlaid on the following pages:

- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page
- PFD Inset Map
- PFD Forward Looking Depiction Area (when SVS is selected ON)

Multi-Function Display (continued)

Traffic Advisory System (TAS) - Optional (continued)

TAS Alerts:

Traffic is displayed according to TCAS symbology using four different symbols.

1. Non-Threat Traffic – An open white diamond with black with black center indicates traffic is beyond a 6 nm range and greater than ± 1200 feet from the requesting aircraft.
2. Proximity Advisory (PA) - A solid white diamond indicating that the intruding aircraft is within ± 1200 feet and 6 nm range, but is still not considered a TA threat.
3. Traffic Advisory (TA) – A solid yellow circle that indicates that traffic has met the criteria for a traffic advisory and is considered to be potentially hazardous. A yellow TRAFFIC annunciation is displayed at the top left of the attitude indicator on the PFD and an alert is heard in the cockpit, advising "Traffic", along with additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA. For example, the voice alert "Traffic, 11 o'clock high, three miles" would indicate that the traffic is in front of and slightly to the left of the own aircraft, above own altitude, and approximately three nautical miles away. A TA will be displayed for a minimum of 8 seconds, even if the condition(s) that triggered the TA are no longer present.
4. Traffic Advisory Off Scale – On the Traffic Map page, a half TA symbol indicating a traffic advisory (TA), which is detected but is outside of the range of the map, will be displayed at the edge of the scale on the azimuth of the detected traffic. On the map page the off-scale traffic advisory is provided in a text box located on the lower left corner of the map.

Traffic information for which TAS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page or in a banner at the lower left corner of maps other than the Traffic Map Page on which traffic can be displayed.

TAS customization options are available to the pilot by depressing the MENU key while on the Navigation Map Page, and then selecting "Map Setup" then "Traffic" Group. TAS traffic may also be displayed on the Navigation Map by selecting the MAP softkey and then selecting TRAFFIC softkey.

Multi-Function Display (continued)

Traffic Advisory System (TAS) - Optional (continued)

TAS Alerts (continued)

Additional details on the Traffic Advisory System (TAS) are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-44 Seminole (Garmin P/N 190-01462-01) and/or the Garmin G1000 Pilot's Guide for the Piper PA-44 Seminole (Garmin P/N 190-01461-01).

Terrain Proximity

NOTE

If the G1000 system is configured to use the optional Terrain Awareness and Warning System (TAWS), Terrain Proximity will not be available for use.

G1000 Terrain Proximity is a terrain awareness system that increases situational awareness and aids in preventing controlled flight into terrain (CFIT). It is similar to the Terrain Awareness and Warning System (TAWS) but does not comply with TSO-C151b certification standards. Terrain Proximity does not provide warning annunciations or voice alerts but it does provide color indications on map displays when terrain and obstacles are within a certain altitude threshold from the aircraft. Although the terrain and obstacle color map displays are the same, TAWS uses a more extensive database and more sophisticated algorithms to assess aircraft distance from terrain and obstacles. The terrain and obstacles database may not contain all obstructions, so the information provided should be used as an aid to situational awareness and should never be used to navigate or maneuver around terrain.

Multi-Function Display (continued)

Terrain Proximity (continued)

GPS altitude, is derived from satellite position and may differ from baro-corrected altitude read from the altimeter. It is converted to mean sea level (MSL) – based altitude (GPS-MSL altitude) and is used in conjunction with GPS position to calculate and predict the aircraft's flight path in relation to the surrounding terrain and obstacles, whose altitudes are also referenced to MSL.

System Status:

Terrain Proximity requires the following components to operate properly:

- valid 3-D GPS position
- valid terrain/obstacle database

If Terrain Proximity does not have a valid 3-D GPS position, a yellow "No GPS Position" text will be displayed at the center of the Terrain Proximity Page and on the PFD inset map if terrain is selected. If there is not a valid terrain/obstacle database, the system will not display the yellow and red colors associated with the offending obstacles and terrain.

Operation of Terrain Proximity:

Terrain is displayed on the following pages:

- Navigation Map Page
- Terrain Proximity Page
- Trip Planning Page
- Flight Plan Page
- PFD Inset Map

To display terrain data on maps other than the Terrain Proximity page, select the MAP softkey (select INSET softkey for the PFD inset map) on the Navigation Map Page and then select the TERRAIN softkey. When Terrain Proximity is selected on maps other than the Terrain Proximity Page, an icon to indicate the feature is enabled for display, and a legend for Terrain Proximity colors is shown.

Multi-Function Display (continued)

Terrain Proximity (continued)

Terrain customization options are available by pressing the MENU key while on the Navigation Map page, and then selecting "Map Setup" then "Map" group. Options selected on the Navigation Map page will be used on other map pages (less the Terrain Proximity page itself) that display terrain information. Additional information about obstacles can be displayed by panning over the display on the map. The panning feature is enabled by depressing the RANGE knob then pushing the knob in the desired direction until it is over the obstacle of interest. There is no inhibit function associated with Terrain Proximity, as there are no aural or visual alerts to inhibit.

Terrain Proximity Page:

The Terrain Proximity page is specialized to show terrain and obstacle data in relation to the aircraft's current altitude, without clutter from the basemap. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the RANGE Knob from 1 to 200 nm, as indicated by the map range rings (or arcs).

Operation of Terrain Proximity:

The Terrain Proximity Page is located in the Map Page Group on the MFD.

On all pages that display terrain data, obstacles and terrain are depicted with the following colors:

- Red - above or within 100 feet below the aircraft altitude.
- Yellow - between 100 feet and 1000 feet below the aircraft altitude.
- Black - more than 1000 feet below the aircraft altitude.

Terrain Proximity Alerts:

Terrain Proximity does not provide warning annunciations or voice alerts associated with obstacles or terrain.

Multi-Function Display (continued)

Terrain Awareness and Warning System (TAWS -B) – Optional

NOTE

If the G1000 system is configured to use the optional Terrain Awareness and Warning System (TAWS), Terrain Proximity will not be available for use.

The Terrain Awareness and Warning System (TAWS-B) is an optional feature used to increase situational awareness and aid in reducing controlled flight into terrain (CFIT). TAWS-B provides visual and aural cautions and warning alerts when terrain and obstacles are within a given altitude threshold from the aircraft. The displayed alerts and warnings are advisory in nature only. TAWS-B satisfies TSO-C151b Class B certification requirements whereas the more limited Terrain Proximity does not.

TAWS-B uses terrain and obstacle information supplied by government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. The data undergoes verification by Garmin to confirm accuracy of the content, per TSO-C151b standards, however, the displayed information should never be understood as being all-inclusive and data may be inaccurate.

TAWS-B uses information provided from the GPS receiver to provide a horizontal position and altitude. GPS altitude, derived from satellite measurements, is converted to the height above geodetic sea level (GSL), which is the height above mean sea level (MSL) calculated geometrically. GPS position and GSL altitude is used to generate TAWS-B terrain and obstacle alerts. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude.

System Status:

During G1000 power-up, TAWS-B conducts a self-test of its aural and visual annunciations. The system test can also be manually initiated by selecting the TAWS-B page then depress the MENU key, then select the "Test TAWS" option. An aural alert "TAWS System Test OK" or "TAWS System Failure" is issued at test completion, regardless of whether the test was initiated automatically or manually. TAWS-B System Testing is disabled when ground speed exceeds 30 knots.

Multi-Function Display (continued)

Terrain Awareness and Warning System (TAWS-B) - Optional (continued)

System Status (continued)

TAWS-B requires the following to operate properly:

- A valid terrain/obstacle/airport terrain database
- A valid 3-D GPS position solution

If a valid 3-D GPS position solution and vertical accuracy requirements are not attained or the aircraft is out of the database coverage area, a TAWS N/A annunciation will appear on the TAWS-B page and the aural annunciation "TAWS Not Available" is heard. When the GPS signal is re-established and the aircraft is within the database coverage area, the aural message "TAWS Available" is heard.

Operation of TAWS-B:

Terrain is displayed on the following pages:

- Navigation Map Page
- TAWS Page
- Trip Planning Page
- Flight Plan Page
- PFD Inset Map

To display terrain data on maps other than the TAWS-B page, select the MAP softkey (select INSET softkey for the PFD inset map) on the Navigation Map page and then select the TERRAIN softkey. When TAWS-B is selected on maps other than the TAWS-B page, an icon to indicate the feature is enabled for display and a legend for TAWS-B terrain colors is shown.

Terrain customization options are available by pressing the MENU key while on the Navigation Map page, and then selecting "Map Setup" then "Map" group. Options selected on the Navigation Map page will be used on other map pages (less the TAWS-B page itself) that display terrain information. Additional information about obstacles can be displayed by panning over the display on the map. The panning feature is enabled by depressing the RANGE knob then pushing the knob in the desired direction until it is over the obstacle of interest.

Multi-Function Display (continued)

Terrain Awareness and Warning System (TAWS-B) – Optional (continued)

Operation of TAWS (continued)

To inhibit the aural and visual Premature Descent Alert (PDA) and Forward Looking Terrain Awareness (FLTA) alerts (RTC, ITI, ROC and IOI), press the INHIBIT softkey on the TAWS-B page or depress the MENU key then select "Inhibit TAWS" or "Enable TAWS" depending on the current state. In either case, inhibiting and enabling TAWS alerts depends on the status of the INHIBIT softkey, as the INHIBIT softkey performs both functions. Use caution when inhibiting TAWS as the system should be enabled when appropriate. Once TAWS is inhibited, a TAWS INH alert annunciation is displayed on the TAWS-B page of the MFD and at the upper left corner of the altitude tape on the PFD.

NOTE

If the TAWS system has failed or the TAWS alerts are inhibited manually when the Final Approach Fix is the active waypoint on a GPS WAAS approach, a LOW ALT annunciation may appear on the PFD next to the altimeter if the current aircraft altitude is at least 164 feet below the prescribed altitude at the Final Approach Fix.

TAWS-B Page:

The TAWS-B page is located in the Map Page Group on the MFD.

The TAWS page is specialized to show terrain, obstacle, and potential impact point data in relation to the aircraft's current altitude, without clutter from the base map. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference. If an obstacle and the projected flight path of the aircraft intersect, the display automatically zooms in to the closest potential point of impact on the TAWS-B page.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft; the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the RANGE knob from 1 to 200 nm, as indicated by the map range rings or arcs.

Alert Type	PFD/MFD Alert Annunciation	MFD Pop-Up Alert	Aural Message	Response Technique
Excessive Descent Rate Warning (EDR)	PULL-UP	PULL UP	"Pull Up"	WARNING
Reduced Required Terrain Clearance Warning (RTC)	PULL-UP	TERRAIN - PULL UP	"Terrain, Terrain; Pull Up, Pull Up"	WARNING
Imminent Terrain Impact Warning (ITI)	PULL-UP	TERRAIN AHEAD - PULL UP	"Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"	WARNING
Reduced Required Obstacle Clearance Warning (ROC)	PULL-UP	OBSTACLE - PULL UP	"Obstacle, Obstacle; Pull Up, Pull Up"	WARNING
Imminent Obstacle Impact Warning (IOI)	PULL-UP	OBSTACLE AHEAD - PULL UP	"Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"	WARNING
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN	"Caution, Terrain; Caution, Terrain"	CAUTION
Imminent Terrain Impact Caution (ITI)	TERRAIN	TERRAIN AHEAD	"Terrain Ahead; Terrain Ahead"	CAUTION
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE	"Caution, Obstacle; Caution, Obstacle"	CAUTION
Imminent Obstacle Impact Caution (IOI)	TERRAIN	OBSTACLE AHEAD	"Obstacle Ahead; Obstacle Ahead"	CAUTION
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW - TERRAIN	"Too Low, Terrain"	CAUTION
Altitude Callout "500"	None	None	"Five-Hundred"	N/A
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"	CAUTION
Negative Climb Rate Caution (NCR)	TERRAIN	DON'T SINK	"Don't Sink"	CAUTION

* See associated Response Techniques checklists on pages 7-29 and 7-30.

TAWS-B Alert Types
Table 1

Multi-Function Display (continued)

Terrain Awareness and Warning System (TAWS-B) – Optional (continued)

TAWS-B Page (continued)

On all pages that display terrain data, the obstacles and terrain are depicted with the following colors:

- Red - above or within 100 feet below the aircraft altitude.
- Yellow - between 100 feet and 1000 feet below the aircraft altitude.
- Black - more than 1000 feet below the aircraft altitude.

TAWS-B Alerts:

Alerts are issued when flight conditions meet parameters that are set within TAWS-B software algorithms. TAWS-B alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, visual annunciations are displayed on the PFD and MFD and aural alerts are simultaneously issued. The TAWS-B Alert Annunciation is shown at the upper left of the altimeter tape on the PFD and below the Terrain Legend on the MFD. If the TAWS-B page is not displayed at the time, a pop-up alert appears on the MFD. To acknowledge the pop-up alert:

- Press the CLR Key (returns to the currently viewed page), or
- Press the ENT Key (accesses the TAWS-B page)

TAWS-B alerts types are shown in Table 1 on page 7-28.

Response Technique - WARNING:

1. Level the wings while simultaneously adding maximum power.
2. Smoothly pitch up at a rate of 2° to 3° per second towards an initial target pitch attitude of 15°.
3. Adjust pitch attitude to ensure terrain clearance, while respecting stall warning. If the flaps are extended, retract flaps to the up position.
4. Continue climb at best angle of climb speed (V_X) until terrain or obstacle clearance is assured.
   - Only vertical maneuvers are recommended unless operating in VMC or the pilot determines, after using all available information and instruments, that a turn, in addition to the vertical escape maneuver, is the safest course of action.
   - Pilots are authorized to deviate from an air traffic control (ATC) clearance to the extent necessary to comply with a TAWS warning. Pilots should notify ATC of any deviation after the TAWS threat is eliminated.

Multi-Function Display (continued)

Terrain Awareness and Warning System (TAWS-B) – Optional (continued)

TAWS-B Alerts (continued)

Response Technique - CAUTION:

1. Take positive corrective action until the alert ceases.
2. Based on analysis of all available instruments and information:
   - Stop descending or,
   - Initiate a climb and/or,
   - Turn as necessary.

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Multi-Function Display (continued)

Garmin Datalink (GDL) – Optional

SiriusXM Weather and SiriusXM Satellite Radio® entertainment services is provided through the optional GDL 69A, a remote-mounted data-link satellite receiver. SiriusXM Satellite Weather and SiriusXM Satellite Radio® services, available by subscription, have coded IDs unique to the installed GDL 69A. These coded ID's must be provided to activate service. These ID's are located on the label on the back of the data link receiver and on the SiriusXM Information Page on the MFD and in the SiriusXM Satellite Radio Activation Instructions included with the unit. SiriusXM uses the coded IDs to send an activation signal that allows the G1000 system to display weather data and/or entertainment programming provided through the GDL 69A.

NOTE

Pulling the XM circuit breaker will disable the Garmin Datalink (GDL), which include SiriusXM weather.

SiriusXM Weather:

Received graphical weather information and associated text is displayed on the Multi Function Display (MFD) and the Primary Flight Display (PFD) inset map. SiriusXM satellite weather operates in the S-band frequency range and provides continuous reception capabilities at any altitude throughout North America.

The primary map for viewing SiriusXM Weather data is the Weather Data Link page in the Map page group. This is the only G1000 map display capable of showing information for all available SiriusXM weather products.

Selecting the products for display on the Weather Data Link page is made by pressing the softkey associated with that product. The label for the product is shown in capital letters in the Weather Products column in Table 2. When a weather product is selected for display, the corresponding softkey label changes to gray to indicate the product is enabled. Unavailable weather products have subdued softkey labels (softkeys are disabled from selection).

Multi-Function Display (continued)

Garmin Datalink (GDL) – Optional (continued)

SiriusXM Satellite Weather (continued)

NOTE

Echo Tops and Cloud Tops are not selectable at the same time due to their color similarities.

The following pages can display various portions of XM Weather data:

- Navigation Map
- Weather Datalink Page (able to display all XM Weather data)
- Weather Information Page
- AUX - Trip Planning Page
- Nearest Pages
- Flight Plan Pages
- PFD Inset Map

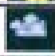
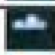
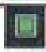
When a weather product is active on the Weather Data Link page or the Navigation Map page, the age of the data is displayed on the screen. The product age shown on the display is the elapsed time (in minutes) since the weather data provider compiled the weather product. This age can be significantly different (newer) than the actual age of the weather contained within the weather product. Weather products are broadcast at specific intervals.

If for any reason, a weather product is not refreshed within the broadcast rate intervals, the system removes the expired data from the display and shows dashes instead of the product age. This ensures that the displayed data is consistent with what is currently being broadcast by SiriusXM weather service. If more than half of the expiration time has elapsed, the color of the product age changes to yellow. If the data for a weather product is not available, the system displays "N/A" instead of product age next to the weather product symbol.

Multi-Function Display (continued)

Garmin Datalink (GDL) - Optional (continued)

SirusXM Satellite Weather (continued)

Weather Product	Symbol	Expiration Time (minutes)	Broadcast Rate (minutes)
NEXRAD		30	5 (U.S.) 10 (Canada)
Cloud Top (CLD TOP)		60	15
Echo Top (ECHO TOP)		30	7.5
SirusXM Lightning (XM LTNG)		30	5
Cell Movement (CELL MOV)		30	5
SIGMETs/AIRMETs (SIG/AIR)		60	12
METARs		90	12
City Forecast (CITY)		60	12
Surface Analysis (SFC)		60	12
Freezing Levels (FRZ LVL)		60	12
Winds Aloft (WIND)		60	12
County Warnings (COUNTY)		60	5
Cyclone Warnings (CYCLONE)		60	12
Icing Potential (CP and SLD) (ICING)		90	22
Pilot Weather Report (PIREPs)		90	12
Air Report (AIREPs)		90	12
Turbulence (TURB)		180	12
No Radar Coverage (RADAR CVRG)	No product image	30	5
TFRs	No product image	60	12
TAFs	No product image	60	12

Weather Product Symbols, Expiration Times and Broadcast Rates
Table 2

Multi-Function Display (continued)

Garmin Datalink (GDL) – Optional (continued)

SirusXM Satellite Weather (continued)

Table 2 shows the weather product symbols, the expiration time and the broadcast rate. The broadcast rate represents the interval at which SiriusXM weather service transmits new signals that may or may not contain updated weather products. It does not represent the rate at which weather information is updated or new data is received by the Data Link Receiver. Weather data are refreshed at intervals defined and controlled by XM Satellite Radio and their data vendors.

Additional details on weather products are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-44 Seminole, (Garmin P/N 190-01462-01) and/or the Garmin G1000 Pilot's Guide for the Piper PA-44 Seminole, (Garmin P/N 190-01461-01).

Customizing the Weather Data Link page is possible by selecting Weather Data Link page from the Map group, press the MENU key, select Weather Setup option from the Page Menu and press the ENT key. Turn the large FMS knob to scroll to a weather product of interest then rotate the small FMS knob to scroll through the options for each product (ON/OFF, range settings, etc.). Press the ENT key to select the option then press the FMS knob or the CLR key to return to the Weather Data Link page with the changed settings.

Customizing Weather Data Link options is also available on the Navigation Map page. Proceed to the Navigation Map page, depress the MENU key, highlight the Map Setup option and press the ENT key, turn the small FMS knob to highlight the Weather group, turn the large FMS knob to highlight and move between the product selections. When an item is highlighted, turn the small FMS knob to select the option and press the ENT key. Press the FMS knob or the CLR key to return to the Navigation Map page with the changed settings.

Multi-Function Display (continued)

Garmin Datalink (GDL) – Optional (continued)

SirusXM Radio Entertainment:

The optional SiriusXM Satellite Radio entertainment feature of the GDL 69A Data Link Receiver is available for the pilot's and passengers' enjoyment. SirusXM Satellite Radio offers a variety of radio programming over long distances without having to constantly search for new stations. The GDL 69A can receive the S-band, SirusXM Satellite Radio® entertainment services at any altitude throughout the Continental U.S. Based on signals from satellites, coverage far exceeds land-based transmissions.

Entertainment audio is not available on the GDL 69 Data Link Receiver as it is on the GDL 69A Data Link Receiver.

XM Radio is never muted for the cabin passengers unless a stereo input to the stereo input jack is installed. XM Radio is automatically muted for the front seat crew members during the following conditions:

- Aircraft radio reception
- Push-to-talk switch activation
- AIRSPEED voice alert
- STALL voice alert
- CHECK GEAR voice alert
- Marker beacon audio activity
- Master caution and master warning chimes
- Audible system messages

The XM Radio Page provides information and control of the audio entertainment features of the SirusXM Satellite Radio. To get to the XM Radio page, proceed to the AUX Page Group on the MFD, turn the small FMS knob to the AUX-XM Information page and select the RADIO softkey.

Additional details on the XM Radio features are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-44 Seminole, (Garmin P/N 190-01462-01) and/or the Garmin G1000 Pilot's Guide for the Piper PA-44 Seminole, (Garmin P/N 190-01461-01).

Databases

The G1000 utilizes several databases. Database titles display in yellow if they have expired. Database cycle information is displayed on the MFD at power up, but more detailed information is available on the AUX pages. Internal database validation prevents incorrect data from being displayed.

The upper Secure Digital (SD) data card slot is typically vacant as it is used for software maintenance and navigational database updates. The lower data card slot should contain a data card with the system's terrain/obstacle information and optional data such as Safe Taxi, Flight Carts and JeppView electronic charts.

Safe Taxi Database

The Garmin Safe Taxi database contains detailed airport diagrams for selected airports. These diagrams aid in the following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals and services. This database is updated on a 56-day cycle and has no expiration date.

Terrain Database

The terrain databases are updated periodically and have no expiration date. Coverage of the terrain database is between North 75° latitude and South 60° latitude in all longitudes. Coverage of the airport terrain database is worldwide.

Obstacle Database

The obstacle database contains data for obstacles that are 200 feet and higher. Coverage of the obstacle database includes the United States and Europe. This database is updated on a 56-day and has no expiration date. It is important to note that not all obstacles are charted and therefore may not be in the obstacle database.

Navigation Database

Navigation database coverage options include the Americas, International, or Worldwide. This database is updated on a 28-day cycle.

Databases (Continued)

FliteCharts Database

The Garmin FliteCharts database contains procedure charts for the purchased coverage area. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function.

JeppView Database

The Jeppesen JeppView electronic charts database contains procedure charts for the purchased coverage area. An own-ship position icon will be displayed on these charts. This database is updated on a 14-day cycle. If not updated within 70 days of the expiration date, JeppView will no longer function.

7.10 GFC 700 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

Autopilot Controls

Controls for selecting lateral and vertical flight director modes and for engaging/disengaging autopilot and flight director, are located on the MFD bezel. Additional autopilot related functions are controlled by the following:

A/P DISC / TRIM INTER Switch – Autopilot Disconnect and Trim Interrupt switch located on the control wheel. Depressing this red switch interrupts the electric pitch trim and disconnects the autopilot.

Electric Pitch Trim Switch – Split switch located on the control wheel. Commands nose up or nose down pitch trim when both halves of the switch are operated simultaneously.

CWS Switch – Control Wheel Steering switch located on the control wheel. While this switch is depressed, the autopilot servos are disconnected, allowing the pilot to fly the airplane manually.

TO/GA Switch – Optional Takeoff/Go-Around switch located in the left throttle lever. Depressing this switch commands the flight director to an initial takeoff or go-around pitch attitude.

LVL Switch - Optional Level mode switch located on the instrument panel above the MFD. Depressing this blue switch activates the autopilot Level Mode, which engages the autopilot and commands the airplane to level pitch and roll attitudes.

7.10 GFC 700 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) (Continued)

AUTOPILOT OPERATION

When the AVION MASTER switch is selected ON, the GFC700 automatically conducts a self-test, as indicated by a white boxed PFT on the PFD. Successful completion of this self-test is indicated by extinguishing the PFT with no AP failure indications and an autopilot "warble" tone (the same tone as autopilot disconnect). If the GFC700 preflight test is not completed successfully, the autopilot and electric pitch trim will not function.

Selected autopilot modes are displayed on the AFCS Status Box at the top of the PFD. Lateral modes are displayed on the left, autopilot status is in the middle, and vertical modes are on the right. All active modes are shown in green and armed modes are white.

Pressing the AP key activates the autopilot and flight director in the default ROL and PIT modes. Pressing the FD key activates only the flight director in default ROL and PIT modes. Pressing any key associated with a valid lateral or vertical mode activates that mode and the default mode in the opposing axis. For example, pressing the ALT key activates the flight director in ALT hold mode with the default lateral (ROL) mode. Re-selection of any valid lateral or vertical mode toggles between the selected mode and the default mode for that axis.

If the information required to compute a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis. A flashing yellow mode annunciation and annunciator light indicate loss of sensor (ADC) or navigation data (VOR, LOC, GPS, VNV, WAAS) required to compute commands. If the loss occurs in the lateral axis, the system defaults to ROL mode and rolls wings level. If the loss occurs in the pitch axis, the system defaults to PIT mode and maintains the current pitch attitude. The flashing annunciation stops when the affected mode key is pressed, another mode for the axis is selected, or after 10 seconds, if no action is taken.

7.10 GFC 700 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) (Continued)

Autopilot Disengagement Methods:

The autopilot can be disengaged manually by the following "normal" methods which are indicated by a yellow flashing AP annunciation:

- Pressing the A/P DISC / TRIM INTER switch on the control wheel
- Activation of either half or both halves of the manual electric pitch trim switch on the control wheel
- Pressing the AP key on the MFD
- Pressing the TO/GA switch on the throttle (if optional Underspeed Protection not installed)

The autopilot can be disengaged manually by the following "abnormal" methods which are indicated by a red flashing AP annunciation:

- Pulling the AUTOPILOT or PITCH TRIM circuit breaker
- Activation of the stall warning system (if optional Underspeed Protection not installed)

The autopilot can be momentarily disengaged by pressing and holding the CWS switch on the control wheel.

The autopilot will disengage automatically under the following conditions which are indicated by a red flashing AP annunciation:

- Internal autopilot system failure
- Total AHRS failure
- Total ADC failure
- Inability to compute default flight director modes

After any autopilot disengagement, the aural disconnect alert can be canceled by pressing the A/P DISC switch or manual electric pitch trim switches

AUTOPILOT FEATURES

Overspeed Recovery Mode

Overspeed Recovery attempts to prevent the aircraft from exceeding Vne by providing a flight director pitch up command whenever the airspeed trend vector exceeds Vne. If flying manually, the pilot may follow the pitch up commands, or if engaged, the autopilot will follow the command. The pitch up command will not exceed that for level flight; to decelerate more rapidly the pilot should reduce engine power. When Overspeed Recovery is active, an

AUTOPILOT FEATURES (Continued)

Overspeed Recovery Mode (Continued)

amber MAXSPD is displayed above the airspeed tape. Overspeed Recovery is not active in ALT or GS modes and the airspeed reference (FLC) cannot be adjusted while in Overspeed Recovery mode.

Takeoff Mode (optional)

Takeoff Mode allows the pilot to manually follow the flight director command bars after takeoff rotation. Takeoff Mode is activated by pressing the TO/GA switch on the left throttle lever while on the ground. Whenever Takeoff Mode is active, "TO" will be displayed as the lateral and vertical modes in the AFCS status box.

Go-Around Mode (optional)

Go-Around Mode allows the pilot to manually follow the flight director command bars during a go-around maneuver. Go-Around Mode is activated by pressing the TO/GA switch on the left throttle lever while in flight. Whenever Go-Around Mode is active, "GA" will be displayed as the lateral and vertical modes in the AFCS status box. Autopilot coupled Go-Around is available as an optional feature. During a coupled go-around the autopilot remains engaged and the pilot must add power and reduce drag according to the Go-Around checklist (Section 4).

Underspeed Protection (Optional)

Underspeed Protection (USP) is a flight director function that provides low speed awareness and prevents the airplane from stalling. The autopilot must be engaged for USP to function. An AIRSPEED aural alert and an amber MINSPD annunciation activates to indicate a low airspeed condition. If airspeed continues to decrease, a USP ACTIVE CAS warning is triggered and the airplane pitches down. If the flight director is in a non-altitude critical mode (VS, VNAV, PIT,LVL or FLC) the airplane pitches down to maintain airspeed above the stall warning speed. If the flight director is in an altitude critical mode (ALT, GP, GS, TO or GA) the airplane may decelerate to stall warning. After stall warning the airplane rolls wings level and pitches down to achieve and maintain a speed approximately two knots above stall warning. When in USP mode, the flight director modes remain unchanged, and the pitch mode annunciation turns white. In all cases, the pilot should take action to exit the underspeed condition by increasing engine power and decreasing drag as appropriate.

AUTOPILOT FEATURES (Continued)

Level Mode (Optional)

Level Mode commands the airplane to wings level and zero vertical speed. It is activated by pressing the blue switch (labeled LVL) at the top center of the instrument panel. Level Mode may be activated at anytime with the autopilot engaged or disengaged. Activation is indicated by green LVL and LVL for lateral and vertical modes respectively. Level mode should not be relied upon if the autopilot is operating in any failure condition.

Electronic Stability and Protection (Optional)

Electronic Stability and Protection (ESP) provides a control force feedback to deter the pilot from operating outside a defined envelope. ESP functions only when the autopilot is operable, but is disengaged. As the aircraft approaches the defined operating limits, the autopilot servos automatically engage to nudge the aircraft back to the nominal operating envelope. The pilot can easily overpower the restoring tendency, and may interrupt ESP with the AP disconnect or CWS switches. At any time (usually for training reasons), the ESP function may be disabled from the AUX – SYSTEM SETTINGS page on the MFD. When disabled in this manner, ESP OFF is displayed. ESP will automatically re-enable after each electrical power cycle. If ESP has failed, an ESP FAIL system message will be displayed under the MSG softkey on the PFD.

Expanded Engagement Envelope (Optional)

Expanded engagement envelope allows autopilot engagement up to the pitch and roll attitudes shown in the autopilot limitations of Section 2. If the autopilot is engaged at a pitch or roll attitude within the expanded engagement envelope but beyond the maximum autopilot command limits, the airplane will be pitched or rolled to the maximum autopilot command limits.

Audio Panel

The audio panel contains traditional transmitter and receiver selectors, as well as an integral intercom and marker beacon system. The marker beacon lights appear on the PFD and the marker beacon audio can be heard over the headsets or cockpit speaker. In addition, a clearance recorder records the last 2½ minutes of received audio. Lights above the audio panel selection buttons indicate which selections are active. If a failure of Com 1 and Com 2 occurs, a fail-safe communications path is available between the pilot's headset/microphone and Com 1. The fail-safe communications path is activated by pulling the AUDIO MKR circuit breaker located on the circuit breaker panel.

The PILOT knob located towards the bottom of the audio panel allows switching between volume and squelch control as indicated by illumination of VOL or SQ. Turn the knob to adjust intercom volume or squelch. The MAN SQ key must be selected to allow squelch adjustment.

The red DISPLAY BACKUP button at the bottom of the audio panel allows manual selection of the reversionary display mode. Reversionary mode is selected when the red button is extended, normal display mode is selected when the button is depressed.

GTX 33 Mode S Transponder

The GTX 33 Mode S Transponder provides Mode A, Mode C, and Mode S capabilities. Mode S capability includes the following features:

- Level-2 data link capability which is used to exchange information between aircraft and ATC facilities.
- Surveillance identifier capability which is required in Europe.
- Flight Identification reporting which reports the aircraft identification as either the aircraft registration or an assigned flight plan number.
- Altitude reporting as provided by the aircraft air data system.
- Airborne status determination which reports Ground or Flight mode.
- Transponder capability reporting which communicates Mode A, Mode C, and mode S capability.
- Mode S Enhanced Surveillance (EHS) requirements.
- Acquisition squitter which is a 24-bit identification address transmitted periodically to enable ground stations and aircraft equipped with a Traffic Avoidance System (TAS) to recognize similarly equipped aircraft.

The Hazard Avoidance Section provides more details on traffic avoidance systems.

33ES (Extended Squitter) Transponder (Option)

In addition to the capabilities of the GTX 33 transponder, the GTX 33ES with Extended Squitter Enabled provides Version 2 Automatic Dependent Surveillance-Broadcast (ADS-B) which meets the TSO C166b mandate for 2020. ADS-B Out information consisting of, position, velocity, and heading, are automatically transmitted to other aircraft and ground stations.

The combined installation of GTX 33ES, and GTS 800 have the following capability:

ADS-B Out: transmits position, velocity, and heading to other aircraft and ground station.

ADS-B In: receives position, velocity, and heading information from aircraft and ground stations.

Traffic information will be displayed as a combination of two systems:

- ADS-B traffic information from other ADS-B equipped aircraft
- GTS 800 Traffic Advisory System (TAS)

NOTE

ADS-B traffic information will be available on the normal G1000 traffic display maps/pages. In the absence of ADS-B traffic information, the GTS 800 system will display all other transponder equipped aircraft.

ADS-B transmission defaults to enabled at each power cycle. To enable/disable the transmission of the ADS-B information, press the ADS-B TX Softkey under the PFD XPDR menu. Do not disable ADS-B transmission unless requested by ATC. If either the GTX 33 or 33ES fails, a red "x" will be displayed in the XPDR field.

Standby Instrument:

NOTE

If electrical power is removed from the Aspen EFD-1000 standby instrument prior to completion of its self-test, the unit will remain ON and deplete its internal battery. If this occurs, turn the BATT MASTR switch ON and wait for the self-test to be completed or press the red REV button on the unit to turn it OFF.

Standby Instrument (Continued):

The Aspen Evolution EFD1000 is a fully digital, independent flight instrument display which provides attitude, barometric altitude, airspeed, heading, vertical speed, slip/skid and turn rate indications. The purpose of this flight instrument is to provide a reference to crosscheck the G1000 system information for system reliability and to display basic flight information during a G1000 system failure.

The EFD1000 is located to the left of the PFD in direct view of the pilot. During normal operation, power is provided by the essential bus. If both alternators are inoperative, the EFD1000 will continue to operate on the essential bus until the primary battery is depleted. The EFD1000 will then operate on the emergency battery/bus for 30 minutes, permitting the pilot to find a suitable landing location.

In the event of a complete electrical failure (loss of both alternators, and both the primary and emergency batteries) the EFD1000 will revert to its internal battery allowing approximately 30 additional minutes of operation. If this occurs the EFD1000 will illuminate an "ON BAT" annunciation and display an estimated battery charge state.

The standby instrument must be checked for proper operation prior to flight. IFR flight is prohibited when any component of the standby instrument is inoperative.

7.11 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.

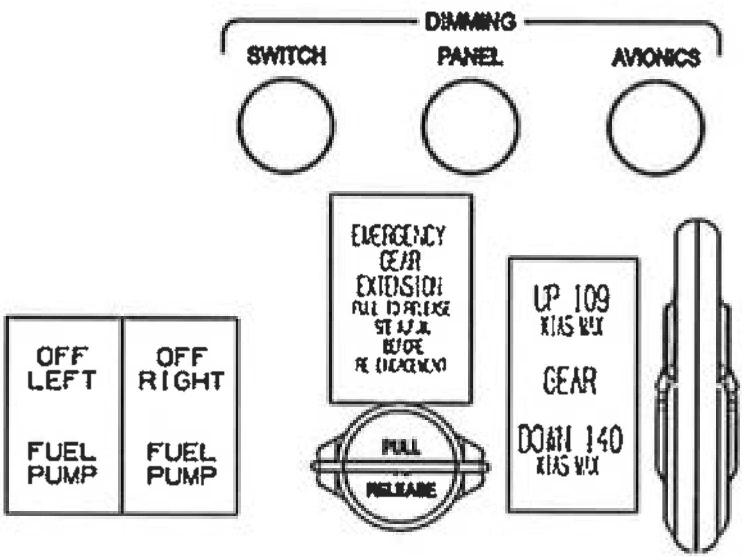
7.11 LANDING GEAR (Continued)

NORMAL OPERATION

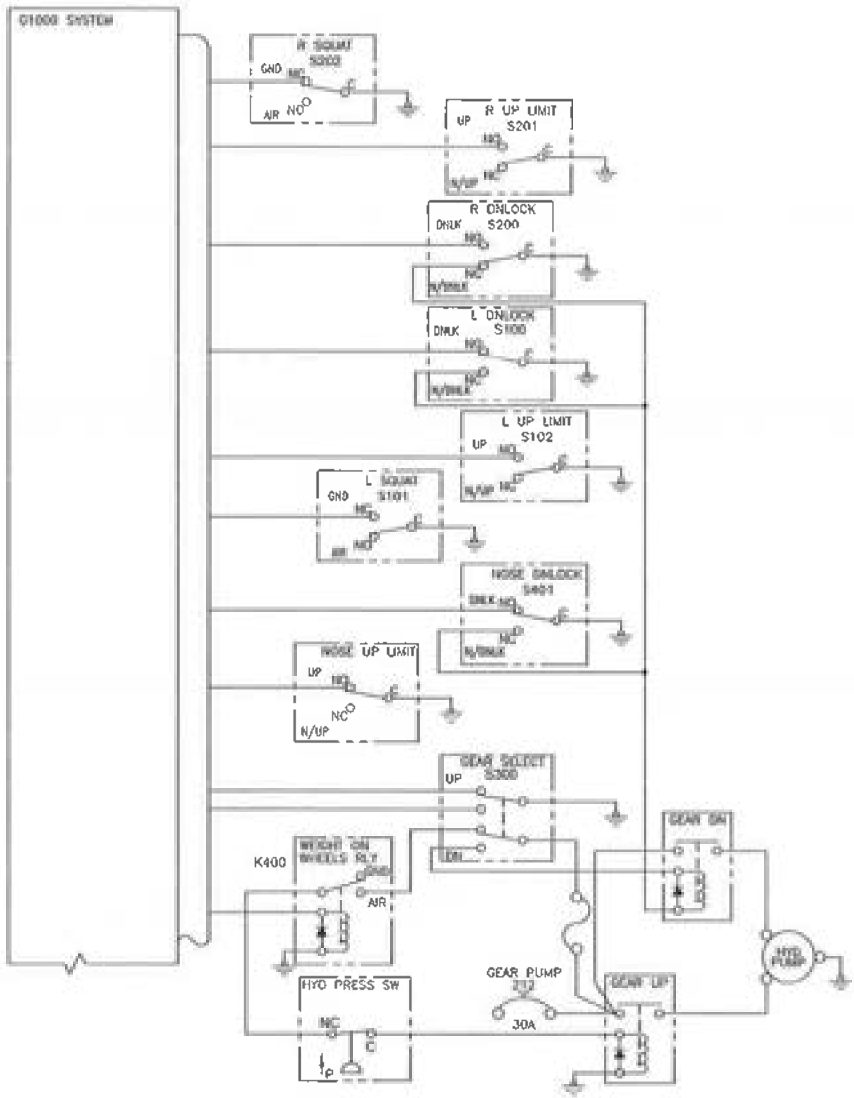
Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-9 and 7-11). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-7). The gear selector switch 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

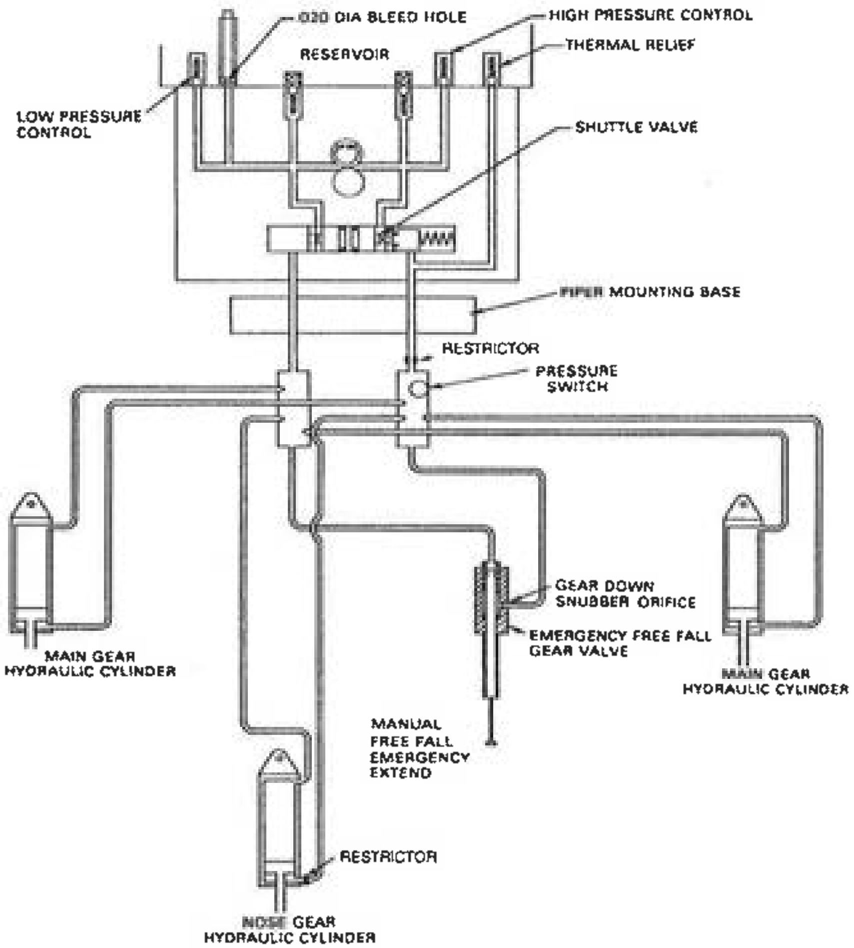
If the landing gear is in transit and the hydraulic pump is running , do not move the gear selector switch to the opposite position before the gear has reached its full travel limit. A sudden reversal may damage the hydraulic pump.



LANDING GEAR SELECTOR
Figure 7-7



LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC
Figure 7-9



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Figure 7-11

7.11 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 serves as a taxiing aid and allows the pilot to visually confirm the position of the nose gear.

Landing Gear Indications

Landing gear indications on the MFD can be any of the following:

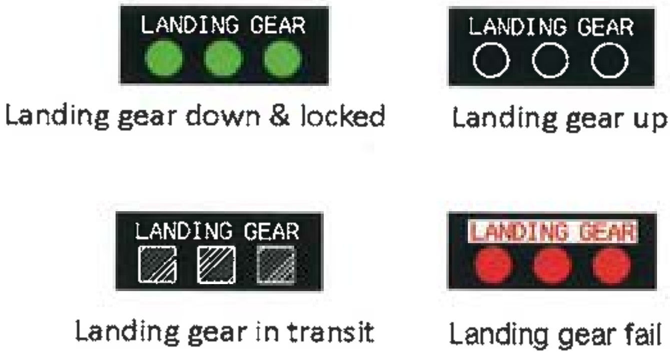
- gear down: solid green circle
- gear up: hollow white circle
- gear in transit: crosshatched square
- abnormal/unknown gear position: solid red circle

Microswitches located in the landing gear system determine when the gear are in the full up position or in the down and locked position.

The signals from these microswitches are used to display the appropriate landing gear position on the MFD (or reversionary mode display).

The landing gear selector position is monitored. When the gear selector disagrees with the position of the landing gear, a GEAR SYS CAS message is displayed (warning if on the ground and caution if in flight). If the position of the landing gear are unknown (due to disagreement of the microswitch signals), the landing gear indications on the MFD become solid red circles and a Master Warning or Master Caution is activated (warning if on the ground and caution if in flight).

Landing Gear Indications (Continued)



LANDING GEAR INDICATIONS
Figure 7-13

Gear Position Unsafe

Should the throttle be placed in a low manifold pressure setting and/or the flaps extended while the gear is retracted, a CHECK GEAR CAS message alerts the pilot that the gear is retracted. The CHECK GEAR CAS message is activated under the following conditions:

(a) The gear is not down and locked down and the manifold pressure is 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 is not down and locked and wing flaps are extended to the second or third notch position.

The CHECK GEAR CAS message is a Caution in flight above approximately 400 feet AGL and becomes a Warning when below approximately 400 feet AGL.

Altitude above ground level (AGL) is determined by comparing GPS altitude and position to a terrain database.

CHECK GEAR Mute

The CHECK GEAR aural alert may be muted by pressing the appropriate MASTER WARN RESET or MASTER CAUTION RESET switch. If the aural alert is muted, the CHECK GEAR CAS message remains in the CAS window as a reminder.

The CHECK GEAR aural alert may only be muted if it was triggered by low manifold pressure. The CHECK GEAR aural alert triggered by flap position can only be silenced by retracting the flaps or by extending the gear.

7.11 LANDING GEAR (Continued)

SAFETY SWITCH

If the gear selector is 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 when the master switch is turned on. On takeoff, when the landing gear oleo strut drops to its full extension, the safety switch closes, allowing the hydraulic pump to raise the gear. Prior to initiating the preflight check, be sure the landing gear selector is in the DOWN position and that the three green gear indicators are displayed once the G1000 system is operating.

EMERGENCY EXTENSION

The landing gear is designed to extend even in the event of hydraulic failure. The gear is held in the retracted position by hydraulic pressure. If the hydraulic system lost pressure, gravity will extend the gear. 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 due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks and proper function of the hydraulic and electrical systems have been verified. See the Maintenance Manual for proper landing gear system check out procedures.

NOTE

If the emergency gear extension is used for training purposes the emergency gear extension knob 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.

7.13 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.

7.15 FLIGHT CONTROL SYSTEM

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

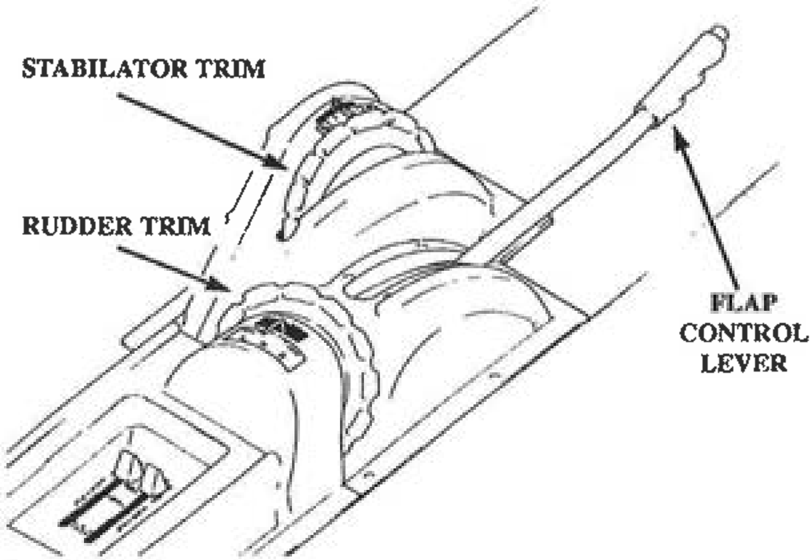
EMPENNAGE

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 7-15).

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 7-15

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.

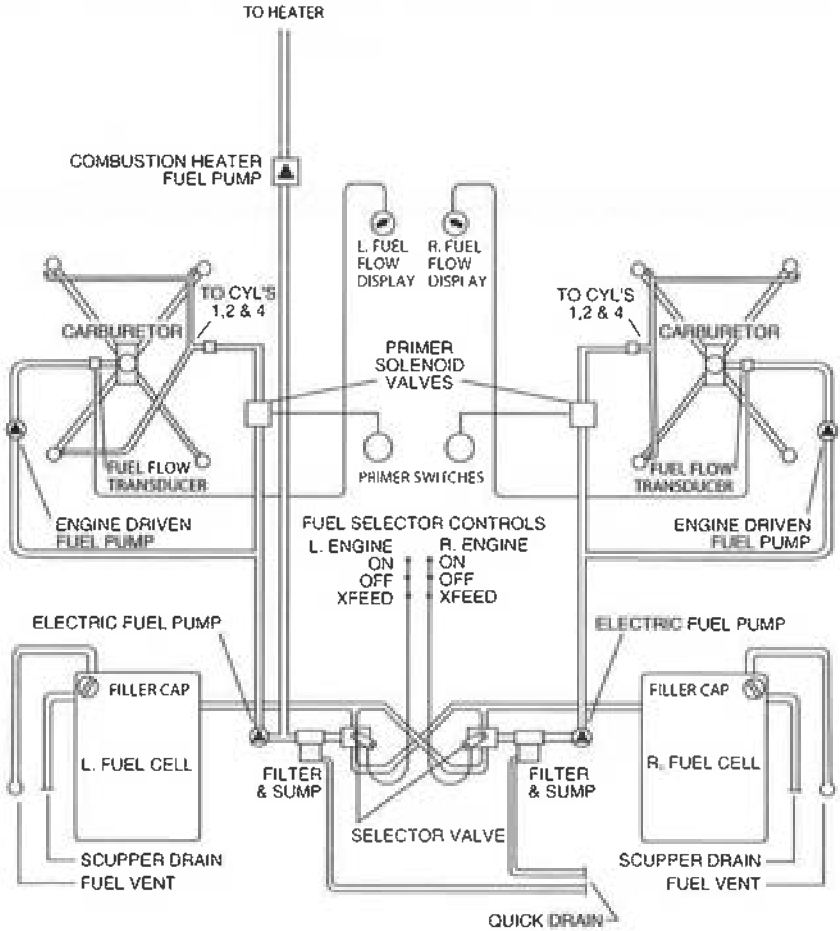
An over-center lock incorporated in the actuating linkage holds the right flap when it is in the retracted (up) position so that it may be used as a step.

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.

7.17 FUEL SYSTEM

Fuel is stored in two 55 gallon fuel tanks, one in each nacelle (Figure 7-17). 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 7-17

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 operate at 14 VDC (a voltage converter steps main battery voltage from 28 to 14 volts). They 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 takeoff and landing.

NOTE

The electric fuel pumps operate on 14 VDC. An inverter converts 28 VDC aircraft power to the required fuel pump voltage.

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 GAUGES

Fuel quantities and pressures are indicated on gauges located on the MFD EIS window or Engine page. There is a separate fuel quantity gauge 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

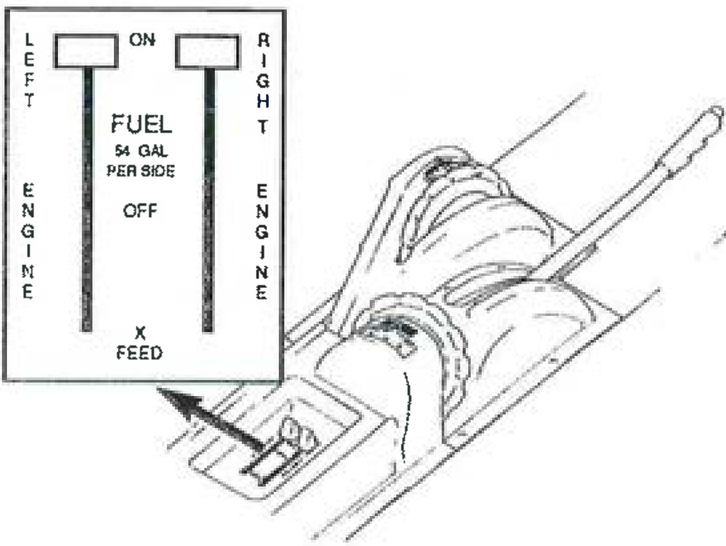
Before each flight, fuel must be drained from the low points in the fuel system to ensure that any accumulation of moisture or sediment is removed from the system. A fuel drain is provided for each half of the fuel system. The fuel drains are located on the right side of the fuselage just forward of the entrance step. (Refer to fuel draining procedure in paragraph 8.21, Fuel System.)

FUEL CONTROLS

Fuel management controls are located on the console between the front seats (Figure 7-19). 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 tank on the same side as the engine. When the X-FEED position is selected, that engine will draw fuel from the tank on the opposite side, in order to extend range, keep fuel weight balanced or 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 fuel selectors on X-FEED except as required in the BEFORE TAXIING checklist. Do not take off or land with a selector on X-FEED.



FUEL SYSTEM CONTROLS
Figure 7-19

7.19 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 28 volt, 80 ampere alternators (Figure 7-21), one mounted on each engine. The alternator provides full electrical power output even at low engine rpm.

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 28-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 32-volts. If this should occur, the APPROPRIATE ALTR FAIL CAS WARNING WILL BE ACTIVATED.

BATTERY

A 13.6 ampere-hour, 24-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.

EMERGENCY BATTERY

The electrical system includes an emergency battery, which provides electrical power to the emergency bus during a complete electrical failure, or when electrical power from the primary electrical system is insufficient. With the EMERG BATT switch in the ARM position, power is applied to this equipment automatically after a total electrical failure. The emergency bus powers the standby instrument, as well as all PFD functions (except Com2 and Nav2). The emergency battery is sized to provide this functionality for a minimum of 30 minutes.

The emergency battery is isolated from emergency bus equipment by a relay, which is controlled by the EMERG BATT switch. The emergency battery is diode isolated from the electrical power generating system. This allows the generating system to charge the emergency battery during normal operations.

7.19 ELECTRICAL SYSTEM (Continued)

EMERGENCY BATTERY (Continued)

CAUTION

The emergency battery voltage (E VOLTS) must be a minimum of 23.5 volts prior to flight.

SWITCHES

A series of switch banks are located in various places on the instrument panel. Engine switches are located on the lower left corner of the panel, below the left control yoke. The left engine switches (left and right magnetos and primer) are separated from the right engine switches (left and right magneto and primer) by the horizontally mounted engine start switch. Pushing the left or right side of this switch, engages the starter on each engine respectively. The lower part of the magneto switches are guarded, to prevent them from being turned of inadvertently.

The left and right electric fuel pump switches are located on the lower panel below and to the right of the left control yoke.

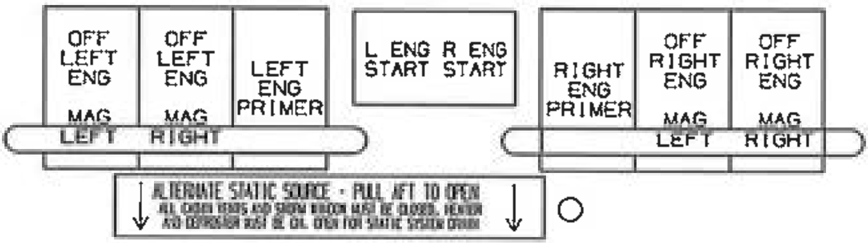
Switches for the battery master, alternators, avionics master and emergency battery are located in a bank to the left of the throttles. The lower part of the emergency battery switch is guarded, to prevent it from being turned off inadvertently.

Switches for the autopilot, pitot heat, day/night and lights (nav, recognition, landing and strobe) are located in a bank to the right of the throttles.

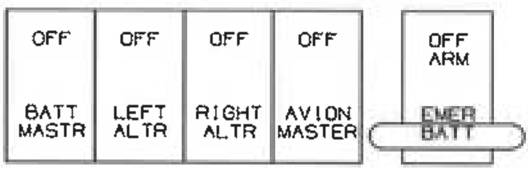
Controls for the cabin heat and ventilation fan are located on the far right side of the panel.

Lighting intensity for the back-lit switches, instrument panel lights, and avionics, are controlled by three rotary controls located on the instrument panel below the PFD.

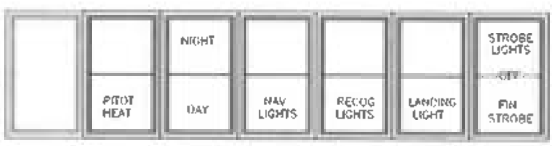
SWITCHES (Continued)



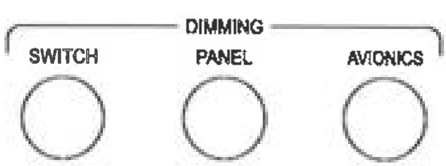
Engine Switches



Left Switch Bank



Right Switch Bank

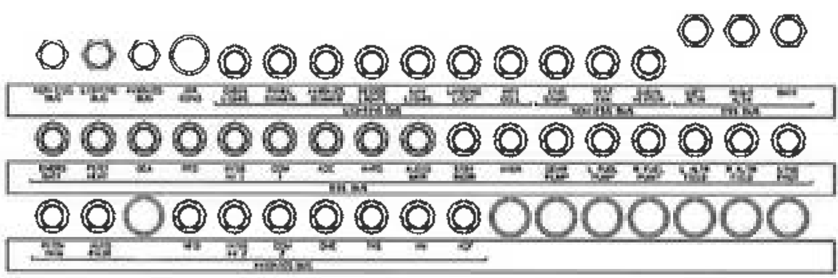


Dimmer Controls

ELECTRICAL POWER SWITCHES
Figure 7-21

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 7-23). The circuit breaker panel is provided with blank spaces to accommodate additional circuit breakers if extra electrical equipment is installed. 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 7-23

POWER DISTRIBUTION

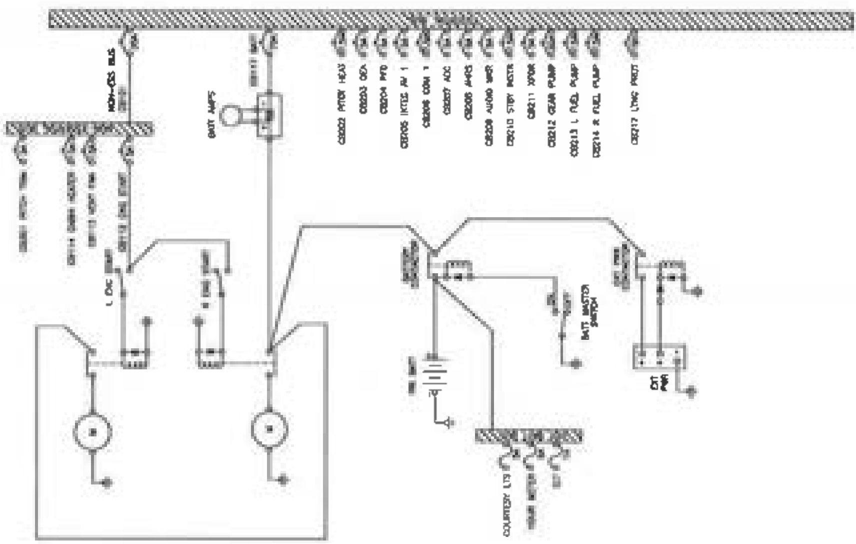
A battery bus (Figure 7-25), located in the battery compartment, provides a continuous source of power to the clock, the engine Hobbs meter, the flight-time Hobbs meter and the heater Hobbs meter. Because the battery bus is connected directly to the battery, power is available even when the battery master 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 essential bus. Essential bus overcurrent protection is provided by a 70 amp BATT circuit breaker. The essential bus (Figure 7-23), distributes power to other systems through circuit breakers.

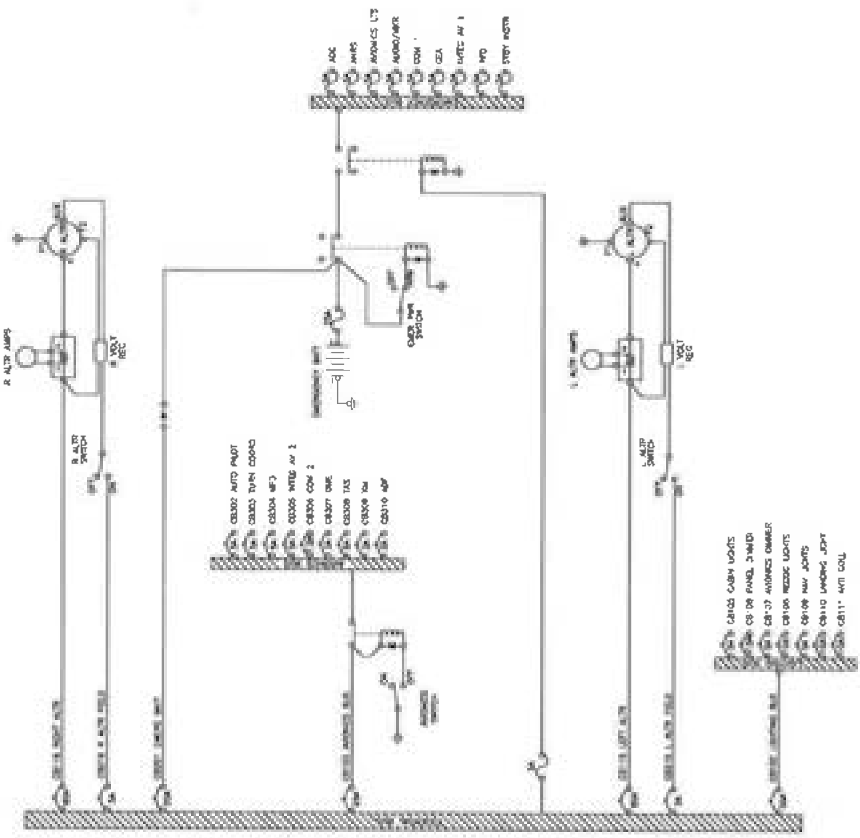
Each alternator system has an independent ON-OFF rocker switch and a solid state voltage regulator that automatically regulates alternator field current. When selected ON, the positive output of each alternator is fed through individual shunts to the tie bus. Overcurrent protection is provided by the 80 amp tie bus L ALTR and R ALTR circuit breakers.

A main bus, a non-essential bus and an avionics bus, with associated circuit breakers, are located at the circuit breaker panel.

Current from the tie bus is fed to the avionics bus through a solenoid contactor. When the avionics master switch is selected ON, the solenoid contactor closes, permitting current flow to the avionics bus. Avionics bus overload protection is provided by the 25 amp AVIONICS BUSS circuit breaker. The non-essential bus is also fed from the tie bus. Overload protection is provided by the tie bus 35 amp NON-ESS BUS circuit breaker.



ELECTRICAL POWER DISTRIBUTION SYSTEM
Figure 7-25
Sheet 1 of 2



ELECTRICAL POWER DISTRIBUTION SYSTEM
Figure 7-25
Sheet 2 of 2

LIGHTING

Interior lighting consists of a glareshield mounted light strip, internally lit placards and switches and back-lit avionics displays. Lighting intensities are controlled by three rotary switches located on the instrument panel below the PFD.

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.

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.

EXTERNAL POWER RECEPTACLE

Should the airplane's battery be depleted, a receptacle located on the lower right side of the fuselage, aft of the wing allows connection of an external battery for engine start.

CAUTION

External power is supplied directly to the electrical bus. Turn off all electrical equipment before applying or removing 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. For further information see EXTERNAL POWER RECEPTACLE in Section 8 of this Handbook.

7.21 PITOT STATIC SYSTEM

Static and total pressure is sensed by a single pitot head installed on the bottom of the left wing. Independent pressure lines are plumbed from the pitot head to the Garmin air data computer and to the Aspen standby instrument (Figure 7-27).

The control valve for the alternate static source is located below the left side of the instrument panel. When the valve is set in the alternate position, the Garmin air data computer and Aspen standby instrument uses cabin 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. Altimeter error with alternate static pressure, 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

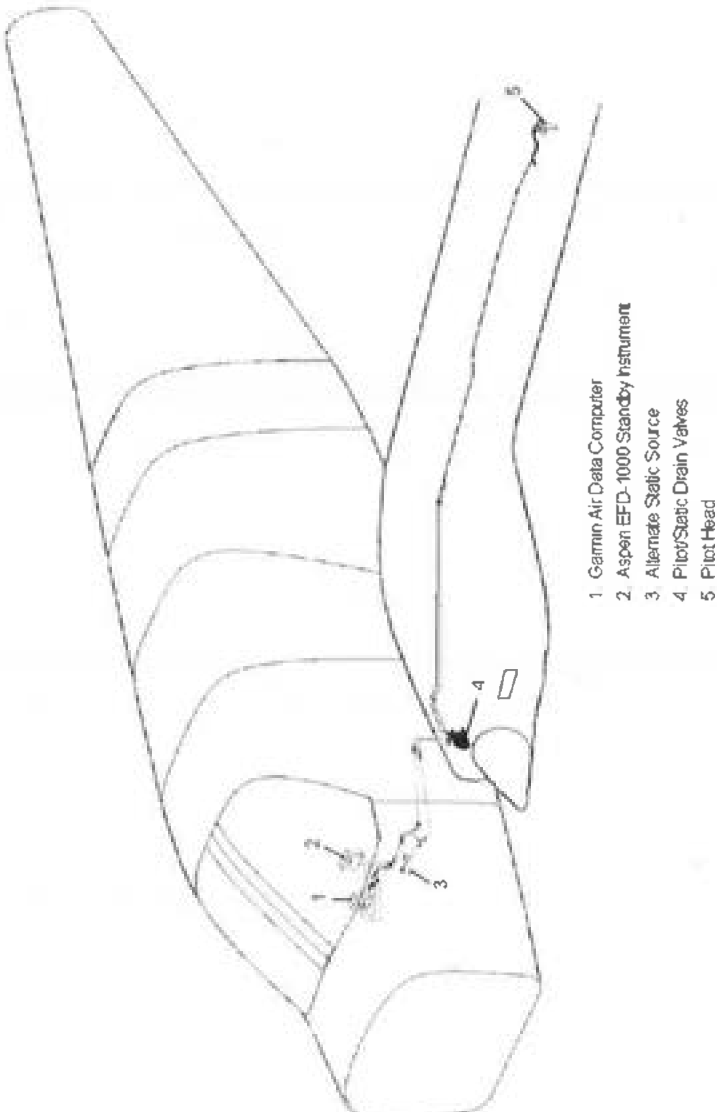
During preflight, check to make sure the pitot cover is removed.

Pitot and static lines can be drained through separate drain valves located on the lower left sidewall adjacent to the pilot.

The heated pitot head reduces problems with icing or heavy rain. The pitot heat switch is located in the switch bank to the right of the throttles. The system has a separate circuit breaker located in the circuit breaker panel and labeled PITOT HEAT. The pitot heat system should be checked during preflight inspection.

CAUTION

Care should be exercised when checking 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

7.23 HEATING, VENTILATING AND DEFROSTING SYSTEM

HEAT

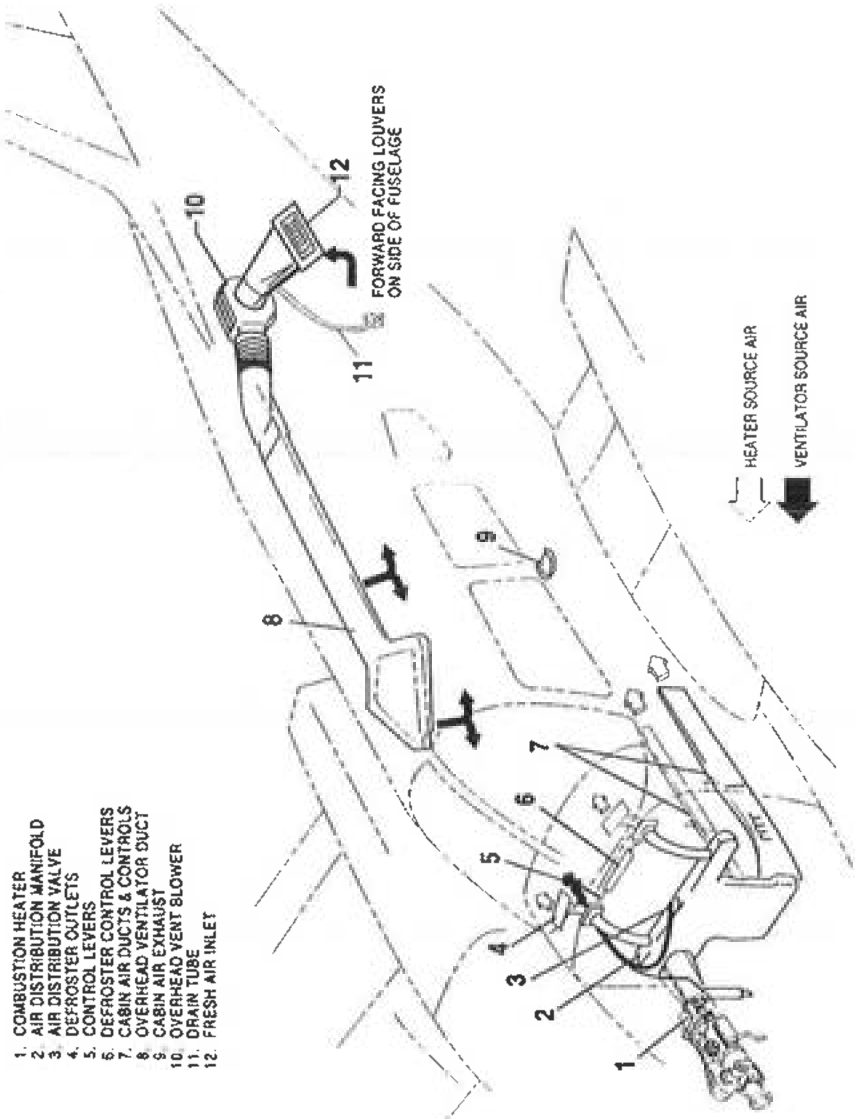
Heated air for cabin heat and windshield defrosting is provided by a Janitrol combustion heater located in the forward fuselage (Figure 7-29). Air from the heater is distributed by a manifold, through ducts along the cabin floor to outlets at each seat. Heated air from the manifold is also directed through 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 right 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.

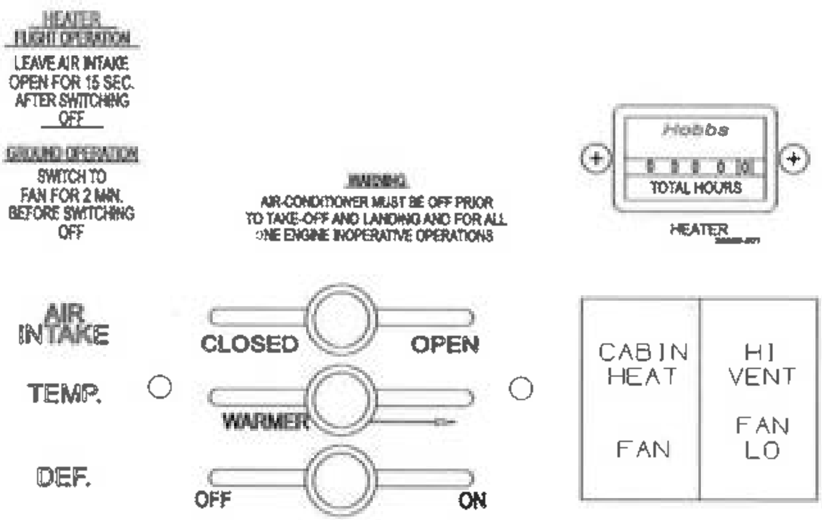
For cabin heat, the AIR INTAKE lever on the instrument panel must be partially or fully open and the three-position switch set to the CABIN HEAT position. This simultaneously starts fuel flow and ignites the heater. During ground operation, it also activates the ventilation blower which is integral to 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, the heater cycles automatically to maintain that 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 monitored from an instrument panel mounted Hobbs meter (Figure 7-31). The meter is located above and to the right side of the panel, above the heater control switches.



ENVIRONMENTAL SYSTEM
Figure 7-29



ENVIRONMENTAL CONTROLS AND ANNUNCIATORS
Figure 7-31

Safety Switches

Two safety switches, activated by the intake valve, prevent both fan and heater operation when the air intake lever is in the closed position. When the landing gear is retracted, a micro switch 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 in the heater unit acts as a safety device to turn the heater off if a malfunction occurs. Should the switch deactivate the heater, the HTR OVRHEAT CAS warning will activate. To restore heater operation, reset the red button located on the heater shroud in the nose compartment.

To prevent activation of the overheat switch 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 switch to OFF. During flight, leave the air intake lever open for a minimum of fifteen seconds after turning the 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 ajacent to the cabin heat switch, (Figure 7-31) and labeled VENT FAN.

7.25 INSTRUMENT PANEL

The instrument panel (Figure 7-33) is designed to accommodate the Garmin G1000 avionics, the Aspen standby instrument, all avionics options and required switches. See Figure 7-33 for location of each item/ detail.

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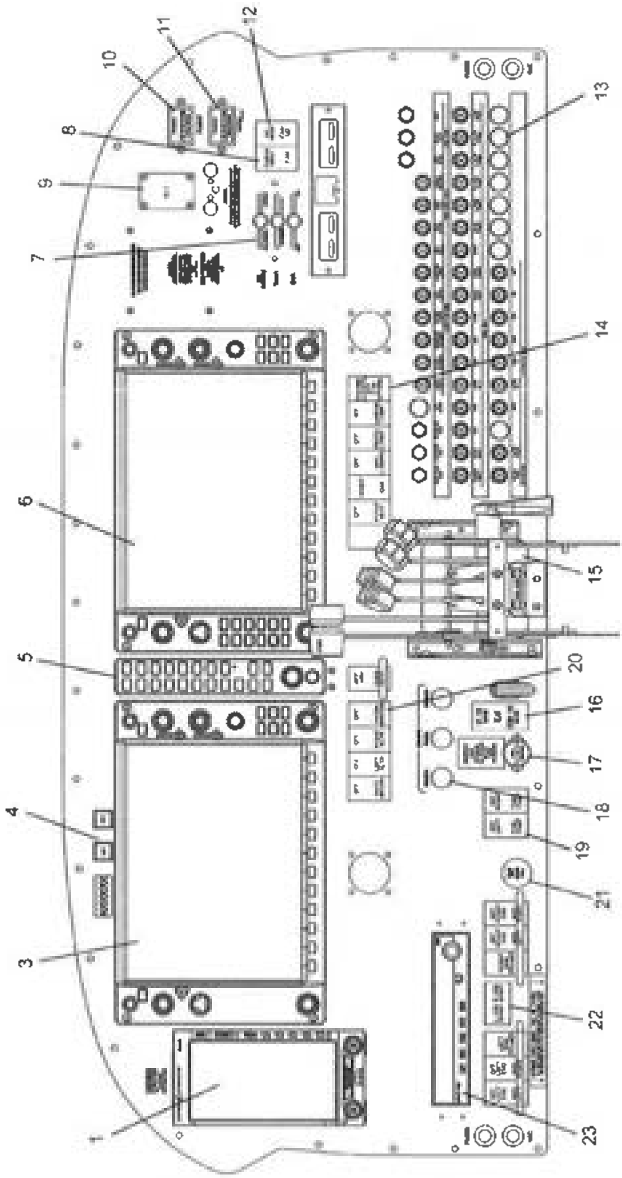


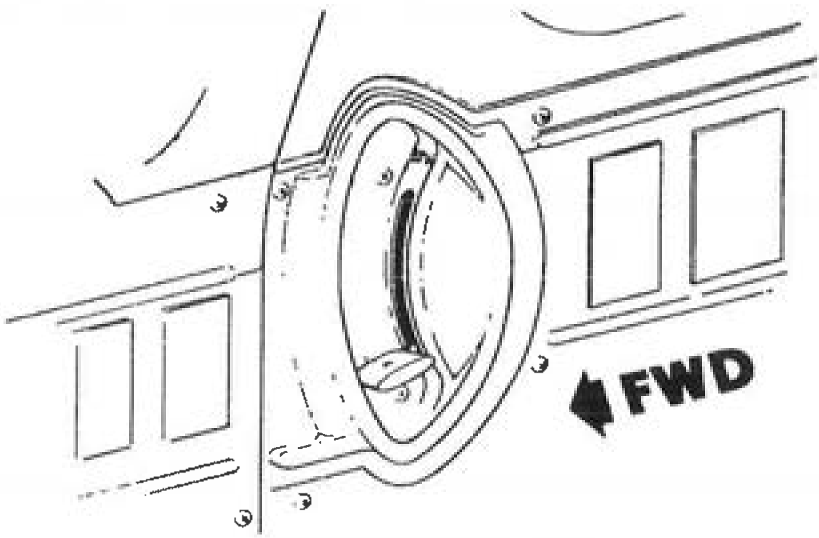
INSTRUMENT PANEL
Figure 7-33
(Sheet 1 of 2)

1. Aspen STBY
2. Not used
3. PFD
4. Master warning / master caution switches
5. Audio Panel
6. MFD
7. Environmental controls (See figure 7-31)
8. Cabin heater fan
9. ELT switch
10. Flight HOBBS meter
11. Heater HOBBS meter
12. Ventilation fan
13. Circuit Breakers
14. Right switch bank (L to R) (See figure 7-21)
    a. Pitot heat
    b. Day / night switch
    c. Nav lights
    d. Recognition lights
    e. Landing light
    f. Strobe light / fin strobe
15. Throttle quadrant
16. Landing gear selector
17. Emergency gear extension knob & guard
18. Dimmer controls (L to R)
    a. Switches
    b. Panel
    c. Avionics
19. Left and right fuel pump switches
20. Left switch bank – (L to R, See figure 7-21)
    a. Battery master
    b. Left alternator
    c. Right alternator
    d. Avionics master
    e. Emergency battery
21. Parking brake
22. Engine switches (L to R)
    a. Left engine switches (left and right magneto and primer)
    b. Left engine starter
    c. Right engine starter
    d. Right engine primer
    e. Right engine left magneto
    f. Right engine right magneto
23. ADF (option)

INSTRUMENT PANEL (Continued)
Figure 7-33
(Sheet 2 of 2)

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 7-35) down to the LATCHED position. Then engage the top latch to the LATCHED position. Both latches must be secure before flight.

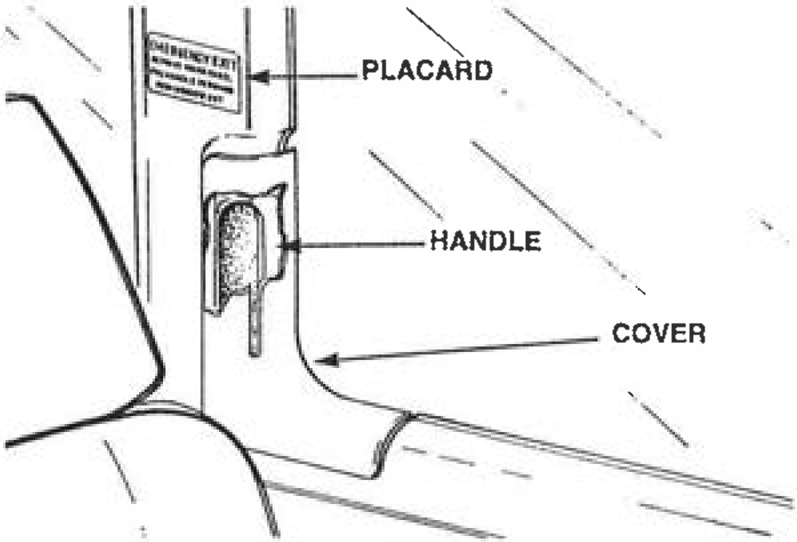


CABIN DOOR SIDE LATCH
Figure 7-35

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 7-37).

CAUTION

The emergency exit is for ground use only. When released, the window will fall free from the fuselage.



EMERGENCY EXIT
Figure 7-37

STANDARD FEATURES

Standard front cabin features include cabin and baggage door locks, a pilot's storm window, map pockets, 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.

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.

FIRE EXTINGUISHER

A portable, handheld, fire extinguisher, 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.

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.....STALL aural alert 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 alert is activated by two lift detectors on the leading edge of the left wing, outboard of the engine nacelle. The inboard detector activates the alert when the flaps are in the 25 and 40 degree positions, the outboard when the flaps are in positions less than 10°.

7.35 EMERGENCY LOCATOR TRANSMITTER

The 406 MHz Emergency Locator Transmitter (ELT) meets the requirements of TSO-C126a. In the event of a crash, the unit activates automatically and transmits the standard tone on 121.5 MHz, lasting until the battery power is depleted. In addition, for the first 24 hours of operation, a 406 MHz signal transmits at 50-second intervals. This transmission lasts 440 ms and contains identification data programmed into the beacon and is received by Cospas-Sarsat satellites. The transmitted data is referenced in a database and used to identify the beacon and owner. It operates on self-contained batteries and is located in the aft fuselage section. It is accessible through a rectangular cover on the right 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 or if there is any evidence of corrosion or leakage of any cell on the small interface board and connector.

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 ME-406 ELT OPERATION

The ELT unit has a two position switch placarded ARM and ON. A remote switch is located on the right side of the instrument panel, allowing the pilot to arm or test the transmitter 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 when the ELT is activated.

Whenever the ELT is activated, a warning buzzer in the tailcone "beeps" periodically. The time between pulses lengthen after a predetermined transmitter "ON" time. It is intended to make the buzzer audible from outside the aircraft when the engines are not running.

Should the ELT be activated inadvertently or if a self-test is desired, position the remote switch to the ON position then immediately reposition it to the ARM position. This can also be accomplished by moving the switch on the ELT unit from the ARM/OFF position to the ON position, then back to the ARM/OFF position.

If the transmitter is activated by an impact, it can be turned off by moving the ELT switch on the unit to the ON position, then to the ARM/OFF position. It may also be turned off by positioning the remote switch to the ON position and then immediately to the ARM position. Once these switch positions have been established, the ELT is ready for normal operation. The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

NOTE

When testing the ELT, 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.

7.35 EMERGENCY LOCATOR TRANSMITTER (Continued)

ARTEX ME-406 ELT OPERATION (Continued)

The ELT should be checked after flight 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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AIRPLANE HANDLING, SERVICING AND MAINTENANCE

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 available on the Piper.com website. 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. These are available on the Piper.com website. 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.

Maintenance manuals, parts catalogs, and revisions to both, are available from Piper Service Centers.

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. Appropriate 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 Piper Aircraft, Inc.

8.3 AIRPLANE INSPECTION PERIODS (Continued)

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.

A spectographic 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 certified 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-PRF-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.

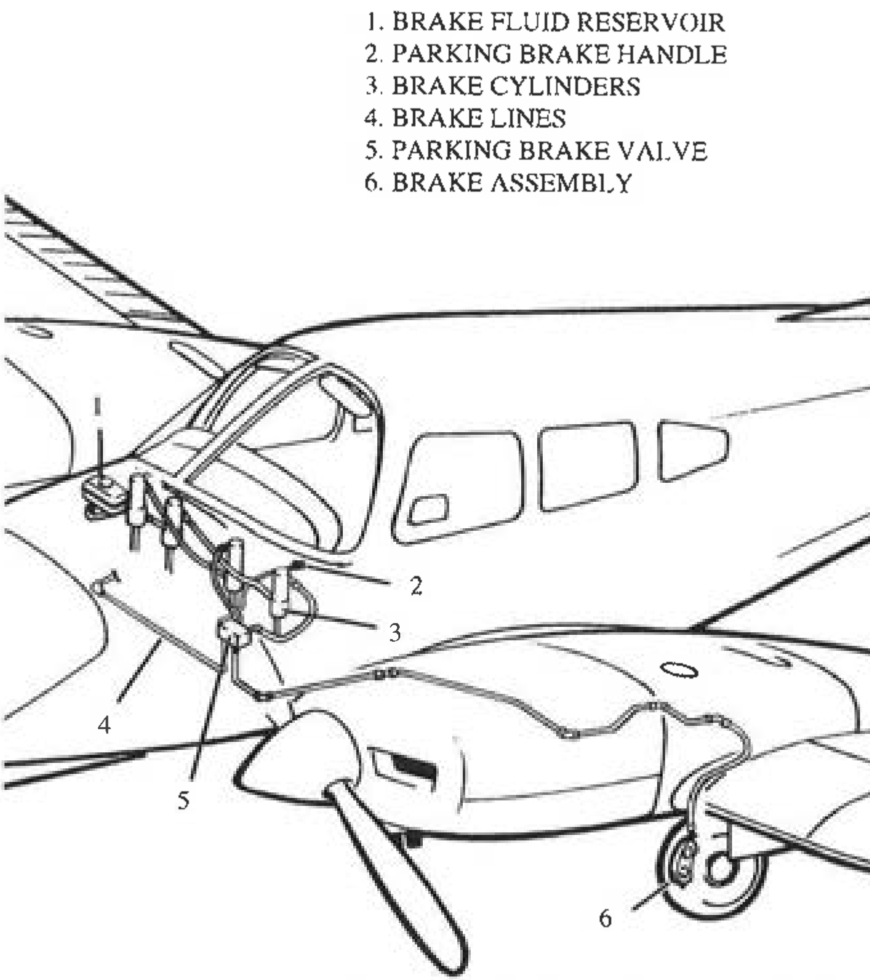
8.15 LANDING GEAR SERVICE

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-PRF-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-I-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)

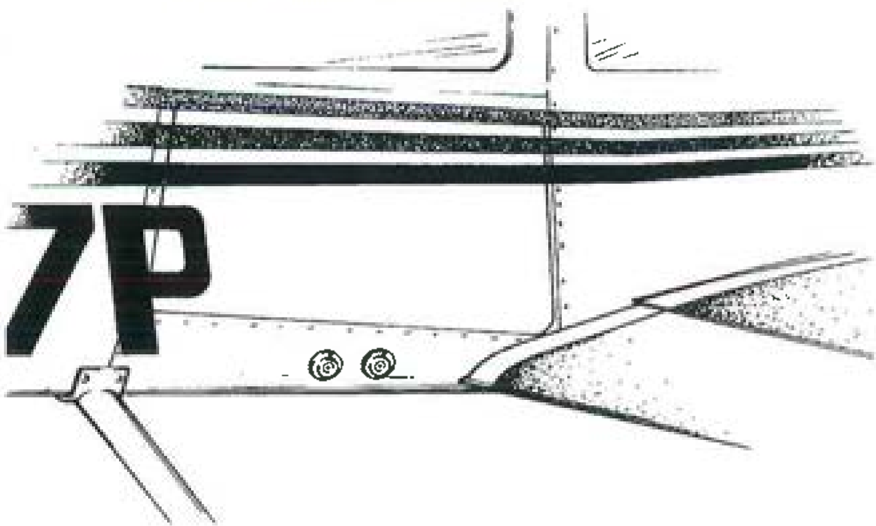
(d) Draining Fuel Strainers, Sumps and Lines

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 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 24-volt battery is gained through the fiberglass nose cone.

8.27 BATTERY SERVICE (Continued)

The external power receptacle is located on the right side of the fuselage behind the wing.

Refer to the Maintenance Manual for detailed procedures for servicing instructions.

8.29 SERIAL NUMBER PLATES

The serial number plate is located on the bottom 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.

8.33 CLEANING (Continued)

(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.

8.33 CLEANING (Continued)

(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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SUPPLEMENTS

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SECTION 9

SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of supplements which are necessary for 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
APPAREO VISION 1000 UNIT

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Appareo Vision 1000 unit is installed in accordance with Piper Drawing 107422. This information 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. This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the optional Appareo Vision 1000 unit is installed.

FAA APPROVED: Eric A. Wright
ODA–510620–CE
Piper Aircraft, Inc.
Vero Beach, Florida

DATE OF APPROVAL: June 5, 2013

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Appareo Vision 1000 unit is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

OPERATION

This system does not require flight crew interface during aircraft operation. The flight crew need only insure that an Appareo SD card is in the Vision 1000 prior to use.

NOTE

During low light operations, quality of images may be reduced.

To insert memory card:

1. Open access door on Vision 1000
2. Ensure proper orientation of SD memory card and insert, (push in to secure)
3. Check status of LED (see table below)
4. Close Vision 1000 access door

To remove memory card:

1. Open access door on Vision 1000
2. Push on SD memory card to release and remove
3. Close Vision 1000 access door

SECTION 4 - NORMAL PROCEDURES (Continued)

Status Indicators:

Table 1: LED Status		
Item	LED Status	Configuration
1	Red	Fault detected: Refer to ICA
2	Blue	Booting
3	Green	Operating
4	Yellow	SD card not inserted: insert SD card and verify Green LED SD card not formatted correctly: format SD to NTSF, verify Green LED GPS lock not received: Allow 15 minutes to clear, if problem persists contact Appareo
5	NO LED	Not functioning: Refer to ICA

SECTION 5- PERFORMANCE

No change.

SECTION 6- WEIGHT AND BALANCE

Factory installed optional equipment is included in the certified weight and balance data in Section 6 of the Pilot's Operating Handbook.

SECTION 7- DESCRIPTION AND OPERATION

The Vision 1000 system is a data acquisition and recording system. It records aircraft attitude, rate, acceleration, GPS position, and cockpit audio and video.

The Vision 1000 system is protected via an in-line fuse located behind the instrument panel. Power may be removed from the Vision 1000 system by selecting AVION MASTER OFF or by unplugging the cannon plug on the camera.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 2
FOR
FLIGHTCOM MODEL 403 INTERCOM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Flightcom model 403 intercom is installed in accordance with Piper Drawing 107423. This information 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. This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the optional Flightcom model 403 intercom is installed.

FAA APPROVED:

Eric A. Wright
ODA–510620–CE
Piper Aircraft, Inc.
Vero Beach, Florida

DATE OF APPROVAL: June 5, 2013

SECTION 1 - GENERAL

This supplement supplies the information necessary for operation of the airplane when the optional Flightcom model 403 intercom is installed. The information in this supplement is to be used in conjunction with the complete handbook.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

Intercom Failsafe Feature

In the event of a power supply interruption to the intercom, a failsafe mode in the intercom will connect the copilot's headset directly to the Garmin GMA1347 copilot input.

The Flightcom model 403 intercom does not have a dedicated curcuit breaker but is protected via an in-line fuse located behind the instrument panel.

SECTION 4 - NORMAL PROCEDURES

Adjusting the Intercom and Headsets

To adjust the intercom and headsets:

1. Plug headsets into the co-pilot and passenger jacks in the aircraft.
2. If you are using monaural headsets, place the toggle switch next to the headphone jack in the Mono setting.

NOTE

Using stereo headphones without a Mono setting will cause only one earphone to be active.

3. Turn on the aircraft BATT MASTR switch to turn on the intercom.
4. Set the intercom Volume control knob to the 11 o'clock position.
5. Set the intercom Squelch control knob to the 3 o'clock position.
6. Turn up each headset volume to 1/2 the available volume control.
7. Position the headset boom microphone 1/8" from the mouth.

SECTION 4 - NORMAL PROCEDURES (Continued)

Adjusting the Intercom and Headsets (Continued)

NOTE

Noise canceling microphones will not operate correctly if they are more than 1/8" from the mouth.

8. While speaking loudly, adjust the ICS volume controls on the Garmin audio panel to set the pilot and copilot volumes to a comfortable level. The Flightcom 403 ICS volume should then be adjusted to set passenger ICS volumes.

Adjusting the Squelch Control

To adjust the squelch control:

1. While no one is talking, turn the intercom Squelch control knob as far clockwise as possible while still blocking background noise.
2. Re-adjust the setting in flight to compensate for different noise levels.

NOTE

If you set the squelch too high by turning the Squelch control knob counterclockwise, your voice will be cut out unless you talk very loudly; if you set the squelch too low by turning the Squelch control knob clockwise, the background noise will be heard occasionally. The intercom will not interfere with normal use of the radio and will allow passengers to hear the aircraft radio and sidetone.

Radio Transmission

To transmit on the radio as the co-pilot and/or passengers, push the PTT switch associated with your headset plug-in panel. Only the person whose push-to-talk switch is depressed will be heard over the radio. No other intercom conversations will be transmitted over the radio at that time.

NOTE

If your push-to-talk switch fails, you can use a handheld microphone to talk on the radio while listening over the intercom

SECTION 4 - NORMAL PROCEDURES (Continued)

Isolate Switch

For normal intercom and transmit operations, place the Isolate switch in the ICS position. To isolate the passengers from transmitting and receiving radio communications, place the Flightcom 403 Isolate switch in the Isolate position. Placing the Isolate switch in this position will allow continued use of the intercom between copilot and passengers. Isolation of the the pilot ICS and radio transmission/reception will be controlled through use of the Garmin audio panel ICS isolation intercom controls.

SECTION 5- PERFORMANCE

No change.

SECTION 6- WEIGHT AND BALANCE

Factory installed optional equipment is included in the certified weight and balance data in Section 6 of the Pilot's Operating Handbook.

SECTION 7- DESCRIPTION AND OPERATION

See Flightcom Model 403 Panel-Mount Intercom Installation/Operation Manual for a complete description of the Flightcom model 403 system (www.Flightcom.net).

The Flightcom 403 panel-mount intercom is installed in the aircraft to provide radio communication capability to the aft seat passengers. The Flightcom 403 system is interfaced with the copilot and both aft passenger headset plug-in panels. The aft seat passengers may transmit on the radio by pressing the press to talk (PPT) switch on their associated headset plug-in panel. Pilot radio transmissions will have priority over the passengers. The pilot is not effected by the configuration of the Flightcom 403 system and is independently controlled by the Garmin GMA 1347 audio panel. Isolation of the ICS and radio transmissions is performed using a combination of Garmin GMA 1347 audio panel and Flightcom 403 system isolation switches . See section 4 of this supplement for normal operating procedures.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 3
FOR
S-TEC SYSTEM 55X TWO AXIS
AUTOMATIC FLIGHT GUIDANCE SYSTEM
WITH TRIM MONITOR SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the S-TEC System 55X Two Axis Automatic Flight Guidance System with Trim Monitoring System is installed per the Equipment List. This information 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:
Eric A. Wright
ODA-510620-CE
Piper Aircraft, Inc.
Vero Beach, Florida

DATE OF APPROVAL: June 5, 2013

SECTION 1 - GENERAL

This supplement acquaints the pilot with the features and functions of the System 55X Two Axis Autopilot and provides operating instructions for the system when installed in the Piper Model PA-44-180 Seminole. The aircraft must be operated within the limitations provided herein when the autopilot is in use.

The automatic flight control system (AFCS) in this aircraft includes:

- Autopilot Computer
- Flight Director
- Manual Electric Pitch Trim with Trim Monitor and Trim Master Switch
- Pitch, Pitch Trim and Roll Servos
- Yoke-mounted AP Disconnect/Trim Interrupt Switch

SECTION 2 - LIMITATIONS

2.1 AUTOPILOT LIMITATIONS

1. The S-TEC System 55X Pilot Operating Handbook, P/N 87109, dated 11-08-2000 or later revision, must be carried in the aircraft and be available to the pilot while in flight.
2. Autopilot must be disconnected during take-off and landing or at anytime below 200 FT AGL.
3. Autopilot must be disconnected above 185 KIAS.
4. Maximum flap deflection is limited to 2 notches during autopilot operations.
5. Autopilot operation approved for CAT I approaches only.
6. Autopilot must be disconnected during go-around maneuvers.
7. Autopilot coupled approaches prohibited below 80 KIAS.
8. Autopilot coupled single engine approaches are prohibited.

2.2 PLACARDS

On the instrument panel near the elevator trim switch:

ELEV. TRIM
PUSH ON / OFF

SECTION 3 - EMERGENCY PROCEDURES

AUTOPILOT MALFUNCTION

In the event of an autopilot malfunction, or anytime the autopilot is not performing as expected or commanded:

Aircraft Control.................................Maintain by overpowering autopilot servos
AP DISC/TRIM INTER Switch.................................DEPRESS
FD/AP MASTR Switch.................................OFF
AUTOPILOT Circuit Breaker (Row 3, Col. 2).................................PULL

NOTE

Do not re-engage the autopilot until the problem has been identified and corrected.

Bank Angle and Altitude Loss During a Malfunction and Recovery:

a. An autopilot or autotrim malfunction during climb, cruise, or descent, with a three second delay in recovery initiation can produce up to a 60° angle of bank and 340 ft. of altitude loss.

b. An autopilot or autotrim malfunction during an approach (coupled or uncoupled), maneuvering flight, or single engine approach with a one second delay in recovery initiation can produce up to a 20° angle of bank and 80 ft. of altitude loss.

Single Engine Operations:

a. Engine failure during an autopilot approach operation:
Disengage autopilot, conduct remainder of approach manually.

b. Engine failure during normal climb, cruise, descent:
Retrim aircraft, perform normal aircraft engine out procedures.

c. Maintain aircraft yaw trim throughout all single engine operation.

SECTION 3 - EMERGENCY PROCEDURES (continued)

PITCH TRIM RUNAWAY

Aircraft Control........................Maintain by overpowering the autopilot servos
AP DISC/TRIM INTER Switch ....DEPRESS and HOLD
ELEV TRIM Master Switch..Push OFF
PITCH TRIM Circuit Breaker (Row 3, Col. 1)..PULL
Pitch Trim...RETRIM MANUALLY
AP DISC/TRIM INTER Switch ....RELEASE

NOTE

Autopilot operations with an inoperative electric pitch trim system will require the pilot to manually trim the aircraft.

G1000/AVIONICS SYSTEM FAILURES

PFD Failure

Following a PFD failure, the autopilot computer will not annunciate all horizontal mode failures. For example, if a PFD failure is experienced while operating in HDG mode, the autopilot computer will continue to show HDG and the autopilot mode annunciations on the MFD (in reversionary mode) will be blank. If a PFD failure is experienced while operating in NAV or GPSS mode, the autopilot computer will show a flashing NAV indication along with a steady FAIL annunciation. The autopilot mode annunciations on the MFD (in reversionary mode) will be blank. In these PFD failure scenarios, the autopilot reverts to its dedicated sensors to hold wings level and altitude constant. The autopilot should be disconnected to change attitude or altitude and then reengaged to hold wings level and altitude when desired.

Attitude Heading Reference System (AHRS) Failure

After an AHRS failure, the autopilot will disconnect. The course pointer on the HSI will point straight up. Course may be set using the digital window and the CDI will still function properly.

Air Data Computer (ADC) Failures

ADC failure will cause the autopilot to disconnect.

SECTION 3 - EMERGENCY PROCEDURES (continued)

G1000/AVIONICS SYSTEM FAILURES (Continued)

Cooling Fan Failures

When any of these CAS messages illuminate, it is possible to exceed

the manufacturer's specified temperature limits for the affected equipment. The avionics fan (AV FAN FAIL advisory CAS message) supplies cooling air to the transponder, GIA, and autopilot.

Refer to the specific G1000 system component failure in Section 3 for additional details.

SECTION 4 - NORMAL PROCEDURES

This section contains preflight procedures for the autopilot, pitch trim and yaw damper systems. **For detailed normal operating procedures, including system description, pre-flight and in-flight procedures, refer to the S-TEC System FiftyFive X Pilot Operating Handbook, P/N 87109, dated March 1, 2008 or later revision.**

PRE-FLIGHT PROCEDURES - Autopilot

During pre-flight inspection:

Empennage...VERIFY LEFT/RIGHT AUTOPILOT STATIC PORT HOLES ARE CLEAR

NOTE

Full system voltage is required for this test, either by alternator power or by a suitable external power source.

NOTE

The G1000 will annunciate a "FAILED PATH - A Data Path has Failed" systems message until the FD/AP MASTR Switch is turned on.

AVION MASTER Switch .... Verify ON
FD/AP MASTR Switch ....ON
ELEV TRIM Master Switch..ON

SECTION 4 - NORMAL PROCEDURES (continued)

PRE-FLIGHT PROCEDURES - AUTOPILOT (continued)

Autopilot Self Test...COMPLETE
"RDY" is displayed

NOTE

If the autopilot system fails to initialize, it will annunciate "FAIL" and not allow any mode to function.

HDG Button on AP Computer ....PRESS
Verify "HDG" displayed on PFD.

NOTE

It is impractical to test the autopilot NAV, APR and REV functions during a preflight test without an active VOR within reception range or a VOR signal generator, therefore these modes may be checked while in-flight.

VS Button on AP Computer...PRESS
Verify "HDG" and "VS" displayed on PFD

VS Knob on AP Computer..........................Select 500 ft/min Climb then 500 ft/min Descent
Verify pitch control and FD bars follow commanded vertical speed

Pitch Control..Pull Aft then Push Forward
Verify trim wheel runs opposite to Pull/Push direction in ~3 seconds

CWS Button on Control Wheel..........................PRESS and HOLD
Verify pitch and roll servos disengaged

CWS Button on Control Wheel.....................................Release
Verify pitch and roll servos re-engage but can be overpowered

AP DISC/TRIM INTER Button on Control Wheel ....PRESS
Verify pitch and roll servos disengage
Verify FD bars disappear

AP DISC/TRIM INTER Button on Control Wheel ....PRESS AGAIN
Verify autopilot disconnect tone silences

SECTION 4 - NORMAL PROCEDURES (continued)

PRE-FLIGHT PROCEDURES - AUTOPILOT (continued)

FD/AP MASTR Switch .... Select FD
Verify FD bars appear
Verify roll, pitch and yaw servos disengaged
AP DISC/TRIM INTER Button on Control Wheel .... PRESS and HOLD
Verify FD bars disappear

PRE-FLIGHT PROCEDURES - MANUAL ELECTRIC TRIM

NOTE

Full system voltage is required for this test, either by alternator power via a running engine or by a suitable external power source.

AVION MASTER Switch .... Verify ON
FD/AP MASTR Switch .... ON
ELEV TRIM Master Switch .... ON
Autopilot Self Test .... COMPLETE
"RDY" is displayed
Trim Switches on Control Wheel .... Activate Nose Up and Nose Down
Verify trim wheel moves in proper direction
Verify "TRIM" appears on AP annunciator row of PFD
Verify "TRIM" flashes on AP computer
Verify trim servo can be overpowered by holding trim wheel stationary
Trim Switches on Control Wheel (Each Half) .... Activate Nose Up and Nose Down
Verify no trim wheel motion
Verify no "TRIM" annunciations
Trim Switches on Control Wheel .... Activate Nose Up or Nose Down Continuously
AP DISC/TRIM INTER Switch .... PRESS
Verify trim wheel stops
Verify trim monitor horn sounds
Verify flashing "FAIL" light and steady "ON" light in trim master switch
ELEV TRIM Master Switch .... RESET to ON

SECTION 4 - NORMAL PROCEDURES (continued)

PRE-FLIGHT PROCEDURES - MANUAL ELECTRIC TRIM (continued)

NOTE

If either the Manual Electric Trim or Autotrim fails any portion of the preflight test, push the ELEV TRIM (Master) switch OFF. DO NOT USE THE ELECTRIC TRIM UNTIL THE FAULT IS CORRECTED.

NOTE

With ELEV TRIM (Master) switch OFF, the Trim indicator on the autopilot computer and audio warning are operational. If the Electric Trim fails or has an in-flight power failure, the system automatically reverts to using out-of-trim annunciations and audio warnings. SHOULD THIS OCCUR, PUSH THE ELEVATOR TRIM (Master) SWITCH OFF, AND REVERT TO MANUAL AIRCRAFT TRIM UNTIL THE FAULT IS CORRECTED.

NOTE

BEFORE FLIGHT, VERIFY THAT THE AUTOPILOT IS DISENGAGED AND ALL TRIM SYSTEMS ARE SET FOR TAKEOFF.

GLIDE SLOPE FLIGHT PROCEDURE - AUTOMATIC ARM/CAPTURE

To arm the Automatic Glideslope (GS) capture function the following conditions must be met:

A. NAV Receiver must be tuned to, and receiving the appropriate localizer frequency.

B. Glideslope signal must be valid.

C. Autopilot must be in NAV APR and ALT hold mode.

D. Aircraft must have less than 50% full scale of localizer centerline and greater than 10% full scale below glideslope centerline.

The armed GS mode can be disabled by pressing the APR mode selector button. The GS annunciation will flash to acknowledge deactivation. To re-arm the GS mode, press the APR mode selector button again. The GS annunciation will immediately extinguish, but reappear after one second.

SECTION 4 - NORMAL PROCEDURES (continued)

GLIDE SLOPE FLIGHT PROCEDURE - AUTOMATIC ARM/ CAPTURE (continued)

With the GS mode armed, once the aircraft arrives at 5% needle deflection below the glideslope center line, the ALT annunciation will extinguish to indicate engagement/capture of the glideslope mode. If the aircraft deviates from the glideslope centerline by more than 50%, the GS annunciation will flash.

NOTE

If the approach positions the aircraft slightly above the GS centerline then manual engagement of the glideslope mode can be instantly achieved by pressing the ALT mode selector switch.

CAUTION

Manual engagement of the GS mode while above the GS centerline will result in the aircraft moving aggressively toward the GS centerline. DO NOT manually engage the GS mode if the aircraft is more than 20% above the GS centerline.

Approach the GS intercept point (usually the OM) with the flaps set to approach deflection of up to 2 notches (see Limitations section), at 110 KIAS with the aircraft stabilized in ALT hold mode. At the glideslope intercept, lower the landing gear and adjust power for desired descent speed. For best tracking results, make power adjustments in small, smooth increments to maintain desired airspeed.

At the missed approach point or the decision altitude, but no lower than 200 feet AGL, disconnect the autopilot for landing or for the go-around maneuver (see Limitations section). If a missed approach is required, the autopilot may be re-engaged after the aircraft has been reconfigured for and established in a stabilized climb.

NOTE

If a valid localizer or glideslope signal is lost during the approach, as evidenced by flashing "APR" or "GS" and PFD steering bars, the pilot should immediately execute a missed approach and advise ATC of intentions.

SECTION 4 - NORMAL PROCEDURES (continued)

GPS APPROACH WITH VERTICAL GUIDANCE

Select and load the appropriate GPS WAAS approach (LPV, LNAV/VNAV or LNAV+V) into the MFD or PFD via the PROC button. Select GPSS or APR to allow the autopilot to execute the lateral approach sequence. At any point prior to intercepting the glidepath, the APR button must be selected for the autopilot to follow the vertical guidance. A good practice is to select APR early in the approach sequence so it is not forgotten on final approach.

CAUTION

The aircraft will not automatically level off at the Decision Altitude (DA). The pilot must maintain continuous awareness of their altitude and disconnect the autopilot at the DA for a manual landing or go-around maneuver. BARO MINS may be set on the PFD to remind the pilot when the DA is reached.

At the Decision Altitude (DA) or Missed Approach Point (MAP), but no lower than 200 feet AGL, disconnect the autopilot and execute either a manual landing or go-around maneuver.

GO-AROUND MANEUVER

If a missed approach is required, the autopilot may be reengaged after the aircraft has been reconfigured for and established in a stabilized climb.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

No change.

SECTION 7 - DESCRIPTION AND OPERATION

This section contains system description and operation for the autopilot, and electric trim systems. **For detailed normal operating procedures, including system description, pre-flight and in-flight procedures, refer to the S-TEC System FiftyFive X Pilot Operating Handbook, P/N 87109, dated March 1, 2008 or later approved revision.**

AUTOPILOT and FLIGHT DIRECTOR SYSTEMS - AUTOPILOT

The System Fifty Five X is a rate based autopilot. For roll control the autopilot senses turn rate from a dedicated turn coordinator as well as closure rate to the selected course, along with the non-rate quantities of heading error, course error and course deviation indication. For pitch control the autopilot senses vertical speed, acceleration, and closure rate to the selected glideslope/glidepath, along with non-rate quantities of altitude and glideslope/glidepath deviation. These sensed data provide feedback to the autopilot, which processes them in order to control the aircraft through the use of servos coupled to the control system.

- The roll servo is connected to the aileron system and is used for control about the roll (longitudinal) axis.
- The pitch servo is connected to the stabilator, and is used for primary control about the pitch (lateral) axis.
- The pitch trim servo is connected to the elevator or stabilator trim tabs and is used to relieve the forces on the elevator or stabilator system.

For autopilot control, set the Autopilot Master switch to the FD/AP position.

NOTE

A roll mode of the autopilot must be engaged in order to allow any pitch mode to be engaged.

AUTOPILOT and FLIGHT DIRECTOR SYSTEMS - FLIGHT DIRECTOR

The Flight Director (FD) is a display of the flight profile and is commanded by the autopilot. Flight director steering bars and aircraft reference symbol are the principal FD components.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

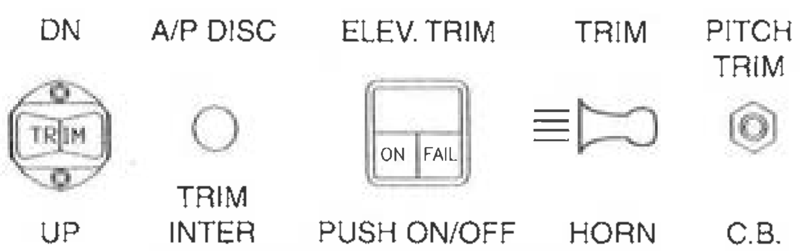
AUTOPILOT and FLIGHT DIRECTOR SYSTEMS - FLIGHT DIRECTOR (continued)

Flight director only guidance is possible by selecting FD on the FD/AP MASTR switch. An audible alert will sound when switching from FD/AP to FD, thereby acknowledging that FD mode is engaged. During the FD only mode of operation, the autopilot servos remain disengaged and the pilot manually flies the aircraft by following the flight director steering bars. Flight director only guidance is available in all lateral and vertical modes that are available during normal autopilot coupled flight.

ELECTRIC TRIM SYSTEM

The S-TEC Electric Trim System is designed to accept any single failure, either mechanical or electrical, without resulting in an uncontrolled trim runaway condition. During autotrim mode the system is designed to limit the effect of any failure causing trim operation. In order to assure proper operation of these safeguards, it is necessary to conduct a pre-flight test of the system.

The Trim Monitor System consists of the components pictured in Figure 1 and is designed to alert the pilot of a trim failure or a trim in motion.

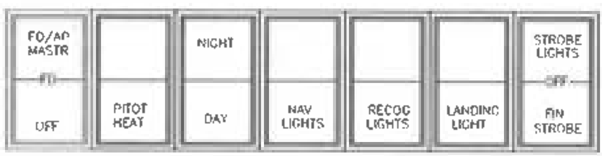


TRIM SYSTEM WITH TRIM MONITOR
Figure 1

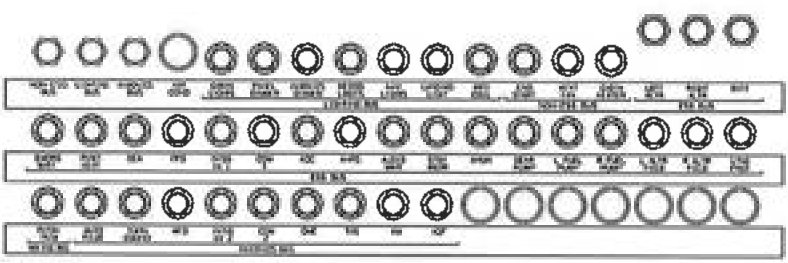
The system is activated by pushing the ELEV TRIM (PUSH ON/OFF) Master switch ON. A green ON light and a red FAIL light will illuminate in the switch and the trim audio horn will activate for one second, as a test. A trim fault will cause the FAIL light to illuminate along with continuous horn operation. The pilot should press and hold the red AP DISC/ TRIM INTER button on the control wheel and conduct the appropriate emergency procedures listed in Section 3 of this supplement.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

ELECTRICAL SYSTEM

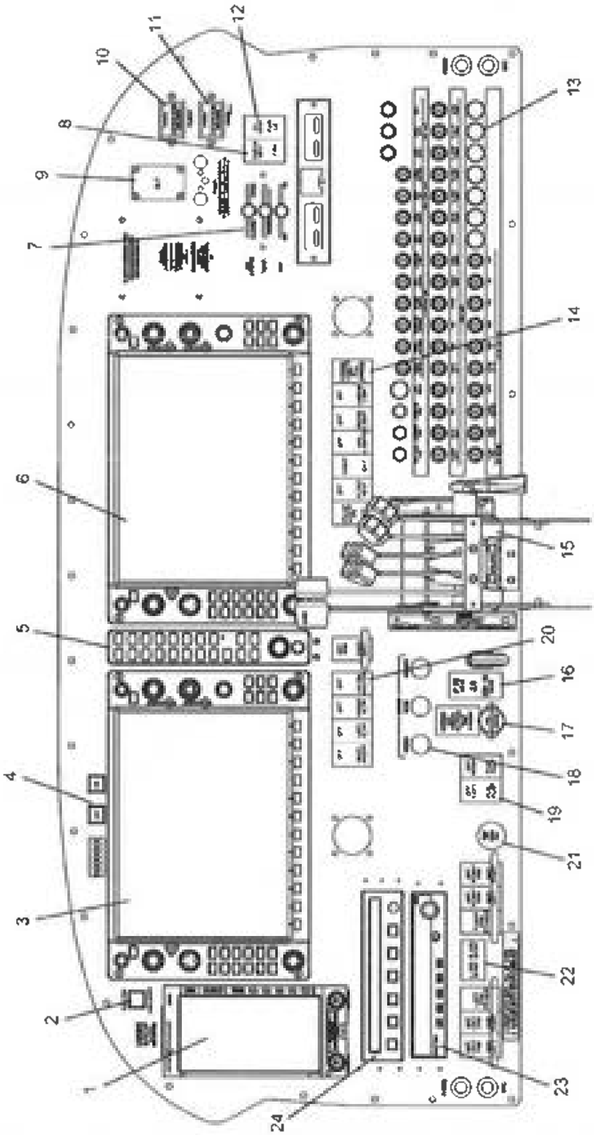


RIGHT SWITCH BANK
Figure 2



TYPICAL CIRCUIT BREAKER PANEL
Figure 3

SECTION 7 - DESCRIPTION AND OPERATION (continued)



INSTRUMENT PANEL
Figure 4
(Sheet 1 of 2)

1. Aspen STBY
2. Electric trim
3. PFD
4. Master warning / master caution switches
5. Audio Panel
6. MFD
7. Environmental controls (See figure 7-31)
8. Cabin heater fan
9. ELT switch
10. Flight HOBBS meter
11. Heater HOBBS meter
12. Ventilation fan
13. Circuit Breakers
14. Right switch bank (L to R) (See figure 7-21)
    a. Flight director / autopilot switch (option)
    b. Pitot heat
    c. Day / night switch
    d. Nav lights
    e. Recognition lights
    f. Landing light
    g. Strobe light / fin strobe
15. Throttle quadrant
16. Landing gear selector
17. Emergency gear extension knob & guard
18. Dimmer controls (L to R)
    a. Switches
    b. Panel
    c. Avionics
19. Left and right fuel pump switches
20. Left switch bank – (L to R, See figure 7-21)
    a. Battery master
    b. Left alternator
    c. Right alternator
    d. Avionics master
    e. Emergency battery
21. Parking brake
22. Engine switches (L to R)
    a. Left engine switches (left and right magneto and primer)
    b. Left engine starter
    c. Right engine starter
    d. Right engine primer
    e. Right engine left magneto
    f. Right engine right magneto
23. ADF (option)
24. Autopilot controller (option)

INSTRUMENT PANEL (CONTINUED)
Figure 4
(Sheet 2 of 2)

SECTION 8 - HANDLING, SERVICING, AND MAINTENANCE

No change.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 4 FOR BENDIX/KING KR-87 DIGITAL ADF WITH GARMIN PFD INDICATOR

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Bendix/King KR-87 Digital ADF with the Garmin Primary Flight Dispaly (PFD) 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: Eric A. Wright
DOA-510620-CE
Piper Aircraft, Inc.
Vero Beach, Florida

DATE OF APPROVAL: June 5, 2013

SECTION 1 - GENERAL

The Bendix/King Digital ADF is a panel mounted, digitally tuned, automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1799 kHz and eliminates the need for mechanical band switching. The system is comprised of a receiver, a built-in electronic timer, a bearing indicator and a KA-44B combined loop and sense antenna.

The Bendix/King Digital ADF can be used for position plotting and homing procedures, and for aural reception of amplitude modulated (AM) signals.

The "flip-flop" frequency display allows switching between pre-selected "STANDBY" and "ACTIVE" frequencies by pressing the frequency transfer button. Both preselected frequencies are stored in a non-volatile memory circuit (no battery power required) and displayed in self-dimming gas discharge numerics. The active frequency is continuously displayed in the left window, while the right window will display either the standby frequency or the selected readout from the built-in timer.

The built-in electronic timer has two separate and independent timing functions: (1) An automatic flight timer that starts whenever the unit is turned on. This timer functions up to 59 hours and 59 minutes. (2) An elapsed timer which will count up or down for up to 59 minutes and 59 seconds. When a preset time interval has been programmed and the countdown reaches :00, the display will flash for 15 seconds. Since both the flight timer and elapsed timer operate independently, it is possible to monitor either one without disrupting the other. The pushbutton controls and the bearing indicator are internally lighted.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

To Operate as an Automatic Direction Finder:

1. OFF/VOL Control - ON.
2. Frequency Selector Knobs - SELECT desired frequency in the standby frequency display.
3. FRQ Button - PRESS to move the desired frequency from the standby to the active position.
4. ADF Button (on audio panel) - PRESS to activate ADF audio through headset.
5. SPKR Button (on audio panel) - PRESS to activate ADF audio through cockpit speaker.
6. OFF/VOL Control - SET to desired volume level.
7. ADF Button - PRESS to select ADF mode.
8. ADF Bearing - Display ADF bearing on PFD by selecting the PFD softkey, then pressing the BRG1 or BRG2 softkey until "ADF" is displayed in the appropriate Bearing 1 or Bearing 2 information window and bearing pointer is displayed on the HSI.

ADF Test (Pre-flight or In-flight):

1. ADF Button - SELECT ANT mode and note pointer moves to 90° position and then disappears.
2. ADF Button - SELECT ADF mode and note the pointer moves without hesitation to the station bearing. Excessive pointer sluggishness, wavering or reversals indicate a signal that is too weak or a system malfuction.

SECTION 4 - NORMAL PROCEDURES (continued)

NOTE

The Standby Frequency which is in memory while Flight Time or Elapsed Time modes are being displayed may be called back by pressing the FRQ button, then transferred to active use by pressing the FRQ button again.

To Operate Elapsed Time Timer-Count Down Mode:

1. OFF/VOL Control - ON.
2. FLT/ELT Mode Button - PRESS (once or twice) until ET is annunciated.
3. SET/RST Button - PRESS until the ET annunciation begins to flash.
4. FREQUENCY SELECTOR KNOBS - SET desired time in the elapsed time display. The small knob is pulled out to tune the 1's. The small knob is pushed in to tune the 10's. The outer knob tunes minutes up to 59 minutes.

NOTE

Selector knobs remain in the time set mode for 15 seconds after the last entry or until the SET/RST, FLT/ET, or FRQ button is pressed.

5. SET/RST Button - PRESS to start countdown. When the timer reaches 0, it will start to count up as display flashes for 15 seconds.

NOTE

While FLT or ET are displayed, the active frequency on the left side of the window may be changed, by using the frequency selector knobs, without any effect on the stored standby frequency or the other modes.

SECTION 4 - NORMAL PROCEDURES (continued)

ADF Operation NOTES:

Erroneous ADF Bearing Due to Radio Frequency Phenomena:

In the U.S., the FCC, which assigns AM radio frequencies, occasionally will assign the same frequency to more than one station in an area. Certain conditions, such as Night Effect, may cause signals from such stations to overlap. This should be taken into consideration when using AM broadcast station for navigation.

Sunspots and atmospheric phenomena may occasionally distort reception so that signals from two stations on the same frequency will overlap. For this reason, it is always wise to make positive identification of the station being tuned, by switching the function selector to ANT and listening for station call letters.

Electrical Storms:

In the vicinity of electrical storms, an ADF indicator pointer tends to swing from the station tuned toward the center of the storm.

Night Effect:

This is a disturbance particularly strong just after sunset and just after dawn. An ADF indicator pointer may swing erratically at these times. If possible, tune to the most powerful station at the lowest frequency. If this is not possible, take the average of pointer oscillations to determine relative station bearing.

Mountain Effect:

Radio waves reflecting from the surface of mountains may cause the pointer to fluctuate or show an erroneous bearing. This should be taken into account when taking bearings over mountainous terrain.

Coastal Refraction:

Radio waves may be refracted when passing from land to sea or when moving parallel to the coastline. This also should be taken into account.

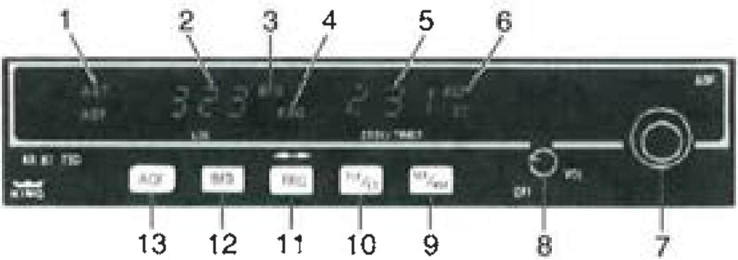
SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the certified weight and balance data in Section 6 of the Pilot's Operating Handbook and Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION



KR-87 Digital ADF

ADF Displays in Garmin PFD

King Digital ADF Operating Controls and Indicators
Figure 1

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Legend - Figure 1

1. Mode Annunciation - Antenna (ANT) is selected by the "out" position of the ADF button. This mode improves the aural reception and is usually used for station identification. The bearing pointer is deactivated and will park in the 90° relative position. Automatic Direction Finder (ADF) mode is selected by the depressed position of the ADF button. This mode activates the bearing pointer. The bearing pointer will point in the direction of the station relative to the aircraft heading.
2. Active Frequency Display - The frequency to which the ADF is tuned is displayed here. The active ADF frequency can be changed directly when either of the timer functions are selected.
3. Beat Frequency Oscillator (BFO) - The BFO mode, activated and annunciated when the "BFO" button is depressed, permits the carrier wave and associated morse code identifier broadcast on the carrier wave to be heard.

NOTE

CW signals (Morse Code) are unmodulated and no audio will be heard without use of BFO. This type of signal is not used in the United States air navigation. It is used in some foreign countries and marine beacons.

4. Standby Frequency Annunciation (FRQ) - When FRQ is displayed, the STANDBY frequency is displayed in the right display. The STANDBY frequency is selected using the frequency select knobs. The selected STANDBY frequency is put into the ACTIVE frequency window by pressing the frequency transfer button.
5. Standby Frequency Display - Either the standby frequency, the flight timer, or the elapsed time is displayed in this position. The flight timer and elapsed timer are displayed replacing the standby frequency which goes into "blind" memory to be called back at any time by depressing the FRQ button. Flight time or elapsed time are displayed and annunciated alternatively by depressing the FLT/ET button.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Legend - Figure 1 (continued)

6. Timer Mode Annunciation - Either the elapsed time (ET) or flight time (FLT) mode is annunciated here.
7. Frequency Selector Knobs - Selects the standby frequency when FRQ is displayed and directly selects the active frequency whenever either of the timer functions is selected. The frequency selector knobs may be rotated either clockwise or counterclockwise. The small knob is pulled out to tune the 1's. The small knob is pushed in to tune the 10's. The outer knob tunes the 100's with rollover into the 1000's. These knobs are also used to set the desired time when the elapsed timer is used in the countdown mode.
8. Off/Volume Control (OFF/VOL) - Controls primary power and audio output level. Clockwise rotation from OFF position applies primary power to receiver; further clockwise rotation increases audio level. Audio muting causes the audio output to be muted unless the receiver is locked on a valid station.
9. Set/Reset Button (SET/RST) - The set/reset button, when pressed, resets the elapsed timer whether it is being displayed or not.
10. Flight Time/Elapsed Time Mode Selector Button (FLT/ET) - The Flight Timer/Elapsed Time mode selector button, when pressed, alternatively selects either Flight Timer mode or Elapsed Timer mode.
11. Frequency Transfer Button (FRQ) - The FRQ transfer button, when pressed, exchanges the active and standby frequencies. The new frequency becomes active and the former active frequency goes into standby.
12. BFO Button - The BFO button selects the BFO mode when in the depressed position (see Note under item 3).
13. ADF Button - The ADF button selects either the ANT mode or the ADF mode. The ANT mode is selected with the ADF button in the out position. The ADF mode is selected with the ADF button in the depressed position.
14. Bearing Pointer (on PFD) - The cyan arrow indicates magnetic bearing to the station, in degrees.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 5
FOR
BENDIX/KING KN-63 DME

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Bendix/King KN-63 DME 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: Eric A. Wright
DOA-510620-CE
Piper Aircraft, Inc.
Vero Beach, Florida

DATE OF APPROVAL: June 5, 2013

SECTION 1 - GENERAL

The Bendix/King KN-63 DME supplies continuous slant range distance information from a fixed ground station to an aircraft in flight.

The equipment consists of Garmin Primary Flight Display (PFD) which contains all the operating controls and displays, and a remotely mounted KN-63 Receiver-Transmitter.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

DME Operation

1. NAV 1 and NAV 2 VHF Navigation Receivers - ON; TUNE FREQUENCY to VOR/DME station frequencies, as required.

   NOTE

   When the VORTAC or VOR/DME frequency is selected, the appropriate DME frequency is automatically channeled.

2. DME IDENTIFICATION - select DME button on audio panel (audio ID will always come though the headset and will come through the cockpit speaker if SPKR is selected on the audio panel).

SECTION 5 - PERFORMANCE

No change.

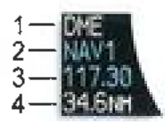
SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the certified weight and balance data in Section 6 of the Pilot's Operating Handbook and Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION

DME Display on Garmin PFD
Figure 1

Legend - Figure 1



1. DME Information Window

2. DME MODE ANNUNCIATOR
   Displays the DME operating mode; NAV 1 or NAV 2 or HOLD as selected in the DME TUNING window.

3. FREQUENCY
   Displays the frequency of the VOR/DME or VORTAC selected on the associated navigation radio or the frequency being held (HOLD) that was previously selected.

4. DISTANCE DISPLAY (NM)
   DME distance to VOR/DME or VORTAC displayed in .1 nautical mile increments up to 99.9 NM, then in increments of one nautical mile to up to 389 NM.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Legend - Figure 1 (continued)

5. DME TUNING Window (NAV1, NAV2, HOLD)
   Allows access to the DME operating mode as follows:

   NAV 1 Selects DME operation with No. 1 VHF navigation set; enables channel selection by NAV 1 frequency selector controls.

   5

   NAV 2 Selects DME operation with No. 2 VHF navigation set; enables channel selection by NAV 2 frequency selector controls.

   HOLD Selects DME memory circuit; DME remains channeled to station which was last channeled when HOLD was selected and will continue to display information relative to this channel. Allows both the NAV 1 and NAV 2 navigation receivers to be set to new operational frequencies without affecting the previously selected (HOLD) DME operation.

NOTE

In the HOLD mode, the frequency being held remains in the DME Information Window and does not update when NAV1 or NAV2 frequencies are being updated.

NOTE

If NAV1 or NAV2 are red-x'd on the PFD, the associated DME indication will be valid if it was the active DME when the NAV failure occurred. Switching to the DME associated with the failed NAV will not be possible.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 6
FOR

AMSAFE INFLATABLE SEAT RESTRAINTS
(STC SA02276AK)

The FAA approved operational supplement for the AMSAFE Inflatable Seat Restraints, installed in accordance with STC SA02276AK, is required for operation of this system. AMSAFE will be responsible to supply and revise the operational supplement. It is permitted to include the AMSAFE Inflatable Seat Restraints supplement in this location of the Pilot's Operating Handbook unless otherwise stated by AMSAFE. The information contained in the AMSAFE Inflatable Seat Restraints 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 AMSAFE Inflatable Seat Restraints system. For limitations, procedures and performance information not contained in the AMSAFE supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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TABLE OF CONTENTS

SECTION 10

OPERATING TIPS

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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) Always determine position of landing gear by checking the gear position indications.

(e) 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.

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.

10.3 OPERATING TIPS (Continued)

(f) 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.

(g) Anti-collision lights should not be operating when flying through clouds, fog, or haze, since reflected light can produce spacial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

(h) 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.

(i) All pilots who plan to fly above 10,000 feet should take initial high altitude physiological training and then take refresher training every two or three years.

(j) 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.

(k) 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. A rapid reduction in power (full throttle to idle in less than 2 seconds) may be harmful to the engine. See Section 4 for power settings which are recommended for simulated one engine operation.

10.3 OPERATING TIPS (Continued)

(l) 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.

(m) The airplane should not be flown in severe turbulence as damage to the airframe structure could result.

(n) 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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