SENECA V

PA-34-220T (1999 KG)

SN 3449001 AND UP

PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. 3449132

AIRPLANE REGIST. NO. D-GWIT

PA-34-220T (1999 KG)
REPORT: VB-1649 FAA APPROVED BY:

PETER E. PECK
D.O.A. NO. SO-1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL:
JANUARY 23, 1997

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE FEDERAL AVIATION REGULATIONS AND ADDITIONAL INFORMATION PROVIDED BY THE MANUFACTURER AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL. THIS HANDBOOK MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

Piper™

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 THE NEW PIPER AIRCRAFT, INC. MUST BE PROPERLY INSERTED.

Published by
PUBLICATIONS DEPARTMENT
The New Piper Aircraft, Inc.
Issued: JANUARY 23, 1997

APPLICABILITY

Application of this handbook is limited to the specific Piper PA-34-220T model airplane designated by serial number and registration number on the face of the title page of this handbook.

WARNING

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

WARNING

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

REVISIONS

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

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

I. Identifying Revised Material

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

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

II. Revision Procedure

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

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

ORIGINAL PAGES ISSUED

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

Title, ii through viii, 1-i, 1-ii, 1-1 through 1-12, 2-i, 2-ii, 2-1 through 2-14, 3-i through 3-iv, 3-1 through 3-40, 4-i through 4-iv, 4-1 through 4-54, 5-i, 5-ii, 5-1 through 5-36, 6-i, 6-ii, 6-1 through 6-14, 7-i, 7-ii, 7-1 through 7-68, 8-i, 8-ii, 8-1 through 8-20, 9-i, 9-ii, 9-1 through 9-64, 10-i, 10-ii, 10-1 through 10-4

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-34-220T, Seneca V Pilot's Operating Handbook, REPORT: VB-1649 issued JANUARY 23, 1997.

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1 (PR970926)	v	Added Rev. 1 to L of R page.	
	3-ii	Revised Table of Contents.	
	3-iii	Revised Table of Contents.	
	3-iv	Revised Table of Contents.	
	3-12	Added para. 3.5d.	
	3-13	Added para. 3.5d.	
	3-14 thru 3-31	Revised para's. 3.5e thru 3.5p, and relocated information.	
	3-31a	Added page and para. 3.14.	
	3-31b	Added page and para. 3.15.	
	3-32 thru 3-40	Revised para's. 3.17, 3.19, 3.21, 3.23, 3.25, 3.27, 3.29 3.31, 3.33 & 3.35, and relocated information.	
	4-i	Revised Table of Contents.	
	4-9	Revised para. 4.5c.	
	4-10	Revised para. 4.5c.	
	4-11	Revised para. 4.5c.	
	4-12	Revised para. 4.5c.	
	4-13	Revised para. 4.5e.	
	4-15	Revised para. 4.5g.	
	4-16	Revised para. 4.5h.	
	4-17	Revised para. 4.5h.	
	4-29 thru 4-35	Revised para's. 4.13 thru 4.13f.	
	4-36	Revised para. 4.17.	
	4-39	Revised para. 4.21.	
	4-41	Revised para's. 4.23a & 4.23b.	Peter E. Peck
	5-23	Revised Fig. 5-23.	
	5-31	Revised Fig. 5-39.	Sept. 26, 1997
	9-5	Revised Section 2.	Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 2	vi	Added Rev. 2 to L of R page.	
(PR980422)	2-i	Revised Table of Contents.	
	2-8	Revised para. 2.29 by adding Icing Information.	
	2-9	Revised para. 2.29	
	3-2	Revised para. 3.3.	
	3-29	Revised para. 3.9i, item 4.	
	4-iii	Revised Table of Contents.	
	4-1	Revised para. 4.1.	
	4-2	Revised para. 4.3, item (b).	
	4-5	Revised para. 4.5a.	
	4-15	Revised para. 4.5g, by adding Warning.	
	4-16	Revised para. 4.5h, by adding Warning.	
	4-17	Revised para. 4.5i.	
	4-24	Revised para. 4.9c.	
	4-39	Revised para. 4.21, by adding Warning.	
	4-40	Revised para. 4.23, by adding Warning.	
	4-42	Revised para. 4.25a.	
	4-45	Revised para. 4.27.	
	4-55	Added para. 4.55, Icing Information.	
	4-56	Added Blank Page.	
	5-16	Revised Fig. 5-11.	
	5-17	Revised Fig. 5-13.	
	5-18	Revised Fig. 5-15.	
	5-20	Revised Fig. 5-17.	Peter E. Peck
	7-2	Revised para. 7.5.	Peter E. Peck
	7-43	Revised Fig. 7-35.	
	7-47	Revised Fig. 1.	April 22, 1998 Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 3	vii	Added page and Rev. 3.	
(PR980819)	viii	Added page.	
	2-8	Revised Para. 2.27.	
	3-21	Revised Para. 3.5k.	
	4-10	Revised Para. 4.5c.	
	4-11	Revised Para. 4.5c.	
	4-12	Revised Para. 4.5c.	
	4-14	Revised Para. 4.5f.	
	4-30	Revised Para's. 4.13a & b.	
	4-31	Revised Para's. 4.13c & d.	
	4-33	Revised Para. 4.13e.	
	4-38	Revised Para. 4.19.	
	4-55	Corrected typo.	
	7-31	Revised Para. 7.19.	
	9-i	Revised T of C.	
	9-18	Revised Section 3.	
	9-65 thru 9-76	Added Supplement 9 - Bendix/King KX 155A Comm/Nav System.	Peter E. Peck August 19, 1998 Date
Rev. 4 (PR991119)	vi-a	Added Rev. 4 and corrected page number in footer.	
	vi-b	Corrected page number in footer.	Christina L. Marsh
	9-14	Revised Supplement 3 by adding Section 2 Placard.	Nov. 19, 1999 Date
Rev. 5	vi-a	Added Rev. 5 to L of R.	
(PR000207)	vi-b	Added Rev. 5 to L of R.	
	4-5	Revised Para. 4.5a.	
	4-11	Revised Para. 4.5c.	
	4-13	Revised Para. 4.5e.	
	4-18	Revised Para. 4.5k.	
	4-20	Revised Para. 4.5o.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 5	4-24	Revised Para. 4.9b & 4.9c.	
(PR000207)	7-37	Revised Para. 7.23.	
(continued)	9-i	Revised T of C.	
	9-22	Revised Section 4.	
	9-77	Added Supplement 10 -	
	thru	Garmin GNS 430 Comm/Nav.	
	9-84		
	9-85	Added Supplement 11 -	
	thru	S-TEC System 55 Autopilot.	Christina L. Marsh
	9-86		
	10-3	Revised Para. 10.3.	Feb. 7, 2000 Date
Rev. 6	vi-b	Added Rev. 6 to L of R.	Christina L. Marsh
(PR000522)	9-14	Revised Section 2.	
			May 22, 2000 Date
Rev. 7	vi-b	Added Rev. 7 to L of R.	
(PR000612)	vi-c	Added Page & Rev. 7 to L of R.	
	vi-d	Added Page.	
	2-13	Revised para. 2.31.	
	4-48	Revised para. 4.33.	
	7-25	Revised para. 7.17.	
	7-26	Revised Figure 7-21 title.	
	7-29	Revised para. 7.17.	
	9-i	Revised T of C.	
	9-ii	Revised T of C.	
	9-83	Revised Section 4.	
	9-87	Added Supplement 12 -	
	thru	Garmin GNS 430 Comm/Nav	
	9-94	w/ Traffic Adv. & Lightning	
		Strike Adv. Data.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 7 (PR000612) continued	9-95 thru 9-102	Added Supplement 13 - Garmin GNS 530 Comm/Nav w/ Traffic Adv. & Lightning Strike Adv. Data.	
	9-103 thru 9-108	Added Supplement 14 - BF Goodrich Skywatch Traffic Advisory System Model SKY497.	
	9-109 thru 9-116	Added Supplement 15 - Avidyne 5-RR-MFC Series FlightMax Flight Situation Display w/ Software 530-0104.	Christina L. Marsh
	9-117 thru 9-120	Added Supplement 16 - BF Goodrich Aerospace WX-500 Stormscope Series II Weather Mapping Sensor.	Christina L. Marsh June 12, 2000 Date
Rev. 8 (PR010223)	vi-c	Added Rev. 8 to L of R.	
	vi-d	Added Rev. 8 to L of R.	
	4-54	Revised para. 4.53.	
	6-11	Revised Fig. 6-9.	
	9-ii	Revised T of C.	
	9-121 thru 9-130	Added pages and Supplement 17.	
	9-131 thru 9-140	Added pages and Supplement 18.	
	9-141 thru 9-142	Added pages and Supplement 19.	
	9-143 thru 9-148	Added pages and Supplement 20.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 8 (PR010223) continued	9-149 thru 9-154 9-155 thru 9-158	Added pages and Supplement 21. Added pages and Supplement 22.	Christina L. Marsh Feb. 23, 2001 Date
Rev. 9 (PR011101)	vi-d 9-i 9-ii 9-159 thru 9-166	Added Rev. 9 to L of R. Revised T of C. Revised T of C. Added pages and Supplement 23.	Albert J. Mill Nov. 01, 2001 Date
Rev. 10 (PR020107)	vi-d 9-ii 9-167 thru 9-176	Added Rev. 10 to L of R. Revised T of C. Added pages and Supplement 24.	Albert J. Mill Jan. 07, 2002 Date
Rev. 11 (PR020225)	vi-d 1-5 2-6 2-13 6-13	Added Rev. 11 to L of R. Revised para. 1.11 & 1.15. Revised para. 2.11. Revised para. 2.31. Revised Figure 6-13.	Albert J. Mill Feb. 25, 2002 Date
Rev. 12 (PR020531)	vi-d 6-11	Added Rev. 12 to L of R. Revised Figure 6-9.	Albert J. Mill May 31, 2002 Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 13	vi-e	Added page and Rev. 13.	
(PR021210)	vi-f	Added page.	
	9-i	Revised T of C.	
	9-177	Added pages	Albert J. Mill
	thru	and Supplement 25.	
	9-178		Dec. 10, 2002
			Date
Rev. 14	vi-e	Added Rev. 14 to L of R.	
(PR030205)	7-5	Revised para. 7.5.	
	7-6	Revised para. 7.7.	
	7-9	Revised fig. 7-5.	
	7-9a	Added page and fig. 7-5a.	Albert J. Mill
	7-9b	Added page.	
	7-12	Revised para. 7.9.	Feb. 5, 2003
			Date
Rev. 15	iii	Added Warning.	
(PR030430)	iv	Moved info. from page iii.	
	vi-e	Added Rev. 15 to L of R.	
	vi-f	Added Rev. 15 to L of R.	
	2-6	Revised para. 2.11.	
	6-12	Revised fig. 6-11.	
	8-1	Moved info. to page 8-1b and revised para. 8.1.	
	8-1a	Added page and revised para. 8.1.	
	8-1b	Added page and moved info. from pages 8-1 and 8-2.	
	8-2	Moved info. to page 8-1b and revised para. 8.3.	
	9-ii	Revised T of C.	
	9-36	Revised Section 4.	
	9-164	Revised Section 7.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 15	9-179	Added pages	
(PR030430)	9-180	and Supplement 26.	
continued	10-i	Revised T of C.	
	10-1	Revised subject headings.	Albert J. Mill
			April 30, 2003
			Date
Rev. 16	vi-f	Added Rev. 16 to L of R.	
(PR031110)	3-4	Revised para. 3.5a.	
	3-8	Revised para. 3.5a.	
	3-25	Revised para. 3.9d.	
	3-27	Revised para. 3.9h.	
	4-16	Revised para. 4.5h.	
	4-17	Revised para. 4.5h.	Albert J. Mill
	9-118	Revised section 1.	Nov. 10, 2003
			Date
Rev. 17	vi-f	Added Rev. 17 to L of R.	
(PR040112)	9-ii	Revised T of C.	
	9-181	Added pages	Albert J. Mill
	thru	and Supplement 27.	
	9-184		Jan. 12, 2004
			Date
Rev. 18	vi-f	Added Rev. 18 to L of R.	
(PR041213)	4-18	Revised para. 4.5m.	
	4-46	Revised para. 4.31.	Linda J. Dicken
			Dec. 13, 2004
Rev. 19	vi-f	Added Rev. 19 to L of R.	
(PR060424)	5-23	Revised Figure 5-23.	Linda J. Dicken
			April 24, 2006
Rev. 20	vi-f	Added Rev. 20 to L of R.	
(PR070219)	4-49	Revised para. 4.35.	
			Linda J. Dicken
			Feb. 19, 2007

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 21	ii	Updated copyright.	
(PR110617)	vi-g	Added page.	
		Added Rev. 21 to L of R.	
	vi-h	Added page.	
	3-iii	Revised T of C.	
	3-iv	Revised T of C.	
	3-11	Revised Para. 3.5c.	
	3-20a	Added page.	
		Added new Para. 3.5k.	
	3-20b	Added page.	
	3-21	Changed Para. 3.5k to 3.5l.	
	3-31	Revised Para. 3.13a.	
	3-38a	Added page.	
		Added Para. 3.26.	
	3-38b	Added page.	
	3-39	Revised Para. 3.27.	
	4-16	Revised Para. 4.5h.	Albert J. Mill
	4-40	Revised Para. 4.23.	June 17, 2011
Rev. 22	vi-g	Added Rev. 22 to L of R.	
(PR111010)	vi-h	Added Rev. 22 to L of R.	
	4-i to 4-iii	Revised T of C.	
	4-13	Revised Para. 4.5d.	
		Relocated text to page 4-14.	
	4-14	Added text from page 4-13.	
		Revised Para. 4.5e.	
		Relocated text to page 4-15.	
	4-15	Added text from page 4-14.	
		Relocated text to page 4-16.	
	4-16	Added text from page 4-15.	
		Relocated text to page 4-17.	
	4-17	Added text from page 4-16.	
		Relocated text to page 4-18.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 22 (continued)	4-18	Added text from page 4-17. Relocated text to page 4-19.	
	4-19	Added text from page 4-18. Relocated text to page 4-20.	
	4-20	Added text from page 4-19. Revised Para. 4.5o. Relocated text to page 4-21.	
	4-21	Added text from page 4-20.	
	4-36	Revised Para. 4.15a. Revised Para. 4.17. Relocated text to page 4-37.	
	4-37	Added text from page 4-36. Revised Para. 4.17. Relocated text to page 4-38.	
	4-38	Added text from page 4-37. Relocated text to page 4-39.	
	4-39	Added text from page 4-38.	
	4-49	Revised Para. 4.35. Relocated text to page 4-50.	Albert J. Mill
	4-50	Added text from page 4-49.	October 10, 2011
Rev. 23 (PR111101)	vi-h	Added Rev. 23 to L of R.	
	3-8	Revised Para. 3.5a.	
	3-27	Revised Para. 3.9h.	Wayne E. Gaulzetti November 1, 2011
Rev. 24 (PR121106)	ii	Updated copyright.	
	vi-h	Added Rev. 24 to L of R.	
	2-2	Revised Para. 2.3.	
	3-9	Revised Para. 3.5b.	
	3-10	Revised Para. 3.5b.	
	3-30	Revised Paragraphs 3.11a and 3.11b.	
	4-9	Revised Section 4.5c.	
	4-17	Revised Para. 4.5h.	
	4-29	Revised Sect. 4.13.	
	7-65	Added Figure number 7-41.	Wayne E. Gaulzetti
	8-8	Revised Para. 8.15.	November 6, 2012

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TABLE OF CONTENTS

SECTION 1

GENERAL

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SECTION 1
GENERAL

1.1 INTRODUCTION

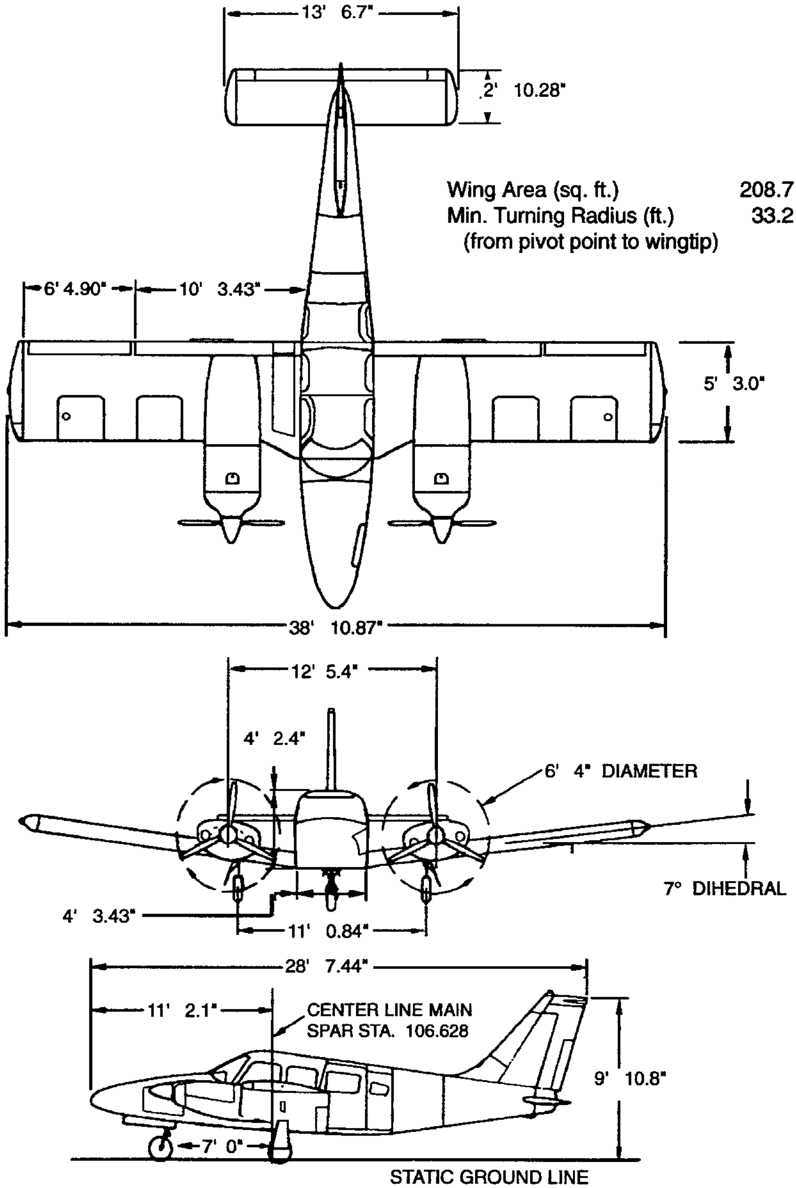
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by the Federal Aviation Regulations and additional information provided by the airplane manufacturer and constitutes the FAA Approved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

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

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

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

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



THREE VIEW
Figure 1-1

1.3 ENGINE

(a) Number of Engines	2
b) Engine Manufacturer	Teledyne Continental
(c) Engine Model Number	
(1) Left	TSIO-360RB
(2) Right	LTSIO-360RB
	Max. Cont. Power
(d) Rated Horsepower	220 BHP
(e) Rated Speed (rpm)	2600
(f) Bore (inches)	4.438
(g) Stroke (inches)	3.875
(h) Displacement (cubic inches)	360
(i) Compression Ratio	7.5:1
(j) Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

1.5 PROPELLER

STANDARD

(a) Number of Propellers	2
(b) Propeller Manufacturer	Hartzell
(c) Propeller Hub & Blade Models*	
(1) Left	BHC-J2YF-2CUF/ FC8459B-8R
(2) Right	BHC-J2YF-2CLUF/ FJC8459B-8R
(d) Number of Blades	2
(e) Propeller Diameter (in.)	
(1) Maximum	76
(2) Minimum	75
(f) Propeller Type	Constant Speed, Hydraulically Activated, Full Feathering

*The propellers have the same designation when deicing boots are installed.

OPTIONAL

(a) Number of Propellers	2
(b) Propeller Manufacturer	McCauley
(c) Propeller Hub & Blade Models*	
(1) Left	3AF32C522/82NJA-6
(2) Right	3AF32C523/L82NJA-6
(d) Number of Blades	3
(e) Propeller Diameter (in.)	
(1) Maximum	76
(2) Minimum	75
(f) Propeller Type	Constant Speed, Hydraulically Activated, Full Feathering

1.7 FUEL

AVGAS ONLY

(a) Fuel Capacity (U.S. gal.) (total)	128
(b) Usable Fuel (U.S. gal.) (total)	122
(c) Fuel	
(1) Minimum Grade	100 Green or 100LL Blue Aviation Grade
(2) Alternate Fuels	Refer to latest revision of Continental Service Bulletin Fuel and Oil Grades.

1.9 OIL

(a) Oil Capacity (U.S. qts.) (per engine)	8
(b) Oil Specification	Refer to latest revision of Continental Service Bulletin Fuel and Oil Grades.

*The propellers have the same designation when deicing boots are installed.

(c) Oil Viscosity

	Aviation Grade	S.A.E. No.
(1) Below 40°F	1065	30
(2) Above 40°F	1100	50

When operating temperatures overlap indicated ranges, use the lighter grade of oil. Multi-viscosity oils meeting Teledyne Continental Motors' Specification MHS-24A are approved.

1.11 MAXIMUM WEIGHTS

(a) Max. Ramp Weight	4430 lbs/2009 kg.
(b) Max. Takeoff Weight	4407 lbs/1999 kg.
(c) Max. Landing Weight	4407 lbs/1999 kg.
(d) Max. Zero Fuel Weight - Std.	4407 lbs/1999 kg.
(e) Max. Weights in Baggage Compartment	
(1) Forward	100 lbs/45 kg
(2) Aft	85 lbs/38 kg

1.13 STANDARD AIRPLANE WEIGHTS

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

1.15 BAGGAGE SPACE

	FORWARD	AFT
(a) Maximum Baggage	100 lbs/45 kg	85 lbs/38 kg
(b) Baggage Space (cu. ft.)	15.3	17.3
(c) Baggage Door Size (in.)	24 x 21	

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs. per sq. ft.)	21.2
(b) Power Loading (lbs. per hp)	10.0

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1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

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

(a) General Airspeed Terminology and Symbols

CAS	Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Airspeed is the speed of an aircraft 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.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
KTAS	True Airspeed expressed in Knots.

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (cont)

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 aircraft 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.

V_{SSE}	Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches Hg(1013.2mb); The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003566°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 (cont)

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

TIT Gauge	Turbine Inlet Temperature Gauge

(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.

Demonstrated Crosswind Velocity (DEMO. X-WIND)	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 Or 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 (cont)

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

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SECTION 2

LIMITATIONS

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SECTION 2
LIMITATIONS

2.1 GENERAL

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

This airplane must be operated as a normal category airplane in compliance with the operating limitations stated in the form of placards and markings and those given in this section and 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.	204	203
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	164	165

2.3 AIRSPEED LIMITATIONS (Cont)

SPEED	KIAS	KCAS
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
4407 lbs/1999 kg GW	135	137
3205 lbs.	113	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 rough air.

SPEED	KIAS	KCAS
Maximum Gear Extended Speed (V_{LE}) - Do not exceed this speed with landing gear extended.	128	130
Maximum Landing Gear Operating Speed (V_{LO}) - Do not extend or retract landing gear above these speeds.		
Extension	128	130
Retraction	107	109
Maximum Flaps Extended Speed (V_{FE})- Do not exceed this speed at the given flap setting.		
10º	140	141
25º	120	122
40º	113	113
One Engine Inoperative Best Rate of Climb Speed. (V_{YSE})	88	91
Air Minimum Control Speed (V_{MCA}) - Lowest airspeed at which airplane is controllable with one engine operating at takeoff power and no flaps.	66	67

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	KIAS
Red Radial Line (Never Exceed)	204
Yellow Arc (Caution Range - Smooth Air Only)	164 to 204
Green Arc (Normal Operating Range)	67 to 164
White Arc (Flap Down)	61 to 113
Blue Radial Line (One Engine Inoperative Best Rate of Climb Speed)	88
Red Radial Line (One Engine Inoperative Air Minimum Control Speed)	66

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	2
(b) Engine Manufacturer	Teledyne Continental
(c) Engine Model Number	
(1) Left	TSIO-360RB
(2) Right	LTSIO-360RB
(d) Engine Operating Limits	Max. Cont. Power
(1) Rated Horsepower (BHP)	220
(2) Max. Rotational Speed (RPM)	2600
(3) Max. Manifold Pressure (Inches of Mercury)	38
(4) Max. Cylinder Head Temperature	460°F
(5) Max. Oil Temperature	240°F
(e) Oil Pressure	
Minimum (red line)	10 PSI
Maximum (red line)	100 PSI

2.7 POWER PLANT LIMITATIONS (Cont)

(f) Fuel Grade (AVGAS ONLY)
(Min. grade) 100 or 100LL Aviation Grade

(g) Number of Propellers 2

(h) Propeller Manufacturer

Hartzell (Two Blade) (Standard)
Propeller Hub and Blade Models

a. Left BHC-J2YF-2CUF/FC8459B-8R
b. Right BHC-J2YF-2CLUF/FJC8459B-8R

NOTES
(2-blade propellers only)

Avoid continuous operation between 1900 and 2100 RPM above 32 IN. HG. manifold pressure.

Avoid continuous ground operation between 1600 and 2100 RPM in cross and tail winds.

McCauley (Three Blade) (Optional)
Propeller Hub and Blade Models

a. Left 3AF32C522( )/( )82NJA-6
b. Right 3AF32C523( )/( )L82NJA-6

(i) Propeller Diameter (inches)
Maximum 76
Minimum 75

2.7a POWER PLANT LEANING LIMITATIONS

Mixture FULL RICH at all engine powers above high speed cruise power.

2.9 POWER PLANT INSTRUMENT MARKINGS

(a)	Tachometer	
	Green Arc (Normal Operating Range)	600 RPM to 2600 RPM
	Red Line (Maximum)	2600 RPM
(b)	Cylinder Head Temperature	
	Green Arc (Normal Range)	240°F to 460°F
	Red Line (Maximum)	460°F
(c)	Oil Temperature	
	Green Arc (Normal Operating Range)	100°F to 240°F
	Red Line (Maximum)	240°F
(d)	Oil Pressure	
	Red Line (Minimum)	10 PSI
	Yellow Arc (Caution - Ground Operation Only)	10 PSI to 30 PSI and 80 PSI to 100 PSI
	Green Arc (Normal Operating Range)	30 PSI to 80 PSI
	Red Line (Maximum)	100 PSI
(e)	Manifold Pressure	
	Green Arc (Normal Operating Range)	10 IN. to 38 IN. HG.
	Red Line (Maximum)	38 IN. HG.
(f)	Turbine Inlet Temperature	
	Green Arc	1200°F to 1650°F
	Red Line (Maximum)	1650°F

NOTE:

A maximum temperature of 1700°F is allowed for 60 seconds, in order to determine peak T.I.T. for fuel management.

2.11 WEIGHT LIMITS

(a)	Max. Ramp Weight	4430 lbs/2009 kg
(b)	Max. Takeoff Weight	4407 lbs/1999 kg
(c)	Max. Landing Weight	4407 lbs/1999 kg
(d)	Max. Weights in Baggage Compartments	
	Forward	100 lbs/45 kg
	Aft	85 lbs/38 kg

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
3400	82.0	94.6
4250	86.7	94.6
4407	88.0	94.6

NOTES:

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at the inboard edge of the fuel tank.

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 MANEUVERING LOAD FACTORS

(a) Positive Load Factor (Maximum)	
(1) Flaps Up	3.8 G
(2) Flaps Down	2.0 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved.

2.19 TYPES OF OPERATION

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

(a) Day V.F.R.
(b) Night V.F.R.
(c) Day I.F.R.
(d) Night I.F.R.
(e) Icing conditions when equipped per Ice Protection System Installation Supplement (refer to Section 9).

2.21 FUEL LIMITATIONS

NOTE

The unusable fuel for this airplane has been determined as 3.0 U.S. gallons in each wing in critical flight attitude.

(a) Total Capacity	128 U.S. GALS.
(b) Unusable Fuel	6 U.S. GALS.
(c) Usable Fuel	122 U.S. GALS.

2.23 HEATER LIMITATIONS

Operation of the combustion heater above 25,000 feet is not approved.

2.25 OPERATING ALTITUDE LIMITATIONS

Flight above 25,000 feet is not approved. Flight up to and including 25,000 feet is approved if equipped with oxygen in accordance with FAR 23.1441 and avionics in accordance with FAR 91 or FAR 135.

2.27 GYRO SUCTION LIMITS

The operating limits for the suction system are 4.5 to 5.2 inches of mercury for all operations as indicated by the gyro suction gauge.

-or-

The operating limits for the suction system are 4.8 to 5.2 inches of mercury for all operations as indicated by the gyro suction gauge.

2.29 ICING INFORMATION

"WARNING"

Severe icing may result from environmental conditions outside of those for which the airplane is certified. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protection systems, and may seriously degrade the performance and controllability of the airplane.

During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.

Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.

Accumulation of ice on the upper surface of the wing, aft of the protected area.

Accumulation of ice on the engine nacelles and propeller spinners farther aft than normally observed.

2.29 ICING INFORMATION (cont)

Since the autopilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.

All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night. [NOTE: This supersedes any relief provided by the Master Minimum Equipment List (MMEL).]

2.31 PLACARDS

In full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS. AND MANUALS. NO ACROBATIC MANEUVERS (INCLUDING SPINS) APPROVED.

THIS AIRCRAFT APPROVED FOR V.F.R., I.F.R., DAY, NIGHT & ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135.

MINIMUM SINGLE ENGINE CONTROL SPEED 66 KIAS

SINGLE ENGINE STALLS NOT RECOMMENDED. CAN CAUSE 400 FT. LOSS OF ALTITUDE AND 15° PITCH ANGLE.

WARNING - TURN OFF STROBE LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT, OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

On side panel to left of pilot:

CAUTION - COMPASS CALIBRATION MAY BE IN ERROR WITH ELECTRICAL EQUIPMENT OTHER THAN AVIONICS ON.

2.31 PLACARDS (Cont)

On instrument panel in full view of the pilot:

V_A 135 AT 4407 LBS.
(SEE A.F.M.)
V_{LO} 128 DN, 107 UP
V_{LE} 128 MAX.
DEMO X-WIND 17 KTS

On instrument panel near emergency gear release:

EMERGENCY GEAR EXTENSION
PULL TO RELEASE. SEE A.F.M.
BEFORE RE-ENGAGEMENT

On instrument panel near gear selector switch:

GEAR	UP	107 KIAS MAX.
	DOWN	128 KIAS MAX.

In full view of the pilot (adjacent to cowl flap controls):

MAXIMUM TAKEOFF WEIGHT 4407 POUNDS
MAXIMUM LANDING WEIGHT 4407 POUNDS

On storm window:

DO NOT OPEN
ABOVE 129 KIAS

On the instrument panel in full view of the pilot (2-blade propellers only)

AVOID CONTINUOUS GROUND OPERATION 1600 - 2100 RPM IN CROSS/TAIL WIND.
AVOID CONTINUOUS OPERATIONS 1900 - 2100 RPM ABOVE 32" MANIFOLD PRESSURE.

Adjacent to upper door latch (rear door):

ENGAGE LATCH BEFORE FLIGHT

On the inside of forward baggage compartment door:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. SEE THE LIMITATIONS SECTION OF THE AIRPLANE FLIGHT MANUAL.

Adjacent to front door latch :

Caution:

DO NOT ATTEMPT TO CLOSE DOOR WITH HANDLE IN LATCHED POSITION.

2.31 PLACARDS (Cont)

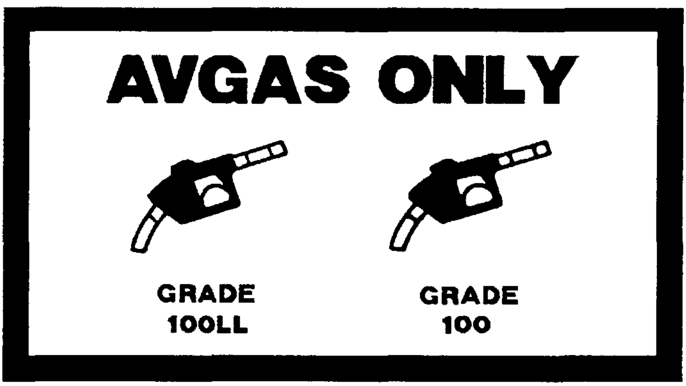
On the inside of cup dispenser door:

MAXIMUM WEIGHT 2 LBS

On the inside of both oil filter access doors:

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

Adjacent to fuel tank filler caps:



On aft baggage closeout:

MAXIMUM BAGGAGE THIS COMPARTMENT 85 LBS.
NO HEAVY OBJECTS ON HAT SHELF.

2.31 PLACARDS (Cont)

On the executive writing table:

CAUTION

THIS TABLE MUST BE STOWED DURING TAKEOFF AND LANDING.

In full view of the pilot and passengers:

NO SMOKING

In full view of the pilot:

ARMRESTS ARE TO BE IN THE STOWED POSITION FOR TAKEOFF AND LANDING

2.31 PLACARDS (Cont)

On right hand side of entertainment console top:

MONITOR, ALL
LOOSE ITEMS,
AND CONSOLE
TOP ARE TO BE
IN THE STOWED
POSITION FOR
TAKEOFF AND
LANDING

On right hand side of entertainment console top:

MAXIMUM WEIGHT
ALLOWABLE ON
THE CONSOLE
TOP IN THE
EXTENDED
POSITION
IS 10 LBS.

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EMERGENCY PROCEDURES

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EMERGENCY PROCEDURES

SECTION 3
EMERGENCY PROCEDURES

3.1 GENERAL

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

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

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

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

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

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

3.3 AIRSPEEDS FOR SAFE OPERATIONS

One engine inoperative air minimum control (VMCA).................... 66 KIAS
One engine inoperative best rate of climb (VYSE).......................... 88 KIAS
One engine inoperative best angle of climb (VXSE) .... 83 KIAS
Maneuvering (VA - 4407 LBS) .... 135 KIAS
Never exceed (VNE)... 204 KIAS

3.5 EMERGENCY PROCEDURES CHECKLIST

3.5a Engine Inoperative Procedures (3.9)

IDENTIFYING DEAD ENGINE AND VERIFYING POWER LOSS (3.9a)

Loss of thrust.

Nose of aircraft will yaw in direction of dead engine (with coordinated controls).

Rudder pedal force will be required in the direction away from the dead engine to maintain straight flight.

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE) (3.9b)

Throttle .... CLOSE
Propeller... FEATHER (800 RPM MIN.)
Mixture .... IDLE CUT-OFF
Cowl Flap... CLOSE
Fuel Selector .... OFF
Airconditioner (If installed)... OFF
Alternator.. OFF
Standby Fuel Pump.. OFF
Magneto Switches.. OFF
Prop Sync (If installed).. OFF
Electrical Load.. REDUCE
Crossfeed .... AS REQUIRED

ENGINE FAILURE DURING TAKEOFF (SPEED BELOW 85 KIAS OR GEAR DOWN) (3.9c)

If engine failure occurs during takeoff and 85 KIAS has not been attained:

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

If insufficient runway remains for a complete stop:

Throttles .... IMMEDIATELY CLOSE
Mixtures .... IDLE CUT-OFF
Fuel Selectors .... OFF
Magneto Switches .... OFF
Standby Fuel Pumps .... OFF
Battery Master Switch .... OFF
Brakes .... apply max. braking

MAINTAIN DIRECTIONAL CONTROL, MANEUVERING TO AVOID OBSTACLES IF NECESSARY.

ENGINE FAILURE DURING TAKEOFF (SPEED ABOVE 85 KIAS) (3.9d)

If sufficient runway remains for a complete stop:

Directional Control .... MAINTAIN
Throttles .... IMMEDIATELY CLOSE

LAND IF AIRBORNE AND STOP STRAIGHT AHEAD

Brakes .... AS REQUIRED

3.5a Engine Inoperative Procedures (3.9d) (Continued)

ENGINE FAILURE DURING TAKEOFF (SPEED ABOVE 85 KIAS)

If runway remaining is inadequate for stopping and the decision is made to continue:

WARNING

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

In many combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to one engine inoperative climb chart for clean configuration positive climb performance.

Mixture controls....................FULL FORWARD
Propeller controls....................FULL FORWARD
Throttles....................38 in. Hg. MAP
Directional Control....................MAINTAIN
Flaps....................FULL UP
Landing Gear (in level or climbing flight)....................RETRACT
Inoperative Engine....................IDENTIFY BY CLOSING THROTTLE
Propeller (Inop. Engine)....................FEATHER
Establish Bank....................2° to 3° INTO OPERATIVE ENGINE
Climb Speed....................88 KIAS
Trim....................ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 BALL SLIP INDICATED ON THE TURN AND BANK INDICATOR

Cowl Flap (Inop. Engine)....................CLOSE

When a positive rate of climb has been established:

Engine Securing....................COMPLETE

LAND AS SOON AS PRACTICAL AT THE NEAREST SUITABLE AIRPORT.

ENGINE FAILURE DURING CLIMB (3.9e)

Airspeed .... MAINTAIN 88 KIAS

Directional Control .... MAINTAIN

Power .... MAX. CONTINUOUS

Inoperative Engine .... IDENTIFY and VERIFY

Inoperative Engine .... COMPLETE ENGINE SECURING PROCEDURE

Trim .... ADJUST TO 2° to 3° BANK TOWARD OPERATIVE ENGINE WITH APPROXIMATELY 1/2 BALL SLIP INDICATED ON THE TURN AND BANK INDICATOR

Cowl Flap (Operative Engine) .... 1/2 OPEN

LAND AS SOON AS PRACTICAL AT THE NEAREST SUITABLE AIRPORT.

3.5a Engine Inoperative Procedures (Continued)

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

Rudder..APPLY AGAINST YAW
(Operative Engine)

Throttles (Both Engines)...................................RETARD TO STOP TURN

Pitch Attitude ....LOWER NOSE TO ACCELERATE
ABOVE V_{MCA} (66 KIAS)

Operative Engine ....INCREASE POWER AS AIRSPEED
INCREASES ABOVE V_{MCA} (66 KIAS)

If altitude permits, a restart may be attempted.

If restart fails or if altitude does not permit restart:

Inoperative Engine Propeller ....FEATHER

Trim ....ADJUST TO 2° to 3° BANK
TOWARD OPERATIVE ENGINE
WITH APPROXIMATELY 1/2
BALL SLIP INDICATED ON
THE TURN AND BANK INDICATOR

Inoperative Engine...Complete Engine
Securing Procedure

Cowl Flap (Operative Engine).. 1/2 OPEN

LAND AS SOON AS PRACTICAL AT THE NEAREST SUITABLE AIRPORT.

ONE ENGINE INOPERATIVE LANDING (3.9g)

Inoperative Engine............................ENGINE SECURING PROCEDURE COMPLETE

Seat Belts/Harnesses...FASTEN/ADJUST

Fuel Selector (Operative Engine) ....ON

Standby Fuel Pump (Operative Engine)..ON

Mixture (Operative Engine).. FULL RICH

Propeller Control (Operative Engine).............................FULL FORWARD

Cowl Flap (Operative Engine).. 1/2 OPEN

Altitude & Airspeed...MAKE NORMAL APPROACH

When Landing is Assured:

Landing Gear .... DOWN

Flaps.. AS REQUIRED

Final Approach Speed.. 90 KIAS

Power .... RETARD SLOWLY AND FLARE AIRPLANE

Trim .... AS POWER IS REDUCED (AIRPLANE WILL YAW IN DIRECTION OF OPERATIVE ENGINE)

3.5a Engine Inoperative Procedures (Continued)

WARNING

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

WARNING

One Engine Go-Around is not possible from the approach configuration unless sufficient altitude is available to raise flaps and landing gear in a descent.

CAUTION:

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

ONE ENGINE INOPERATIVE GO-AROUND

Mixture ....VERIFY FULL FORWARD
Propeller..VERIFY FULL FORWARD
Throttle ....MAX ON OPERATIVE ENGINE
Flaps.. RETRACT SLOWLY
Landing Gear ....RETRACT
Airspeed..88 KIAS
Trim .... ADJUST TO 2° to 3° BANK
TOWARD OPERATIVE ENGINE
WITH APPROXIMATELY 1/2
BALL SLIP INDICATED ON
THE TURN AND BANK INDICATOR
Cowl Flap (Operating Engine)...1/2 OPEN

3.5b Air Starting Procedure (3.11)

UNFEATHERING PROCEDURE/ STARTER ASSISTED (3.11a)

Fuel Selector (Inoperative Engine) .... ON
Standby Fuel Pump .... ON
Throttle .... Open 1/2 inch
Mixture .... FULL RICH
Magneto Switches (Inoperative Engine) .... ON
Prop Control (Inoperative Engine) .... MID RANGE
Starter .... ENGAGE until prop windmills
Throttle .... REDUCE POWER until engine is warm
Standby Fuel Pump .... OFF

Alternator (after restart) .... ON
Engine Instruments .... CHECK
Cowl Flap .... AS REQUIRED
Airconditioner (If installed) .... (As desired) ON
Propeller .... Manual Sync with operative engine
Throttle .... Set as Desired
Prop Sync (If installed) .... (As desired) ON

UNFEATHERING PROCEDURE/ UNFEATHERING ACCUMULATOR ASSISTED (3.11b) *

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
Standby Fuel Pump (Inop. Engine) .... ON
Throttle .... Open 1/4 inch
Mixture .... FULL RICH
Magneto Switches (Inoperative Engine) .... ON
Prop Control .... FULL FORWARD
Throttle .... REDUCE POWER until engine is warm
Standby Fuel Pump (Inop. Engine) .... OFF
Alternator .... ON

If engine does not start, prime as required and engage starter.

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 to keep the prop from overspeeding.

Engine Instruments .... CHECK
Cowl Flap .... AS REQUIRED
Air Conditioner (If installed) .... (As desired) ON
Propeller .... Manual Sync with operative engine
Throttle .... Set as Desired
Prop Sync (If installed) .... (As desired) ON

* Optional Equipment with Hartzell Propeller installation.

3.5c Engine Fire (3.13)

ENGINE FIRE DURING START (3.13a)

Engine Fire During Start (3.13a)

Starter Switch...CONTINUE to crank engine
Mixture ....IDLE CUT-OFF
Throttle .... OPEN
Fuel Selector .... OFF
Standby Fuel Pump Switch.. OFF

If fire continues:

Remaining engine ....SHUT DOWN
Airplane ....EVACUATE

NOTES

If fire has spread to the ground from excess fuel, taxi away from fire area if possible.

ENGINE FIRE IN FLIGHT (3.13b)

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

If fire persists:

Airspeed... INCREASE in attempt to blow out fire

Land as soon as possible at the nearest suitable airport.

3.5d TURBOCHARGER FAILURE (3.14)

CAUTION:

If a turbocharger failure is the result of loose, disconnected or burned through exhaust system components, a potentially serious fire hazard exists. If a failure within the exhaust system is suspected in flight, shut down the engine immediately and LAND AS SOON AS POSSIBLE. If a suspected exhaust system failure occurs prior to takeoff, DO NOT FLY THE AIRCRAFT.

NOTE:

A turbocharger malfunction at altitudes above 10,000 feet MSL may result in an overly rich fuel mixture, which could result in a partial power loss and/or a rough running engine. In worst case conditions a complete loss of engine power may result.

COMPLETE LOSS OF ENGINE POWER:

If a suspected turbocharger or turbocharger control system failure results in a complete loss of engine power, the following procedure is recommended:

Mixture... IDLE CUTOFF
Throttle..CRUISE
Propeller Control..FULL FORWARD
Mixture.. ADVANCE SLOWLY until engine restarts
and adjust for smooth engine operation

Reduce power and land as soon as possible.

3.5d TURBOCHARGER FAILURE (3.14) (continued)

PARTIAL LOSS OF ENGINE POWER

If the turbocharger wastegate fails in the OPEN position, a partial loss of engine power may result. The following procedure is recommended if a suspected turbocharger or turbocharger wastegate control failure results in a partial loss of engine power.

Throttle.. AS REQUIRED
Propeller.. AS REQUIRED
Mixture... AS REQUIRED
Land as soon as possible.

ENGINE POWER OVERBOOST

If the turbocharger wastegate control fails in the CLOSED position, an engine power overboost condition may occur. The following procedure is recommended for an overboost condition:

Throttle.............REDUCE as necessary to keep manifold pressure within limits

NOTE

Expect manifold pressure response to throttle movements to be sensitive.

Propeller.. AS REQUIRED
Mixture..FULL RICH
Land as soon as possible.

3.5e Turbine Inlet Temperature (TIT) Indicator Failure (3.15)

If failure occurs during takeoff, climb, or landing:

Mixture..Full Rich

If failure occurs prior to setting cruise power:

Power .... Set Power per POH Section 5
Power Setting Table
Mixture.. Lean to Approx. POH Section 5
Power Setting Table Fuel Flow
+4 GPH. Monitor CHT and Oil Temp.

CAUTION

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. Less range/endurance will result due to higher fuel flow/fuel consumption.

If failure occurs after setting cruise power and mixture:

Power ....Note/Maintain Power Setting
Mixture..Increase Indicated Fuel Flow +1 GPH.
Monitor CHT and Oil Temp.

CAUTION

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. Less range/endurance will result due to higher fuel flow/fuel consumption.

If failure occurs prior to or during descent:

Power .... Set for Descent
Mixture..Full Rich

3.5f Fuel Management During One Engine Inoperative Operation (3.17)

CRUISING (3.17a)

CROSSFEED

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

NOTE

Use crossfeed in level cruise flight only.

COMING OUT OF CROSSFEED (Prior to Landing)

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

LANDING (3.17b)

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

3.5g Engine Driven Fuel Pump Failure (3.19)

Throttle .... RETARD
Standby Fuel Pump (Affected Engine) .... ON
Throttle .... RESET (As Required)
Mixture .... RESET (As Required)

CAUTION

If normal engine operation and fuel flow is not immediately re-established, the standby fuel pump should be turned off. The lack of a fuel flow indication could indicate a leak in the fuel system, or fuel exhaustion. If system leak is verified, switch fuel selector to OFF. Proceed with engine securing procedure.

3.5h Landing Gear Unsafe Warnings (3.21)

Red gear warning annunciator light indicates when the gear is in transit.

Recycle gear if indication continues.

Red gear warning annunciator light will illuminate along with the gear warning horn should the gear not be down and locked if throttles are brought to a low setting.

3.5i Landing Gear Malfunctions (3.23)

MANUAL EXTENSION OF LANDING GEAR (3.23a)

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

Check following before extending gear manually:

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

To extend, reposition guard clip downward clear of knob and proceed as follows:

Airspeed...REDUCE (85 KIAS max.)
Gear Selector ....GEAR DOWN POSITION
Emerg. Gear Extend Knob..PULL
Indicator Lights.. 3 GREEN

Leave emergency gear extension knob out.

WARNING

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

GEAR UP LANDING (3.23b)

Select suitable landing area.

Ground Personnel ....INFORM (If possible)
Fuel .... BURN OFF (If time allowed)
Seatbelts and Harness ....FASTEN/ADJUST
CHECK INERTIA REEL
Passengers... BRIEF
Normal Landing Checklist...COMPLETE
Autopilot .... OFF
Battery Master (Daytime) .... OFF
Approach.. NORMAL

When runway is made and landing is assured:

Mixtures .... IDLE CUTOFF
Prop Controls ....FEATHER
Fuel Selectors.. OFF

Touch down at minimum airspeed and level attitude.

Battery Master (Night)... OFF

Evacuate when aircraft comes to a stop.

3.5j Electrical Failures (3.25)

SINGLE ALTERNATOR FAILURE

(Alternator #1 or #2 Inop. Light Illuminated - Annunciator Panel). (3.25a)

Verify Failure.. CHECK AMMETER
Electrical load .... REDUCE until total load is less than 85 Amps
Failed Alternator Switch... OFF
Failed Alternator Circuit Breaker .... CHECK AND RESET
Failed Alternator Switch (After OFF at least 1 second) ....ON

If power is NOT restored:

Failed Alternator Switch... OFF
Amperage... MONITOR and maintain below 85 Amps

While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment, particularly windshield or propeller heat, may be limited. Immediate action should be taken to avoid or exit icing conditions. Under no circumstances may the total electrical load exceed 85 amps. The cabin recirculation blowers, and position, strobe and landing lights should not be used unless absolutely necessary.

3.5j Electrical Failures (3.25) (Continued)

DUAL ALTERNATOR FAILURE

(Alternator #1 and #2 Inop. Light Illuminated - Annunciator Panel). (3.25b)

CAUTION

The alternator output circuit breakers must not be opened manually when the alternators are functioning properly.

NOTE

Anytime total bus voltage is below approximately 25 Vdc, the LO BUS voltage annunciator will illuminate.

Verify Failure...CHECK AMMETER

Electrical load ....REDUCE to minimum required for safe flight

Alternator Switches .... OFF

Alternator Circuit Breakers..CHECK & RESET AS REQUIRED

Alternator Switches (One at a time after OFF at least 1 second)..ON

If only one alternator resets:

Operating Alternator Switch...ON

Failed Alternator Switch... OFF

Electrical load ....MAINTAIN less than 85 Amps

Amperage...MONITOR

3.5j Electrical Failures (3.25) (Continued)

DUAL ALTERNATOR FAILURE (Continued)

If neither alternator resets:

Both Alternator Switches.. OFF

CONTINUE FLIGHT WITH REDUCED ELECTRICAL LOAD ON BATTERY POWER ONLY.

NOTE

LO BUS voltage annunciator will also be illuminated.

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

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

If battery is depleted, the landing gear must be lowered using the emergency gear extension procedure. Gear position lights will be inoperative. The flaps will also be inoperative and a flaps up landing will be required

3.5k Electrical Fire (3.26)

Fire in Flight

Fire .... Extinguish

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

If source of fire is known:

Offending system circuit breaker..PULL
Vents .... OPEN
Cabin Heat .... OFF
Fire .... Verify Extinguished
Land as soon as possible.

If source of fire is unknown:

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

CAUTION

Disabling the electrical system in low ambient light conditions could make viewing the flight instruments impossible.

Battery Master Switch .... OFF

Alternator Switches .... OFF

Vents .... OPEN
Cabin Heat .... OFF
Fire .... Verify Extinguished

NOTE

The landing gear extension/retraction system and flaps will be inoperative. Prior to landing, lower the gear using the MANUAL EXTENSION OF LANDING GEAR procedure and expect a flaps up landing.

Land as soon as possible.

3.5k Electrical Fire (3.26) (Continued)

If electrical power is required for safety of flight:

WARNING

Compass error may exceed 10 degrees with alternator inorperative.

NOTE

Turning ON the optional ground clearance switch will activate the No. 1 Nav/Com radio only.

Battery Master Switch .... OFF
Alternators .... OFF
Ground Clearance Switch (if installed) .... ON

CAUTION

Reset only those circuit breakers if essential for safety of flight. A time delay between reactivating/resetting any electrical equipment or circuit breaker should be allowed to verify fire/ smoke does not occur.

If Ground Clearance Switch NOT installed or additional equipment required:

All circuit breakers (except Battery and Alternators) .... PULL
Battery Master Switch .... ON
Alternators .... ON (One at a time)
Required Electrical Equipment Circuit Breakers .... PUSH IN
(One at a time)

NOTE

If battery and alternators remain off or associated landing gear and flap circuit breakers remain pulled, the landing gear extension/retraction system and flaps will be inoperative. Prior to landing, lower the gear using the MANUAL EXTENSION OF LANDING GEAR procedure and expect a flaps up landing.

Land as soon as possible.

3.5l Vacuum System Failures (3.27)

(Left or right Vacuum Inop. Light Illuminated - Annunciator Panel).

Gyro Suction Gauge ....CHECK (within normal operating range)

Although either vacuum pump independently has sufficient capacity to operate the flight instruments and the deice boots in a normal manner, intentional or continued operation in icing conditions is not recommended. Immediate action should be taken to avoid or exit icing conditions.

(Left and right Vacuum Inop. Light Illuminated - Annunciator Panel).

If both vacuum systems are inoperable, the turn coordinator and pilot's directional gyro will be the only usable gyroscopic flight instruments, wing and tail deicer boots will be inoperative. A precautionary landing should be considered depending on operating conditions

3.5m Spin Recovery (Intentional Spins Prohibited) (3.29)

NOTE

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

Throttles ....RETARD to IDLE

Rudder..FULL OPPOSITE TO DIRECTION OF SPIN

Control wheel... FULL FORWARD if nose does not drop

Ailerons.. NEUTRAL

Rudder... NEUTRALIZE when rotation stops

Control wheel..SMOOTH BACK PRESSURE to recover from dive

3.5n Emergency Descent (3.31)

Throttles .... CLOSED
Propellers .... FULL FORWARD
Mixture .... AS REQUIRED for smooth operation
Landing gear .... EXTEND below 128 KIAS
Airspeed .... 128 KIAS Max.

3.5o Combustion Heater Overheat (3.33)

Unit will automatically cut-off.

Do not attempt to restart.

3.5p Propeller Overspeed (3.35)

Throttle (Affected Engine) .... RETARD
Oil pressure (Affected Engine) .... CHECK
Prop control (Affected Engine) .... FULL DECREASE RPM (DO NOT FEATHER) THEN SET if any control available
Airspeed .... REDUCE
Throttle (Affected Engine) .... AS REQUIRED to remain below 2600 rpm

3.7 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

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

EMERGENCY PROCEDURES CHECKLIST (3.5)

3.9 Engine Inoperative Procedures (3.5a)

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

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

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

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

Begin the securing procedure by moving the throttle of the inoperative engine towards IDLE. If no changes are noted, the correct identification of the dead engine is confirmed. Move the propeller control to FEATHER (fully aft) before the propeller speed drops below 800 RPM. The propellers can be feathered only while the engine is rotating above 800 RPM. Loss of centrifugal force due to slowing rpm will actuate a stop pin that keeps the propeller from feathering each time the engine is stopped on the ground. One engine inoperative performance will decrease significantly if the propeller of the inoperative engine is not feathered.

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

NOTE

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

3.9c Engine Failure During Takeoff (Speed Below 85 KIAS or Gear Down) (3.5a)

Determination of runway length, single engine climb rate, and accelerate/ stop distance will aid in determining the best course of action in the event of an engine failure during takeoff.

If engine failure occurs during the takeoff roll, the takeoff MUST be aborted. If failure occurs after liftoff but before 85 KIAS is achieved or before the gear is retracted, the takeoff should also be aborted. Immediately CLOSE the throttles, land if airborne, apply brakes as required and stop straight ahead.

If an engine failure occurs below 85 KIAS and there is not adequate runway remaining for landing, deceleration and stop, immediately retard the throttles fully aft and mixture controls to idle cut-off. Move the fuel selectors to the off position. Turn OFF the magneto switches followed by the stand by fuel pump and battery master switch while applying maximum braking.

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

3.9d Engine Failure During Takeoff (Speed Above 85 KIAS) (3.5a)

If engine failure occurs after liftoff with the gear still down and 85 KIAS has been attained, the course of action to be taken will depend on the runway remaining and aircraft configuration. Also the pilot's decision must be based on a personal judgement, taking into consideration such factors as obstacles, the type of terrain beyond the runway, altitude and temperature, weight and loading, weather, airplane condition, and the pilot's own proficiency and capability.

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

3.9d Engine Failure During Takeoff (Speed Above 85 KIAS) (3.5a) (Cont)

WARNING

In many combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to One Engine Inoperative Climb chart for clean configuration positive climb performance.

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

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

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

Verify the mixture, propeller and throttle controls are fully forward while maintaining directional control. Remember, keep in mind that the One Engine Inoperative Air Minimum Control speed (VMCA) is 66 KIAS and the One Engine Inoperative Best Rate of Climb speed (VYSE) is 88 KIAS. Verify that the flaps and landing gear are up.

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

After the aircraft is trimmed, and a positive rate of climb has been established, complete the engine securing procedure.

Land as soon as practical at the nearest suitable airport.

3.9e Engine Failure During Climb (3.5a)

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

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

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

Land as soon as practical at the nearest suitable airport.

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

Should an engine fail during flight at an airspeed below V_{MCA} (66 KIAS) apply rudder towards the operative engine to minimize the yawing motion. The throttles should be retarded to stop the yaw towards the inoperative engine. Lower the nose of the aircraft to accelerate above 66 KIAS and increase the power on the operative engine as the airspeed exceeds 66 KIAS. The airplane should be banked 5° towards the operating engine during this recovery to maximize control effectiveness.

After an airspeed of at least 88 KIAS (V_{YSE}) has been established, an engine restart attempt may be made if altitude permits. If the restart has failed, or altitude does not permit, the engine should be secured.

Move the propeller control of the inoperative engine to FEATHER and complete the engine securing procedure. Adjust the trim to a 2° to 3° bank into the operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator. The cowl flap on the operative engine should be set to 1/2 open to maintain engine temperatures within allowable limits.

3.9g One Engine Inoperative Landing (3.5a)

Complete the Engine Securing Procedure. The landing gear should not be extended and the wing flaps should not be lowered until certain of making the field. Check seat belts and harnesses are properly secured. Check that the fuel selector and the standby fuel pump of the operative engine are ON and the mixture control is FULL RICH. Move the propeller control FULL FORWARD. Adjust the cowl flap control of the operating engine to the 1/2 open position to keep temperatures within limits.

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

When landing is assured, extend the landing gear and lower the flaps as required. Establish a final approach speed of 90 KIAS and retard the power slowly to touchdown using trim as required.

3.9h One Engine Inoperative Go-Around (3.5a)

WARNING:

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

WARNING

One Engine Go-Around is not possible from the approach configuration unless sufficient altitude is available to raise flaps and landing gear in a descent.

CAUTION:

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

To execute a one engine inoperative go-around, verify the mixture and propeller levers are full forward. The throttle should be advanced slowly to the maximum manifold pressure 38 in. Hg. Retract the flaps slowly and then retract the landing gear. Maintain airspeed at the one engine inoperative best rate of climb speed of 88 KIAS. Trim the aircraft for 2° to 3° bank toward the operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator. Set the cowl flaps of the operating engine to the 1/2 open position.

3.9i Summary of Factors Affecting Single Engine Operations.

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

Landing gear extended/Flaps Up ....-200 ft./min.
Flaps extended 25°/Gear Down..-300 ft./min.
Flaps extended fully/Gear Down..- 350 ft./min.
Inoperative engine propeller windmilling
(Gear and Flaps Up) ....-200 ft./min.

WARNING

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

3.9i Summary of Factors Affecting Single Engine Operations. (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. Altitude is more valuable to safety after takeoff than is airspeed in excess of the best single-engine climb speed.
3. A windmilling propeller and extended landing gear cause a severe drag penalty and, therefore, **climb or continued level flight is improbable**, depending on weight, altitude and temperature. Prompt retraction of the landing gear, identification of the inoperative engine, and feathering of the propeller is of utmost importance if the takeoff is to be continued.
4. In no case should airspeed be allowed to fall below V_{XSE} (83 KIAS) unless touchdown is imminent even though altitude is lost, since any lesser speed will result in significantly reduced climb performance.
5. If the requirement for an immediate climb is not present, allow the airplane to accelerate to the single-engine best rate-of-climb airspeed since this speed will always provide the best chance of climb or least altitude loss in a given time.
6. To maximize controllability during recovery following an engine loss near or below V_{MC}, immediately reduce pitch attitude. The airplane should be banked approximately 5° into the operative engine and the rudder used to maintain straight flight. This will result in the ball of the turn and slip indicator being displaced 1/2 to 3/4 diameter towards the operating engine.
7. To maximize climb performance after airplane is under control of the pilot and failed engine is secured, the airplane should be trimmed in a 2° to 3° bank towards the operating engine with the rudder used as needed for straight flight. This will result in approximately 1/2 ball displacement towards the operating engine. This ball displacement should be maintained during any necessary maneuvering to maintain best possible climb margins.

3.11 AIR STARTING PROCEDURE (3.5b)

3.11a Unfeathering Procedure/ Starter Assisted

Move the fuel selector for the inoperative engine to the ON position and check to make sure the standby fuel pump for that engine is on. Open the throttle 1/2 inch and the mixture should be set FULL RICH. Turn ON the magneto switches and position the propeller control mid range.

Engage the starter until the propeller windmills freely. If the engine does not start, prime as necessary. After restart, turn OFF the standby fuel pump, set the throttle at reduced power until the engine is warm and turn the alternator switch ON. Check the engine instruments for proper indications and place the cowl flap in the required position for proper engine cooling. Once the engine is warm the throttle and prop controls can be set as necessary for cruise.

3.11b Unfeathering Procedure/ Unfeathering Accumulator Assisted *

Move the fuel selector for the inoperative engine to the ON position and check to make sure the standby fuel pump for that engine is on. Open the throttle 1/4 inch and the mixture to FULL RICH. Turn ON the magneto switches and push the propeller control full forward.

If the propeller does not windmill freely within 5 - 7 seconds after the propeller control has been moved full forward, prime as necessary and engage the starter for 1 - 2 seconds. After restart, turn OFF the standby fuel pump, set the throttle at reduced power until the engine is warm and turn the alternator switch ON.

NOTE

When propeller unfeathering occurs, it may be necessary to retard the prop control slightly to keep the prop from overspeeding.

Check the engine instruments for proper indications and place the cowl flap in the required position for proper engine cooling. Once the engine is warm the throttle and prop controls can be set as necessary for cruise.

* Optional Equipment with the Hartzell propeller installation.

3.13 ENGINE FIRE (3.5c)

3.13a Engine Fire During Start (3.5c)

Continue to crank the engine. Move the mixture control to IDLE CUT-OFF, OPEN the throttle, and position the fuel selector and standby fuel pump switch to OFF.

If the fire continues longer than a few seconds the remaining engine should be shut down and the aircraft abandoned. If available, an external fire extinguishing method should be used to put out the fire.

NOTE

If fire has spread to the ground from excess fuel, taxi away from fire area if possible.

3.13b Engine Fire In Flight (3.5c)

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

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

Land as soon as possible at the nearest suitable airport.

3.14 TURBOCHARGER FAILURE (3.5d)

CAUTION:

If a turbocharger failure is the result of loose, disconnected or burned through exhaust system components, a potentially serious fire hazard exists. If a failure within the exhaust system is suspected in flight, shut down the engine immediately and LAND AS SOON AS POSSIBLE. If a suspected exhaust system failure occurs prior to takeoff, DO NOT FLY THE AIRCRAFT.

NOTE:

A turbocharger malfunction at altitudes above 10,000 feet MSL may result in an overly rich fuel mixture, which could result in a partial power loss and/or a rough running engine. In worst case conditions a complete loss of engine power may result.

COMPLETE LOSS OF ENGINE POWER:

If a suspected turbocharger or turbocharger control system failure results in a complete loss of engine power, the following procedure is recommended. Retard the mixture control to the IDLE CUTOFF position. If necessary, reset the throttle to cruise power position and the propeller control to the full forward position. Slowly advance the mixture until the engine restarts and adjust for smooth engine operation. Reduce the power to the minimum required and ***land as soon as possible.***

PARTIAL LOSS OF ENGINE POWER

If the turbocharger wastegate fails in the OPEN position, a partial loss of engine power may result. The following procedure is recommended if a suspected turbocharger or turbocharger wastegate control failure results in a partial loss of engine power.

Should a partial loss of engine power occur (i.e. wastegate fails open), the throttle, propeller and mixture controls can be set as required for flight. Monitor all engine gauges and ***land as soon as possible*** to have the cause of the power loss investigated.

3.14 TURBOCHARGER FAILURE (3.5d) (continued)

ENGINE POWER OVERBOOST

If a turbocharger wastegate control fails in the CLOSED position, an engine power overboost condition may occur. The following procedure is recommended for an overboost condition:

NOTE

Expect manifold pressure response to throttle movements to be sensitive.

Set the throttle and propeller controls as necessary to keep the manifold pressure within limits. Set the mixture control to full rich. Land as soon as possible to have the cause of the overboost condition investigated.

3.15 TURBINE INLET TEMPERATURE (TIT) INDICATOR FAILURE (3.5e)

In the event the Turbine Inlet Temperature (TIT) indicator or sensor fails during flight, continued flight is possible using conservative mixture/ TIT settings. If TIT failure occurs during takeoff, climb, descent, or landing, maintain a full rich mixture to assure adequate fuel flow for engine cooling.

If TIT failure occurs prior to setting cruise power, set power per the POH Section 5 power setting table and then lean to the approximate POH power setting table fuel flow +4 GPH. This fuel flow will maintain adequate engine cooling and a TIT value below TIT limits. Monitor CHT and Oil Temperature for normal operation.

CAUTION

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. Less range/endurance will result due to higher fuel flow/fuel consumption.

If TIT failure occurs after setting cruise power and mixture per the POH Section 5 power setting table, maintain the power setting and increase indicated fuel flow by + 1 GPH. This fuel flow will maintain adequate engine cooling and TIT value below TIT limits. Monitor CHT and Oil Temperature for normal operation.

CAUTION

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. Less range/endurance will result due to higher fuel flow/fuel consumption.

The TIT indicating system should be repaired as soon as practical.

3.17 FUEL MANAGEMENT DURING ONE ENGINE INOPERATIVE OPERATION (3.5f)

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

3.17a CRUISING

CROSSFEED

Crossfeed should be employed only when it is necessary to extend range during single engine operation. Crossfeed must be off for takeoffs and landings.

To activate the crossfeed system, move the fuel selector of the operative engine to crossfeed. At this time a crossfeed annunciator in the annunciator panel will illuminate, informing you that fuel from the inoperative engine is being transferred to the operating engine. Set the fuel selector of the inoperative engine to the off position.

COMING OUT OF CROSSFEED

To return to normal operation during a single engine landing when the crossfeed system has been in use, use the following procedure. On the operative engine turn on the standby fuel pump and then position the fuel selector of the operative engine to on. Verify that the fuel selector of the inoperative engine is in the off position.

3.17b LANDING

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

3.19 ENGINE DRIVEN FUEL PUMP FAILURE (3.5g)

Loss of fuel pressure and engine power can be an indication of failure of the engine driven fuel pump.

Should a malfunction of the engine driven fuel pump occur, the standby fuel pump system can supply sufficient fuel pressure for engine power. Any combination of RPM and Manifold Pressure defined on the Power Setting Table may be used, but leaning may be required for smooth operation. Normal cruise, descent and approach procedures should be used.

CAUTION

If normal engine operation and fuel pressure are not immediately re-established, the standby fuel pump should be turned off. The lack of a fuel pressure indication could indicate a leak in the fuel system, or fuel exhaustion. If system leak is verified, switch fuel selector to off and proceed with engine securing procedure.

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3.21 LANDING GEAR UNSAFE WARNINGS (3.5h)

The red landing gear warning annunciator (GEAR WARN) will illuminate when the landing gear is in transition between the full up position and the down-and-locked position. The pilot should recycle the landing gear if continued illumination of the annunciator occurs. Additionally, the annunciator will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked.

3.23 LANDING GEAR MALFUNCTIONS (3.5i)

3.23a Manual Extension of Landing Gear (3.5i)

Several items should be checked prior to extending the landing gear manually. Check for popped circuit breakers and ensure the battery master switch is ON. Then check the alternators. If it is daytime,the Day/Night Dimmer Switch should be in the Day position.

To execute a manual extension of the landing gear, reposition the guard clip downward clear of the extension knob and reduce power to maintain airspeed below 85 KIAS. Place the landing gear selector switch in the GEAR DOWN position and pull the emergency gear extension knob. Check for 3 green indicator lights.

WARNING

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

3.23b Gear-Up Landing (3.5i)

If all normal and emergency gear extension procedures have failed, a gear up landing will be necessary. Select a suitable landing area. If possible, inform ground personnel of the emergency situation. If time allows, burn off excess fuel. Brief passengers and be sure that all occupants have seat belts and shoulder harnesses secured properly.

When ready to land, complete the landing checklist as for a normal landing; however the gear selector should be in the UP position. Turn OFF the autopilot and, in daylight, turn OFF the battery master. During a night landing when the battery master is left ON, the gear warning horn may sound when the throttles are retarded.

Make a normal approach and when the runway is made and landing is assured, place mixtures in IDLE CUTOFF, FEATHER the propellers, and turn OFF the fuel selectors.

Land smoothly, touching down in a level attitude. At night, turn OFF the battery master after touchdown. All occupants should evacuate as soon as the airplane has stopped.

3.25 ELECTRICAL FAILURES (3.5j)

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

Anytime total bus voltage is below approximately 25 Vdc, the LO BUS voltage annunciator will illuminate.

NOTE

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

3.25a Single Alternator Failure (Alternator #1 or #2 Inop. Light Illuminated - Annunciator Panel) (3.5j)

CAUTION

The alternator output circuit breakers should not be opened manually when the alternators are functioning properly.

If one ammeter shows zero output or the ALTernator annunciator light is illuminated, reduce electrical loads to a minimum, turn the inoperative alternator switch OFF and check its circuit breaker. Reset if required. After at least one second, turn the ALT switch ON.

If the alternator remains inoperative, turn the ALT switch OFF, maintain an electrical load not to exceed 85 amps on the operating alternator and exercise judgment regarding continued flight. While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment, particularly windshield or propeller heat, may be limited. Immediate action should be taken to avoid or exit icing conditions. Under no circumstances may the total electrical load exceed 85 amps. The cabin recirculation blowers, and position, strobe and landing lights should not be used unless absolutely necessary.

3.25b Dual Alternator Failure (Alternator #1 and #2 Inop. Light Illuminated- Annunciator Panel) (3.5j)

CAUTION

The alternator output circuit breakers should not be opened manually when the alternators are functioning properly.

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

If only one alternator output can be restored, leave the operating ALTernator switch ON, turn the faulty ALTernator switch OFF, reduce electrical loads to less than 85 amps and monitor the alternator output.

If neither alternator output can be restored, turn both ALT switches OFF. Continue flight with reduced electrical load and land as soon as practical. The battery is the only remaining source of electrical power.

3.26 Electrical Fire (3.5k)

Should there be an electrical fire in flight, the first step should be to extinguish the fire. Aircraft control should be maintained with reference to the attitude indicator, airspeed and altimeter.

If the source of the fire is known, pull the circuit breaker associated with each offending system. Open the vents to allow dilution of the smoke and fumes and turn off the cabin heat. Verify that the fire is extinguished and ***land as soon as possible.***

CAUTION

Disabling the electrical system in low ambient light conditions could make viewing the flight instruments impossible.

NOTE

The landing gear extension/retraction system and flaps will be inoperative. Prior to landing, lower the gear using the MANUAL EXTENSION OF LANDING GEAR procedure and expect a flaps up landing.

If the source of the fire is unknown, turn off the battery master switch and alternator switches. Open the vents to allow dilution of the smoke and fumes and turn off the cabin heat. Verify that the fire is extinguished and ***land as soon as possible.***

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

CAUTION

Reset only those circuit breakers essential for safety of flight. A time delay between reactivating/resetting any electrical equipment or circuit breaker should be allowed to verify fire/ smoke does not occur.

3.26 Electrical Fire (3.5k) (Continued)

NOTE

Turning ON the optional ground clearance switch will activate the No. 1 Nav/Com radio only.

If electrical power is required for safety of flight, turn off the battery master switch and alternator switches. Turn on the optional ground clearance switch. If the airplane is NOT equipped with a ground clearance switch or if it is equipped with a ground clearance switch and additional equipment (other than the No. 1 Nav/Com) are required, electrical items may be reactivated one at a time. Pull all circuit breakers except the battery and alternators. Turn on the battery master switch and then the alternators one at a time. Push in the circuit breakers (one at a time with a time delay in between) to reactivate the required equipment. ***Land as soon as possible.***

NOTE

If battery and alternators remain off or associated landing gear and flap circuit breakers remain pulled, the landing gear extension/retraction system and flaps will be inoperative. Prior to landing, lower the gear using the MANUAL EXTENSION OF LANDING GEAR procedure and expect a flaps up landing.

3.27 VACUUM SYSTEM FAILURES (3.5l)

A malfunction of either vacuum pump is indicated by the illumination of the vacuum inop annunciators.

Although either vacuum pump independently has sufficient capacity to operate the flight instruments and the deice boots in a normal manner, intentional or continued operation in icing conditions is not recommended. Immediate action should be taken to avoid or exit icing conditions.

Failure of both vacuum pumps is indicated by the illumination of the vacuum inop annunciators and a suction gauge reading less than 4.5 inches of mercury.

If both vacuum systems are inoperable, the turn coordinator and pilot's directional gyro will be the only usable gyroscopic flight instruments, wing and tail deicer boots will be inoperative. A precautionary landing should be considered depending on operating conditions

3.29 SPIN RECOVERY (INTENTIONAL SPINS PROHIBITED) (3.5m)

NOTE

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

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

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

3.31 EMERGENCY DESCENT (3.5n)

In the event an emergency descent becomes necessary, CLOSE the throttles and move the propeller controls full FORWARD. Adjust the mixture controls as necessary to attain smooth operation.

Extend the landing gear below 128 KIAS.

Maintain 128 KIAS Max. in descent.

3.33 COMBUSTION HEATER OVERHEAT (3.5o)

In the event of an overheat condition, the fuel, air and ignition to the heater is automatically cut off. Do not attempt to restart the heater until it has been inspected and the cause of the malfunction has been determined and corrected.

3.35 PROPELLER OVERSPEED (3.5p)

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

If propeller overspeed should occur, retard the throttle. The propeller control should be moved to full DECREASE rpm (do NOT feather) and then set if any control is available. Airspeed should be reduced and throttle used to maintain 2600 RPM.

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NORMAL PROCEDURES

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SECTION 4
NORMAL PROCEDURES

4.1 GENERAL

This section provides the normal operating procedures for the PA-34-220T, SENECA V airplane. All of the normal operating procedures required by the FAA as well as those procedures which have been determined as necessary for the operation of the airplane, as determined by the operating and designed features, are presented.

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

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

This section also contains Icing Information. A series of guide lines are presented to help recognize, operate in, and exit from an inadvertant encounter with severe icing.

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

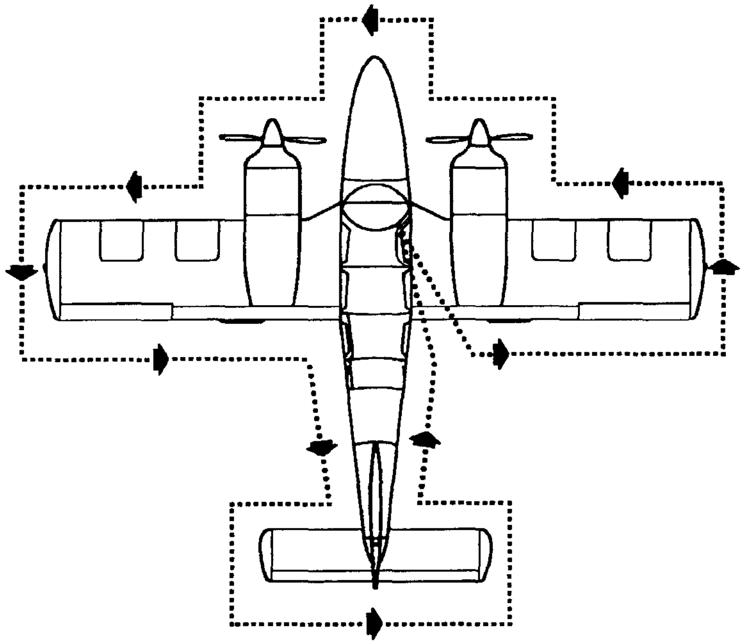
The second part of this section contains the amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an inflight reference due to the lengthy explanation. The short form checklists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

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the operation of the airplane. These 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 engines, airplane and equipment, atmospheric conditions and piloting technique.

(a) Best Rate of Climb Speed (V_Y)	88 KIAS
(b) Best Angle of Climb Speed (V_X)	83 KIAS
(c) Turbulent Air Operating Speed (See Subsection 2.3)	135 KIAS
(d) Maximum Flap Speed	113 KIAS
(e) Landing Final Approach Speed (Flaps 40°) Short Field Effort	80 KIAS
(f) Intentional One Engine Inoperative Speed	85 KIAS
(g) Maximum Demonstrated Crosswind Velocity	17 KTS



WALK AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

4.5a Preflight Checklists (4.9)

CAUTION:

The flap position should be noted before boarding the airplane. The flaps must be placed in the up position before they will be locked and support weight on the step.

COCKPIT (4.9a)

Control Wheel .... release restraints
Static System .... DRAIN
Parking Brake .... SET
Magneto Switches .... OFF
Standby Fuel Pump Switches .... OFF
Flight Controls .... PROPER OPERATION
Gear Selector .... DOWN

4.5a Preflight Checklists (4.9) (Continued)

COCKPIT (4.9a) (Continued)

Throttles .... IDLE
Mixture Controls .... IDLE CUT-OFF
Alternate Static Source .... NORMAL
Cowl Flaps .... OPEN
Stabilator & Rudder Trim .... NEUTRAL
Fuel Selectors .... ON
Radio Master Switch .... OFF
All Electrical Switches .... OFF
Battery Master Switch .... ON
Annunciator Panel .... PRESS TO TEST
Fuel Gauges .... CHECK QUANTITY
Landing Gear Lights .... 3 GREEN
Flaps .... EXTEND
Battery Master Switch .... OFF
Windows .... check CLEAN
Required Papers .... check ON BOARD
POH .... check ON BOARD
Baggage .... STOW PROPERLY - SECURE
Crossfeed drains .... DRAIN

RIGHT WING (4.9b)

Crossfeed Drains .... CHECK CLOSED
Surface Condition .... CLEAR of ICE, FROST & SNOW
Flap and Hinges .... CHECK
Aileron, Hinges & Freedom of Movement .... CHECK
Static Wicks .... CHECK
Wing Tip and Nav/Anti-Collision Lights .... CHECK
Fuel Filler Cap .... CHECK & SECURE
Fuel Tank Vent .... CLEAR

CAUTION:

When draining any amount of fuel, care should be taken to ensure that no fire hazard exists before starting engine.

RIGHT WING (4.9b) (Continued)

Wing Tank Drains (2) .... DRAIN
Tie Down .... REMOVE
Fuel Filter Drain .... DRAIN
Engine Oil & Cap .... CHECK & SECURE
Propeller & Spinner .... CHECK
Air Inlets .... CLEAR
Cowl Flap Area .... CHECK
Main Gear Strut .... PROPER INFLATION
(3.2 ± .50 in.)
Main Wheel Tire .... CHECK
Brake, Block & Disc .... CHECK
Chock .... REMOVE

NOSE SECTION (4.9c)

General Condition .... CHECK
Windshield .... CLEAN
Landing Lights .... CHECK
Tow bar .... REMOVED AND STOWED
Chock .... REMOVE
Nose Gear Strut .... PROPER INFLATION
(1.2 ± .25 in.)
Nose Wheel Tire .... CHECK
Forward baggage door (key removable
in locked position only) .... SECURE AND LOCKED

4.5a Preflight Checklists (4.9) (Continued)

LEFT WING (4.9d)

Surface Condition ....CLEAR of ICE, FROST & SNOW
Main Gear Strut..PROPER INFLATION (3 1/2 in.)
Main Wheel Tire..CHECK
Brake, Block & Disc ....CHECK
Chock ....REMOVE
Cowl Flap Area..CHECK Engine Oil & Cap CHECK & SECURE
Propeller & Spinner..CHECK
Air Inlets ....CLEAR
Fuel Filter Drain..DRAIN
Stall Warning Vanes (2)..CHECK
Pitot Head ....CLEAR
Tie Down..REMOVE

CAUTION:

When draining any amount of fuel, care should be taken to ensure that no fire hazard exists before starting engine.

Wing Tank Drains (2)..DRAIN
Fuel Tank Vent..CLEAR
Fuel Filler Cap ....CHECK & SECURE
Wing Tip and Nav/Anti-Collision Lights ....CHECK
Aileron, Hinges & Freedom of Movement..CHECK
Flap and Hinges..CHECK
Static Wicks..CHECK

FUSELAGE (LEFT SIDE) (4.9e)

General Condition ....CHECK
Antennas..CHECK
Fresh Air Inlet..CLEAR
Battery Vents..CLEAR
External Power Receptacle..CHECK
Rear doors..LATCHED
Left static vent ....CLEAR

EMPENNAGE (4.9f)

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

FUSELAGE (RIGHT SIDE) (4.9g)

General Condition ....CHECK
Fresh Air Inlet................................CLEAR
Right static vent ....CLEAR
Cabin Door ....CHECK

MISCELLANEOUS (4.9h)

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

CAUTION

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

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

4.5b Before Starting Engine Checklists (4.11)

BEFORE STARTING ENGINE (4.11)

Preflight Check .... COMPLETED
Flight Planning .... COMPLETED
Aft Cabin Doors .... CLOSE & SECURE
Forward Cabin Door .... CLOSE & SECURE
Seats .... ADJUSTED & LOCKED

CAUTION:

With the shoulder harness fastened and adjusted, a pull test of it's locking restraint feature should be performed.

Seatbelts and Harness .... FASTEN/ADJUST
CHECK INERTIA REEL
Empty Seats .... SEAT BELTS SNUGLY FASTENED
Alternators .... ON

WARNING

No braking will occur if knob is pulled before brake application.

Parking Brake .... SET
Gear Selector .... GEAR DOWN
Throttles .... IDLE
Propeller Controls .... FULL FORWARD
Mixture .... IDLE CUT-OFF
Friction Handle .... AS DESIRED
Alternate Air Controls .... OFF
Cowl Flaps .... OPEN
Stabilator & Rudder Trim .... SET
Fuel Selectors .... ON
Heater Switch .... OFF
Radio Master Switch .... OFF
Electrical Switches .... OFF
Circuit Breakers .... CHECK IN

4.5c Engine Start Checklists (4.13)

ENGINE START - GENERAL (4.13)

CAUTION:

For cold weather starting, ensure magneto and master switches are off and mixture controls are in idle cut-off before turning propeller manually.

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.

If engine does not start within 10 seconds, prime and repeat starting procedure. Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 20 second rest period between cranking periods. Maximum of 6 start periods allowed. If start is not achieved on sixth attempt allow starter to cool for 30 minutes before attempting additional starts. Longer cranking periods will shorten the life of the starter.

NOTE:

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

NOTE:

Do not attempt an engine start while the engine gauges are in the process of conducting the self test feature. (See Section 7, para. 7.25a.)

4.5c Engine Start Checklists (4.13) (Continued)

NORMAL START - COLD ENGINE (4.13a)

Throttles .... 1 INCH OPEN
Propeller Controls .... FULL FORWARD
Battery Master Switch .... ON
Gear Lights .... 3 GREEN
*Standby Fuel Pump .... ON
*Magneto Switches .... ON
*Mixture .... RICH - THEN IDLE CUTOFF

NOTE

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

*Propeller Area .... CLEAR
*Starter .... ENGAGE
*Mixture (when engine fires) .... ADVANCE
*Throttle .... ADJUST
*Oil Pressure .... CHECK

Repeat Above Procedure (*) for Second Engine Start

Voltmeter .... CHECK (28 ±-1 VOLT)
Alternator .... CHECK AMP OUTPUT
Gyro Vacuum .... CHECK (within normal operating range)

ENGINE START - COLD WEATHER (4.13b)

Throttles .... 1/2 INCH OPEN
Propeller Controls .... FULL FORWARD
Battery Master Switch .... ON
Gear Lights .... 3 GREEN
*Standby Fuel Pump .... ON
*Magneto Switches .... ON
*Mixture .... FULL RICH
*Throttle .... IDLE (after 5 sec. of prime)
*Propeller Area .... CLEAR
*Starter .... ENGAGE
*Throttle .... ADJUST AS REQUIRED
*Oil Pressure .... CHECK

Repeat Above Procedure (*) for Second Engine Start

Voltmeter .... CHECK (28 ±-1 VOLT)
Alternator .... CHECK AMP OUTPUT
Gyro Vacuum .... CHECK (within normal operating range)

4.5c Engine Start Checklists (4.13) (Continued)

NORMAL START - HOT ENGINE (4.13c)

Throttles .... 1/2 INCH OPEN
Propeller Controls .... FULL FORWARD
Mixture .... IDLE CUT-OFF
Battery Master Switch .... ON
Gear Lights .... 3 GREEN
Standby Fuel Pump .... OFF

NOTE

Pump may be turned ON after successful engine start, if long periods of engine idle in high ambient temperatures are anticipated.

Magneto Switches .... ON
Propeller Area .... CLEAR
Starter .... ENGAGE
Mixture (when engine fires) .... ADVANCE
Throttle .... ADJUST
Oil Pressure .... CHECK
Voltmeter .... CHECK (28 ± 1 VOLT)
Alternator .... CHECK AMP OUTPUT
Gyro Vacuum .... CHECK (within normal operating range)

ENGINE START WHEN FLOODED (4.13d)

Throttle .... OPEN FULL
Propeller Control .... FULL FORWARD
Mixture .... IDLE CUT-OFF
Battery Master Switch .... ON
Standby Fuel Pump .... OFF

NOTE

Pump may be turned ON after successful engine start, if long periods of engine idle in high ambient temperatures are anticipated.

Magneto Switches .... ON
Propeller Area .... CLEAR
Starter .... ENGAGE
Mixture (when engine fires) .... ADVANCE SLOWLY
Throttle .... RETARD TO 1000 RPM
Oil Pressure .... CHECK
Voltmeter .... CHECK (28 ± 1 VOLT)
Alternator .... CHECK AMP OUTPUT
Gyro Vacuum .... CHECK (within normal operating range)

ENGINE START WITH EXTERNAL POWER SOURCE (4.13e)

NOTE

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

CAUTION:

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

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

Battery Master Switch ....OFF
Alternator Switches ....OFF
All Electrical Equipment ....OFF
Receptacle Door ....OPEN
External Power Plug ....INSERT in RECEPTACLE

Proceed with normal start.

Throttles ....LOWEST POSSIBLE RPM
External Power Plug..DISCONNECT from RECEPTACLE
Receptacle Door ....SECURE
Battery Master Switch ....ON
Alternator Switches ....ON
Throttles..1000 RPM
Oil Pressure ....CHECK
Voltmeter ....CHECK BUS VOLTAGE (28 ± 1 Volt)
Alternator Output..CHECK, BOTH LT and RT
Gyro Vacuum ....CHECK (within normal operating range)

4.5d Before Taxiing Checklist (4.15)

WARM-UP (4.15a)

External Power Source Unit .... REMOVE (IF APPLIED)
Throttles .... 1000 to 1200 RPM

NOTE

Idle fuel mixture will be rich at high density altitudes. Under extreme conditions it may be necessary to manually lean the mixture in order to sustain engine operation at low RPM. When practical, operate the engines at higher idling speed.

BEFORE TAXIING (4.15b)

Battery Master Switch .... ON
Gyros...SET
Altimeter and Clock .... CHECK & SET
Radio Master Switch... ON
Lights .... AS REQUIRED
Heater and Defroster .... AS DESIRED
Fuel Selectors.. ON, CHECK CROSSFEED
Radios .... CHECK & SET
Autopilot .... TEST & OFF
Electric Trim .... CHECK
Passenger Briefing .... COMPLETE
Parking Brake .... RELEASE

4.5e Taxiing Checklist (4.17)

TAXIING (4.17)

Taxi Area .... CLEAR
Standby Fuel Pumps .... AS REQUIRED

NOTE

During extended periods of engine idle at high ambient temperatures, fuel flow to the engine can be interrupted by the formation of fuel vapor bubbles in the fuel line. This condition can be corrected by turning the standby fuel pump ON, to provide positive pressure to the engine driven pump inlet.

4.5e Taxiing Checklist (4.17) (Continued)

TAXIING (4.17) (Continued)

NOTE

Idle fuel mixture will be rich at high density altitudes. Under extreme conditions it may be necessary to manually lean the mixture in order to sustain engine operation at low RPM. When practical, operate the engines at higher idling speed.

Throttles .... APPLY SLOWLY
Brakes .... CHECK
Steering .... CHECK
Flight Instruments .... CHECK

NOTE

During taxi, if the Low Bus Voltage annunciator illuminates, increase engine RPM (if possible) to retain adequate battery charging.

4.5f Ground Check Checklist (4.19)

GROUND CHECK (4.19)

CAUTION:

Alternate air is unfiltered. Use of alternate air during ground or flight operations, when dust or other contaminant's are present, may result in engine damage from particle ingestion.

Parking Brake .... SET
Mixtures .... FULL RICH
Propeller Controls .... FULL FORWARD
Throttles .... 1000 RPM
Engine Instruments .... CHECK
Throttles .... 1500 RPM
Propeller Controls (Max. Drop - 300 RPM) .... FEATHER - CHECK
Throttles .... 2300 RPM
Propeller Controls (Max. Drop - 300 RPM) .... EXERCISE
Alternate Air .... CHECK ON (OBSERVE APPROX. 25 RPM DROP) THEN OFF

4.5f Ground Check Checklist (4.19) (Continued)

GROUND CHECK (4.19) (Continued)

Throttles .... 2000 RPM
Magnetos (Max. Drop - 150 RPM:
Max. Diff. - 50 RPM) .... CHECK
Voltmeter .... CHECK BUS (28 ±-1 VOLT)
Alternator Output .... CHECK, BOTH LT and RT
Annunciator Panel Lights .... OUT
Gyro Vacuum Gauge .... CHECK AS REQUIRED
(within normal operating range)

WARNING:

If flight into icing conditions (in visible moisture below +5°C) is anticipated or encountered during climb, cruise or descent, activate the aircraft ice protection system,including the pitot heat, as described in supplement no. 3 - Ice Protection System.

Ice Protection Equipment .... CHECK AS REQUIRED
Throttles .... IDLE - CHECK
Throttles .... 800 to 1000 RPM
Friction Handle .... SET

4.5g Before Takeoff Checklist (4.21)

WARNING:

Refer to paragraph 4.55, Icing Information, prior to any flight operations. (Takeoff, cruise, landing, etc.)

BEFORE TAKEOFF (4.21)

Doors .... LATCHED
Seat Backs .... ERECT
Seats .... ADJUSTED & LOCKED IN POSITION
Seat Belts, Harnesses .... FASTENED/ADJUSTED
Armrests .... STOWED
Battery Master Switch .... ON
Alternators .... ON

4.5g Before Takeoff Checklist (4.21) (Continued)

BEFORE TAKEOFF (4.21) (Continued)

Standby Fuel Pumps .... ON
Flight Instruments .... CHECK
Engine Instruments .... CHECK

WARNING:

If flight into icing conditions (in visible moisture below +5°C) is anticipated or encountered during climb, cruise or descent, activate the aircraft ice protection system, including the pitot heat, as described in supplement no. 3 - Ice Protection System.

Prop Heat .... AS REQUIRED
Windshield Heat .... AS REQUIRED
Pitot/Stall Warning Heat .... AS REQUIRED
Prop Controls .... FULL FORWARD
Mixtures .... FULL FORWARD
Alternate Air .... OFF
Flaps .... SET
Airconditioner (if installed) .... OFF
Stabilator and Rudder Trims .... SET
Fuel Selectors .... ON
Flight Controls .... CHECK
Parking Brake .... RELEASE

4.5h Takeoff Checklist (4.23)

WARNING:

Refer to paragraph 4.55, Icing Information, prior to any flight operations. (Takeoff, cruise, landing, etc.)

WARNING:

If headsets are not worn during high cockpit noise conditions, the Traffic Information System (TIS) or Traffic Advisory System (TAS) aural alerts may not be audible in airplanes so equipped.

4.5h Takeoff Checklist (4.23) (Continued)

CAUTION:

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

NOTE:

Takeoffs are normally made with full throttle. However, under some off standard conditions, the manifold pressure indication can exceed its indicated limit at full throttle. Limit manifold pressure to 38 in. Hg. maximum.

NORMAL (0° FLAP) PERFORMANCE TAKEOFF (4.23a)

Flaps....................UP
Stabilator and Rudder Trim....................CHECK SET
Brakes....................HOLD
Mixture....................FULL RICH
Power....................2600 RPM, 38 in. Hg. MAN PRESS
Brakes....................RELEASE
Rotate Speed....................(Max. T.O. Wt.) 79 KIAS
Obstacle Clearance Speed....................(Max. T.O. Wt.) 79 KIAS
Gear....................UP
Climb Speed (after obstacle clearance)....................88 KIAS

SHORT FIELD PERFORMANCE TAKEOFF (4.23b)

Flaps....................25°
Stabilator and Rudder Trim....................CHECK SET
Brakes....................HOLD
Mixture....................FULL RICH
Power....................2600 RPM, 38 in. Hg. MAN PRESS
Brakes....................RELEASE
Rotate Speed....................(Max. T.O. Wt.) 71 KIAS
Obstacle Clearance Speed....................(Max. T.O. Wt.) 73 KIAS
Gear....................UP
Flaps....................RETRACT SLOWLY WHILE ACCELERATING
Climb Speed (after obstacle clearance)....................88 KIAS

4.5i Climb Checklist (4.25)

MAXIMUM PERFORMANCE CLIMB (4.25a)

Best Rate (Flaps Up)... 88 KIAS
Best Angle (Flaps Up) .... 83 KIAS
Cowl Flaps .... FULL OPEN
Power ....Max. Continuous Power
Standby Fuel Pumps ....**OFF at a safe altitude**
(ON above 10,000 FT)

CRUISE CLIMB (4.25b)

Mixture .... FULL RICH
Power .... 2500 RPM, 32 in. Hg. MAN PRESS
Climb Speed... 110 KIAS
Cowl Flaps ....CLOSED or As Required
1/2 OPEN
Standby Fuel Pumps ....**OFF at a safe altitude**
(ON above 10,000 FT)

4.5j Cruise Checklist (4.27)

CRUISING (4.27)

Power .... SET per Power Setting Chart
Mixture Controls...ADJUST
Fuel Pump .... (Confirm OFF)
Cowl Flaps .... AS REQUIRED

4.5k Descent Checklist (4.29)

DESCENT (4.29)

Throttles .... AS REQUIRED
Mixture Controls...ADJUST
Cowl Flaps .... CLOSED
Altimeter ....SET
Windshield Defrost...AS DESIRED

4.5m Approach and Landing Checklist (4.31)

APPROACH AND LANDING (4.31)

NAV Source...................... VERIFY HSI Nav Guidance is set for approach
Seat Backs...ERECT
Seat Belts, Harnesses .... FASTEN/ADJUSTED
Armrests .... STOWED
Standby Fuel Pumps .... ON
Fuel Selectors.. ON
Cowl Flaps .... AS REQUIRED
Mixture Controls...FULL RICH
Propeller Controls...FULL FORWARD
Landing Gear (Below 128 KIAS).. DOWN
Landing Gear Lights .... 3 GREEN
Nacelle Mirror ....NOSE GEAR DOWN
Airconditioner (if installed) .... OFF
Autopilot .... OFF
Toe Brakes ....DEPRESS TO CHECK

NORMAL LANDING (4.31a)

Flaps (Below 113 KIAS) .... FULL DOWN
Airspeed... 90 KIAS
Trim .... AS REQUIRED
Throttles... AS REQUIRED
Touchdown ....MAIN WHEELS
Braking .... AS REQUIRED

SHORT FIELD PERFORMANCE LANDING (4.31b)

Flaps (Below 113 KIAS) .... FULL DOWN
Airspeed (At Max. Weight) .... 82 KIAS
Trim .... AS REQUIRED
Throttles..IDLE
Touchdown ....MAIN WHEELS
Flaps..RETRACT
Control Wheel..BACK PRESSURE
Braking ....MAXIMUM without SKIDDING

4.5n Go-Around Checklist (4.33)

GO-AROUND (4.33)

Mixtures .... FULL RICH
Propeller Controls ....FULL FORWARD
Throttles ....FULL
POWER ....
Control Wheel.. BACK PRESSURE TO OBTAIN
POSITIVE CLIMB ATTITUDE at 85 KIAS
Flaps..RETRACT SLOWLY
Gear...UP
Cowl Flaps .... AS REQUIRED
Trim .... AS REQUIRED

4.5o After Landing Checklist (4.35)

AFTER LANDING (4.35)

Clear of runway.
Flaps..RETRACT
Cowl Flaps .... FULL OPEN
Airconditioner (if installed) ....AS DESIRED
Radar (if installed) ....OFF
Standby Fuel Pumps .... AS REQUIRED

NOTE

During extended periods of engine idle at high ambient temperatures, fuel flow to the engine can be interrupted by the formation of fuel vapor bubbles in the fuel line. This condition can be corrected by turning the standby fuel pump ON, to provide positive pressure to the engine driven pump inlet.

NOTE

Idle fuel mixture will be rich at high density altitudes. Under extreme conditions it may be necessary to manually lean the mixture in order to sustain engine operation at low RPM. When practical, operate the engines at higher idling speed.

Strobe Lights...OFF
Landing and Taxi Lights.. AS REQUIRED

4.5p Stopping Engine Checklist (4.37)

STOPPING ENGINE (4.37)

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

4.5q Mooring Checklist (4.39)

MOORING (4.39)

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

4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

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

4.9 PREFLIGHT CHECK (4.5a)

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

CAUTION

The flap position should be noted before boarding the airplane. The flaps must be placed in the UP position before they will lock and support weight on the step.

4.9a Cockpit (4.5a)

Upon entering the cockpit, release the seat belts securing the control wheel. Open the static system drain located on the side panel next to the pilot's seat to remove any moisture that has accumulated in the lines.

Set the parking brake by first depressing and holding the toe brake pedals and then pulling out the parking brake knob. Ensure that the magneto switches and the standby fuel pump switches are in the OFF position.

Check the primary flight controls for proper operation and check that the landing gear selector is in the DOWN position. The throttles should be at IDLE and the mixture controls should be in IDLE CUT-OFF. Verify that the alternate static system valve is in the normal position.

Move the cowl flap controls to the full OPEN position to facilitate inspection and ensure cooling after engine start. Set the stabilator and rudder trim to neutral so that the tabs can be checked for alignment. This check is performed prior to engine start so that you can hear any noise that might indicate binding. Ensure that both fuel selectors are ON.

4.9 PREFLIGHT CHECK (4.5a) (Continued)

4.9a Cockpit (4.5a) (Continued)

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

Check the annunciator lights with the PRESS-TO-TEST button located to the left of the annunciator panel. Check the fuel quantity gauges for adequate supply of fuel. Check that the three landing gear lights are illuminated and that the red gear warning light is not illuminated. Extend the flaps for the walk-around inspection. Turn OFF the battery master switch.

Check the windows for cleanliness. Check that the POH and all required papers are on board. Properly stow any baggage and secure. Before leaving the cockpit, drain the two crossfeed drains on the forward side of the spar box.

4.9b Right Wing (4.5a)

After exiting the cockpit, the first items to check during the walk-around are the fuel crossfeed line drains to ensure that the crossfeed drains are closed. These drains are located on the bottom of the fuselage just forward of the entrance step.

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

Open the fuel cap to check the cap vent, fuel quantity and color of the fuel. The vent should be free of obstructions. The quantity should match the indication that was on the fuel quantity gauges. Replace cap securely.

CAUTION:

When draining any amount of fuel, care should be taken to ensure that no fire hazard exists before starting engine.

Proceeding along the wing, verify that the fuel tank vent located on the underside of the wing, outboard of the nacelle, is clear of obstructions. The two fuel tank drains under the wing should be opened to drain moisture and sediment. Remove the tie down.

4.9b Right Wing (4.5a) (Continued)

Proceed forward to the engine cowling. Check its general condition; look for oil or fluid leakage and that the cowling is secure. Drain the gascolator (fuel filter) drain near the outboard bottom of the engine nacelle (refer to Section 8 for more detailed draining procedure).

Open the oil access door and check the oil quantity (six to eight quarts). Eight quarts are required for maximum range. Make sure that the dipstick has properly seated after checking. Check and ensure that the oil filler cap is securely tightened and secure the access door.

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

Next, complete a check of the landing gear. Check the main gear strut for proper inflation. There should be 3.2 ± .50 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake, block and disc. Remove the chock.

4.9c Nose Section (4.5a)

Check the general condition of the nose section. The windshield should be clean, secure and free from cracks or distortion. Check the condition and security of the landing/taxi lights. If the tow bar was used, remove and stow. Next remove the chock and check the nose gear strut for leaks and proper strut inflation. There should be 1.2 ± .25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation.

Open the forward baggage compartment and check to make sure that the baggage has been stowed properly. Close, secure and lock the baggage door. The forward baggage compartment door key can be removed in the locked position only.

4.9 PREFLIGHT CHECK (4.5a) (Continued)

4.9d Left Wing (4.5a)

The wing surface should be clear of ice, frost, snow or other extraneous substances. Check the main gear strut for proper inflation. There should be 3-1/2 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake, block and disc. Remove the chock. Next, check the cowl flap area. The cowl flap should be open and secure.

Next, check the engine cowling. Check its general condition; look for oil or fluid leakage and that the cowling is secure. Open the oil access door and check the oil quantity (six to eight quarts). Eight quarts are required for maximum range. Make sure that the dipstick has properly seated after checking. Check and ensure that the oil filler cap is securely tightened and secure the access door.

The propeller and spinner should be checked for detrimental nicks, cracks, or other defects, and the air inlets are clear of obstructions. Drain the gascolator (fuel filter) drain near the outboard bottom of the engine nacelle (refer to Section 8 for more detailed draining procedure).

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

Check the pitot head. If a pitot cover was installed, it must be removed before flight and the holes checked for obstructions. Remove the tie down.

CAUTION:

When draining any amount of fuel, care should be taken to ensure that no fire hazard exists before starting engine.

The two fuel tank drains under the wing should be opened to drain moisture and sediment. Proceeding along the wing, verify that the fuel tank vent located on the underside of the wing, outboard of the nacelle, is clear of obstructions.

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

4.9d Left Wing (4.5a) (Continued)

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

4.9e Fuselage (Left Side) (4.5a)

Check the general condition of the left side of the fuselage. All side windows should be clean and without defects. Antennas should be in place and securely attached. Check the fresh air inlet for any obstructions. Check that the two rear doors are secure and that the hinges are operational. Next check that the battery vents are clear of obstructions. Verify external power door closes and secure. Check that the static vent holes are free from obstructions.

4.9f Empennage (4.5a)

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

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

4.9g Fuselage (Right Side) (4.5a)

Check the general condition of the right side of the fuselage. Check the dorsal fin air scoop and right static vent for obstructions. Check that the cabin door attachments are secure and that the hinges are operational.

4.9 PREFLIGHT CHECK (4.5a) (Continued)

4.9h Miscellaneous (4.5a)

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

CAUTION

Care should be taken when an operational check of the heated pitot head and the heated lift detectors is being performed. Both units become very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

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

4.11 BEFORE STARTING ENGINE (4.5b)

After preflight interior and exterior checks and flight planning have been completed and the airplane has been determined ready for flight, both the forward and aft cabin doors should be secured. All occupied seats should be adjusted and secured in position and seat belts and shoulder harnesses properly fastened. All seat belts on seats not occupied should be fastened and pulled secure.

NOTE

With the shoulder harness fastened and adjusted, a pull test of it's locking restraint feature should be performed.

4.11 BEFORE STARTING ENGINE (4.5b) (Continued)

Turn on the alternator switches.

WARNING

No braking will occur if knob is pulled prior to brake application.

Set the parking brake by first depressing and holding the toe brake pedals, then pulling out the parking brake handle. Verify that the landing gear selector is in the DOWN position.

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

Verify that the alternate air control for each engine is OFF and the cowl flaps are OPEN.

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

All other electrical switches and radio master switch should be OFF to avoid an electrical overload when the starter is engaged. Check that all circuit breakers are in.

4.13 ENGINE START GENERAL (4.5c)

CAUTION:

For cold weather starting, ensure magneto and master switches are off and mixture controls are in idle cut-off before turning propeller manually.

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.

If engine does not start within 10 seconds, prime and repeat starting procedure. Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 20 second rest period between cranking periods. Maximum of 6 start periods allowed. If start is not achieved on sixth attempt allow starter to cool for 30 minutes before attempting additional starts. Longer cranking periods will shorten the life of the starter.

NOTE:

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

NOTE:

Do not attempt an engine start while the engine gauges are in the process of conducting the self test feature. (See Section 7, para. 7.25a.)

4.13 ENGINE START (4.5c) (Continued)

4.13a Normal Start - Cold Engine (4.5c)

Open the throttles approximately 1 inch and advance the propeller controls to FULL FORWARD. Turn the battery master switch ON and check that the three green gear position lights are illuminated. Turn on the standby fuel pump and the magneto switches. Advance the mixture control to FULL RICH for approximately 4 seconds then to IDLE CUT-OFF. The engine is now primed.

NOTE

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

Verify the propeller area is clear. Once you are sure the area is clear and the engine can safely be started, engage the starter.

When the engine fires, advance the mixture control to FULL RICH. Move the throttle to the desired setting and check the oil pressure 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. After smooth engine operation, the standby fuel pump may be turned OFF.

Repeat the above procedure for the opposite engine. After both engines have been started, check bus voltage and the alternators for sufficient output and the gyro vacuum gauge for a reading within the normal operating range.

4.13b Engine Start - Cold Weather (4.5c)

Open the throttles 1/2 inch and advance the propeller controls to FULL FORWARD. Turn the battery master switch ON and check that the three green gear position lights are illuminated. Turn on the standby fuel pump and the magneto switches. Advance the mixture control to FULL RICH and after approximately 5 seconds of prime, reposition the throttle to the idle position.

Verify the propeller area is clear. Once you are sure the area is clear and the engine can safely be started, engage the starter.

When the engine fires, adjust the throttle as necessary. Check the oil pressure for a positive indication. Normally there should be an indication of oil pressure within 30 seconds. In cold weather it may take a few seconds longer. If after allowing sufficient time there is no oil pressure, shut down the engine until the cause is determined and remedied.

Repeat the above procedure for the opposite engine. After both engines have been started, check bus voltage and the alternators for sufficient output and the gyro vacuum gauge for a reading within the normal operating range.

4.13c NORMAL START - HOT ENGINE (4.5c)

Open the throttles 1/2 inch and advance the propeller controls to FULL FORWARD. Verify the mixture control is at the idle cut-off. Turn the battery master switch ON and check that the three green gear position lights are illuminated. Verify the standby fuel pump is OFF. Turn both magneto switches ON.

Verify the propeller area is clear. Once you are sure the area is clear and the engine can safely be started, engage the starter. When the engine fires, slowly advance the mixture control. Move the throttle to the desired setting and check the oil pressure for a positive indication.

Repeat the above procedure for the opposite engine. After both engines have been started, check bus voltage and the alternators for sufficient output and the gyro vacuum gauge for a reading within the normal operating range.

4.13d Engine Start When Flooded (4.5c)

If an engine is flooded (by overpriming, for example), advance the throttle and propeller controls full forward, and the mixture control to idle cut-off. Turn ON the battery master switch. The standby fuel pump should be OFF. Turn on the magneto switches and verify the propeller area is clear. Once you are sure the area is clear and the engine can safely be started, engage the starter.

Advance the mixture control only after the engine has fired, and retard the throttle control to 1000 RPM. Check the oil pressure gauge 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.

Repeat the above procedure for the opposite engine. After both engines have been started, check bus voltage and the alternators for sufficient output and the gyro vacuum gauge for a reading within the normal operating range.

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

NOTE

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

CAUTION:

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

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

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

A standard external power receptacle feature allows the operator to use an external power source to crank the engines without having to gain access to the airplane's battery.

Turn the battery master, alternator switches, and all electrical equipment OFF. Insert the plug of the auxiliary power unit into the receptacle located on the left aft side of the fueslage.

Proceed with the normal starting technique. After the engines have started, reduce power to the lowest possible RPM to reduce sparking.

Disconnect the external power source from the aircraft and secure the receptacle door. Turn the battery master and alternator switches ON. Advance the throttles to 1000 RPM. Check oil pressures, bus voltage and alternator outputs. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT. Check gyro vacuum gauge for a reading within the normal operating range.

4.13f Preheating

The use of preheat and auxiliary power (battery cart) will facilitate starting during cold weather and is recommended when the engine has been cold soaked at temperatures of 10°F and below in excess of two hours. Successful starts without these aids can be expected at temperatures below normal, provided the aircraft battery is in good condition and the ignition and fuel systems are properly maintained.

The following procedures are recommended for preheating, starting, warm-up, run-up and takeoff.

(a) Select a high volume hot air heater. Small electric heaters which are inserted into the cowling bug eye do not appreciably warm the oil and may result in superficial preheating.

4.13f Preheating (Continued)

WARNING

Superficial application of preheat to a cold-soaked engine can have disastrous results.

A minimum of preheat application may warm the engine enough to permit starting but will not de-congeal oil in the sump, lines, cooler, filter, etc. Typically, heat is applied to the upper portion of the engine for a few minutes after which the engine is started and normal operation is commenced. The operator may be given a false sense of security by indications of oil and cylinder temperatures as a result of preheat. Extremely hot air flowing over the cylinders and oil temperature thermocouples may lead one to believe the engine is quite warm; however, oil in the sump and filter are relatively remote and will not warm as rapidly as a cylinder. For example, even when heat is applied directly, oil lines are usually lagged with material which does an excellent job of insulating

Congealed oil in such lines may require considerable preheat. The engine may start and apparently run satisfactorily, but can be damaged from lack of lubrication due to congealed oil in various parts of the system. The amount of damage will vary and may not become evident for many hours. On the other hand, the engine may be severely damaged and could fail shortly following application of high power. Improper or insufficient application of preheat and the resulting oil and cylinder temperature indications may encourage the pilot to expedite his ground operation and commence a takeoff prematurely. This procedure only compounds an already bad situation.

Proper procedures require thorough application of preheat to all parts of the engine. Hot air should be applied directly to the oil sump and external oil lines as well as the cylinders, air intake and oil cooler. Excessively hot air can damage non-metallic components such as seals, hoses and drive belts, so do not attempt to hasten the preheat process.

4.13f Preheating

Before starting is attempted, turn the engine by hand or starter until it rotates freely. After starting, observe carefully for high or low oil pressure and continue the warm-up until the engine operates smoothly and all controls can be moved freely. Do not close the cowl flaps to facilitate warm-up as hot spots may develop and damage ignition wiring and other components.

(b) Hot air should be applied primarily to the oil sump and filter area. The oil drain plug door or panel may provide access to these areas. Continue to apply heat for 15 to 30 minutes and turn the propeller, by hand, through 6 or 8 revolutions at 5 or 10 minute intervals.

(c) Periodically feel the top of the engine and, when some warmth is noted, apply heat directly to the upper portion of the engine for approximately five minutes. This will provide sufficient heating of the cylinders and fuel lines to promote better vaporization for starting. If enough heater hoses are available, continue heating the sump area. Otherwise, it will suffice to transfer the source of heat from the sump to the upper part of the engine.

(d) Start engine immediately after completion of the preheating process. Since the engine will be warm, use normal starting procedure.

NOTE

Since the oil in the oil pressure gauge line may be congealed, as much as 60 seconds may elapse before oil pressure is indicated. If oil pressure is not indicated within one minute, shut the engine down and determine the cause.

(e) Operate the engine at 1000 RPM until some oil temperature is indicated. Monitor oil pressure closely during this time and be alert for a sudden increase or decrease. Retard throttles, if necessary, to maintain oil pressure below 100 psi. If oil pressure drops suddenly to less than 30 psi, shut down the engine and inspect lubrication system. If no damage or leaks are noted, preheat the engine for an additional 10 to 15 minutes before restarting.

4.15 BEFORE TAXIING (4.5d)

4.15a. Warm-Up (4.5d)

If an External Power Source Unit has been used for starting, it should be disconnected and the battery master should be turned ON.

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

NOTE

Idle fuel mixture will be rich at high density altitudes. Under extreme conditions it may be necessary to manually lean the mixture in order to sustain engine operation at low RPM. When practical, operate the engines at higher idling speed.

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

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

4.15b. Before Taxiing (4.5d)

Verify the battery master is turned ON. Set the gyros, the altimeter and clock as required. Turn ON the radio master switch. Lights and heater/defroster may be turned on as desired. Check the operation of the fuel management controls by moving each fuel selector to crossfeed for a short time, while the other selector is in the ON position. Return the selectors to the on position. Check the radios, and set them as desired. Check the autopilot (See Section 9) and the electric trim system.

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

4.17 TAXIING (4.5e)

Check to make sure the taxi area is clear. The standby fuel pumps can be turned on, as required for smooth engine performance, during taxi operations.

NOTE

During extended periods of engine idle at high ambient temperatures, fuel flow to the engine can be interrupted by the formation of fuel vapor bubbles in the fuel line. This condition can be corrected by turning the standby fuel pump ON, to provide positive pressure to the engine driven pump inlet.

4.17 TAXIING (4.5e) (Continued)

NOTE

Idle fuel mixture will be rich at high density altitudes. Under extreme conditions it may be necessary to manually lean the mixture in order to sustain engine operation at low RPM. When practical, operate the engines at higher idling speed.

Always apply the throttles slowly. While taxiing, apply the brakes to determine their effectiveness. Make slight turns to check steering. As much as possible, turns during taxiing should be made using rudder pedal motion and differential power (more power on the engine on the outside of the turn, less on the inside engine) rather than brakes.

During the taxi, check the flight instruments (turn indicator, directional gyro, coordination ball & compass).

NOTE

During taxi, if the Low Bus Voltage annunciator illuminates, increase engine RPM (if possible) to retain adequate battery charging.

4.19 GROUND CHECK (4.5f)

CAUTION:

Alternate air is unfiltered. Use of alternate air during ground or flight operations, when dust or other contaminant's are present, may result in engine damage from particle ingestion.

A thorough check should be made before takeoff, using a checklist. Before advancing the throttle to check the magnetos and the propeller action, be sure that the engine oil temperature is 75°F or above. Head the airplane into the wind if possible (see crosswind limits for propellers) and set the parking brake.

Advance mixture and propeller controls forward and the throttle controls to 1000 RPM. Check engine instruments to see that they are functional and that readings are within limitations. Advance the throttles to 1500 RPM, and retard the propeller controls aft to check feathering; however, do not allow a drop of more than 300 RPM.

4.19 GROUND CHECK (4.5f) (Continued)

Advance the throttles to 2300 RPM and exercise the propeller controls to check the function of the governor. Retard control until a 200 to 300 drop in RPM is indicated. This should be done three times on the first flight of the day. 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, thus indicating proper function of the governor. Return the propeller controls to full forward position and move the alternate air controls to ON then OFF. Avoid prolonged ground operation with alternate air ON as the air is unfiltered.

Retard the throttles until engine speed reaches 2000 RPM. Check the magnetos on each engine by turning OFF, then ON, each of four magneto switches in turn. The normal drop on each magneto is 100 RPM and the maximum drop should not exceed 150 RPM. The maximum differential drop should not exceed 50 RPM. After checking one magneto, do not check the next until the engine speed returns to 2000 RPM. Operation of an engine on one magneto should be kept to a minimum.

CAUTION:

Ensure that the alternators are not indicating full charge prior to takeoff.

Check the bus voltage for 28 ±-1 volts. Check alternator output - alternator output readings should be about equal. All annunciator lights should be out. A reading within the normal operating range on the gyro vacuum gauge signifies proper operation of the gyro vacuum system.

CAUTION:

Although either vacuum pump independently has sufficient capacity to operate the flight instruments and the deice boots in a normal manner, intentional or continued operation in icing conditions is not recommended.

4.19 GROUND CHECK (4.5f) (Continued)

NOTE:

If flight into icing conditions (in visible moisture below +5°C) is anticipated, conduct a preflight check of the ice protection systems per supplement No. 3 "Ice Protection System Installation."

Retard the throttles to check idling. Set the throttles between 800 and 1000 RPM. Set the desired amount of friction on the engine control levers.

4.21 BEFORE TAKEOFF (4.5g)

WARNING:

Refer to paragraph 4.55, Icing Information, prior to any flight operations. (Takeoff, cruise, landing, etc.)

Ensure cabin doors are closed and latched properly. Check that all seat backs are erect and seats are adjusted and locked in position. Check that all seat belts and harnesses are fastened and adjusted and armrests are stowed. Ensure that the battery master, alternator and standby fuel pump switches are ON. Check and set all of the flight instruments as required and engine gauges for normal engine indication.

WARNING:

If flight into known icing conditions (in visible moisture below +5°C) is anticipated or encountered during climb, cruise or descent, activate the aircraft ice protection system, including the pitot heat, as described in supplement No. 3 "Ice Protection System".

Turn propeller heat, windshield heat, and pitot/stall warning heat on if necessary. The propeller controls should be set to full forward and the mixture controls to FULL RICH. Verify that the engine alternate air selectors are in the OFF position. If flaps are to be used for takeoff, visually confirm that they have extended. The airconditioner (if installed) must be OFF to ensure normal takeoff performance. Check and set the stabilator and rudder trims. Verify that both fuel control selectors are set to the ON position. Ensure proper flight control movement and response. Release the parking brake.

4.23 TAKEOFF (4.5h)

To achieve the takeoff performance specified in Section 5, it is necessary to set rated power (2600 RPM, 38 in. Hg.) prior to brake release.

WARNING:

Refer to paragraph 4.55, Icing Information, prior to any flight operations. (Takeoff, cruise, landing, etc.)

WARNING

If headsets are not worn during high cockpit noise conditions, the Traffic Information System (TIS) or Traffic Advisory System (TAS) aural alerts may not be audible in airplanes so equipped.

CAUTION:

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

NOTES

Takeoffs are normally made with full throttle However, under some off standard conditions, the manifold pressure indication can exceed its indicated limit at full throttle. Limit manifold pressure to 38 in. Hg.

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.

Avoid fast turns onto the runway, followed by immediate takeoff, especially with a low fuel supply. Fast taxi turns immediately prior to takeoff run can cause temporary malfunction of one engine on takeoff.

As power is applied at the start of the takeoff roll, look at the engine instruments to see that the engines are operating properly and putting out normal power, and at the airspeed indicator to see that it is functioning. Apply throttle smoothly until 38 in. Hg. manifold pressure is obtained. DO NOT APPLY ADDITIONAL THROTTLE.

The flap setting for normal takeoff is 0°. In certain short field takeoff efforts when the shortest possible ground roll and the greatest clearance distance over a 50 ft. obstacle is desired, a flap setting of 25° is recommended.

4.23a Normal (0° Flap) Performance Takeoff (4.5h)

When obstacle clearance is no problem, a normal flaps up (0°) takeoff may be used. Set the flaps to the up (0°) position. Set the stabilator trim indicator in the takeoff range. Apply and hold the brakes and bring the engines to full power before release. Release the brakes, accelerate to 79 KIAS and ease back on the wheel enough to let the airplane lift off the runway. Hold 79 KIAS until the obstacle is cleared. After obstacle clearance, accelerate to the best rate of climb speed, 88 KIAS, or higher if desired, retracting the landing gear when a gear-down landing is no longer possible on the runway.

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

The distances required using this takeoff procedure are given on a chart in the Performance Section of this handbook.

4.23b Short Field Performance Takeoff (4.5h)

When the shortest possible ground roll and the greatest clearance distance over a 50-foot obstacle is desired, use a 25-degree flap setting. Set the stabilator trim indicator slightly nose up from the takeoff range. Apply and hold the brakes and bring the engines to full power before release. Release the brakes, accelerate to 71 KIAS and rotate firmly so that when passing through the 50-foot height the airspeed is approximately 73 KIAS. Retract the gear when a gear down landing is no longer possible on the runway.

4.23 TAKEOFF (4.5h) (Continued)

4.23b Short Field Performance Takeoff (4.5h) (Continued)

It should be noted that the airplane is momentarily near VMC when using the above procedure. IN THE EVENT THAT AN ENGINE FAILURE SHOULD OCCUR WHILE THE AIRPLANE IS AT THIS AIRSPEED, IT IS MANDATORY THAT THE THROTTLE ON THE OPERATING ENGINE BE RETARDED AND THE NOSE LOWERED IMMEDIATELY TO MAINTAIN CONTROL OF THE AIRPLANE. It should also be noted that when a 25-degree flap setting is used on the takeoff roll, an effort to hold the airplane on the runway too long may result in a wheel barrowing tendency. This should be avoided.

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

The distances required using this takeoff procedure are given on a chart in the Performance Section of this handbook.

4.25 CLIMB (4.5i)

NOTE:
The standby fuel pumps must be on during climbs above 10,000 feet.

4.25a Takeoff Climb (4.5i)

On climb-out after takeoff, it is recommended that the best angle of climb speed (83 KIAS) be maintained only if obstacle clearance is a consideration. The best rate of climb speed (88 KIAS) should be maintained with takeoff power on the engines until adequate terrain clearance is obtained.

4.25b Cruise Climb (4.5i)

At this point, engine power should be reduced to 2500 RPM and 32 inches Hg. manifold pressure for cruise climb. Establish a climb speed of 110 KIAS and position the cowl flaps 1/2 OPEN or as required to maintain proper engine temperatures.

4.25 CLIMB (4.5i) (Continued)

4.25b Cruise Climb (4.5i) (Continued)

This combination of reduced power and increased airspeed provides better engine cooling, less engine wear, reduced noise level and better forward visibility.

When reducing engine power the throttles should be retarded first, followed by the propeller controls. The mixture controls should remain at full rich during the climb. Cowl flaps should be set to the 1/2 open position or adjusted as required, to maintain cylinder head and oil temperatures within the normal ranges specified for the engine.

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

4.27 CRUISE (4.5j)

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

For maximum engine service life, cylinder head temperatures should be maintained below 420°F and oil temperatures below 200°F during cruise. These temperatures can be maintained by opening the cowl flaps, reducing the power, enriching the mixture or any combination of these methods.

4.27 CRUISE (4.5j) (Continued)

WARNING

Flight in icing conditions is prohibited unless aircraft is equipped with the approved and complete Piper ice protection system (see Supplement 3, Section 9). If icing is encountered, immediate action should be taken to fly out of icing conditions. Icing is hazardous due to greatly reduced performance, loss of forward visibility, possible longitudinal control diffi-culties due to increased control sensitivity. and impaired power plant and fuel system operation.

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 alternate air control in the ON position.

The ammeter readout for the electrical system should be monitored during flight, especially during night or instrument flight, so that corrective measures can be taken in case of malfunction. The procedures for dealing with electrical failures are contained in the Emergency Procedure Section of this handbook. The sooner a problem is recognized and corrective action taken, the greater is the chance of avoiding total electrical failure.

Both alternator switches should be ON for normal operation. Selecting the electrical system mode will allow review of the bus voltage, left and right alternator output, and battery charge/discharge current. Certain failures can cause the alternator output voltage to increase uncontrollably. To prevent damage, alternator control units are installed to automatically shut off the alternator(s).

The red left or right alternator inop. annunciator on the annunciator panel will illuminate to warn of the tripped condition.

**Left Alt.
Inop.**

**Right Alt.
Inop.**

Alternator outputs will vary with the electrical equipment in use and the state of charge of the battery. Alternator outputs should not exceed 85 amperes. The red low voltage annunciator will warn of bus voltage below requirements.

**Low Bus
Voltage**

Should the current requirement exceed 170 amps, the alternators will continue at 85 amps each, the remainder coming from the battery. Therefore, to ensure against battery discharge, it is recommended that electrical loads be adjusted to limit continuous alternator outputs to 85 amps. It is not recommended to take off into IFR operation with only one alternator operative even though electrical loads may be less than 85 amps.

Since the SENECA V has one combined fuel tank per engine, it is advisable to feed the engines symmetrically during cruise so that approximately the same amount of fuel will be left in each side for the landing. A crossfeed is provided and can be used in cruise after 30 minutes of flight to balance the fuel quantity and extend the range during single-engine operation.

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauging systems are operating. If the fuel flow indication is considerably higher than the fuel actually being consumed or if an asymmetric flow gauge indication is observed, a fuel nozzle may be clogged and require cleaning.

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, the landing gear will free-fall to the gear down position.

The true airspeed with gear down is approximately 75% of the gear retracted airspeed for any given power setting. Allowances for the reduction in airspeed and range should be made when planning extended flight between remote airfields or flight over water.

For flight above 12,500 feet see FAR 91.32 requirements for oxygen and Section 9- Supplements in this handbook.

4.29 DESCENT (4.5k)

When power is reduced for descent, the mixtures should be enriched as altitude decreases. The propellers may be left at cruise setting; however if the propeller speed is reduced, it should be done after the throttles have been retarded. Cowl flaps should normally be closed and the T.I.T. should be maintained at approximately 1300°F or higher to keep the engines at the proper operating temperature. Set the altimeter. Adjust the windshield defrost as required during descent.

4.31 APPROACH AND LANDING (4.5m)

Sometime prior to the start of the approach, verify the navigation source information being provided to the HSI is set for the desired published approach.

NOTE

The HSI displays course deviation from a VOR, Localizer (LOC), or Glideslope (G/S) when NAV or VLOC is the navigation source and displays GPS track deviation when GPS is the selected navigation source.

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

The red GEAR WARN light on the annunciator panel will illuminate when the landing gear is in transition between the full up position and the down and locked position. Additionally, the light will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked. The light is off when the landing gear is in either the full down and locked or full up positions.

The landing gear should be lowered at speeds below 128 KIAS and the flaps at speeds as follows:

10° - 140 KIAS maximum
25° - 120 KIAS maximum
40° - 113 KIAS maximum

Prior to entering the traffic pattern, the aircraft should be slowed to approximately 120 KIAS, and this speed should be maintained on the downwind leg. The landing check should be made on the downwind leg. The seat backs should be erect, armrests stowed, and the seat belts and shoulder harnesses should be fastened.

NOTE

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

The standby fuel pumps should be ON. Both fuel selectors should be ON, and the cowl flaps should be set as required. Select landing gear DOWN and check for three green lights on the panel and look for the nose wheel in the nose wheel mirror.

Maintain a traffic pattern speed of 100 KIAS and a final approach speed of 90 KIAS. If the aircraft is lightly loaded, the final approach speed may be reduced to 79 KIAS. Set the mixture controls to full rich.

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

The landing gear position should be checked again on final approach by checking the three green indicator lights on the instrument panel and looking at the external mirror to check that the nose gear is extended.

NOTE

The airconditioner should be OFF to ensure maximum rate of climb in the event of a go-around. Pump the toe brakes to ensure that the system is capable of uniform braking during landing rollout.

Flap position for landing will depend on runway length and surface wind. Full flaps will reduce stall speed during final approach and will permit contact with the runway at a slower speed.

Good pattern management includes a smooth, gradual reduction of power on final approach, with the power fully off before the wheels touch the runway. This gives the gear warning horn a chance to blow if the gear is not locked down. If electric trim is available, it can be used to assist a smooth back pressure during flare out.

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

4.31 APPROACH AND LANDING (4.5m) (Continued)

4.31a Normal Landing (4.5m)

For a normal landing, approach with full flaps (40°) and partial power until shortly before touch-down. Hold the nose up as long as possible before and after contacting the ground with the main wheels.

If a crosswind or high wind landing is necessary, approach with higher than normal speed and with 0° to 25° of flaps. Immediately after touch-down, raise the flaps.

During a crosswind approach, hold a crab angle into the wind until ready to flare out for the landing. Then lower the wing that is into the wind, to eliminate the crab angle without drifting, and use the rudder to keep the wheels aligned with the runway. Avoid prolonged side slips with a low fuel indication.

The maximum demonstrated crosswind component for landing is 17 KTS.

4.31b Short Field Performance Landing (4.5m)

For a short field landing, approach with full flaps (40°) at 82 KIAS. Immediately after touch-down, raise the flaps, apply back pressure to the wheel and apply brakes.

4.33 GO-AROUND (4.5n)

If a go-around from a normal approach with the airplane in the landing configuration becomes necessary, apply takeoff power to both engines (not to exceed 38 in. Hg. manifold pressure). While the pitch attitude is increased to obtain the balked landing climb speed of 85 KIAS, slowly retract the flaps and retract the landing gear, when a positive climb is established, and adjust cowl flaps for adequate engine cooling.

Airspeed should then be established at the best angle of climb speed (83 KIAS) for obstacle clearance or to the best rate of climb speed (88 KIAS), if obstacles are not a factor. Reset the longitudinal trim as required.

4.35 AFTER LANDING (4.5o)

When clear of the active runway, retract the flaps and open the cowl flaps. Operate the airconditioner as desired. Turn off the radar, and operate the standby fuel pumps, as required.

NOTE

During extended periods of engine idle at high ambient temperatures, fuel flow to the engine can be interrupted by the formation of fuel vapor bubbles in the fuel line. This condition can be corrected by turning the standby fuel pump ON, to provide positive pressure to the engine driven pump inlet.

NOTE

Idle fuel mixture will be rich at high density altitudes. Under extreme conditions it may be necessary to manually lean the mixture in order to sustain engine operation at low RPM. When practical, operate the engines at higher idling speed.

Turn off the strobe lights. Use the Landing/Taxi light as required.

4.37 STOPPING ENGINE (4.5p)

Prior to shutdown, switch the heater (if ON) to the FAN position a few minutes for cooling and then turn it OFF. Turn all radio and electrical equipment and external lights OFF.

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

NOTE

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

4.39 MOORING (4.5q)

If necessary, the airplane should be moved on the ground with the aid of the optional nose wheel tow bar, which is stowed in the forward baggage compartment.

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

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

4.41 STALLS

The loss of altitude during a power off stall with the gear and flaps retracted may be as much as 400 feet. The loss of altitude with the gear down and 40° of flaps may also be as much as 400 feet.

A power on stall may result in as much as 150 feet of altitude loss.

NOTE

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

4.43 TURBULENT AIR OPERATION

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

4.45 RESERVED

4.47 VSSE - INTENTIONAL ONE ENGINE INOPERATIVE SPEED

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

VSSE 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 VSSE

The intentional one engine inoperative speed, VSSE, for the SENECA V is 85 KIAS.

4.49 VMCA - AIR MINIMUM CONTROL SPEED

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

VMCA for the SENECA V has been determined to be 66 KIAS. Under no circumstances should an attempt be made to fly at a speed below this VMCA with only one engine operating. As a safety precaution, when operating under single-engine flight conditions either in training or in emergency situations, maintain an indicated airspeed above 85 KIAS, VSSE.

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

Initiate recovery during the demonstration by immediately reducing power on the operating engine and promptly lowering the nose of the airplane to accelerate to VSSE.

The most critical situation occurs where the stall speed and VMCA speed coincide. Care should be taken to avoid this flight condition, because at this point loss of directional control occurs at the same time the airplane stalls, and a spin could result.

VMCA DEMONSTRATION

(a) Landing Gear .... UP

(b) Flaps .... UP

(c) Airspeed .... at or above 85 KIAS (VSSE)

(d) Mixture .... FULL RICH

(e) Propeller Controls .... HIGH RPM

(f) Throttle (Simulated Inoperative Engine) .... IDLE

(g) Throttle (Other Engine) .... MAX ALLOWABLE

(h) 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.

4.51 PRACTICE ONE ENGINE INOPERATIVE FLIGHT

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

Propeller rpm for Zero Thrust

The RPM used to simulate one engine inoperative flight is approximately 2300 RPM.

4.53 NOISE LEVEL

The corrected noise level of this aircraft is 77.0 dB(A) with the two blade propeller and 73.9 dB(A) with the three 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 Appendix G noise standards applicable to this type.

The corrected noise level of this aircraft as measured per ICAO Annex 16, Chapter 10, is 78.5 dB(A) for aircraft with the standard two blade propeller and is 76.0 dB(A) for aircraft with the optional three blade propeller.

4.55 ICING INFORMATION

"THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCIVE TO SEVERE IN-FLIGHT ICING"

Visible rain at temperatures below 0 degrees Celsius ambient air temperature.

Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient air temperature.

"PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT"

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section of the AFM for identifying severe icing conditions are observed, accomplish the following:

Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.

Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.

Do not engage the autopilot.

If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.

If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.

Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.

If the flaps are extended, do not retract them until the airframe is clear of ice.

Report these weather conditions to Air Traffic Control.

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TABLE OF CONTENTS

SECTION 5

PERFORMANCE

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SECTION 5
PERFORMANCE

5.1 GENERAL

This section contains the required FAA performance information applicable to this aircraft. Additional information is provided for flight planning purposes.

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

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

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

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

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

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

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

WARNING

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

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning the 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 licensed at the factory has been entered in Figure 6-5. If any alterations to the airplane have been made effecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

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

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

(1) Basic Empty Weight	3122 lbs.
(2) Occupants (2 x 170 lbs.)	340 lbs.
(3) Baggage and Cargo	27 lbs.
(4) Fuel (6 lb./gal. x 80)	480 lbs.
(5) Takeoff Weight	3969 lbs.
(6) Landing Weight (a)(5) minus (g)(1), (3969 lbs. minus 355 lbs.)	3614 lbs.

The takeoff and landing weights are below the maximums and the weight and balance calculations have determined that the C.G. position is within the approved limits.

(b) Takeoff and Landing

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Accelerate and Stop Distance graphs (Figures 5-11 thru 5-17) to determine the length of runway necessary for the takeoff and/or the barrier distance.

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

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

	Departure Airport	Destination Airport
(1) Pressure Altitude	2000 ft.	3000 ft.
(2) Temperature	21°C	22°C
(3) Wind Component	9 KTS (Headwind)	10 KTS (Headwind)
(4) Runway Length Available	7400 ft.	9000 ft.
(5) Runway Required (Normal Procedure, Std. Brakes)		
Takeoff	1620 ft.*	
Accelerate and Stop	3032**	
Landing		2240 ft.***

NOTE

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

* reference Figure 5-15
** reference Figure 5-11
*** reference Figure 5-45

(c) Climb

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time and Distance to Climb graph (Figure 5-25). After the fuel, time and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to the graph (Figure 5-25). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

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

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

(1)	Cruise Pressure Altitude	16,500 ft.
(2)	Cruise OAT	-13°C
(3)	Time to Climb (12.5 min. minus 1.5 min.)	11 min*
(4)	Distance to Climb (22 naut. miles minus 2 naut. miles)	20 n.m.*
(5)	Fuel to Climb (12 gal. minus 1 gal.)	11Gal.*

* reference Figure 5-25

(d) Descent

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

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time and distance for descent (Figure 5-41). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time and distance values from the graph (Figure 5-41). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the flight plan.

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

(1) Time to Descend (16 min. minus 3 min.)	13 min.*
(2) Distance to Descend (44 naut. miles minus 7 naut. miles)	37 n.m.*
(3) Fuel to Descend (6 gal. minus 1 gal.)	5 Gal*

* reference Figure 5-41

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the 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 5-31).

Calculate the cruise fuel for the cruise power setting from the information provided on Figure 5-29.

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	394 n.m.
(2) Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (394 n.m. minus 20 n.m. miles minus 37 n.m.)	337 n.m.
(3) Cruise Power	Normal Cruise
(4) Cruise Speed	187 kts.*
(5) Cruise Fuel Consumption	Approx. 24 GPH**
(6) Cruise Time (e)(2) divided by (e)(4), (337 miles divided by 187 kts)	1.8 hr.
(7) Cruise Fuel (e)(5) multiplied by (e)(6), (24 GPH multiplied by 1.8 hr.)	43.2 gal.

* reference Figure 5-31
** reference Figure 5-29

(f) Total Flight Time

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

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

(1) Total Flight Time

(c)(3) plus (d)(1) plus (e)(6),	
(0.18 hrs. plus 0.22 plus 1.8 hr.)	2.2 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)(5) plus (d)(3) plus (e)(7),	
(11 gal. plus 5 gal. plus 43.2)	59.2 gal.
(59.2 gal. multiplied by 6 lb./gal.)	355.2 lb.

5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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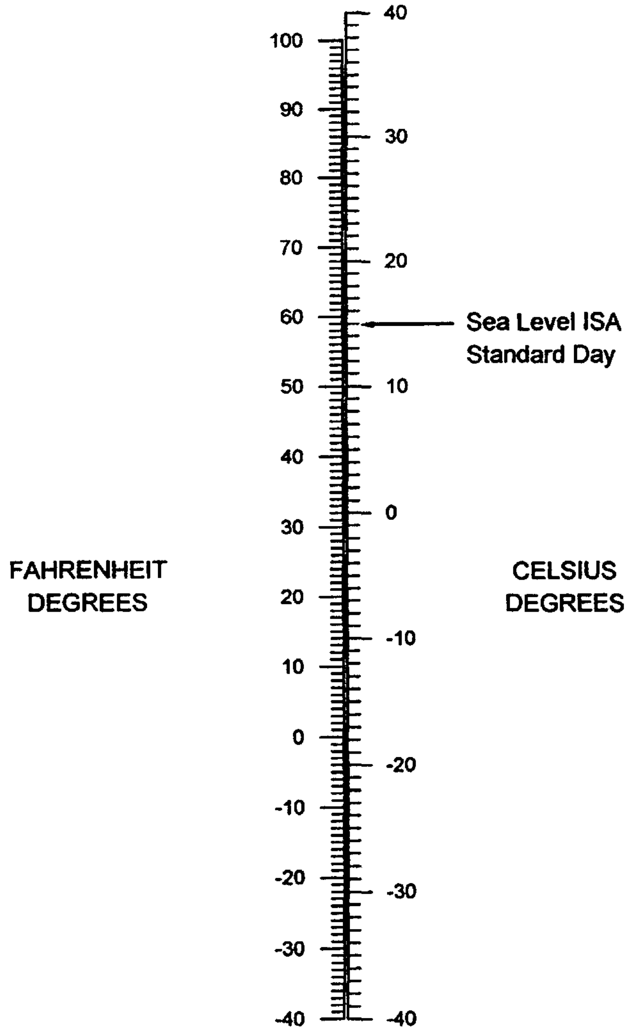
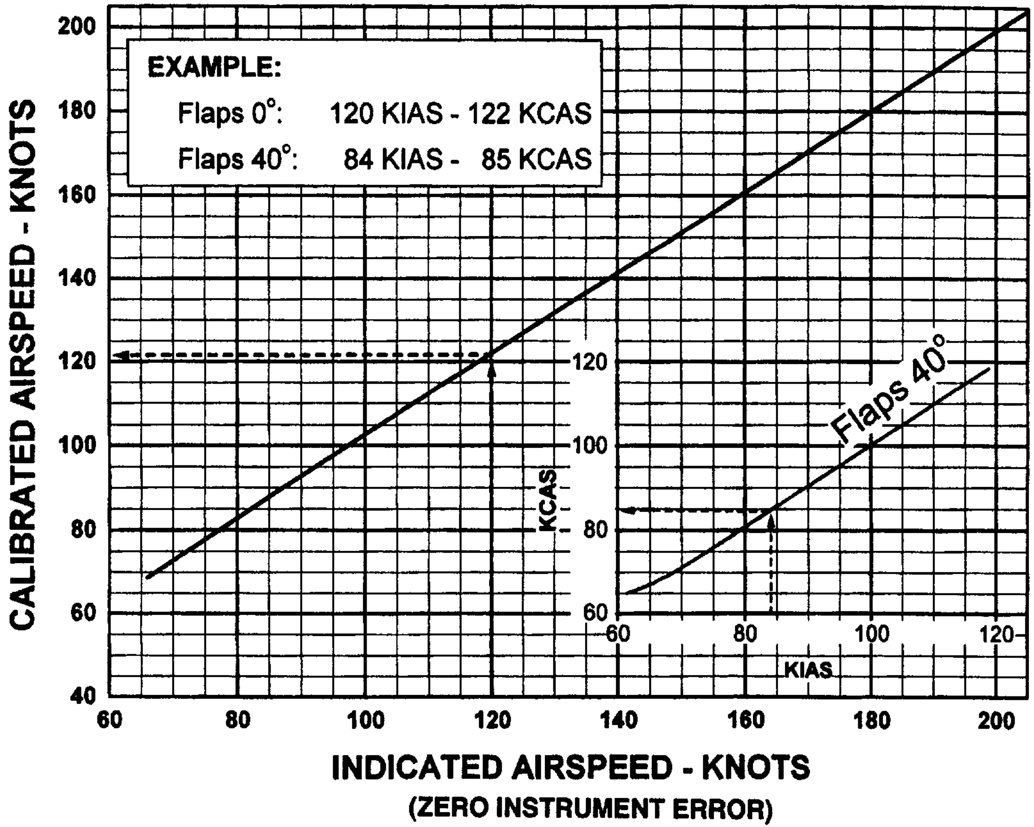
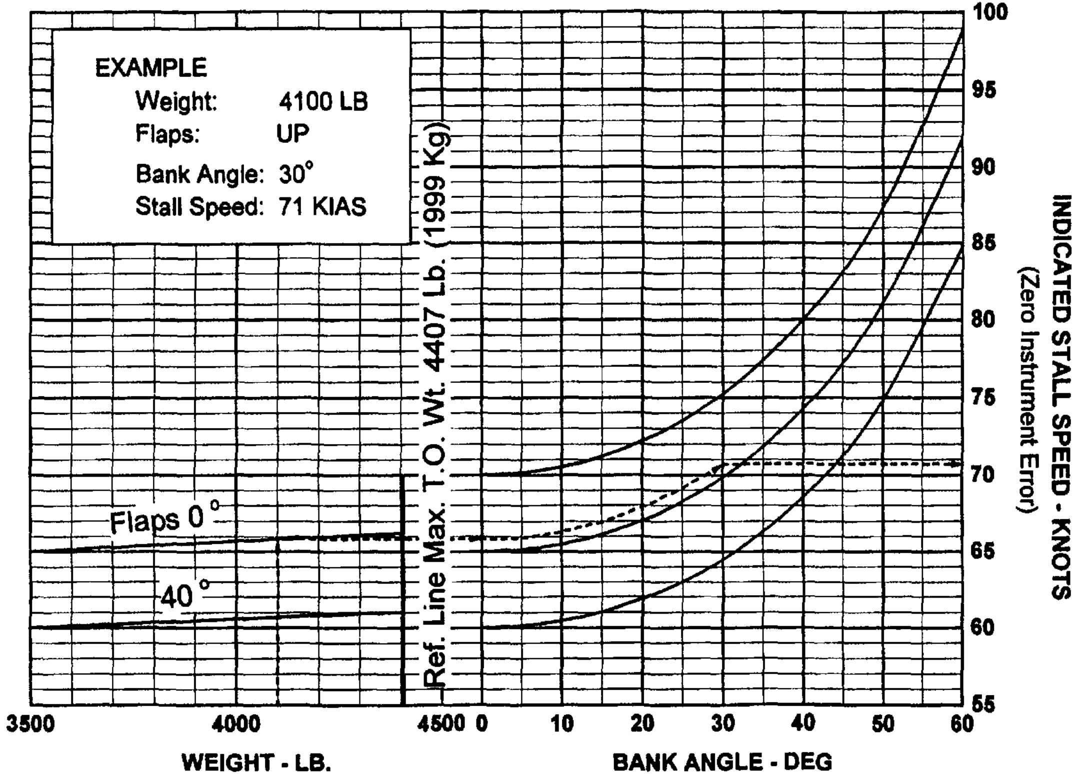


TEMPERATURE CONVERSION
Figure 5-1

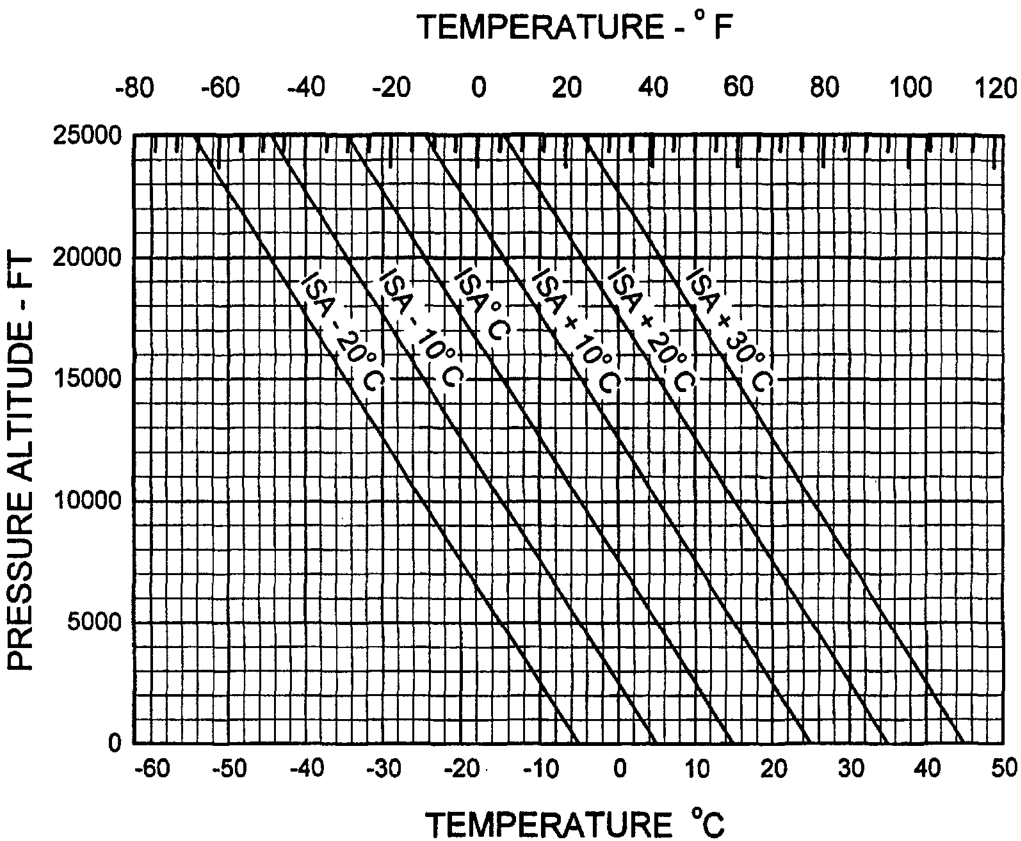


AIRSPEED CALIBRATION
Figure 5-3

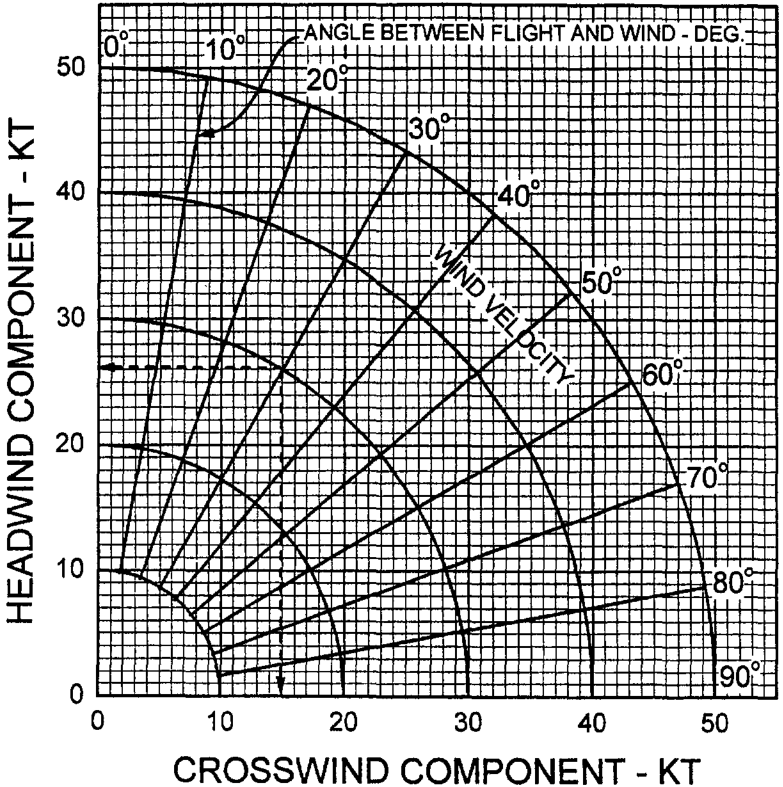
POWER OFF STALL SPEED



STALL SPEED VS. ANGLE OF BANK
Figure 5-5



ISA CONVERSION
Figure 5-7



EXAMPLE:

Wind Velocity:	30 Kt
Angle between flight path and wind:	30°
Headwind:	26 Kt
Crosswind:	15 Kt

WIND COMPONENTS
Figure 5-9

ACCELERATE STOP DISTANCE - 0° FLAPS

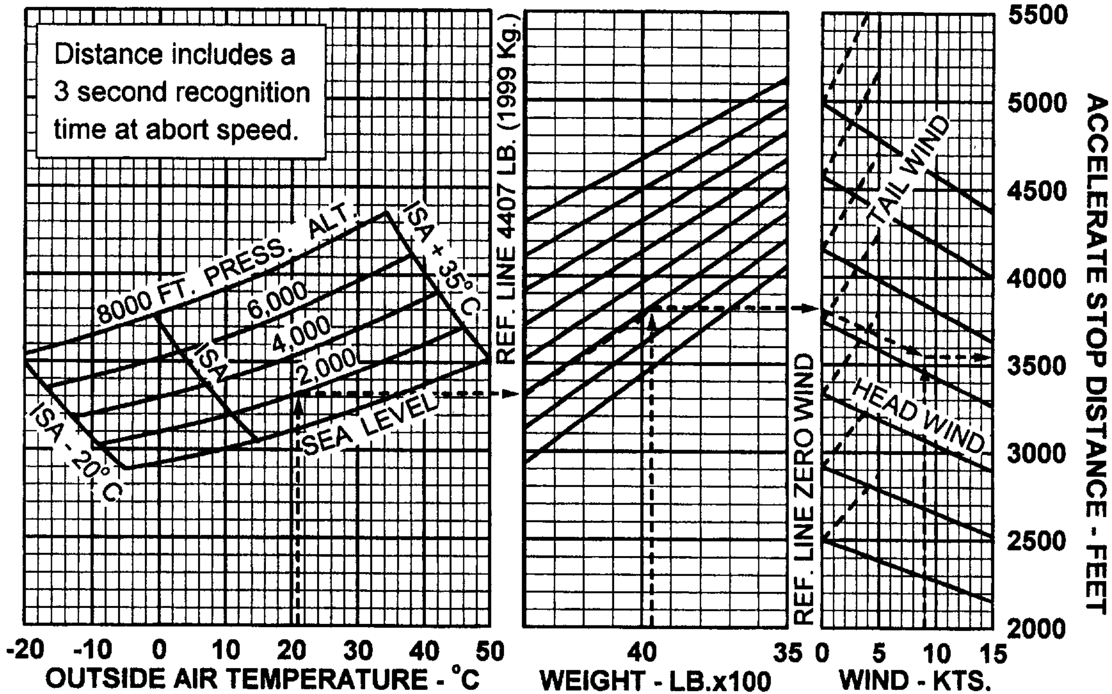
ASSOCIATED CONDITIONS:

Wing Flaps:	0°	Runway:	PAVED, LEVEL & DRY
Power:	2600 RPM	Abort Speed:	79 KIAS
	38 In. Hg. MAP	Braking:	MAXIMUM
	AT BRAKE RELEASE	Cowl Flaps	FULL OPEN

EXAMPLE

OAT:	21° C	Gross Wt.:	3969 LB
Press. Alt.:	2000 FT	Headwind:	9 KT

Accel / Stop Dist.: 3550 FT



ACCELERATE AND STOP DISTANCE - 0° FLAPS
Figure 5-11

ACCELERATE STOP DISTANCE - 25° FLAPS

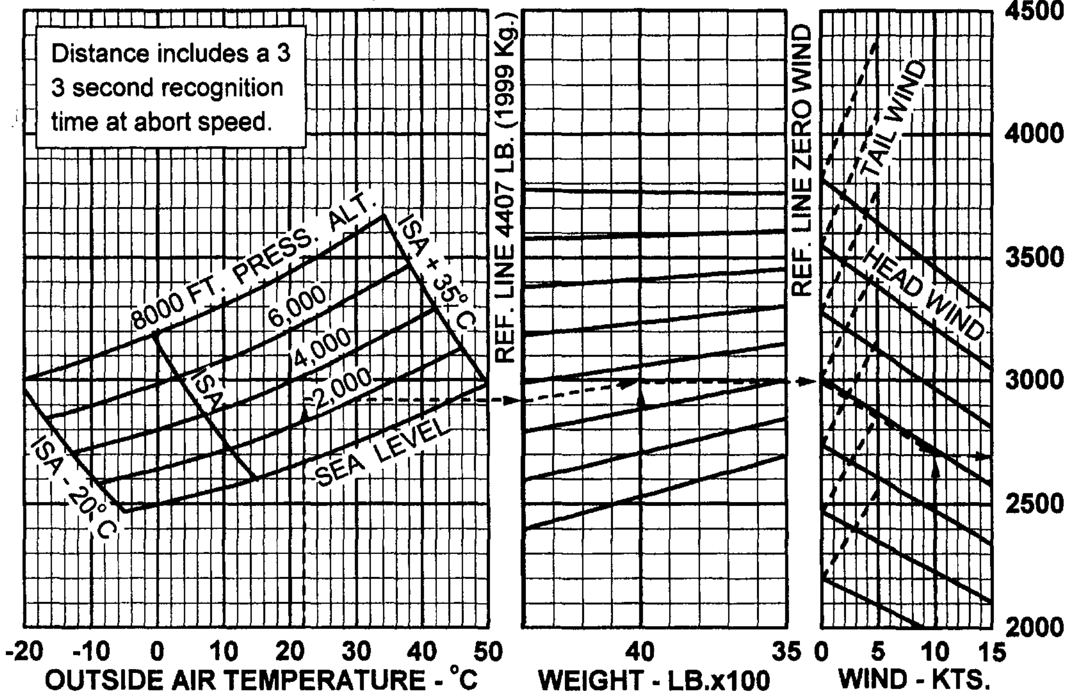
ASSOCIATED CONDITIONS:

Wing Flaps: 25°
Power: 2600 RPM
38 In. Hg. MAP
AT BRAKE RELEASE

Runway: PAVED, LEVEL & DRY
Abort Speed: 71 KIAS
Braking: MAXIMUM
Cowl Flaps FULL OPEN

EXAMPLE

OAT: 22° C
Gross Wt.: 4000 LB
Press. Alt.: 3000 FT
Headwind: 10 KT
Accel / Stop Dist.: 2700 FT



ACCELERATE AND STOP DISTANCE - 25° FLAPS
Figure 5-13

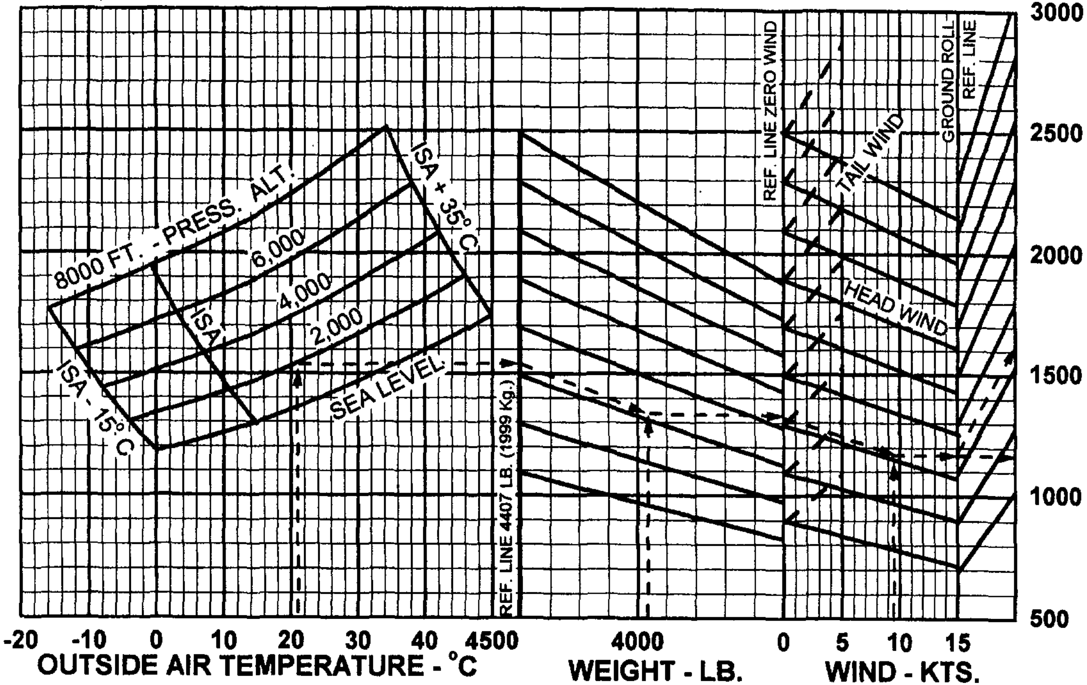
NORMAL PROCEDURE TAKEOFF - 0° FLAPS

ASSOCIATED CONDITIONS:

Wing Flaps: 0°
Cowl Flaps: FULL OPEN
Liftoff Speed: 79 KNOTS
Barrier Speed: 79 KNOTS
Runway: PAVED, LEVEL & DRY
Power: 2600 RPM
38 In. Hg. MAP
BEFORE BRAKE RELEASE

EXAMPLE:

O.A.T.: 21° C
Pressure Altitude: 2000 Ft.
Gross Weight: 3969 Lb.
Headwind: 9 Kt.
Takeoff Gr. Roll Dist.: 1170 Ft.
Takeoff Dist.: 1620 Ft.



NORMAL PROCEDURE TAKEOFF - 0° FLAPS
Figure 5-15

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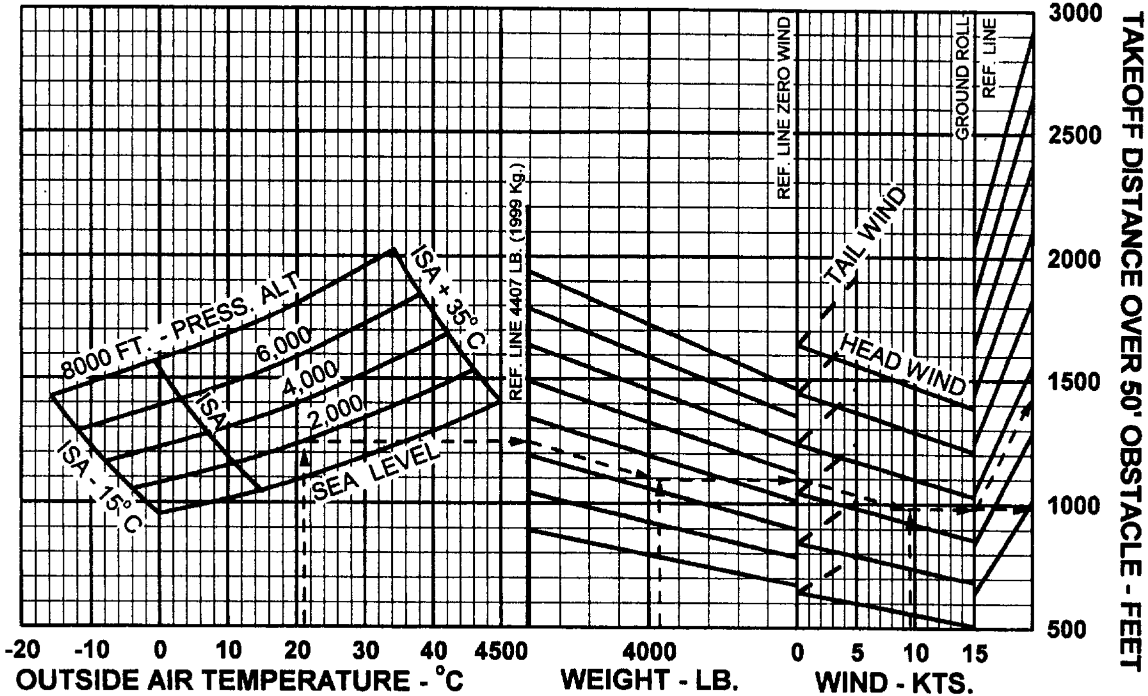
MAXIMUM EFFORT TAKEOFF - 25° FLAPS

ASSOCIATED CONDITIONS:

Wing Flaps: 25°
Cowl Flaps: FULL OPEN
Liftoff Speed: 71 KNOTS
Barrier Speed: 73 KNOTS
Runway: PAVED, LEVEL & DRY
Power: 2600 RPM
38 In. Hg. MAP
BEFORE BRAKE RELEASE

EXAMPLE:

O.A.T.: 21° C
Pressure Altitude: 2000 Ft.
Gross Weight: 3969 Lb.
Headwind: 9 Kt.
Takeoff Gr. Roll Dist.: 955 Ft.
Takeoff Dist.: 1430 Ft.



MAXIMUM EFFORT TAKEOFF - 25° FLAPS
Figure 5-17

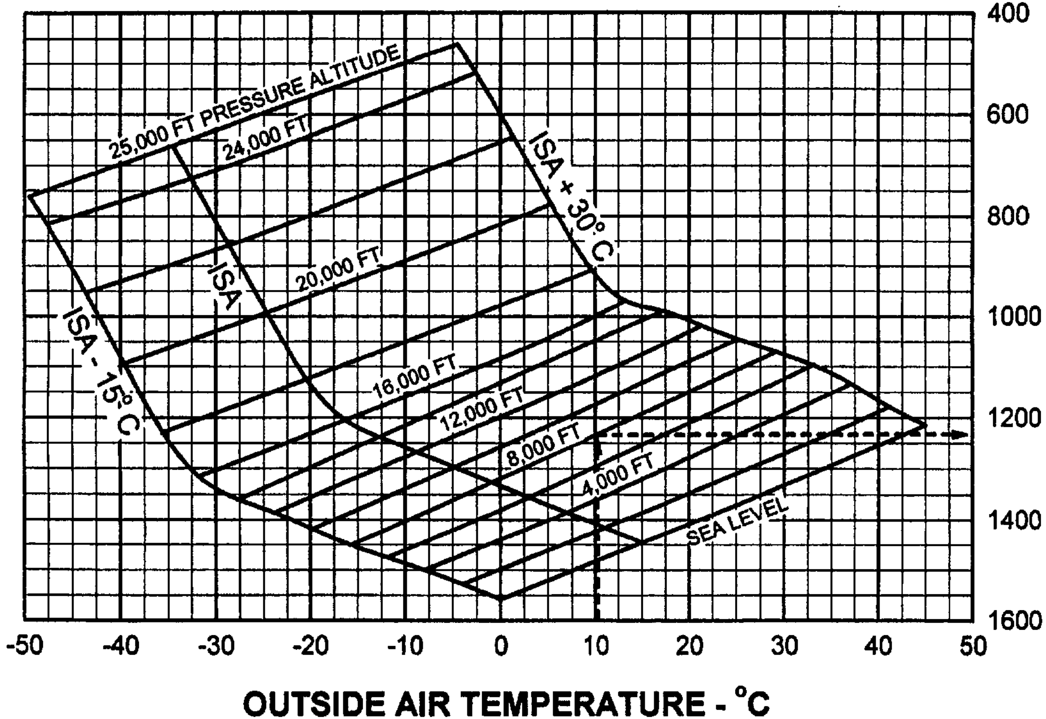
TAKEOFF CLIMB PERFORMANCE - GEAR DOWN, FLAPS 0°

ASSOCIATED CONDITIONS:

Gross Weight: 4407 LB
Wing Flaps: 0°
Cowl Flaps: FULL OPEN
Landing Gear: DOWN
Mixture: FULL RICH
Engines: BOTH OPERATING
Power: 2600 RPM
38 IN. HG. MAP
Airspeed: 88 KIAS

EXAMPLE:

OAT: 10° C
Pressure Altitude: 8000 FT.
Rate of Climb: 1233 FPM



TAKEOFF CLIMB PERFORMANCE
Figure 5-19

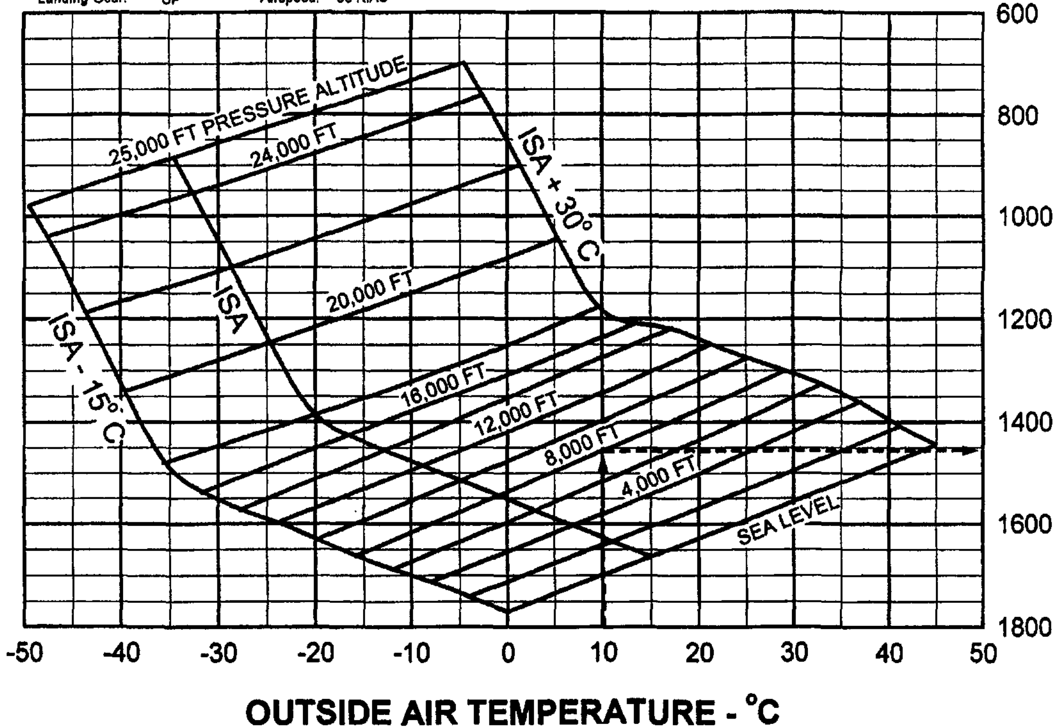
MULTI-ENGINE CLIMB PERFORMANCE - GEAR UP, FLAPS 0°

ASSOCIATED CONDITIONS:

Gross Weight:	1999 KG (4407 LB)	Mixture:	FULL RICH
		Engines:	BOTH OPERATING
Wing Flaps:	0°	Power:	2600 RPM
Cowl Flaps:	FULL OPEN		38 IN. HG. MAP
Landing Gear:	UP	Airspeed:	88 KIAS

EXAMPLE:

OAT:	10° C
Pressure Altitude:	8000 FT.
Rate of Climb:	1458 FPM



MULTI ENGINE CLIMB PERFORMANCE GEAR RETRACTED
Figure 5-21

SINGLE ENGINE CLIMB PERFORMANCE - GEAR UP, FLAPS 0°

ASSOCIATED CONDITIONS:

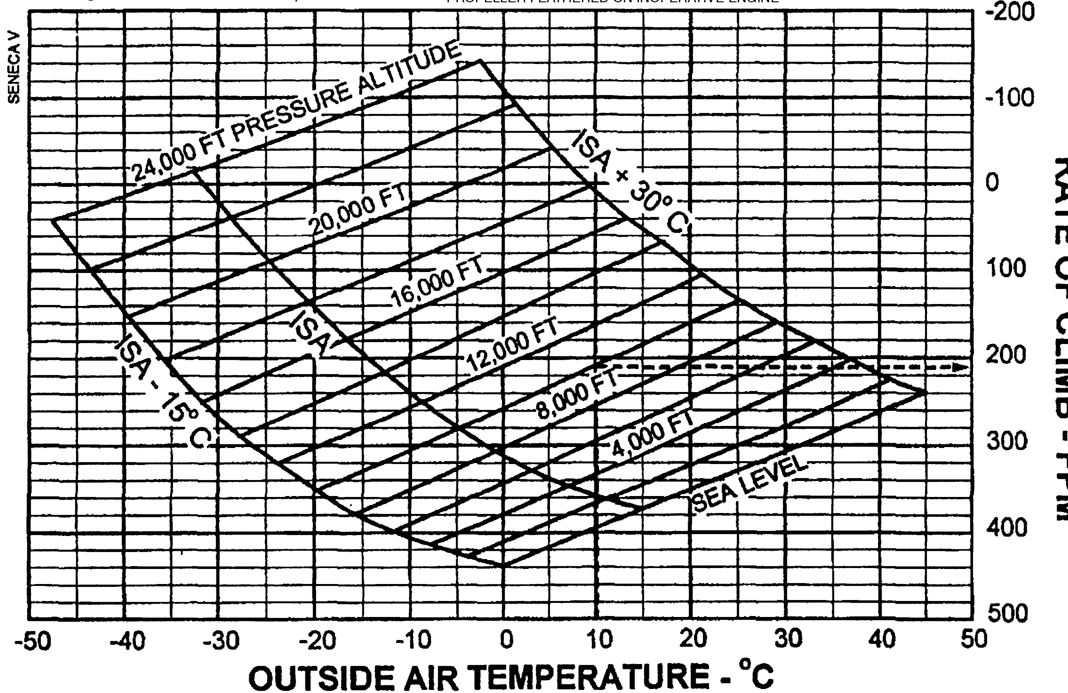
Gross Weight:	1999 KG (4407 LB)	Mixture:	FULL RICH
Wing Flaps:	0°	Engines:	ONE OPERATING
Cowl Flaps:	1/2 OPEN	Power:	2600 RPM 38 IN. HG. MAP
Landing Gear:	UP	Airspeed:	88 KIAS

NOTE:
3 to 5 degree bank into live engine is required to achieve indicated climb performance.

EXAMPLE:

OAT:	10° C
Pressure Altitude:	8000 FT.
Rate of Climb:	211 FPM

PROPELLER FEATHERED ON INOPERATIVE ENGINE



SINGLE ENGINE CLIMB PERFORMANCE GEAR RETRACTED
Figure 5-23

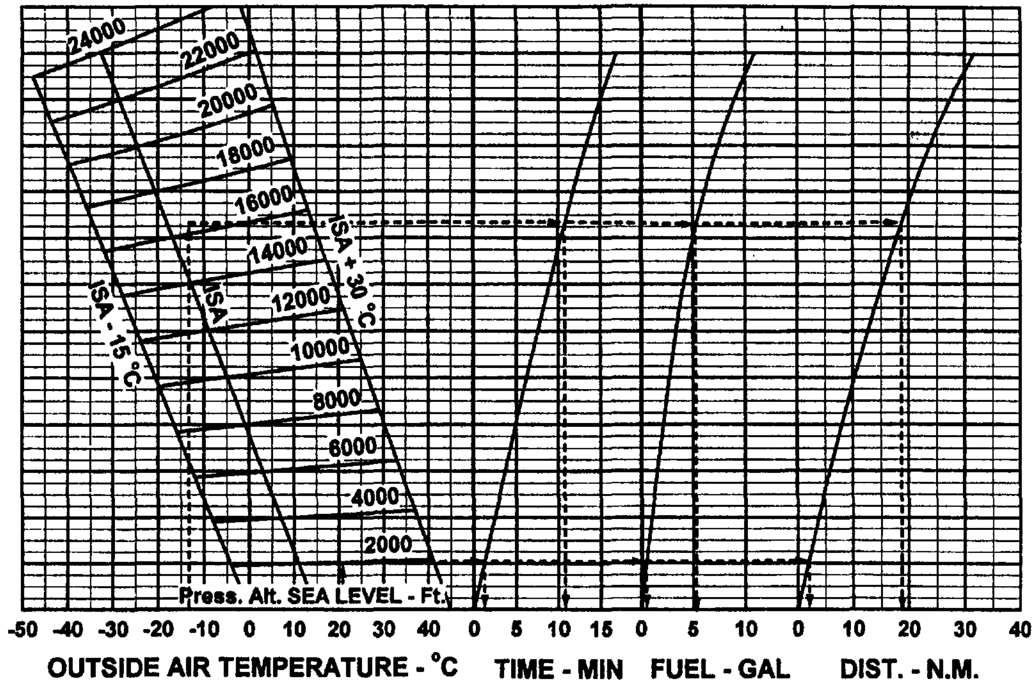
TIME, FUEL, DISTANCE TO CLIMB

ASSOCIATED CONDITIONS:

Gross Weight:	4407 LB	Power:	2600 RPM
Landing Gear:	UP		38 IN. HG. OR
Cowl flaps:	FULL OPEN		FULL THROTTLE
Climb Speed:	88 KIAS	Mixture:	FULL RICH

EXAMPLE:

Departure Airport O.A.T.:	21 °C	Time to Climb:	11 - 1	= 10 MIN
Departure airport Altitude:	2000 FT.	Fuel to Climb:	5.5 - 0.5	= 5 GAL
Cruise O.A.T.:	-13 °C	Distance to Climb:	19 - 2	= 17 N.M.
Cruise Altitude:	16,500 FT.			



TIME, FUEL AND DISTANCE TO CLIMB
Figure 5-25

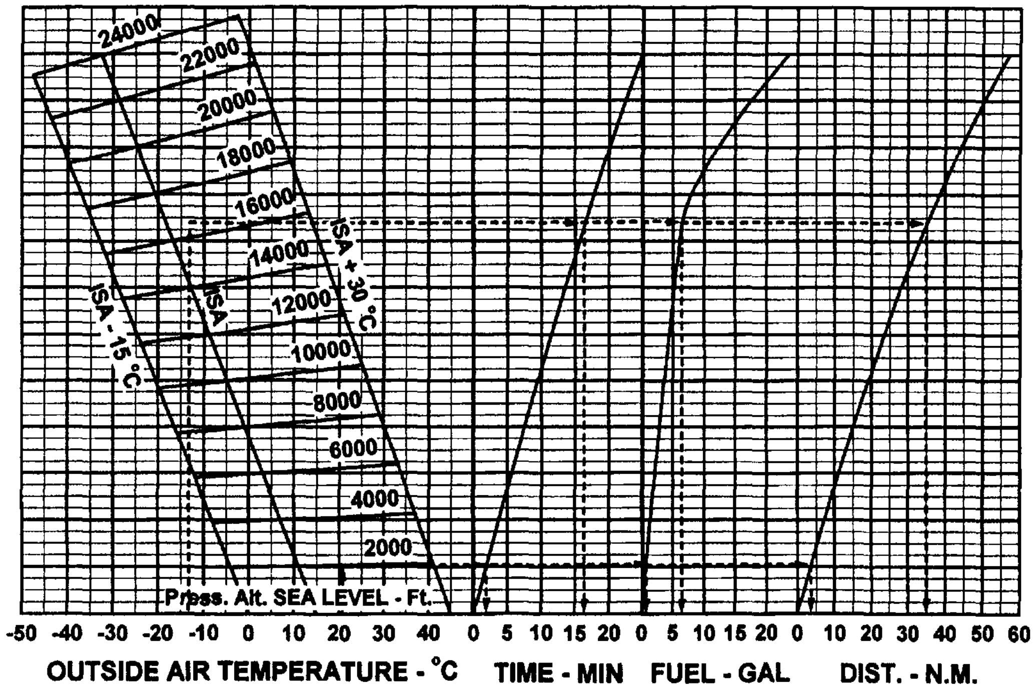
TIME, FUEL, DISTANCE TO CRUISE CLIMB

ASSOCIATED CONDITIONS:

Gross Weight:	4407 LB	Power:	2500 RPM
Landing Gear:	UP		32 IN. HG. OR
Cowl flaps:	1/2 OPEN	Mixture:	FULL RICH
Climb Speed:	110 KIAS		

EXAMPLE:

Departure Airport O.A.T.:	21 °C	Time to Climb:	16 - 2	= 14 MIN
Departure airport Altitude:	2000 FT.	Fuel to Climb:	6.5 - 0.5	= 6 GAL
Cruise O.A.T.:	-13 °C	Distance to Climb:	35 - 3	= 32 N.M.
Cruise Altitude:	16,500 FT.			



TIME, FUEL AND DISTANCE TO CRUISE CLIMB
Figure 5-27

POWER SETTING TABLE

	Pressure Altitude	RPM	Manifold Pressure	Approximate Fuel Flow	Turbine Inlet Temperature
High Speed Cruise	Above 23,000 Ft.	2500	29" Hg	26 GPH	Lean to Peak *Not to Exceed 1650° F
	Below 23,000 Ft.	2500	30" Hg	28 GPH	
Normal Cruise	Above 20,000 Ft.	2500	28" Hg	24 GPH	
	Below 20,000 Ft.	2400	29" Hg		
	Below 20,000 Ft.	2300	30" Hg		
Economy Cruise	Above 20,000 Ft.	2400	26" Hg	22 GPH	
	Below 20,000 Ft.	2300	27" Hg		
	Below 20,000 Ft.	2200	28" Hg		
Long Range Cruise	Below 23,000 Ft.	2200	25" Hg	18 GPH	

*Permissable to lean to 1700° F for up to 60 sec. in order to determine peak TIT.

Note:
The fuel flows shown are approximate. Fuel flows may vary ±1 GPH depending upon altitude and outside air temperature.

POWER SETTING TABLE
Figure 5-29

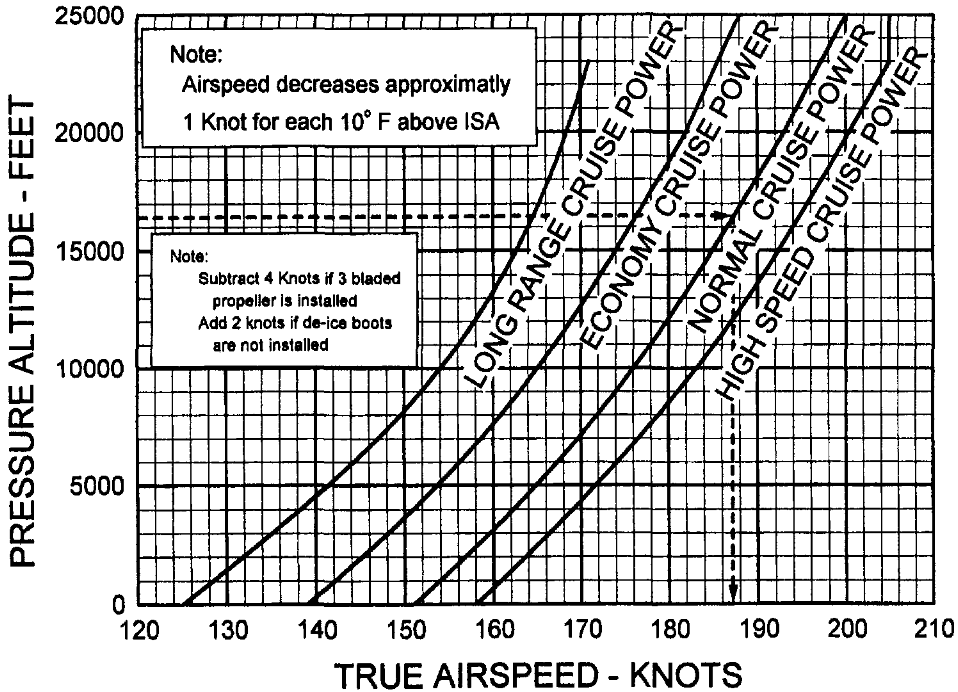
ISA DAY SPEED POWER

ASSOCIATED CONDITIONS:

Cowl Flaps:	CLOSED	Mixture:	PEAK TIT
Landing Gear:	UP	Gross Weight:	1999 KG
Wing Flaps:	0°		(4407 LB)

EXAMPLE:

O.A.T:	-13°C
Pressure Altitude:	16,500 Ft
Power:	Normal Cruise
True Airspeed:	187 KTAS



SPEED POWER
Figure 5-31

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ISA RANGE - 122 GAL USABLE

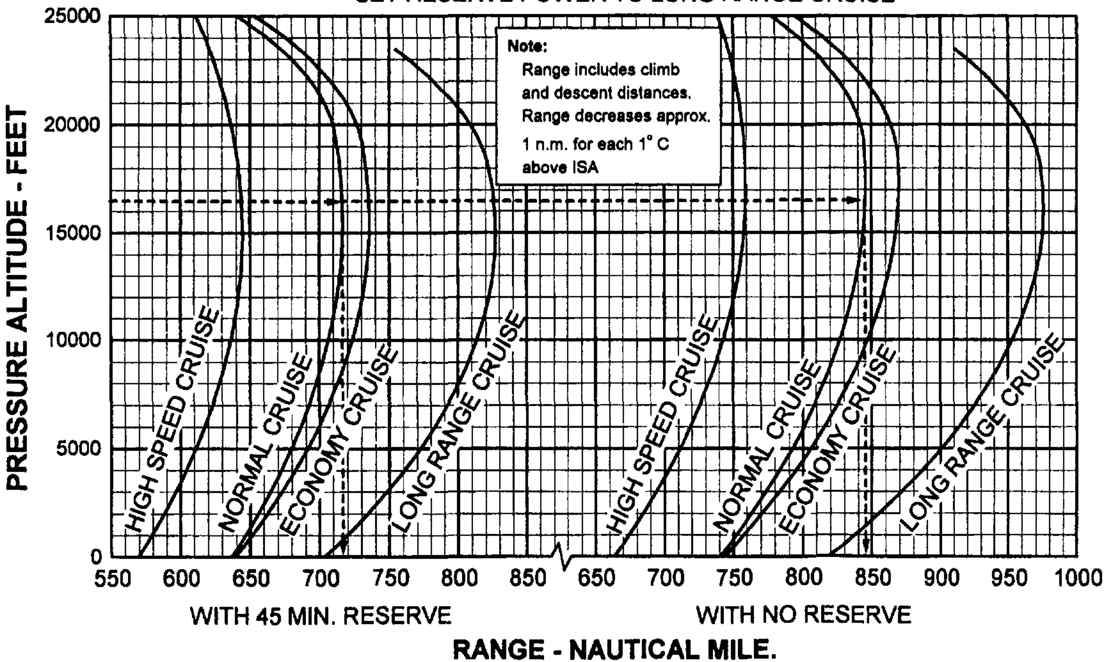
ASSOCIATED CONDITIONS:

Usable Fuel:	122 GAL	Wing Flaps:	0°
Gross Wt.:	1999 KG LB (4407 LB)	Climb Power:	M.C.P.
		Descent:	1000 FPM @ 145 KIAS
Landing Gear:	UP	Wind:	NONE
Cowl Flaps:	CLOSED	Mixture:	PEAK TIT

EXAMPLE:

Cruise Altitude:	16,500 FT
Power:	NORMAL CRUISE
Range W/ Reserves:	716 N.M.
Range W/O Reserves:	845 N.M.

SET RESERVE POWER TO LONG RANGE CRUISE



STANDARD TEMPERATURE RANGE - 122 GALLONS USABLE
Figure 5-35

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ENDURANCE - 122 GAL USABLE

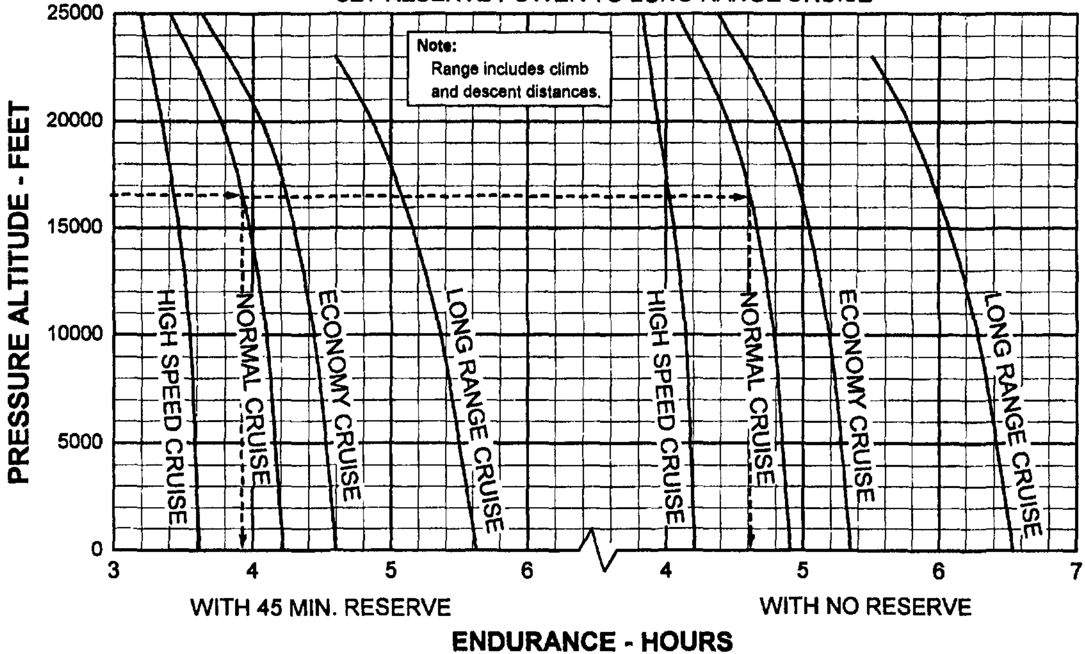
ASSOCIATED CONDITIONS:

Usable Fuel:	122 GAL	Wing Flaps:	0°
Gross Wt.:	1999 KG (4407) LB	Climb Power:	M.C.P
		Descent:	1000 FPM @ 145 KIAS
Landing Gear:	UP	Wind:	NONE
Cowl Flaps:	CLOSED	Mixture:	PEAK TIT

EXAMPLE:

Cruise Altitude:	16,500 FT
Power:	NORMAL CRUISE
Endurance W/ Reserves:	3.9 HR.
Endurance W/O Reserves:	4.6 HR.

SET RESERVE POWER TO LONG RANGE CRUISE



ENDURANCE - 122 GALLONS USABLE
Figure 5-39

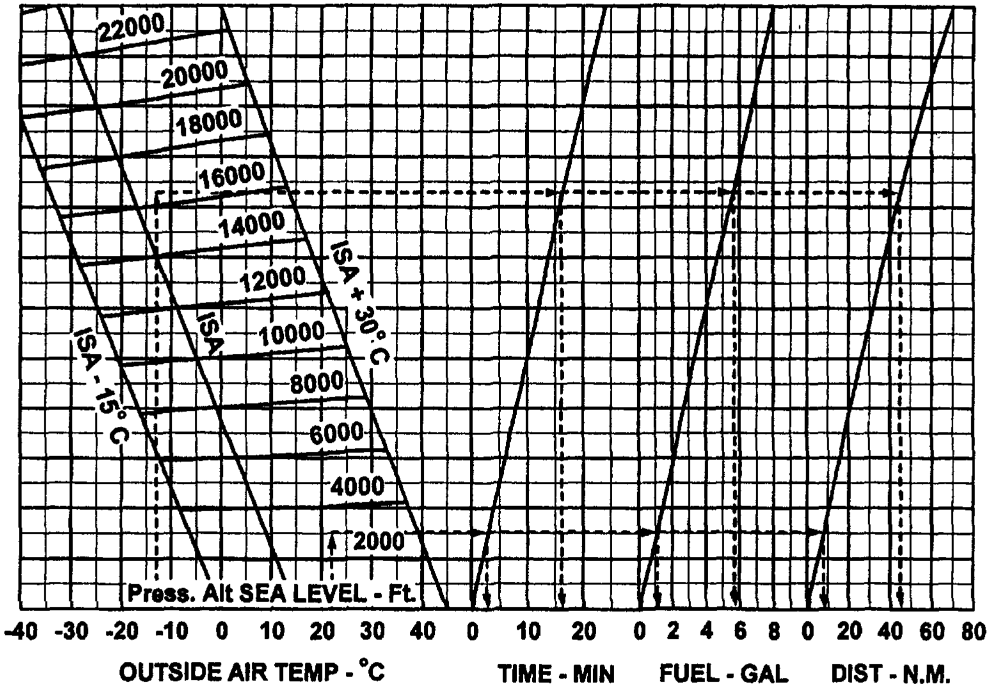
TIME, FUEL, DISTANCE TO DESCEND

ASSOCIATED CONDITIONS:

Airspeed: 145 KIAS Landing Gear: UP
Descent: 1000 FPM Wing Flaps: 0°
Wind: NONE

EXAMPLE:

Cruise O.A.T.:	-13 °C	Fuel to Descend:	6 - 1 = 5 GAL
Cruise Altitude:	16,500 FT.	Time to Descend:	16 - 3 = 13 MIN
Destination Airport O.A.T.:	22 °C	Distance to Descend:	44 - 7 = 37 N.M.
Destination Airport Altitude:	3000 FT.		



FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-41

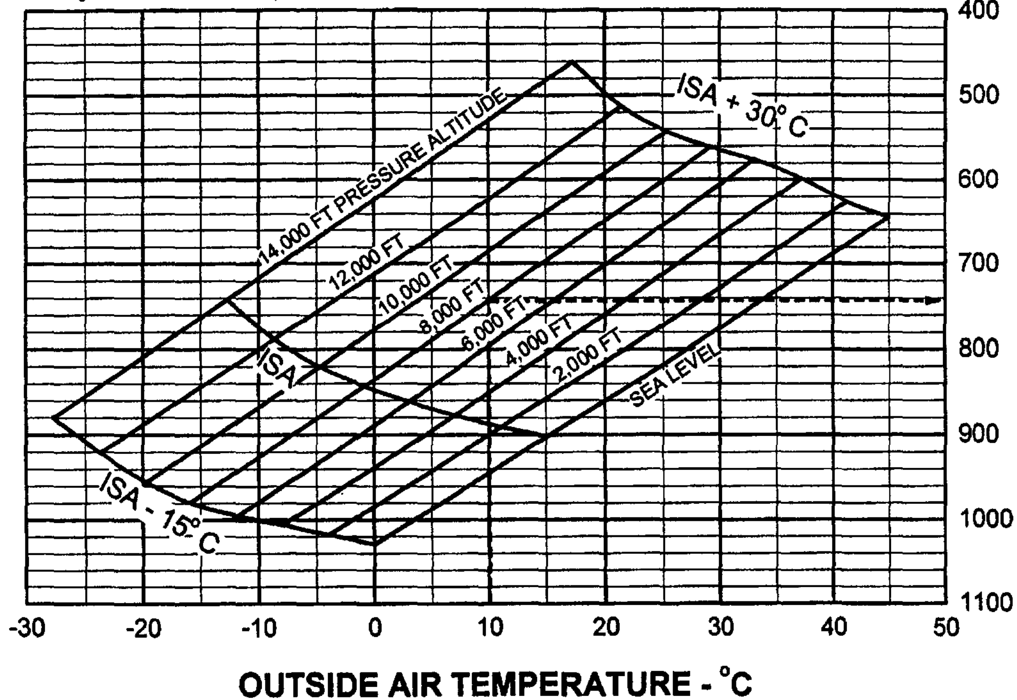
BALKED LANDING CLIMB PERFORMANCE - GEAR DOWN, FLAPS 40°

ASSOCIATED CONDITIONS:

Gross Weight:	1999 KG (4407 LB)	Mixture:	FULL RICH
		Engines:	BOTH OPERATING
Wing Flaps:	40°	Power:	2600 RPM
Cowl Flaps:	1/2 OPEN		38 IN. HG. MAP
Landing Gear:	DOWN	Airspeed:	90 KIAS

EXAMPLE:

OAT:	10° C
Pressure Altitude:	8000 FT.
Rate of Climb:	742 FPM



BALKED LANDING CLIMB PERFORMANCE
Figure 5-43

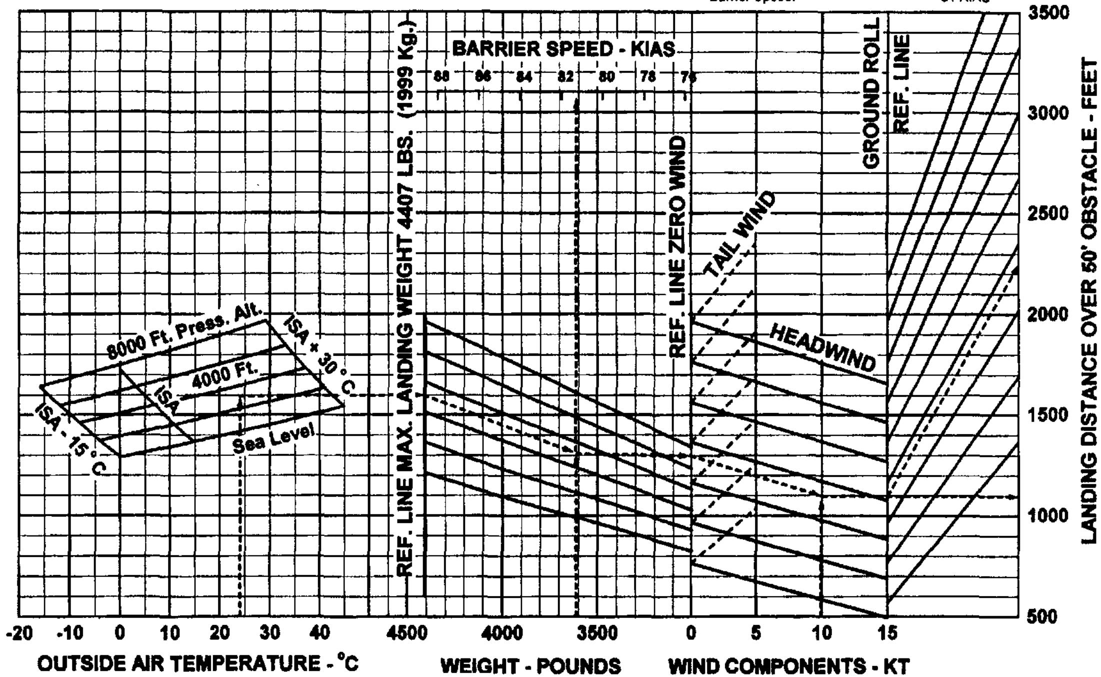
NORMAL PROCEDURE LANDING - FLAPS 40°

ASSOCIATED CONDITIONS:

Both Throttles:	CLOSED
Touchdown:	FULL STALL
Braking:	MAXIMUM
Runway:	PAVED, LEVEL & DRY

EXAMPLE:

O.A.T.:	22°C
Pressure Altitude:	3000 Ft.
Gross Weight:	3614 Lb.
Headwind:	10 Kt.
Landing Ground Roll distance:	1095 Ft.
Landing Distance Over 50 Ft. Barrier:	2240 Ft.
Barrier Speed:	81 KIAS



NORMAL PROCEDURE LANDING - 40° FLAPS
Figure 5-45

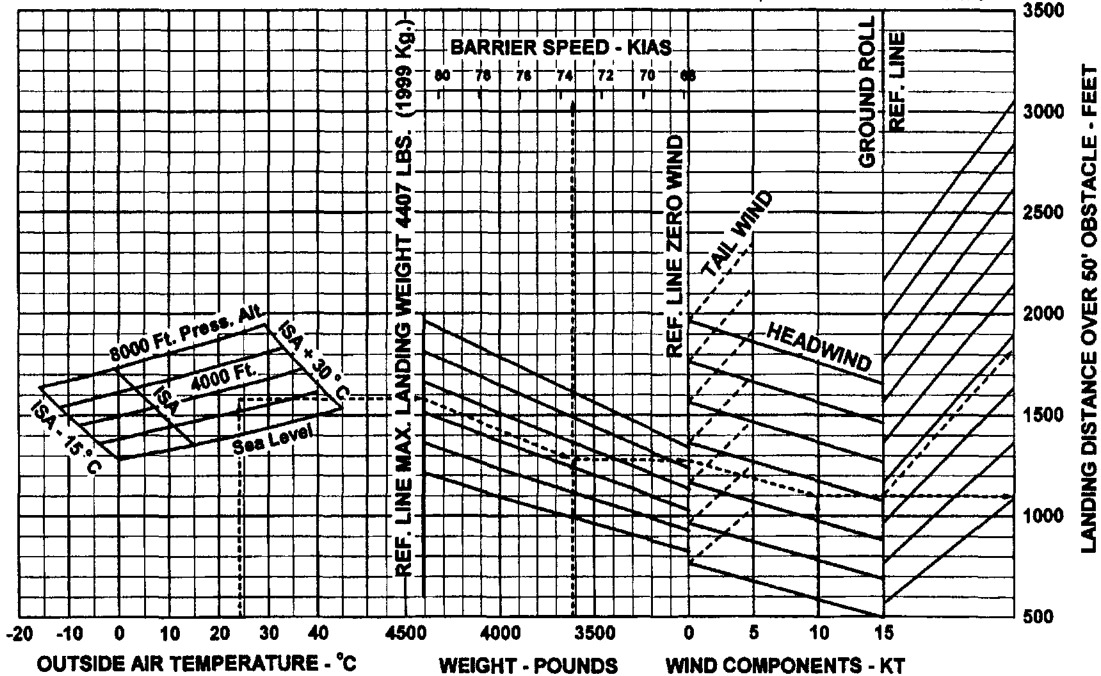
SHORT FIELD LANDING - FLAPS 40°

ASSOCIATED CONDITIONS:

Both Throttles:	CLOSED
Touchdown:	FULL STALL
Braking:	MAXIMUM
Runway:	PAVED, LEVEL & DRY

EXAMPLE:

O.A.T.:	22°C
Pressure Altitude:	3000 Ft.
Gross Weight:	3614 Lb.
Headwind:	10 Kt.
Landing Ground Roll distance:	1100 Ft.
Landing Distance Over 50 Ft. Barrier:	1828 Ft.
Barrier Speed:	73 KIAS



SHORT FIELD LANDING PROCEDURE- 40° FLAPS
Figure 5-47

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TABLE OF CONTENTS

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 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. Before the airplane is licensed, 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 easily 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 (Cont)

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 the C.G. within allowable limits. Check calculations prior to adding fuel to ensure against improper loading.

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

6.3 AIRPLANE WEIGHING PROCEDURES

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

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

(a) Preparation

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

(2) Remove excessive dirt, grease, moisture, 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 (6.0 gallons total, 3.0 gallons each wing).

(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 all entrance and baggage doors 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 the brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

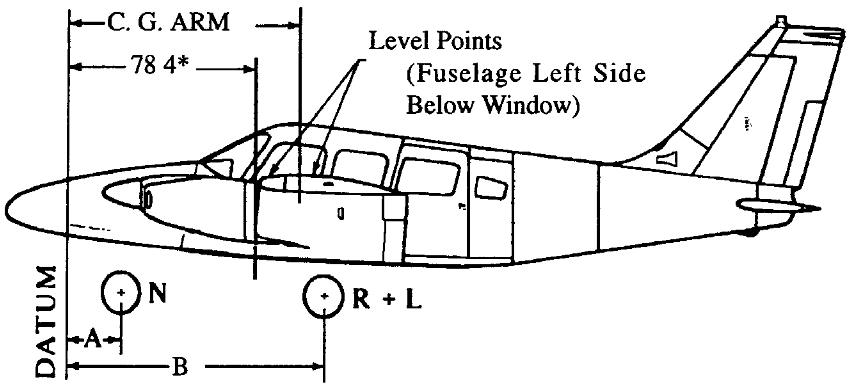
Scale Position and Symbol	Scale Reading	Tare	Net Weight
Nose Wheel	(N)		
Right Main Wheel	(R)		
Left Main Wheel	(L)		
Basic Empty Weight, as Weighed	(T)		

WEIGHING FORM
Figure 6-1

6.3 AIRPLANE WEIGHING PROCEDURES (Cont)

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-34-220T airplane when it is level. Refer to Leveling paragraph 6.3 (b).



A = 25.3
B = 109.8

*The datum is 78.4 inches ahead of the wing leading edge at the inboard edge of the inboard fuel tank.

LEVELING DIAGRAM
Figure 6-3

(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:

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

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

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

The basic empty weight of the airplane as licensed at 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-34-220T, SENECA V

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 6.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD-- NORMAL CATEGORY OPERATION

(Ramp Weight)** - (Basic Empty Weight) = Useful Load

(4430 lbs.) - (lbs.) = lbs.

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

** Includes fuel allowances for start-up, taxi and run-up (23 lbs.).

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-34-220T		Serial Number		Registration Number			Page Number	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt.	Arm	Moment /100	Wt.	Moment /100
		As licensed						

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-34-220T		Serial Number		Registration Number			Page Number	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt.	Arm	Moment /100	Wt.	Moment /100

WEIGHT AND BALANCE RECORD (cont)
Figure 6-7 (cont)

6.7 GENERAL LOADING RECOMMENDATIONS

The following general loading recommendation is intended only as a guide. The charts, graphs, and instructions should be checked to assure the airplane is within the allowable weight vs. center of gravity envelope.

STANDARD 5 SEAT AND CONSOLE CONFIGURATION:

(a) Pilot Only
Load rear baggage compartment to capacity first. Without aft baggage, fuel load may be limited by forward envelope for some combinations of optional equipment.

(b) 2 Occupants - Pilot and Passenger in Front
Load rear baggage compartment to capacity first. Without aft baggage, fuel load may be limited by forward envelope for some combinations of optional equipment.

(c) 3 Occupants - 2 in front, 1 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by forward envelope. Without aft baggage, fuel may be limited by forward envelope for some combinations of optional equipment.

(d) 4 Occupants - 2 in front, 1 in middle, 1 in rear
Investigation is required to determine optimum location for baggage.

(e) 4 Occupants - 2 in front, 2 in rear
Investigation is required to determine optimum location for baggage.

(f) 5 Occupants - 2 in front, 1 in middle, 2 in rear
With 5 occupants the aft passengers, weight, fuel and baggage may be limited by envelope. Investigation is required to determine optimum location for baggage. Note placard if installed.

OPTIONAL SIX SEAT CONFIGURATION:

(g) 4 Occupants - 2 in front, 2 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by forward envelope. Without aft baggage, fuel load may be limited by forward envelope for some combinations of optional equipment.

(h) 5 Occupants - 2 in front, 2 in middle, 1 in rear
Investigation is required to determine optimum location for baggage.

6.7 GENERAL LOADING RECOMMENDATIONS (Cont)

(i) 5 Occupants - 1 in front, 2 in middle, 2 in rear
Load forward baggage compartment to capacity first. Aft baggage and/or fuel load may be limited by aft envelope.

(j) 6 Occupants - 2 in front, 2 in middle, 2 in rear
With six occupants, the aft passengers weight, fuel and baggage may be limited by envelope. Investigation is required to determine optimum location for baggage. Note placard if installed.

For all airplane configurations, it is the responsibility of the pilot in command to make sure that the airplane always remains within the allowable weight vs. center of gravity envelope while in flight.

6.9 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.

NOTES

Actual fuel allowance for start-up, taxi and run-up (23 lbs. max.) should be determined based on local operating condition.

Moment due to gear retraction does not significantly affect C.G. location.

	Weight (Lbs.)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	3212	88.5	284262
Pilot and Front Passenger	340	85.5	29070
Passengers (Center Seats) (Aft Facing)		119.1	
Passengers (Rear Seats)	340	157.6	53584
Baggage (Forward) (100 Lbs. Max.)	58	22.5	1305
Baggage (Aft) (85 Lbs. Max.)		178.7	
Zero Fuel Weight	3950	93.2	368221
Fuel (122 Gal. Max.)	480	93.6	44928
Ramp Weight (4430 Lbs. Max.)	4430	93.3	413149
Fuel Allowance for Start, Taxi Runup	-23	93.6	-2153
Takeoff Weight (4407 Lbs. Max.)	4407	93.3	410996

The center of gravity (C.G.) of this sample loading problem is at 93.3 inches aft of the datum line. Locate this point (93.3) 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.

Takeoff Weight (4407 Lbs. Max.)	4407	93.3	410996
Minus Estimated Fuel Burnoff	-450	93.6	-42120
Landing Weight (4407 Lbs. Max.)	3957	93.2	368876

Locate the center of gravity for 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.

SAMPLE LOADING PROBLEM
Figure 6-9

	Weight (Lbs.)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		85.5	
Passengers (Center Seats) (Aft Facing)		119.1	
Passengers (Rear Seats)		157.6	
Baggage (Forward) (100 Lbs. Max.)		22.5	
Baggage (Aft) (85 Lbs. Max.)		178.7	
Zero Fuel Weight			
Fuel (122 Gal. Max.)		93.6	
Ramp Weight (4430 Lbs. Max.)			
Fuel Allowance for Start, Taxi Runup	-23	93.6	-2153
Takeoff Weight (4407 Lbs. Max.)			

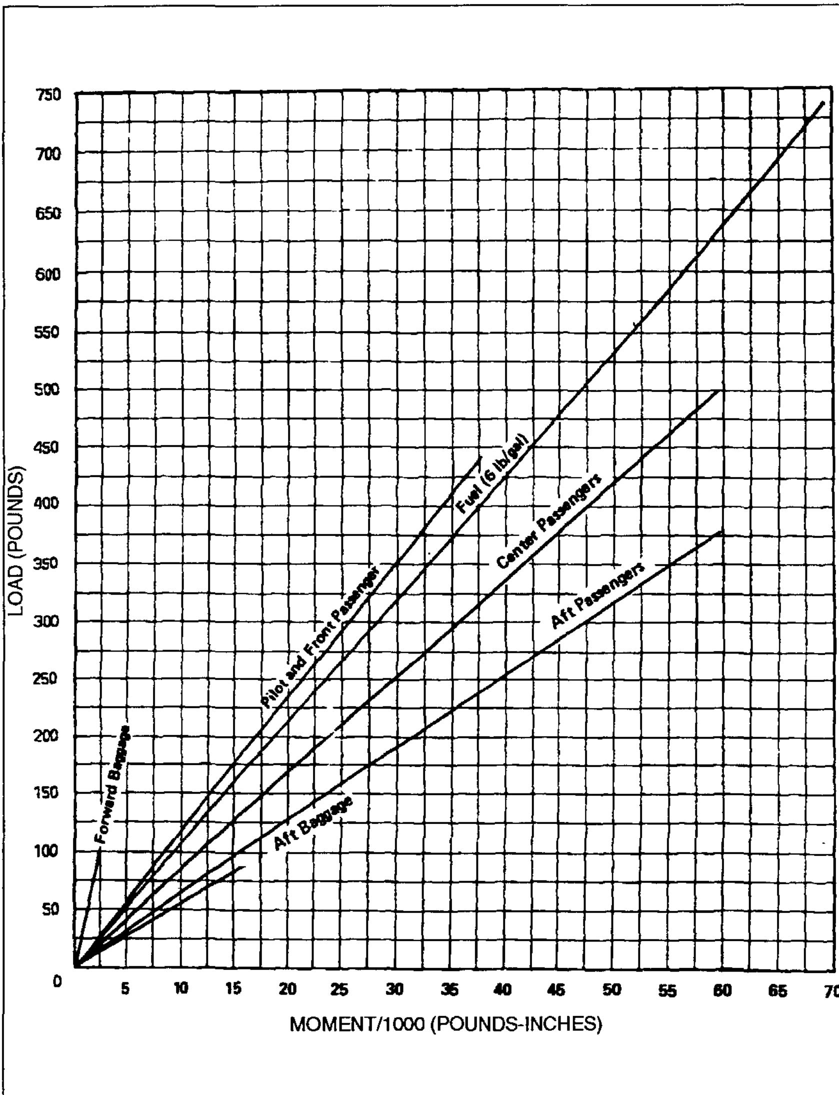
The center of gravity (C.G.) for the takeoff weight of the actual loading problem is at _______ inches aft of the datum line. Locate this point (_____) on the C.G. range and weight graph. If this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Takeoff Weight (4407 Lbs. Max.)			
Minus Estimated Fuel Burnoff		93.6	
Landing Weight (4407 Lbs. Max.)			

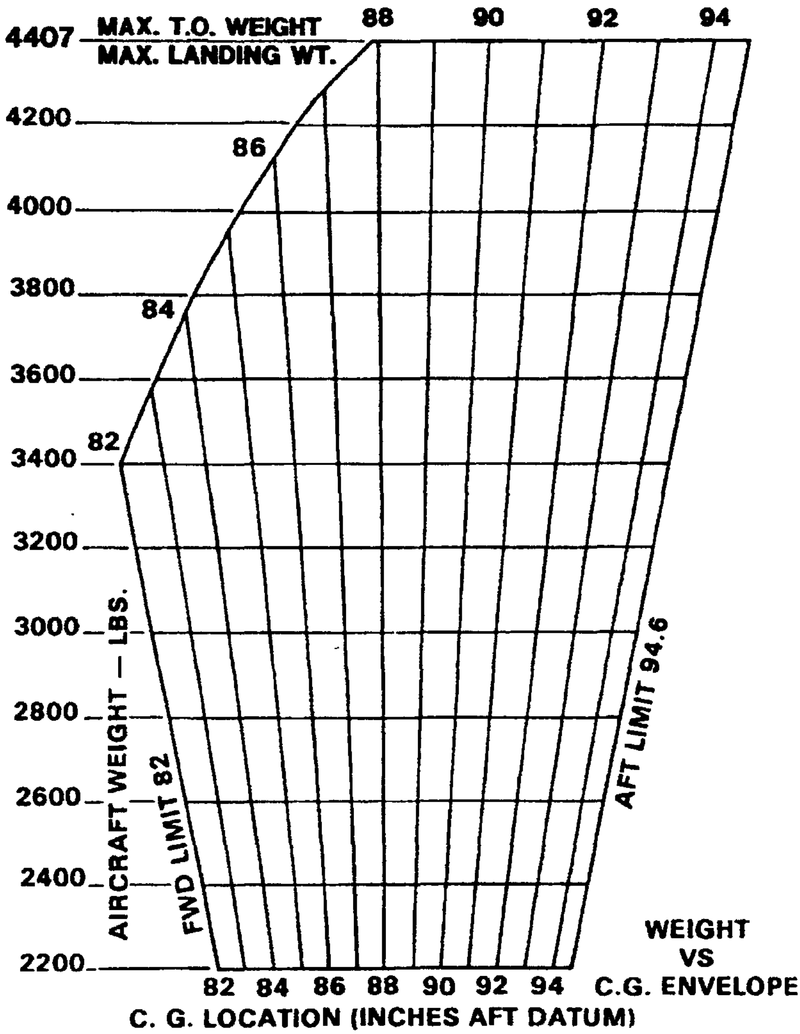
Locate the center of gravity for the landing weight on the C.G. range and weight graph. If this point falls within the weight C.G. envelope, the loading may be assumed acceptable for landing

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

WEIGHT AND BALANCE LOADING FORM
Figure 6-11



LOADING GRAPH
Figure 6-13



Moment change due to retracting Landing Gear = -32 in. - lbs.

C.G. RANGE AND WEIGHT
Figure 6-15

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The SENECA V is a twin-engine, all metal, retractable landing gear, turbocharged airplane. It has seating for up to six occupants, (1) one hundred pound luggage compartments located in the nose, and (1) eighty-five pound luggage area aft of the rear seats.

7.3 AIRFRAME

The basic airframe is of aluminum alloy with steel engine mounts and landing gear and thermo-plastic or fiberglass fairings. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure. There is a front door on the right side and a rear door on the left. A cargo door is installed aft of the rear passenger door. Both rear doors may be opened for loading large pieces of cargo. A door on the left side of the nose section gives access to the nose section baggage compartment.

The wing is of a conventional design and employs a laminar flow NACA 652-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the center seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. Each wing contains three fuel tanks as standard equipment. The tanks on one side are filled through a single filler neck located well outboard of the engine nacelle.

7.3 AIRFRAME (Cont)

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

7.5 ENGINES AND PROPELLERS

Engines

The Seneca V is powered by two Teledyne Continental Motors L/TSIO-360-RB engines. They are direct drive, horizontally opposed, fuel injected, air cooled. turbocharged-aftercooled with the variable wastegate, variable-absolute control system. Maximum continuous rated power is 220 horsepower at 2600 RPM and 38 inches Hg. manifold pressure.

Accessories normally installed include a belt-driven alternator, a propeller governor, two magnetos, an oil filter, a starter, one gear-driven vacuum pump and a belt-driven air conditioning compressor. (TSIO-360-RB only)

The engines are equipped with engine mounted 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 is eliminated by the counter-rotation of the engines, the left engine rotating in a clockwise direction when viewed from the cockpit, and the right engine rotating counterclockwise.

The engine oil dipstick is accessible through an access door on the top of the engine cowling. The oil dipsticks are not interchangeable from one engine to the other.

The engine is accessible through a removable four piece fiberglass engine cowling. Engine mounts are constructed of steel tubing, and a fully focalized bed type dynafocal configuration is incorporated to reduce vibration.

Turbocharger

Turbocharging is accomplished by an Allied Signal Garrett turbocompressor. Turbochargers extract energy from engine cylinder exhaust gases and use this energy to compress engine induction air. This allows the engine to maintain rated power at altitude. When engine induction air is compressed by the turbocharger, the air temperature is increased. The elevated air temperature is reduced by an air aftercooler located between the compressor and the throttle. This aids in engine cooling and improves engine power and efficiency.

The turbocharger extracts exhaust energy from the cylinders to pressurize the induction air. Air flows through a flush inlet located on the right side of the lower cowling and into an induction air box, where it is filtered and then passes on to the turbo compressor. At the compressor, air pressure and temperature are increased. Pressure increases air density making a greater mass of air available to the engine cylinders on the intake stroke. Air then flows through an aftercooler where air temperature is reduced, further increasing the density of air available to the cylinder. Downstream of the aftercooler, induction air flows across the throttle butterfly valve into individual intake tubes flowing to each cylinder. Metered fuel is injected into the cylinder head, upstream of the intake valve. After the fuel burns in the cylinder, exhaust gases flow into the exhaust manifold and then to the turbocharger where exhaust energy is extracted to drive the compressor.

Turbo compressed air is throttled across the throttle butterfly as set by the throttle lever. A variable absolute control system monitors pressure differential and uses engine oil pressure to automatically position the waste gate valve. The waste gate bleeds excess exhaust gas from the exhaust transition to the tailpipe, bypassing the turbocharger. Thus the controller automatically maintains manifold pressure.

The engine is protected against overboost damage from excessive manifold pressure. The wastegate controller senses manifold pressure and will continually adjust turbocharger output, maintaining the manifold pressure set by the throttle. The controller automatically protects the engine from overboost damage by limiting manifold pressure to 38 inches Hg. In the event of a controller malfunction, there is a pressure relief valve on the induction wing assembly which will relieve manifold pressure at approximately 42 in. Hg.

Manifold pressure limits can be exceeded with full throttle operation during certain off standard ambient conditions and low engine oil temperature. During such conditions limit manifold pressure to 38 inches maximum.

7.5 ENGINES AND PROPELLERS (Cont)

Induction Air System

CAUTION

Alternate air is unfiltered. Use of alternate air during ground or flight operations when dust or other contaminants are present may result in engine damage from particle ingestion.

The engine air induction system receives ram air through a flush inlet located on the right side of the lower cowling. Air enters this inlet and flows through a removable air filter located in an airbox which is an integral part of the cowling. The filter removes dust and other foreign matter from the induction air. However, in the event the flush inlet or the filter should become obstructed by ice or other causes, the pilot must manually select alternate air to provide air to the engine. This alternate air control is located on the center console just below the engine control quadrant. When the induction air lever is up, or on primary air, the engine is operating on filtered air drawn through the flush inlet in the cowling. When the lever is down, or on alternate air, the engine is operating on unfiltered air, drawn from inside the cowling. In addition to the alternate air door, this lever actuation also controls a butterfly valve located in the air duct which supplies cooling air to the aftercooler. The purpose of this valve is to simultaneously close off the cooling air to the induction aftercooler when alternate air is selected thus providing additional heat to the induction air to eliminate any ice in the induction system should it form.

Application of alternate air will result in a loss of manifold pressure when operating at high altitude where the turbocharger wastegate is closed. Loss of manifold pressure of up to 5 inches of Hg. can result at maximum continuous power, with a possible greater reduction resulting at cruise power settings.

Fuel Injection System

The engines are equipped with a Precision RSA-5AD2 fuel injection system. An engine-driven fuel pump supplies fuel under pressure to the fuel injection regulator, which measures air flow and meters the correct proportion of fuel to a flow divider. The flow divider then directs the fuel to each of the individual cylinder injection nozzles. A fuel vent system provides a common reference point vent pressure to the engine driven fuel pump and injection nozzles. The vent source is taken downstream of the turbocharger to ensure proper vent pressure during turbocharger operation.

Propellers

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

The Seneca V is equipped with all metal, two blade, constant speed, controllable pitch and fully feathering Hartzell propellers installed as standard equipment. Three blade, all metal, constant speed, controllable pitch and fully feathering McCauley propellers are installed as optional equipment.

Constant propeller rotational speed (rpm) is maintained by a balance of air load and engine rotational forces. The Hartzell governor, mounted on the left front of the engine pressurizes and regulates the flow of engine oil to a piston in the propeller dome. The piston is mechanically linked to the propeller blades. Governor oil pressure against the piston works to decrease propeller blade pitch, thus increasing propeller and engine rpm. The counterweights located on the propeller blade shank cause a centrifugal twisting moment on the propeller blade which works to increase blade pitch and decrease propeller and engine rpm. Simple control of the interaction of these and other forces to maintain a constant rpm is provided by the propeller control lever in the cockpit.

Each propeller is controlled by the propeller control levers located in the center of the power control quadrant. Feathering of a propeller is accomplished by moving the propeller control lever fully aft through the low rpm detent, into FEATHER position. Feathering takes place in approximately six seconds. Unfeathering is accomplished by moving the propeller control forward and engaging the starter until the propeller is windmilling.

Unfeathering Accumulators *

An optional propeller unfeathering system may be installed which consists of increased capacity governors, gas charged accumulators and a latching propeller control lever.

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

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

The feathering latches hold the propeller control lever in the feathered position and prevent inadvertent unfeathering. These latches must be manually released (pushed forward) to unfeather the propeller but do not change the feathering procedure.

With this system installed the feathering time is approximately six seconds and unfeathering times is six to eight seconds depending on the oil temperature.

A feathering lock, operated by centrifugal force, prevents feathering during shut down by making it impossible to feather anytime the engine speed falls below 800 rpm. For this reason, when airborne, and the pilot wishes to feather a propeller to save an engine, they must be sure to move the propeller control into FEATHER position before the engine speed drops below 800 rpm.

* Optional Equipment with Hartzell propeller installation only.

7.7 ENGINE CONTROLS

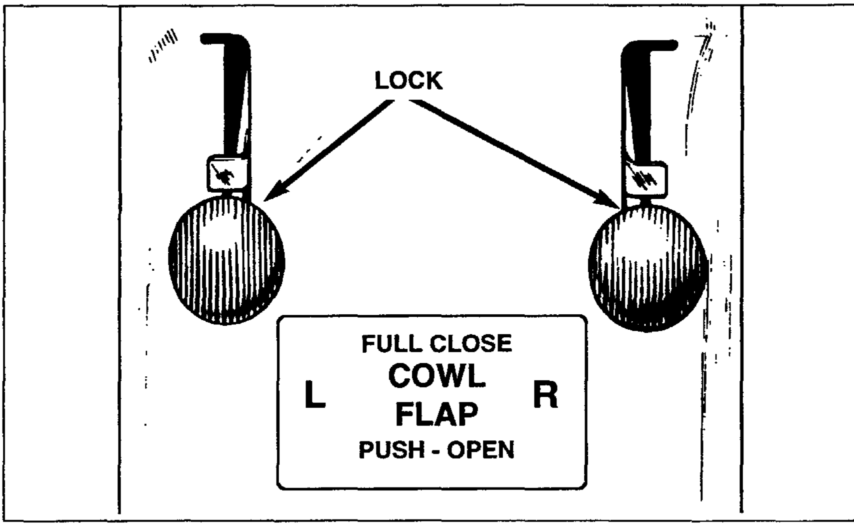
Engine controls consist of a throttle, a propeller control and a mixture control lever for each engine. These controls are located on the control quadrant on the lower center of the instrument panel where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control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

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

All throttle operations should be made with a smooth, not too rapid movement to prevent unnecessary engine wear or damage to the engines, and to allow time for the turbocharger speed to stabilize.

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

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



COWL FLAP CONTROL
Figure 7-1

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

The alternate air controls are located on the control quadrant just below the engine control levers. When an alternate air 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. Should the primary air source become blocked, the alternate air control lever must be moved and locked to the down (alternate air ON) position.

The cowl flap control levers (Figure 7-1), 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. The full open position is used for climb and ground operations while the intermediate lever position is used for single engine operation.

7.9 LANDING GEAR

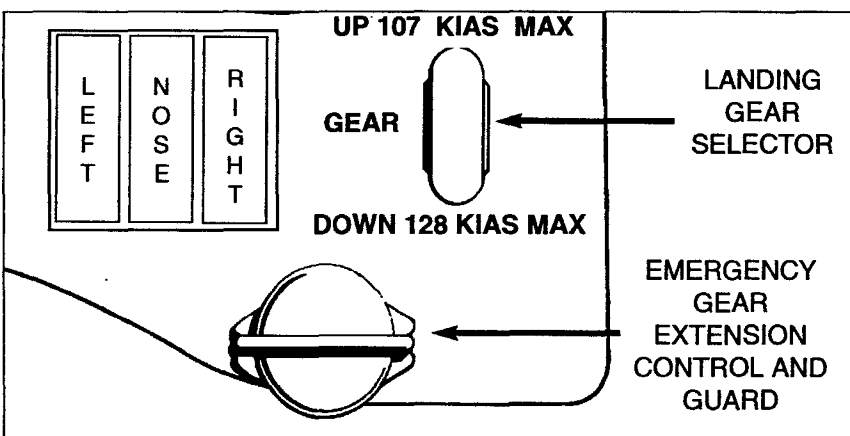
The SENECA V is equipped with hydraulically operated, fully retractable, tricycle landing gear. On takeoff, the gear should be retracted before an airspeed of 107 KIAS is exceeded. The landing gear may be lowered at any speed up to 128 KIAS.

NORMAL OPERATION

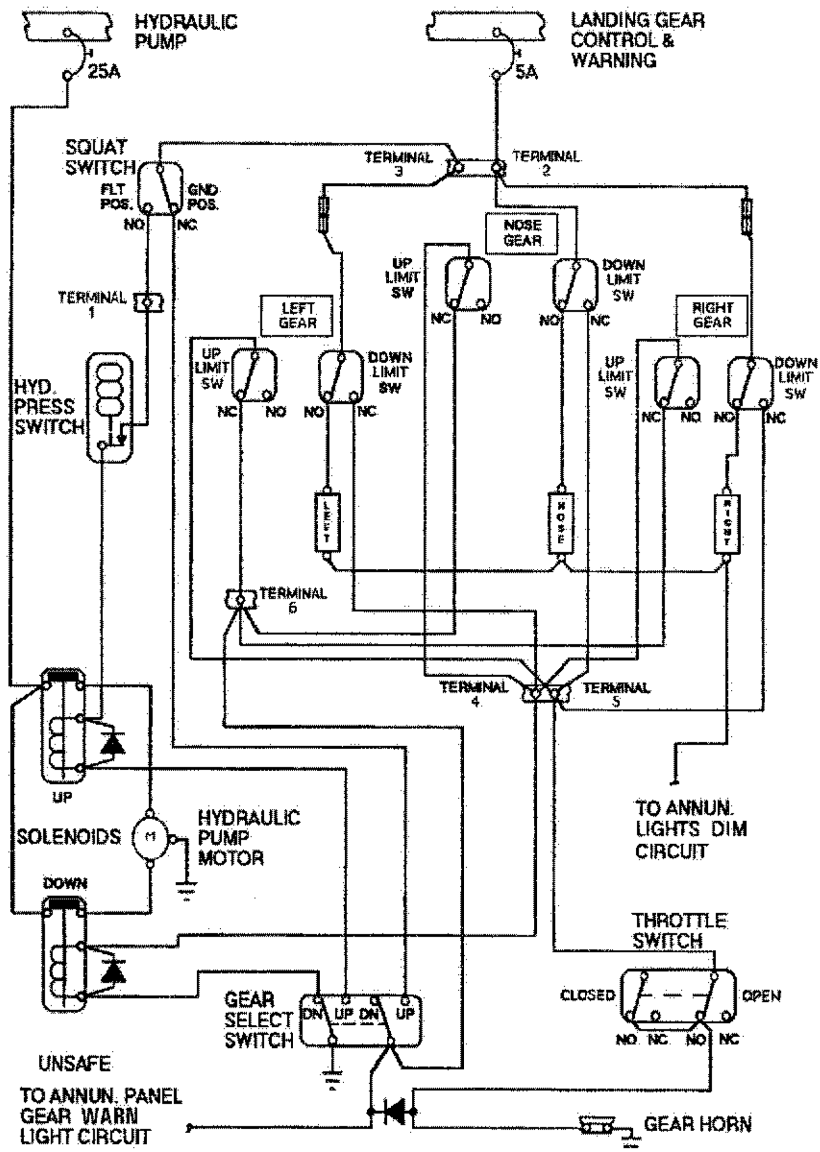
Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-5 and 7-7). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-3). The gear selector switch, 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 but may take up to 15 seconds.

CAUTION

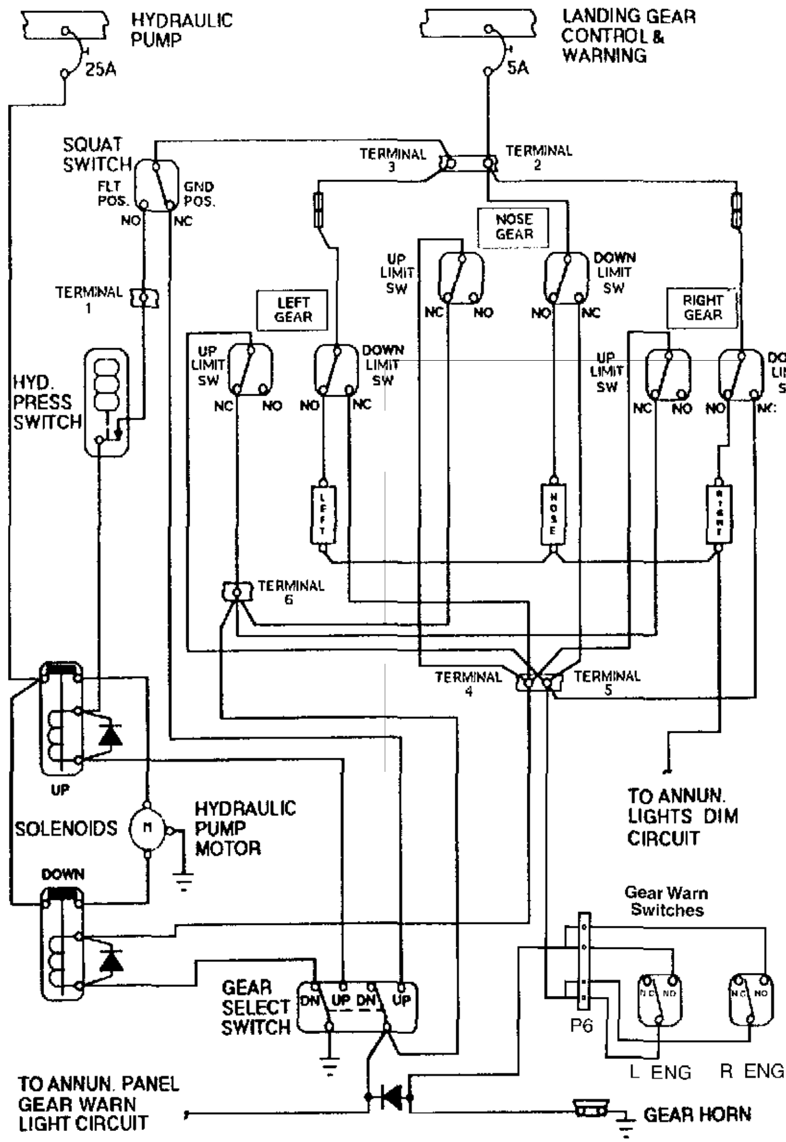
If the landing gear is in transit, and the hydraulic pump is running, it is NOT advisable to move the gear selector switch to the opposite position before the gear has reached its full travel limit, because a sudden reversal may damage the electric pump.



LANDING GEAR SELECTOR
Figure 7-3



LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC
(For aircraft with throttle mounted gear warning horn micro-switches)
Figure 7-5



LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC
(For aircraft with engine mounted gear warning horn MAP switches)
Figure 7-5a

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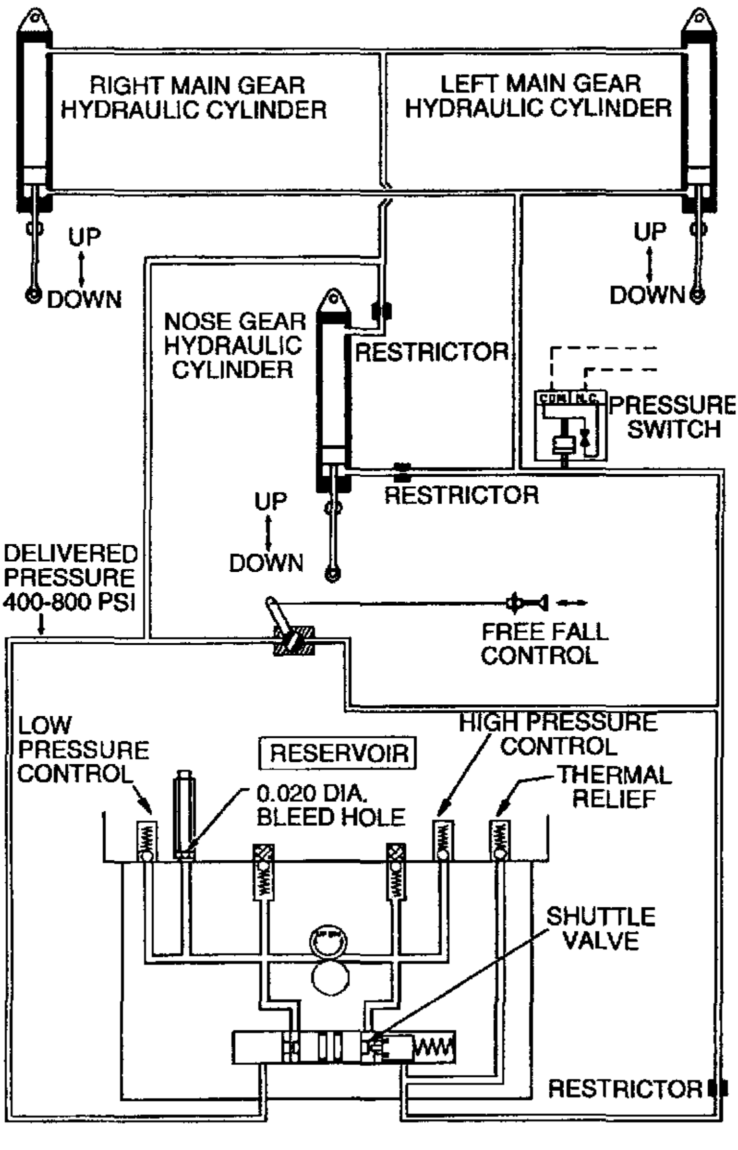
7.9 LANDING GEAR (Cont)



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Figure 7-7

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 forward into the nose section. Aerodynamic loads and springs assist in gear extension and in locking the gear in the down position. During gear extension, once the nose has started toward the down position, the airstream pushes against it and assists in moving it to the downlocked position. After the gear is down and the downlock hooks engage, springs maintain force on each hook to keep it locked until it is released by hydraulic pressure.

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

ANNUNCIATOR LIGHTS

If the gear is in neither the full up nor the full down position, a red warning light located in the annunciator cluster illuminates.

The three green lights to the left of the landing gear selector switch illuminate to indicate that each of the three landing gear is down and locked.

The green gear lights are dimmed when the DAY/NIGHT dimmer switch is in the night position. If the green lights are not observed after the landing gear selector switch is placed in the DOWN position, the first thing to check is the proper position of the DAY/NIGHT dimmer switch.

NOTE:

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

7.9 LANDING GEAR (Cont)

ANNUNCIATOR LIGHTS (Cont)

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

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

In order to check the bulbs, push the square indicator lights in until a click is heard then gently pull out the light assembly only far enough to expose bulbs, the bulbs can then be interchanged. Replace the light assembly by slowly pushing the assembly in until it clicks.

WARNING HORN

Should the throttle be placed in a low setting - as for a landing approach while the gear is retracted, a warning horn sounds to alert the pilot that the gear is retracted. The gear warning horn emits a 90 cycle per minute beeping sound.

Some aircraft incorporate gear up warning horn micro-switches mounted in the throttle quadrant. Other aircraft incorporate gear up warning manifold pressure switches mounted on each engine. In either configuration, the gear warning horn will activate under the following conditions:

(a) The gear is not locked down and the manifold pressure has fallen below approximately 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.

SAFETY SWITCH

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

EMERGENCY EXTENSION

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

Emergency gear extension must not be attempted at airspeeds in excess of 85 KIAS. An emergency gear extension knob, located beneath the gear selector switch is provided for this purpose. Pulling this knob releases the hydraulic pressure holding the gear in the up position and allows the gear to fall free. During normal operation, this knob is covered by a guard to prevent inadvertent extension of the gear. Before pulling the emergency gear extension knob, place the landing gear selector switch in the DOWN position to prevent the pump from trying to raise the gear.

NOTE

If the emergency gear knob has been pulled out to lower the gear by gravity, due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gears hydraulic and electrical systems. See PA-34-220T (Seneca V) Maintenance Manual for proper landing gear system check out procedures.

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

7.9 LANDING GEAR (Cont)

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 nose baggage compartment. For filling instructions, see the PA-34-220T (Seneca V) Maintenance Manual.

GROUND OPERATION

The nose gear is steerable through a 27 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. The landing lights, located on the nose gear, turn off automatically when the gear is retracted.

TIRES

All three landing gear carry 6.00 x 6 tires. The nose wheel has a 6-ply tire and the main wheels have 8-ply tires. 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 PA-34-220T (Seneca V) Maintenance Manual.

7.11 BRAKE SYSTEM

NORMAL OPERATION

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 the copilot's rudder pedals. A brake system hydraulic reservoir, independent of the landing gear hydraulic reservoir, is located behind a panel in the rear top of the nose baggage 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 knob is located on the lower left instrument panel. To set the parking brake, first depress and hold the toe brake pedals and then pull out the parking brake knob. To release the parking brake, first depress and hold the toe brake pedals and then push in on the parking brake knob.

WARNING

No braking will occur if knob is pulled prior to brake application.

7.13 FLIGHT CONTROL SYSTEM

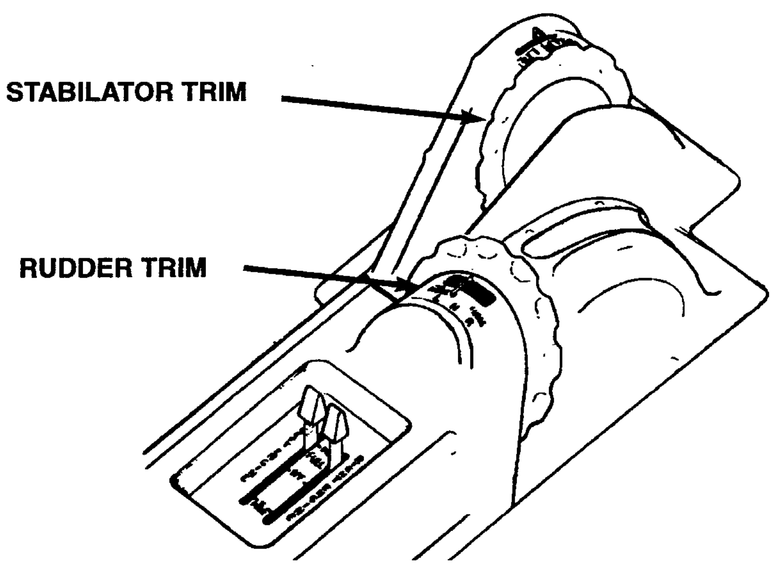
Dual flight controls are installed in the SENECA V as standard equipment. The controls actuate the control surfaces through a cable system.

CONTROL SURFACES

The ailerons are of the Frise type. This design allows the leading edge of the aileron to extend into the airstream to provide increased drag and improved roll control. The differential deflection of the ailerons tends to eliminate adverse yaw in turning maneuvers and to reduce the amount of coordination required in normal turns.

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 7-9).

The vertical tail is fitted with a rudder which incorporates a combination rudder trim and servo tab. The rudder trim control is located on the control console between the front seats (refer to Figure 7-9).



TRIM CONTROLS
Figure 7-9

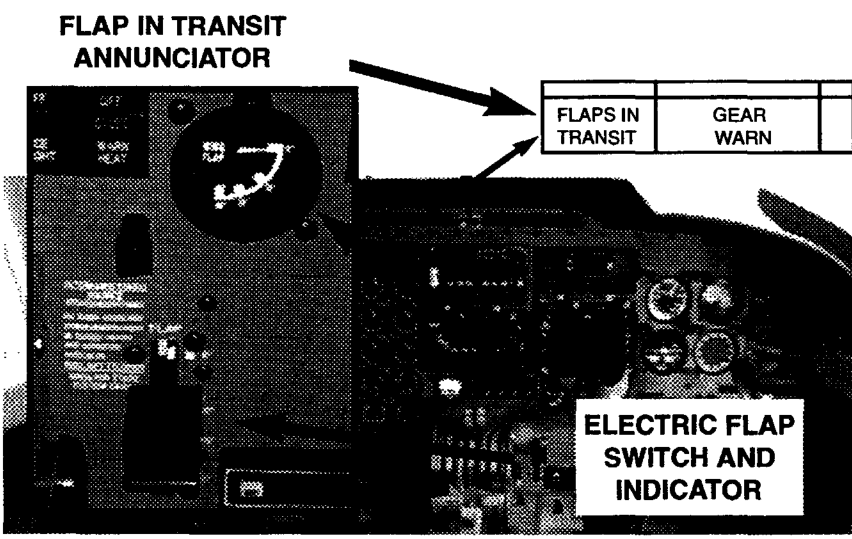
FLAPS

The flaps are electrically operated (refer to Figure 7-11). A control lever is located on the lower right instrument panel. An indicator light is located in the annunciator panel. Selection of a new flap position will activate the flap motor and the light. When the flaps reach the desired position the flap motor is automatically switched off and the indicator light goes out.

In the event of a flap drive malfunction; move the flap lever until the light goes out. The flap position can be determined by the electric flap position indicator located on the instrument panel, just above the flap handle.

There are four stops for the flap control lever, full up (0° flap), 1st notch (10° flap), 2nd notch (25° flap), and full down (40° flap).

A past center lock incorporated in the actuating linkage hold the flap when it is in the retracted position so that it may be used as a step on the right side. Since the flap will not support a step load except in the fully retracted position, the flaps should be retracted when people are entering or leaving the airplane.



ELECTRIC FLAP SYSTEM
Figure 7-11

7.15 FUEL SYSTEM

FUEL TANKS

Fuel is stored in fuel tanks located in each wing. The tanks in each wing are interconnected to function as a single tank (refer to Figure 7-13). All tanks on each side are filled through a single filler in the outboard tank, and as fuel is consumed from the inboard tank, it is replenished by fuel from outboard.

Only three gallons of fuel in each wing is unusable, giving the SENECA V a total 122 usable gallons. The minimum fuel grade is 100 or 100LL Aviation Grade.

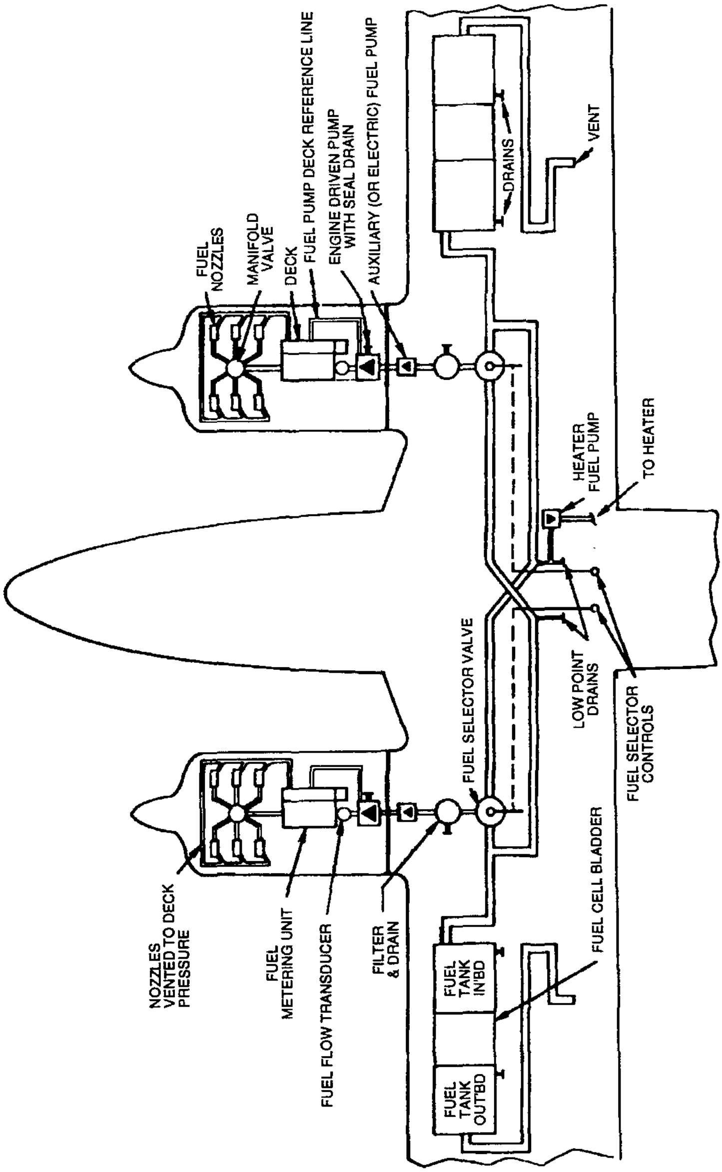
The fuel tank vents, one installed under each wing, feature an anti-icing design to prevent ice formation from blocking the fuel tank vent lines.

FUEL INJECTION SYSTEM

Each engine has an engine-driven fuel pump that is a part of the fuel injection system. An standby fuel system is provided. The purpose of the electrically-powered standby fuel system is to supply fuel to the engine in case of engine-driven fuel pump shaft failure or malfunction, for ground and inflight engine starting, and for vapor suppression.

The two standby fuel pump switches are located in the overhead switch panel and are two-position rocker switches: ON and OFF.

In case of a failed engine-driven fuel pump, the emergency standby fuel pump should be engaged by selecting the appropriate switch on the overhead switch panel labeled FUEL PUMP.



FUEL SYSTEM SCHEMATIC
Figure 7-13

FUEL DRAINS

Before each flight, fuel must be drained from low points in the fuel system to ensure that any accumulation of moisture or sediment is removed from the system and to check for proper fuel. Fuel drains are provided for each fuel filter (2), each fuel tank (4), and each crossfeed line (2).

The fuel filter drains are located on the outboard underside of each engine nacelle; two fuel tank drains are located on the underside of each wing; fuel crossfeed drains are located at the lowest point in the fuel system, on the underside of the fuselage, just inboard of the trailing edge of the right wing flap.

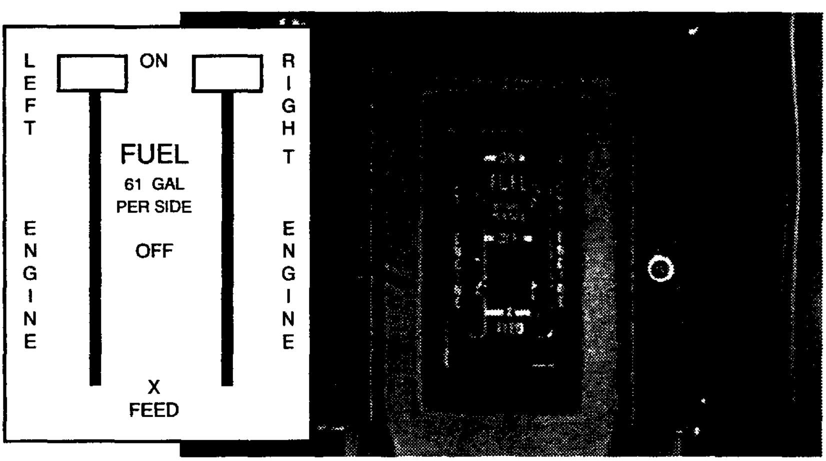
7.15 FUEL SYSTEM (Cont)

FUEL CONTROLS

Fuel management controls are located on the console between the front seats. There is a control lever for each of the engines, and each is placarded ON - OFF - X FEED. During normal operation, the levers are in the ON position, and each engine draws fuel from the tanks on the same side as the engine. The two fuel systems are interconnected by crossfeed lines. When the X FEED position is selected, the engine will draw fuel from the tanks on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. During the crossfeed operation, a crossfeed annunciator will illuminate to inform the pilot that crossfeed is selected. The OFF position shuts off the fuel flow to that engine.

NOTE

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



FUEL CONTROLS
Figure 7-15

7.17 ELECTRICAL SYSTEM

The electrical system of the SENECA V is capable of supplying sufficient current for complete night IFR equipment.

ALTERNATORS

Primary electrical power is supplied by two 28 volt, 85 ampere alternators (Figure 7-17), one mounted on each engine.

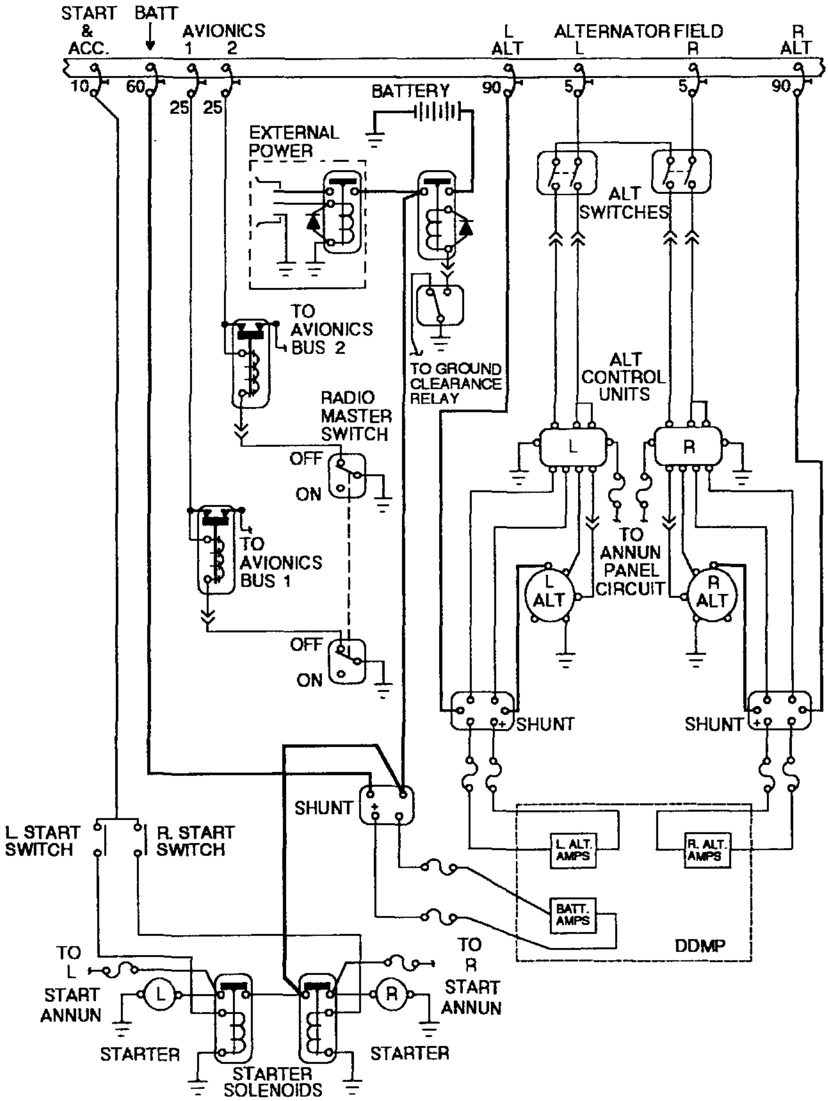
BATTERY

A 19 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 aft fuselage section and is accessible through an access panel in the rear baggage compartment, is normally kept charged by the alternators. If it becomes necessary to charge the battery, it should be removed from the airplane.

ALTERNATOR CONTROL UNITS

Two solid state alternator control units maintain effective load sharing while regulating electrical system bus voltage to 28 volts. The alternator control unit 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 alternator light on the annunciator panel will illuminate. Alternator control units are located on a shelf in the right hand nose section.

7.17 ELECTRICAL SYSTEM (Cont)



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-17

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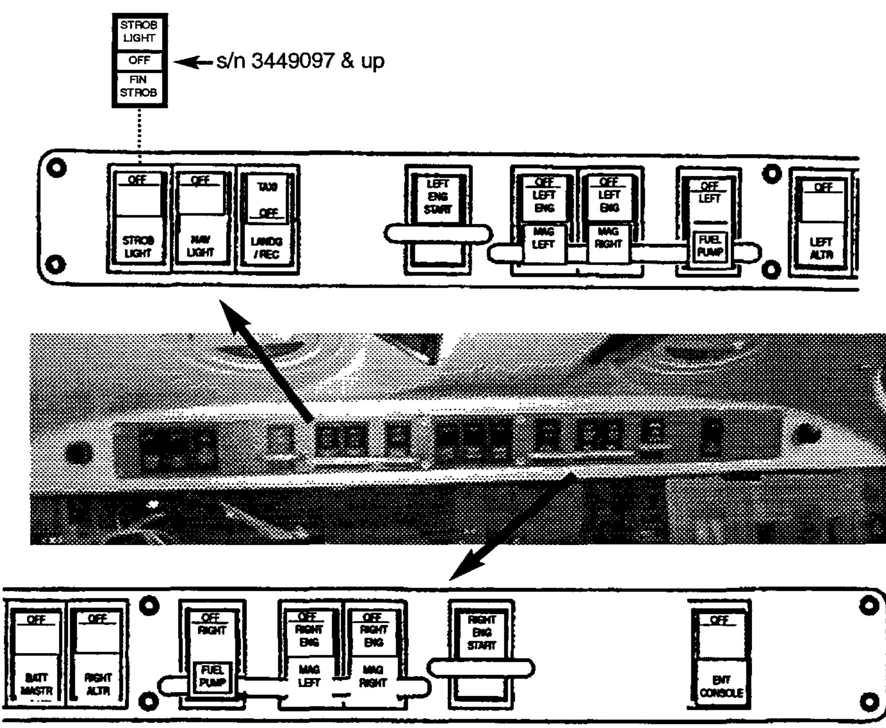
SWITCHES

All powerplant and exterior light switches are grouped in an overhead switch panel. Switches dedicated for avionics and anti/de-ice, are conveniently located below the avionics stacks. (Figure 7-19)

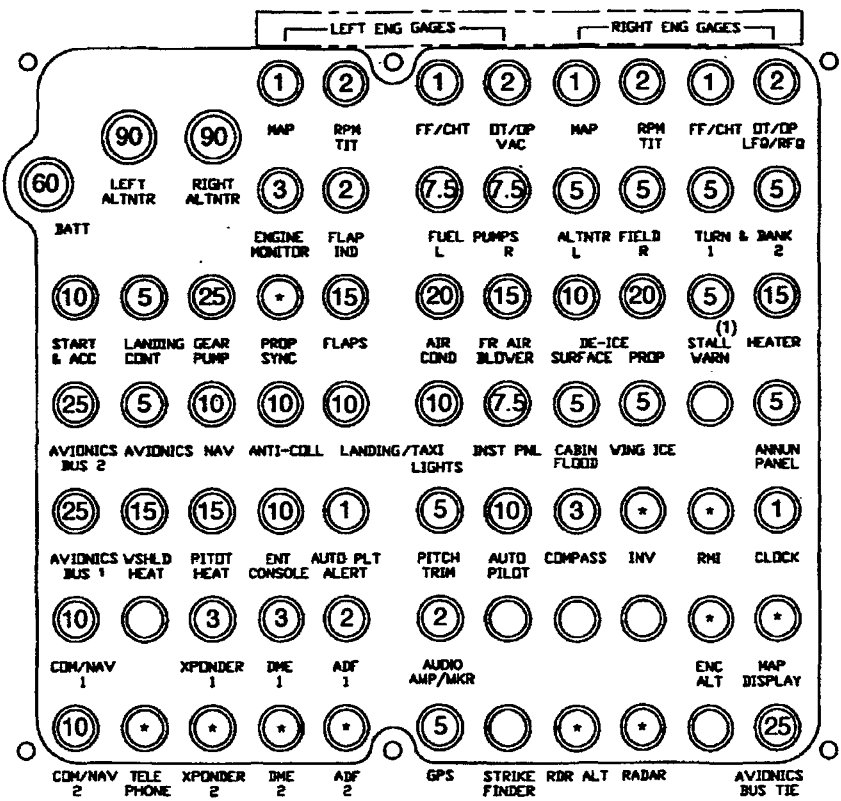


SWITCH PANEL
Figure 7-19

7.17 ELECTRICAL SYSTEM (Cont)

CIRCUIT BREAKERS

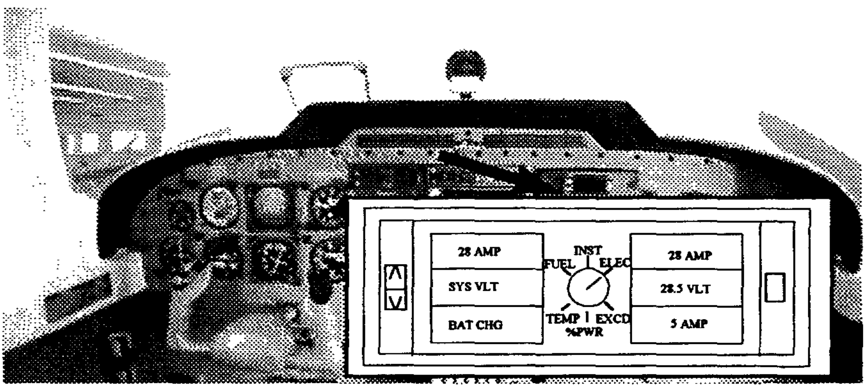
The electrical system and equipment are protected by circuit breakers located on a circuit breaker panel on the lower right side of the instrument panel. In the event of equipment malfunctions or a sudden surge of current, a circuit breaker can trip automatically. The pilot can reset the breaker by pressing it in (preferably after a few minutes cooling period). The circuit breakers can be pulled out manually. Optional ice protection and airconditioner C/B's shown. (* Other optional equipment C/B locations.)



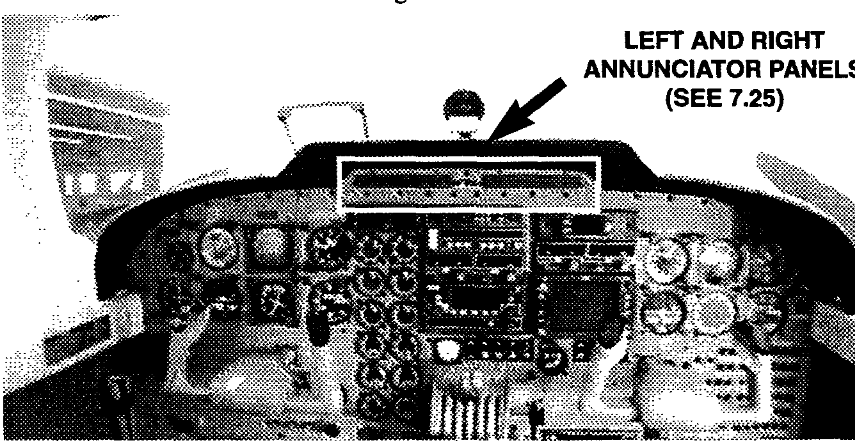
TYPICAL CIRCUIT BREAKER PANEL
Figure 7-21

7.17 ELECTRICAL SYSTEM (Cont)

The two electrical system annunciator lights [L ALT INOP] and [R ALT INOP] (Figure 7-25) are located in the annunciator clusters. When either alternator fails, or is selected OFF, the appropriate red ALT INOP annunciator light will illuminate. A low voltage monitor will illuminate the red annunciator light [LOW BUS VOLTAGE] when the bus voltage drops below 25 ±.3 volts (See figures below). A fuse provides overload protection for the voltage monitor.



VOLTMETER / AMMETER (DDMP)
Figure 7-23



ANNUNCIATORS
Figure 7-25

7.17 ELECTRICAL SYSTEM (Cont)

In the event that either alternator inop. annunciator should illuminate, the status of the alternator can be verified by selecting the electrical mode of the Digital Display Monitoring Panel (DDMP).

Should an overvoltage condition occur in either alternator, its alternator control unit will shut off the voltage to that alternator. Output from from either alternator can be shut off manually by turning that alternators switch off.

Approximately 2500 RPM or more is required to obtain full alternator output of 85 amperes. It is normal to have low output at idle RPM. This is due to the reduced drive ratio from the engine.

Should either alternator ammeter indicate a load much higher than the known consumption of the electrical equipment in use, an alternator malfunction should be suspected and the respective alternator switch turned off. In this event, the remaining alternator should show a normal indication on the ammeter after approximately one minute.

If both alternators indicate a load much higher than the known consumption for more than approximately five minutes, an electrical defect other than the alternator system should be suspected because a discharged battery will reduce the alternator load as it approaches the charged conditions.

A zero ammeter reading indicates an alternator is not producing current and should be accompanied by illumination of the ALT annunciator light. A single alternator is capable of supporting a continued flight in case of alternator or engine failure in most conditions: however, with deicing equipment and other high loads, care must be exercised to prevent the loads from exceeding the 85 ampere rating and subsequent depletion of the battery.

For abnormal and/or emergency operations and procedures, refer to Section 3 in this Handbook.

7.17 ELECTRICAL SYSTEM (Cont)

LIGHTS

Interior lighting consists of instrument panel post lights, overhead lights and internally lighted avionics and switches. Radio, panel and switch lights are controlled by the rheostat switches located below the pilots control column.

Two floodlights, mounted in the overhead panel, provide additional instrument and cockpit lighting for night flying. Each light is controlled by a rheostat switch located in the overhead switch panel. A map light window in the lens is actuated by an adjacent switch.

Exterior lighting systems include nose-mounted taxi lights, nose-mounted and wing tip landing lights, navigation lights and strobe/anti-collision lights.

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. Fin strobe (if installed) may be used on ground.

An optional cabin courtesy light system consists of a front entrance light over the forward cabin door (switch located next to light) and rear entrance light (switch located on cabin side panel), which replaces the reading light over the aft cabin door. These lights are operated individually with switches that are incorporated as part of each light assembly. The courtesy light circuit is independent of the aircraft battery switch; therefore, the lights can be operated regardless of the position of the battery switch. Unless the engines are running, the courtesy lights should not be left on for extended time periods, as battery depletion could result.

EXTERNAL POWER RECEPTACLE

An external power receptacle starting installation is located on the left rear fuselage. A cable from an external power source can be connected to the receptacle, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.

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 and alternator switches and all electrical equipment OFF. Insert the external power source 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 electrical 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 ENGINE START CHECKLISTS - Section 4.

7.19 VACUUM SYSTEM

The vacuum system operates the air driven gyro instruments. The vacuum system (Figure 7-27) consists of a vacuum pump on each engine, plus plumbing and regulating equipment.

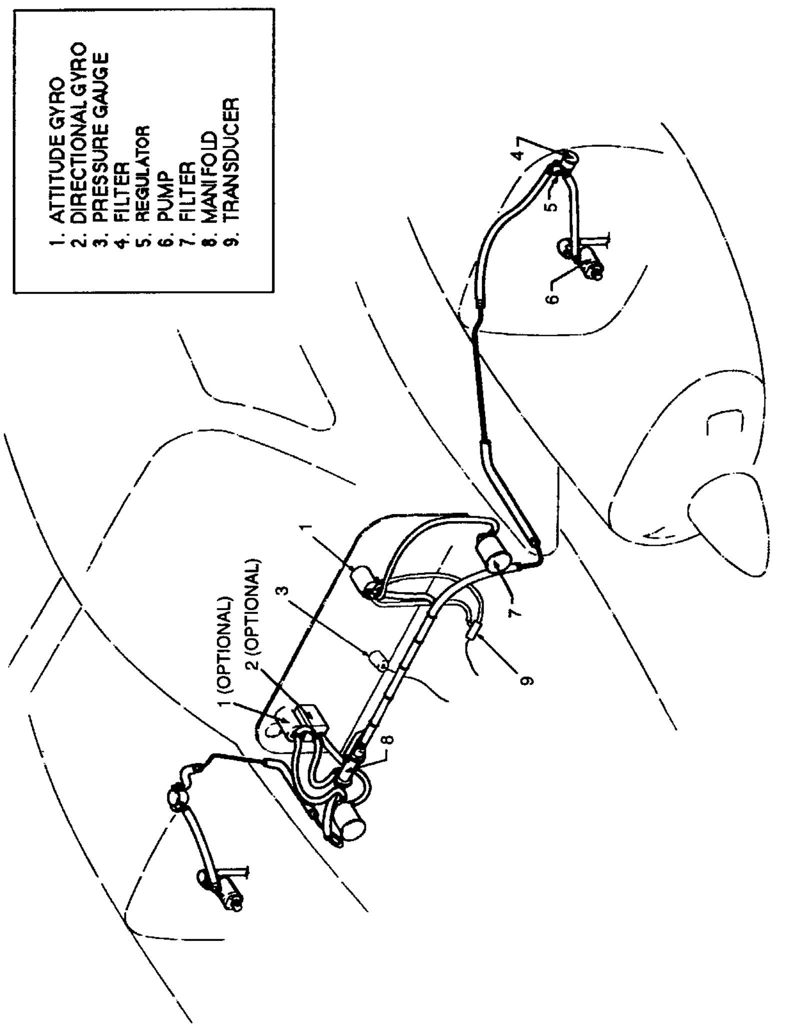
The vacuum pumps are dry type pumps, which eliminates the need for an air oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears the gyros will become inoperative.

The vacuum gauge, mounted on the bottom left of the instrument gauges (refer to Figure 7-35), provides valuable information to the pilot about the operation of the vacuum system.

A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system. Two amber VACUUM INOP indicator lights are provided in the annunciator panel (one for the left engine and one for the right engine) and will illuminate should the system vacuum fall below a specified pressure.

Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads within the normal operating range, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located on the aft side of each engine firewall.



VACUUM SYSTEM
Figure 7-27

7.21 PITOT STATIC SYSTEM

Pitot pressure for the airspeed indicator is picked up by the pitot head installed on the bottom of the left wing and carried through lines within the wing and fuselage to the gauge on the instrument panel (refer to Figure 7-29). Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static source pads, one on each side of the rear fuselage forward of the stabilator. They connect to a single line leading to the instruments. The dual pickups balance out differences in static pressure caused by side slips or skids.

An alternate static source control valve is located below the instrument panel to the right of the control quadrant. When the valve is set to the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. During alternate static source operation, these instruments may give slightly different readings, depending on conditions within the cabin. Airspeed, setting of heating and ventilating controls, or the position of the storm window can influence cabin air pressure. The pilot can determine the effects of the alternate static source on instrument readings by switching from standard to alternate sources at different airspeeds and heating and ventilating configurations (including open storm window below 129 KIAS).

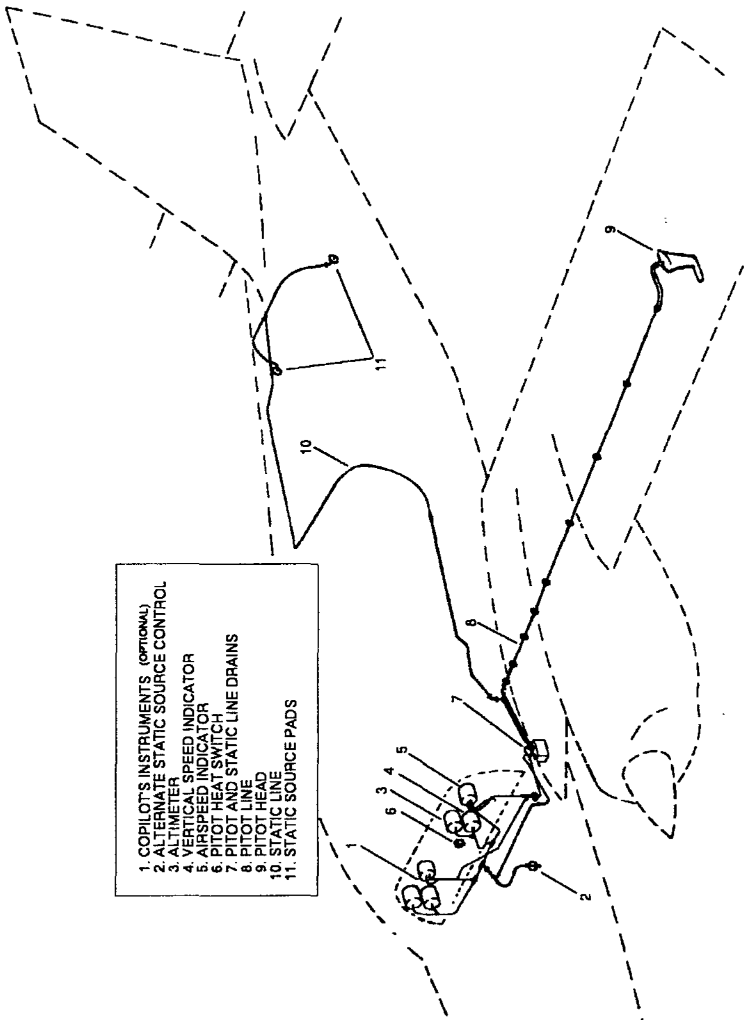
The holes in the sensors for pitot and static pressure must be fully open and free from blockage. Partially or completely blocked sensor holes will give erratic or zero readings on the instruments. To prevent bugs and water from entering the pitot holes when the airplane is parked, a cover should be placed over the pitot head.

NOTE

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

A heated pitot head, which alleviates problems with icing and heavy rain, is installed as standard equipment. The switch for pitot heat is located below the left avionics stack. The pitot heat system has a separate circuit breaker located in the circuit breaker panel and labeled PITOT HEAT. A visual alert is provided for off or inoperative conditions by an annunciator labeled PITOT HEAT OFF/INOP located in the right annunciator panel. Static source pads have been demonstrated to be non-icing; however, in the event icing does occur, selecting the alternate static source will alleviate the problem.

If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks, or moisture. The pitot and static lines may be drained through separate drains located on the side panel to the left of the pilot's seat.



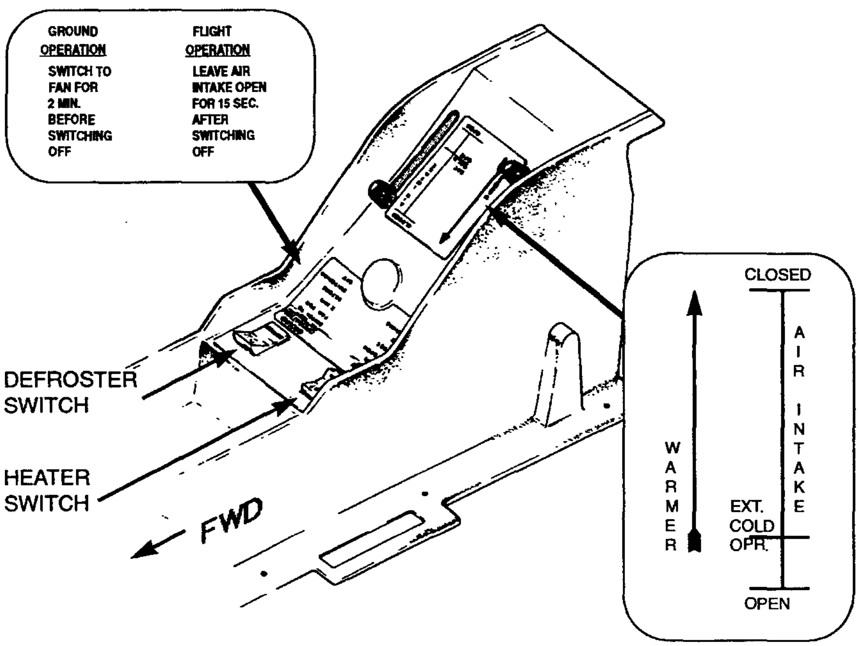
PITOT STATIC SYSTEM
Figure 7-29

7.23 HEATING, VENTILATING AND DEFROSTING SYSTEM

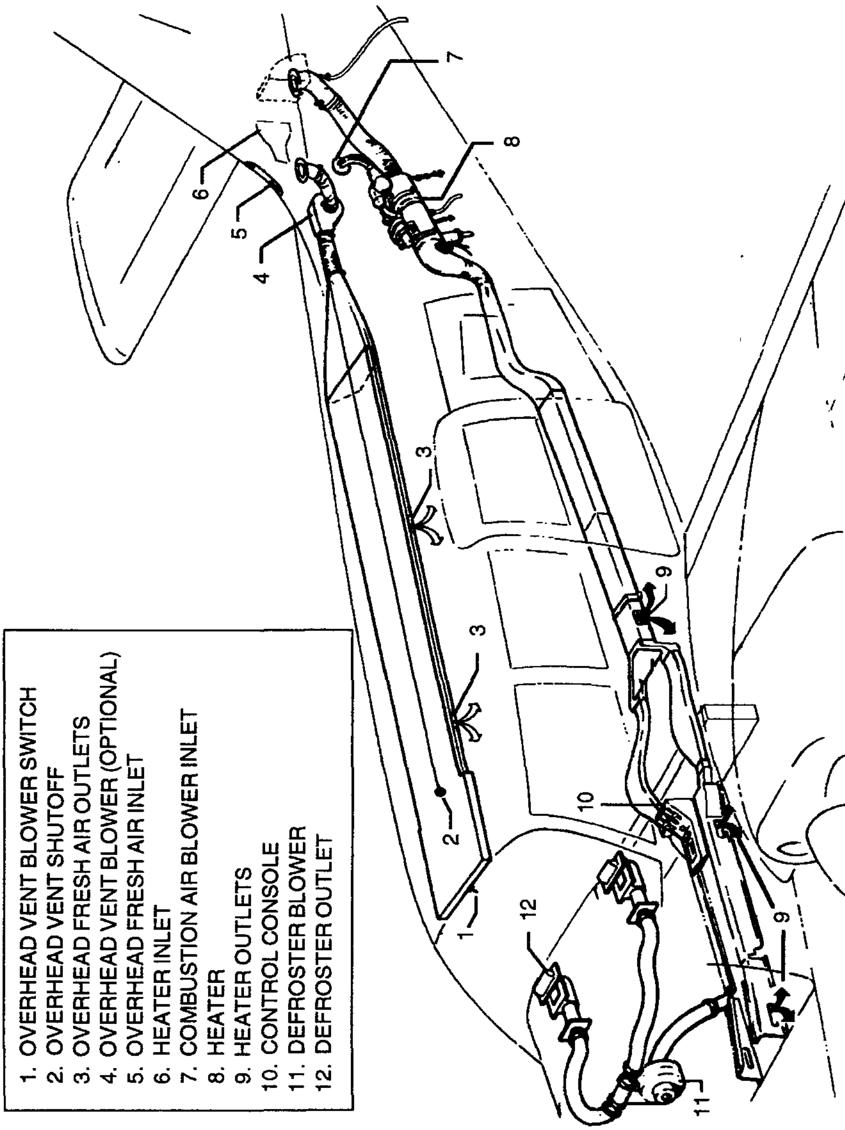
HEAT AND DEFROST SYSTEM

Heated air for cabin heat and windshield defrosting is provided by a combustion heater located in the aft fuselage behind the cabin baggage compartment close-out panel (refer to Figure 7-33). Air from the heater is ducted forward along the cabin floor to outlets at each seat and to the windshield area.

Operation of the combustion heater is controlled by a three-position switch located to the left on the control console (Figure 7-31) between the front seats and labeled FAN, OFF and HEAT. Airflow and temperature are regulated by the two levers on the console. The right-hand lever regulates AIR INTAKE and the left-hand 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.



HEAT, VENTILATION & DEFROST CONTROL CONSOLE
Figure 7-31



CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM
Figure 7-33

For cabin heat, the AIR INTAKE lever on the heater control console must be partially or fully open and the three-position switch set to the HEAT position. This simultaneously starts fuel flow and ignites the heater; and, during ground operation, it also activates the ventilation blower which is an integral part of the combustion heater.

With instant starting and no need for priming, heat should be felt within a few seconds. When cabin air reaches the temperature selected on the cabin temperature lever, ignition of the heater cycles automatically to maintain the selected temperature.

The combustion heater uses fuel from the airplane fuel system. An electric fuel pump draws fuel from the right tank at a rate of approximately one-half gallon per hour. Fuel used for heater operation should be considered when planning for a flight.

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 cabin floor outlet.

When heat is not desired during ground operation, place the three-position switch in the FAN position and the ventilation blower sends fresh air through the heater ductwork for cabin ventilation and windshield defogging. When the heater controls are used either for cabin heat or for ventilation, air is automatically ducted to the windshield area for defrosting.

The flow of defroster air to the windshield area can be increased by the activation of a defroster fan. The fan is controlled by a two-position defroster switch located on the control console between the front seats and labeled DEFROST - ON - OFF.

Safety Switches

Two safety switches activated by the intake valve and located aft of the heater unit prevent both fan and heater operation when the air intake lever is in the closed position. A micro switch, which actuates when the landing gear is retracted, turns off the ventilation blower so that in flight the cabin air is circulated by ram air pressure only.

7.23 HEATING, VENTILATING AND DEFROSTING SYSTEM (Cont)

Overheat Switch and Annunciator

An overheat switch located in the heater unit acts as a safety device to render the heater inoperative if a malfunction should occur. Should the switch deactivate the heater, the red HEATER OVERHEAT light on the annunciator panel will illuminate. The overheat switch is located on the forward outboard end of the heater vent jacket. The red reset button on the heater shroud can be reached through the bulkhead access panel in the aft cabin close-out panel.

To prevent activation of the overheat switch upon normal heater shutdown during ground operation, turn the three-position switch to FAN for two minutes with the air intake lever in the open position before turning the switch to OFF. During flight, leave the air intake lever open for a minimum of fifteen seconds after turning the switch to OFF.

OVERHEAD VENTILATION

Overhead outlets also supply fresh air for cabin ventilation. The occupant of each seat can manually adjust a louvered outlet in the ceiling to regulate the flow of fresh air to that seat area. Pulling the CABIN AIR control, located in the ceiling behind the speaker, stops the flow of air through the ceiling outlets.

A fresh air blower is installed in the overhead ventilation system to provide additional fresh air flow during ground operation. The switch, labeled LOW - OFF - HI, is in the right instrument panel next to the c/b panel. (See item 10 Fig. 7-35.)

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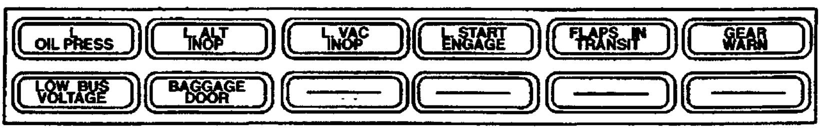
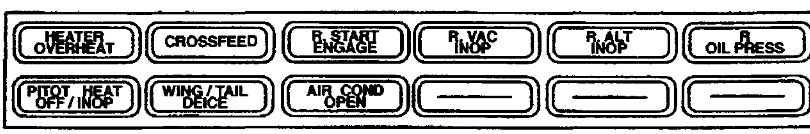
7.25 INSTRUMENT PANEL

The instrument panel (Figure 7-35) is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The pilots artificial horizon is vacuum operated while the directional gyro (HSI) and turn and bank are electrically operated. The vacuum gauge is located on the bottom left of the instrument stack and is marked with a green arc from 4.8 to 5.2 in.Hg. to indicate the system is supplying adequate vacuum to the various instruments. The turn coordinator, located to the left of the directional gyro, is electrically operated.

Two annunciator panels are located above the engine gauges and avionics. Each panel arrangement contains twelve annuncaitors, six across and two high. The annunciator panels incorporate a press-to-test feature and a day/night switch located between the two clusters. The annunciator provides a visual warning of possible malfunctions including failure alert and pre-cautionary warnings.



Left Annunciator Cluster



Right Annunciator Cluster

While the illumination of some of these lights in flight is an indication of a possible system malfunction, illumination of others is just an indication of a system condition. The pilot should closely monitor instrument panel gauges to check the condition of a system whose corresponding light on the annunciator panel illuminates.

During preflight the operational status of the annunciator panel should be tested by use of the press-to-test button. When the button is depressed all annunciator panel lights should illuminate.

NOTE

When an engine is feathered, the alternator, gyro vacuum and engine oil pressure annunciator lights will remain illuminated.

The engine gauges are 2 in. round instruments located vertically in two columns under the left annunciator panel (see Fig. 7-35 for exact location). Included are manifold pressure, tachometer (RPM), turbine inlet temperature (TIT), fuel flow, cylinder head temperature, oil pressure and oil temperature. The normal operating range for ground and flight operation is indicated on the instruments by a green arc. Yellow arcs indicate a caution range while red lines dictate minimum or maximum limits.

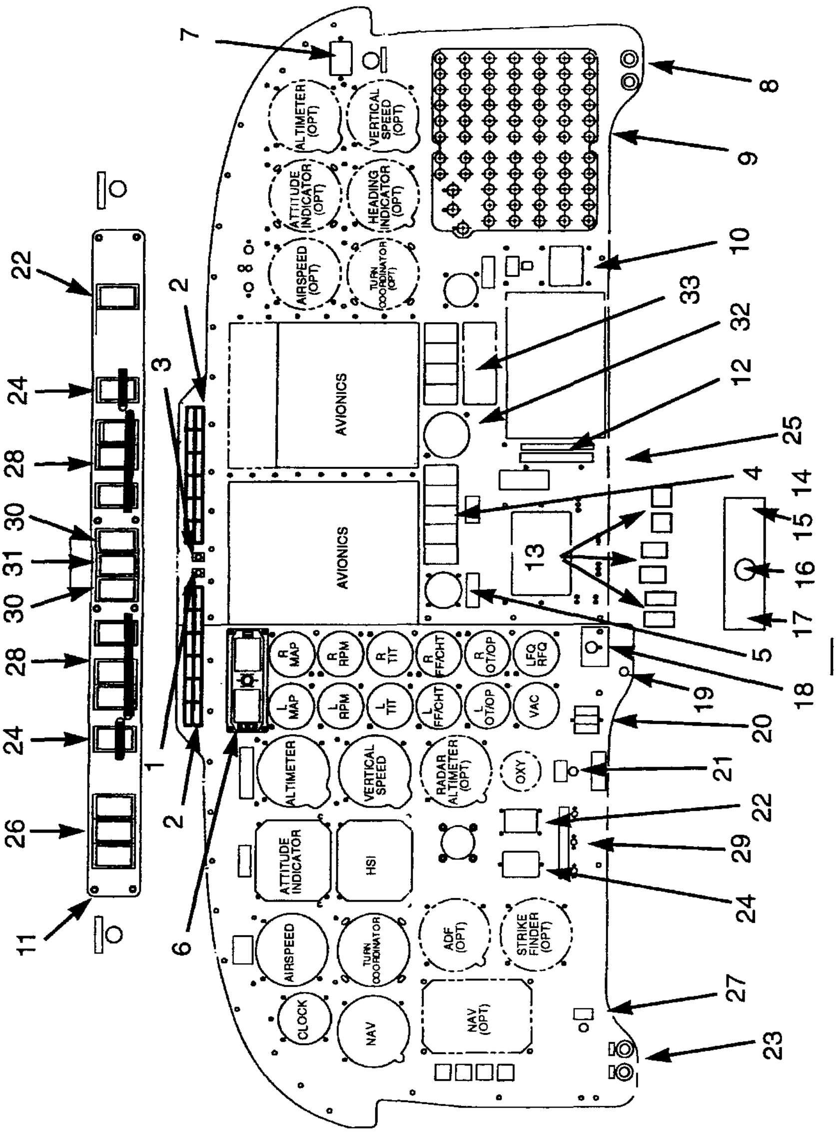
Engine and electrical switches are located in a single row switch cluster in an overhead switch panel. The row of switches include the battery master, left and right alternator, standby fuel pumps, left and right magnetos, left and right starter and entertainment console. Nav., strobe, recognition and landing/taxi light switches are located to the far left in the overhead switch panel. Anti/de-ice switches are located below the left avionics stack. A 2 inch round flap indicator is located above and slightly to the right of the flap selector. The parking brake handle (park brake - pull) is located below and to the far left instrument panel. Jacks for the pilots microphone and headset are below and to the left of the parking brake handle.

Instrument panel lighting is provided by post lights, overhead panel lights and internally lighted engine gauges, avionics and switches. Optimum cockpit lighting for night flying is achieved by using a combination of the panel lights and the overhead flood lights. The panel lights are adjusted by three rheostats labeled switch lights, panel lights and avionics located below the pilots control column. The overhead lights are adjusted by rheostats adjacent the overhead switch panel. A white map light can be selected from either overhead flood light.

7.25 INSTRUMENT PANEL (Continued)

TYPICAL INSTRUMENT PANEL

1. DAY/NIGHT DIMMER SWITCH
2. ANNUNCIATOR PANEL
3. ANNUNCIATOR PANEL PRESS TO TEST SWITCH
4 ICE PROTECTION CONTROLS (SWITCHES LEFT TO RIGHT) SURFACE DEICE, PROP HEAT, WINDSHIELD HEAT, ICE LIGHT, AND PITOT/STALL WARN HEAT
5. AMMETER (DEICE SYSTEM)
6. DIGITAL DISPLAY MONITORING PANEL
7. HOUR METER
8. COPILOT'S MIKE & PHONE JACKS
9. CIRCUIT BREAKER PANEL
10. AIR CONDITIONING SYSTEM SWITCHES (OPT)
11. OVERHEAD SWITCH PANEL
12. WING FLAP SELECTOR
13. CONTROL LEVERS (FROM LEFT TO RIGHT)
    L & R THROTTLE
    L & R PROPELLER
    L & R MIXTURE
14. CONTROL FRICTION LOCK (ON RIGHT SIDE OF QUADRANT)
15. ALTERNATE AIR CONTROL LEVER - RIGHT
16. PROPELLER SYNCROPHASER
17. ALTERNATE AIR CONTROL LEVER - LEFT
18. LANDING GEAR SELECTOR
19. EMERGENCY GEAR EXTENSION KNOB & GUARD
20. GEAR DOWN ANNUNCIATOR LIGHTS
21. OXYGEN CONTROL
22. ELT SWITCH PANEL
23. PILOT'S MIKE & PHONE JACKS
24. KA 51 COMPASS SLAVING SWITCH PANEL
25. ALTERNATE STATIC SOURCE (BEHIND PANEL)
26. EXTERNAL LIGHTING SWITCHES
27. PARKING BRAKE HANDLE
28. ENGINE SYSTEMS SWITCHES
29. DIMMER CONTROLS
30. ALTERNATOR SWITCHES
31. BATTERY MASTER SWITCH
32 WING FLAP INDICATOR
33. AVIONICS SWITCHES



TYPICAL INSTRUMENT PANEL
Figure 7-35 (cont)

7.25 INSTRUMENT PANEL (Continued)

Radios are mounted in two stacks above and to the right of the control quadrant in the upper instrument panel. Radios are also located on the lower left of the co-pilots panel. A radio master (radio mstr) switch is located below the right avionics stack. It controls the power to all radios through the radio master contactor. The radio master switch has an on and off position. When the battery master (batt mstr) switch is turned on, power is supplied to the radio master switch relay, opening the contactors and preventing current flow to the radios. When the radio master (radio mstr) switch is turned on, power is removed from the radio master switch relay, allowing the contactor to spring closed and permitting current flow to the radios.

Ground clearance energy saver system provides direct power to comm#1 with the battery master switch in the off position. An internally lit switch, located below the right avionics stack provides annunciation for engagement of the system. When the switch is engaged direct aircraft battery power is applied to comm #1, audio amplifier and radio accessories. Ground clearance must be turned off or deplection of battery could result. To turn off the ground clearance, turn the battery master switch on momentarily, then off.

NOTE:

The battery master switch must be in the off position for ground clearance system to operate.

The control quadrant - throttles, propeller and mixture controls is in the center of the lower instrument panel. To the left of the control quadrant is the landing gear selector and the emergency landing gear extender knob. To the right of the control quadrant is the control friction lock and the four position, electric flap control.

The optional copilot's flight instruments are on the upper right instrument panel. The circuit breaker panel located in the lower right instrument panel contains breakers for the BATTERY, two ALTERNATORS, the main bus and two avionics busses (AVI BUS #1 & #2).

Jacks for the copilot's microphone and headset are to the right and below the circuit breaker panel.

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM

The Flightline Engine Instrument/Engine Monitoring System is a microprocessor based instrument with analog and digital format displays of engine related instruments. The Engine Instrument/Engine Monitoring System can be divided into two parts: 1) the Digital Display Monitoring Panel (DDMP) and 2) the single/dual analog instrument displays (see Figure 1).

The DDMP is a microprocessor which monitors/records engine parameter exceedences and provides the interface between a GPS receiver and engine parameter sensors for digital display of the analog instruments, engine power, and fuel management. The DDMP displays its information on 6 eight character displays which are controlled via an Up/Dwn button, a Select button, and a rotary mode selection knob.

The rotary mode selection knob allows the user to cycle through the 6 top level operations:

1. FUEL - Fuel management
2. INST - Engine instrument display
3. ELEC - Electrical parameter display
4. EXCD - Exceedence record display
5. %PWR - Engine per cent power display/determination
6. TEMP - Temperature display

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

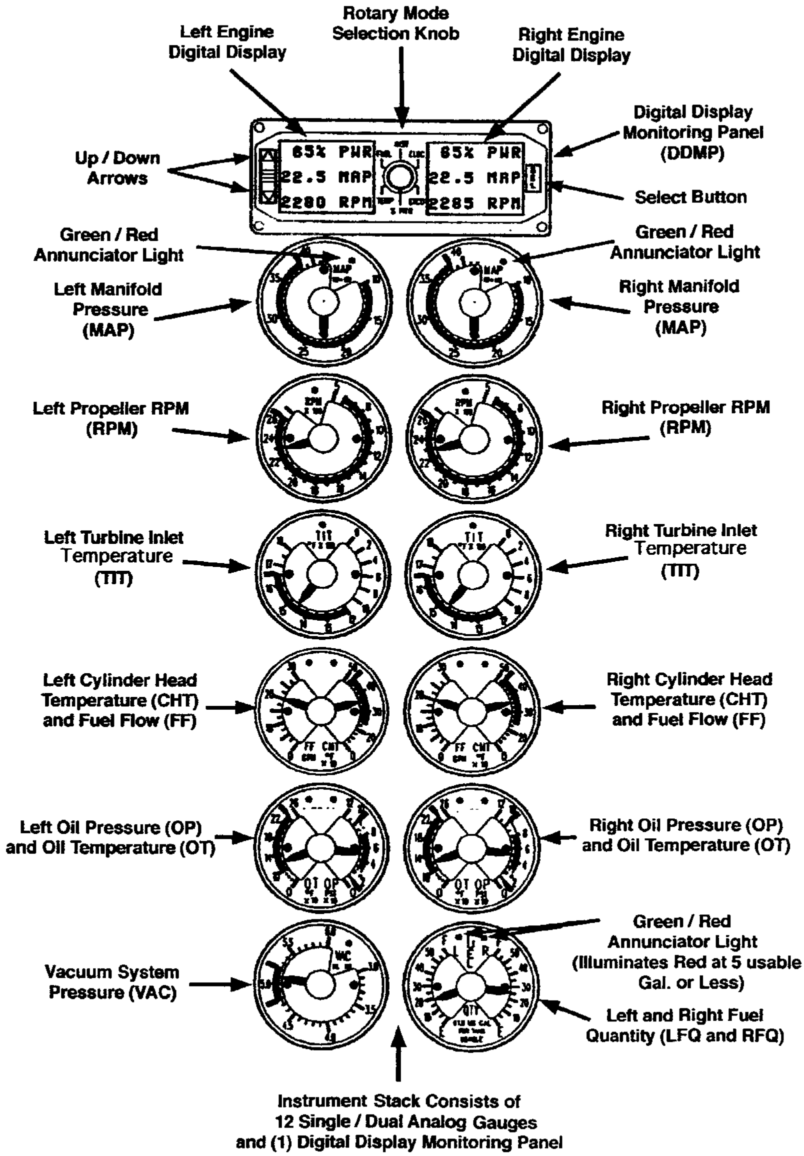
Below the DDMP are two vertical stacks of analog instruments which display (going top to bottom/left to right), manifold pressure (MAP), Propeller RPM (RPM), turbine inlet temperature (TIT), fuel flow (FF), cylinder head temperature (CHT), oil temperature (OT), oil pressure (OP), vacuum system pressure (VAC), and left/right fuel quantity (QTY). Each left/right analog indicator displays its respective engine parameter and provides data for the DDMP. Analog instruments consist of a 2 inch nonreflective glass face/dial, controllable backlighting, and an annunciator light capable of showing steady green or steady/flashing red. A steady green annunciator indicates that analog parameter is being displayed digitally in the DDMP. A steady red annunciator is illuminated when an engine parameter limit has been exceeded. Any exceedence condition will override the current DDMP display and show the parameter in exceedence, the exceedence value, illuminate a red annunciator light, (see Figure 2) and activate an audible tone. The exceedence audible tone and DDMP exceedence display will continue until the select switch is depressed. The red annunciator light will remain illuminated until the parameter is no longer in exceedence. If multiple exceedences occur, the operator must acknowledge each exceedence individually to mute the audible alarm. A steady red annunciator light in the fuel quantity gauge indicates 5 gallons or less of usable fuel remaining. Brightness of the analog instrument backlighting and DDMP display can be adjusted using the cockpit panel lighting control. Analog instrument annunciator light intensity is controlled using the panel annunciator Day/Night dimmer switch.

NOTE:

*When both analog and digital presentations exist for an aircraft instrument, **analog formats are the primary source of information** and digital displays are considered as advisory only.*

The Engine Instrument/Engine Monitoring System performs the following self-test sequence during initial power up to verify proper system operation:

1. DDMP displays Seneca model and Flightline Revision number.
2. Current Date/Time will be displayed.
3. Illumination of Red annunciator lights.
4. Analog indicator pointers will go to full scale.
5. Red annunciator lights will extinguish.
6. Illumination of Green annunciator lights.
7. Audible horn will sound for approximately 1 second.
8. Analog indicator pointers will return to rest position.
9. Green annunciator lights will extinguish.
10. Illumination of all 8 characters in each DDMP display window.
11. Internal system checks.



FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING
Figure 1

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

During normal operations, all indicators and their associated sensors will have continuous system health monitoring. In the event an indicator or sensor error is detected during the self-test sequence or normal operations, an audible horn will sound for 3 seconds, a DDMP instrument fail message will be displayed, and a flashing red annunciator light will illuminate indicating the following:

1. 2 flashes/second - instrument failure.
2. 4 flashes/second - sensor failure.

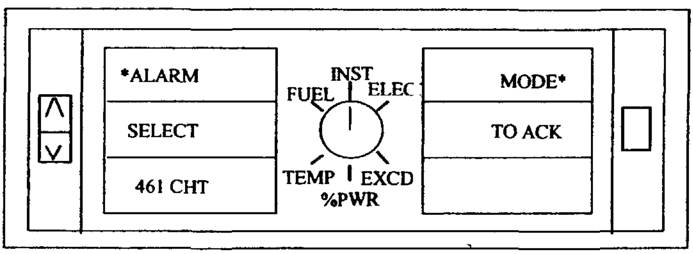


Figure 2

TOP LEVEL OPERATIONS:

FUEL MANAGEMENT (FUEL)

The fuel management mode provides fuel management functions based on inputs from pilot fuel loading entries, fuel flow sensors, and the Global Positioning System (GPS). This information is intended to assist the pilot in fuel management but should be considered as advisory only. No allowances for deviations (weather, ATC delays, etc.) or fuel reserves are factored into fuel management calculations, therefore the pilot is the final authority for all fuel management decisions.

All fuel management functions are based on total usable fuel available, therefore it is very important to visually verify and input accurate fuel loadings.

NOTE:
Usable fuel load entries are the combined total of all fuel tanks and not a per tank value.

Once an accurate fuel loading has been determined, fuel loading entry into the DDMP is initiated by placing the rotary selection knob on FUEL. Press the Select button until the Fuel Loading window is displayed (See Figure 3). The 3 options of 1) full fuel loading, 2) partial fuel loading, or 3) cancel to terminate the fuel loading procedure can be chosen.

To enter a fuel load, use the Up/Down arrows to position the cursor next to "FULL" or "PARTIAL" and press Select. "FULL" defaults to 122 gallons (maximum usable fuel) and allows the pilot to decrease the fuel loading to lower fuel loading values if desired. "PARTIAL" defaults to 0 gallons and allows the pilot to increase the fuel loading value to any value up to maximum usable fuel (122 gallons). Pressing Select again will bring up the fuel loading confirmation window. Choose yes or no using the Up/Down arrows then press Select to enter. If the fuel loading window has been selected in error, the CANCEL option can be chosen using the Up/Down arrows then the Select button to terminate the fuel loading sequence.

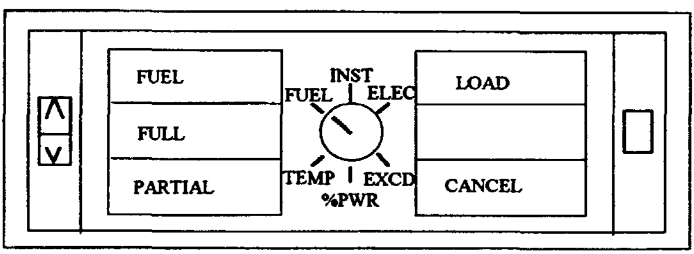


Figure 3

Once an accurate loading of usable fuel is entered in the DDMP, two additional fuel management displays (Figures 4 and 5) can be presented by pressing the Select button. More depressions of the Select button will simply cycle through the fuel load entree and two fuel management displays.

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

FUEL MANAGEMENT DISPLAY #1

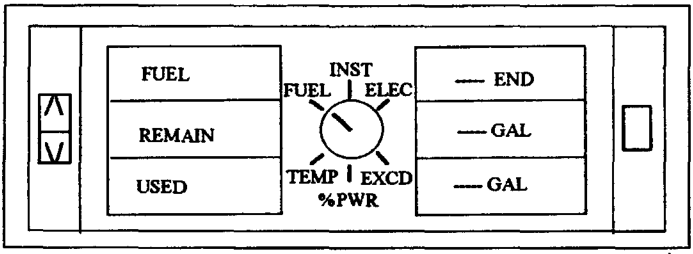


Figure 4

END - Endurance/flight time remaining. This calculation is based on current fuel flow rate and usable fuel remaining.
REMAIN - Fuel remaining in tank. This calculation is based on last usable fuel load entree and fuel used.
USED - Fuel used. This calculation is based on fuel used since last usable fuel load entree.

FUEL MANAGEMENT DISPLAY #2

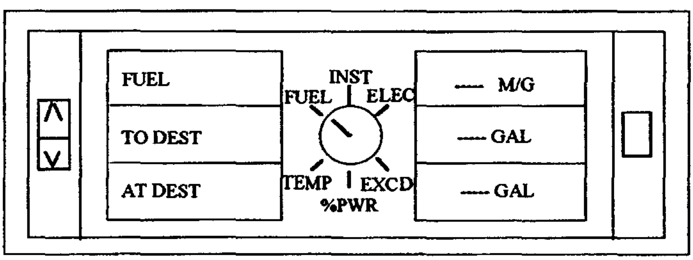


Figure 5

M/G - Nautical miles/gallon of fuel. This calculation is based on current fuel flow rate and GPS ground speed.
To DEST - fuel required to destination (current GPS waypoint). This calculation is based on current fuel flow rate, GPS distance to waypoint, and GPS ground speed.
At DEST - fuel remaining at destination (current GPS waypoint). This calculation is based on current usable fuel remaining, fuel flow rate, GPS distance to waypoint, and GPS ground speed.

ENGINE INSTRUMENT DISPLAY (INST)

The INST mode of operation enables the user to digitally display any of the engine related analog instruments in their respective left and right DDMP windows (See figure 6). The INST mode is selected by placing the rotary selection knob on INST. The Select button is then used to choose the parameter display location in one of the 6 DDMP windows. Once the DDMP display window is determined, the Up/Down button can be used to sequence through the appropriate analog instruments and choose the display parameter. This process would be repeated until all 6 DDMP windows are configured. The default DDMP instrument configuration after each Flightline system power up is MAP, RPM, and TIT.

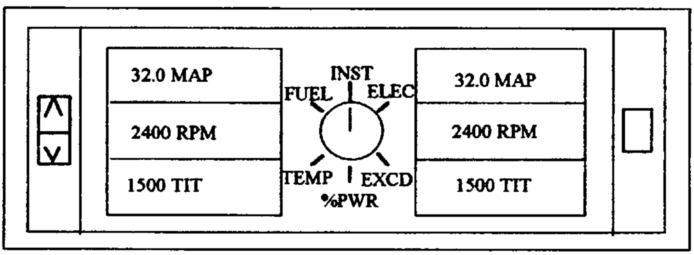


Figure 6

ELECTRICAL DISPLAY (ELEC)

The electrical mode displays electrical system information on left/right alternator amperage output, main bus voltage, and battery charge/discharge rate (see Figure 7).

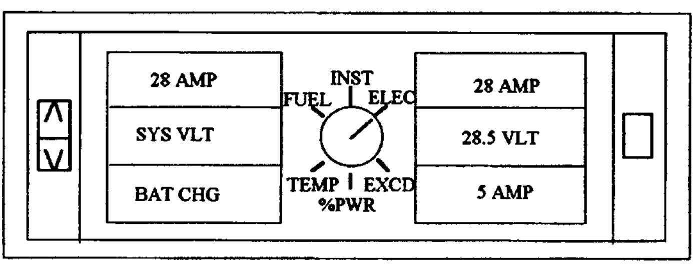


Figure 7

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

EXCEEDENCE DISPLAY (EXCD)

The EXCD mode of operation enables the user to display any parameter limitation exceedence that has occurred during ground/flight operations. Parameter name, duration of exceedence (hrs:min:sec), exceedence peak value, exceedence sequence number, time of day, and date are recorded during each occurrence in chronological order for over 200 exceedence records. Any exceedences beyond the DDMP memory limit will start to overwrite old exceedence records. Display of exceedences is accomplished by placing the rotary knob on EXCD. The DDMP will display the most resent exceedence in the format shown in figure 8. Additional exceedence records can be viewed in chronological order using the up/down arrows. Exceedence records can be cleared from the DDMP display by pressing Select which brings up the menu in Figure 9. Using the Up/Down arrows you can move to the "Clear All" window and then press select which clears all exceedences from the DDMP display. Choosing Cancel will revert back to the exceedence display format in Figure 8.

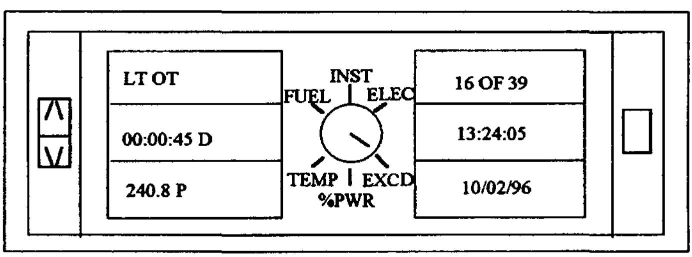


Figure 8

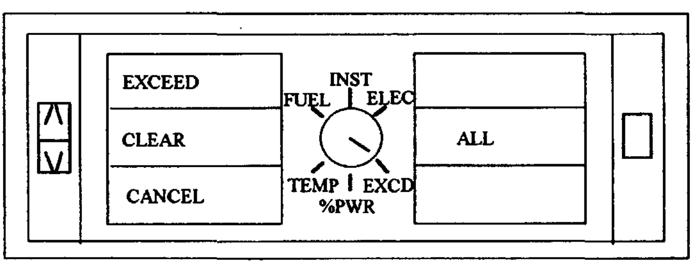


Figure 9

The following abbreviations are used in the exceedence mode:

1.	LO VLT	Low System Voltage
2.	HI VLT	High System Voltage
3.	LT MAP	High Left Manifold Pressure
4.	RT MAP	High Right Manifold Pressure
5.	LT RPM	High Left RPM
6.	RT RPM	High Right RPM
7.	LT TIT	High Left Turbine Inlet Temperature
8.	RT TIT	High Right Turbine Inlet Temperature
9.	LT CHT	High Left Cylinder Head Temperature
10.	RT CHT	High Right Cylinder Head Temperature
11.	LT OT	High Left Oil Temperature
12.	RT OT	High Right Oil Temperature
13.	LT LOP	Low Left Oil Pressure
14.	RT LOP	Low Right Oil Pressure
15.	LT HOP	High Left Oil Pressure
16.	RT HOP	High Right Oil Pressure
17.	LO VAC	Low Vacuum
18.	HI VAC	High Vacuum
19.	LFQ	Low Left Fuel Quantity
20.	RFQ	Low Right Fuel Quantity

PERCENT POWER DISPLAY (%PWR)

The percent power mode initially displays current cruise power output in 5% increments, manifold pressure, and RPM of each engine (see Figure 10) based on measured manifold pressure, RPM, pressure altitude, outside air temperature, and fuel flow. Any engine powers outside of the cruise range (50 % to 80 %) will produce — — — 's in the DDMP % power window.

NOTE:

The Pilots Operating Handbook (Report: VB 1649) shall be the final authority if any inconsistency exists between DDMP % Power Display information and the Pilot's Operating Handbook performance charts.

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

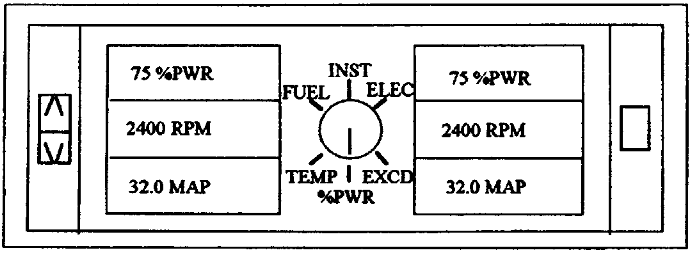


Figure 10

A desired percent power setting can be chosen by pressing the select button to bring up the display shown in Figure 11. Initially, current values of %PWR, RPM, and MAP are displayed. %PWR can be incrementally changed using the Up/Down arrows from 50% to 80% power in 5% increments. As %PWR is changed, a suggested RPM (close to current engine RPM) will be displayed along with approximate values of MAP and fuel flow using best economy leaning procedures. If a different engine RPM is desired, the Select button is pressed to navigate to the RPM window and the Up/Down arrows used to vary the RPM in 100 RPM increments. This variation in RPM changes expected values of MAP and fuel flow accordingly. Once the desired %PWR and RPM combination are chosen, subsequent pressing of the Select button will choose the Return window and then cycle back to the original percent power display (Figure 10).

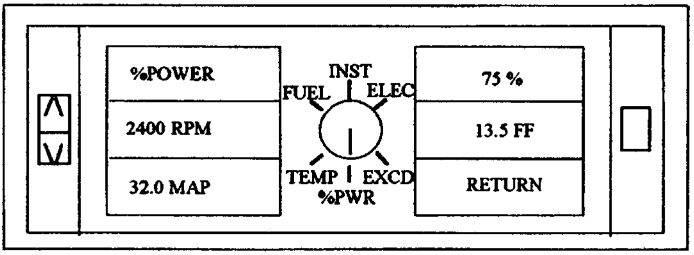


Figure 11

TEMPERATURE DISPLAY (TEMP)

The temperature mode displays outside air temperature and cabin air temperature in both degrees F and degrees C. The Select button will cycle the temperature display between degrees F and degrees C. (See Figure 12).

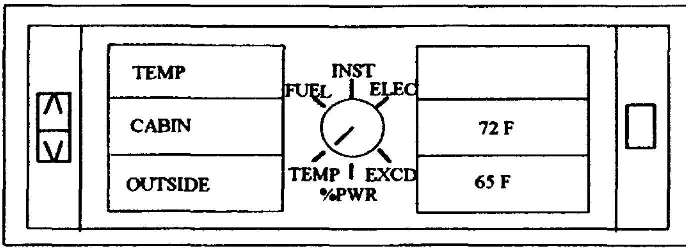


Figure 12

DDMP MAINTENANCE MODE

The maintenance mode provides maintenance operations, System Self Test, and time of day/date adjustment functions to the operator . This mode is entered by depressing the Up/Down arrow and the Select keys while in the ELEC Mode in the following sequence:

1. Up arrow
2. Down arrow
3. Up arrow - twice
4. Select Key

The DDMP will then display the format seen in Figure 13.

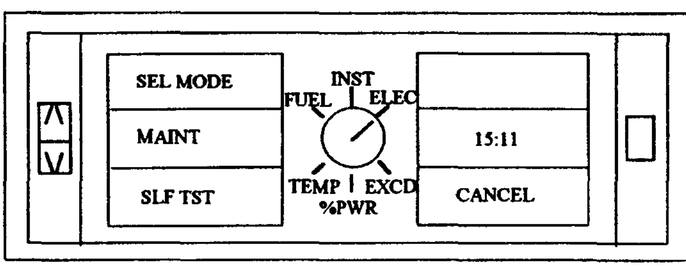


Figure 13

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

The MAINT menu provides access to factory calibrations of instruments and should not be entered/tampered with by unauthorized personnel. Access to this menu is limited to personnel with knowledge of the 4 character access code.

The SLF TST menu allows the operator to activate the system self test sequence that occurs during initial power up.

The Date and time menus allow initial input of date and time into system memory (see Figure 14). Maneuver to the desired window (time or date) using Up/Down buttons and press Select to open the menu. Press Select again to activate the left most pair of digits and increment the numbers to the desired setting using the Up/Down arrows. This procedure of pressing Select to activate the adjacent digit pairs and incrementing using Up/Down arrows is repeated until the new date or time is entered. Date and time will be retained in memory indefinitely until further adjustment is necessary. Termination of the date/time menu is initiated by choosing Return using the Up/Dwn arrows and then the Select button.

The Cancel menu returns the DDMP back to the ELEC display.

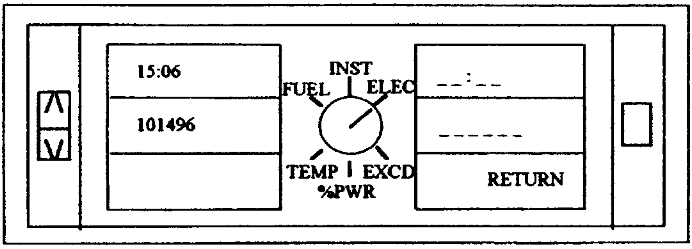


Figure 14

AUXILIARY COMMUNICATIONS

DDMP information can be accessed/stored on a personal computer via a RS-232 connection (located under pilot's side instrument panel) and standard terminal emulation software. DDMP data can be accessed using the terminal emulation software instructions and the following required settings:

Baud Rate:	9600
Parity:	None
Data Bits	8
Stop Bits:	1

7.25a FLIGHTLINE ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

Once a DDMP data connection has been made, the operator should select the "Data Dump" option. The DDMP will then send current instrument data to the connected device enabling a permanent record of the flight to be stored to disk. Data is sent approximately every 5 seconds in a comma delimited ASCII format for each of the following parameters:

Parameter	Units
Manifold Pressure	In Hg
Propeller RPM	RPM
Turbine Inlet Temperature	°F
Fuel Flow	Gal/Hr
Cylinder Head Temperature	°F
Oil Temperature	F
Oil Pressure	PSI
Vacuum Pressure	In Hg
Fuel Quantity	Gal
Cabin Air Temperature	°F
Outside Air Temperature	°F
Pressure Altitude	Ft
System Voltage	Volts
Alternator Current	Amps
Battery Charge Current	Amps

Additional auxiliary communication options may be found in the Flightline Instrument Maintenance Manual.

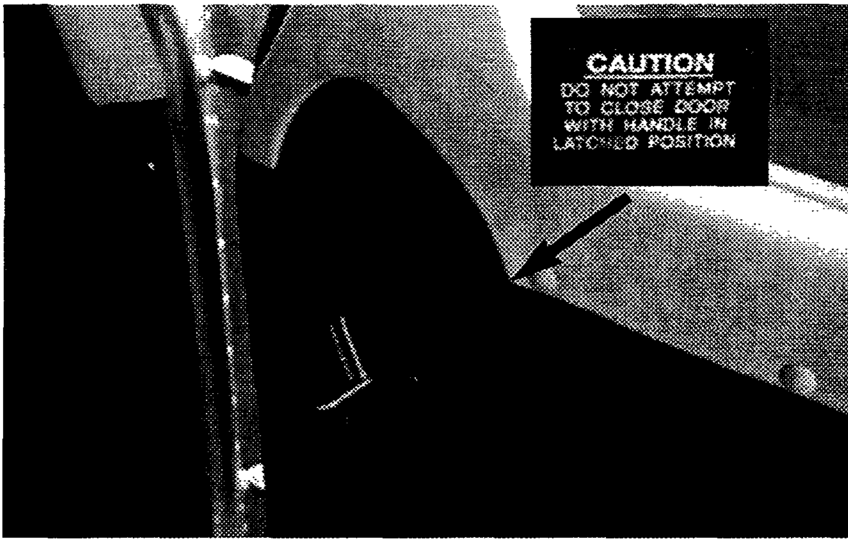
7.27 CABIN FEATURES

Cabin entry for the front seats is made through the cabin door on the right side of the airplane. To close the cabin door, hold the door closed with the armrest while moving the side door latch (Figure 7-37) down to the LATCHED position.

Cabin entry for the center and rear seats is made through the aft cabin door on the left side of the airplane. This door is double latched. To close the aft cabin door, pull the door closed with both the arm rest and the upper assist strap. Then engage the top latch to the LATCHED position. Both latches must be secure before flight.

The aft cargo door is opened by a lever located on the forward edge of the door. Pulling down on the lever disengages two locking pins from the frame.

7.27 CABIN FEATURES (Continued)



FRONT CABIN DOOR SIDE LATCH
Figure 7-37

STANDARD FEATURES

Standard front cabin features include door locks (fore and aft cabin and nose baggage), 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, cabin sound-proofing, passenger assist straps and baggage restraint straps in the nose and aft baggage areas.

SEATS

All seat backs have three positions: normal, intermediate and recline. An adjustment lever is located at the base of each seat back on the outboard side.

The pilots and co-pilots seats are adjustable fore, aft and vertically. They 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. Pivoting armrests are provided on the inboard side of each front seat.

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 center and rear seats are easily removed to provide room for bulky items. Removal of the seats is accomplished by removing the two bolts holding the aft attach points and sliding the seat aft.

NOTE

To remove the center seats, retainers securing the back legs of the seats must be unlocked. Releasing the retainers is accomplished by depressing the plunger behind each rear leg. Any time the seats are installed in the airplane, the retainers should be in the locked position.

To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.

CAUTION

Removal of any seats(s) require Weight and Balance computations. Refer to Section 6 of this POH to determine suitability for flight with seats removed.

SEAT BELTS AND SHOULDER HARNESSES

Seat belts and adjustable shoulder harnesses with inertial reels are standard on all seat locations. 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.

Shoulder harnesses shall be worn during takeoff, landing and during an emergency situation.

7.27 CABIN FEATURES (Continued)

Other features suiting individual needs are headrests, a fire extinguisher, an oxygen system, and a special cabin sound-proofing package are just a few.

A refreshment console is located between the center seats. It is removed in a manner identical to the removal of the center seats.

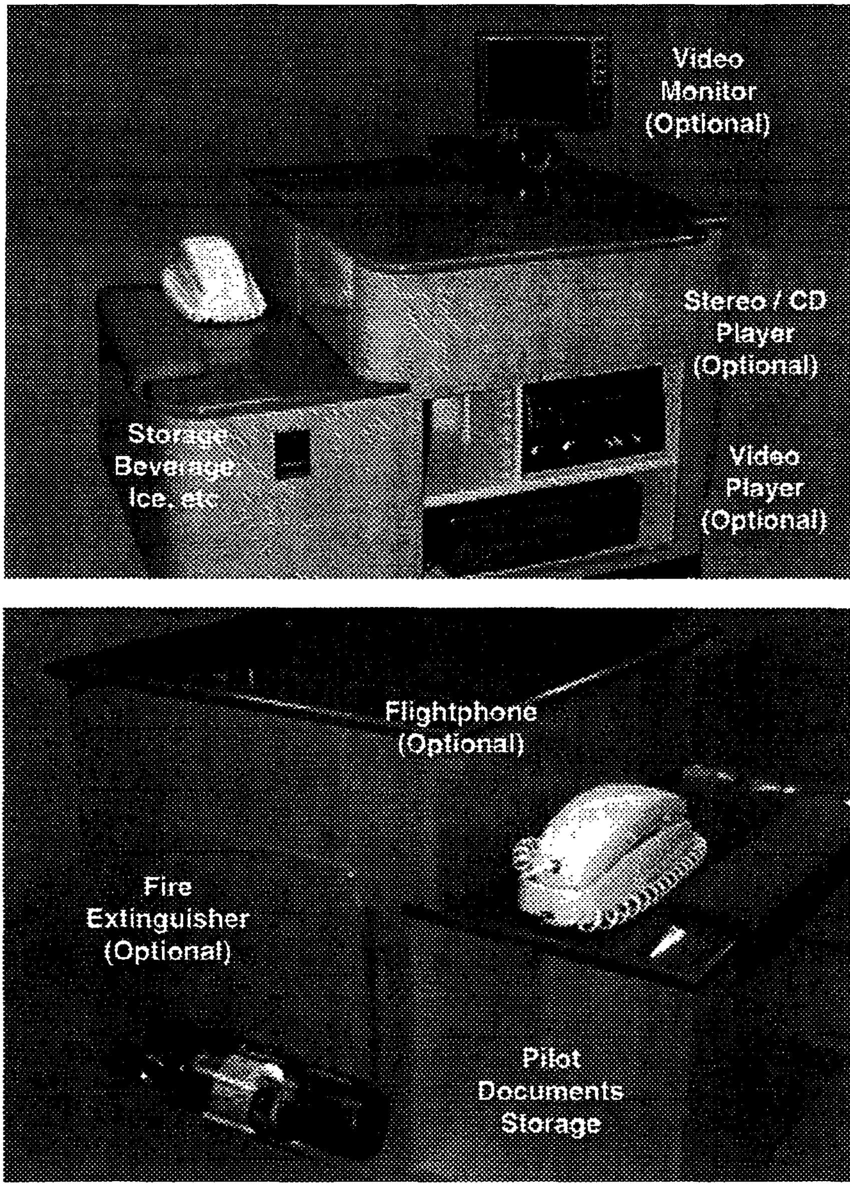
A cabin work table, serving the two seats on the right side of the passenger cabin, is offered with the club seating arrangement. The table must be stowed during takeoff and landing. If the table is to be used, it should be set up after a level cruise is established.

To set the cabin work table, simply pull up then out. To stow the cabin work table, lift up and slide it back in to the side panel.

OPTIONAL FEATURES

Air conditioning is among the very few cabin options. This option if installed will enhance the environment of the aircraft cabin by supplying conditioned air that is adjustable by the user. Complete details of this option can be found in Section 9, Supplement 2 at the end of this book.

Another option is the entertainment/executive console in place of the right hand aft facing seat. Some of the features are a horizontally sliding, pull out table, an area set up for a multi-media entertainment system, a monitor, a phone and pilots reference material compartment. (See Figure 7-39.)



ENTERTAINMENT/EXECUTIVE CONSOLE (OPTIONAL)
Figure 7-39

7.29 BAGGAGE AREA

There are two separate baggage compartments. One, the nose section baggage compartment, is accessible through a baggage door on the left side of the nose section. It has a maximum weight capacity of 100 pounds. The cabin baggage compartment, located aft of seats five and six has a weight capacity of 85 pounds. This compartment is loaded and unloaded through the rear cabin door. Tie-down straps are provided and should be used at all times. A cargo loading door, installed aft of the rear door, facilitates the loading of bulky items. The forward baggage compartment and passenger doors use the same key. The key can be removed from the forward baggage compartment door only when in the locked position. (See Fig. 7-40.)

CAUTION

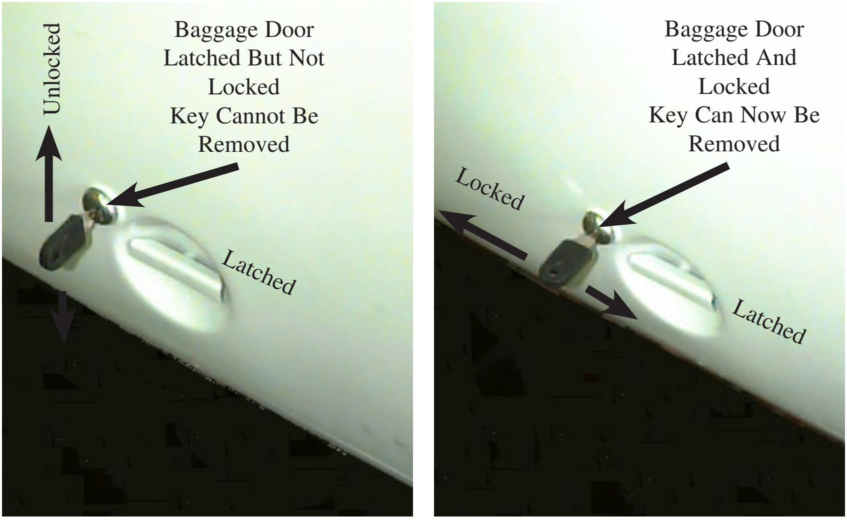
It is the pilot's responsibility to be sure that the nose baggage door is latched and locked properly. If the nose baggage door key can be removed in the unlocked position, immediate service to or replacement of the locking mechanism should occur.

A nose section baggage compartment light illuminates automatically whenever the baggage door is opened. The baggage compartment light is independent of the aircraft battery switch; therefore, when the baggage door is opened, the light will illuminate regardless of the position of the battery switch. The baggage door should not be left open or ajar for extended time periods as battery depletion could result.

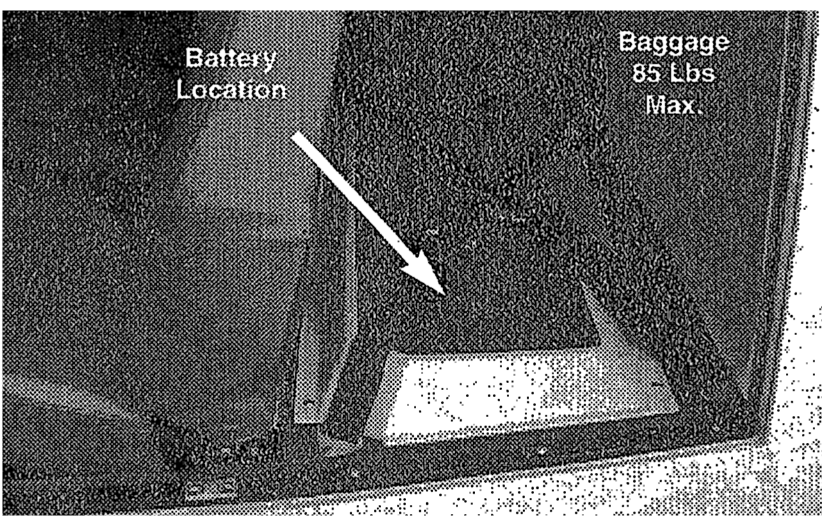
A forward baggage door ajar annunciator system senses the baggage door latch pin position. Failure to latch the forward baggage door will illuminate an amber light on the pilot's annunciator panel. The annunciator, when illuminated, is Baggage Door advising the pilot of this condition.

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.)



NOSE BAGGAGE DOOR
Figure 7-40



REAR BAGGAGE COMPARTMENT
Figure 7-41

7.31 FINISH

All exterior surfaces are finished with polyurethane.

To allow proper paint matching, paint colors and mixing numbers are noted in the front of the original airframe logbook.

7.33 STALL WARNING

An approaching stall is indicated by a stall warning indicator 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 the Section 5.

The stall warning indicator consists of a continuous sounding horn located behind the instrument panel. The stall warning horn has a different sound from that of the gear warning horn which has a 90 cycles per minute beeping sound.

The stall warning indicator is activated by two lift detectors on the leading edge of the left wing, outboard of the engine nacelle. The inboard detector activates the indicator when the flaps are in the 25 and 40 degree positions, the outboard when the flaps are set to 0° to 10°.

A squat switch in the stall warning system does not allow the units to be activated on the ground.

7.35 EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT) meets the requirements of FAR 91.52. It operates on self-contained batteries and is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate is attached with slotted-head nylon screws for ease of removal; these screws may be readily removed with a variety of common items such as a dime, key, knife blade, etc. If there are no tools available in an emergency, the screw heads may be broken off by any means.

A battery replacement date is marked on the transmitter to comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If the tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

7.35 EMERGENCY LOCATOR TRANSMITTER (Continued)

ARTEX 110-4 ELT OPERATION

On the ELT unit itself is a two position switch placarded ON and OFF. The OFF position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane.

A pilots remote switch, placarded ON and ARM is located on the lower center portion of the pilot's instrument panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in ARM position. Moving the switch to ON will activate the transmitter. A warning light located above the remote switch will alert you when ever the ELT is activated.

Should the ELT be activated inadvertently it can be reset by either positioning the remote switch to the ON then immediately relocating it to the ARM position, or by setting the switch on the ELT to ON and then back to OFF.

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON and then immediately to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

NOTE:

Three sweeps of the emergency tone and an illuminated warning light indicates a normally functioning unit. The warning light must illuminate during the first 3 second test period. If it does not illuminate, a problem is indicated such as a "G" switch failure.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane's ELT is probably transmitting. Setting the remote switch back to OFF will automatically reset the ELT and should stop the signal being received on 121.50 MHz.

TABLE OF CONTENTS

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing, and maintenance of the SENECA V. For complete maintenance instructions, refer to the PA-34-220T Maintenance Manual.

WARNING

Inspection, maintenance and parts requirements for all non-PIPER approved STC installations are not included in this handbook. When a non-PIPER approved STC installation is incorporated on the airplane, those portions of the airplane affected by the installation must be inspected in accordance with the inspection program published by the owner of the STC. Since non-PIPER approved STC installations may change systems interface, operating characteristics and component loads or stresses on adjacent structures, PIPER provided inspection criteria may not be valid for airplanes with non-PIPER approved STC installations.

WARNING

Modifications must be approved in writing by PIPER prior to installation. Any and all other installations, whatsoever, of any kind will void this warranty in it's entirety.

8.1 GENERAL (CONTINUED)

WARNING

Use only genuine PIPER parts or PIPER approved parts obtained from PIPER approved sources, in connection with the maintenance and repair of PIPER airplanes.

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Additionally, reworked or salvaged parts or those parts obtained from non-PIPER approved sources, may have service histories which are unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or may have other hidden damage not discernible through routine visual or nondestructive testing. This may render the part, component or structural assembly, even though originally manufactured by PIPER, unsuitable and unsafe for airplane use.

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

8.1 GENERAL (CONTINUED)

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Service Department to obtain the latest information pertaining to their airplane, and to avail themselves of Piper's support systems.

Piper takes a continuing interest in having owners get the most efficient use from their airplane and keeping it in the best mechanical condition. Consequently, Piper, from time to time, issues service releases including Service Bulletins, Service Letters, Service Spares Letters, and others relating to the airplane.

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent directly to the latest FAA-registered owners in the United States (U.S.) and Piper Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Piper Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Service Centers and, if necessary, to the latest FAA-registered owners in the U.S. Owners should give careful attention to Service Letter information.

Piper Service Spares Letters offer improved parts, kits and optional equipment which were not available originally, and which may be of interest to the owner.

Piper offers a subscription service for Service Bulletins, Service Letters, and Service Spares Letters. This service is available to interested persons such as owners, pilots, and mechanics at a nominal fee, and may be obtained through an authorized Piper Service Center or Piper's Customer Service Department.

Maintenance manuals, parts catalogs, and revisions to both, are available from Piper Service Centers or Piper's Customer Service Department.

Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

8.3 AIRPLANE INSPECTION PERIODS

WARNING

All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., recommended by PIPER are solely based on the use of new, remanufactured or overhauled PIPER approved parts. If parts are designed, manufactured, remanufactured, overhauled and/or approved by entities other than PIPER, then the data in PIPER'S maintenance/service manuals and parts catalogs are no longer applicable and the purchaser is warned not to rely on such data for non-PIPER parts. All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., for such non-PIPER parts must be obtained from the manufacturer and/or seller of such non-PIPER parts.

Piper has developed inspection items and required inspection intervals (i.e.: 50, 100, 500, and 1000 hours) for the specific model aircraft. Appropriate forms are contained in the applicable Piper Maintenance Manual, and should be complied with by a properly trained, knowledgeable, and qualified mechanic at a Piper Authorized Service Center or a reputable repair shop. Piper cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed Inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continuous airworthiness is maintained. Complete details are available from all local distributors representing The New Piper Aircraft, Inc.

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

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, except as provided in applicable FAR's. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance required on the airplane should be accomplished by appropriately licensed personnel.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
- (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
- (2) Aircraft Registration Certificate Form FAA-8050-3.

(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, the parking brake is released and power should be applied to start the taxi roll. The following checks should be performed:

(1) Taxi a few feet forward and apply the toe 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.
(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.

8.9 GROUND HANDLING (cont)

(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) The parking brake knob is located on the lower left of the instrument panel. To set the parking brake, first depress and hold the toe brake pedals and then pull out the parking brake knob. To release the parking brake, first depress and hold the toe brake pedals and then push in on the parking brake knob.

WARNING

No braking will occur if knob is pulled prior to brake application.

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 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 the induction air filter:
Removal of the induction air filter should be accomplished by personnel authorized by the appropriate civil aviation authority.

(b) Inspection of Induction Air Filters:
Inspection of the induction air filters should occur prior to each flight and may be accomplished by observing the filter just inside the NACA duct on each engine. If paper element is torn, ruptured, or if screen is damaged, the filter must be replaced. A more thorough inspection at a maintenance facility should occur at least once every 50 hours, and more often, when operating in harsh conditions.

(c) Cleaning and Replacement of 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. Inspect filter. The usable life of the filter should be restricted to one year or 500 hours, whichever comes first.

8.11 ENGINE INDUCTION AIR FILTERS (cont)

(d) Installation of induction Air Filters

Installation of the induction air filter should be accomplished by personnel authorized by the appropriate civil aviation authority.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. This should be checked periodically or at every 50-hour inspection and replenished when necessary. The brake reservoir is located in the forward maintenance area. Remove the four screws and rotate the fiberglass nose cone forward and down. The reservoir is located at the top rear of the compartment. Keep the fluid level at the level marked on the reservoir.

No adjustment of brake clearance is necessary. Refer to the Maintenance Manual for brake lining replacement instructions.

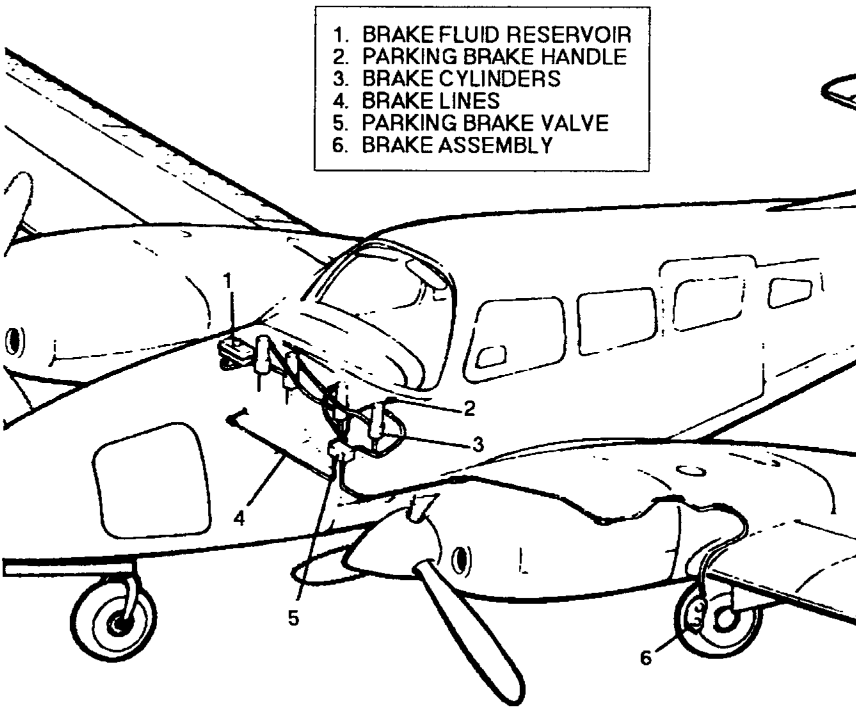
8.15 LANDING GEAR SERVICE

Two jack points are provided for jacking the aircraft for servicing. One is located outboard of each main landing gear. Before jacking, attach a tail support to the tail skid. Approximately 500 pounds of ballast should be placed on the tail support.

CAUTION

Be sure to apply sufficient support ballast; otherwise the airplane may tip forward, and the nose section could be damaged.

Landing gear oleos should be serviced according to instruction on the units. Under normal static load (empty weight of airplane plus full fuel and oil). main oleo struts should be exposed approximately 3.20 inches and the nose oleo strut should be exposed 1.2 $\pm$ .25 inches. Refer to the Maintenance Manual for complete information on servicing oleo struts.



BRAKE SYSTEM
Figure 8-1

8.17 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 HARTZELL COUNTERWEIGHT TYPE PROPELLERS

FOR PROPELLER HUBS:
BHC-J2YF-2CUF and BHC-J2YF-2CLUF

Temp. °F	Pressure (PSI)
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 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.

The gas charge in the optional 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 OIL REQUIREMENTS

The oil capacity of the Teledyne Continental engines is 8 quarts per engine with a minimum safe quantity of 3 quarts per engine. It is recommended that oil be added if the quantity falls to 6 quarts. It is recommended that engine oil be drained and renewed every 100 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The following grades are required for temperatures:

	OIL VISCOSITY Aviation Grade	S.A.E. No.
Below 40°F	1065	30
Above 40°F	1100	50

8.21 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 wing between the fuel selector valves and the auxiliary pumps in the nacelles. The fuel injector screen is located in the housing where the fuel inlet line connects to the injector. This screen should be cleaned every 50 hours of operation.

(b) Fuel Requirements (AVGAS ONLY)

The minimum aviation grade fuel for the SENECA V 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.

Whenever 100 or 100LL grade fuel is not available, commercial grade 100/130 should be used. (See Fuel Grade Comparison Chart.) Refer to the latest issue of Continental Service Bulletin - Fuel and Oil Grades.

8.21 FUEL SYSTEM (cont)

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

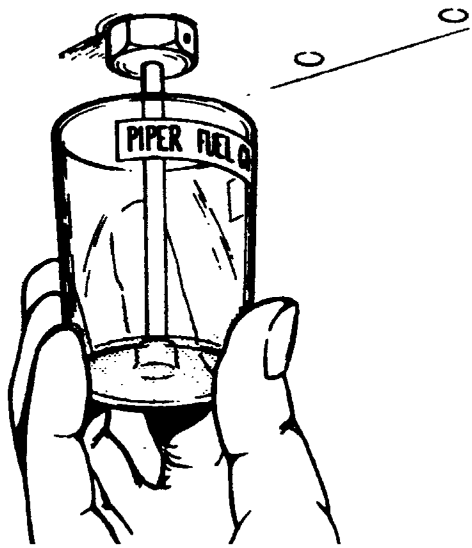
* -Grade 100LL fuel in some overseas countries is currently colored green and designated as 100L.
** -Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 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.

CAUTIONS

Some fuels have anti-icing additives preblended in the fuel at the refinery, so no further blending should be performed.

Fuel additive cannot be used as a substitute for preflight draining of the fuel system.



FUEL DRAIN
Figure 8-3

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.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks to the bottom of the filler neck with 100 grade fuel. Each wing holds a maximum of 64 gallons, giving a total of 128 gallons of fuel.

8.21 FUEL SYSTEM (cont)

(d) Draining Fuel Strainer, Sumps and Lines

Each gascolator strainer is provided with a quick drain which should be drained before the first flight of the day and after refueling, to check for fuel contamination and proper fuel. 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 fuel tank is provided with a fuel quick drain to check for contamination. Each tank should be checked for contamination in accordance with the above procedure. Crossfeed drains are located on the bottom of the fuselage inboard of the right flap. The fuel drained at each quick drain 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.

(e) Draining Fuel System

The bulk of the fuel may be drained either by opening the valve at the inboard end of each tank or by siphoning. The remaining fuel in the lines may be drained through the gascolators and the two drains located on the bottom of the fuselage, inboard of the right flap.

8.23 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 tire should be inflated to 40 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.

8.25 BATTERY SERVICE

Access to the 24-volt 19 ampere hour battery is gained through an access cover located in the aft baggage compartment.

The battery fluid level must not be brought above the baffle plates. It should be checked every 30 days to determine that the fluid level is proper and the connections are tight and free of corrosion. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use distilled water only. A hydrometer check will determine the percent of charge in the battery.

If the battery is not properly charged, recharge it starting with a rate of 4 amperes and finishing with a rate of 2 amperes. Quick charges are not recommended .

The external power receptacle is located on the lower left fuselage below the cargo door. Be sure that the master switch is off while inserting or removing a plug at this receptacle. Connect 24 VDC external power source only.

Refer to the PA-34-220T Maintenance Manual for detailed procedures for cleaning and servicing the battery.

8.27 SERIAL NUMBER PLATES

The serial number plate is located on the left side of the fuselage near the leading edge of the stabilator. The serial number should always be used when referring to the airplane on service or warranty matters.

8.29 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 PA-34-220T Maintenance Manual.

8.31 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.

CAUTION

Do not spray solvent into the alternator, pressure pump, starter, air intakes, or alternate air inlets.

(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 operate the engine until excess solvent has evaporated or otherwise been removed.

(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.

(4) Remove the protective tape from the magnetos.

(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the PA-34-220T 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 PA-34-220T Maintenance Manual.

CAUTION

Do not brush the micro switches.

8.31 CLEANING (cont)

(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.

(3) To remove exhaust stains, allow the solution to remain on the surface longer.

(4) To remove stubborn oil and grease, use a cloth dampened with naphtha.

(5) Rinse all surfaces thoroughly.

(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.

(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.

(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.

(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff bristle 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 Carpet

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a nonflammable dry cleaning fluid. Floor carpets may be removed and cleaned like any household carpet.

8.31 CLEANING (cont)

(g) Cleaning Deicing Equipment*

The deicers should be cleaned when the aircraft is washed using a mild soap and water solution.

In cold weather, wash the boots with the airplane inside a warm hangar if possible. If the cleaning is to be done outdoors, heat the soap and water solution before taking it out to the airplane. If difficulty is encountered with the water freezing on boots direct a blast of warm air along the region being cleaned using a portable ground heater.

As an alternate cleaning solvent, use benzol or nonleaded gasoline. Moisten the cleaning cloth in the solvent, scrub lightly, and then, with a clean, dry cloth, wipe dry so that the cleaner does not have time to soak into the rubber. Petroleum products such as these are injurious to rubber, and therefore should be used sparingly if at all.

With the deicer boots properly cleaned, a coating of Agemaster No. 1 should be applied as described in the PA-34-220T Maintenance Manual. This treatment helps protect the boot rubber from ozone attack, aging and weathering.

After the Agemaster coating is dry, a coating of B.F. Goodrich Icex may be applied to the boots if icing conditions are anticipated. For specific instructions refer to the PA-34-220T Maintenance Manual.

8.33 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, left hand side, forward of the door, using the strap provided.

* Optional equipment

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SUPPLEMENTS

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SUPPLEMENTS

SECTION 9

SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of Supplements which are necessary for efficient operation of the airplane when equipped with one or more of the various optional systems and equipment not approved with the standard airplane.

All of the supplements provided in this section are FAA Approved and consecutively numbered as a permanent part of this Handbook. The information contained in each Supplement applies only when the related equipment is installed in the airplane.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 1
FOR
FIXED OXYGEN SYSTEM INSTALLATION
SCOTT AVIATION PRODUCTS
AMBASSADOR MARK III

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional fixed oxygen system is installed per the Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED: ______________________________
PETER E. PECK
D.O.A. NO. SO-1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: JANUARY 23, 1997

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional fixed oxygen system is installed in accordance with FAA Approved Piper data.

This fixed oxygen system provides supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet). The major components of the Scott oxygen system are a 77 cubic foot oxygen cylinder, an oxygen supply gauge, an ON-OFF flow control knob, a pressure regulator, six plug-in receptacles and six oxygen masks.

The oxygen cylinder is mounted in the forward baggage compartment. When fully charged, the cylinder contains oxygen at a pressure of 1850 psi at 70°F. The oxygen supply gauge is mounted in the pilot's instrument panel. The oxygen flow control knob, labeled Oxygen/ Pull-On is also mounted in the pilot's instrument panel. The pressure regulator is mounted directly on the oxygen cylinder, once the oxygen flow control knob is on, each of the oxygen plug-in receptacles operates as an automatic on-off valve. The oxygen cylinder can be recharged through the forward baggage compartment on the left side of the fuselage.

If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, the control knob should be pulled to the ON position, allowing oxygen to flow from the cylinder through the system. Connecting the constant flow mask fitting to a receptacle and turning it 90 degrees clockwise, automatically releases oxygen to the mask through the on-off valve feature of the receptacle. The occupant then dons the mask and breathes normally for a sufficient supply of oxygen.

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen use is essential, descend immediately to a safe altitude.

When not in use, masks may be stowed in the storage pockets behind the front and center seats. Always remove fittings from the oxygen receptacles and stow the mask when they are not in use. If the control knob is pulled on and the fitting is in the receptacle, oxygen will flow through the mask continuously. Masks may be damaged if they are not properly stowed.

CAUTION

Positively **NO SMOKING** while oxygen is being used by anyone in the aircraft.

To stop the flow of oxygen through the system, the control knob should be pushed to the OFF position. To bleed down low pressure lines, it is recommended that the mask assembly be left connected to the outlet for at least three minutes after the control knob is turned off.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid, and other flammable material should be kept away from oxygen equipment.

SECTION 2- LIMITATIONS

(a) No smoking allowed when oxygen system is in use.
(b) Six occupants maximum when oxygen is required.
(c) Oxygen duration (Bottle pressure 1850 PSI):

DURATION IN HOURS AT ALTITUDE
(Based on 90% Consumption)

Persons Using System	10,000	15,000	20,000	25,000
1	9.3	9.8	10.1	10.3
2	4.7	4.9	5.1	5.2
3	3.1	3.3	3.4	3.4
4	2.3	2.5	2.5	2.6
5	1.9	2.0	2.0	2.1
6	1.6	1.6	1.7	1.7

SECTION 3 - EMERGENCY PROCEDURES

(a) Time of useful consciousness at 25,000 feet is approximately 3 minutes.
(b) If oxygen flow is interrupted as evidenced by the flow indicators or hypoxic indications:
 (1) Install another mask unit.
 (2) Install mask connection in an unused outlet if available.
 (3) If flow is not restored, immediately descend to below 12,500 feet.

In the event an emergency descent becomes necessary, CLOSE the throttles and move the propeller controls full FORWARD. Adjust the mixture control as necessary to attain smooth operation. Extend the landing gear at 130 KIAS and maintain this airspeed.

SECTION 4- NORMAL PROCEDURES

PREFLIGHT

(a) Check oxygen quantity.
(b) Turn on oxygen system and check flow indicators on all masks. All masks are stored in the seat pockets of the front and middle seats.

IN-FLIGHT

(a) Adjust oxygen mask.
(b) Turn on system.
(c) Monitor flow indicators and quantity.

CAUTION

Do not use oxygen system below 200 PSI to prevent contamination and/or moisture from entering depleted cylinder-regulator assembly. If cylinder has been depleted it must be removed and refurbished in accordance with the manufacturer's recommended procedures.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 3
FOR
ICE PROTECTION SYSTEM INSTALLATION

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional ice protection system is installed per the Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:
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THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: JANUARY 23, 1997

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Ice Protection System is installed in accordance with FAA Approved Piper data.

For flight into known icing conditions, a complete ice protection system (Figure 9-1) is required on the SENECA V.

SECTION 2 - LIMITATIONS

(a) The ice protection system was designed and tested for operation in the meteorological conditions of FAR 25, Appendix C, for continuous maximum and intermittent maximum icing conditions. **The ice protection system was not designed or tested for flight in freezing rain and/or mixed conditions or for icing conditions more severe than those of FAR 25, Appendix C. Therefore, flight in those conditions may exceed the capabilities of the ice protection system.**

(b) Equipment required for flight into known or forecast icing:
   (1) Pneumatic wing and empennage boots and SURF DEICE annunciation.
   (2) Wing ice detection light.
   (3) Electrothermal propeller deice pads on the propeller blades.
   (4) Electrically heated windshield and WSHLD HEAT annunciation.
   (5) Heated lift detector.
   (6) Heated pitot head.
   (7) 2 Operating alternators.
   (8) 2 Operating vacuum pumps.
   (9) Alternate static source.
   (10) All equipment required for night IFR flight.

(c) If all the equipment listed is not installed and operative, the following placard must be installed in full view of the pilot.

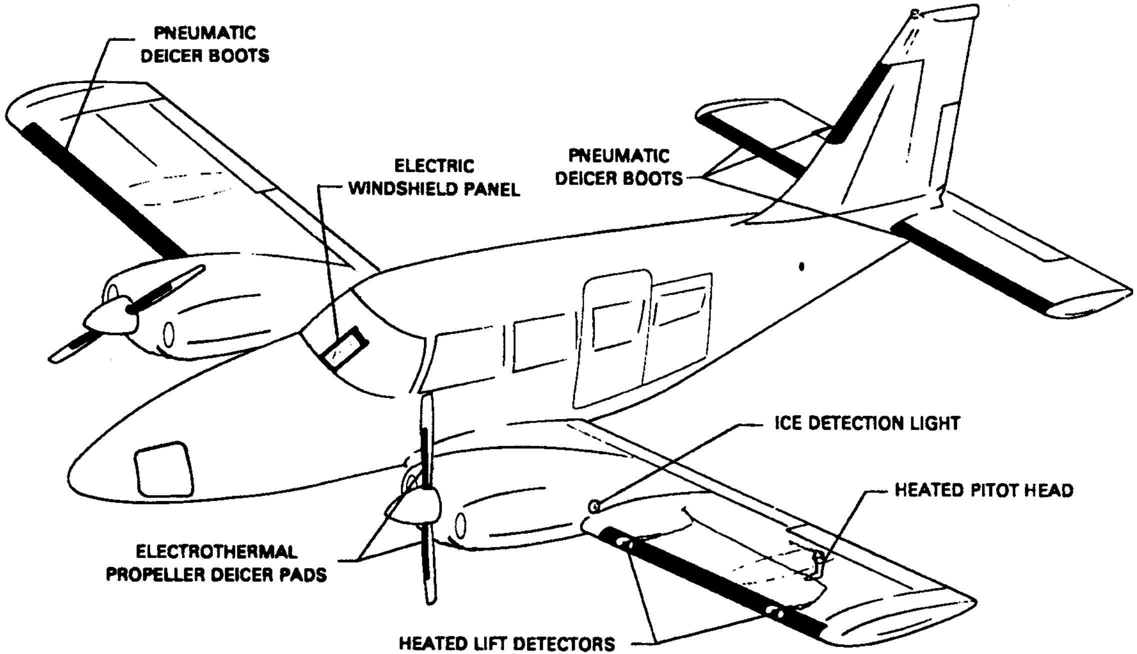
WARNING

THIS AIRCRAFT IS NOT APPROVED FOR FLIGHT IN ICING CONDITIONS.

PLACARDS

On instrument panel in full view of the pilot:
(S/N 3449105, 3449134, 3449140 thru 3449146, 3449150 thru 3449158, 3449161 thru 3449174, unless Piper Service Bulletin 1043 has been complied with)

FLIGHT INTO KNOWN ICING
ABOVE 20,000 FT. MSL
NOT APPROVED


PNEUMATIC
DEICER BOOTS
ELECTRIC
WINDSHIELD PANEL
PNEUMATIC
DEICER BOOTS
ICE DETECTION LIGHT
HEATED PITOT HEAD
ELECTROTHERMAL
PROPELLER DEICER PADS
HEATED LIFT DETECTORS

SECTION 3 - EMERGENCY PROCEDURES

WARNING

The malfunction of any required deice equipment requires immediate action to exit icing conditions. Depending on the severity of the icing encounter, failure to take immediate positive action can lead to performance losses severe enough to make level flight impossible. Therefore, upon verification of a system malfunction or failure, climb or descend out of icing conditions if this provides the shortest route. If exit must be made in level flight, consider the use of maximum power and exit by the most direct route. The effect of the additional fuel burned at higher power settings on aircraft range must be considered and an alternate airport chosen if necessary.

ENGINE FAILURE IN ICING CONDITIONS

Select alternate air and attempt restart.

If unable to restart engine:

Inoperative Propeller .... FEATHER
Airspeed .... at or above 88 KIAS
Descend if necessary to maintain airspeed.

Electrical Load .... REDUCE
Avoid further icing conditions if possible.

Land as soon as practical.

Maintain at least 89 KIAS on final.

Do not extend gear or lower flaps until certain of making field.
Flaps .... 25°

ALTERNATOR FAILURE IN ICING CONDITIONS

(Left or Right Alternator Inop. annunciator light illuminated)

NOTE

Anytime total tie bus voltage is below 25 Vdc, the LOW BUS VOLTAGE annunciator will illuminate.

Verify failure....CHECK AMMETER
Electrical load (if Low Bus Voltage annunciator illuminated)....Reduce until load is less than 85 amps & LOW BUS VOLTAGE annunciator extinguished.
Failed ALTR switch....OFF
Failed ALTR circuit breaker....CHECK and RESET as required
Failed ALTR switch (after OFF at least one second)....ON

If power not restored:
Failed ALTR switch....OFF
Ammeter....Monitor and maintain below 85 amps

While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment, particularly windshield or propeller heat, may be limited. Immediate action should be taken to avoid or exit icing conditions. Under no circumstances may the total electrical load exceed 85 amps. The electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

SECTION 3 - EMERGENCY PROCEDURES (CONT'D)

SINGLE VACUUM PUMP FAILURE IN ICING CONDITIONS

(Left or Right Vacuum Inop. light illuminated - annunciator panel)

Gyro Suction Gauge................................Check (within normal operating range).

Although either vacuum pump has sufficient capacity to operate the deice boots and flight instruments in a normal manner, immediate action should be taken to exit icing conditions.

PROPELLER HEAT SYSTEM MALFUNCTION

Excessive vibration may be an indication that the propeller heat is not functioning properly.

Propeller control ....exercise
Propeller heat ammeter ....check for proper indications:
(a) ON (needle in green arc) for approx. 90 seconds
(b) OFF for approx. 90 seconds

A reading below the green arc during the ON cycle is an indication that the propeller blades may not be deicing properly.

PROP HEAT switch ....OFF if failure is indicated

WARNING

It is imperative that the PROP HEAT switch be turned OFF if vibration persists. This can be a symptom of uneven blade deicing which can lead to propeller unbalance and engine failure.

IMMEDIATE ACTION SHOULD BE TAKEN TO EXIT ICING CONDITIONS.

SURFACE DEICE MALFUNCTION

If SURFACE DE-ICE annunciator light remains illuminated more than 30 seconds, pull the surface deice circuit breaker. Immediate action should be taken to exit icing conditions.

SECTION 4- NORMAL PROCEDURES

The Piper SENECA V is approved for flight into known icing conditions when equipped with the complete Piper Ice Protection System. Operating in icing conditions of the Continuous Maximum and Intermittent Maximum as defined in FAR 25, Appendix C has been substantiated; however, there is no correlation between these conditions and forecasts of reported Light, Moderate and Severe conditions.

Therefore, on the basis of flight tests, the following guidelines should be observed.

(a) **Flight into severe icing is not approved.**

(b) **Freezing rain must always be avoided.**

(c) Moderate icing conditions above 10,000 ft. should be avoided whenever possible; if moderate icing conditions are encountered above 10,000 ft., a descent to a lower altitude should be initiated if practical.

(d) Operation in light icing is approved at all altitudes.

Icing conditions of any kind should be avoided whenever possible, since any minor malfunction which may occur is potentially more serious in icing conditions.

WARNING

Do not cycle pneumatic boots with less than 1/4 inch of ice accumulation; operation of boots with less than 1/4 inch ice accumulation can result in failure to remove ice.

Do not hold momentary surface deice switch ON.

Continuous attention of the pilot is required to monitor the rate of ice build-up in order to effect the boot cycle at the optimum time. Boots should be cycled when ice has built to between 1/4 and 1/2 inch thickness on the leading edge to assure proper ice removal. Repeated boot cycles at less than 1/4 inch can cause a cavity to form under the ice and prevent ice removal, boot cycles at thicknesses greater than 1/2 inch may also fail to remove ice.

Icing conditions can exist in any clouds when the temperature is below freezing; therefore it is necessary to closely monitor outside air temperature when flying in clouds or precipitation. Clouds which are dark and have sharply defined edges have high water content and should be avoided whenever possible. **Freezing rain must always be avoided.**

NOTE

Pneumatic boots must be cleaned regularly for proper operation in icing conditions. The exterior surfaces of the aircraft should be checked prior to flight. **Do not attempt flight with frost, ice or snow adhering to the exterior surfaces of the aircraft or landing gear.**

Prior to dispatch into forecast icing conditions all ice protection should be functionally checked for proper operation. Before entering probable icing conditions use the following procedures:

(a) Windshield defroster - ON (immediately)

(b) Pitot heat - ON (immediately)

(c) Windshield heat - ON (immediately)

(d) Propeller deice - ON (when entering icing conditions)

(e) Wing deice - ON (after 1/4 to 1/2 inch accumulation)

(f) Relieve propeller unbalance (if required) by increasing RPM briefly. Repeat as required.

Heat for the lift detectors is activated by the pitot heat switch.

When ice has accumulated on the unprotected surfaces of the airplane, aerodynamic buffet commences between 5 and 10 knots above the stall speed. A substantial margin of airspeed should be maintained above the normal stall speed, since the stall speed may increase by up to 10 knots in prolonged icing encounters. Allow for increased landing distance due to higher approach speeds.

SECTION 4- NORMAL PROCEDURES (Continued)

If ice is remaining on the unprotected surfaces of the airplane at the termination of the flight, the landing should be made using full flaps and carrying a slight amount of power whenever practical, and approach speeds should be increased by 10 to 15 knots.

Cruise speed may be significantly reduced in prolonged icing encounters. If icing conditions are encountered at altitudes above 10,000 feet, it may be necessary to descend in order to maintain airspeed above the best rate of climb speed (88 KIAS).

NOTE

Pneumatic boots must be regularly cleaned and waxed for proper operation in icing conditions. Pitot, windshield and lift detector heat should be checked on the ground before dispatch into icing conditions.

SECTION 5- PERFORMANCE

WARNING

Ice accumulation of the unprotected surfaces can result in significant performance loss.

Installation of ice protection equipment results in a 30 F. P. M. decrease in single engine climb performance and a reduction of 850 feet in single engine service ceiling.

All other performance is unchanged.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the Aircraft Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT

For flight into known icing conditions (FIKI), a complete ice protection system (9-1) is required on the Seneca V.

The complete ice protection system consists of the following components: Pneumatic wing and empennage boots, wing ice detection light, electrothermal propeller deice pads, electrically heated windshield panel, heated lift detectors, heated pitot head. A single component or a combination of components may be installed. However, the warning placard specified in Section 2 of this supplement is required when the complete system is not installed. Such a placard is also required if any component is inoperative.

The aircraft is designed to allow operation in the meteorological conditions of the FAR 25 envelopes for continuous maximum and intermittent maximum icing. **The airplane is not designed to operate for an indefinite period of time in every icing condition encountered in nature.** Activation of the ice protection system prior to entering icing conditions and attempting to minimize the length of the icing encounter will contribute significantly to the ice flying capabilities of the airplane.

Pneumatic Boot Deice System

The pneumatic wing and empennage boots are installed on the leading edges of the wings, the vertical stabilizer and the horizontal stabilator. During normal operation, when the surface deicer system is off, the engine-driven pneumatic pumps apply a constant suction to the deicer boots to provide smooth, streamlined leading edges.

Deicer boots are inflated by a momentary ON type SURFACE DE-ICE switch (Figure 9-3) located on the instrument panel above the control quadrant. Actuation of the surface deice switch activates a system cycle timer that energizes the pneumatic pressure control valves until the system pressure reaches 17 psi or until 6 seconds is reached. The boot solenoid valves are activated and air pressure is released to the boots, inflating all surface deicers on the airplane.

SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT (CONT'D)

Pneumatic Boot Deice System (Cont'd)

A green indicator light (Wing/Tail Deice) located in the right annunciator cluster illuminates when the wing-tail deicer surface boots are inflated above 8 psi. When the cycle is complete, the deicer solenoid valves permit automatic overboard exhaustion of pressurized air. Suction is then reapplied to the deicer boots.

Circuit protection for the surface deicer system is provided by a SURFACE DE-ICE circuit breaker located on the circuit breaker panel.

Wing Ice Detection Light

Wing icing conditions may be detected during night flight by use of an ice detection light installed in the outboard side of the left engine nacelle. The light is controlled by a WING ICE LIGHT switch (Figure 9-3). A WING ICE LIGHT circuit breaker located in the circuit breaker panel provides circuit protection.

Propeller Deice Pad System

Electrothermal propeller deicer pads are bonded to the leading edges of the propeller blades. The system is controlled by an ON-OFF type PROP DE-ICE switch (Figure 9-3). Power for the propeller deicers is supplied by the airplane's electrical system through a PROP DE-ICE circuit breaker in the circuit breaker panel. When the prop deice switch is actuated, power is applied to a timer through the PROP DE-ICER ammeter which monitors the current through the propeller deicing system. With the propeller deicing system on, the prop deicer ammeter needle should indicate within the shaded portion of the ammeter for a normal reading.

ICE DETECTION LIGHT, SURFACE DEICER, PROPELLER DEICER AND HEATED WINDSHIELD CONTROL SWITCHES
Figure 9-3

SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT (CONT'D)

Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller deicer pads.

The McCauley 3-blade propellers and Hartzell two blade propellers are deiced by heating the entire deicer pads alternately in the following sequence:

(a) The entire deicer pads on the right engine for 90 seconds.

(b) The entire deicer pads on the left engine for 90 seconds.

When the system is turned ON, heating may begin on any one of the above steps, depending upon the positioning of the timer switch when the system was turned OFF from previous use. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off.

A preflight check of the propeller deicers can be performed by turning the prop deice switch on and feeling the propeller deicer pads for proper heating sequence. The deicer pad should become warm to the touch.

The heat provided by the deicer pads reduces the adhesion between the ice and the propeller so that centrifugal force and the blast of airstream cause the ice to be thrown off the propeller blades in very small pieces.

Heated Windshield Panel

A heated glass panel is installed on the exterior of the pilot's windshield to provide visibility in icing conditions. The panel is heated by current from the airplane's electrical power supply and controlled by an ON-OFF control switch. The control switch is located below the left avionics stack and is placarded WINDSHIELD PANEL HEAT - SEE AIRCRAFT FLIGHT MANUAL.

SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT (CONT'D)

CAUTION

If the airplane is to be flown with the heated glass panel removed, rotate the receptacle plate 180° and replace it to cover the holes in the fuselage skin. Also replace the windshield collar screws.

An operational check may be performed by turning the heated windshield panel switch on for a period not exceeding 30 seconds. Proper operation is indicated by the glass section being warm to the touch.

Heated Lift Detectors and Heated Pitot Head

Two heated lift detectors and a heated pitot head installed on the left wing are controlled by a single ON-OFF type PITOT HEAT switch located below the left avionics stack.

The heated lift detectors, one inboard and one outboard on the left wing, are installed to prevent icing conditions from interfering with operation of the stall warning transmitters. A Stall Warn circuit breaker in the circuit breaker panel protects the system against an overvoltage condition. The stall warning system should not be depended on when there is ice on the wing.

A heated pitot head, mounted under the left wing, is installed to provide heat to alleviate ice accumulation from blocking the pressure intake. The heated pitot head also has a separate circuit breaker located in the circuit breaker panel labeled Pitot Heat.

CAUTION

Care should be taken when an operational check of the heated pitot head and the heated lift detectors is being performed. Both units become very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

With the PITOT HEAT switch ON, check the heated pitot head and heated lift detector for proper heating.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 4
FOR
PROPELLER SYNCHROPHASER INSTALLATION

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional propeller synchrophaser is installed per the Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: JANUARY 23, 1997

SECTION I - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional propeller synchrophaser is installed in accordance with FAA Approved Piper data.

The function of the synchrophaser is to maintain both propellers at the same RPM and at a selected phase angle. This eliminates the propeller beat effect and minimizes vibration.

When the propeller synchrophaser is installed, the left engine is established as the master engine, and the right engine is equipped with a slave governor which automatically maintains its RPM with the left engine RPM.

When the propeller synchrophaser is installed, a three-position switch is located on the throttle quadrant below the propeller controls. It is labeled OFF for manual control and 1 or 2 for propeller synchrophaser. A blue press-to-test light is located below the switch and illuminates when the propellers are out of synchronization.

SECTION 2- LIMITATIONS

Placards:
On the throttle quadrant below engine and propeller controls:

> USE OFF POSITION FOR TAKEOFF, LANDING AND SINGLE ENGINE OPERATIONS.

SECTION 3- EMERGENCY PROCEDURES

The propeller synchrophaser must be in the OFF position for all single engine operations.

SECTION 4- NORMAL PROCEDURES

During taxi, takeoff, landing or single engine operations the propeller synchrophaser switch should be in the OFF position. The blue press-to-test light below the switch will illuminate while the propellers are out of synchronization, whether the switch is in the OFF, 1, or 2 position.

When the switch is in the OFF position the propellers can be synchronized manually and the light will go out when propeller synchronization is complete.

For automatic synchronization, the propellers should be synchronized manually to within approximately 10 RPM and the switch placed in the 1 position. The blue light will go out when synchronization is complete. For a given RPM and power setting, switch position 2 may provide smoother operation by means of providing a different phase angle. Set the switch to position 1 or 2, whichever provides the smoothest operation. Normally, propeller synchrophasing will take place within a few seconds, but occasionally it may take up to a full minute.

When the power setting is to be changed, the synchrophaser switch should be set to OFF for 30 seconds before the power setting is adjusted; then the synchrophaser switch may be returned to the 1 or 2 position, whichever provides the smoothest operation. If the propeller RPM differential exceeds 50 RPM, the switch should be set at OFF for 30 to 40 seconds; then the propellers can be synchronized again and the synchrophaser switch returned to 1 or 2.

Pulling the circuit breakers completely deactivates the propeller synchrophaser system. If the master switch is turned OFF or if there is an electrical system failure, the slave engine will return to the controlled selected RPM plus approximately 25 RPM out of synchronization regardless of the position of the synchrophaser switch.

SECTION 5- PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 5
FOR
BENDIX/KING KFC 150 SERIES
FLIGHT CONTROL SYSTEM

The FAA Approved Operational Supplement to the Bendix/King 150 Series Flight Control System as installed per STC SA1575CE-D is supplied by the autopilot manufacturer. Bendix/King will be responsible to supply and revise the operational supplement. It is permitted to include the Bendix/King supplement in this location of the Pilots Operating Handbook unless otherwise stated by Bendix/King. The information contained in the Bendix/King 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 autopilot. For limitations, procedures and performance information not contained in the Bendix/King supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 6
FOR
BENDIX/KING RDR 2000 VERTICAL PROFILE WEATHER RADAR SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Bendix/King RDR 2000 Vertical Profile Weather Radar System is installed per the Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED ______________________

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DATE OF APPROVAL JANUARY 23, 1997

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Bendix/King RDR 2000 Vertical Profile Weather Radar System is installed in accordance with FAA Approved Piper data.

SECTION 2 - LIMITATIONS

Do not operate the radar during refueling operations or within 15 feet of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

WARNING

Do not operate the radar during refueling operations or within 15 feet of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

NOTE

At altitudes above 4,500 feet AGL when the range is set to 2.5 miles, a small sector of return may be observed as an arc at approximately 1.5 miles on the weather display. This is ground reflection which will diminish with increasing range. This anomaly is not significant and does not effect the operation or display of weather radar.

Preflight and normal operating procedures are outlined in the Bendix/King RDR 2000 Vertical Profile Weather Radar System Pilot's Guide, P/N 006-08755-0000, latest revision.

SECTION 5 - PERFORMANCE

No change to the aircraft Performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 6 - WEIGHT AND BALANCE

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

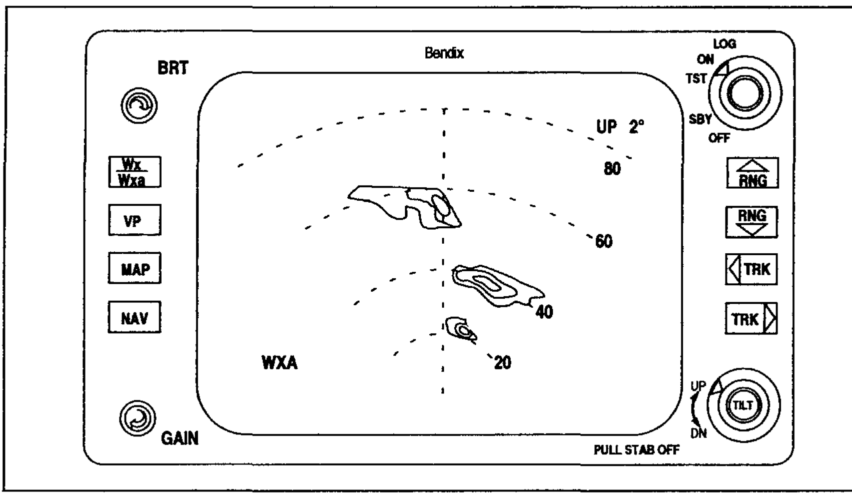
SECTION 7 - DESCRIPTION AND OPERATION

The RDR 2000 Vertical Profile Weather Radar system consists of the:

a. RS 181A sensor which combines the system components of antenna, receiver, and transmitter.
b. The IN 182A indicator which incorporates all the operational controls.

The system's antenna is installed inside the nose of the aircraft.

OPERATION AND CONTROLS



RDR 2000 CONTROLS AND INDICATOR
Figure 7-1

OPERATION AND CONTROLS (CONT.)

CONTROL/ DISPLAY	FUNCTION
BRT Control	Adjusts brightness of the display for varying cockpit light conditions.
Wx/Wxa Button	When pressed, alternately selects between the Wx (weather) and Wxa (weather alert) modes of operation. Wx or Wxa will appear in the lower left of the display. Areas of high rainfall appear in magenta color. When the Wxa mode is selected, magenta areas of storms flash between magenta and black.
VP Button	When pressed, selects and deselects the vertical profile mode of operation. Selecting the VP mode of operation (see Figure 7-3) will not change the selected mode of operation: TST, Wx, Wxa, or MAP. Once in VP, these modes may be changed as desired. VP will engage from the MAP mode but NAV will be disabled during VP operation.
MAP Button	When pressed places indicator in ground-mapping mode. Selecting ground-mapping (MAP) will disable the weather-alert feature and will activate the gain control. The magenta color is not activated while in the ground-mapping (MAP) mode.
NAV Button	When pressed, places indicator in navigation mode so that preprogrammed waypoints may be displayed. If other modes are also selected, the NAV display will be superimposed on them. This button is effective only if an optional radar graphics unit and flight management system is installed. If actuated without these units, NO NAV will appear at lower left screen. The radar is still capable of displaying weather.

OPERATION AND CONTROLS (CONT.)

CONTROL/ DISPLAY	FUNCTION
GAIN Control Knob	Manual gain control becomes active ***only*** when ground-mapping (MAP) is selected. Gain is internally set in ***all other*** modes.
Radar Function Selector Switch	1. **LOG** position is used only when the Bendix/King IU 2023 series radar graphics unit is installed along with a compatible long range navigation system, a listing of the latitudes and longitudes of selected waypoints will be displayed. If a compatible RNAV is used, selected VOR frequencies, along with bearings and distances to waypoints, will be presented. No radar transmission occurs in this mode.
	2. **ON** position selects the condition of normal operation, allowing for weather detection or other modes of operation. Radar transmission exists in the ON position.
	3. **TST** position will display the test pattern on the indicator (see Figure 7-5); no transmission occurs.The antenna will scan while in the test (TST) mode.
	4. **SBY** position places system in the standby condition during warm-up and when the system is not in use. After 30 seconds in this mode during warm-up, the system is in a state of readiness. No radar transmissions occurs; the antenna is parked in the down position. STBY is displayed in the lower left of the display.

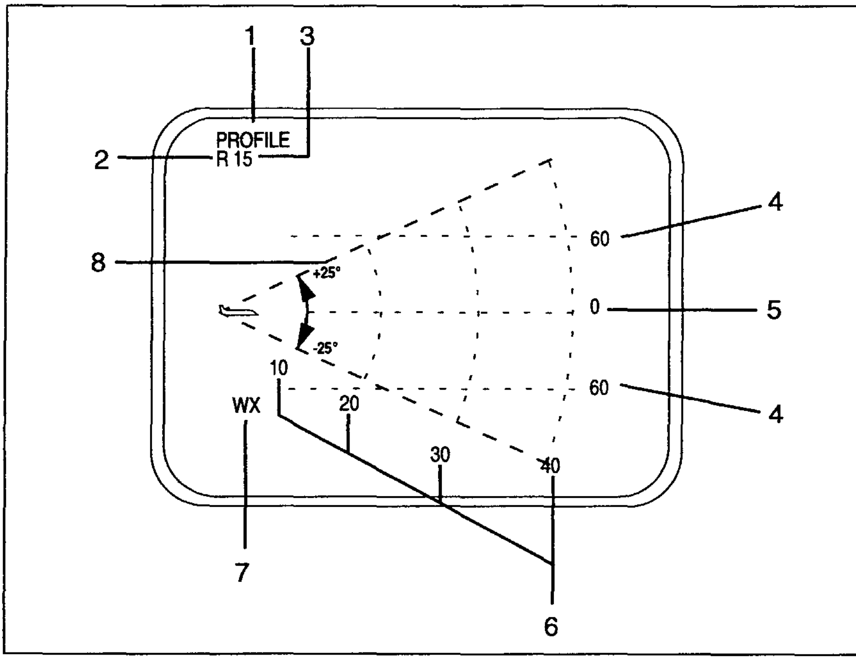
OPERATION AND CONTROLS (CONT.)

CONTROL/ DISPLAY	FUNCTION
Radar Function Selector Switch (cont.)	5. **OFF** position removes primary power from the radar indicator and the sensor. The antenna is parked in the down position.
△ RNG Selector Button	When pressed clears the display and advances the indicator to the next higher range. Selected range is displayed in upper right corner of the last range mark (Figure 7-1) and distance to other range rings is displayed along the right edge.
RNG ▽ Selector Button	When pressed clears the display and decreases the indicator to the next lower range. Selected range is displayed in upper right corner of the last range mark (Figure 7-1) and distance to other range rings is displayed along the right edge.
TRK ▷ and ◁ TRK Buttons	When pressed provides a yellow azimuth line and a digital display of the azimuth line placement left or right from the nose of the aircraft. For vertical profile (VP) operations, the track button performs two functions:

OPERATION AND CONTROLS (CONT.)

CONTROL/ DISPLAY	FUNCTION
	1. Prior to engaging VP, the appropriate button (left or right) is used to place the track line at the desired azimuth angle to be vertically scanned (sliced). When VP is engaged, the slice will be taken at the last position of the track line, whether it is visible or not. If the track line has not been selected after power has been applied to system and VP is engaged, the slice will be taken at 0 degrees (directly in front of the aircraft). 2. Continuously holding the TRK button will result in the system slicing in two-degree increments.
Antenna **TILT** Adjustment Knob	Permits manual adjustment of antenna tilt to a maximum of 15° up or down in order to obtain the best indicator presentation. The tilt angle is displayed in the upper right corner of the display. Depending upon the MOD status of the indicator, tilt read out may display in tenth degree.

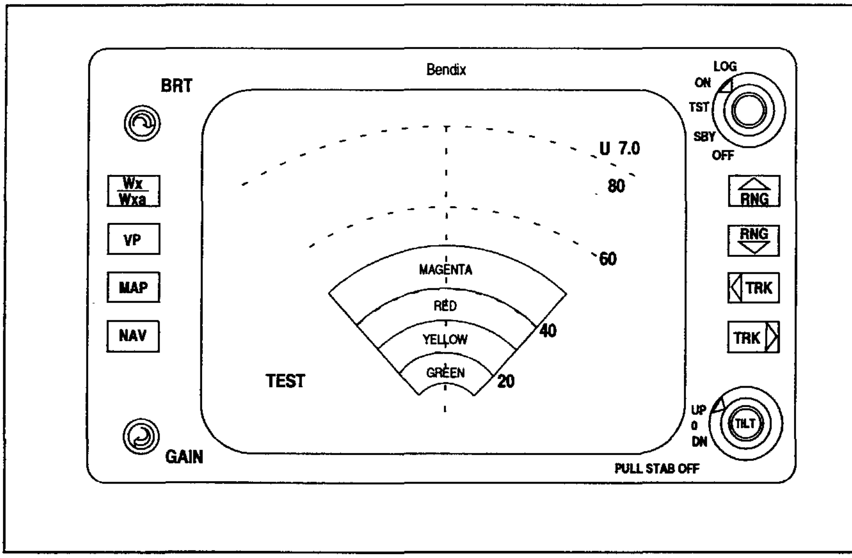
OPERATION AND CONTROLS (CONT.)



VERTICAL PROFILE MODE (RDR 2000)
Figure 7-3

1. Vertical PROFILE mode annunciation
2. Left or right track annunciation.
3. Degrees of track left or right of aircraft nose.
4. Displays plus and minus thousands of feet from relative altitude. Will vary with selected range.
5. Relative altitude reference line.
6. Range rings.
7. Selected weather mode (Wx or Wxa).
8. Vertical profile scan angle of 50°.

OPERATION AND CONTROLS (CONT.)



TEST PATTERN
Figure 7-5

Complete and detailed description on the function and use of the various controls and displays are outlined in the Bendix/King RDR 2000 Vertical Profile Weather Radar System Pilot's Guide, P/N 006-08755-0000, latest revision.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 16
FOR
BF GOODRICH AEROSPACE
WX-500 STORMSCOPE - SERIES II WEATHER MAPPING SENSOR

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the BF Goodrich Aerospace WX-500 Stormscope is installed. 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: Christina L. Marsh
CHRISTINA L. MARSH
D.O.A. NO. SO- I
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: June 12, 2000

SECTION 1 - GENERAL

This supplement provides information necessary for the operation of the aircraft with the BF Goodrich WX-500 Stormscope.

WARNING

Never use your Stormscope system to attempt to penetrate a thunderstorm. The FAA Advisory Circular, Subject: Thunderstorms, and the Airman's Information Manual (AIM) recommend that a pilot "avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo."

CAUTION

There are several atmospheric phenomena other than nearby thunderstorms that can cause isolated discharge points in the strike display mode. Clusters of two or more discharge points in the strike display mode, however, do indicate thunderstorm activity when they reappear after clearing the screen. Avoid the clusters and you'll avoid the thunderstorms. In the cell display mode, even a single discharge point may represent thunderstorm activity and should be avoided.

SECTION 2 - LIMITATIONS

The BF Goodrich Aerospace WX-500 Stormscope Users Guide, p/n 009-11501-001, Rev. A, dated September 10, 1997, or later appropriate revision, must be immediately available to the flight crew whenever weather avoidance is predicated on the use of this system.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

Normal operating procedures are described in the BF Goodrich Aerospace WX-500 Stormscope Users Guide, p/n 009-11501-001, Rev. A, dated September 10, 1997, or later appropriate revision.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

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

SECTION 7 - DESCRIPTION AND OPERATION

A. OPERATING PROCEDURES

See the BF Goodrich Aerospace WX-500 Stormscope Users Guide for a complete description of the WX-500 system.

B. PILOT'S DISPLAY (Airplane Dependent)

The BF Goodrich Aerospace WX-500 Stormscope's data will appear on either the Avidyne FlightMax 740, the Garmin GNS 530, or the Garmin GNS 430.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 27
FOR
GARMIN GTX 330 TRANSPONDER

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GTX 330 Transponder is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED: ______________
ALBERT J. MILL
D.O.A. NO. SO - 1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: January 12, 2004

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the Garmin GTX 330 Transponder is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

A. Display of TIS traffic information is advisory only and does not relieve the pilot responsibility to "see and avoid" other aircraft. Aircraft maneuvers shall not be predicated on the TIS displayed information.

B. Display of TIS traffic information does not constitute a TCAS I or TCAS II collision avoidance system as required by 14 CFR Part 121 or Part 135.

C. Title 14 of the Code of Federal Regulations (14 CFR) states that "When an Air Traffic Control (ATC) clearance has been obtained, no pilot-in-command (PIC) may deviate from that clearance, except in an emergency, unless he obtains an amended clearance." Traffic information provided by the TIS uplink does not relieve the PIC of this responsibility.

D. The 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum) P/N 190-00140-13 Rev. A or later revision must be accessible to the flight crew during flight.

E. 400/500 Series Main Software 4.00 or later FAA approved software is required to operate the TIS interface and provide TIS functionality.

SECTION 3 - EMERGENCY PROCEDURES

To transmit an emergency signal:

- Mode Selection Key - ALT
- Code Selection - SELECT 7700

To transmit a signal representing loss of all communications:

- Mode Selection Key - ALT
- Code Selection - SELECT 7600

SECTION 4 - NORMAL PROCEDURES

BEFORE TAKEOFF:

- To transmit Mode C (Altitude Reporting) code in flight:

- Mode Selection Key - ALT
- Code Selector Keys - SELECT assigned code.

To transmit Mode A (Aircraft Identification) code in flight:

- Mode Selector Key - ON
- Code Selector Keys - SELECT assigned code.

NOTE

During normal operation with the ON mode selected, the reply indicator ‘R”flashes, indicating transponder replies to interrogations.

NOTE

Mode A reply codes are transmitted in ALT also; however, Mode C codes only are suppressed when the Function Selector ON key is selected.

1. DETAILED TRANSPONDER OPERATING PROCEDURES

   Normal transponder operating procedures are described in the GARMIN GTX 330 Pilot’s Guide, P/N 190-00207-00, Rev. A, or later appropriate revision.

2. DISPLAY OF TRAFFIC INFORMATION SERVICE (TIS) DATA

   TIS surveillance data uplinked by Air Traffic Control (ATC) radar through the GTX 330 Mode S Transponder will appear on the interfaced display device (Garmin 400 or 500 series products). For detailed operating instructions and information regarding the TIS interface, refer to the 400/500 Series Garmin Display Interfaces (Pilot’s Guide Addendum) P/N 190-00140-13 Rev. A or later appropriate revision.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in section 6 of the Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION

See the 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum), P/N 190-00140-13, and GTX 330 Pilot's Guide, P/N 190-00207-00, for a complete description of the GTX 330 system.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

GARMIN G500/G600 TXi DISPLAY SYSTEM

as installed in

Piper PA-34-220T

Make and Model Airplane

Registration Number: D-GWIT

Serial Number: 3449132

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02571SE for the installation and operation of the Garmin G500/G600 TXi System. This document must be carried in the airplane at all times.

The information contained herein supplements or supersedes the information made available to the operator by the aircraft manufacturer in the form of clearly stated placards or markings, or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures and performance information not contained in this document, consult the basic placards or markings, or the basic FAA approved Airplane Flight Manual. FAA approved sections of the AFMS are labeled “FAA APPROVED”. Sections not labeled “FAA APPROVED” are for guidance only.

FAA APPROVED BY: JR Brownell

JR Brownell
ODA STC Unit Administrator
GARMIN International, Inc
ODA-240087-CE

DATE: 12/12/2023

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LOG OF REVISIONS			
Rev	Page	Description	FAA Approval
1	All	Initial issue.	*Erik Frisk* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : 11/17/2017
2	5	Added new layout types	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : 08/16/2018
	6	Added new layout types	
	11	Updated software version number	
	16	Added section 2.30 discussing portable electronic devices	
	16	Added section 2.31 discussing database updates	
	23	Added reference to G5 AFMS	
	30	Added section 3.2.9 for Resetting a G5 standby instrument.	
	38	Added section 4.2.4.5 for discussing Garmin Autopilots for selected altitude	
	40	Added section 4.2.5.3 discussing Garmin Autopilots for vertical speed mode.	
	40	Added section 4.2.6 for coupling to VNAV.	
	41	Added section 4.3 for Cold Weather Compensation procedures.	
	43	Included new layouts in circuit breaker labels	
	44	Included FS510 for database update methods.	

LOG OF REVISIONS			
	48	Added FS510 for system data logging functionality.	
	49	Included Baro sync functionality in section 7.15 for interface with a G5 and GAD 29.	
	52	Included requirement for baro altitude for VNAV functionality	
	54	Included description of density altitude display in section 7.15.14	
	55	Added checkbox for GFC 500/GFC 600 being installed in the system.	
	56	Added description for GFC 500 autopilots not capturing CDI preview needles.	
	57	Added reference to G5 and GFC 500 in 7.16.3.	
	61	Added description of CDI selection on G5.	
	64	Included description of a selectable CHT gauge in section 7.19.3.	
	67	Included description of Flight Stream 510 LRU.	
	68	Added section 7.21 for visual reporting points	
	68	Added section 7.22 to describe altitudes provided by the database.	
3	1	Added GEA 71B references	<u>*JR Brownell*</u> ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : 06/25/2019
	2	Additional OAT text	
	3-4	Updated diagrams	
	5	New abbreviations added	

LOG OF REVISIONS			
	7	Formatting	
	11	Additional turboprop information in Section 2.24	
	14	Turboprop gauge types added	
	15	Updated MFD logic in Section 2.34	
	18	Added HDG monitor to Section 3.1.4	
	26	Added EDM procedures as Section 3.2.10	
	27	Added EDM annunciation to Section 3.3.1	
	29	Added EDM annunciation to Section 3.3.2	
	30	Added EDM annunciation to Section 3.3.3	
	35	New Section 3.4	
	40	Added GEA 71B references	
	43	New turboprop modes shown in Section 7.7	
	47	Added HDG monitor to Section 7.15.1	
		Updated standard rate turn text in Section 7.15.2	
	49	Note added to Section 7.15.3	
	51	Preview needle text added to Section 7.15.7	
	52	Added preview needle to table 1	
	56	Updated FD text in Section 7.16.2	

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	57	New ARC VSI text for Section 7.16.5	
	62-68	Additional turboprop gauge information added to Section 7.19	
	68	New Section 7.23	
4	1	Added planforms	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : 10/26/2020
	6	New sw versions	
	9	New recommendation text	
	10	Corrected punctuation	
	12	New section 2.32. All other sections moved down.	
	15	Layout change	
	16	New sections 2.36 and 2.37	
	23	Additional coloration added for clarity.	
	24	New procedure. Updated procedure title.	
	27-33	Additional sections, coloration, and content added. Additional annunciations.	
	34	Addition to procedure in 4.1	
	37	Clarification to STEC functionality.	
	39	New interface added.	
	40	Layout updates, clarification text	
	43	Additional coloration added for clarity	
	47	Additional text	

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	50	Additional text	
	53	MACH, variable V_{NO} text	
	54	New installer checkbox and description of CDI feature. Updated text	
	55	Updated title	
	56	New subsections and corrected table #	
	58	Clarified text	
	60-62	New feature text	
	66	New interface added to list	
	67	Updated primary gauge list, added new text, and corrected table #	
	68	Clarified title, added note	
	70	Updated section with new features.	
	71	New section.	
	72	Amended text for twin timers and corrected table #'s	
	73-74	Added new sections 7.24 thru 7.26	
5	6	Updated software versions	*<u>Erik Frisk</u>* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : 07/09/2021
	15	Removed limitation, added EIS text	
	17	New procedures table of contents	
	30	Updated procedure	
	31-35	Reordered and added annunciations	

LOG OF REVISIONS			
	36	New procedures table of contents	
	57	Corrected spelling	
	63	Added g-meter description	
	69	Updated text	
	71	Formatting	
	74-75	Updated and additional systems descriptions	
6	6	Updated SW version	*JR Brownell* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : 07/23/2021
	33	Added Smart Glide annunciation	
	77	New section 7.27	
7	6	New definition	*JR Brownell* ODA STC Unit Administrator GARMIN International, Inc ODA-240087-CE Date : 02/02/2022
	7	New sw version	
	9	Updated reference	
	12	Updated chart naming	
	17	Added turboprop required gauge, additional context to manifold pressure support	
	20-21	Updated TOC	
	26	Added GI275 standby	
	30	New fuel imbalance procedures	
	35-37	New fuel imbalance procedures/ignition/start sections	
	38	Added fuel imbalance	

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	41	Added fuel imbalance	
	43	Added annunciation	
	44-45	Updated tables	
	46	Updated TOC	
	47	Updated text, updated reference, added new CAWS checkout	
	52	Updated text	
	59	Added standby models	
	72	Updated caption number	
	78	Updated text	
	68	Updated for new functionality	
	85-88	Listed additional indication, added CAWS integration text, updated text	
	91-93	Added fuel and imbalance description	
	94	Updated table numbers	
	95	Updated hyperlink, added new function	
	97-102	New Appendix	
8	Section 1	New installer checkboxes, reorganized, various text updates. Section 1.9 Removed System Overview Block Diagrams.	*Erik Frisk* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : 01/25/2023
	Section 2	Removed non-limitations. Reorganized. Systems	

LOG OF REVISIONS			
		descriptions moved to Section 7.	
	Section 3	New and updated procedures.	
	Section 4	New and updated procedures.	
	Section 7	New system descriptions. Reorganized sections.	
	All	Added “FAA Approved” or “NOT FAA APPROVED” to footers for all pages.	
9	92-94	Updated PC-12 EIS data in Tables A-1, A-2, and A-3	See page i

TABLE OF CONTENTS

Section 1: GENERAL

1.1 Definitions

ADAHRS: Air Data and Attitude Heading Reference System

ADC: Air Data Computer

AHRS: Attitude & Heading Reference System

AFM: Aircraft Flight Manual

AFMS: Aircraft Flight Manual Supplement

CDI: Course Deviation Indicator

CRS: Course

EDM: Emergency Descent Mode

EIS: Engine Indicating System

FD: Flight Director

FLTA: Forward-looking Terrain Alerting

FS510: Flight Stream 510

GDU: Garmin Display Unit

GEA: Garmin Engine Adapter

GPSS: GPS Steering

HDG: Heading

HSI: Horizontal Situation Indicator

IFR: Instrument Flight Rules

IMC: Instrument Meteorological Conditions

LOI: Loss of Integrity

MFD: Multifunction Display

PED: Portable Electronic Device

PFD: Primary Flight Display

SBAS: Space-based Augmentation System

SVT: Synthetic Vision Technology

TAWS: Terrain Awareness and Warning System (a TSO-C151b function)

TIS-A: Traffic Information Service (Addressed).

TIS-B: Traffic Information Service (Broadcast)

VFR: Visual Flight Rules

VMC: Visual Meteorological Conditions

VNAV: Vertical Navigation

VS: Vertical Speed

1.2 Minimum Software Version

The following or later software versions must be installed for this AFMS revision to be applicable to the installation:

Table 1-1 Minimum Software Versions

Component	Identification	Software Version
GDU	PFD, MFD, and/or EIS	3.50
GEA 71B	Engine Adapter	2.71
GEA 110	Engine Adapter	2.21

NOTE

This section is not intended to be a comprehensive list of approved software. It is intended to provide a means to determine if this AFMS revision is applicable to the software that is installed in the aircraft. Do not use this AFMS revision if the installation has a software version less than that shown in the table above.

1.3 System Description

The G500/G600 TXi system is a display and sensor system which provides one or more of the following functions:

- Primary Flight Display (PFD) – Provides attitude, heading, air data and navigation information to the pilot
- Multi-Function Display (MFD) – Provides pilot awareness of factors that may affect the overall conduct of the flight
- Engine Indicating System (EIS) – Provides engine and airframe operating parameters to the pilot

The G500/G600 TXi system consists of one or more displays. PFD functions are supported by interfaced AHRS/ADC (either integrated or external) and at least one GPS navigator. An optional GAD 43/43e adapter provides additional functions such as third-party autopilot and analog interfaces. An optional GCU 485 controller provides additional dedicated controls for PFD operation. Other PFD interfaces may include VHF navigation radios, radar altimeter, ADF, and DME.

EIS functions are supported by either a GEA 110 engine/airframe unit, or a GEA 71B Enhanced unit, along with sensors to measure engine parameters.

MFD functions are supported by GPS navigator interfaces and a variety of other optional interfaces such as datalinks, traffic systems, Stormscope®, and weather radar.

Although intuitive and user friendly, the system requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid procedures in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides a detailed Pilot's Guide and a tablet trainer app. Pilots should take full advantage of these tools to enhance their familiarity with the system.

1.4 GDU Derivatives

There are multiple displays and layouts available for the aircraft. This section describes the different GDU types.

1.4.1 GDU 1060

The GDU 1060 is a 10" PFD/MFD or MFD/MFD display, with an optional EIS function. Each function is segregated into a portion of the display. If installed the EIS function occupies on the left or right edge of the display and is always shown.

1.4.2 GDU 700P

The GDU 700P is a 7" portrait display which provides a single PFD, MFD, EIS, or MFD/EIS function. In some installations, a 700P display may provide backup PFD or EIS information in the event that the primary PFD or EIS display fails or malfunctions.

1.4.3 GDU 700L

The GDU 700L is a 7" landscape PFD, MFD, MFD/EIS, or EIS display.

1.5 AHRS / ADC

The AHRS and ADC sense aircraft attitude and air data to be used for display to the pilot and for use by other installed systems. The AHRS and ADC can be either remote-mounted or integrated into the display.

All AHRS units have a magnetometer interface for determining magnetic heading. The AHRS also requires GPS and airspeed inputs for aiding the system.

1.6 OAT Probes

All ADC units have an OAT probe interface for measuring outside air temperature. Static and ISA relative temperatures can be displayed on the GDU in those installations. In EIS-only installations, the OAT can be interfaced with the system directly and will only display Total Air Temperature on the EIS display.

1.7 Standby Instruments or Standby PFD

Except for installations that are limited to VFR, PFD installations require standby attitude, altitude, and airspeed instruments. Several types of standby instruments are acceptable, including individual analog instruments and certain electronic standby indicators.

An integrated standby system configuration is also available, which consists of two GDU 700P 7” portrait displays, each with separate AHRS / ADC functionality. One display serves as the PFD, and the other display can be either an EIS, MFD, or MFD/EIS display. The EIS/MFD provides standby PFD functionality which is displayed automatically when faults are detected or upon manual command. A backup battery provides emergency power to the PFD and sensors in the event of a failure of aircraft power.

1.8 Backup Battery

An optional GBB 54 backup battery can be installed to provide emergency power to a GDU 700P/L display. The backup battery is mounted remotely and provides power to the GDU when aircraft power is unavailable. The GDU, in turn, may be equipped with an integrated ADAHRS and can provide power to the EIS sensors for one engine. This allows for continued PFD and EIS functionality when aircraft electrical power is lost.

1.9 PFD Controller

An optional GCU 485 PFD controller may be installed to provide dedicated PFD controls. Although control of all PFD functions is available using the GDU knobs and touchscreen, the PFD controller provides dedicated knobs for heading, altitude, vertical speed, airspeed, and BARO setting. Dedicated buttons are also provided for CDI source selection, GPSS emulation mode, altitude capture arming, and vertical speed mode engagement.

1.10 Installation Description

The following describes the units installed in the TXi System and the functions or features that are configured for this aircraft. Reference this section when using the Normal or Emergency Procedures in Sections 3 and 4. A function or installed feature is applicable to this aircraft only when the corresponding box is checked.

The major components of the TXi System are protected with resettable circuit breakers available to the pilot. The breakers installed in the aircraft are checked below.

1.10.1 Installed Displays

Table 1-2 Installed Displays

	Description	**Derivative**	**Circuit Breaker Label(s)**
☐	Pilot PFD	☐1060 (10”) ☐700P (7” Portrait) ☐700L (7” Landscape)	☐ PFD ☐ PFD 1
☐	Pilot MFD	☐700P (7” Portrait) ☐700L (7” Landscape)	☐ MFD ☐ MFD 1
☐	Pilot EIS	☐700P (7” Portrait) ☐700L (7” Landscape)	☐ EIS ☐ EIS 1
☐	Center MFD	☐1060 (10”) ☐700P (7” Portrait) ☐700L (7” Landscape)	☐ MFD ☐ MFD 3
☐	Center EIS	☐1060 (10”) ☐700P (7” Portrait) ☐700L (7” Landscape)	☐ EIS ☐ EIS 3
☐	Co-Pilot PFD	☐1060 (10”) ☐700P (7” Portrait) ☐700L (7” Landscape)	☐PFD 2
☐	Co-Pilot MFD	☐1060 (10”) ☐700P (7” Portrait) ☐700L (7” Landscape)	☐MFD 2
☐	Co-Pilot EIS	☐1060 (10”) ☐700P (7” Portrait) ☐700L (7” Landscape)	☐EIS 2
☐	Pilot or Center Standby	☐700P (7” Portrait) ☐GI275 ADI ☐MD302 Standby	☐STBY ATT

1.10.2 Installed Controllers and Annunciators

Table 1-3 Installed Controllers and Annunciators

	Description	Derivative	Circuit Breaker Label(s)
☐	Pilot GCU	GCU 485	☐ PFD CTLR ☐ PFD CTLR 1
☐	Co-Pilot GCU	GCU 485	☐ PFD CTLR 2
☐	Remote Engine Annunciator	N/A	N/A

1.11 Installed Data Units

Table 1-4 Installed Data Units

	Description	Derivative	Circuit Breaker Label(s)
☐	Pilot ADAHRS	☐ GSU 75 Integrated ☐ GSU 75 Remote	☐ ADAHRS ☐ ADAHRS 1
☐	Pilot AHRS	☐ GRS 77 Remote ☐ GRS 79 Remote	☐ AHRS ☐ AHRS 1
☐	Pilot ADC	☐ GDC 72 Remote	☐ ADC ☐ ADC 1
☐	Co-Pilot ADAHRS	☐ GSU 75 Integrated ☐ GSU 75 Remote	☐ ADAHRS ☐ ADAHRS 2
☐	Co-Pilot AHRS	☐ GRS 77 Remote ☐ GRS 79 Remote	☐ AHRS ☐ AHRS 2
☐	Co-Pilot ADC	☐ GDC 72 Remote	☐ ADC ☐ ADC 2
☐	Engine 1 EIS Sensors	☐ GEA 110 ☐ GEA 71B(e)	☐ ENG SNSR ☐ ENG SNSR L ☐ ENG SNSR 1
☐	Engine 2 EIS Sensors	☐ GEA 110 ☐ GEA 71B(e)	☐ ENG SNSR ☐ ENG SNSR R ☐ ENG SNSR 2
☐	PFD Adapter	GAD 43(e)	☐ PFD ADAPTR
☐	Backup VFR GPS	N/A	N/A
☐	Backup Battery	GBB 54	N/A

☐ This system incorporates dual power busses to power the TXi System. Each unit checked above will have 2 circuit breakers each labeled with the above label and an “A” and “B” as appropriate for each power circuit.

1.11.1 System Audio Alerts

The following audio alerts are available in this aircraft:

- ☐ Altitude Alerting Tones
- ☐ Terrain, TAWS-A, or TAWS-B Alerting
- ☐ Touchscreen Clicks
- ☐ EDM Aural Alerting
- ☐ Approach Minimums

1.11.2 Standby and Backup Systems

- ☐ This installation uses separate standby instruments (other than a GDU) or does not require standby instruments (aircraft limited to VFR).
- ☐ This installation uses the Integrated Standby System with dual GDU 700P displays for the primary and standby flight instruments.

1.11.3 Engine Instruments and Controls

- ☐ TXi EIS is the engine start computer in this aircraft
- ☐ TXi EIS is the auto-ignition controller in this aircraft
- ☐ TXi EIS controls the fuel balancing with the fuel pumps
- ☐ EIS alerting is displayed on and controlled with the aircraft Caution and Warning buttons
- ☐ EIS includes dynamic engine gauges. Gauge indications could be different depending on the aircraft engine status or other parameters such as OAT. See the attached gauge diagrams or Appendices for aircraft specific gauge markings.

1.11.4 Types of Operations

- ☐ This installation is limited to VFR and the following placard is installed in the aircraft:

“AIRCRAFT LIMITED TO VFR”

1.11.5 Autopilot

- ☐ This aircraft is equipped with a GFC 600 capable of Emergency Descent Mode.

☐ This aircraft is equipped with a manual Emergency Descent Mode activation switch.

☐ This installation is equipped and configured to provide EDO VNAV display and autopilot coupling.

☐ This installation is equipped and configured to provide EDO VNAV *display only*.

1.11.6 Primary Flight Display

☐ This installation supports cold weather compensated approach altitudes.

☐ This installation supports cold weather compensated approach minimums.

☐ The CDIs for all PFDs in the system synchronize when the source is changed.

☐ The BARO setting for all PFDs in the system synchronize when the value is changed.

☐ The BARO settings between the standby ADI and PFDs in the system synchronize when the value is changed on any display.

1.12 Autopilot Interfaces

The G500/G600 TXI System provides various autopilot integration capabilities dependent upon the type of autopilot installed in a particular aircraft.

The G500/G600 TXi installation in this aircraft provides the following autopilot functions (appropriate boxes will be checked):

☐ This installation *does not* interface with the autopilot (basic wing leveling autopilot, or no autopilot is installed in the aircraft).

☐ Course / NAV Selection coupling to the autopilot.

☐ Heading Bug coupling capability to the autopilot.

☐ Roll Steering emulated via heading mode.

☐ Roll Steering capable autopilot.

☐ Altitude Pre-Selector integrated with the autopilot.

☐ Vertical speed bug integrated with the autopilot

☐ Flight Director display driven from external autopilot or FD computer.

- ☐ A GAD 43 Adapter is installed in this aircraft
  - ☐ GAD 43 provides attitude to the autopilot
  - ☐ GAD 43 provides yaw rate to the yaw damper
  - ☐ GAD 43 provides baro correction to the altitude preselector
  - ☐ GAD 43 provides altitude preselect and/or vertical speed
- ☐ G500/G600 TXi provides attitude / air data to autopilot
- ☐ Autopilot Modes annunciated on PFD
- ☐ GFC 500 or GFC 600 is installed in this aircraft and the TXi provides a means for mode annunciation, altitude selection, vertical speed selection, heading bug selection, and navigation source selection.
- ☐ The pilot can change the flight director depiction between single and dual cue.

Section 2: LIMITATIONS

2.1 Databases

Databases identified as intended for helicopters must not be used. These databases are identified by the word “HELI” or “HELICOPTER” in their title, as displayed on the database status page.

2.2 AHRS Operational Area

IFR Operations are prohibited north of 72°N and south of 70°S latitudes. In addition, IFR operations are prohibited in the following four regions:

1) North of 65° North latitude between longitude 75° W and 120° W

2) North of 70° North latitude between longitude 70° W and 128° W

3) North of 70° North latitude between longitude 85° E and 114° E

4) South of 55° South latitude between longitude 120° E and 165° E

2.3 Magnetic Variation Operational Area

IFR operations are prohibited in areas where the magnetic variation is greater than 99.9 degrees East or West.

2.4 Aerobatic Maneuvers

In installations with a TXi PFD, aerobatic maneuvers must not be conducted if uninterrupted attitude information is required.

2.5 Synthetic Vision

The synthetic vision presentation must not be used as the sole reference for aircraft control (without reference to the primary flight instruments).

The synthetic vision presentation must not be used as the sole reference for navigation or obstacle/terrain/traffic avoidance.

2.6 Moving Maps

Moving map displays (ownship position relative to map features) must not be used as the primary or sole means of navigation or course guidance.

2.7 Terrain Display

Maneuvers and navigation must not be based solely on the display of terrain, obstacles, or wires on the moving map terrain displays.

2.8 Terrain/TAWS Alerts

Terrain/TAWS alerts must be inhibited when landing at an airport that is not in the airport database.

2.9 Datalink Products (SiriusXM, FIS-B, and Connext)

Use of datalink weather information as the sole means for maneuvering in, near, or around areas of hazardous weather is prohibited.

Use of datalink services as the primary means to provide Temporary Flight Restriction (TFR) or Notice to Air Missions (NOTAM) information is prohibited.

2.10 Traffic Display

Use of traffic display as the sole basis for maneuvering to avoid traffic is prohibited.

2.11 Weather Radar

Weather radar use in vicinity of refueling operations is prohibited.

Weather radar use while personnel are in the vicinity (approximately 20 feet) of the radar sweep area is prohibited.

WARNING

An operating radar generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE THE RADAR EQUIPMENT UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED THE SAFETY PRECAUTIONS AND INSTRUCTIONS IN THE RADAR USER MANUAL.

2.12 Stormscope® Display

The use of the Stormscope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited.

2.13 Surface Operations

SafeTaxi or ChartView functions must not be used as the sole basis for ground maneuvering.

2.14 Backup GPS

Use of Backup GPS as a primary means of navigation is prohibited in IMC.

2.15 Database Updates

In-flight database transfers or updates are prohibited in flight unless part of the Database SYNC function that occurs in the background to move databases from one LRU to another.

2.16 Minimum Crew

There are no additional limitations applicable to the minimum crew required for safe and effective operation of the aircraft utilizing a G500 / G600 TXi system.

2.17 Kinds of Operations

Unless placarded as limited to VFR only operations, equipment installed in a certified aircraft is approved for Day and Night / VFR and IFR operations in accordance with 14 Code of Federal Regulations Part 91, Part 121, and Part 135 when appropriately maintained.

<u>The tables below list the minimum fully functional equipment required for flight.</u>

The following note applies where indicated with an asterisk:

> For VFR operations under 14 CFR Part 91, the aircraft must have at least one source of altitude and airspeed information. This may be from either the PFD or the standby instruments. (i.e., all “1a” items or all “1b” items from Table 2-1 and Table 2-2)

Table 2-1 Primary Flight Display (Non-Integrated Standby)

	Equipment	Number installed	VFR	IFR
	Primary Flight Display	1 or 2	1	1
	Garmin GPS/SBAS Navigator (interfaced to a PFD)	1 or 2	-	1
	Air data and Attitude / Heading Unit (ADAHRS)	1 or 2	1a*	1
OR	Attitude / Heading Unit (AHRS)	1 or 2	-	1
	Air data computer (ADC)	1 or 2	1a*	1
	Magnetometer (GMU)	1 or 2	-	1
	Standby Attitude Indicator	1	-	1
	Standby Airspeed Indicator	1	1b	1
	Standby Altimeter	1	1b	1
	Non-stabilized Magnetic Compass	1	1	1

Table 2-2 Primary Flight Display (Integrated Standby)

	Equipment	Number installed	VFR	IFR
	Pilot Primary Flight Display	1 or 2	1a*	1
	Pilot MFD or EIS Display providing backup PFD functions	1	1b	1
	Garmin GPS/SBAS Navigator (interfaced to a PFD)	1 or 2	-	1
OR	Air data and Attitude / Heading Unit (ADAHRS)	2	1a*	2
	Attitude / Heading Unit (AHRS)	2	-	2
	Air data computer (ADC)	2	1a*	2
	Magnetometer (GMU)	2	-	2
	Non-stabilized Magnetic Compass	1	1	1
	PFD Backup Battery	1	-	1
	Display Backup Switch	1	-	1

Table 2-3 Engine Indicating System (if installed)

Equipment	Number installed	Req'd
EIS Display	1	1
Engine Adaptor Unit (GEA 110 or 71B)	1 or 2	All

All EIS indications must be valid prior to takeoff including any additional engine instrumentation required by the aircraft Kinds Of Equipment list as listed in the Aircraft Flight Manual

Table 2-4 Engine Annunciations (if installed)

	Equipment	Number installed	Req'd
OR	EIS Engine Annunciator	0 or 1	All
	PFD with EIS Engine Annunciator	0 or 1	All

2.18 Placards

2.18.1 KFC 275/325 Altitude Preselect

When the altitude preselect option is installed with KFC 275/325 autopilots, SOFT RIDE (SR) mode must be disengaged when altitude capture mode is engaged (green ALTC). The following placard must be installed near the autopilot mode controller or above PFD 1:

"DISENGAGE SOFT RIDE DURING ALTITUDE CAPTURE (ALTC)"

Section 3: EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 PFD Failure

PFD failure is indicated by the loss of displayed information on the PFD, including a blank, frozen, or unresponsive display.

1. Use standby flight instruments for attitude, airspeed, altitude, and heading reference.

   NOTE

   When a 7” display is operating in PFD/EIS display backup mode, the fuel selector should be positioned to use fuel from a tank for which fuel quantity is indicated unless it is deemed operationally necessary by the pilot to select a tank for which quantity is not indicated.

   NOTE

   In some installations, auxiliary or tip fuel quantity gauges may not be available in PFD/EIS composite display backup mode.

2. Refer directly to the navigation source for navigation information (such as GPS).
3. Seek VMC or land as soon as practical.

   If autopilot is engaged:

4. Verify autopilot mode and cross check against standby flight and navigation data.

3.1.2 Blank Screen

If the installed equipment in the aircraft includes a GDL 60 Wireless Access unit:

1. Press the screen or rotate either knob at least one click.

If the display returns:

2. Open the CNXT and CNXT BATT circuit breakers.

If the screen is still blank or there is no GDL 60 Wireless Access unit in the aircraft, refer to procedure 3.1.1 PFD Failure.

3.1.3 AHRS Failure

AHRS failure is indicated by the removal of the attitude/heading information and a red X on the PFD. Rate-of-turn information (heading trend vector) will not be available. A heading failure will also occur as described in Section 3.2.1.

1. Use Standby Attitude Indicator.
2. Seek VMC or land as soon as practical.

If multiple AHRS sources are installed:

3. Select operative AHRS using the PFD Sensors menu

NOTE

If the AHRS is restarting in flight without an operative GPS navigator, attempt to minimize maneuvering and turbulence during and after the restart process. Without an operative GPS navigator, excessive maneuvering or turbulence may prevent the AHRS from completing alignment properly. Continue to minimize maneuvering and seek smooth air for the first 5 minutes after the attitude becomes valid following the in-air alignment restart. If maneuvering or turbulence cannot be avoided, carefully cross-check the AHRS for correctness against other flight instruments.

3.1.4 ADC Failure

ADC failure is indicated by:

- Red X over the airspeed and altitude tapes
- Yellow X over the vertical speed tape
- Dashed out TAS and OAT fields

Wind calculations will also be unavailable. If valid GPS data is available, the PFD will automatically revert to display GPS calculated altitude relative to mean sea level. GPS altitude is displayed at the top of the altitude tape.

1. Use Standby Airspeed Indicator and Altimeter
2. Seek VMC or land as soon as practical

If multiple ADC sources are installed:

3. Select operative ADC using the PFD Sensors menu

3.1.5 ATTITUDE, ALT, HDG, or IAS monitor CAUTION

If an ATTITUDE, ALT, HDG, or IAS monitor CAUTION is displayed in amber on the attitude display or airspeed/altitude tape:

Figure 3-1- Miscompare Flags

1. Cross check flight instruments against all available information to determine which indications are correct
2. Seek VMC or land as soon as practical

NOTE

White ATTITUDE/ALT/HDG/IAS annunciations indicate that the other AHRS/ADC source is not available.

3.1.6 Aircraft Electrical System Failure

In the event of a total loss of aircraft electrical power, the G500/G600 TXi system will cease to operate, except for displays which are equipped with an optional backup battery. Refer to procedures for failure of affected equipment and operation on backup battery. For power loss effects on the G5 standby, see the AFMS for the G5, 190-01112-13.

3.1.7 Operation on Backup Battery (if installed)

Displays equipped with a backup battery will continue to operate after a loss of aircraft electrical power. Twin engine aircraft equipped with EIS will lose right engine gauges, fuel quantity from the right tank(s), and amps and volts from the right side. Operating on backup battery power is indicated by the presence of a battery icon on the affected display and a system advisory. A minimum of 30 minutes of operation on the backup battery is provided.

1. Seek VMC or land as soon as possible.

3.1.8 Display Backup Malfunction

Display backup malfunction is indicated by repeated changes to the display layout (e.g., display changes back and forth between normal and backup mode).

1. Select Display Backup switch to ON to force all displays into backup mode.

3.1.9 Backup Battery Malfunction

A malfunction of the backup battery is indicated by the following indication:

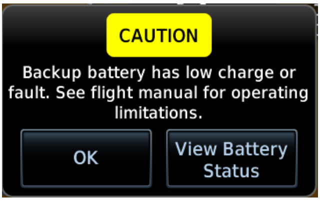

Figure 3-2 Backup Battery Caution

.

1. Seek VMC or land as soon as practical.

3.1.10 EIS Failure

EIS failure is indicated by the loss of displayed information on the EIS, including a blank, frozen, or unresponsive display of EIS parameters.

1. Position engine controls to ensure operation within engine limitations.

3.1.11 Loss of Electrical Power to 3-inch Electric Standby Attitude Indicator (flashing amber STBY PWR light) (Mid Continent 4300 Series)

When a 3-inch electric standby attitude indicator is installed, loss of primary electrical power to the attitude indicator is annunciated by a flashing amber light on the indicator. The attitude indicator is operating on backup battery power, and <u>pilot action is required</u> for the gyro to continue operating.

1. Press STBY PWR button on the indicator one time.
2. Verify that the flashing amber light extinguishes.
3. Verify that the red gyro warning flag is not displayed.
4. Seek visual meteorological conditions (VMC) or land as soon as practical (operation of standby attitude indicator is limited by battery life).

WARNING

Do not press the STBY PWR button a second time after the flashing amber light extinguishes. This will turn off the backup battery and the red gyro warning flag will be displayed. If the STBY PWR button is inadvertently pressed and the red gyro warning flag is displayed, press the STBY PWR button again to return to battery power operation (red gyro warning flag should not be displayed).

3.1.12 Loss of Electrical Power to the Garmin GI-275 Standby Attitude Indicator

When the GI-275 loses primary power, a yellow battery icon will appear on the ADI. This indicates the GI-275 is operating on battery power. The battery will operate the system for ~30 minutes.

1. Seek visual meteorological conditions (VMC) or land as soon as practical (operation of standby attitude indicator is limited by battery life).

3.1.13 Loss of Electrical Power to 2-inch Electric Standby Attitude Indicator (flashing or steady amber STBY text) (Mid Continent 4200 Series)

When a 2-inch electric standby attitude indicator is installed, loss of primary electrical power to the attitude indicator is annunciated by amber STBY text on the Annunciation Control Unit. The attitude indicator is operating on backup battery power, and <u>pilot action may be required</u> for the gyro to continue operating.

If the amber STBY text is flashing (manual operation):

1. Press the STBY PWR button one time.
2. Verify that the amber STBY text is steadily illuminated.
3. Verify that the red gyro warning flag is not displayed.
4. Seek visual meteorological conditions (VMC) or land as soon as practical (operation of standby attitude indicator is limited by battery life).

If the amber STBY text is steadily illuminated (automatic operation):

1. Verify that the red gyro warning flag is not displayed.
2. Seek visual meteorological conditions (VMC) or land as soon as practical (operation of standby attitude indicator is limited by battery life).

WARNING

Do not press the STBY PWR button when the amber STBY text is steadily illuminated. This will turn off the backup battery and the red gyro warning flag will be displayed. If the STBY PWR button is inadvertently pressed and the red gyro warning flag is displayed, press the STBY PWR button again to return to battery power operation (red gyro warning flag should not be displayed).

3.1.14 TAWS/Terrain Alerts

The following table describes the terrain alerting used in this system.

Table 3-1 TAWS/Terrain Alerts

Aural Alert	Visual Alert	Action
"Terrain, Terrain Pull up, Pull up" -OR- "Obstacle, Obstacle Pull up, Pull up" -OR- "Wire, Wire Pull up, Pull up" -OR- "Warning, Terrain, Terrain" -OR- "Warning, Obstacle, Obstacle" -OR- "Warning, Wire, Wire" -OR- "Pull up"	PULL UP -OR- TERRAIN -OR- OBSTACLE -OR- WIRE	Disconnect autopilot and initiate maximum performance climb (maximum takeoff power and best angle of climb airspeed) NOTE: Only the climb maneuver is recommended, unless operating in VMC or it is determined, based on all available information, that turning in addition climbing is the safest course of action.
"CAUTION, Terrain" -OR- "CAUTION, Obstacle" -OR- "CAUTION, Wire"	TERRAIN -OR- OBSTACLE -OR- WIRE	Take corrective action until the alert ceases. Using all available information to determine the appropriate action, alter the flight path away from the threat by stopping descent, climbing, and/or turning.
"Too low, Terrain"	TERRAIN	Establish climb to the minimum altitude for present position/procedure
"Sink Rate"	TERRAIN	Decrease rate of descent
"Don't sink"	TERRAIN	Establish a positive rate of climb

3.1.15 FUEL IMBALANCE (Red)

The fuel imbalance has exceeded the aircraft limitation. A fuel leak, fuel ice or another problem may be preventing the fuel balancing system from functioning. Refer to the aircraft specific procedures below.

3.1.15.1 Pilatus PC-12 (S/N 112-888)

The fuel imbalance is greater than 40 gallons (~268 pounds). The system should turn off the heavy wing fuel pump (if in the fuel pump is selected to AUTO).

1- If On-Ground .... Do Not Take Off

2- Refer to the aircraft AFM Emergency procedures for “AUTO FUEL BALANCING FAILURE”. Wherever “fuel segments” are referenced in that procedure, use conversion table in section A.2 of Aircraft Specific **EIS** Data of this AFMS to equate “segments” to fuel quantity on the TXi EIS fuel quantity gauges.

3.2 Abnormal Procedures

3.2.1 Heading Failure - Airborne

Heading failure is indicated by removal of the digital magnetic heading display on the HSI and a red HDG FAIL annunciation.

If GPS ground track is available, it will automatically be displayed in place of heading when airborne. The heading bug and course pointer will continue to function normally, using GPS ground track as a reference instead of magnetic heading.

If GPS track is not available:

1. Use standby compass for heading reference.

NOTE

Without magnetic heading or GPS track, the CDI provides no directional information. Only course deviation information is presented, and the orientation of the CDI is based on the selected course, regardless of aircraft heading. Course deviation indications will behave like a traditional CDI. VOR deviations will be relative to the selected course with a TO/FROM indication. Localizer deviations will not be affected by the selected course, and reverse sensing will occur when tracking inbound on a localizer back course.

3.2.2 Heading Failure – On the Ground

Heading failure is indicated by removal of the digital magnetic heading display on the HSI and a red HDG FAIL annunciation.

1. Do not take off.

3.2.3 Display Fan Failure

Display fan failure is indicated by an amber FAN FAIL annunciation on the affected display. Without fan cooling, the affected display will overheat and shutdown.

1. Prepare for loss of the affected display.

3.2.4 GPS Data Failure

GPS data failure may be indicated by any or all of the following:

- Loss of GPS course deviation information on HSI
- Amber “LOI” text on the PFD
- Amber “DG” text on the PFD
- Amber “NO GPS POSITION” text on the moving map
- Loss of waypoint bearing/distance information

1. Select alternate GPS source, if available, by pressing “CDI” button on PFD.

If alternate GPS source is not available:

2. Select alternate navigation source (VOR, LOC, or ADF, if available) or refer directly to external navigation data.

3.2.5 Navigation Data Failure (VOR/LOC/GS/ADF)

Navigation data failure may be indicated by any or all of the following:

- Loss of course deviation information on PFD
- Loss of glideslope/glidepath information on PFD
- Loss of bearing pointer on HSI

1. Select alternate navigation source or refer directly to external navigation data.

3.2.6 Synthetic Vision Malfunction

If the synthetic vision depiction is known or suspected to be inaccurate or malfunctioning:

1. Turn off synthetic terrain using the PFD Terrain/SVT menu.

3.2.7 Electrical Load Shedding

The following equipment is considered non-essential. If it becomes necessary to reduce electrical load (for example, during loss of generators or alternators), power to these units may be removed in the order listed.

1. PFD ADAPTER circuit breaker(s) [if installed] – PULL

NOTE

When the PFD ADAPTER is shed, this may result in the loss of autopilot function and/or loss of some navigation data on the PFD (VOR/LOC, ADF, DME, radar altimeter).

2. PFD CTLR circuit breaker(s) [if installed] – PULL

NOTE

Any non-required displays on the co-pilot side may also be powered off.

3.2.8 AHRS ALIGN

If an “AHRS ALIGN / Keep Wings Level” annunciation is displayed on the attitude indicator in flight, limit aircraft operation to:

- ±10º bank
- ±5º pitch
- 200 KTAS or less

CAUTION

Exceeding these values may delay or prevent AHRS alignment.

3.2.9 EIS Display Parameter Failure

Indicated by individual parameters having a red or yellow X drawn through the gauge and data removed (see EIS failure procedure for loss of entire EIS function).

1. Monitor remaining parameters and set engine controls to operate within limitations.

3.2.10 G5 Standby Reset

If a G5 is used as a standby for the TXi, and for any reason does not respond to the power button to turn on or off the G5, a hard reset needs to be performed on the G5. To perform a hard reset, use the following procedure.

1. Press and hold the power button on the G5 for 15 seconds.

3.2.11 Emergency Descent Mode (EDM)

If the aircraft if equipped with a GFC 600 autopilot capable of Emergency Descent Mode, the pilot's PFD will host menu buttons and alerting for EDM in the event of activation/deactivation or system malfunctions.

If the aircraft if equipped with a GFC 600 autopilot capable of Emergency Descent Mode, the following procedures apply:

3.2.11.1 Emergency Descent Mode Automatic Activation

If the aircraft is above the activation altitude with the autopilot engaged, and the cabin altitude climbs above the configured threshold, automatic activation of EDM will commence. Refer to the Airplane Flight Manual Supplement for the GFC 600 for specific EDM altitude triggers and EDM behaviors.

To Temporarily Inhibit Automatic EDM Activation

1. Select the "Inhibit EDM" button on the EDM popup when presented on the PFD. This will inhibit automatic EDM for 5 minutes.

To Inhibit Automatic EDM Activation (for the duration of the flight)

1. Deselect the "Auto EDM" button on the PFD → System menu.

- or -

2. Override EDM when it is activated by pressing the A/P DISC button on the control yoke, or the "AP" button on the GFC 600.

To Re-enable Automatic EDM Activation

1. Select the "Auto EDM" button on the PFD → System menu.

3.2.12 Fuel Imbalance (Yellow)

The aircraft fuel tanks have exceeded the configured limit for fuel balancing. The pilot should take appropriate action to correct the fuel imbalance. Certain aircraft require specific procedures and are described below.

3.2.12.1 Piper PA-46-500TP (Meridian)

The fuel imbalance annunciator and boost pumps are controlled by the Garmin TXi fuel imbalance monitor. The FUEL IMBALANCE alert in the TXi will flash until acknowledged. The following procedures apply to the PA-46-500TP aircraft:

If the imbalance is greater than 25# but less than 40#:

1- Comply with the aircraft AFM Emergency Procedure for FUEL SYSTEM Imbalance.

NOTE

The TXi fuel imbalance is illuminated and flashes when the imbalance is 25# or greater. There is no other indication that the fuel imbalance exceeds 40# other than display of the fuel quantity. **The pilot *must* monitor the imbalance and take further action should the imbalance exceed 40#.**

If the fuel imbalance exceeds 40#:

1- Comply with the aircraft AFM Emergency Procedure for FUEL SYSTEM Imbalance Indications for the flashing "FUEL IMBALANCE" annunciation.

3.2.12.2 Pilatus PC-12 (S/N 112-888)

The original aircraft fuel imbalance system was replaced with the Garmin TXi fuel imbalance monitor. The following procedures apply to the PC-12 aircraft.

3.2.12.2.1 BALANCE ON Indication (Green)

A fuel imbalance of greater than 10.5 gallons (~70 pounds) exists. The automatic fuel imbalance system has activated the heavy-side fuel pump to balance the fuel between tanks. No pilot action is required.

3.2.12.2.2 IMBALANCE (Yellow)

The fuel imbalance system may not be functioning correctly. The fuel imbalance is between 26.4 (~177 pounds) gallons and 40 gallons (~268 pounds).

1- If On-Ground .... Do Not Take Off

2- Refer to the aircraft AFM Emergency procedures for "AUTO FUEL BALANCING FAILURE". Wherever "fuel segments" are referenced in that procedure, use conversion table in section A.2 of Aircraft Specific **EIS** Data of this AFMS to equate "segments" to fuel quantity on the TXi EIS fuel quantity gauges.

3.2.13 Fuel Quantity Indication Failure (PC-12 only)

If the EIS shows a yellow X on one or more of the fuel quantity indications or the total fuel quantity data field, the automatic fuel balancing system will not operate.

1- If On-Ground .... Do Not Take Off

2- Refer to the aircraft AFM Emergency procedures for "AUTO FUEL BALANCING FAILURE". Wherever "fuel segments" are referenced in that procedure, use conversion table in section A.2 of Aircraft Specific **EIS** Data of this AFMS to equate "segments" to fuel quantity on the TXi EIS fuel quantity gauges.

NOTE

While in-flight, periodically disconnect the autopilot and verify the control forces for wings level flight do not require abnormal roll trim input. If abnormal roll trim is required, proceed to the FUEL IMBALANCE (Section 3.1.15) emergency procedure in this AFMS.

3.2.14 Turboprop Auto-Ignition Failure

If the GDU is configured as the auto-ignition controller in the system (see Section 1.11.3), use the following procedures in the event of abnormal ignition function.

3.2.14.1 Ignitors Not Activated

If the ignitors are not activated as expected during engine start or flame-out:

1. Turn ON the ignitors manually with the aircraft ignition switch.

3.2.14.2 Ignitors Not Deactivated

If the ignitors are not de-activated as expected during engine shutdown:

1. Turn the ignitors switch to AUTO with the aircraft ignition switch.
2. If the ignitors are still active, open the ignitor circuit breaker(s).

3.2.15 Turboprop Engine-Start Abnormal Procedures

If the GDU is configured as the engine-start computer in the system (see Section 1.11.3), use the AFM procedures in the event of abnormal engine start indications.

3.3 WARNING, CAUTION, STATUS, and ADVISORY Annunciations

The following tables show the color and significance of the warning, caution, and advisory messages for G500/G600 TXi displays.

NOTE

Some aircraft AFM procedures refer to alert blink rates to differentiate between a caution or warning condition. TXi cautions are colored yellow, and warnings are colored red.

3.3.1 WARNING Annunciations – RED or RED		
Annunciation	*Pilot Action*	*Cause*
EDM	Take all appropriate actions to correct the condition that triggered the emergency descent.	The pilot or autopilot has initiated an emergency descent.
ENGINE	Observe the warning indication on the EIS display and take appropriate action.	One or more engine parameters have exceeded a warning threshold.
HDG FAIL	Use Standby Magnetic Compass or GPS track information.	Display system is not receiving valid heading input from the ADAHRS or AHRS; accompanied by a red X through the digital heading display.
IMBALANCE	Follow the imbalance procedures in Section 3.1.15 of this AFMS.	Fuel imbalance has exceeded the aircraft limitations.
Red Airspeed Parameter	Take immediate action to correct the airspeed limitation being exceeded.	An Indicated Airspeed (IAS) or MACH speed limitation has been exceeded.
Red Engine Parameter	Take appropriate action to correct condition causing engine parameter exceedance.	The engine parameter has exceeded the warning threshold.
Red X	Reference the data source or alternate equipment.	A red X through any display field, indicates that display field is not receiving data or is corrupted.

3.3.1 WARNING Annunciations – RED or RED

3.3.2 CAUTION Annunciations – YELLOW or YELLOW

Annunciation	*Pilot Action*	*Cause*
AHRS ALIGN – Keep Wings Level	Limit aircraft attitude to ±10º bank and ±5º pitch as AHRS Aligns - OK to taxi.	Attitude and Heading Reference System is aligning. AHRS may not align with excessive pitch/bank angles.
AHRS NOT READY – Do Not Takeoff	Remain stationary and allow AHRS to finish initialization and allow navigators to acquire sufficient GPS position.	AHRS sensors are not ready for flight. Additionally, the interfaced navigator does not have sufficient GPS position.
ALT, HDG, or IAS	Cross-check the flagged information against other sources to identify erroneous information.	Difference detected between displayed airspeed, heading, or altitude (dual ADC installations only).
ATTITUDE Note: Autopilot may automatically disconnect	Fly aircraft manually and crosscheck attitude indication with standby attitude indicator and other sources of attitude information (airspeed, heading, altitude, etc.)	The PFD attitude monitors have detected an AHRS malfunction or an error between AHRS sources (if two sources installed). Autopilot will disconnect if AHRS is being used to drive the autopilot.
BACKUP GPS	Observe limitations regarding use of backup GPS	No external GPS data is available, and system is using backup GPS.
EDM	Understand that emergency descent mode on the autopilot is not functional.	EDM mode is not functional. Refer to the system advisory message for details.

3.3.1 WARNING Annunciations – RED or RED		
ENGINE	Observe the caution indication on the EIS display and take appropriate action.	One or more engine parameters have exceeded a caution threshold.
FAN FAIL	Prepare for loss of display. Display may overheat and shut down.	Cooling fan for the display has failed.
GLIDE	Follow the Smart Glide procedures in the GTN Xi AFMS.	Smart Glide is active.
IMBALANCE	Follow the imbalance procedures in the 3.2.12 of this AFMS.	Fuel tank imbalance exists between the tanks connected by the yellow line.
L ENG or R ENG	Be aware that the EIS has detected a significant power difference between two engines.	The engine may be producing significantly less power than the other engine and the rudder bias system has engaged. See the GFC 600 AFMS for more details.
MAG ANOM (text near the heading readout)	Be aware that the heading indications may be misaligned until clear of the magnetic interference.	The AHRS has detected a magnetic anomaly. This generally occurs near large buildings or metallic areas. **Take off with MAG ANOM is permitted**.
NO AP DATA	Verify autopilot mode of operation using alternate means.	Autopilot mode of operation is not available.
No GPS Position	Use alternate information for positional and situational awareness	GPS data is unavailable.

3.3.1 WARNING Annunciations – RED or RED		
ON ADC 1/2	Confirm intended ADC source selection	The PFD is using the cross-side ADC (dual PFD and ADC installations only).
ON AHRS 1/2	Confirm intended AHRS source selection	The PFD is using the cross-side AHRS (dual PFD and AHRS installations only).
RB FAIL	No action necessary.	Rudder bias system has failed on the GFC 600. See the GFC 600 AFMS for more details.
TAWS N/A, TAWS FAIL	Use vigilance, terrain depiction and TAWS alerting is no longer provided.	Database errors or lack of required GPS position.
TRAFFIC	Visually acquire the traffic to see and avoid.	The interfaced traffic system has determined that nearby traffic may be a threat to the aircraft.
Yellow EIS Parameter	Take appropriate action to correct condition causing engine parameter exceedance.	The engine parameter has exceeded the caution threshold.
Yellow X	Reference the data source or alternate equipment.	A yellow X through any display field, indicates that display field is not receiving data or is corrupted.

3.3.3 Status Annunciations – GREEN		
Annunciation	*Pilot Action*	*Cause*
BALANCE ON	None	Automatic fuel imbalance system is ON.

3.3.4 Advisory Annunciations – WHITE

Annunciation	*Pilot Action*	*Cause*
ATTITUDE, ALT, HDG, or IAS (text on PFD)	Be aware that the other (unselected) AHRS/ADC source is not available	The other (unselected) AHRS/ADC source is unavailable.
EDM	Be aware that automatic EDM activation will not occur.	Automatic EDM engagement has been inhibited by the pilot.
ESP	Be aware the GFC 600 pitch ESP is active.	GFC 600 ESP has been activated. See the GFC 600 AFMS for more details.
MAG ANOM (text near the heading readout)	Be aware that the heading indications may be misaligned until clear of the magnetic interference.	The AHRS has detected a magnetic anomaly. This generally occurs near large buildings or metallic areas. **Take off with MAG ANOM is permitted.**
ON ADC 1/2	Confirm intended ADC source selection.	The PFD is using the secondary ADC (single PFD installation only).
ON AHRS 1/2	Confirm intended AHRS source selection.	The PFD is using the secondary AHRS (single-PFD installation only).
RB OFF	No action necessary.	Rudder bias system has been manually deactivated. See the GFC 600 AFMS for more details.
Various Advisory Messages may appear in the Advisory list, accessed by pressing the Advisory key.	View and understand all advisory messages. Refer to the TXi Pilot Guide for appropriate pilot or service action.	Typically, they indicate communication issues within the TXi System.

3.3.5 Engine Text Lamps	
Annunciation	*System Description*
BETA	Propeller beta valve is OPEN. Indicates the propeller is in the reverse operating range.
BLEED	Bleed valve is OFF
IGN	Engine ignition is ON
INSEP	Inertial separator is OPEN
START (White)	Stater is ENGAGED
START (Blue)	The starter was shut off before the engine reached a stable running state. Used for starter cooling timing.

3.4 Engine Exceedances

When the TXi system includes Turboprop EIS, engine exceedance and some basic airframe exceedances can be logged in the system. Should an exceedance occur, the pilot is notified 30 seconds after the exceedance has ended via a system advisory. The pilot will be reminded of the exceedance when on the ground with a system advisory until the exceedance is acknowledged on the System → Logs → Exceedances page. Additional details regarding the exceedance are available on the exceedance log page. All exceedance thresholds are configured by the installer and will vary from aircraft to aircraft. Refer to the EIS Appendix of this document for aircraft specific details.

Section 4: NORMAL PROCEDURES

4.1 Before Takeoff

1. Review displays for any abnormal warning, caution, or advisory indications.

WARNING

It is prohibited to initiate flight when a "Service Required" advisory is present on the PFD, MFD, or EIS display.

2. If equipped with a TAWS/Terrain warning system, ensure that the terrain alert audio test can be heard clearly (a system test audio clip is played during the startup self-test).
3. Visually verify the fuel quantity on board during the exterior preflight checks and enter that value into the fuel computer if equipped.
4. If configured with fuel quantity systems that include a fuel conditioner, ensure all fuel tanks have been initialized and no fuel tanks are represented with a gray barber pole. See Section 7.19.8 for more details.

4.1.1 Master Caution and Warning System Check

For TXi EIS systems connected to the aircraft Master Caution and Master Warning annunciators, complete the Annunciation Push to Test from the EIS menu to verify the system functionality.

1. Press the ENGINE CAUTION Button. Verify the aircraft master caution light illuminates.
2. Press the aircraft master caution button. Confirm the following:
   - The yellow "Acknowledged" annunciation is shown on the EIS
   - The master caution light extinguishes on the aircraft button
   - The green bar on the test button for master caution is extinguished
3. Press the ENGINE WARNING Button. Verify the master warning aircraft light illuminates.
4. Press the aircraft master warning button. Confirm the following:
   - The red "Acknowledged" annunciation is shown on the EIS

- The master warning light extinguishes on the aircraft button
- The green bar on the test button for master warning is extinguished

4.1.2 Integrated Standby System Check

1. Verify that no amber or red battery icon is displayed on the PFD.
2. Verify that attitude, heading, altitude, and airspeed are displayed normally on the PFD (no warnings, cautions, or advisories related to these functions).
3. Select the “Display Backup” switch to the ON position
   a. Verify that the standby PFD information is displayed on the backup display (MFD becomes a PFD display, or both displays become PFD/EIS composite displays)
   b. Ensure that attitude, heading, altitude, and airspeed are displayed normally on the standby PFD (no warnings, cautions, or advisories related to these functions)
4. Select the “Display Backup” switch to the AUTO position and verify that both displays return to their normal PFD, MFD, or EIS state.

WARNING

Failure to verify these functions before flight may result in the loss of all attitude or air data or both, resulting in loss of aircraft control.

4.1.3 Electric Standby Attitude Gyro (Mid Continent 4200 and 4300 Series)

When an electric standby attitude gyro is installed, test the backup battery before takeoff.

1. Apply power to electric standby attitude gyro and allow the gyro to reach operating speed (approximately 5 minutes).
2. Verify that the red gyro flag is not in view.
3. Press and hold the STBY PWR button until the amber annunciator begins to flash.

4. Verify that the green annunciator is displayed continuously, and the red annunciator is not displayed for the duration of the test (approximately 1 minute).

CAUTION
The standby attitude gyro must be considered inoperative if the red annunciator is displayed during the test.

4.2 Autopilot Operation

4.2.1 Autopilot Disconnect Test

In some installations, the autopilot may receive attitude from an installed PFD Adapter. This adapter converts digital AHRS attitude into analog attitude for use by the autopilot. If this is installed, an "AP DISC" button will be present in the PFD Test Menu, and this function must be tested using the following procedure.

1. While on the ground, engage the autopilot.
2. In the PFD Test Menu, press the AP DISC button and verify that the autopilot disconnects.

CAUTION
Do not use the autopilot if the AP DISC button fails to disengage the autopilot normally.

4.2.2 Autopilot NAV / APR mode coupling

To couple the autopilot NAV / APR mode:

1. Select the desired navigation source on the Pilot's PFD with the CDI button.
2. Select the desired NAV / APR mode on the autopilot.

NOTE
The autopilot will use the navigation source that is displayed on the Pilot's PFD.

4.2.3 GPSS Emulation

To use emulated GPSS roll steering commands with autopilots that do not support GPSS roll steering in NAV / APR modes:

1. Select the desired GPS navigation source on the Pilot's PFD.
2. Enable GPSS emulation on the PFD using one of the following methods:

a. Use the AP HDG REF button in the heading context menu

b. Use the GPSS button on the PFD controller (if installed)

c. Select GPSS on the external HDG/GPSS switch (if installed)

3. Engage the autopilot in HDG mode.

NOTE

When GPSS emulation is enabled, the heading bug will be hollowed out, and the PFD heading button will display "GPSS" text along with a crossed-out heading bug. The "GPSS" text will be white when GPSS commands are available, and it will be amber when there is no GPSS command available.

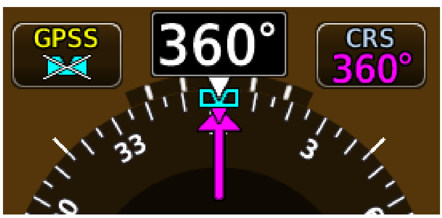

Figure 4-1 HSI: GPSS Emulation Active

NOTE

GPSS can be enabled from PFD 2, but GPSS is not annunciated on PFD 2. The GPSS commands to the autopilot are based on the GPS source displayed on PFD 1.

4.2.4 Altitude Preselect

Certain autopilots may use the PFD selected altitude bug for altitude preselect and capture. Except as described in this section, refer to the autopilot AFMS and/or Pilot's Guide for autopilot system operation.

4.2.4.1 S-Tec 55/55X Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.

2. On the autopilot programmer computer press/hold VS then press ALT to arm altitude hold mode.

4.2.4.2 Collins Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.
2. On the autopilot flight control panel select ALT SEL mode.

CAUTION

Changing the selected altitude bug while ALT SEL mode is selected may result in autopilot mode changes. Verify the autopilot mode after changing the selected altitude.

4.2.4.3 Bendix/King Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.
2. Press the ALT CAP button in the ALT context menu or the ARM button on the PFD controller to arm or disarm the selected altitude.

CAUTION

Changing the selected altitude bug while ALTC mode is active will result in cancellation of ALTC mode. Verify the autopilot mode after changing the selected altitude.

NOTE

When the selected altitude is armed for capture, ALTC is displayed in white text in the upper right corner of the PFD. When altitude capture mode is active, ALTC is displayed in green text in the upper right corner of the PFD. When a KA 315 annunciator panel is installed, the “ALT ARM” annunciator on this panel will not be operative.

NOTE

KFC 200/250 autopilots will inhibit glideslope (GS) mode if altitude capture (ALTC) mode is engaged during glideslope intercept.

4.2.4.4 Cessna Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.
2. Press the ALT CAP button in the ALT context menu or the ARM button on the PFD controller to arm or disarm the selected altitude.

NOTE

When the selected altitude is armed for capture, ARMED is displayed in white text above the selected altitude.

4.2.4.5 Garmin Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.
2. The altitude selected will be the armed mode for altitude capture. When the aircraft reaches the selected altitude, the autopilot will automatically switch to ALT mode.

4.2.5 Vertical Speed Bug Coupling

Certain autopilots may be coupled to the PFD vertical speed bug for maintaining a selected vertical speed. Except as described in this section, refer to the autopilot AFMS and/or Pilot's Guide for autopilot system operation.

4.2.5.1 S-Tec 2100/55/55X and Avidyne DFC90 Autopilots

To select and maintain a vertical speed:

1. Select the desired vertical speed with the PFD vertical speed bug.
2. On the autopilot programmer computer press VS to engage vertical speed mode.

NOTE

The selected vertical speed will automatically be reduced toward zero when approaching the selected altitude bug. AUTO will be displayed in the vertical speed context menu button when vertical speed is being reduced automatically. Manually changing the selected vertical speed while AUTO is displayed will cancel automatic vertical speed reduction.

NOTE

The VS knob on the Avidyne DFC90 autopilot will synchronize with the PFD VS bug on the TXi PFD. The VS bug value may be adjusted from either the TXi PFD or the DFC90

4.2.5.2 Bendix/King Autopilots

To select and maintain a vertical speed:

1. Press the VS ENG button in the VS context menu or the ENG button on the PFD controller to sync the VS to current vertical speed and engage vertical speed mode.
2. Select the desired vertical speed with the PFD vertical speed bug.

NOTE

When engaging VS mode, the VS bug will be synced to the current vertical speed. VS is displayed in green text in the upper right corner of the PFD to indicate that VS mode is engaged.

While VS mode is engaged, the vertical speed bug may be changed by:

- Adjust the vertical speed bug with the PFD knob, or
- Press and hold the vertical trim rocker switch on the autopilot in the desired direction, or
- Press the CWS button on the control wheel to synchronize the vertical speed bug to the current vertical speed.

4.2.5.3 Garmin Autopilots

To select and maintain a vertical speed:

1. Press the VS button on the mode controller.
2. Select the desired vertical speed with the PFD vertical speed bug.

NOTE

When engaging the VS mode, the VS bug will be synced to the current vertical speed. VS displayed in green text in the upper right corner of the PFD to indicate that VS mode is engaged.

4.3 Cold Weather Compensation

In the PFD MENU → Minimums menu:

1. Select TEMP COMP as the minimums source.
2. Enter the temperature at the destination airport.
3. If equipped with a GTN Navigator, ensure the GTN temperature compensation mode is enabled as desired.

NOTE

Pilots must coordinate with ATC when flying temperature compensated approaches.

4.4 True Course Navigation or Manual Magnetic Variation Navigation

1. Set the SYSTEM → Units → NAV ANGLE to the desired value.
2. Ensure the setting matches the navigation angle selected on all interfaced GPS/SBAS navigators.

Section 5: PERFORMANCE

No change.

Section 6: WEIGHT AND BALANCE

See current weight and balance data.

Section 7: SYSTEM DESCRIPTION

Both a detailed G500/G600 TXi Pilot's Guide and trainer software applications are available to help the pilot familiarize themselves with the features and functions of the TXi system.

A power button is provided at the top right corner of the bezel on each display (lower left on GDU 700L). When the display is ON, pressing the power button results in an onscreen menu with controls prompting action to close the menu, power the display OFF, or enter display backup mode (if applicable).

Two SD card slots are provided for loading software and databases and for logging flight data. An optional Flight Stream 510 can also be inserted into the top-most SD card slot to add wireless capabilities to the TXi.

The following colors are used consistently within the TXi system:

Table 7-1 Annunciation Color Codes

Color	Functions
RED or RED	Warning conditions Operating Limits
YELLOW or YELLOW	Cautionary conditions Conditional operating ranges
GREEN	Safe operating conditions Normal operating ranges VOR/Localizer Data Engaged Modes
WHITE	Scales and Markings Current data and values Armed Modes Advisory information
MAGENTA	GPS Data Active flight plan legs
CYAN	Pilot selectable

7.1 Controls Overview

Dual concentric knobs and a capacitive touchscreen provide control of functions for the units. The touchscreen controls accept single touch, two finger pinch, and single finger swiping actions. Virtual "buttons" which can be touched to provide control functions are depicted using white outlines, round corners, and shading. Display range can be controlled using two finger pinching. Map panning can be accomplished using single finger swiping. The enhanced HSI map display range can be controlled using two finger pinch or single finger swipe.

7.2 Glove Usage

No device may be used to cover fingers used to operate the TXi display unless the Glove Qualification Procedure located in the Pilot's Guide has been successfully completed. The Glove Qualification Procedure must be successfully completed for each combination of pilot, glove, and GDU 1060/700P/700L that is intended to be used.

7.3 Display Brightness

Display brightness is controlled automatically based on input to a bezel mounted photocell. The brightness level can be manually adjusted using controls in the System → Backlight selection. Optionally, brightness can be controlled using cockpit lighting dimmer switches or rheostats.

7.4 System Status

The G500/G600 TXi system status can be viewed via the status page; this includes the GDU serial number and system ID of the unit, the software version loaded on the unit, and the AHRS and ADC software if the integral ADAHRS is installed.

An External LRUs list displays information and status of various units that are interfaced to the TXi system. This list only includes LRUs that can report status information, which is typically limited to other Garmin LRUs. Software versions, serial numbers, and LRU status are typically provided. A green checkmark indicates normal online status, and a red X indicates offline or failed status. Some LRUs, like the GDL 69, GSR 56, and GTX 345, provide a button to see more detailed information about the status of that unit. These LRU-specific status pages provide additional controls, like the ability to register the unit, as applicable.

7.5 Databases

The G500/G600 TXi system utilizes databases to provide some system functions.

Database status information is available to the pilot at system startup on the MFD splash screen and during normal operations on the MFD system status page for units with an MFD, or PFD Menu for PFD only units. Controls are provided for enabling database sync and chart streaming and for manually initiating a database update. EIS-only units do not support database functions. System time (as received from an interfaced GPS navigator or the internal backup GPS) is used to determine if a database is within its effective period. On the splash screen, databases are displayed in amber if they are expired, not yet effective, or if the current date/time is unknown. Databases are displayed in white if they are within their effective date range. All database status information is depicted in white on the System Status page.

The GDU utilizes two sets of databases – those which are active, and standby databases which are databases whose valid period has not yet begun. Upon reaching the effective date of a standby database the pilot is prompted to update the database in use.

Internal database validation prevents incorrect data from being displayed.

Databases can be updated using an SD card, by Syncing with other compatible units, or using database concierge through a Flight Stream 510 and PED. Databases are stored internally on the GDU.

The terrain and basemap databases are updated periodically and have no expiration date.

The Garmin or Jeppesen navigation database contains data associated with navigation including airports, navigation aids, airways, airspaces, and other data.

The obstacle database contains data for obstacles and wires that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. Wires which have been identified as a hazard to fixed wing aircraft are included in the database. Coverage of the obstacle database includes the United States and Europe. Wire coverage is limited to the United States. This database is updated on a 56-day cycle.

CAUTION

Not all obstacles or wires are included in the databases.

The Garmin SafeTaxi database contains airport diagrams for selected airports. This database is updated on a 56-day cycle.

The Garmin FliteCharts or Jeppesen ChartView electronic charts database contains procedure charts for the coverage area purchased. An own-ship position icon will be displayed on these charts when the aircraft icon on the chart page is not X'd. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts or ChartView will no longer function.

The airport directory database contains information on landing facilities, such as operating hours, services available, and transportation/lodging resources. Airport directory information may be available from multiple sources and coverage areas. This database is updated on a 56-day cycle.

The magnetic variation model contains data about variations in the earth's magnetic field based on location. This database is loaded using the GDU and is stored on the AHRS. This database is included with the navigation database and is updated on a five-year cycle.

7.6 Crew Profiles

The crew profile function is provided for units which have an MFD to allow the management of pilot-controlled settings. If the aircraft is operated by multiple pilots, each pilot can recall their individual settings for use. These profiles include settings from all displays in the system.

Upon power up, the MFD splash screen provides the option for the pilot to select a crew profile. If no selection is made the unit will default to the crew profile used on the last power cycle. Profiles can be managed via the System → Setup page. Only one profile may be selected as active at a time. New profiles are created with the settings currently in use.

7.7 Display Backup Modes

Display backup modes are provided to replace the functionality of a failed PFD or EIS display by providing the same function on another display. Display backup capability is enabled based on the configuration of the GDUs installed in the aircraft. The display backup mode is limited in space and may not show all engine parameters normally available on the EIS display.

Figure 7-1 Twin Piston Display Backup

Figure 7-2 Single Engine Turboprop Display Backup

7.8 Integrated Standby System

For Class I and II aircraft, standby instruments (attitude, altitude, airspeed) may be provided by a second GDU 700P display. The integrated standby system consists of two GDU 700P displays installed adjacent to each other, with one display configured as the PFD and the second display configured as either an EIS or an MFD.

One display has an integrated ADAHRS and the other will be interfaced to a GSU 75. A "display backup" switch is installed which will force both displays into their display backup mode of operation when activated.

A GBB 54 backup battery will provide power to the PFD and sensors (GEA 110, GMU 44, GTP 59) in the event of primary aircraft power failure. This configuration will provide the following functionality:

- If the PFD fails or communication with the PFD is lost, the MFD/EIS will automatically display its backup primary flight information (attitude, altitude, airspeed) with the MFD or EIS behaving as follows:

    - An MFD will transition to a full-screen PFD display
    - An EIS will transition to a split-screen PFD/EIS display
- The two displays monitor and compare the independent attitude, altitude, and airspeed data. If either display detects a difference between any of the parameters (attitude, altitude, or airspeed), the MFD/EIS display will automatically display its backup primary flight information and amber annunciations will appear next to the data generating the miscompare.

7.9 Electric Standby Attitude Gyro

If an electric standby attitude gyro is installed, the gyro operates from the aircraft electrical system with a dedicated emergency battery specific to the electric gyro. The electric attitude gyro battery capacity may vary considerably depending on temperature, charge status, and battery life condition. Low temperatures below 32°F will temporarily degrade battery capacity. Internal chemistry will slowly degrade battery capacity over several years of operation even when correctly maintained. A poorly maintained battery will suffer accelerated degradation. Extended storage in a discharged state and over-charging will permanently damage the battery. Complete charging is required to bring the battery up to full capacity if it has been unused for more than four months or has been partially discharged.

7.10 Backup GPS

Each Garmin TXi GDU is equipped with a backup GPS receiver. When the optional backup GPS antenna is connected, the TXi system will provide 2D GPS position information from the backup GPS if all the certified GPS sources are lost. There is no pilot action required to enable use of backup GPS data.

Backup GPS data is only used to provide non-safety critical functions after the failure of all certified GPS position sources. Backup GPS data will only be provided if a valid GPS position has been received from a certified GPS source since becoming airborne and is subsequently lost.

Backup GPS data is utilized to provide the following functions: ownship position on the moving map, GPS track display, waypoint bearing/distance information, ground speed, and wind calculations. When backup GPS data is in use, a yellow “BACKUP GPS” annunciation is displayed on all georeferenced maps. Navigation using backup GPS is not provided. Overlays of Stormscope®, traffic, terrain, and obstacles on the moving map is disabled when backup GPS is in use. Traffic information from TIS-A and TCAS sources is still available on the traffic page. Other functions which are inhibited include bearing pointer on waypoint info page, chart geo-referencing, Synthetic Vision, GPS altitude displays, GPS navigation status field, and terrain page display.

7.11 Aircraft Audio Interface

The Pilot PFD is interfaced to the aircraft audio system to provide aural alerts (altitude alerter, minimums, terrain). If multiple PFDs are installed, only the Pilot PFD is interfaced to the audio system (to prevent duplicated aural alerts).

GDU 700P MFD displays may be interfaced to audio system for terrain alerts or touch clicks, but only if there is no Pilot PFD installed.

GDU 700P/700L EIS displays are not interfaced to the audio system.

7.12 Advisory Notifications

An Advisory notification system is available on all installed GDUs. This system notifies the pilot when a new advisory is available and displays a queue of active advisories.

When a new advisory occurs, an “Advisory” button appears and flashes at the bottom of each GDU.

Pressing the advisory button opens a popup window with a list of the active advisories. Advisories are scrollable and are separated by a horizontal line between entries.

Advisories are common to all GDUs, meaning that the same list of advisories is displayed on all GDUs.

7.13 System Settings

The Setup page provides pilot controls for click volume, time format, and local time offset. Controls are provided to set the nearest airport criteria so that airports not usable by the aircraft type do not appear in waypoint searches. A control is provided that allows the pilot to select which weather receiver is used for the weather shortcut accessed by turning the outer dual concentric knob. Crew profiles are managed from this page. Settings on this page are crossfilled to all other GDUs in the system.

Units of Measure for temperature, barometric pressure, nav angle, altitude, fuel, distance, and wind speed are pilot controllable via the System → Units page. These units are propagated throughout the system with the exception of Air Temperature Reference and Fuel

Computer units which only affect the display being used to make the selection.

The units and markings on the PFD are not user configurable. They match the units as specified in the aircraft's FAA approved Airplane Flight Manual and standby instruments.

7.14 System Data Logging

The TXi system incorporates a data logging feature that can record parameters related to the aircraft's primary flight instruments, engine indications, and aircraft configuration. Recorded data is stored in internal memory and can be exported to an SD Card by the pilot. Data logs can be sent via the Flight Stream 510 to a PED in the cockpit. Additionally, if an engine exceedance is detected in the system, a separate flight log is recorded during the exceedance period with a higher data rate than the normal flight data log.

7.15 Primary Flight Display

PFD functions are controlled by the dual concentric knob located adjacent to the PFD and using touchscreen controls. The outer knob assigns the function of the inner knob and is annunciated at the bottom of the display adjacent to the knob. The PFD knobs control Selected Heading Bug, Course Pointer, Selected Altitude Bug, Vertical Speed Bug, Airspeed Bug, and Barometric Correction. In addition, the inner knob provides for numeric entry. The knob function defaults to HDG if it is not rotated for a period of 10 seconds.

When interfaced to a G5 via GAD 29, the TXi will send its BARO setting to the G5 but the G5 cannot send its BARO setting to the TXi. It is recommended that BARO SYNC be enabled when using VNAV functionality as the GTN will only use the pilot-side BARO unless there is a failure.

The PFD can also be controlled using the touchscreen controls. Touching any of the buttons on the screen will display a context sensitive menu. The inner knob may be used to directly change the displayed value or buttons within the menu may be used to access additional control or utilize the touchscreen to enter data.

The PFD can optionally be controlled using a remotely mounted controller which provides dedicated knobs and buttons for Selected Heading Bug, Course Pointer, Selected Altitude Bug, Vertical Speed Bug, Airspeed Bug, Barometric Correction, and GPSS as well as optional controls for interfaced autopilot functions.

A Menu button on the PFD provides access to additional controls and settings.

7.15.1 Primary Flight Data

The PFD displays attitude, heading, airspeed, barometric altitude, and vertical speed data. Airspeed and altitude displays include a six second trend indicator.

Pilot selectable bugs may be provided for airspeed, altitude, vertical speed, and heading.

The G500/G600 TXi requires at least one Garmin GPS/SBAS navigation unit to ensure the integrity of the Attitude and Heading Reference System. The ADAHRS or AHRS will continue to operate in a reversionary mode if the GPS fails, and the attitude display on the PFD will still be presented.

When dual ADC or AHRS sensors are installed and configured, the pilot is provided with AHRS/ADC source selection controls via the PFD Menu → Sensors menu.

The default ADC or AHRS source on power up is ADC 1 and AHRS 1 for the pilot side PFD and ADC 2 and AHRS 2 for the co-pilot side PFD.

For single PFD installations, selection of ADC 2 or AHRS 2 as the sensor source will cause a "ON ADC 2" or "ON AHRS 2", respectively, to be displayed with black text on a white background, to the right of the HSI.

For installations with two (2) PFDs, the pilot's PFD will display "ON ADC 2" or "ON AHRS 2" with black text on yellow background if the sensor source is changed from the default. The co-pilot's PFD will display "ON ADC 1" or "ON AHRS 1" with black text on yellow background if the sensor source is changed from the default.

When dual ADC or AHRS sensors are installed and configured, software monitors provide detection of sensor miscompares. If a monitor detects a difference between sources exceeding the allowable limit, a visual attitude, altitude, or airspeed miscompare annunciation will be shown on the PFD.

Miscompares are annunciated using black text on a yellow background as follows: airspeed miscompare is "IAS" shown below the airspeed pointer, barometric altitude miscompare is "ALT" below the barometric altitude pointer, heading miscompare is "HDG" in the bottom of the digital heading display window, and attitude miscompare is "ATTITUDE" on the attitude indicator. The PFD inhibits the "HDG", "IAS", "ALT", and "ATTITUDE" annunciations in dual TXi PFD installations when both PFDs are displaying the same sensor source.

A no compare monitor is used to determine when data to the second ADC or AHRS source is not able to be used for comparison. No compares are annunciated using black text on a white background in the same location and same text as miscompare annunciations.

Figure 7-3- Miscompare Flags on SVT

Figure 7-4- No Compare Flags

7.16 ADAHRS and AHRS Normal Operating Mode

The Attitude and Heading Reference System integrity monitoring function requires external GPS and Air Data to be provided to the AHRS. An ADAHRS receives Air Data internally and therefore only requires external GPS.

NOTE

Attitude will remain valid if either GPS or Air Data is lost.

NOTE

In dual GPS installations, only one GPS needs to be available to the ADAHRS or AHRS for IFR flight.

CAUTION

Changing the AHRS/ADC sensor source when a white ATTITUDE/IAS/ALT annunciation is displayed on the PFD will result in the selection of an inoperative sensor source and subsequent loss of information. Operating both PFDs on the same sensor source will inhibit the AHRS/ADC comparison monitor.

7.16.1 Attitude

The attitude display is a blue over brown presentation and optionally can display synthetic vision data (SVT).

Standard rate turn marks are provided on the roll scale for bank angles up to 30°. When a standard rate turn would be higher than 30° of bank, the indicator will be displayed at 30°. A turn rate indicator is displayed across the top of the HSI compass dial. Tick marks are shown for half-standard and standard rate turns.

If pitch exceeds 20° nose down or 30° nose up, or bank angle exceeds ±65°, the attitude display will automatically declutter removing non-essential data to facilitate recognition and recovery from extreme attitudes. Red chevrons which indicate the direction to level pitch are displayed when pitch attitudes exceed 30° nose down or 50° nose up.

Slip/skid information is shown using a white trapezoid below the sky pointer.

7.16.2 Synthetic Vision Technology

SVT may optionally be provided to assist the pilot in maintaining situational awareness with regard to the terrain, obstacles, and traffic surrounding the aircraft.

SVT controls are provided via Menu → Terrain/SVT. Synthetic terrain, horizon headings, and airport signs can be toggled on and off from this menu.

SVT provides additional information on the PFD:

- **Synthetic Terrain:** an artificial, database derived, three-dimensional view of the terrain ahead of the aircraft within a field of view of approximately 25 degrees left and 25 degrees right of the aircraft heading.
- **Obstacles**: obstacles such as towers, including buildings over 200 AGL that are within the depicted synthetic terrain field of view. Powerlines are not depicted in synthetic vision.
- **Flight Path Marker (FPM)**: an indication of the current lateral and vertical path of the aircraft. The FPM is always displayed when synthetic terrain is selected for display.
- **Traffic**: a display on the PFD indicating the position of other aircraft detected by a traffic system interfaced to the G500/G600 system.
- **Horizon Line**: a white line indicating the true horizon is always displayed on the SVT display.
- **Horizon Headings**: a pilot selectable display of heading marks displayed just above the horizon line on the PFD.
- **Airport Signs**: pilot selectable “signposts” displayed on the synthetic terrain display indicating the position of nearby airports that are in the G500/G600 database.
- **Runway Highlight**: a highlighted presentation of the location and orientation of the runway(s) at the destination airport.

The synthetic terrain display is intended to aid the pilot awareness of the terrain and obstacles in front of the airplane. It may not provide either the accuracy or fidelity, or both, on which to solely base decisions and plan maneuvers to avoid terrain or obstacles. The synthetic vision elements are not intended to be used for primary aircraft control in place of the primary flight instruments.

Note

In aircraft with nose high or nose low pitch attitudes during normal maneuvers, the sky awareness, or ground awareness bands may appear over the SVT display. It is recommended that if this is discreating, that SVT be turned off for those maneuvers.

7.16.3 Airspeed

The airspeed tape on the left side of the PFD displays red/white striping to indicate the maximum allowable airspeed (V_{NE}/V_{MO}/M_{MO}). This maximum allowable airspeed display is configured to indicate the appropriate maximum allowable airspeed for the airplane, including variations for altitude or Mach number.

When the aircraft is configured for M_{MO} the MACH number is optionally shown below the PFD airspeed tape. When the pilot selects the field to be shown from the PFD Menu, it will become visible when the MACH number reaches 0.40M and will be removed from the display when the speed is reduced below that threshold. This field will appear on the display if a MACH threshold is being exceeded (red) or the airspeed trend detects the M_{MO} speed will be exceeded within 6 seconds in the current flight conditions (yellow), regardless of the PFD menu settings.

The airspeed tape displays a red low-speed awareness band at the lower range of the airspeed tape. This low-speed awareness band is configured to a fixed value. It does not indicate an actual or calculated stall speed and does not adjust with variations in aircraft weight or other factors.

The airspeed tape is configured to indicate the appropriate maximum normal operating airspeed for the airplane (V_{NO}), including variations for altitude, when the aircraft type design or applied STCs require V_{NO} markings.

All other airspeed tape indications are configured to indicate the type design limitations. The airspeed tape does not adjust these additional markings (including landing gear, or flap speed limitations) for variations with aircraft weight, altitude, or other factors.

Airspeed reference bugs are provided on the airspeed tape on are pilot configurable via Menu → Airspeeds.

True airspeed and groundspeed are displayed below the airspeed tape and are always in knots.

7.16.4 Barometric Altitude and Vertical Speed

Barometric Altitude and Vertical Speed are displayed on tapes on the right side of the display. Barometric correction can be set using dual rotary knobs or touchscreen. Selected altitude and vertical speed bugs may be provided and when set are synchronized across all PFDs. The selected altitude bug may be removed by selecting a value of -1,000ft.

If the pilot uses standard baro mode when above the transition altitude, the pilot can preset the non-standard altimeter setting using the BARO controls without leaving STD mode.

Barometric altitude is required for Vertical Navigation (VNAV) calculations on interfaced GTN. Baro sync should be enabled on TXi units. VNAV uses the pilot-side baro setting unless that unit fails, in which case the co-pilot side baro setting will be used.

7.16.5 Navigation

Navigation information is presented on the PFD through a combination of horizontal situation indicator (HSI), a lateral deviation indicator (LDI) above the heading display, vertical deviation indicator (VDI), and GPS navigation status information. Optional bearing pointers, distance measuring equipment (DME) display, and marker beacon annunciations may be displayed.

Navigation information can be selected from up to four independent sources by pressing the “CDI” touchscreen button at the bottom center of the display and selecting the desired navigation source. The selected navigation source is shown on the left side of the HSI or LDI. CDI source selection can be synchronized across multiple TXi PFDs if enabled by the pilot or installer. If only 2 navigation sources are available, the CDI button will simply cycle between those two sources and not provide a menu for source selection.

Automation of CDI source selection and course selection is provided in the following situations:

- Localizer CDI Switch Prompting (if available) – the CDI button on the PFD will flash when established on the final approach course of a LOC-based approach, if the CDI source is GPS. This serves as a reminder to change the CDI source to LOC.
- Localizer Course Auto-Slewing – the appropriate LOC course will be automatically preset when a LOC-based approach is loaded in the navigator and the CDI source is not already selected to LOC.
- Missed Approach Point Auto-Switching from VLOC to GPS – When the missed approach segment of an approach is begun (navigator unsuspended after the missed approach point), the CDI source will automatically switch from VOR/LOC back to GPS. NOTE: this functionality is not available with GNS 480 (CNX 80) navigators, as they do not suspend at the missed approach point.

7.16.6 HSI

The course pointer and deviation indicator are shown as a single, solid line for GPS 1 and VLOC 1, and as an outline with no fill for GPS 2 and VLOC 2. GPS and VLOC sources are further differentiated with color.

Optional CDI preview is available for ILS and GPS approaches when interfaced with a GTN navigator. If enabled, grey CDI/VDI needles will indicate the loaded approach deviations while still navigating on a GPS course.

The selected course is displayed above and to the right of the HSI. The selected course is set via touchscreen keyboard entry or dual-concentric knob.

In addition, the HSI can display two simultaneous bearing pointers sourced from GPS, VHF NAV, or ADF. DME distances can be displayed adjacent to the HSI.

The bearing pointer display and navigation source are pilot controlled under the PFD Menu → HSI Setup → Bearing Pointers sub menu.

An enhanced HSI may be selected by the pilot under the PFD Menu → HSI Options sub menu. The enhanced HSI includes an integral moving map within the HSI depiction. HSI map data is a subset of the data on the MFD map page. Traffic, terrain, obstacle, topographic, and weather overlays are also available for the HSI map. Flight plan, runways, TAWS FLTAs, and TFRs are always displayed. Overlays are controlled on the HSI Map Overlays menu.

7.16.7 Lateral Deviation Indicator (LDI)

A Lateral Deviation Indicator (LDI) is always displayed on the PFD above the heading display. This LDI shows course deviation, navigation source, and VLOC station identifier or GPS phase of flight. The LDI uses the same color convention as the HSI.

The LDI incorporates automatic reverse sensing correction into the deviation display. When the difference between the heading and the selected course is greater than 107°, the LDI will enable reverse sensing correction. Reverse sensing correction inverts the course deviation needle and to/from indicator so that they correctly indicate the direction of the course and waypoint. The course deviation needle will be deflected in the direction of the desired course, and the to/from indicator will point in the direction of the waypoint (similar to how the HSI depiction inverts with heading changes).

Message, waypoint, OBS, SUSP, phase of flight, LOI, and DR annunciations from a GTN or GNS interfaced to the TXi are annunciated on the upper CDI.

7.16.8 Vertical Deviation Indicator (VDI)

Vertical guidance is shown by a vertical deviation indicator (VDI) inboard of the barometric altitude tape. The VDI can display up to two sources of vertical deviation depending on the interfaced navigator. The following table describes the available vertical deviation indications.

Table 7-2 Vertical Deviation Indication Description

Indication	Description
Magenta Diamond	GPS Approach Vertical Guidance
Magenta “V”	Barometric VNAV Guidance
Green Diamond	VHF Glideslope Approach Guidance
Open Gray Diamond	Preview approach guidance shown when the current CDI source is not the approach CDI source.

7.16.9 GPS Steering Indicator

When the TXi source selection is GPS, the autopilot and flight director are disengaged, and the GPS is providing roll steering commands, a “V” shaped caret displays the roll steering commands from the GPS along the edge of the roll indices on the PFD attitude display. If the pilot were to align the roll pointer (or sky pointer) with the caret, the lateral path will coincide with the steering provided by the GPS. The display of this indicator is optional and can be toggled from the PFD Menu.

7.16.10 DME Display

Pressing on the DME field opens a DME popup menu. The DME popup menu allows selection of a DME tuning source when two navigation sources are connected and, if supported by the DME, a hold option.

7.16.11 Marker Beacon Display

The PFDs can show marker beacon annunciations from an interfaced marker beacon receiver. The marker beacon annunciations are shown to the left of the selected altitude.

7.16.12 Height Above Ground Display (Radar Altimeter or GPS-based)

The PFD includes a pilot selectable AGL Field in the PFD menu. This allows the pilot to display a GPS-derived height above ground field on the PFD. The AGL field will show the height above ground until the aircraft is above 2500' AGL in which case the field will be hidden until the aircraft is below 2500' AGL again. This field is only available if the PFD is not interfaced with a radar altimeter.

If interfaced to a radar altimeter the radar altitude will be displayed on the PFD adjacent to the altitude tape. Additionally, when the radar altitude AGL value is within the viewable range of the barometric altitude tape, a ground awareness band is displayed.

If the installed radar altimeter includes self-test capability the Test controls are provided in the "Test" sub-menu under the PFD Menu. Refer to the Radar Altimeter user documentation for information about values displayed during the Test.

NOTE

For KRA 405 Radar Altimeters the displayed Test value will be between 25 and 50ft.

7.16.13 Minimum Altitude Display and Alerting

When enabled by the pilot, an altitude minimums bug will be displayed in cyan on the barometric altitude tape. If a radar altimeter is installed, the pilot can select between barometric or radar-altitude minimums.

Altitude minimums are accessed under the PFD Menu → Minimums sub menu and can be set by touchscreen keypad or dual-concentric knob.

Both visual and aural altitude minimums alerts are provided. During a descent to minimums, the minimums bug will change from cyan to white when the aircraft descends to within 100 ft of minimums. An aural "Minimums, Minimums" alert will be triggered when the aircraft's altitude descends through minimums and the minimums bug will change to yellow. As the aircraft altitude climbs back above minimums, the minimums bug will change to white 50 ft above minimums and cyan 150 ft above minimums. Alerting is rearmed once the aircraft is 150 ft or more above the minimums altitude.

7.16.14 Outside Air Temperature/Density Altitude

The PFD provides a pilot configurable display of outside air temperature or density altitude information below the airspeed tape. The pilot can choose to show Static Air Temperature (SAT), Total Air Temperature (TAT), or temperature delta from the International Standard Atmosphere (ISA). Density Altitude can also be configured to be displayed instead of the temperature.

NOTE

When operating with ice accumulation on the temperature probe, the displayed air temperature may be in error by as much as 4°C.

7.16.15 Navigation Data for Autopilots

The G500/G600 TXi system can provide course and heading data to the autopilot based on the data selected for display on the HSI. For aircraft equipped with multiple GPS/NAV systems, the PFD acts as a selection hub for the autopilot's NAV mode, and the G500/G600 TXi may also provide GPS Steering (GPSS) data.

Not all autopilot systems are approved for coupling to vertical guidance on GPS based approaches; consult the AFMS for the autopilot and/or GPS system.

For dual PFDs installations, control of navigation course, heading, or altitude data affecting the autopilot from the co-pilot side can only be made if the systems are synchronized with each other. If the aircraft has been configured to allow the pilot to change CDI synchronization the controls are provided under the PFD Menu.

If the autopilot is capable of receiving GPSS Roll Steering information, the data is transmitted via a digital communications bus from the G500/G600 TXi to the autopilot. The PFD receives this data from the GPS. In dual GPS installations, the PFD sends Roll Steering information for the currently selected GPS source.

For autopilots which are not GPSS Roll Steering capable, the G500/G600 TXi can convert GPSS turn commands into a heading error signal for the autopilot. When the autopilot is operated in HDG mode and GPSS is selected on the PFD, the autopilot will fly the turn commands from the GPS navigator selected on PFD 1. If an autopilot is interfaced to the GDU which supports GPS steering (GPSS), an additional touchscreen button is provided on the selected heading popup window for toggling the autopilot heading reference between GPSS and selected heading. When GPSS is selected, the heading bug display will change to a cyan outline with no fill and the selected heading display will annunciate “GPSS” with an icon of a crossed-out heading bug. The heading bug may still be adjusted by the pilot as a visual reference without affecting GPSS to the autopilot.

If the GPSS data is invalid (for example, if there is no active GPS leg) or the selected HSI source on PFD 1 is not GPS, the annunciated GPSS text will be yellow, and a zero turn (wings level) command will be sent to the autopilot.

GPSS commands are not available when the CDI is selected to a VOR/LOC source.

7.16.16 Flight Director Display

If autopilot flight director commands are interfaced to the G500/G600 TXi, they will be presented as a single cue flight director on the PFD. Control of the flight director is accomplished via the autopilot/flight director controller; there are no pilot controls or adjustments for the flight director on the G500/G600 TXi.

The GDU limits the distance the flight director pitch commands may deviate from the aircraft attitude icon. If the pitch command provided by the autopilot flight director is greater than the distance allowed by the GDU, the command bars will be displayed at the maximum distance allowed by the GDU. As the aircraft pitch changes to satisfy the command bars, the bars will continue to be displayed at the maximum distance from the aircraft attitude icon until the aircraft pitch deviation is within the command display limit.

In supported installations, the flight director will show hollow bars when the autopilot is not engaged, and solid-colored bars when the autopilot is engaged.

Some installations support a pilot control to switch between dual or single cue flight director depictions. The hollow indication is not available on the dual cue flight director.

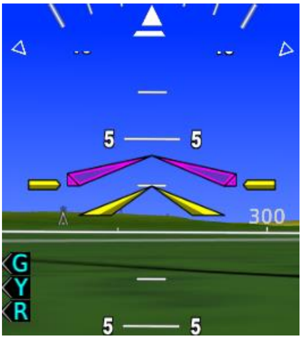

Figure 7-5- Flight Director Bars (Autopilot Not Engaged)

The flight director on PFD 2 (if installed) is a duplicate of the flight director shown on PFD 1 (i.e., the flight director is based on the mode references displayed on PFD 1). When utilizing the flight director on PFD 2, the heading, CDI source, altitude, or other information affecting the flight director must be cross-checked and verified between the two PFDs. It is recommended that CDI sources and BARO sources are always synchronized between PFDs, either with installation settings or pilot-controlled settings.

7.16.17 Attitude and Rate Data Sources for Autopilots

Attitude-based autopilots may be driven by the standby gyro, a remote mounted gyro, the GDU, a G5 when driving a GFC 500, or the GAD 43 adapter. If the TXi system is providing attitude to the autopilot, it will be indicated in Section 1.12. Otherwise, the autopilot is receiving attitude or rate information from the standby or a remote gyro and the autopilot attitude input is independent of the attitude displayed on the PFD.

The pilot must understand the autopilot system inputs to detect faults and capabilities with inoperative equipment. Refer to the autopilot flight manual for operational information.

7.16.18 Altitude Pre-Select and VS Engagement

Optionally, G500/G600 TXi system can provide altitude preselect functions such that the autopilot can capture the pre-selected altitude or couple to the selected vertical speed if these capabilities are supported by the autopilot equipment installed. Refer to the autopilot operator's manual or autopilot Airplane Flight Manual Supplement for the proper operation of the autopilot system.

Controls for altitude preselect functions are provided using the selected altitude context menu, and vertical speed controls are provided using the vertical speed context menu. Altitude preselect and VS mode annunciations are displayed adjacent to the altitude preselect display above the altitude tape.

7.16.19 ARC Style VSI

When an ARC style VSI is configured on the PFD, it is replaced with a standard vertical VSI when the PFD screen is reduced below a 60% PFD on the 10" TXi display. ARC VSI's are not available in 7" PFD's or in aircraft where TCAS II is interfaced with the TXi PFD.

7.16.20 G-Meter

The TXi has a pilot selectable G-meter to optionally display on the PFD. Text coloration will match those colors ranges configured on the gauge by the installer. In larger PFD windows, the pilot can select to display the G-meter to the left of the airspeed tape or in the digital readout under the airspeed tape. With smaller PFD layouts, the g-meter is only available in the digital format. There are min/max G reset controls, and G-meter visibility controls in the PFD menu.

7.17 MFD Functions

The MFD functions are controlled using the dual concentric knob located adjacent to the MFD or using touchscreen controls. The outer knob can be used to select various MFD pages and is indicated at the bottom of the display adjacent to the knob. The inner knob can be used to control the display range. Various MFD functions can be controlled using the touchscreen. The MFD knob on GDU 1060 PFD/MFD installations can also be used to control PFD functions by pressing and holding the knob for a full one second to toggle between MFD and PFD knob controls.

On all MFD pages, the *nose* of the ownship symbol represents the actual location of your aircraft.

The MFD startup page can be chosen by the pilot in the Systems Setup menu. This can include showing the PFD in full screen mode on startup.

7.17.1 Map Page

A 2D moving map function is provided on the MFD. The appearance and determination of data displayed on the moving map is controlled by pilot selections made via a Menu button. The map menu provides on/off controls for map overlays, a map detail selector, and a map setup button which accesses additional map controls.

The map range can be altered using the touchscreen or rotary knob to allow for display of data pertinent to the operation being conducted. The current zoom scale or range of the map is continuously indicated by a range ring centered around the ownship with a range indication at the 11 o'clock position on the ring. In addition to zooming, a panning function is provided to allow the position of the map to be centered on a location other than the ownship. Panning mode is entered by dragging a single finger on the display. The map orientation can be changed to North Up by pressing the North Up arrow in the top left corner.

If an active flight plan is present in the interfaced navigator, it will be depicted on the map. Traffic, Terrain, Weather, Land, and Aviation data can be selected for overlay on the map.

The main MFD map and weather maps have three map views which are pilot controlled. The map views are shared between MFDs within cockpit and changes made to a map view will sync to other MFDs showing the same map view.

7.17.2 Traffic Display

The MFD can display traffic data from interfaced traffic systems. Sources of traffic data include TIS-A, TAS/TCAS, and ADS-B traffic. The information from these systems is displayed on and controlled using the MFD.

Traffic system operating controls and system status are provided on the dedicated traffic page via touchscreen control in the lower left corner and/or the Menu button, depending on the interfaced traffic system type. A display altitude filter is provided in the lower right corner. Filtering of targets based on altitude is accomplished by the display and affects the traffic page and map page. When interfaced to a TIS traffic system, altitude filtering is not available.

The *center* of the traffic target icon serves as the reported location for the target aircraft.

Additional functions are provided on the dedicated traffic page when an ADS-B traffic system is interfaced including the depiction of motion vectors.

Absolute motion vectors are colored white and depict the reported track of the traffic target referenced to the ground. An absolute motion vector pointed towards your ownship symbol *does not* necessarily mean the traffic target is getting closer to your aircraft.

Relative motion vectors are colored green and depict the motion of the traffic target relative to your ownship symbol. The direction the traffic target is pointed may vary greatly from the motion vector and a target may be getting closer to your aircraft independent of the direction the target is pointed. A green relative motion vector pointed towards your ownship indicates that the traffic target *is* converging on your aircraft.

For ADS-B traffic systems - if while on ground without valid magnetic heading and the aircraft stops the traffic page orientation will change from TRACK UP to LATCHED. In this mode the display remains oriented to the last valid track until a new valid track is obtained.

Traffic can be displayed on the moving map as an overlay. Additional filtering based on traffic type (all, advisories, alerts) can be selected using the Menu Traffic selection. For TIS-A traffic selection of the advisories and alerts will result in display of alerted targets only.

Traffic page units are always in nautical miles and feet. If systems units for altitude are selected to meters, then an annunciation is provided on the traffic page indicating that traffic altitudes are depicted in feet and the traffic overlay icon for the map includes a "FT" indication.

If a traffic alert occurs and the MFD is not selected to the dedicated traffic page, then a traffic "popup window" is provided which depicts the traffic and provides controls to either go to the dedicated traffic page or close the popup window. On a GDU 1060, if a traffic alert occurs and the display is showing a full screen PFD, then a button is provided which will return to split screen mode and display the dedicated traffic page. On systems with a PFD installed, a yellow TRAFFIC annunciator is provided adjacent to the HSI.

Traffic system controls and display settings are synchronized across TXi displays.

7.18 Terrain Awareness and Alerting

The following terrain awareness and alerting functions may be provided by the TXi system: Terrain Proximity, Terrain FLTA, or TAWS-B. If the TXi system is interfaced to a GNS or GTN navigator equipped with TAWS-B, then the TXi will display TAWS-B parameters provided by the GNS or GTN. The Terrain or TAWS function provided by the TXi system is indicated by a text box in the lower left corner of the Terrain Page.

Terrain Proximity function is a 2D depiction of terrain, obstacle, and powerlines with no alerting. A dedicated terrain page is provided on the MFD on which the relative height of terrain, obstacles, and powerlines are depicted using color to convey the height of the obstruction relative to aircraft altitude based on database data. An obstacle and/or wire overlay icon will be shown near the bottom of the display when the obstacle or wire depiction is being provided as determined by the zoom scale. The Terrain Proximity function is present on the system regardless of other higher-level terrain functions that may be selected.

If SVT is enabled in the TXi system, then the Terrain - FLTA function is provided. Forward Looking Terrain Alerts and Reduced Terrain Clearance Alerts are provided for terrain, obstacles, and wires.

If TAWS-B is enabled in the TXi system, then the same alerts as the Terrain – FLTA configuration are provided plus additional alerts necessary for TSO-C151c compliance.

If the TXi is interfaced to a GNS or GTN with TAWS-B enabled, then TAWS alerts are only displayed from the GPS/TAWS navigator interfaced as GPS 1 and are displayed regardless of the CDI 1-2 setting.

Visual indications are provided for terrain, obstacle, and wire alerts as follows:

- For all TXi configurations which provide alerts and all configurations where the TXi is interfaced to GNS or GTN with TAWS-B enabled:
  - An annunciator located on the PFD adjacent to the HSI provides text annunciations of system status, self-test, and alert conditions using yellow, red, or white as appropriate to the condition.

- For all TXi configurations which provide alerts and all configurations where the TXi is interfaced to a GTN with TAWS-B enabled:
  - If a terrain alert occurs and the MFD is not selected to the dedicated terrain page, then a terrain "popup window" is provided, which depicts the obstruction generating the alert with controls provided to either go to the dedicated terrain page or close the popup window. On a GDU 1060, if a terrain alert occurs and the display is showing a full screen PFD, a button is provided which will return to split screen mode and display the dedicated terrain page.
  - The terrain page and map page will depict the area or obstruction causing the alert as an area of color corresponding to the alert severity and encircling the obstruction.
  - If Synthetic Vision depiction is turned on, an area corresponding to the alert area on the map/terrain page is shaded in the corresponding color for terrain alerts. Obstacle alerts will cause the relevant obstacle to be depicted in the alert color in SVT. Powerline alerts do not have a corresponding indication in SVT.
  - In Dual PFD installations, TXi generated alert audio is only provided by the Pilot side GDU. If the Pilot side GDU becomes inoperative, the Co-Pilot side GDU visual annunciations may still function, but the aural alerts will not be heard.

Controls are provided for terrain, obstacle, and wire alerts as follows:

- For all TXi configurations in which the TXi system provides alerts:

- Controls are provided in the menu on the Terrain Page. A “Terrain Inhibit” button inhibits terrain, obstacle, and powerline alerts when pressed. Annunciations are provided on the PFD and Terrain Page to indicate that alerts are inhibited. A “Terrain Test” button initiates a self-test sequence which results in aural and visual self-test annunciations.

7.18.1 Charts

The MFD can provide depiction of aeronautical charts on a dedicated charts page as well as the map page. Charts are geo-referenced on both the map and charts pages. The map page will always depict the chart that is currently selected on the charts page; this chart is overlaid on top of the terrain, TOPO, and Basemap layers but below the traffic and ownship layers. The overlaid chart is oriented appropriately for the current orientation of the map considering the selected map orientation and position/direction of the ownship. The charts page will include a depiction of the ownship, colored magenta, if the selected chart supports geo-referencing and the ownship is located within a geo-referenced portion of the selected chart. If geo-referencing is not available on the charts page an icon is presented that indicates the ownship is not being depicted.

SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and ChartView use is limited to airport surface orientation to improve flight crew situational awareness during ground operations.

7.18.2 Flight Plan Page

The MFD includes a Flight Plan page which displays the active flight plan from the selected GPS navigator. The flight plan page is only a display of the active flight plan from the navigator (flight plans in the navigator catalog cannot be displayed). The active flight plan cannot be edited using the MFD. Flight plan waypoints for which additional information is available appear as buttons. Touching a button will jump to the Waypoint Info page for that waypoint.

On a GDU 1060, the active flight plan is shown for the GPS source that corresponds to the PFD CDI selection (e.g., GPS 1 when the CDI source is GPS 1 or VOR/LOC 1, GPS 2 when the CDI source is GPS 2 or VOR/LOC 2). This is the same GPS source shown on the PFD NAV Status field. If a G5 is installed as part of the GFC

500 system, the navigation source matches the TXi and there are no side (1 or 2) indications on the G5.

On a GDU 700P MFD, the active flight plan for the associated PFD is displayed (e.g.- if the co-pilot has a PFD and MFD in the co-pilot panel, the co-pilot PFD CDI selection will change the flight plan data on the associated PFD). If the MFD is a center located stand-alone MFD, the flight plan shown will be from the pilot's PFD source selection.

7.18.3 Weather Data

The MFD can display weather data from interfaced datalink systems. Sources of weather data include the Garmin "GDL 69(A)" and "GDL 69(A) SXM" Sirius XM receivers, Garmin GSR 56 Iridium Transceiver, and Garmin ADS-B transceivers. If one of these optional weather datalink receivers is installed, the pilot will be able to access graphical and text weather products using the MFD. Datalink weather products use color and/or timestamps to indicate the recency with which the data was received.

Selected weather products from each receiver can be overlaid on the map page as well as the enhanced HSI map while all received products can be displayed on the dedicated weather pages. The products available on the map page and HSI are different for each weather receiver. The map page and HSI provide controls to select the desired weather receiver; only one weather receiver can be selected at a time.

Text and graphical datalink weather associated with a facility can only be viewed when a database which includes that facility is installed.

The G500/G600 TXi system can optionally control various airborne weather radars and display their data. Weather radar data is depicted on the dedicated weather radar page and can be overlaid on the map page. The weather radar page contains controls for operating modes, gain, bearing, tilt, stabilization, horizontal and vertical scan sectors, and scan directions, as applicable. Controls for Garmin radars may include advanced functions such as altitude compensating tilt, turbulence detection, weather advisories, and ground clutter suppression, and a 15-color scale. The TXi will automatically command the radar into standby mode upon landing.

NOTE

Weather radar may be shown on multiple cockpit displays, and some other displays may use a 3-color scale for weather returns (instead of a 4-color scale). The 4-color scale used in the TXi is displayed on the radar page, and the 4-color scale provides additional distinction between heavy (red) and extreme (magenta) returns.

The GWX 70/75/80 Weather Radar can optionally provide a turbulence detection function. The turbulence detection function can only detect turbulence between 2.5 nautical miles and 40 nautical miles ahead of the aircraft. The display of turbulence is only provided when the radar range is set to 160 nautical miles or less.

NOTE

Turbulence detection does not detect all turbulence, especially that which is occurring in clear air. The display of turbulence indicates the possibility of Severe or greater turbulence, as defined in the Aeronautical Information Manual.

The MFD can optionally display data from Stormscope® lightning detection systems. Stormscope data can be depicted on the map page, dedicated Stormscope page, and HSI map. For detailed information about the capabilities and limitations of the Stormscope system, refer to the documentation provided with that system.

7.18.4 Waypoint Information

The MFD provides pages that display information about the different waypoint types. These pages can be accessed by touching one of the supported waypoint types on the map and then pressing the provided Waypoint Info button, or by navigating to the Waypoint Info page group from the home page

7.19 Engine Indicating System

Engine Indicating functions are optionally provided for single and twin-engine aircraft with four and six-cylinder reciprocating engines, and some single-engine and multi-engine turboprop aircraft powered by Pratt & Whitney PT6A derivative engines.

The following indications are provided in all EIS installations:

Table 7-3 Standard Engine Gauges

Piston Powered Aircraft	Turboprop Powered Aircraft
Tachometer Manifold Pressure * Fuel Flow Oil Pressure Oil Temperature Cylinder Head Temperature (CHT) Exhaust Gas Temperature (EGT)	Torque Propeller RPM Gas Generator RPM Engine Temperature (ITT) Fuel Flow Oil Pressure Oil Temperature

* If required

Other engine or airframe indications in the aircraft may be provided by either the EIS display or previously installed indicators in their original locations. The following indications may be provided on the G500/G600 TXi EIS display:

- Fuel Pressure
- Electrical gauges (Amps / Volts)
- Main and Auxiliary Fuel Quantity
- Carburetor Air Temperature (CAT)
- Turbine Inlet Temperature (TIT)
- Inlet Air Temperature (IAT)
- Compressor Discharge Temperature (CDT)
- IAT/CDT Differential
- Vacuum or Air Pressure (e.g.- instrument suction or deice boot pressure)
- Rudder Trim position indication

Pilot-selectable data fields may be present on GDU 700P/L displays, or on the MFD Engine page. Additional functions provided by the EIS system include a fuel computer, HOBBS and flight timers/meters, percent engine power, and pilot-selectable engine advisories.

The layout of EIS gauges is dependent on the G500/G600 TXi display type and number of engines. The determination of which data is presented in which slot is set by the installer in configuration mode based on data in the STC which specifies the data located in each position. The markings on the EIS gauges depict the operating ranges and limitations provided in the Airplane Flight Manual and Type Certificate Datasheet. In some cases, the TXi EIS is configured to declutter engine gauges by eliminating markings that do not apply to the current engine condition. See Section 7.19.2 for further details.

For installations in which the EIS display is not within the primary field of view, an EIS annunciator is required to be installed within the primary field of view which will draw the pilot's attention to the EIS display when certain parameters are outside normal operating ranges. This annunciation may be provided on a G500/G600 TXi PFD or by a separate red/yellow "ENGINE" annunciator lamp.

Some previously installed aircraft gauges included non-required markings such as advisory marks for certain altitude and power combinations. EIS gauges will include all markings required to comply with operating limitations associated with that gauge. Markings not required by regulation, and which do not convey limitations or operating ranges are provided to the pilot by means of a placard, or by means of dynamic gauge markings based on the state of the engine or other parameters (e.g.- Altitude, OAT, etc.). Consult the EIS Appendix of this document for aircraft specific dynamic EIS settings.

EIS gauges include display characteristics to attract the pilot's attention when outside normal operating ranges. Gauge behavior in caution or warning ranges is dependent on gauge type and is suppressed when the engine is OFF, and the aircraft is on the ground.

The engine gauges are configured to alert abnormal operating conditions. Alerting for the primary engine gauges (Table 2) is limited to color changes to the gauge pointer, title, and value unless flashing alerts are specified in the EIS Data appendix (Aircraft Specific **EIS** Data). Non-primary gauge alerting also incorporates flashing and master caution or warning (if installed).

Table 7-4 Primary Engine Gauges

Piston Powered Aircraft	Turboprop Powered Aircraft
Engine Tachometer Manifold Pressure Fuel Flow Oil Pressure	Torque Propeller RPM Gas Generator RPM Engine Temperature (ITT) Fuel Flow

On the GDU, flashing alerts will continue indefinitely until the pilot manually acknowledges the alert by pressing the "C" or "W" button at the bottom of the primary EIS or PFD screen..

7.19.1.1 Aircraft Master Caution and Warning System

When installed and connected to the aircraft's master caution and warning annunciators, the red and yellow "W" and "C" on-screen buttons on the TXi are not displayed and the EIS alerts are indicated using the aircraft master caution and warning system. The alerts are also acknowledged using the aircraft Master Caution and Warning annunciator buttons. This system does not generate master caution and warning audio alerts. Pilot should identify the cause of the caution or warning prior to acknowledging the alert.

7.19.2 Dynamic Gauge Ranges

The gauge markings may be dynamically updated based on certain conditions. For example, ITT gauge markings may change based on the state of the engine (e.g.- different marking while the engine is starting). This allows the pilot to easily interpret several different limitations for the engine that may be based on operating conditions such as temperature, air/ground logic, or engine parameters. The installer will configure those dynamic gauges based on the individual aircraft parameters listed in the aircraft Pilot's Operation Handbook.

7.19.3 Engine Tachometer (Piston Aircraft Only)

For aircraft in which a starting vibrator is installed the RPM indication is not accurate during engine cranking.

For aircraft equipped with P lead sensors to measure engine RPM, the RPM indication may momentarily fluctuate when selecting operation on a single magneto.

7.19.4 Carburetor Air Temperature (Piston Aircraft Only)

The Carburetor Air Temperature gauge (if installed) is marked with a blue arc from -15 to 5 °C which indicates a range of temperatures where carburetor icing is likely to occur. Operation in this temperature range should be avoided in conditions where carburetor icing is possible (humid air or visible moisture).

7.19.5 CHT (Piston Aircraft Only)

A CHT cooling rate monitor is provided on the CHT graph gauge. A single blue down arrow is presented on the graph gauge when cylinder head temperature is decreasing at a rate of approximately 30 degrees Fahrenheit per minute. A double blue down arrow is displayed when the cylinder head cooling rate is approximately 60 degrees Fahrenheit per minute or greater.

The cylinders can be cycled through by touching the CHT gauge. Each cylinder will numerically display its respective CHT, and after 10 seconds will revert to displaying the hottest CHT.

7.19.6 EGT (Piston Aircraft Only)

An exhaust gas temperature gauge is provided on the EIS display for all configurations. The EIS display can provide indications of EGT for each cylinder and additionally can indicate a primary EGT which is a measurement of the EGT in the exhaust manifold. On the GDU 1060, EGT information is presented on the EIS strip and the MFD engine page. The EIS strip gauge presents the primary EGT (if installed) or hottest EGT of the individual EGTs. The EGT presentation on the GDU 700P/L and GDU 1060 MFD EIS pages shows all cylinders plus primary EGT at the same time on a graphical gauge. Primary EGT is labeled as E, while individual cylinders are labeled by number. The digital EGT readout displays the hottest EGT or the EGT for the cylinder selected by the pilot by touching the EGT graph to cycle through the cylinders.

Cylinder specific EGT displayed on the EGT graph gauge does not provide configurable operating ranges (yellow, red) and will not provide any alerting or non-safe range indications to the pilot. Primary EGT displayed on the EGT graph gauge and bar gauge can be configured with blue arcs, green arcs, yellow arcs and red maximum lines.

7.19.7 Mixture Leaning (Piston Aircraft Only)

G500/G600 TXi EIS provides four different leaning modes depending on the installed configuration: rich of peak, lean of peak, primary EGT, and TIT leaning. The system lean mode can be set from the Engine Menu.

Lean mode is entered by pressing the Lean Button. When in lean mode peak, EGT/TIT is indicated by the appropriate temperature bar turning white on the graph gauge. A white line is also drawn at the recorded maximum EGT/TIT value. The system will display "PEAK" at the top of the CHT/EGT graph gauge for three seconds when a peak is detected. The top of the CHT/EGT will then display the EGT/TIT value for the appropriate cylinder/turbo and the temperature differential from the maximum recorded EGT/TIT value.

Rich of peak leaning detects and indicates the first engine cylinder to peak during the leaning process. Once the first peak in EGT is detected, the temperature differential from the recorded maximum EGT of the first cylinder to peak is displayed.

Lean of peak leaning detects and indicates the last engine cylinder to peak during the leaning process. Once the last peak EGT is detected for each engine cylinder, the system will display the temperature differential from the recorded maximum EGT of the last cylinder to peak.

EGT leaning is available when the system is configured to display an EGT other than the EGTs for each cylinder (such as an EGT probe installed in the exhaust manifold). EGT leaning looks for a peak in primary EGT during the leaning process. Once a peak in EGT is detected, the system will display the temperature differential from the maximum primary EGT value.

TIT leaning is available when the aircraft is configured to measure a single TIT. TIT leaning looks for a peak in TIT during the leaning process. Once a peak in TIT is detected, the system will display the temperature differential from the maximum recorded TIT value.

The system supports dual TIT measurements for single engine aircraft. In this configuration, a leaning mode is available for the first TIT sensor to peak, TIT – First Peak, or for the second TIT sensor to peak, TIT – Second Peak. TIT – First Peak functions similar to rich of peak leaning mode. TIT – Second Peak functions similar to lean of peak leaning mode.

7.19.8 Fuel Quantity Indications

Previously installed aircraft low fuel quantity annunciators will be deactivated as part of the fuel quantity installation in some aircraft. In this case, the low fuel annunciators will be placarded as deactivated, and a red or yellow arc must be added to the fuel quantity gauge to indicate the fuel level that corresponds to the low fuel annunciation.

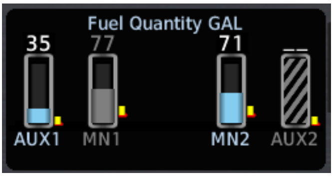

Figure 7-6- Fuel Tank States

In EIS configured to interface with some fuel conditioner units, the fuel gauge value is only read when the respective tank is selected. In these cases, on startup the tank that is not selected will show an uninitialized state using a gray barber pole as illustrated by the "AUX2" tank in Figure 7-6 above. In order to initialize the tank, the pilot needs only to select that tank until a valid quantity reading is achieved after which the pilot can select the appropriate tank for the flight condition. Active fuel quantity readings are indicated by a blue beaker or white digital values. Non-selected tanks indicate the previous fuel quantity for 5 seconds after being deselected, then indicate dashed values. The fuel beaker (if displayed) will show the value when last selected for reference only. The non-selected fuel tanks will be “grayed out”.

7.19.9 Fuel Flow

Aircraft that were previously equipped with a fuel flow gauge which measured metered fuel pressure may have this gauge replaced by a gauge which measures fuel flow directly. When these gauges are replaced in accordance with this STC, the fuel pressure and fuel flow markings on such gauges are replaced by equivalent fuel flow markings.

In some turboprop installations, fuel flow values may be erratic or erroneous before fuel is introduced into the system during engine starts. Once fuel is present in the system, the fuel flow values are accurate. The pilot should disregard fuel flow indications during engine start before fuel is introduced in these aircraft.

Fuel flow values may be in error by as much as 15% if the K factor calibration is improperly set. Do not depend solely on the fuel flow indication to determine fuel used, fuel remaining, or fuel reserves.

7.19.10 Fuel Computer

A Fuel Computer/Totalizer is provided on the GDU 1060 MFD engine page and on the GDU 700 EIS display. The Fuel Computer/Totalizer is accessed through the Menu. The fuel computer function provides computation and display of estimated fuel remaining, range, endurance, endurance at destination, fuel at destination, efficiency, and fuel used. The fuel computer calculates these values using the engine fuel flow sensor, ground speed, flight plan, and estimated fuel remaining. Estimated fuel remaining values are derived differently than the measured fuel quantity shown on the fuel quantity gauges.

The fuel computer calculates the remaining fuel based on the initial fuel value entered by the pilot. The estimated fuel remaining is derived by the fuel computer by subtracting the measured fuel flow from the pilot’s initial fuel entry. “TAB”, “FULL”, and “SYNC FROM GAUGES” buttons are available to aid the pilot in entering the initial fuel quantity. Refer to the AFM for an acceptable method to determine on-ground fuel quantity for normal fuel planning and the initial fuel quantity used for the fuel computer.

CAUTION

Fuel quantity indications shown on the fuel gauges may not be accurate when the aircraft is on the ground. It is the responsibility of the pilot to ensure that the initial fuel value entered in the Fuel Computer is accurate.

User calibration of the fuel flow measurements used for the fuel computer is provided. The fuel flow calibration function compares the estimated fuel used determined by the fuel computer with the actual fuel used determined by the pilot when refueling. Using these inputs, the system develops a fuel flow correction factor which will be applied to future fuel flow calculations. Calibration offset is limited to ±15% of the K-Factor.

7.19.11 Fuel Imbalance

The EIS may be configured with a fuel imbalance limitation. This limitation will be a published airframe limitation. When the imbalance condition is met, the EIS will indicate an imbalance and indicate the tanks that are associated with the imbalance condition. The pilot should take the appropriate action to remedy the fuel imbalance condition per the aircraft flight manual procedures if one exists.

7.19.11.1 Piper PA46-500TP Meridian

The Meridian LOW FUEL light is now triggered by the Garmin EIS. In previous installations the low fuel light would be illuminated when the total fuel on board was 100#. In this installation the low fuel light is triggered by a 50# fuel level in either fuel tank.

7.19.11.2 Pilatus PC-12 (All models)

The fuel balancing system is now activated by the Garmin EIS. System indications on the EIS are as follows:

Table 7-5 PC-12 Fuel Balancing System Indications

EIS Indication on the Fuel Quantity Gauge	Aircraft System Functionality
Green **BALANCE ON**	The fuel balancing system is moving fuel from the fuller tank to the lower tank using the aircraft fuel pump for the fuller tank. A corresponding CAWS fuel pump indicator should also be illuminated for the high-side fuel pump. This occurs at an imbalance of ~10.5 gallons (for longer than 60 seconds) and will shut off when the tanks are balanced.
Yellow **IMBALANCE**	The fuel balancing system is moving fuel from the fuller tank to the lower tank using the aircraft fuel pump for the fuller tank, but the imbalance has reached a critical level. A corresponding CAWS fuel pump indicator should also be illuminated for the high-side fuel pump. This occurs at an imbalance of >26.4 gallons (for longer than 60 seconds). The pilot should refer to the AFMS emergency procedures in Section 3.2.12.
Red **IMBALANCE**	The fuel imbalance is at or above the airframe limitation of 40 gallons and the fuel pumps are no longer being used to try to balance the aircraft. The pilot should refer to the AFMS emergency procedures in Section 3.1.15

7.19.12 Engine Advisories

Engine advisories can be configured by the pilot from the Engine Menu to provide notifications to the pilot via an Advisory notification when the pilot configured threshold has been exceeded. These thresholds are determined solely by the pilot and have no effect on the display of EIS operating range indications or gauge alerting and are not shown on the EIS page in any way.

The following parameters may be configured by the pilot to provide advisories:

Table 7-6 Available Engine Advisories

Piston Powered Aircraft	Turboprop Powered Aircraft
High CHT Low Oil TEMP High Oil TEMP CHT Cooling Rate EGT DIFF Low Endurance Low EST Fuel Remaining Low Bus Voltage High Bus Voltage Low Battery Voltage High Battery Voltage High TIT	Low Oil TEMP High Oil TEMP Low Endurance Low EST Fuel Remaining Low Bus Voltage High Bus Voltage Low Battery Voltage High Battery Voltage

7.19.13 Engine and Airframe Timers

The timers can be accessed from the Engine Menu.

Table 7-7 System Timer Functions

Timer Label	Timer Function
FLIGHT	Flight timer increments in tenths of an hour whenever the aircraft is in an airborne state. This can be triggered via a weight on wheels switch, GPS ground speed, or true airspeed depending on the aircraft installation.
HOBBS	Analogous to an analog HOBBS meter that increments in tenths of an hour whenever one engine is registering >5 PSI of engine oil pressure.
TACH (piston-engine only)	Analogous to analog tachometers such that the timer increments based on the current engine RPM compared to the 75% power setting for that engine.

The flight hour meter will increment in tenth of an hour resolution when the aircraft is in the air and the engine hour meter will increment in tenth of an hour resolution when any engine is running. On multi-engine aircraft, the engine hour meter will start incrementing when the respective engine is running and are tracked separately from one another.

7.20 Flight Stream 510 or GDL 60 (Optional)

The Flight Stream product line uses a wireless transceiver to provide data to and from a GTN to personal electronic devices (PEDs). The Flight Stream 510 is mounted in the GTN SD card slot and includes a Bluetooth and Wi-Fi transceiver. The GDL 60 is a separate LRU available when installed along with a GTN Xi.

Data such as traffic, datalink weather, entertainment audio information, and attitude information is sent from the Flight Stream to the PED. The PED is capable of sending databases to the Flight Stream which will then be available on the GTN. Limitations regarding database operations are found in Section 2.15.

Garmin provides a list of tested and compatible devices that can be used with the Flight Stream. Connection to the Flight Stream may be possible with devices other than those on the supported device list, but Bluetooth® and/or Wi-Fi stability and wireless data integrity cannot be guaranteed.

For details about the Garmin supported devices and apps for use with the Flight Stream product line, please visit: https://explore.garmin.com/en-US/connext/

7.21 European Visual Reporting Points

If the TXi is interfaced to a GTN, and a flight plan contains a visual reporting point (VRP), the TXi must have a database that contains the VRP in order to appropriately display the VRP. If the database on the TXi does not contain the VRP, the VRP will display on the MFD map as an intersection.

7.22 Database Provided Altitudes

When the TXi displays altitude data for waypoints included in IFR procedures, the altitudes provided are those shown on the procedure chart for “Turbojet” or “Jet” aircraft. If altitudes for other aircraft such as “Turboprop” or “Prop” are required, the crew must manually edit the waypoint altitude on the GTN navigator.

7.23 Engine Cycle Counter (Turboprop Only)

The TXi system will log engine cycles if configured. Only full engine cycles are counted. The engine cycle is incremented when the system detects all of the following: Engine Start, Takeoff, Landing, Engine Shutdown.

7.24 Landings Counter
The TXi can count takeoff and landing cycles when EIS is included in the TXi system. The cycle information is based on the system detection of takeoffs and landings.

7.25 Percent Power Indications
For both piston and turboprop EIS, percent power and total power (SHP, HP) are available to the pilot. SHP is available on the gauge inset or the pilot-selectable engine fields, and HP is only available on the pilot-selectable fields. Piston HP calculations are approximate, based on the availability of manifold pressure, engine RPM, fuel flow, and outside air temperature. The value is precise enough to verify power settings. In all cases the aircraft AFM should be the primary reference for engine power settings.

The EIS cannot detect a failure of the ignition source of a piston engine and therefore could continue to read positive engine power even if the ignition source of the engine has failed. The pilot should monitor the engine and EIS indications to determine the actions necessary should the ignition source of the engine fail.

7.26 Rudder Trim Gauge
The rudder trim gauge can be configured with a green gauge range to indicate approved takeoff position for the rudder trim. If no green range exists on the rudder trim gauge, the pilot is responsible for determining the appropriate trim position for all flight operations. The rudder trim may not be symmetrical, and the gauge limits may be different between the full-scale left and full-scale right position of the gauge. Refer to the aircraft operating manual for specific details of the rudder trim system.

7.27 Pilot Configurable MFD Startup Pages
The MFD allows the pilot to select a specific startup page. This page will be shown in lieu of the HOME page on system startup when selected. Additionally, in PFD/MFD or MFD/MFD GDU 1060 installations, the pilot can elect to start the system in a full-screen mode for a single pane. The pilot can always revert the system to its default startup behavior on the Systems → Setting page for each MFD pane and all MFD pages are still accessible from the HOME page or via MFD knob controls.

7.28 Smart Glide (optional)
When installed with a GTN Xi with Smart Glide enabled, the TXi will provide Smart Glide map indications, PFD annunciation, and Emergency Page data for the Smart Glide feature. For more details on the Smart Glide function, refer to the GTN Xi Pilot’s Guide (P/N 190-02327-03 rev. C or later) and AFMS (P/N 190-01007-C2 or 190-01007-C3 rev. 4 or later).

7.29 MFD Flight Plan Display

When an MFD is associated with a specific PFD (e.g.- The co-pilot's side has a 700P PFD and a 700P MFD), the flight plan displayed on the MFD is from the navigation source selected on the PFD CDI. If the MFD is not associated with a specific pilot position (e.g., The MFD is a stand-alone center MFD) the flight plan displayed is from the navigation source selected on the pilot's PFD CDI.

7.30 MFD Engine Page

The MFD engine page is intended as a secondary display of engine operating parameters. As such, any engine alert can only be acknowledged on the primary EIS display. The alerts will be *displayed* on the MFD engine page for reference.

Appendix A Aircraft Specific EIS Data

A.1 Pilatus PC-12 EIS Markings and Limitations

The following tables describe the EIS limitations and gauge markings for each approved model of the PC-12 aircraft.

NOTE

> The PC-12 Emergency and Abnormal procedures in the AFM reference blink rates for caution and warning indications of 40 blinks/min and 80 blinks per/min respectively. In the G500/600 TXi, the blink rate is not an indication of alerting priority. Color is the indication for caution (yellow) and warning (red) indications. The pilot shall use the TXi EIS caution and warning colors to determine the gauge status when referencing the aircraft AFM procedures.

Table A-1: PC-12 All Series with -67B Engines

Aircraft Equipped with Pratt & Whitney PT6A-67B								
Parameter		Red	Yellow	Green	Yellow	Red	Dynamic Markings	Exceedances *alert on timeout*
Torque (psi)		N/A	N/A	0 to 36.9	36.9 to 44.3; 44.4 to 61.0*	44.3 61.0 max.*	0-23.9: Green; 23.9: Red max.* (eng. running, Np < 1000 RPM) 44.4-61.0: Red* after 20 sec.	> 36.9: 5 min. timer > 44.4: 20 sec. timer > 61.0: 0 sec. timer
ITT (°C)	Start	N/A	N/A	400 to 760	760 to 800; 800 to 1000*	800 1000 max.*	350: Yellow min.* (Np ≥ 1000)	> 800: 20 sec. timer > 870: 5 sec. timer > 1000: 0 sec. timer
	Run	N/A	N/A	400 to 760	760 to 800; 800 to 870*	800 870 max.*	350: Yellow min.* (Np ≥ 1000)	> 760: 5 min timer > 800: 20 sec. timer > 870: 0 sec. timer
Ng (%)		N/A	N/A	60 to 104	N/A	104	60: Yellow min.* (eng. running)	> 104: 0 sec. timer
Np (RPM) [1]		N/A	N/A	1640 to 1730	1760 to 1870*	1870	< 950: Red* after 5 sec. (on ground, propeller not feathered) 1640: Yellow min. radial (Ng ≥ 90%) < 1640: Yellow* after 5 sec. (Ng ≥ 90%)	> 1760: 20 sec. timer > 1870: 0 sec. timer
Oil Press. (psi)		40 60	60 to 90	90 to 135	135 to 200*	135 200 max.*	40: Red min.* (eng. running) 40-60: Yellow* (eng. running) Red* after 20 sec. 60-90: Yellow* after 5 sec. Red* after 20 sec. (Ng ≥ 72%)	> 135 for 20 sec. > 200 for 0 sec.
Oil Temp. (°C)		N/A	N/A	10 to 105	105 to 110*	110	< -40: Red min.* (eng. running) -40 to 10: Yellow* (eng. running) 105-110: Red* after 10 min.	> 105 for 10 min. > 110 for 0 min.

* ***denotes alerting***

Notes:

[1] A white radial is drawn at 1000 RPM Np to denote the value at which the torque gauge markings dynamically change.

Table A-2: PC-12 All Series with -67P Engines

Aircraft Equipped with Pratt & Whitney PT6A-67P							
Parameter	**Red**	**Yellow**	**Green**	**Yellow**	**Red**	**Dynamic Markings**	**Exceedances** *alert on timeout*
Torque (psi)	N/A	N/A	0 to 44.3	36.9 44.4 to 61.0*	44.3 61.0 max.*	0-23.9: Green; ≥ 23.9: Red max* (eng. running, Np < 1000 RPM) 44.4-61.0: Red* after 20 sec.	> 44.4: 20 sec. timer > 61.0: 0 sec. timer
ITT (°C) Start	N/A	N/A	400 to 820	820 to 850; 850 to 1000*	850 1000 max.*	350: Yellow min.* (Np ≥ 800)	> 850: 20 sec. timer > 870: 5 sec. timer > 1000: 0 sec. timer
ITT (°C) Run	N/A	N/A	400 to 820	820 to 850; 850 to 870*	850 870 max.*	350: Yellow min.* (Np ≥ 800)	> 820: 5 min timer > 850: 20 sec. timer > 870: 0 sec. timer
Ng (%)	N/A	N/A	60 to 104	N/A	104	60: Yellow min.* (eng. running)	> 104: 0 sec. timer
Np (RPM) [1]	N/A	N/A	1640 to 1730	1760 to 1870*	1870	< 950: Red* after 5 sec. (on ground, propeller not feathered) 1640: Yellow min. radial (Ng ≥ 90%) < 1640: Yellow * after 5 sec. (Ng ≥ 90%)	> 1760: 20 sec. timer > 1870: 0 sec. timer
Oil Press. (psi)	40 60	60 to 90	90 to 135	135 to 200*	135 200 max*	40: Red min.* (eng. running) 40-60: Yellow* (eng. running) Red* after 20 sec. 60-90: Yellow* after 5 sec. Red* after 20 sec. (Ng ≥ 72%)	> 135 for 20 sec. > 200 for 0 sec.
Oil Temp. (°C)	N/A	N/A	10 to 105	105 to 110*	110	< -40: Red min.* (eng. running) -40 to 10: Yellow* (eng. running) 105-110: Red* after 10 min.	> 105 for 10 min. > 110 for 0 min.

*** denotes alerting***

Notes:

[1] A white radial is drawn at 1000 RPM Np to denote the value at which the torque gauge markings dynamically change.

Table A-3: PC-12 Electrical Gauges

Electrical Gauges								
Ref.	**Parameter**	**Red**	**Yellow**	**Green**	**Yellow**	**Red**	**Dynamic Markings**	**Exceedances**
[1] [2]	DC Amps Bat (A)	N/A	N/A	N/A	N/A	N/A	< -60: Yellow* (eng. running)	N/A
[3]	DC Amps Gen 2 (A)	N/A	N/A	N/A	140 max.*	N/A	N/A	N/A
[4]	DC Volt Bat (V)	N/A	N/A	N/A	29.6 max.*	N/A	< 22: Yellow* after 3 sec. (Ng ≥ 50%)	N/A
[5]	DC Volt Gen 1 (V)	N/A	N/A	N/A	31.5 max.*	N/A	< 22: Yellow* after 3 sec. (Ng ≥ 50%)	N/A
[6]	DC Volt Gen 2 (V)	N/A	N/A	N/A	31.5 max.*	N/A	< 22: Yellow* after 3 sec. (Ng ≥ 50%)	N/A

** denotes alerting*

Notes:

[1] MSN 112-205, 207-251, 253-320, 322-400
[2] TXi EIS does not warn when battery current increases 10 amps or more in a 7 second interval.
[3] MSN 112-205, 207-251, and 253-260
[4] MSN 261-320 and 322-400
[5] MSN 401-544, 546-601, 603-888
[6] MSN 261-320, 322-544, 546-601, 603-888

A.2 Pilatus PC-12 Fuel Conversion Table

For all fuel related emergency procedures in a Pilatus PC-12 with the Garmin TXi EIS installed, the AFM refers to fuel "segments". The following table shows the conversion for segments, pounds, and gallons of fuel.

Table A-4: Pilatus PC-12 Fuel Segment Conversion Table

Segments	MSNs 111-140		MSNs 141-888	
	Pounds	Gallons	Pounds	Gallons
1	48	7	48	7
2	96	14	97	14
3	**144**	**21**	**145**	**22**
4	**192**	**29**	**193**	**29**
5	**240**	**36**	**241**	**36**
6	289	43	290	43
7	337	50	338	50
8	385	57	386	57
9	433	64	435	65
10	481	72	483	72
11	529	79	531	79
12	577	86	579	86
13	625	93	628	93
14	673	100	676	101
15	721	107	724	108
16	770	114	772	115
17	818	122	821	122
18	866	129	869	129
19	914	136	917	136
20	962	143	966	144
21	1010	150	1014	151
22	1058	157	1062	158
23	1106	164	1110	165
24	1154	172	1159	172
25	1202	179	1207	179
26	1250	186	12565	187
27	1299	193	1304	194
28	1346	200	1352	201

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FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System
as installed in

Piper PA-34-220T
Make and Model Airplane

Registration Number: D-GWIT Serial Number: 34-49132

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02019SE-D for the installation and operation of the Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved by: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 23-JUL-2021

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4	11/24/14	7 11 16 18 20 20 & 21 26 27 32 34	Table 1 • Added new functions Section 1.4 • New section Section 2.7 • Modified limitation Section 2.12 • Added wire obstacles Section 2.21 • Modified limitation Section 2.22 & 2.23 • Added limitations Section 3.2.10 • Added Flight Stream 210 to procedure Section 4.1 • Removed telephone audio deactivation procedure Section 7.5 • Added wire obstacles Section 7.9 • Added Flight Stream 210	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *11/25/2014*

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	Page			
Revision Number	Date	Number	Description	FAA Approved
		34 37	<u>Section 7.10</u> • Added wire obstacles <u>Section 7.17</u> • Added section	
5	02/25/16	All	<u>All Sections</u> • Reformatted and updated sections to better coincide with the VFR AFMS. <u>Section 2</u> • Added RF leg description and limitations • Added QFE limitations • Added Autopilot limitations • Added polar operation limitation • Added text regarding new data units in the GTN • Added Fuel Range Ring description and limitations • Added Flight Stream 210 limitation <u>Section 4</u> • Added autopilot capability assessment regarding RF legs • Updated installer descriptions of configuration checkboxes • Added Search and Rescue autopilot note • Added RNP 1.0 installation options <u>Section 7</u> • Added GMA 35c information • Removed references to GDL 88 and replaced with generic ADS-B	<u>*Michael Warren*</u> ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : <u>*02/25/2016*</u>

LOG OF REVISIONS				
		Page		
Revision Number	Date	Number	Description	FAA Approved
			• Added GWX 70 turbulence detection note • Added GTN crossfill information	
6	09/09/16	1	Table 1 • Added Flight Stream 510 data	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *09/09/2016*
		5	Section 1.2 • Removed text	
		6-8	Section 1.5 • Added definitions	
		9	Section 2.1 • Updated CRG Revisions	
		12	Table 3 • Added Flight Stream 510 line	
		12	Section 2.7 • MMC additions	
		12	Section 2.8 • Added reference to section 2.29	
		18	Section 2.28 • Fixed error	
		18	Sections 2.29-2.31 • New Sections	
		22	Section 3.2.8 • Reworded and added additional text	
		23	Sections 3.2.9-3.2.13 • New Sections • Renumbered sections	
		27	Section 4.7 • New section	
		29	Section 7.1 • New revision numbers	

LOG OF REVISIONS				
Revision Number	Date	Page Number	Description	FAA Approved
		32	Section 7.9 • Added Flight Stream 510	
		33	Section 7.10 • Reworded	
		34	Table 4 • Added PTC	
		38	Section 7.19 • Flight Stream 510 content added	
		41-42	Sections 7.25-7.26 • New sections	
7	10/17/17	6-8	Sections 1.5 • New definitions	*Erik Frisk* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *11-01-2017*
		9	Section 2.1 • Updated CRG Revisions	
		10	Section 2.4 • Updated FDE compliance text	
		12	Section 2.6 • Updated software grid	
		13	Section 2.10 • Renamed section	
		19-20	Section 2.32-2.33 • New sections	
		22	Section 3.2.1-2 • Updated text	
		32	Section 7.27 • Updated PG Revisions	
		45	Section 7.27 • New section	
8	08/08/18	6-9	Section 1.5 New abbreviation added	*Erik Frisk* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *08-08-2018*
		10	Section 2.1 • Updated CRG Revisions	

LOG OF REVISIONS				
Revision Number	Date	Page Number	Description	FAA Approved
		13	Section 2.6 • Updated software grid	
		14	Section 2.9 • Changed approach requirements for VOR or ADF approaches	
		15	Section 2.11 • All text updated	
		16	Section 2.14 • Title change Section 2.15 • User airport text added	
		19	Section 2.30 • Updated charts text	
		20	Section 2.32 • Added new text	
		25	Section 3.2.11 • New text Section 3.2.14 • New section added	
		26	Section 3.2.15 • New section added	
		30	Section 4.6 • New section added	
		31	Section 4.9 • New section added	
		33	Section 7.1 • Updated PG versions	
		34	Section 7.5 • Additional options	
		40	Section 7.14 • Text updated	
		44	Section 7.23 • Updated text add bullet	
		46-48	Section 7.28 – 7.31 • New sections added	

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	Page			
Revision Number	Date	Number	Description	FAA Approved
9	01/03/20	12 13 33 44 46	Section 2.5 • Added statement to clarify when CDI key is enabled. Section 2.6 • Updated applicable software. Section 7.3 • Added language to clarify when CDI auto-switching will occur Section 7.23 • Added Default FPA to list of crossfilled items Section 7.28 • Removed recommendation to manually sync FPA	*Erik Frisk* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *01-03-2020*
10	12/11/20	6 10 11 13 14	Section 1.3 • Updated reference to AC 120-76D Section 2.1 • Updated Cockpit Reference Guide revisions Section 2.4 • Replaced references to Garmin WFDE Program with Garmin RAIM Prediction tool. Section 2.6 • Updated software versions Section 2.10 • Removed VOR from list of approaches not approved with GPS guidance.	*Erik Frisk* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *12-11-2020*

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
		18	Section 2.22 • Changed wording for clarity	
		20	Section 2.32 • Clarified function of OBS mode	
		33	Section 7.1 • Updated Pilot's Guide revisions • Removed sentence to improve clarity	
		48	Section 7.32 • New section added	
11	07/23/21	47	Section 7.28 • Updated wording to improve clarity	See Page i
		48	Section 7.32 • Corrected reference from GTN Xi to GTN	

Table of Contents

Section 1. General

1.1 Garmin GTN Navigators

The Garmin GTN navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146c GTN 625, 635, 650, 725, or 750 navigator(s) and one or more Garmin approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

	GTN 625	GTN 635	GTN 650	GTN 725	GTN 750
GPS SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)	X	X	X	X	X
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments		X	X		X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		X
Moving map including topographic, terrain, aviation, and geopolitical data	X	X	X	X	X
Display of datalink weather products, SiriusXM, FIS-B, Connext (all optional)	X	X	X	X	X
Control and display of airborne weather radar (optional)				X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data, including ADS-B (optional)	X	X	X	X	X
Display of StormScope® data (optional)	X	X	X	X	X
Display of marker beacon annunciators (optional)	X*	X*	X*	X	X
Remote audio panel control (optional)				X	X
Remote transponder control (optional)	X	X	X	X	X
Remote audio entertainment datalink control (optional)	X	X	X	X	X
TSO-C151c Class B TAWS (optional)	X	X	X	X	X
Supplemental calculators and timers	X	X	X	X	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X	X	X	X	X
Control of Flight Stream 210 (optional)	X	X	X	X	X
Control of Flight Stream 510 (optional)	X	X	X	X	X

* Display of marker beacon annunciations on the GTN 6XX is only possible when installed with a Garmin GMA 350 audio panel.

Table 1 – GTN Functions

The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

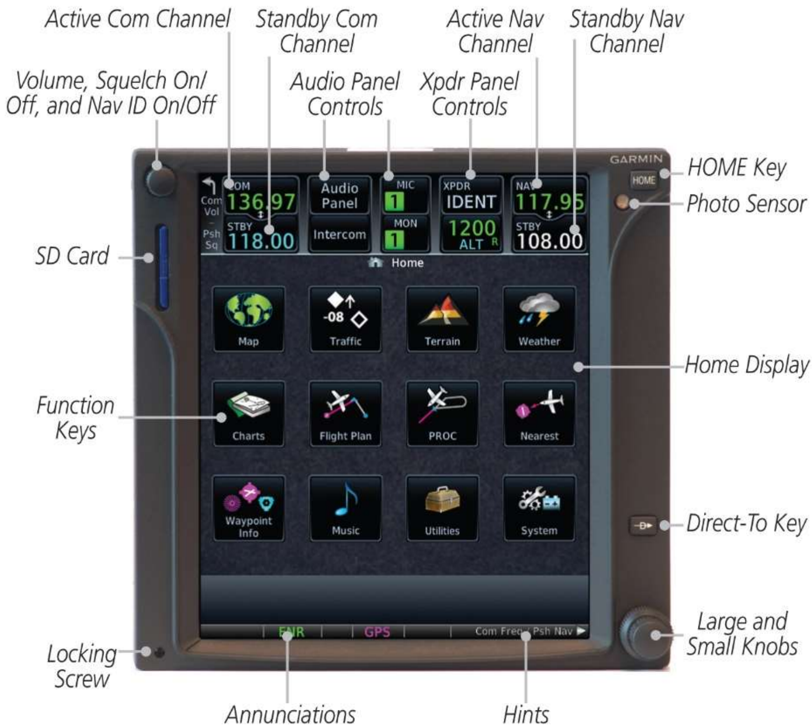

Figure 1 - GTN 750 Control and Display Layout

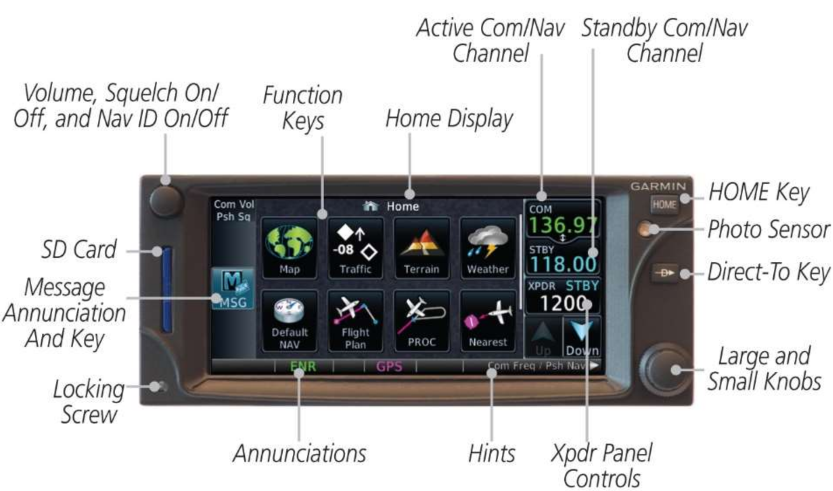

Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

This Flight Manual Supplement documents the installed capabilities of the GTN specific to the aircraft for which this manual is created.

NOTE

In sections which contain a square checkbox (□) the installer will have placed an "X" in the boxes next to the capabilities applicable to the installation.

The GTN system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

- ☐ VHF Communication Radio
- ☐ Primary VHF Navigation
- ☐ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- ☐ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- ☐ TSO-C151c Terrain Awareness and Warning System – See section 2.15
- ☐ Enroute Baro-VNAV

GPS/SBAS TSO-C146c Class 3 Operation

The GTN complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR enroute, terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GTN navigator and antenna, and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV".

The Garmin GNSS navigation system 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 including procedures with RF legs subject to the limitations herein. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

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.

Applicable to dual installations consisting of two Garmin GNSS units*:* The Garmin 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 20-138A and FAA Order 8400.12A. 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 GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system 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.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV 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 GNSS navigation system consists of one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

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

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Advanced RNP Capabilities
The GTN includes 3 out of 6 of the features required for operations in airspace requiring Advance RNP based on the *ICAO document 9613 Performance Based Navigation (PBN) Manual, fourth edition, 2013* and is therefore not approved for Advanced RNP operations. The following table describes the six Advanced RNP capabilities and the GTN capabilities.

Advanced RNP Feature	**GTN Capability**
RF legs	Available if enabled for installation. See Section 2.12 for limitations.
Parallel offsets	Available.
Scalable RNP	GTN provides CDI scalability in compliance with TSO-C146c. RNP scalability is not available.
RNAV holding	Available.
Fixed radius transitions	Not available in GTN.
Time of arrival control (TOAC)	Not available in GTN.

1.3 Electronic Flight Bag

The GTN 750/725 are operationally suitable as installed equipment, Type B EFB applications in accordance with AC 120-76D when using current FliteChart or ChartView data.

Use of the Flight Stream interface and data for the purpose of Electronic Flight Bag applications is not approved as part of this STC. Additional approval may be required to obtain operational approval for use of the Flight Stream and supplied data to supplement EFB systems.

1.4 Electronic Checklists

The GTN checklist functions are designed to DO-178B software design assurance level B and support a minor failure classification. While this STC does not grant operational approval for operators requiring such approval, there are no limitations precluding operators from obtaining their own operational approval for the checklist function.

1.5 Definitions

The following terminology is used within this document:

ADF:	Automatic Direction Finder
ADS-B:	Automatic Dependent Surveillance Broadcast
AEG:	Aircraft Evaluation Group (FAA)
APR:	Approach
ASR:	Automated Speech Recognition
ATK:	Along TracK
CDI:	Course Deviation Indicator
DME:	Distance Measuring Equipment
ECAC:	European Civil Aviation Conference
EFB:	Electronic Flight Bag
EGNOS:	European Geostationary Navigation Overlay Service
EHSI:	Electronic Horizontal Situation Indicator
FPA:	Flight Path Angle
FIS-B:	Flight Information Services Broadcast
GAGAN:	GPS Aided GEO Augmented Navigation
GDU:	Garmin Display Unit
GMA:	Garmin Multimedia Audio
GNSS:	Global Navigation Satellite System
GPA:	Glidepath Angle
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
GTN:	Garmin Touchscreen Navigator

HOT: Hazardous Obstacle Transmission wires
HSI: Horizontal Situation Indicator
IAP: Instrument Approach Procedure
IFR: Instrument Flight Rules
ILS: Instrument Landing System
IMC: Instrument Meteorological Conditions
LDA: Localizer Directional Aid
LNAV: Lateral Navigation
LNAV +V: Lateral Navigation with advisory Vertical Guidance
L/VNAV: Lateral/Vertical Navigation
LOC: Localizer
LOC-BC: Localizer Backcourse
LP: Localizer Performance
LPV: Localizer Performance with Vertical Guidance
LP +V: Localizer Performance with Advisory Vertical Guidance
MLS: Microwave Landing System
MMC: Multi-Media Card
NOTAM: Notice to Airmen
OBS: Omni Bearing Selector
PED: Portable Electronic Device
PTC: Push-To-Command
RAIM: Receiver Autonomous Integrity Monitoring
RF Leg: Radius-To-Fix Leg of a Charted Instrument Procedure
RFL: Reverse Frequency Lookup
RMT: Remote
RNAV: Area Navigation
RNP: Required Navigational Performance
SAR: Search and Rescue
SBAS: Satellite Based Augmentation System
SD: Secure Digital
SDF: Simplified Directional Facility
SUSP: Suspend
TACAN: Tactical Air Navigation System
TAS: Traffic Awareness System
TAWS: Terrain Awareness and Warning System
TCAS: Traffic Collision Avoidance System
TCH: Threshold Crossing Height
TFR: Temporary Flight Restriction

TIS:	Traffic Information Service
VHF:	Very High Frequency
VFR:	Visual Flight Rules
VGSI:	Visual Glide-Slope Indicator
VLOC:	VOR/Localizer
VMC:	Visual Meteorological Conditions

VNAV:	Vertical Navigation
VOR:	VHF Omnidirectional Range
VRP:	Visual Reporting Point
WAAS:	Wide Area Augmentation System
WFDE:	WAAS Fault Data Exclusion
XFR:	Transfer

Section 2. LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide, part number and revision listed below (or later revisions), *must* be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

- GTN 6XX Cockpit Reference Guide P/N 190-01004-04 Rev N
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev M

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations.

2.3 Minimum Equipment

The GTN must have the following system interfaces fully functional in order to be used for primary navigation during IFR operations:

Interfaced Equipment	Number installed	Number Required for IFR
External HSI/CDI/EHSI	1 or more	1
External GPS Annunciator	See Note 1	1

Table 2 – Required Equipment

Note 1: Certain installations require an external GPS annunciator panel. If installed, this annunciator must be fully functional to use the GTN GPS navigation for IFR operations.

Single engine piston aircraft under 6,000 lbs. maximum takeoff weight:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator

All other aircraft:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation. The separate source of VHF navigation must not be the primary GTN, but it may be a secondary GTN.

Operation in remote or oceanic operation requires two sources of GPS navigation.

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability. An acceptable means of compliance for FDE prediction programs is to use a certified service which meets the requirements of FAA AC 20-138 and FAA AC 90-105A for prediction.

The following table describes some of the available RAIM prediction programs.

Prediction Program	Internet address or program details	Coverage Area
Garmin RAIM Prediction Tool	https://fly.garmin.com/fly-garmin/support/raim/	Worldwide
FAA Service Availability Prediction Tool	http://sapt.faa.gov	US Only
Flight Service Station	1-800-WXBRIEF https://www.1800wxbrief.com	US Only
AUGER GPS RAIM Prediction Tool	http://augur.ecacnav.com/augur/app/home	ECAC Airspace Only

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when 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 shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes 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 shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

> For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin RAIM Prediction Tool to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be

unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), Standard Terminal Arrival (STAR), and enroute RNAV "Q" and RNAV "T" routes should be loaded into the flight plan from the database in their entirety, rather than loading 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.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the 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.

2.5 System Use

In installations with two GTNs and an external GPS annunciator (See Table 2) the GTN connected to the external GPS annunciator must be used as the navigation source for all IFR operations.

The only approved sources of course guidance are on the external CDI, HSI, or EHSI display. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

If the GTN is interfaced with an external indicator capable of performing its own source selection, the GTN CDI Key will be disabled. The GTN will display "GPS" even when the external indicator has VLOC selected.

2.6 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 3 can be viewed on the System – System Status or Connext Setup pages.

Software Item	**Software Version** *(or later FAA Approved versions for this STC)*
Main SW Version	6.71
GPS SW Version	5.3
Com SW Version	2.30
Nav SW Version	6.03
Flight Stream 210	2.90
Flight Stream 510	2.6X

Table 3 - Software Versions

2.7 MMC / SD Database Cards

It is required that the SD database card or Flight Stream 510 (MMC) be present in the GTN at all times. The SD or MMC device must not be removed or inserted during flight or while the GTN is powered on.

NOTE

Removal of the SD or MMC device will result in certain features and databases not being available and may slow system performance.

2.8 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

See Section 2.29 for limitations regarding database update procedures.

2.9 Ground Operations

Do not use SafeTaxi or ChartView functions as the basis for ground maneuvering. SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and ChartView are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.10 Instrument Approaches

a) Instrument approaches using GPS guidance may only be conducted when the GTN is operating in the approach mode. (LNAV, LNAV +V, L/VNAV, LPV, LP, or LP +V)
b) When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.
c) The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin LOC/GS receivers to fly the final approach segment, LOC/GS navigation data must be selected and presented on the CDI of the pilot flying. When using the VOR or ADF receiver to fly the final approach segment of a VOR or NDB approach, GPS may be the selected navigation source so long as the VOR or NDB station is operational and the signal is monitored for final approach segment alignment.
d) Advisory vertical guidance deviation is provided when the GTN annunciates LNAV + V or LP +V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.
e) Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GTN system flight plan by its name. Pilots are prohibited from flying any approach path that contains manually entered waypoints.

f) IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN and/or the CDI.

2.11 QFE Barometric Setting

When flying procedures requiring the use of QFE barometric settings, the pilot must ensure that the barometric setting for the source interfaced with the GTN is set to QFE as appropriate. GTN does not support barometric VNAV for QFE operations.

2.12 RF Legs

This STC does not grant operational approval for RF leg navigation for those operators requiring operational approval. Additional FAA approval may be required for those aircraft intending to use the GTN as a means to provide RNP 1 navigation in accordance with FAA Advisory Circular AC 90-105.

The following limitations apply to procedures with RF legs:

- Aircraft is limited to 180 KIAS while on the RF leg
- RF legs are limited to RNP 1 procedures. RNP AR and RNP <1 are not approved
- Primary navigation guidance on RF legs must be shown on an EHSI indicator with auto-slew capability turned ON
- GTN Moving Map, EHSI Map, or Distance to Next Waypoint information must be displayed to the pilot during the RF leg when flying without the aid of the autopilot or flight director.
- The active waypoint must be displayed in the pilot's primary field of view.

2.13 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

It is possible to create flight plan waypoint sequences, including Search and Rescue patterns, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance with regard to flight path deviation.

2.13.1 RNP 1.0 RF Leg Types

AC 90-105 states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot.

This STC has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the GTN installation complies with limitation set forth in Section 2.12 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

2.14 Terrain Alerting Function (All Units)

Terrain, point obstacle, and wire obstacle information appears on the map and terrain display pages as red and amber terrain, obstacles, or wires and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain, obstacle and wire information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.15 TAWS Function (Optional)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

TAWS shall be inhibited when landing at an airport that is not included in the airport database, or is not designated as a User Airport in the GTN.

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional in order to use the TAWS system.

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.16 Polar Operations

Use of the GTN for primary navigation for latitudes above 89.00° N and below 89.00° S is prohibited.

2.17 Datalink Weather Display (Optional)

This limitation applies to datalink weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88 or GTX 345, and Connext via a GSR 56.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

Datalink text weather is decoded for the convenience of the pilot, however it is possible that the decoding may be affected by anomalies in the data or differences in the units of measure between the decoding system and the text weather source. All text weather displayed on the GTN also includes the raw weather text for pilot review.

2.18 Traffic Display (Optional)

Traffic may be displayed on the GTN when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. 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.

Traffic is displayed in feet regardless of the unit settings for altitude. If the units for altitude are different than feet, a “FT” label will appear on the traffic icon on and main map page, and the dedicated traffic page will include an “ALT IN FT” notification.

2.19 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN is limited to supplemental use only. The use of the StormScope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited. StormScope® lightning data on the display is intended only as an aid to enhance situational awareness of hazardous weather, not penetration. It is the flight crew’s responsibility to avoid hazardous weather using official weather data sources.

When the GTN StormScope® page is operating without a heading source, as indicated by the “HDG N/A” label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

2.20 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination.

2.21 Fuel Range Rings

The fuel range rings displayed on the moving map are intended for situational awareness and do not represent a direct indication of endurance or fuel remaining. The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes by default. The reserve value can be changed from the GTN map setup menu.

Fuel range data is derived by the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

2.22 Glove Use / Covered Fingers

No glove or covered fingers may be used to operate the GTN unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725, 750 or GTN 625, 635, 650 combinations.

2.23 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.24 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750/725 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

2.25 Telephone Audio
Telephone audio must not be distributed to the pilot or co-pilot unless a phone call is active.

CAUTION

Failure to turn off telephone audio when the telephone is not in use may result in telephone ringer or text message aural notifications being received during critical phases of flight.

2.26 Multi Crew Aircraft (GMA 35 Only)*
For aircraft type certified with more than one required pilot, or operations requiring more than one pilot, the "Group Co-Pilot with Passenger" audio panel option shall not be activated. This option is found in the Intercom Setup Menu when a Garmin GMA 35 audio panel is installed.

2.27 Wire Obstacle Database
Only the "Obstacle/HOT Line" database may be used. Use of the "Obstacle/Wire" database is prohibited. The database version can be viewed on the start-up database verification or System- System Status pages.

2.28 Portable Electronic Devices
This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

The Flight Stream interface and data provided to a portable electronic device is not approved to replace any aircraft display equipment, including navigation or traffic/weather display equipment.

2.29 Database Updates
Database updates via MMC / SD card or Flight Stream wireless transfers must be done while the aircraft is on the ground and stationary. In-flight database transfers or updates are prohibited in flight unless part of the Database SYNC function that occurs in the background to move databases from one LRU to another.

2.30 Charts Database (Dual GTN7XX and TXi GDU)
When the aircraft installation includes 2 GTNs capable of displaying charts (GTN 700, 725 or 750) and crossfill is enabled between the GTNs, the GTNs must have identical charts types (ChartView or FliteCharts) and charts cycles installed. Failure to have identical charts could affect the chart lookup features and automatic chart selection.

Additionally, when the GTN and TXi are installed in the same cockpit, it is required that the GTN and TXi have the same chart types and cycles to ensure appropriate lookup and chart syncing/streaming functionality. If Chart Streaming or Database Sync functions are disabled, this limitation does not apply.

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* Includes GMA 35 and GMA 35c Audio Panels

2.31 Automatic Speech Recognition

Pilots may not use the ASR function to operate the GTN/GMA unless they have completed the ASR Qualification Procedure located in the GTN Cockpit Reference Guide successfully. The ASR Qualification Procedure is specific to each pilot / headset / aircraft combination.

2.32 OBS Mode

OBS mode allows the pilot to navigate to a waypoint along a course. On a single GTN, press the OBS button and use the OBS or Course knob on the interfaced CDI, HSI, or EHSI to select the desired course. The GTN will annunciate OBS while OBS mode is active. Once the course has been selected, press the OBS button again to exit OBS mode. In a dual GTN installation, the OBS course will crossfill to the other GTN after exiting OBS mode if crossfill is enabled. Use of OBS mode for flight plan segments greater than 250NM is prohibited.
OBS Mode is not available between the FAF and MAP of any instrument approach.

2.33 Advisory Visual Approaches

All advisory visual approaches shall be conducted in VMC. Advisory visual approaches are intended to be used as an aid to situational awareness and do not guarantee terrain or obstruction clearance along the approach path. Use of advisory visual approaches in IMC is prohibited.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural “PULL UP”:

Autopilot..**DISCONNECT**
Aircraft Controls............................. **INITIATE MAXIMUM POWER CLIMB**
Airspeed...**BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:

Altitude ....**CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" and/or "LOI".

If the LOI annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. If LOI occurs while the GTN is in the ENR or OCN phase of flight, it may also display DR.

If the DR annunciation is displayed, the map will continue to be displayed with an amber "DR" overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation.. **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation.. **USE GTN**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE (no DR annunciated on the GTN):

Navigation..................... **FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a LPV, LP +V, LNAV/VNAV, or LNAV +V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation to LNAV. The approach may be continued using the LNAV only minimums. If the VISUAL approach is downgraded, the GTN will remove the vertical deviation indication from the VDI, but continue to annunciate VISUAL in amber.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:
Communications .... **USE ALTERNATE COM**

If no alternate COM is available:
COM RMT XFR key (if installed)....... **PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GTN. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)†

Audio Panel Circuit Breaker .... **PULL**

NOTE

This procedure will force the audio panel into fail safe mode which provides only the pilot with communications and only on a single COM radio. If any non GTN 750 COM is installed, communication will be only on that radio. If only a GTN 750 is installed in the aircraft, then the pilot will have only the GTN 750 COM available. No other audio panel functions including aural alerting and the crew and passenger intercom will function.

† Includes GMA 35 and GMA 35c Audio Panels

3.2.5 TAWS CAUTION (Terrain or Obstacle Ahead, Sink Rate, Don't Sink)

When a TAWS CAUTION occurs, take corrective action until the alert ceases. Stop descending or initiate either a climb or a turn, or both as necessary, based on analysis of all available instruments and information.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2.6 TAWS INHIBIT

The TAWS Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GTN Cockpit Reference Guide for additional information.

To Inhibit TAWS:

Home Hardkey .... **PRESS**
Terrain Button .... **PRESS**
Menu Button .... **PRESS**
TAWS Inhibit Button... **PRESS TO ACTIVATE**

3.2.7 TER N/A and TER FAIL

If the amber **TER N/A** or **TER FAIL** status annunciator is displayed, the system will no longer provide TAWS alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

3.2.8 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a heading source to the GTN, the following limitations apply:

- Roll steering will not be provided to the autopilot for heading legs. The autopilot must be placed in HDG mode for heading legs.
- Map cannot be oriented to Heading Up.
- Overlaying traffic data from a TAS/TCAS I or Garmin ADS-B-IN unit interfaced to an on board traffic system will not be displayed on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or Garmin ADS-B-IN traffic data.
- All overlaying StormScope® data on the main map display will be removed. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.
- Onboard weather radar overlay on the main map will not be displayed. The flight crew must utilize the dedicated weather radar page on the GTN system to view weather radar data from the onboard weather radar.

StormScope® must be operated in accordance with Section 7.8 when no heading is available.

3.2.9 ASR (VOICE COMMAND) SYSTEM FAILURES

In the event the ASR system fails and there is a need to disable the voice command inputs to the GTN:

To Disable ASR:

Home Hardkey.. **PRESS**
System Button... **PRESS**
Voice Commands Button.. **PRESS**
Voice Commands Enable Button.. **TOGGLE OFF**

3.2.10 LOSS OF GTN TOUCH CONTROL

In the event the GTN becomes unusable due to uncommanded page changes, the ASR function may be the source.

To Disable ASR:

Audio Panel Circuit Breaker... **PULL**
Home Hardkey.. **PRESS**
System Button... **PRESS**
Voice Commands Button.. **PRESS**
Voice Commands Enable Button.. **TOGGLE OFF**
Audio Panel Circuit Breaker... **PUSH**

3.2.11 DATA SOURCE – PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

If the GTN is being used to forward pressure altitude to a transponder, the transponder will not be receiving pressure altitude from the GTN while that message is present.

3.2.12 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 (NAV/GPS 2, COM 2) and the Flight Stream 210 (BT LINK), if installed.

3.2.13 IN-AIR RESTART OF GTN

In the event of a GTN restart in the air, the crew should utilize the CANCEL button if presented with the database update screen after the GTN is restarted. This will ensure restoration of the navigation functions as soon as possible.

3.2.14 BARO-ALT INPUT FAILURE

Barometric altitude is required for descent VNAV functionality and automatic sequencing of altitude terminated legs. If the BARO altitude input to the GTN has failed, enroute barometric VNAV will not be available. The pilot will also be required to manually sequence any altitude terminated legs.

3.2.15 TEMPERATURE INPUT FAILURE

Temperature input is required for the VNAV Transition to Approach functionality. In the event of a temperature input failure, VNAV transition to approach should be disregarded. The crew must ensure that vertical guidance from descent VNAV to approach guidance is appropriate and that if an autopilot is in use, the crew intercepts the approach vertical guidance from below.

Section 4. NORMAL PROCEDURES

Refer to the GTN Cockpit Reference Guide defined in Section 2.1 of this document or the Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Databases .... **REVIEW DATES**
Self-Test.................................. **VERIFY OUTPUTS TO NAV INDICATORS**
Self-Test - TAWS Remote Annunciator:
- PULL UP .... **ILLUMINATED**
- TERR .... **ILLUMINATED**
- TERR N/A .... **ILLUMINATED**
- TERR INHB .... **ILLUMINATED**

Self-Test - GPS Remote Annunciator:
- VLOC .... **ILLUMINATED**
- GPS .... **ILLUMINATED**
- LOI or INTG .... **ILLUMINATED**
- TERM .... **ILLUMINATED**
- WPT .... **ILLUMINATED**
- APR .... **ILLUMINATED**
- MSG .... **ILLUMINATED**
- SUSP or OBS .... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators .... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GTN the pilot should rotate the course pointer as prompted on the GTN.

If an EHSI is used to display navigation data from the GTN the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

> The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

See Section 4.5 for RF leg capabilities related to EHSI.

4.4 Autopilot Operation

The GTN may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in a roll steering mode.

The GTN supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GTN. This heading interface can also provide map orientation, traffic and StormScope heading data and wind calculations.

CAUTION

> The GTN does not provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of roll steering when course deviation is not provided.

☐ This installation *has* a heading source. The GTN will provide roll steering on heading legs for the autopilot.

☐ This installation *does not have* a heading source. The crew cannot use the GTN roll steering to fly heading legs with the autopilot.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button .... **PRESS**
"Enable APR Output" Button.. **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot.. **ENGAGE APPROACH MODE**

☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will enable vertical guidance.

Vertical Guidance.......................................**CONFIRM AVAILABLE**
Autopilot... **ENGAGE APPROACH MODE**

☐ The installation *does not* support any vertical capture or vertical tracking.

The GTN allows for the utilization of IFR procedures that include RF (Radius to Fix) legs as part of RNP 1.0 capabilities.

☐ This installation is equipped to support coupled RF leg navigation up to RNP 1.0.

☐ This installation is equipped to support *un-coupled* RF leg navigation up to RNP 1.0.

☐ This installation *does not* support RF leg navigation.

4.6 Coupling the Autopilot for Descent VNAV

The GTN outputs VNAV deviations to properly configured Garmin G500/600 GDU, G500/600/700TXi GDU, or G5 displays. In order to provide autopilot coupling to the baro VNAV guidance, the interface must also include either a Garmin GFC500 or GFC600 with VNAV capability. If VNAV is enabled on the GTN in these installations, VNAV guidance may be coupled to the autopilot using the VNAV function of the GFC.

☐ This installation is equipped and configured to provide VNAV display and autopilot coupling.

☐ This installation is equipped and configured to provide VNAV *display only*.

☐ This installation *does not* support VNAV display or coupling.

☐ This installation is configured with VNAV Transition to Approach.

4.7 Coupling the Autopilot during Search and Rescue Operations

Search and Rescue (SAR) patterns created in the GTN flight plan may include turns that cannot be accomplished with standard autopilot turn rates. Monitor autopilot performance relative to the desired path if coupled when using Search and Rescue patterns.

4.8 Database Conflict Resolution

When a conflict occurs between databases on different GTNs that are utilizing Database SYNC the pilot should resolve that conflict by pressing the "Resolve Conflict" button on the GTN that has the desired databases. This would be the GTN with the newest database on the SD card or Flight Stream 510. After initiating the conflict resolution, the pilot can view the SYNC status of the database on the other GTN by viewing the System -> Standby Database page. Once the database SYNC is complete, the receiving GTN must be restarted to install the new database and complete the conflict resolution process.

NOTE

The databases on the receiving LRU will be overwritten by the databases from the LRU from which the "Resolve Conflicts" action was initiated.

4.9 Cold Weather Compensation

The GTN can compute altitudes for cold weather compensation for applicable IFR approaches. If the instrument approach chart requires temperature compensation, the pilot should enter the destination airport temperature into the GTN. Approach altitudes provided on the map and flight plan are adjusted based on the pilot entered temperature and the altitudes on the flight plan page are appended with a snowflake icon.

Pilots must coordinate with ATC when flying temperature compensated procedures.

Pilots must manually adjust the approach minimums as applicable. The GTN does not provide temperature compensated approach minimum values. Garmin G500/600/700TXi systems can provide compensated minimum values when interfaced with a GTN.

☐ This installation supports cold weather compensated intermediate approach and minimums altitudes.

☐ This installation supports cold weather compensated *intermediate approach altitudes and missed approach altitudes only*.

☐ This installation does not support cold weather compensation.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GTN 6XX or GTN 7XX Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control and function.

• GTN 6XX Pilot's Guide	P/N 190-01004-03 Rev P or later
• GTN 7XX Pilot's Guide	P/N 190-01007-03 Rev R or later

7.2 Leg Sequencing

The GTN supports all ARINC 424 leg types. Certain leg types require altitude input in order to sequence (course to altitude, for example). If a barometric corrected altitude source is not interfaced to the GTN, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

☐ This installation *has* a barometric corrected altitude source. The GTN will automatically sequence altitude legs.

☐ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

7.3 Auto ILS CDI Capture

Auto ILS CDI Capture can automatically switch the CDI from GPS to VLOC before the Final Approach fix. This feature is only available on installations that meet any of the following conditions:

- Equipped with GFC 600
- GTN CDI key enabled

On these installations the auto-switching will only occur if the following conditions are met:

- ILS Autoswitch setting enabled on GTN
- ILS/LOC approach loaded and activated
- Correct nav frequency tuned on GTN NAV radio
- Aircraft established on the final approach course

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.4 Activate GPS Missed Approach

☐ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity, Terrain Alerting, and TAWS

CAUTION

Not all obstacles and wires are contained in the Obstacle/HOT Line database. The system provides depiction (and alerts, if TAWS is installed) only for obstacles and wires contained in the database.

NOTE

The area of coverage may be modified as additional terrain data sources become available.

☐ This installation supports *Terrain Proximity*. *No aural or visual alerts* for terrain or obstacles are provided. Terrain Proximity *does not* satisfy the TAWS requirement of 91.223.

☐ This installation supports *Terrain Alerting*. Aural and visual alerts are provided. Terrain Alerting *does not* satisfy the TAWS requirement of 91.223.

☐ This installation supports *TAWS B*. Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

Terrain on the dedicated terrain page or main map overlay is depicted in the following manner:

- Terrain more than 1,000 feet below the aircraft is not depicted or depicted as black.
- Terrain between 1,000 feet and 100 feet below the aircraft is depicted as amber.
- Terrain within 100 feet below the aircraft, or above the aircraft, is depicted as red.

Obstacles and wires on the dedicated terrain page or main map are depicted in the following manner:

- Obstacles and wires more than 2,000 feet below the aircraft are not depicted.
- Obstacles and wires between 2,000 feet and 1,000 feet below the aircraft are depicted as white.
- Obstacles and wires between 1,000 feet and 100 feet below the aircraft are depicted as amber.
- Obstacles and wires within 100 feet below the aircraft, or above the aircraft, are depicted as red.

Multiple obstacles may be depicted using a single obstacle icon and an asterisk to indicate obstacle grouping is occurring. The color of the asterisk indicates the relative altitude of the tallest obstacle in the group. The asterisk does not indicate any information about the relative altitude or number of obstacles not being displayed in the obstacle group.

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding terrain and obstacle colors and grouped obstacle icons.

7.6 GMA 35/35c Audio Panel (Optional)

The GTN 725 and 750 can interface to a GMA 35/35c remotely mounted audio panel and marker beacon receiver. Controls for listening to various radios, activating the cabin speaker, clearance playback control, and marker beacon are accessed by pressing the "Audio Panel" button on the GTN display screen. Optional Bluetooth pairing functionality can be accessed from the associated System /Connext Setup page (GMA 35c only). Volume controls for the audio panel are accessed by pressing the "Intercom" button on the GTN display screen.

Aircraft alerting audio may be routed through the GMA 35/35c audio panel. There are no pilot controls for alert audio volumes. In the event of a loss of GMA35/35c function alert audio routed through the audio panel may not be heard.

7.7 Traffic System (Optional)

This system is configured for the following type of traffic system. The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding the functionality of the traffic device.

☐ No traffic system is interfaced to the GTN.

☐ A TAS/TCAS I traffic system is interfaced to the GTN.

☐ A TIS traffic system is interfaced to the GTN.

☐ A TCAD traffic system is interfaced to the GTN.

☐ A Garmin ADS-B traffic system is interfaced to the GTN.

☐ A Garmin ADS-B traffic system is interfaced to the GTN. The ADS-B traffic system is also interfaced to an on-board traffic system.

7.8 StormScope® (Optional)

When optionally interfaced to a StormScope® weather detection system, the GTN may be used to display the StormScope® information. Weather information supplied by the StormScope® will be displayed on the StormScope® page of the GTN system. For detailed information about the capabilities and limitations of the StormScope® system, refer to the documentation provided with that system.

<u>Heading Up mode:</u>

If the GTN system is receiving valid heading information, the StormScope® page will operate in the heading up mode as indicated by the label "HDG UP" presented at the upper right corner of the display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft and *is* automatically rotated to the correct relative position as the aircraft turns.

<u>Heading Not Available mode:</u>

If the GTN system is not receiving valid heading information, either because a compatible heading system is not installed, or the interfaced heading system has malfunctioned, the StormScope® page will continue to operate without a heading source and indicate "HDG N/A" in the upper right corner of the GTN display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft but *is not* automatically rotated to the correct relative position as the aircraft turns. When operating in this mode, StormScope® strikes must be cleared after each turn the aircraft performs.

7.9 Power

- Power to the GTN is provided through a circuit breaker labeled NAV/GPS (1/2).
- Power to the optional GTN COM is provided through a circuit breaker labeled COM (1/2).
- Power to the optional GMA 35 is provided through a circuit breaker labeled AUDIO.
- Power to the optional Flight Stream 210 is provided through a circuit breaker labeled BT LINK.
- Power to the optional Flight Stream 510 is provided through the GTN MMC/SD card slot and protected via the GTN circuit breaker.

7.10 Databases and Flight Plan Waypoints/Procedures

Database versions (or cycles) and effective dates are displayed on the start-up database verification page immediately after power-on for those databases with an effective or expiration date. Databases with no effective or expiration date (e.g. - terrain database) are considered effective upon installation in the GTN. Database information can also be viewed on the System – System Status page.

The Obstacle Database has an area of coverage that includes the United States and Europe and is updated as frequently as every 56 days. The HOT Line wire database only includes the continental United States and portions of Canada/Mexico.

Only the Obstacle/HOT Line wire database may be used in accordance with the limitation found in Section 2.27.

If a stored flight plan contains a waypoint or procedure that does not correspond to a waypoint or procedure in the navigation database in use, the waypoint or procedure will become locked (depicted as “lockd”) in the flight plan. Flight plans with locked waypoints may be placed in the active flight plan portion of the system but no navigation will be provided. The locked waypoint/procedure must be resolved by removing or replacing it with the correct waypoint/procedures in the flight plan before the system will provide navigation.

7.11 External Switches

External switches may be installed and interfaced to the GTN. These switches may be stand alone or integrated with a TAWS or GPS annunciator. Table 4 lists the switches and function they perform:

Switch Label	Function
CDI	Toggles between GPS / VLOC sources. This switch may be part of an external annunciator panel.
COM CHAN DN	Toggles down through the preset com frequencies.
COM CHAN UP	Toggles up through the preset com frequencies.
COM RMT XFR	Transfers the COM active / standby frequencies.
NAV RMT XFR	Transfers the NAV active / standby frequencies.
OBS	Performs an OBS or SUSP function. This switch is part of an external annunciator panel and is placarded with the following: "Green OBS indicates OBS or SUSP mode – GTN annunciator bar indicates which is active. Push OBS button to change OBS or SUSP mode."
OBS/SUSP	Performs an OBS or SUSP function.
TERR INHB	Toggles the TAWS Inhibit function on/off. This switch is part of an external annunciator panel. The terrain display is still presented if TAWS is Inhibited.
PTC	Push-to-Command switch for Voice Command input to the GMA and the GTN.

Table 4 – External Switches

7.12 Airspace Depiction and Alerts

The GTN aides the flight crew in avoiding certain airspaces with Smart Airspace and airspace alerts. Smart Airspace de-emphasizes depicted airspace that is not near the aircraft's current altitude. Airspace Alerts provide a message indication to the flight crew when the aircraft's current ground track will intercept an airspace type that has been selected for alerting.

NOTE

Smart Airspace and Airspace Alerts are separate features. Turning on/off Smart Airspace does not affect Airspace Alerts, and vice versa.

7.13 Garmin ADS-B Traffic System Interface (Optional)

A Garmin ADS-B traffic system may be interfaced to the GTN. The *nose* of the ownship symbol on both the GTN main map page and dedicated traffic page serves as the actual location of your aircraft. The *center* of the traffic target icon serves as the reported location for the target aircraft. Motion vectors for traffic may be displayed in either absolute or relative motion. The location of the traffic targets relative to the ownship are the same, regardless of the selected motion vector.

Absolute motion vectors are colored either cyan or white, depending on unit configuration. Absolute motion vectors depict the reported track of the traffic target referenced to the ground. An absolute motion vector pointed towards your ownship symbol *does not* necessarily mean the traffic target is getting closer to your aircraft.

Relative motion vectors are always colored green and depict the motion of the traffic target relative to your ownship symbol. The direction the traffic target is pointed may vary greatly from the motion vector and a target may be getting closer to your aircraft independent of the direction the target is pointed. A green relative motion vector pointed towards your ownship indicates that the traffic target *is* converging on your aircraft.

If more than one target is occupying the same area of the screen, the GTN will combine the two or more traffic targets into one traffic group. The presence of an asterisk to the left of a target indicates that traffic has been grouped. The highest priority traffic target in the group is displayed to the pilot. When applied to airborne targets the asterisk will be displayed in white or cyan depending on the traffic depiction color used in the installation. The asterisk will be brown for grouped ground targets. The asterisk will not turn amber, even if an alerted target is included in the group.

An alerted target may be placed in the same group as non-alerted targets. In this case, the alerted target will be displayed. Two alerted targets will not be placed in the same group. All alerted targets will be displayed on the screen.

Traffic targets displayed on the dedicated traffic page may be selected in order to obtain additional information about a traffic target or to view all targets in a grouped target. When a grouped target is selected, the "Next" button on the dedicated traffic page will cycle through all targets located in close proximity to where the screen has been touched.

7.14 GWX 70/75 Weather Radar (Optional)

The GWX 70/75 Weather Radar uses Doppler technology to optionally provide advanced features to the flight crew such as turbulence detection and ground clutter suppression. Turbulence detection can detect turbulence up to 40nm from the aircraft and will be displayed at radar ranges of 160nm or less.

NOTE

Turbulence detection does not detect all turbulence especially that which is occurring in clear air. The display of turbulence indicates the possibility of severe or greater turbulence, as defined in the Aeronautical Information Manual.

7.15 Charts (Optional)

The GTN 750/725 can display both procedure charts and weather data on the main map page at the same time. When datalink NEXRAD or Precipitation is overlaid on the main map page, the weather data is displayed *below* an overlaid procedure chart. When airborne weather radar is overlaid on the main map page, the radar data is displayed *above* an overlaid procedure chart.

7.16 Transponder Control (Optional)

The GTN can be interfaced to a Garmin transponder for control and display of squawk code, mode, and additional transponder functions. The activation of the "Enable ES" button on the transponder page does not indicate the aircraft is in full compliance with an ADS-B Out solution in accordance with TSO-C166b (1090ES). Consult your transponder documentation for additional information.

7.17 Telephone Audio (Optional)

Telephone audio distribution to the crew defaults to OFF on each power cycle of the GTN. Prior to utilizing the telephone function, the crew must distribute telephone audio to the desired recipients. If the crew is utilizing the telephone function it is required that the telephone audio be turned off upon completing telephone usage.

7.18 Depiction of Obstacles and Wires

7.18.1 Dedicated Terrain Page

The dedicated Terrain page will always depict point obstacles at zoom scales of 10 nm or less and depict wire obstacles at zoom scales of 5 nm or less. The obstacle or wire overlay icon (see Figure 3) will be shown near the bottom of the display when the obstacle or wire depiction is active based on the zoom scale.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Terrain page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

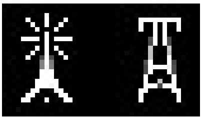

Figure 3 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.18.2 Map Page

The Map page may be configured to depict point obstacles and wire obstacles at various zoom scales by the pilot by using the Map page menu. The obstacle or wire overlay icon (see Figure 4) will be shown near the bottom of the display when the obstacle or wire overlay is active based on the current zoom scale and setting selected by the pilot.

The settings chosen by the pilot on the Map page menu (including obstacle and wire display ranges) are saved over a power cycle.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Map page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

NOTE

The Map page may be configured by the pilot to not show any obstacles or wires at any zoom scale.

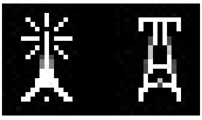

Figure 4 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.19 Flight Stream 210/510 (Optional)

The Flight Stream product line uses a wireless transceiver to provide data to and from a GTN to personal electronic devices (PEDs).

The Flight Stream 210 is a remotely mounted unit that provides the capability to interface Portable Electronic Devices (PEDs) to the GTN via Bluetooth. The Flight Stream 510 is mounted in the GTN SD card slot and includes a Bluetooth and Wi-Fi transceiver.

Data such as traffic, flight plan, datalink weather, entertainment audio information, and attitude information is sent from the Flight Stream to the PED. The PED is capable of sending flight plans and databases (510 only) to the Flight Stream which will then be available on the GTN. Limitations regarding database operations are found in Section 2.29.

Garmin provides a list of tested and compatible devices that can be used with the Flight Stream. Connection to the Flight Stream may be possible with devices other than those on the supported device list, but Bluetooth® and/or Wi-Fi stability and wireless data integrity cannot be guaranteed.

For details about the Garmin supported devices and apps for use with the Flight Stream product line, please visit: http://garmin.com/connext/supported_devices

7.20 Map Page

7.20.1 Configuration

The moving map and weather pages are capable of displaying a large quantity and variety of data. Map data is layered to ensure that data which is typically more critical is drawn above less critical data, however at some zoom scales and configurations the map may be cluttered with large amounts of data. Controls are provided on the Map and Weather pages for the pilot to select which data displayed, the declutter level, and the zoom scales at which data is added to or removed from the display. It is the responsibility of the pilot to select settings for the map page that will provide the display of data most appropriate to the operation being conducted.

7.20.2 Flight Plan Depiction

The map page depicts the current active flight plan. When an off-route Direct To is active the flight plan will no longer be depicted on the map.

7.20.3 Fuel Range Ring

The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes at the current aircraft groundspeed by default. The pilot may change the fuel reserve time value on the map setup menu. Changes to the fuel reserve time are persisted over GTN power cycles.

Visibility of the fuel range ring may be affected by the underlying map data selectable by the pilot. The pilot may make changes to the topographic or terrain data in order or more clearly observe the fuel range ring at any time.

Fuel range data is derived from the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

7.21 User Defined Waypoints

When a User Defined Waypoint is created, a default name will automatically be provided, and the pilot is given the option to enter a different name for the waypoint. Pages which have the autofill function will prevent some waypoint names from being used. If it is desired to name the waypoint with a subset of the name of an existing waypoint in the database then this must be accomplished on the Waypoint Info / User Waypoints page.

Waypoints which are created when a Search and Rescue pattern is created are not considered User Waypoints and therefore functions associated with User Waypoints are not provided for these waypoints.

7.22 Times and Distances

Time and Distance data to the next waypoint is always calculated from the present position to that waypoint and does not account for the path which may be flown (such as intercepting a course) to reach the waypoint.

When navigating using GPS guidance most legs are TO type legs where distance to the next waypoint decreases along the route. However, some procedures include FROM type legs. When navigating on a leg that is a FROM leg indications that it is a FROM leg include the TO/FROM flag indicating FROM and distances increasing in distance fields.

7.23 GTN-GTN Crossfill

Specific data will sync between GTNs when installed in a dual GTN configuration. If data is not included in this list, it is not crossfilled. The following data will crossfill between the two GTNs with CROSSFILL ON or OFF:

- User Waypoints
- FPL Catalog
- Traffic Alerts
- Missed Approach Popups
- Altitude Leg Popups
- Heading
- Date/Time Conventions
- CDI Scale
- Default FPA

The following unit changes will crossfill:

- Temperature
- NAV Angle
- Fuel

The following items are crossfilled only when the GTNs are set to CROSSFILL ON:

- User Holds
- Approaches
- Flight Plan Changes
- Direct-To
- Selected OBS Course Changes

7.24 Direct-To Operations

When conducting Direct-To operations the Flight Plan tab provides a list of waypoints in the flight plan for which Direct-To is available. Some entries in the flight plan such as Holds and Course Reversals are not eligible for Direct-To and the pilot must instead select the associated waypoint if Direct-To operation is desired.

7.25 Automatic Speech Recognition (ASR)

ASR allows the pilot to interact with the GMA and GTN via voice commands. Commands are constructed around the “Verb – Noun – (Suffix)” syntax for most ASR commands.

- **“SHOW”** Commands – Used to show pages or data fields on the GTN
- **“SAY”** Commands – Used to instruct the ASR engine to say certain phrases related to the flight
- **“TUNE”** Commands – Used to tune certain frequencies into the standby position of the ASR GTN (usually GTN #1)

The “Page” suffix is used in conjunction with the “Show” phrase to command pages to be displayed on the GTN. (e.g.- “Show Main Map Page”)

Audio Panel commands are available to switch audio sources.

- **“SELECT”** to choose which radio the MIC will be selected
- **“TOGGLE”** to toggle the monitor of a specific NAV/COM radio
- **“DISTRIBUTE”** to change the source of audio for the respective seat positions
- **“MUTE”** to mute audio inputs on the audio panel for the respective seat positions

Supplemental commands that allow map zooming, and page navigation are also available.

- **“BACK”**
- **“CANCEL”**
- **“ZOOM IN”**
- **“ZOOM OUT”**

Each command is initiated via the Push-to-Command (PTC) switch. Aural tones will indicate to the pilot the status of the command. A positive tone (low to high) will indicate the system executed a command. A negative tone (high to low) will indicate the system did not understand the command or could not execute due to system state or configuration. “SAY” commands do not provide aural tones as feedback.

The pilot must maintain vigilance regarding ASR command information. Due to the nature of voice recognition, there are times when ASR will interpret a command differently than the pilot intended. The pilot should always cross check the ASR response to the information contained within the GTN as appropriate to ensure in-flight information is accurately understood. If a conflict exists between information gathered via ASR and that available in the GTN system, the pilot should defer to the GTN system information.

Prior to using ASR, the pilot must complete the ASR Qualification Procedure from the GTN Cockpit Reference Guide.

The Command History Page details the commands received by ASR for that power cycle. A full list of commands and guidance for using ASR can be found in the *GTN 6XX/7XX Telligence Voice Command Guide,* 190-01007-50.

When using ASR for "TUNE" commands, it is recommended that the pilot enable Reverse Frequency Lookup (RFL) on the associated GTN.

7.26 European Visual Reporting Points

If the GTN is interfaced with a G500/600 PFD/MFD, and a flight plan in the GTN contains a VRP, the G500/600 must have a database that contains the VRP in order to appropriately display the VRP on the MFD map. If the database on the PFD/MFD does not contain the VRP, the VRP will display on the MFD map as an intersection.

7.27 Advisory Visual Approaches

The GTN will provide advisory visual approaches to many runways in the aviation database. Lateral guidance for the visual approach is aligned with the runway bearing. Vertical guidance is provided for those runways with VGSI information for distances up to 4.0NM from the runway. If a terrain database is installed in the GTN, the GTN provides vertical guidance up to 28NM from the runway end unless the computed glideslope would impact terrain or obstacles from the database. If the projected impact point is under 28NM and greater than 4NM, the flight plan line for the approach is shortened to indicate where vertical guidance is active for the approach. If the terrain impact point is less than 4NM from the runway and there is no VGSI data available, vertical guidance is not provided for that approach. Lateral guidance is still available when vertical guidance is removed.

CDI and VDI indications are equivalent to those of other GPS-based approaches (e.g.- LPV or LNAV+V). The GTN annunciates "VISUAL" in the annunciator bar to indicate a visual approach is active.

When loading, or activating the approach, the GPA and TCH information for that approach will be displayed on a popup. If there is no vertical guidance available, the popup will display "(NO VERTICAL GUIDANCE)".

Visual approaches are intended to be used as an aid to situational awareness. Visual approaches are advisory in nature and do not guarantee terrain and obstacle clearance for the approach runway.

7.28 Descent VNAV

The GTN can provide multi-waypoint descent baro-VNAV guidance for the enroute and initial approach phases of flight. Altitudes associated with instrument procedures are retrieved from the navigation database when the procedure is added to the flight plan.

Altitudes in cyan on the GTN are valid VNAV guidance waypoints and the GTN will provide vertical guidance based on the displayed altitude constraints and default flight path angle (FPA). Altitude colored white are advisory only.

The following are recommendations for using descent VNAV:

- The pilot should verify all altitudes for procedures after loading the procedure into the flight plan.
- When the GTN is installed with a multiple TXi PFDs, it is highly recommended that GDU BARO SYNC be enabled and used during all VNAV operations.

In aircraft where there are multiple GDUs and two GTNs, VNAV will use the barometer setting from the pilot's side GDU for both GTNs. In the event the pilot's side GDU has failed, the GTNs will use the co-pilot's GDU barometer setting.

Descent VNAV is limited to flight path angles (FPA) between -1° and -5°, and a vertical speed required (VSR) descending at less than 4000 fpm. If a flight plan change is made during a VNAV descent, VNAV will be recalculated and could result in active VNAV path changes. If the current VNAV FPA is less than -1°, a new VNAV path may be computed during a flight plan change and result in a new Top of Descent point. This can also occur during VNAV Direct-To operations.

VNAV constraints are not allowed inside the FAF. VNAV altitudes are not saved in the flight plan catalog.

When VNAV is disabled by the pilot, it will be automatically re-enabled when the pilot initiates a lateral Direct-To to a waypoint.

7.29 Along Track Waypoints

The GTN allows for the creation of flight plan waypoints that are based off an offset distance from a waypoint in the flight and places the new along track waypoint (ATK) in the flight plan. Once placed in the flight plan, the pilot may navigate using that waypoint in the same manner as other flight plan waypoints.

Along track waypoints cannot be created on a Vectors to Final (VTF) approach and are limited to the lateral constraints of the flight plan. This means that the pilot cannot place an ATK before the first waypoint of a flight plan or after the last waypoint of a flight plan.

ATKs are fixed once placed and will not move if the referenced waypoint is changed or removed from the flight plan. ATKs are not saved in the flight plan catalog. ATKs cannot reference another ATK in the flight plan.

7.30 Database Provided Altitudes

When the GTN provides altitude data for waypoints included in IFR procedures, the altitudes provided are those shown on the procedure chart for “Turbojet” or “Jet” aircraft. If altitudes for other aircraft such as “Turboprop” or “Prop” are required, the crew must manually edit the waypoint altitude.

7.31 Database Sync with G500/600 or G500/600/700TXi GDUs

When a GTN hosts a Flight Stream 510 for database syncing to GDUs, the GTN and GDU must be configured for the same chart database type (FliteCharts or ChartView). If the GDU and GTN are not configured for the same chart type, charts database sync and Chart Streaming will not be available.

7.32 Remote Database Confirmation (Optional)

Enabling remote database confirmation allows a second GTN to skip the database and instrument panel self-test pages on startup. Two GTNs are required for remote database confirmation and the feature is not allowed when a Flight Stream 510 is installed. With this feature enabled, database updates will require restarting both GTN units to access the database page.

TT31 Mode S Transponder
Operating Manual

00454-00-AF
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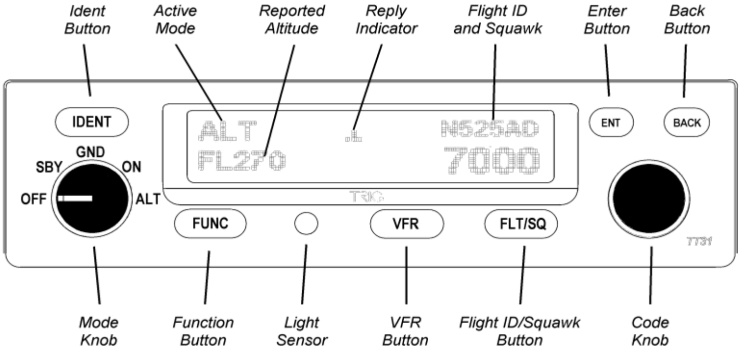
Trig Avionics Limited
Heriot Watt Research Park
Riccarton, Currie
EH14 4AP
Scotland, UK

EN / DE / FR

Front Panel



Display

The display shows the operating mode of the transponder, the reported pressure altitude, and the current squawk code and Flight ID. The reply indicator is active when the transponder replies to interrogations.

The pressure altitude is displayed as a Flight Level, which is the pressure altitude in hundreds of feet. When non-standard atmospheric conditions apply, this may not match the altimeter indicated altitude, but will be correctly displayed by the ATC radar.

Mode Selector Knob

The left hand knob controls the power to the transponder and the operating mode.

OFF	Power is removed from the transponder.
SBY	The transponder is on, but will not reply to any interrogations.
GND	The transponder will respond to Mode S ground interrogations from surface movement radar.
ON	The transponder will respond to all interrogations, but altitude reporting is suppressed.
ALT	The transponder will respond to all interrogations.

When airborne, the transponder should always be set to ALT unless otherwise directed by Air Traffic Control. When you are taxiing on the ground, the transponder should be set to GND mode. If your installation includes a squat switch or is configured with an automatic air/ground system it will switch automatically and you do not need to manually select the GND position.

Push Buttons

IDENT	Press the IDENT button when ATC instructs you to “Ident” or “Squawk Ident”. This activates the SPI pulse in the transponder replies for 18 seconds. IDENT will appear in the display.
FUNC	Pressing the FUNC button provides access to the flight timer, stopwatch, ADS-B monitor (depending on installation) and altitude monitor function.
VFR	Pressing the VFR button sets the transponder to the pre-programmed conspicuity code. Pressing the button again restores the previous squawk code.
FLT/SQ	Pressing FLT/SQ alternates the primary display between squawk code and Flight ID.
ENT	The ENT button enters a digit in the code selector.
BACK	The BACK button goes back to the previous digit in the code selector.

Code Selector Knob

The right hand knob is used to set squawk codes and the Flight ID. The FLT/SQ button selects which will be updated. Turning the knob will highlight the first digit on the display, and the digit can be changed as required. Press the ENT button to advance to the next digit. When ENT is pressed on the last digit, the new squawk code or Flight ID will replace the previous value. If the code entry is not completed within 7 seconds, the changes are ignored and the previous code restored.

1200	VFR code in the USA
7000	VFR code commonly used in Europe
7500	Hijack code
7600	Loss of communications
7700	Emergency code

The Flight ID should correspond to the aircraft call sign entered on your flight plan. If no flight plan is active, the aircraft registration should be used as your Flight ID. Use only letters and digits. If the Flight ID is less than 8 characters long, entering a blank character will end it.

Flight Timer

The Flight Timer records the time for which the transponder has been powered on and operating in flight mode – either ON or ALT. Press the FUNC button to display the Flight Timer.

Stopwatch

The stopwatch can be used as a convenient timer. Press the FUNC button to display the stopwatch. Pressing ENT will reset and start the timer. Pressing ENT again will stop the timer.

Altitude Monitor

The Altitude Monitor activates an audio annunciator or annunciator light (depending on installation) when the aircraft pressure altitude differs from the selected altitude by more than 200 feet. Press the FUNC button to display the altitude monitor enable screen. Pressing ENT toggles the altitude monitor at the current altitude.

When altitude monitoring is in use, a small deviation pointer appears adjacent to the altitude display on the transponder.

ADS-B Monitor

The ADS-B Monitor is only available on installations that include an ADS-B position source. The ADS-B Monitor provides a display of the position information that is being transmitted in ADS-B position reports. This can provide confirmation that the correct information is being transmitted, particularly where the GPS source is remote from the transponder.

In the event that valid position information is NOT available from the GPS, the latitude and longitude display will be replaced by dashes; if no valid latitude and longitude is shown then ADS-B position information is NOT being transmitted.

Loss of ADS-B position information will also result in a WARNING message being displayed.

Warning Messages

If the transponder detects a problem, the screen will indicate WARNING and a brief statement of the problem. Depending on the nature of the problem, your transponder may not be replying to interrogations. Note the message on the screen and pass that information to your avionics maintenance organisation. Press ENT to clear the message; if the fault is still present the message will reappear.

Fault Annunciation

If the transponder detects an internal failure, the screen will indicate FAULT and a brief statement of the problem. No replies will be made to interrogations when a fault is detected.

Some FAULT indications can be recovered by switching the transponder off and back on again, although in all cases a FAULT code implies that there is a fault with the transponder or the installation. Note the FAULT message at the bottom of the screen and pass that information to your avionics maintenance organisation.

Configuration Mode

The system is configured when it is first installed by your avionics supplier. Configuration items include the Mode S aircraft address, the interface to the other aircraft systems, the aircraft category, and the pre-programmed values for VFR squawk code. To view or change these settings you must use Configuration Mode.

> **Do not use Configuration Mode in flight. Check with your avionics installer before changing the configuration.**

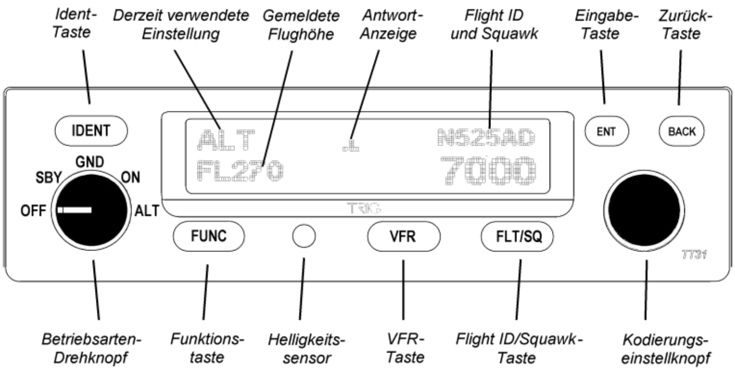
To enter configuration mode, hold down the FUNC button whilst switching on the transponder. Configuration items can be changed using the Code Knob and the ENT and BACK buttons. Pressing FUNC advances to the next configuration item.

When configuration is complete, switch the transponder off. When it is switched back on the transponder will use the new configuration.

Low Temperature Operation

The TT31 is certified to operate correctly down to -20C, but at low temperatures the display may be impaired. On a cold day you may need to wait for the cockpit to warm up to ensure normal operation.

Gerätefront



Anzeige

Die Anzeige gibt folgendes wieder: Betriebsart des Transponders, die gemeldete Druckhöhe, sowie den derzeitigen Squawk Code und Flight ID. Die „Reply“-Anzeige ist aktiv, wenn das Gerät auf Anfragen antwortet.

Die Druckhöhe wird als Flugfläche (FL) angezeigt, d.h. als Druckhöhe in Schritten von 100 Fuß. Wenn die Wetterlage von der Standardatmosphäre abweicht, kann die Anzeige u.U. von der des Höhenmessers abweichen, wird aber vom ATC Radar korrekt wiedergegeben.

Betriebsarten-Drehknopf

Der linke Drehknopf regelt die Stromversorgung zum Transponder sowie die Betriebsart.

OFF	Die Stromzufuhr zum Transponder ist unterbrochen.
SBY	Der Transponder ist eingeschaltet, antwortet aber nicht auf Anfragen.
GND	Der Transponder antwortet auf Mode-S-Anfragen des Vorfeld-Radars.
ON	Der Transponder antwortet auf alle Anfragen, aber ohne Höhenübermittlung.
ALT	Der Transponder antwortet auf alle Anfragen.

Im Fluge sollte der Transponder stets auf „ALT“ eingestellt sein, außer wenn die Flugsicherung dies über Funk anders fordert. Beim Rollen am Boden sollte der Transponder stets auf "GND" eingestellt sein. Wenn Sie einen Bodensicherheitsschalter einbauen wollen, der mit einem automatischen

Bord/Boden System konfiguriert ist, wird er sich automatisch auf "GND" schalten lassen, sodass Sie es nicht von Hand machen müssen.

Drucktasten

IDENT	Drücken Sie die „IDENT"-Taste, wenn die Flugsicherung Sie zum „Ident" oder „Squawk Ident" auffordert. Dies aktiviert den SPI-Puls in den Antworten des Transponders für 18 Sekunden. Die Funktion IDENT wird in der Anzeige des Gerätes wiedergegeben.
FUNC	Durch Drücken der „FUNC"-Taste gelangen Sie zu den Funktionen der Flugzeitmessung, Stoppuhr, ADS-B Monitor (in Abhängigkeit der Ausrüstung) und Flughöhenüberwachung.
VFR	Ein Druck auf die „VFR"-Taste aktiviert den vorprogrammierten Code. Ein weiterer Tastendruck reaktiviert den vorherigen Squawk-Code.
FLT/SQ	Mit der Taste „FLT/SQ" können Sie zwischen der Anzeige des Squawk-Codes und der Flight ID wechseln.
ENT	Mit der „ENT"-Taste können Sie einzelne Zahlen eingeben.
BACK	Durch Drücken der Taste „BACK" können Sie bei Eingabe des Codes eine Stelle zurückgehen.

Kodierungseinstellknopf

Der rechte Drehknopf wird zur Einstellung von Squawk-Codes und Flight IDs benutzt. Mit der „FLT/SQ"-Taste wird die jeweils zu ändernde Funktion gewählt. Ein Drehen des Knopfes aktiviert die erste Stelle der Anzeige, die dann nach Bedarf geändert werden kann. Per „ENT"-Taste gelangt man zur jeweils nächsten Stelle. Wenn bei der letzten Stelle „ENT" gedrückt wird, ersetzt der neue Squawk-Code oder die neue Flight ID die zuvor genutzten Zahlen. Wenn eine Zahl nicht innerhalb von 7 Sekunden verändert wird, werden die bisherigen Änderungen vom Gerät ignoriert, und die vorherige Zahlenkombination wird wieder hergestellt.

1200	VFR code in den USA
7000	Am häufigsten in Europa genutzter VFR-Code
7500	Code für Entführungen
7600	Funkausfall
7700	Notfall

Die Flight ID sollte dem Rufzeichen entsprechen, das Sie im Flugplan eingetragen haben. Wenn Sie keinen Flugplan erstellt haben, sollte das Kennzeichen des Lfz als Flight ID genutzt werden. Benutzen Sie nur Buchstaben und Zahlen. Wenn die Flight ID kürzer als acht Stellen ist, geben Sie eine Leerstelle als Endzeichen ein.

Flugzeitmessung

Der Flugzeitmesser zeichnet die Zeit auf, seitdem die Stromzufuhr zum Transponder eingeschaltet und eine der Flugeinstellungen, d.h. „ON“ oder „ALT“, aktiviert wurde. Durch Drücken der „FUNC“-Taste können Sie die Flugzeit anzeigen lassen.

Stoppuhr

Die Stoppuhr kann ebenfalls zur Zeitmessung genutzt werden. Drücken Sie die „FUNC“-Taste, um die Stoppuhr aufzurufen. Ein Druck auf „ENT“ wird die Stoppuhr auf 0 setzen und neu starten. Ein weiterer Druck auf „ENT“ hält die Zeitmessung an.

Flughöhenüberwachung

Die Flughöhenüberwachung aktiviert ein akustisches oder optisches Warnsignal (in Abhängigkeit der Ausrüstung), wenn die Flughöhe mehr als 200 Fuß von der zuvor eingestellten Angabe abweicht. Drücken Sie die „FUNC“-Taste bis zum Erreichen der Anzeige zur Aktivierung der Funktion „Altitude Monitor“. Per „ENT“-Taste programmieren Sie Ihre aktuelle Flughöhe als Ausgangswert.

Wenn diese Funktion eingeschaltet ist, erscheint neben der Höhenangabe die kleine Abweichungsanzeige nach oben oder unten.

ADS-B Monitor

Diese Funktion kann nur genutzt werden, wenn das Lfz zur Positionsbestimmung für ADS-B ausgerüstet ist. Der ADS-B Monitor zeigt die Position basierend auf Daten, die durch ADS-B-Positionsmeldungen übermittelt werden. Dies kann zur Bestätigung der Richtigkeit der übertragenen Positionsinformationen dienen, insbesondere, wenn der GPS-Empfang sehr schwach ist.

Falls eine zuverlässigen Positionsangabe durch das GPS NICHT möglich ist, werden die Längen- und Breitengrade als Horizontalstriche angezeigt. Wenn dies der Fall ist, werden ADS-B-Positionsinformationen NICHT übermittelt.

Warnmeldungen

Falls eine Störung auftritt, meldet der Transponder dies sofort. Die Anzeige WARNING leuchtet auf; zusätzlich wird eine kurze Beschreibung des Problems angezeigt. Es ist nun von der Art des Problems abhängig, ob der Transponder weiterhin auf Anfragen antwortet. Übermitteln Sie diese Fehlermeldung an Ihren Avionik-Betrieb. Drücken Sie ENT, und die Fehlermeldung erlischt. Falls das Problem weiterhin besteht, wird der Transponder dies entsprechend melden.

Fehlermeldung

Wenn der Transponder einen internen Fehler feststellt, wird dies in der Anzeige durch „FAULT“ plus einer kurzen Problembeschreibung gemeldet. Sobald ein Fehler festgestellt wurde, antwortet der Transponder nicht mehr auf Anfragen durch die Flugsicherung.

Einige „FAULT“-Anzeigen können durch Aus- und Einschalten des Transponders behoben werden, jedoch bedeutet jede Anzeige dieser Art, dass ein Fehler im Gerät oder der Installation vorliegt. Melden Sie die vom Gerät entsprechend gegebene Problembeschreibung zur Behebung an Ihren Avionik-Betrieb.

Einstellung „Konfiguration“

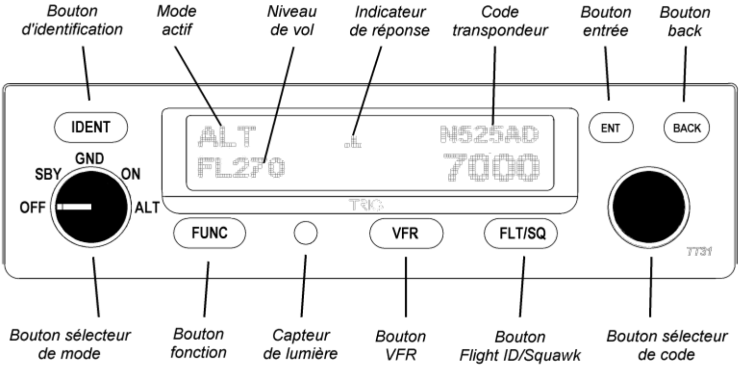
Das Gerät ist zum Zeitpunkt des Einbaus durch Ihren Avionik-Zulieferer konfiguriert. Die Konfiguration beinhaltet den Mode-S-Code, das Interface zu anderen Geräten, die Lfz-Kategorie, und die vorprogrammierten Werte für VFR Squawk Codes. Um diese Einstellungen zu sehen oder zu ändern müssen Sie die Einstellung „Konfiguration“ benutzen.

> **Benutzen Sie die Einstellung „Konfiguration“ niemals im Fluge. Setzen Sie sich mit Ihrem Avionik-Betrieb in Verbindung, bevor Sie die Konfiguration verändern.**

Um zur Einstellung „Konfiguration“ zu gelangen, halten Sie die Taste „FUNC“ gedrückt, während Sie das Gerät einschalten. Konfigurationspunkte können durch Drehen des Kodierungsdrehknopfes und durch Drücken der Tasten „ENT“ und „BACK“ verändert werden. Nach Abschluss der Konfiguration schalten Sie den Transponder aus. Sobald er erneut eingeschaltet wird, benutzt er die neue Konfiguration.

Betrieb bei niedriger Temperatur

Der TT31 ist zugelassen für fehlerfreien Betrieb bis zu –20°C, auch wenn bei sehr niedrigen Temperaturen u.U. die Anzeigequalität vermindert ist. Um die normale Benutzung unter kalten Bedingungen sicherzustellen, ist es ggf. erforderlich, eine adäquate Kabinentemperatur zu erzeugen.



Panneau

Affichage

L'écran affiche le mode de fonctionnement du transpondeur, l'altitude-pression mesurée, ainsi que le code transpondeur et le code d'identification de vol en cours. L'indicateur de réponse est actif lorsque le transpondeur répond aux interrogations.

L'altitude-pression s'affiche en niveau de vol, c'est à dire l'altitude-pression en centaines de pieds. Lorsque les conditions atmosphériques ne sont pas standards, cette valeur peut être différente de l'altitude indiquée par l'altimètre, mais son affichage sera correct sur les écrans radar du contrôle de la circulation aérienne.

Bouton Sélecteur de Mode

Le bouton de gauche commande la mise sous tension du transpondeur ainsi que le mode de fonctionnement.

OFF	Le transpondeur est hors tension.
SBY	Le transpondeur est sous tension mais ne répondra à aucune interrogation.
GND	Le transpondeur répondra aux interrogations du sol en Mode S des radars de mouvement à la surface.
ON	Le transpondeur répondra à toutes les interrogations, mais sans information d'altitude.
ALT	Le transpondeur répondra à toutes les interrogations.

En vol, le transpondeur doit toujours être sur ALT sauf avis contraire du contrôle de la circulation aérienne. Lorsque l'appareil roule au sol, le transpondeur doit être sur GND. Si l'installation comprend un contact de train ou dispose d'un système de détection automatique air/ground alors la sélection GND changera automatiquement, vous n’aurez pas besoin de le faire manuellement.

Boutons Poussoirs

IDENT	Appuyer sur IDT lorsque le contrôle de la circulation aérienne demande « Ident » ou « Squawk Ident ». Ceci active l’impulsion spéciale d’identification de position (SPI) dans les réponses du transpondeur pendant 18 secondes. IDENT apparaîtra à l’écran.
FUNC	Appuyer sur le bouton FUNC permet d'accéder au temporisateur de vol, au chronomètre, au moniteur d'ADS-B (selon l'installation) et à la fonction de moniteur d'altitude.
VFR	Une pression sur le bouton VFR permet d’afficher directement le code pré-programmé. Une seconde pression sur ce bouton restaure le code transpondeur précédent.
FLT/SQ	La pression de FLT/SQ alterne l'affichage primaire entre le squawk code et l'identification de vol.
ENT	Le bouton ENT permet de valider chaque chiffre dans le sélecteur de code.
BACK	Le bouton BACK saute de nouveau au chiffre précédent dans le sélecteur de code.

Bouton Sélecteur

Le bouton de droite permet d’afficher le code transpondeur et le code d’identification de vol. Le bouton FLT/SQ choisit qui sera mis à jour. La rotation du bouton accentuera le premier chiffre sur l'affichage, et le chiffre peut être changé comme exigé. Appuyer sur ENT pour avancer au chiffre suivant. Lorsque le bouton ENT est enfoncé après le dernier chiffre, le nouveau code transpondeur ou le nouveau code d’identification de vol s’affiche en remplacement du précédent. Si le code n’est pas saisi en moins de 7 secondes, les modifications sont ignorées et le code précédent est restauré.

1200	Code VFR aux Etats-Unis
7000	Code VFR couramment utilisé en Europe
7500	Intervention illicite
7600	Panne radio
7700	Code de détresse

Le code d’identification de vol doit correspondre à numéro de vol déclaré dans le plan de vol. S’il n’y a pas de plan de vol, l’immatriculation de l’avion doit être utilisée comme code d’identification de vol. Utiliser uniquement des lettres et des chiffres. Si le code d’identification de vol comporte moins de 8 caractères, saisir un caractère espace pour le terminer.

Temporisateur de Vol

Le temporisateur de vol enregistre le temps l'où le transpondeur a été mis sous tension et actionnant en vol le mode ON ou ALT. Appuyez sur le bouton FUNC pour montrer le temporisateur de vol.

Chronomètre

Le chronomètre peut être employé comme temporisateur commode. Appuyez sur le bouton FUNC pour montrer le chronomètre. En serrant la volonté ENT remettez à zéro et commencez le temporisateur. La pression ENT encore arrêtera le temporisateur.

Moniteur D'Altitude

Le moniteur d'altitude active un annonciateur ou une lumière audio d'annonciateur (selon l'installation) quand l'altitude pression d'avion diffère de l'altitude choisie par plus de 200 pieds. Appuyez sur le bouton FUNC pour montrer le moniteur d'altitude permettent l'écran. Serrant les cabillots ENT l'altitude surveillent à l'altitude courante.

Quand la surveillance d'altitude est en service, un petit indicateur de déviation apparaît à côté de l'affichage d'altitude sur le transpondeur.

Moniteur ADS-B

Le moniteur d'ADS-B est seulement disponible sur les installations qui incluent une source de position d'ADS-B. Le moniteur d'ADS-B fournit un affichage d'information de position qui est transmise dans des rapports de position d'ADS-B. Ceci peut fournir la confirmation que l'information correcte est transmise, en particulier où la source de GPS est éloignée du transpondeur.

Au cas où l'information valide de position ne serait pas fournie par le GPS, l'affichage de latitude et de longitude sera remplacé par des tirets; si aucune latitude et longitude valides n'est montrée alors l'information de position d'ADS-B n'est pas transmise.

Messages d’avertissement

Si le transpondeur détecte un problème, l’écran affichera WARNING ainsi qu’un bref état de la situation. En fonction de la nature du problème, il se peut que le transpondeur ne réponde plus aux interrogations. Noter le message qui apparaît à l’écran et transmettre l’information au service de maintenance du fournisseur d’avionique.   Appuyer sur ENT pour effacer le message; si la panne est toujours présente, le message réapparaîtra.

Annonce de Panne

Si le transpondeur détecte une panne interne grave, un message FAULT apparaît à l’écran avec un bref état de la situation. Le transpondeur ne répond plus aux interrogations lorsqu'une panne est détectée.

FR

Certaines indications de pannes (FAULT) peuvent être rétablies en mettant le transpondeur hors tension puis à nouveau sous tension, bien que dans tous les cas, un message FAULT indique un problème avec le transpondeur ou avec l'installation. Noter le message FAULT en bas de l'écran et transmettre l'information au service de maintenance du fournisseur d'électronique aéronautique.

Mode Configuration

Le système est configuré lors de sa première installation par le fournisseur d'avionique. Les éléments de configuration comprennent l'adresse Mode S de l'avion, l'interface avec les autres systèmes de l'avion, la catégorie de l'avion, et les valeurs pré-programmées du code transpondeur VFR. Pour visualiser ou modifier ces réglages, le mode configuration doit être utilisé.

> **Ne pas utiliser le mode configuration en vol. Consulter votre installateur d'avionique avant toute modification de la configuration.**

Pour passer en mode configuration, maintenir le bouton FN enfoncé tout en mettant sous tension du transpondeur. Les éléments de configuration peuvent être modifiés à l'aide du bouton sélecteur de code et les boutons ENT et BACK. Une pression sur FN permet d'avancer jusqu'à l'élément de configuration suivant.

Lorsque la configuration est terminée, mettre le transpondeur hors tension. Lorsqu'il sera de nouveau mis sous tension, le transpondeur utilisera la nouvelle configuration.

Opération à Basses Températures

Le transpondeur est certifié pour fonctionner correctement jusqu'à -20°C, mais à ces températures, l'affichage peut s'en trouver affecté. S'il fait froid, un temps d'attente jusqu'à ce que le cockpit soit réchauffé peut être nécessaire pour garantir un fonctionnement normal.

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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 Seneca V.

10.2 SAFETY TIPS

A small child should be placed in an approved child restraint seat during aircraft operation. ***The child should not be held or share a seat belt with another person.*** Acceptable child restraint seats are defined in publications such as Federal Aviation Administration Advisory Circular 91-62a.

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 113 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the UP position before they will lock and support weight on the step.

(d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

(e) Always determine position of landing gear by checking the gear position lights.

(f) The shape of the wing fuel tanks is such that in certain maneuvers the fuel may move away from the tank outlet. If the outlet is uncovered, the fuel flow will be interrupted and a temporary loss of power may result. Pilots can prevent inadvertent uncovering of the outlet by avoiding maneuvers which could result in uncovering the outlet.

10.3 OPERATING TIPS (Continued)

(f) (Cont'd)

Extreme running turning takeoffs should be avoided as fuel flow interruption may occur.

Prolonged slips and skids which result in excess of 2000 feet of altitude loss, or other radical or extreme maneuvers which could cause uncovering of the fuel outlet must be avoided as fuel flow interruption may occur when the tank being used is not full.

(g) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of his feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

(h) Anti-collision lights should not be operating when flying through overcast and clouds, since reflected light can produce spatial disorientation. Do not operate strobe lights when taxiing in the vicinity of other aircraft.

(i) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications such as regulations, advisory circulars, Aviation News, AIM and safety aids.

(j) Pilots who fly above 10,000 feet should be aware of the need for special physiological training. Appropriate training is available at approximately twenty-three Air Force Bases throughout the United States for a small fee. The training is free at the NASA Center in Houston and at the FAA Aeronautical Center in Oklahoma.

Forms to be completed (Physiological Training Application and Agreement) for application for the training course may be obtained by writing to the following address:

Chief of Physiological Training, AAC-143
FAA Aeronautical Center
P. 0. Box 25082
Oklahoma City, Oklahoma 73125

It is recommended that all pilots who plan to fly above 10,000 feet take this training before flying this high and then take refresher training every two or three years.

10.3 OPERATING TIPS (Continued)

(k) Sluggish RPM control and propeller overspeed with poor RPM recovery after rapid throttle application are indications that nitrogen pressure in the propeller dome is low.

(l) Experience has shown that the training advantage gained by pulling a mixture control or turning off the fuel to simulate engine failure at low altitude is not worth the risk assumed, therefore it is recommended that instead of using either of these procedures to simulate loss of power at low altitude, the throttle be retarded slowly to idle position. Fast reduction of power may be harmful to the engine. A power setting of 2300 RPM is recommended for simulated one engine operation.

(m) Before starting either engine, check that all radio switches, light switches and the pitot heat switch are in the OFF position so as not to create an overloaded condition when the starter is engaged.

(n) The airplane should not be flown in severe turbulence as damage to the airframe structure could result.

(o) The best speed for takeoff is about 75 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of an engine failure.

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