# SEMINOLE

# PA-44-180

## SN 4496395, 4496397 AND UP
## WITH GARMIN G1000 SYSTEM

# PILOT'S OPERATING HANDBOOK

AND

# FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. ____________________

AIRPLANE REGIST. NO. ________________

PA-44-180
REPORT: VB-2636 FAA APPROVED BY: ____________________

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O.D.A. 510620-CE
PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL:
NOVEMBER 3, 2016

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.

THIS FLIGHT MANUAL IS EASA APPROVED EXCEPT FOR AIRCRAFT EQUIPPED WITH G5 STANDBY INSTRUMENT OR HARTZELL SCIMITAR PROPELLER BLADE. THIS APPROVAL IS VALID FOR THE AFM/POH VB-2636.

Piper®

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## APPLICABILITY

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

**WARNING**

**Extreme care must be exercised to limit the use of this handbook to applicable aircraft. This handbook is valid for use with the airplane identified on the face of the title page. Subsequent revisions supplied by Piper must be properly inserted.**

**WARNING**

**This handbook cannot be used for operational purposes unless kept in a current status.**

**WARNING**

**Inspection, maintenance and parts requirements for all non-PIPER APPROVED STC installations are not included in this handbook. When a non-PIPER APPROVED STC installation is incorporated on the airplane, those portions of the airplane affected by the installation must be inspected in accordance with the inspection program published by the owner of the STC. Since non-PIPER APPROVED STC installations may change systems interface, operating characteristics and component loads or stresses on adjacent structures, PIPER provided inspection criteria may not be valid for airplanes with non-PIPER APPROVED STC installations.**

## REVISIONS

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

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

### I. Identifying Revised Material

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

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

### II. Revision Procedure

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

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

## ORIGINAL PAGES ISSUED

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

Title, ii through viii, 1-1 through 1-16, 2-1 through 2-20, 3-1 through 3-52, 4-1 through 4-30, 5-1 through 5-34, 6-1 through 6-14, 7-1 through 7-82, 8-1 through 8-22, 9-1 through 9-24, 10-1 through 10-4.

## PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-44-180, Seminole Pilot's Operating Handbook, REPORT: VB-2636 issued November 3, 2016

| Revision Number and Code | Revised Pages | Description of Revisions | FAA Approved Signature and Date |
|---|---|---|---|
| Rev. 1 (PR171215) | ii | Updated copyright. | |
| | v, vi | Added Rev. 1 to L of R. | |
| | 1-5 | Revised Para. 1.5. | |
| | 1-7 | Revised Para. 1.13. | |
| | 1-8, -9 | Revised Para. 1.21. | |
| | 1-12 - 1-15 | Revised and reordered terminology of Para. 1.23. | |
| | 2-i | Revised T of C. | |
| | 2-3 | Revised Para. 2.7. | |
| | 2-7 thru 2-9 | Revised Para. 2.27. | |
| | 2-11 | Revised Para. 2.27. | |
| | 2-13, -14 | Revised Para. 2.27. | |
| | 2-17 | Revised Para. 2.31. | |
| | 3-i, -ii | Revised T of C. | |
| | 3-1 | Revised Para. 3.1. | |
| | 3-4 thru 3-6 | Revised Para. 3.1 - typos, checklist page numbers. | |
| | 3-7 thru 3-14 | Revised Para. 3.5a. | |
| | 3-19 | Revised Para. 3.5b | |
| | 3-20 thru 3-22 | Revised and relocated Paras. 3.5c, 3.5d and 3.5e. | |
| | 3-23, -24 | Revised Para. 3.5e. | |
| | 3-29, -30 | Revised Para. 3.5j. | |
| | 3-50 | Revised Para. 3.5o. | |
| | 3-51 | Revised Para. 3.5q. | |
| | 3-52 | Revised Para. 3.5t. | |
| | 4-i | Revised T of C. | |
| | 4-8 | Revised Para. 4.5b. | |
| | 4-10 | Revised Para. 4.5c | |
| | 4-10a, 4-10b | Added pages. Revised and relocated Para. 4.5c. | |

## PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont.)

| Revision Number and Code | Revised Pages | Description of Revisions | FAA Approved Signature and Date |
|---|---|---|---|
| Rev. 1<br>(continued) | 4-11 thru<br>4-14 | Revised and relocated<br>Para's. 4.5c and 4.5d. | |
| | 4-15, -16 | Revised Para's. 4.5f<br>and 4.5g. | |
| | 4-17 | Revised Para. 4.5h. | |
| | 4-19, -20 | Revised Para. 4.5j. | |
| | 4-22 | Revised Para. 4.5l. | |
| | 4-25 | Revised Para. 4.5m. | |
| | 5-4 thru<br>5-7 | Revised Para. 5.5. | |
| | 6-5 | Revised Para. 6.5 - typo. | |
| | 7-i, ii | Revised T of C. Page numbers. | |
| | 7-2 | Revised Para. 7.5. | |
| | 7-5 | Revised Fig. 7-1. | |
| | 7-6 | Revised Para. 7.7. | |
| | 7-9 | Revised Para. 7.9. | |
| | 7-12 | Revised Para. 7.9. | |
| | 7-16 | Revised Para. 7.9. | |
| | 7-21 | Revised Para. 7.9. | |
| | 7-54 | Revised Para. 7.15. | |
| | 7-56 thru<br>7-58 | Revised Fig. 7-17 and<br>Para. 7-17. | |
| | 7-59, -60 | Revised Para. 7.19. | |
| | 7-61 | Revised Fig. 7-21. | |
| | 7-63 | Revised Para. 7.19. | |
| | 7-65 | Revised Fig. 7-25. | |
| | 7-75 | Revised Fig. 7-33 index. | |
| | 7-76 | Revised Para. 7.27. | |
| | 9-i | Revised T of C. | |
| | 9-25<br>9-56 | Added Supplement 5.<br>Added pages. | Eric A. Wright<br>December 15, 2017 |
| Rev. 2<br>(PR180702) | ii | Updated copyright. | |
| | vi | Added Rev. 2 to L of R. | |
| | vi-a, -b | Added new pages. | |

## PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont.)

| Revision Number and Code | Revised Pages | Description of Revisions | FAA Approved Signature and Date |
|---|---|---|---|
| Rev. 2 (continued) | 2-4 | Revised Para. 2.11. | |
| | 2-17 | Revised Para. 2.31. | |
| | 3-22 | Revised Para. 3.5e to amend Oil Pressure procedure. | |
| | 3-30 | Typo. | |
| | 4-i | Revised T.O.C. | |
| | 4-8 | Revised Para. 4.5b. | |
| | 4-10b - 4-14 | Relocated text to accommodate addition to page 4-15. | |
| | 4-15 | Revised Para. 4.5f. | |
| | 7-45 | Revised Standby Instrument. | |
| | 7-60 | Revised Para. 7.19. | |
| | 9-i | Revised T.O.C. | Eric A. Wright |
| | 9-57, -58 | Added Supplement 6. | July 2, 2018 |
| Rev. 3 (PR181001) | vi-a, -b | Added Rev. 3 to L of R. | |
| | 1-8, -9 | Revised Para. 1.21. | |
| | 1-8a thru 1-8j | Added pages for table. | |
| | 2-7 thru 2-15 | Revised Para. 2.27. | |
| | 2-18 thru 2-20 | Revised Para. 2.33. | |
| | 3-2, -3 | Revised Para. 3.1. | |
| | 3-19 | Revised Para. 3.5c. | |
| | 3-32 thru 3-38 | Revised Para. 3.5k. | |
| | 3-41, -42 | Revised Para. 3.5k. | |
| | 3-52 | Revised Para. 3.5t. | |
| | 4-13 | Revised Para. 4.5d. | |
| | 4-26 | Revised Para. 4.5o. | |
| | 6-i | Revised T.O.C. | |
| | 7-1 | Revised Para. 7.3. | |
| | 7-3 | Revised Para. 7.5. | |
| | 7-7 | Revised Para. 7.9. | |

## PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont.)

| Revision Number and Code | Revised Pages | Description of Revisions | FAA Approved Signature and Date |
|---|---|---|---|
| Rev. 3 (cont.) | 7-10 thru 7-13 | Revised Primary Flight Display information. | |
| | 7-17 | Revised Fig. 7-5. | |
| | 7-20 | Revised TIS Alerts. | |
| | 7-21 | Revised TAS Alerts. | |
| | 7-23, -24 | Revised TAS Alerts. | |
| | 7-25, -26 | Relocate text. | |
| | 7-27 thru 7-32 | Revised TAWS-B to add WireAware information. Relocated text and revised Table 7-1. | |
| | 7-36, -37 | Removed CRG-PG info. | |
| | 7-38 | Revised Databases typos. | |
| | 7-40, -41 | Revised Para. 7.10. | |
| | 7-43 | Revised Level Mode. | |
| | 7-44 | Removed CRG-PG info. | |
| | 9-24 | Revised Legend Note. | |
| | 9-32 | Revised Para. 4.5b. | |
| | 9-40 thru 9-42 | Revised Para. 4.5f and relocated text. | Eric A. Wright October 1, 2018 |
| Rev. 4 (PR191216) | i | Added EASA approval. | |
| | ii | Updated copyright. | |
| | vi-b | Added Rev. 4 to L of R. | |
| | 2-8 thru 2-17 | Revised Para. 2.27 and relocated Para's 2.29, 2.31. | |
| | 2-18 | Relocated Para's 2.29 and 2.31. Revised Para. 2.31. | |
| | 2-19, -20 | Relocated Para. 2.33. | |
| | 4-29 | Revised Para. 4.5t. | |
| | 7-7, -8 | Revised Para. 7.9. | |
| | 7-29 | Revised TAWS-B Note. | |
| | 7-38 | Revised Databases info. | |
| | 7-40 | Revised Para. 7.10. | |
| | 9-57 | Revised Supplement 6. | Eric A. Wright December 16, 2019 |

## PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont.)

| Revision Number and Code | Revised Pages | Description of Revisions | FAA Approved Signature and Date |
|---|---|---|---|
| Rev. 5 (PR200402) | ii | Updated copyright. | |
| | vi-c, -d | Added Rev. 5 to L of R. Added new pages. | |
| | 1-5 | Revised Para. 1.7. | |
| | 1-6 | Revised Para. 1.11. | |
| | 1-8a thru 1-8j | Revised Para. 1.21. Column header typo PNB to PBN. | |
| | 2-i | Revised T.O.C. | |
| | 2-1 | Revised Para. 2.1. | |
| | 2-2, -3 | Relocate text and revised Para. 2.7. | |
| | 2-9 thru 2-11 | Revised Para. 2.27(d). | |
| | 2-18, -19 | Revised Para. 2.31. | |
| | 3-19, -20 | Revised Para. 3.5c. | |
| | 4-10b | Revised Para. 4.5c. | |
| | 4-12 | Revised Para. 4.5c. | |
| | 4-13 | Revised Para. 4.5d. | |
| | 4-16 | Revised Para. 4.5g. | |
| | 4-26 | Revised Para. 4.5o. | |
| | 4-29 | Revised Para. 4.5t. | |
| | 5-9 | Revised List of Figures. | |
| | 5-26 | Revised Fig. 5-25. | |
| | 5-30 thru 5-33 | Relocate figures, revised Fig. 5-35 and added Fig. 5-35a. | |
| | 7-43 | Revised ESP paragraph. | |
| | 7-45 thru 7-46 | Revised Standby Instrument. Added pages 7-45a & 7-45b | |
| | 7-61, -62 | Revised Fig. 7-21, Fig. 7-23. | |
| | 7-67, -68 | Revised Para. 7.21, Fig. 7-27. | |
| | 7-73 thru 7-75 | Revised Para. 7.25, Fig. 7-33 and Fig. 7-33 index. | |
| | 8-12 | Revised Para. 8.19. | |
| | 9-i | Revised T.O.C. | |
| | 9-39 | Revised Para. 4.5d. | |
| | 9-41 | Revised Para. 4.5g. | |
| | 9-53 thru 9-55 | Revised Supplement 5, Fig. 7-33 and Fig. 7-33 index. | |
| | 9-59 thru 9-66 | Added Supplement 7. | Eric A. Wright April 2, 2020 |

**PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont.)**

| Revision Number and Code | Revised Pages | Description of Revisions | FAA Approved Signature and Date |
|---|---|---|---|
| Rev. 6 (PR200616) | i | Revised EASA approval. | |
| | vi-d | Added Rev. 6 to L of R. | |
| | 2-3 | Added Para. 2.7 Note. | |
| | 2-19 | Added Para. 2.31 Note. | Scott Edwards |
| | 4-17, -18 | Revised Para. 4.5h | June 16, 2020 |
| Rev. 7 (PR210226) | ii | Updated copyright. | |
| | vi-d | Added Rev. 7 to L of R. | |
| | 1-5 | Revised Para. 1.7. | |
| | 1-6 | Revised Para. 1.11. | |
| | 2-3 | Revised Para. 2.7(g). | |
| | 2-7 | Revised Para. 2.27(b). | |
| | 2-9 | Revised Para. 2.27(d). | |
| | 2-17 | Removed Para. 2.27 Note. | |
| | 3-42 | Revised Para. 3.5(k) typo. | |
| | 7-46 | Revised Para. 7.11. | |
| | 7-48 | Revised Figure 7-9. | |
| | 7-48a, 7-48b | Added pages. Added Figure 7-9 (Sheet 2 of 2). | |
| | 7-49 | Revised Figure 7-11. | |
| | 8-2 | Revised Para. 8.1. | |
| | 8-6 | Revised Para. 8.7. | |
| | 8-12 | Revised Para. 8.17. | |
| | 8-12a, 8-12b | Added pages. Relocated text. | |
| | 8-13 | Revised Para. 8.21. | Mitchell R. Cannon |
| | 9-4 | Revised Section 4. | Mitchell R. Cannon |
| | 10-2 | Revised Para. 10.3. | February 26, 2021 |

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

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

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

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

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

**NOTE**

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

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## 1.3 NOTATIONS

**WARNING**

**Operating procedures or techniques which may result in personal injury or loss of life if not carefully followed or a hazard which may require immediate crew recognition and corrective action.**

***CAUTION***

*Operating procedures or techniques which may result in damage to equipment if not carefully followed or the need for immediate crew awareness and possible need for future corrective action.*

**NOTE**

Supplemental information or highlights considered of sufficient significance to require emphasizing.

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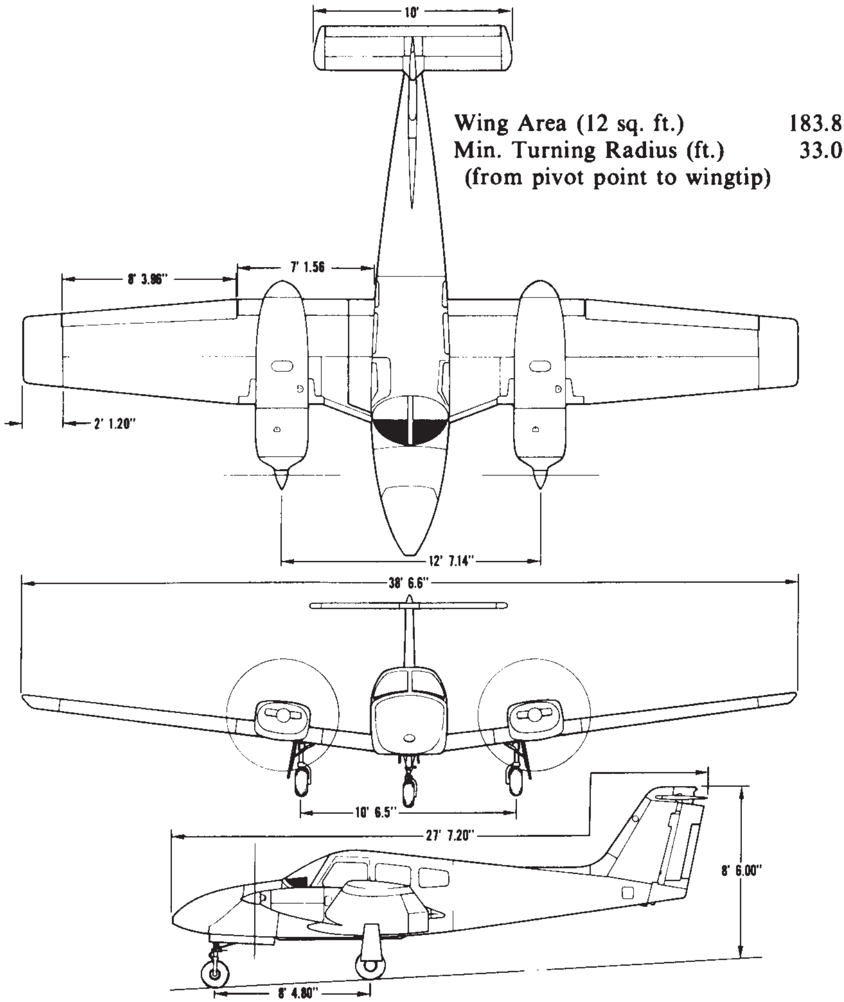


**THREE VIEW**
Figure 1-1

## 1.5 ENGINES

| | | |
|---|---|---|
| (a) | Number of Engines | 2 |
| (b) | Engine Manufacturer | Lycoming |
| (c) | Engine Model Number | |
| | Left | IO-360-B1G6 |
| | Right | LIO-360-B1G6 |
| (d) | Rated Horsepower | 180 |
| (e) | Rated Speed (RPM) | 2700 |
| (f) | Bore (in.) | 5.125 |
| (g) | Stroke (in.) | 4.375 |
| (h) | Displacement (cu. in.) | 361 |
| (i) | Compression Ratio | 8.5:1 |
| (j) | Engine Type | Fuel Injected, Four Cylinder, Direct Drive, Horizontally Opposed, Air Cooled |

## 1.7 PROPELLERS

The installed propellers may be:

| **Propeller Manufacturer** | **Hartzell** | **Hartzell** |
|---|---|---|
| Blade Model and Description | HC-C2Y(K, R)-2CEUF/ FC7666A-2R (Left)<br>HC-C2Y(K, R)-2CLEUF/ FJC7666A-2R (Right)<br>Straight Blade | HC-C2YR-2CEUFP/ FC7497 (Left)<br>HC-C2YR-2CLEUFP/ FJC7497 (Right)<br>Scimitar Blade |
| Number of Blades | 2 | 2 |
| Propeller Diameter (inches) | 74 (Maximum)<br>72 (Minimum) | 74 (Maximum)<br>72.5 (Minimum) |
| Propeller Type | Constant Speed, Hydraulically Actuated, Full Feathering | Constant Speed, Hydraulically Actuated, Full Feathering |

## 1.9 FUEL

AVGAS ONLY

| | |
|---|---|
| (a) Fuel Capacity (U.S. gal.) (total) | 110 |
| (b) Usable Fuel (U.S. gal.) (total) | 108 |
| (c) Fuel | |
| (1) Minimum Octane | 100 Green or 100LL Blue Aviation Grade |

## 1.11 OIL

| | |
|---|---|
| (a) Oil Capacity (U.S. qts.) (per engine) | 8 |
| (b) Oil Specification | Refer to latest revision of Lycoming Service Instruction 1014. |
| (c) Oil Viscosity per Average Ambient Temperature for Starting. | Refer to latest revision of Lycoming Service Instruction 1014. |

## 1.13 MAXIMUM WEIGHTS

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

## 1.15 STANDARD AIRPLANE WEIGHTS

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

## 1.17 BAGGAGE SPACE AND ENTRY DIMENSIONS

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

## 1.19 SPECIFIC LOADING

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

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS

The Garmin G1000 Integrated Avionics GNSS long range navigation system installed in this airplane is a GPS system with a Satellite Based Augmentation System (SBAS) comprised of two TSO-C145d Class 3 approved Garmin GIA 64Ws, TSO-C146d Class 3 approved Garmin GDU Display Units (1050 and 1054), and two Garmin-approved GA36 GPS/SBAS antennas (one is a GA37 if optional GDL 69 is installed), and GPS software version 5.1 or later approved version. The Garmin GNSS navigation system in this aircraft is installed in accordance with AC 20-138D. When all the equipment is operative, the Garmin G1000 system has two independent GNSS long-range navigation systems. Failure of any of the above equipment or the posting of ‘BOTH ON GPS1’ or ‘BOTH ON GPS2’ annunciators indicate only one operational GNSS system.

The Garmin G1000 Integrated Avionics GNSS navigation system as installed in this airplane complies with the requirements of AC 20-138D and has airworthiness approval for navigation using GPS and GPS/SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR en-route, terminal area, non-precision approach, and approach procedures with vertical guidance operations.

The Garmin G1000 Integrated Avionics GNSS navigation system as installed in this airplane complies with the equipment, performance, and functional requirements established for the following navigation specifications.

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNAV 10<br><br>RNP 10<br><br>Oceanic and Remote Areas of Operation (Class II Navigation) | GNSS FDE/RAIM availability must be verified prior to flight. Maximum predicted FDE/RAIM unavailability is 34 minutes. [1]<br><br>Two GNSS systems required to be operational, (one GNSS system for those routes requiring only one long range navigation system).<br><br>No time limit using GNSS as the primary navigation sensor.<br><br>Part 91, Part 91 subpart K, 121, 125, and 135 operators require operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-105A.<br><br>FAA AC 91-70B.<br><br>EASA AMC 20-12. | R | A1 | The GPS equipment as installed complies with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace without reliance on other long-range navigation systems, when used in conjunction with the G1000 WFDE Prediction program. [1] |
| B-RNAV / RNAV 5 (Europe) | Must have GNSS/ SBAS capability and availability or GNSS RAIM/FDE availability must be verified prior to flight. Maximum predicted RAIM/ FDE unavailability is 5 minutes. [1]<br><br>This does not constitute an operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-96A CHG 1.<br><br>EASA AMC 20-4A. | R | B2 | |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNP 4 Oceanic and Remote Areas of Operation (Class II Navigation) | GNSS FDE/RAIM availability must be verified prior to flight. Maximum predicted FDE/RAIM unavailability is 25 minutes. [1]<br><br>Two operational long-range nav systems required, (or one navigation system and one GNSS sensor for those routes requiring only one long-range navigation sensor).<br><br>No time limit using GNSS as the primary navigation sensor.<br><br>Part 91, Part 91 subpart K, 121, 125, and 135 operators require operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-105A.<br><br>FAA AC 91-70B. | R | L1 | The GPS equipment as installed complies with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace without reliance on other long-range navigation systems, when used in conjunction with the G1000 WFDE Prediction program. [1] |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNAV 2 | Must have GNSS/ SBAS capability and availability or GNSS RAIM/FDE availability must be verified prior to flight. Maximum predicted RAIM/ FDE unavailability is 5 minutes. 1<br><br>The GNSS RNAV system is installed and meets the performance and functional requirements of AC 90-100A CHG 2.<br><br>In accordance with AC 90-100A, CHG 2, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A CHG 2 are authorized to fly RNAV 2 procedures.<br><br>Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-100A CHG 2. | R | C2 | Includes RNAV Q and T routes. |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNAV 1 | Must have GNSS/ SBAS capability and availability or GNSS RAIM/FDE availability must be verified prior to flight. Maximum predicted RAIM/ FDE unavailability is 5 minutes. [1]<br><br>The GNSS RNAV system is installed and meets the performance and functional requirements of AC 90-100A CHG 2.<br><br>In accordance with AC 90-100A, CHG 2, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A CHG 2 are authorized to fly RNAV 1 procedures.<br><br>Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-100A CHG 2. | R | D2 | Includes RNAV terminal departure and arrival procedures. |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| P-RNAV (Europe) | GNSS receiver is required for takeoff in P-RNAV airspace.<br><br>Must have GNSS/ SBAS capability and availability or GNSS RAIM/FDE availability must be verified prior to flight.<br><br>This does not constitute an operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-96A CHG 1.<br><br>JAA TGL10 Rev 1. | R | D2 | ICAO flight plan code for P-RNAV no longer exists.<br>P-RNAV utilizes RNAV 1 flight plan codes. |
| RNP 1 | Procedures containing Radius-to-Fix (RF) legs are not authorized.<br><br>Must have GNSS/ SBAS capability and availability or GNSS RAIM/FDE availability must be verified prior to flight. Maximum predicted RAIM/ FDE unavailability is 5 minutes. [1]<br><br>In accordance with AC 90-105A, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-105A are authorized to fly RNP 1 procedures. | FAA AC 20-138D.<br><br>FAA AC 90-105A. | R | O2 | Includes RNP terminal departure and arrival procedures. |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNP 1 (continued) | Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval. | (continued) | (cont.) | (cont.) | (continued) |
| RNP APCH LNAV minima | Procedures containing Radius-to-Fix (RF) legs are not authorized.<br><br>Must have GNSS/ SBAS capability and availability or GNSS RAIM/FDE availability must be verified prior to flight. Maximum predicted RAIM/ FDE unavailability is 5 minutes. [1]<br><br>All instrument approach procedures that are retrieved from the current navigation database are authorized.<br><br>In accordance with AC 90-105A, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-105A are authorized to fly RNP APCH LNAV minima procedures.<br><br>Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-105A.<br><br>EASA AMC 20-27A. | R | S1 | Includes non-precision approaches based on conventional navigation aids with “or GPS” in the title and area navigation approaches titled “GPS”, “RNAV (GPS)”, and “RNAV (GNSS)”. |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNP APCH LNAV/ VNAV minima | Procedures containing Radius-to-Fix (RF) legs are not authorized.<br><br>Must have GNSS/ SBAS capability and availability or GNSS RAIM/FDE availability must be verified prior to flight. Maximum predicted RAIM/ FDE unavailability is 5 minutes.[1]<br><br>All instrument approach procedures that are retrieved from the current navigation database are authorized.<br><br>In accordance with AC 90-105A, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-105A are authorized to fly RNP APCH LNAV/VNAV minima procedures.<br><br>Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval.<br><br>This aircraft is not authorized to perform Barometric Based Vertical Guidance (baro-VNAV) approches in the EASA airspace system. | FAA AC 20-138D.<br><br>FAA AC 90-105A.<br><br>EASA AMC 20-27A with CM-AS-002. | R | S2 | Includes area navigation approaches titled “RNAV (GPS)” and “RNAV (GNSS).”<br><br>Vertical guidance is based on GPS/SBAS when within SBAS coverage and by baro-VNAV when outside SBAS coverage, or when SBAS has been pilot disabled for approaches with ‘WAAS VNAV NA’.<br><br>The aircraft complies with the criteria of AMC 20-27 for RNP approaches to LNAV/ VNAV minima, with the exception that VNAV is based on SBAS/GNSS geometric altitude when SBAS/GNSS is available and authorized |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNP APCH LP minima | Procedures containing Radius-to-Fix (RF) Legs are not authorized.<br><br>All instrument approach procedures that are retrieved from the current navigation database are authorized.<br><br>In accordance with AC 90-107, Part 91 operators (except subpart K), following the operational considerations and training guidance in AC 90-107 are authorized to fly RNP APCH LP minima procedures.<br><br>Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-107. | N/A | N/A | Includes area navigation approaches titled “RNAV (GPS)” and “RNAV (GNSS)”.<br><br>GNSS/SBAS capability and availability is required for LP procedures. |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

| Navigation Specification | Operational Requirements/ Authorizations | Reference Documents | ICAO Flight Plan Code | | Notes |
|---|---|---|---|---|---|
| | | | Item 10a Code | Item 18 PBN/ | |
| RNP APCH LPV minima | Procedures containing Radius-to-Fix (RF) Legs are not authorized.<br><br>All instrument approach procedures that are retrieved from the current navigation database are authorized.<br><br>In accordance with AC 90-107, Part 91 operators (except subpart K), following the aircraft and training guidance in AC 90-107 are authorized to fly RNP APCH LPV minima procedures.<br><br>Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval. | FAA AC 20-138D.<br><br>FAA AC 90-107.<br><br>EASA AMC 20-28. | B | N/A | Includes area navigation approaches titled "RNAV (GPS)" and "RNAV (GNSS)."<br><br>GNSS/SBAS capability and availability is required for LPV procedures. |
| RNP AR APCH | | | | | Not Authorized. |

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

<table>
<tr><th rowspan="2">Navigation Specification</th><th rowspan="2">Operational Requirements/ Authorizations</th><th rowspan="2">Reference Documents</th><th colspan="2">ICAO Flight Plan Code</th><th rowspan="2">Notes</th></tr>
<tr><th>Item 10a Code</th><th>Item 18 PBN/</th></tr>
<tr><td>Advanced RNP<br>See Notes for specific Advanced RNP functions.</td><td>This does not constitute an operational approval.</td><td>FAA AC 20-138D.</td><td>N/A</td><td>N/A</td><td><u>RNAV Holding:</u><br>Supported.<br><br><u>RF Legs:</u><br>Not supported.<br><br><u>Parallel Offsets:</u><br>Supported.<br><br><u>Higher Continuity:</u><br>Supported when both GIA 64 GPS/SBAS receivers are operating and providing GPS navigation guidance.<br><br><u>Scalable RNP:</u><br>Not supported.<br><br><u>Fixed Radius Transitions (FRT):</u><br>Not supported.<br><br><u>Time of Arrival Control</u> (TOAC):<br>Not supported.</td></tr>
</table>

## 1.21 G1000 GNSS (GPS/SBAS) NAVIGATION SYSTEM EQUIPMENT APPROVALS (continued)

1. FDE/RAIM availability worldwide can be determined via the following:
    - Using the Garmin RAIM/Fault Detection and Exclusion Prediction Tool available on the Garmin website fly.garmin.com.

Also, within the United States:

- Via the FAA's RAIM Service Availability Prediction Tool (SAPT) website: http://sapt.faa.gov.
- Contacting a Flight Service Station (not DUATS) to obtain non-precision approach RAIM.

Also, within Europe:

- Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.

Verification of FDE/RAIM availability is not necessary if SBAS coverage is confirmed to be available along the entire route of flight.

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

Navigation information is referenced to the WGS-84 reference system.

## 1.23 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

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

(a) General Airspeed Terminology and Symbols

| | |
|---|---|
| CAS | Calibrated Airspeed means the indicated speed of an airplane, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level. |
| KCAS | Calibrated Airspeed expressed in Knots. |
| GS | Ground Speed is the speed of an airplane relative to the ground. |
| IAS | Indicated Airspeed is the airspeed of an airplane as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error. |
| KIAS | Indicated Airspeed expressed in Knots. |
| TAS | True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility. |
| KTAS | True Airspeed expressed in Knots. |
| $V_O$ | Maximum Operating Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane. |

## 1.23 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)

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

## 1.23 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)

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

(b) Meteorological Terminology

| | |
|---|---|
| IMC | Instrument Meterological Conditions. |
| ISA | International Standard Atmosphere in which:<br>(1) The air is a dry perfect gas;<br>(2) The temperature at sea level is 15° Celsius (59° Fahrenheit);<br>(3) The pressure at sea level is 29.92 in. Hg (1013.2 mb)<br>(4) The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003564°F) per foot and zero above that altitude. |
| OAT | Outside Air Temperature is the free air static temperature obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects. |
| Indicated Pressure Altitude | The number actually read from an altimeter when the barometric subscale has been set to 29.92 in. Hg (1013.2 mb). |

## 1.23 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)

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

(c) Power Terminology

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

(d) Engine Instruments

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

(e) Airplane Performance and Flight Planning Terminology

| | |
|---|---|
| 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. |

## 1.23 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)

| | |
|---|---|
| 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 | 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. |
| 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

| | |
|---|---|
| A.O.D. | Aft of Datum. |
| Arm | The horizontal distance from the reference datum to the center of gravity (C.G.) of an item. |
| Center of Gravity (C.G.) | The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane. |
| 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. |
| Datum | An imaginary vertical plane from which all horizontal distances are measured for balance purposes. |

## 1.23 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)

| | |
|---|---|
| Basic Empty Weight | Standard empty weight plus optional equipment. |
| Maximum Landing Weight | Maximum weight approved for the landing touchdown. |
| 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 Zero Fuel Weight | Maximum weight exclusive of usable fuel. |
| 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.) |
| Payload | Weight of occupants, cargo and baggage. |
| Standard Empty Weight | Weight of a standard airplane including unusable fuel, full operating fluids and full oil. |
| Station | A location along the airplane fuselage usually given in terms of distance in inches from the reference datum. |
| Unusable Fuel | Fuel remaining after a runout test has been completed in accordance with govern-mental regulations. |
| Usable Fuel | Fuel available for flight planning. |
| Useful Load | Difference between takeoff weight, or ramp weight if applicable, and basic empty weight. |

## 1.23 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)

(g) Avionics System Abbreviations/Terminology

| | |
|---|---|
| **1** | Refers to pilot's side (AHRS1, ADC1, GPS1) |
| **2** | Refers to co-pilot's side (AHRS2, ADC2, GPS2) |
| **ADC** | Air Data Computer |
| **ADS-B** | Automatic Dependent Surveillance - Broadcast |
| **AFCS** | Automatic Flight Control System |
| **AHRS** | Attitude and Heading Reference System |
| **CAS** | Crew Alerting System |
| **EBD** | Evolution Backup Display (Aspen standby instrument) |
| **EIS** | Engine Indication System |
| **FDE** | Fault Detection and Exclusion |
| **FOB** | Fuel On Board |
| **GDL** | Garmin Data Link |
| **GDU** | Garmin Display Unit |
| **GEA** | Garmin Engine/Airframe Processing Unit |
| **GFC** | Garmin Flight Control System |
| **GIA** | Garmin Integrated Avionics Unit |
| **GMA** | Garmin Audio Panel |
| **GMU** | Garmin Magnetometer Unit |
| **GPS** | Global Positioning System |
| **GRS** | Garmin AHRS |
| **GTX** | Garmin Transponder |
| **MFD** | Multi-Function Display |
| **PFD** | Primary Flight Display |
| **PFT** | Preflight Test |
| **SBAS** | Satellite-Based Augmentation System |
| **TAWS** | Terrain Awareness and Warning System |
| **WAAS** | Wide Area Augmentation System |

## TABLE OF CONTENTS

## SECTION 2

## LIMITATIONS

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# SECTION 2

# LIMITATIONS

## 2.1 GENERAL

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

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

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

## 2.3 AIRSPEED LIMITATIONS

| SPEED | KIAS | KCAS |
|---|---|---|
| Never Exceed Speed ($V_{NE}$) - Do not exceed this speed in any operation. | 202 | 194 |
| Maximum Structural Cruising Speed ($V_{NO}$) - Do not exceed this speed except in smooth air and then only with caution. | 169 | 165 |
| Maximum Operating Maneuvering Speed ($V_O$) - Do not make full or abrupt control inputs above this speed. | | |
| At 3800 lb Gross Weight | 135 | 133 |
| At 2870 lb Gross Weight | 115 | 115 |

**CAUTION**

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

## 2.3 AIRSPEED LIMITATIONS (continued)

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

**NOTE**

$V_{MCA}$ for this airplane is defined by aerodynamic stall.

## 2.5 AIRSPEED INDICATOR MARKINGS

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

## 2.7 POWER PLANT LIMITATIONS

(a) Number of Engines — 2

(b) Engine Manufacturer — Lycoming

(c) Engine Model No.
- Left — IO-360-B1G6
- Right — LIO-360-B1G6

(d) Engine Operating Limits
- (1) Maximum Horsepower — 180
- (2) Maximum Rotation Speed (RPM) — 2700
- (3) Maximum Manifold Pressure — Full Throttle
- (4) Maximum Cylinder Head Temperature — 500°F
- (5) Maximum Oil Temperature — 245°F

(e) Oil Pressure
- Minimum — 25 PSI
- Maximum — 115 PSI

(f) Fuel (AVGAS ONLY) (minimum grade) — 100 or 100LL Aviation Grade

(g) The propellers in this table are approved for use, but a straight blade propeller and a scimitar blade propeller may not be installed on the same airplane.

| **Propeller Manufacturer** | **Hartzell** | **Hartzell** |
|---|---|---|
| Blade Model and Description | HC-C2Y(K, R)-2CEUF/ FC7666A-2R (Left)<br>HC-C2Y(K, R)-2CLEUF/ FJC7666A-2R (Right)<br>Straight Blade | HC-C2YR-2CEUFP/ FC7497 (Left)<br>HC-C2YR-2CLEUFP/ FJC7497 (Right)<br>Scimitar Blade |
| Number of Blades | 2 | 2 |
| Propeller Diameter (inches) | 74 (Maximum)<br>72 (Minimum) | 74 (Maximum)<br>72.5 (Minimum) |

**NOTE**

Hartzell Scimitar blade is NOT EASA Approved.

## 2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer

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

(b) Oil Temperature

| | |
|---|---|
| Green Band (Normal Operating Range) | 75°F to 245°F |
| Red Line ( Maximum) | 245°F |

(c) Oil Pressure

| | |
|---|---|
| Green Band (Normal Operating Range) | 55 PSI to 95 PSI |
| Yellow Band (Caution Range) (Idle) | 25 PSI to 55 PSI |
| Yellow Band (Warm Up, Taxi & T.O.) | 95 PSI to 115 PSI |
| Red Line (Minimum) | 25 PSI |
| Red Line (Maximum) | 115 PSI |

(d) Cylinder Head Temperature

| | |
|---|---|
| Green Band (Normal Range) | 200°F to 500°F |
| Red Line (Maximum) | 500°F |

(e) Fuel Flow

| | |
|---|---|
| Green Band (Normal Operating Range) | 3.0 GPH to 25.0 GPH |

## 2.11 SYSTEMS LIMITATIONS

a) Alternator

| | |
|---|---|
| 1) Maximum Load Ground | 60 AMPS |
| 2) Maximum Load Flight | 65 AMPS |

b) Main Battery

| | |
|---|---|
| Minimum | 25 VOLTS |
| Maximum | 32 VOLTS |

c) Emergency Battery

| | |
|---|---|
| Minimum | 20 VOLTS |
| Minimum Required for Flight | 23.3 VOLTS |
| Maximum | 32 VOLTS |

## 2.13 WEIGHT LIMITS

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

**NOTE**

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

## 2.15 CENTER OF GRAVITY LIMITS

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

**NOTE**

Straight line variation between points given.

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

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

## 2.17 MANEUVER LIMITS

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

## 2.19 FLIGHT LOAD FACTORS

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

(b) Negative Load Factor (Maximum) — -1.5 G

No inverted maneuvers approved.

## 2.21 TYPES OF OPERATION

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

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

## 2.23 FUEL LIMITATIONS

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

## 2.25 MAXIMUM SEATING CONFIGURATION

The maximum seating capacity is 4 persons.

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS

### (a) Cockpit Reference & Pilot's Guide

The Garmin G1000 Cockpit Reference Guide for the PA-44-180 Seminole (Garmin P/N 190-02199-00 latest appropriate revision and -XX part number) must be immediately available to the pilot while operating the airplane.

### (b) System Software Requirements.

The G1000 must utilize system software 2694.01 or later approved software versions for aircraft SN 4496395, 4496397 thru 4496431, and 4496433 thru 4496446.

The G1000 must utilize system software 3344.00 or later approved software versions for aircraft SN 4496432, 4496447 and up.

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

### (c) Databases

Navigation Database

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

Instrument approach navigation predicated upon the Garmin G1000 GPS receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the G1000 navigation database. The G1000 navigation database must incorporate the current update cycle or each waypoint must be verified for accuracy with current approach chart data. Manual entry of data points is prohibited.

Navigation database coverage options include the Americas, International, or Worldwide.

TAWS / TERRAIN Database

- Terrain database covers all longitudes and latitudes.
- Obstacle database coverage includes United States, Canada, and Europe.

WireAware Database

- WireAware database coverage includes the United States and portions of Canada and Mexico.

**NOTE**

Database coverage areas may change over time. Reference the database status page to determine which regions are currently loaded to the system.

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

### (d) Flight Planning

In areas where GPS SBAS coverage is not available, the pilot must verify RAIM availability. See Section 1.21 for available FDE/RAIM prediction programs.

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

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 RAIM/FDE shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM/FDE 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/FDE requirements can be met. For operations where the route requires oceanic/remote area (Class II) navigation, the aircraft's operator or flight crew must determine that RAIM/FDE will be available along the intended route of flight. If RAIM/FDE will be unavailable for more than 34 minutes for RNP-10 airspace or 25 minutes for RNP-4 airspace, then the operation must be rescheduled when RAIM/FDE is available.

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

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## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

**(e) Enroute**

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs) and Obstacle Departure Procedures (ODPs), 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.

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

**(f) Approaches**

(1) Vertical Guidance

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

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

### (f) Approaches (continued)

(1) Vertical Guidance (continued)

When GPS SBAS corrections are unavailable or if operating outside of GPS SBAS coverage, instrument approaches utilizing the GPS receiver will be conducted in the approach mode and Fault Detection and Exclusion mode. Loss of Integrity annunciations must not be displayed at the final approach fix. Vertical guidance from GPS will not be available if GPS SBAS corrections are unavailable or if operating outside of GPS SBAS coverage. GPS SBAS corrections should be selected OFF when operating outside of GPS SBAS system coverage. Barometric vertical guidance (Baro-VNAV) may be used for LNAV/VNAV approaches in the absence of SBAS coverage.

**NOTE**

This aircraft is not authorized to perform barometric vertical guidance (baro-VNAV) approaches in the EASA airspace system.

IFR non-precision approach with vertical guidance approval using the GPS/SBAS sensor is limited to published approaches within the U.S. and EASA Airspace Systems. Approaches to airports in other airspace are not approved unless authorized by the appropriate governing authority.

(2) GPS Approaches

See Section 1, paragraph 1.21. for approved GPS operations/ approaches.

(3) Non GPS Approaches

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

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

### (g) Attitude and Heading Reference System (AHRS)

(1) AHRS Operational Area

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

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

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

**NOTE**

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

### (h) Terrain, TAWS-B, and Obstacle Display

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

The TAWS B system is intended as a situational awareness tool, and should not be used as the sole means for avoiding obstacles or terrain. To avoid giving unwanted audible alerts, TAWS B should be inhibited when landing at an airport that is not included in the airport database. All TAWS B caution and warning aural alerts must be followed immediately upon receipt unless the pilot has visual contact with the terrain and can visually maintain adequate terrain/obstacle clearance. Pilots are authorized to deviate from their current ATC clearance to the extent necessary to comply with terrain/obstacle warnings from the TAWS B per FAR 91.223.

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

### (h) Terrain, TAWS-B, and Obstacle Display (continued)

Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. The terrain and TAWS-B databases cover all latitude and longitudes and the obstacle database covers the United States, Canada, and Europe.

**NOTE**

The area of coverage may be modified as additional obstacle data sources become available.

### (i) Datalink Weather Display

Optional XM weather information displayed on the MFD is limited to supplemental use only and may not be used in lieu of an official weather data source.

**WARNING**

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

### (j) Traffic Display

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

### (k) Synthetic Vision System (SVS)

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

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

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

### (l) Electronic Flight Bag (EFB)

The G1000 Integrated Avionics System as installed in this aircraft supports approval of AC 120-76D, Software Type B Electronic Flight Bag (EFB) electronic aeronautical chart applications when using current FliteChart or ChartView data.

For operations under 14 CFR Part 91, it is suggested that a secondary or backup source of aeronautical information necessary for the flight, is available to the pilot in the aircraft. The secondary or backup information may be either traditional paper-based material or displayed electronically. If the source of aeronautical information is in electronic format, operators must determine non-interference with the G1000 system and existing aircraft systems for all flight phases.

Airworthiness approval has not been obtained for the use of EFB in EASA airspace. Geo-referenced data (airplane symbol) presented on moving maps and electronic approach charts must be used for situational awareness only. Paper charts or other EASA approved electronically displayed information must be used as the primary source of aeronautical information. If the source of aeronautical information is electronically displayed, operators must determine noninterference with the G1000 system and existing aircraft systems for all flight phases. For EASA aircraft this limitation supersedes the second paragraph of chapter 2.27(l).

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

### (m) ChartView, FliteCharts, and SafeTaxi®

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

### (n) Flight Stream 510 (For aircraft operating in EASA airspace)

(1) Data Received by Personal Electronic Devices (PED)
The PED is not approved as the sole source of information to base tactical or strategic decision making and is not approved to replace the information provided by the G1000 GIFD system. The Flight Stream 510 interface and data provided to a portable electronic device is not approved to replace any required or installed aircraft display equipment, including navigation or traffic/weather display equipment. The data presented on the PED may not have the required integrity to be used as the sole source of information to base tactical or strategic decision making.

(2) Flight Plan Transfer
Use of the Flight Stream 510 for flight plan importing during critical phases of flight by the pilot flying is prohibited.

(3) Electronic Flight Bag (EFB)
Use of the Flight Stream 510 interface and data for the purpose of Electronic Flight Bag (EFB) applications is not approved. Use of any device as an EFB may require separate approvals.

## 2.27 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS (continued)

**(o) Minimum fully functional equipment required for flight operations:**

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

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

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

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

**NOTE**

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

## 2.29 GFC 700 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

1. The autopilot must be disengaged during takeoff and landing.
2. Autopilot minimum engagement heights:
   a. 400 feet AGL during takeoff and subsequent climb operations.
   b. 1000 feet AGL during cruise and descent operations.
   c. 200 feet AGL during approach operations.
3. Autopilot minimum approved operating speed:
   On Approach - 90 KIAS
   Other than Approach - 80 KIAS
4. Autopilot maximum approved operating speed - 190 KIAS
5. Maximum fuel imbalance during autopilot operations - 10 gal.
6. Autopilot coupled go-around prohibited with one engine inoperative.
7. Maximum autopilot engagement limits:
   a. Pitch axis: +/-50º
   b. Roll axis: +/-75º
8. If the stall warning system is inoperative, Underspeed Protection (USP) will not activate in altitude critical modes (ALT, GS, GP, TO and GA).
9. Autopilot approved for Category 1 precision approaches and non-precision approaches only.

## 2.31 STANDBY INSTRUMENT LIMITATIONS

**NOTE**

See Section 2.27 (o) for approved VFR and IFR operations when the standby instrument has an invalid or failed function.

1. Aspen Standby Instrument
   a. The Aspen Evolution Backup Display (EBD) Pilot's Guide P/N 091-00027-001, Revision A, or later appropriate revision) must be immediately available to the flight crew.
   b. Use of the EBD for IFR operations within 750 nautical miles of the magnetic north or south pole, is NOT AUTHORIZED.

## 2.31 STANDBY INSTRUMENT LIMITATIONS (continued)

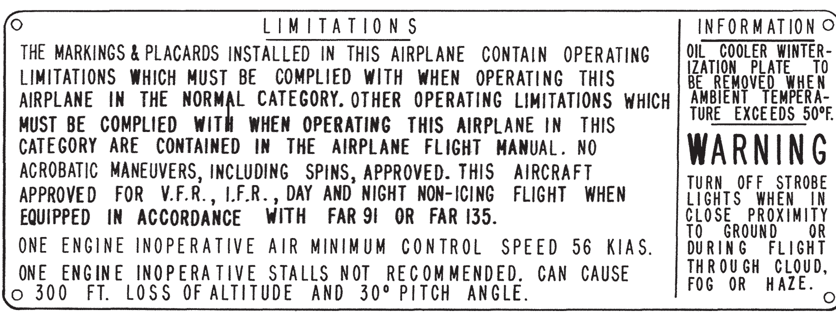
2. Garmin G5 Standby Instrument
   The G5 must utilize the following or later FAA approved software versions:

| Component | Software Version |
|---|---|
| G5 Standby Instrument | 6.40 |

**NOTE**

Garmin G5 Standby Instrument is NOT EASA Approved.

## 2.33 PLACARDS




## 2.33 PLACARDS (continued)

On storm window:

DO NOT OPEN ABOVE 129 KIAS

On lower left portion of instrument panel:

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

Near emergency gear release:

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

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

Near the Emergency Exit release handle:

EMERGENCY EXIT
REMOVE COVER PANEL
PULL HANDLE FORWARD
PUSH WINDOW OUT

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

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

Checklists within this section are divided into two distinct parts.

1. Emergency procedures checklists, depicted within boxes, describe immediate action sequences that should be followed during critical situations.
2. When applicable, amplified procedures are provided immediately below the relevant emergency procedure, to enhance the pilot's understanding of the procedure.

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

Most basic emergency procedures are a normal part of pilot training. The information presented in this section is not intended to replace this training. In order to remain proficient, pilots should periodically review standard emergency procedures.

## 3.1 GENERAL (continued)

**NOTE**

A detailed description of the Crew Alerting System and other annunciations and system messages may be found in the latest appropriate revisions and -XX part numbers of Garmin G1000 Cockpit Reference Guide (Garmin P/N 190-02199-00) and the Garmin G1000 Pilot's Guide (Garmin P/N 190-02198-00).

### Annunciations and Alerts

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

### Crew Alerting System (CAS) Messages

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

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

## 3.1 GENERAL (continued)

### Crew Alerting System (CAS) Messages (continued)

**Warnings – Red**

| Event | CAS Message | Checklist Page | Cause* |
|---|---|---|---|
| **CAS Warnings with Text Messages** | | | |
| Alternator Failure | L ALTR FAIL<br>R ALTR FAIL | 3-28<br>3-29 | Left and/or right alternator is turned ON and has failed as determined by voltage regulator |
| High Cylinder Head Temperature | L ENG CHT<br>R ENG CHT | 3-23 | Left and/or right engine CHT exceeds 500 °F |
| Low Fuel Quantity | L FUEL QTY<br>R FUEL QTY | 3-24 | Left or right fuel quantity is less than 5 gals. |
| CO Level High | CO LVL HIGH | 3-52 | CO level greater than 200 parts per million (PPM). |
| Starter Engaged | L START ENGD<br>R START ENGD | 3-49 | Left or right engine starter is engaged for greater than 30 seconds |
| Landing Gear Failure | GEAR SYS | 3-27 | Landing gear system malfunction while on the ground |
| Landing Gear Position Unsafe | CHECK GEAR | 3-26 | Landing gear selector is not in the down position when aircraft is less than 400 ft AGL with MAP less than 14 in Hg (mutable aural) or flaps greater than first "notch" (non-mutable aural).<br>Landing gear is selected UP while on the ground. |
| High Heater Temperature | HTR OVRHEAT | 3-51 | Cabin heater has sensed an overheat condition and has shut down the heater |
| Underspeed Protection | USP ACTIVE | 3-43 | The autopilot Underspeed Protection (USP) mode is actively preventing an under speed condition. |

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

## 3.1 GENERAL (continued)

### Crew Alerting System (CAS) Messages (continued)

#### Warnings – Red (continued)

| Event | CAS Message | Checklist Page | Cause* |
|---|---|---|---|
| CAS Warnings with EIS Indications | | | |
| Propeller Overspeed | None | 3-50 | Propeller speed is greater than 2720 RPM for more than 5 seconds. |
| Oil Temperature Exceedance | None | 3-23 | Oil Temperature greater than 245°F. |
| Oil Pressure Exceedance | None | 3-22 | Oil Pressure less than 25 PSI or greater than 115 PSI. |
| Total Fuel Quantity Low | None | 3-24 | Total fuel quantity less than 10 gals. |
| Battery Voltage | None | NA | Primary battery voltage less than:<br>24 V when RPM less than 1100 or<br>25 V when RPM greater than 1100<br>Or<br>Primary battery voltage greater than 32 V. |
| Alternator Amperage | None | 3-28 | Left and/or right alternator amperage is greater than 65 AMPS. |
| Emergency Battery Voltage | None | 3-32 | Emergency battery voltage is less than 20 V or greater than 32 V. |
| Landing Gear Failure | None | 3-27 | Malfunction in any of the landing gear as indicated by a red circle on the landing gear display. |

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

## 3.1 GENERAL (continued)

### Crew Alerting System (CAS) Messages (continued)

#### Cautions – Amber

| CAS Event | CAS Message | Checklist Page | Cause* |
|---|---|---|---|
| **CAS Cautions with Text Messages** | | | |
| CO Level High | CO LVL HIGH | 3-52 | CO level greater than or equal to 50 but less than 200 parts per million (PPM). |
| Low Fuel Quantity | L FUEL QTY<br>R FUEL QTY | 3-24 | Left or right fuel quantity is less than 10 gals. |
| Landing Gear Failure | GEAR SYS | 3-27 | Landing gear system malfunction while in flight |
| Landing Gear Position Unsafe | CHECK GEAR | 3-26 | Landing gear selector is not in the down position when aircraft is greater than 400 ft AGL with MAP less than 14 in Hg (mutable aural) or flaps greater than first “notch” (non-mutable aural) |
| Hydraulic Pump | HYDR PUMP ON | 3-48 | Hydraulic pump has been running for greater than 16 seconds |
| Pitot Heat Fail | PITOT HEAT FAIL | 3-47 | Pitot heat is selected ON and is inoperative |
| Pitot Heat Off | PITOT HEAT OFF | 3-47 | Pitot heat is selected OFF (double chime is suppressed) |

| CAS Cautions with EIS Indications | | | |
|---|---|---|---|
| Oil Pressure Exceedance | None | 3-22 | Oil pressure between 26 PSI and 55 PSI when propeller speed is greater than 1500 RPM or oil pressure between 96 and 115 PSI. |
| Total Fuel Quantity Low | None | 3-24 | Total fuel quantity is less than 20 gals. |
| Emergency Battery Voltage | None | NA | Emergency battery voltage is less than 23.3 V. |

## 3.1 GENERAL (continued)

### Crew Alerting System (CAS) Messages (continued)

**Advisories – White**

| CAS Event | CAS Message | Checklist Page | Cause* |
|---|---|---|---|
| **CAS Advisory with Text Message** | | | |
| Emergency Power In Use | EMERG BATT ON | 3-31 | Emergency battery is in use |
| Fuel Imbalance | FUEL IMBAL | NA | Left and right fuel quantities differ by greater than 10 gals. |
| PFD Fan Failure | PFD FAN FAIL | 3-47 | The PFD cooling fan has failed |
| MFD Fan Failure | MFD FAN FAIL | 3-47 | The MFD cooling fan has failed |
| Avionics Fan Failure | AV FAN FAIL | 3-47 | The avionics cooling fan has failed |

### Terminology

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

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

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

## 3.3 AIRSPEEDS FOR SAFE OPERATIONS

One engine inoperative air minimum control ................................56 KIAS
One engine inoperative best rate of climb.....................................88 KIAS
One engine inoperative best angle of climb..................................82 KIAS
Maneuvering (3800 lb)........................ 135 KIAS (115 KIAS @ 2870 LB)
Never exceed ..........................................................................202 KIAS

## 3.5 EMERGENCY PROCEDURES CHECKLIST

### 3.5a Engine Inoperative Procedures

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

| Engine Securing Procedure (Feathering Procedure) | |
|---|---|
| THROTTLE | CLOSE |
| PROPELLER | FEATHER (950 RPM Min.) |
| MIXTURE | CUT-OFF |
| COWL FLAP | CLOSE |
| MAG LEFT/RIGHT Switches | OFF |
| FUEL PUMP Switch | OFF |
| ALTR Switch | OFF |
| FUEL selector | OFF |
| Electrical load | REDUCE |

### 3.5a Engine Inoperative Procedures (continued)

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

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

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

**If insufficient runway remains for a complete stop:**

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

If engine failure occurs during the takeoff roll, the takeoff MUST be aborted. If failure occurs after liftoff but before 75 KIAS is achieved or before the landing gear is retracted, the takeoff should also be aborted.

### 3.5a Engine Inoperative Procedures (continued)

## Engine Failure During Takeoff (Speed Above 75 KIAS)

**If sufficient runway remains for a complete stop:**

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

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

**WARNING**

**In many combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to Climb Performance chart- One Engine Operating - Gear Up, Figure 5-21.**

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

***Land as soon as practical.***

### 3.5a Engine Inoperative Procedures (continued)

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

Attempt to maintain the one engine inoperative best rate of climb speed ($V_{YSE}$: 88 KIAS). Do not allow airspeed to decrease below the air minimum control speed ($V_{MCA}$: 56 KIAS).

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

Once the aircraft is trimmed and the inoperative engine is secured, close the cowl flap of the operating engine as much as possible without exceeding engine temperature limits. Land as soon as practical at the nearest suitable airport.

## 3.5a Engine Inoperative Procedures (continued)

### Engine Failure During Climb

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

***Land as soon as practical.***

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

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

### 3.5a Engine Inoperative Procedures (continued)

| Engine Failure During Flight (Speed Below VMCA) | |
|---|---|
| Rudder | APPLY AGAINST YAW |
| THROTTLES (Both Engines) | RETARD TO ARREST TURN/YAW |
| Pitch Attitude | LOWER NOSE TO ACCELERATE ABOVE VMCA (56 KIAS) |
| Operating Engine | INCREASE POWER AS AIRSPEED INCREASES ABOVE VMCA (56 KIAS) |
| **If altitude permits, a restart may be attempted. If restart fails or if altitude does not permit restart:** | |
| Inoperative Engine | IDENTIFY and VERIFY |
| PROPELLER (Inop. Engine) | FEATHER |
| MIXTURE (Inop. Engine) | CUT-OFF |
| Establish Bank | 2° to 3° INTO OPERATING ENGINE |
| Airspeed | ATTAIN AND MAINTAIN AT LEAST 88 KIAS |
| Rudder Trim | TOWARD OPERATING ENGINE TO APPROXIMATELY 1/2 TRAPEZOID ON THE SLIP INDICATOR |
| COWL FLAP (Operating Engine) | AS REQUIRED |
| COWL FLAP (Inop. Engine) | CLOSE |
| MAG LEFT/RIGHT Switches (Inop. Engine) | OFF |
| FUEL PUMP (Inop. Engine) | OFF |
| ALTR Switch (Inop. Engine) | OFF |
| FUEL Selector (Inop. Engine) | OFF |

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

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

### 3.5a Engine Inoperative Procedures (continued)

## Engine Failure During Flight (Speed Above VMCA)

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

**Before securing inoperative engine:**

FUEL QTY......................................CHECK (XFEED AS REQUIRED)
FUEL PUMP ........................................................................ON
MIXTURE.............................................................. FULL RICH
ALT-AIR .......................................................................... OPEN
MAG LEFT/RIGHT Switches ................................................ CHECK
OIL °F.............................................................................. CHECK
OIL PSI ........................................................................... CHECK

**If engine does not restart, complete Engine Securing Procedure.**

Power (Operating Engine)..............................................AS REQUIRED
FUEL Selector (Operating Engine)....................................................ON
(XFEED AS REQUIRED)
FUEL PUMP (Operating Engine)...................................AS REQUIRED
COWL FLAP (Operating Engine) ..................................AS REQUIRED
Establish Bank.............................2° to 3° INTO OPERATING ENGINE
Airspeed.................... ATTAIN AND MAINTAIN AT LEAST 88 KIAS
Rudder Trim .....................................TOWARD OPERATING ENGINE
TO APPROXIMATELY 1/2
TRAPEZOID ON THE SLIP INDICATOR
Electrical Load ................................DECREASE TO MIN. REQUIRED

**CAUTION**

*If engine failure is due to fuel starvation and a fuel leak is suspected, carefully monitor remaining fuel quantity if XFEED is used.*

***Land as soon as practical.***

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

### 3.5a Engine Inoperative Procedures (continued)

If an engine failure is caused by fuel starvation, both engines may be operated from one fuel tank using XFEED as appropriate. If a fuel leak is suspected, select XFEED OFF and complete the Engine Securing Procedure.

## One Engine Inoperative Landing

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

**When Landing is Assured:**

GEAR ........................ DOWN
FLAPS ........................ 25° (2nd Notch)
Final Approach Speed ........................ 90 KIAS
Power ........................ RETARD SLOWLY AND FLARE AIRPLANE
Trim ........................ AS POWER IS REDUCED (AIRPLANE WILL YAW IN DIRECTION OF OPERATING ENGINE)

**WARNING**

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

***CAUTION***

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

### 3.5a Engine Inoperative Procedures (continued)

## One Engine Inoperative Go-Around

MIXTURE (Operating Engine)............................................ FULL RICH
PROPELLER (Operating Engine) .............................. FULL INCREASE
THROTTLES ......... SMOOTHLY ADVANCE TO TAKEOFF POWER
FLAPS ................................................RETRACT INCREMENTALLY
GEAR .......................................................................................UP
Establish Bank.............................2° to 3° INTO OPERATING ENGINE
Airspeed.................... ATTAIN AND MAINTAIN AT LEAST 88 KIAS
Rudder Trim ......................................TOWARD OPERATING ENGINE
TO APPROXIMATELY 1/2
TRAPEZOID ON THE SLIP INDICATOR
COWL FLAP (Operating Engine) ..................................AS REQUIRED

**WARNING**

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

**WARNING**

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

**WARNING**

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

***CAUTION***

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

## 3.5a Engine Inoperative Procedures (continued)

### Summary of Factors Affecting Single Engine Operations

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

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

### 3.5a Engine Inoperative Procedures (continued)

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

1. Discontinuing a takeoff upon engine failure is advisable under most circumstances. Continuing the takeoff, if engine failure occurs prior to reaching obstacle speed and gear retraction, is not advisable.
2. A windmilling propeller and extended landing gear cause a severe drag penalty and therefore, climb or continued level flight is improbable, depending on weight, altitude and temperature. Prompt retraction of the landing gear, identification of the inoperative engine, and feathering of the propeller is of utmost importance if the takeoff is to be continued.
3. Airspeed should not be allowed to fall below $V_{XSE}$ (82 KIAS) any lesser speed will result in significantly reduced climb performance.
4. Once obstacles and terrain are cleared, accelerate to the single-engine best rate-of-climb airspeed.
5. To maximize controllability during recovery following an engine loss near or below $V_{MC}$, the airplane should be banked approximately 5° into the operating engine and the rudder used to maintain straight flight. This will result in the trapazoid of the turn and slip indicator being displaced 1/2 to 3/4 towards the operating engine.
6. To maximize climb performance after airplane is under control of the pilot and failed engine is secured, maintain a 2° to 3° bank towards the operating engine and trim the rudder as needed for straight flight. This will result in approximately 1/2 trapazoid displacement towards the operating engine. This trapazoid displacement should be maintained during any necessary maneuvering to maintain best possible climb margins.

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## 3.5b Reserved

## 3.5c Air Starting Procedure

### Unfeathering Procedure / Unfeathering Accumulator Functioning

**NOTE**

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

FUEL Selector (Inoperative Engine) .................................................. ON
MAG LEFT/RIGHT Switches (Inoperative Engine)........................... ON
FUEL PUMP (Inoperative Engine).................................................... ON
THROTTLE (Inoperative Engine).................................. OPEN 1/4 inch
PROPELLER (Inoperative Engine)........................... FULL INCREASE
MIXTURE (Inoperative Engine) ........................................ ADVANCE
(after propeller rotation)
THROTTLE .....................................Reduce power until engine is warm
ALTR ....................................................................ON (after restart)
FUEL PUMP................................................As Required (after restart)

**NOTE**

Starter assist is required if the propeller is stationary (not rotating) within 5-7 seconds after the propeller control has been moved forward.

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

**If restart is not successful:**

MIXTURE (Inoperative Engine) ............................................ CUT-OFF

Proceed to Section 3.5(a) Engine Securing Procedure (Feathering Procedure).

### 3.5c Air Starting Procedure (continued)

## Unfeathering Procedure/ Starter Assisted

FUEL Selector (Inoperative Engine) .......... ON
MAG LEFT/RIGHT Switches (Inoperative Engine).......... ON
FUEL PUMP (Inoperative Engine).......... ON
THROTTLE (Inoperative Engine) .......... OPEN 1/4 inch
PROPELLER (Inoperative Engine) .......... INCREASE (to cruise setting)
MIXTURE (Inoperative Engine) .......... FULL RICH
ENG START (Inoperative Engine).......... ENGAGE UNTIL PROP WINDMILLS

**NOTE**

The ENG START switch should be engaged as soon as possible after advancing the mixture control to minimize the possibility of flooding the engine.

THROTTLE ..........REDUCE POWER until engine is warm
ALTR .......... ON (after restart)
FUEL PUMP ..........As Required (after restart)

**If restart is not successful:**

MIXTURE (Inoperative Engine) .......... CUT-OFF

Proceed to Section 3.5(a) Engine Securing Procedure (Feathering Procedure).

### 3.5d Engine Roughness

| Engine Roughness | |
|---|---|
| ALT-AIR | OPEN |
| **If roughness continues after one minute:** | |
| ALT-AIR | CLOSE |
| MIXTURE | Adjust for maximum smoothness |
| FUEL PUMP | ON |
| Engine Gauges | CHECK |
| MAG LEFT/RIGHT Switches | Individually select OFF and ON |

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

Engine roughness may be caused by blockage in the injector nozzles, induction system icing, ignition problems or too lean or rich mixture.

Adjust the mixture for smoothest operation. Move the alternate air to OPEN and turn on the electric fuel pump. Switch to XFEED on the effected engine to verify that fuel contamination is the problem. Return fuel selector to ON if problem is not corrected.

Upon completion of this checklist, if roughness persists, consider a precautionary landing.

### 3.5e Engine Indication System (EIS)

## Oil Pressure

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

Affected Engine.................................................................. VERIFY

**Low Oil Pressure:**

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

**If accompanied by high oil temperature:**

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

**If accompanied by normal oil temperature:**

***Land as soon as practical.***

**High Oil Pressure:**

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

***Land as soon as practical.***

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

A complete loss of oil pressure may signify oil exhaustion. Continued operation of the engine could result in a serious emergency situation or severe engine damage. Complete the Engine Securing Procedure (para. 3.5a) on the faulty engine. If engine oil is depleted, the engine will seize and if feathering is not initiated above 950 RPM the propeller will not feather.

### 3.5e Engine Indication System (EIS) (continued)

## High Oil / Cylinder Head Temperature

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

**Or**

**Indication: Master Warning, Triple Chime,** L ENG CHT / R ENG CHT

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

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

Excessive cylinder head temperature may parallel excessive oil temperature.

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

### 3.5e Engine Indication System (EIS) (continued)

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

**CAUTION**

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

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

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

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

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

## 3.5f Engine Fire

### Engine Fire During Start

**If engine has not started:**

MIXTURE .......................................................... CUT-OFF
THROTTLE .......................................................... FULL OPEN
ENG START .................................... CONTINUE to CRANK ENGINE

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

**If fire continues:**

FUEL Selectors .......................................................... OFF
FUEL PUMPS .......................................................... OFF
MIXTURES .......................................................... CUT-OFF
THROTTLES .......................................................... FULL OPEN
External Fire Extinguisher .......................................................... USE
Airplane .......................................................... EVACUATE

**NOTE**

If fire continues, shut down both engines and evacuate.

### Engine Fire in Flight

FUEL Selector (Affected Engine) .......................................................... OFF
THROTTLE (Affected Engine) .......................................................... CLOSE
PROPELLER (Affected Engine) .......................................................... FEATHER
MIXTURE (Affected Engine) .......................................................... CUT-OFF
COWL FLAP (Affected Engine) .......................................................... OPEN
Affected Engine .................................... COMPLETE Engine Securing Procedure

**If fire persists:**

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

***Land as soon as possible.***

### 3.5g Electrical Fire

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

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

***Land as soon as possible.***

*Prior to landing:*

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

**WARNING**

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

### 3.5h Landing Gear Unsafe

**Landing Gear Unsafe**

**Indication: Master Warning, Aural Alert,** CHECK GEAR

| | |
|---|---|
| GEAR | DOWN |
| Gear Position Indications | 3 GREEN |

**Indication: Master Caution, Aural Alert,** CHECK GEAR

| | |
|---|---|
| GEAR | DOWN (if desired) |
| Gear Position Indications | 3 GREEN |

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

### 3.5h Landing Gear Unsafe (continued)

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

The CHECK GEAR aural that is triggered by low manifold pressure may be muted by pressing the lower right softkey on the PFD. The CHECK GEAR aural that is triggered by flap position, can only be silenced by retracting the flaps or extending the landing gear.

### 3.5i Landing Gear Malfunctions

## Landing Gear Malfunction

**Indication: Master Warning, Triple Chime,** GEAR SYS

**Indication: Master Caution, Double Chime,** GEAR SYS

**Indication: EIS Landing Gear Display**

**Check following before extending gear manually:**

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

**Manual Extension of Landing Gear:**

Airspeed....................................................REDUCE (100 KIAS max.)
GEAR ......................................................................................DOWN
Emerg. Gear Extend Knob .......................... Move wire guard and PULL
Gear Position Indications .................................................3 GREEN

Leave emergency gear extension knob out.

**WARNING**

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

### 3.5j Electrical Failures

**CAUTION**

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

**NOTE**

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

## Single Alternator Failure

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

Verify Failure ......................................CHECK ALTR AMPS Indication
Electrical Load ..........................................REDUCE less than 65 AMPS
(60 AMPS if on ground)
Failed ALTR Switch ..................................................................OFF
Failed Alternator Field Circuit Breaker .......................................RESET
L ALTR FIELD Circuit Breaker (Row 2, Col. 15)
R ALTR FIELD Circuit Breaker (Row 2, Col. 16)
Failed ALTR Switch ..................................................................ON

***If alternator still failed:***

Failed ALTR Switch ..................................................................OFF
ALTR AMPS Indication ......................................................MONITOR
(MAINTAIN less than 65 AMPS)
(60 AMPS if on ground)

## 3.5j Electrical Failures (continued)

### Dual Alternator Failure

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

**CAUTION**

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

Verify Failure ....................................CHECK ALTR AMPS Indication

**Attempt to reset alternators:**

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

**If only one alternator resets:**

Operating ALTR Switch ..........................................................ON
Failed ALTR Switch ..........................................................OFF
Electrical Load ................................ MAINTAIN LESS than 65 AMPS (60 AMPS on ground)
Ammeter ..........................................................MONITOR

**If neither alternator resets:**

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

### 3.5j Electrical Failures (continued)

***To ensure 30-minutes of battery life:***

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

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

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

### 3.5j Electrical Failures (continued)

## Complete Electrical Failure

**Indication: Single Chime,** EMERG BATT ON

**CAUTION**

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

**NOTE**

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

**NOTE**

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

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

**Prior to landing:**

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

**Approximately 30 minutes of electrical power is available.**

***Land as soon as possible.***

The following equipment will operate while on the emergency bus:

- Primary Flight Display (reversionary mode)
- Engine Instruments
- COM1
- NAV1
- Standby Instrument
- Audio Panel
- Avionics Lighting/Dimming

### 3.5j Electrical Failures (continued)

**Emergency Battery Voltage**

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

**WARNING**

**Complete electrical failure is imminent.**

***Land as soon as possible.***

### 3.5k Avionics System Failures

**NOTE**

The latest appropriate revision and -XX part number of the Garmin G1000 Cockpit Reference Guide, PN 190-02199-00, and the Garmin G1000 Pilot's Guide, PN 190-02198-00, contain detailed descriptions of the G1000 and GFC 700 autopilot systems.

**PFD Failure**

**Indication: PFD display goes blank.**

Standby Instrument ........................................... Verify OPERATIONAL
Aircraft Control ..................................................Use standby instrument
DISPLAY BACKUP (red button on audio panel)...........................PUSH
(button extended)
Aircraft Control ................................. Use MFD and Standby Instrument

***Exit and avoid IMC as soon as practical.***

### 3.5k Avionics System Failures (continued)

**NOTE**

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

**NOTE**

* Multiple pieces of equipment depend on the PFD for proper functionality, including COM1 (121.5 MHz is still available), NAV1, NAV1 DME, GPS1, Traffic, and the GFC 700 autopilot. When the PFD fails, the pilot must manually fly the airplane and use COM2, NAV2, and NAV2 DME when required.

**NOTE**

* NAV1 DME will continue to function if it was being used prior to the PFD failure. If NAV2 DME is selected, NAV1 DME will no longer function.

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

When the MFD is in reversionary display mode, course deviation indications for GPS and VOR (* VOR2 only) are available on the HSI and weather products (if installed) are available for display on the inset map.

* Applicable to SN 4496395, 4496397 thru 4496431, and 4496433 thru 4496446 only.

### 3.5k Avionics System Failures (continued)

## MFD Failure

**Indication: MFD display goes blank.**

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

***Exit and avoid IMC as soon as practical.***

**NOTE**

The PFD will automatically revert to reversionary mode.

**NOTE**

XM will be inoperative. TAS and ADS-B Traffic (if installed) will be inoperative.

**NOTE**

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

**NOTE**

* Multiple pieces of equipment depend on the MFD for proper functionality, including COM2 (121.5 MHz is still available), NAV2, DME, GPS2, ADF, and ESP. When the MFD fails, the pilot must use COM1, NAV1, when required.

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

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

* Applicable to SN 4496395, 4496397 thru 4496431, and 4496433 thru 4496446 only.

### 3.5k Avionics System Failures (continued)

## AHRS Failures

<u>**AHRS Total Failure**</u>

**On Ground:**

**Indication: Sky/Ground presentation removed, course pointer straight up, red X's on all attitude and heading indicators.**

System Messages (Messages Softkey) .................................. CONSIDER
AHRS Circuit Breaker (Row 2, Col. 8) ........................................ RESET

If AHRS data still invalid:
***IFR operations not authorized.***

**In Flight:**

**Indication: Sky/Ground presentation removed, course pointer straight up, red X's on all attitude and heading indicators.**

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

**NOTE**

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

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

If AHRS data still invalid:
**Exit and avoid flight in IMC**

**NOTE**

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

**NOTE**

Traffic Advisory System (TAS) and ADS-B Traffic (if installed) symbols will not be displayed on the moving map, however TAS and ADS-B Traffic (if installed) information remain available on the TAS page.

**NOTE**

For partial AHRS failures, a red **X** will appear over the affected indication(s).

### 3.5k Avionics System Failures (continued)

## Air Data Computer (ADC) Failures

**ADC Total Failure**

**On Ground:**

**Indication: Red or yellow X's on all Air Data indications.**

System Messages (Messages Softkey)....................................CONSIDER
ADC Circuit Breaker (Row 2, Col. 7)..........................................RESET

If ADC data still invalid:

***IFR operations not authorized.***

**In Flight:**

**Indication: Red or yellow X's on all Air Data indications.**

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

**NOTE**

During failure of ADC, Traffic Advisory System (TAS) and GFC700 autopilot (including ESP and USP) will be inoperative.

If ADC data still invalid:

***Exit and avoid flight in IMC.***

## 3.5k Avionics System Failures (continued)

### Erroneous or Loss of Engine and Fuel Displays

**Indication: Yellow X over affected engine indication or fuel display**

**NOTE**

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

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

**If indications for any of the following are invalid:**

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

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

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

### 3.5k Avionics System Failures (continued)

## Erroneous or Loss of Warning/Caution CAS Messages

**Indication: Yellow X is shown over the CAS message window or CAS message present when not expected or CAS message not present when expected.**

1. If a yellow X is placed over the CAS message window, monitor engine and airframe indications.

**NOTE**

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

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

**NOTE**

CAS messages are inhibited for many parameters on the Engine Indication System (EIS) display of the MFD. The Master Warning and Master Caution indications and associated chimes are still activated whenever any indicated parameter enters the red or yellow bands.

**If a yellow X appears over the CAS message window, *land has soon as practical.***

### 3.5k Avionics System Failures (continued)

## Communications (COM1 and COM2) Failure

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

**NOTE**

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

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

***Exit and avoid IMC as soon as practical.***

## Dual GPS Failure

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

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

**If no alternate navigation sources are available:**

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

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

**WARNING**

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

### 3.5k Avionics System Failures (continued)

**WARNING**

**TAWS is Inoperative.**

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

**NOTE**

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

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

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

**NOTE**

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

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

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

TAWS and TAS are inoperative.

## 3.5k Avionics System Failures (continued)

### Autopilot Malfunction

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

**WARNING**

**Do not press the LVL switch (if installed) if an autopilot or pitch trim malfunction is suspected.**

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

### Automatic Autopilot Disconnect

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

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

**NOTE**

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

### 3.5k Avionics System Failures (continued)

## Electric Pitch Trim Failure

**Indication: Red boxed PTRM on PFD**

**NOTE**

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

Autopilot ........................................................................ DISCONNECT

## Electric Pitch Trim Runaway

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

**WARNING**

**Do not press the LVL switch (if installed) if an autopilot or pitch trim malfunction is suspected.**

**NOTE**

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

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

### 3.5k Avionics System Failures (continued)

## Autopilot Overspeed Recovery

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

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

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

**NOTE**

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

## Autopilot Underspeed Recovery

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

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

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

## 3.5k Avionics System Failures (continued)

### Autopilot Out-Of-Trim

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

***CAUTION***

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

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

***CAUTION***

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

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

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

## 3.5k Avionics System Failures (continued)

### Abnormal Flight Director Mode Transitions

**Indication: Flashing lateral or vertical mode annunciations on PFD**

**NOTE**

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

**Loss of selected vertical mode**

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

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

**Loss of selected lateral mode**

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

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

### Autopilot Preflight Test Failure

**Indication: Red Boxed PFT on PFD**

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

**NOTE**

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

## 3.5k Avionics System Failures (continued)

### Loss Of Navigation Information

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

**NOTE**

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

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

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

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

### 3.5k Avionics System Failures (continued)

| Cooling Fan Failures |
|---|
| **Indication: CAS Advisory, Single Chime,** AV FAN FAIL / PFD FAN FAIL / MFD FAN FAIL |
| **If failure occurs on ground:** |
| ***Do not fly until issue is resolved.*** |
| **If failure occurs in flight:** |
| ***Fix issue prior to next flight.*** |

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

| Pitot Heat |
|---|
| **Indication: Master Caution, No Chime,** PITOT HEAT OFF |
| PITOT HEAT Switch........................................................ON (If desired) |
| **Indication: Master Caution, Double Chime,** PITOT HEAT FAIL |
| PITOT HEAT Switch........................................................................OFF |
| PITOT HEAT Circuit Breaker (Row 2, Col. 2) ............................RESET |
| PITOT HEAT Switch.........................................................................ON |
| **If Pitot Heat still inoperative:** |
| ***Exit and Avoid Instrument Meteorological Conditions.*** |

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

### 3.5l Hydraulic Pump Failures

## Hydraulic Pump Failures

**Hydraulic pump will not deactivate:**

**Indication: Master Caution, Double Chime, HYDR PUMP ON**

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

***Prior to landing:***

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

***If GEAR PUMP Circuit Breaker Opens:***

Complete Manual Extension of Landing Gear checklist

**Hydraulic pump will not activate:**

**Indication: Gear Position Indications remain in current position**

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

***If landing gear remains up (prior to landing):***

Complete Manual Extension of Landing Gear checklist

***If landing gear remains down:***

Airspeed.........................................REMAIN BELOW VLE (140 KIAS)

### 3.5m Starter Engaged

**Starter Engaged**

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

**If on the ground:**

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

**If in flight:**

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

***Land as soon as possible.***

### 3.5n Spin Recovery (Intentional Spins Prohibited)

**Spin Recovery**

**WARNING**

**Intentional Spins Prohibited.**

**NOTE**

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

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

### 3.5o Open Door

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

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

### 3.5p Propeller Overspeed

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

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

### 3.5q Emergency Descent

| Emergency Descent | |
|---|---|
| THROTTLES | CLOSED |
| PROPELLERS | FULL INCREASE |
| MIXTURES | AS REQUIRED |
| GEAR (Below 140 KIAS) | DOWN |
| Airspeed | 140 KIAS |

### 3.5r Emergency Exit

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

### 3.5s Heater Overheat

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

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

### 3.5t Carbon Monoxide CAS Indications

**CO Detector Warning**

**Indication: Master Warning, Triple Chime,** CO LVL HIGH

**If the CO Detector Warning or Caution activates in flight:**

Press the CO RST softkey (on the engine page) to reset the CO Detector.

***If the Warning or Caution continues:***

Shut off the heater and any other opening to the engine compartment.

Open a fresh air source immediately.

Don't smoke.

***Land as soon as practical.***

Be sure the source of the contamination is corrected before further flight.

**NOTE**

The caution CAS message will remain until the CO level drops below 50 parts per million (PPM) by volume of carbon monoxide concentration. Do not recycle the unit through the circuit breaker. A three-minute delay is required for the CO sensor to stabilize after each power-up.

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# SECTION 4

# NORMAL PROCEDURES

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## SECTION 4

## NORMAL PROCEDURES

# SECTION 4

# NORMAL PROCEDURES

## 4.1 GENERAL

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

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

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

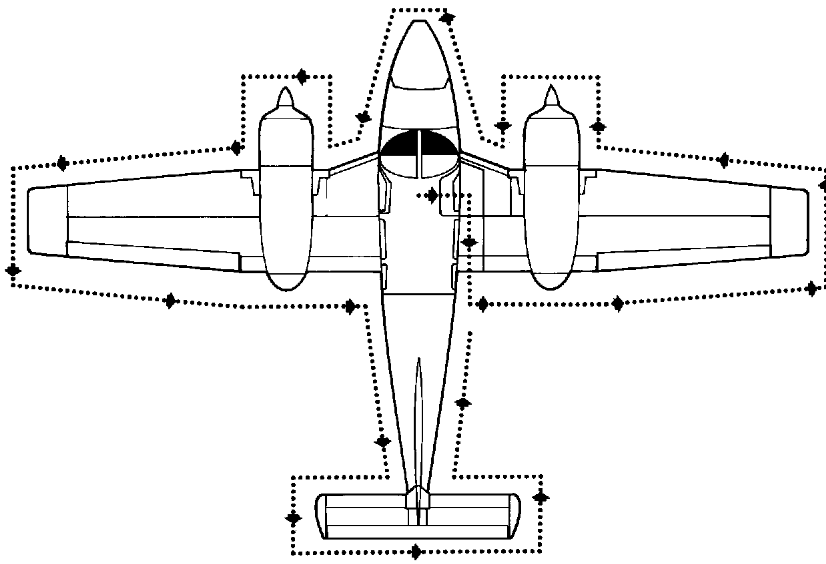
Normal operating procedures associated with optional systems and equipment, which require handbook supplements, are presented in Section 9, Supplements.

## 4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are for standard airplanes flown at gross weight under standard conditions at sea level.

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

(a) Best Rate of Climb Speed (Vy) .............................................. 88 KIAS
(b) Best Angle of Climb Speed (Vx) ........................................... 82 KIAS
(c) Maximum Operating Maneuvering
Speed (Vo).................................... 135 KIAS (115 KIAS @ 2870 LB)
See Airspeed Limitations Section 2.3
(d) Maximum Flap Speed ........................................................... 111 KIAS
(e) Landing Final Approach Speed (Flaps 40 degrees)
Short Field Effort ..................................................................... 75 KIAS
(f) Intentional One Engine Inoperative Speed ($V_{SSE}$) ................ 82 KIAS
(g) Maximum Demonstrated Crosswind Velocity....................... 17 KIAS



**WALK-AROUND**
Figure 4-1

## 4.5 NORMAL PROCEDURES CHECKLIST

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

## 4.5 NORMAL PROCEDURES CHECKLIST (continued)

### 4.5a Preflight Checklists

**COCKPIT**

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

**CAUTION**

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

---

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

## 4.5 NORMAL PROCEDURES CHECKLIST (continued)

### 4.5a Preflight Checklists (continued)

#### RIGHT WING

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

---

Eight quarts of oil are required for maximum range flights.

## 4.5a Preflight Checklists (continued)

### NOSE SECTION

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

### LEFT WING

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

---

Eight quarts of oil are required for maximum range flights.

## 4.5a Preflight Checklists (continued)

### FUSELAGE (LEFT SIDE)

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

### EMPENNAGE

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

### FUSELAGE (RIGHT SIDE)

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

### MISCELLANEOUS

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

***CAUTION***

*Care should be taken when checking the heated pitot head. The unit becomes very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.*

PITOT HEAT Switch ........................................ ON
Exterior Lighting Switches ........................................ ON & CHECK
Pitot/Static Head ........................................ CHECK - WARM
PITOT HEAT Switch ........................................ OFF
All Lighting Switches ........................................ OFF
BATT MASTR Switch ........................................ OFF
Passengers ........................................ BOARD

## 4.5b Before Starting Engine Checklists

### BEFORE STARTING ENGINE

Preflight Check ........................................ COMPLETED
Flight Planning ........................................ COMPLETED
Cabin Door .................... CLOSE & LATCH (Lower then Upper)
Seats ........................................ ADJUSTED & LOCKED
Seatbelts and Harness ................................ FASTEN/ADJUST
CHECK INERTIA REEL
PARK BRAKE ........................................ SET
GEAR ........................................ DOWN
THROTTLES ........................................ IDLE
PROPELLERS ........................................ FULL INCREASE
MIXTURES ........................................ CUT-OFF
Friction Handle ........................................ AS DESIRED
ALT-AIR ........................................ CLOSE
COWL FLAPS ........................................ OPEN
Stabilator & Rudder Trim ........................................ SET
FUEL Selectors ........................................ ON
LEFT/RIGHT ALTR Switches .... ON (OFF, if external power connected)
EMERG BATT ........................................ ARM
E VOLTS Indication ........................ 23.3 VOLTS (minimum)
AVION MASTER Switch ........................................ OFF
STROBE LIGHTS ........................................ FIN STROBE
All Other Electrical Switches ........................................ OFF
CABIN HEAT Switch ........................................ OFF
Circuit Breakers ........................................ CHECK
Proceed with appropriate Engine Start Checklist.

**NOTE**

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

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

## 4.5c Engine Start Checklists

### ENGINE START - GENERAL

**WARNING**

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

**NOTE**

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

**NOTE**

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

## 4.5c Engine Start Checklists (continued)

### NORMAL START - COLD ENGINE

BATT MASTR Switch ........................................ ON
Gear Position Indications ........................................ 3 GREEN
CAS Messages ........................................ CONSIDER ANY ILLUMINATED
PFD Annunciations ........................................ CONSIDER ANY ILLUMINATED
THROTTLES ........................................ 1/4 inch OPEN
PROPELLERS ........................................ FULL INCREASE
*FUEL PUMP ........................................ ON
*MAG LEFT/RIGHT Switches ........................................ ON
*MIXTURE ........................................ PRIME - then CUT-OFF
*Propeller Area ........................................ CLEAR
*ENG START ........................................ ENGAGE
*MIXTURE ........................................ ADVANCE
*THROTTLE ........................................ ADJUST WHEN ENGINE STARTS TO 1000 RPM
*OIL PSI ........................................ CHECK

Repeat above procedure (*) for second engine start
VOLTS ........................................ CHECK
ALTR AMPS ........................................ CHECK
FUEL PUMPS ........................................ OFF

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

## 4.5c Engine Start Checklists (continued)

### NORMAL START - HOT ENGINE

BATT MASTR Switch .......... ON
Gear Position Indications .......... 3 GREEN
CAS Messages .......... CONSIDER ANY ILLUMINATED
PFD Annunciations .......... CONSIDER ANY ILLUMINATED
THROTTLES .......... 1/2 inch OPEN
PROPELLERS .......... FULL INCREASE
*MIXTURE .......... CUT-OFF
*FUEL PUMP .......... ON
*MAG LEFT/RIGHT Switches .......... ON
*Propeller Area .......... CLEAR
*ENG START .......... ENGAGE
*MIXTURE .......... ADVANCE
*THROTTLE .......... ADJUST to LOW RPM
*OIL PSI .......... CHECK

If engine does not start, add small amount of prime and repeat above.

Repeat above procedure (*) for second engine start
VOLTS .......... CHECK
ALTR AMPS .......... CHECK
FUEL PUMPS .......... OFF

### 4.5c Engine Start Checklists (continued)

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

**WARNING**

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

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

BATT MASTR Switch ........................................ OFF
LEFT/RIGHT ALTR Switches ........................................ VERIFY OFF
External Power (24-28 VDC source) ........................................ CONNECT
Gear Position Indications ........................................ 3 GREEN
CAS Messages ........................................ CONSIDER ANY ILLUMINATED
PFD Annunciations ........................................ CONSIDER ANY ILLUMINATED
THROTTLES ........................................ 1/4 inch OPEN
PROPELLERS ........................................ FULL INCREASE
*FUEL PUMP ........................................ ON
*MAG LEFT/RIGHT Switches ........................................ ON
*MIXTURE ........................................ PRIME - then CUT-OFF
*Propeller Area ........................................ CLEAR
*ENG START ........................................ ENGAGE
*MIXTURE ........................................ ADVANCE
*OIL PSI ........................................ CHECK

If engine does not start, add prime and repeat above.

Repeat above procedure (*) for second engine start
THROTTLES ........................................ LOWEST POSSIBLE RPM
BATT MASTR Switch ........................................ ON
External Power ........................................ DISCONNECT
LEFT/RIGHT ALTR Switches ........................................ ON
VOLTS ........................................ CHECK
ALTR AMPS ........................................ CHECK
FUEL PUMPS ........................................ OFF

## 4.5c Engine Start Checklists (continued)

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

After engine start and the throttle is set as desired, the oil pressure should be checked for a positive indication. If no oil pressure is indicated within 30-seconds, shut down the engine and have it checked. In cold weather it may take somewhat longer for an oil pressure indication.

**NOTE**

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

### ENGINE START WHEN FLOODED

BATT MASTR Switch ........................................ ON
Gear Position Indications ........................................ 3 GREEN
CAS Messages ........................................ CONSIDER ANY ILLUMINATED
PFD Annunciations ........................................ CONSIDER ANY ILLUMINATED
THROTTLES ........................................ OPEN FULL
PROPELLERS ........................................ FULL FORWARD
MIXTURES ........................................ CUT-OFF
*FUEL PUMP ........................................ OFF
*MAG LEFT/RIGHT Switches ........................................ ON
*Propeller Area ........................................ CLEAR
*ENG START ........................................ ENGAGE
*MIXTURE ........................................ ADVANCE
*THROTTLE ........................................ RETARD
*OIL PSI ........................................ CHECK

Repeat above procedure (*) for second engine start

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

## 4.5c Engine Start Checklists (continued)

### ENGINE START WITH EXTERNAL POWER SOURCE

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

**NOTE**

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

External Power (24-28 VDC source) ........................................ CONNECT
Gear Position Indications ........................................ 3 GREEN
CAS Messages ........................................ CONSIDER ANY ILLUMINATED
PFD Annunciations ........................................ CONSIDER ANY ILLUMINATED
THROTTLES ........................................ 1/4 inch OPEN
PROPELLERS ........................................ FULL INCREASE
*FUEL PUMP ........................................ ON
*MAG LEFT/RIGHT Switches ........................................ ON
*MIXTURE ........................................ PRIME - then CUT-OFF
*Propeller Area ........................................ CLEAR
*ENG START ........................................ ENGAGE
*MIXTURE ........................................ ADVANCE
*THROTTLE ........................................ ADJUST WHEN ENGINE STARTS TO 1000 RPM
*OIL PSI ........................................ CHECK

Repeat above procedure (*) for second engine start

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

### 4.5d Warm-Up Checklist

**WARM-UP**

THROTTLES....................1000 to 1200 RPM

**BEFORE TAXIING**

External Power Source.................... VERIFY REMOVED
BATT MASTR Switch.................... VERIFY ON
FUEL Selectors....................ON, BOTH XFEED (30 SEC), ON
AVION MASTER Switch....................ON
MFD splash screen....................Verify Database Currency
FUEL Totalizer....................FOB SYNC or ENTER MANUALLY
CAS Messages.................... CONSIDER ANY ILLUMINATED
PFD Annunciations.................... CONSIDER ANY ILLUMINATED
System Messages (Messages Softkey).................... Consider
TRAFFIC (if installed)....................TEST
ANN Test Softkey....................PRESS

**CAUTION**

*Adjust headset volume to hear the STALL..STALL voice alert at an acceptable level. This will ensure all aural alerts and tones will be audible through the headset.*

Standby Flight Instrument....................VERIFY ON with no red X's or failure annunciations
Altimeters (Standby and PFD)....................SET
Lights.................... AS REQUIRED
CABIN HEAT....................AS DESIRED
Radios....................CHECK & SET
Autopilot....................Verify Preflight Self-Test (PFT) completed and disconnect tone heard.
FUEL Selectors.................... VERIFY ON
Passenger Briefing....................COMPLETE
PARK BRAKE.................... RELEASE

---

To test the traffic system (if installed), the ADS-B softkey on the Map - Traffic Map page on the MFD must be selected off. The ANN Test softkey is located on the Aux-System Status page of the MFD.

## 4.5e Taxiing Checklist

### TAXIING

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

**NOTE**

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

## 4.5f Ground Check Checklist

### GROUND CHECK

PARK BRAKE...................................................SET
MIXTURES.....................................................FULL RICH
PROPELLERS...................................................FULL INCREASE
Engine Instruments...........................................CHECK
THROTTLES....................................................1500 RPM
PROPELLERS (Max. Drop - 500 RPM)...........................FEATHER - CHECK
THROTTLES....................................................2000 RPM
LEFT/RIGHT MAG (Max. Drop - 175 RPM:
Max. Diff. - 50 RPM).........................................CHECK
ALT-AIR......................................................CHECK
THROTTLES....................................................2200 RPM
PROPELLERS (Max. Drop - 300 RPM)...........................EXERCISE
THROTTLES (550 to 650 RPM)...................................IDLE - CHECK
FUEL PUMPS...................................................ON
THROTTLES....................................................1000 RPM
Friction Handle..............................................SET

### 4.5f Ground Check Checklist (continued)

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

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

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

**If E VOLTS greater than or equal to 23.3 VOLTS:**

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

Operation of an engine on one magneto should be kept to a minimum.

### 4.5f Ground Check Checklist (continued)

The governor can be checked by retarding the propeller control until a drop of 100 RPM to 200 RPM appears, then advancing the throttle to get a slight increase in manifold pressure. The propeller speed should stay the same when the throttle is advanced, indicating proper function of the governor.

Alternate air should also be checked prior to takeoff to be sure the control is operating properly. Avoid prolonged ground operation with alternate air OPEN as the air is unfiltered.

### 4.5g Before Takeoff Checklist

**BEFORE TAKEOFF**

Flight Controls ........................................FREE and CORRECT
Flight Instruments ........................................CHECK
Engine Instruments ........................................CHECK
FUEL QTY ........................................SUFFICIENT
PROPELLERS ........................................FULL INCREASE
MIXTURES ........................................FULL RICH
ALT-AIR........................................CLOSE
COWL FLAPS ........................................OPEN
FLAPS........................................CHECK & SET
Stabilator and Rudder Trims........................................SET
FUEL Selectors ........................................ON
CAS Messages ........................................CONSIDER ANY ILLUMINATED
PFD Annunciations........................................CONSIDER ANY ILLUMINATED
System Messages (Messages Softkey)........................................Consider
Transponder........................................AS REQUIRED
FUEL PUMPS........................................ON
PITOT HEAT........................................AS REQUIRED
STROBE LIGHTS ........................................ON
Door........................................LATCHED (Lower then Upper)
PARK BRAKE ........................................RELEASE

***CAUTION***

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

### 4.5h Takeoff Checklist

**CAUTION**

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

**NOTE**

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

Takeoff should not be attempted with ice or frost on the wings. Takeoff distances and 50-foot obstacle clearance distances are shown on the 0° FLAP, SHORT FIELD PERFORMANCE TAKEOFF chart in the Performance Section of this Handbook. The performance shown on charts will be reduced by uphill gradient, tailwind component, soft, wet, rough or grassy surface, or poor pilot technique.

**NORMAL TAKEOFF**

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

**NOTE**

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

---

When obstacle clearance is not a factor, a normal takeoff technique may be used with flaps set to 0° or 10°. Set the stabilator trim indicator in the takeoff range. Accelerate to 75 KIAS and ease back on the control wheel enough to let the airplane lift off. After lift-off, accelerate to the best rate of climb speed, 88 KIAS, retracting the landing gear and flaps while accelerating.

### 4.5h Takeoff Checklist (continued)

#### 0° FLAP, SHORT FIELD PERFORMANCE TAKEOFF

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

---

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

### 4.5i Climb Checklist

#### MAXIMUM PERFORMANCE CLIMB

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

## 4.5i Climb Checklist (continued)

**CRUISE CLIMB (4.25b)**

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

---

After attaining an altitude for adequate terrain and obstacle clearance, a cruise climb speed of 105 KIAS or higher is recommended. The combination of reduced power and increased climb speed provides better engine cooling, less engine wear, reduced fuel consumption, lower cabin noise level, and better forward visibility. When reducing engine power, the throttles should be retarded first, followed by the propeller controls. Consistent operational use of cruise climb power settings is strongly recommended since this practice will make a substantial contribution to fuel economy, increased engine life, and will reduce the incidence of premature engine overhauls.

## 4.5j Cruise Checklist

**CRUISING**

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

**WARNING**

**Flight in icing conditions is prohibited. If icing is encountered, select alternate air and take immediate action to exit icing conditions. Ensure PITOT HT is ON. Monitor engines and select ALT-AIR OPEN if roughness or power loss is experienced. Icing is hazardous due to greatly reduced performance, loss of forward visibility, possible longitudinal control difficulties and impaired power plant and fuel system operation.**

## 4.5j Cruise Checklist (continued)

### CRUISING (continued)

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

Best economy mixture is obtained by moving the mixture control aft until peak EGT is reached. Performance Cruise mixture is obtained by leaning to peak EGT and then enrichening until the EGT is 125°F rich of the peak value. Under some conditions of altitude and throttle position, the engine may exhibit roughness before peak EGT is reached. If this occurs, the EGT corresponding to the onset of engine roughness should be used as the peak reference value.

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

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

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

Alternator outputs will vary with the electrical equipment in use and the state of charge of the battery. ALTR AMPS should not exceed 60 amperes on the ground or 65 amperes in flight. The VOLTS indication will flash red if bus voltage drops below minimum requirements.

IFR operation is not recommended with a single alternator.

## 4.5j Cruise Checklist (continued)

### CRUISING (continued)

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

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

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

## 4.5k Descent Checklist

### DESCENT

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

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

## 4.5l Approach and Landing Checklist

### APPROACH AND LANDING

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

**NOTE**

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

**NOTE**

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

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

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

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

## 4.5l Approach and Landing Checklist (continued)

### NORMAL LANDING

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

---

Landing may be made with any flap setting. Normally full flaps are used, which reduces stall speed and permits slower speed at contact. Maximum braking after touch-down is achieved by retracting the flaps, applying back pressure to the wheel and applying pressure on the brakes. However, unless maximum braking is needed or unless a strong crosswind or gusty condition exists, it is best to wait until turning off the runway to retract the flaps. This will permit full attention to be given to the landing and landing rollout.

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

**NOTE**

The maximum demonstrated crosswind component during landing is 17 KTS.

### 4.5l Approach and Landing Checklist (continued)

**SHORT FIELD PERFORMANCE LANDING**

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

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

### 4.5m Go-Around Checklist

**GO-AROUND**

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

**WARNING**

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

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

### 4.5n After Landing Checklist

**AFTER LANDING**

Clear of runway.
FLAPS .................... RETRACT
COWL FLAPS .................... FULL OPEN
ALT-AIR .................... CLOSE
FUEL PUMPS .................... OFF
LIGHTS .................... AS REQUIRED
PITOT HEAT .................... OFF

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

## 4.5o Stopping Engine Checklist

### STOPPING ENGINE

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

**NOTE**

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

**NOTE**

In case the standby instrument remains “ON” due to improper shutdown, the unit switches to internal battery and depletes it. To turn off the Aspen EBD, press the “SHUT DOWN” command from Main Menu page 6 or hold the red “REV” button for 20 seconds. To turn off the Garmin G5, press and hold the power button for five seconds.

## 4.5p Mooring Checklist

**MOORING**

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

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

The ailerons and stabilator should be secured by looping the seat belt through the control wheel and pulling it snug. The rudder need not be secured under normal conditions, as its connection to the nose wheel holds it in position. The flaps are locked when in the fully retracted position. Wheel chocks should be positioned in place, or the parking brake set. Tie-down ropes may be attached to mooring rings under each wing and to the tail skid.

## 4.5q VSSE - Intentional One Engine Inoperative Speed

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 PA-44-180 is 82 KIAS.

### 4.5r VMCA - Air Minimum Control Speed

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

VMCA DEMONSTRATION

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

**CAUTION**

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

**CAUTION**

*One engine inoperative stalls are not recommended.*

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

### 4.5s Practice One Engine Inoperative Flight

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

**CAUTION**

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

Propeller rpm for Zero Thrust

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

### 4.5t Noise Level

The corrected noise levels for this aircraft are as follows:

| Propeller Designation | 14 CFR Part 36 | ICAO Annex 16 |
|---|---|---|
| Straight Blade<br>HC-C2Y(K,R)-2CEUF/FC7666A-2R<br>HC-C2Y(K,R)-2CLEUF/FJC7666A-2R | 74.7 dB(A)<br>(Amdt. 36-4) | 74.7 dB(A)<br>(Vol I, Part II, Ch 6) |
| Scimitar Blade<br>HC-C2YR-2CEUFP/FC7497<br>HC-C2YR-2CLEUFP/FJC7497 | 82.4 dB(A)<br>(Amdt. 36-28) | 82.4 dB(A)<br>(Vol I, Ch 10) |

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 14 CFR Part 36 - Noise Standards: Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all 14 CFR Part 36 noise standards applicable to this type.

### 4.5u Stalls

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

**NOTE**

The stall warning system is inoperative with the Battery Master OFF

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## SECTION 5

## PERFORMANCE

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# SECTION 5

# PERFORMANCE

## 5.1 GENERAL

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

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

## 5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

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

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

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

## 5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING (continued)

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

**WARNING**

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

## 5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

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

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

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

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

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

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

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

(b) Takeoff and Landing

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

## 5.5 FLIGHT PLANNING EXAMPLE (continued)

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

Apply the departure airport conditions and takeoff weight to the appropriate takeoff performance graphs (Figures 5-11, 5-13 and 5-15) to determine the necessary runway length for takeoff and/obstacle clearance.

Calculate the landing distance using the existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below.

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

**NOTE**

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

*reference Figure 5-15

**reference Figure 5-35

## 5.5 FLIGHT PLANNING EXAMPLE (continued)

(c) Climb

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

First determine the Fuel, Time and Distance to Climb from sea level to the desired cruise altitude and OAT. Then determine the Fuel, Time and Distance to Climb from sea level to the departure field pressure altitude and OAT. Subtract the departure field values from the cruise values to get the true Time, Fuel and Distance to Climb for the flight. See the following example (reference Figure 5-23):

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

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

*reference Figure 5-23

## 5.5 FLIGHT PLANNING EXAMPLE (continued)

(d) Descent

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

First determine the Fuel, Time and Distance to Descend from cruise altitude and OAT to sea level. Then determine the Fuel, Time and Distance to Descend from the destination field altitude and OAT to sea level. Then subtract the destination field values from the cruise values to get the true Time, Fuel and Distance to Descend for the flight. See the following example (reference Figure 5-33):

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

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

*reference Figure 5-33

## 5.5 FLIGHT PLANNING EXAMPLE (continued)

(e) Cruise

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

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

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

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

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

*reference Figure 5-27

## 5.5 FLIGHT PLANNING EXAMPLE (continued)

(f) Total Flight Time

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

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

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

(g) Total Fuel Required

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

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

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

## 5.7 PERFORMANCE GRAPHS

### LIST OF FIGURES

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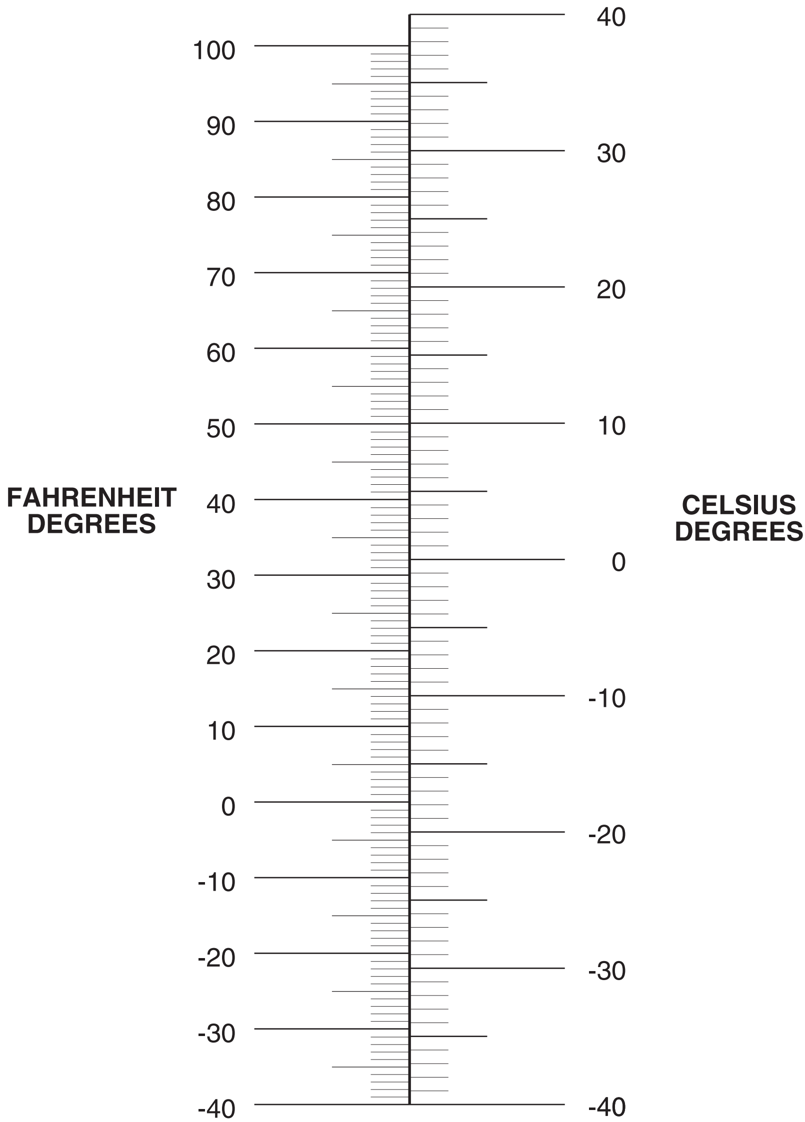
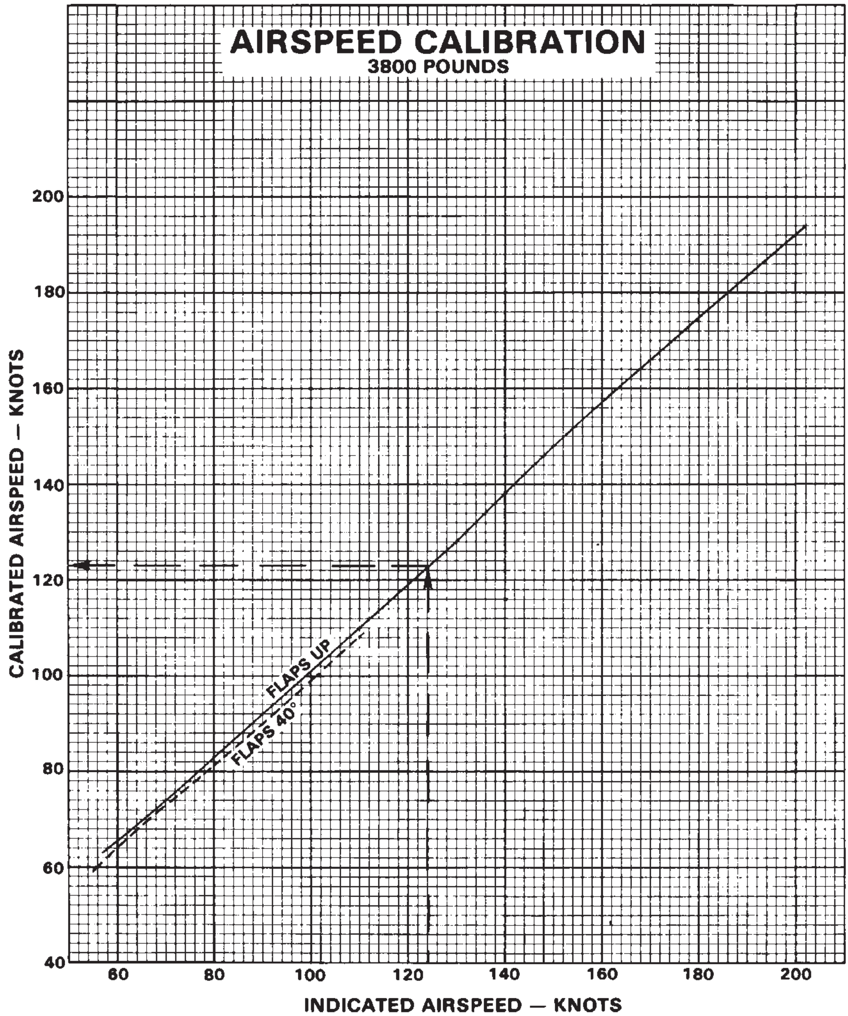
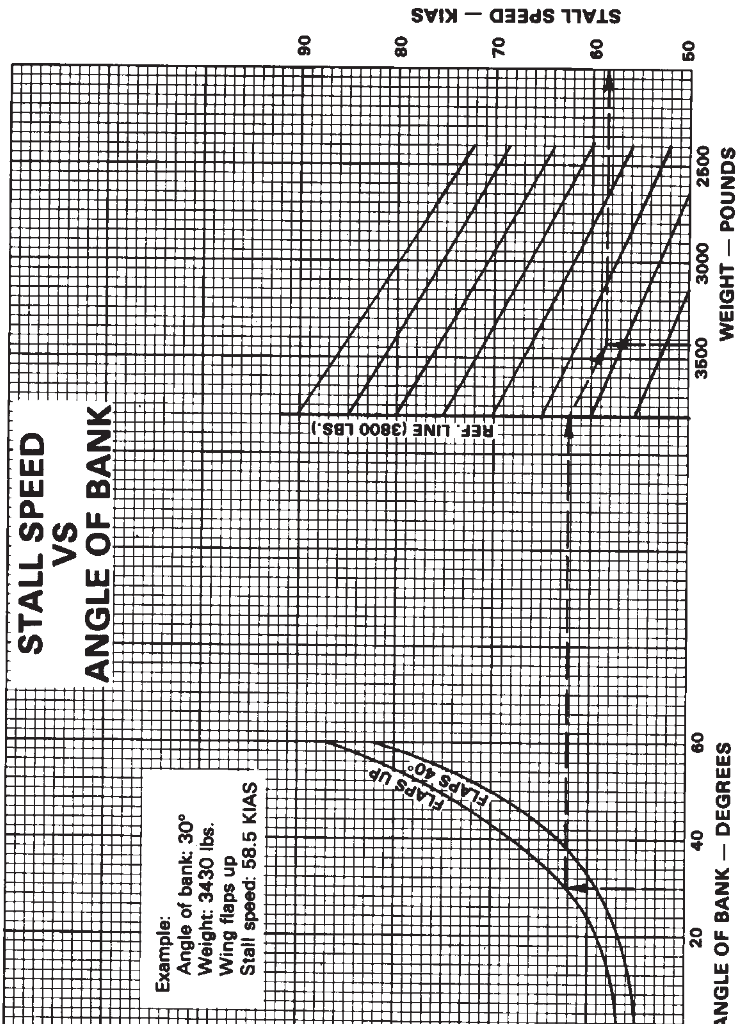



**Temperature Conversion**
Figure 5-1

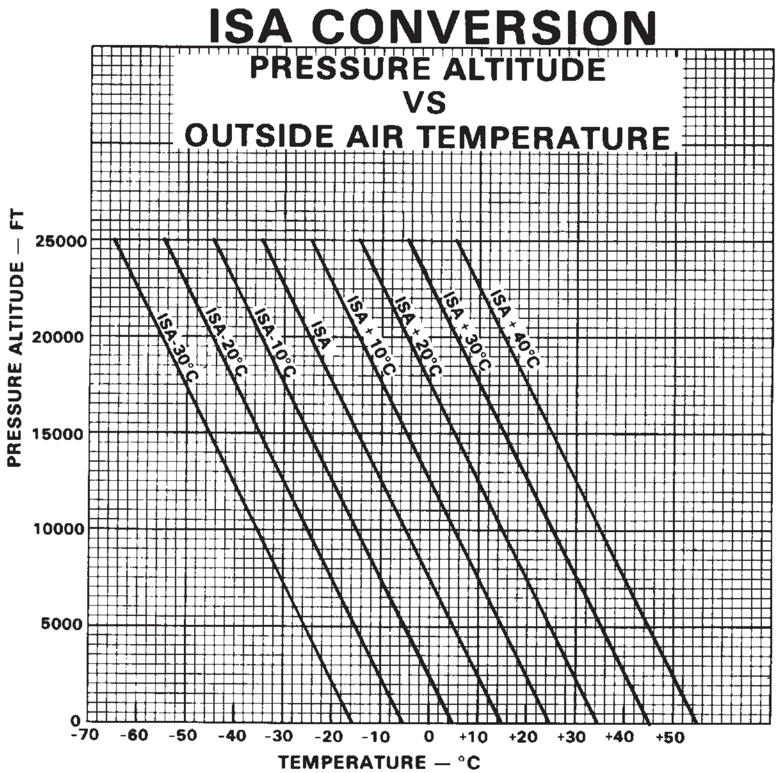



Example:
Indicated airspeed: 124 knots
Flaps up
Calibrated airspeed: 123 knots

**Airspeed Calibration**
Figure 5-3



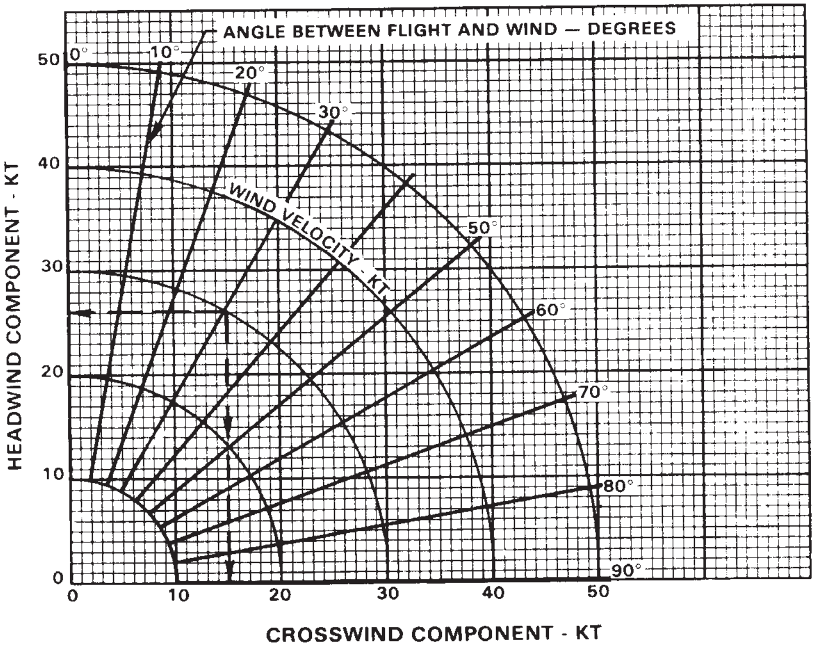

**Stall Speed Vs. Angle of Bank**
Figure 5-5



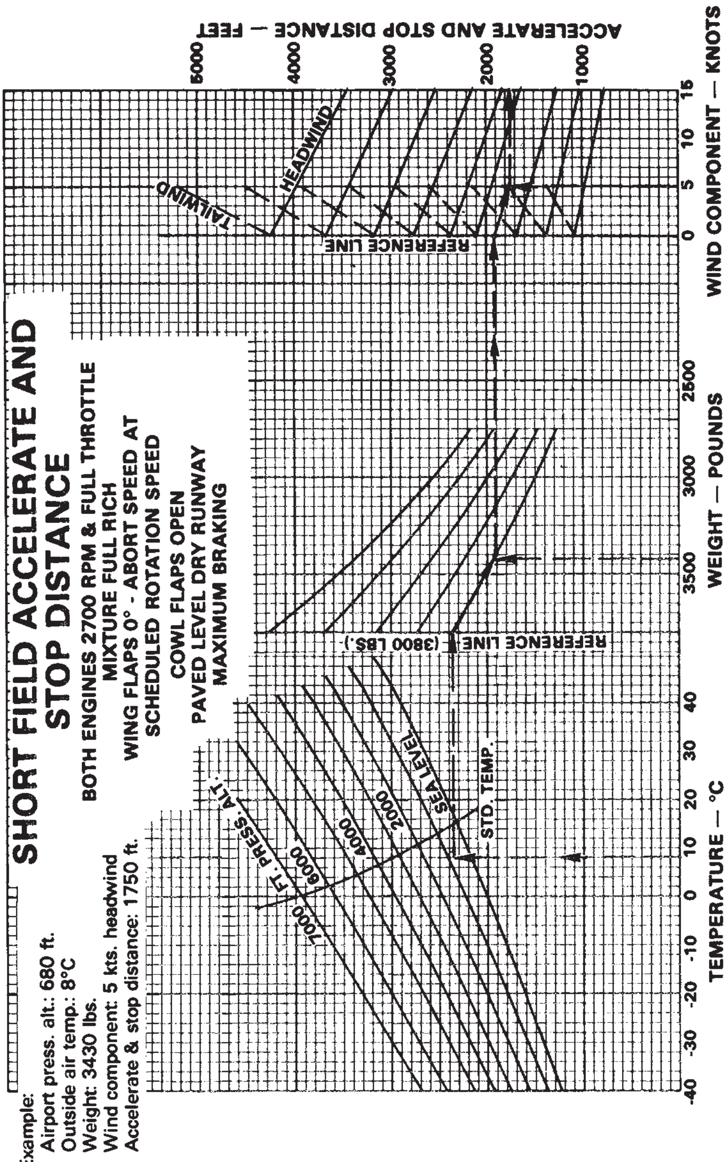

**ISA Conversion**
Figure 5-7

# WIND COMPONENTS

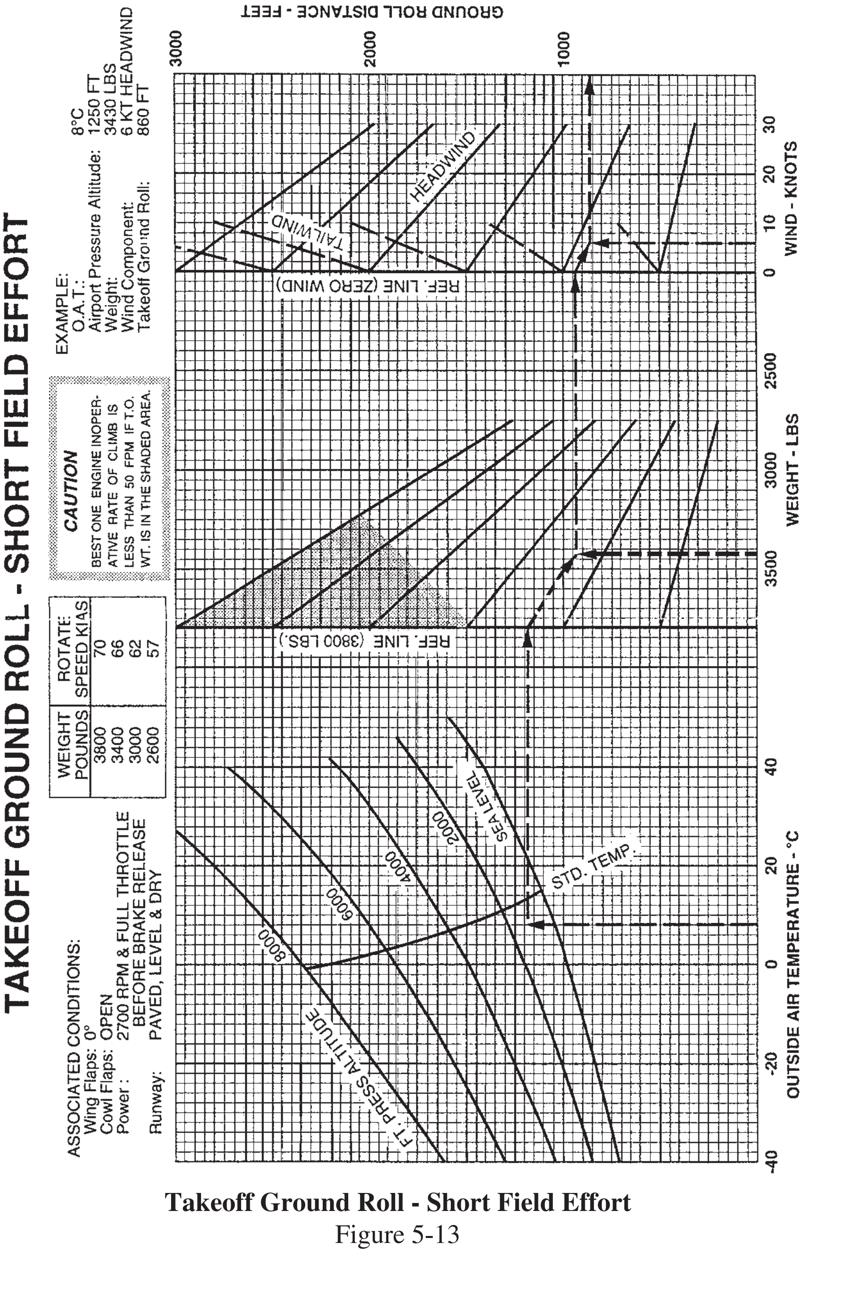
Example:
Wind velocity: 30 KT
Angle between flight path and wind: 30°
Headwind: 26 KT
Crosswind component: 15 KT




**Wind Components**
Figure 5-9




**Accelerate And Stop Distance - Short Field Effort**
Figure 5-11




**Takeoff Ground Roll - Short Field Effort**
Figure 5-13

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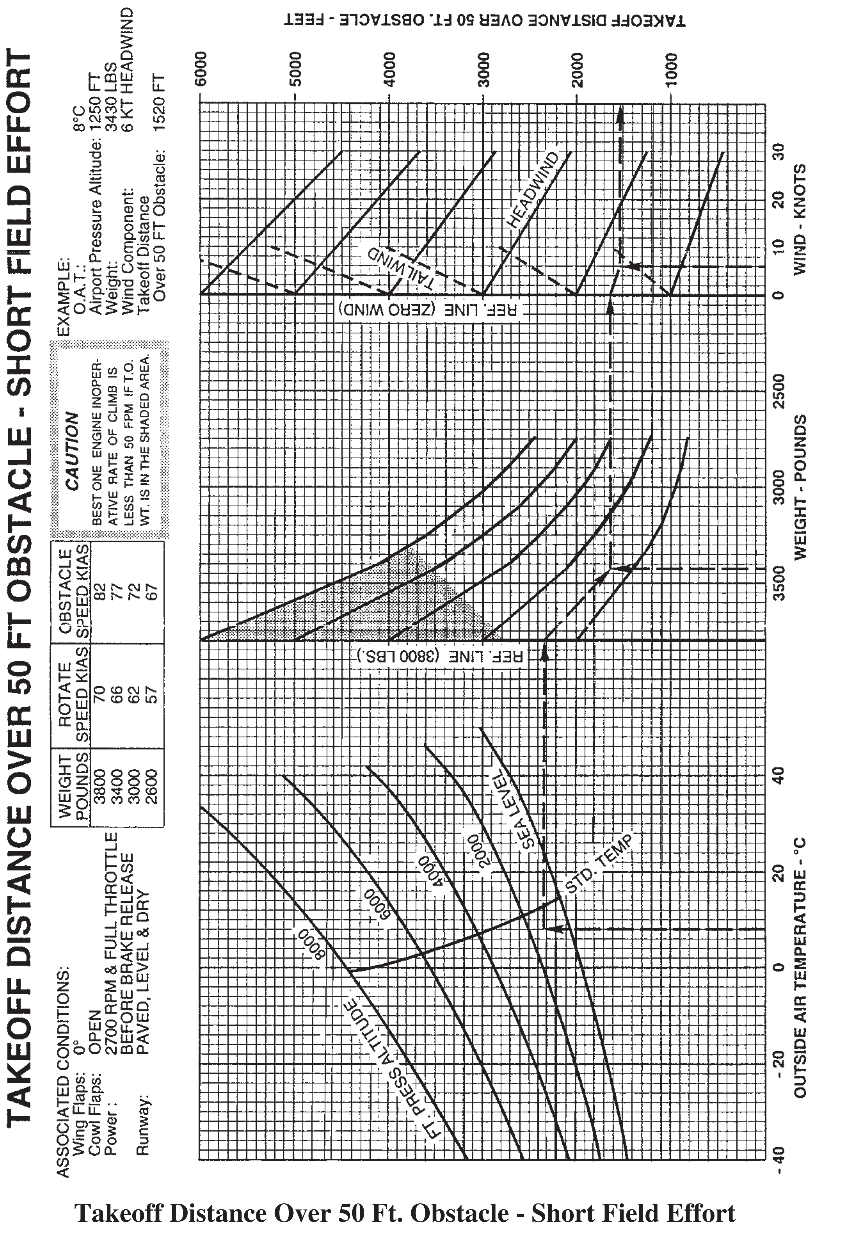


**Takeoff Distance Over 50 Ft. Obstacle - Short Field Effort**
Figure 5-15

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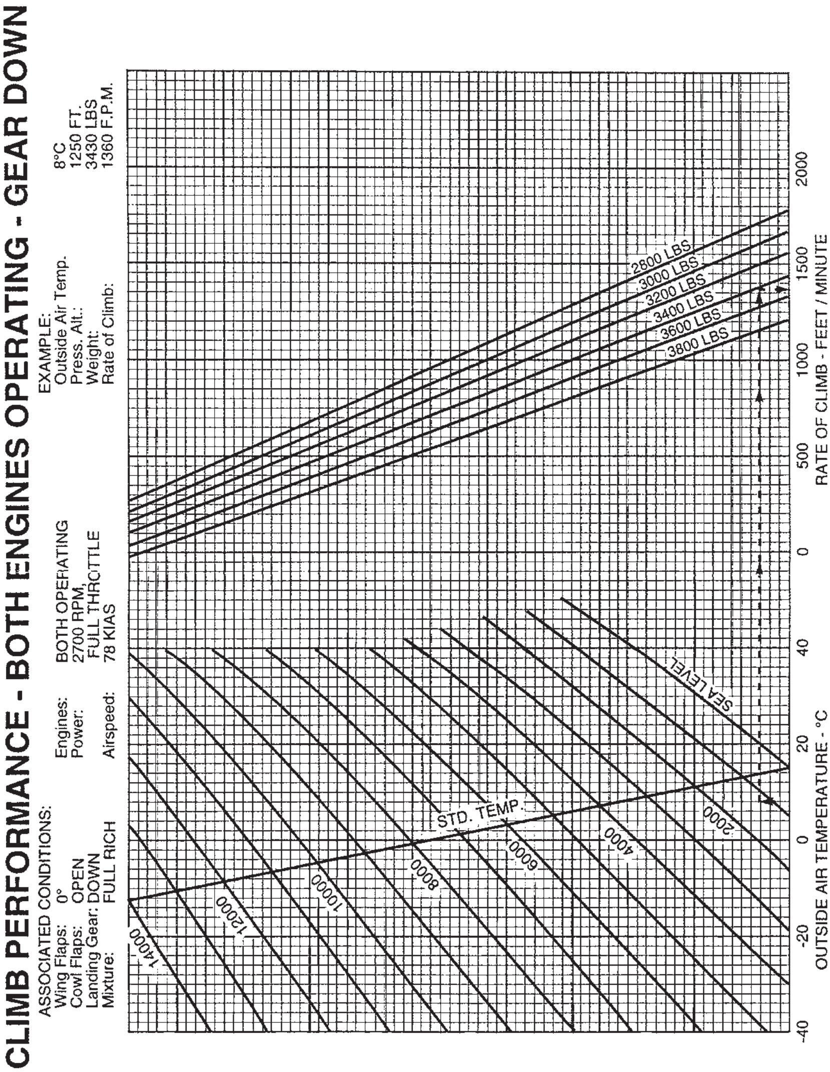


**Climb Performance - Both Engines Operating - Gear Down**

Figure 5-17

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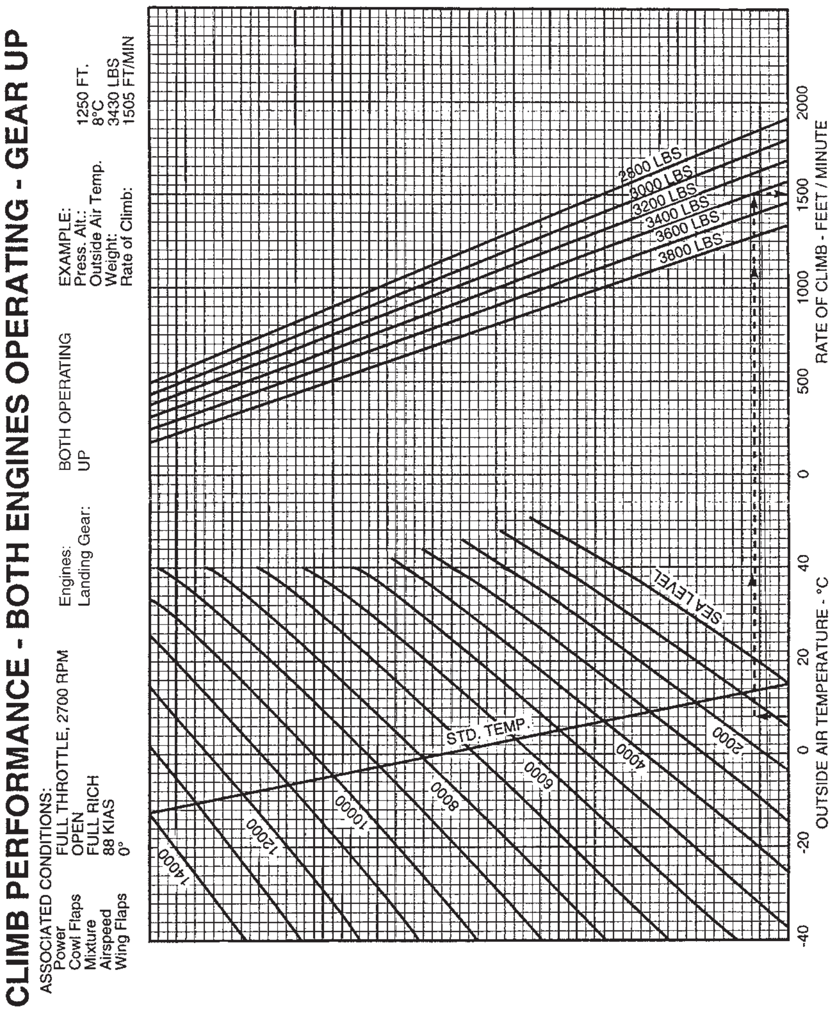
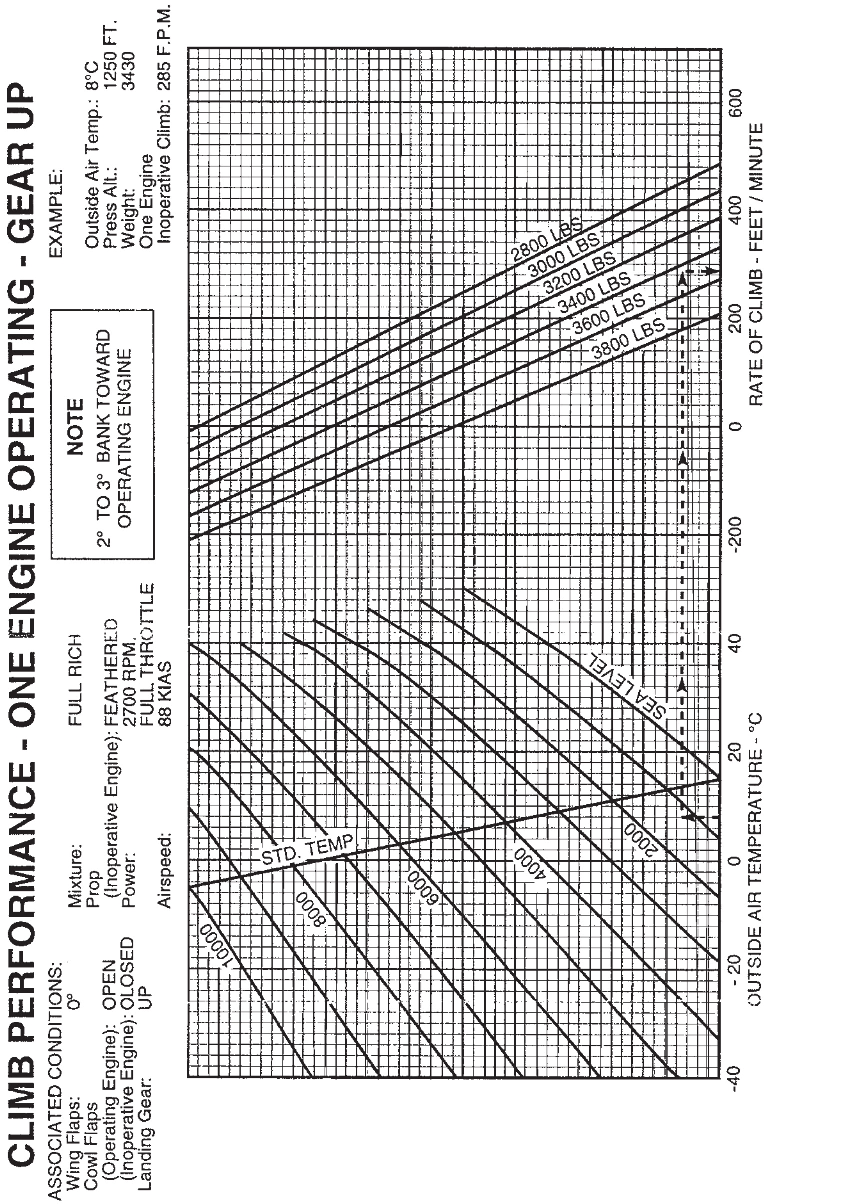
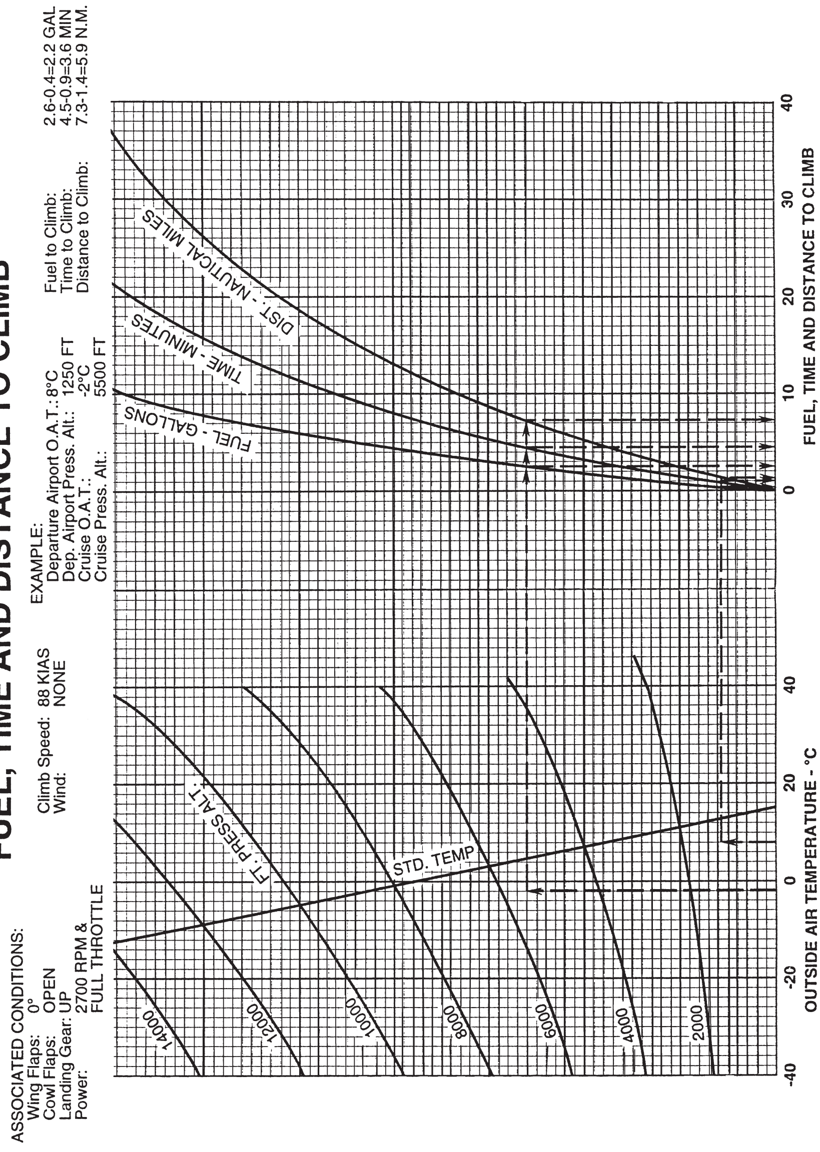



**Climb Performance - Both Engines Operating - Gear Up**
Figure 5-19




**Climb Performance - One Engine Operating - Gear Up**

Figure 5-21




**Fuel, Time And Distance To Climb**
Figure 5-23

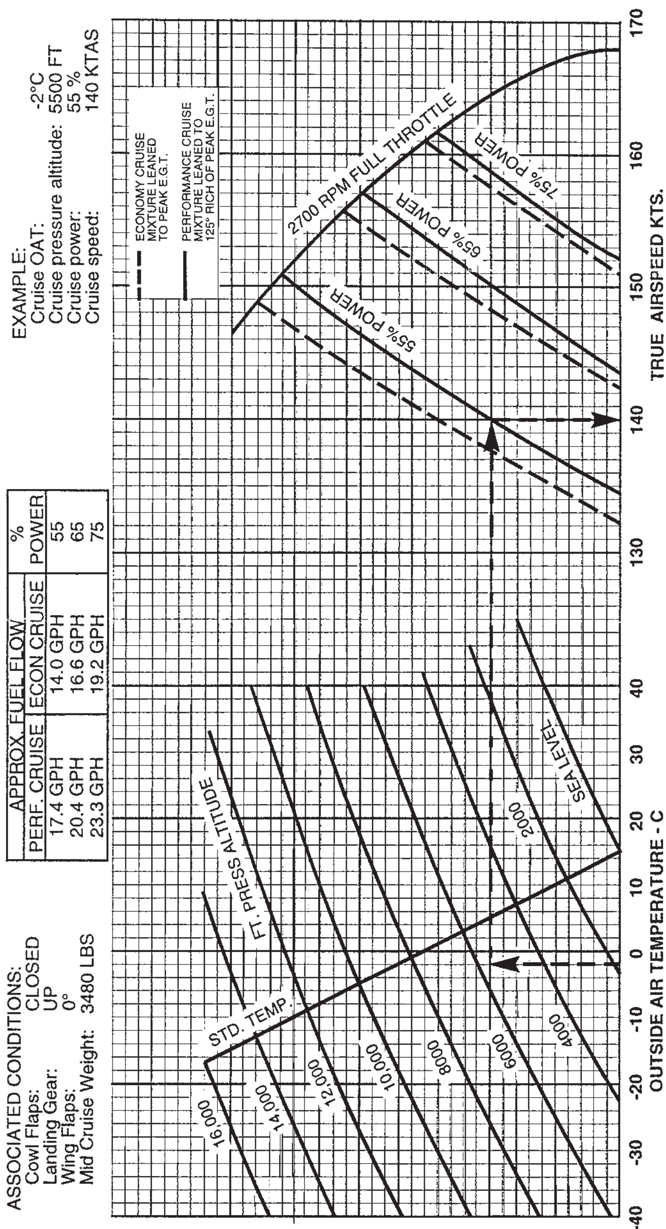
# FUEL AND POWER SETTING TABLE

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

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

*PERFORMANCE CRUISE POWER

**Fuel & Power Setting Table**
Figure 5-25




**Speed Power**
Figure 5-27

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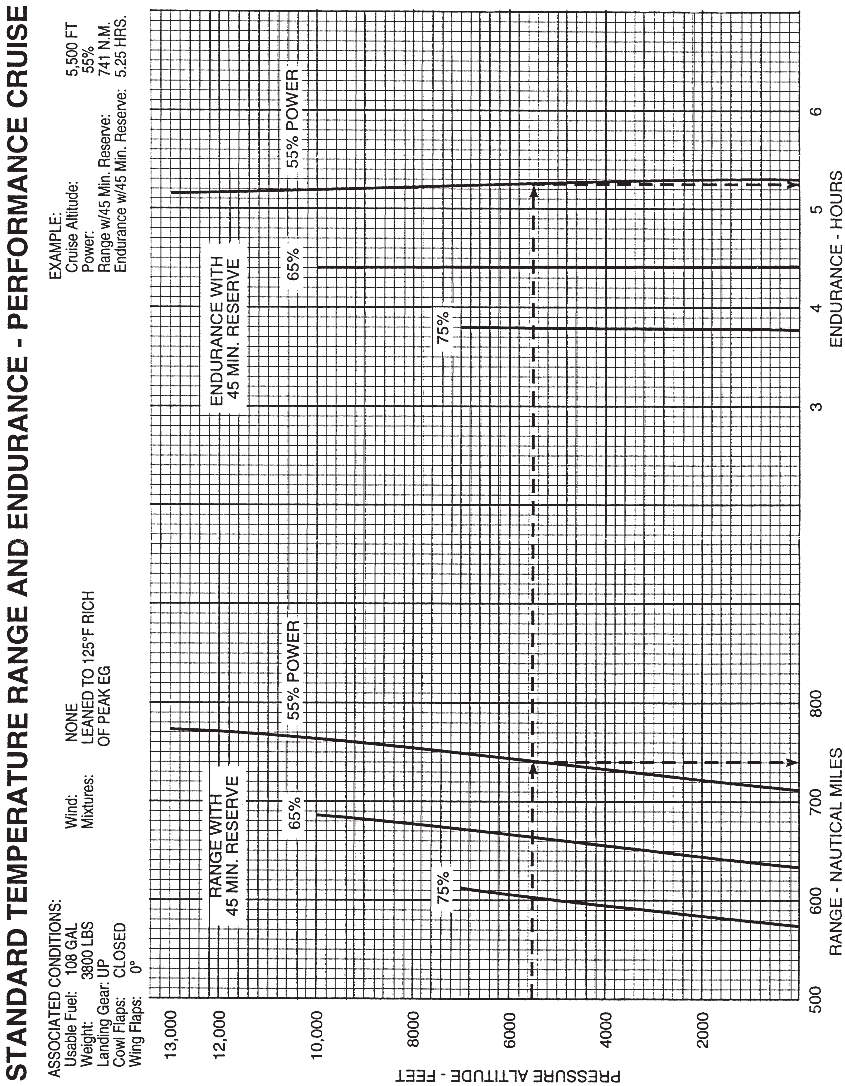
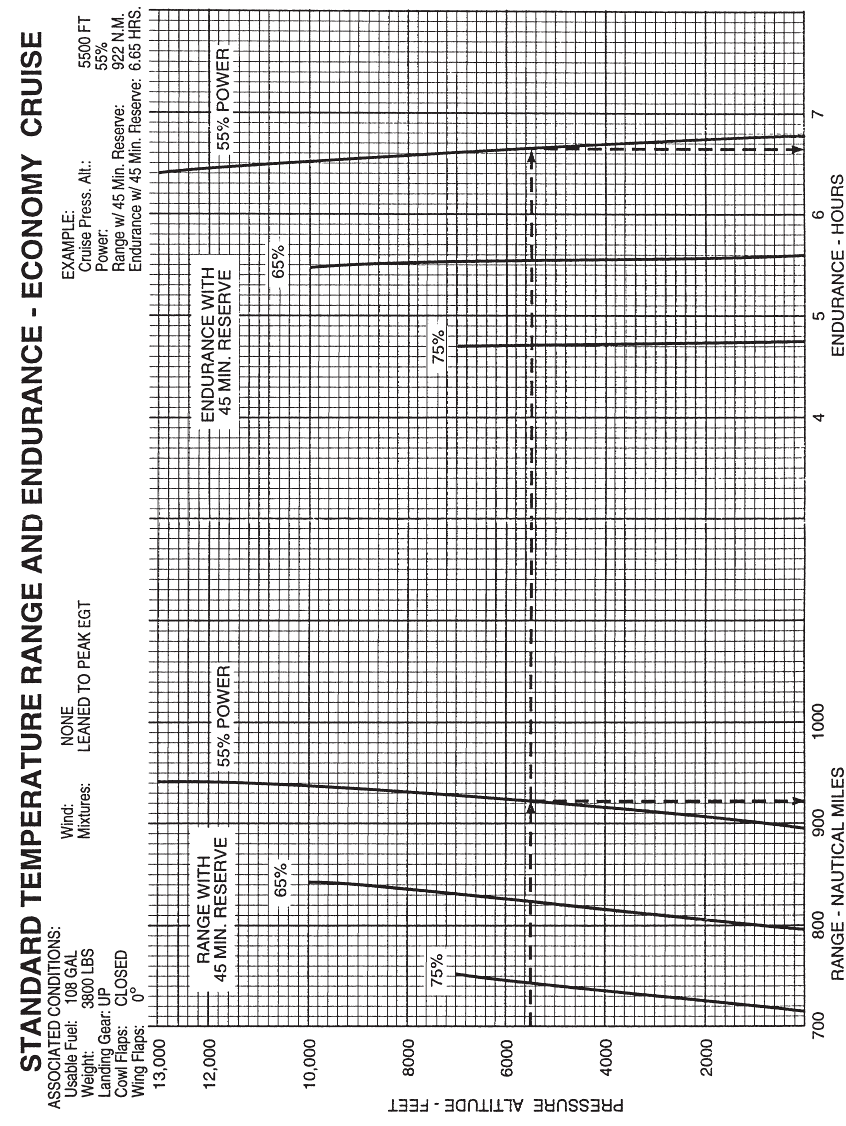
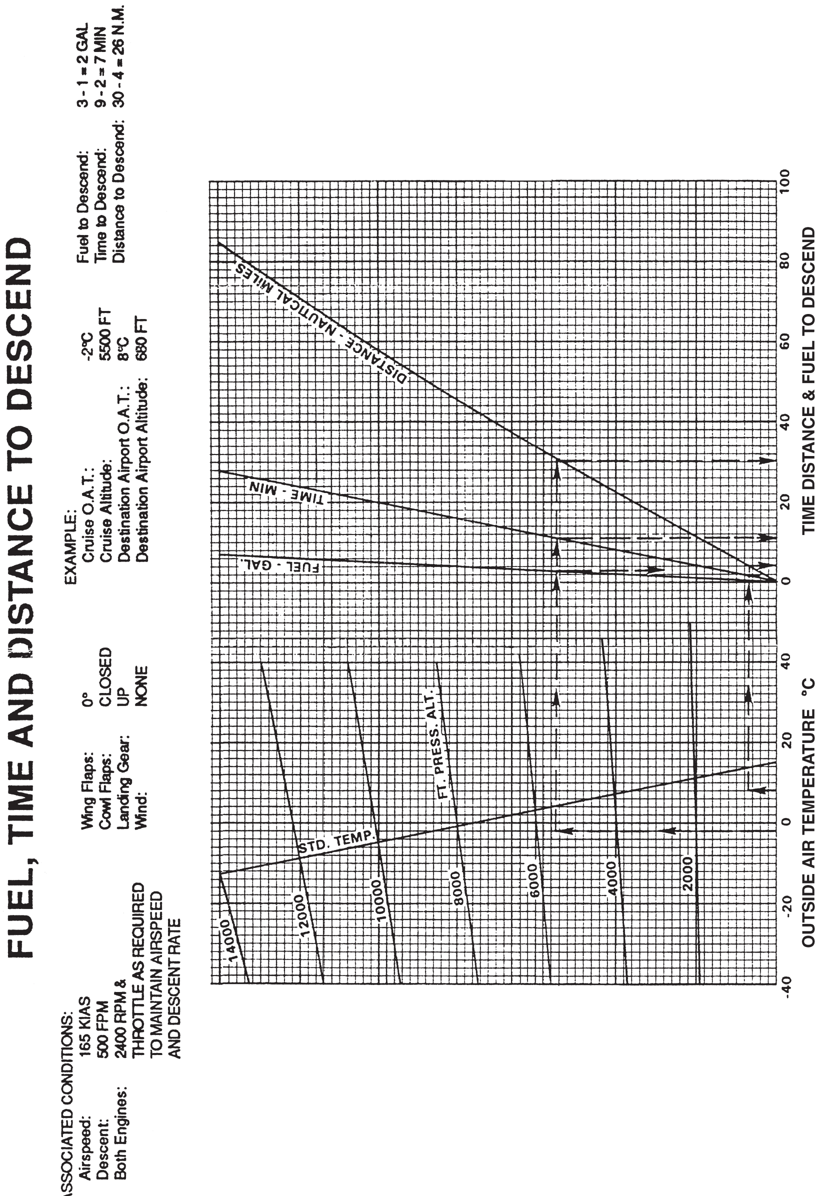



**Standard Temperature Range And Endurance - Performance Cruise**
Figure 5-29

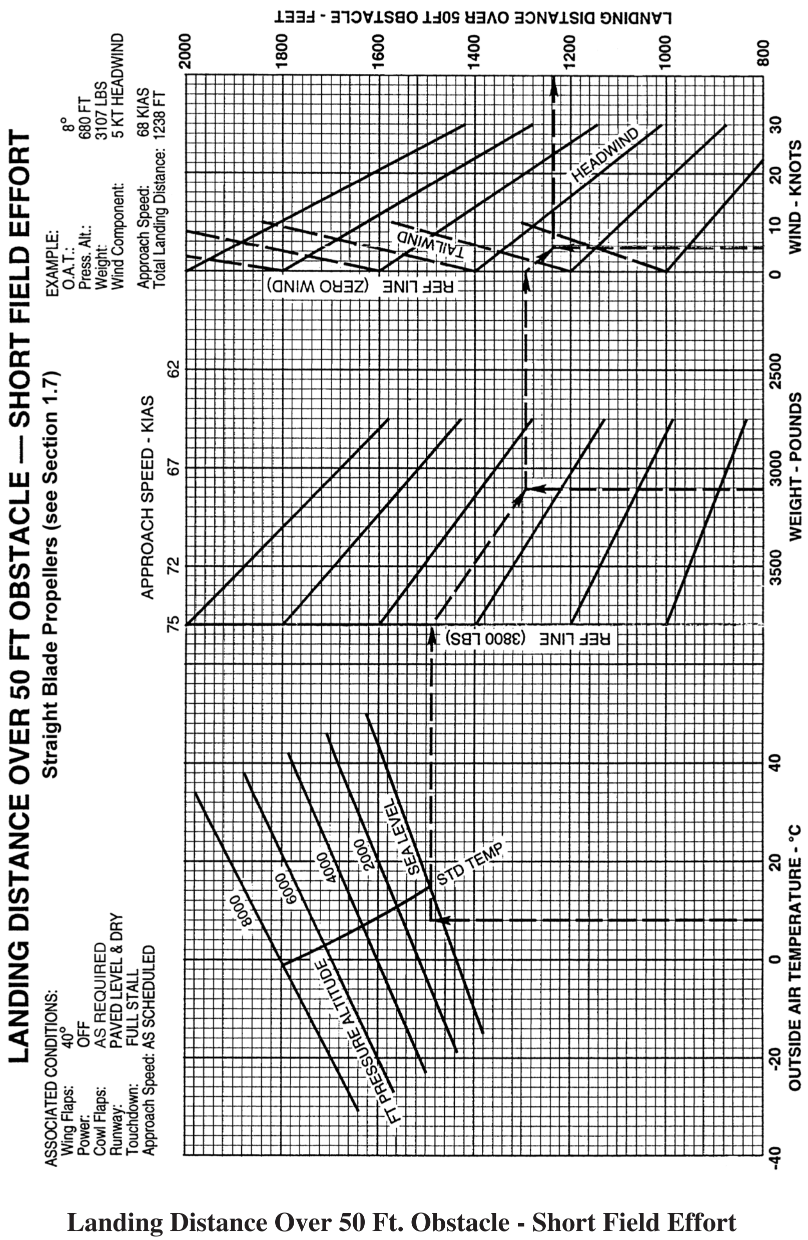



**Standard Temperature Range And Endurance - Economy Cruise**
Figure 5-31

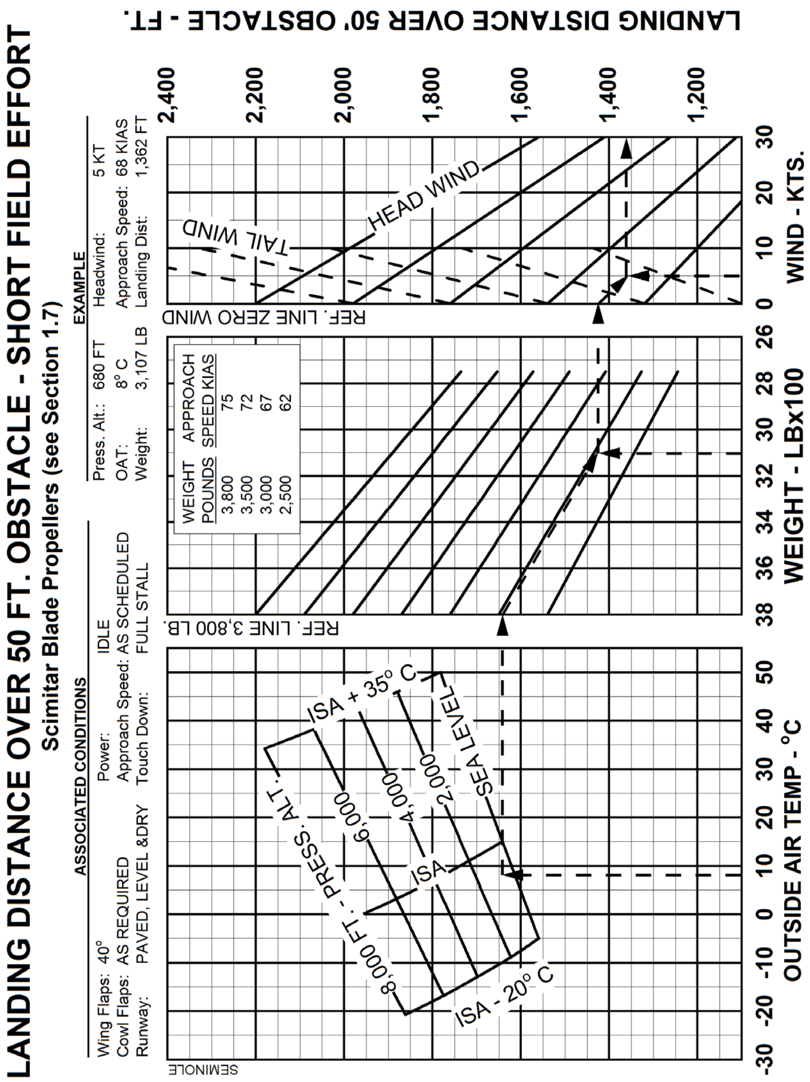



**Fuel, Time And Distance To Descend**

Figure 5-33

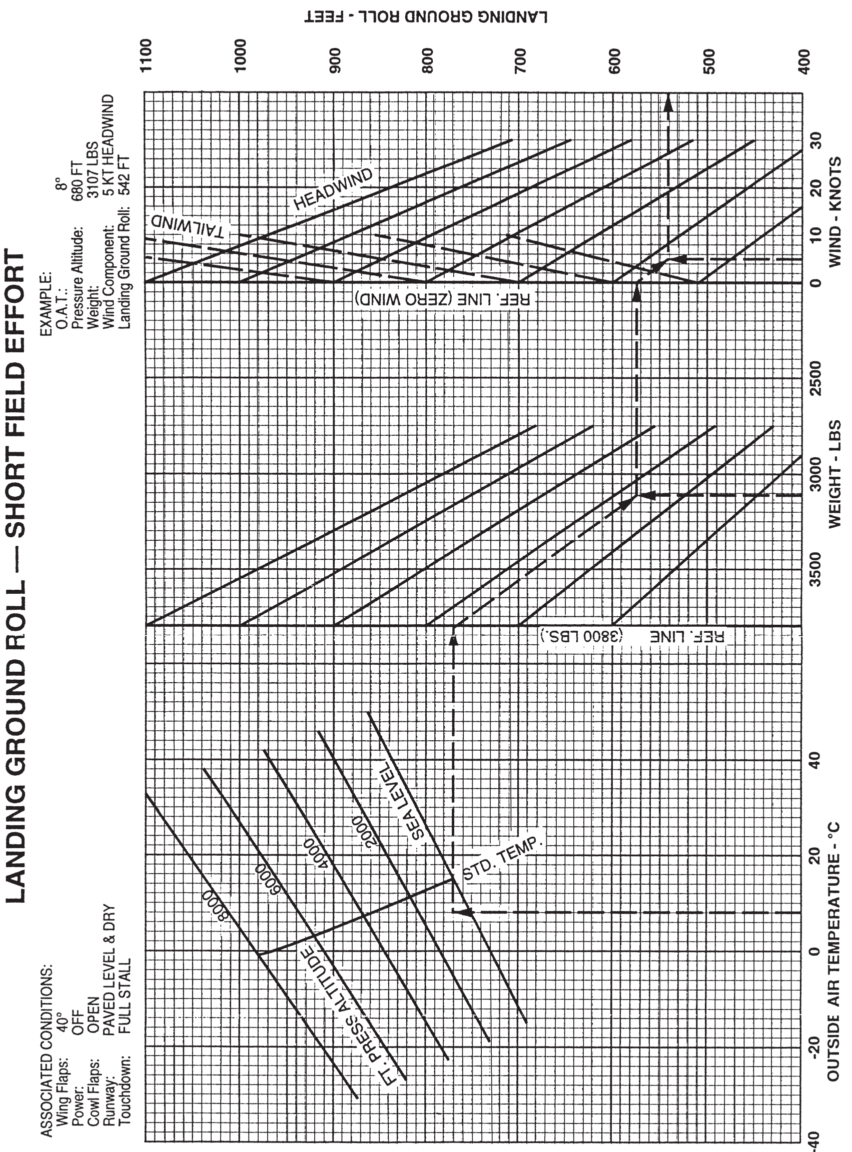



**Landing Distance Over 50 Ft. Obstacle - Short Field Effort**
Figure 5-35




**Landing Distance Over 50 Ft. Obstacle - Short Field Effort**

Figure 5-35a




**Landing Ground Roll - Short Field Effort**
Figure 5-37

## 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 he makes a takeoff.

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

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

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

## 6.1 GENERAL (continued)

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

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

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

## 6.3 AIRPLANE WEIGHING PROCEDURE

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

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

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

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.
(2) Remove excessive dirt, grease, moisture, and foreign items such as rags and tools, from the airplane before weighing.
(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate each engine until all undrainable fuel is used and engine stops. Then add the unusable fuel (2.0 gallons total. 1.0 gallon each wing).

## 6.3 AIRPLANE WEIGHING PROCEDURE (continued)

**CAUTION**

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

(4) Fill with oil to full capacity.

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

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

(b) Leveling

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

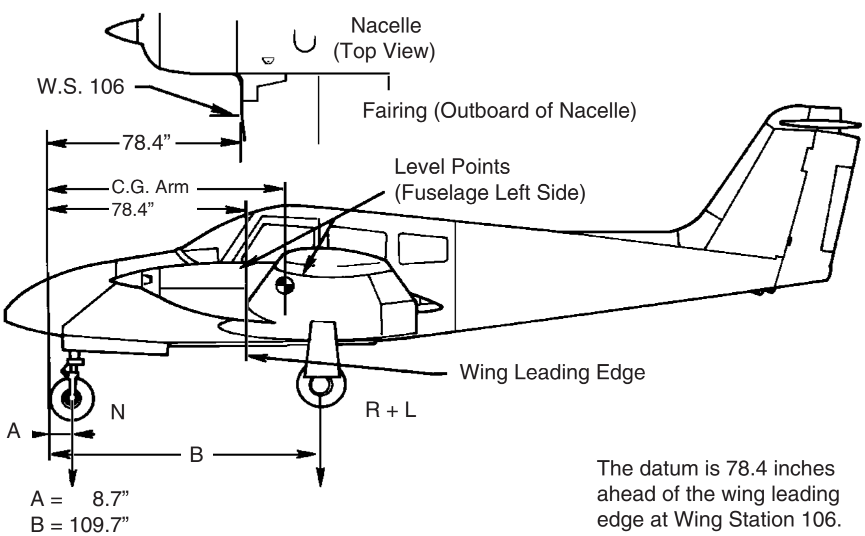
(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing- Airplane Basic Empty Weight

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

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

**Weighing Form**
Figure 6-1




**Leveling Diagram**
Figure 6-3

## 6.3 AIRPLANE WEIGHING PROCEDURE (continued)

(d) Basic Empty Weight Center of Gravity

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

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

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

Where: $T = N + R + L$

## 6.5 WEIGHT AND BALANCE DATA AND RECORD

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

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

## MODEL PA-44-180, SEMINOLE

Airplane Serial Number__________________________

Registration Number ____________________________

Date __________________________________________

AIRPLANE BASIC EMPTY WEIGHT

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

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

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

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

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

**Weight and Balance Data Form**
Figure 6-5

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

**Weight and Balance Record**
Figure 6-7

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

**Weight and Balance Record (continued)**
Figure 6-7 (continued)

## 6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

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

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

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

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

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

## 6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (continued)

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

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

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

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

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

**Sample Loading Problem**
Figure 6-9

## 6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (continued)

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

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

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

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

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

**Weight and Balance Loading Form**
Figure 6-11

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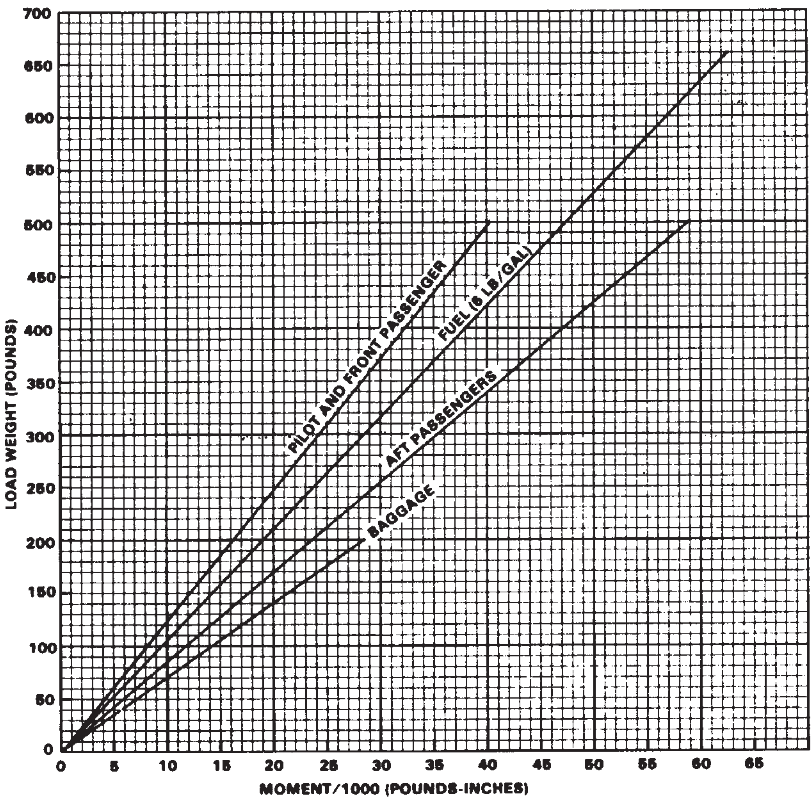
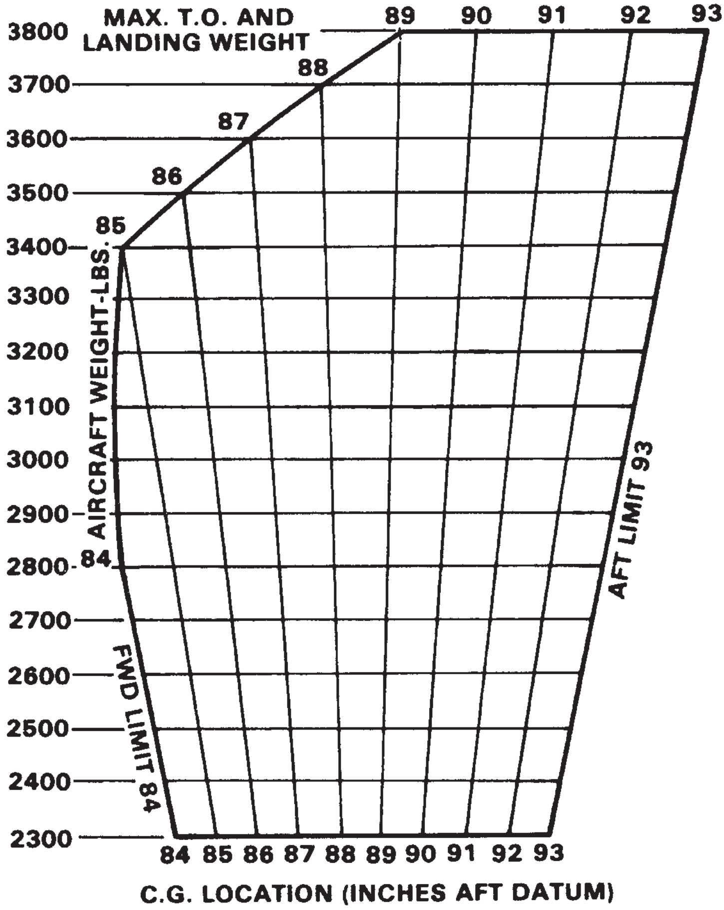



**Loading Graph**
Figure 6-13




**C.G. Range and Weight**
Figure 6-15

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## SECTION 7

## DESCRIPTION AND OPERATION OF THE AIRPLANE AND IT'S SYSTEMS

## TABLE OF CONTENTS (continued)

## SECTION 7

## DESCRIPTION AND OPERATION OF THE AIRPLANE AND IT'S SYSTEMS

# SECTION 7

# DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

## 7.1 THE AIRPLANE

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

## 7.3 AIRFRAME

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

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

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

## 7.3 AIRFRAME (continued)

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

## 7.5 ENGINES AND PROPELLERS

### Engines

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

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

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

#### Induction Air System

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

## 7.5 ENGINES AND PROPELLERS (continued)

### Propellers

Counter-rotating propellers provide balanced thrust during takeoff and climb which eliminates the critical engine factor in single-engine flight.

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

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

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

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

## 7.5 ENGINES AND PROPELLERS (continued)

### Unfeathering Accumulators

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

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

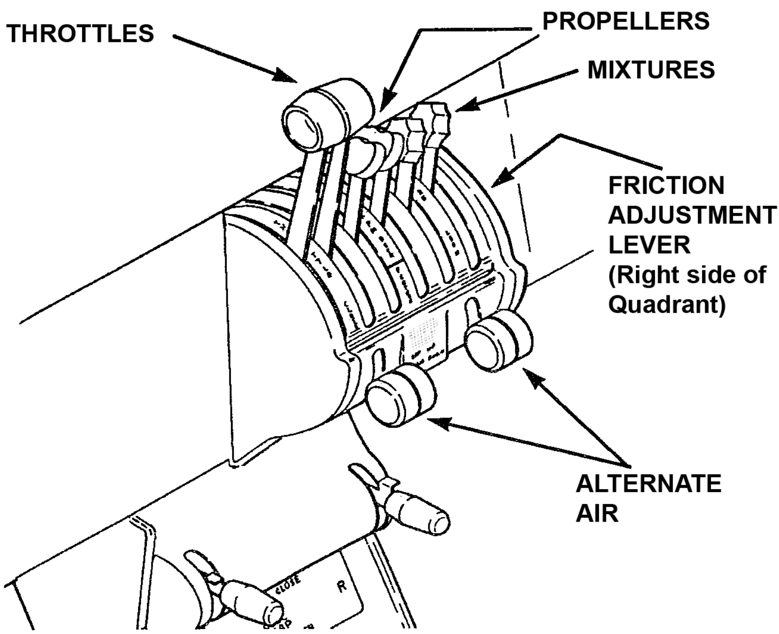
## 7.7 ENGINE CONTROLS

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

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

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

## 7.7 ENGINE CONTROLS (continued)




**CONTROL QUADRANT**
Figure 7-1

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

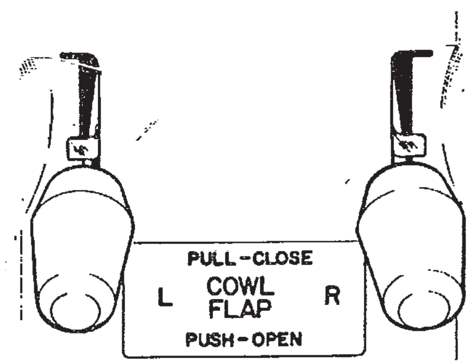
The mixture control levers are used to adjust the air to fuel ratio. An engine is shut down by the placing of the mixture control lever in the full lean (cut-off) position.

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

## 7.7 ENGINE CONTROLS (continued)

The 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 CLOSE, position the engine is operating on filtered air; when the lever is in the down, or OPEN, position the engine is operating on unfiltered, heated air.

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




**COWL FLAP CONTROLS**
Figure 7-3

## 7.9 GARMIN G1000 AVIONICS SYSTEM

**NOTE**

Refer to the latest appropriate revision and -XX part number of the Garmin G1000 Pilot's Guide for the Piper PA-44 Seminole, (Garmin P/N 190-02198-00) for complete descriptions of the G1000 integrated avionics system and operating procedures.

The Garmin G1000 Integrated Avionics System consists of a Primary Flight Display (PFD), a Multi-Function Display (MFD), an Audio Panel, an Attitude and Heading Reference System (AHRS), an Air Data Computer (ADC), and the sensors and computers to process flight and engine information for display to the pilot. The system contains dual GPS SBAS receivers, dual VOR/ILS receivers, dual VHF communications transceivers, a transponder, and an integrated crew alerting system (CAS) to alert the pilot of advisory, caution and warning messages. The G1000 system also provides System Message Advisories, which alert the pilot to abnormalities associated with the G1000 system. The G1000 system also has a terrain proximity system, Traffic Information Service (TIS) and FliteCharts. Optional avionics equipment include ADF, DME, Class B TAWS, Traffic Advisory System (TAS), SurfaceWatch, Jeppesen ChartView, Synthetic Vision, AOPA Facilities Directory, Flight Stream 510 WiFi and Bluetooth® connectivity, and the Garmin Datalink (GDL) for XM weather and music.

### Primary Flight Display

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

## 7.9 GARMIN G1000 AVIONICS SYSTEM (continued)

### Primary Flight Display (continued)

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

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

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

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

**Primary Flight Display (continued)**

**Attitude and Heading Reference System (AHRS)**

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

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

**Air Data Computer (ADC)**

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

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

If the entire ADC unit fails, a red X will be displayed over altitude and airspeed indicators, and a yellow X will be displayed over the vertical speed indicator.

**Primary Flight Display (continued)**

**Crew Alerting System (CAS) Messages**

The Crew Alerting System (CAS) consists of Master Warning and Master Caution indicators operating in conjunction with CAS messages and aural alerts. The Master Warning and Caution indicators are located on the lower right softkey of the PFD.

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

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

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

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

**Warning (Red) Messages**

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

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

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

## Primary Flight Display (continued)

### Crew Alerting System (CAS) Messages (continued)

#### Caution (Amber) Messages

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

Cautions may be acknowledged by pressing the lower right softkey on the PFD. When acknowledged, the Master Caution indicator will extinguish, and if applicable, the CAS message will will revert to normal (amber on black) text. Caution text messages persist until the initiating condition is removed.

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

#### Advisory (White) Messages

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

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

### System Annunciations

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

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

**Primary Flight Display (continued)**

**Aural Alerts**

The G1000 system generates the following aural alerts:

- Master Warning - Repeating triple chime.
- Master Caution - Non-repeating double chime.
- Advisory - Non-repeating single chime.
- Autopilot disconnect and preflight test complete (warble tone).
- TAWS, Terrain, and Obstacle cautions/warnings and various voice alerts.
- Traffic System various voice alerts.
- Airspeed greater than $V_{NE}$ - “Airspeed...Airspeed” voice alert.
- Low airspeed - Airspeed voice alert of an impending underspeed condition (if equipped with optional Underspeed Protection).
- Stall Warning - “Stall...Stall” voice alert.
- “Five-hundred” voice alert - when aircraft descends within 500 feet above the terrain or runway threshold.
- “Minimums..Minimums” voice alert - when the aircraft reaches MDA/DH if set by the pilot.
- “SurfaceWatch” voice alerts (if SurfaceWatch installed).
- “Timer Expired” voice alert when countdown timer reaches zero.
- “Vertical Track” voice alert when aircraft is one minute from VNAV Top of Descent.
- “CHECK GEAR” voice alert - In flight when the manifold pressure is 14 inches of mercury or below and the landing gear selector is not in the DOWN position.
- “CHECK GEAR” voice alert - In flight when the flaps are extended more than 10° and the landing gear selector is not in the DOWN position.
- “CHECK GEAR” voice alert - On the ground when the landing gear selector is in the UP position.
- “Engaging Autopilot” voice alert when autopilot automatically engages in LVL mode. (if equipped with optional Electronic Stability and Protection)

**Primary Flight Display (continued)**

**System Message Advisories**

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

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**Primary Flight Display (continued)**

**Reversionary Mode - PFD**

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

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

**NOTE**

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

**Primary Flight Display (continued)**

**Synthetic Vision System (SVS) - Optional**

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

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

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

**Multi-Function Display**

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

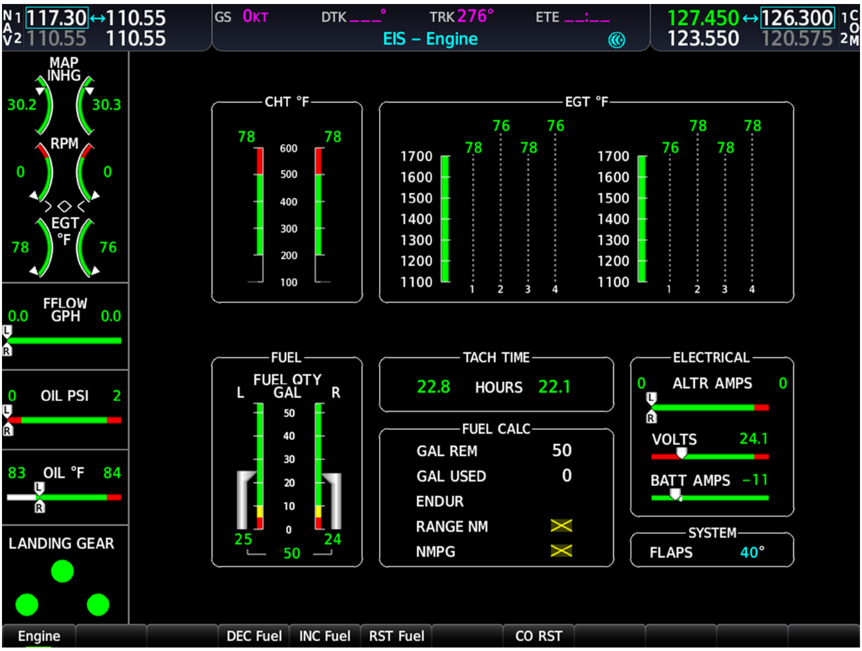
- Engine parameters
- Aircraft system parameters
- Various map and system status pages for Navigation, Traffic Map, Weather Datalink, and TAWS-B

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

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

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

**Multi-Function Display (continued)**




**TYPICAL ENGINE PAGE**
Figure 7-5

## Multi-Function Display (continued)

### Reversionary Mode - MFD

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

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

**NOTE**

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

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**Multi-Function Display (continued)**

**Traffic Information Service (TIS)**

**NOTE**

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

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

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

*Traffic Map Page*

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

**Multi-Function Display (continued)**

**Traffic Information Service (TIS) (continued)**

*Traffic Map Page (continued)*

Traffic is overlaid on the following pages:

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

TIS Alerts

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

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

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

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

**Multi-Function Display (continued)**

## Traffic Advisory System (TAS) – Optional

Traffic Advisory System

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

The GTS 800 provides a system test mode to verify the TAS system is operating normally. The test must be initiated from STANDBY mode with ADS-B selected off, and takes 10 seconds to complete. When the system test is initiated, a test pattern of traffic symbols appears on the Traffic Map page. Upon completion of the test, the system announces, “TAS System Test”. If the system test does not pass, the TAS status in the upper corner of the map will be TAS: FAIL. When the system test is complete, the traffic system enters STANDBY mode.

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

**Multi-Function Display (continued)**

**Traffic Advisory System (TAS) – Optional (continued)**

Traffic Map Page

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

Traffic is overlaid on the following pages:

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

## Multi-Function Display (continued)

### Traffic Advisory System (TAS) – Optional (continued)

TAS Alerts

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

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

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

ADS-B traffic will be displayed with similar TAS symbology in the shape of an arrow head. Range of ADS-B traffic will be limited to the TAS surveillance volume. See the G1000 NXi pilot’s guide for more information.

**Multi-Function Display (continued)**

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

**Terrain Proximity**

**NOTE**

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

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

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

**Multi-Function Display (continued)**

**Terrain Proximity (continued)**

System Status:

Terrain Proximity requires the following components to operate properly:

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

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

Operation of Terrain Proximity:

Terrain is displayed on the following pages:

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

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

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

## Multi-Function Display (continued)

### Terrain Proximity (continued)

Terrain Proximity Page:

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

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

Operation of Terrain Proximity:

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

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

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

Terrain Proximity Alerts:

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

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

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

## Multi-Function Display (continued)

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

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

For additional safety, the terrain system incorporates Garmin's WireAware™ wire obstacle information. The system shows wire obstacles such as power lines on maps as well as the Synthetic Vision display. For the Terrain-SVT and TAWS-B only, this system can also issue cautions or warnings for potential impact with wire obstacles.

WireAware database information includes Hazardous Obstacle Transmission (HOT) power lines which are typically high voltage transmission lines depicted on VFR Sectional charts, and are considered of special interest to fixed-wing pilots. These include power lines which may span rivers, valleys, canyons, or be in close proximity to airports.

WireAware database coverage is mostly limited to tall transmission lines and their associated support structures. It does not typically have information for the smaller utility poles or lines. WireAware obstacle database coverage exists mainly in the United States; with limited coverage in portions of Canada and Mexico. The height of the wire obstacles is commonly estimated and should not be relied upon for maneuvering decisions.

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

**Multi-Function Display (continued)**

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

System Status:

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

TAWS-B requires the following to operate properly:

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

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

Operation of TAWS-B:

Terrain is displayed on the following pages:

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

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

**Multi-Function Display (continued)**

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

Operation of TAWS-B (continued)

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

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

**NOTE**

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

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

* See associated Response Techniques checklists on page 7-32.

**TAWS-B Alert Types**
Table 7-1

## Multi-Function Display (continued)

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

TAWS-B Page:

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

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

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

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

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

TAWS-B Alerts:

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

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

TAWS-B alert types are shown in Table 7-1.

**Multi-Function Display (continued)**

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

TAWS-B Alerts (continued)

Response Technique – WARNING:

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

Response Technique – CAUTION:

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

## Multi-Function Display (continued)

### Garmin Datalink (GDL) – Optional

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

**NOTE**

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

SiriusXM Weather:

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

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

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

**Multi-Function Display (continued)**

**Garmin Datalink (GDL) – Optional (continued)**

SiriusXM Satellite Weather (continued)

**NOTE**

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

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

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

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

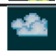
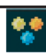
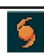
If for any reason, a weather product is not refreshed within the broadcast rate intervals, the system removes the expired data from the display and shows dashes instead of the product age. This ensures that the displayed data is consistent with what is currently being broadcast by SiriusXM weather service.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

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

## Multi-Function Display (continued)

### Garmin Datalink (GDL) – Optional (continued)

SirusXM Satellite Weather (continued)

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

**Weather Product Symbols, Expiration Times and Broadcast Rates**
Table 2

**Multi-Function Display (continued)**

**Garmin Datalink (GDL) – Optional (continued)**

SirusXM Satellite Weather (continued)

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

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

Data Logger:

An optional GDL 59 may be installed to provide a Wi-Fi transceiver for transmitting data collected from the G1000 for trend monitoring and maintenance planning. The stored data logs can include engine trend and exceedance data, system maintenance data, and crew advisory system (CAS) messages. The system can store up to two gigabytes of data. Post flight reports can be sent wirelessly to a Wi-Fi hotspot through the GDL 59’s Wi-Fi transceiver either manually via the MFD or configured for automatic upload.

## Multi-Function Display (continued)

### Garmin Datalink (GDL) – Optional (continued)

SirusXM Radio Entertainment:

The optional SirusXM Satellite Radio can receive the S-band, SirusXM Satellite Radio® entertainment services at any altitude throughout the Continental U.S. Based on signals from satellites, coverage far exceeds land-based transmissions.

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

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

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

**Databases**

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

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

**NOTE**

Database coverage areas are shown in Section 2.27 (c).

Safe Taxi Database

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

Terrain Database

The terrain databases are updated periodically and have no expiration date.

Obstacle Database

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

Navigation Database

The navigation database is updated on a 28-day cycle.

**Databases (continued)**

FliteCharts Database

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

JeppView Database

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

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

### AUTOPILOT CONTROLS

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

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

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

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

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

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

## 7.10 GFC 700 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) (continued)

### AUTOPILOT OPERATION

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

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

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

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

## 7.10 GFC 700 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) (continued)

**Autopilot Disengagement Methods:**

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

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

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

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

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

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

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

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

### AUTOPILOT FEATURES

**Overspeed Recovery Mode**

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

## AUTOPILOT FEATURES (continued)

### Overspeed Recovery Mode (continued)

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

### Takeoff Mode (Optional)

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

### Go-Around Mode (Optional)

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

### Underspeed Protection (Optional)

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

## AUTOPILOT FEATURES (continued)

### Level Mode (Optional)

**WARNING**

**Do not press the LVL switch if an autopilot or pitch trim malfunction is suspected.**

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

### Electronic Stability and Protection (Optional)

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

### Expanded Engagement Envelope (Optional)

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

### Audio Panel

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

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

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

### Transponders

The standard equipment GTX 335R transponder provides Mode A, Mode C, Mode S and ADS-B Out capabilities. The optional GTX345R transponder includes all standard features, plus ADS-B In capabilities, TIS-B traffic and FIS-B weather.

## STANDBY INSTRUMENT

The aircraft may be equipped with either an Aspen standby instrument or Garmin G5 standby instrument. Both instruments are fully digital, independent flight instrument displays which provide attitude, barometric altitude, airspeed, heading, vertical speed, slip/skid and turn rate indications. The purpose of these standby flight instruments is to provide a reference to crosscheck the G1000 system information for system reliability and to display basic flight information during a G1000 system failure.

The standby instrument is located to the left of the PFD in direct view of the pilot. During normal operation, power is provided by the essential bus. During an alternator failure, the standby instrument will continue to operate on the essential bus until the primary battery is depleted. The standby instrument will then operate on the emergency battery/bus for 30 minutes permitting the pilot to find a suitable landing location.

### Aspen Standby Instrument

In the event of a complete electrical failure of the alternator, primary and emergency batteries; the Aspen standby instrument will revert to its internal battery allowing approximately 30 additional minutes of operation. In this occurrence the Aspen standby instrument will illuminate an “ON BAT” annunciation and display an estimated battery charge state. For a detailed system description of the Aspen standby unit, refer to Aspen Evolution Backup Display (EBD) Pilot’s Guide P/N 091-00027-001, Revision A, or later appropriate revision.

### Garmin G5 Standby Instrument

In the event of a complete electrical failure of the alternator, primary and emergency batteries; the Garmin G5 standby instrument will revert to its internal battery allowing approximately four hours of additional operation. In this occurrence the Garmin G5 standby instrument will display a battery status indicator showing battery endurance in hours and minutes.

## STANDBY INSTRUMENT (continued)

Garmin Standby Instrument Operation

The Garmin G5 standby instrument will power on with the application of aircraft power. The display will automatically power down when aircraft power is removed during aircraft shutdown. If there is a desire to power down the G5 standby unit without removing aircraft power, press and hold the power button.

The Garmin G5 standby knob performs the following functions:

| | |
|---|---|
| **Press** | Press to access the Menu. |
| | From the Menu, press to select the desired menu item. |
| | Press to accept the displayed value when editing numeric data or selecting from a list. |
| **Turn** | From the Menu, turn the knob to move the cursor to the desired menu item. |
| | Turn to select the desired value when editing numeric data or selecting from a list. |
| | Turn to adjust the baro setting. |

Backlight Intensity Adjustment:

The Garmin G5 powers up in the Auto adjustment mode.

To select Manual backlighting mode from Auto backlighting mode:

1. While the unit is turned on, press the Power button.
2. Turn the knob to manually adjust the backlight intensity.
3. Press the knob to close the backlight page.

To select Auto backlighting mode from Manual backlighting mode:

1. While the unit is turned on, press the Power button.
2. Press the Power button again to select Auto.
3. Press the knob to close the backlight page.

## STANDBY INSTRUMENT (continued)

System Messages

The Garmin standby has the capability of displaying system messages to the crew along the bottom of the display. A system message is indicated through a white indication on the G5.

Messages can be displayed by pressing the Garmin G5 standby knob, and selecting the Message menu item.



Refer to Garmin G5 Electronic Flight Instrument Pilot's Guide for Certified Aircraft, part number 190-01112-12 Rev D (or later approved revisions), for a list of system messages and description of the Garmin G5 standby flight instrument. This reference material is not required to be on board the aircraft but does contain a more in depth description of all the functions and capabilities of the Garmin G5 standby instrument.

**NOTE**

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

## 7.11 LANDING GEAR

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

NORMAL OPERATION

Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-9 and 7-11). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-7). The gear selector switch which has a wheel-shaped knob must be pulled out before it is moved to the UP or DOWN position. When hydraulic pressure is exerted in one direction the gear is retracted; when it is exerted in the other direction the gear is extended. Gear extension or retraction normally takes six to ten seconds.

**CAUTION**

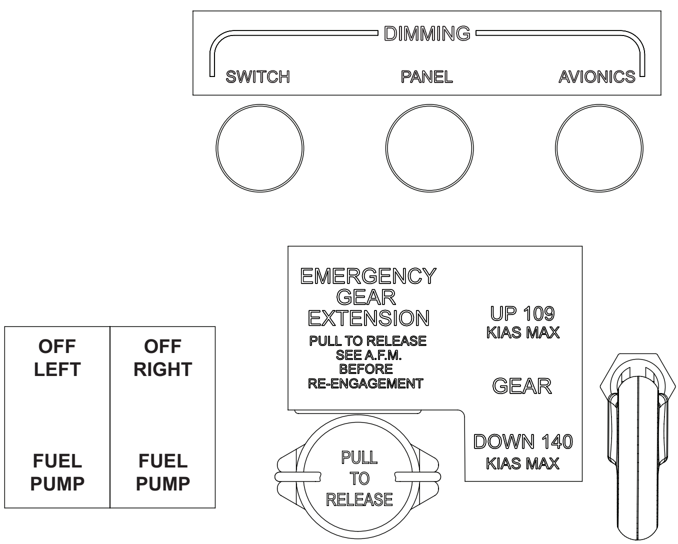
*If the landing gear is in transit and the hydraulic pump is running , do not move the gear selector switch to the opposite position before the gear has reached its full travel limit. A sudden reversal may damage the hydraulic pump.*

## 7.11 LANDING GEAR (continued)

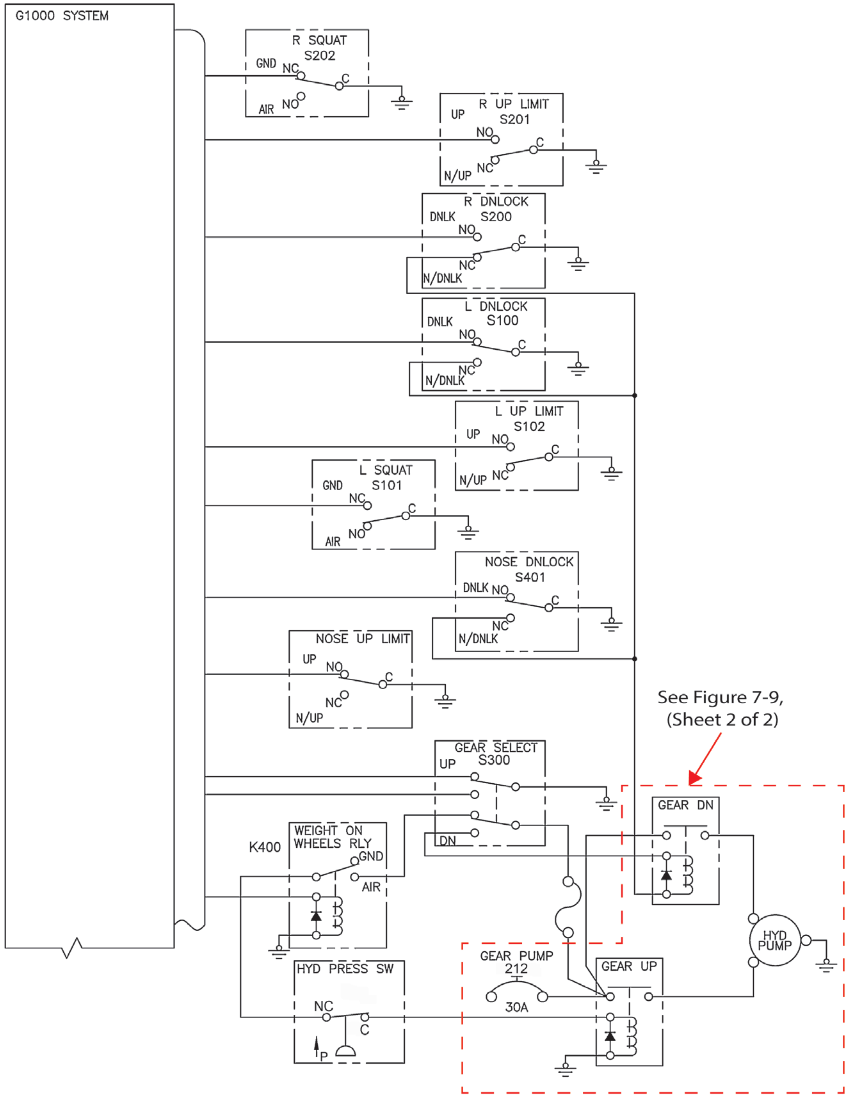
When the gear is fully extended or fully retracted and the gear selector is in the corresponding position, electrical limit switches stop the flow of current to the motor of the hydraulic pump.

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

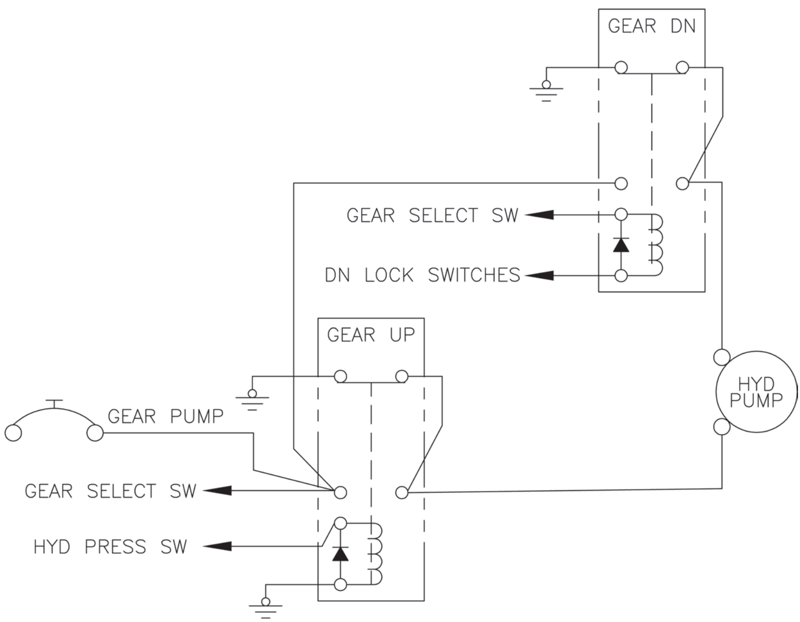
A convex mirror on the left engine nacelle serves as a taxiing aid and allows the pilot to visually confirm the position of the nose gear.




**LANDING GEAR SELECTOR**
Figure 7-7




**LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC**
Figure 7-9
(Sheet 1 of 2)




**DETAIL -**
**SN 4496471, 4496519 & UP and aircraft with kit # 88693 installed**

**LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC**
Figure 7-9
(Sheet 2 of 2)

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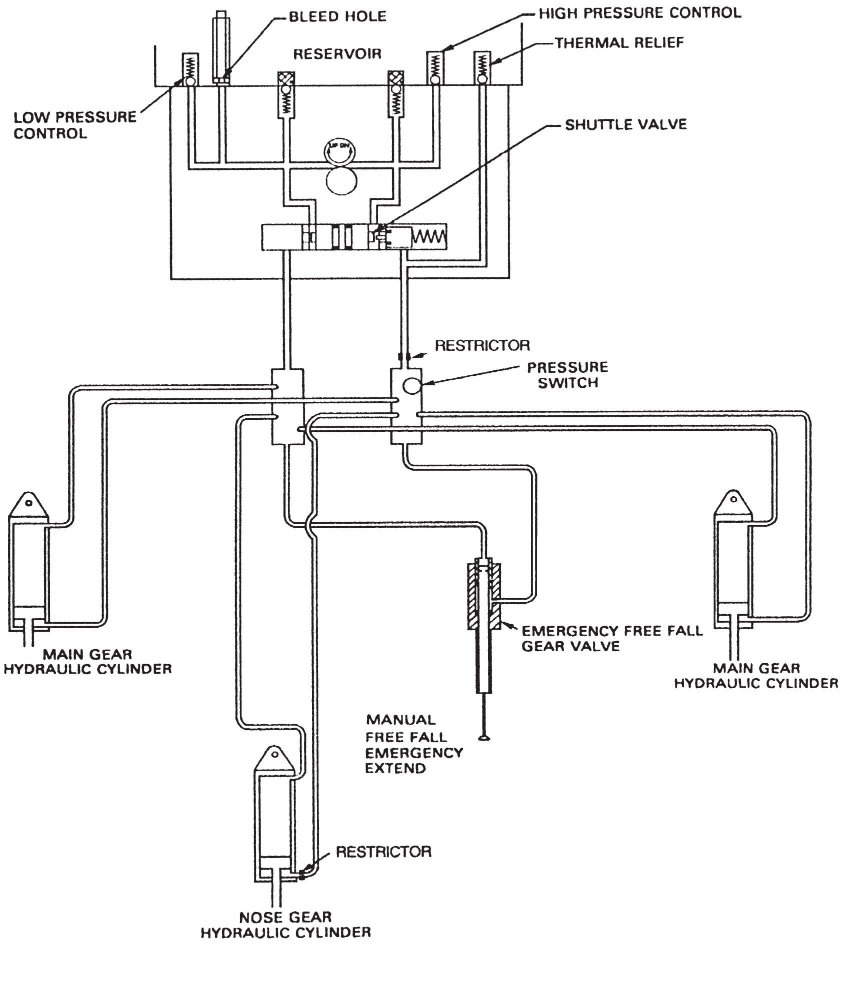



**LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC**
Figure 7-11

## 7.11 LANDING GEAR (continued)

### Landing Gear Indications

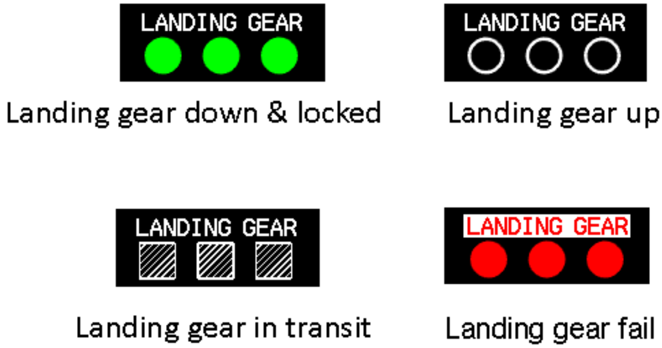
Landing gear indications on the MFD can be any of the following:

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

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

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

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




**LANDING GEAR INDICATIONS**
Figure 7-13

### Gear Position Unsafe

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

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

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

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

### CHECK GEAR Mute

The CHECK GEAR aural alert may be muted by pressing the WARNING or CAUTION softkey. If the aural alert is muted, the CHECK GEAR CAS message remains in the CAS window as a reminder.

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

## 7.11 LANDING GEAR (continued)

SAFETY SWITCH

If the gear selector is placed in the UP position when the airplane is on the ground, a squat switch located on the left main gear will prevent the hydraulic pump from actuating when the battery master switch is turned on. On takeoff, when the landing gear oleo strut drops to its full extension, the safety switch closes, allowing the hydraulic pump to raise the gear. Prior to initiating the preflight check, be sure the landing gear selector is in the DOWN position and that the three green gear indicators are displayed once the G1000 system is operating.

EMERGENCY EXTENSION

The landing gear is designed to extend even in the event of hydraulic failure. The gear is held in the retracted position by hydraulic pressure. If the hydraulic system lost pressure, gravity will extend the gear. To extend and lock the gears in the event of hydraulic failure, it is necessary only to relieve the hydraulic pressure. An emergency gear extension knob, located below and to the left of the gear selector switch is provided for this purpose. A guard across the knob  prevents inadvertant movement. Moving the guard aside and pulling the emergency gear extension knob releases the hydraulic pressure holding the gear in the up position and allows the gear to fall free. Before pulling the emergency gear extension knob, place the landing gear selector switch in the DOWN position to prevent the pump from trying to raise the gear.

**NOTE**

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

**NOTE**

If the emergency gear extension is used for training purposes the emergency gear extension knob may be pushed in again when desired, if there has not been any apparent malfunction of the landing gear system.

HYDRAULIC RESERVOIR

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

GROUND OPERATION

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

TIRES

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

STRUTS

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

## 7.13 BRAKE SYSTEM

NORMAL OPERATION

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

PARKING BRAKE

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

## 7.15 FLIGHT CONTROL SYSTEM

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

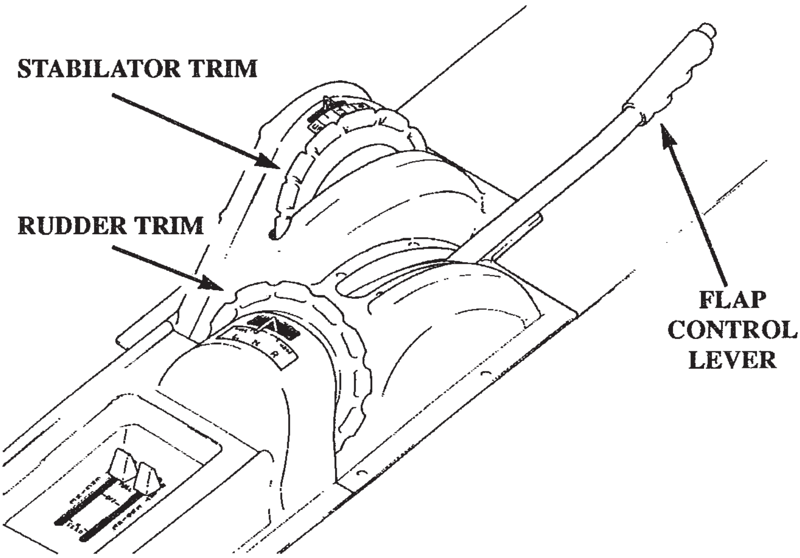
EMPENNAGE

The horizontal tail surface (stabilator) is of the all movable slab type with an anti-servo tab mounted on the trailing edge. This tab, actuated by a control mounted on the console between the front seats, also acts as a longitudinal trim tab (refer to Figure 7-15).

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

FLAPS

The flaps are manually operated and spring loaded to return to the retracted (up) position. A four-position flap control handle (Figure 7-15) located on the console between the front seats adjusts the flaps for reduced landing speeds and glide path control.




**FLAP AND TRIM CONTROLS**
Figure 7-15

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

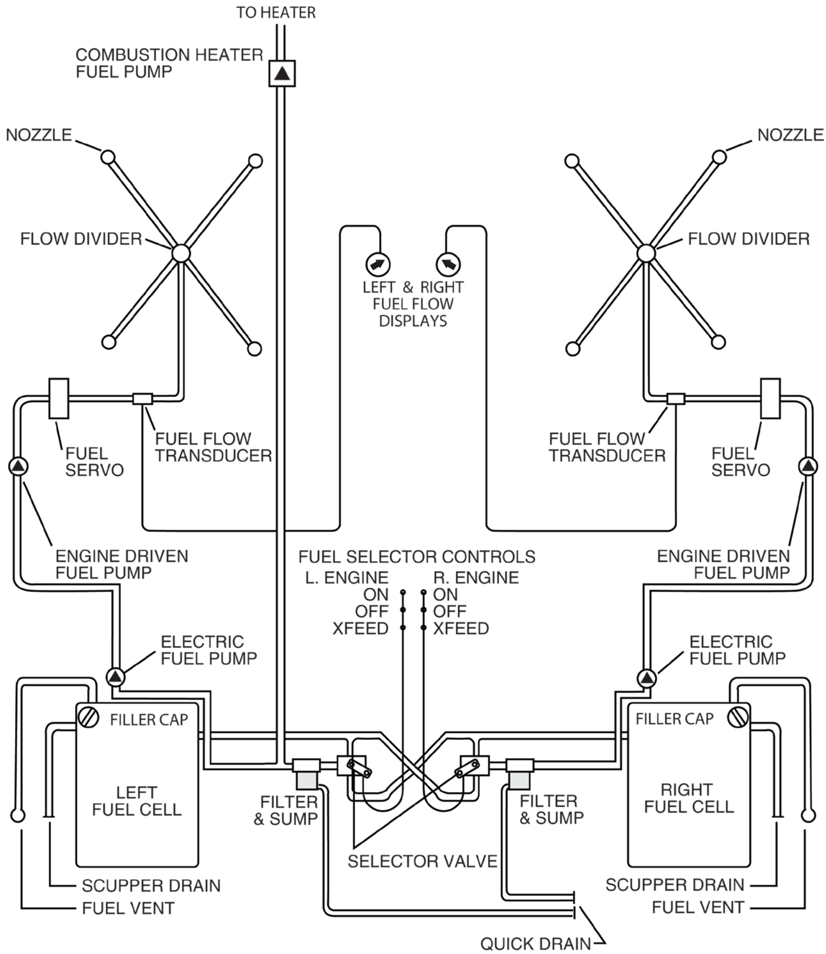
An over-center lock incorporated in the actuating linkage holds the right flap when it is in the retracted (up) position so that it may be used as a step.

**NOTE**

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

## 7.17 FUEL SYSTEM

Fuel is stored in two 55 gallon fuel tanks, one in each nacelle (Figure 7-17). One gallon of fuel in each nacelle is unusable, giving a total of 108 usable gallons. The minimum fuel grade is 100 octane. The fuel tank vents, one installed under each wing, feature an anti-icing design to prevent ice formation from blocking the fuel tank vent lines.




**FUEL SYSTEM SCHEMATIC**
Figure 7-17

FUEL PUMPS

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

FUEL GAUGES

Fuel quantities and fuel flows are indicated on displays located on the MFD EIS window or Engine page. There is a separate fuel quantity display for each tank.

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

FUEL DRAINS

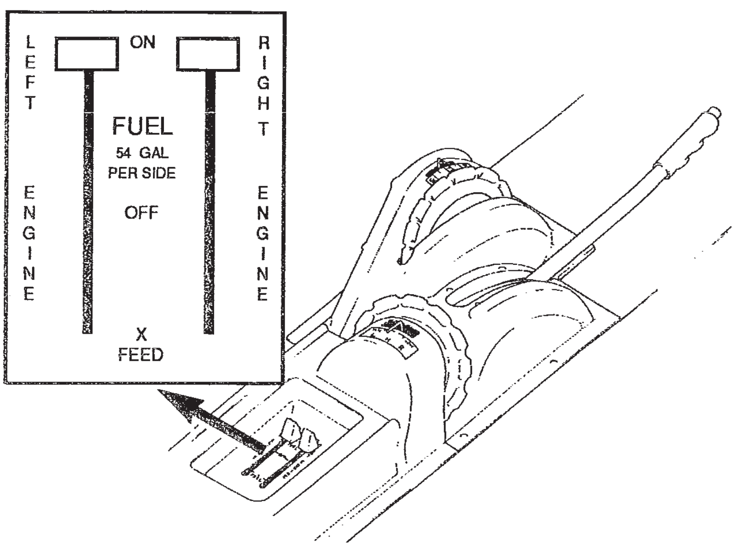
Before each flight, fuel must be drained from the low points in the fuel system to ensure that any accumulation of moisture or sediment is removed from the system. A fuel drain is provided for each half of the fuel system. The fuel drains are located on the right side of the fuselage just forward of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

FUEL CONTROLS

Fuel management controls are located on the console between the front seats (Figure 7-19). There is a control lever for each engine, and each is placarded ON - OFF - XFEED. During normal operation, the levers are in the ON position, and each engine draws fuel from the tank on the same side as the engine. When the XFEED position is selected, that engine will draw fuel from the tank on the opposite side, in order to extend range, keep fuel weight balanced or during single-engine operation. The OFF position shuts off the fuel flow to that engine.

**NOTE**

When one engine is inoperative and the fuel selector for the operating engine is on XFEED the selector for the inoperative engine must be in the OFF position. Do not operate with both fuel selectors on XFEED except as required in the BEFORE TAXIING checklist. Do not take off with a selector on XFEED.




**FUEL SYSTEM CONTROLS**
Figure 7-19

## 7.19 ELECTRICAL SYSTEM

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

ALTERNATORS

The primary electrical power is supplied by two belt-driven 28 volt, 65 ampere alternators (Figure 7-25), one mounted on each engine. The alternator provides full electrical power output even at low engine rpm.

VOLTAGE REGULATORS

Each alternator is protected by an alternator control unit which incorporates a voltage regulator and an overvoltage relay. The regulators maintain effective load sharing while regulating electrical system bus voltage to 28-volts. An overvoltage relay in each alternator circuit prevents damage to electrical and avionics equipment by taking an alternator off the line if its output exceeds 32-volts. If this should occur, the appropriate ALTR FAIL CAS WARNING will be activated.

BATTERY

A 13.6 ampere-hour, 24-volt battery provides current for starting, for use of electrical equipment when the engines are not running, and for a source of stored electrical power to back up the alternator output. The battery, which is located in the nose section is normally kept charged by the alternators. If it becomes necessary to charge the battery, it should be removed from the airplane.

EMERGENCY BATTERY

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

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

## 7.19 ELECTRICAL SYSTEM (continued)

EMERGENCY BATTERY (continued)

**CAUTION**

*The emergency battery voltage (E VOLTS) must be a minimum of 23.3 volts prior to flight.*

SWITCHES

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

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

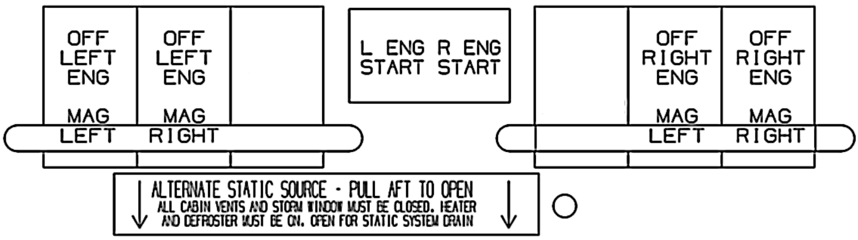
Switches for the battery master, alternators, avionics master and emergency battery are located in a bank to the left of the throttles. The lower part of the emergency battery switch is guarded, to prevent it from being turned off inadvertently.

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

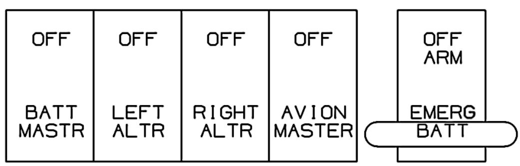
Controls for the cabin heat and ventilation fan are located on the far right side of the panel.

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

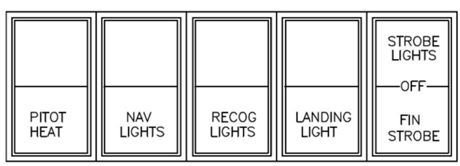
SWITCHES (continued)



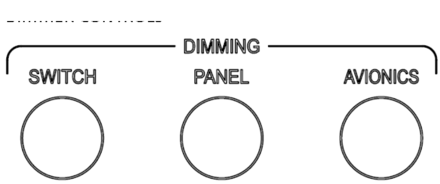

Engine Switches




Left Switch Bank




Right Switch Bank

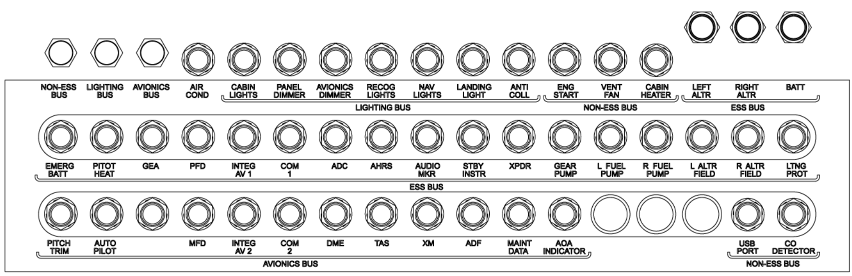



Dimmer Controls

**ELECTRICAL POWER SWITCHES**
Figure 7-21

CIRCUIT BREAKERS

The electrical system and equipment are protected by circuit breakers located on a circuit breaker panel on the lower right side of the instrument panel (Figure 7-23). The circuit breaker panel is provided with blank spaces to accommodate additional circuit breakers if extra electrical equipment is installed. In the event of equipment malfunctions or a sudden surge of current, a circuit breaker can trip automatically. The pilot can reset the breaker by pressing it in (preferably after a few minutes cooling period). The circuit breakers can be pulled out manually.




**TYPICAL CIRCUIT BREAKER PANEL**

Figure 7-23

POWER DISTRIBUTION

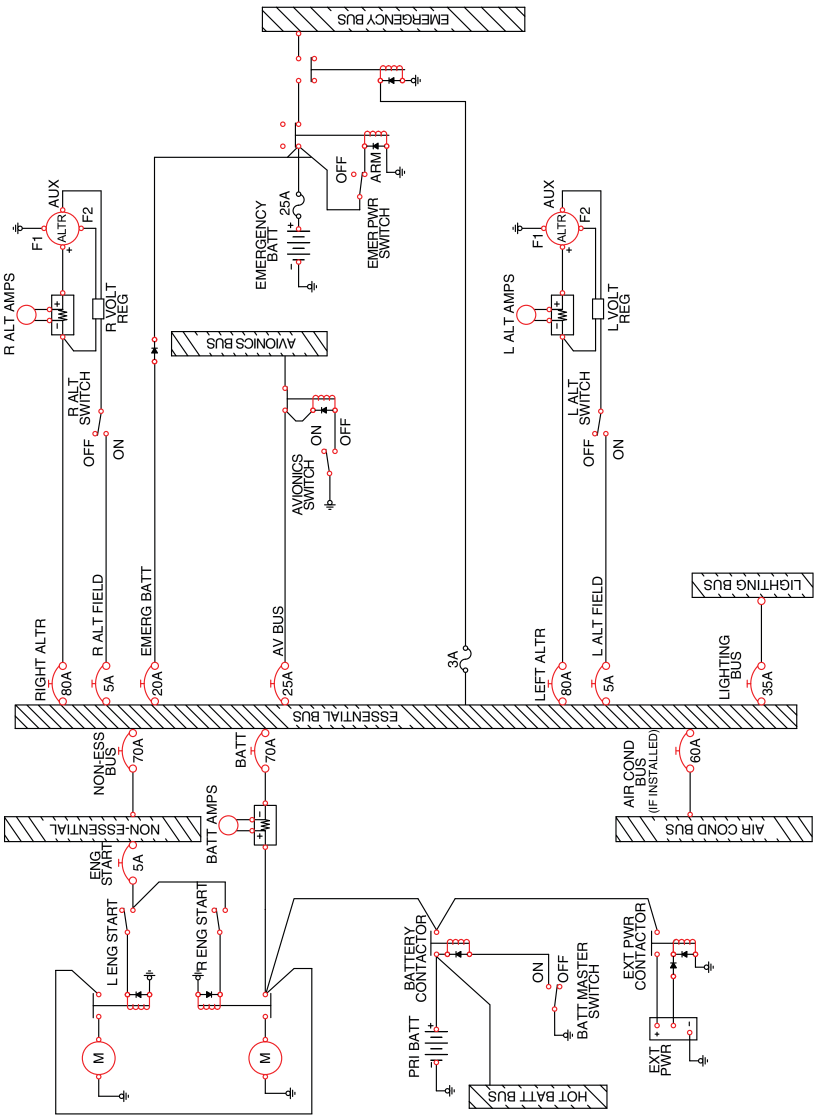
A battery bus (Figure 7-25), located in the battery compartment, provides a continuous source of power to the clock, the engine Hobbs meter, the flight-time Hobbs meter and the heater Hobbs meter. Because the battery bus is connected directly to the battery, power is available even when the battery master switch is OFF. Fuses located on the battery bus are used to protect these circuits.

When the battery master switch is turned ON, the battery solenoid contactor closes, enabling current to flow from the battery to both the starter contactors and the essential bus. Essential bus overcurrent protection is provided by a 70 amp BATT circuit breaker. The essential bus (Figure 7-23 and Figure 7-25), distributes power to other systems through circuit breakers.

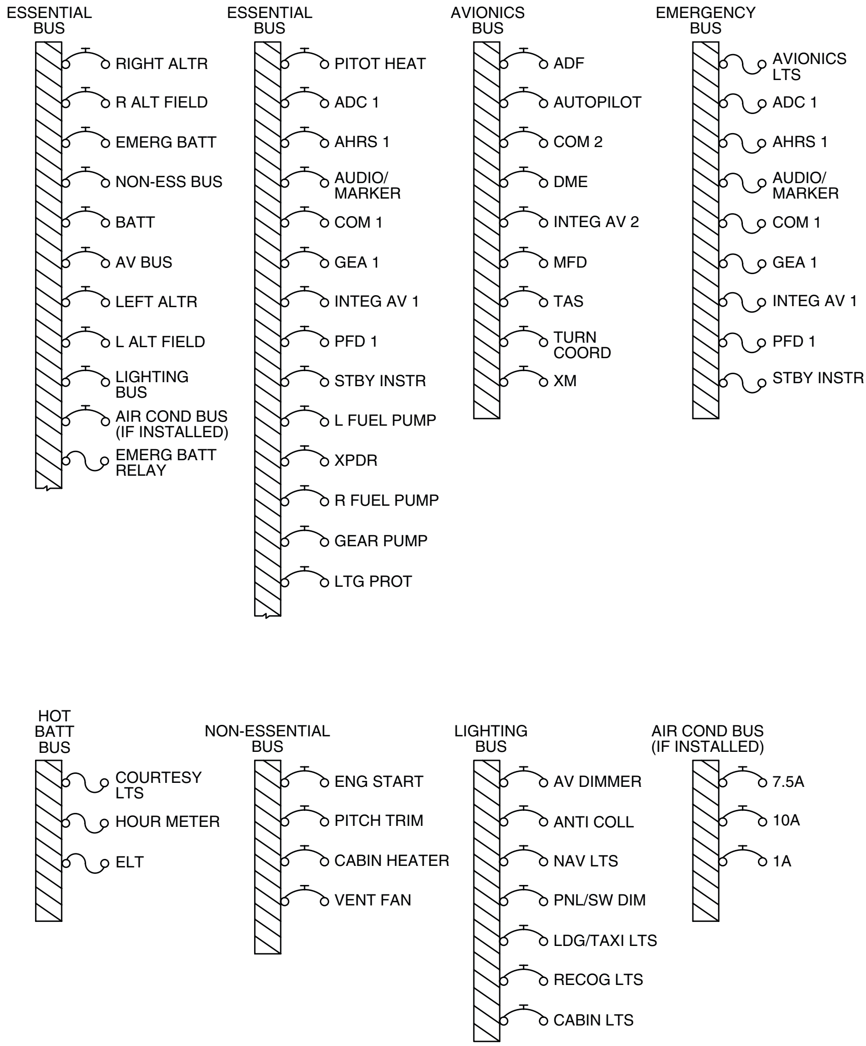
Each alternator system has an independent ON-OFF rocker switch and a solid state voltage regulator that automatically regulates alternator field current. When selected ON, the positive output of each alternator is fed through individual shunts to the tie bus. Overcurrent protection is provided by the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

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

Current from the tie bus is fed to the avionics bus through a solenoid contactor. When the avionics master switch is selected ON, the solenoid contactor closes, permitting current flow to the avionics bus. Avionics bus overload protection is provided by the 25 amp AVIONICS BUS circuit breaker. The non-essential bus is also fed from the tie bus. Overload protection is provided by the tie bus 70 amp NON-ESS BUS circuit breaker.




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




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

LIGHTING

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

A floodlight, mounted in the overhead panel, provides additional instrument and cockpit lighting for night flying. The light is controlled by a rheostat switch located adjacent to the light. A map light window in the lens is actuated by an adjacent switch.

Exterior lighting systems include landing/taxi lights, navigation lights, strobe/anti-collision lights, and recognition lights. The wing tip recognition light system consists of two lights; one in each wing tip.

**WARNING**

**Anti-collision lights should not be operating when flying through cloud, fog or haze, since the reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground, such as during taxiing, takeoff or landing.**

EXTERNAL POWER RECEPTACLE

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

***CAUTION***

*External power is supplied directly to the electrical bus. Turn off all electrical equipment before applying or removing external power.*

Turn the battery master switch and all electrical equipment OFF. Connect the power connector plug assembly to an appropriate external battery. Insert the plug into the external power receptacle. This completes a circuit which permits current to flow from the external power source directly to the starter contactors and the tie bus. Instructions on a placard located on the cover of the receptacle should be followed when starting with external power. For instructions on the use of the external power, refer to Starting Engines - Section 4. For further information see EXTERNAL POWER RECEPTACLE in Section 8 of this Handbook.

## 7.21 PITOT STATIC SYSTEM

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

The control valve for the alternate static source is located below the left side of the instrument panel. When the valve is set in the alternate position, the Garmin air data computer and standby instrument uses cabin static pressure. The storm window and cabin vents must be closed and the cabin heater and defroster must be on during alternate static source operation. Altimeter error with alternate static pressure, is less than 50 feet unless otherwise placarded.

To prevent bugs and water from entering the pitot and static pressure holes when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

**NOTE**

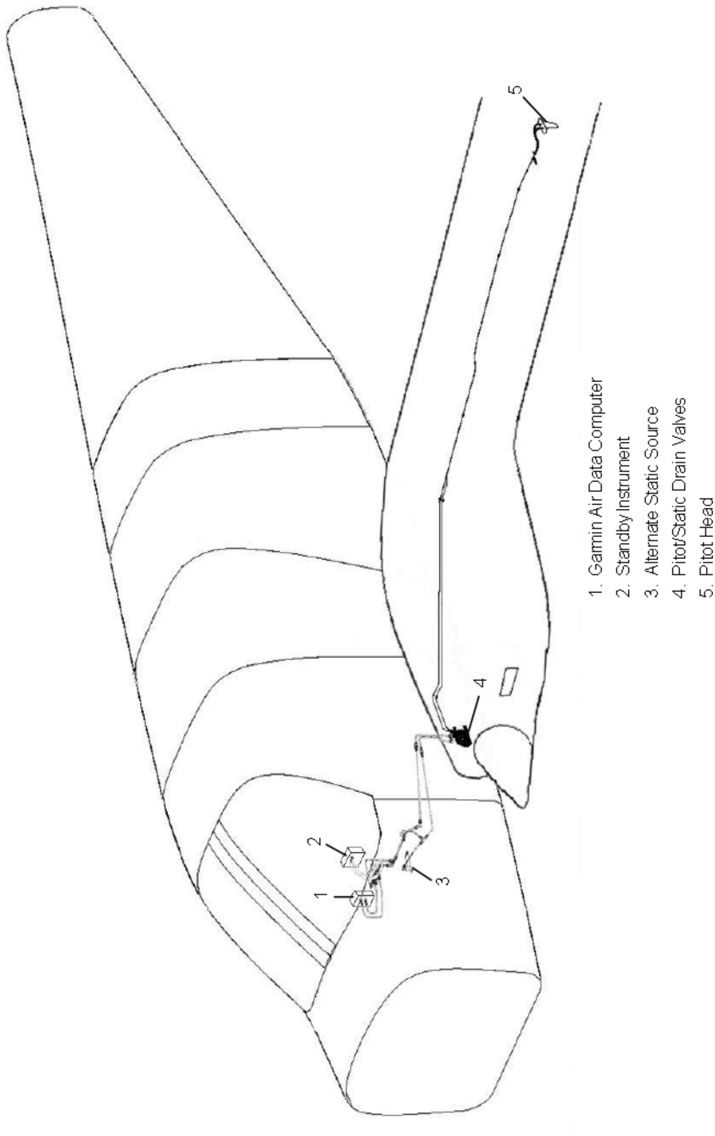
During preflight, check to make sure the pitot cover is removed.

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

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

***CAUTION***

*Care should be exercised when checking the heated pitot head. The unit becomes very hot. Ground operation of pitot heat should be limited to 3 minutes maximum to avoid damaging the heating units.*




**PITOT AND STATIC PRESSURE SYSTEM**
Figure 7-27

## 7.23 HEATING, VENTILATING AND DEFROSTING SYSTEM

HEAT

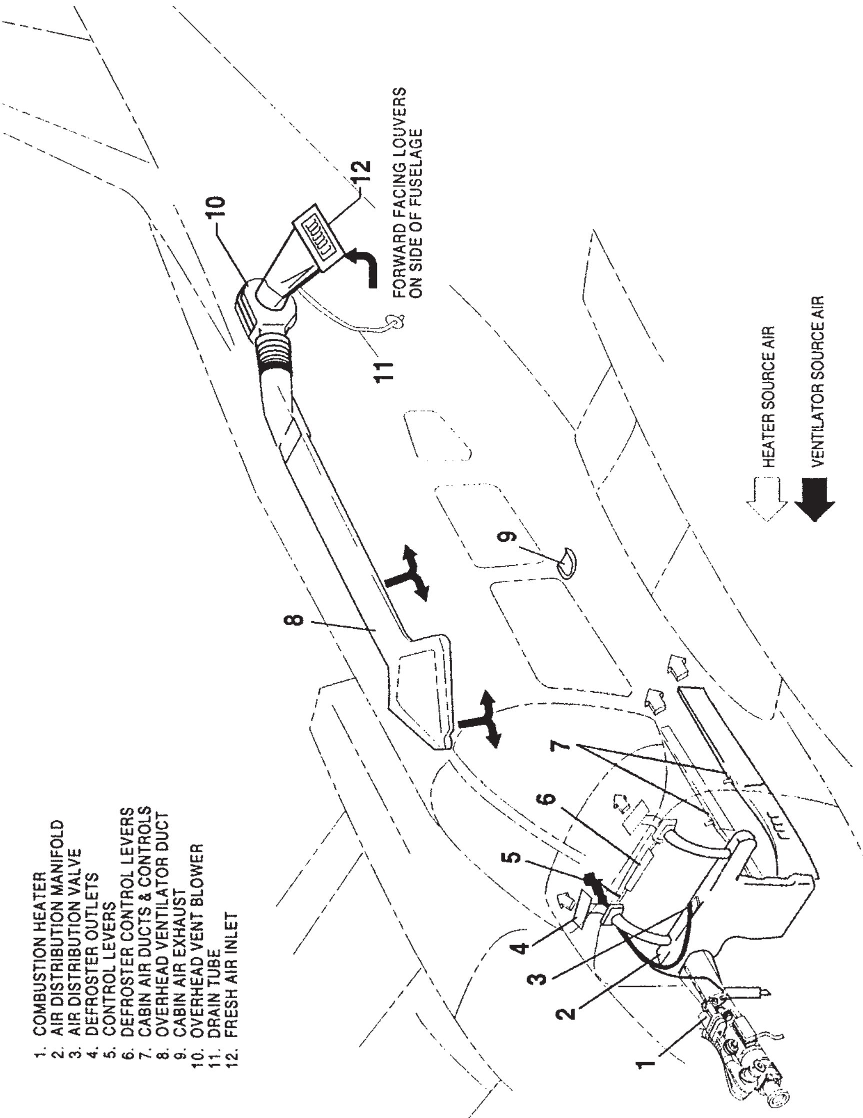
Heated air for cabin heat and windshield defrosting is provided by a Janitrol combustion heater located in the forward fuselage (Figure 7-29). Air from the heater is distributed by a manifold, through ducts along the cabin floor to outlets at each seat. Heated air from the manifold is also directed through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

Operation of the combustion heater is controlled by a three-position switch located on the instrument panel (Figure 7-31) and labeled CABIN HEAT - FAN. Airflow and temperature are regulated by the three levers to the right of the switch. The upper lever regulates AIR INTAKE and the center lever regulates cabin temperature. Cabin comfort can be maintained as desired through various combinations of lever positions. Passengers have secondary control over heat output by individually adjustable outlets at each seat location. The third lever on the instrument panel controls heated airflow to the windshield defrosters.

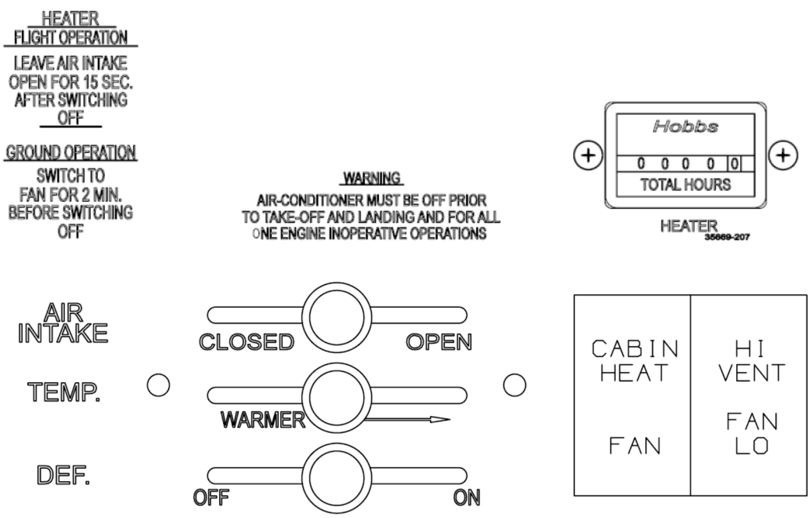
For cabin heat, the AIR INTAKE lever on the instrument panel must be partially or fully open and the three-position switch set to the CABIN HEAT position. This simultaneously starts fuel flow and ignites the heater. During ground operation, it also activates the ventilation blower which is integral to the combustion heater. With instant starting and no need for priming, heat should be felt within a few seconds. When cabin air reaches the temperature selected on the cabin temperature lever, the heater cycles automatically to maintain that temperature.

The combustion heater uses fuel from the airplane fuel system. An electric fuel pump draws fuel from the left tank at a rate of approximately one-half gallon per hour. Fuel used for heater operation should be considered when planning for a flight.

Hours of combustion heater operation can be monitored from an instrument panel mounted Hobbs meter (Figure 7-31). The meter is located above and to the right side of the panel, above the heater control switches.




**ENVIRONMENTAL SYSTEM**
Figure 7-29




**ENVIRONMENTAL CONTROLS AND ANNUNCIATORS**
Figure 7-31

Safety Switches

Two safety switches, activated by the intake valve, prevent both fan and heater operation when the air intake lever is in the closed position. When the landing gear is retracted, a micro switch turns off the ventilation blower so that in flight the cabin air is circulated by ram air pressure only.

Overheat Switch and Annunciator

An overheat switch in the heater unit acts as a safety device to turn the heater off if a malfunction occurs. Should the switch deactivate the heater, the HTR OVRHEAT CAS warning will activate. To restore heater operation, reset the red button located on the heater shroud in the nose compartment.

To prevent activation of the overheat switch during ground operation, turn the three-position switch to FAN for two minutes with the air intake lever in the open position, before turning the switch to OFF. During flight, leave the air intake lever open for a minimum of fifteen seconds after turning the switch to OFF.

VENTILATION

When heat is not desired during ground operation, place the three-position switch in the FAN position and the ventilation fan will blow fresh air through the heater duct work for cabin ventilation and windshield defogging. To introduce fresh, unheated air into the cabin during flight, the air intake should be open and the heater off. Ram air enters the system and can be individually regulated at each floor outlet.

Overhead outlets also supply fresh air for cabin ventilation. The occupant of each seat can manually adjust an outlet in the ceiling to regulate the flow of fresh air to that seat area. A fresh air blower is installed in the overhead ventilation system to provide additional fresh air flow during ground operation. Operation of the fresh air blower is controlled by a three-position switch located ajacent to the cabin heat switch, (Figure 7-31) and labeled VENT FAN.

## 7.25 INSTRUMENT PANEL

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

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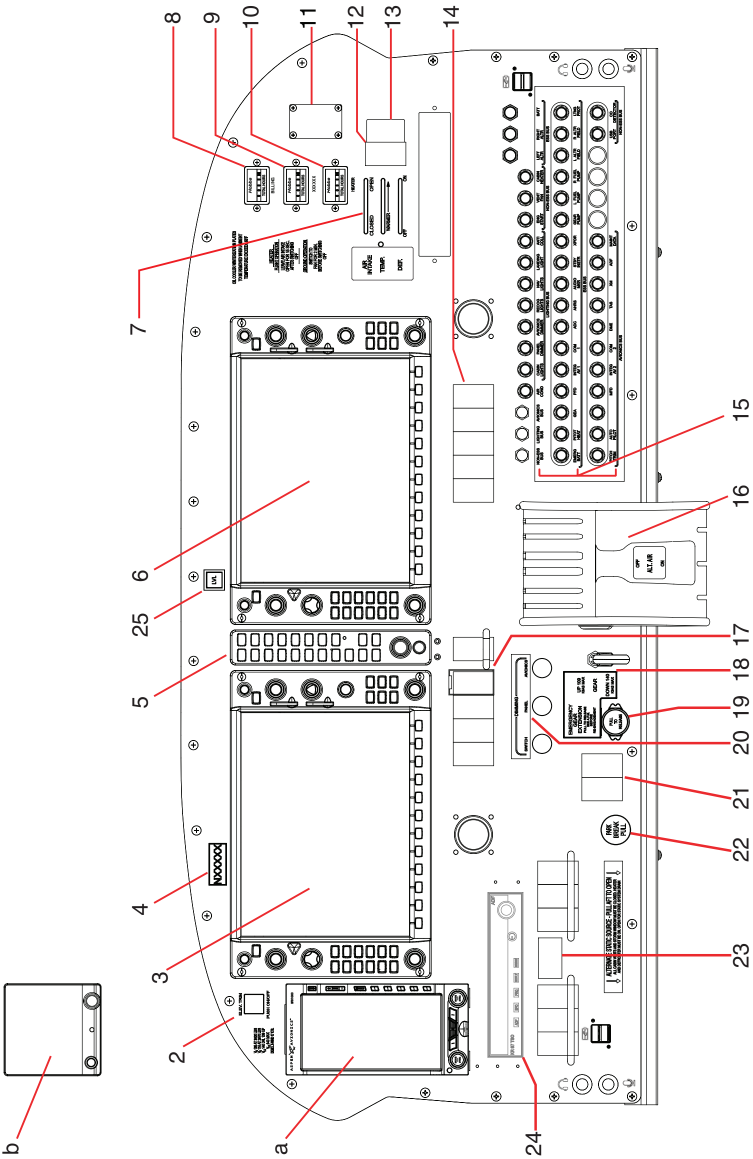


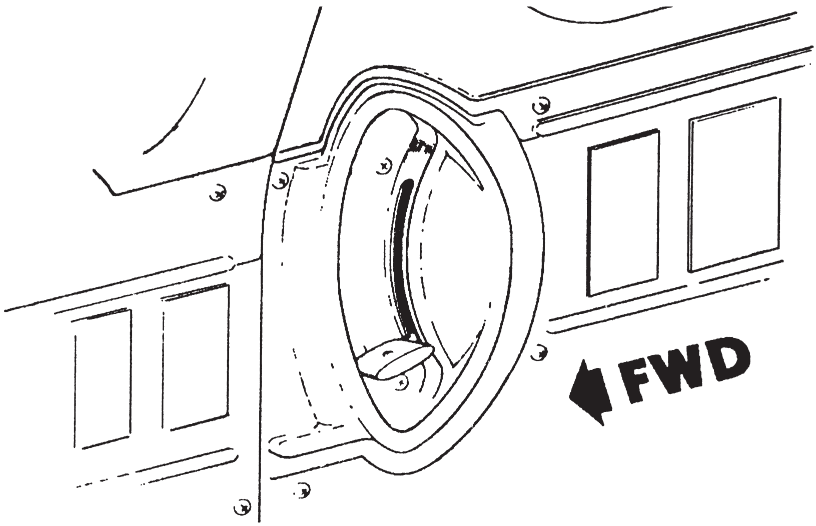

**INSTRUMENT PANEL**
Figure 7-33
(Sheet 1 of 2)

1. Standby instrument
   a. Aspen EBD-1000
   b. Garmin G5
2. Elevator Trim switch
3. PFD
4. Registration Number plate
5. Audio Panel
6. MFD
7. Environmental controls (See Figure 7-31)
8. HOBBS meter - Billing - Optional
9. HOBBS meter - Maintenance or Flight
10. HOBBS meter - Heater
11. ELT switch
12. Cabin heater fan
13. Ventilation fan
14. Right switch bank (L to R) (See Figure 7-21)
    a. Pitot Heat
    b. Nav lights
    c. Recognition lights
    d. Landing light
    e. Strobe light
15. Circuit Breakers
16. Throttle quadrant
17. Left switch bank – (L to R, See Figure 7-21)
    a. Battery Master
    b. Left Alternator
    c. Right Alternator
    d. Avionics Master
    e. Emergency Battery
18. Landing gear selector
19. Emergency gear extension knob & guard
20. Dimmer controls (L to R)
    a. Switches
    b. Panel
    c. Avionics
21. Left and right fuel pump switches
22. Parking brake
23. Engine switches (L to R)
    a. Left engine switches (left and right magneto)
    b. Left engine starter
    c. Right engine starter
    d. Right engine switches (left and right magneto)
24. ADF (optional)
25. Level Mode (LVL) switch (opional)

**INSTRUMENT PANEL (continued)**
Figure 7-33
(Sheet 2 of 2)

## 7.27 CABIN FEATURES

Cabin entry is made through the cabin door on the right side. The cabin door is double latched. To close the cabin door, hold the door closed with the armrest while moving the lower door latch (Figure 7-35) down to the LATCHED position. Then engage the upper latch to the LATCHED position. Both latches must be secure before flight.

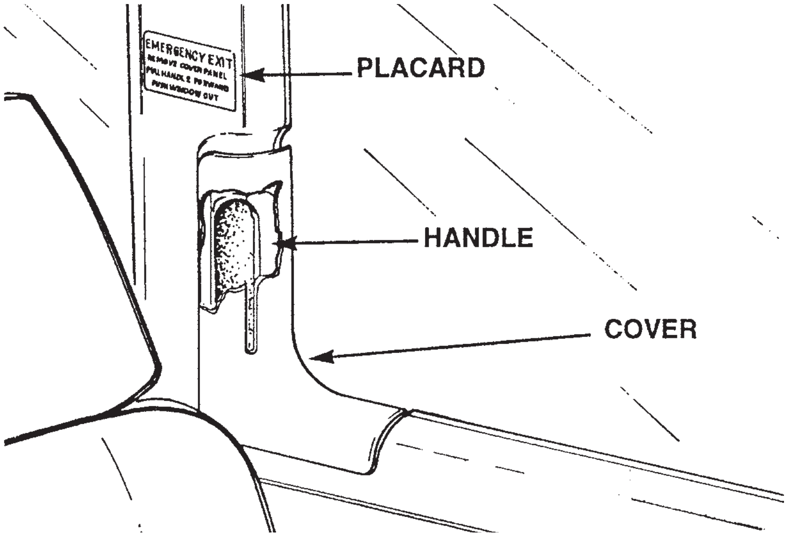



**CABIN DOOR LOWER LATCH**
Figure 7-35

The pilot's left side window is an emergency exit. The emergency exit release handle is located beneath the thermoplastic cover on the vertical post between the first and second left side windows (Figure 7-37).

**_CAUTION_**

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




**EMERGENCY EXIT**
Figure 7-37

STANDARD FEATURES

Standard front cabin features include cabin and baggage door locks, a pilot's storm window, map pockets, and sun visors. An armrest is located on the side panel adjacent to each front seat. Additional standard cabin items are pockets on the front seat backs, a portable fire extinguisher, a special cabin sound-proofing package, a coat hanger support bar and baggage restraint straps in the aft baggage area.

A worktable is available and can be attached to the rear of either the pilot or copilot seat. The worktable is stored along the left side in the baggage area. It is secured with a strap.

## SEATS

All seat backs have three positions: normal, intermediate and recline. An adjusment lever is located at the base of each seat back on the outboard side.

The two front seats are adjustable fore, aft and vertically. The seats are adjustable fore and aft by lifting the bar below the seat front and moving to the desired position. Release the handle and move the seat until the locking pin engages. To raise the vertically adjustable pilot and copilot seats, push back on the pushbutton located at the lower right of each seat, relieve the weight from the seat and it will rise. To lower the seat, push the button and apply weight until the proper position is reached.

The rear seats are easily removed to provide room for bulky items. Rear seat installations incorporate leg retainers with latching mechanisms, which must be released before the rear seats can be removed. Releasing the retainers is accomplished by depressing the plunger behind each rear leg.

**NOTE**

To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.

## SEAT BELTS AND SHOULDER HARNESSES

Seat belts and adjustable shoulder harnesses with inertial reels are standard on all four seats. The pilot should adjust this fixed seat belt strap so that all controls are accessible while maintaining adequate restraint for the occupant. The seat belt should be snugly fastened over each unoccupied seat.

The shoulder harness is routed over the shoulder adjacent to the window and attached to the seat belt in the general area of the occupant's inboard hip. A check of the inertial reel mechanism is made by pulling sharply on the strap. The reel should lock in place and prevent the strap from extending. For normal body movements, the strap will extend or retract as required.

FIRE EXTINGUISHER

A portable, handheld, fire extinguisher, is mounted between the pilot and copilot seats, behind the fuel selector console. Read the instructions on the nameplate and become familiar with the unit before an emergency situation.

## 7.29 BAGGAGE AREA

The 24 cubic foot baggage compartment, located aft of the seats, has a weight capacity of 200 pounds. This compartment is loaded and unloaded through a separate 22 x 20 inch baggage door, and the compartment is accessible during flight. Tie-down straps are provided and they should be used at all times. The baggage compartment door and passenger door use the same key.

**NOTE**

It is the pilot's responsibility to be sure when baggage is loaded that the airplane C.G. falls within the allowable C.G. range. (See Weight and Balance Section.)

## 7.31 FINISH

The standard exterior finish is painted with acrylic enamel. To keep the finish attractive, economy size spray cans of touch-up paint are available from Piper Dealers.

## 7.33 STALL WARNING

An approaching stall is indicated by a STALL.....STALL aural alert which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on the Stall Speed vs Angle of Bank graph in Section 5.

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

## 7.35 EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT), is located in the aft portion of the fuselage and is accessible through a rear closeout panel on the right side of the fuselage. This panel 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, a key, a 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 ELT 1000 OPERATION

There is a three position switch (placarded ON ARM/OFF, and TEST) on the ELT unit. The switch is set to ARM/OFF when the ELT is installed at the factory, and it should remain in that position whenever the unit is installed in the airplane.

A remote switch (placarded ON ARM/OFF, and TEST) is located on the copilot's instrument panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in ARM /OFF 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.

The Artex ELT 1000 (406 MHz) is equipped with a warning buzzer. This warning buzzer, which receives power from the ELT itself, is mounted in the tailcone. Whenever the ELT is activated the buzzer "beeps" periodically. The time between pulses lengthens after 12 hours. The objective is to hear the buzzer from outside the aircraft while the engine is not running.

Should the ELT be activated inadvertently it can be reset by either positioning the cockpit remote switch or the local ELT box switch to ON then immediately switching it to the ARM position. The ELT cannot be reset if either the cockpit remote switch or the ELT local switch is in the ON 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**

A monthly functional check is recommended to verify operational status of the ELT. Prior to testing, the aircraft must be located to receive GPS signals with avionics on. Within the first 5 minutes after the hour, select the cockpit remote switch to the test position for ~ 1 second and then return to the ARM/OFF position. The remote switch LED light and buzzer should then activate for ~ 2 seconds. If the 2 second LED light and buzzer indication is not received, refer to the ARTEX ELT 1000 maintenance manual.

## 7.35 EMERGENCY LOCATOR TRANSMITTER (continued)

ARTEX ELT 1000 OPERATION (continued)

The ARTEX ELT 1000 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 ARM/OFF will automatically reset the ELT and should stop the signal being received on 121.50 MHz.

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## AIRPLANE HANDLING, SERVICING AND MAINTENANCE

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## AIRPLANE HANDLING, SERVICING AND MAINTENANCE

# SECTION 8

# AIRPLANE HANDLING, SERVICING AND MAINTENANCE

## 8.1 GENERAL

This section provides guidelines relating to the handling, servicing and maintenance of the Seminole. For complete maintenance instructions, refer to the PA-44-180 Maintenance Manual.

**WARNING**

**Inspection, maintenance and parts requirements for all non-PIPER approved STC installations are not included in this handbook. When a non-PIPER approved STC installation is incorporated on the airplane, those portions of the airplane affected by the installation must be inspected in accordance with the inspection program published by the owner of the STC. Since non-PIPER approved STC installations may change systems interface, operating characteristics and component loads or stresses on adjacent structures, PIPER provided inspection criteria may not be valid for airplanes with non-PIPER approved STC installations.**

**WARNING**

**Modifications must be approved in writing by PIPER prior to installation. Any and all other installations, whatsoever, of any kind will void this warranty in it's entirety.**

## 8.1 GENERAL (continued)

**WARNING**

**Use only genuine PIPER parts or PIPER approved parts obtained from PIPER approved sources, in connection with the maintenance and repair of PIPER airplanes.**

**Genuine PIPER parts are produced and inspected under rigorous procedures to ensure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.**

**Additionally, reworked or salvaged parts or those parts obtained from non-PIPER approved sources, may have service histories which are unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or may have other hidden damage not discernible through routine visual or nondestructive testing. This may render the part, component or structural assembly, even though originally manufactured by PIPER, unsuitable and unsafe for airplane use.**

**PIPER expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.**

## 8.1 GENERAL (continued)

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Service Department to obtain the latest information pertaining to their airplane, and to avail themselves of Piper's support systems.

Piper takes a continuing interest in having owners get the most efficient use from their airplane and keeping it in the best mechanical condition. Consequently, Piper, from time to time, issues service releases including Service Bulletins, Service Letters, Service Spares Letters, and others relating to the airplane.

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are available on the Piper.com website. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Piper Service Letters deal with product improvements and servicing techniques pertaining to the airplane. These are available on the Piper.com website. Owners should give careful attention to Service Letter information.

Piper Service Spares Letters offer improved parts, kits and optional equipment which were not available originally, and which may be of interest to the owner.

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

Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

## 8.3 AIRPLANE INSPECTION PERIODS

**WARNING**

**All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., recommended by PIPER are solely based on the use of new, remanufactured or overhauled PIPER approved parts. If parts are designed, manufactured, remanufactured, overhauled and/or approved by entities other than PIPER, then the data in PIPER'S maintenance/service manuals and parts catalogs are no longer applicable and the purchaser is warned not to rely on such data for non-PIPER parts. All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., for such non-PIPER parts must be obtained from the manufacturer and/or seller of such non-PIPER parts.**

Piper has developed inspection items and required inspection intervals (i.e.: 50, 100, 500, and 1000 hours) for the specific model aircraft. Appropriate forms are contained in the applicable Piper Service/Maintenance Manual, and should be complied with by a properly trained, knowledgeable, and qualified mechanic at a Piper Authorized Service Center or a reputable repair shop. Piper cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed Inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continuous airworthiness is maintained. Complete details are available from all local distributors representing Piper Aircraft, Inc.

## 8.3 AIRPLANE INSPECTION PERIODS (continued)

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

A spectographic analysis of the engine oil is available from several sources. This inspection, if performed properly, provides a good check of the internal condition of the engine. To be accurate, induction air filters must be cleaned or changed regularly, and oil samples must be taken and sent in at regular intervals.

## 8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used to carry persons or property for hire. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance required on the airplane should be accomplished by appropriately certified personnel.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

## 8.7 AIRPLANE ALTERATIONS

If the owner desires to have their aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
  (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
  (2) Aircraft Registration Certificate Form FAA-8050-3.
  (3) Aircraft Radio Station License if transmitters are installed.

(b) To be carried in the aircraft at all times:
  (1) Pilot's Operating Handbook.
  (2) Weight and Balance data, plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
  (3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

## 8.9 GROUND HANDLING

(a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly.

**_CAUTION_**

*When towing with power equipment, do not turn the nose gear beyond its steering radius in either direction, as this will result in damage to the nose gear and steering mechanism.*

*Do not tow the airplane when the controls are secured.*

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and / or tail by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures as well as taxi techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following checks should be performed:

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.

## 8.9 GROUND HANDLING (continued)

(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.

(5) When taxiing over uneven ground, avoid holes and ruts.

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

(c) Parking

When parking the airplane, be sure that it is sufficiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) To park the airplane, head it into the wind if possible.

(2) Set the parking brake by depressing the toe brakes and pulling out the parking brake control. To release the parking brake, depress the toe brakes and push in the parking brake control, then release the toe brakes.

**CAUTION**

*Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.*

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.

(2) Retract the flaps.

(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.

(4) Block the wheels.

(5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

**CAUTION**

*Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.*

**NOTE**

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

(6) Install a pitot head cover if available. Be sure to remove the pitot head cover before flight.

(7) Cabin and baggage doors should be locked when the airplane is unattended.

## 8.11 ENGINE INDUCTION AIR FILTERS

(a) Removing Induction Air Filter

(1) Remove the upper cowling to gain access to the air filter box.

(2) Turn the three studs and remove the air filter box cover.

(3) Lift the air filter from the filter box.

(b) Cleaning Induction Air Filters

The induction air filters must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

To clean the filter:

(1) Tap filter gently to remove dirt particles. Do not use compressed air or cleaning solvents.

(2) Inspect filter. If paper element is torn or ruptured or gasket is damaged, the filter should be replaced. The usable life of the filter should be restricted to one year or 500 hours, whichever comes first.

## 8.11 ENGINE INDUCTION AIR FILTERS (continued)

(c) Installation of Induction Air Filters

After cleaning, place filter in air box and install cover. Secure cover by turning studs. Replace cowl.

## 8.13 BRAKE SERVICE

The brake system is filled with MIL-PRF-5606 (petroleum base) hydraulic brake fluid. This should be checked periodically or at every 50-hour inspection and replenished when necessary. The brake reservoir is located in the forward maintenance area. Remove the four screws and rotate the fiberglass nose cone forward and down. The reservoir is located at the top rear of the compartment. Keep the fluid level at the level marked on the reservoir.

No adjustment of brake clearance is necessary. Refer to the Maintenance Manual for brake lining replacement instructions.

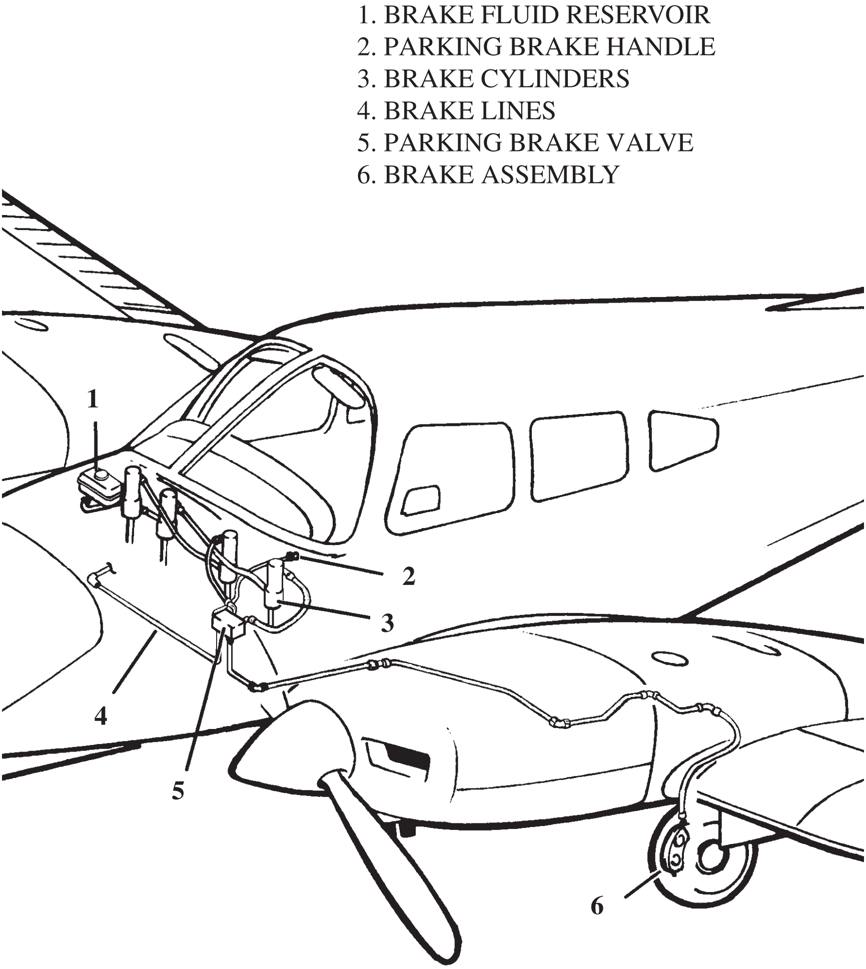
## 8.15 LANDING GEAR SERVICE

Two jack points are provided for jacking the aircraft for servicing. One is located outboard of each main landing gear. Before jacking, attach a tail support to the tail skid. Approximately 500 pounds of ballast should be placed on the tail support.

***CAUTION***

*Be sure to apply sufficient support ballast; otherwise the airplane may tip forward, and the nose section could be damaged.*

Landing gear oleos should be serviced according to instruction on the units. Under normal static load (empty weight of airplane plus full fuel and oil), main oleo struts should be exposed 2.60 inches and the nose oleo strut should be exposed 2.70 inches. Refer to the Maintenance Manual for complete information on servicing oleo struts.




**BRAKE SYSTEM**
Figure 8-1

## 8.17 HYDRAULIC SYSTEM SERVICE

The hydraulic landing gear system reservoir is an integral part of the electric hydraulic pump assembly. The combination pump and reservoir is accessible through a panel in the baggage compartment. Fill the reservoir with MIL-PRF-5606 hydraulic fluid. The fluid level should be checked periodically or every 50 hour inspection and replenished when necessary.

To check fluid level, remove the filler plug/dipstick and note fluid level on dipstick. The filler plug also incorporates a vent. When reinstalling filler plug, tighten to full tight then loosen 1 1/2 turns to allow proper venting. The instructions are also placarded on the pump reservoir. For SN 4496471, 4496519 & UP, and aircraft with Kit 88693 installed, check the fluid level by viewing the fluid through the transparent reservoir. Verify the fluid is at or above the bottom white circumferential line on the reservoir when gear is down/extended. If aircraft is oriented such that fluid in power pack is not level/parallel with the circumferential lines, the fluid level below the filler cap on the inboard side of the reservoir should be used.

## 8.19 PROPELLER SERVICE

The gas charge in the propeller cylinder should be kept at the pressure specified on the placard located in the spinner cap. The pressure in the cylinder will increase about one-third psi for every degree Fahrenheit increase in temperature. This effect should be considered when checking pressure. The charge maintained must be accurate and free of excessive moisture since moisture may freeze the piston during cold weather. Dry nitrogen gas is recommended.

## 8.19 PROPELLER SERVICE (continued)

CHAMBER PRESSURE REQUIREMENTS WITH TEMPERATURE FOR COUNTERWEIGHT TYPE PROPELLERS

| 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 gas charge in the unfeathering accumulators should be maintained at 90 - 100 PSI. It is important to use nitrogen only for this purpose since any moisture in the system may freeze and render it inoperative. Do not check this charge pressure while engine is running.

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.

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## 8.21 OIL REQUIREMENTS

The oil capacity of the Lycoming engines is 8 quarts per engine with a minimum safe quantity of 2 quarts per engine. It is necessary that oil be maintained at full for maximum endurance flights. It is recommended that engine oil be drained and renewed every 50 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The interval between oil and oil filter change is not to exceed four (4) months. Lycoming Service Bulletin No. 446 should be complied with each 50 hours, also.

**NOTE**

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

## 8.23 FUEL SYSTEM

(a) Servicing Fuel System

The fuel screens in the strainers require cleaning at 50 hour or 90 day intervals, whichever occurs first. The fuel gascolator strainers are located in the fuselage under the rear seats. The fuel selector valves and the auxiliary pumps are in the wings adjacent to the nacelles.

(b) Fuel Requirements

The minimum aviation grade fuel for the PA-44-180 is 100. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes.

Refer to the latest issue of Lycoming Service Instruction No. 1070 for additional information.

A summary of current grades as well as the previous fuel designations is shown in the following chart:

### FUEL GRADE COMPARISON CHART

| Previous Commercial Fuel Grades (ASTM-D910) | | | Current Commercial Fuel Grades (ASTM-D910-75) | | | Current Military Fuel Grades (MIL-G-5572E) Amendment No. 3 | | |
|---|---|---|---|---|---|---|---|---|
| Grade | Color | Max. TEL ml/U.S. gal | Grade | Color | Max. TEL ml/U.S. gal | Grade | Color | Max. TEL ml/U.S. gal |
| 80/87 | red | 0.5 | 80 | red | 0.5 | 80/87 | red | 0.5 |
| 91/98 | blue | 2.0 | *100LL | blue | 2.0 | none | none | none |
| 100/130 | green | 3.0 | 100 | green | **3.0 | 100/130 | green | **3.0 |
| 115/145 | purple | 4.6 | none | none | none | 115/145 | purple | 4.6 |

* -Grade 100LL fuel in some overseas countries is currently colored green and designated as 100L.

** -Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

The operation of the aircraft is approved with an anti-icing additive in the fuel. When an anti-icing additive is used it must meet the specification MIL-1-27686, must be uniformly blended with the fuel while refueling, must not exceed 0.15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than 0.10% by volume. One and one half liquid ozs. per ten gallon of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

***CAUTION***

*Assure that the additive is directed into the flowing fuel stream. The additive flow should start after and stop before the fuel flow. Do not permit the concentrated additive to come in contact with the aircraft painted surfaces or the interior surfaces of the fuel tanks.*

***CAUTION***

*Some fuels have anti-icing additives preblended in the fuel at the refinery, so no further blending should be performed.*

*Fuel additive can not be used as a substitute for preflight draining of the fuel system.*

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the fillers located inside the access cover aft of the engine cowling on the outboard side of the nacelles. Each nacelle tank holds a maximum of 55 U .S. gallons. When using less than the standard 110 gallon capacity, fuel should be distributed equally between each side.

## 8.23 FUEL SYSTEM (continued)

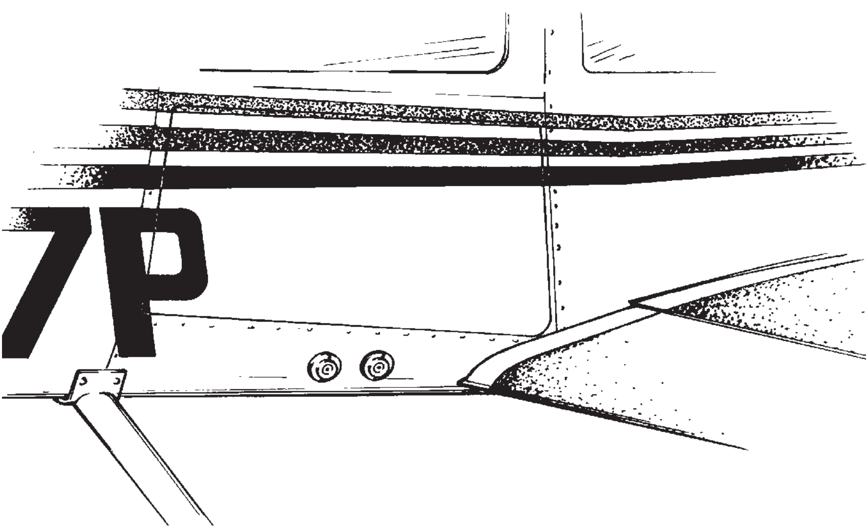
(d) Draining Fuel Strainers, Sumps and Lines

The aircraft is equipped with single point drains (Figure 8-3) which should be drained before the first flight of the day and after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each half of the fuel system can be drained from a single point which is located just forward of the entrance step. Fuel selectors should be in the ON position during draining. The fuel drained should be collected in a transparent container and examined for contamination.

***CAUTION***

*When draining fuel, be sure that no fire hazard exists before starting the engines.*




**FUEL DRAINS**
Figure 8-3

(e) Draining Fuel System

The fuel may be drained by opening the valves at the right side of the fuselage just forward of the entrance step or by siphoning. The remaining fuel in the lines may be drained through the gascolators.

## 8.25 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures. The main gear tires should be inflated to 55 psi and the nose gear should be inflated to 50 psi.

Interchange the tires on the main wheels, if necessary, to produce even wear. All wheels and tires are balanced before original installation, and the relationship of the tire, tube, and wheel should be maintained if at all possible. Unbalanced wheels can cause extreme vibration on takeoff. In the installation of new components, it may be necessary to rebalance the wheel with the tire mounted.

When checking the pressure, examine the tires for wear, cuts, bruises and slippage.

## 8.27 BATTERY SERVICE

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

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

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

## 8.29 SERIAL NUMBER PLATES

The serial number plate is located on the bottom of the fuselage near the aft end of the tail cone. The serial number should always be used when referring to the airplane on service or warranty matters.

## 8.31 LUBRICATION

Lubrication at regular intervals is an essential part of the maintenance of an airplane. For lubrication instructions and a chart showing lubrication points, types of lubricants to be used, lubrication methods and recommended frequencies, refer to the Maintenance Manual.

## 8.33 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.
(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

***CAUTION***

*Do not spray solvent into the alternator, starter, air intakes, or alternate air inlets.*

## 8.33 CLEANING (continued)

(3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

**CAUTION**

*Do not operate the engine until excess solvent has evaporated or otherwise been removed.*

(4) Remove the protective tape from the magnetos.

(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the Maintenance Manual.

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

(1) Place a pan under the gear to catch waste.

(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.

(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.

(4) Remove the cover from the wheel and remove the catch pan.

(5) Lubricate the gear in accordance with the Lubrication Chart in the Maintenance Manual.

(6) Caution: Do not brush the micro switches.

## 8.33 CLEANING (continued)

(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.

## 8.33 CLEANING (continued)

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff brush, and vacuum where necessary.

(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Carefully follow the manufacturer's instructions. Avoid soaking or harsh rubbing.

**CAUTION**

*Solvent cleaners require adequate ventilation.*

(3) Leather should be cleaned with saddle soap or a mild hand soap and water.

(f) Cleaning Carpets

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a non-inflammable dry cleaning fluid. Floor carpets may be removed and cleaned like any household carpet.

## 8.35 WINTERIZATION

For winter operation a winterization kit is installed on the inlet opening of the oil cooler outboard chamber of the plenum chamber. This kit should be installed whenever the ambient temperature is 50ºF or less. When the kit is not being used it can be stowed in the nose cone compartment.

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# TABLE OF CONTENTS

## SECTION 9

## SUPPLEMENTS

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# SECTION 9

# SUPPLEMENTS

## 9.1 GENERAL

This section provides information in the form of supplements which are necessary for the various optional systems and equipment not approved with the standard airplane.

All of the supplements provided in this section are FAA approved and consecutively numbered as a permanent part of this handbook. The information contained in each supplement applies only when the related equipment is installed in the airplane.

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# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL

## SUPPLEMENT NO. 1
## FOR
## APPAREO VISION 1000 UNIT

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Appareo Vision 1000 unit is installed in accordance with Piper Drawing 107422. This information supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the optional Appareo Vision 1000 unit is installed.

FAA APPROVED: ______________________

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

DATE OF APPROVAL: November 3, 2016

## SECTION 1 - GENERAL

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

## SECTION 2 - LIMITATIONS

No change.

## SECTION 3 - EMERGENCY PROCEDURES

No change.

## SECTION 4 - NORMAL PROCEDURES

OPERATION

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

**NOTE**

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

To insert memory card:

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

To remove memory card:

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

## SECTION 4 - NORMAL PROCEDURES (continued)

**Status Indicators:**

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

## SECTION 5- PERFORMANCE

No change.

## SECTION 6- WEIGHT AND BALANCE

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

## SECTION 7- DESCRIPTION AND OPERATION

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

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

# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL

## SUPPLEMENT NO. 2
## FOR
## FLIGHTCOM MODEL 403 INTERCOM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Flightcom model 403 intercom is installed in accordance with Piper Drawing 107423. This information supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the optional Flightcom model 403 intercom is installed.

FAA APPROVED: ______________________
Eric A. Wright
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DATE OF APPROVAL: November 3, 2016

## SECTION 1 - GENERAL

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

## SECTION 2 - LIMITATIONS

No change.

## SECTION 3 - EMERGENCY PROCEDURES

### Intercom Failsafe Feature

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

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

## SECTION 4 - NORMAL PROCEDURES

### Adjusting the Intercom and Headsets

To adjust the intercom and headsets:

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

**NOTE**

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

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

## SECTION 4 - NORMAL PROCEDURES (Continued)

### Adjusting the Intercom and Headsets (Continued)

**NOTE**

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

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

### Adjusting the Squelch Control

To adjust the squelch control:

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

**NOTE**

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

### Radio Transmission

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

**NOTE**

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

## SECTION 4 - NORMAL PROCEDURES (Continued)

### Isolate Switch

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

## SECTION 5- PERFORMANCE

No change.

## SECTION 6- WEIGHT AND BALANCE

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

## SECTION 7- DESCRIPTION AND OPERATION

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

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

# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL

## SUPPLEMENT NO. 3
## FOR
## BENDIX/KING KR-87 DIGITAL ADF
## WITH GARMIN PFD INDICATOR

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Bendix/King KR-87 Digital ADF with the Garmin Primary Flight Dispaly (PFD) is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED: ______________________
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DATE OF APPROVAL: November 3, 2016

## SECTION 1 - GENERAL

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

The Bendix/King Digital ADF can be used for position plotting and homing procedures, and for aural reception of amplitude modulated (AM) signals.

The "flip-flop" frequency display allows switching between pre-selected "STANDBY" and "ACTIVE" frequencies by pressing the frequency transfer button. Both preselected frequencies are stored in a non-volatile memory circuit (no battery power required) and displayed in self-dimming gas discharge numerics. The active frequency is continuously displayed in the left window, while the right window will display either the standby frequency or the selected readout from the built-in timer.

The built-in electronic timer has two separate and independent timing functions: (1) An automatic flight timer that starts whenever the unit is turned on. This timer functions up to 59 hours and 59 minutes. (2) An elapsed timer which will count up or down for up to 59 minutes and 59 seconds. When a preset time interval has been programmed and the countdown reaches :00, the display will flash for 15 seconds. Since both the flight timer and elapsed timer operate independently, it is possible to monitor either one without disrupting the other. The pushbutton controls and the bearing indicator are internally lighted.

## SECTION 2 - LIMITATIONS

No change.

## SECTION 3 - EMERGENCY PROCEDURES

No change.

## SECTION 4 - NORMAL PROCEDURES

**To Operate as an Automatic Direction Finder:**

1. OFF/VOL Control - ON.
2. Frequency Selector Knobs - SELECT desired frequency in the standby frequency display.
3. FRQ Button - PRESS to move the desired frequency from the standby to the active position.
4. ADF Button (on audio panel) - PRESS to activate ADF audio through headset.
5. SPKR Button (on audio panel) - PRESS to activate ADF audio through cockpit speaker.
6. OFF/VOL Control - SET to desired volume level.
7. ADF Button - PRESS to select ADF mode.
8. ADF Bearing - Display ADF bearing on PFD by selecting the PFD softkey, then pressing the BRG1 or BRG2 softkey until "ADF" is displayed in the appropriate Bearing 1 or Bearing 2 information window and bearing pointer is displayed on the HSI.

**ADF Test (Pre-flight or In-flight):**

1. ADF Button - SELECT ANT mode and note pointer moves to 90° position and then disappears.
2. ADF Button - SELECT ADF mode and note the pointer moves without hesitation to the station bearing. Excessive pointer sluggishness, wavering or reversals indicate a signal that is too weak or a system malfuction.

## SECTION 4 - NORMAL PROCEDURES (continued)

**NOTE**

The Standby Frequency which is in memory while Flight Time or Elapsed Time modes are being displayed may be called back by pressing the FRQ button, then transferred to active use by pressing the FRQ button again.

**To Operate Elapsed Time Timer-Count Down Mode:**

1. OFF/VOL Control - ON.
2. FLT/ELT Mode Button - PRESS (once or twice) until ET is annunciated.
3. SET/RST Button - PRESS until the ET annunciation begins to flash.
4. FREQUENCY SELECTOR KNOBS - SET desired time in the elapsed time display. The small knob is pulled out to tune the 1's. The small knob is pushed in to tune the 10's. The outer knob tunes minutes up to 59 minutes.

**NOTE**

Selector knobs remain in the time set mode for 15 seconds after the last entry or until the SET/RST, FLT/ET, or FRQ button is pressed.

5. SET/RST Button - PRESS to start countdown. When the timer reaches 0, it will start to count up as display flashes for 15 seconds.

**NOTE**

While FLT or ET are displayed, the active frequency on the left side of the window may be changed, by using the frequency selector knobs, without any effect on the stored standby frequency or the other modes.

## SECTION 4 - NORMAL PROCEDURES (continued)

### ADF Operation NOTES:

*Erroneous ADF Bearing Due to Radio Frequency Phenomena*:

In the U.S., the FCC, which assigns AM radio frequencies, occasionally will assign the same frequency to more than one station in an area. Certain conditions, such as Night Effect, may cause signals from such stations to overlap. This should be taken into consideration when using AM broadcast station for navigation.

Sunspots and atmospheric phenomena may occasionally distort reception so that signals from two stations on the same frequency will overlap. For this reason, it is always wise to make positive identification of the station being tuned, by switching the function selector to ANT and listening for station call letters.

*Electrical Storms*:

In the vicinity of electrical storms, an ADF indicator pointer tends to swing from the station tuned toward the center of the storm.

*Night Effect*:

This is a disturbance particularly strong just after sunset and just after dawn. An ADF indicator pointer may swing erratically at these times. If possible, tune to the most powerful station at the lowest frequency. If this is not possible, take the average of pointer oscillations to determine relative station bearing.

*Mountain Effect*:

Radio waves reflecting from the surface of mountains may cause the pointer to fluctuate or show an erroneous bearing. This should be taken into account when taking bearings over mountainous terrain.

*Coastal Refraction*:

Radio waves may be refracted when passing from land to sea or when moving parallel to the coastline. This also should be taken into account.

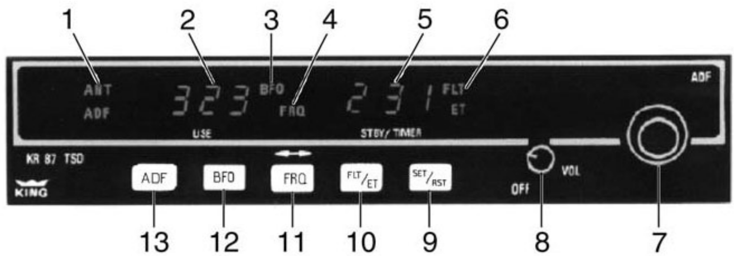
## SECTION 5 - PERFORMANCE

No change.

## SECTION 6 - WEIGHT AND BALANCE

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

## SECTION 7 - DESCRIPTION AND OPERATION




**KR-87 Digital ADF**


**ADF Displays in Garmin PFD**

**King Digital ADF Operating Controls and Indicators**
Figure 1

## SECTION 7 - DESCRIPTION AND OPERATION (continued)

### Legend - Figure 1

1. Mode Annunciation - Antenna (ANT) is selected by the "out" position of the ADF button. This mode improves the aural reception and is usually used for station identification. The bearing pointer is deactivated and will park in the 90° relative position. Automatic Direction Finder (ADF) mode is selected by the depressed position of the ADF button. This mode activates the bearing pointer. The bearing pointer will point in the direction of the station relative to the aircraft heading.
2. Active Frequency Display - The frequency to which the ADF is tuned is displayed here. The active ADF frequency can be changed directly when either of the timer functions are selected.
3. Beat Frequency Oscillator (BFO) - The BFO mode, activated and annunciated when the "BFO" button is depressed, permits the carrier wave and associated morse code identifier broadcast on the carrier wave to be heard.

**NOTE**

CW signals (Morse Code) are unmodulated and no audio will be heard without use of BFO. This type of signal is not used in the United States air navigation. It is used in some foreign countries and marine beacons.

4. Standby Frequency Annunciation (FRQ) - When FRQ is displayed, the STANDBY frequency is displayed in the right display. The STANDBY frequency is selected using the frequency select knobs. The selected STANDBY frequency is put into the ACTIVE frequency window by pressing the frequency transfer button.
5. Standby Frequency Display - Either the standby frequency, the flight timer, or the elapsed time is displayed in this position. The flight timer and elapsed timer are displayed replacing the standby frequency which goes into "blind" memory to be called back at any time by depressing the FRQ button. Flight time or elapsed time are displayed and annunciated alternatively by depressing the FLT/ET button.

## SECTION 7 - DESCRIPTION AND OPERATION (continued)

**Legend - Figure 1 (continued)**

6. Timer Mode Annunciation - Either the elapsed time (ET) or flight time (FLT) mode is annunciated here.
7. Frequency Selector Knobs - Selects the standby frequency when FRO is displayed and directly selects the active frequency whenever either of the timer functions is selected. The frequency selector knobs may be rotated either clockwise or counterclockwise. The small knob is pulled out to tune the 1's. The small knob is pushed in to tune the 10's. The outer knob tunes the 100's with rollover into the 1000's. These knobs are also used to set the desired time when the elapsed timer is used in the countdown mode.
8. Off/Volume Control (OFF/VOL) - Controls primary power and audio output level. Clockwise rotation from OFF position applies primary power to receiver; further clockwise rotation increases audio level. Audio muting causes the audio output to be muted unless the receiver is locked on a valid station.
9. Set/Reset Button (SET/RST) - The set/reset button, when pressed, resets the elapsed timer whether it is being displayed or not.
10. Flight Time/Elapsed Time Mode Selector Button (FLT/ET) - The Flight Timer/Elapsed Time mode selector button, when pressed, alternatively selects either Flight Timer mode or Elapsed Timer mode.
11. Frequency Transfer Button (FRQ) - The FRQ transfer button, when pressed, exchanges the active and standby frequencies. The new frequency becomes active and the former active frequency goes into standby.
12. BFO Button - The BFO button selects the BFO mode when in the depressed position (see Note under item 3).
13. ADF Button - The ADF button selects either the ANT mode or the ADF mode. The ANT mode is selected with the ADF button in the out position. The ADF mode is selected with the ADF button in the depressed position.
14. Bearing Pointer (on PFD) - The cyan arrow indicates magnetic bearing to the station, in degrees.

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# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL

## SUPPLEMENT NO. 4
## FOR
## BENDIX/KING KN-63 DME

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Bendix/King KN-63 DME is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: November 3, 2016

## SECTION 1 - GENERAL

The Bendix/King KN-63 DME supplies continuous slant range distance information from a fixed ground station to an aircraft in flight.

The equipment consists of Garmin Primary Flight Display (PFD) which contains all the operating controls and displays, and a remotely mounted KN-63 Receiver-Transmitter.

## SECTION 2 - LIMITATIONS

No change.

## SECTION 3 - EMERGENCY PROCEDURES

No change.

## SECTION 4 - NORMAL PROCEDURES

### DME Operation

1. NAV 1 and NAV 2 VHF Navigation Receivers - ON; TUNE FREQUENCY to VOR/DME station frequencies, as required.

**NOTE**

When the VORTAC or VOR/DME frequency is selected, the appropriate DME frequency is automatically channeled.

2. DME IDENTIFICATION - select DME button on audio panel (audio ID will always come though the headset and will come through the cockpit speaker if SPKR is selected on the audio panel).

## SECTION 5 - PERFORMANCE

No change.

## SECTION 6 - WEIGHT AND BALANCE

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

## SECTION 7 - DESCRIPTION AND OPERATION


**DME Display on Garmin PFD**

Figure 1

### Legend - Figure 1


1. DME Information Window
2. DME MODE ANNUNCIATOR
   Displays the DME operating mode; NAV 1 or NAV 2 or HOLD as selected in the DME TUNING window.
3. FREQUENCY
   Displays the frequency of the VOR/DME or VORTAC selected on the associated navigation radio or the frequency being held (HOLD) that was previously selected.
4. DISTANCE DISPLAY (NM)
   DME distance to VOR/DME or VORTAC displayed in .1 nautical mile increments up to 99.9 NM, then in increments of one nautical mile to up to 389 NM.

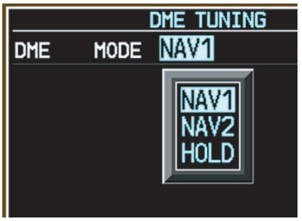
## SECTION 7 - DESCRIPTION AND OPERATION (continued)

**Legend - Figure 1 (continued)**

5. DME TUNING Window (NAV1, NAV2, HOLD)
   Allows access to the DME operating mode as follows:

   NAV 1 Selects DME operation with No. 1 VHF navigation set; enables channel selection by NAV 1 frequency selector controls.

5




   NAV 2 Selects DME operation with No. 2 VHF navigation set; enables channel selection by NAV 2 frequency selector controls.

   HOLD Selects DME memory circuit; DME remains channeled to station which was last channeled when HOLD was selected and will continue to display information relative to this channel. Allows both the NAV 1 and NAV 2 navigation receivers to be set to new operational frequencies without affecting the previously selected (HOLD) DME operation.

**NOTE**

In the HOLD mode, the frequency being held remains in the DME Information Window and does not update when NAV1 or NAV2 frequencies are being updated.

**NOTE**

If NAV1 or NAV2 are yellow X'd on the PFD, the associated DME indication will be valid if it was the active DME when the NAV failure occurred. Switching to the DME associated with the failed NAV will not be possible.

# SUPPLEMENT 5

## CARBURETED O-360/ LO-360 ENGINE INSTALLATION

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the carbureted O-360/ LO-360 engines are 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.

This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the carbureted O-360/ LO-360 engines are installed.

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

DATE OF APPROVAL: December 15, 2017

## SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the carbureted O-360/ LO-360 engines are installed. The information contained within this supplement is to be used "as described" in conjunction with the complete handbook.

### 1.3 ENGINES

(c) Engine Model Number

| | |
|---|---|
| Left | O-360-A1H6 |
| Right | LO-360-A1H6 |

(j) Engine Type — Carbureted, Four Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

## SECTION 2 - LIMITATIONS

### 2.7 POWERPLANT LIMITATIONS

(c) Engine Model No.

| | |
|---|---|
| Left | O-360-A1H6 |
| Right | LO-360-A1H6 |

### 2.33 PLACARDS

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

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

## SECTION 3 - EMERGENCY PROCEDURES

### 3.5 EMERGENCY PROCEDURES CHECK LIST

**NOTE**

Only those emergency procedures that are specific to a carbureted engine, are provided in this supplement. Refer to Pilot Operating Handbook Section 3 for all emergency procedures.

## 3.5 EMERGENCY PROCEDURES CHECK LIST (continued)

### 3.5a Engine Inoperative Procedures

**Engine Failure During Flight (Speed Above VMCA)**

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

**Before securing inoperative engine:**

FUEL QTY .......................................CHECK (XFEED AS REQUIRED)
FUEL PUMP.......................................................................... ON
MIXTURE.......................................................................FULL RICH
CARB HEAT .......................................................................... ON
MAG LEFT/RIGHT Switches ............................................. CHECK
OIL ºF.................................................................................. CHECK
OIL PSI ................................................................................ CHECK

**If engine does not restart, complete Engine Securing Procedure.**

Power (Operating Engine) ................................................ AS REQUIRED
FUEL Selector (Operating Engine) ......................................................ON
(XFEED AS REQUIRED)
FUEL PUMP (Operating Engine).................................... AS REQUIRED
COWL FLAP (Operating Engine)................................... AS REQUIRED
Establish Bank...............................2° to 3° INTO OPERATING ENGINE
Airspeed ..................... ATTAIN AND MAINTAIN AT LEAST 88 KIAS
Rudder Trim..................................... TOWARD OPERATING ENGINE
TO APPROXIMATELY 1/2
TRAPEZOID ON THE SLIP INDICATOR
Electrical Load ................................. DECREASE TO MIN. REQUIRED

***CAUTION***

*If engine failure is due to fuel starvation and a fuel leak is suspected, carefully monitor remaining fuel quantity if XFEED is used.*

***Land as soon as practical.***

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

## 3.5 EMERGENCY PROCEDURES CHECK LIST (continued)

### 3.5a Engine Inoperative Procedures (continued)

If an engine failure is caused by fuel starvation, both engines may be operated from one fuel tank using XFEED as appropriate. If a fuel leak is suspected, select XFEED OFF and complete the Engine Securing Procedure.

### 3.5c Air Starting Procedure

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

### 3.5d Engine Roughness

## Engine Roughness

**NOTE**

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

CARB HEAT ........................................ ON

**If roughness continues after one minute:**

CARB HEAT ........................................ OFF
MIXTURE........................................ Adjust for maximum smoothness
FUEL PUMP........................................ ON
Engine Gauges ........................................ CHECK
MAG LEFT/RIGHT Switches................Individually select OFF than ON

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

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

## 3.5 EMERGENCY PROCEDURES CHECK LIST (continued)

### 3.5q Emergency Descent

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

## SECTION 4 - NORMAL PROCEDURES

**NOTE**

Only those Normal Procedures that are specific to a Carbureted engine, are provided in this supplement. Refer to Pilot Operating Handbook Section 4 for all Normal Procedures.

### 4.5a Preflight Checklists

No change.

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5b Before Starting Engine Checklists

#### BEFORE STARTING ENGINE

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

**NOTE**

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

---

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

## 4.5c Engine Start Checklists

### ENGINE START - GENERAL

**WARNING**

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

**NOTE**

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

**NOTE**

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

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5c Engine Start Checklists (continued)

#### NORMAL START - COLD ENGINE

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

Repeat above procedure (*) for second engine start

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

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

### 4.5c Engine Start Checklists (continued)

#### NORMAL START - HOT ENGINE

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

If engine does not start, add small amount of prime and repeat above.

Repeat above procedure (*) for second engine start

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

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

**WARNING**

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

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

BATT MASTR Switch ................................................................ OFF
LEFT/RIGHT ALTR Switches ......................................................... OFF
External Power.............................................................CONNECTED
CAS Messages ................................. CONSIDER ANY ILLUMINATED
PFD Annunciations .......................... CONSIDER ANY ILLUMINATED

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5c Engine Start Checklists (continued)

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

THROTTLES ........................................ 1/4 inch OPEN
PROPELLERS ........................................ FULL INCREASE
MIXTURES ........................................ FULL RICH
*FUEL PUMP ........................................ ON
*MAG LEFT/RIGHT Switches ........................................ ON
*ENG PRIMER ........................................ AS REQUIRED
*Propeller Area ........................................ CLEAR
*ENG START ........................................ ENGAGE
*OIL PSI ........................................ CHECK

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

Repeat above procedure (*) for second engine start

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

After engine start and the throttle is set as desired, the oil pressure should be checked for a positive indication. If no oil pressure is indicated within 30-seconds, shut down the engine and have it checked. In cold weather it may take somewhat longer for an oil pressure indication.

**NOTE**

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

### 4.5c Engine Start Checklists (continued)

#### ENGINE START WHEN FLOODED

BATT MASTR Switch ........................................................................ON
Gear Position Indications ........................................................ 3 GREEN
CAS Messages .............................. CONSIDER ANY ILLUMINATED
PFD Annunciations ........................ CONSIDER ANY ILLUMINATED
THROTTLES ....................................................................... OPEN FULL
PROPELLERS ................................................................FULL FORWARD
MIXTURES ............................................................................CUT-OFF
*FUEL PUMP............................................................................... OFF
*MAG LEFT/RIGHT Switches ..........................................................ON
*Propeller Area ..........................................................................CLEAR
*ENG START........................................................................ ENGAGE
*MIXTURE ......................................................................... ADVANCE
*THROTTLE.........................................................................RETARD
*OIL PSI .............................................................................. CHECK

Repeat above procedure (*) for second engine start

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

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5c Engine Start Checklists (continued)

**ENGINE START WITH EXTERNAL POWER SOURCE**

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

**NOTE**

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

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

Repeat above procedure (*) for second engine start

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

### 4.5d Warm-Up Checklist

**WARM-UP**

THROTTLES ........................................ 1000 to 1200 RPM

**BEFORE TAXIING**

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

---

To test the traffic system (if installed), the ADS-B softkey on the Traffic Map page must be selected off.

### 4.5e Taxiing Checklist

No change.

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5f Ground Check Checklist

**GROUND CHECK**

PARK BRAKE ..........................................................................SET
MIXTURES ......................................................................FULL RICH
PROPELLERS ..........................................................FULL INCREASE
Engine Instruments ..................................................................CHECK
THROTTLES......................................................................... 1500 RPM
PROPELLERS (Max. Drop - 500 RPM) ................FEATHER - CHECK
THROTTLES......................................................................... 2000 RPM
LEFT/RIGHT MAG (Max. Drop - 175 RPM:
Max. Diff. - 50 RPM)...............................................................CHECK
CARB HEAT ............................................................................CHECK
THROTTLES......................................................................... 2200 RPM
PROPELLERS (Max. Drop - 300 RPM) ................................EXERCISE
THROTTLES (550 to 650 RPM) ....................................IDLE - CHECK
FUEL PUMPS.................................................................................ON
THROTTLES......................................................................... 1000 RPM
Friction Handle ..........................................................................SET

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

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

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

**If E VOLTS greater than or equal to 23.3 VOLTS:**

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

---

Operation of an engine on one magneto should be kept to a minimum.

The governor can be checked by retarding the propeller control until a drop of 100 RPM to 200 RPM appears, then advancing the throttle to get a slight increase in manifold pressure. The propeller speed should stay the same when the throttle is advanced, indicating proper function of the governor.

Carburetor heat should also be checked prior to takeoff to be sure the control is operating properly and to purge any ice which may have formed during taxiing. Avoid prolonged ground operation with carburetor heat ON as the air is unfiltered.

### 4.5g Before Takeoff Checklist

**BEFORE TAKEOFF**

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

**CAUTION**

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

### 4.5h Takeoff Checklist

No change.

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5i Climb Checklist

No change.

### 4.5j Cruise Checklist

**CRUISING**

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

**WARNING**

**Flight in icing conditions is prohibited. If icing is encountered, take immediate action to exit icing conditions. Ensure PITOT HT is ON. Monitor engines and select CARB HT ON if roughness or power loss is experienced. Icing is hazardous due to greatly reduced performance, loss of forward visibility, possible longitudinal control difficulties and impaired power plant and fuel system operation.**

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

Best economy mixture is obtained by moving the mixture control aft until peak EGT is reached. Performance Cruise mixture is obtained by leaning to peak EGT and then enrichening until the EGT is 125°F rich of the peak value. Under some conditions of altitude and throttle position, the engine may exhibit roughness before peak EGT is reached. If this occurs, the EGT corresponding to the onset of engine roughness should be used as the peak reference value.

## 4.5j Cruise Checklist (continued)

### CRUISING (continued)

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

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

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

Alternator outputs will vary with the electrical equipment in use and the state of charge of the battery. ALTR AMPS should not exceed 60 amperes on the ground or 65 amperes in flight. The VOLTS indication will flash red if bus voltage drops below minimum requirements.

IFR operation is not recommended with a single alternator.

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

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

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

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5k Descent Checklist

No change.

### 4.5l Approach and Landing Checklist

**APPROACH AND LANDING**

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

**NOTE**

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

**NOTE**

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

## 4.5l Approach and Landing Checklist (continued)

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

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

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

**NORMAL LANDING**

No change.

**SHORT FIELD PERFORMANCE LANDING**

No change.

## SECTION 4 - NORMAL PROCEDURES (continued)

### 4.5m Go-Around Checklist

**GO-AROUND**

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

**WARNING**

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

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

### 4.5n After Landing Checklist

**AFTER LANDING**

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

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

**4.5o Stopping Engine Checklist**

No change.

**4.5p Mooring Checklist**

No change.

**4.5q $V_{SSE}$ - Intentional One Engine Inoperative Speed**

No change.

**4.5r $V_{MCA}$ - Air Minimum Control Speed**

No change.

**4.5s Practice One Engine Inoperative Flight**

No change.

**4.5t Noise Level**

No change.

**4.5u Stalls**

No change.

## SECTION 5 - PERFORMANCE

No change.

## SECTION 6 - WEIGHT AND BALANCE

No change.

## SECTION 7 - DESCR/OPERATION

### 7.5 ENGINES AND PROPELLERS

**Engines**

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

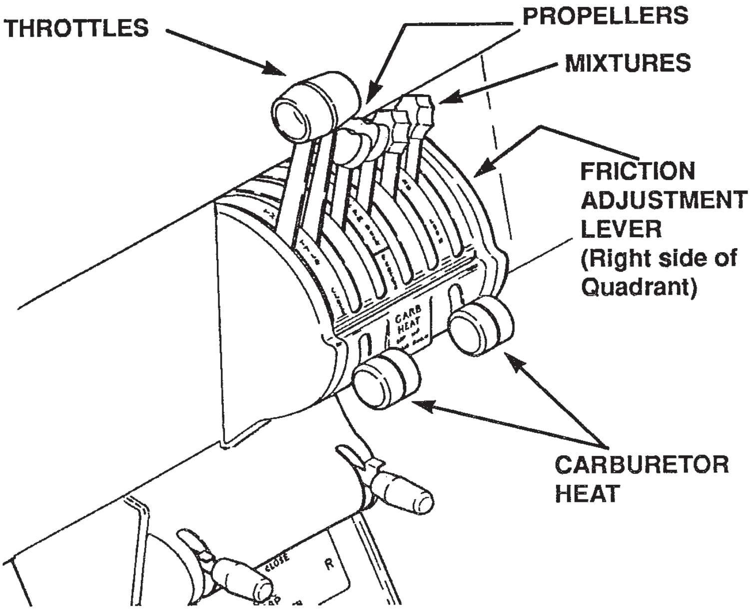
The engine oil dipstick is accessible through a door located on the upper cowl of each nacelle.

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

**Induction Air System**

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

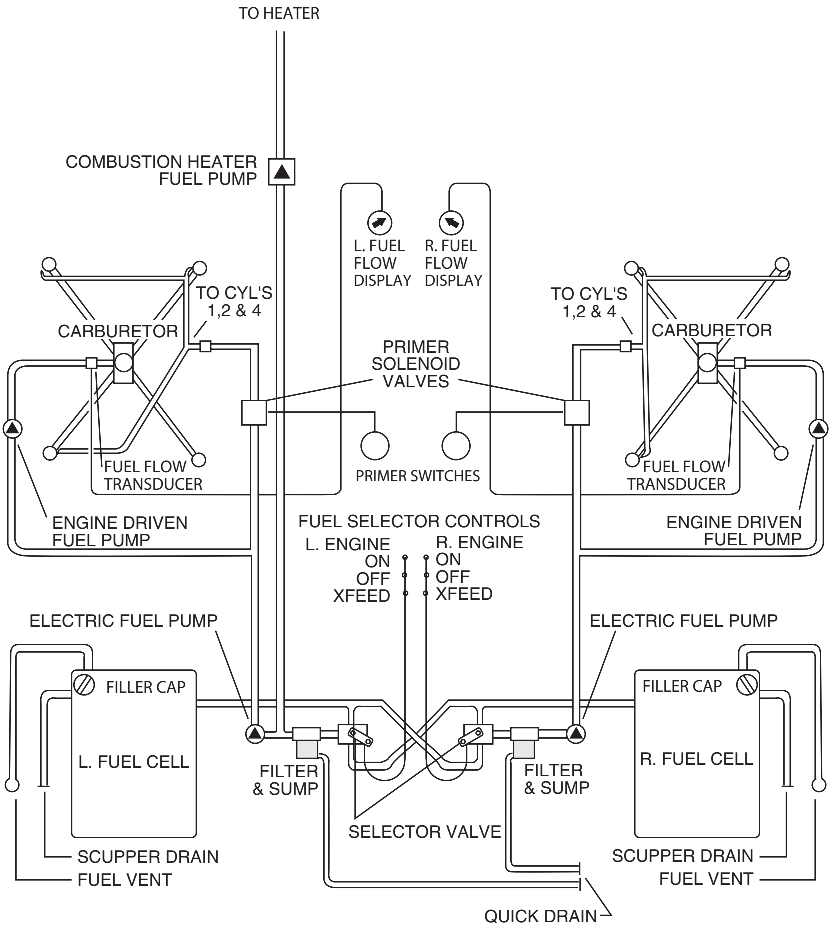
### 7.7 ENGINE CONTROLS (continued)




**CONTROL QUADRANT**
Figure 7-1

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

## 7.17 FUEL SYSTEM




**FUEL SYSTEM SCHEMATIC**
Figure 7-17

FUEL PUMPS

Normally, fuel is supplied to the engines through engine-driven fuel pumps. Auxiliary electric fuel pumps serve as a back-up feature. The electric fuel pumps operate at 14 VDC (a voltage converter steps main battery voltage from 28 to 14 volts). They are controlled by rocker switches on the switch panel below and to the right of the pilot's control column. The electric fuel pumps should be ON during takeoff and landing.

**NOTE**

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

ELECTRIC PRIMER SYSTEM

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

**NOTE**

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

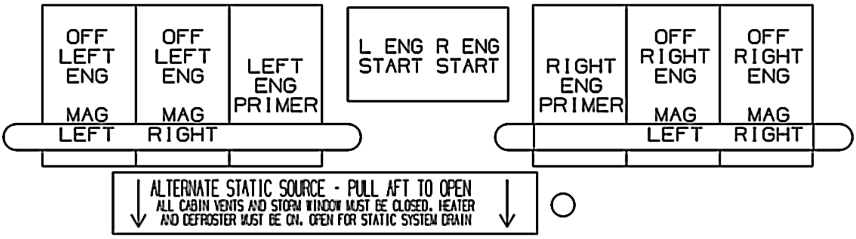
With fuel pressure available, the primer button is depressed actuating the primer solenoid valve and allowing fuel to flow through the lines to the primer jets in the intake of the number 1, 2 and 4 cylinders.

## 7.19 ELECTRICAL SYSTEM

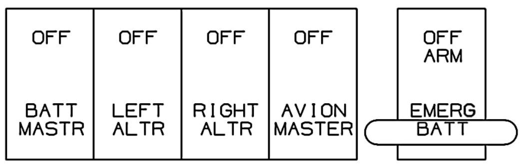
SWITCHES

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

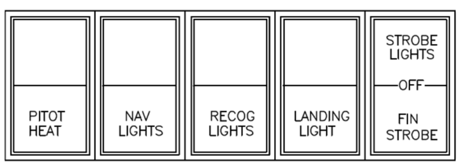
SWITCHES (continued)



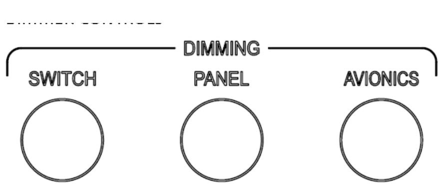

Engine Switches




Left Switch Bank

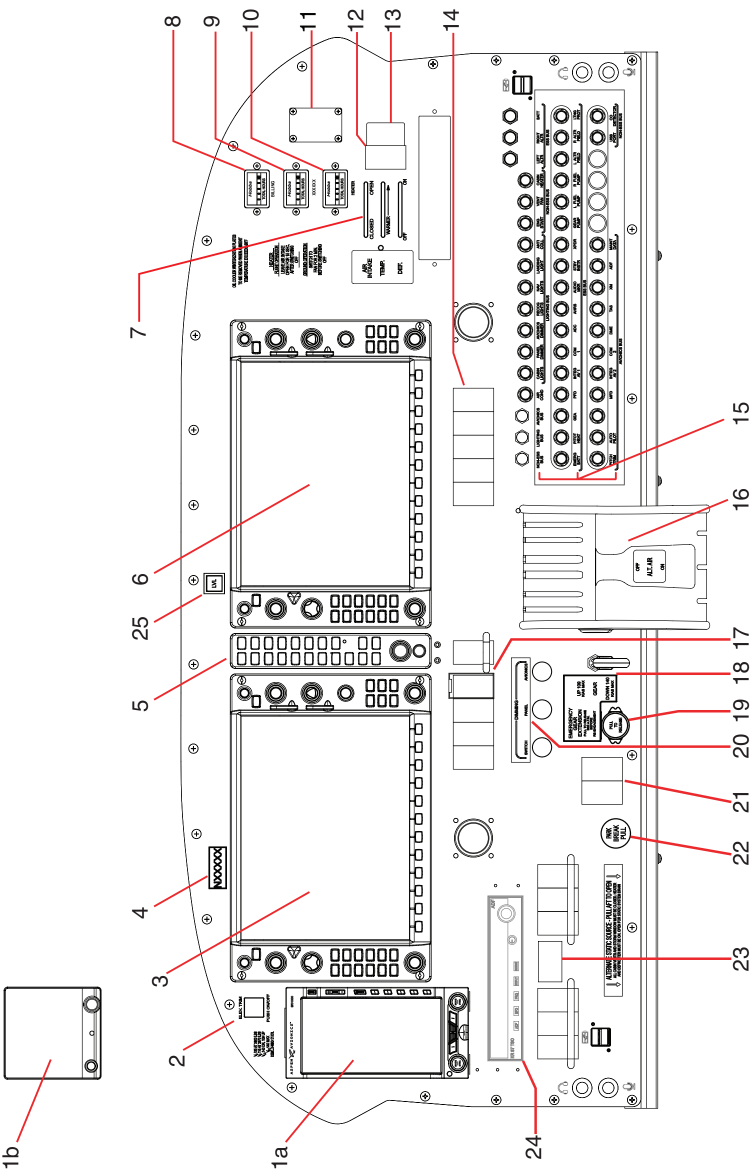



Right Switch Bank




Dimmer Controls

**ELECTRICAL POWER SWITCHES**
Figure 7-21




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

1. Standby instrument
   a. Aspen EBD-1000
   b. Garmin G5
2. Elevator Trim switch
3. PFD
4. Registration Number plate
5. Audio Panel
6. MFD
7. Environmental controls (See Figure 7-31)
8. HOBBS meter - Billing - Optional
9. HOBBS meter - Maintenance or Flight
10. HOBBS meter - Heater
11. ELT switch
12. Cabin heater fan
13. Ventilation fan
14. Right switch bank (L to R) (See Figure 7-21)
    a. Pitot Heat
    b. Nav lights
    c. Recognition lights
    d. Landing light
    e. Strobe light
15. Circuit Breakers
16. Throttle quadrant
17. Left switch bank – (L to R, See Figure 7-21)
    a. Battery Master
    b. Left Alternator
    c. Right Alternator
    d. Avionics Master
    e. Emergency Battery
18. Landing gear selector
19. Emergency gear extension knob & guard
20. Dimmer controls (L to R)
    a. Switches
    b. Panel
    c. Avionics
21. Left and right fuel pump switches
22. Parking brake
23. Engine switches (L to R)
    a. Left engine switches (left and right magneto and primer)
    b. Left engine starter
    c. Right engine starter
    d. Right engine switches (primer and left and right magneto)
24. ADF (option)
25. Level Mode (LVL) switch (opional)

**INSTRUMENT PANEL (continued)**
Figure 7-33
(Sheet 2 of 2)

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# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL

## SUPPLEMENT NO. 6
## FOR

## AMSAFE INFLATABLE SEAT RESTRAINTS
## (FAA STC SA02276AK)
## (EASA STC 10031010)

The FAA approved operational supplement for the AMSAFE Inflatable Seat Restraints, installed in accordance with STC SA02276AK, is required for operation of this system. AMSAFE will be responsible to supply and revise the operational supplement. It is permitted to include the AMSAFE Inflatable Seat Restraints supplement in this location of the Pilot's Operating Handbook unless otherwise stated by AMSAFE. The information contained in the AMSAFE Inflatable Seat Restraints supplement may supersede or supplement the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual with respect to the operation of the AMSAFE Inflatable Seat Restraints system. For limitations, procedures and performance information not contained in the AMSAFE supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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# PILOT'S OPERATING HANDBOOK
# AND
# FAA APPROVED AIRPLANE FLIGHT MANUAL

## SUPPLEMENT NO. 7
## FOR

## SAFE FLIGHT ANGLE OF ATTACK SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Safe Flight Angle of Attack (AoA) system is installed per the Equipment List.

The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED: ______________________
ERIC A. WRIGHT
ODA-510620-CE
PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: ______April 2, 2020______

## SECTION 1 - GENERAL

The Safe Flight Angle of Attack (AoA) Indexer, referred to as the “AoA Indicator” or simply “display” in this supplement, is a system that receives and displays angle of attack information from the lift transducer vane installed in the right wing of the aircraft.

## SECTION 2 - LIMITATIONS

1. The angle of attack system provides advisory information only and does not replace the aircraft’s primary stall warning system.

## SECTION 3 - EMERGENCY PROCEDURES

No change.

## SECTION 4 - NORMAL PROCEDURES

### 4.5e BEFORE TAXIING

AVION MASTER Switch.................................................................ON
AoA Indicator......................................................... VERIFY SELF TEST
AoA Indication..........................................lights illuminated (not blank)

**NOTE**

If AoA indications are suspected to not be accurate, discontinue use of the AoA Indicator.

**NOTE**

If the AoA Indicator screen turns off after the power-on self-test, check that the AOA INDICATOR circuit breaker is pushed in.

### 4.5i BEFORE TAKEOFF

AoA Reference Marker....................................................SET (if desired)

## 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 Pilot's Operating Handbook and Airplane Flight Manual.

## SECTION 7 - DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

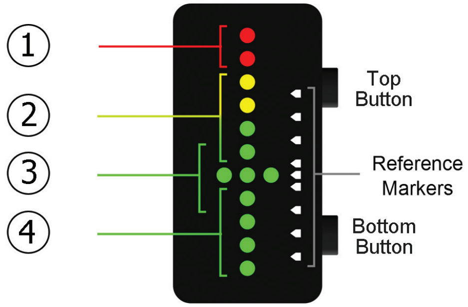
**NOTE**

The AoA Indicator provides advisory information only and does not replace the aircraft's primary stall warning system.

The Safe Flight AoA indicating system receives and displays Angle of Attack (AoA) information from the lift transducer on the leading edge of the right wing. The position of the lift transducer vane on the wing's leading edge is converted to AoA within the indicator computer on the glareshield. Indication of angle of attack can serve as a reliable aid for low airspeed awareness. The AoA system is completely independent of the existing stall warning system.

### SYSTEM DESCRIPTION

The AoA Indicator consists of a series of red, yellow and green lights, a reference marker, and two buttons on the right side as shown in Figure 7-1 below.




**AoA Indicator**
Figure 7-1

## SECTION 7 - DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS (continued)

The lights on the display shown in Figure 7-1 are a general representation of angle of attack.

1. Stall is imminent or stall is occurring.
2. Approaching stall, such as stall warning.
3. Aircraft is operating at an angle of attack which provides adequate stall margin.
4. Aircraft is operating at a relatively low angle of attack.

The reference marker is a white triangle along the right side of the display which can be set by the pilot as a target angle of attack during specific phases of flight. Experience with various flight conditions will allow the reference marker to be set at the optimum locations.

The two buttons on the right side of the display perform multiple functions. When the upper button is pressed quickly, it raises the reference marker towards the high AoA side and when the lower button is pressed quickly, it lowers the reference marker towards the low AoA side. Immediately after either button is pressed, all lights on the display will momentarily illuminate giving the pilot awareness of where the reference marker is being set. Holding the top button for four seconds mutes or unmutes the audio. Holding the bottom button for two seconds dims or brightens the display.

Circuit protection for the Safe Flight AoA system is provided by the AOA INDICATOR circuit breaker located on the bottom right of the instrument panel, Row 3, Col. 12.

SYSTEM USAGE

After turning on the AVION MASTER switch in the BEFORE TAXIING checklist, the pilot should verify that the AoA system self-test has successfully completed. During the self-test all indicator lights will illuminate for approximately five seconds, followed by a set of lights that corresponds to the current lift transducer vane position. An audio warning will also sound for the duration of the self-test. There is no specific lighting expectation during ground operations, however, two red flashing lights at the top of the display or one green light at the bottom of the display could indicate a jammed lift transducer vane. If the red LED on the high side of the display is blinking slowly, the system must not be used until a system calibration has been completed. Refer to Section 8 of this supplement for further instructions.

## SECTION 7 - DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS (continued)

**NOTE**

If AoA indications are suspected to not be accurate, discontinue use of the AoA Indicator.

The reference marker can be set to a target angle of attack for the desired phase of flight. During the takeoff roll, as airflow increases over the wing, the AoA indication will change to a representative in-flight condition. See Figure 7-1 for representative AoA indications.

Power is removed from the AoA Indicator when the AVION MASTER switch is turned off.

## SECTION 8 - AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

The Safe Flight AoA indicating system is not field repairable. If the operation of the system is in doubt, apply power to the system and verify that the power-on self-test has completed properly. If the power-on self-test is unsuccessful, hold the top and bottom buttons on the AoA Indicator for two seconds while power is applied. The display will illuminate all reference marker segments and then will illuminate a particular light segment on the display. Note which light segments illuminated, as this will aid in diagnosing the problem. When contacting support, have the following information available:

1. Unit part number
2. Unit serial number
3. Unit software revision
4. Fault code (which LEDs illuminated on the display)

The part number, serial number, and software revision can be found on the nameplate on the lower surface of the AoA Indicator. Detaching the unit is not necessary as the values can be seen with the aid of a mirror or by taking a picture with a slim camera.

## SECTION 10 - OPERATING TIPS

No change.

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# TABLE OF CONTENTS

## SECTION 10

## OPERATING TIPS

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# SECTION 10

# OPERATING TIPS

## 10.1 GENERAL

This section provides operating tips of particular value in the operation of the Piper Seminole.

## 10.3 OPERATING TIPS

(a) Learn to trim for takeoff so that only a very light back pressure on the wheel is required to lift the airplane off the ground.

(b) On takeoff, do not retract the gear prematurely. The airplane may settle and make contact with the ground because of lack of flying speed, atmospheric conditions, or rolling terrain.

(c) Flaps may be lowered at airspeeds up to 111 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the UP position before they will lock and support weight on the step.

(d) Always determine position of landing gear by checking the gear position indications.

(e) The shape of the nacelle fuel tanks is such that in certain maneuvers and with low fuel levels, the fuel may move away from the tank outlet. If the outlet is uncovered, the fuel flow will be interrupted and a temporary loss of power may result. Pilots can prevent inadvertent uncovering of the outlet by avoiding maneuvers which could result in uncovering the outlet.

    Extreme running turning takeoffs should be avoided.

    Prolonged slips and skids which result in excess of 2000 feet of altitude loss, or other radical or extreme maneuvers which could cause uncovering of the fuel outlet must be avoided as fuel flow interruption may occur when the tank being used is not full.

## 10.3 OPERATING TIPS (continued)

(f) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of their feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

(g) Anti-collision lights should not be operating when flying through clouds, fog, or haze, since reflected light can produce spacial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

(h) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications such as regulations, advisory circulars, Aviation News, AIM and safety aids.

(i) All pilots who plan to fly above 10,000 feet should take initial high altitude physiological training and then take refresher training every two or three years.

(j) Sluggish RPM control and propeller overspeed with poor RPM recovery after rapid throttle application are indications that nitrogen pressure in the propeller dome is low.

(k) Experience has shown that the training advantage gained by pulling a mixture control or turning off the fuel to simulate engine failure at low altitude is not worth the risk assumed, therefore it is recommended that instead of using either of these procedures to simulate loss of power at low altitude, the throttle be retarded slowly to idle position. A rapid reduction in power (full throttle to idle in less than 2 seconds) may be harmful to the engine. See Section 4 for power settings which are recommended for simulated one engine operation.

## 10.3 OPERATING TIPS (continued)

(l) Before starting either engine, check that all radio switches, light switches and the pitot heat switch are in the OFF position so as not to create an overloaded condition when the starter is engaged.

(m) The airplane should not be flown in severe turbulence as damage to the airframe structure could result.

(n) The best speed for takeoff is about 75 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of an engine failure.

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