SARATOGA II HP

PA-32R-301

SN 3246018 AND UP

PILOT'S OPERATING HANDBOOK

This is the Flight Manual which forms part of the Certificate of Airworthiness for aircraft G-ELLA

CIVIL AVIATION AUTHORITY 80 23/10/96

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. 3246050

AIRPLANE REGIST. NO. N9279Q

PA-32R-301
REPORT: VB-1600 FAA APPROVED BY:

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

DATE OF APPROVAL:
NOVEMBER 30, 1995

FAA APPROVED IN NORMAL CATEGORY BASED ON CAR 3. THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR 3 AND CONSITTUTES THE APPROVED AIRPLANE FLIGHT MANUAL AND MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES

Piper

WARNING

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

Published by
PUBLICATIONS DEPARTMENT
Issued: November 30, 1995

APPLICABILITY

Application of this handbook is limited to the specific Piper PA-32R-301 model airplane designated by serial number on the face of the title page of this handbook.

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

REVISIONS

The information compiled in the Pilot's Operating Handbook, with the exception of the equipment list, will be kept current by revisions distributed to the airplane owners. The equipment list was current at the time the airplane was licensed by the manufacturer and thereafter must be maintained by the owner.

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

I. Revisions

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.
3. Page numbers followed by a small letter shall be inserted in direct sequence with the same common numbered page.

II. Identification of Revised Material

Revised text and illustrations shall be indicated by a black vertical line along the outside margin of the page, opposite revised, added or deleted material. A line along the outside margin of the page opposite the page number will indicate that an entire page was added.

Black lines will indicate only current revisions with changes and additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation or the physical location of material on a page will not be identified.

ORIGINAL PAGES ISSUED

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

Title, ii through vii, 1-1 through 1-12, 2-1 through 2-12, 3-1 through 3-18, 4-1 through 4-28, 5-1 through 5-32, 6-1 through 6-14, 7-1 through 7-34, 8-1 through 8-18, 9-1 through 9-25, 10-1 through 10-2.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revision to the PA-32R-301, Saratoga II HP Pilot's Operating Handbook, REPORT: VB-1600 issued November 30, 1995.

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1 (PR960717)	v	Revised Log or Rev.'s.	
	2-8	Revised Header & Placards.	
	3-ii	Revised TOC.	
	3-17	Revised Heading No.	
	5-9	Revised List of Figs.	
	5-17	Revised Fig. 5-13.	Peter E. Peck
	6-9	Revised Para. 6.7.	
	6-13	Revised Fig. 6-13.	
	7-i	Revised TOC.	July 17, 1996 Date
	7-7	Revised Para. 7.9.	
	7-20	Revised Caution.	
Rev. 2 (PR960830)	v	Revised Log or Rev.'s.	Peter E. Peck
	9-26	Revised Footer Typo.	
	9-27 thru 9-28	Added Supplement No. 5.	Aug. 30, 1996 Date
Rev. 3 (PR970918)	v	Revised Log of Rev.'s.	
	4-ii	Revised Table of Contents.	
	4-9	Revised Para. 4.5.	
	4-10	Revised Para. 4.5.	
	4-27	Added Para. 4.39.	
	4-28	Added Para. 4.39.	
	5-16	Revised Fig. 5-11.	
	5-29	Revised Fig. 5-37.	Peter E. Peck
	7-7	Revised Para. 7.9.	
	7-26	Revised Para. 7.23.	
	7-27	Revised Para. 7.23.	Sep. 18, 1997 Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 4 (PR020415)	vi 2-3 2-4	Added Rev. 4 to L of R. Revised para. 2.7. Revised para. 2.9.	Albert J. Mill April 15, 2002 Date

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SECTION 1

GENERAL

1.1 INTRODUCTION

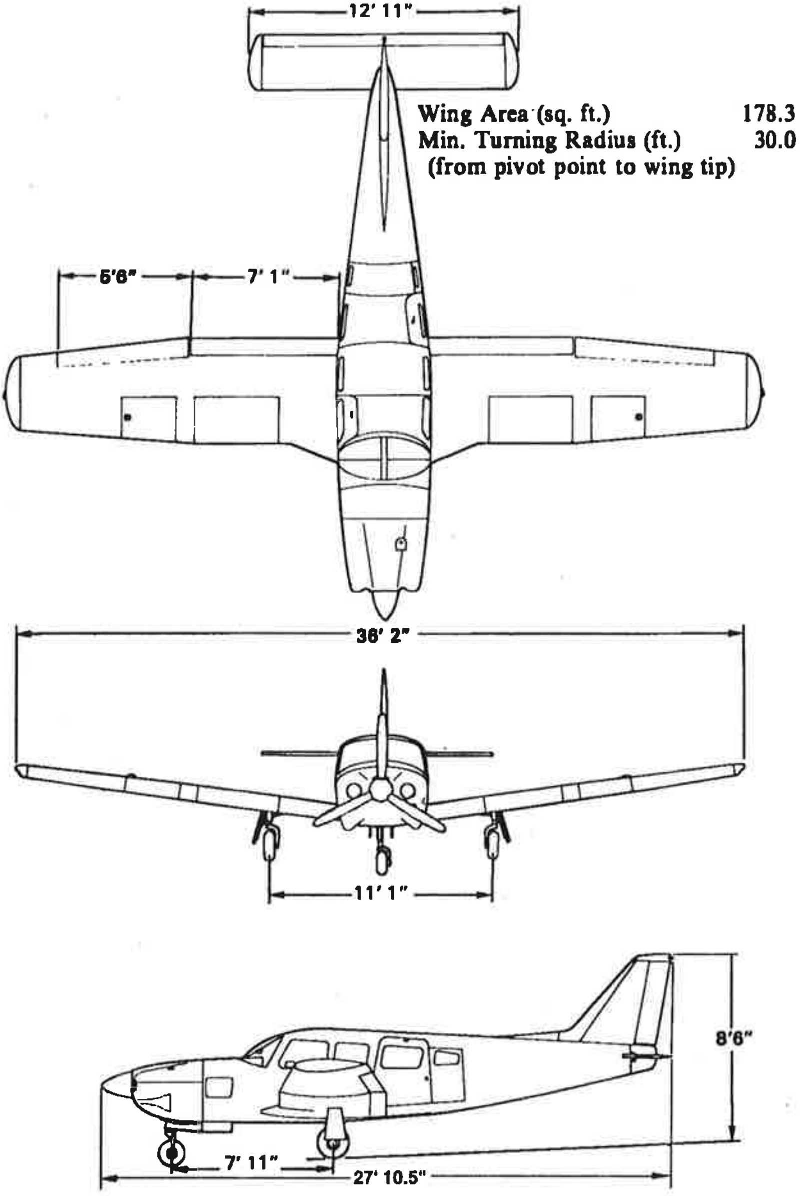
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by FAR/CAR. It also contains supplemental data supplied by the airplane manufacturer.

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

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

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

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



THREE VIEW
Figure 1-1

1.3 ENGINE

(a)	Number of Engines	1
(b)	Engine Manufacturer	Lycoming
(c)	Engine Model Number	IO-540-K1G5
(d)	Rated Horsepower	300
(e)	Rated Speed (rpm)	2700
(f)	Bore (inches)	5.125
(g)	Stroke (inches)	4.375
(h)	Displacement (cubic inches)	541.5
(i)	Compression Ratio	8.7:1
(j)	Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled, Fuel Injected

1.5 PROPELLER

(a)	Number of Propellers	1
(b)	Propeller Manufacturer	Hartzell
(c)	Blade Model	F7663DR
(d)	Number of Blades	3
(e)	Hub Model	HC-I3YR-1RF
(f)	Propeller Diameter (inches)	
	(1) Minimum	77
	(2) Maximum	78
(g)	Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

AVGAS ONLY

(a) Fuel Capacity (U.S. gal.) (total)	107
(b) Usable Fuel (U.S. gal.) (total)	102
(c) Fuel Grade, Aviation	
(1) Minimum Grade	100 - Green or 100LL - Blue Aviation Grade
(2) Alternate Fuels	Refer to latest revision of Lycoming Service Instruction 1070

1.9 OIL

(a) Oil Capacity (U.S. quarts)	12
(b) Oil Specification	Refer to latest issue of Lycoming Service Instruction 1014.

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

	SINGLE	MULTI
(1) Above 80°F	60	60
(2) Above 60°F	50	40 or 50
(3) 30°F to 90°F	40	40
(4) 0° to 70°F	30	30, 40 or 20W-30
(5) 0°F to 70°F	20	20W50 or 15W-50
(6) 0°F to 90°F	20	30 or 20W-30

1.11 MAXIMUM WEIGHTS

(a)	Maximum Takeoff Weight (lbs.)	3600
(b)	Maximum Landing Weight (lbs.)	3600
(c)	Maximum Ramp Weight (lbs.)	3615

	FORWARD	AFT
Compartments	100	100

1.13 STANDARD AIRPLANE WEIGHTS

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

1.15 BAGGAGE SPACE

		FORWARD	AFT
(a)	Compartment Volume (cubic feet)	7.0	17.3
(b)	Entry Width (inches)	16.0	48.0
(c)	Entry Height (inches)	22.0	26.0

1.17 SPECIFIC LOADING

(a)	Wing Loading (lbs. per sq. ft.)	20.2
(b)	Power Loading (lbs. per hp)	12.0

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

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

(a) General Airspeed Terminology and Symbols

CAS	Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Airpseed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in "Knots."
M	Mach number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

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

(e) Airplane Performance and Flight Planning Terminology

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

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.

Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum Weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

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SECTION 2
LIMITATIONS

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LIMITATIONS

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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.

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 (VNE) - Do not exceed this speed in any operation.	191	189
Maximum Structural Cruising Speed (VNO) - Do not exceed this speed except in smooth air and then only with caution.	160	158
Design Maneuvering Speed (VA) - Do not make full or abrupt control movements above this speed.		
At 3600 LBS. G.W.	134	132
At 2230 LBS. G.W.	105	104

CAUTION

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

SPEED	KIAS	KCAS
Maximum Flaps Extended Speed (VFE) - Do not exceed this speed with the flaps extended.	110	109
Maximum Landing Gear Extension Speed (VLO) - Do not exceed this speed when extending the landing gear.	132	130
Maximum Landing Gear Retraction Speed (VLO) - Do not exceed this speed when retracting the landing gear.	110	109
Maximum Landing Gear Extended Speed (VLE) Do not exceed this speed with the landing gear extended.	132	130

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	191 KTS
Yellow Arc (Caution Range - Smooth Air Only)	160 KTS to 191 KTS
Green Arc (Normal Operating Range)	67 KTS to 160 KTS
White Arc (Flap Down)	63 KTS to 110 KTS

KLN 90B Memory Jogger

Left Page Summary

NAV
1†- CDI, DIS, GS, ETE, BRG
2- Present position
3- DTK, TK, XTK, MSA, ESA
4- VNAV
5†- Moving map

FPL
0- Active flight plan
1-25 Stored flight plans

MODE
1‡- LEG mode status and change CDI scale factor
2‡- OBS mode status and change CDI scale factor

TRIP
0- Enter TAS and wind.
1- P. Pos to wpt-DIS, BRG, ETE, fuel
2- P.Pos to wpt-ESA, SUA
3- Wpt to wpt- DIS, BRG, ETE, fuel
4- Wpt to wpt-ESA, SUA
5- For any FPL- DIS, ETE, fuel
6- For any FPL- ESA, SUA

CALC
1- Pressure/Density altitude
2- TAS
3- Computes wind info
4- VNAV angle or vert. speed
5- Conversions
6- Time zone conversions
7- Sunrise/Sunset

STAT
1- Satellite condition
2- Estimated position error
3- Software versions
4- Operation time & cycles
5- RAIM prediction

SETUP
0- Update database
1- Initialize postion
2- Set system time and date
3- Nearest airport criteria
4- Flight timer operation
5- Height above airport alert
6- Turn anticipation on/off
7- Barometric units
8- Airspace alert on/off
9- Aural alert volume

OTHER
1- Nearest FSS freqs.
2- Nearest Center freqs.
3- User waypoint list
4- List of airports w/remarks
5*- Fuel reqd., fuel on board
6*- Fuel specifics
7*- Fuel flow rates
8*- Fuel used (totalizer)
9*- TAS/Mach display
10*- SAT, TAT, Pressure alt., Density alt.

† *With both right and left pages set to these pages the screen will change to show a larger picture.*
‡ *These pages also support mode changing if no external GPS CRS switch is installed in the aircraft.*
* *Page only displayed if appropriate equipment is interfaced with the KLN 90B.*

AlliedSignal General Aviation Avionics
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Olathe, Kansas 66062-1212
TELEX 669916 KINGRAD • FAX 913-791-1302
TELEPHONE (913) 768-3000

12/94 006-08785-0000 5K Printed in USA

AlliedSignal AEROSPACE

KLN 90B Memory Jogger

Right Page Summary

NAV
1†- CDI, DIS, GS, ETE, BRG
2- Present position
3- DTK, TK, XTK, MSA, ESA
4- VNAV
5†- Moving map

D/T
1- Distance, ETE
2- Distance, ETA
3- Distance, DTK
4- Dep. time, present time, ETA, flight time, ETE

ACTV
Shows information on flight plan waypoints or D→ wpts.

REF
Inserts reference waypoints into flight plan.

CTR
1- Inserts CTR wpts into FPL.
2- Displays CTR wpts.

† *With both right and left pages set to these pages the screen will change to show a larger picture.*

APT
1- ID, airport name, lat/long
2- ID, City name, elevation, time from UTC, IAP
3- Runway info
4- Comm frequency lists
5- User remarks
6- Customs, fuel, oxygen, fees
7- Select SID or STAR
8- Select approach and IAF

VOR
ID, DME capability, name, class, freq., mag. variation, lat/long.

NDB
ID, name, frequency, lat/long position

INT
ID, location relative to VOR, lat/long position

SUPL
ID, location relative to VOR, lat/long position

Summary of Operation

- Emergency Nearest Airport Search - Press MSG then ENT.
- Operation of left and right knobs - Cursor on
  - Press desired CRSR button. With the cursor on, outer knob controls cursor location and inner knob selects the character.
  - With the inner knob in, make selection character by character.
  - With inner knob out, make selection by scanning through the database alphabetically. (Right side only)
- Operation of left and right knobs - Cursor off
  - Outer knob selects page type (APT, VOR, etc.)
  - Inner knob selects specific page (APT 1, APT 2, etc.)
- Direct To operation
  - Press D→ once. Enter desired wpt using left concentric knobs, press ENT to view wpt info, press ENT to confirm.
  - Alternatively, display desired waypoint on right hand page or highlight desired wpt in flight plan then press D→ then press ENT to confirm.
  - To center D-bar. With non-wpt page displayed press D→ then ENT.
  - To cancel direct to operation press D→ then CLR then ENT.

/ JOGGER

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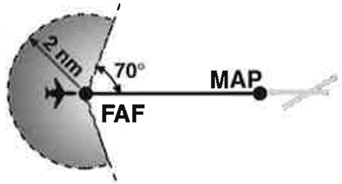
TIPS (Continued)

10. If the approach includes a DME arc, the DME arc intercept point will be a) on your present position radial off the arc VOR when you select an arc IAF, or b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a radar vector, bring up the first waypoint of the arc in the **Super NAV 5** page scanning field (or under the cursor on the **FPL 0** page), press [CLR], then [ENT]. Fly the arc in LEG. Adjust the HSI or CDI course pointer with reference to the desired track value on the **Super NAV 5** page (it will flash when the pointer needs to be adjusted). Left/right D-bar information is relative to the arc. Displayed distance is not along the arc but straight to the active waypoint. (The **ARC** radial is also displayed on the **Super NAV 5** page.)
11. Two nm from the FAF inbound and in LEG, the KLN 90B will go into APR **ACTV** and the D-bar scaling will change from ±1.0 nm to ±0.3 nm.
12. APR **ARM** to APR **ACTV** is automatic provided all of the following are satisfied:
    a. In APR **ARM** (normally automatic).
    b. <u>In **LEG** mode!</u>
    c. <u>FAF is the active waypoint!</u>
    d. Within 2 nm of the FAF.
    e. Outside the FAF.
    f. Inbound to the FAF.
    g. RAIM is available. (For early prediction go to STA 5 page.)



13. RAIM availability is mandatory for approach operation.
14. APR **ACTV** mode is mandatory for approach operation.
15. DIRECT-TO operation between the FAF and MAP cancels approach **ACTV**. Fly the missed approach in APR **ARM**.
16. Flagged navigation inside the FAF may usually be restored by pressing the external GPS APR button to change from **ACTV** to **ARM**. Fly the missed approach procedure.
17. Instrument approaches using the KLN 90B may be essentially automatic starting 30 nm out (with manual baro setting update) or it may require judicious selection of the OBS and LEG modes.
18. APR **ARM** may be cancelled at any time by pressing the GPS APR button. (A subsequent press will reselect it.)

C. PAGE MESSAGES - Messages that could appear during approach operations. Refer to the Pilot's Guide for a complete list of messages.

ACTV ANNUNCIATOR FAIL Indicates an annunciator drive circuit failure. A maintenance write-up. Cross check the KLN 90B display for status.

ADJUST NAV IND CRS TO XXX° Manually adjust the mechanical HSI or CDI to the indicated value.

ARM ANNUNCIATOR FAIL Indicates an annunciator drive circuit failure. A maintenance write-up. Cross check the KLN 90B display for status.

PAGE MESSAGES (Continued)

ARM GPS APPROACH Manually arm approach mode. (A reminder given 3 nm from the FAF if the approach mode was disarmed manually.)

BAD SATELLITE GEOMETRY AND RAIM NOT AVAILABLE Can appear in approach ACTV mode only. Integrity monitoring is lost and satellite geometry is degraded. Can be followed by a NAV flag.

BAD SATELLITE GEOMETRY SEE EPE ON STA 2 PAGE Integrity monitoring is lost and the estimated position error is greater than allowed for the current phase of flight. Cross check the position with other on-board equipment every 15 minutes.

CHECK ACTV ANNUNCIATOR Indicates an overcurrent condition in the annunciator circuit. A maintenance write-up. Cross check the KLN 90B display for approach mode status.

CHECK ARM ANNUNCIATOR Indicates an overcurrent condition in the annunciator circuit. A maintenance write-up. Cross check the KLN 90B display for approach mode status.

IF REQUIRED SELECT OBS Use OBS mode for holding patterns or procedure turns. Appears 4 nm from a waypoint that normally would require the OBS mode.

PRESS ALT TO SET BARO A reminder given 30 nm from the destination airport to update the barometric setting.

PRESS GPS APR FOR NAV After a NAV flag in approach ACTV mode, press GPS APR button to restore navigation for the missed approach. (Integrity monitoring is less critical in approach ARM mode so navigation may be restored.)

RAIM NOT AVAILABLE APR MODE INHIBITED PREDICT RAIM ON STA 5 RAIM is predicted to not be available at either the FAF or the MAP. Determine when RAIM will be available on the STA 5 page. Integrity monitoring is required for approach operation.

RAIM NOT AVAILABLE CROSS CHECK POSITION Integrity monitoring is absent. Compare the GPS position with other on-board navigation equipment.

RAIM POSITION ERROR CROSS CHECK POSITION RAIM has detected a problem with a satellite. Compare the GPS position with other on-board navigation equipment.

REDUNDANT WPT IN FPL EDIT ENROUTE WPTS AS NECESSARY Examine the active flight plan and remove those waypoints that occur both in the enroute and the approach or SID/STAR sections of the flight plan.

2.7 POWER PLANT LIMITATIONS

(a)	Number of Engines	1
(b)	Engine Manufacturer	Lycoming
(c)	Engine Model No.	IO-540-K1G5
(d)	Engine Operating Limits	
	(1) Maximum Horse Power	300
	(2) Maximum Rotation Speed (RPM)	2700
	(3) Maximum Oil Temperature (°F)	245
(e)	Oil Pressure	
	Minimum (red line)	25 PSI
	Maximum (red line)	115 PSI
(f)	Fuel Grade (minimum grade)	100 - Green or 100LL - Blue Aviation Grade
(g)	Number of Propellers	1
(h)	Propeller Manufacturer	Hartzell
(i)	Propeller Hub and Blade Model	HC-I3YR-1 RF F7663DR
(j)	Propeller Diameter (inches)	
	Minimum	77
	Maximum	78
(k)	Blade Angle Limits	
	Low Pitch Stop	12.4° ± 0.2°
	High Pitch Stop	32.0° ± 1.0°

2.9 POWER PLANT INSTRUMENT MARKINGS

(a)	Tachometer	
	Green Arc (Normal Operating Range)	600 to 2700 RPM
	Red Line (Maximum)	2700 RPM
(b)	Oil Temperature	
	Green Arc (Normal Operating Range)	100° to 245°F
	Red Line (Maximum)	245F
(c)	Oil Pressure	
	Green Arc (Normal Operating Range)	55 PSI to 95 PSI
	Yellow Arc (Caution Range) (Idle)	25 PSI to 55 PSI
	Yellow Arc (Caution Range) (Start and Warm Up)	95 PSI to 115 PSI
	Red Line (Minimum)	25 PSI
	Red Line (Maximum)	115 PSI
(d)	Cylinder Head Temperature (Not required equipment)	
	Green Arc (Normal Operationg Range)	200° to 500°F
	Red Radial Line (Maximum)	500°F
(e)	Fuel Flow/Pressure	
	Normal Operating Range	0 gal/hr. to 34.9 gal/hr.
(f)	Vacuum Pressure	
	Green arc (normal operating range)	4.8 to 5.2 in. Hg.
	Red Line (minimum)	4.8 in. Hg.
	Red Line (maximum)	5.2 in. Hg.

2.11 WEIGHT LIMITS

(a)	Maximum Takeoff Weight	3600 LBS.
(b)	Maximum Ramp Weight	3615 LBS.
(c)	Maximum Baggage (100 lbs. each compartment)	200 LBS.

NOTE

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

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
3600	91.4	95.0
3200	83.5	95.0
2400 (and less)	78.0	95.0

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at the intersection of the untapered and inboard tapered section.

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

2.15 MANEUVER LIMITS

No acrobatic maneuvers including spins approved.

2.17 FLIGHT LOAD FACTORS

(a) Positive Load Factor (Maximum)	3.8 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved
(c) Positive Load Factor - Flaps Down (Maximum)	2.0 G
(d) Negative Load Factor - Flaps Down (Maximum)	No inverted maneuvers approved

2.19 TYPES OF OPERATIONS

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

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

2.21 FUEL LIMITATIONS

(a) Total Capacity..107 U.S. GAL.
(b) Unusable Fuel..5 U.S. GAL.
The unusable fuel for this airplane has been determined as 2.5 gallons in each wing in critical flight attitudes (2.5 gallons is the total per side, each side having two interconnected tanks).
(c) Usable Fuel..102 U.S. GAL.
The usable fuel in this airplane has been determined as 51 gallons in each wing (51 gallons is the total per side, each side having two interconnected tanks).

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2.25 PLACARDS

In full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS. NO ACROBATIC MANEUVERS INCLUDING SPINS, APPROVED.
THIS AIRCRAFT APPROVED FOR V.F.R., I.F.R., DAY AND NIGHT NON-ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135.
WARNING
TURN OFF STROBE LIGHTS WHEN IN CLOSE PROXIMITY TO GROUND, OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

On the instrument panel in full view of the pilot:

VA 134 KIAS at 3600 LBS.
(See A.F.M.)

On the instrument panel in full view of the pilot:

DEMO X-WIND 17 KTS

In full view of the pilot:

VLO 132 DN, 110 UP
VLE 132 MAX

Near gear selector switch:

GEAR UP	**110 KIAS MAX**
DOWN	**132 KIAS MAX**

Adjacent to upper door latch (rear door):

ENGAGE LATCH BEFORE FLIGHT

In full view of the pilot:

DO NOT EXCEED 23 INCHES OF MANIFOLD PRESSURE BELOW 2100 RPM.

In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

WARNING AIR CONDITIONER MUST BE OFF TO INSURE NORMAL TAKEOFF CLIMB PERFORMANCE.

On the inside of the forward baggage compartment:

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

On aft baggage closeout:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. NO HEAVY OBJECTS ON HAT SHELF.

On storm window:

DO NOT OPEN ABOVE 129 KIAS.

On executive writing table:

CAUTION — THIS TABLE MUST BE STOWED DURING TAKEOFF AND LANDING.

Adjacent to fuel tank filler caps:

(456-682)

In full view of the pilot:

**SECURE ARMRESTS FOR
TAKEOFF AND LANDING**

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SECTION 3
EMERG. PROCEDURES

SECTION 3
EMERG. PROCEDURES

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SECTION 3

EMERGENCY PROCEDURES

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SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

The recommended procedures for coping with various types of emergencies and critical situations are provided by this section. All of the required (FAA regulations) emergency procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

Emergency procedures associated with those optional systems and equipment which require handbook supplements are provided in Section 9 (Supplements).

The first portion of this section consists of an abbreviated emergency checklist which supplies an action sequence for critical situations with little emphasis on the operation of systems.

The remainder of the section is devoted to amplified emergency procedures containing additional information to provide the pilot with a more complete understanding of the procedures.

These procedures are suggested as a course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

Most basic emergency procedures, such as a power off landings, are a normal part of pilot training. Although these emergencies are discussed here, this information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all aircraft. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

3.3 AIRSPEEDS FOR SAFE OPERATION

Stall Speeds
3600 lbs (Gear Up, 0° Flap) ....67 KIAS
3600 lbs (Gear Down, 40° Flap)....................63 KIAS
Maneuvering Speeds
3600 lbs....................134 KIAS
2230 lbs....................105 KIAS
Never Exceed Speed ....191 KIAS
Power Off Glide Speed
3600 lbs (Gear Up, 0° Flap) ....83 KIAS

3.5 EMERGENCY PROCEDURES CHECKLIST

ENGINE FIRE DURING START

Start....................crank engine
Mixture ....idle cut-off
Throttle ....open
Electric fuel pump....................OFF
Fuel selector....................OFF
Abandon if fire continues

ENGINE POWER LOSS DURING TAKEOFF

If sufficient runway remains for a normal landing, leave gear down and land straight ahead.

If area ahead is rough, or if it is necessary to clear obstructions:
Gear selector switch....................UP

If sufficient altitude has been gained to attempt a restart:
Maintain safe airspeed
Fuel selector....................switch to tank containing fuel
Electric fuel pump....................check ON
Mixture ....check RICH
Alternate air ....OPEN
If power is not regained, proceed with power off landing.

ENGINE POWER LOSS IN FLIGHT

If at low altitude:

Airspeed ....MAINTAIN 83 KIAS Minimum

Prepare for power off landing.

ENGINE POWER LOSS IN FLIGHT (continued)

If altitude permits:

Fuel selector .... switch to tank containing fuel
Electric fuel pump .... ON
Mixture .... RICH
Alternate air .... OPEN
Engine gauges .... check for indication of cause of power loss

If no fuel flow is indicated, check tank selector position to be sure it is on a tank containing fuel.

When power is restored:
Alternate air .... CLOSED
Electric fuel pump .... OFF
Mixture .... adjust as necessary

If power is not restored prepare for power off landing.

POWER OFF LANDING

Trim for 83 KIAS
Locate suitable field.
Establish spiral pattern.
1000 ft. above field at downwind position for normal landing approach.
When field can easily be reached extend full flaps for shortest landing.

Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:
Landing gear selector .... DOWN
Flaps .... As desired
Throttle .... Close
Mixture .... idle cut-off
Magnetos .... OFF
Battery Master switch .... OFF
ALTR Switch .... OFF
Fuel selector .... OFF
Seat belt and harness .... tight

NOTE:

If battery master switch is OFF, the landing gear can not be retracted and the gear position lights and flaps will be inoperative

FIRE IN FLIGHT

Source of fire ....check

Electrical fire (smoke in cabin):

Batt. Master switch ....OFF

ALTR switch ....OFF

Vents ....open

Cabin heat ....OFF

Land as soon as practicable.

Engine fire:

Fuel selector ....OFF

Throttle ....CLOSED

Mixture ....idle cut-off

Electric fuel pump ....check OFF

Heater and defroster ....OFF

Proceed with power off landing procedure

NOTE:

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

LOSS OF OIL PRESSURE

Land as soon as possible and investigate cause. Prepare for power off landing.

LOSS OF FUEL FLOW

Electric fuel pump ....ON

Fuel selector ....check on tank containing usable fuel

ENGINE DRIVEN FUEL PUMP FAILURE

Throttle ....retard

Electric fuel pump ....ON

Throttle ....reset as required

CAUTION:

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

HIGH OIL TEMPERATURE

Land at nearest airport and investigate the problem. Prepare for power off landing.

ELECTRICAL FAILURES

ALT annunciator light illuminated
Ammeter....................check to verify inop. alt.

If ammeter shows zero
ALT switch....................OFF

Reduce electrical loads to minimum
ALT circuit breaker....................check and reset as required
ALT switch....................ON

If power not restored
ALT switch....................OFF

If alternator output cannot be restored, reduce electrical loads and land as soon as practical. The battery is the only remaining source of electrical power.

ELECTRICAL OVERLOAD (ALTERNATOR OVER 20 AMPS ABOVE KNOWN ELECTRICAL LOAD)

ALT switch .... ON
BAT switch .... OFF

If alternator loads are reduced
Electrical load .... reduce to minimum

Land as soon as practical.

NOTE

Due to increased system voltage and radio frequency noise, operation with ALT switch ON and BAT switch OFF should be made only when required by an electrical system failure.

If alternator loads are not reduced
ALT switch .... OFF
BAT switch .... as required

Land as soon as possible. Anticipate complete electrical failure.

NOTE

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

PROPELLER OVERSPEED

Throttle .... retard
Oil pressure .... check
Prop control .... full DECREASE rpm, then set if any control available
Airspeed .... reduce
Throttle .... as required to remain below 2700 rpm

EMERGENCY LANDING GEAR EXTENSION

NOTE:

Refer to paragrap;h 4.39 for differences when emergency gear extension is being performed for training purposes.

Prior to emergency extension procedure:
Batt. Master switch ....check ON
ALTR switch ....check ON
Circuit breakers ....check
Day /night dimming switch (in daytime) ....day
Gear indicator bulbs ....check by depressing Annunc. test

If landing gear does not check down and locked:
Airspeed ....Reduce below 90 KIAS

Landing gear selector ....GEAR DOWN POSITION

If landing gear still does not check down and locked:
Emergency gear knob ....PULL, while fish tailing airplane (under normal conditions will take approx. 10 seconds to be down and locked)

If all electrical power has been lost, the landing gear must be extended using the above procedures. The gear position indicator lights will not illuminate.

SPIN RECOVERY

Rudder ....full opposite to direction of rotation

Control wheel ....full forward while neutralizing ailerons

Throttle ....idle
Rudder ....neutral (when rotation stops)

Control wheel ....as required to smoothly regain level flight attitude

OPEN DOOR

If the door latch is open, the door will trail slightly open and airspeeds will be reduced slightly.

To close the door in flight:
Slow airplane to 90 KIAS
Cabin vents ....close
Storm window ....open

If door latch is open ....pull on armrest while moving latch handle to latched position

3.7 EMERGENCY PROCEDURES (GENERAL)

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

3.9 ENGINE FIRE DURING START

Engine fires during start are usually the result of overpriming. The first attempt to extinguish the fire is to try to start the engine and draw the excess fuel back into the induction system.

If a fire is present before the engine has started, move the mixture control to idle cut-off, open the throttle and crank the engine. This is an attempt to draw the fire back into the engine.

If the engine has started, continue operating to try to pull the fire into the engine.

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

The fuel selector valve should be OFF and the mixture at idle cut-off if an external fire extinguishing method is to be used.

3.11 ENGINE POWER LOSS DURING TAKEOFF

The proper action to be taken if loss of power occurs during takeoff will depend on the circumstances of the particular situation.

If sufficient runway remains to complete a normal landing, leave the landing gear down and land straight ahead.

If the area ahead is rough, or if it is necessary to clear obstructions, move the gear selector switch to the UP position.

If sufficient altitude has been gained to attempt a restart, maintain a safe airspeed and switch the fuel selector to another tank containing fuel. Check the electric fuel pump to insure that it is ON and that the mixture is RICH. The alternate air should be OPEN.

If engine failure was caused by fuel exhaustion, power will not be regained after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with Power Off Landing procedure (refer to the emergency checklist and paragraph 3.15).

3.13 ENGINE POWER LOSS IN FLIGHT

Complete engine power loss is usually caused by fuel flow interruption and power will be restored shortly after fuel flow is restored. If power loss occurs at a low altitude, the first step is to prepare for a power off landing (refer to paragraph 3.15). An airspeed of at least 83 KIAS should be maintained.

If altitude permits, switch the fuel selector to another tank containing fuel and turn the electric fuel pump ON. Move the mixture control to RICH and the alternate air to OPEN. Check the engine gauges for an indication of the cause of the power loss. If no fuel flow is indicated, check the tank selector position to be sure it is on a tank containing fuel.

When power is restored move the alternate air to the CLOSED position, turn OFF the electric fuel pump and adjust the mixture control as necessary.

If the preceding steps do not restore power, prepare for an emergency landing.

If time permits, turn the ignition switch to L then to R then back to BOTH. Move the throttle and mixture control levers to different settings. This may restore power if the problem is too rich or too lean a mixture or if there is a partial fuel system restriction. Try other fuel tanks. Water in the fuel could take some time to be used up, and allowing the engine to windmill may restore power. If power loss is due to water, fuel flow indications will be normal.

If engine failure was caused by fuel exhaustion, power will not be restored after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with the Power Off Landing procedure (refer to the emergency checklist and paragraph 3.15).

3.15 POWER OFF LANDING

If loss of power occurs at altitude, trim the aircraft for best gliding angle (83 KIAS, Air Cond. off) and look for a suitable field. If measures taken to restore power are not effective, and if time permits, check your charts for airports in the immediate vicinity; it may be possible to land at one if you have sufficient altitude. At best gliding angle, with no wind, with the engine windmilling and the propeller control in full DECREASE rpm, the aircraft will travel approximately 1.5 miles for each thousand feet of altitude in a no wind condition. If possible, notify the FAA or any other authority, by radio of your difficulty and intentions. If another pilot or passenger is aboard, let them help.

When you have located a suitable field, establish a spiral pattern around this field. Try to be at 1000 feet above the field at the downwind position, to make a normal landing approach. When the field can easily be reached, extend full flaps for the shortest landing. Excess altitude may be lost by widening your pattern, using flaps or slipping, or a combination of these.

Whether to attempt a landing with gear up or down depends on many factors. If the field chosen is obviously smooth and firm, and long enough to bring the plane to a stop, the gear should be down. If there are stumps or rocks or other large obstacles in the field, the gear in the down position will better protect the occupants of the aircraft. If, however, the field is suspected to be excessively soft or short, or when landing in water of any depth, a wheels-up landing will normally be safer and do less damage to the airplane.

Touchdown should normally be made at the lowest possible airspeed with flaps fully extended.

When committed to landing, verify the landing gear selector position as required by field conditions. Lower the flaps as desired, close the throttle, move the mixture to idle cut-off, and shut off the magnetos. Turn the battery master and alternator switches OFF. Move the fuel selector valve to OFF. The seat belts and shoulder harness should be tightened.

NOTE

> If the battery master switch is OFF, the gear cannot be retracted. The gear position lights and flaps will be inoperative.

3.17 FIRE IN FLIGHT

The presence of fire is noted through smoke, smell and heat in the cabin. It is essential that the source of the fire by promptly identified through instrument readings, character of smoke, or other indications since the action to be taken differs somewhat in each case.

Check for the source of the fire first.

If an electrical fire is indicated (smoke in the cabin), turn the battery master and alternator switches OFF. The cabin vents should be opened and the cabin heat turned OFF. A landing should be made as soon as possible.

If an engine fire is present, switch the fuel selector to OFF, close the throttle, and move the mixture to idle cut-off. Check that the electric fuel pump is OFF. In all cases, the heater and defroster should be OFF. If radio communication is not required select battery master and alternator switches OFF. If the terrain permits, a landing should be made immediately.

NOTE

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

3.19 LOSS OF OIL PRESSURE

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

A complete loss of oil pressure indication may signify oil exhaustion or may be the result of a faulty gauge. In either case, proceed toward the nearest airport and be prepared for a forced landing. If the problem is not a pressure gauge malfunction, the engine may stop suddenly. Maintain altitude until such time as a dead stick landing can be accomplished. Don't change power settings unnecessarily, as this may hasten complete power loss.

Depending on the circumstances, it may be advisable to make an off airport landing while power is still available, particularly if other indications of actual oil pressure loss, such as sudden increases in temperatures, or oil smoke, are apparent, and an airport is not close.

If engine stoppage occurs, proceed with Power Off Landing.

3.21 LOSS OF FUEL FLOW

The most probable cause of loss of fuel flow is either fuel depletion in the fuel tank selected or failure of the engine driven fuel pump. If loss of fuel flow occurs, turn ON the electric fuel pump and check that the fuel selector is on a tank containing usable fuel.

If loss of fuel pressure is due to failure of the engine driven fuel pump the electric fuel pump will supply sufficient fuel flow.

After fuel flow and power are regained, turn the electric fuel pump OFF. If fuel flow starts to drop, turn the electric fuel pump ON and land at the nearest suitable airport as soon as possible and have the cause investigated.

CAUTION

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

3.23 ENGINE DRIVEN FUEL PUMP FAILURE

If an engine driven fuel pump failure is indicated, retard the throttle and turn ON the electric fuel pump. The throttle should then be reset as required. A landing should be made at the nearest appropriate airport as soon as possible and the cause of the failure investigated.

CAUTION

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

3.25 HIGH OIL TEMPERATURE

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a defective gauge, or other causes. Land as soon as practical at an appropriate airport and have the cause investigated.

A steady, rapid rise in oil temperature is a sign of trouble. Land at the nearest airport and let a mechanic investigate the problem. Watch the oil pressure gauge for an accompanying loss of pressure.

3.26 ELECTRICAL FAILURES

Loss of alternator output is detected through zero reading on the ammeter. Before executing the following procedure, insure that the reading is zero and not merely low by actuating an electrically powered device, such as the pitot heat, recognition light, etc. If no increase in the ammeter reading is noted, alternator failure can be assumed.

The electrical load should be reduced as much as possible. Check the alternator circuit breakers for a popped circuit.

The next step is to attempt to reset the overvoltage relay. This is accomplished by moving the ALT switch to OFF for one second and then to ON. If the trouble was caused by a momentary overvoltage condition (30.5 volts and up) this procedure should return the ammeter to a normal reading.

If the ammeter continues to indicate "0" output, or if the alternator will not remain reset, turn off the ALT switch, maintain minimum electrical load and land as soon as practical. All electrical load is being supplied by the battery.

3.27 ELECTRICAL OVERLOAD (alternator over 20 amps above known electrical load)'

If abnormally high alternator output is observed (more than 20 amps above known electrical load for the operating conditons) it may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists attempt to reduce the load by turning off non-essential equipment.

Turn the BAT switch OFF and the ammeter should decrease. Turn the BAT switch ON and continue to monitor the ammeter. If the alternator output does not decrease within 5 minutes, turn the BAT switch OFF and land as soon as practical. All electrical loads are being supplied by the alternator.

NOTE

Due to higher voltage and radio frequency noise, operation with the ALT switch ON and the BAT switch OFF should be made only when required by an electrical failure.

NOTE

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

3.29 PROPELLER OVERSPEED

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

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

3.31 EMERGENCY LANDING GEAR EXTENSION

Prior to proceeding with an emergency gear extension, check to insure that the battery master and alternator switches are ON and that the circuit breakers have not opened. If it is daytime, the day/night dimmer switch should be in the day position. Check the landing gear indicators for faulty bulbs by depressing the annunciator press to test..

NOTE

Refer to Par. 4.39 for differences when emergency extension procedure is performed for training purposes.

If the landing gear does not check down and locked, reduce the airspeed to below 90 KIAS. Move the landing gear selector to the DOWN position. If the landing gear still does not check down and locked, PULL the emergency extend knob while fish tailing the airplane.

Under normal conditions, the above procedure, will require approximately 10 seconds for the gear to extend and lock down.

If all electrical power has been lost, the landing gear must be extended using the above procedure. The gear position indicator lights will not illuminate.

3.33 SPIN RECOVERY

Intentional spins are prohibited in this airplane. If a spin is inadvertently entered, immediately apply full rudder opposite to the direction of rotation. Move the control wheel full forward while neutralizing the ailerons. Move the throttle to IDLE. When the rotation stops, neutralize the rudder and ease back on the control wheel as required to smoothly regain a level flight attitude.

3.35 OPEN DOOR

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

If the door latch is open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 90 KIAS, close the cabin vents and open the storm window. If the door latch is open, pull on the armrest while moving the latch handle to the latched position.

3.37 ENGINE ROUGHNESS

Engine roughness may be caused by dirt in the injector nozzles, induction filter icing, or ignition problems.

First adjust the mixture for maximum smoothness. The engine will run rough if the mixture is too rich or too lean.

Move the alternate air to OPEN and then turn ON the electric fuel pump.

Switch the fuel selector to another tank to see if fuel contamination is the problem.

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

The magneto switch should then be moved to "L" then "R," then back to "BOTH." If operation is satisfactory on either magneto, proceed on that magneto at reduced power with full RICH mixture to a landing at the first available airport.

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

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NORMAL PROCEDURES

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SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section describes the recommended procedures for the conduct of normal operations for the airplane. All of the required (FAA regulations) procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided in Section 9 (Supplements).

These procedures are provided to present a source of reference and review and to supply information on procedures which are not the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

The first portion of this section consists of a short form check list which supplies an action sequence for normal operations with little emphasis on the operation of the systems.

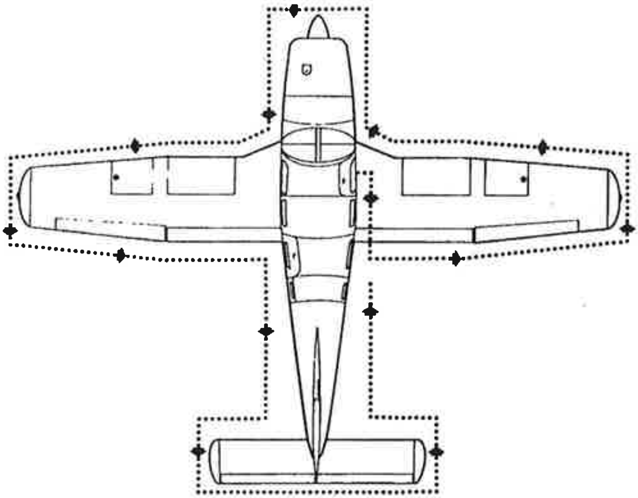
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanation. The short form checklist should be used for this purpose.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

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

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

(a) Best Rate of Climb Speed
gear down, flaps up ....85 KIAS
gear up, flaps up ....93 KIAS
(b)Turbulent Air Operating Speed (See Subsection 2.3)...............134 KIAS
(c)Maximum Flap Speed ....111 KIAS
(d)Landing Final Approach Speed (Full Flaps)..............................80 KIAS
(e)Maximum Demonstrated Crosswind Velocity ....17 KTS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

PREFLIGHT CHECK

COCKPIT

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

Fuel strainer .... drain & check for water & sediment
Control wheel .... release restraints
Gear Handle .... down
Parking brake .... set
Avionics .... OFF
All switches .... OFF
Mixture .... idle cut-off
Magneto switches .... OFF
Battery master switch .... ON
Fuel gauges .... check quantity
Annunciator panel .... check
Flaps .... extend
Battery master switch .... OFF
Primary flight controls .... proper operation
Trim .... neutral
Pitot and static systems .... drain
Windows .... check clean
Required papers and POH .... check on board
Tow bar and baggage .... stow properly - secure
Baggage door-Rear .... close and secure

RIGHT WING

Surface condition....clear of ice, frost, snow
Flap and hinges....check
Aileron and hinges....check
Static wicks....check - secure
Wing tip and lights....check
Fuel tank....check supply visually - secure cap
Fuel quantity gauge....check
Fuel tank vent....clear

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

Fuel tank sumps....drain and check for water, sediment and proper fuel
Tie down and chock....remove
Main gear strut....proper inflation (4.5 ± .5 in.)
Tire....check
Brake block and disc....check
Fresh air inlet....clear

NOSE SECTION

Baggage door....close and secure
General condition....check
Baggage door....close and secure
Cowling....secure
Windshield....clean
Propeller and spinner....check
Air inlets....clear
Engine baffle seals....check
Chock....remove
Nose gear strut....proper inflation (3.25 ± .25 in.)
Nose Gear Doors....check
Nose wheel tire....check
Landing Light....secure
Oil....check quantity
Dipstick....properly seated
Oil filler cap....secure

LEFT WING

Surface condition .... clear of ice, frost, snow
Fresh air inlet .... clear

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

Fuel tank sump .... drain and check for water, sediment and proper fuel
Tie down and chock .... remove
Main gear strut .... proper inflation ($4.5 \pm .5$ in.)
Tire .... check
Brake block and disc .... check
Fuel tank vent .... clear
Fuel quantity gauge .... check
Fuel tank .... check supply visually - secure cap
Stall warning vanes .... check
Pitot head .... remove cover - holes clear
Wing tip and lights .... check
Aileron and hinges .... check
Flap and hinges .... check
Static wicks .... check secure

FUSELAGE

Antennas .... check
Static Vents .... clear
Empennage .... clear of ice, frost, snow
Stabilator and trim tab .... check
Tie down .... remove

MISCELLANEOUS

Battery master switch .... ON
Flaps .... retract
Interior lighting .... ON and check
Pitot heat switch .... ON

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

Exterior lighting switches ....ON and check
Pitot ....check - warm
Stall warning horn....................check
All lighting switches ....OFF
Pitot heat switch....................OFF
Battery master switch ....OFF
Passengers....................board
Doors....................Closed and secure
Seats ....Adjusted & Locked
Seat belts and harness ....fasten/adjust
check inertia reel

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

ENGINE START - GENERAL

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

CAUTION: If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.

NOTE: Starter manufacturers recommend that starter cranking periods be limited to 30 seconds with a two minute rest period between cranking periods. Longer cranking periods will shorten the life of the starter.

BEFORE STARTING ENGINE

Brakes ....set
Circuit breakers....................check in
Alternate air ....OFF
Propeller ....full INCREASE rpm
Avionics ....OFF
Fuel selector....................desired tank

NORMAL START - COLD ENGINE

Throttle....................1/2 in. open
Battery master switch ....ON
Alternator switch ....ON
Magneto switches ....ON
Electric fuel pump ....ON
Mixture ....prime - then idle cut-off
Propeller....................clear
Starter....................engage
Mixture....................full RICH
Throttle ....adjust
Oil pressure ....check

NORMAL START - HOT ENGINE

Throttle....1/2 in. open
Battery master switch....ON
Alternator switch....ON
Magneto switches....ON
Electric fuel pump....ON
Mixture....idle cut-off
Propeller....clear
Starter....engage
Mixture....advance
Throttle....adjust
Oil pressure....check

ENGINE START WHEN FLOODED

Throttle....open full
Battery master switch....ON
Alternator switch....ON
Magneto switches....ON
Electric fuel pump....OFF
Mixture....idle cut-off
Propeller....clear
Starter....engage
Mixture....advance
Throttle....retard
Oil Pressure....check

STARTING WITH EXTERNAL POWER SOURCE

CAUTION: It is possible to use the ship's battery in parallel by turning only the battery master switch ON. This will give longer cranking capabilities, but will not increase the amperage. Care should be exercised because if the ship's battery has been depleted , the external power supply can be be reduced to the level of the ship's battery. This can be tested by turning only the battery master switch momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

NOTE: For all normal operations using the PEP jumper cables, the battery master and alternator switches should be OFF.

Battery master switch....OFF
Alternator switch....OFF
Magneto switches....ON

All electrical equipment .... OFF
Terminals .... connect
External power plug .... insert in fuselage
Proceed with normal start
Throttle .... lowest possible RPM
External power plug .... disconnect from fuselage
Battery master switch .... ON - check ammeter
Alternator switch .... ON - check ammeter
Oil pressure .... check

WARM-UP

Throttle .... 1000 to 1200 RPM

TAXIING

Taxi area .... clear
Parking brake .... release
Prop .... high RPM
Throttle .... apply slowly
Brakes .... check
Steering .... check

GROUND CHECK

Parking brake .... set
Propeller .... full INCREASE
Throttle .... 2000 RPM
Magnetos .... max. drop 175 RPM - max. diff. 50 RPM
Vacuum .... 4.8 to 5.2 in. Hg.
Oil temperature .... check
Oil pressure .... check
Air conditioner .... check
Ammeter .... check
Annunciator panel .... press-to-test
Propeller .... exercise - then full INCREASE

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

Alternate air .... check
Electric fuel pump .... OFF
Fuel flow .... check
Throttle .... retard

BEFORE TAKEOFF

Battery master switch .... Verify ON
Alternator switch .... Verify ON
Magneto switches .... Verify ON
Flight instruments .... check
Fuel selector .... proper tank
Electric fuel pump .... ON
Engine gauges .... check
Alternate air .... CLOSED
Seats .... Adjusted & Locked
Seat backs .... erect
Belts/harness .... fastened/check
Empty seats .... seat belts, securely fastened
Mixture .... set
Propeller .... set
Flaps .... set
Trim .... set
Controls .... free
Doors .... latched
Air conditioner .... OFF

TAKEOFF

NORMAL TECHNIQUE

Flaps .... retracted
Trim .... set
Accelerate to 84 to 88 KIAS, depending on aircraft weight.
Control wheel .... back pressure to smoothly rotate to climb attitude
Landing gear (when straight ahead landing on runway not possible) .... up

SHORT FIELD, OBSTACLE CLEARANCE

Flaps .... 25°
Trim .... slightly aft of neutral
Throttle .... full power prior to brake release
Accelerate to 69 to 72 KIAS depending on aircraft weight.
Control wheel .... back pressure to rotate to climb attitude

After breaking ground, accelerate to 74 to 77 KIAS depending on aircraft weight.

Landing gear ....up
Accelerate to climb speed
Flaps ....retract slowly

CLIMB

Best rate (3600 lb) (gear down)
(flaps up)..85 KIAS
Best rate (3600 lb) (gear up)
(flaps up)..93 KIAS
En route..105 KIAS
Electric fuel pump ....OFF at desired altitude

CRUISE

Power ....set per power table
Mixture ....adjust

APPROACH AND LANDING

Fuel selector..proper tank
Seats ....Adjusted & Locked
Seat backs..erect
Belts/harness ....fasten/adjust
Electric fuel pump ....ON
Mixture ....set
Propeller ....full increase
Gear ....down - 132 KIAS max.
Flaps..set - 110 knots max.
Air conditioner..OFF

NORMAL TECHNIQUE

Flaps ....as required
Trim..95 KIAS
Throttle ....as required

SHORT FIELD TECHNIQUE

Flaps .... 40°
Trim.. 80 KIAS
Throttle .... as required

GO-AROUND

Propeller .... full INCREASE
Throttle .... full FORWARD
Control wheel .... back pressure to rotate to climb attitude
Airspeed .... 83 KIAS
Gear .... UP
Flaps .... retract slowly
Trim .... as required

STOPPING ENGINE

CAUTION:

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

Flaps .... retract
Electric fuel pump .... OFF
Air conditioner .... OFF
Avionics .... OFF
Electrical switches .... OFF
Propeller .... full INCREASE
Throttle .... closed
Mixture .... idle cut-off
Magneto Switches .... OFF
Alternator switch .... OFF
Battery master switch .... OFF

MOORING

Parking brake ....set
Flaps ....full up
Control wheel ....secured with belts
Wheel chocks ....in place
Tie downs ....secure

4.7 PREFLIGHT CHECK

Prior to entering the cockpit place a container under the fuel strainer valve located under the fuselage. 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.

CAUTION

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

COCKPIT

CAUTION

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

Upon entering the cockpit, drain the fuel strainer by pressing down on the lever located on the right-hand side of the cabin, below the forward edge of center seat. The fuel selector should be positioned in the following sequence while draining the strainer: "OFF," "LEFT" and "RIGHT." This is done to insure that the fuel in the lines between each tank outlet and the fuel strainer is drained, as well as the fuel in the fuel strainer. When the fuel tanks are full, it will take approximately six seconds to drain all the fuel in one of the lines from a tank to the fuel strainer. If the fuel tanks are less than full, it will take a few seconds longer. After draining the fuel strainer, check for leakage and for water and sediment at the drain under the aircraft with the fuel selector on a tank position.

Release the seat belts securing the control wheel and check that the gear selector is in the down position. Set the parking brake by first depressing and holding the toe brake pedals and then pull the parking brake lever while depressing the knob attached to the top of he handle. Insure that all electrical switches are OFF. Turn OFF all avionics equipment (to save power and prevent wear on the units). The mixture should be in idle cut-off and the magneto switches in the OFF position. . Turn ON the battery master switch, check the fuel quantity gauges for adequate supply, check that the annunciator panel illuminates and check the flaps for proper operation. Turn OFF the battery master switch. Check the primary flight controls for proper operation and set the trim to neutral. Open the pitot and static drains to remove any moisture that has accumulated in the lines. Check the windows for cleanliness and that the required papers are on board. Properly stow and secure the tow bar and baggage. Close and secure the rear baggage door.

RIGHT WING

Begin the walk-around at the trailing edge of the right wing by checking that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition. Check the wing tip and lights for damage.

Open the fuel cap and visually check the fuel supply. Check the fuel indicator gauge. Each inboard tank is furnished with an external fuel quantity indicator to assist the pilot in determining fuel quantities of less than 35 gallons. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. The fuel tank vent should be clear of obstructions.

Place a container under the quick drain. Drain the fuel tanks through the quick drain located at the lower inboard rear corner of each tank, making sure that enough fuel has been drained to verify the proper fuel and insure that all water and sediment is removed. The fuel system should be drained daily prior to the first flight and after each refueling.

CAUTION

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

Remove the tie down and chock.

Next, complete a check of the landing gear. Check the gear strut for proper inflation; there should be 4.5 ± .5 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake block and disc.

Check that the fresh air inlet is clear of foreign matter.

NOSE SECTION

Check the general condition of the nose section. Verify that the nose baggage door is closed, secure, and locked. Look for oil or fluid leakage and that the cowling is secure. Check the windshield and clean if necessary. The propeller and spinner should be checked for detrimental nicks, cracks, or other defects. The air inlets should be clear of obstructions. Check the condition of the engine baffel seals. Check the general condition of the nose wheel door and for excessive play.

Remove the chock and check the nose gear strut for proper inflation; there should be 3.25 ± .5 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. The landing light should be checked for cleanliness and security. Check the oil level; make sure that the dipstick has been properly seated and that the oil filler cap has been properly secured.

LEFT WING

The wing surface should be clear of ice, frost, snow, or other extraneous substances. Check that the fresh air inlet is clear of foreign matter and remove the tie downs and chocks. Check the main gear struts for proper inflation: there should be 4.5 ± .5 inches of strut exposure under a normal static load. Check the tire and the brake block and disc. Remove the chock.

Open the fuel cap and visually check the fuel supply. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. (See RIGHT WING for further fuel system description.) The fuel tank vent should be clear of obstructions. Place a container under the quick drain. Drain enough fuel to verify the proper fuel and to insure that all water and sediment has been removed.

Remove tie down and remove the cover from the pitot head on the underside of the wing. Make sure the holes are open and clear of obstructions. Check the wing tip and lights for damage. Check the aileron, flap, and hinges for damage and operational interference. Check that the static wicks are firmly attached and in good condition.

FUSELAGE

Check the condition of any antennas located on the fuselage. Check that the static vent holes are free of obstructions. All surfaces of the empennage should be examined for damage and operational interference. Fairings and access covers should be attached properly. Check the baggage to be sure it is stowed properly. Check that the lights on the tail are clean and intact. The elevator and rudder should be operational and free from interference of any type. Check the condition of the tabs and insure that all hinges and push rods are sound and operational. If the tail has been tied down, remove the tie down rope.

MISCELLANEOUS

Turn the battery master switch "ON" and begin checking the interior lights by turning "ON" the necessary switches. After the interior lights are checked, turn "ON" the pitot heat switch and the exterior light switches. Next, perform a walk-around check on the exterior lights and examine and dispose of the contents in the container placed under the fuel strainer drain.

With 0° flaps check the stall warning horn by moving the inboard lift detector slightly up. Reset the flaps to 25° or 40° and check the outboard lift detector. Check the heated pitot head for proper heating. Turn all electrical switches and battery master switch OFF.

CAUTION:

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

When all passengers are on board, the pilot should check the cabin doors for proper closing and latching procedures. The rear door should be closed, and the overhead latch button turned to the ``LOCK'' position. The front door should be gently pulled shut while the door handle is firmly latched. Seat belts on empty seats should be snugly fastened. All passengers should fasten their seat belts and shoulder harnesses and check that the seats are adjusted and locked in position.

NOTE:

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

ENGINE START - GENERAL

CAUTION :

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

CAUTION:

If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.

4.9 BEFORE STARTING ENGINE

Before starting the engine, the brakes should be set and the propeller lever moved to the full INCREASE rpm position. The fuel selector should then be moved to the desired tank. Check to make sure all the circuit breakers are in and the radios are OFF.

4.11 STARTING ENGINE

(a) NORMAL START: Cold Engine

Open the throttle lever approximately 1/2 inch. Turn ON the battery master, alternator, and magneto switches. Turn on the electric fuel pump. Move the mixture control to full RICH for approximately 4 seconds. The engine is now primed.

Move the mixture control to idle cut-off, verify that the propeller area is clear, and engage the starter. When the engine fires, release the starter switch, advance the mixture control to full RICH and move the throttle to the desired setting. Check for proper oil pressure indication.

If the engine does not fire within five to ten seconds, disengage the starter and reprime.

(b) NORMAL START: Hot Engine

Open the throttle approximately 1/2 inch. Turn ON the battery master, alternator, and magneto switches. Turn on the electric fuel pump. Leave the mixture control in idle cut-off. Verify that the propeller area is clear, and engage the starter. When the engine fires, release the starter switch, advance the mixture and move the throttle to the desired setting. Check for proper oil pressure indication.

(c) Starting Engine When Flooded

The throttle lever should be full OPEN. Turn ON the battery master, alternator, and magneto switches. Turn OFF the electric fuel pump. Move the mixture control to idle cut-off, verify that the propeller area is clear, and engage the starter. When the engine fires, release the starter switch, advance the mixture and retard the throttle. Check for proper oil pressure indication.

(d) Starting Engine With External Power Sources

CAUTION

It is possible to use the ship's battery in parallel by turning the battery master switch ON. This will give longer cranking capabilities, but will not increase the amperage. Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

NOTE

For all normal operations using the PEP jumper cables, the master switch should be OFF.

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

Verify the battery master and alternator switches are OFF, magneto switches are ON, and all external equipment is OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 24-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located on the fuselage. Note that when the plug is inserted, the electrical system is ON. Turn the magneto swithces ON and proceed with the normal starting technique. Batery master and alternator switches will be OFF.

After the engine has started, reduce power to the lowest possible RPM, to reduce sparking, and disconnect the jumper cable from the aircraft. Turn the master switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT.

When the engine is firing evenly, advance the throttle to 800 RPM. If oil pressure is not indicated within thirty seconds, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get an oil pressure indication. If the engine has failed to start, refer to the Lycoming Operating Handbook, Engine Troubles and Their Remedies.

Starter manufacturers recommend that cranking periods be limited to thirty seconds with a two minute rest between cranking periods. Longer cranking periods will shorten the life of the starter.

4.13 WARM-UP

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

Takeoff may be made as soon as the ground check is completed and the engine is warm.

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.

4.15 TAXIING

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Ascertain that the chocks have been removed and that propeller back blast and taxi areas are clear. Release the parking brake.

Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. Taxi with the propeller set in low pitch, high RPM setting. While taxiing, make slight turns to ascertain the effectiveness of the steering.

Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.

Avoid holes and ruts when taxiing over uneven ground.

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.

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4.17 GROUND CHECK

Set the parking brake. The magnetos should be checked at 2000 RPM with the propeller set at high RPM. Drop off on either magneto should not exceed 175 RPM and the difference between the magnetos should not exceed 50 RPM. Operation on one magneto should not exceed 10 seconds.

Check the vacuum gauge; the indicator should read 4.8 inches Hg. to 5.2 inches Hg. at 2000 RPM. Check oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day.

Check the air conditioner and the ammeter for proper operation. The ammeter can be checked by temporary activation of the pitot heat or landing light and observing an increase on the ammeter. .Check the annunciator panel lights with the press-to-test button.

The propeller control should be moved through its complete range to check for proper operation and then placed in full INCREASE rpm for takeoff. To obtain maximum rpm, push the pedestal-mounted control fully forward on the instrument panel. Do not allow a drop of more than 500 RPM during this check. In cold weather, the propeller control should be cycled from high to low RPM at least three times before takeoff to make sure that warm engine oil has circulated. Check the alternate air.

CAUTION :

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

The electric fuel pump should be turned OFF briefly after starting or during warm-up to make sure that the engine-driven pump is operating. Prior to takeoff, the electric pump should be turned ON again to prevent loss of power during takeoff, should the engine-driven pump fail. Check oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day.

4.19 BEFORE TAKEOFF

All aspects of each particular takeoff should be considered prior to executing the takeoff procedure.

After all aspects of the takeoff are considered, a pretakeoff check procedure must be performed.

Ensure that the battery master, altenator, and magneto switches are ON. Check and set all of the flight instruments as required. Check the fuel selector to make sure it is on the proper tank (fullest). Turn ON the electric fuel pump and check the engine gauges. The alternate air should be in the CLOSED position. All seat backs should be erect, adjusted and locked in position.. All seat belts and shoulder harness must be fastened

NOTE

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

The mixture and propeller control levers should be set. Fasten the seat belts snugly around the empty seats.

Exercise and set the flaps and trim tab. Insure proper flight control movement and response. All doors should be properly secured and latched and the parking brake released. On air conditioned models, the air conditioner must be OFF to insure normal takeoff performance.

4.21 TAKEOFF

NORMAL TECHNIQUE (SEE CHART, SECTION 5)

When the available runway length is well in excess of that required and obstacle clearance is no factor, the normal takeoff technique may be used. The flaps should be set in the retracted position and the pitch trim set slightly aft of neutral. Align the airplane with the runway, apply full power, and accelerate to 84 to 88 KIAS depending on weight. Apply back pressure to the control wheel to lift off, then control pitch attitude as required to attain the desired climb speed. Retract the landing gear when a straight-ahead landing on the runway is no longer possible.

SHORT FIELD TECHNIQUE (SEE CHART, SECTION 5)

For departure from short runways with adjacent obstructions, a short field takeoff technique with flaps set to 25° should be used in accordance with the short field takeoff ground roll -flaps 25° and short field performance - flaps 25° charts. Maximum power is established before brake release and the airplane is accelerated to 69 to 72 KIAS depending on aircraft weight for liftoff. After liftoff, control the airplane attitude to accelerate to 74 to 77 KIAS depending on aircraft weight, passing through the 50 foot obstacle height. Once clear of the obstacle retract the landing gear and accelerate to 93 KIAS while retracting the flaps.

4.23 CLIMB

The best rate of climb at gross weight and maximum continuous power will be obtained at 93 KIAS. The recommended procedure for climb is to use maximum continuous power with the mixture full rich. For climbing en route, a speed of 105 KIAS is recommended. This will produce better forward speed and increased visibility over the nose during the climb.

Upon reaching a safe altitude, the electric fuel pump may be turned off.

4.25 CRUISING

The cruising speed is determined by many factors, including power setting, altitude, temperature, loading and equipment installed in the airplane.

When leveling off at cruise altitude, the pilot may reduce to a cruise power setting in accordance with the *power setting table in section 5 of this manual. When selecting cruising RPM below 2300, limiting manifold pressure for continuous operation, as specified by the appropriate ``Avco-Lycoming Operator's Manual'', should be observed.

To obtain the desired power, set the manifold pressure and RPM according to the power setting table in this manual.

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes. The mixture should be leaned during cruising operation 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 obtain the performance presented in the Performance Section of this handbook, all conditions listed on the performance charts must be met.

To lean the mixture, disengage the lock and pull the mixture control until the engine becomes rough, indicating that the lean mixture limit has been reached in the leaner cylinders. Then enrich the mixture by pushing the control towards the instrument panel until engine operation becomes smooth. The fuel flow meter will give a close approximation of the fuel being consumed. The low side of the power setting, as shown on the fuel flow meter, indicates best economy for that percent of power while the high side indicates best power.

If the airplane is equipped with the optional exhaust gas temperature (EGT) gauge, a more accurate means of leaning is available to the pilot. For this procedure, refer to the "Avco-Lycoming Operator's Manual."

Following level-off for cruise, the airplane should be trimmed.

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

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

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

In order to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each tank at one hour intervals.

Always remember that the electric fuel pump should be turned ON before switching tanks, and should be left on for a short period thereafter. To preclude making a hasty selection, and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use. The electric fuel pump should be normally OFF so that any malfunction of the engine driven fuel pump is immediately apparent. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately positioned to the fullest tank and the electric fuel pump switched to the ON position.

4.27 APPROACH AND LANDING

Accomplish the Landing Checklist early in the landing approach.

NOTE

With the shoulder harness fastened and adjusted, a pull test of its locking restraint feature should be performed. Check that all seats are adjusted and locked in position.

Depending on field length and other factors the following procedures are appropriate:

NORMAL TECHNIQUE (No Performance Chart Furnished)

When available runway length is in excess of required runway length, a normal approach and landing technique may be utilized. The aircraft should be flown down the final approach course at 95 KIAS with power required to maintain the desired approach angle. The amount of flap used during approach and landing and the speed of the aircraft at contact with the runway should be varied according to the conditions of wind and aircraft loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions. As landing distances with this technique will vary, performance charts are not furnished.

SHORT FIELD LANDING APPROACH POWER OFF (See Chart, Section 5)

When available runway length is minimal or obstacle clearance to landing is of major concern, this approach/landing technique may be employed. The aircraft should be flown on the final approach at 80 KIAS with full flaps, gear down and idle power. The glide path should be stabilized as early as possible. Reduce the speed slightly during landing flareout and contact the ground close to stall speed. After ground contact, retract the flaps and apply full aft travel on the control wheel and maximum braking consistent with existing conditions.

4.29 GO-AROUND

To initiate a go-around from a landing approach, the prop control should be set to full INCREASE and the throttle should be advanced to full throttle while the pitch attitude is increased to obtain the balked landing climb speed of 83 KIAS. Retract the landing gear and slowly retract the flaps when a positive climb is established. Allow the airplane to accelerate to the best rate of climb speed (93 KIAS). Reset the longitudinal trim as required.

4.31 STOPPING ENGINE

Prior to shutdown, all radio and electrical equipment should be turned OFF.

At the pilot's discretion, the flaps should be raised and the electric fuel pump turned OFF.

NOTE

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

The air conditioner should be turned OFF, the propeller set in the full INCREASE position, and the engine stopped by disengaging the mixture control lock and pulling the mixture control back to idle cut-off. The throttle should be left full aft to avoid engine vibration while stopping. Then the magneto, alternator, and master switches must be turned OFF.

4.33 MOORING

Set the parking brake. If necessary, the airplane should be moved on the ground with the aid of the nose wheel tow bar provided with each airplane and secured behind the rear seats. The aileron and stabilator controls should be secured by looping the safety belt through the control wheel and pulling it snug. The flaps are locked when in the UP position and should be left retracted.

Tie downs can be secured to rings provided under each wing and to the tail skid. The rudder is held in position by its connections to the nose wheel steering and normally does not have to be secured.

4.35 STALLS

The stall characteristics of the Saratoga HP are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The gross weight stalling speed with power off and full flaps is 63 KIAS. With the flaps up this speed is increased 4 KTS. Loss of altitude during stalls can be as great as 400 feet, depending on configuration and power.

NOTE

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

During preflight, the stall warning system should be checked by turning the master switch on, setting the flaps to 25° or 40° and raising the outboard lift detector to determine if the horn is actuated. The flaps should then be reset to 0° and the inboard lift detector raised to determine if the horn is actuated.

4.37 TURBULENT AIR OPERATION

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

4.39 LANDING GEAR

The pilot should become familiar with the function and significance of the landing gear position indicators and warning lights.

The red gear warning light on the instrument panel and the horn operate simultaneously in flight when the throttle is reduced to where the manifold pressure is approximately 14 inches of mercury or below, and the gear selector switch is not in the DOWN position.

The red gear warning light in the annunciator cluster and the horn will operate simultaneously on the ground when the master switch is ON and the gear selector switch is in the UP position.

4.39 LANDING GEAR (CONT'D)

The three green lights on the instrument panel operate individually as each associated gear is locked in the extended position.

When the Emergency Landing Gear Extension Procedure (Par. 3.29) is performed for training purposes, the following changes must be made to the procedure in order to prevent the hydraulic pump from activating during the procedure. Pull the LANDING GEAR PUMP circuit breaker prior to executing the emergency extension procedure. The circuit breaker must be reset after completion of the procedure to allow normal gear system operation.

4.41 WEIGHT AND BALANCE

It is the responsibility of the owner and pilot to determine that the airplane remains within the allowable weight vs. center of gravity envelope while in flight.

For weight and balance data, refer to Section 6 (Weight and Balance).

4.43 NOISE LEVEL

The corrected noise level of this aircraft is 81.7 dB(a).

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 F.A.R. 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all F.A.R. 36 noise standards applicable to this type.

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SECTION 5

PERFORMANCE

5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to the Saratoga II HP 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 any allowance for varying degrees of pilot proficiency or mechanical deterioration of the aircraft. This performance, however, can be duplicated by following the stated procedures in a properly maintained airplane.

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

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

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

WARNING

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

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5.5 FLIGHT PLANNING EXAMPLE

(a)Aircraft Loading

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

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

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

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

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

(1)Basic Empty Weight	2100 lbs.
(1)Occupants (6 x 170 lbs.)	1020 lbs.
(3)Baggage and Cargo	60 lbs.
(4)Fuel (6 lb/gal. x 50)	300 lbs.
(5)Takeoff Weight	3480 lbs.
(6)Landing Weight	
(a)(5) minus (g)(1),	
(3480 lbs. minus 180 lbs.)	3300 lbs.

The takeoff weight is below the maximum of 3600 lbs. and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

After determining the aircraft loading, all aspects of the takeoff and landing must be considered.

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

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Takeoff Ground Roll graph (Figures 5-7, 5-9, 5-11, and 5-13) to determine the length of runway necessary for the takeoff and/or the barrier distance.

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

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

	Departure Airport	Destination Airport
(1)Pressure Altitude	1200 ft.	400 ft.
(2)Temperature	16°C	24°C
(3)Wind Component	10 KTS Headwind	5 KTS Headwind
(4)Runway Length Available	3000 ft.	4600 ft.
(5)Runway Required	2638 ft.*	1460 ft.**
(6)Take off fuel	2 gal.	

*reference Figure 5-7
**reference Figure 5-37

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.

(c) Climb

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

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Distance, and Time to Climb graph (Figure 5-21). After the fuel, distance and time for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-21). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

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

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

(1) Cruise Pressure Altitude	6000 ft.
(2) Cruise OAT	6° C
(3) Time to Climb (7 min. minus 1 min.)	6 min.*
(4) Distance to Climb (11.3 nautical miles minus 1 nautical miles)	10.3 nautical miles*
(5) Fuel to Climb (3.3 gal minus 1 gal.)	2.3 gal.*

*reference Figure 5-21

(d) Descent

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

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

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

(1) Time to Descend (12 min. minus 1 min.)	11 min*
(2) Distance to Descend (28 nautical miles minus 2 nautical miles)	26 nautical miles*
(3) Fuel to Descend (3 gal. minus 0.5 gal.)	2.5 gal.*

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the appropriate Avco Lycoming Operator's Manual and the Power Setting Table (Figure 5-23) 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 Cruise Power graph (Figure 5-27).

Calculate the cruise fuel consumption for the cruise power setting from the information provided by the Avco Lycoming Operator's Manual.

*reference Figure 5-33

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 consumption by the cruise time.

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

(1)	Total Distance	253 nautical miles
(2)	Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (253 nautical miles minus 10.3 nautical miles minus 26 nautical miles)	217 nautical miles
(3)	Cruise Power	Economy
(4)	Cruise Speed	154 KTAS
(5)	Cruise Fuel Consumption	16.5 GPH
(6)	Cruise Time (e)(2) divided by (e)(4), (217 nautical miles divided by 154 KTS)	1.41 hr. (1 hr. 24 min.)
(7)	Cruise Fuel (e)(5) multiplied by (e)(6), (16.5 GPH multiplied by 1.41 hrs.)	23.2 gal.

(f) Total Flight Time

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

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

(1)	Total Flight Time (c)(3) plus (d)(1) plus (e)(6), (.10 hrs. plus .18 hrs. plus 1.41 hrs.)	1.69 hr.
	(6 min. plus 11 min. plus 1 hr. 24 min.)	1 hr. 41 min.

*reference Figure 5-27

(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
(b)(5) plus (c)(5) plus (d)(3) plus (e)(7),
(2.0 gal. plus 2.3 gal. plus 2.5 gal. plus 23.2 gal.) 30.0
(30.0 gal. multiplied by 6 lb/gal.) 180.0 lbs.

5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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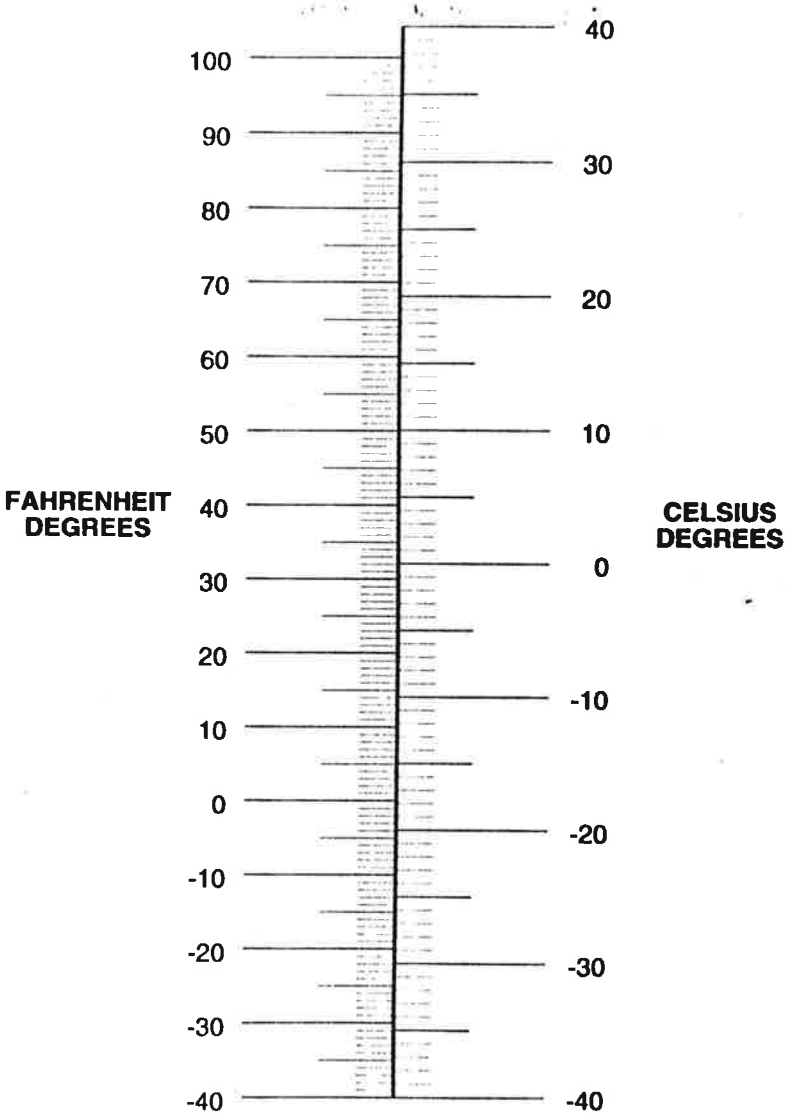
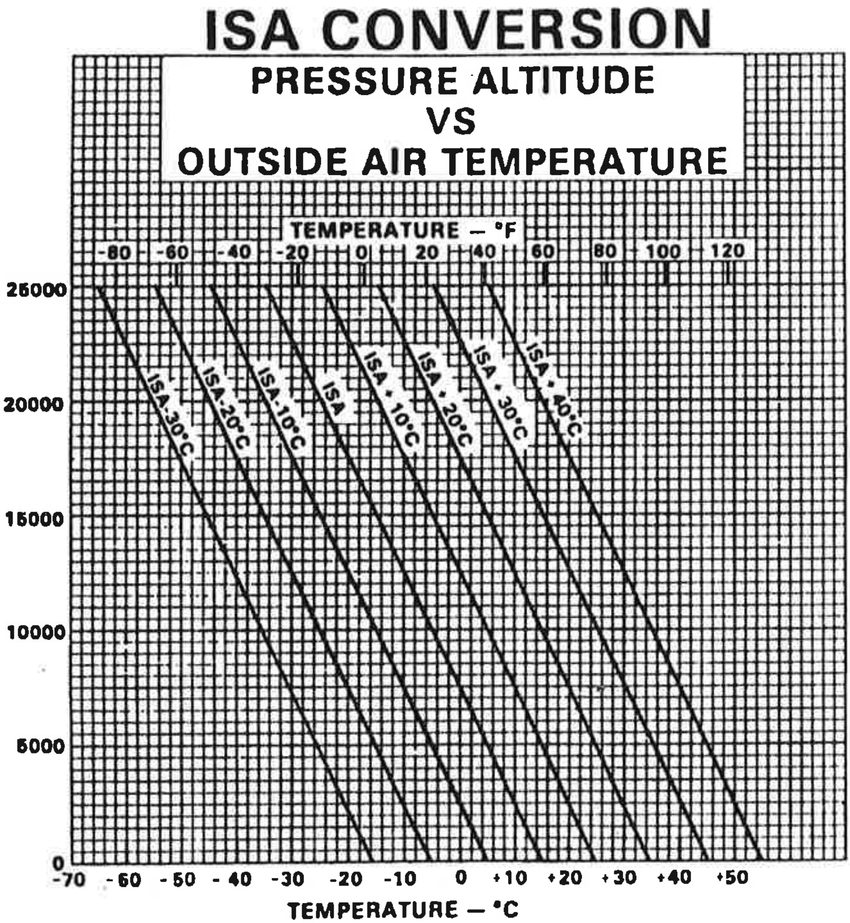
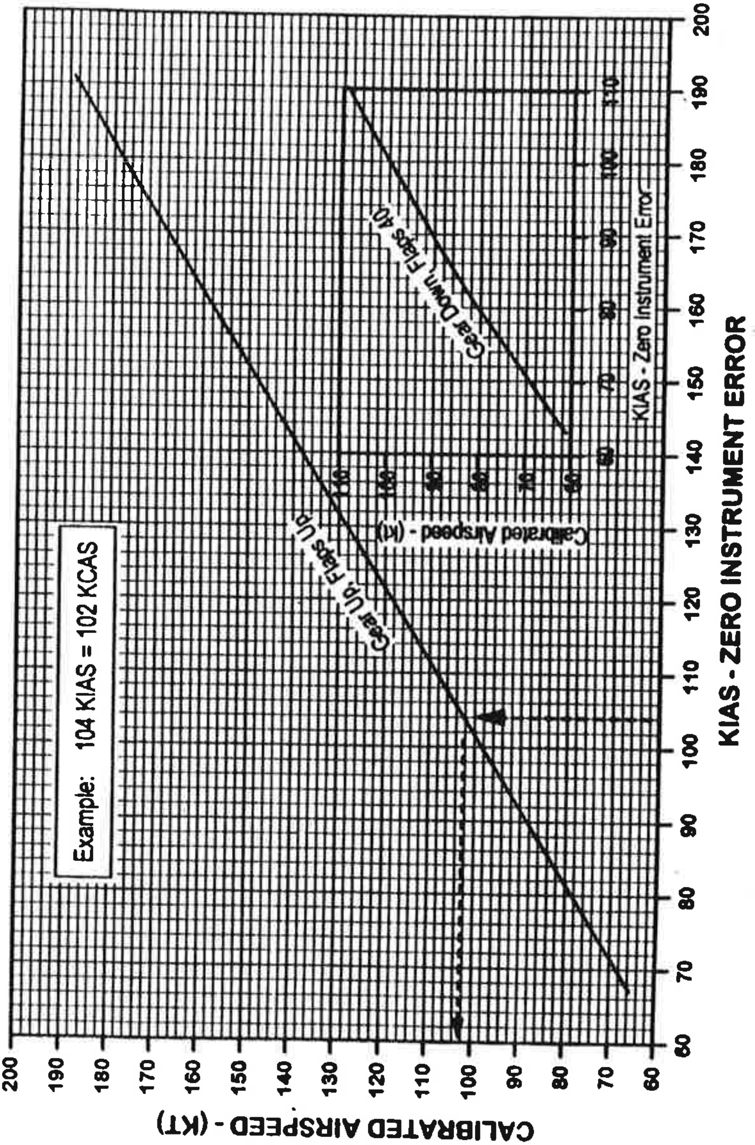


TEMPERATURE CONVERSION
Figure 5-1



PRESSURE ALTITUDE
VS
OUTSIDE AIR TEMPRATURE
Figure 5-2



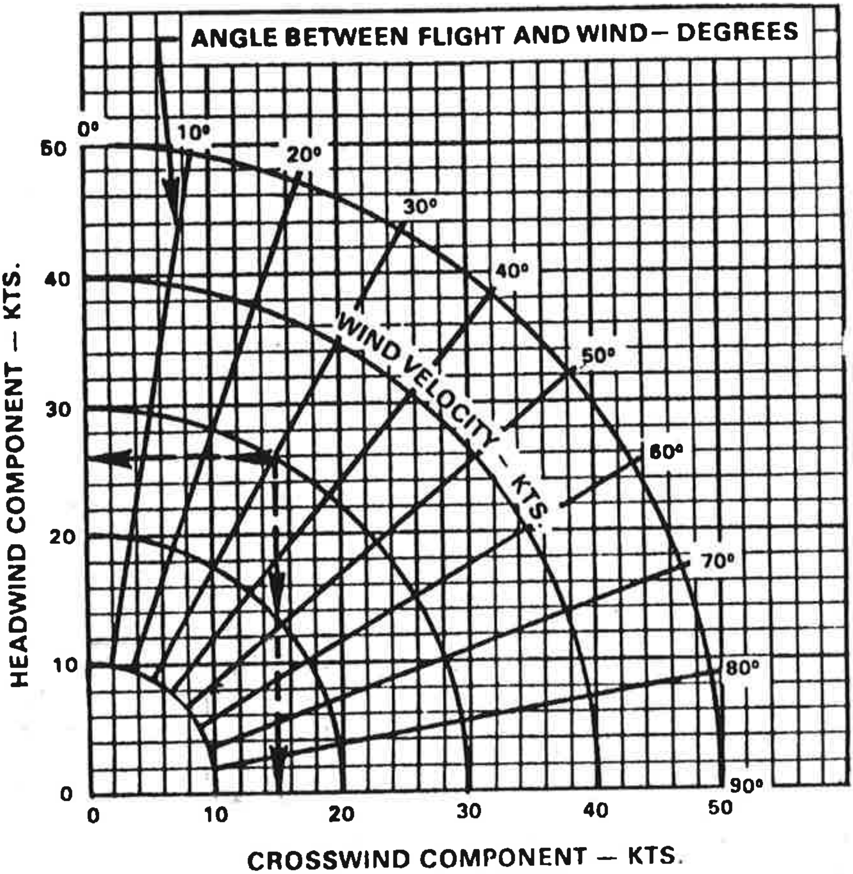
AIRSPEED SYSTEM CALIBRATION
ALL FLAP DEFLECTIONS
Figure 5-3

WIND COMPONENTS

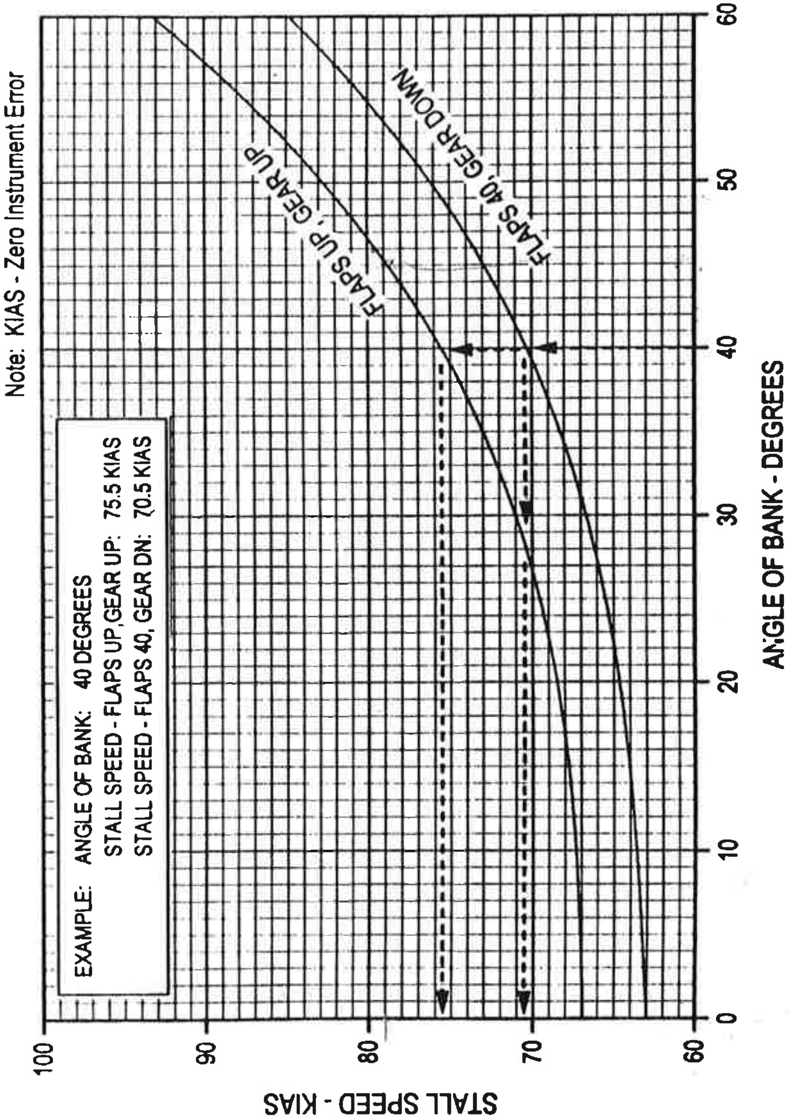
NOTE: Maximum demonstrated crosswind velocity is 17 knots. (not a limitation)

EXAMPLE:

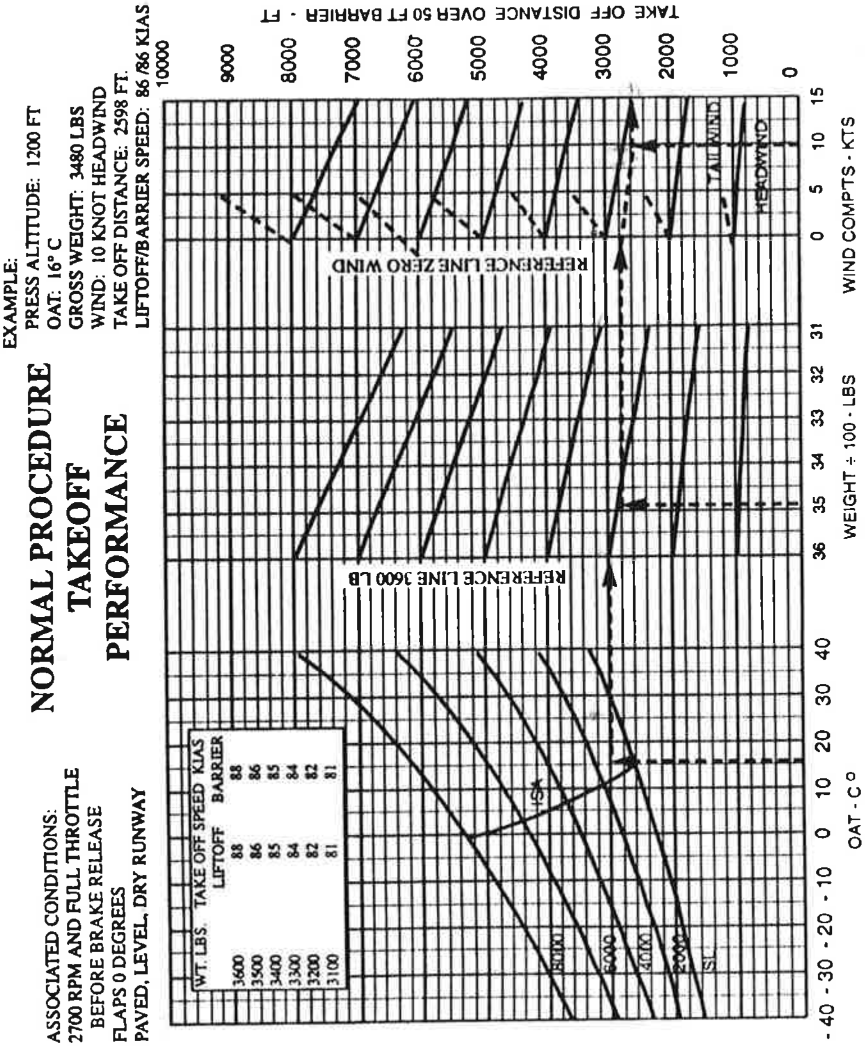
Wind velocity: 30 knots
Angle between flight path and wind: 30°
Headwind component: 26 knots
Crosswind component: 15 knots



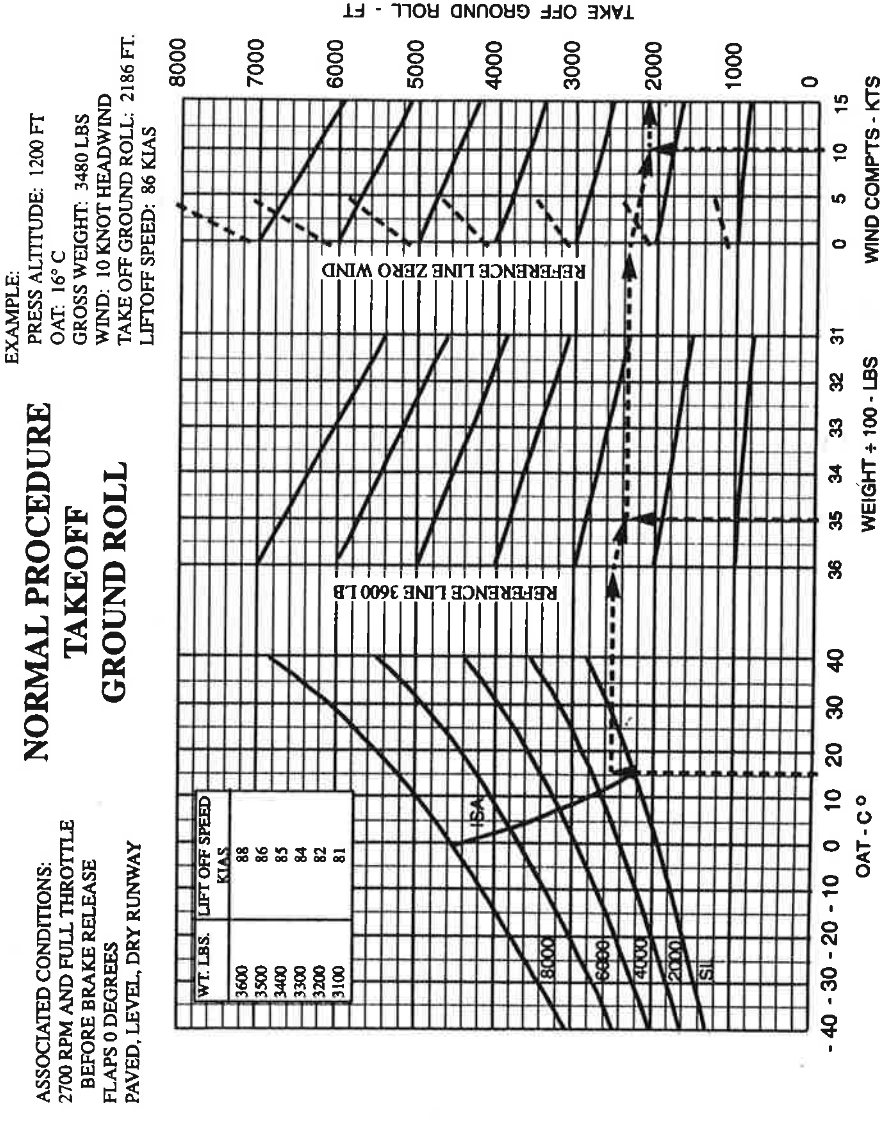
WIND COMPONENTS
Figure 5-6



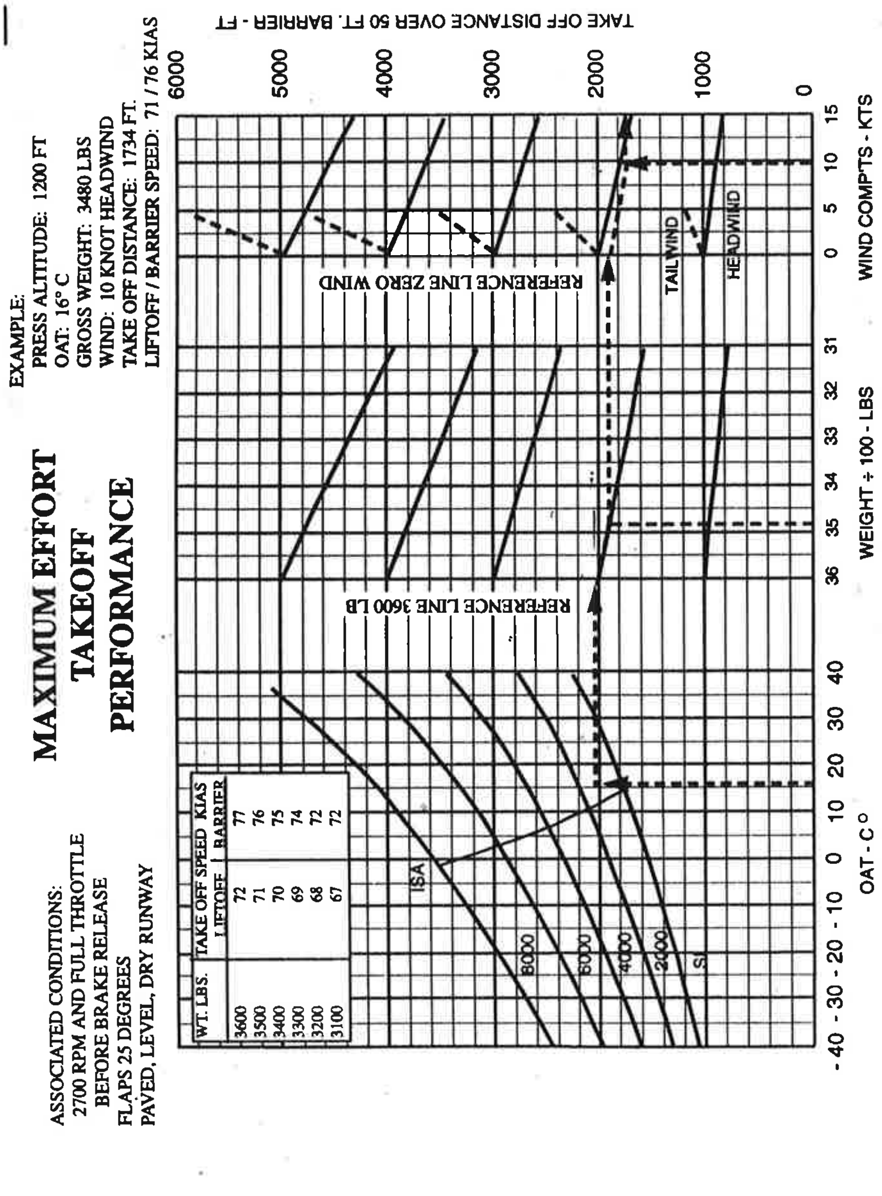
STALL SPEED VERSUS ANGLE OF BANK
GROSS WEIGHT 3600 LBS
Figure 5-5



NORMAL PROCEDURE TAKEOFF PERFORMANCE
OVER 50 FEET
Figure 5-7

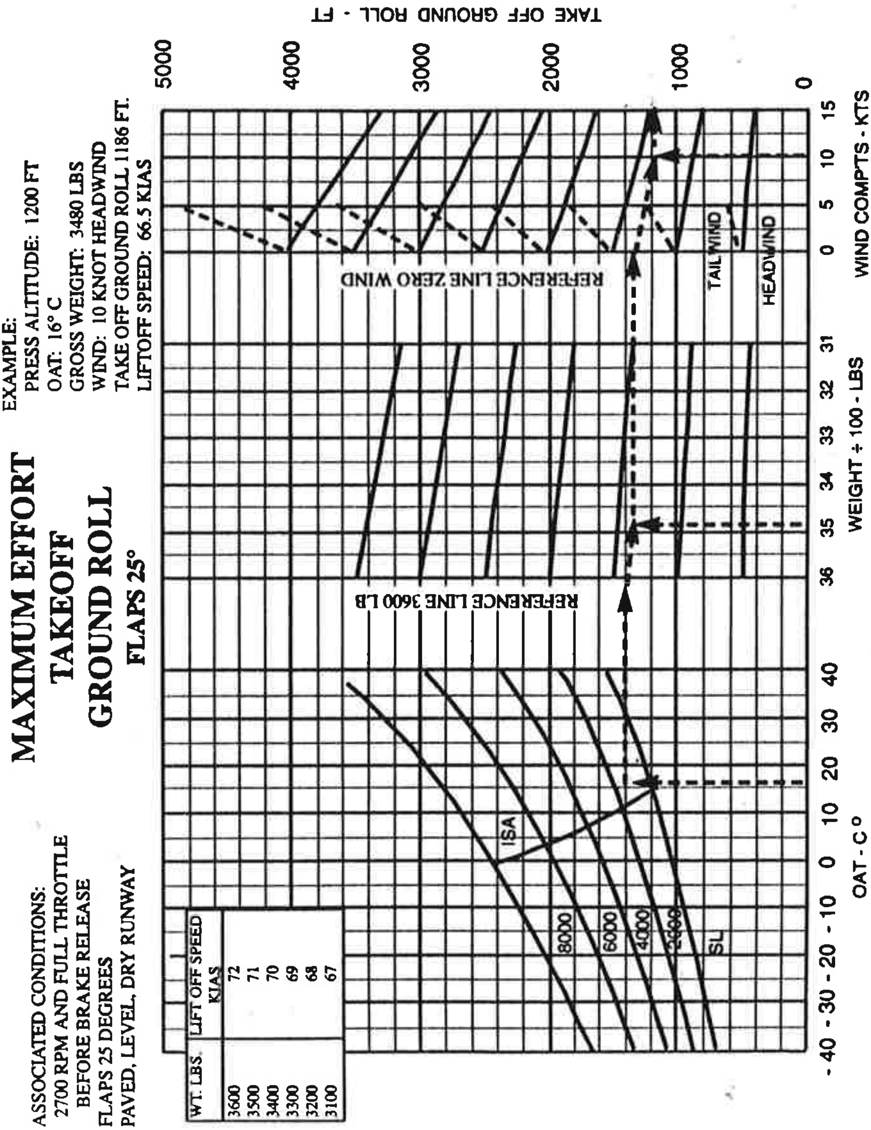


NORMAL PROCEDURE TAKEOFF GROUND ROLL
Figure 5-9



MAXIMUM EFFORT TAKEOFF PERFORMANCE - FLAPS 25°

Figure 5-11



MAXIMUM EFFORT TAKEOFF GROUND ROLL - FLAPS 25°
Figure 5-13

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MAXIMUM RATE OF CLIMB, GEAR UP

ASSOCIATED CONDITIONS

POWER 2700 RPM
FULL THROTTLE
MIXTURE FULL RICH
LANDING
GEAR UP
FLAPS UP
AIRSPEED 93 KIAS

EXAMPLE

PRESSURE ALTITUDE 2500 FT
OAT 10 ° C
RATE OF CLIMB 957 FPM

PRESSURE ALTITUDE FT.	OAT			
	-20 ° C	0 ° C	20 ° C	40 ° C
SL	1582	1305	1057	806
1000	1467	1204	968	734
2000	1368	1111	892	662
3000	1256	1019	805	579
4000	1159	934	725	509
5000	1062	843	645	434
6000	967	754	568	366
7000	866	665	490	299
8000	773	585	420	233
9000	681	505	345	169
10000	588	425	270	99
11000	505	347	198	37
12000	423	277	138	- 19
13000	334	194	67	- 80
14000	247	119	- 4	- 135
15000	174	51	- 54	- 196
16000	96	- 9	- 117	- 250

MAXIMUM RATE OF CLIMB (3600 LBS GROSS WEIGHT)
Figure 5-19

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FUEL, TIME AND DISTANCE TO CLIMB

ASSOCIATED CONDITIONS

POWER	2700 RPM FULL THROTTLE
MIXTURE	FULL RICH
LANDING GEAR	UP
FLAPS	UP
AIRSPEED	93 KIAS

EXAMPLE

AIRPORT	
PRESSURE ALTITUDE	1800 FT
OAT	ISA + 5 °C
RATE OF CLIMB	957 FPM
CRUISE	
ALTITUDE	8500 FT
OAT	ISA - 6 °C
TIME TO CLIMB (10-2)	8 MIN.
FUEL TO CLIMB (5-1)	4 GAL.
DISTANCE TO CLIMB (17-3)	14 N.M.

NOTES: 1. DISTANCES SHOWN ARE BASED ON ZERO WIND.
2 ADD 2 GALLONS OF FUEL FOR ENGINE START, TAXI, AND TAKEOFF.

PRESSURE ALTITUDE FT.	OAT								
	ISA - 10 °C			ISA			ISA + 10 °C		
	FROM SEA LEVEL								
	TIME MIN	FUEL GAL	DIST NM	TIME MIN	FUEL GAL	DIST NM	TIME MIN	FUEL GAL	DIST NM
SL	0	0	0	0	0	0	0	0	0
1000	1	1	1	1	1	1	1	1	2
2000	2	1	3	2	1	3	2	1	3
3000	3	2	4	3	2	5	3	2	5
4000	4	2	6	4	2	6	5	2	7
5000	5	3	7	5	3	8	6	3	10
6000	6	3	9	7	3	11	7	4	12
7000	7	4	11	8	4	13	9	4	15
8000	8	4	14	10	5	16	11	5	18
9000	10	5	16	11	5	19	13	6	22
10000	12	6	19	13	6	22	15	7	26
11000	14	6	22	15	7	26	18	8	31
12000	16	7	26	18	8	31	21	9	37
13000	18	8	31	21	9	37	25	10	44
14000	21	9	37	25	10	44	30	12	53
15000	25	10	44	30	12	53	37	14	67

FUEL, TIME AND DISTANCE TO CLIMB
3600 LBS TAKEOFF WEIGHT
Figure 5-21

POWER SETTING TABLE

SARATOGA II HP

Press. Alt. Feet	Std. Alt. Temp. °C	LONG RANGE RPM 2100	2200	2300	2400	ECONOMY RPM 2100	2200	2300	2400	NORMAL RPM 2200	2300	2400	2500	HIGH SPEED 2700
		MANIFOLD PRESSURE - INCHES MERCURY												
SL	15	23.2	22.7	22.2	21.7	25.6	25.0	24.4	23.8	28.0	27.2	26.5	25.9	27.0
1000	13	22.9	22.3	21.9	21.4	25.2	24.6	24.0	23.5	27.6	26.9	26.2	25.6	26.8
2000	11	22.5	22.0	21.5	21.1	24.9	24.3	23.7	23.2	27.3	26.6	25.9	25.3	26.5
3000	9	22.2	21.7	21.2	20.8	24.6	23.9	23.4	22.9	26.8	26.2	25.6	24.9	26.2
4000	7	21.9	21.4	20.9	20.5	24.3	23.7	23.1	22.6	—	25.8	25.3	24.7	25.8
5000	5	21.6	21.1	20.6	20.2	24.0	23.4	22.8	22.3	—	—	25.0	24.4	
6000	3	21.3	20.8	20.3	19.9	23.7	23.1	22.5	22.0	—	—	—	24.1	
7000	1	21.0	20.5	20.0	19.6	23.3	22.8	22.3	21.7	—	—	—	—	
8000	-1	20.7	20.2	19.8	19.3	—	22.4	22.0	21.4					
9000	-3	20.5	20.0	19.5	19.1	—	—	—	21.2					
10,000	-5	20.2	19.7	19.2	18.8	—	—	—	—					
11,000	-7	19.9	19.4	19.0	18.5									
12,000	-9	—	19.0	18.7	18.3									
13,000	-11	—	—	—	18.0									
14,000	-13	—	—	—	—									

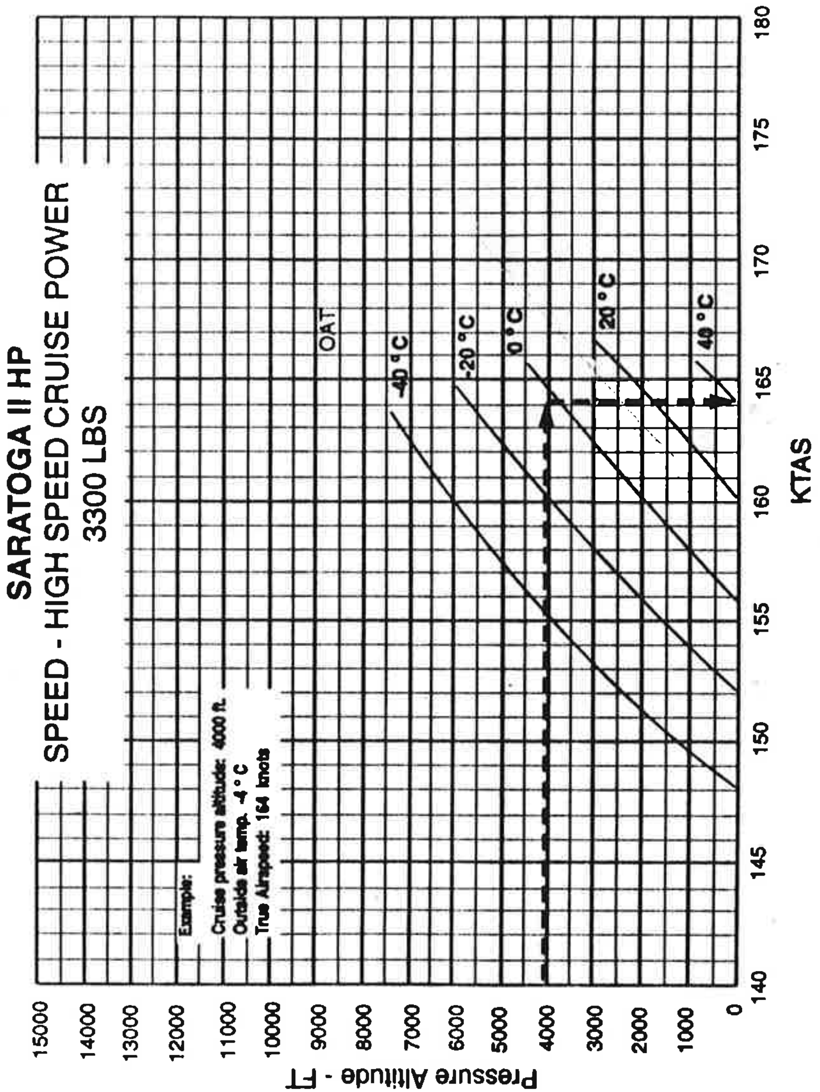
APPROX. FUEL FLOW / MIXTURE

Long range	14.5 GPH / 50° Rich of Peak EGT
Economy	16.5 GPH / 50° Rich of Peak EGT
Normal	18.5 GPH / 50° Rich of Peak EGT
High Speed	29.0 GPH / Full Rich

To maintain constant power, correct manifold pressure approximately 0.5 in Hg for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperature above standard; subtract for temperature below standard.

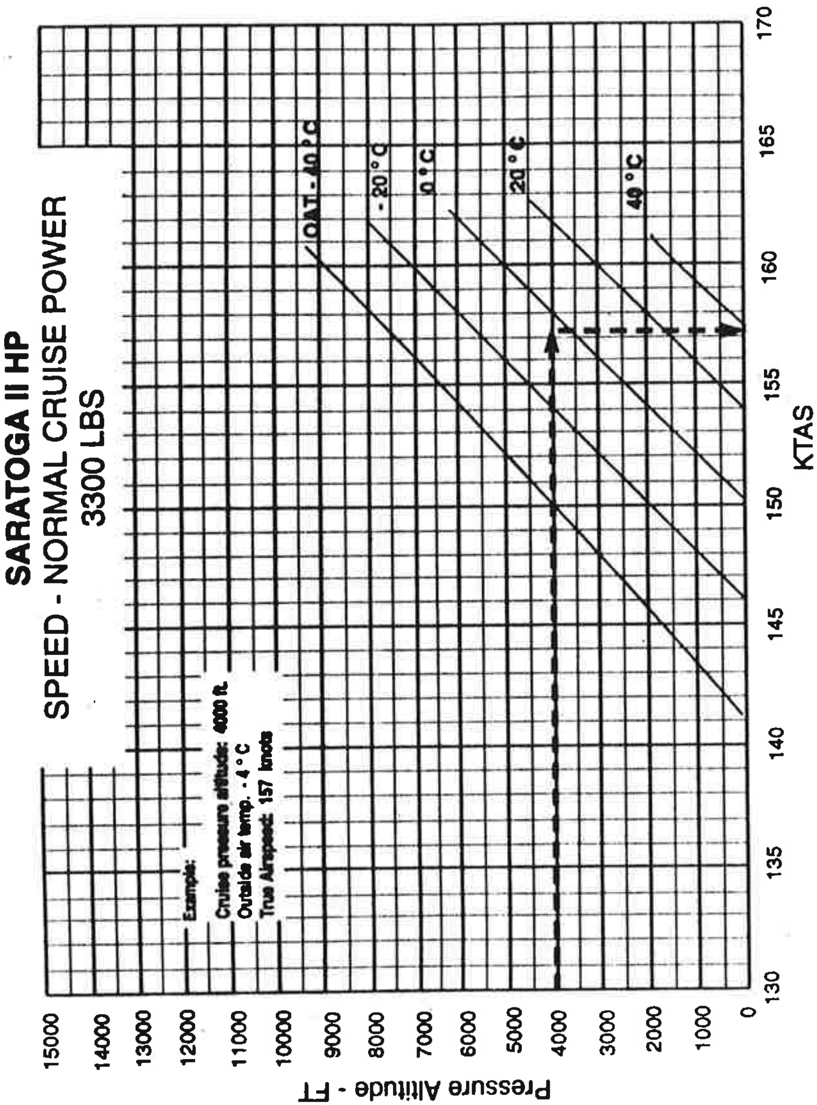
NOTE: Full throttle manifold pressure values may not be obtainable when atmospheric conditions are non-standard.

POWER SETTING TABLE
Figure 5-23

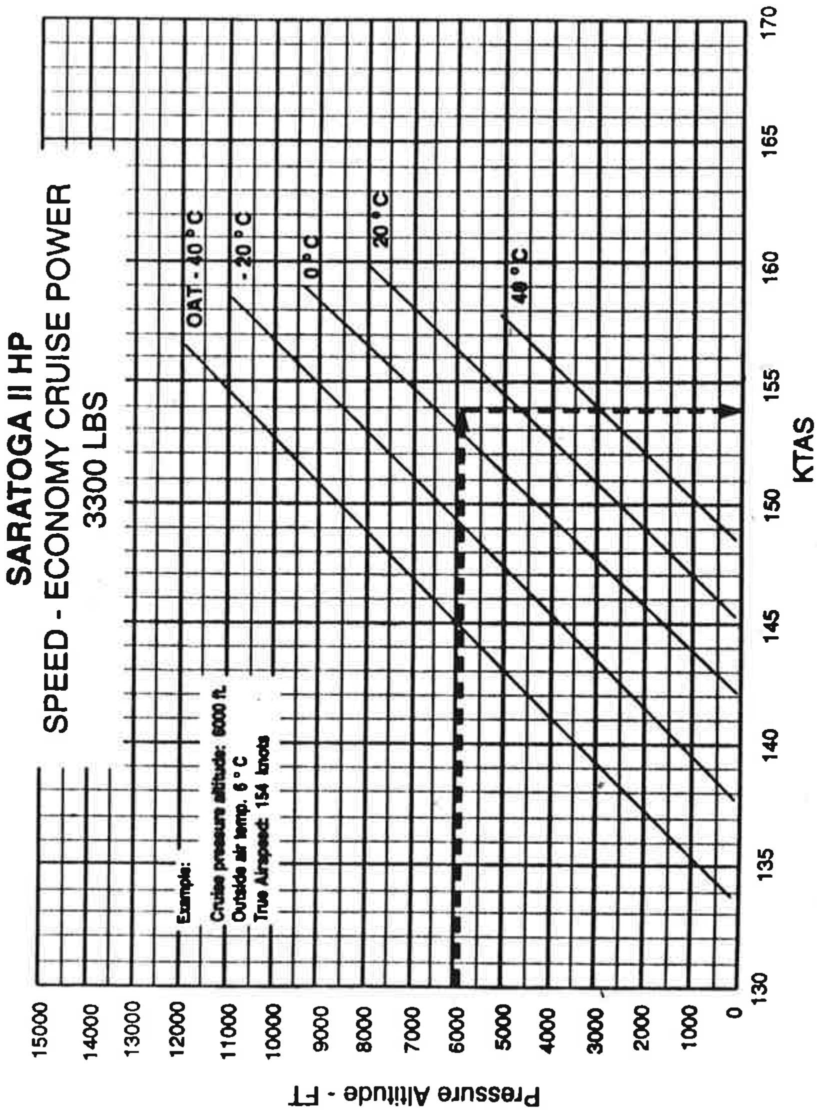


SPEED - HIGH SPEED CRUISE

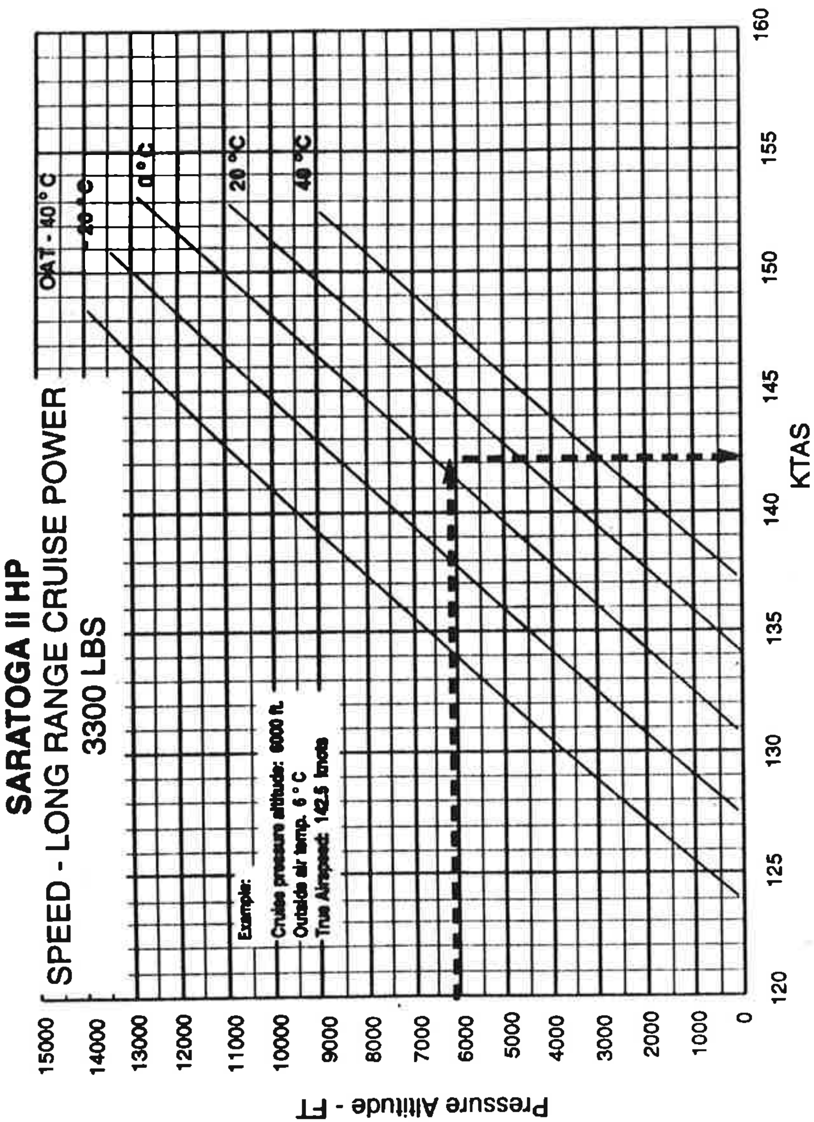
Figure 5-25



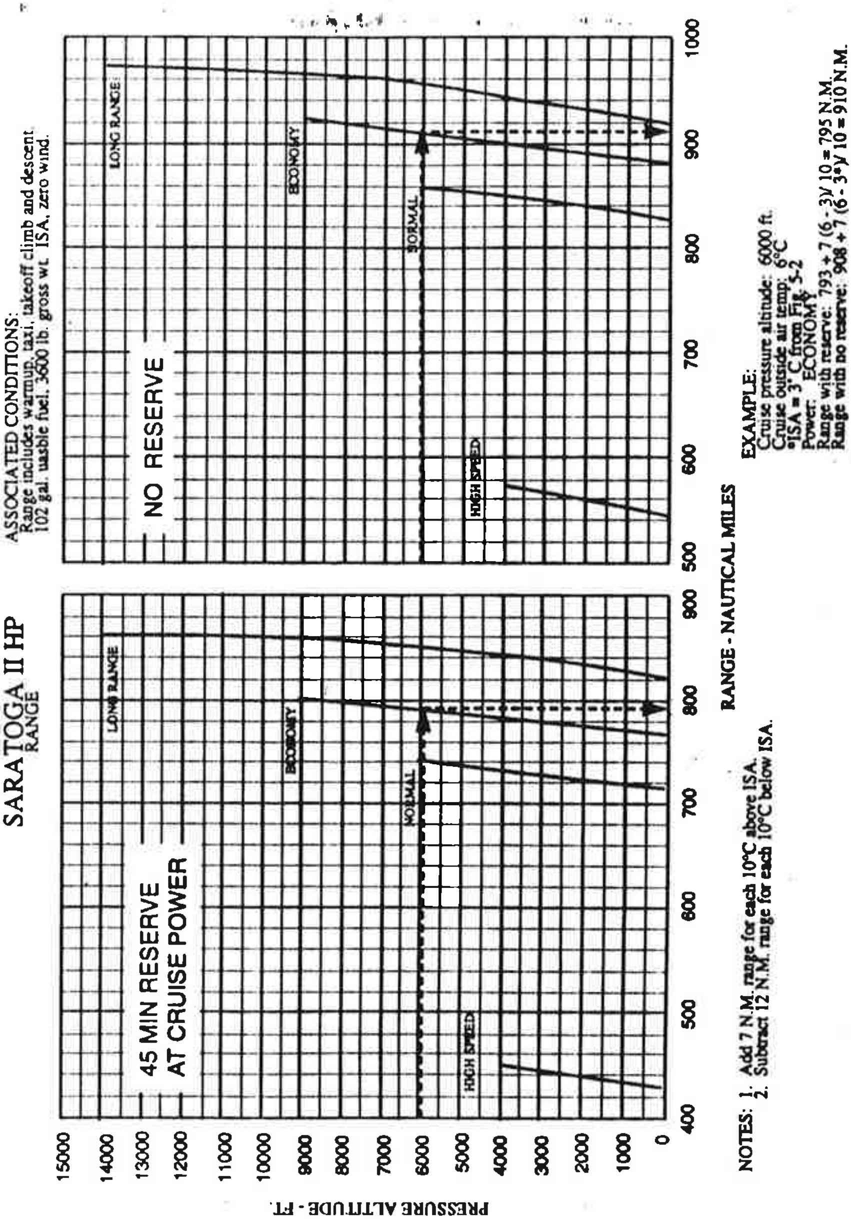
SPEED - NORMAL CRUISE POWER
Figure 5-27



SPEED - ECONOMY CRUISE POWER
Figure 5-27a

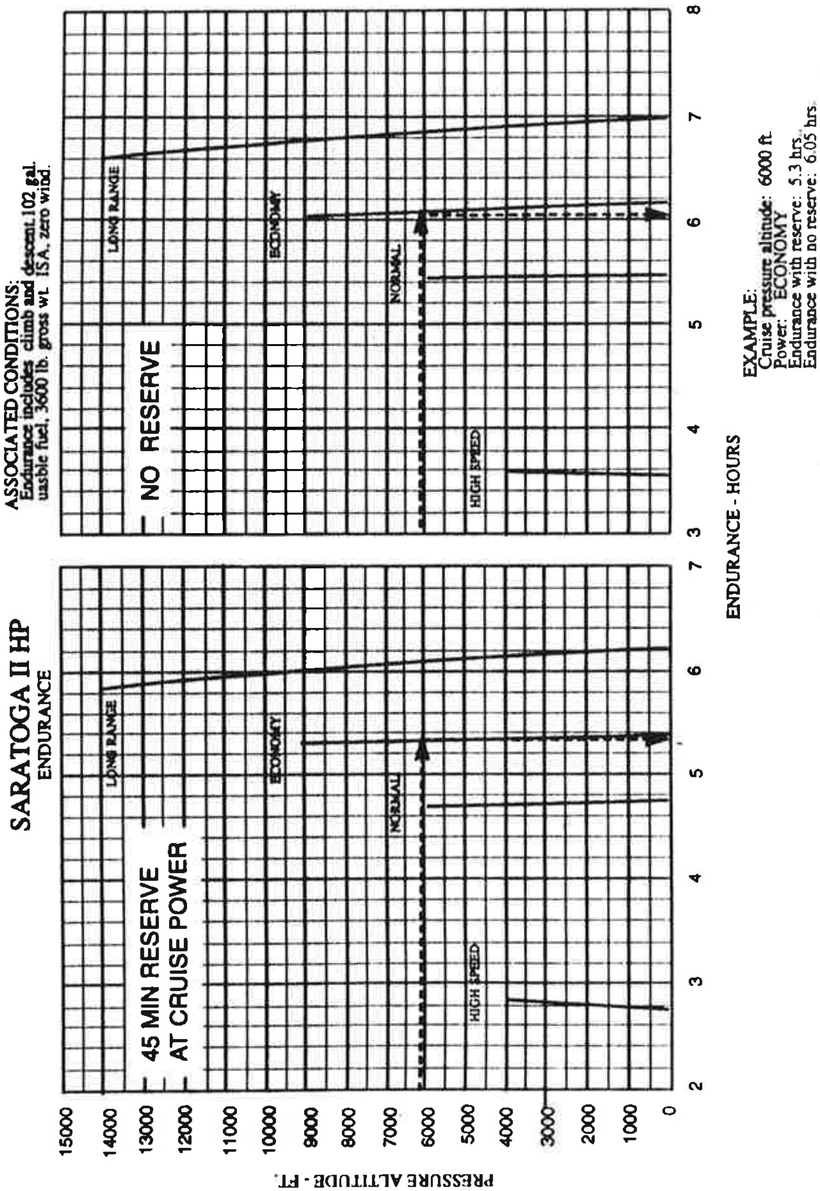


SPEED - LONG RANGE CRUISE POWER
Figure 5-27b



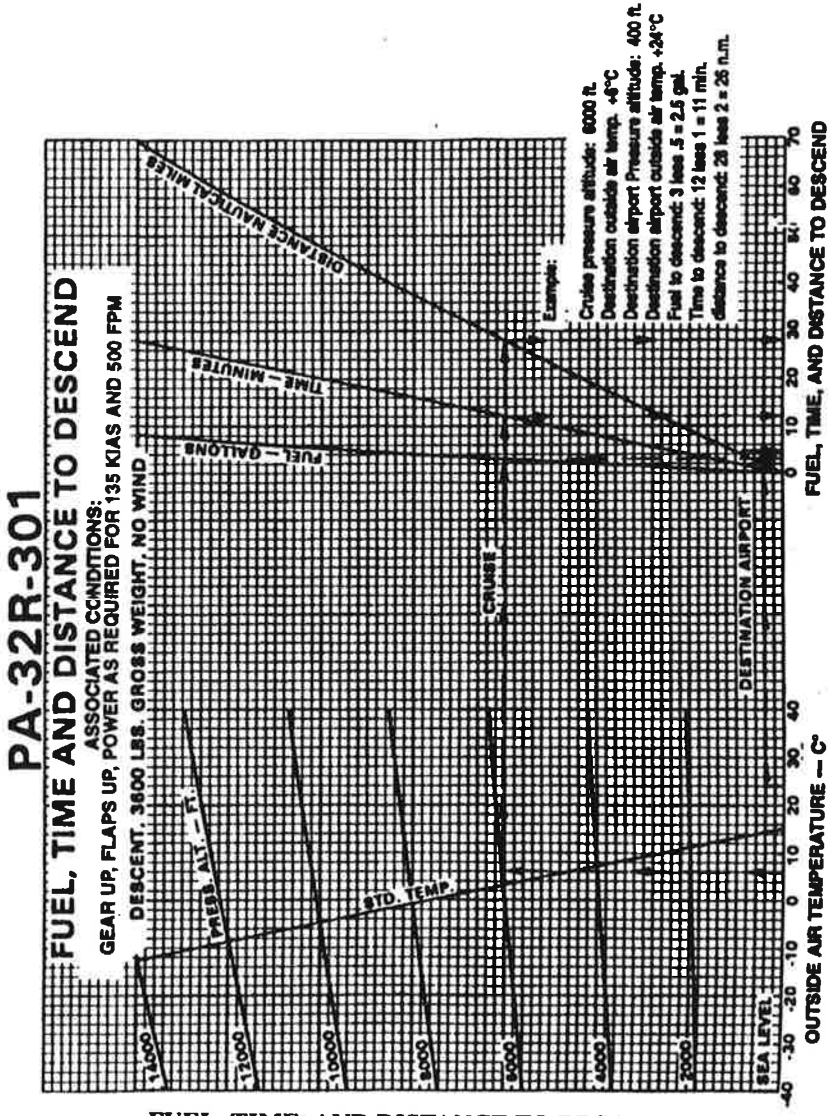
RANGE - CRUISE POWER

Figure 5-29

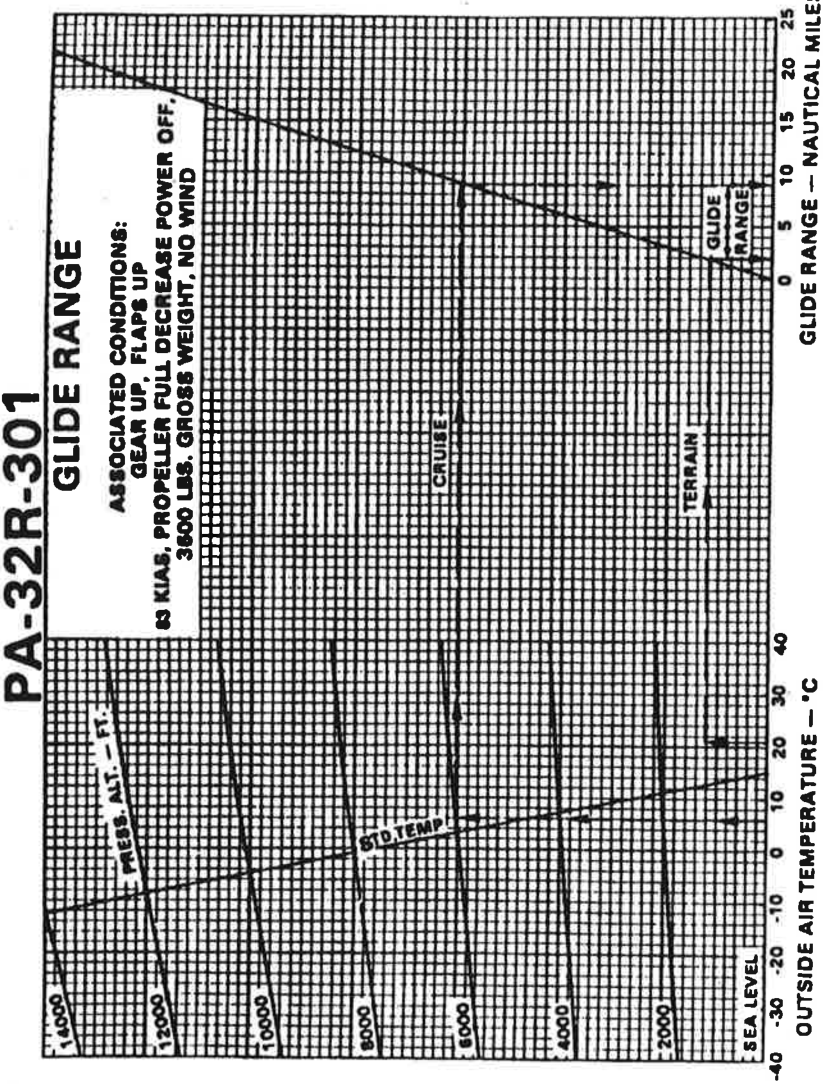


ENDURANCE

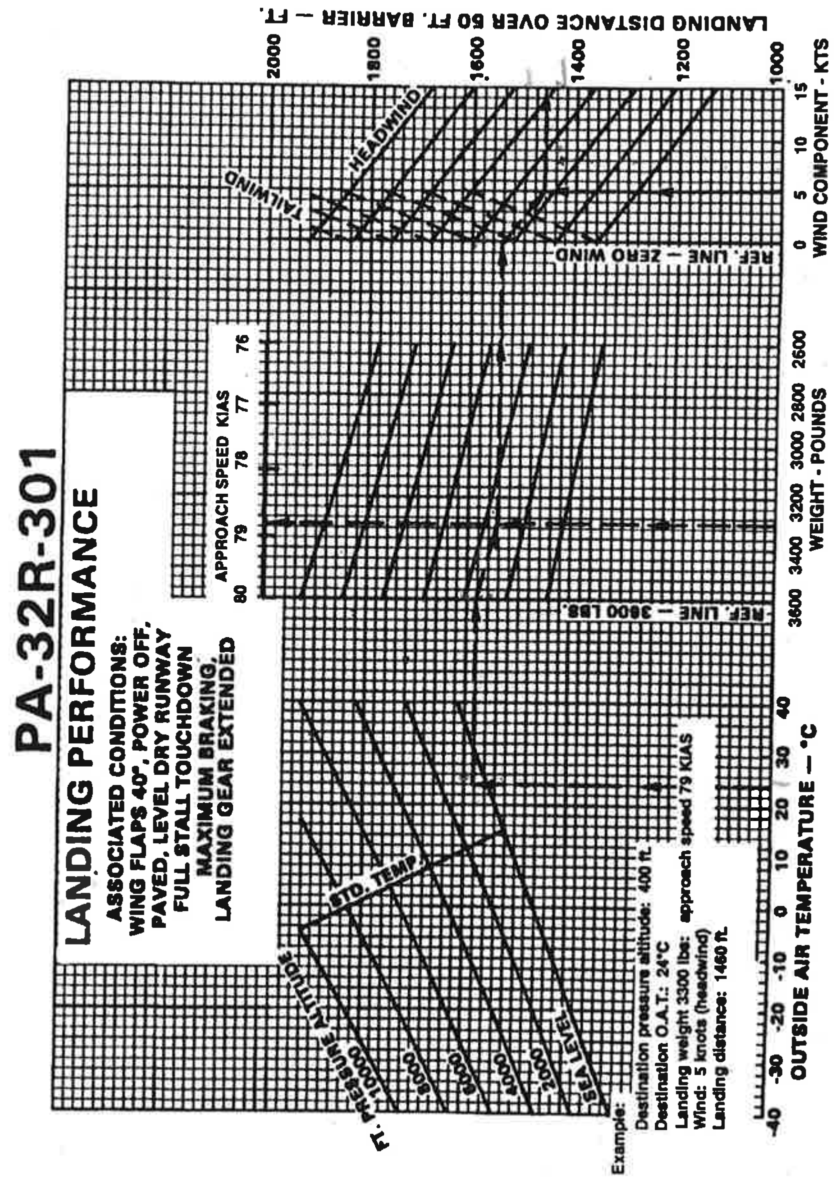
Figure 5-31



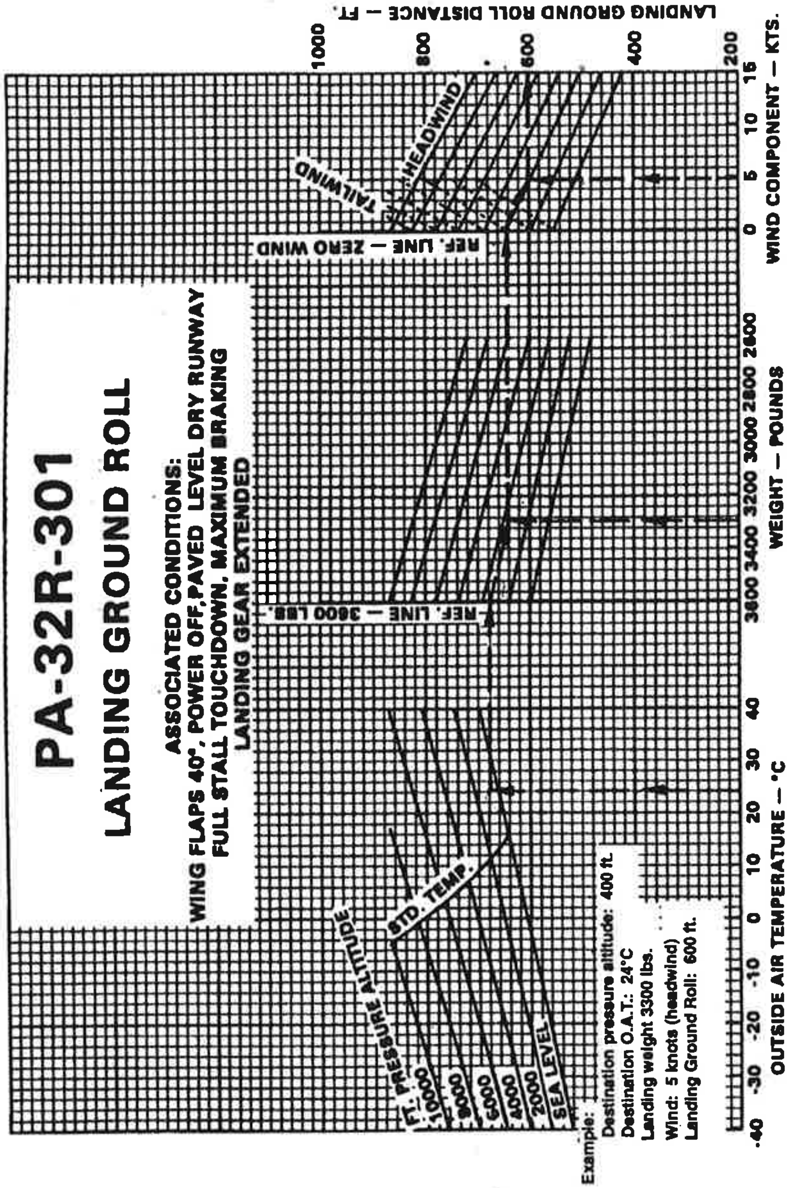
FUEL, TIME, AND DISTANCE TO DESCEND
Figure 5-33



GLIDE RANGE
Figure 5-35



LANDING PERFORMANCE
Figure 5-37



LANDING GROUND ROLL

Figure 5-38

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WEIGHT & BALANCE

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SECTION 6

WEIGHT AND BALANCE

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SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

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

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

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

A properly loaded airplane, however, will perform as intended. Before the airplane is licensed, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can 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.

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 insure against improper loading.

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

6.3 AIRPLANE WEIGHING PROCEDURE

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

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

(a) Preparation

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

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

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops. Then add the unusable fuel (5 gallons total, 2.5 gallons each wing).

CAUTION

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engine for a minimum of three minutes at 1000 RPM on each tank to insure that 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 all entrance and baggage doors closed.

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

(b) Leveling

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

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

(c) Weighing - Airplane Basic Empty Weight

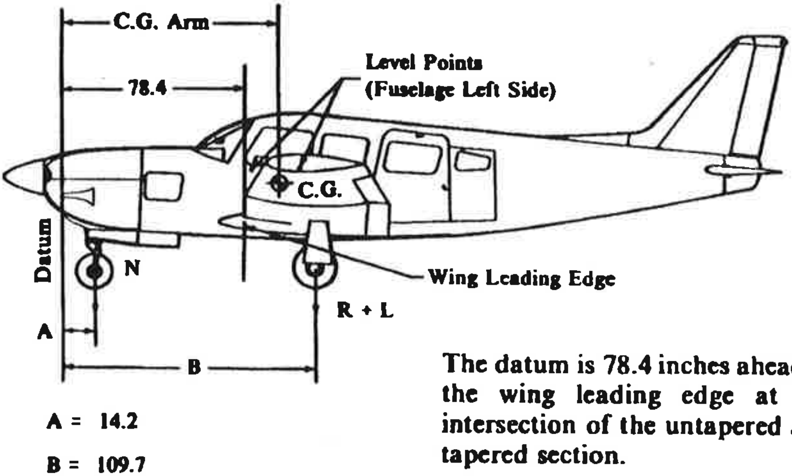
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

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

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-32R-301 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



The datum is 78.4 inches ahead of the wing leading edge at the intersection of the untapered and tapered section.

LEVELING DIAGRAM
Figure 6-3

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

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

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 licensed at the factory. These figures apply only to the specific airplane serial number and registration number shown.

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

MODEL PA-32R-301 SARATOGA II HP

Airplane Serial Number 3246050

Registration Number N9279Q

Date 9/30/96

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs)	x	C.G. Arm (Inches Aft of Datum)	=	Moment (In-Lbs)
Standard Empty Weight*	Actual	2401.8		83.8		201291
	~~Computed~~					
Optional Equipment		12.6		88.5		1116
Basic Empty Weight		2414.4		83.8		202407

*The standard empty weight includes full oil capacity and 5.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

(3615 lbs) - (2414.4 lbs) = 1200.6 lbs.

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

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-32R-301		Serial Number 3246050		Registration Number N9279Q			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
9/30/96		As licensed					2414.4	202407
27/7/2004.		SEE ATTACHED SCHEDULE	–	5.75	~~[illegible]~~	-403.20 -241.50	2408.25	202326.72
22.4.16.		SEE ATTACHED SCHEDULE						

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-32R-301		Serial Number		Registration Number			Page Number	
DATE	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt (lb)	Arm (in)	Moment /100	Wt (lb)	Moment /100
		As licensed						

WEIGHT AND BALANCE RECORD (cont)

6.7 GENERAL LOADING RECOMMENDATIONS

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

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

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

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

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

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

(f) 6 Occupants - 2 in front, 2 in middle, 2 in rear
With six occupants fuel and/or baggage may be limited by envelope. Load fwd. baggage compartment to capacity first.

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

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

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

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

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

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

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

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	2272	83.4	189485
Pilot and Front Passenger	340.0	85.5	29070
Passengers (Center Seats) (Aft Facing)		119.1	
Passengers (Rear Seats)	340.0	157.6	53584
Fuel (102 Gallon Maximum)	500	94.0	47000
Baggage (Forward) (100 Lb. Limit)	100	42.0	4200
Baggage (Aft) (100 Lb. Limit)	63	178.7	11258
Ramp Weight (3615 Lbs. Max.)	3615	92.6	334597
Fuel Allowance for Engine Start, Taxi & Runup	-15.0	94.0	-1410
Take-off Weight (3600 Lbs. Max.)	3600	92.6	333187

The center of gravity (C.G.) for the take-off weight of this sample loading problem is at 92.6 inches aft of the datum line. Locate this point (92.6) 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	3600	92.6	333187
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.	-360	94.0	-33840
Landing Weight	3240	92.4	299347

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 INSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL TIMES.

SAMPLE LOADING PROBLEM
(NORMAL CATEGORY)
Figure 6-9

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		85.5	
Passengers (Center Seats) (Aft Facing)		119.1	
Passengers (Rear Seats)		157.6	
Fuel (102 Gallon Maximum)		94.0	
Baggage (Forward) (100 Lb. Limit)		42.0	
Baggage (Aft) (100 Lb. Limit)		178.7	
Ramp Weight (3615 Lbs. Max.)			
Fuel Allowance for Engine Start, Taxi & Runup	-15.0	94.0	-1410
Take-off Weight (3600 Lbs. Max.)			

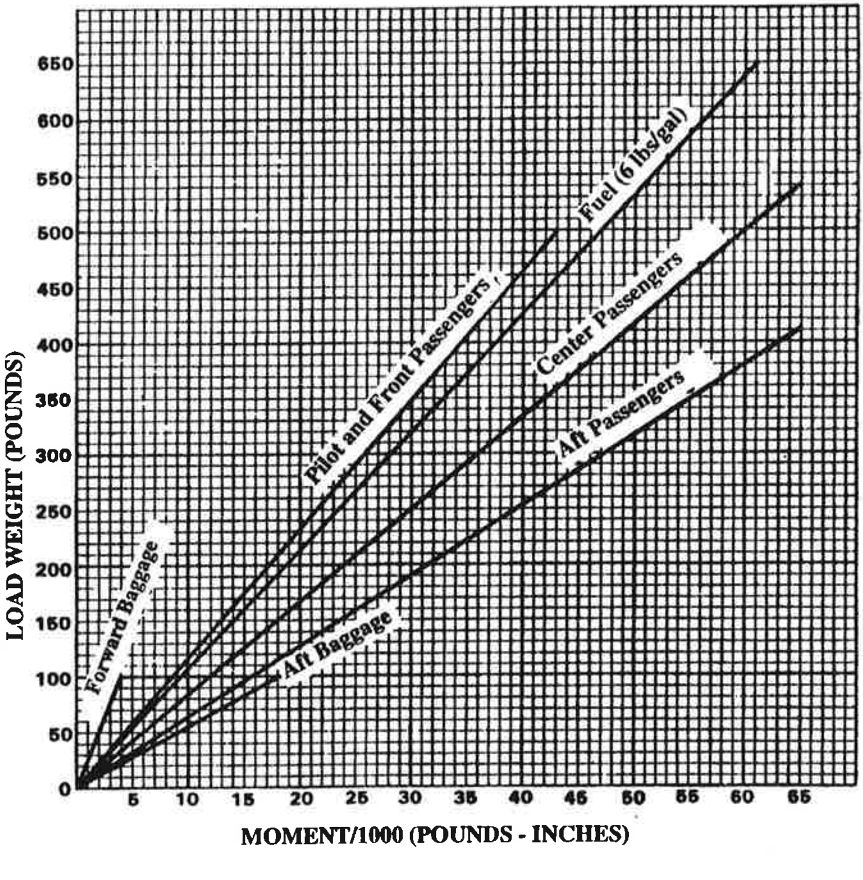
The center of gravity (C.G.) for the take-off weight of this loading problem is at inches aft of the datum line. Locate this point on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Take-off Weight			
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.		94.0	
Landing Weight			

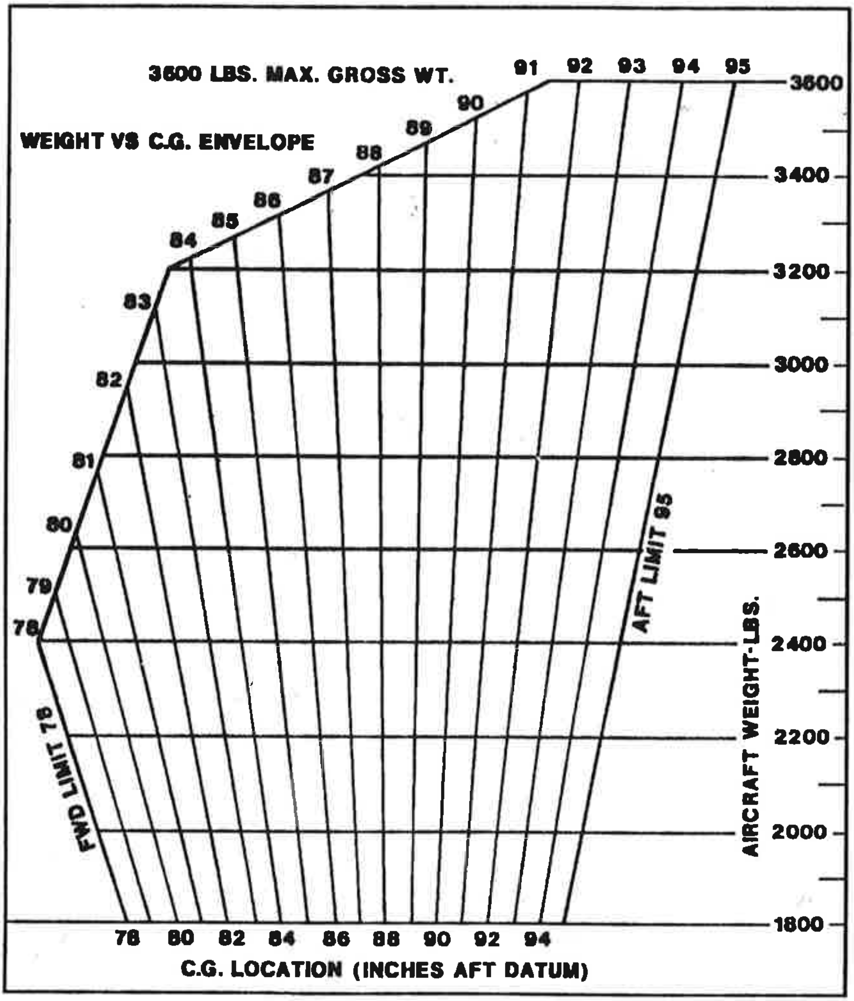
Locate the center of gravity of the landing weight on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, the loading may be assumed acceptable for landing.

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

WEIGHT AND BALANCE LOADING FORM
(NORMAL CATEGORY)
Figure 6-11



LOADING GRAPH
Figure 6-13



C.G. RANGE AND WEIGHT
Figure 6-15

SECTION 7
DESCR. & OPERATION

SECTION 7
DESCR. & OPERATION

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Saratoga II HP is a single engine, low wing, retractable landing gear airplane. It is all metal, seats up to six occupants, and has two separate one hundred pound capacity baggage compartments.

7.3 AIRFRAME

With the exception of the steel engine mount, parts of the landing gear, miscellaneous steel parts, the cowling, and the lightweight plastic extremities (tips of wings, tail fin and stabilator etc.), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure. There is a front door on the right side and a rear door on the left. A cargo door is installed aft of the rear passenger door. When both rear doors are open, large pieces of cargo can be loaded through the extra-wide opening. A door on the right side of the nose section gives access to the nose baggage compartment.

The wing is of a semi-tapered design and employs a laminar flow NACA 65_2-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the center seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. Each wing contains two interconnected fuel tanks. Both tanks on one side are filled through a single filler neck located in the outboard tank.

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

7.5 ENGINE AND PROPELLER

The Lycoming engine is rated at 300 horsepower at 2700 rpm. This engine has a compression ratio of 8.7 to 1 and requires 100 minimum grade fuel. The engine is equipped with a geared starter, a 90 ampere alternator, dual magnetos, vacuum pump drive, a diaphragm-type fuel pump, and fuel injection.

The exhaust system consists of individual exhaust pipes routed to two heavy gauge stainless steel mufflers, one for each bank of cylinders. Exhaust gases are directed overboard at the underside of the engine cowling. The mufflers are surrounded by a shroud which provides heat for the cabin and for windshield defrosting.

The cowling is designed to cool the engine in all normal flight conditions, including protracted climb, without the use of cowl flaps or cooling flanges.

An induction scoop is located on the left side of the lower cowl. An intake air box is attached to the inside of the cowl adjacent to the air filter box.

The intake air box incorporates a manually operated two-way valve designed to allow induction air either to pass through the filter or to bypass the filter and supply heated air directly to the engine. Alternate air selection insures induction air flow should the filter become blocked. Since the air is heated, the alternate air system offers protection against induction system blockage caused by snow or freezing rain, or by the freezing of moisture accumulated in the induction air filter. Alternate air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

The fuel injection system consists of a servo regulator which meters fuel flow in proportion to airflow to the engine, giving the proper fuel-air mixture at all engine speeds, and a fuel flow divider which receives the metered fuel and accurately divides the fuel flow among the individual cylinder fuel nozzles.

A combination fuel flow indicator and manifold pressure gauge is installed in the left side of the instrument panel. The fuel flow indicator is connected to the fuel flow divider and monitors fuel pressure. The instrument converts fuel pressure to an indication of fuel flow in gallons per hour and percentage of cruise power.

The constant speed propeller is controlled by a governor mounted at the left forward side of the crankcase. Control from the engine control quadrant is provided by a push-pull control.

7.7 ENGINE CONTROLS

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

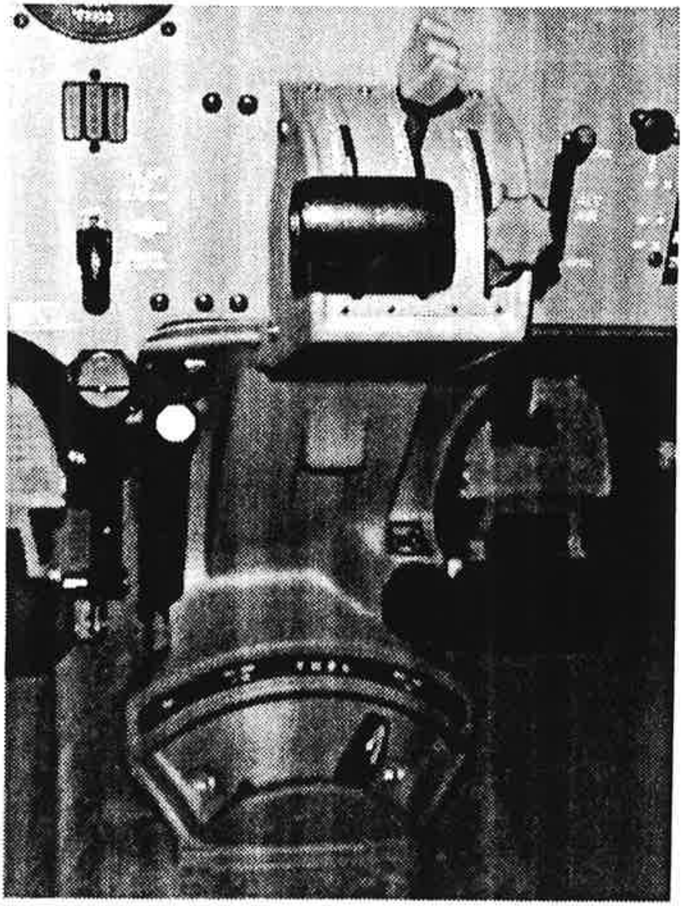
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a feature to prevent an inadvertent gear up landing.

The propeller control lever is used to adjust the propeller speed from high RPM to low RPM.

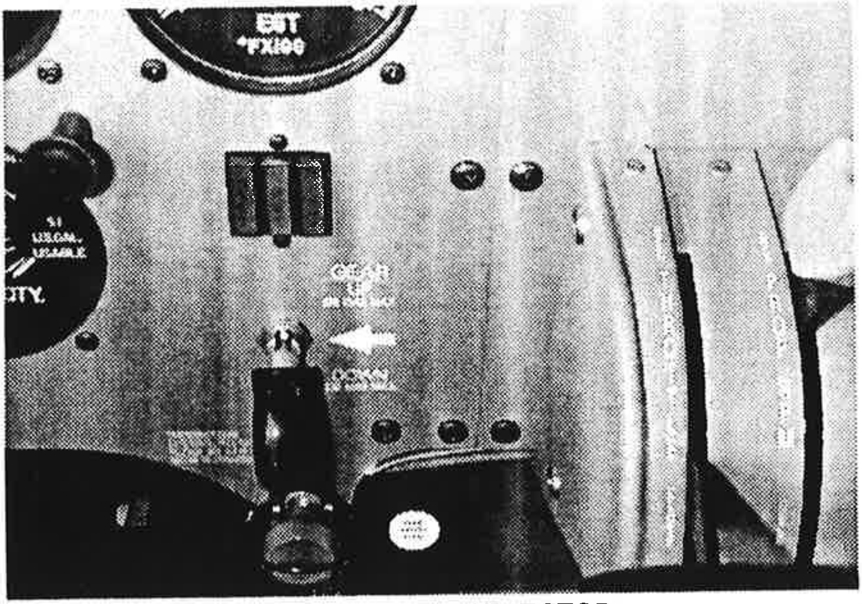
The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. In addition, the mixture control has a lock to prevent activation of the mixture control instead of the pitch control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual and the leaning procedure in Section 4 of this handbook.

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

The alternate air control is located to the right of the control quadrant. When the alternate air lever is in the up, or closed, 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 control is operated by pressing the knob to the left to clear the retaining gate and then moved in the desired direction (refer to Figure 7-1).



CONTROL QUADRANT AND CONSOLE
Figure 7-1



LANDING GEAR SELECTOR
Figure 7-3

7.9 LANDING GEAR

The airplane is equipped with a retractable tricycle landing gear, which is hydraulically actuated by an electrically powered reversible pump. The pump is controlled by a selector switch on the instrument panel to the left of the control quadrant (Figure 7-3). The landing gear is retracted or extended in about seven seconds.

EMERGENCY GEAR extension system allows the landing gear to free fall, with spring assist on the nose gear, into the extended position where the mechanical locks engage. If a gear system malfunction has been indicated and the EMERGENCY Gear extension system used, it is recommended that the EMERGENCY GEAR extension control be left in the pulled position until the aircraft is safely on jacks. See the Service Manual for proper landing gear system check-out procedures. If the aircraft is being used for training purposes or a pilot check-out flight the EMERGENCY GEAR extension control and HYD PUMP circuit breaker must be reset in order for hydraulic pressure to be generated in the UP side of the system and the gear retracted.

Gear down and locked positions are indicated by three green lights located above the selector, and a red " GEAR WARN" light located in the annunciator cluster. An all lights out condition indicates the gear is up. The landing gear should not be retracted above a speed of 110 KIAS and should not be extended above a speed of 132 KIAS.

NOTE:

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

A micro-switch in the throttle quadrant activates a warning horn and red "GEAR WARN" light under the following conditions:

(1) Gear up and power reduced below approximately 14 inches of manifold pressure.

(2) Gear selector switch UP while on the ground and throttle in retarded position.

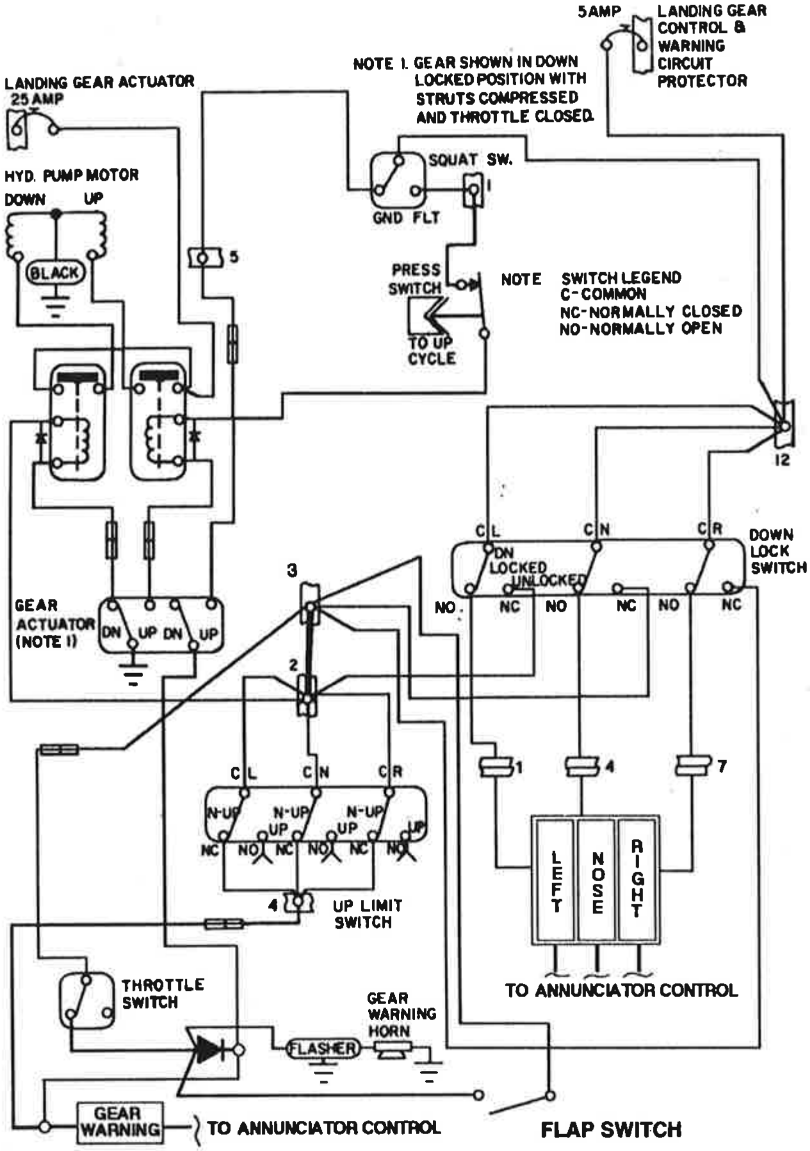
(3) Whenever the flaps are extended beyond the approach position (10°)and the landing gear is not down and locked.

The gear warning horn emits a 90 cycle per minute beeping sound in contrast to the stall warning horn which emits a continuous sound.

The nose gear is steerable through a 22.5 degree arc each side of center through the use of the rudder pedals. As the nose wheel retracts, the steering linkage disengages to reduce rudder pedal loads in flight. The nose wheel is equipped with a hydraulic shimmy dampener to reduce nose wheel shimmy.

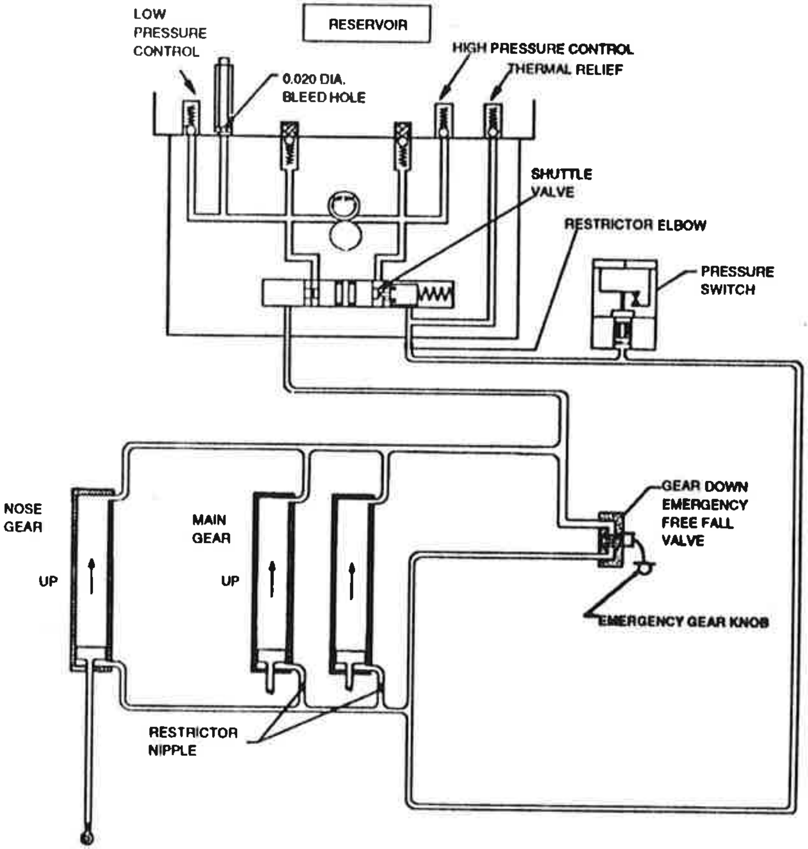
The oleo struts are of the air-oil type, with normal extension being 3.25 ± .25 inches for the nose gear and 4.5 ± .5 inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

The standard brake system includes toe brakes on the left and right set of rudder pedals and a hand brake located below and near the center of the instrument panel. The toe brakes and the hand brake have individual brake cylinders, but all cylinders use a common reservoir. The parking brake is incorporated in the lever brake and is operated by first depressing and holding the toe brake pedals and then pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, first depress and hold the toe brake pedals and then pull back on the brake lever; then allow the handle to swing forward.



LANDING GEAR ELECTRICAL SCHEMATIC

Figure 7-5



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Oildyne pump and cable emergency gear release
Figure 7-7

7.11 FLIGHT CONTROLS

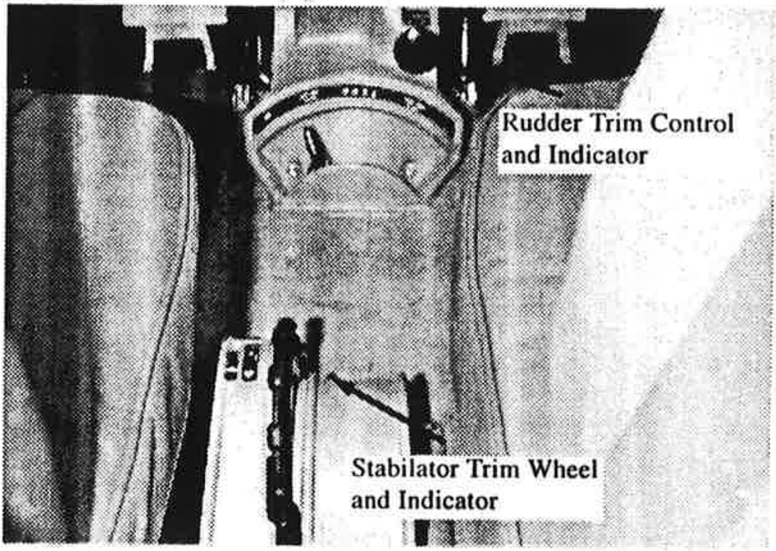
Dual flight controls are provided as standard equipment. A cable system provides actuation of the control surfaces when the flight controls are moved in their respective directions.

The horizontal surface (stabilator) features a trim tab/servo mounted on the trailing edge. This tab serves the dual function of providing trim control and pitch control forces. The trim function is controlled by a trim control wheel located on the control console between the two front seats (Figure 7-9). Rotating the wheel forward gives nose down trim and rotation aft gives nose up trim.

The rudder is conventional in design and incorporates a rudder trim. The trim mechanism is a spring-loaded recentering device. The trim control is located on the right side of the pedestal below the throttle quadrant. Turning the trim control clockwise gives nose right trim and counterclockwise rotation gives nose left trim.

The wing flaps are electrically controlled (fig. 7-10) by a selector lever mounted on the instrument panel to the right of the control pedestal. A flap annunciator light is provided as part of the annunciator panel located in the upper center section of the instrument panel. Selection of a new flap position will activate the flap motor and the light. When the flaps reach the desired position, the flap motor is automatically switched off and the indicator light goes out.

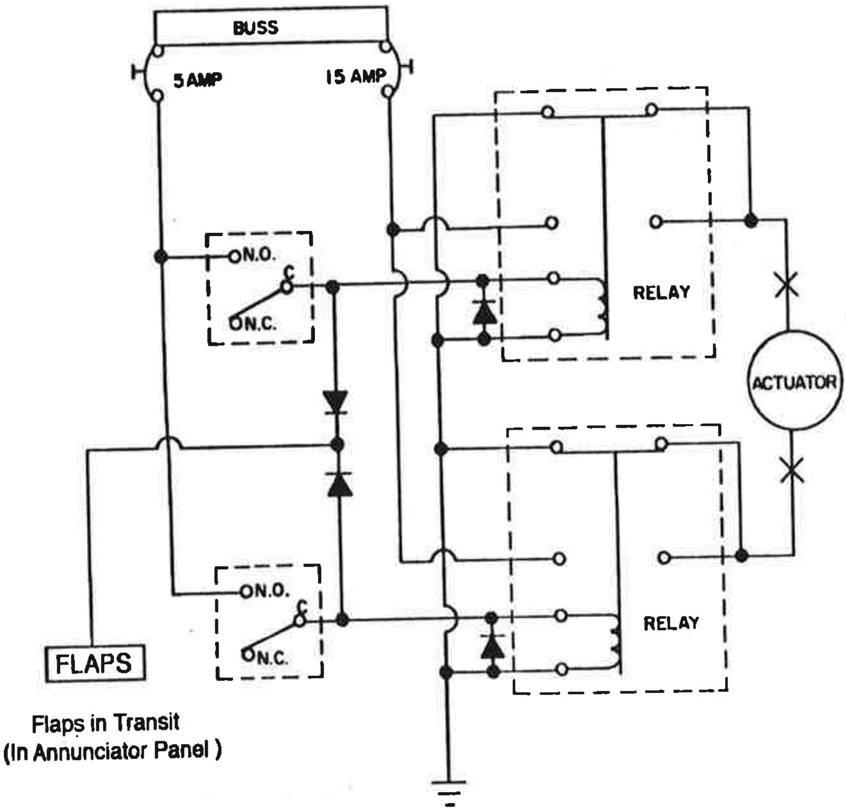
In the event of a flap drive malfunction; move the flap lever until the light goes out. The position of the flap lever relative to the instrument panel markings indicates the approximate flap position.



FLIGHT CONTROL CONSOLE
Figure 7-9

There are four stops for the flap control lever, full up (0° flap), 1st notch (10° flap), 2nd notch (25° flap) and full down (40° flap).
When extending or retracting flaps, there is a pitch change in the aircraft. This pitch change can be corrected either by stabilator trim or increased control wheel force. When the flaps are in the retracted position the right flap is provided with a over-center lock mechanism which acts 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 retracted (up) position.



ELECTRIC FLAP SCHEMATIC
Figure 7-10

7.13 FUEL SYSTEM

The standard fuel capacity of the Saratoga II HP is 107 gallons, of which 102 gallons are usable. The inboard tank is attached to the wing structure with screws and nut plates and can be removed for service or inspection. The outboard tank consists of a bladder fuel cell that is interconnected with the inboard tank. A flush fuel cap is located in the outboard tank only.

When using less than the standard 107 gallon capacity of the tanks, fuel should be distributed equally between each side.

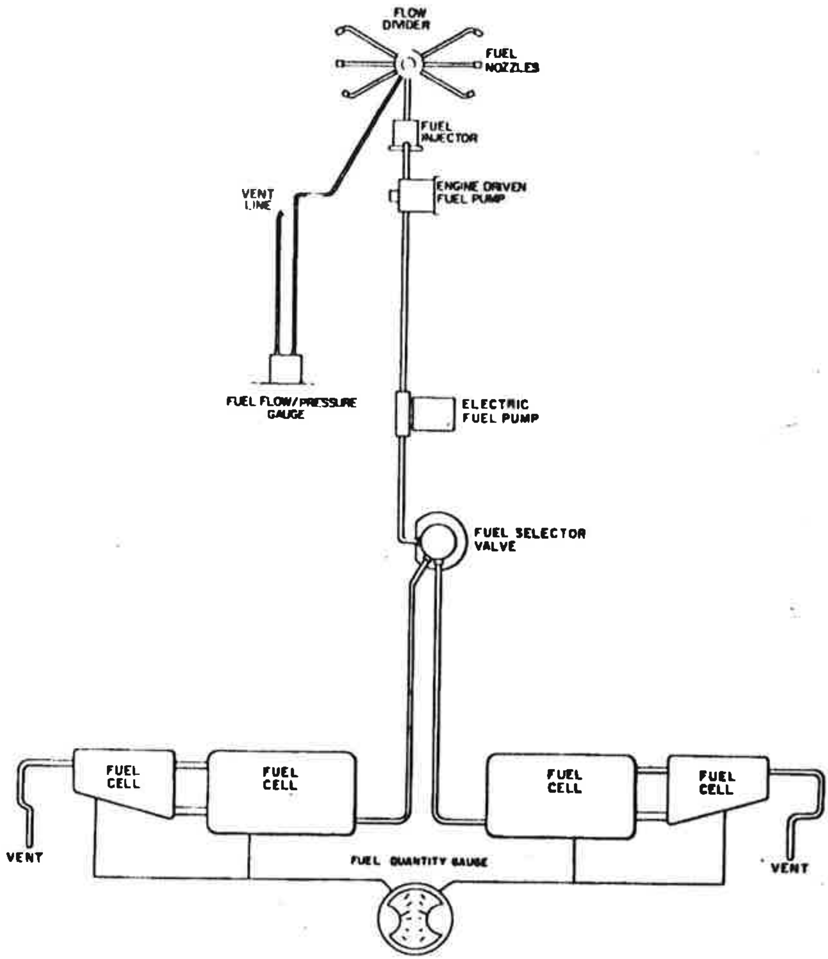
The fuel selector control is located below the center of the instrument panel on the sloping face of the control tunnel (refer to Figure 7-1). It has three positions, one position corresponding to each wing tank plus an OFF position.

To avoid the accumulation of water and sediment, the fuel tank sumps and strainer should be drained daily prior to first flight and after refueling. Each inboard tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. The fuel strainer and a system quick drain valve are located in the fuselage at the lowest point of the fuel system. It is important that the fuel system be drained in the following manner:

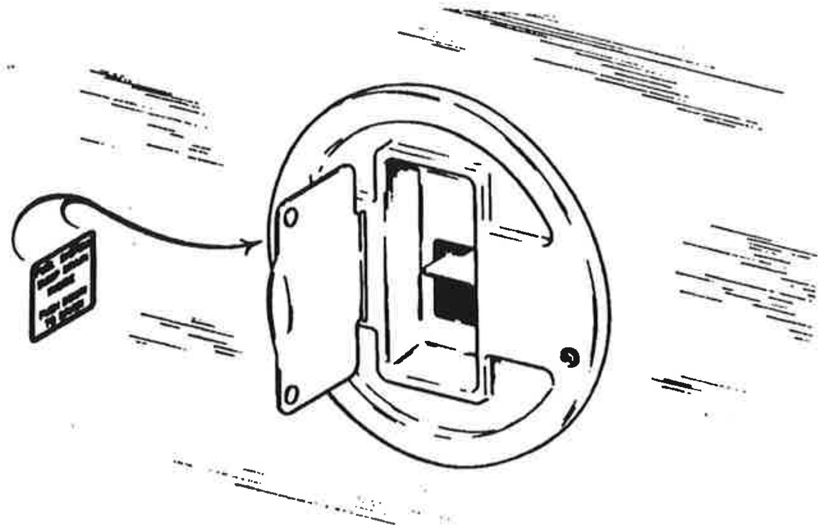
1. Drain each tank sump through its individual quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has flowed to ensure the removal of all water and sediment.
2. Place a container beneath the fuel strainer sump drain outlet located under the fuselage.
3. Drain the fuel strainer sump by pressing down on the lever located on the right side of the cabin on the forward edge of the wing spar housing (Figure 7-13). Move the selector through the following sequence: OFF position, left, right, while draining the strainer sump. Make sure that enough fuel has flowed to drain the fuel line between each tank outlet and the fuel strainer, as well as the strainer itself. With full fuel tanks, it will take approximately 6 seconds to drain all of the fuel from the line from either tank to the fuel strainer. When the tanks are less than full, it will take a few seconds longer.
4. Examine the contents of the container placed under the fuel sump drain outlet. When the fuel flow is free of water and sediment, close the drain and dispose of the contents of the bottle.

CAUTION

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



FUEL SYSTEM SCHEMATIC
Figure 7-11



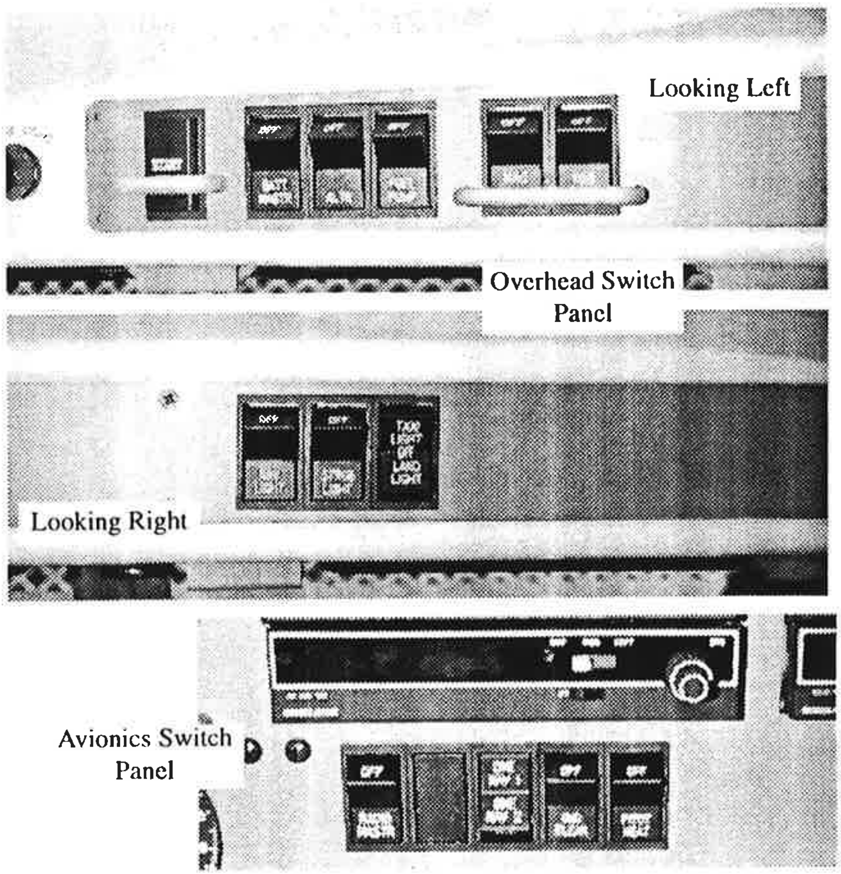
FUEL DRAIN LEVER
Figure 7-13

After using the underseat quick drain, check from the outside to make sure that it has closed completely and is not leaking.

A dual fuel quantity gauge is located in the lower center of the instrument panel next to the gear selector.

A fuel quantity indicator to measure the fuel not visible through the filler neck in each wing is installed in the inboard fuel tank. This gauge indicates usable fuel quantities from 5 gallons to 35 gallons in the ground attitude. The sole purpose of this gauge is to assist the pilot in determining fuel quantities of less than 35 gallons during the preflight inspection.

An electric fuel pump is provided for use in case of failure of the engine driven pump. The electric pump operates from a single switch and independent circuit protector. It should be ON for all takeoffs and landings.



SWITCH PANELS
Figure 7-15

7.15 ELECTRICAL SYSTEM

The 28-volt electrical system includes a 24-volt battery for starting and to back up alternator output. Electrical power is supplied by a 90 ampere alternator. The battery, a master switch relay, a voltage regulator and an overvoltage relay are located beneath the floor of the forward baggage compartment. Access to these electrical components is gained by removing the compartment floor and access panel located on the left side of the forward fuselage.

All powerplant and exterior light switches are grouped in an overhead switch panel with all avionics switches grouped in a switch panel located just above the throttle quadrant. (figure 7-15). The circuit breaker panel is located on the lower right side of the instrument panel (figure 7-19). Each breaker is clearly marked to show which circuit it protects. Also, circuit provisions are made to handle the addition of communications and navigational equipment.

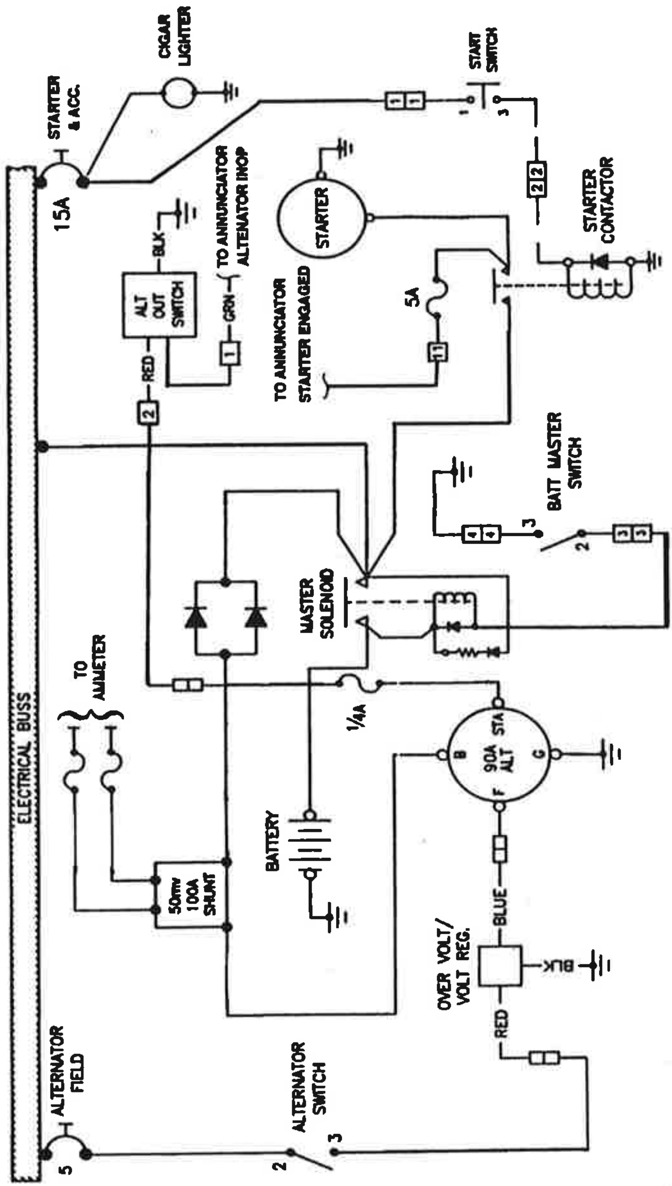
Standard electrical accessories include the starter, the electric fuel pump, the stall warning horn, the ammeter, and the annunciator panel.The annunciator panel includes, alternator inop, oil pressure, gear warn, flaps, starter engaged, low bus voltage, pitot heat off/inop, and vacuum inop indicator lights and provisions for optional baggage door ajar, air conditioner door open. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that the applicable system gauge should be checked and monitored to determine when or if any corrective action is required.

Optional electrical accessories include the navigation lights, anti-collision strobe lights, instrument panel lighting and cabin courtesy lights. The cabin courtesy light installation consists of two light/switch panels, one mounted above each cabin entrance. Make sure the lights are off when leaving the aircraft. Leaving the lights on for an extended period of time could cause depletion of the battery.

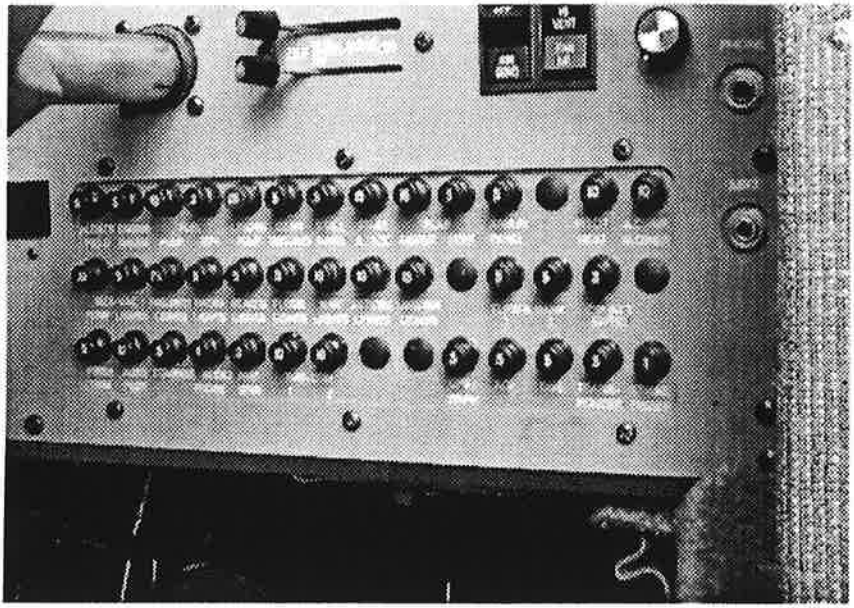
Two lights, mounted in the overhead panel, provide instrument and cockpit lighting for night flying. The lights are controlled by rheostat switches located adjacent to them. A map light window in each lens is actuated by an adjacent switch. A wing tip recognition/landing light system consists of 2 lights (one in each wing tip) and is operated by a rocker type switch mounted in the overhead switch panel.

Circuit provisions are made to handle the addition of communications and navigational equipment.

The ammeter in the alternator system displays in amperes the load placed on the alternator. It does not indicate battery discharge. With all electrical equipment off (except the master switch) the ammeter will be indicating the amount of charging current demanded by the battery. As each item of electrical equipment is turned on, the current will increase to a total appearing on the ammeter. This total includes the battery. The average continuous load for night flight, with radios on, is about 35 amperes. This 35 ampere value, plus approximately 2 amperes for a fully charged battery, will appear continuously under these flight conditions.



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-17



CIRCUIT BREAKER PANEL
Figure 7-19

For Abnormal and/or Emergency procedures, see Section 3.

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.

CAUTION

Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.

7.17 VACUUM SYSTEM

The vacuum system is designed to operate the air driven gyro instruments. This includes the directional and attitude gyros when installed. The system consists of an engine driven vacuum pump, a vacuum regulator, a filter and the necessary plumbing.

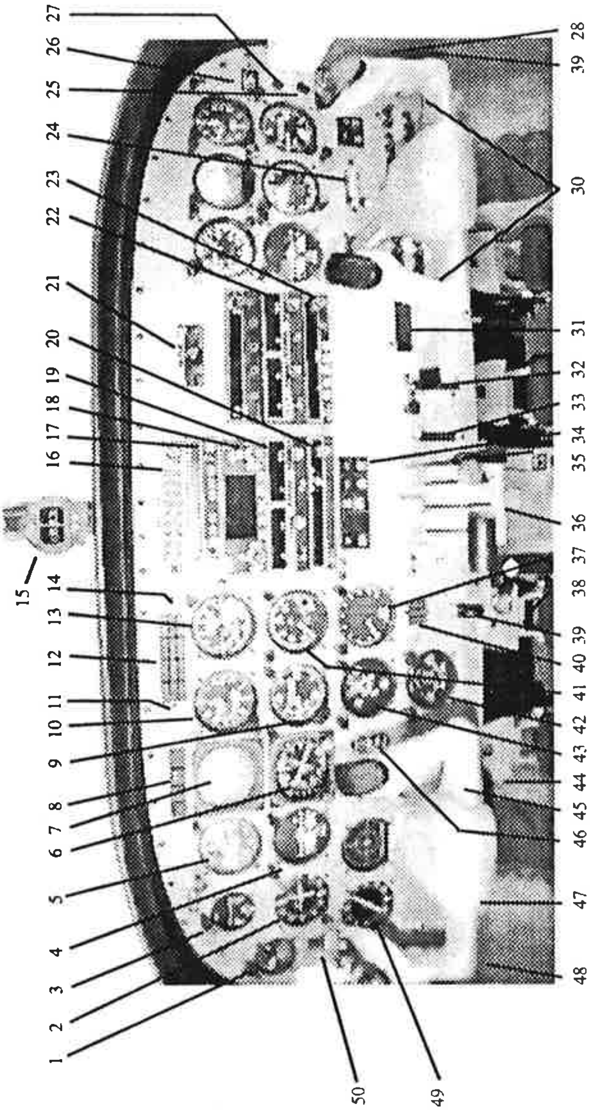
The vacuum pump is a dry type pump which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears the gyros will become inoperative.

The vacuum gauge, mounted on the left instrument panel, (refer to Figure 7-21) provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (a vacuum inop indicator light is provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.2 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.

1. GYRO SUCTION
2. LOC/VOR/GS IND.
3. CLOCK
4. TURN & BANK
5. AIRSPEED IND.
6. H.S.I.
7. FLT. COMAND IND.
8. A/P ANNUNCATOR
9. VERT. SPEED IND.
10. ALTIMETER
11. ANN. DAY/NITE SW
12. ANNUNC. PANEL
13. MAP/FUEL FLOW IND.
14. ANN. PRESS TO TEST
15. WET COMPASS
16. AUDIO AMP.
17. AUTOPILOT
18. G.P.S.
19. AVIONIC EQUIPMENT
20. AVIONIC EQUIPMENT
21. INTERCOMM SYSTEM
22. AVIONIC EQUIPMENT
23. AVIONIC EQUIPMENT
24. CLIMATE CONTROL
25. CIGAR LIGHTER
26. ENGINE HOUR METER
27. DATA LOADER PLUG
28. PHONE JACK
29. MIKE JACK
30. CKT. BREAKER PANEL
31. DIGITAL AMMETER
32. WING FLAP SELECTOR
33. ALT. AIR CONTROL
34. SWITCH PANEL
35. FRICTION LOCK
36. THROTTLE QUAD.
37. E.G.T. GAUGE
38. EMERG. GEAR EXTEN.
39. GEAR SELECTOR
40. GEAR LIGHTS
41. TACHOMETER
42. FUEL QUANTITY
43. OILPRESS/TEMP/C.H.T.
44. PANEL LIGHT DIMMER
45. RADIO LIGHT DIMMER*
46. SLAVE METER ACC *
47. E.L.T. SWITCH*
48. MIKE/PHONE JACKS*
49. A.D.F. INDICATOR
50. AUX VACUUM SW.

* BEHIND CONTROL WHEEL ON PANEL



TYPICAL INSTRUMENT PANEL

Figure 7-21

7.19 INSTRUMENT PANEL

The instrument panel is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The artificial horizon and directional gyro are vacuum operated and are located in the center of the left-hand instrument panel. The vacuum gauge is located on the upper left hand instrument panel. The turn indicator, on the left side, is electrically operated.

The radios are located in the center section of the panel, and the circuit breakers are in the lower right corner of the panel. An optional radio MASTER switch is located on the lower center instrument panel in the switch cluster. It controls the power to all radios through the aircraft MASTER switch. The radio power switch has an OFF, and ON position.

A ground clearance energy saver system is available to provide direct power to Comm 1 without turning on the master switch. An internally lit pushbutton switch, located on the instrument panel, provides annunciation for engagement of the system. When the button is engaged direct aircraft battery power is applied to Comm 1, audio amplifier (speaker) and radio accessories. The switch must be turned OFF or depletion of the battery could result.

7.21 PITOT-STATIC SYSTEM

Pitot pressure for the airspeed indicator is sensed by a heated pitot head installed on the bottom of the left wing and is carried through lines within the wing and fuselage to the gauge on the instrument panel (refer to Figure 7-23). Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static source pads, one on each side of the rear fuselage forward of the elevator. The dual pickups balance out differences in static pressure caused by slight side slips or skids.

An alternate static source is provided as standard equipment. The control valve is located below the left side of the instrument panel. When the valve is set in the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. The storm window and cabin vents must be closed and the cabin heater and defroster must be on during alternate static source operation. The altimeter error is less than 50 feet unless otherwise placarded.

If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks or moisture. The static lines may be drained by a valve located on the side panels next to the pilot's seat. The pitot system drains through the pitot mast.

The holes in the sensors for pitot and static pressure must be fully open and free from blockage. Blocked sensor holes will give erratic or zero readings on the instruments.

NOTE

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

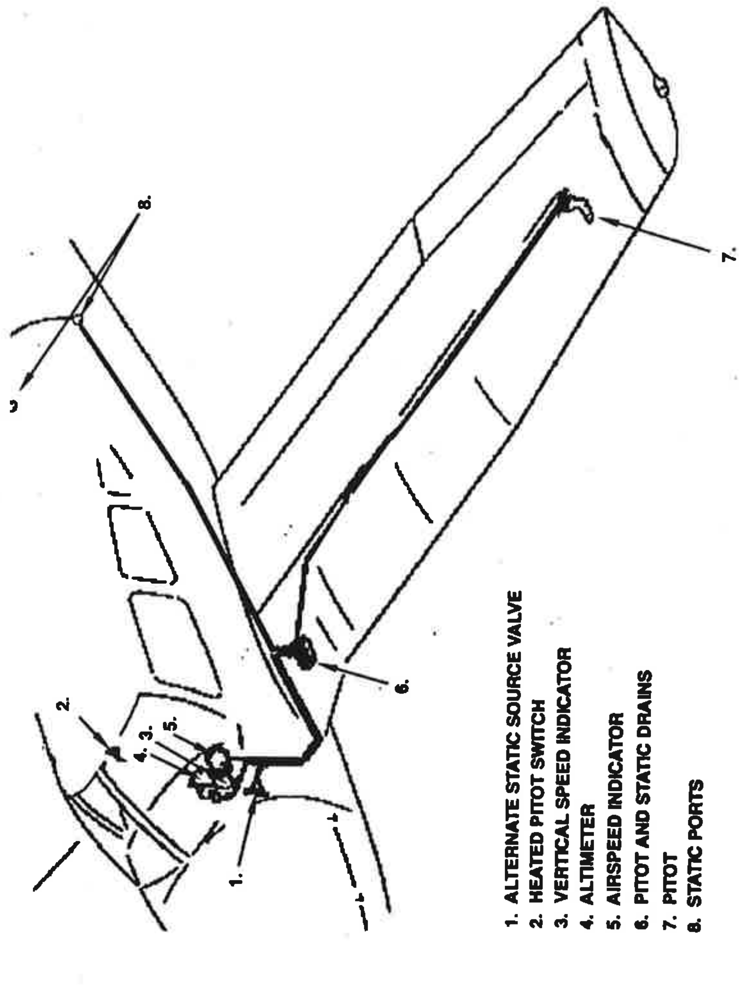
A heated pitot head, which alleviates problems with icing and heavy rain is installed as standard equipment. The switch for pitot heat is located in the overhead switch panel. The pitot heat system has a separate circuit breaker located in the circuit breaker panel and labeled PITOT/STALL, WARN HEAT. Static source pads have been demonstrated to be non-icing: however, in the event icing does occur, selecting the alternate static source will alleviate the problem.

7.23 CABIN FEATURES

For ease of entry and exit and for pilot and passenger comfort, the front seats are adjustable fore and aft. All seats recline and have armrests and are available with optional headrests. The front seats can be equipped with optional vertical adjustment. The center and rear seats may be removed for additional cargo space.

NOTE

To remove the center seats, retainers securing the back legs of the seats must be unlocked. This is accomplished by depressing the plunger behind each rear leg. Any time the seats are installed in the airplane, the retainers should be in the locked position. To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.



PITOT-STATIC SYSTEM
Figure 7-23

Shoulder harnesses with inertia reels are standard equipment for all seats.

The inertia reel should be checked by tugging sharply on the strap. The reel will lock in place under this test and prevent the strap from extending. Under normal movement, the strap will extend and retract as required.

For each front seat passenger, a single strap adjustable shoulder harness is installed. The shoulder strap is routed over the shoulder adjacent to the windows and attached to the lap belt in the general area of the person's inboard hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant.

Shoulder harnesses should be routinely worn during takeoff, landing and whenever an inflight emergency occurs.

An optional refreshment console is located between the center seats. It is removed in an identical manner to the center seats.

A cabin work table, serving the two seats on the right side of the passenger cabin is available as optional equipment. The table must be stowed during takeoff and landing. If the table is to be used, it should be set up after a level cruise is established.

To set up the cabin work table, simply pull up, then out. To stow the cabin work table, lift up and slide it back in to the side panel.

7.25 BAGGAGE AREA

The airplane has two separate baggage areas, each with a 100 pound capacity. A 7 cubic foot forward luggage compartment, located just aft of the fire wall, is accessible through a 16 x 22 inch door on the right side of the fuselage. A 17.3 cubic foot aft compartment is located behind the fifth and sixth seats and is accessible through the cargo door on the aft side of the fuselage and during flight from inside the cabin.

An automatic forward baggage compartment light feature is available which utilizes a magnetic reed switch and a magnet for activation. The switch and magnet are mounted just above the hinge line of the forward baggage door.

Opening the baggage door fully, activates the switch which turns on the baggage compartment light. The baggage compartment light is independent of the aircraft master switch; therefore, the light will illuminate regardless of the position of the master switch. The baggage door should not be left open for extended time periods, as battery depletion could result.

An optional forward baggage door ajar annunciation system is available which senses baggage door latch pin position. Failing to latch the forward baggage door will illuminate an amber light located on the pilot's annunciator panel. The annunciation, when illuminated, is "BAGG DOOR AJAR" advising the pilot of this condition.

NOTE

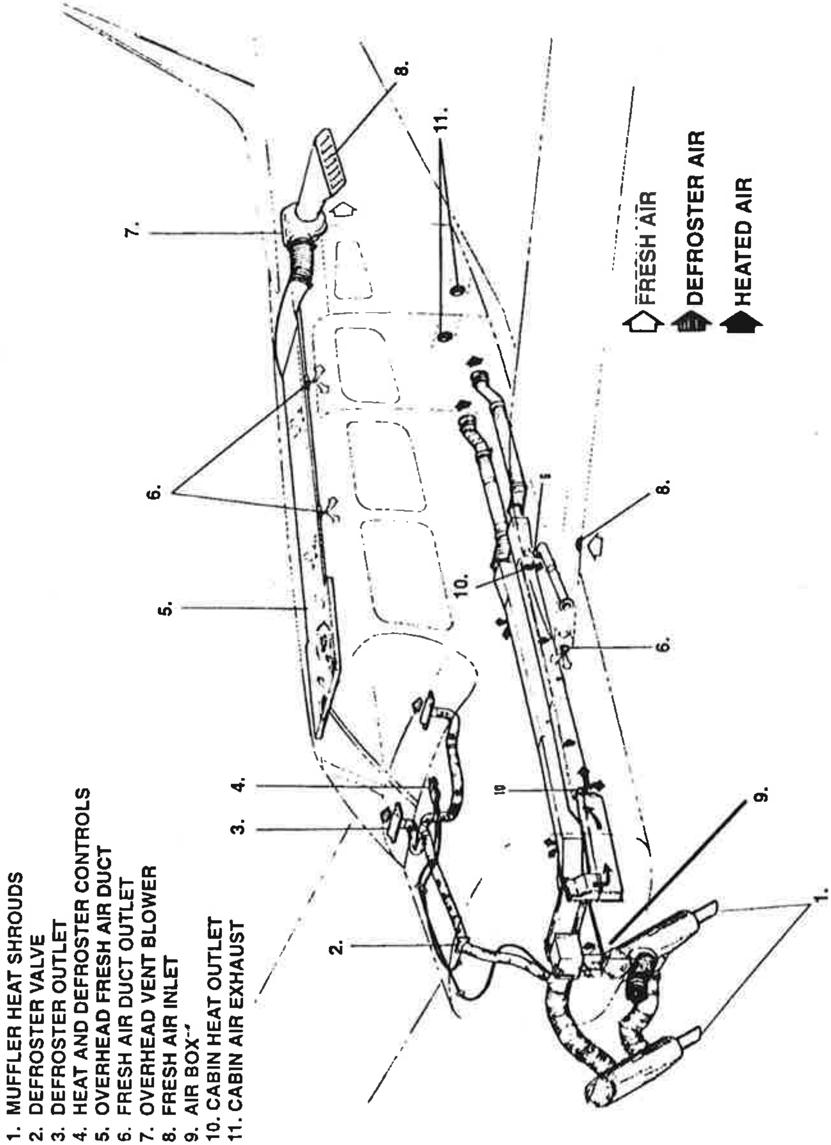
It is the pilot's responsibility to be sure when the baggage is loaded that the airplane's C.G. falls within the allowable C.G. range. (Refer to Weight and Balance Section.)

7.27 HEATING AND VENTILATING SYSTEM

Fresh air is ducted from a vent in the forward left lower cowling to the left heater muff by a flexible hose. It is then routed to the right heater muff by flexible hose Hot air from the right heater muff is routed through a flexible hose on the right side of the engine compartment, to the valve box mounted on the fire wall just above the tunnel cut out. It is then ducted down each side of the tunnel below the baggage floor to the çabin ducting and outlets (Figure 7-25).

CAUTION

When cabin heat is operated, heat duct surface becomes hot. This could result in burns if arms or legs are placed too close to heat duct outlets or surface.



HEATING AND VENTILATING SYSTEM
Figure 7-25

Defrost heat is bled off from the main flow at the heater muff and routed through flexible hose to a shut-off valve located to the right of center at the top of the fire wall. From this point, it is ducted to the defroster outlets.

Fresh air inlets are located in the leading edge of each wing and in the left side of the tail cone. Two adjustable outlets are located on each side of the cabin, one forward and one aft of the front seat near the floor. There are also adjustable outlets above each seat. In airplanes without air conditioning, an optional blower may be added to the overhead vent system to aid in the circulation of cabin air.

7.29 STALL WARNING

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild to moderate airframe buffeting may also precede the stall. Stall speeds are shown on graphs in the Performance Section. The stall warning horn emits a continuous sound. The landing gear warning horn is different in that it emits a 90 cycle per minute beeping sound. The stall warning horn is activated by lift detectors installed on the leading edge of the left wing. During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detectors and checking to determine if the horn is actuated.

7.31 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. To keep the finish attractive looking, economy size spray cans of touch-up paint are available from Piper Dealers.

An optional polyurethane enamel finish is available.

7.33 AIR CONDITIONING*

The air conditioning system is a recirculating air system. The major components include an evaporator, a condenser, a compressor, a blower, switches and temperature control.

The evaporator is located behind the rear baggage compartment. This cools the air used for the air conditioning system.

*Optional equipment

The condenser is mounted on a retractable scoop located on the bottom of the fuselage and to the rear of the baggage compartment area. The scoop extends when the air conditioner is ON and retracts to a flush position when the system is OFF.

The compressor is mounted on the forward right underside of the engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel in the climate control center panel. The temperature control regulates the temperature of the cabin. Turning the control clockwise increases cooling; counterclockwise decreases cooling.

The fan speed switch and the air conditioning ON-OFF switch are inboard of the temperature control. The fan can be operated independently of the air conditioning; however, the fan must be on for air conditioner operation. Turning either switch off will disengage the compressor clutch and retract the condenser door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

The fan switch allows operation of the fan with the air conditioner turned OFF to aid in cabin air circulation. "LOW" or "HIGH" can be selected to direct a flow of air through the air conditioner outlets in the overhead duct. These outlets can be adjusted or turned off individually.

The condenser door light is located in the annunciator cluster at the top center of the instrument panel in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

A circuit breaker on the circuit breaker panel protects the air conditioning electrical system.

Whenever the throttle is in the full forward position, it activates a micro switch which disengages the compressor and retracts the scoop. This allows maximum power and maximum rate of climb. The fan continues to operate and the air will remain cool for about one minute. When the throttle is retarded approximately 1/4 inch, the clutch will engage, the scoop will extend, and the system will again supply cool, dry air.

7.35 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the left side of the nose section aft of the cowling. An external battery can be connected to the socket, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.

7.37 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT), when installed, is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate is attached with slotted-head nylon screws for ease of removal; these screws may be readily removed with a variety of common items, such as a dime, 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. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52.

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.

*Optional equipment

ARTEX 110-4 ELT OPERATION

On the ELT unit itself is a two position switch placarded ON and OFF. The OFF position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane.

A pilots remote switch, placarded ON and ARM is located on the pilot's lower left instrument panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in ARM position. Moving the switch to ON will activate the transmitter. A warning light located above the remote switch will alert you when ever the ELT is activated.

Should the ELT be activated inadvertently it can be reset by either positioning the remote switch to the ON then immediately relocating it to the ARM position, or by setting the switch on the ELT to ON and then back to OFF.

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON and then immediately to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

NOTE:

Three sweeps of the emergency tone and an illuminated warning light indicates a normally functioning unit. The warning light must illuminate during the first 3 second test period. If it does not illuminate, a problem is indicated such as a "G" switch failure.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane's ELT is probably transmitting. Setting the remote switch back to OFF will automatically reset the ELT and should stop the signal being received on 121.50 MHz.

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SECTION 8
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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

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SECTION 8

AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

8.1 GENERAL

This section provides guidelines relating to the handling, servicing, and maintenance of the Saratoga II HP. For complete maintenance instructions, refer to the latest revision of the appropriate Maintenance Manual.

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Services Department to obtain the latest information pertaining to their airplane, and to avail themselves of Piper's support systems.

Piper takes a continuing interest in having owners get the most efficient use from their airplane and keeping it in the best mechanical condition. Consequently, Piper, from time to time, issues service releases including Service Bulletins, Service Letters, Service Spares Letters, and others relating to the airplane.

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent directly to the latest FAA-registered owners in the United States (U.S.) and Piper Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Service Centers and, if necessary, to the latest FAA-registered owners in the U.S. Owners should give careful attention to Service Letter information.

Service Spares Letters offer improved parts, kits, and optional equipment which were not available originally, and which may be of interest to the owner.

Piper offers a subscription service for Service Bulletins, Service Letters, and Service Spares Letters. This service is available to interested persons such as owners, pilots, and mechanics at a nominal fee, and may be obtained through an authorized Piper Service Center or Piper's Customer Services Department.

Maintenance manuals, parts catalogs, and revisions to both, are available from Piper Service Centers or Piper's Customer Services Department.

Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

8.3 AIRPLANE INSPECTION PERIODS

Piper has developed inspection items and required inspection intervals for the PA-32R (see the latest revision of the PA-32R Maintenance and Inspection Manuals). The PA-32R Inspection Manual contains appropriate forms, and all inspection procedures 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 continued airworthiness is maintained. Complete details are available from Piper.

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 spectrographic analysis of the engine oil is available from several sources. This inspection, if performed properly, provides a good check of the internal condition of the engine. To be accurate, induction air filters must be cleaned or changed regularly, and oil samples must be taken and sent in at regular intervals.

8.5 PREVENTIVE MAINTENANCE

The holder of a pilot certificate issued under Federal Aviation Regulations (FAR) Part 61 may perform certain preventive maintenance as defined in the FARs. This maintenance may be performed only on an aircraft which the pilot owns and operates, and which is not used in air carrier or air taxi/commercial operations service.

All other aircraft maintenance must be accomplished by a person or facility appropriately certificated by the Federal Aviation Administration (FAA) to perform that work.

Anytime maintenance is accomplished, an entry must be made in the appropriate aircraft maintenance records. The entry shall include:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
  (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
  (2) Aircraft Registration Certificate Form FAA-8050-3.
  (3) Aircraft Radio Station License if transmitters are installed.

(b) To be carried in the aircraft at all times:
  (1) Pilot's Operating Handbook.
  (2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
  (3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

8.9 GROUND HANDLING

(a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the rear baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly. Towing lugs are incorporated as part of the nose gear fork.

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.

CAUTION

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.

(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) To set the parking brake, first depress and hold the toe brakes and then pull back on the brake lever and depressing the knob on the handle. To release the parking brake, first depress the brake pedals and then pull back on the handle until the catch disengages; then allow the handle to swing forward.

CAUTION

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Block the wheels.

(5) Secure tie-down ropes to the wing tie-down rings and to the tail ring 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 AIR FILTER

(a) Removing Engine Air Filter

(1) Remove the upper cowling.

(2) Remove the screws securing the filter box to the lower cowl. Remove the filter.

(b) Cleaning Engine Air Filter

The injector air filter 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 the filter gently to remove dirt particles, being careful not to damage the filter. DO NOT wash the filter in any liquid. DO NOT attempt to blow out dirt with compressed air.

(2) If the filter is excessively dirty or shows any damage, replace it immediately.

(3) Wipe the filter housing with a clean cloth soaked in unleaded gasoline. When the housing is clean and dry, install the filter.

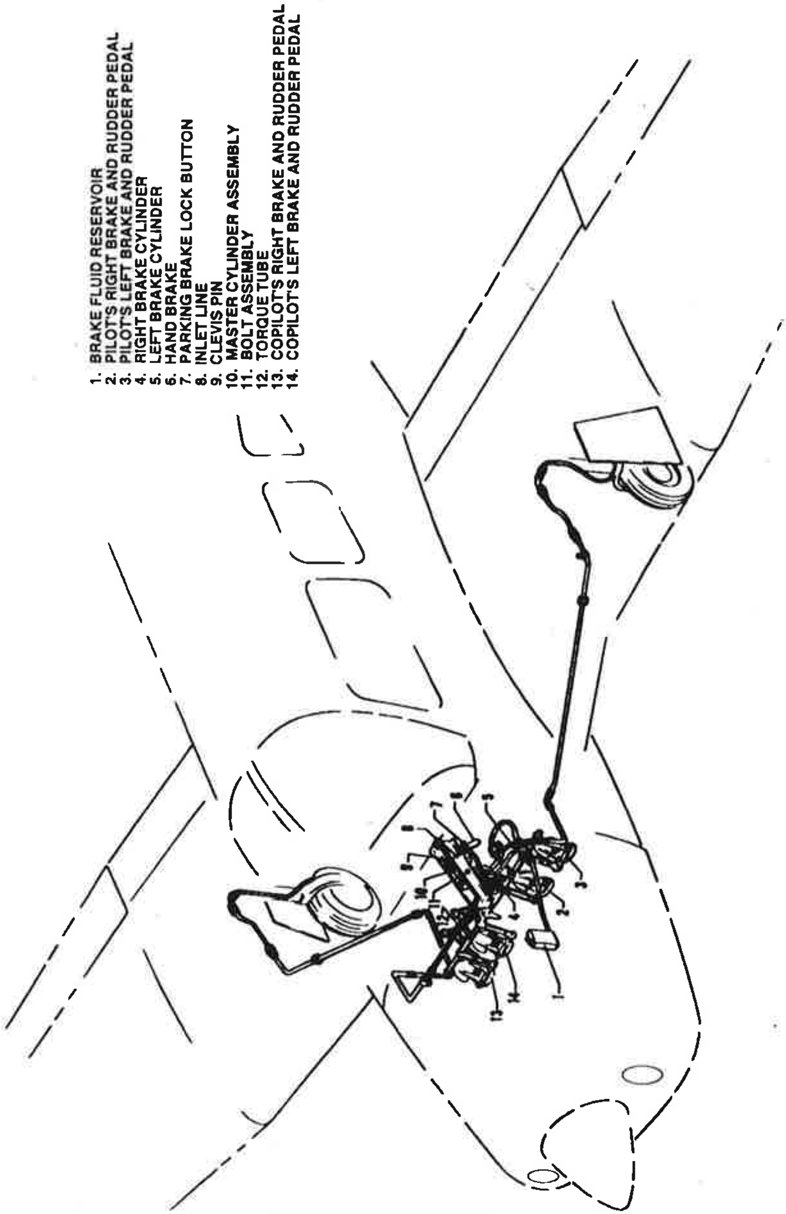
(c) Installation of Engine Air Filter

After cleaning or when replacing the filter, install the filter in the reverse order of removal.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. The fluid level should be checked periodically or at every 100 hour inspection and replenished when necessary. The brake reservoir is located on the left side of the fire wall in the engine compartment. If the entire system must be refilled, fill with fluid under pressure from the brake end of the system. This will eliminate air from the system.

No adjustment of the brake clearances is necessary. If, after extended service, brake blocks become excessively worn they should be replaced with new segments.



BRAKE SYSTEM
Figure 8-1

8.15 LANDING GEAR SERVICE

The main landing gear uses Cleveland Aircraft Products 6.00 x 6 wheels with 6.00 x 6, eight-ply rating tires and tubes. The nose wheel uses a Cleveland Aircraft Products 5.00 x 5 wheel with a 5.00 x 5 six-ply rating, type III tire and tube. (Refer to paragraph 8.23.)

Wheels are removed by taking off the hub cap, cotter pin, axle nut, and the two bolts holding the brake segment in place. Mark tire and wheel for reinstallation; then dismount by deflating the tire, removing the three through-bolts from the wheel and separating the wheel halves.

Landing gear oleos should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until 4.5 ± .5 inches of oleo piston tube is exposed, and the nose gear should show 3.25 ± .25 inches. To add air to the oleo struts, attach a strut pump to the valve assembly near the top of the oleo strut housing and pump the oleo to the desired position. To add oil, jack the aircraft, release the air pressure in the strut, remove the valve core and add oil through this opening with the strut extended. After the strut is full, compress it slowly and fully to allow excess air and oil to escape. With the strut still compressed reinsert the valve core and pump up the strut as above.

In jacking the aircraft for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 250 pounds of ballast should be placed on the base of the tail stand before the airplane is jacked up. The hydraulic jacks should be placed under the jack points on the bottom of the wing and the airplane jacked up until the tail skid is at the right height to attach the tail stand. After the tail stand is attached and the ballast added, jacking may be continued until the airplane is at the height desired.

The steering arms from the rudder pedals to the nose wheel are adjusted at the rudder pedals or at the nose wheel by turning the threaded rod end bearings in or out. Adjustment is normally accomplished at the forward end of the rods and should be done in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals and rudder are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the plane follows a perfectly straight line. The turning arc of the nose wheel is 22.5° +/- 2° in either direction and is limited by stops at the rudder pedals.

8.17 PROPELLER SERVICE

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, and 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, the surface should be cleaned and waxed periodically.

8.19 OIL REQUIREMENTS

The oil capacity of the Lycoming IO-540 series engine is 12 quarts, and the minimum safe quantity is 2-3/4 quarts. 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 also be complied with each 50 hours. The following grades are required for temperatures:

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

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

NOTE

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

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50 hour inspection, the fuel screens in the strainer and in the injector must be cleaned. The screen in the injector is located in the housing where the fuel line connects to the injector. The fuel strainer is located under the floor panel and is accessible for cleaning through an access plate on the underside of the fuselage. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.

(b) Fuel Requirements (AVGAS ONLY)

The minimum aviation grade fuel is 100. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes.

Whenever 100 or 100LL grade fuel is not available, commercial grade 100/130 should be used. (See Fuel Grade Comparison Chart.) Refer to the latest issue of Lycoming Service Instruction No. 1070 for additional information.

A summary of the 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-5572F)		
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 anit-icing additive is used it must meet the specification MIL-I-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ozs. per ten gallon of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

CAUTIONS

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.

Some fuels have anti-icing additives pre-blended in the fuel at the refinery, so no further blending should be performed.

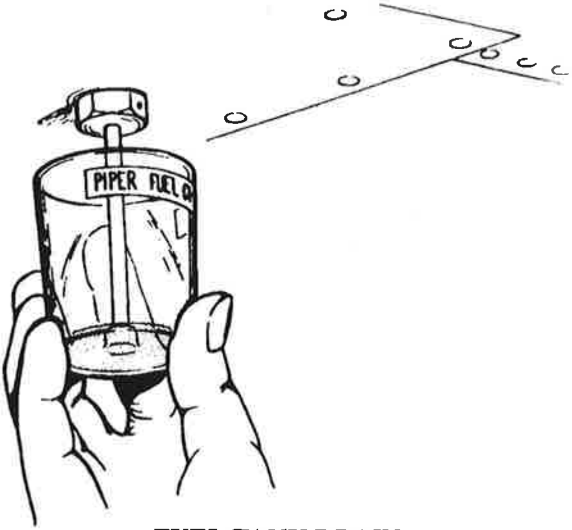
Fuel additive can not be used as a substitute for preflight draining of the fuel system drains.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 53.5 U.S. gallons. When using less than the standard 107 gallon capacity, fuel should be distributed equally between each side.

(d) Draining Fuel Strainer, Sumps and Lines

The fuel tank sumps and strainer should be drained before the first flight of the day and after refueling to avoid the accumulation of water and sediment. Each inboard fuel tank has an individual quick drain at the lower inboard corner. A fuel strainer with a fuel system quick drain is located at the lowest point in the system. Each tank sump should be drained through its individual quick drain until sufficient fuel has flowed to ensure the removal of any contaminants. The fuel strainer sump quick drain, operated by a lever inside the cabin on the right forward edge of the wing spar housing should be opened while the fuel selector valve is moved through the two tank positions. Enough fuel should flow at each position to allow the fuel lines and the strainer to ensure removal of contaminants. A quick drain fuel sampler is provided for the checking of the fuel clarity. (See Description-Airplane and Systems Section for more detailed instructions.)



FUEL TANK DRAIN
Figure 8-3

CAUTION

When draining fuel, be sure that no fire hazard exists before starting engine.

After using the fuel system quick drain, check from outside the airplane to be sure that it has closed completely and is not leaking.

(e) Draining Fuel System

The bulk of the fuel may be drained by opening the individual drain on each tank. The remaining fuel may be drained through the fuel strainer.

CAUTION

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

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures - 35 psi for the nose gear and 38 psi for the main gear. All wheels and tires are balanced before original installation, and the relationship of tire, tube, and wheel should be maintained upon reinstallation. Unbalanced wheels can cause extreme vibration in the landing gear; therefore, in the installation of new components, it may be necessary to rebalance the wheels with the tires mounted. When checking tire pressure, examine the tires for wear, cuts, bruises, and slippage.

8.25 BATTERY SERVICE

Access to the 24-volt battery is through an access panel in the left side of the fuselage and by removing the floor of the forward baggage compartment. The battery box has a plastic tube which is normally closed off with a cap and which should be opened occasionally to drain off any accumulation of liquid. The battery should be checked for proper fluid level. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use water only. A hydrometer check will determine the percent of charge in the battery.

If the battery is not up to charge, recharge starting at a 4 amp rate and finishing with a 2 amp rate. Quick charges are not recommended.

8.27 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.
(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

CAUTION

Do not spray solvent into the alternator, vacuum pump, starter, or air intakes.

(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 applicable Service 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.

CAUTION

Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.
(4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff bristle brush, and vacuum where necessary.
(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. 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 noninflammable dry cleaning fluid. Floor carpets may be cleaned like any household carpet.

SECTION 9
SUPPLEMENTS

SECTION 9
SUPPLEMENTS

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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 efficient operation of the airplane when equipped with one or more of the various optional systems and equipment not provided with the standard airplane.

All of the Supplements provided by 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 1
FOR
AIR CONDITIONING INSTALLATION

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when optional air conditioning is installed. This supplement supplies information necessary for the operation of the airplane when the optional air conditioning system is installed. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED Peter E. Peck

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DATE OF APPROVAL NOVEMBER 30, 1995

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional air conditioning system is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

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 air conditioning system is installed.

SECTION 2 - LIMITATIONS

(a) To insure maximum climb performance the air conditioner must be turned OFF manually prior to takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned OFF manually before the landing approach in preparation for a possible go-around.

(b) Placards
In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

``WARNING - AIR CONDITIONER MUST
BE OFF TO INSURE NORMAL TAKEOFF
CLIMB PERFORMANCE.''

In the annunciator cluster (condenser door light):

AIR COND DOOR

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

Prior to takeoff, the air conditioner should be checked for proper operation as follows:

(a) Check aircraft master switch ON.

(b) Turn the air conditioner control switch to ON and the fan switch to one of the operating positions - the "AIR COND DOOR" warning light will turn on, thereby indicating proper air conditioner condenser door actuation.

(c) Turn the air conditioner control switch to OFF - the "AIR COND DOOR" warning light will go out, thereby indicating the air conditioner condenser door is in the up position.

(d) If the "AIR COND DOOR" light does not respond as specified above, an air conditioner system or indicator bulb malfunction is indicated and further investigation should be conducted prior to flight.

The above operational check may be performed during flight if an in flight failure is suspected.

The condenser door light is located in the annunciator cluster in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

SECTION 5 - PERFORMANCE

Operation of the air conditioner will cause slight decreases in cruise speed and range. Power from the engine is required to run the compressor, and the condenser door, when extended, causes a slight increase in drag. When the air conditioner is turned off there is normally no measurable difference in climb, cruise or range performance of the airplane.

NOTE

To insure maximum climb performance the air conditioner must be turned off manually before takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned off manually before the landing approach in preparation for a possible go-around.

Although the cruise speed and range are only slightly affected by the air conditioner operation, these changes should be considered in preflight planning. To be conservative, the following figures assume that the compressor is operating continuously while the airplane is airborne. This will be the case only in extremely hot weather.

(a) The decrease in true airspeed is approximately 6 KTS at all power settings.
(b) The decrease in range may be as much as 55 nautical miles for the 102 gallon capacity.

The climb performance is not compromised measurably with the air conditioner operating since the compressor is declutched and the condenser door is retracted, both automatically, when full throttle position is selected. When full throttle position is not used or in the event of a malfunction which would cause the compressor to operate and the condenser door to be extended, a decrease in rate of climb of as much as 100 fpm can be expected. Should a malfunction occur which prevents condenser door retraction when the compressor is turned off, a decrease in rate of climb of as much as 50 fpm can be expected.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT 2
FOR
AUXILIARY VACUUM SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Piper Auxiliary Vacuum System is installed in accordance with Piper Drawing No. 87778-3. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL NOVEMBER 30, 1995

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Piper Auxiliary Vacuum System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

SECTION 2 - LIMITATIONS

(a) The auxiliary vacuum system is limited to standby function only, do not take off with the engine driven dry air pump inoperative.

(b) Discontinue flight in Instrument Meteorological Conditions (IMC) if vacuum pressure falls below 4.8 In. Hg.

(c) The auxiliary pump/motor assembly and elapsed time indicator must be removed from service after 500 hours accumulated operating time or 10 years whichever occurs first.

SECTION 3 - EMERGENCY PROCEDURES

(a) VAC OFF or Vacuum Inop. Warning - Auxiliary Vacuum Switch AUX ON.

(b) Verify vacuum system suction 4.8 to 5.2 In. Hg.

CAUTION

Compass error may exceed 10° when auxiliary vacuum system is in operation.

(c) Monitor electrical load - verify alternator capacity is not being exceeded as indicated by the ammeter. If required turn off non-essential electrical equipment.

(d) Land at the earliest opportunity to have primary system repaired.

SECTION 4 - NORMAL PROCEDURES

(a) Preflight Check.

(1) Turn on battery switch and verify VAC OFF light illuminated.

NOTE

Due to the electrical power requirement of the auxiliary vacuum pump it is suggested that the engine be operating while making the following checks.

(2) Turn on auxiliary vacuum pump and verify AUX ON light is illuminated and electrical load (approximately 15 amps) on ammeter.

(3) Turn off auxiliary vacuum pump and verify AUX ON light extinguished

(b) Inflight Check.

(1) Turn off non-essential electrical equipment.

(2) Turn on auxiliary vacuum pump and verify AUX ON light illuminated and electrical load (approximately 15 amps) on ammeter.

(3) Turn off auxiliary vacuum pump and verify AUX ON light extinguished and return to normal flight.

NOTE

For maximum service life, avoid continuous non-emergency operation of the auxiliary vacuum pump.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT & BALANCE

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

SECTION 7 - DESCRIPTION AND OPERATION

The auxiliary dry air pump system provides an independent back-up source of pneumatic power to operate the gyro flight instruments in the event the engine driven air pump fails.

The control switch (labeled AUX VAC) for the auxiliary pump system is located on the left side of the instrument panel below the vacuum suction gage. The control switch operating modes are "push-for-on" and "push-for-off".

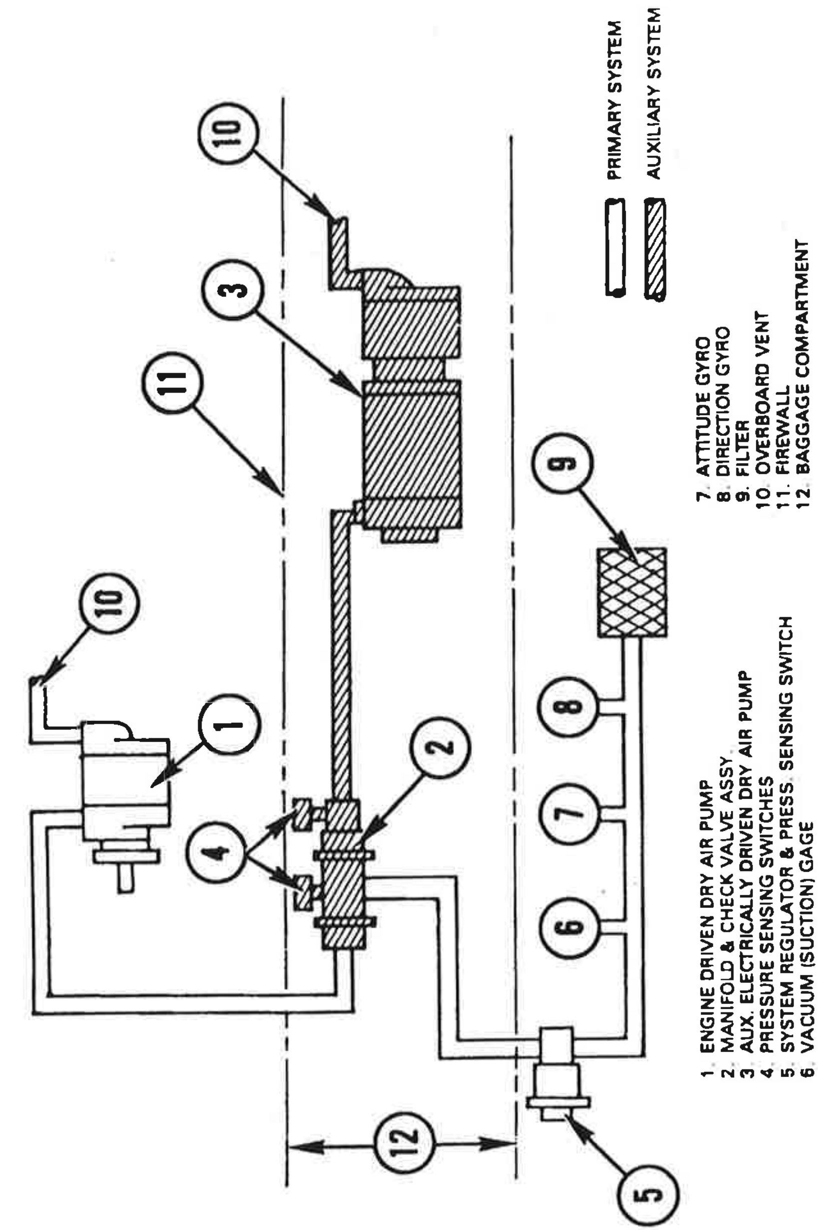
The switch button incorporates two annunciator light sections labeled VAC OFF and AUX ON. The VAC OFF section is controlled by a vacuum switch in the primary pneumatic system and illuminates an amber light when the engine driven pump is inoperative or when the system vacuum falls below the switch activation level. The AUX ON section is controlled by a vacuum switch in the auxiliary pneumatic system and illuminates a blue light when the auxiliary pump is operating and creating a vacuum in the system. When the auxiliary pump is activated at high altitude, or if the system has developed air leaks, the AUX ON light may fail to illuminate. This indicates that the system vacuum is still below theAUX ON switch activation level even though the auxiliary pump is operating and can be verified by observing the vacuum system indicator.

The annunciator lights do not incorporate a press-to-test feature. If the lights do not illuminate as expected, check for burned out lamps, replace with MS 25237-330 bulbs and retest the system.

System electrical protection is provided by a 20 amp circuit breaker in the pump motor circuit and a 5 amp in line fuse in the annunciator light circuit. The breaker is mounted on the circuit breaker panel.

SECTION 7 - DESCRIPTION AND OPERATION (CONT)

The auxiliary pump is in the forward baggage compartment under the right side floor board. The auxiliary system connects to the primary system at a manifold downstream of the vacuum regulator. Isolation of the primary and auxiliary systems from each other is accomplished by check valves on each side of the manifold. The primary system vacuum switch is located in the center of the manifold and senses vacuum supplied to the gyros. The auxiliary system vacuum switch is located on the manifold between the check valve and the auxiliary pump and senses vacuum generated by the auxiliary pump. In order to assure high reliability of the auxiliary air pump system as a back-up power supply for gyro instruments, the pump/motor assembly must be removed and replaced after a time in service as specified in the limitations Section 2 of this handbook. An elapsed time indicator is incorporated into the auxiliary pump electrical system to show accumulated hours of operation.


PRIMARY SYSTEM
AUXILIARY SYSTEM
1 ENGINE DRIVEN DRY AIR PUMP
2 MANIFOLD & CHECK VALVE ASSY
3 AUX. ELECTRICALLY DRIVEN DRY AIR PUMP
4 PRESSURE SENSING SWITCHES
5 SYSTEM REGULATOR & PRESS. SENSING SWITCH
6 VACUUM (SUCTION) GAGE
7. ATTITUDE GYRO
8. DIRECTION GYRO
9. FILTER
10 OVERBOARD VENT
11. FIREWALL
12 BAGGAGE COMPARTMENT

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 3
FOR
BENDIX/KING KLN 90B GPS
NAVIGATION SYSTEM WITH
KAP/KFC 150 AUTOPILOT SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Bendix/King KLN 90B GPS Navigation System is installed per Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL NOVEMBER 30, 1995

SECTION 1 - GENERAL

The KLN 90B GPS panel mounted unit contains the GPS sensor, the navigation computer, a CRT display, and all controls required to operate the unit. It also houses the data base cartridge which plugs directly into the back of the unit.

The data base cartridge is an electronic memory containing information on airports, navaids, intersections, SID's, STAR's, instrument approaches, special use airspace, and other items of value to the pilot.

Every 28 days, Bendix/King receives new data base information from Jeppesen Sanderson for the North American data base region. This information is processed and downloaded onto the data base cartridges. Bendix/King makes these data base cartridge updates available to KLN 90B GPS users.

Provided the KLN 90B GPS navigation system is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

VFR/IFR en route oceanic and remote, en route domestic, terminal, and instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System, North Atlantic Minimum Navigation Performance Specifications (MNPS) Airspace and latitudes bounded by 74° North and 60° South using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33. Navigation data is based upon use of only the global positioning system (GPS) operated by the United States.

NOTE:

Aircraft using GPS for oceanic IFR operations may use the KLN 90B to replace one of the other approved means of long-range navigation. A single KLN 90B GPS installation may also be used on short oceanic routes which require only one means of long range navigation.

NOTE:

FAA approval of the KLN 90B does not necessarily constitute approval for use in foreign airspace.

SECTION 2 - LIMITATIONS

A. The KLN 90B GPS Pilot's Guide, P/N 006-08773-0000, dated December, 1994 (or later applicable revision) must be immediately available to the flight crew whenever navigation is predicated on the use of the system. The Operational Revision Status (ORS) of the Pilot's Guide must match the ORS level annunciated on the Self Test page.

B. IFR Navigation is restricted as follows:

1. The system must utilize ORS level 20 or later FAA approved revision.
2. The data on the self test page must be verified prior to use. Verify valid altitude data is available to the KLN 90B prior to flight.
3. IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
4. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the KLN 90B data base. The KLN 90B data base must incorporate the current update cycle.

   (a) The KLN 90B Memory Jogger, P/N 006-08785-0000, dated 12/94
   (or later applicable revision) must be immediately available to the flight crew during instrument approach operations.

   (b) Instrument approaches must be conducted in the approach mode and RAIM must be available at the Final Approach Fix.

   (c) APR ACTV mode must be annunciated at the Final Approach Fix.

   (d) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches are not authorized.

   (e) When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation.

   (f) The KLN 90B can only be used for approach guidance if the reference coordinate datum system for the instrument approach is WGS-84 or NAD-83. (All approaches in the KLN 90B data base use the WGS-84 or the NAD-83 geodetic datums.)

5. The aircraft must have other approved navigation equipment appropriate to the route of flight installed and operational.

SECTION 3 - EMERGENCY PROCEDURES

ABNORMAL PROCEDURES

A. If the KLN 90B GPS information is not available or invalid, utilize remaining operational navigation equipment as required.

B. If a "RAIM NOT AVAILABLE" message is displayed while conducting an instrument approach, terminate the approach. Execute a missed approach if required.

C. If a "RAIM NOT AVAILABLE" message is displayed in the en route or terminal phase of flight, continue to navigate using the KLN 90B or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR approved navigation system.

D. Refer to the KLN 90B Pilot's Guide, Appendices B and C, for appropriate pilot actions to be accomplished in response to annunciated messages.

SECTION 4 - NORMAL PROCEDURES

WARNING:

Familiarity with the en route operation of the KLN 90B does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the KLN 90B.

A. OPERATION

Normal operating procedures are outlined in the KLN 90B GPS Pilot's Guide, P/N 006-08773-0000, dated December, 1994, (or later applicable revision). A KLN 90B Memory Jogger, P/N 006-08785-0000 dated 12/94 (or later applicable revision) containing an approach sequence, operating tips and approach related messages is intended for cockpit use by the KLN 90B familiar pilot when conducting instrument approaches.

B. SYSTEM ANNUNCIATORS/SWITCHES/CONTROLS

1. HSI NAV presentation (NAV/GPS) switch annunciator - May be used to select data for presentation on the pilot's HSI; either NAV data from the number one navigation receiver or GPS data from the KLN 90B GPS. Presentation on the HSI is also required for autopilot coupling. NAV is green. GPS is blue.
2. Message (MSG) annunciator -Will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 90B GPS to view the message. (Appendix B of the KLN 90B Pilot's Guide contains a list of all of the message page messages and their meanings). MSG is amber.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

3. Waypoint (WPT) annunciator - Prior to reaching a waypoint in the active flight plan, the KLN 90B GPS will provide navigation along a curved path segment to ensure a smooth transition between two adjacent legs in the flight plan. This feature is called turn anticipation. Approximately 20 seconds prior to the beginning of turn anticipation the WPT annunciator will flash, going solid upon initialization of the turn, and extinguishing upon turn completion. WPT is amber.

WARNING:

Turn anticipation is automatically disabled for FAF waypoints and those used exclusively in SID/STARS where overflight is required. For waypoints shared between SID/STARS and published en route segments (requiring overflight in the SID/STARS), proper selection on the presented waypoint page is necessary to provide adequate route protection on the SID/STARS.

4. GPS omni bearing or leg (GPS CRS OBS/LEG) course switch/ annunciator - Used to select the basic modes of KLN 90B operation, either a) single waypoint with omni - bearing course (OBS) selection through that waypoint (like a VOR) or b) automatic leg sequencing (LEG) between waypoints. GPS CRS is white. OBS may either be white or amber. LEG is green.

NOTE:

Either LEG or OBS will illuminate during system self test depending upon switch position.

5. HSI course control ① knob - Provides analog course input to the KLN 90B in OBS when the NAV/GPS switch/annunciator is in GPS. When the NAV/GPS switch annunciation is in NAV, GPS course selection in OBS mode is digital through the use of the controls and display at the KLN 90B. The HSI course control knob must also be set to provide proper course datum to the autopilot if coupled to the KLN 90B in LEG or OBS.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

NOTE

Manual HSI course centering in OBS using the control knob can be difficult, especially at long distances. Centering the dbar can best be accomplished by pressing —D► and then manually setting the HSI pointer to the course value prescribed in the KLN 90B displayed message.

6. GPS approach (GPS APR ARM/ACTV) switch/annunciator - Used to a) manually select or deselect approach ARM (or deselect approach ACTV) and b) annunciate the stage of approach operation either armed (ARM) or activated (ACTV). Sequential button pushes if in ACTV would first result in approach ARM and then approach arm canceled. Subsequent button pushes will cycle between the armed state (if an approach is in the flight plan) and approach arm canceled. Approach ACTV cannot be selected manually. GPS APR and ARM are white. ACTV is green.
7. RMI NAV presentation switch - May be used to select data for presentation on the RMI; either NAV 2 data from the number two navigation receiver, or GPS data from the KLN 90B GPS.

C. PILOT'S DISPLAY

Left/right steering information is presented on the pilot's HSI as a function of the NAV/GPS switch position.

D. AUTOPILOT COUPLED OPERATION

The KLN 90B may be coupled to the autopilot by first selecting GPS on the NAV/GPS switch. Manual selection of the desired track on the pilot's HSI course pointer is required to provide course datum to the autopilot. (Frequent manual course pointer changes may be necessary, such as in the case of flying a DME arc.) The autopilot approach mode (APR) should be used when conducting a coupled GPS approach.

NOTE

Select HDG mode for DME arc intercepts. NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

SECTION 4 - NORMAL PROCEDURES (CONT'D)

E. APPROACH MODE SEQUENCING AND RAIM PREDICTION

NOTE

The special use airspace alert will automatically be disabled prior to flying an instrument approach to reduce the potential for message congestion.

1. Prior to arrival, select a STAR if appropriate from the APT 7 page. Select an approach and an initial approach fix (IAF) from the APT 8 page.

   NOTES

   - Using the right hand outer knob, select the ACT (Active Flight Plan Waypoints) pages. Pull the right hand inner knob out and scroll to the destination airport, then push the inner knob in and select the ACT 7 or ACT 8 page.

   - To delete or replace a SID, STAR or approach, select FPL 0 page. Place the cursor over the name of the procedure, press ENT to change it, or CLR then ENT to delete it.

2. En route, check for RAIM availability at the destination airport ETA on the STA 5 page.

   NOTE

   RAIM must be available at the FAF in order to fly an Instrument approach. Be prepared to terminate the approach upon loss of RAIM.

3. At 30 nm from the FAF:

   a. Verify automatic annunciation of APR ARM.
   b. Note automatic dbar scaling change from ± 5.0nm to ± 1.0 nm over the next 30 seconds.
   c. Update the KLN 90B altimeter baro setting as required.
   d. Internally the KLN 90B will transition from en route to terminal integrity monitoring.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

4. Select Super NAV 5 page to fly the approach procedure.
   a. If receiving radar vectors, or need to fly a procedure turn or holding pattern, fly in OBS until inbound to the FAF.

      NOTE:
      OBS navigation is TO-FROM (like a VOR) without waypoint sequencing.

   b. NoPT routes including DME arc's are flown in LEG. LEG is mandatory from the FAF to the MAP.

      NOTE:
      Select HDG mode for DME arc intercepts. NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

      WARNING:
      Flying final outbound from an off airport vortac on an overlay approach; beware of the DME distance increasing on final approach, and the GPS distance-to-waypoint decreasing, and not matching the numbers on the approach plate!

5. At or before 2 nm from the FAF inbound:
   a. Select the FAF as the active waypoint, if not accomplished already.
   b. Select LEG operation.

6. Approaching the FAF inbound (within 2 nm.):
   a. Verify APR ACTV.
   b. Note automatic dbar scaling change from ± 1.0 nm to ± 0.3 nm over the 2 nm inbound to the FAF.
   c. Internally the KLN 90B will transition from terminal to approach integrity monitoring.

7. Crossing the FAF and APR ACTV is not annunciated:
   a. Do not descend.
   b. Execute missed approach.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

8. Missed Approach:
   a, Climb
   b. Navigate to the MAP (in APR ARM if APR ACTV is not available).

NOTE:
There is no automatic LEG sequencing at the MAP.

c. After climbing in accordance with the published missed approach procedure, press [—D►], verify or change the desired holding fix and press ENT.

GENERAL NOTES

- The data base must be up to date for instrument approach operation.
- Only one approach can be in the flight plan at a time.
- If the destination airport is the active waypoint at the time of the instrument approach selection, the active waypoint will shift automatically to the chosen IAF.
- Checking RAIM prediction for your approach while en route using the STA 5 page is recommended. A self check occurs automatically within 2nm of the FAF. APR ACTV is inhibited without RAIM.
- Data cannot be altered, added to or deleted from the approach procedures contained in the data base. (DME arc intercepts may be relocated along the arc through the SUPER NAV 5 or the FPL 0 pages).
- Some approach waypoints do not appear on the approach plates (including in some instances the FAF)!

SECTION 4 - NORMAL PROCEDURES (CONT'D)

- Waypoint suffixes in the flight plan:

  i - IAF
  f - FAF
  m - MAP
  h - missed approach holding fix.

- The DME arc IAF (arc intercept waypoint) will be a) on your present position radial off the arc VOR when you load the IAF into the flight plan, or b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a current radar vector, bring up the arc IAF waypoint in the SUPER NAV 5 page scanning field or under the cursor on the FPL 0 page, press CLR, then ENT. Fly the arc in LEG. adjust the HSI or CDI course pointer with reference to the desired track value on the SUPER NAV5 page (it will flash to remind you). Left/right dbar information is relative to the arc. Displayed distance is not along the arc but direct to the active waypoint. If desired, select NAV 2 page for digital DME arc distance to and radial from the reference VOR. (The ARC radial is also displayed on the SUPERNAV5 page.)

- The DME arc IAF identifier may be unfamiliar. Example: D098G where 098 stands for the 098° radial off the referenced VOR, and G is the seventh letter in the alphabet indicating a 7 DME arc.

SECTION 4 - NORMAL PROCEDURES (CONT'D

- APR ARM to APR ACTV is automatic provided:

  a. You are in APR ARM (normally automatic).
  b. You are in LEG mode!
  c. The FAF is the active ; waypoint
  d. Within 2 n.m. of the FAF.
  e. Outside of the FAF.
  f. Inbound to the FAF.
  g. RAIM is available.

- Direct-To operation between the FAF and MAP cancels APR ACTV. Fly the missed approach in APR ARM.

- Flagged navigation inside the FAF may usually be restored (not guaranteed) by pressing the GPS APR button changing from ACTV to ARM. Fly the missed approach.

- The instrument approach using the KLN 90B may be essentially automatic starting 30 nm out (with a manual baro setting update) or it may require judicious selection of the OBS and LEG modes.

- APR ARM may be canceled at any time by pressing the GPS APR button. (A subsequent press will reselect it.)

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 Basic Pilot's Operating Handbook.s

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PILOT'S OPERATING HANDBOOK

SUPPLEMENT NO. 4
FOR
KING 150 SERIES FLIGHT CONTROL SYSTEM

This supplement has been DELETED as the FAA Approved Operational Supplement to the Bendix/King 150 Series Flight Control System as installed per STC SA1572CE-D. An approved operational supplement is provided by Bendix/King and will be revised as required by Bendix/King. It is permitted to include the Bendix/King supplement in this location of the Pilots Operating Handbook unless otherwise stated by Bendix/King.

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PIPER MODEL PA-32R-301

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

TABLE OF CONTENTS

King Radio Corporation
Olathe, Kansas 66062
A wholly-owned subsidary of
AlliedSignal Inc.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

PIPER MODEL PA-32R-301
(S/N 3213042 AND UP)

SARATOGA II HP

WITH

BENDIX/KING 100/150 SERIES FLIGHT CONTROL SYSTEM

Reg. No. N9279Q

Ser. No. 3246050

The information contained in this manual is FAA Approved material, along with the FAA Approved Airplane Flight Manual, placards and instrument markings, and is applicable to the operation of the airplane when modified by the installation of the Bendix/King 100/150 Series Automatic Flight Control System as per STC SA1572CE-D.

FAA APPROVED: Chris Durkin

CHRIS DURKIN
DAS Coordinator
King Radio Corporation
DAS4CE

DATE: 6-4-93

SECTION 1 - GENERAL

This manual is provided to acquaint the pilot with the limitations as well as normal and emergency operating procedures of the King 100/150 Series Automatic Flight Control Systems. The limitations presented are pertinent to the operation of the 100/150 System as installed in the Piper Model PA-32R-301 airplane; the Flight Control System must be operated within the limitations herein specified.

The 100 Series AFCS is certified in this airplane with roll axis control only.

The 150 Series AFCS is certified in this airplane with 2 axis autopilot control, pitch and roll.

The KAS 297B vertical speed and altitude selector, when added to a KFC 150 or a KAP 150 Flight Control System provides the pilot with the following features: ability to select vertical speed hold: ability to select, arm and, upon approaching the selected altitude, automatically transfer into Altitude Hold; altitude alerting as specified by F.A.R. 91.51.

The 100 Series AFCS has an optional manual electric pitch trim system.

The 150 Series AFCS has an electric pitch trim system which provides autotrim during autopilot operation and manual electric trim for the pilot. The trim system is designed to withstand any single inflight malfunction. Trim faults are visually and aurally annunciated.

A lockout device prevents autopilot engagement until the system has been successfully preflight tested.

The following conditions will cause the Autopilot to automatically disengage:

A. Power failure.

B. Internal Flight Control System failure.

C. With the KCS 55A Compass System, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged. With the HDG flag present, the autopilot may be re-engaged in the basic wings level mode along with any vertical mode.

D. Roll rates in excess of 14° per second will cause the autopilot to disengage except when the CWS switch is held depressed.

SECTION 1
GENERAL

E. Pitch rates in excess of 8° per second will cause the autopilot to disengage except when the CWS switch is held depressed.

The airplane BATTERY MASTR function is unchanged and can be used in an emergency to shut off electrical power to all flight control systems while the problem is isolated. The alternator must also be shut off.

The RADIO MASTR switch supplies power to the avionics bus bar of the radio circuit breakers and the autopilot circuit breaker.

The following circuit breakers are used to protect the following elements of the King 150 Series Autopilot:

LABEL	FUNCTION
AUTO PILOT	Supplies power to the KC 192, the KC 191, or the KC 190 Computer, the autopilot pitch and roll servos, and the Trim Circuit Breaker. It also applies power to the Optional KAS 297B Altitude/Vertical Speed Selector, when installed.
PITCH TRIM	Supplies power to the Autotrim and Manual Electric Pitch Trim Systems.
COMPASS	Supplies power to the optional KCS 55A Compass System.
ENCODING ALT	Supplies power to the Bendix/King KEA 130A Altimeter, when installed.

SECTION 2 - LIMITATIONS

A. During autopilot operation, a pilot with seat belt fastened must be seated at the left pilot position.

B. The autopilot must be OFF during takeoff and landing.

C. Do not overide the autopilot to change pitch or roll attitude.

D. The system is approved for Category I operation only (Approach mode selected).

E. Autopilot maximum airspeed limitation: 175 KIAS.

F. Autopilot flap limitation: Maximum flap extension 25°.

G. Maximum fuel imbalance with the autopilot engaged: 12 Gallons.

H. Continued autopilot or manual electric trim system use is prohibited following abnormal or malfunctioning operation, and prior to corrective maintenance.

I. The entire preflight test procedure outlined under Section 4, paragraph A of this supplement, including steps 1 through 10, must be successfully completed prior to each flight. Use of the autopilot or manual electric trim system is prohibited prior to completion of these tests.

J. The PITCH TRIM circuit breaker must be pulled following any inflight illumination of the red TRIM warning light, but only after first completing the Emergency Procedures Section 3 paragraph A. The manual electric trim and autopilot autotrim systems will be disabled with the PITCH TRIM circuit breaker pulled.

K. Altitude Select captures below 800 feet AGL are prohibited (when the optional KAS 297B Altitude/Vertical Speed selector is installed).

L. The autopilot must be disengaged below 200 feet AGL during approach operations and below 800 feet AGL for all other phases of flight.

M. The KFC 150/KAP 150 and KAP 100 Flight Control Systems Pilot's Guide, P/N 006-08377-0001 dated July 1990 or later revisions must be immediately available to the pilot whenever the autopilot or manual electric trim are in use.

SECTION 3 - EMERGENCY PROCEDURES

The five step procedure listed under paragraph A should be among the basic airplane emergency procedures that are committed to memory. It is important that the pilot be proficient in accomplishing all five steps without reference to this manual.

A. In case of Autopilot, Autopilot Trim, or Manual Electric Trim malfunction, (accomplish Items 1 and 2 simultaneously):

1. Airplane Control Wheel - **GRASP FIRMLY** and regain aircraft control.
2. **A/P DISC/TRIM INTER** Switch - **PRESS** and **HOLD** throughout recovery.
3. Aircraft - **RETRIM** manually as needed.
4. **PITCH TRIM** Circuit Breaker - **PULL.**
5. **AUTO PILOT** Circuit Breaker - **PULL.**

NOTE

THE **RADIO MASTR** SWITCH MAY BE USED AS AN ALTERNATE MEANS OF REMOVING ALL POWER FROM THE AUTOPILOT AND ELECTRIC TRIM SYSTEMS. IF NECESSARY PERFORM STEPS 1 THROUGH 3 ABOVE, THEN TURN THE **RADIO MASTR** SWITCH **OFF** BEFORE LOCATING AND PULLING THE **AUTO PILOT** AND **PITCH TRIM** CIRCUIT BREAKERS. TURN THE **RADIO MASTR** SWITCH **ON** AS SOON AS POSSIBLE TO RESTORE POWER TO ALL OTHER AVIONICS EQUIPMENT. PRIMARY ATTITUDE, AIRSPEED, SLAVED COMPASS, AND ALTITUDE INSTRUMENTS WILL REMAIN OPERATIONAL AT ALL TIMES.

**************************** **WARNING** ****************************
DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT FOLLOWING AN AUTOPILOT, AUTOTRIM, OR MANUAL ELECTRIC TRIM MALFUNCTION.
****

Maximum Altitude losses due to autopilot malfunction:

Configuration	Alt Loss
Cruise Climb, Descent	300′
Maneuvering	75′
APPR	60′

B. Amplified Emergency Procedures

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

1. An autopilot or autopilot trim malfunction occurs when there is an uncommanded deviation in the airplane flight path or when there is abnormal control wheel or trim wheel motion. In some cases, and especially for autopilot trim, there may be little to no airplane motion, yet the red **TRIM** annunciator may illuminate and an alert tone may sound. The KAP 100 and KAP/KFC 150 autopilots incorporate monitors that detect abnormal airplane motion, therefore, if the airplane for any reason is moved rapidly in pitch or roll the autopilot may be disconnected automatically.

   The main concern in reacting to an autopilot or autopilot trim malfunction, or to an automatic disconnect of the autopilot, is in maintaining control of the airplane. Immediately grasp the control wheel and press and hold down the A/P DISC/TRIM INTER switch throughout the recovery. Manipulate the controls as required to safely maintain operation of the airplane within all of its operating limitations. Elevator trim should be used manually as needed to relieve control forces. Once the airplane has been stabilized the A/P DISC/TRIM INTER switch may be released.

   With the autopilot mode OFF the servo motors are no longer connected to the airplane's flight controls; autopilot trim will also be isolated from the electric trim system. Finally, the AUTO PILOT and PITCH TRIM circuit breakers must be pulled to completely disable these systems.

****************************** WARNING ******************************

DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT FOLLOWING AN AUTOPILOT/AUTOTRIM MALFUNCTION UNTIL CORRECTIVE SERVICE ACTION HAS BEEN PERFORMED ON THE SYSTEM.

****

SECTION 3
EMERGENCY PROCEDURES

2. A manual electric trim malfunction may be recognized by the illumination of a red **TRIM** fail annunciator accompanied by an alert tone, or by unusual trim wheel motions with the autopilot mode OFF without pilot actuation of the manual electric trim switch. As with an autopilot malfunction, the first concern following a manual electric trim malfunction is regaining control of the airplane. Grasp the control wheel firmly and press and hold down the A/P DISC/TRIM INTER switch. For the Piper Model PA-32R-301 airplane, locate and pull the PITCH TRIM and AUTO PILOT circuit breakers (located on the left extreme of the right hand circuit breaker subpanel). The RADIO MASTR switch may be used as required to remove all power from the Autopilot and Electric Trim systems while the circuit breakers are located and pulled. Return the RADIO MASTR switch to the ON position as soon as possible. With the RADIO MASTR switch off, all flight instruments will remain operational; however, communications, navigation, and identification equipment will be inoperable.

****************************** WARNING ******************************
DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT OR TO USE THE MANUAL ELECTRIC TRIM SYSTEM FOLLOWING A MANUAL ELECTRIC TRIM MALFUNCTION UNTIL CORRECTIVE SERVICE ACTION HAS BEEN PERFORMED ON THE SYSTEM.
****

3. Note that the emergency procedure for any malfunction is essentially the same: immediately grasp the control wheel and regain airplane control while pressing and holding the A/P DISC/TRIM INTER switch down, and manually retrim the airplane as needed. After these steps have been accomplished secure the autopilot or electric trim system using the proper switches and circuit breakers. As with any other airplane emergency procedure, it is important that the 5 steps of the Autopilot/Electric Trim Emergency Procedures located on Page 4 of this supplement are committed to memory.

4. It is important that all portions of the autopilot and electric trim system are preflight tested prior to each flight in accordance with the procedures published herein in order to assure their integrity and continued safe operation during flight.

SECTION 4 - NORMAL PROCEDURES

A. Preflight (Perform prior to each flight)

1. **GYROS** - Allow 3-4 minutes for gyros to come up to speed.

2. **RADIO MASTR - ON.**

3. **PREFLIGHT TEST BUTTON - PRESS** momentarily (Wait 5 seconds after power on) and **NOTE:**

   a. All annunciator lights on (**TRIM** annunciator flashing). All legends and digits are displayed on the KAS 297B Altitude/Vertical Speed Selector (if installed).

   b. After approximately 5 seconds, all annunciator lights off except AP which will flash approximately 12 times and then remain off.

   c. Note the aural alert tone sounds along with the flashing AP light.

**************************** WARNING ****************************
IF TRIM WARNING LIGHT STAYS ON THEN THE AUTOTRIM DID NOT PASS PREFLIGHT TEST. MANUAL ELECTRIC TRIM CAN NOT BE USED. WHEN THE KAP/KFC 150 SYSTEM IS INSTALLED THE AUTOPILOT CIRCUIT BREAKER MUST BE PULLED AND THE AUTOPILOT SYSTEM IS NOT OPERATIONAL OR USABLE. WHEN THE KAP 100 SYSTEM WITH THE OPTIONAL MANUAL ELECTRIC TRIM SYSTEM IS INSTALLED, THE PITCH TRIM CIRCUIT BREAKER MUST BE PULLED. THE AUTOPILOT IS STILL OPERATIONAL.
****

4. **MANUAL ELECTRIC TRIM - TEST** as follows:

   a. Actuate left side of split switch unit to the fore and aft positions. The trim wheel should not move on its own. Rotate the trim wheel manually against the engaged clutch to check the pilot's overpower capability.

   b. Actuate right side of split switch unit to the fore and aft positions. Trim wheel should not move on its own and normal trim wheel force is required to move it manually.

   c. Press the **A/P DISC/TRIM INTER** switch down and hold. Manual Electric Trim should not operate either nose up or nose down.

SECTION 4
NORMAL PROCEDURES

5. **FLIGHT DIRECTOR** (KFC 150 ONLY) - **ENGAGE** by pressing **FD** or **CWS** button.

6. **AUTOPILOT** - **ENGAGE** by pressing **AP ENG** button.

7. **CONTROL WHEEL** (KAP 150 AND KFC 150 ONLY) - **HOLD** to keep from moving. Use the vertical trim switch on the Mode Controller to command a pitch **UP**. Observe that the autotrim runs in the nose up direction after approximately four seconds. Depress and hold control wheel steering switch **(CWS)** and verify that autotrim stops; then release vertical trim and **CWS** switches. Use the vertical trim switch on the Mode Controller to command a pitch **DN**. Observe that the autotrim runs in the nose down direction after approximately four seconds. Release Mode Controller vertical trim switch and control wheel.

8. **FLIGHT CONTROLS** - **MOVE** fore, aft, left and right to verify that the autopilot can be overpowered.

9. **AP/DISC/TRIM INTER** Switch - **PRESS**. Verify that the autopilot disconnects and all flight director modes are canceled (KFC 150 ONLY).

10. **TRIM** - **SET** to take off position manually.

B. AUTOPILOT OPERATION

******************************** WARNING ********************************

THE PILOT IN COMMAND MUST CONTINUOUSLY MONITOR THE AUTOPILOT WHEN IT IS ENGAGED, AND BE PREPARED TO DISCONNECT THE AUTOPILOT AND TAKE IMMEDIATE CORRECTIVE ACTION - INCLUDING MANUAL CONTROL OF THE AIRPLANE AND/OR PERFORMANCE OF EMERGENCY PROCEDURES - IF AUTOPILOT OPERATION IS NOT AS EXPECTED OR IF AIRPLANE CONTROL IS NOT MAINTAINED.

DURING ALL AUTOPILOT COUPLED OPERATIONS THE PILOT IN COMMAND MUST USE PROPER AUTOPILOT COMMANDS AND USE THE APPROPRIATE COMBINATION OF ENGINE POWER AND WING FLAPS TO ENSURE THAT THE AIRPLANE DOES NOT STALL, EXCEED 175 KIAS, OR EXCEED OTHER BASIC AIRPLANE OPERATING LIMITATIONS.

****

1. Before takeoff

   A/P DISC/TRIM INTER Switch - **PRESS**.

2. Autopilot Engagement

   a. **FD** Mode Selector Button (KFC 150 ONLY) - **PRESS.**

   b. Verify or set Elevator to place the airplane in a trimmed condition prior to Autopilot engagement.

   AP ENG Button - **PRESS.** Note **AP** annunciator **ON.** If no other modes are selected the autopilot will operate in wings level and pitch attitude hold. (KAP 100 DOES NOT HAVE A PITCH MODE).

**************************** WARNING *****************************
DO NOT HELP THE AUTOPILOT OR HAND-FLY THE AIRPLANE WITH THE AUTOPILOT ENGAGED AS THE AUTOPILOT WILL RUN THE PITCH TRIM TO OPPOSE YOUR CONTROL WHEEL MOVEMENT. A MISTRIM OF THE AIRPLANE, WITH ACCOMPANYING LARGE ELEVATOR CONTROL FORCES, MAY RESULT IF THE PILOT MANIPULATES THE CONTROL WHEEL MANUALLY WHILE THE AUTOPILOT IS ENGAGED. NOT APPLICABLE TO THE KAP 100.
****

3. Climb or Descent (Not applicable for KAP 100 - system may be used for roll control during climb or descent but only roll control is provided. The pilot must manually control the pitch axis.)

   a. Using CWS

      1) **CWS** Button - **PRESS** and **MOVE** aircraft nose to the desired attitude.

      2) **CWS** Button - **RELEASE.** Autopilot will maintain aircraft pitch attitude up to the pitch limits of +15° or -10°.

   b. Using Vertical Trim

      1) **VERTICAL TRIM** Control - **PRESS** either up or down to modify aircraft attitude at a rate of .7 deg/sec up to the pitch limits of +15° or -10°.

      2) **VERTICAL TRIM** Control - **RELEASE** when desired aircraft attitude is reached. The autopilot will maintain the desired pitch attitude.

c. Using Vertical Speed Select (if installed).

Refer to paragraphs E.1 and E.2 on Page 19 for Climb or Descent using the Optional Vertical Speed Selector.

4. Altitude Hold (Not applicable for KAP 100).

a. **ALT** Mode Selector Button - **PRESS**. Note **ALT** mode annunciator **ON**. Autopilot will maintain the selected pressure altitude.

NOTE

IN ACCORDANCE WITH FAA RECOMMENDATION (AC00-24B), USE OF BASIC "PITCH ATTITUDE HOLD" MODE IS RECOMMENDED DURING OPERATION IN SEVERE TURBULENCE.

b. Change selected altitudes

1) Using CWS (recommended for altitude changes greater than 100 ft.)

a) **CWS** Button - **PRESS** and fly aircraft to desired pressure altitude.

b) **CWS** Button - **RELEASE** when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

2) Using Vertical Trim (Recommended for altitude changes less than 100 ft.)

a) **VERTICAL TRIM** Control - **PRESS** either up or down. Vertical Trim will seek an altitude rate of change of about 500 fpm.

b) **VERTICAL TRIM** Control - **RELEASE** when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

5. Heading Changes

a. Manual Heading Changes

1) **CWS** Button - **PRESS** and **MANEUVER** aircraft to the desired heading.

2) **CWS** Button - **RELEASE.** The autopilot will maintain aircraft in wings level attitude.

NOTE

AIRCRAFT HEADING MAY CHANGE IN THE WINGS LEVEL MODE DUE TO AN AIRCRAFT OUT OF TRIM CONDITION.

b. Heading Hold

1) **HEADING** Selector Knob - **SET BUG** to desired heading.

2) **HDG** Mode Selector Button - **PRESS.** Note **HDG** mode annunciator **ON.** Autopilot will automatically turn the aircraft to the selected heading.

c. Command Turns (Heading Hold mode ON)

1) **HEADING** Selector Knob - **MOVE BUG** to the desired heading. Autopilot will automatically turn the aircraft to the new selected heading.

6. NAV Coupling

a. When equipped with HSI.

1) Course Bearing Pointer - **SET** to desired course.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

2) **HEADING** Selector Knob - **SET BUG** to provide desired intercept angle.

3) **NAV** Mode Selector Button - **PRESS.**

SECTION 4
NORMAL PROCEDURES

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with the NAV annunciator flashing; when the computed capture point is reached the HDG will disengage, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate and the capture/ track sequence will automatically begin.

b. When equipped with DG.

1) OBS knob - **SELECT** desired course.

2) **NAV** Mode Selector Button - **PRESS.**

3) **HEADING** Selector Knob - **ROTATE BUG** to agree with **OBS** course.

NOTE

WHEN NAV IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selected) and NAV flashing; when the computed capture point is reached the HDG annunciator will go out, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/track sequence will automatically begin.

7. Approach (**APR**) Coupling

   a. When equipped with HSI.

      1) Course Bearing Pointer - **SET** to desired course.

NOTE

WHEN EQUIPPED WITH NAV1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

      2) Heading Selector Knob - **SET BUG** to provide desired intercept angle.

      3) **APR** Mode Selector Button - **PRESS**.

         a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in **HDG** mode (or wings level if **HDG** not selected) with the **APR** annunciator flashing; when the computed capture point is reached the **HDG** will disengage, the **APR** annunciator will illuminate steady and the selected course will be automatically captured and tracked.

         b) If the D-Bar is less than 2 to 3 dots: the **HDG** mode will disengage upon selecting **APR** mode; the **APR** annunciator will illuminate steady and the capture/ track sequence will automatically begin.

   b. When equipped with DG.

      1) **OBS** knob - **SELECT** desired approach course.

      2) **APR** Mode Selector Button - **PRESS**.

      3) **HEADING** Selector Knob - Rotate Bug to agree with **OBS** course.

SECTION 4
NORMAL PROCEDURES

NOTE

WHEN APR IS SELECTED THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selected) and APR flashing; when the computed capture point is reached the HDG annunciator will go out, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

8. BC Approach Coupling

a. When equipped with HSI.

1) Course Bearing Pointer - **SET** to the ILS front course inbound heading.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE ILS FRONT COURSE INBOUND HEADING.

2) **HEADING** Selector Knob - **SET BUG** to provide desired intercept angle.

3) **BC** Mode Selector Button - **PRESS**.

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in **HDG** mode (or wings level if **HDG** not selected) with **BC** annunciated steady and **APR** annunciator flashing; when the computed capture point is reached the **HDG** will disengage, and the **BC** and **APR** annunciators will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the **HDG** mode will disengage upon selecting **BC** mode; the **APR** **BC** annunciators will illuminate and the capture/track sequence will automatically begin.

b. When equipped with DG.

1) **OBS** knob - **SELECT** the ILS front course inbound heading.

2) BC Mode Selector Button - **PRESS**.

3) Heading Selector Knob - **ROTATE** Bug to the ILS front course inbound heading.

NOTE

WHEN BC IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate **HDG** (unless **HDG** not selected) and **BC** modes with **APR** flashing; when the computed capture point is reached the **HDG** annunciator will go out, the **BC** and **APR** annunciators will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the **HDG** mode will disengage upon selecting **BC** mode; the **BC** and **APR** annunciators will illuminate and the capture/track sequence will automatically begin.

SECTION 4
NORMAL PROCEDURES

9. Glideslope Coupling (Not applicable for KAP 100).

NOTE

GLIDESLOPE COUPLING IS INHIBITED WHEN OPERATING IN **NAV** OR **APR BC** MODES. GLIDESLOPE COUPLING OCCURS AUTOMATICALLY IN THE **APR** MODE.

a. **APR** Mode - **ENGAGED.**

b. At glideslope centering - **NOTE GS** annunciator **ON.**

NOTE

AUTOPILOT CAN CAPTURE GLIDESLOPE FROM ABOVE OR BELOW THE BEAM WHILE OPERATING IN EITHER PITCH ATTITUDE HOLD OR ALT HOLD MODES.

10. Missed Approach

a. **A/P DISC/TRIM INTER** Switch - **PRESS** to disengage AP.

b. **MISSED APPROACH - EXECUTE.**

c. **CWS** Button - **PRESS** (KFC 150 only) as desired to activate FD mode during go-around maneuver.

d. **AP ENG** Button - **PRESS** (If AP operation is desired). Note AP annunciator **ON.**

NOTE

THE KAP 100 ONLY PROVIDES ROLL CONTROL. THE PILOT MUST MANUALLY FLY THE PITCH AXIS.

NOTE

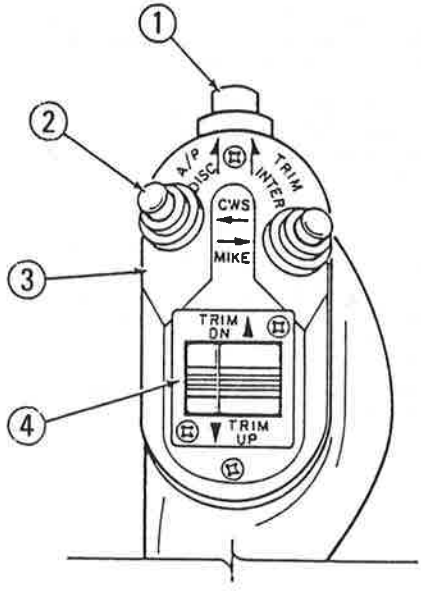
IF IT IS DESIRED TO TRACK THE ILS COURSE OUTBOUND AS PART OF THE MISSED APPROACH PROCEDURE, USE THE NAV MODE TO PREVENT INADVERTANT GS COUPLING.

11. Before Landing

a. **A/P DISC/TRIM INTER** Switch - **PRESS** to disengage **AP.**

SECTION 7 - SYSTEM DESCRIPTION AND OPERATION

Refer to the Pilot's Guide for the Bendix/King KFC 150/KAP 150 and KAP 100 Flight Control Systems P/N 006-08377-0001.



AUTOPILOT CONTROL WHEEL SWITCH CAP

1. AUTOPILOT DISCONNECT/TRIM INTERRUPT (A/P DISC/TRIM INTER) Switch - When depressed will disengage the autopilot and cancel all operating Flight Director modes (if equipped with a Flight Director). When depressed and held will interrupt all electric trim power (stop trim motion), disengage the autopilot and cancel all operating Flight Director modes.

SECTION 7
SYSTEM DESCRIPTION AND OPERATION

2. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the pitch and roll servos) without cancellation of any of the selected modes. Will engage the Flight Director mode if not previously engaged. Automatically synchronizes the Flight Director/Autopilot to the pitch attitude present when the CWS switch is released, or to the present pressure altitude when operating in the ALT hold mode. Will cancel GS couple. The aircraft must pass through the glideslope again to allow GS recouple. When the KAP 100 is installed, only the above comments related to the roll axis are applicable.

3. AUTOPILOT CONTROL WHEEL SWITCH ASSEMBLY - Switch assembly mounted on the pilot's control wheel associated with the autopilot and manual electric trim systems.

4. MANUAL ELECTRIC TRIM CONTROL SWITCHES - A split switch unit in which the left half provides power to engage the trim servo clutch and the right half to control the direction of motion of the trim servo motor. Both halves of the split trim switch must be actuated in order for the manual trim to operate in the desired direction. When the autopilot is engaged, operation of the manual electric trim will automatically disconnect the autopilot.

C. FLIGHT DIRECTOR OPERATION (KFC 150 Systems Only)

The flight director modes of operation are the same as those used for autopilot operations except the autopilot is not engaged and the pilot must maneuver the aircraft to satisfy the flight director commands.

D. KAS 297B VERTICAL SPEED AND ALTITUDE SELECTOR OPERATION (IF INSTALLED)

1. Vertical Speed Select

a. **VERTICAL SPEED SELECT** knob - **PULL** small knob to the **"OUT"** position.

****************************** WARNING ******************************
VERIFY UNIT IS DISPLAYING VERTICAL SPEED SELECT WINDOW PRIOR TO INITIATING ANY CHANGE IN THE SELECTED VERTICAL SPEED VALUE.
****

b. **VERTICAL SPEED SELECT** knob - **ROTATE** until desired vertical speed is displayed.

c. VERTICAL SPEED MODE **(ENG)** button - **PUSH** to engage the Vertical Speed Hold mode.

2. Changing Vertical Speed

a. Using CWS

1) **CWS** Button - **PRESS** and **HOLD.**

2) Airplane - Establish desired vertical speed.

3) **CWS** Button - **RELEASE.**

b. Using Vertical Trim Control

1) **VERTICAL TRIM CONTROL** - **PRESS** either up or down to increase or decrease the vertical speed. Displayed vertical speed changes 100 fpm for every second the control is held down.

SECTION 4
NORMAL PROCEDURES

****************************** WARNING ******************************
WHEN OPERATING AT OR NEAR THE BEST RATE OF CLIMB AIRSPEED AND USING VERTICAL SPEED HOLD, IT IS EASY TO DECELERATE TO AN AIRSPEED ON THE BACK SIDE OF THE POWER CURVE (A DECREASE IN AIRSPEED RESULTS IN A REDUCED RATE OF CLIMB). CONTINUED OPERATION ON THE BACK SIDE OF THE POWER CURVE IN VERTICAL SPEED HOLD MODE WILL RESULT IN A STALL.

WHEN OPERATING AT OR NEAR THE MAXIMUM AUTOPILOT SPEED, IT WILL BE NECESSARY TO REDUCE POWER IN ORDER TO MAINTAIN THE DESIRED RATE OF DESCENT AND NOT EXCEED THE MAXIMUM AUTOPILOT SPEED.
****

3. ALTITUDE PRESELECT

   a. **ALTITUDE SELECT** knob - **PUSH** small knob to the "IN" position.

****************************** WARNING ******************************
VERIFY UNIT IS DISPLAYING ALTITUDE SELECT WINDOW PRIOR TO INITIATING ANY CHANGE IN THE SELECTED ALTITUDE VALUE.
****

   b. **ALTITUDE SELECT** knob - **ROTATE** until the desired altitude is displayed.

   c. ALTITUDE SELECT MODE **(ARM)** button - **PUSH** to arm the Altitude Select Mode.

   d. Airplane - **ESTABLISH THE AIRCRAFT ATTITUDE** necessary to intercept the selected altitude.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

No change from basic Airplane Flight Manual.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 5
FOR
KING KHF-950 HF TRANCEIVER

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional King KHF-950 HF Tranceiver is installed. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED ______________________

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

DATE OF APPROVAL ____AUGUST 30, 1996____

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional King KHF-950 HF Transceiver is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

(a) No baggage aft compartment.

(b) Placards

Located on aft baggage closeout:
No baggage allowed this compartment.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

Normal operating procedures are outlined in the King KHF-950 Pilot's Operating Handbook, P/N 006-8343-0001, latest revision.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the Equipment List attached to the Pilot's Operating Handbook.

UNITED KINGDOM SUPPLEMENT TO PILOT'S OPERATING HANDBOOK

Approved by: ______________________

Peter E. Peck
D.O.A. NO. SO-1
The New Piper Aircraft, Inc.
Vero Beach, Florida USA

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C.A.A. AMENDMENT RECORD SHEET

REV. NO.	REV. DATE	REV. BY	C.A.A. APP	REVISION TITLE	PAGES AFFECTED

F.A.A. AMENDMENT RECORD SHEET

REV. NO.	REV. DATE	REV. BY	C.A.A. APP	REVISION TITLE	PAGES AFFECTED

INTRODUCTION

The data in this supplement must be included in the Pilot's Operating Handbook (P.O.H.) when operating on the United Kingdom register. In cases of conflicting information, the data in this supplement supercedes information published in VB-1614 or VB-1600 (as applicable by aircraft serial number).

LIMITATIONS

Category:

Aircraft of this type are eligible for certification in the Transport Category (Passenger). However, this aeroplane may be restricted to a particular use of some other category, which will be stated in the Certificate of Airworthiness.

Performance:

When certificated in the Transport Category (Passenger) the aeroplane is classified in Performance Group E. It must be operated in accordance with the performance data in the Pilot's Operating Handbook Report VB-1614 or VB-1600 except that autopilot minimum altitudes must be obtained from the information in this supplement. Only figures 5-7 and 5-9 shall be used for take off performance. Short field effect take off performance, figures 5-11 and 5-13 must not be used for public transport flights.

LIMITATIONS (Cont'd.)

Performance (Cont'd.)

For take off operations from short dry grass fields with firm subsoil, increase take off distance by 20%. For take off operations from short wet grass fields, with firm subsoil, increase take off distance by 25%. These factors apply to take off distance to 50 feet - the effect on the ground roll will be greater.

For landing operations from short dry grass fields with firm subsoil, increase landing distance by 20%. For landing operations from short wet grass fields with firm subsoil, increase landing distance by 30%. These factors apply to landing distance from 50 feet. The wind correction grids are factored so that 50% of headwinds and 150% of tailwinds are obtained. The reported winds may, therefore, be used directly in the grids.

Flight Over Water Speed:

The representative cruising true airspeed for flight over water is 155 knots.

Minimum Crew:

The minimum crew is one pilot.

LIMITATIONS (Cont'd.)

Number of Occupants:

The number of persons carried must not exceed six, nor exceed the number of seats installed. Children under the age of 2, carried in the arms of passengers, are excluded from this count.

Climatic Conditions:

The operating suitability of the aeroplane has been established for temperatures up to the range defined by I.S.A. +22° C.

A minimum temperature has not been established.

Type of Operation:

Flying VFR and IFR during day or night is permitted when the required equipment is installed and when allowed by the Air Navigation Regulations.

When flying above 10,000 feet, it is the pilot's responsibility to consider the physical limitations of the pilot and passengers, oxygen equipment required and compliance with all applicable Air Navigation Regulations.

LIMITATIONS (Cont'd.)

Autopilots:

When a Bendix/King 150 series autopilot is installed, it shall ***not*** remain engaged at heights below 1000 feet above the terrain. When coupled to an ILS glide slope, it shall ***not*** remain engaged at heights below 200 ft above the terrain.

Equipment:

Operation of this aircraft is not approved without the following listed equipment installed and operational.

1. Starter Engaged Light
2. Low Voltage Monitor Light

PROCEDURES

Starter Engaged Warning Light:

A "STARTER ENGAGED" warning light is installed on the pilot's side of the instrument panel, This warning light illuminates when the starter switch is engaged and extinguishes when the starter switch is disengaged.

PROCEDURES (Cont'd.)

Starter Engaged Warning Light: (Cont'd)

Should the warning light remain illuminated after the starter switch is disengaged, turn the BATTERY MASTER SWITCH OFF and have the fault corrected before attempting to start the engine.

Low Voltage Monitor Light

Pre Flight Check:

Before Engine Start

Alternator	Off
Battery Master	On
Low Voltage Warn Light	On

Emergency Procedure

Low Voltage Warn Light	On
Alternator (Ammeter)	Check Zero
If Zero, Alternator	Off

PROCEDURES (Cont'd.)

Notes:

A. A landing should be made as soon as possible. Under the alternator failure conditions the battery endurance should be 30 minutes

B. VHF communication transmission should be restricted to maximum of 3 minutes during total flight.

C. Other electrical services may be used at the pilot discretion but the battery endurance will be reduced prorata.

APPENDIX

The following format could be used as suggested in Para 5.2.

AIRCRAFT REGISTRATION

G - ELLA

SUPPLEMENT NO

AIRWORTHINESS NOTICE No 88

A steady/flashing warning light is fitted which will illuminate if the generator/alternator fails and the battery supplies power to the bus bar

Before engine start

Check low volts warning - ON

After engine start

Check low volts warning - OFF

If warning illuminates during flight -

Reduce electrical load -

Battery duration approx ...30.... mins

Land as soon as possible.

NOTE: Warning may illuminate with low engine rpm. Check it goes out when rpm increased.

ASPEN AVIONICS

Aspen Avionics, Inc.
5001 Indian School NE
Albuquerque, NM 87110 USA

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
ASPEN AVIONICS EVOLUTION FLIGHT DISPLAY SYSTEM
EFD1000 PRIMARY FLIGHT DISPLAY
Optionally with
EFD1000 AND/OR EFD500 MULTI-FUNCTION DISPLAYS
or
Aspen Evolution Backup Display

The information contained in this Supplement must be attached to the FAA Approved Airplane Flight Manual or placed with the Pilot's Operating Handbook or other operating information when the Aspen EFD1000 PFD and optionally the Aspen EFD1000 MFD and/or EFD500 MFD are installed in accordance with AML STC SA10822SC. This document must be carried in the aircraft at all times.

The information in this Supplement supplements or supersedes the information in the FAA Approved Airplane Flight Manual or other operating information only as set forth herein.

For limitations, procedures, and performance data not contained in this Supplement, consult the Airplane Flight Manual or other operating information.

Airplane Make: ____________________

Airplane Model: ____________________

Airplane Registration Number: ____________________

Airplane Serial Number: ____________________

FAA APPROVED By: ____________________
Scott A. Horn
Manager, Fort Worth Aircraft Certification Office, ASW-140
Fort Worth, Texas 76177

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DOCUMENT REVISIONS FAA APPROVED PAGES

Document Revision	FAA Approved Pages Revised	Description of Change	FAA Approval Date	ECO
Earlier revisions are on file				
W	All	Complete Rewrite, added ADS-B Integration	2/20/2015	4258
Y	All	Updated based on FAA comments. Added AOA Functionality.	None	4502
Z	All	Addressed FAA Comments.	17JUL2015	4525
AA	All	Removed references to Pilot Guides from the Limitations Section and added references to the Pilot Guides in the Systems Description section. Updated Copyright to 2016. Added the EBD Model. Added GDL 88 integration information.	None	4712
AB	All	Added caution into Sections 7.9 & 7.11.		4732

Prepared By:	Penny Heinz	*Reviewed By:*	David Bibby	**See ECO Record For Release Authorization**

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TABLE OF TABLES

1 General

1.1 System Overview

The Evolution Flight Display System consists of one or more integrated Electronic Flight Display (EFD1000 or EFD500) systems. The EFD1000 system can be configured as a primary flight display (PFD) or as a multi-function display (MFD) and the EFD500 system can only be configured as a MFD.

When the EFD1000 is configured as a PFD, the EFD1000 provides display of attitude, airspeed, altitude, vertical speed, turn rate, slip/skid and direction of flight. Depending on the optional equipment connected to the EFD 1000 and the PFD version, the system can also provide display of lateral and vertical navigation deviations, flight director commands, synthetic vision, weather information, traffic information, and several other features. The following PFD versions are supported on the EFD1000: PFD PRO, PFD PRO C3, PFD VFR, PFD PILOT, PFD EBD Advanced and PFD EBD Basic.

When the EFD1000 is configured as an MFD, the EFD1000 provides navigation and weather information, terrain and obstacle data, and traffic information that can be displayed on a moving map. The EFD1000 MFD also provides PFD reversion capability, synthetic vision, terminal procedure charts, a secondary display of attitude, airspeed, and altitude, and several other features depending on the optional equipment that is connected to the EFD1000.

The EFD500 MFD provides all of the features of the EFD1000 MFD except for PFD reversion capability and a secondary display of attitude, airspeed and altitude.

1.2 Installed Equipment List

Table 1 shows the list of Aspen Equipment installed in this aircraft. Use the table to determine the parts of the AFMS that are applicable to this aircraft.

Table 1 - Installed Equipment List

Installed Equipment	EFD1000 PFD PRO -or- EFD1000 PFD EBD Advanced	EFD1000 PFD PRO C3	EFD1000 PFD PILOT -or- EFD1000 PFD EBD Basic	EFD1000 PFD VFR	EFD1000 MFD	EFD500 MFD	Remarks
N/A = Not Available							
Evolution Flight Display System with Internal Battery Software Version (MAP \ IOP)							
Evolution Flight Display System with Emergency Backup Battery (EBB) Software Version (MAP \ IOP)		N/A		N/A		N/A	
RSM with GPS						N/A	
RSM without GPS						N/A	
Angle of Attack (AOA) System		N/A					

Installed Equipment	EFD1000 PFD PRO -or- EFD1000 PFD EBD Advanced	EFD1000 PFD PRO C3	EFD1000 PFD PILOT -or- EFD1000 PFD EBD Basic	EFD1000 PFD VFR	EFD1000 MFD	EFD500 MFD	Remarks
ADS-B OUT integrated with the Aspen PFD		N/A	N/A		N/A	N/A	ADS-B OUT Make and Model:
ADS-B IN Traffic Interface without TCAS 1 or TAS incorporated		N/A	N/A				ADS-B IN Traffic Interface Make and Model:
Conflict Situational Awareness- traffic alerting (CSA)		N/A	N/A				GDL88 integration only
ADS-B IN Traffic Interface with TCAS I incorporated		N/A	N/A				ADS-B IN Traffic Interface Make and Model:
ADS-B IN Traffic Interface with TAS Incorporated		N/A	N/A				ADS-B IN Traffic Interface Make and Model:
TCAS I Traffic Interface			N/A				
TAS Traffic Interface			N/A				
TIS-A Traffic Interface			N/A				
XM Datalink Weather Interface (EWR50)		N/A	N/A				
ADS-B IN (FIS-B) Weather Interface		N/A	N/A				ADS-B IN (FIS-B) Weather Interface Make and Model:
L3 Stormscope® Interface (STRK)		N/A	N/A				
Terminal Procedure Charts	N/A	N/A	N/A	N/A			Requires a database.
MFD NAV Map	N/A	N/A	N/A	N/A	√	√	Requires a database.
EA100 Autopilot AHRS Software Version			N/A			N/A	
Evolution Synthetic Vision and the Aspen Terrain Warning System (TWS)		N/A	N/A	N/A			Requires a database.
10-Hour Evolution Synthetic Vision Demo and the Aspen Terrain Warning System (TWS)		N/A	N/A	N/A	N/A	N/A	Only enabled for a trial period. Acknowledgment page shows the status of the trial period. Requires a database.
Audible alerts for the Aspen Terrain Warning System (TWS)			N/A	N/A	N/A	N/A	Audible alerts are only available if TAWS is not installed.
Aspen Connected Gateway (CG100) Software Version	N/A	N/A	N/A	N/A			Not authorized for EASA-registered aircraft.

Installed Equipment	EFD1000 PFD PRO -or- EFD1000 PFD EBD Advanced	EFD1000 PFD PRO C3	EFD1000 PFD PILOT -or- EFD1000 PFD EBD Basic	EFD1000 PFD VFR	EFD1000 MFD	EFD500 MFD	Remarks
Radar Altitude Numeric Display Input			N/A	N/A		N/A	
Radar Altitude Decision Height Input			N/A	N/A		N/A	
ADF1 Interface			N/A	N/A		N/A	
ADF2 Interface			N/A	N/A		N/A	
VHF1 (VLOC1) Navigation Radio Interface			N/A			N/A	
VHF2 (VLOC2) Navigation Radio Interface			N/A			N/A	
GPS1 Interface							GPS Make and Model:
GPS2 Interface			N/A				GPS Make and Model:
Altitude Pre-selector Function			N/A		N/A	N/A	
A/P Source Select			N/A	N/A		N/A	

Table 2 is used to identify the backup equipment applicable to this aircraft's installation. This table is completed during installation by the installation facility.

Table 2 - Backup Instruments Configuration for the PFD PRO, PFD PRO C3, PFD PILOT or PFD VFR

Model of backup Attitude Indicator in this aircraft:	
Type of Standby Airspeed Indicator in this aircraft: (EFD1000 MFD with EBB or Mechanical Airspeed Indicator) *	
Type of Standby Altimeter in this aircraft: (EFD1000 MFD with EBB or Mechanical Altimeter) *	

*An EFD1000 MFD connected to an EBB is required unless a standby mechanical Airspeed indicator and standby Altimeter are installed.

1.3 List of Acronyms and Abbreviations

A........ Alert
A/P .... Autopilot
ACU .... Analog Converter Unit
ADAHRS .... Air Data Attitude Heading Reference System
ADF .... Automatic Direction Finder
ADS-B .... Automatic Dependent Surveillance- Broadcast
AHRS .... Attitude Heading Reference System
AFM .... Airplane Flight Manual
AFMS .... Airplane Flight Manual Supplement
AGL .... Above Ground Level
AIR .... AIRMET
AIRMET .... Airmen's Meteorological Information
AML .... Approved Model List
AMMD .... Aerodrome Moving Map Display
ANT .... Antenna
AOA .... Angle of Attack
APPR .... Approach
ASPEN GTWY .... See GTWY
BARO .... Barometric Pressure Setting
BAT .... Battery
C........ Caution
C3 .... Class III
CG100 .... Connected Gateway remote LRU
CHG .... Change
CM .... Configuration Module
CNUS .... Continental United States
Config........ Configuration
CSA........ Conflict Situational Awareness -traffic alerting
CTL .... Control
CWS........ (autopilot) Control Wheel Steering
DH........ Decision Height
DISC .... Disconnect
EA .... Evolution Adapter
EASA .... European Aviation Safety Agency
EBB........ Emergency Backup Battery
EBD........ Evolution Backup Display
ECO .... Engineering Change Order
EFB .... Electronic Flight Bag
EFD........ Evolution Flight Display
EFIS .... Electronic Flight Instrument System
EMER........ Emergency
EOC .... Executable Object Code
ESV........ Evolution Synthetic Vision
EWR........ Evolution Weather Receiver
EXT PWR........ External Power
FAA .... Federal Aviation Administration
FIS-B........ Flight Information Service- Broadcast
FPL .... Flight Plan
FPM .... Flight Path Marker
Ft. .... Fort
FOV........ Field of View
GEO-REFERENCED........ Chart scaling that permits ownship depiction
GTWY .... Aspen Connected Gateway, including the CG100
GPS .... Global Positioning System
GPSS .... GPS Steering

HDG	Heading
HORZ	Horizontal
HSI	Horizontal Situation Indicator
IAS	Indicated Airspeed
ID	Identification
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
Inc.	Incorporated
INIT	Initialization
INTEG	Integrity
IOP	Input-Output Processor
JSUM	Jeppesen Services Update Manager
KIAS	Knots Indicated Airspeed
KOEL	Kinds of Operations Equipment List
L3	L3 Communications
LRU	Line replaceable Unit
LTNG	Lightning
LOC	Localizer
MAP	Main Application Processor
MEMS	Micro Electromechanical Systems
MFD	Multi-Function Display
MIC	Microphone
MIN	Minimums
MSG	Message
N/A	Not Applicable
NACO	National Aeronautical Charting Office
NAV	Navigation
NAVAIDS	Navigational Aids
NE	Northeast
NEXRAD	Next Generation Radar
NM	New Mexico
NORM	Normal
NOTAM	Notices To Airmen
NXRD	NEXRAD
OAT	Outside Air Temperature
PFD	Primary Flight Display
POM	Pitot Obstruction Monitor
POS	Position
PRESEL	Altitude Preselect
RA	Radar Altitude
REV	Reversion
RGNL	Regional
RMVD	Removed
RSM	Remote Sensor Module
SAI	Secondary Attitude Indicator
SDHC	Secure Digital, High-Capacity
SHSI	Secondary Horizontal Situation Indicator
SID	Standard Instrument Departure
SIG	SIGMET
SIGMET	Significant Meteorological Information
STAR	Standard Terminal Arrival Route
STC	Supplemental Type Certificate
STRK	Strikes (Stormscope)
SV	Synthetic Vision
TAS	True Airspeed
TAS	Traffic Advisory System
TCAS	Traffic and Collision Avoidance System

b. When the cabin temperature is below -20°C, takeoff is NOT AUTHORIZED.

c. When the "ON BAT" annunciation is shown on any EFD display, takeoff is NOT AUTHORIZED.

d. Barometric pressure must be set on the EBD.

2.3 EFD1000 and EFD500 MFD System Limitations

1. Maneuvering based solely on the EFD1000 terrain and obstacle depiction is not authorized.
2. For the Evolution **Synthetic Vision** option, the following limitations apply:
   a. Obstacles on the Synthetic Vision display can be concealed by overlaid indicators such as AOA.
   b. Navigation or maneuvering based solely on the EFD1000 or MFD500 Synthetic Vision background display and associated Terrain Warning System (TWS) is not authorized.
   c. Barometric pressure must be set accurately for proper operation.
   d. Cold temperatures affect the accuracy of the SV system.
3. The moving map displays are not a substitute for approved maps or charts required by the operating rules.
4. The RSM GPS is limited to EMERGENCY USE ONLY.
5. Barometric pressure must be set accurately for proper terrain depiction.
6. Cold temperatures affect the accuracy of the terrain depiction.
7. When the EFD1000 MFD is used as the **backup altimeter and/or airspeed indicator** (see Table 2), the following limitations apply:
   a. When the EBB charge status is less than 80% or has failed, takeoff is NOT AUTHORIZED.
   b. When the cabin temperature is below -20°C, takeoff is NOT AUTHORIZED.
   c. When the "ON BAT" annunciation is shown on any EFD display, takeoff is NOT AUTHORIZED.
8. For **Traffic and Weather** options, the following limitations apply:
   a. Maneuvering based solely on the traffic display is not authorized.
   b. XM Weather information is supplemental to data available from official sources.
   c. NEXRAD data is limited to the contiguous United States.
   d. FIS-B information is to be used for pilot planning decisions and pilot near-term decisions focused on avoiding areas of inclement weather that are beyond visual range or where poor visibility precludes visual acquisition of inclement weather.
   e. FIS-B information, including, weather information, NOTAMs, and TFR areas, are intended for the sole purpose of assisting in long- and near-term planning decision making. The system lacks sufficient resolution and updating capability necessary for aerial maneuvering associated with immediate decisions.
9. For the **Terminal Procedure Charts** option, the following limitations apply:
   a. The aircraft ownship position presented on the Airport Diagrams and Terminal Procedures charts may be inaccurate – reference to ownship position for navigation or maneuvering is prohibited.
   b. Except as provided for by regulation, the Terminal Procedures Charts depictions on the EFD are not substitutes for aeronautical charts required to be carried aboard the

TERR .... Terrain
TFR .... Temporary Flight Restriction
TIS .... Traffic Information System
TWS .... Terrain Warning System
TFC .... Traffic
TFCA .... Traffic altitude filter "Above"
TFCB .... Traffic altitude filter "Below"
TFCN .... Traffic altitude filter "Normal"
TFCU .... Traffic altitude filter "Unrestricted"
TRFC .... Traffic
UAT .... Universal Access Transceiver
UNAV .... Unavailable
V .... Volts
VECT .... Vector
VFR .... Visual Flight Rules
VHF .... Very High Frequency
VMC .... Visual Meteorological Conditions
VOR .... VHF Omni-directional Radio Range
VLOC .... VOR / Localizer
W .... Warning
WPT .... Waypoint
XFILL .... Cross fill
XM .... XM Satellite-based weather information

2 Limitations

The following limitations pertain to the installed equipment in the aircraft. See Table 1 for the list of installed equipment in this aircraft.

2.1 Kinds of Operation for the PFD PRO, PFD PRO C3, PFD PILOT or PFD VFR

This is a list of installed Aspen equipment that affects flight operations. This list does not preclude any approved Minimum Equipment List or other equipment required by regulation.

See the aircraft placard located on the flight deck to determine if this aircraft is authorized for Day, Night, VFR or IFR.

At minimum, one vertical column of equipment must be operational for flight. See Table 1 for the equipment installed in this aircraft:

Example: There is a placard in clear view of the pilot that specifies the kind of operations to which the operation of the airplane is limited or from which it is prohibited. If the placard shows authorization for IFR and the aircraft has an operational EFD1000 PFD and EFD1000 MFD, Magnetic Compass, Standby Altimeter, Standby Airspeed Indicator and IFR GPS (Configuration 2), and the aircraft has all the other equipment and certifications required by regulation, the aircraft is qualified for IFR flight.

Table 3 - Minimum Equipment Required for a Flight Operation

	Day VFR	Day/ Night VFR	Day/ Night VFR	IFR Config. 1	IFR Config. 2	IFR Config. 3
EFD1000 PFD (includes PRO, VFR or PILOT)	✓	✓		✓	✓	✓
EFD1000 MFD with EBB		✓		✓		
EFD1000 MFD with Internal Battery					✓	
Magnetic Compass	✓	✓	✓	✓	✓	✓
Standby Attitude Indicator				✓	✓	✓
Standby Airspeed Indicator			✓		✓	✓
Standby Altimeter			✓		✓	✓
IFR Approved GPS				✓	✓	

2.2 EFD1000 PFD System Limitations

1. The moving map display is not a substitute for approved maps or charts required by the operating rules.
2. For the Evolution **Synthetic Vision** option, the following limitations apply:
   a. Maneuvering based solely on the EFD1000 terrain and obstacle depiction is not authorized.
   b. Obstacles on the Synthetic Vision display can be concealed by overlaid indicators such as AOA.
   c. Navigation or maneuvering based solely on the EFD1000 Synthetic Vision background display and associated Terrain Warning System (TWS) is not authorized.
   d. Barometric pressure must be set accurately for proper operation.

aircraft. This function does not replace any system or equipment required by the regulations.

10. For the **Aspen CG100 Connected Gateway (CG100)** option, the following limitations apply:
    a. The Flight Plan Review Map is not to be used for navigation.
    b. The pilot must verify that the flight plan as shown on the MFD is correct and authorized before sending the flight plan to the navigator(s).
    c. The Aspen GTWY and the associated applications on the wireless portable device are only to be used as intended by Aspen Avionics. Any manipulation of the system or unauthorized access is prohibited.
11. For the **AOA SYSTEM**, the following limitations apply:
    a. The AOA system is non-required and is to be used only as supplemental information to show the stall margin and trend toward stall. The AOA system is not a substitute for the certified aircraft stall warning system.
    b. Airspeed failure or erroneous airspeed will result in erroneous AOA indications.
    c. No operational credit may be taken for such items as reduced approach speed and shorter landing distances.
    d. The AOA indications are not to be used for takeoff reference.
    e. The AOA indications are not valid when the wings or empennage are frost or ice-contaminated.
    f. The AOA indications are not valid when spoilers or speed brakes are deployed.

2.4 Placards

1. When the EBB is installed, the following placard must be installed in full view of the pilot:

EMER BAT DISPATCH LIMIT 80% SEE EFD AFMS

2. When the EA100 is installed, the following placard must be installed in full view of the pilot:

A/P AHRS FAIL

3. When the EFD1000 VFR PFD is installed, the following placard must be installed in full view of the pilot:

No Vertical Deviation on PFD

4. During initialization of the EFD1000 MFD and EFD500 MFD, the following electronic placard is displayed if Synthetic Vision and instrument procedure charts are configured:

> **CAUTION:**
> Synthetic Vision information and terrain information are for awareness Only. Do not maneuver based solely on this Information.
>
> The aircraft ownship position presented on Instrument Procedure Charts and Airport Diagrams may be inaccurate - reference to ownship position for navigation or maneuvering is prohibited.

5. During initialization of the EFD1000 PFD, the following electronic placard is displayed if Synthetic Vision is configured:

> **CAUTION:**
> Synthetic Vision information and terrain information are for awareness Only. Do not maneuver based solely on this Information.

6. When the Aspen Synthetic Vision Demo is configured and the trial period is not expired, the following electronic placard is displayed:

> **CAUTION:**
> Aspen Synthetic Vision Demo
> Time Remaining: ## Hours ## Minutes
>
> Synthetic Vision information and Terrain information are for awareness Only. Do not maneuver based solely on this Information.

7. When the Aspen Synthetic Vision Demo is configured and the trial period has expired, the following electronic placard is displayed:

> **CAUTION:**
> Aspen Synthetic Vision Demo has Expired
> To Re-Enable SV, See your Authorized Dealer

8. During initialization of the EFD1000 PFD and EFD1000/500 MFD, the following electronic placard is displayed if the AOA System is configured:

> **CAUTION:**
> The AOA Indicator is not for use as a primary instrument for flight.

3 Emergency/Abnormal Procedures

3.1 Emergency Procedures

No Change to the aircraft procedures.

3.2 Abnormal Procedures

3.2.1 Pitot Tube Icing resulting in Attitude Indicator Failure and Erroneous Airspeed indication

1. PITOT HEAT..ON
2. AUTOPILOT ....DISCONNECT
3. ATTITUDE ....Maintain attitude by reference to standby sources of Attitude
4. Consider Exiting IMC

3.2.2 "ON BAT" Annunciation

The "ON BAT annunciation is an indication that the alternator or generator has failed.

1. Aircraft Electrical Power ....Follow AFM Procedures to Restore Power. If unable to restore the alternator or generator, proceed as follows:
2. EFD1000/500 Circuit Breaker / Switch.....Pull / Open (turn off) for each Display
3. Press MENU then turn the Left knob........Reduce the Display brightness to the lowest practical brightness to conserve battery energy.
4. Exit IMC as soon as practical.

NOTE:
The duration of the internal battery system (at 99% remaining) is less than 30 minutes. The duration of the Emergency Backup Battery (at 99% remaining) is more than 30 minutes.

CAUTION:
When the EFD is operated until its battery is exhausted, the screen may fade to solid white for several seconds before blanking. To avoid this condition at night, manually turn off the EFD once the display shows 0% battery remaining.

3.2.3 EFD1000 MFD reversion to a PFD

1. Autopilot...DISCONNECT
2. EFD1000 MFD REV Button.........................MOMENTARY PRESS to show the Reversionary PFD Display
3. REVERSIONARY PFD Display................Select XFILL as desired
4. BARO SETTING.......................................Verify
5. A/P Source Select (if installed).................MFD
6. Autopilot..CONNECT AS DESIRED

NOTE:
The altitude level-off alert tone, altitude deviation alert tone and synthetic vision caution and warning tones are not available on a reversionary PFD

3.2.4 Attitude and Heading (AHRS) Reset

1. AUTOPILOT .... MANUALLY DISCONNECT
2. MENU .... Select the first page, titled "GENERAL SETTINGS"
3. "AHRS: RESET?" LINE SELECT KEY .... PRESS
4. "AHRS: RESET?" LINE SELECT KEY .... PRESS AGAIN TO CONFIRM RESET

3.2.5 Turn Off the EFD in Flight

EFD1000 MFD (with EBB), EFD1000 PFD EBD Advanced or EFD1000 PFD EBD Basic

1. EFD (Aspen) Circuit Breaker / Switch .... PULL / OFF
2. EBB Disconnect Switch .... DISC

EFD1000/500 PFD or MFD with Internal Battery

1. EFD Circuit Breaker / Switch .... PULL / OFF
2. REV Button .... Push and hold until the display turns off

3.2.6 Continuous EFD1000 or EFD500 System Reset (does not apply to C3 PFD)

In the event of a condition that causes the system to continually reset, proceed as follows:

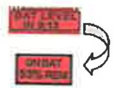
1. REMOVE THE DATABASE CARD .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:
2. TURN OFF THE Aspen GTWY SWITCH. PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:
3. PULL THE ADS-B CIRCUIT BREAKER .... PERMIT THE SYSTEM TO REINITIALIZE If the condition persists, then:
4. PULL THE XM WEATHER CIRCUIT BREAKER .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:
5. PULL THE STORMSCOPE CIRCUIT BREAKER .... PERMIT THE SYSTEM TO REINITIALIZE.

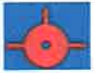
3.3 Warnings, Cautions and Advisories

The following table shows the Warning, Caution and Advisory indication on the EFD1000 and EFD500 and identifies the appropriate pilot action. Several Warning, Caution and Advisory messages are dependent on the options and equipment installed in the airplane. Refer to Table 1 to determine the options and equipment installed in this airplane.

Table 4 - Warning, Caution and Advisory Annunciations

Warning **W** Caution **C** Advisory **A**

	Applies to: EFD1000 PFD PRO C3	EFD1000 PFD PRO -or- EFD1000 PFD EBD Advanced	EFD 1000 VFR	EFD1000 PFD PILOT -or- EBD1000 PFD EBD Basic	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD	Annunciation	Description	Pilot Action
W	✓	✓	✓	✓	✓	✓	✓		Presented whenever the EFD1000 is operating on the internal battery or EBB. The countdown timer appears first, and is then replaced by the ON BAT and % charge annunciation	Reduce the screen brightness to maximize battery duration. See Section 3.2.2 "ON BAT" Annunciation.
W	✓	✓	✓	✓	✓	✓		 	Attitude and Heading indications have failed.	Use standby instruments for attitude reference. Perform AHRS Reset if practical.
W	✓	✓	✓	✓	✓	✓		 	Red chevrons displayed on the Attitude Indicator's pitch scale to indicate extreme pitch up and down attitudes.	Pitch the aircraft in the direction of the chevrons to restore level flight.

W		✓			✓	✓	✓		Synthetic Vision Flight Path marker. Terrain or obstacle conflict within 30 seconds.	Avoid the terrain or obstacle.
W	✓	✓			✓			RA	Radar Altitude Failed	Use alternate means for altitude determination.
W		✓			✓	✓	✓	 Or 	Synthetic Vision system terrain or obstacle conflict within 30 seconds.	Avoid the terrain or obstacle.
W	✓	✓	✓		✓	✓	✓	MAP SW 2.6 and earlier: ~~LTNG~~ ~~NXRD~~ ~~TRFC~~ MAP SW 2.7.2 and later: ~~LTNG~~ ~~NXRD~~ MAP SW 2.7.2: ~~TRFC~~ MAP SW 2.8 and later: ~~TFC~~	XM Weather or Traffic Failure	Use an alternate weather information source Increase vigilance for traffic.
W		✓	✓		✓	✓	✓	~~RGNL~~ ~~CNUS~~	Regional or CONUS NEXRAD data is not valid	Use an alternate weather information source.
W						✓	✓	~~ACE~~	METAR Data is not valid	Use an alternate weather information source.

W		✓	✓		✓	✓	✓	MAP SW 2.6 and earlier ~~+RATE~~ MAP SW 2.7 and later ~~+RATE~~	Stormscope (STRK) has failed.	No action. Avoid thunderstorms.
W	✓	✓	✓		✓			~~LOC1~~ ~~↑VOR1~~	The navigation source is not available.	Use an alternate navigation source
W	✓	✓	✓		✓	✓		~~GPS1~~	The navigation source is not available.	Use an alternate navigation source.
W						✓	✓	AOA FAIL	The Angle Of Attack System has failed.	No Action- The AOA is unusable.
W		✓	✓	✓	✓			~~AOA~~	The Angle Of Attack System has failed	No Action – The AOA is unusable. The AOA indication can be removed using the menu.
C								**Panel Mounted Indicator Lamp** **A/P AHRS Fail** or A/P AHRS FAIL	The attitude system provided to the autopilot has failed.	Fly manually. The autopilot will disconnect and cannot be re-engaged.
C	✓	✓	✓	✓	✓	✓		CROSS CHECK ATTITUDE	Attitude indication could be degraded.	Cross check attitude, airspeed and altitude indications against alternate sources.

C						✓		ADAHRS FAIL	MFD Attitude failure.	No immediate action. MFD reversion is not available.
C						✓		CHECK AHRS	MFD attitude could be degraded.	No immediate action. MFD reversion attitude indicator could be degraded.
C						✓	✓	CROSS LINK FAILURE	No communication between PFD and MFD(s).	Barometric pressure must be set on PFD and MFD.
C						✓	✓	(HDG FAIL)	Failed heading on the MFD	No immediate action. MFD Heading up map orientation is not available, reverts to track-up. Fails Strikes (Stormscope) system.
C	✓	✓	✓	✓	✓	✓		CHECK PITOT HEAT	Possible Pitot Obstruction. Accompanied by Red X attitude and heading.	Use an alternate attitude and heading source. Turn on Pitot Heat to clear the condition if icing is the cause.
C	✓	✓	✓	✓	✓	✓	✓	GPS1 GPS2 RSM GPS GPS1 REVERSION GPS2 REVERSION RSM GPS REVERSION EMER USE ONLY	GPS Invalid indications	Select an operational GPS or alternate navigation.
C		✓			✓	✓	✓		Synthetic Vision Flight Path marker. Terrain or obstacle conflict within 45 seconds.	Avoid the terrain or obstacle.

C		✓			✓	✓	✓	CAUTION – TERRAIN, TERRAIN CAUTION - OBSTACLE, OBSTACLE	Synthetic Vision system terrain or obstacle conflict within 45 seconds.	Avoid the terrain or obstacle.
C						✓	✓	GPS POS FAILED	NAV and Terrain Map indication when of all Navigation GPS devices have failed.	No immediate action. NAV and terrain maps no longer move with the aircraft.
C	✓	✓	✓	✓	✓	✓		INTEG	GPS Integrity indication	The GPS in use is degraded. See the applicable GPS AFMS for more information.
C	✓	✓			✓			MIN 10010	The aircraft has reached or is below the set MINIMUMS. Accompanied by a one-second stuttered tone when the optional tone generator is installed.	Pilot action is based on the reason the minimums setting was enabled.
C	✓	✓	✓	✓	✓			9940	The aircraft has reached (steady) or deviated from (flashing) the selected altitude. Accompanied by a one-second steady tone when the optional tone generator is installed.	Pilot action is based on the reason the altitude alerting setting was enabled.
C	✓	✓			✓			DH	The optional radar altimeter Decision height input indicates the aircraft is at or below the radar altitude set by the pilot.	Pilot action is based on the reason the DH was set on the radar altimeter.

C	✓	✓	✓		✓			 GPSS	Indicates the GPSS source is invalid (e.g. the flight plan was deleted) or a different GPS was selected by the pilot. The autopilot will fly wings-level until valid GPSS signal is available and GPSS is re-engaged.	No immediate action. Select a new flight plan to permit GPSS re-engagement.
C						✓	✓	TERRAIN FAIL	The dedicated terrain display Is unusable.	No immediate action.
C		✓			✓	✓	✓	TRAFFIC 	Traffic Alert. TFC is shown instead of TRFC for MAP SW 2.8 and later.	See and avoid the traffic. Press TRFC (lower center button) to display a plan view of the traffic.
C	✓	✓	✓		✓	✓	✓	MAP SW 2.7.2 and earlier: TRFC UNAV MAP SW 2.8 and later: TFC UNAV	TIS-A option: Traffic data is unavailable.	No immediate action. See and avoid traffic.
C	✓	✓	✓		✓	✓	✓	MAP SW 2.7.2 and earlier: MAP SW 2.8 and later: TFC RMVD	TIS-A option: Traffic was removed. The PFD does not display the AGE.	No immediate action. See and avoid traffic.
C						✓	✓	MAP SW 2.7.2 and earlier: TRFC FAIL MAP SW 2.8 and later: TFC FAIL	TIS-A option: Traffic sensor failure.	No immediate action. See and avoid traffic.

C		✓	✓					UAT LINK	ADS-B OUT: The UAT link between the ADS-B system and the PFD has failed. This message can only be presented when integrated with the Aspen or FreeFlight ADS-B OUT System.	No immediate action.
C		✓	✓					UAT POS	ADS-B OUT: The UAT position source has failed. This message can only be presented when integrated with the Aspen or FreeFlight ADS-B OUT System.	No immediate action.
C		✓	✓					UAT FAIL	ADS-B OUT: The UAT transmitter has failed. This message can only be presented when integrated with the Aspen or FreeFlight ADS-B OUT System.	No immediate action.
C						✓	✓	TFC DEGRADED	No ADS-B Traffic data uplinked from the ground or GDL 88 is in Standby.	No immediate action. See and avoid traffic.
C		✓	✓		✓	✓	✓	TFC	No ADS-B Traffic data uplinked from the ground or GDL 88 is in Standby.	No immediate action. See and avoid traffic.
C		✓	✓		✓	✓	✓	CSA FAIL	Conflict Situational Awareness -traffic alerting is inoperative. GDL 88 integration only.	Traffic alerting is not provided. See and avoid traffic.
C						✓	✓	FAIL	Stormscope Option: Sensor has failed.	No immediate action. Use an alternate means to detect thunderstorms.
C						✓	✓	ERROR	Stormscope Option: Sensor has failed.	No immediate action. Use an alternate means to detect thunderstorms.

C		✓	✓		✓	✓	✓	NXRD : LTNG : SIG : AIR : AGE : TFR :	XM Datalink weather product data not received.	No immediate action. Use alternate means to acquire weather and TFR information.
C		✓	✓		✓	✓	✓	RGNL :	ADS-B Datalink weather product data not received.	No immediate action. Use alternate means to acquire weather and TFR information.
C						✓	✓	CNUS : AGE :	ADS-B Datalink weather product data not received.	No immediate action. Use alternate means to acquire weather and TFR information.
C	✓	✓	✓	✓	✓	✓			Annunciation presented on the HSI whenever the HSI compass card is no longer receiving magnetic corrections. After 6 minutes of free gyro operation the attitude and heading solutions will be removed.	No immediate action. Expect attitude loss after six minutes.
C	✓	✓	✓	✓	✓	✓	✓		Annunciation presented in the menus when the connected EFD battery is not detected or failed	No immediate action. The EFD display will not be available in the event of an aircraft power loss. If the MFD is used for backup altimeter and/or airspeed indicator, takeoff is not authorized. See Section 2.3.

C		✓	✓	✓	✓	✓	✓		When the Upper Pointer points in the yellow/black band, stall is imminent in the Flaps Up configuration.	Reduce the Angle of Attack.
C		✓	✓	✓	✓	✓	✓		When the Lower Pointer points in the yellow/black band, stall is imminent in the Flaps Down configuration.	Reduce the Angle of Attack.
C		✓	✓	✓	✓	✓	✓		When the Upper Pointer points in the yellow band, the airplane is nearing stall in the Flaps Up configuration. When the Lower Pointer points in the yellow band, the airplane is nearing stall in the Flaps Down configuration.	Reduce the Angle of Attack.
A		✓	✓	✓	✓	✓	✓		When the Upper Pointer points in the green band, the stall margin for the Flaps Up configuration is well above stall.	No action.

A		✓	✓	✓	✓	✓	✓		When the Lower Pointer points in the green band, the stall margin for the Flaps Down configuration is well above stall.	No action.
A	✓	✓	✓		✓				GPSS is operational	No action. GPSS can be used if desired.
A	✓	✓	✓		✓	✓			GPS annunciations that are provided by the GPS source. TERM can also be displayed in the same location as APPR.	No action. See the GPS AFMS for additional information on the meaning of these annunciations.
A		✓	✓					UAT CTL: MENU	When this message is displayed, the PFD is the UAT controller.	Press MENU to access the page to change the Code or to IDENT.
A	✓	✓	✓		✓	✓	✓	MAP SW 2.7.2 and earlier: TRFC MAP SW 2.8 and later: TFC TFC ID	Green annunciation that indicates that the traffic sensor is enabled. ID after TFC indicates that traffic identification is displayed if available. This annunciation does not indicate the status of the ADS-B traffic data uplinked from the ground.	No action. See and avoid traffic.

A						✓	✓	MAP SW 2.7.2 and earlier: TRFC STBY MAP SW 2.8 and later: TFC STBY	Green annunciation that indicates that the traffic sensor is in standby.	No action. See and avoid traffic.
A	✓	✓	✓		✓	✓	✓	MAP SW 2.7.2 and earlier: TRFC COAST MAP SW 2.8 and later: TFC COAST	Green annunciation that indicates that the TIS A traffic data has not been refreshed within 6 seconds.	No action. See and avoid traffic.
A		✓	✓		✓	✓	✓	✕RATE 9	Stormscope (strike) option: The rate indicates the approximate number of lightning strikes detected per minute.	No action. Avoid thunderstorms.
A		✓	✓		✓	✓	✓	+RATE 6	Stormscope (strike) option: Cell clustering display mode selected. The rate indicates the approximate number of lightning strikes detected per minute.	No action. Avoid thunderstorms.
A		✓	✓		✓	✓	✓	AGE :05 AIR :02 SIG :11 NXRD :08 LTNG :03	A data age annunciation for XM Datalink products	No action. Useful reference for weather data evaluation. NOTE: The data may be several minutes older than the time shown. It is not real-time data.

A		✓	✓		✓	✓	✓	RGNL CNUS AGE	A data age annunciation for ADS-B weather products.	No action. Useful reference for weather data evaluation. NOTE: The data may be several minutes older than the time shown. It is not real-time data.
A						✓	✓	DATABASE FAIL	Database Failure	No action. Functions that require a database are not available. See Table 1.
A						✓	✓	MAP LOADING...	The Database for the NAV Map is loading	No action. Not all the available data on the NAV Map is displayed yet.
A						✓	✓	OWNSHIP NOT AVAILABLE	Charts Option: The ownship cannot be displayed.	No action.
A						✓	✓	OWNSHIP OFF CHART	Charts Option: The ownship is off the chart.	No action.
A		✓			✓	✓	✓	SV UNAVAILABLE : ADAHRS FAIL	Synthetic Vision Option: Failed	No action
A		✓			✓	✓	✓	SV POSITION INVALID	Synthetic Vision Option: Failed	No action
A		✓			✓	✓	✓	DATABASE FAIL	Synthetic Vision Option: Failed	No action
A		✓			✓	✓	✓	DATABASE INIT	Synthetic Vision Option: Not yet operational	No action
A		✓			✓	✓	✓	SV DATABASE UNAVAILABLE	Synthetic Vision Option: Failed	No action
A		✓			✓	✓	✓	SV LOADING...	Synthetic Vision Option: Not yet operational	No action
A		✓			✓	✓	✓	MAP LOADING...	Synthetic Vision Option: Not yet operational	No action

4.2.4 EFD1000 PFD EBD Advanced or EFD1000 PFD EBD Basic

1. EBB Switch .... NORM
2. MENU .... Select POWER SETTINGS page
3. EXT PWR: (Aircraft Input Voltage) .... Check > 12.3V/24.6V
4. BAT .... Verify battery status is not shown as "FAIL"
5. EFD1000 PFD EBD .... Select "BATTERY"
6. EFD1000 PFD EBD .... Verify battery charge is above 80%
7. EFD1000 PFD EBD .... Select EXT PWR
8. MENU .... Press the MENU button to return to normal operation
9. BARO .... Set

Except as instructed in Section 3.2.2, the EBB switch should be left in the NORM position at all times, including when away from the aircraft.

4.3 Altitude Preselector

1. Altitude Alerter .... Set as desired
2. PRESEL .... Press for ARMED

To deselect:

3. PRESEL .... Press to Disarm

4.4 ADS-B OUT Control

When the EFD1000 PFD displays "**UAT CTL: MENU**", perform the following steps to set the squawk or IDENT:

To set the squawk:

1. Transponder .... Set the squawk
2. Press MENU .... Set the squawk. Press MENU to return

To IDENT:

1. Press MENU .... Press IDENT. Press MENU to return

4.5 Before Approach Checks

1. PFD .... Configure for arrival

If an EFD1000 MFD with EBB is installed in lieu of a backup altimeter and/or airspeed indicator (see Table 2), perform the following:

1. EFD1000 MFD .... Select REV then press XFILL. The MFD must be operated in the PFD reversion mode for landing.

4.6 Shutdown Checks

After conducting normal Shutdown checklist items, ensure the following:

1. EFD1000/500 Switches .... OFF

A		✓			✓	✓	✓		A white flight path marker indicates that approach TWS alerts are available (Terrain Alerts will be generated by terrain 100 feet higher than the runway elevation and all mapped obstacles).	No action
A		✓	✓		✓			OBSTACLE BEHIND AOA	Synthetic Vision Option: An obstacle that is behind the AOA indicator for more than five seconds will elicit this message.	No action
A		✓	✓	✓	✓			AOA AUTO	The AOA indicator is available for display but removed to reduce clutter. This message will be shown until the AOA indicator presents useful information.	No action

4 Normal Procedures

4.1 Exterior Inspection

1. RSM .... Check for condition and security
2. RSM Vent Hole .... Check Clear of obstructions
3. RSM Lightning Tape .... Check for condition and security

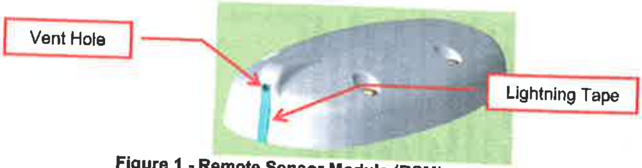


Figure 1 - Remote Sensor Module (RSM)

4.2 Before Take-Off Checks

4.2.1 EFD1000 PFD PRO, EFD1000 PFD PRO C3, EFD1000 PFD PILOT, EFD1000 PFD VFR

1. PFD .... Configure for departure

4.2.2 EFD1000 MFD (without EBB) or EFD500 MFD

1. MFD .... Configure for departure

4.2.3 EFD1000 MFD with EBB

If an EFD1000 MFD with EBB is installed in lieu of a backup altimeter and/or airspeed indicator (see Table 2), perform the following:

1. EBB Switch .... NORM
2. MENU... Select POWER SETTINGS page
3. EXT PWR: (Aircraft Input Voltage) .... Check > 12.3V/24.6V
4. BAT .... Verify battery status is not shown as "FAIL"
5. EFD1000 MFD .... Select "BATTERY"
6. EFD1000 MFD .... Verify battery charge is above 80%
7. EFD1000 MFD .... Select EXT PWR
8. MENU... Press the MENU button to return to normal operation.
9. EFD1000 MFD .... Select REV then press XFILL. The MFD must be operated in the PFD reversion mode for takeoff.

Except as instructed in Section 3.2.2, the EBB switch should be left in the NORM position at all times, including when away from the aircraft.

5 Performance

There is no change to the airplane performance.

6 Weight and Balance

See the current weight and balance documents for this aircraft.

7 Systems Description

The following paragraphs describe the evaluation flight display and the optional interfaces shown in Table 1.

7.1 Evolution Flight Display

The Evolution Flight Display System consists of one or more integrated Electronic Flight Display (EFD1000 or EFD500) systems. The EFD1000 system can be configured as a Primary Flight Display (PFD) or as a multi-function display (MFD). The EFD500 system can be configured as an MFD only. The EBD Basic or the EBD Advanced are Primary Flight Displays used as backup to a non-Aspen Primary Flight Display.

The following Pilot Guides should be carried in the aircraft and available to the pilot as appropriate for the equipment installed in the airplane:

a. For the EFD1000 PFD PILOT, PFD PRO, EBD Basic and EBD Advanced: Aspen Avionics document 091-00005-001, EFD1000 PFD Pilot's Guide, Revision A or subsequent revision.

b. For the EFD1000 PFD VFR: Aspen Avionics document 091-00005-001, EFD1000 PFD Pilot's Guide, Revision A or subsequent revision.

c. For the EFD1000 PFD PRO C3: Aspen Avionics document 091-00019-001, EFD1000 C3 Pro PFD Pilot's Guide Revision ( ) or subsequent revision.

d. For the EFD1000 MFD or EFD500 MFD: Aspen Avionics document 091-00006-001, EFD1000/500 MFD Pilot's Guide Revision ( ) or subsequent revision.

Go to www/aspenavionics.com/support for current Pilot Guides and Pilot Guides Errata and Addenda.

7.1.1 Internal Battery

The EFD1000 and EFD500 contain internal batteries which provide for continued operation for approximately 30 minutes (at a full charge and a shirt-sleeve environment) in the event of a complete loss of electrical power to the systems.

7.1.2 Emergency Backup Battery (EBB)

The EBB is an external rechargeable battery for the EFD1000 MFD, the EFD1000 EBD Advanced and the EFD1000 EBD Basic. This is a larger battery that will provide at least 30 minutes operation (at 80% charge) in the event of complete loss of electrical power.

7.1.3 Intercommunication

The EFD1000 PFD and the EFD1000/500 MFD intercommunicate barometric pressure and other data among these systems. The EFD1000 EBD does not intercommunicate barometric pressure with the non-Aspen Primary Flight display. It is necessary to adjust the barometric pressure directly on the Aspen EFD1000 EBD.

7.2 Databases

The following table provides information regarding the databases in the EFD.

Table 5 - Databases

Database Type	Includes	Update Cycle	Used In	Database Provider	Comment
Terrain	High resolution terrain data for Americas, International, or Worldwide geographic regions. Terrain depiction is limited to the region between 65° North latitude to 65° South latitude	Delivered with the EFD, updated intermittently as announced by Jeppesen	Synthetic Vision, Nav Maps and Terrain Maps	Jeppesen mail order	These databases are not to be used for navigation.
NavData	Includes Navaids, Controlled Airspace, Restricted, Prohibited and Special Use Airspace, Airports, etc.	28 day update cycle	Synthetic Vision and Nav Maps	Jeppesen JSUM©	
Cultural	Includes Roads, Rivers, Railroads, Political boundaries, Cities, etc.	28 day update cycle	Synthetic Vision and Nav Maps	Jeppesen JSUM©	
Obstacles	Includes man made obstacles greater than 200 ft. AGL. This database relies upon data reported by government agencies and may not include all obstacles due to inherent reporting and processing delays in the data. In addition, obstacle data may not be available for all regions within the data card coverage area.	28 day update cycle	Synthetic Vision and Nav Maps and Terrain maps	Jeppesen JSUM©	
Charts	AeroNav Terminal Procedures Charts	28 day update cycle	Terminal Procedures and Airport Diagrams	Seattle Avionics	

7.3 Remote Sensor Module (RSM)

The RSM provides heading information to the EFD1000 and is powered by the EFD1000. Some models have an internal GPS for emergency use that will automatically operate when the external GPS systems fail.

7.4 Traffic Display

There are several Traffic Interfaces that are available. Table 1 Installed Equipment List identifies the equipment in this aircraft.

The traffic data can be displayed on the moving map or as a dedicated view on the MFD when connected to the approved TCAS I, TAS, TIS or ADS-B external sensor. The dedicated view is titled TFC.

Traffic data provides a graphical depiction of aircraft relative to the aircraft heading. When the traffic data is not displayed on the PFD's moving map, the traffic automatically displays during a Traffic Advisory. When the dedicated traffic view is not displayed on the MFD and a Traffic Advisory occurs, a traffic popup is displayed to allow quick selection to view the Traffic Advisory.

The horizontal position reference point for each traffic image on the display is the center of the traffic image. The horizontal position reference point for the ownship on the display is the intersection of the geometric centerline of the wing and the geometric centerline of the ownship symbol fuselage.

7.5 ADS-B

7.5.1 ADS-B OUT

The Aspen or FreeFlight ADS-B OUT system automatically transmits surveillance data to Air Traffic Control and other entities. The ADS-B OUT interfaces with an onboard altimeter and GPS to transmit the squawk, registration, altitude and position. When "UAT CTL: MENU" is displayed on the on the PFD, then control of the squawk and IDENT is temporarily transferred to the PFD MENU.

If the ADS-B OUT system is turned off then ATC will not receive the surveillance data.

If the transponder is turned off, the UAT control will be transferred to the Aspen Display.

7.5.2 ADS-B IN

The Aspen PFD and MFD systems can display weather and traffic information when integrated with a compatible ADS-B system.

7.6 Weather Interface

The Datalink weather data can be displayed on the moving map or as a dedicated view on the MFD when connected to the EWR50 or FIS-B external sensor. The dedicated view is titled WX.

NEXRAD consists of composite images from many radar sites that are collected and compiled. The oldest portions of the contributing NEXRAD sites could be 0 to 20 minutes older than the age depicted.

7.7 Stormscope

The Strikes data shows the electrical discharges (associated with thunderstorms) that are detected by the L3 Stormscope®.

7.8 Terminal Procedure Charts

The MFD supports a dedicated charts view. The dedicated view is titled CHARTS.

The dedicated charts view displays pre-composed terminal procedures from the Seattle Avionics Instrument Procedures Charts Database. The dedicated charts view allows the pilot to overlay the ownship on geo-reference instrument approach procedures and airport diagrams. The ownship is only available for display on the airport diagram when the aircraft is on the ground.

The ownship position is centered at the intersection of the wings and fuselage.

The Terminal Procedures Charts require a database.

Only Geo-referenced charts are eligible for ownship depiction.

7.9 NAV and Terrain Maps

The PFD and MFD both support a moving map.

The PFD moving map is integrated into the navigation display on the bottom-half of the PFD.

The MFD moving map is a dedicated view that displays NAVAIDs, Controlled Airspace, Restricted, Prohibited and Special Use Airspace, Airports, etc.

The terrain and obstacle data can be displayed on the moving map or as a dedicated view on the MFD. The dedicated view is titled TERR. The terrain and obstacle data is advisory only.

CAUTION:
Accurate barometric pressure is essential for accurate terrain and obstacle data.

The terrain and obstacle data is colorized information based on the aircraft's proximity to terrain and obstacles. The aircraft's proximity to terrain and obstacles is determined by computing the altitude difference between the terrain and obstacles in the database and the aircraft's baro-corrected altitude.

The MFD Nav and Terrain maps require a database. The PFD moving map does not require a database.

7.10 EA100 Autopilot AHRS

The EA100 provides pitch and roll signals information to the autopilot.

7.11 Synthetic Vision and Terrain Warning System

The PFD and MFD can both support the display of Synthetic Vision. The display of the Synthetic Vision depiction is advisory only.

The Synthetic Vision depiction is a computer-derived perspective view of the nearby terrain obstacles and airports. The Synthetic Vision depiction supports a flight path marker to display the vertical and lateral path of the aircraft based on two parameters, barometric vertical speed and GPS track. The Synthetic Vision depiction also supports a Terrain Warning System (TWS) that uses the flight path marker to present an estimated time-to-collision function for terrain and obstacles. Unless inhibited by the pilot, TWS operates even when Synthetic Vision is turned off.

The MFD Nav and Terrain maps require a database.

CAUTION:
Accurate barometric pressure is essential for accurate Synthetic Vision and Terrain Warning.

7.12 Connected Gateway

The Connected Gateway provides a means to communicate flight plan information from a portable device to the navigation system.

7.13 Radar Altitude

When installed and configured. Radar Altitude information can be presented on the PFD. When the height exceeds the Radar Altitude maximum height, the indication is suppressed. When the Radar Altitude is at or below the maximum height, the Radar Altitude is shown as a number marked RA on the PFD.

Separately, the Decision Height can be shown as an amber balloon on the PFD.

7.14 ADF Interface

When installed and configured, ADF #1, #2 or both can be shown on the needles controlled by the left and right lower buttons.

7.15 VHF Interface

When installed and configured, VLOC 1 or VLOC 2 can be selected by the lower center button.

7.16 GPS Interface

When installed and configured, GPS1 or GPS2 can be selected using the lower center button.

7.17 Altitude Preselector

The Altitude Preselector is a remote altitude hold function. When armed, the altitude hold will be engaged at the selected altitude.

7.18 Autopilot Source Select

The autopilot normally is connected to the PFD. If the MFD is reverted to a PFD, then the MFD can be selected as the autopilot source.

7.19 AOA System

The Aspen AOA System is a derived AOA system, meaning it uses the air data and inertial functions in the EFD1000 to calculate the approximate AOA. It does not indicate stall warning.

The AOA system is designed to show trend toward stall and stall margin. Stall margin is the actual AOA compared to the stall AOA.

WARNING:
The AOA indications are not valid for takeoff.

There are two pointers that move together. The Upper Pointer indicates stall margin in the flaps up configuration. The Lower Pointer indicates stall margin in the full flaps down configuration.

NOTE:
There is no indication of derived AOA for intermediate flap settings.

When the airplane moves toward stall, the pointers will move from the green band into the yellow band, and eventually to the black/yellow band. Whenever the pointers are rapidly moving toward the yellow/black band, the airplane is rapidly approaching stall.

Conversely, as the airplane accelerates toward cruise speed, both pointers will move toward the blue band and will eventually park at the end of the blue band.

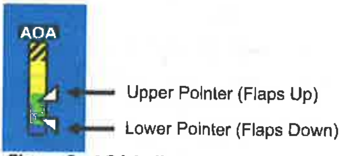


Figure 2 - AOA Indicator

7.19.1 AOA Display Modes

The PFD supports three AOA display modes, Auto, On and Off. The MFD supports one mode, On.

Table 6 - AOA Display Modes

Mode	Description
AUTO	From cruise, the AOA indicator fades in when the Upper Pointer trends past the green/blue transition. This minimizes the indication on the PFD until the AOA presents useful information.
ON	The AOA indicator is always displayed.
OFF	The PFD does not display the AOA indicator.

See Section 4.7 for information on how to select the modes of operation.

7.19.2 AOA Operation by Phase of Flight

The following tables describe the typical AOA indications in various phases of flight in the On and Auto modes.

Table 7 - AOA "ON "Mode

Phase of Flight	Description of the AOA Indicator
Taxi	The AOA indicator is displayed with no pointers.
Takeoff	The AOA pointers fade in at about 35 KIAS. AOA indications are not valid for takeoff.
Climb	In the clean configuration, the AOA pointers will be in the green band.
Cruise	In normal cruise, the AOA pointers are parked at the bottom of the blue band.
Descent	In normal descent, the AOA pointers are parked at the bottom of the blue band.
Approach	As the airplane slows, the AOA trends from the blue band toward the green/yellow transition. When on-speed at one g and full flaps, the Lower Pointer nears the green/yellow transition.
Landing	The pointers trend toward stall during landing.
Rollout	The pointers fade out at approximately 35 KIAS.

Table 8 - AOA "AUTO" Mode

Phase of Flight	Description of the AOA Indicator
Taxi	"AOA AUTO" is displayed.
Takeoff	The AOA indicator with pointers will fade in at about 35 KIAS. AOA indications are not valid for takeoff.
Climb	In the clean configuration, the AOA pointers will be in the green band.
Cruise	The AOA indicator will fade to "AOA AUTO" when the Upper Pointer parks at the end of the blue band.
Descent	"AOA AUTO" is displayed.
Approach	The AOA indicator fades in when the Upper pointer trends above the blue band. As the airplane slows, the AOA trends toward the green/yellow transition. When on-speed at one g and full flaps, the Lower Pointer nears the green/yellow transition.
Landing	The pointers trend toward stall during landing.
Rollout	The indicator fades out at approximately 35 KIAS and the AOA AUTO message fades in.

7.19.3 Pointer Definition

The following table shows the pointer definitions.

Table 9 - Pointer Definition

Pointers	Meaning
Upper Pointer (Flaps Up) 	The Upper Pointer indicates stall margin in the flaps up configuration.
Lower Pointer (Flaps Down) 	The Lower Pointer indicates stall margin in the full flaps down configuration.

7.19.4 Color Band Definition

The color bands mean the following:

Table 10 - Color Band Definition

Color Band	Meaning
Yellow/black hash-marked band	Very little stall margin.
Yellow band	Reduced stall margin.
Green band	AOA is well above stall.
Blue band	Normal cruise, normal descent. AOA is well above stall.

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FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System
as installed in

PIPER PA32R-301
Make and Model Airplane

Registration Number: G-ELLA Serial Number: 3246050

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02019SE-D for the installation and operation of the Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved by: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 2-NOV-2017

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	03/18/11	All	Complete Supplement	*Robert Grove* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *03/18/2011*
2	12/18/12		See Revision 3	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *12/18/2012*
3	03/26/13		See Revision 4	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *04/12/2013*
4	11/24/14	7	Table 1 • Added new functions	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *11/25/2014*
		11	Section 1.4 • New section	
		16	Section 2.7 • Modified limitation	
		18	Section 2.12 • Added wire obstacles	
		20	Section 2.21 • Modified limitation	
		20 & 21	Section 2.22 & 2.23 • Added limitations	
		26	Section 3.2.10 • Added Flight Stream 210 to procedure	
		27	Section 4.1 • Removed telephone audio deactivation procedure	
		32	Section 7.5 • Added wire obstacles	
		34	Section 7.9 • Added Flight Stream 210	

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Revision Number	Date	Number	Description	FAA Approved
		34 37	<u>Section 7.10</u> • Added wire obstacles <u>Section 7.17</u> • Added section	
5	02/25/16	All	<u>All Sections</u> • Reformatted and updated sections to better coincide with the VFR AFMS. <u>Section 2</u> • Added RF leg description and limitations • Added QFE limitations • Added Autopilot limitations • Added polar operation limitation • Added text regarding new data units in the GTN • Added Fuel Range Ring description and limitations • Added Flight Stream 210 limitation <u>Section 4</u> • Added autopilot capability assessment regarding RF legs • Updated installer descriptions of configuration checkboxes • Added Search and Rescue autopilot note • Added RNP 1.0 installation options <u>Section 7</u> • Added GMA 35c information • Removed references to GDL 88 and replaced with generic ADS-B	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *02/25/2016*

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	Page			
Revision Number	Date	Number	Description	FAA Approved
			• Added GWX 70 turbulence detection note • Added GTN crossfill information	
6	09/09/16	1	Table 1 • Added Flight Stream 510 data	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *09/09/2016*
		5	Section 1.2 • Removed text	
		6-8	Section 1.5 • Added definitions	
		9	Section 2.1 • Updated CRG Revisions	
		12	Table 3 • Added Flight Stream 510 line	
		12	Section 2.7 • MMC additions	
		12	Section 2.8 • Added reference to section 2.29	
		18	Section 2.28 • Fixed error	
		18	Sections 2.29-2.31 • New Sections	
		22	Section 3.2.8 • Reworded and added additional text	
		23	Sections 3.2.9-3.2.13 • New Sections • Renumbered sections	
		27	Section 4.7 • New section	
		29	Section 7.1 • New revision numbers	

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	Page			
Revision Number	Date	Number	Description	FAA Approved
		32	Section 7.9 • Added Flight Stream 510	
		33	Section 7.10 • Reworded	
		34	Table 4 • Added PTC	
		38	Section 7.19 • Flight Stream 510 content added	
		41-42	Sections 7.25-7.26 • New sections	
7	10/17/17	6-8	Sections 1.5 • New definitions	See Page i
		9	Section 2.1 • Updated CRG Revisions	
		10	Section 2.4 • Updated FDE compliance text	
		12	Section 2.6 • Updated software grid	
		13	Section 2.10 • Renamed section	
		19-20	Section 2.32-2.33 • New sections	
		22	Section 3.2.1-2 • Updated text	
		32	Section 7.27 • Updated PG Revisions	
		45	Section 7.27 • New section	

Table of Contents

Section 1. General

1.1 Garmin GTN Navigators

The Garmin GTN navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146c GTN 625, 635, 650, 725, or 750 navigator(s) and one or more Garmin approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

	GTN 625	GTN 635	GTN 650	GTN 725	GTN 750
GPS SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)	X	X	X	X	X
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments		X	X		X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		X
Moving map including topographic, terrain, aviation, and geopolitical data	X	X	X	X	X
Display of datalink weather products, SiriusXM, FIS-B, Connext (all optional)	X	X	X	X	X
Control and display of airborne weather radar (optional)				X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data, including ADS-B (optional)	X	X	X	X	X
Display of StormScope® data (optional)	X	X	X	X	X
Display of marker beacon annunciators (optional)	X*	X*	X*	X	X
Remote audio panel control (optional)				X	X
Remote transponder control (optional)	X	X	X	X	X
Remote audio entertainment datalink control (optional)	X	X	X	X	X
TSO-C151c Class B TAWS (optional)	X	X	X	X	X
Supplemental calculators and timers	X	X	X	X	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X	X	X	X	X
Control of Flight Stream 210 (optional)	X	X	X	X	X
Control of Flight Stream 510 (optional)	X	X	X	X	X

* Display of marker beacon annunciations on the GTN 6XX is only possible when installed with a Garmin GMA 350 audio panel.

Table 1 – GTN Functions

The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

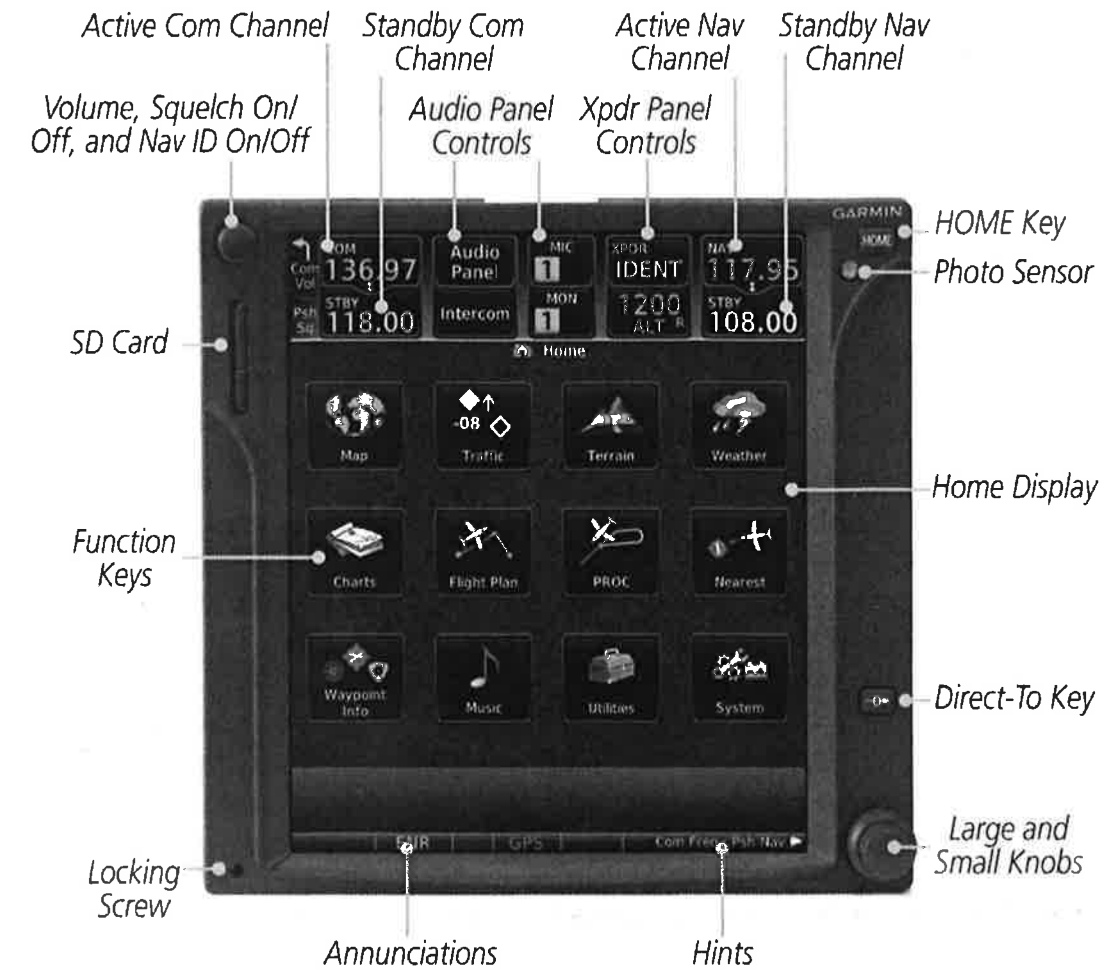

Figure 1 - GTN 750 Control and Display Layout

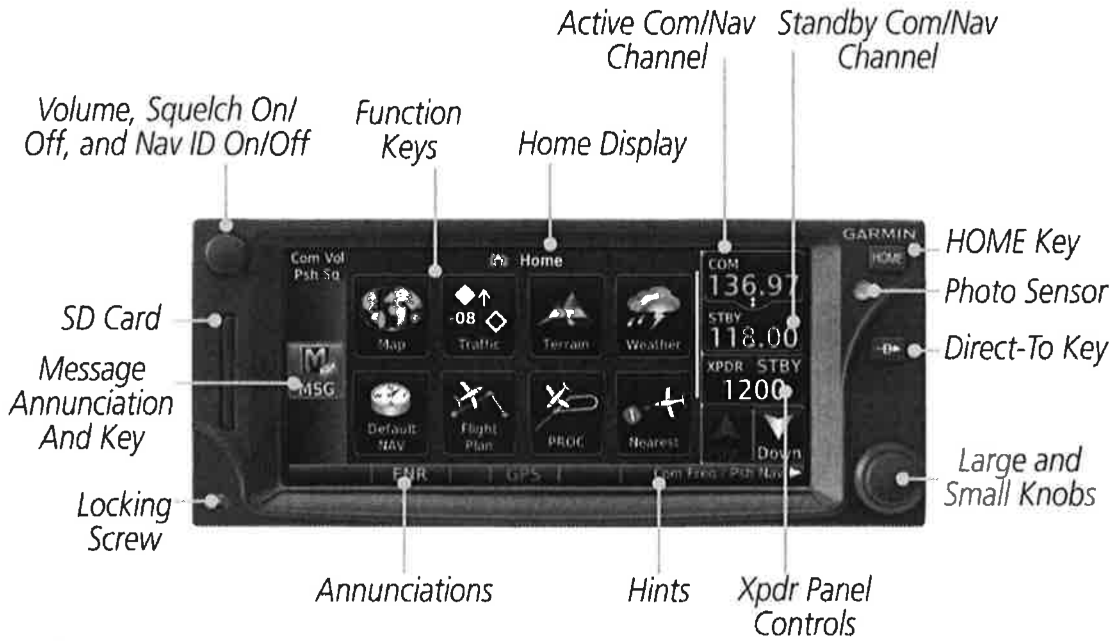

Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

This Flight Manual Supplement documents the installed capabilities of the GTN specific to the aircraft for which this manual is created.

NOTE

In sections which contain a square checkbox (□) the installer will have placed an "X" in the boxes next to the capabilities applicable to the installation.

The GTN system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

- ☑ VHF Communication Radio
- ☑ Primary VHF Navigation
- ☑ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- ☑ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- ☐ TSO-C151c Terrain Awareness and Warning System – See section 2.15

GPS/SBAS TSO-C146c Class 3 Operation

The GTN complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR enroute, terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GTN navigator and antenna, and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV".

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures including procedures with RF legs subject to the limitations herein. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

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

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

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

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system consists of one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

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

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

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Advanced RNP Capabilities
The GTN includes 3 out of 6 of the features required for operations in airspace requiring Advance RNP based on the *ICAO document 9613 Performance Based Navigation (PBN) Manual, fourth edition, 2013* and is therefore not approved for Advanced RNP operations. The following table describes the six Advanced RNP capabilities and the GTN capabilities.

Advanced RNP Feature	**GTN Capability**
RF legs	Available if enabled for installation. See Section 2.12 for limitations.
Parallel offsets	Available.
Scalable RNP	GTN provides CDI scalability in compliance with TSO-C146c. RNP scalability is not available.
RNAV holding	Available.
Fixed radius transitions	Not available in GTN.
Time of arrival control (TOAC)	Not available in GTN.

1.3 Electronic Flight Bag

The GTN 750/725 are operationally suitable as Class 3 Hardware, Type B Software in accordance with AC 120-76B EFB electronic aeronautical information when using current FliteChart or ChartView data.

Use of the Flight Stream interface and data for the purpose of Electronic Flight Bag applications is not approved as part of this STC. Additional approval may be required to obtain operational approval for use of the Flight Stream and supplied data to supplement EFB systems.

1.4 Electronic Checklists

The GTN checklist functions are designed to DO-178B software design assurance level B and support a minor failure classification. While this STC does not grant operational approval for operators requiring such approval, there are no limitations precluding operators from obtaining their own operational approval for the checklist function.

1.5 Definitions

The following terminology is used within this document:

ADF:	Automatic Direction Finder
ADS-B:	Automatic Dependent Surveillance Broadcast
AEG:	Aircraft Evaluation Group (FAA)
APR:	Approach
CDI:	Course Deviation Indicator
DME:	Distance Measuring Equipment
ECAC:	European Civil Aviation Conference
EFB:	Electronic Flight Bag
EGNOS:	European Geostationary Navigation Overlay Service
EHSI:	Electronic Horizontal Situation Indicator
FIS-B:	Flight Information Services Broadcast
GAGAN:	GPS Aided GEO Augmented Navigation
GNSS:	Global Navigation Satellite System
GPA:	Glidepath Angle
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
GTN:	Garmin Touchscreen Navigator
HOT:	Hazardous Obstacle Transmission wires
HSI:	Horizontal Situation Indicator
IAP:	Instrument Approach Procedure
IFR:	Instrument Flight Rules
ILS:	Instrument Landing System

IMC:	Instrument Meteorological Conditions
LDA:	Localizer Directional Aid
LNAV:	Lateral Navigation
LNAV +V:	Lateral Navigation with advisory Vertical Guidance
L/VNAV:	Lateral/Vertical Navigation
LOC:	Localizer
LOC-BC:	Localizer Backcourse
LP:	Localizer Performance
LPV:	Localizer Performance with Vertical Guidance
LP +V:	Localizer Performance with Advisory Vertical Guidance
MLS:	Microwave Landing System
MMC:	Multi-Media Card
NOTAM:	Notice to Airmen
OBS:	Omni Bearing Selector
PED:	Portable Electronic Device
RAIM:	Receiver Autonomous Integrity Monitoring
RF Leg:	Radius-To-Fix Leg of a Charted Instrument Procedure
RMT:	Remote
RNAV:	Area Navigation
RNP:	Required Navigational Performance
SAR:	Search and Rescue
SBAS:	Satellite Based Augmentation System
SD:	Secure Digital
SDF:	Simplified Directional Facility
SUSP:	Suspend
TACAN:	Tactical Air Navigation System
TAS:	Traffic Awareness System
TAWS:	Terrain Awareness and Warning System
TCAS:	Traffic Collision Avoidance System
TCH:	Threshold Crossing Height
TFR:	Temporary Flight Restriction
TIS:	Traffic Information Service
VHF:	Very High Frequency
VFR:	Visual Flight Rules
VGSI:	Visual Glide-Slope Indicator
VLOC:	VOR/Localizer
VMC:	Visual Meteorological Conditions

VOR:	VHF Omnidirectional Range
VRP:	Visual Reporting Point
WAAS:	Wide Area Augmentation System
WFDE:	WAAS Fault Data Exclusion
XFR:	Transfer

Section 2. LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide, part number and revision listed below (or later revisions), *must* be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

- GTN 6XX Cockpit Reference Guide P/N 190-01004-04 Rev L
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev K

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations.

2.3 Minimum Equipment

The GTN must have the following system interfaces fully functional in order to be used for primary navigation during IFR operations:

Interfaced Equipment	Number installed	Number Required for IFR
External HSI/CDI/EHSI	1 or more	1
External GPS Annunciator	See Note 1	1

Table 2 – Required Equipment

Note 1: Certain installations require an external GPS annunciator panel. If installed, this annunciator must be fully functional to use the GTN GPS navigation for IFR operations.

Single engine piston aircraft under 6,000 lbs. maximum takeoff weight:

Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator

All other aircraft:

Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation. The separate source of VHF navigation must not be the primary GTN, but it may be a secondary GTN.

Operation in remote or oceanic operation requires two sources of GPS navigation.

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability. An acceptable means of compliance for FDE prediction programs is to use a certified service which meets the requirements of FAA AC 20-138 and FAA AC 90-105A for prediction.

The following table describes some of the available RAIM prediction programs.

Prediction Program	Internet address or program details	Coverage Area
Garmin RAIM Prediction Tool	https://fly.garmin.com/fly-garmin/support/raim/	Worldwide
Garmin WFDE Prediction program	PC-based program included in GTN trainer v3.00 – 6.30. Instructions provided via Garmin part number 190-00643-01	Worldwide
FAA Service Availability Prediction Tool	http://sapt.faa.gov	US Only
Flight Service Station	1-800-WXBRIEF https://www.1800wxbrief.com	US Only
AUGER GPS RAIM Prediction Tool	http://augur.ecacnav.com/augur/app/home	ECAC Airspace Only

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

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

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

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

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

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

2.5 System Use

In installations with two GTNs and an external GPS annunciator (See Table 2) the GTN connected to the external GPS annunciator must be used as the navigation source for all IFR operations.

The only approved sources of course guidance are on the external CDI, HSI, or EHSI display. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

2.6 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 3 can be viewed on the System – System Status or Connext Setup pages.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
Main SW Version	6.41
GPS SW Version	5.2
Com SW Version	2.20
Nav SW Version	6.03
Flight Stream 210	2.70
Flight Stream 510	2.30

Table 3 - Software Versions

2.7 MMC / SD Database Cards

It is required that the SD database card or Flight Stream 510 (MMC) be present in the GTN at all times. The SD or MMC device must not be removed or inserted during flight or while the GTN is powered on.

NOTE

Removal of the SD or MMC device will result in certain features and databases not being available and may slow system performance.

2.8 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

See Section 2.29 for limitations regarding database update procedures.

2.9 Ground Operations

Do not use SafeTaxi or ChartView functions as the basis for ground maneuvering. SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and ChartView are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.10 Instrument Approaches

a) Instrument approaches using GPS guidance may only be conducted when the GTN is operating in the approach mode. (LNAV, LNAV +V, L/VNAV, LPV, LP, or LP +V)
b) When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.
c) The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin 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.
d) Advisory vertical guidance deviation is provided when the GTN annunciates LNAV + V or LP +V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.
e) Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GTN system flight plan by its name. Pilots are prohibited from flying any approach path that contains manually entered waypoints.
f) IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN and/or the CDI.

2.11 Barometric Setting

The barometric altimeter setting used for any barometric corrected altitude source interfaced to the GTN must be set appropriate to the altitude type depicted on the procedure (QNH or QFE).

2.12 RF Legs

This STC does not grant operational approval for RF leg navigation for those operators requiring operational approval. Additional FAA approval may be required for those aircraft intending to use the GTN as a means to provide RNP 1 navigation in accordance with FAA Advisory Circular AC 90-105.

The following limitations apply to procedures with RF legs:

- Aircraft is limited to 180 KIAS while on the RF leg
- RF legs are limited to RNP 1 procedures. RNP AR and RNP <1 are not approved
- Primary navigation guidance on RF legs must be shown on an EHSI indicator with auto-slew capability turned ON
- GTN Moving Map, EHSI Map, or Distance to Next Waypoint information must be displayed to the pilot during the RF leg when flying without the aid of the autopilot or flight director.
- The active waypoint must be displayed in the pilot's primary field of view.

2.13 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

It is possible to create flight plan waypoint sequences, including Search and Rescue patterns, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance with regard to flight path deviation.

2.13.1 RNP 1.0 RF Leg Types

AC 90-105 states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot.

This STC has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the GTN installation complies with limitation set forth in Section 2.12 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

2.14 Terrain Proximity Function (All Units)

Terrain, point obstacle, and wire obstacle information appears on the map and terrain display pages as red and amber terrain, obstacles, or wires and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain, obstacle and wire information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

NOTE

> Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.15 TAWS Function (Optional)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

TAWS shall be inhibited when landing at an airport that is not included in the airport database.

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional in order to use the TAWS system.

NOTE

> Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.16 Polar Operations

Use of the GTN for primary navigation for latitudes above 89.00° N and below 89.00° S is prohibited.

2.17 Datalink Weather Display (Optional)

This limitation applies to datalink weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88 or GTX 345, and Connext via a GSR 56.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

Datalink text weather is decoded for the convenience of the pilot, however it is possible that the decoding may be affected by anomalies in the data or differences in the units of measure between the decoding system and the text weather source. All text weather displayed on the GTN also includes the raw weather text for pilot review.

2.18 Traffic Display (Optional)

Traffic may be displayed on the GTN when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

Traffic is displayed in feet regardless of the unit settings for altitude. If the units for altitude are different than feet, a "FT" label will appear on the traffic icon on and main map page, and the dedicated traffic page will include an "ALT IN FT" notification.

2.19 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN is limited to supplemental use only. The use of the StormScope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited. StormScope® lightning data on the display is intended only as an aid to enhance situational awareness of hazardous weather, not penetration. It is the flight crew's responsibility to avoid hazardous weather using official weather data sources.

When the GTN StormScope® page is operating without a heading source, as indicated by the "HDG N/A" label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

2.20 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination.

2.21 Fuel Range Rings

The fuel range rings displayed on the moving map are intended for situational awareness and do not represent a direct indication of endurance or fuel remaining. The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes by default. The reserve value can be changed from the GTN map setup menu.

Fuel range data is derived by the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

2.22 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GTN unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725, 750 or GTN 625, 635, 650 combinations.

2.23 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.24 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750/725 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

2.25 Telephone Audio

Telephone audio must not be distributed to the pilot or co-pilot unless a phone call is active.

CAUTION

Failure to turn off telephone audio when the telephone is not in use may result in telephone ringer or text message aural notifications being received during critical phases of flight.

2.26 Multi Crew Aircraft (GMA 35 Only)*

For aircraft type certified with more than one required pilot, or operations requiring more than one pilot, the "Group Co-Pilot with Passenger" audio panel option shall not be activated. This option is found in the Intercom Setup Menu when a Garmin GMA 35 audio panel is installed.

2.27 Wire Obstacle Database

Only the "Obstacle/HOT Line" database may be used. Use of the "Obstacle/Wire" database is prohibited. The database version can be viewed on the start-up database verification or System- System Status pages.

2.28 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

The Flight Stream interface and data provided to a portable electronic device is not approved to replace any aircraft display equipment, including navigation or traffic/weather display equipment.

2.29 Database Updates

Database updates via MMC / SD card or Flight Stream wireless transfers must be done while the aircraft is on the ground and stationary. In-flight database transfers or updates are prohibited in flight unless part of the Database SYNC function that occurs in the background to move databases from one LRU to another.

2.30 Charts Database (Dual GTN7XX)

When the aircraft installation includes 2 GTNs capable of displaying charts (GTN 700, 725 or 750) and crossfill is enabled between the GTNs, the GTNs must have identical charts types (ChartView or FliteCharts) and charts cycles installed. Failure to have identical charts could affect the chart lookup features and automatic chart selection.

2.31 Automatic Speech Recognition

Pilots may not use the ASR function to operate the GTN/GMA unless they have completed the ASR Qualification Procedure located in the GTN Cockpit Reference Guide successfully. The ASR Qualification Procedure is specific to each pilot / headset / aircraft combination.

2.32 OBS Mode

Use of OBS mode for flight plan segments greater than 250NM is prohibited.

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* Includes GMA 35 and GMA 35c Audio Panels

2.33 Advisory Visual Approaches

All advisory visual approaches shall be conducted in VMC. Advisory visual approaches are intended to be used as an aid to situational awareness and do not guarantee terrain or obstruction clearance along the approach path. Use of advisory visual approaches in IMC is prohibited.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural "PULL UP":

Autopilot .... **DISCONNECT**
Aircraft Controls .... **INITIATE MAXIMUM POWER CLIMB**
Airspeed .... **BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:

Altitude .... **CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" and/or "LOI".

If the LOI annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. If LOI occurs while the GTN is in the ENR or OCN phase of flight, it may also display DR.

If the DR annunciation is displayed, the map will continue to be displayed with an amber "DR" overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation .... **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation .... **USE GTN**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE (no DR annunciated on the GTN):

Navigation ....**FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a LPV, LP +V, LNAV/VNAV, or LNAV +V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation to LNAV. The approach may be continued using the LNAV only minimums. If the VISUAL approach is downgraded, the GTN will remove the vertical deviation indication from the VDI, but continue to annunciate VISUAL in amber.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:
Communications .... **USE ALTERNATE COM**

If no alternate COM is available:
COM RMT XFR key (if installed)....... **PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GTN. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)†

Audio Panel Circuit Breaker ....**PULL**

NOTE

This procedure will force the audio panel into fail safe mode which provides only the pilot with communications and only on a single COM radio. If any non GTN 750 COM is installed, communication will be only on that radio. If only a GTN 750 is installed in the aircraft, then the pilot will have only the GTN 750 COM available. No other audio panel functions including aural alerting and the crew and passenger intercom will function.

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† Includes GMA 35 and GMA 35c Audio Panels

3.2.5 TAWS CAUTION (Terrain or Obstacle Ahead, Sink Rate, Don't Sink)

When a TAWS CAUTION occurs, take corrective action until the alert ceases. Stop descending or initiate either a climb or a turn, or both as necessary, based on analysis of all available instruments and information.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2.6 TAWS INHIBIT

The TAWS Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GTN Cockpit Reference Guide for additional information.

To Inhibit TAWS:

Home Hardkey .... **PRESS**
Terrain Button .... **PRESS**
Menu Button .... **PRESS**
TAWS Inhibit Button .... **PRESS TO ACTIVATE**

3.2.7 TER N/A and TER FAIL

If the amber **TER N/A** or **TER FAIL** status annunciator is displayed, the system will no longer provide TAWS alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

3.2.8 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a heading source to the GTN, the following limitations apply:

- Roll steering will not be provided to the autopilot for heading legs. The autopilot must be placed in HDG mode for heading legs.
- Map cannot be oriented to Heading Up.
- Overlaying traffic data from a TAS/TCAS I or Garmin ADS-B-IN unit interfaced to an on board traffic system will not be displayed on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or Garmin ADS-B-IN traffic data.
- All overlaying StormScope® data on the main map display will be removed. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.
- Onboard weather radar overlay on the main map will not be displayed. The flight crew must utilize the dedicated weather radar page on the GTN system to view weather radar data from the onboard weather radar.

StormScope® must be operated in accordance with Section 7.8 when no heading is available.

3.2.9 ASR (VOICE COMMAND) SYSTEM FAILURES

In the event the ASR system fails and there is a need to disable the voice command inputs to the GTN:

To Disable ASR:

Home Hardkey .... **PRESS**
System Button .... **PRESS**
Voice Commands Button .... **PRESS**
Voice Commands Enable Button .... **TOGGLE OFF**

3.2.10 LOSS OF GTN TOUCH CONTROL

In the event the GTN becomes unusable due to uncommanded page changes, the ASR function may be the source.

To Disable ASR:

Audio Panel Circuit Breaker .... **PULL**
Home Hardkey .... **PRESS**
System Button .... **PRESS**
Voice Commands Button .... **PRESS**
Voice Commands Enable Button .... **TOGGLE OFF**
Audio Panel Circuit Breaker .... **PUSH**

3.2.11 DATA SOURCE – PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a barometric corrected altitude source to the GTN, the following features will not operate:

- Automatic leg sequencing of legs requiring an altitude source. The flight crew must manually sequence altitude legs, as prompted by the system.

3.2.12 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 (NAV/GPS 2, COM 2) and the Flight Stream 210 (BT LINK), if installed.

3.2.13 IN-AIR RESTART OF GTN

In the event of a GTN restart in the air, the crew should utilize the CANCEL button if presented with the database update screen after the GTN is restarted. This will ensure restoration of the navigation functions as soon as possible.

Section 4. NORMAL PROCEDURES

Refer to the GTN Cockpit Reference Guide defined in Section 2.1 of this document or the Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Databases .... **REVIEW DATES**
Self-Test .... **VERIFY OUTPUTS TO NAV INDICATORS**
Self-Test - TAWS Remote Annunciator:
- PULL UP .... **ILLUMINATED**
- TERR .... **ILLUMINATED**
- TERR N/A .... **ILLUMINATED**
- TERR INHB .... **ILLUMINATED**

Self-Test - GPS Remote Annunciator:
- VLOC .... **ILLUMINATED**
- GPS .... **ILLUMINATED**
- LOI or INTG .... **ILLUMINATED**
- TERM .... **ILLUMINATED**
- WPT .... **ILLUMINATED**
- APR .... **ILLUMINATED**
- MSG .... **ILLUMINATED**
- SUSP or OBS .... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators .... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GTN the pilot should rotate the course pointer as prompted on the GTN.

If an EHSI is used to display navigation data from the GTN the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

See Section 4.5 for RF leg capabilities related to EHSI.

4.4 Autopilot Operation

The GTN may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in a roll steering mode.

The GTN supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GTN. This heading interface can also provide map orientation, traffic and StormScope heading data and wind calculations.

CAUTION

The GTN does not provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of roll steering when course deviation is not provided.

☐ This installation *has* a heading source. The GTN will provide roll steering on heading legs for the autopilot.

☐ This installation *does not have* a heading source. The crew cannot use the GTN roll steering to fly heading legs with the autopilot.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

☑ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button .... **PRESS**
"Enable APR Output" Button .... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot... **ENGAGE APPROACH MODE**

☑ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will enable vertical guidance.

Vertical Guidance.......................................**CONFIRM AVAILABLE**
Autopilot... **ENGAGE APPROACH MODE**

☐ The installation *does not* support any vertical capture or vertical tracking.

The GTN allows for the utilization of IFR procedures that include RF (Radius to Fix) legs as part of RNP 1.0 capabilities.

☐ This installation is equipped to support coupled RF leg navigation up to RNP 1.0.

☐ This installation is equipped to support *un-coupled* RF leg navigation up to RNP 1.0.

☐ This installation *does not* support RF leg navigation.

4.6 Coupling the Autopilot during Search and Rescue Operations

Search and Rescue (SAR) patterns created in the GTN flight plan may include turns that cannot be accomplished with standard autopilot turn rates. Monitor autopilot performance relative to the desired path if coupled when using Search and Rescue patterns.

4.7 Database Conflict Resolution

When a conflict occurs between databases on different GTNs that are utilizing Database SYNC the pilot should resolve that conflict by pressing the "Resolve Conflict" button on the GTN that has the desired databases. This would be the GTN with the newest database on the SD card or Flight Stream 510. After initiating the conflict resolution, the pilot can view the SYNC status of the database on the other GTN by viewing the System -> Standby Database page. Once the database SYNC is complete, the receiving GTN must be restarted to install the new database and complete the conflict resolution process.

NOTE

The databases on the receiving LRU will be overwritten by the databases from the LRU from which the "Resolve Conflicts" action was initiated.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GTN 6XX or GTN 7XX Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control and function. The Pilot's Guides *do not* need to be immediately available to the flight crew.

- GTN 6XX Pilot's Guide — P/N 190-01004-03 Rev L or later
- GTN 7XX Pilot's Guide — P/N 190-01007-03 Rev N or later

7.2 Leg Sequencing

The GTN supports all ARINC 424 leg types. Certain leg types require altitude input in order to sequence (course to altitude, for example). If a barometric corrected altitude source is not interfaced to the GTN, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

☑ This installation *has* a barometric corrected altitude source. The GTN will automatically sequence altitude legs.

☐ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

7.3 Auto ILS CDI Capture

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.4 Activate GPS Missed Approach

☑ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

Section 7. SYSTEM DESCRIPTIONS

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☑ This installation *has* a barometric corrected altitude source. The GTN will automatically sequence altitude legs.

☐ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

7.3 Auto ILS CDI Capture

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.4 Activate GPS Missed Approach

☑ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity and TAWS

CAUTION

Not all obstacles and wires are contained in the Obstacle/HOT Line database. The system provides depiction (and alerts, if TAWS is installed) only for obstacles and wires contained in the database.

NOTE

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

☑ This installation supports *Terrain Proximity. No aural or visual alerts* for terrain or obstacles are provided. Terrain Proximity *does not* satisfy the TAWS requirement of 91.223.

☐ This installation supports *TAWS B.* Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

Terrain on the dedicated terrain page or main map overlay is depicted in the following manner:

- Terrain more than 1,000 feet below the aircraft is not depicted, or depicted as black.
- Terrain between 1,000 feet and 100 feet below the aircraft is depicted as amber.
- Terrain within 100 feet below the aircraft, or above the aircraft, is depicted as red.

Obstacles and wires on the dedicated terrain page or main map are depicted in the following manner:

- Obstacles and wires more than 2,000 feet below the aircraft are not depicted.
- Obstacles and wires between 2,000 feet and 1,000 feet below the aircraft are depicted as white.
- Obstacles and wires between 1,000 feet and 100 feet below the aircraft are depicted as amber.
- Obstacles and wires within 100 feet below the aircraft, or above the aircraft, are depicted as red.

Multiple obstacles may be depicted using a single obstacle icon and an asterisk to indicate obstacle grouping is occurring. The color of the asterisk indicates the relative altitude of the tallest obstacle in the group. The asterisk does not indicate any information about the relative altitude or number of obstacles not being displayed in the obstacle group.

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding terrain and obstacle colors and grouped obstacle icons.

7.6 GMA 35/35c Audio Panel (Optional)

The GTN 725 and 750 can interface to a GMA 35/35c remotely mounted audio panel and marker beacon receiver. Controls for listening to various radios, activating the cabin speaker, clearance playback control, and marker beacon are accessed by pressing the "Audio Panel" button on the GTN display screen. Optional Bluetooth pairing functionality can be accessed from the associated System /Connext Setup page (GMA 35c only). Volume controls for the audio panel are accessed by pressing the "Intercom" button on the GTN display screen.

Aircraft alerting audio may be routed through the GMA 35/35c audio panel. There are no pilot controls for alert audio volumes. In the event of a loss of GMA35/35c function alert audio routed through the audio panel may not be heard.

7.7 Traffic System (Optional)

This system is configured for the following type of traffic system. The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding the functionality of the traffic device.

- ☑ No traffic system is interfaced to the GTN.
- ☐ A TAS/TCAS I traffic system is interfaced to the GTN.
- ☐ A TIS traffic system is interfaced to the GTN.
- ☐ A TCAD traffic system is interfaced to the GTN.
- ☐ A Garmin ADS-B traffic system is interfaced to the GTN.
- ☐ A Garmin ADS-B traffic system is interfaced to the GTN. The ADS-B traffic system is also interfaced to an on board traffic system.

7.8 StormScope® (Optional)

When optionally interfaced to a StormScope® weather detection system, the GTN may be used to display the StormScope® information. Weather information supplied by the StormScope® will be displayed on the StormScope® page of the GTN system. For detailed information about the capabilities and limitations of the StormScope® system, refer to the documentation provided with that system.

Heading Up mode:

If the GTN system is receiving valid heading information, the StormScope® page will operate in the heading up mode as indicated by the label "HDG UP" presented at the upper right corner of the display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft and *is* automatically rotated to the correct relative position as the aircraft turns.

Heading Not Available mode:

If the GTN system is not receiving valid heading information, either because a compatible heading system is not installed, or the interfaced heading system has malfunctioned, the StormScope® page will continue to operate without a heading source and indicate "HDG N/A" in the upper right corner of the GTN display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft but *is not* automatically rotated to the correct relative position as the aircraft turns. When operating in this mode, StormScope® strikes must be cleared after each turn the aircraft performs.

7.9 Power

- Power to the GTN is provided through a circuit breaker labeled NAV/GPS (1/2).
- Power to the optional GTN COM is provided through a circuit breaker labeled COM (1/2).
- Power to the optional GMA 35 is provided through a circuit breaker labeled AUDIO.
- Power to the optional Flight Stream 210 is provided through a circuit breaker labeled BT LINK.
- Power to the optional Flight Stream 510 is provided through the GTN MMC/SD card slot and protected via the GTN circuit breaker.

7.10 Databases and Flight Plan Waypoints/Procedures

Database versions (or cycles) and effective dates are displayed on the start-up database verification page immediately after power-on for those databases with an effective or expiration date. Databases with no effective or expiration date (e.g. - terrain database) are considered effective upon installation in the GTN. Database information can also be viewed on the System – System Status page.

The Obstacle Database has an area of coverage that includes the United States and Europe, and is updated as frequently as every 56 days. The HOT Line wire database only includes the continental United States and portions of Canada/Mexico.

Only the Obstacle/HOT Line wire database may be used in accordance with the limitation found in Section 2.27.

If a stored flight plan contains a waypoint or procedure that does not correspond to a waypoint or procedure in the navigation database in use, the waypoint or procedure will become locked (depicted as "lockd") in the flight plan. Flight plans with locked waypoints may be placed in the active flight plan portion of the system but no navigation will be provided. The locked waypoint/procedure must be resolved by removing or replacing it with the correct waypoint/procedures in the flight plan before the system will provide navigation.

7.11 External Switches

External switches may be installed and interfaced to the GTN. These switches may be stand alone, or integrated with a TAWS or GPS annunciator. Table 4 lists the switches and function they perform:

Switch Label	Function
CDI	Toggles between GPS / VLOC sources. This switch may be part of an external annunciator panel.
COM CHAN DN	Toggles down through the preset com frequencies.
COM CHAN UP	Toggles up through the preset com frequencies.
COM RMT XFR	Transfers the COM active / standby frequencies.
NAV RMT XFR	Transfers the NAV active / standby frequencies.
OBS	Performs an OBS or SUSP function. This switch is part of an external annunciator panel and is placarded with the following: "Green OBS indicates OBS or SUSP mode – GTN annunciator bar indicates which is active. Push OBS button to change OBS or SUSP mode."
OBS/SUSP	Performs an OBS or SUSP function.
TERR INHB	Toggles the TAWS Inhibit function on/off. This switch is part of an external annunciator panel. The terrain display is still presented if TAWS is Inhibited.
PTC	Push-to-Command switch for Voice Command input to the GMA and the GTN.

Table 4 – External Switches

7.12 Airspace Depiction and Alerts

The GTN aides the flight crew in avoiding certain airspaces with Smart Airspace and airspace alerts. Smart Airspace de-emphasizes depicted airspace that is not near the aircraft's current altitude. Airspace Alerts provide a message indication to the flight crew when the aircraft's current ground track will intercept an airspace type that has been selected for alerting.

NOTE

Smart Airspace and Airspace Alerts are separate features. Turning on/off Smart Airspace does not affect Airspace Alerts, and vice versa.

7.13 Garmin ADS-B Traffic System Interface (Optional)

A Garmin ADS-B traffic system may be interfaced to the GTN. The *nose* of the ownship symbol on both the GTN main map page and dedicated traffic page serves as the actual location of your aircraft. The *center* of the traffic target icon serves as the reported location for the target aircraft. Motion vectors for traffic may be displayed in either absolute or relative motion. The location of the traffic targets relative to the ownship are the same, regardless of the selected motion vector.

Absolute motion vectors are colored either cyan or white, depending on unit configuration. Absolute motion vectors depict the reported track of the traffic target referenced to the ground. An absolute motion vector pointed towards your ownship symbol *does not* necessarily mean the traffic target is getting closer to your aircraft.

Relative motion vectors are always colored green and depict the motion of the traffic target relative to your ownship symbol. The direction the traffic target is pointed may vary greatly from the motion vector and a target may be getting closer to your aircraft independent of the direction the target is pointed. A green relative motion vector pointed towards your ownship indicates that the traffic target *is* converging on your aircraft.

If more than one target is occupying the same area of the screen, the GTN will combine the two or more traffic targets into one traffic group. The presence of an asterisk to the left of a target indicates that traffic has been grouped. The highest priority traffic target in the group is displayed to the pilot. When applied to airborne targets the asterisk will be displayed in white or cyan depending on the traffic depiction color used in the installation. The asterisk will be brown for grouped ground targets. The asterisk will not turn amber, even if an alerted target is included in the group.

An alerted target may be placed in the same group as non-alerted targets. In this case, the alerted target will be displayed. Two alerted targets will not be placed in the same group. All alerted targets will be displayed on the screen.

Traffic targets displayed on the dedicated traffic page may be selected in order to obtain additional information about a traffic target or to view all targets in a grouped target. When a grouped target is selected, the "Next" button on the dedicated traffic page will cycle through all targets located in close proximity to where the screen has been touched.

7.14 GWX 70 Weather Radar (Optional)

The GWX 70 Weather Radar uses Doppler technology to optionally provide advanced features to the flight crew such as turbulence detection and ground clutter suppression. Turbulence detection can detect turbulence up to 40nm from the aircraft and will be displayed at radar ranges of 160nm or less.

NOTE

Turbulence detection does not detect all turbulence especially that which is occurring in clear air. The display of turbulence indicates the possibility of severe or greater turbulence, as defined in the Aeronautical Information Manual.

7.15 Charts (Optional)

The GTN 750/725 can display both procedure charts and weather data on the main map page at the same time. When datalink NEXRAD or Precipitation is overlaid on the main map page, the weather data is displayed *below* an overlaid procedure chart. When airborne weather radar is overlaid on the main map page, the radar data is displayed *above* an overlaid procedure chart.

7.16 Transponder Control (Optional)

The GTN can be interfaced to a Garmin transponder for control and display of squawk code, mode, and additional transponder functions. The activation of the "Enable ES" button on the transponder page does not indicate the aircraft is in full compliance with an ADS-B Out solution in accordance with TSO-C166b (1090ES). Consult your transponder documentation for additional information.

7.17 Telephone Audio (Optional)

Telephone audio distribution to the crew defaults to OFF on each power cycle of the GTN. Prior to utilizing the telephone function, the crew must distribute telephone audio to the desired recipients. If the crew is utilizing the telephone function it is required that the telephone audio be turned off upon completing telephone usage.

7.18 Depiction of Obstacles and Wires

7.18.1 Dedicated Terrain Page

The dedicated Terrain page will always depict point obstacles at zoom scales of 10 nm or less and depict wire obstacles at zoom scales of 5 nm or less. The obstacle or wire overlay icon (see Figure 3) will be shown near the bottom of the display when the obstacle or wire depiction is active based on the zoom scale.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Terrain page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

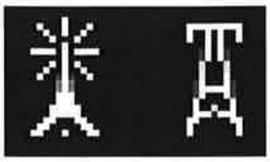

Figure 3 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.18.2 Map Page

The Map page may be configured to depict point obstacles and wire obstacles at various zoom scales by the pilot by using the Map page menu. The obstacle or wire overlay icon (see Figure 4) will be shown near the bottom of the display when the obstacle or wire overlay is active based on the current zoom scale and setting selected by the pilot.

The settings chosen by the pilot on the Map page menu (including obstacle and wire display ranges) are saved over a power cycle.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Map page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

NOTE

The Map page may be configured by the pilot to not show any obstacles or wires at any zoom scale.

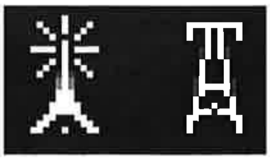

Figure 4 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.19 Flight Stream 210/510 (Optional)

The Flight Stream product line uses a wireless transceiver to provide data to and from a GTN to personal electronic devices (PEDs).

The Flight Stream 210 is a remotely mounted unit that provides the capability to interface Portable Electronic Devices (PEDs) to the GTN via Bluetooth. The Flight Stream 510 is mounted in the GTN SD card slot and includes a Bluetooth and Wi-Fi transceiver.

Data such as traffic, flight plan, datalink weather, entertainment audio information, and attitude information is sent from the Flight Stream to the PED. The PED is capable of sending flight plans and databases (510 only) to the Flight Stream which will then be available on the GTN. Limitations regarding database operations are found in Section 2.29.

Garmin provides a list of tested and compatible devices that can be used with the Flight Stream. Connection to the Flight Stream may be possible with devices other than those on the supported device list, but Bluetooth® and/or Wi-Fi stability and wireless data integrity cannot be guaranteed.

For details about the Garmin supported devices and apps for use with the Flight Stream product line, please visit: http://garmin.com/connext/supported_devices

7.20 Map Page

7.20.1 Configuration

The moving map and weather pages are capable of displaying a large quantity and variety of data. Map data is layered to ensure that data which is typically more critical is drawn above less critical data, however at some zoom scales and configurations the map may be cluttered with large amounts of data. Controls are provided on the Map and Weather pages for the pilot to select which data displayed, the declutter level, and the zoom scales at which data is added to or removed from the display. It is the responsibility of the pilot to select settings for the map page that will provide the display of data most appropriate to the operation being conducted.

7.20.2 Flight Plan Depiction

The map page depicts the current active flight plan. When an off-route Direct To is active the flight plan will no longer be depicted on the map.

7.20.3 Fuel Range Ring

The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes at the current aircraft groundspeed by default. The pilot may change the fuel reserve time value on the map setup menu. Changes to the fuel reserve time are persisted over GTN power cycles.

Visibility of the fuel range ring may be affected by the underlying map data selectable by the pilot. The pilot may make changes to the topographic or terrain data in order or more clearly observe the fuel range ring at any time.

Fuel range data is derived from the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

7.21 User Defined Waypoints

When a User Defined Waypoint is created a default name will automatically be provided and the pilot is given the option to provide a different name for the waypoint. Pages which have the autofill function will prevent some waypoint names from being used. If it is desired to name the waypoint with a subset of the name of an existing waypoint in the database then this must be accomplished on the Waypoint Info / User Waypoints page.

Waypoints which are created when a Search and Rescue pattern is created are not considered User Waypoints and therefore functions associated with User Waypoints are not provided for these waypoints.

7.22 Times and Distances

Time and Distance data to the next waypoint is always calculated from the present position to that waypoint and does not account for the path which may be flown (such as intercepting a course) to reach the waypoint.

When navigating using GPS guidance most legs are TO type legs where distance to the next waypoint decreases along the route. However, some procedures include FROM type legs. When navigating on a leg that is a FROM leg indications that it is a FROM leg include the TO/FROM flag indicating FROM and distances increasing in distance fields.

7.23 GTN-GTN Crossfill

Certain data will sync between GTNs when installed in a dual GTN configuration. The following data will crossfill between the two GTNs with CROSSFILL ON or OFF:

- User Waypoints
- FPL Catalog
- Traffic Alerts
- Missed Approach Popups
- Altitude Leg Popups
- Heading
- Date/Time Conventions
- CDI Scale

The following unit changes will crossfill:

- Temperature
- NAV Angle
- Fuel

The following items are crossfilled only when the GTNs are set to CROSSFILL ON:

- User Holds
- Approaches
- Flight Plan Changes
- Direct-To
- Selected OBS Course Changes

7.24 Direct-To Operations

When conducting Direct-To operations the Flight Plan tab provides a list of waypoints in the flight plan for which Direct-To is available. Some entries in the flight plan such as Holds and Course Reversals are not eligible for Direct-To and the pilot must instead select the associated waypoint if Direct-To operation is desired.

7.25 Automatic Speech Recognition (ASR)

ASR allows the pilot to interact with the GMA and GTN via voice commands. Commands are constructed around the "Verb – Noun – (Suffix)" syntax for most ASR commands.

- **"SHOW"** Commands – Used to show pages or data fields on the GTN
- **"SAY"** Commands – Used to instruct the ASR engine to say certain phrases related to the flight
- **"TUNE"** Commands – Used to tune certain frequencies into the standby position of the ASR GTN (usually GTN #1)

The "Page" suffix is used in conjunction with the "Show" phrase to command pages to be displayed on the GTN. (e.g.- "Show Main Map Page")

Audio Panel commands are available to switch audio sources.

- **"SELECT"** to choose which radio the MIC will be selected
- **"TOGGLE"** to toggle the monitor of a specific NAV/COM radio
- **"DISTRIBUTE"** to change the source of audio for the respective seat positions
- **"MUTE"** to mute audio inputs on the audio panel for the respective seat positions

Supplemental commands that allow map zooming, and page navigation are also available.

- **"BACK"**
- **"CANCEL"**
- **"ZOOM IN"**
- **"ZOOM OUT"**

Each command is initiated via the Push-to-Command (PTC) switch. Aural tones will indicate to the pilot the status of the command. A positive tone (low to high) will indicate the system executed a command. A negative tone (high to low) will indicate the system did not understand the command or could not execute due to system state or configuration. "SAY" commands do not provide aural tones as feedback.

The pilot must maintain vigilance regarding ASR command information. Due to the nature of voice recognition, there are times when ASR will interpret a command differently than the pilot intended. The pilot should always cross check the ASR response to the information contained within the GTN as appropriate to ensure in-flight information is accurately understood. If a conflict exists between information gathered via ASR and that available in the GTN system, the pilot should defer to the GTN system information.

Prior to using ASR, the pilot must complete the ASR Qualification Procedure from the GTN Cockpit Reference Guide.

The Command History Page details the commands received by ASR for that power cycle. A full list of commands and a tips for using ASR can be found in the *GTN 6XX/7XX Telligence Voice Command Guide,* 190-01007-50.

When using ASR for "TUNE" commands, it is recommended that the pilot enable Reverse Frequency Lookup (RFL) on the associated GTN.

7.26 European Visual Reporting Points

If the GTN is interfaced with a G500/600 PFD/MFD, and a flight plan in the GTN contains a VRP, the G500/600 must have a database that contains the VRP in order to appropriately display the VRP on the MFD map. If the database on the PFD/MFD does not contain the VRP, the VRP will display on the MFD map as an intersection.

7.27 Advisory Visual Approaches

The GTN will provide advisory visual approaches to many runways in the aviation database. Lateral guidance for the visual approach is aligned with the runway bearing. Vertical guidance is provided for those runways with VGSI information for distances up to 4.0NM from the runway. If a terrain database is installed in the GTN, the GTN provides vertical guidance up to 28NM from the runway end unless the computed glideslope would impact terrain or obstacles from the database. If the projected impact point is under 28NM and greater than 4NM, the flight plan line for the approach is shortened to indicate where vertical guidance is active for the approach. If the terrain impact point is less than 4NM from the runway and there is no VGSI data available, vertical guidance is not provided for that approach. Lateral guidance is still available when vertical guidance is removed.

CDI and VDI indications are equivalent to those of other GPS-based approaches (e.g.- LPV or LNAV+V). The GTN annunciates "VISUAL" in the annunciator bar to indicate a visual approach is active.

When loading, or activating the approach, the GPA and TCH information for that approach will be displayed on a popup. If there is no vertical guidance available, the popup will display "(NO VERTICAL GUIDANCE)".

Visual approaches are intended to be used as an aid to situational awareness. Visual approaches are advisory in nature and do not guarantee terrain and obstacle clearance for the approach runway.

Revision No.	Description	Affected Pages	Approval
Original	Complete Flight Manual Supplement for EGT-701	1 thru 4	Donald Armstrong Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date 11-12-92
A	Added Fuel Flow features & Switch.	2 thru 4	Donald Armstrong Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date 12-13-96
B	Added RPM and Manifold Pressure features	2 thru 4	Donald Armstrong Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date 6-17-99

United States Of America

Department of Transportation - Federal Aviation Administration

Supplemental Type Certificate

Number SA2586NM

This Certificate issued to J. P. INSTRUMENTS

PO Box 7033
Huntington Beach, CA 92646

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 3 *of the Civil Aviation Regulations, including respective Amendments as specified in the attached Approved Model List.*

Original Product Type Certificate Number: * *See attached FAA Approved J.P. Instruments

Make: * Master Eligibility List No. SA2586NM for list

Model: * of approved aircraft models and applicable TCDS

Description of Type Design Change:
Installation of J. P. Instruments temperature monitoring systems in accordance with FAA Approved J. P. Instruments Drawing List Report No. 100, Revision D, dated December 19, 1996, or later FAA approved revisions. FAA Approved Airplane/Rotorcraft Flight Manual Supplement No. 1 for EGT-701 temperature indicator, Revision A, dated December 13, 1996, or later FAA approved revisions.

Limitations and Conditions: The approval of the change in type design applies to the basic airplane of the specific models that are otherwise unmodified. This approval should not be extended to other specific airplanes of these models on which other previously approved modifications are incorporated, unless it is determined that the interrelationship between this installation and any previously approved configuration will not introduce any adverse effect upon the airworthiness of that airplane. If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission. (See continuation sheet)

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: December 31, 1984

Date of issuance: August 14, 1985

Date reissued:

Date amended: July 13, 1987, November 13, 1992, December 19, 1996, May 15, 1998, June 17, 1999

By direction of the Administrator

(Signature)

Manager, Propulsion Branch
Los Angeles Aircraft Certification Office

(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

J.P INSTRUMENTS

MASTER ELIGIBILITY LIST

NO. SA2586NM

INSTALLATION OF THE EGT 100, 200 SERIES AND 701 SERIES TEMPERATURE INDICATORS, FOR EXHAUST GAS, CYLINDER HEAD TEMPERATURE MONITORING SYSTEM.

STC NUMBER: **SA2586NM**

DATE: AUGUST 14,1985

REV 14
DATE: July 20, 2008

FAA Approved

AUG 22 2008

Los Angeles Aircraft
Certification Office
ANM 140L

REVISION LOG

TO FAA APPROVED MASTER ELIGIBILITY
LIST NO. SA2586N

REVISION NO.	DATE APPROVED	REVISION DESCRIPTION SHEET 2
NC	8-14-85	**Initial Release;** Sheets 1 thru 5
-1	9-23-85	**Addition of;** Cessna Models 320, 336, 340 and Piper Models PA-38, PA-44, PA-60 series; Sheet 6 Format changes and typing corrections Omission of "Approval Date" column on sheet 6 and subsequent sheets
-2	7-22-86	**Addition of:** Gulfstream American 112, 114, AA-5, 560 and 680; Beech 50, 60, 65, 76, Series ; Bellanca 14-13 and 14-19 Series; Cessna 185, 188, and 321 Series; Maule M-4, M-5 and M-6 Series ; Piper PA-22, PA-32-301 Series ; Republic RC-3; Swift GC-1A and GC-1B Series; Sheets 5,6 and 7
-3	7-13-87	**Addition of:** Piper PA-46-310P (Malibu), PA-31P (Navajo) **Suffix (O)**, added to instrument part number indicating Oil temperature PMA'd probe, P/N 400505,-L,-C. Applicable to all Lycoming and Continental direct drive piston engines. **Suffix (T)** added to instrument part number indicating turbine inlet temperature with probe P/N M-111 **Parenthesis ( )** added to any instrument part number, will indicate : " **None, Any** or **All**" of the options in parenthesis are applicable. Reorganized Sheets ALL
-4	5-23-90	**Addition of:** Enstrom Helicopter F-28,-28A,-28C,-28F, 280, 280C, 280F; Hughes Helicopter 269A, 269A-1, 269B, 269C; Robinson Helicopter R22, R22-Alpha, R22-Beta, R22-Mariner; Mooney Aircraft M20L, M20M ; Siai-Marchetti S.205-18/F, -18/R, -20/F, -20/R, 22/R, S.208, S.208A, F.260, F.260B, F.260C ; S.O.C.A.T.A TB10, TB20, TB21 ; Partenavia Costruzioni P68, P68B, P68C, P68C-TC, P68TC, AP68TP 300. Piper PA-46-350P. Sheets 2,5,6,8
-5	11-11-92	**Addition of:** EGT-701 (series) approved aircraft having for 4 or 6 cylinder engines only. Deleted aircraft model: Beech, all 90 series; Piper, PA-31T, -31T1,-31T2,-31T3. Sheets 2,3,7
-6	11-09-95	**Addition of :** GENERAL AVIA Construzioni Aeronautiche F22B, F22R, F22C & F20; Mooney M20R ; Air Tractor AT-300, -301; Ayres Corp. 600S-2D,S-2R,S2R-R1340; Avions Pierre Robin R2160. Sheets 3,6.
-7	12- 19 -96	**Addition of :** Added sheet 9 & 10 model designation system and Eligible Part Numbers. Revised all Part Numbers, all sheets. Added Fuel Flow suffix to P/N. Removed note "EGT-701 approved for 4 & 6 cylinder engines only". Added Cessna 170,A,B, 172R. Bellanca 17-30A series. AERO COMMANDER B-1, B-1A, De Havilland, DHC-2 Mk.series, North American T-28A series, WACO series and Beech 45 series. Sheets ALL
-8	07-14 -98	**Addition of :** Extra EA-300,S, L, EA-300/200. Maule MX-7-180C, MXT-7-180A, M-7-235. A, B, C. M-7-260, MT-7-260. Cessna 182S. 206H. Siai-Marchetti F.260D,E,F. Piper PA23-250 Sheets 4,5,6,8
-9	01-13-99	**Addition of :** Meyers (PROP-JETS, INC) 200, 200A, B, C, D. Gulfstream American GA-7. Beech Model D17S, SD17S, D17R, D17A C17R, G17S. Piper PA-18 Series. Robinson R44 VARGA Series. Grumman G21. Corrected P/N. Was EGT-710 to EGT-701 Sheets 3,5,6,7,8
-10	06- 17 -99	**Addition of :** RPM & MAP to identification list for EGT-701 Sheet ALL
-11	05- 02 -00	**Addition of :** American Champ 8KCAB, 7GCBC, 7ECA, 7GCBA, 7GCAA, 7KCAB. Beech 95-58, Cessna T206H. Gulfstream American 114 B, TC. Maule MXT-7-180 ,A ,B. Mooney (Rocket Conv. Per STC SA 00472SE & STC SA 5691NM) M20K, M20J. Pitts (Aviat) S-1S, S-1T,S-2, S-2A. Christen (Avait) A-1, S-2B. Mooney M-22., M20S. Jobmaster Comp DGA-15P. Weatherly 620, A, B. Thompson Navion C. Cessna U206A, B, C, D, E, F, G.(conv. Per STC 2123NM) Sheets 3,5,6, 7, 8
-12	06-11-01	**Addition of :** American General GA-7 • Beech V35, A, B (STC SA1035WE) • Beech, 58, 76 • Lance, LC40-550FG • Cessna 140 (STC SA547EA) • 172,S,T• 182T, RS, T182T • 182E-Q (STC SA3825SW) • Cirrus SR-20 • Piper PA-18,18A-"150" (STC SA682AL, STC SA00035NY) • Piper PA-24-200 Sheets 1-4
-13	04-18-03	**Addition of :** Beech 77 • Cirrus 22 • Cessna T303 • Diamond Aircraft DA20-A1, DA20-C1,DA40 • Extra Flugzeugbau EA-400 • Slingsby T67M260, T67M260-T3A • Wilga 80, Wilga 2000, •Helio (Alliance Aircraft) H-295, HT-295, H-395, H-391, H-391B, H-700, H-800 Sheets 5, 6, 7, 9
-14	07-20-08	Addition of : American Champion Aircraft Corp., 8GCBC • Beagle (DeHavilland Support, Ltd.) B121 series 1,2,3 • Cessna F182P,Q, FR182 • Chaparral Motors, 2T-1A,-1,-2 • Maule. MXT-7-160, MX-7-180AC, M-5-200, M-7-260, M-4-220C, M-4-220S,T, MT-7-235, M5-235C • Micco Aircraft Co, MAC-145, 145A,B • Mooney M20TN • Moravan Inc. Z-242L,Z-143L • Pilatus Aircraft PC6/350, PC6/350-H1,-H2 • Piper, PA-12,-12S, PA-22-150 • Univair Aircraft Corp. 108, 108-1,-2,-3, 5 • WACO YMF (F5,F5C) Sheets 2, 3, 4, 5, 6, 7 AUG 22 2008 ANM140L Los Angeles Aircraft Certification Office

	MAKE	AIRCRAFT MODEL	T.C.D.S.	Part Number (See Sheet. 11 for Series)
1.	Air Tractor	AT-300,AT-301	A9SW	(9), (E)
2.	Avions Pierre Robin	R2160.	A48EU	(4), (A)
3.	Ayres Corp.	600 S-2D, S-2R, S2R-R1340 S2R-R3S	A3SW	(9), (E)
4.	AERO COMMANDER	B-1, B-1A Lycoming IO-720-A1A 100-180	A8WE A8WE	(8), (D) (4), (A)
5.	American Champion Aircraft Corp.	8KCAB	A21CE	(4), (A)
6.	American Champion Aircraft Corp.	8GCBC	A21CE	(4), (A)
7.	American Champion Aircraft Corp.	7GCBC, 7ECA, 7GCBA, 7GCAA, 7KCAB	A-759	(4), (A)
8.	American General Aircraft Holdings, Grumman	GA-7 Twin	A17SO	(6T*), (BT*)
9.	Beagle (DeHavilland Support Ltd.)(British Aerospace)	B.121 Series 1, 2, 3	A22EU	(4), (A)
10.	Beech	D18S, D18C, E18S, C-45G, TC-45G, C-45H, TC-45H, TC-45J or UC-45J (SNB-5), RC-45J (SNB-5P), E18S-9700, G18S, JRB-6, 3N, 3NM, 3TM, P7W Wasps Jr.	A-765	(9), (E)
11.	Beech	Model D17S, SD17S, D17R, D17A, C17R (Army UC-43E) G17S,	A-649 ATC-713 ATC-604 ATC-779	(9), (E) (9), (E) (9), (E) (9), (E)
12.	Beech	23,A23,A23A,A23-19,19A, B19,M19A,A23-24,B23,C23, A24,A24R,B24R,C24R	A1CE	(4), (A)
13.	Beech	(YT-34)45,(T-34A, B-45)A45,(T-34B) D45 Cont. E-225-8	5A3	(6), (B)
14.	Beech	35,A35,B35,C35,D35,E35, F35,G35,35R	A-777	(6), (B)
15.	Beech	H35,J35,K35,M35,N35,P35,S35, V35,V35A,V35B,35-33,35-A33, 35-B33,35-C33,35-C33A, E33,E33A,E33C,F33,F33A,F33C, G33,36,A36,A36TC,B36TC	3A15	(6), (B)
16.	Beech	V35, V35A, V35B with Optional engine TSI0-520 per STC SA1035WE	3A15	(6), (B)
17.	Beech	50, B50; D50,A,B,C,E, E-5990; E50,F,G,H,J	5A4	(6T), (BT)
18.	Beech	58, 58P, 58PA, 58TC, 58TCA	A23CE	(6T*), (BT*)
19.	Beech	60, A60, B60	A12CE	(6T*), (BT*)
20.	Beech	65, 65-80,65-A80,65-A80-8800, 65-88,65-B80,A65 A65-8200,70,	3A20	(6T), (BT)
21.	Beech	76	A29CE	(4T), (AT)
22.	Beech	77	A30CE	(4), (A)
23.	Beech	95,B95, B95A,D95A,E95,	3A16	(4T), (AT)
24.	Beech	95-55,-A55,-B55,-B55A -C55,-C55A D55,D55A,E55,E55A,56TC, A56TC, 58,58A, 95-58	3A16	(6T*), (BT*)
25.	Bellanca	14-13,14-13-2,-3, -3W	A773	(6), (B)
26.	Bellanca	14-19,19 -2, -3, -3A	1A3	(6), (B)

FAA approved AFM Supplement is required with the EGT-701. The EGT-701 is applicable to all EGT-100/200 series. RPM and MAP applicable to the P\N EGT-701,4 and 6 cylinder engines only

	MAKE	AIRCRAFT MODEL	T.C.D.S.	Part Number (See Sheet. 11 for Series)
		17-30,-A, 17-31,-A, 17-31TC,-A,	A-743	(9), (E)
27.	Boeing Boeing	(STEARMAN) A75L3,75,A75, B75, E75, A75, A75L300, IB75A, E75N1 A75J1, A75N1, B75N1, D75N1	A-743	(7), (C)
			3A43	(4), (A)
28.	Cessna	140	A-768	(4), (A)
29.	Cessna	120 , 140, with 0-200 Conversion per STC-SA547EA	A-5A2	(4), (/
		140A, with 0-200 Conversion per STC-SA547EA	3A19	(4), (A)
30.	Cessna	150,A,B,C,D,E,F,G,H,J,K A150K, 150L, A150L, 150M, A150M, 152, A152	A-799	(6), (B)
31.	Cessna	170. 170A, 170B	3A12	(6), (B)
32.	Cessna	172,172A,B,C,D,E,F,G,H,	3A12	(4), (A)
	Cessna	172I,K,L,M,N,P,Q,R,S,T	3A17	(4), (A)
	Cessna	172RG, P172D	3A17	(6), (B)
	Cessna	R172E,F,G,H,J,K,175,175A,B,C	A13CE	(4), (A)
33.	Cessna	177,177A, 177B	A20CE	(4); (A)
	Cessna	177RG	5A6	(6), (B)
34.	Cessna	180,180A,B,C,D,E,F,G,H,J,K	3A13	(6), (B)
	Cessna	182,182A,B,C,D,E,F,G,H,J,K, 182L,M,N,P,Q,R, S, T R182, T182, TR182 , 182RS, T182T,	3A13	(6), (B)
35.	Cessna	182 Series STC SA00152WI	3A13	(6), (B)
36.	Cessna	182E,F,G,H,J,K, L, M, N, P, Q(Peterson,STC SA3825SW)	A42EU	(6), (B)
37.	Cessna	F182P, Q, FR182	3A24	(6), (E
38.	Cessna	185,185A,B,C,D,E,A185E,A185F	A9CE	(6*), (B*)
39.	Cessna	188,188A,188B,A188,A188A, A188B,T188C	A-790	(7), (C)
40.	Cessna	195,195A, 195B	A-790	(9), (E)
		190	A4CE	(6*), (B*)
41.	Cessna	206,H P206,P206A,B,C,D,E, H TP206A,B,C,D,E, U206,U206A,B,C,D,E,F,G, TU206A,B,C,D,E,F,G T206H	A4CE	(6*), (B*)
42.	Cessna	U206,U206A,B,C,D,E,F,G, (Conv. Per STC 2123 NM)	A16CE	(6*), (B*)
43.	Cessna	207,207A,T207,T207A	3A21	(6*), (B*)
44.	Cessna	210,210A,B,C,D,E,F 210-5,210-5A,T210F,210G, T210G,210H,T210H,210J,T210J, T210K,210K,210L,T210L,210M, T210M,210N,P210N,T210N,210R P210R,T210R	3A10	(6T*), (BT*)
45.	Cessna	310,310A,B,C,D,E,F,G,H, E31OH,310I,J,K,L,N,P,Q,R 310J-1,E310J,T310P,Q,R T310Q,310R,T310R	3A11	(6T), (BT)
46.	Cessna	321	3A25	(6T*), (BT*)
47.	Cessna	320,A,B,C,D,E,F,320-1,335, 340(,340A	A2CE	(6T), (
48.	Cessna	336	A34CE	(6T*), (B
49.	Cessna	T303	A6CE	(6T*), (BT*)
50.	Cessna	337, 337A,B,C,D,E,F,G,H T337B,C,D,E,F,G,H, M337B,P337H,T337H-SP	A7CE	(6T*), (BT*
51.	Cessna	401, 401A,B, 402,402A,B,C,		

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RPM and MAP applicable to the P\N EGT-701,4 and 6 cylinder engines only

	MAKE	AIRCRAFT MODEL	T.C.D.S.	Part Number (See Sheet. 11 for Series)
		411,411A, 414,414A 421,421A 421B,421C		
52.	Chaparral Motors (Great Lakes)	2T-1A, 2T-1A-1, -2	A18EA	(4), (A)
53.	Cirrus	SR-20	A00009CH	(6), (B)
54.	Cirrus	SR-22	A00009CH	(6), (B)
55.	Consolidated Aeronautical	LAKE C-1,-2, LA-4,LA-4A,LA-4P, LA-4-200 LAKE 250	1A13 1A13	(4), (A) (6*), (B*)
56.	Diamond Aircraft Ind.	DA20-A1, DA20-C1	TA4CH	(4), (A)
57.	Diamond Aircraft Ind.	DA40, HK36, HK36TC,TS,TTC,TTC-ECO	A47CE	(4), (A)
58.	De Havilland	DHC-2 Mk. I DHC-2 Mk. II DHC-3 P&W Wasp. R-1340	A-806 A-805	(9), (E) (9), (E)
59.	EXTRA FLUGZEUGBAU	EA-300 EA-300S EA-300L EA-300/200	A67EU	(6), (B)
60.	EXTRA FLUGZEUGBAU	EA-400	A43CE	(6*), (B*)
61.	Enstrom Helicopter	F-28,-28A, -28C, -28F, 280, 280C, 280F	H1CE	(4*), (A*)
62.	GENERAL AVIA Construzioni Aeronautiche	F22B, F22R, F22C F20	A75EU A38EU	(4*), (A*) (6T), (BT)
63.	Grumman Grumman	AA-1, -1A, -1B, -1C AA-5,-5A,-5B AG-5B	A11EA A16EA	(4), (A)
64.	Grumman	G21, G21A	654	(9), (E)
65.	Gulfstream American	112,112TC,112B,112TCA,	A12SO	(4), (A)
66.	Gulfstream American	114, 114A, B, TC	A12SO	(6), (B)
67.	Gulfstream American American General Aircraft Holding Co.,	GA-7	A17SO	(4T), (AT)
68.	Gulfstream	AA-5, AA-5A, AA-5B	A16EA	(4), (A)
69.	Gulfstream American	500, 500-A, B, U, S, 520, 560, 560A, -E,	6A1	(6T), (BT)
70.	Gulfstream American	560F, 680, 680-E, F, 680FL, 680-FL(P), 685	2A4	(6T*), (BT*)
71.	Helio (Alliance Aircraft)	H-295, HT-295, H-395, H-391, H-391B, H-700 H-800	1A8 1A8	(6*), (B*) (8), (D)
72.	Hughes Helicopter	269A, 269A-1, 269B, 269C	4H12	(4*), (A*)
73.	Jobmaster Company	DGA-15P (Army UC-70; Navy GH-1, GH-2,GH-3, NH-1	A-717	(7), (E)
74.	Lancair	LC40-550FG	A00003SE	(6*), (B*)
75.	Maule	M-5-180C, -200, -210TC M-6-180 MXT-7-180, A, B MX-7-180,A,B, C	3A23	(4*), (A*)
76.	Maule	Bee Dee M-4, M-4,-4C,-4S,-4T M-4-210,C,S,T, M-4-220C,S,T M-4-180C,S,T, M-4-220, M-5-210C,-220C,-235C, M-6-235 MX-7-235,A,B,C M-7-235, A,B,C M-7-260, MT-7-260	3A23	(6*), (B*)
77.	Maule	MXT-7-160, MX-7-180AC, M-5-200	3A23	(4), (A)
78.	Maule	M-7-260, M-4-220C, M-4-220S,T, MT-7-235, M5-235C	3A23	(6), (B)
79.	Micco Aircraft Co	MAC-145, 145A,B	3A1	(6*), (B*)
80.	Mooney	M20, M20A,B,C,D,E,F,G,J	2A3	(4), (A)

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RPM and MAP applicable to the P\N EGT-701,4 and 6 cylinder engines only

	MAKE	AIRCRAFT MODEL	T.C.D.S.	Part Number (See Sheet. 11 for Series)
		M20K, L, M, R ,S	2A3	(6*), (B*)
81.	Mooney	M20TN	2A3	(6*), (BT*)
82.	Mooney	M22	A6SW	(6T*), (BT*)
83.	Mooney Rocket Eng. Conv.	M20K Rocket 305 (per STC SA 5691NM)	2A3	(6T*), (BT*)
84.	Mooney Rocket Eng. Conv.	M20J Missile (per STC SA 00472SE)	2A3	(6T*), (BT*)
85.	Moravan Inc. (ZLIN)	Z-242L, Z-143L	A76EU	(4), (A)
86.	Meyers PROP-JETS, INC.	200, 200A, B, C, D	3A18	(6*), (B*)
87.	North American	AT-6 (SNJ-2,-7),-6A,B,C,D,E,F, T-6G	A-2-575	(9), (E)
		NA-260 (USAF T-28A)	1A18	(9), (E)
		T-28A ,B,C,D Wright R-1300-1A	AR-30	(9), (E)
		NA-260 (T-28A Conversion)	1A18	(9), (E)
88.	Partenavia Costruzioni Aeronautiche	P68, P68B, P68C, P68C-TC, P68TC, AP68TP 300	A31EU	(6T*), (BT*)
89.	Pilatus Aircraft Limited	PC6/350, PC6/350-H1,-H2	7A15	(6*), (B*)
90.	Piper (FS2003 Corp.)	PA-12, -12S	A-780	(4), (A)
91.	Piper	PA-18, PA-18S, PA-18 "105" (Special), PA-18S "105" (Special) PA-18A, PA-18 "125" (Army L-21A) PA-18S "125", PA-18AS "125", PA-18 "135" (Army L-21B), PA-18A "135", PA-18S "135", PA-18AS "135", PA-18 "150", PA-18A "150", PA-18S "150", PA-18AS "150",	1A2	(4), (A)
92.	Piper	PA-18A–"150" PA-18 –"150" (Crosswinds STOL STC SA682AL) or (Penn-Yan, STC SA00035NY)	AR-7 1A2	(4), (A)
93.	Piper	PA-20,-20S,20-"115",20S-"115" PA-20-"135", -20S-"135"	1A4	(4), (A)
94.	Piper	PA-22, -22-108,-22-135, -22S-135, PA-22S-150,-22-160,-22S-160	1A6	(4), (A)
95.	Piper	PA-22-150	1A6	(4), (A)
96.	Piper	PA-23,-23-160	1A10	(4T), (AT)
	Piper	PA-23-235, PA-250, E23-250 , 23-250	1A10	(6T), (BT)
97.	Piper	PA-24	1A15	(4), (A)
	Piper	PA -24-250, -24-260	1A15	(6), (B)
	Piper	PA-24-400	1A15	(8), (D)
98.	Piper	PA-25	2A8	(4), (A)
	Piper	PA-25-235, -260	2A8	(6), (B)
99.	Piper	PA-28-140,-150,-151,-160,-161, PA-28-180,-28S-160	2A13	(4), (A)
	Piper	PA-28S-180,-28R-180,-28-181, PA-28R-200, PA-28-236; -28-235 PA-28R-201,-28R-201T -28-201T, PA-28RT-201,-28RT-201T,-28-201	2A13	(6*), (
100.	Piper	PA-30, PA-39, PA-40	A1EA	(4T), (AT
101.	Piper	PA-31,-31-300,-31-325,-31-350	A20SO	(6T), (BT
102.	Piper	PA-31P,31P-350	A8EA	(6T*), (BT

FAA approved AFM Supplement is required with the EGT-701. The EGT-701 is applicable to all EGT-100/200 series.
RPM and MAP applicable to the P\N EGT-701,4 and 6 cylinder engines only

	MAKE	AIRCRAFT MODEL	T.C.D.S.	(See Sheet. 11 for Series)
103	Piper	PA-32-260,-32-300,-32S-300 PA-32R-300, -32RT-300, -32RT-300T, PA-32R-301, -32R-301T, PA-32-301, -32-301T	A3SO	(6*), (B*)
104	Piper Piper	PA-34-200 PA-34-200T,-220T	A7SO A7SO	(4T), (AT) (6T*), (BT*)
105	Piper	PA-38-112	A18SO	(4), (A)
106	Piper	PA-44-180, -44-180T	A19SO	(4T*), (AT*)
107	Piper	PA-46-310P,-350P	A25SO	(6T*), (BT*)
108	Piper	PA-60-600, -60-601, -60-700P, A, CR PA-60-601P, PA-60-602P, PA-60-650	A17WE	(6T*), (BT*)
109	Republic	RC-3	A-769	(6), (B)
110.	Robinson Helicopter	R22, R22 ALPHA, R22 BETA, R22 MARINER R44	H10WE H11NM	(4), (A) (6), (B)
111	Siai-Marchetti	S.205-18/F, -18/R, -20/F, -20/R, -22/R, S.208, S208A F.260, F.260B, F.260C, F.260D, , F.260E, , F.260F,	A9EU A10EU	(4), (A) (6*), (B*)
112	Slingsby	T67M260, T67M260-T3A	A73EU	(6), (B)
113	S.O.C.A.T.A Aerospatiale	TB9,10, TB20, TB21,200	A51EU A51EU	(4), (A) (6*), (B*)
114	Univair Aircraft Corp, Stinson	108,108-1, -2, -3, -5	A-767	(6), (A)
115	Swift	GC-1A	766	(4), (A)
116	Swift	GC-1B	766	(6), (B)
117	Thompson	Navion, A ,B C, D ,E ,F,G ,H	A782	(6), (B)
118	VARGA Augustair, Inc.	2150, 2150A, 2180	4A19	(4), (A)
119	WACO	YMF, YKC, YKC-S, YKS-6, ZKS-6 UPF-7 VPF-7	ATC542 A-533 A-642	(7), (C) (7), (C) (7), (C)
120	WACO	YMF (F5, F5C modification per STC SA1000GL)	ATC 542	(7), (C)
121	PITTS (AVIAT) White Inter.Ltd.	S-1S, S-1T, S-2, S-2A, S-2S, S-2B	A8SO	(4), (A) (6), (B)
122	Christen (AVIAT) White Inter./ Sky Inter.	A-1, A, B	A22NM	(4), (A)
123	Weatherly	620, A, B	A26WE	(9), (E)
124	Wilga	PZL-104 Wilga 80 PZL-104M Wilga 2000	A55EU	(9), (E) (6), (A)

Model designation system by part number for EGT-701

EGT-701- [ ] C -OT [ ]-OP [ ] -A [ ] -T [ ] -I [ ]- F [ ] - R/M - L [ ]

- (L) TFT color display 730-830
- (R/M L) RPM and MAP
- (F) Fuel Flow function
- (I) Induction Air Temperature (IAT)
- (T) Turbine Inlet Temperature (TIT)
- (A) Outside Air Temperature (OAT)
- (OP) Oil Pressure
- (OT) Oil temperature
- Number of Cylinders (4,6,7,8, & 9,) with EGT & CHT function

Model designation system by part number for EGT-100

EGT-100- [ ] - C [ ] –O-T [ ] -A [ ] -T [ ] -I [ ]

- Induction Air Temperature (IAT)
- Turbine inlet temperature (TIT)
- Outside air temperature (OAT)
- Oil temperature (Oil)
- Cylinder Head Temperature (CHT)
- Number of Cyl. with EGT only/and CHT (4,6,7,8,&9)

Example: EGT-701 - (6C O-T A I R/M L) is indicated as such on the TSO label

EGT-701 - 6C – 0T [♦] OP [ ] -A [♦] -T [ ] -I [♦] - F [♦] –R/M L [♦] –L [ ]

EGT 701 Model EDM 800

- 6 Cylinder
- Oil Temperature function
- OAT, Outside Air function
- IAT, Induction Air function
- RPM & MAP function
- Fuel Flow function

FAA approved AFM Supplement is required with the EGT-701. The EGT-701 is applicable to all EGT-100/200 series.

MAKE	AIRCRAFT MODEL	T.C.D.S.	Part Number (See Sheet. 11 for Series)

ELIGIBLE PART NUMBERS for EGT-701 (series)

Note (1) suffix "T" designates twins, two instruments required.

Note (2) suffix " - " denotes turbocharged engines.

Part number (Series)

4 4 Cylinder with RPM & MAP	4 4 Cylinder	6 6 Cylinder with RPM & MAP	6 6 Cylinder	7 7 Cylinder	8 8 Cylinder	9 9 Cylinder	TIT
EGT-701-( )	EGT-701-( )	EGT-701-( )	EGT-701-( )	EGT-701-( )	EGT-701-( )	EGT-701-( )	
4C R/M L	4CL	6C R/M L	6CL	7CL	8CL	9CL	
4COR/M L	4COTOPL	6COTOP R/M L	6COTOPL	7COTOPL	8COTOPL	9COTOPL	
4CA R/M L	4CAL	6CA R/M L	6CAL	7CAL	8CAL	9CAL	
4CT R/M L	4CTL	6CT R/M L	6CTL	7CTL	8CTL	9CTL	•
4CI R/M L	4CIL	6CI R/M L	6CIL	7CIL	8CIL	9CIL	
4CF R/M L	4CFL	6CF R/M L	6CFL	7CFL	8CFL	9CFL	
4COTOPA R/M L	4COTOPLA	6COTOPA R/M L	6COTOPAL	7COTOPAL	8COTOPAL	9COTOPAL	
4COTOPT R/M L	4COTOPTL	6COTOPT R/M L	6COTOPTL	7COTOPTL	8COTOPTL	9COTOPTL	•
4COTOPI R/M L	4COTOPIL	6COTOPI R/M L	6COTOPIL	7COTOPIL	8COTOPIL	9COTOPIL	
4COTOPF R/M L	4COTOPFL	6COTOPF R/M L	6COTOPFL	7COTOPFL	8COTOPFL	9COTOPFL	
4COTOPAT R/M L	4COTOPATL	6COTOPAT R/M L	6COTOPATL	7COTOPATL	8COTOPATL	9COTOPATL	•
4COTOPAI R/M L	4COTOPAIL	6COTOPAI R/M L	6COTOPAIL	7COTOPAIL	8COTOPAIL	9COTOPAIL	
4COTOPAF R/M L	4COTOPAFL	6COTOPAF R/M L	6COTOPAFL	7COTOPAFL	8COTOPAFL	9COTOPAFL	
4COTOPATI R/M L	4COTOPATIL	6COTOPATI R/M L	6COTOPATIL	7COTOPATIL	8COTOPATIL	9COTOPATIL	•
4COTOPATF R/M L	4COTOPATFL	6COTOPATF R/M L	6COTOPATFL	7COTOPATFL	8COTOPATFL	9COTOPATFL	•
4COTOPTI R/M L	4COTOPTIL	6COTOPTI R/M L	6COTOPTIL	7COTOPTIL	8COTOPTIL	9COTOPTIL	•
4COTOPTF R/M L	4COTOPTFL	6COTOPTF R/M L	6COTOPTFL	7COTOPTFL	8COTOPTFL	9COTOPTFL	•
4COTOPIT R/M L	4COTOPITL	6COTOPIT R/M L	6COTOPITL	7COTOPITL	8COTOPITL	9COTOPITL	•
4COTOPTIF R/M L	4COTOPTIFL	6COTOPTIF R/M L	6COTOPTIFL	7COTOPTIFL	8COTOPTIFL	9COTOPTIFL	•
4COTOPAIF R/M L	4COTOPAIFL	6COTOPAIF R/M L	6COTOPAIFL	7COTOPAIFL	8COTOPAIFL	9COTOPAIFL	
4CATIF R/M L	4CATIFL	6CATIF R/M L	6CATIFL	7CATIFL	8CATIFL	9CATIFL	•
4CAT R/M L	4CATL	6CAT R/M L	6CATL	7CATL	8CATL	9CATL	•
4CAI R/M L	4CAIL	6CAI R/M L	6CAIL	7CAIL	8CAIL	9CAIL	
4CAF R/M L	4CAFL	6CAF R/M L	6CAFL	7CAFL	8CAFL	9CAFL	
4CATI R/M L	4CATIL	6CATI R/M L	6CATIL	7CATIL	8CATIL	9CATIL	•
4CATF R/M L	4CATFL	6CATF R/M L	6CATFL	7CATFL	8CATFL	9CATFL	•
4CAIF R/M L	4CAIFL	6CAIF R/M L	6CAIFL	7CAIFL	8CAIFL	9CAIFL	
4CTIF R/M L	4CTIFL	6CTIF R/M L	6CTIFL	7CTIFL	8CTIFL	9CTIFL	•
4CTI R/M L	4CTIL	6CTI R/M L	6CTIL	7CTIL	8CTIL	9CTIL	•
4CTF R/M L	4CTFL	6CTF R/M L	6CTFL	7CTFL	8CTFL	9CTFL	•
4CIF R/M L	4CIFL	6CIF R/M L	6CIFL	7CIFL	8CIFL	9CIFL	
4COTOPATIF R/M L	4COTOPATIFL	6COTOPATIF R/M L	6COTOPATIFL	7COTOPATIFL	8COTOPATIFL	9COTOPATIFL	•

ELIGIBLE PART NUMBERS for EGT-100-( ) and EGT-200( )

Note (1) suffix "T" designates EGT-200 ( ) series for twins

Note (2) suffix "*" denotes for turbocharged engines.

Part number Series

A 4 cylinder	B 6 cylinder	C 7 cylinder	D 8 cylinder	E 9 cylinder	TIT
EGT-100-( )	EGT-100-( )	EGT-100-( )	EGT-100-( )	EGT-100-( )	
4	6	7	8	9	
4C	6C	7C	8C	9C	
4C0	6C0	7C0			
4CA	6CA	7CA			
4CT	6CT	7CT			•
4CI	6CI	7CI			
4COA	6COA	7COA			
4COT	6COT	7COT			•
4COI	6COI	7COI			
4COAT	6COAT	7CAT			•
4COAI	6COAI	7CAI			
4COATI	6COATI	7CTI			•
4COIT	6COIT				•
4CAT	6CAT				•
4CAI	6CAI				
4CATI	6CATI				•
4CTI	6CTI				•

Example: see page 5

Cessna 310 (6T*)

6 = any PN in that column except * items in TIT column

T = Requires two instruments

* = Includes TIT (turbocharged a/c only)

FAA approved AFM Supplement is required with the EGT-701. The EGT-701 is applicable to all EGT-100/200 series.
RPM and MAP applicable to the P\N EGT-701,4 and 6 cylinder engines only

MAKE	AIRCRAFT MODEL	T.C.D.S.	Part Number (See Sheet. 11 for Series)

3/20/08

Subject: Permission to use STC.

To Whom It May Concern:

J.P. Instruments holder of STC SA2586NM
grants to the purchaser of the
EDM-700/730/800/830 series PN EGT-701(Series) and the
Classic Scanner PN EGT-100 (Series)
permission to use the STC.

Signed ______________

U.S. Department of Transportation
Federal Aviation Administration

TRANSPORT AIRPLANE DIRECTORATE
AIRCRAFT CERTIFICATION SERVICE
LOS ANGELES AIRCRAFT CERTIFICATION OFFICE
3229 EAST SPRING STREET
LONG BEACH, CA 90806-2425

NOV 10 1992

J P Instruments
3402-1 West MacArthur
Santa Ana, California 92704

Gentlemen:

J P Instruments, Temperature Indicator;
Technical Standard Order C43b

Your application dated August 24, 1992, requesting the issuance of a Technical Standard Order (TSO) authorization in accordance with the procedural requirements of Federal Aviation Regulation (FAR) Part 21, Subpart O, has been reviewed. Based upon your data and statement of conformance certifying your articles have met the requirements of FAR Part 21, Subpart O, and the minimum performance standards of TSO C43b (Ref. FAR 21.305(b)), authorization is hereby granted for the following:

MODEL/PART NO.	DESCRIPTION
EGT-701( )	Exhaust Gas Temperature Indicator

The technical data submitted with your letter, have been accepted as fulfilling the requirements for your TSO authorization and will be retained in our files.

The quality control procedures contained in your quality control manual, currently on file at the Los Angeles Manufacturing Inspection District Office, and your statement that those procedures will be applied to the manufacture of the subject article at the above address, are considered adequate in accordance with FAR 21.143.

Effective this date, you are authorized to use TSO procedures for the subject temperature indicator. You may identify this article with the applicable TSO markings as required by TSO C43b.

As recipient of this TSO authorization, except as provided in FAR 21.3(d), you are required to report any failure, malfunction, or defect in any product or part manufactured by you or your contracted suppliers, and which you have determined has resulted or could result in any of the occurrences listed in FAR 21.3(c). The report should be communicated initially by telephone to the Manager, Technical and Administrative Support Staff, F

TSO Compliance	Aeronautical Standard	Scope
TSO-C43b Temperature Instruments	8005	Thermocouple, Class IC

TYPE/MODEL EDM-700/800
TSO NUMBER TSO-C43b

Mc MANUFACTURER: J.P.INSTRUMENS
ADDRESS: 3402-I West Mac Arthur Blvd. Santa Ana CA 92704
EC REVISION & CHANGE NUMBER OF DO-160C

CONDITIONS	SECTION	DESCRIPTION OF TEST CONDUCTED AND PASSED
Temperature and Altitude	4.0	Equipment tested to Categories B1
Low Temperature	4.5.1	
High Temperature	4.5.2 & 4.5.3	
In-Flight Loss of Cooling	4.5.4	Equipment identified as Category X no test performed.
Altitude	4.6.1	Equipment tested to Categories B1
Decompression	4.6.2	
Overpressure	4.6.3	Equipment tested to note 2
Temperature Variation	5.0	Equipment tested to Category B. .
Humidity	6.0	Equipment tested to Category A.
Operational Shock and Crash Safety	7.0	Equipment tested to Category B.
Vibration	8.0	Equipment tested with our shock mounts to Category M,N, and B. Table 8-1
Explosion	9.0	Equipment identified as Category X, no test performed.
Waterproofness	10.0	Equipment identified as Category X, no test performed.
Fluids Susceptibility	11.0	Equipment identified as Category X, no test performed.
Sand and Dust	12.0	Equipment identified as Category X, no test performed.
Fungus	13.0	Equipment tested to Category F.
Salt Spray	14.0	Equipment identified as Category X, no test performed.
Magnetic Effect	15.0	Equipment is Category C
Power Input	16.0	Equipment tested to Categories B.
Voltage Spike	17.0	Equipment tested to Category B
Audio Frequency Susceptibility	18.0	Equipment tested to Category B
Induced Signal Susceptibility	19.0	Equipment tested to Category A
Radio Frequency Susceptibility	20.0	Equipment tested for conducted susceptibility to Category A.
Radio Frequency Emission	21.0	Equipment tested to Category A
Lightning Induced Transient Susceptibility	22.0	Equipment identified as Category X, no test performed.
Lightning Direct Effects	23.0	Equipment identified as Category X, no test performed.
Icing	24.0	Equipment identified as Category X, no test performed.
Other Tests		Fire resistance tests were conducted in accordance with Federal Aviation Regulations Part 25, Appendix F.

N

J.P.INSTRUMENTS
PO BOX 7033
HUNTINGTON BEACH CA 92646

Airplane/Rotorcraft Flight Manual
Supplement No. 1
EGT-701 Rev B

1-GENERAL

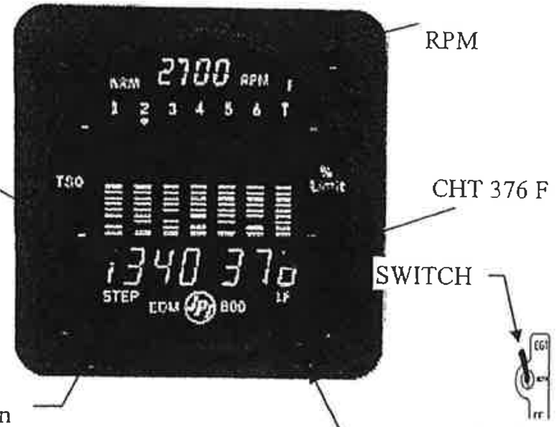
The EGT-701 temperature indicator displays temperature digitally and in analog format. The EGT as displayed is based on probes located near the exhaust outlet for each cylinder and the TIT probe, if installed, is adjacent to the turbo charger. These probes are not necessarily collocated with the primary probes therefore, EGT-701 may not indicate the same as the aircraft primary instruments. The analog display is an electronic bar graph (vertical columns, one per cylinder) of EGT & TIT temperatures presented as a percentage of 1650°F. Below the vertical columns the specific value for EGT and CHT are displayed digitally. The dot over the column indicates which cylinder's digital information is presently displayed. The missing bars at the base of the columns indicates the hottest and coldest Cylinder Head temperature trend . During Lean Find mode the leanest cylinder is displayed along with the fuel flow (optional) at that time. Depressing the LF and STEP button simultaneously brings up the adjustable scan rate function, OAT in °C or °F. Depress the LF button will change the value of the rate or OAT in °C or °F. Exit by Depressing STEP.

If the EGT-701 buttons are not depressed for 10 minutes the system will start scanning automatically. Depressing the STEP button will stop the automatic scan and index through all the functions available. During constant power cruise, if the the LF button is depressed for five seconds the bargraph will level at mid scale. The leveled bars represent the peaks of each column. Each bar represents 10 °F and now acts as an EGT & TIT trend monitor, quickly showing an increase or decrease in temperature. Depress again to return to normal; nothing else is affected. With the fuel flow option there is a three position toggle switch. The positions are: 1) **EGT**, digital and bargraph display of temperatures, 2) **FF**, digital display of GPH, REM and USED Fuel. Temperature bargraph remains. 3) **Both**, cycles through everything installed. The data port output, sends RS232 serial data every 6-sec.

Options of Fuel Flow, TIT, OAT, IAT (induction air temp.), OIL, BAT (voltage) and are only displayed digitally with headlines after the number, as "230 OIL" or "14 GPH". A large value (50 +) of "CLD" indicates shock cooling usually associated with rapid descents at low power. Optional functions not installed will not display. RPM is displayed constantly in the upper display with no alarms. MAP is shown in the scan display.

Alarm limits set for this instrument if different from JPI limits.

CHT__________
OIL__________
TIT__________
DIF__________
CLD__________
BAT__________
TECH__________
DATE__________



P/N EGT-701

GENERAL (cont.)

An alarm causes the digital function to flash as soon as the particular limit is exceeded. Factory set alarm limits for CHT (450 °F) and OIL (230°F) are lower than the actual aircraft limits and can n[illegible] be set by the pilot. The values may be adjusted to suit individual preference by a qualified technician. Other factory set alarm limits are: "BAT" Voltage 15.5/11.0 or 31.0/22.0 Hi/Lo as appropriate; "DIF" (differential Hi/Lo EGT) 500 °F, "TIT" 1650 °F Hi; "OIL" Lo 90 °F; "CLD" (Rate of change of cylinder head temperature in degrees per minute) -60 degrees/minute. The pilot should be aware of the setting of each alarm for his particular aircraft. An alarm is "Canceled" by holding the step button in for 5 seconds and seeing the word "OFF". Then, only that particular alarm is canceled. Canceled alarms will not appear again until the power has been removed and reapplied to the EGT-701. The entire display dims automatically depending on the ambient lighting.

The Cylinder Head with the Gasket probe and oil temperature will indicate generally higher temperatures than instruments provided by the aircraft manufacturer because the EGT-701 sensing thermocouples are not collocated with the primary instrument sensing probes. Therefore, airplane flight manual limitations based on primary instrument indication take precedence over those of the EGT-701

II OPERATING LIMITATIONS

A. The EGT-701 may not replace any existing instrument or indicator required by the aircraft type design or operating limits.

B. The EGT-701 display may not be used in lieu of, or to supersede, engine operating limitations established by the airframe or engine manufacturer during certification.

III. EMERGENCY PROCEDURES

No change

IV. NORMAL PROCEDURES

CAUTION

Comply with manufacturer's Airplane
Flight Manual leaning procedure.
Do not exceed applicable engine
or aircraft limitations.

After establishing desired cruise power depress the LF button to activate the Lean Find Mode. As the mixture is leaned, one column on the EGT-701 display will begin blinking, indicating the exhaust gas temperature for that cylinder has peaked showing its digital value along with the fuel flow (option) at that time. Continue with the leaning procedure as recommended by the aircraft manufacturer while monitoring the primary engine instruments and the EGT-701 display. Once the leaning procedure has been completed, depress the Step button briefly to exit the Lean Find Mode and enter the Monitor Mode.

United States of America

Department of Transportation—Federal Aviation Administration

Supplemental Type Certificate

Number SA00432SE

This certificate, issued to J. P. Instruments
P.O. Box 7033
Huntington Beach, CA 92646

*certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part * of the * Regulations.*

Original Product—Type Certificate Number: *See attached FAA Approved Model List (AML)
Make: No. SA00432SE for a list of approved airplane
Model: models and applicable airworthiness regulations.

Description of the Type Design Change: Fuel flow transducer installed in accordance with J.P. Instruments (JPI) Fuel Flow Installation Manual, Report No. 503, Revision B, dated March 14, 1997, and manufactured in accordance with JPI Drawing List Report No. 500 Revision B, dated March 14, 1997.

Note: This STC requires the installation of either:
1. JPI Fuel flow option with the EGT-701 temperature indicating system per STC SA2586NM; or
2. JPI FS-450 fuel flow indicating system per STC SA00861SE.

Limitations and Conditions: Approval of this change in type design applies to the aircraft models listed on the AML only. This approval should not be extended to other aircraft of these models on which other previously approved modifications are incorporated unless it is determined that the relationship between this change and any of those other previously approved modifications, including changes in type design, will introduce no adverse effect upon the airworthiness of that aircraft. A copy of this certificate, and FAA Approved Model List (AML) No. SA00432SE must be maintained as part of the permanent records for the modified aircraft.

If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: January 3, 1997 *Date reissued:*
Date of issuance: May 2, 1997 *Date amended:* December 18, 2000

FEDERAL AVIATION ADMINISTRATION

By direction of the Administrator

(Signature)

Acting Manager, Seattle Aircraft Certification Office

(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

FAA FORM 8110-2(10-68)

Subject: Permission to use STC.

To Whom It May Concern:

J.P. Instruments holder of STC SA00432SE and STC SA00861SE grants to the purchaser of the EDM-700 series (PN EGT-701) or the (FS-450) PN 450000 Series FUEL FLOW INSTALLATION permission to use the STC SA00432SE, or SA00861SE

Signed ____________

United States of America

Department of Transportation—Federal Aviation Administration

Supplemental Type Certificate

Number SA00861SE

This certificate, issued to J. P. Instruments
P.O. Box 7033
Huntington Beach, CA 92646

*certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part * of the * Regulations.*

Original Product—Type Certificate Number:
Make:
Model:

*See attached FAA Approved Model List (AML) No. SA00861SE for a list of approved airplane models and applicable airworthiness regulations.

Description of the Type Design Change: Installation of J.P. Instruments (JPI) fuel flow indicating system in accordance with JPI Installation Manual FS-450, Report No. 400, Revision -, dated August 16, 2000, or later FAA approved revision.

Limitations and Conditions: Approval of this change in type design applies to the aircraft models listed on the AML only. This approval should not be extended to other aircraft of these models on which other previously approved modifications are incorporated unless it is determined that the relationship between this change and any of those other previously approved modifications, including changes in type design, will introduce no adverse effect upon the airworthiness of that aircraft. A copy of this Certificate, FAA Approved Model List (AML) No. SA00861SE, and Airplane Flight Manual Supplement No. 1, dated December 18, 2000, or later FAA approved revision, must be maintained as part of the permanent records for the modified aircraft.

Note: This STC requires the installation of a fuel flow transducer per STC SA00432SE; or aircraft listed on the FAA approved AML SA00432SE and that have been previously modified with a fuel flow indication system that utilizes the Flowscan fuel flow transducer, P/N: 201-A, 201-B, 201-C or 231 are eligible for installation for the FS-450. This certificate does not constitute installation approval of the fuel flow transducer.

If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: April 7, 2000

Date of issuance: December 18, 2000

Date reissued:

Date amended:

By direction of the Administrator

Adrian [signature]
(Signature)

Acting Manager, Seattle Aircraft Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

FAA FORM 8110-2(10-68)

U.S. Department
of Transportation
Federal Aviation Administration

Transport Airplane Directorate
Los Angeles Aircraft
Certification Office

3960 Paramount Boulevard
Lakewood, California 90712-4137

DEC - 1 2000

J.P. Instruments
Mr. Joseph Polizzotto
3402-I West MacArthur
Santa Ana, California 92704

Dear Mr. Polizzotto:

J.P. Instruments, Fuel Flowmeters;
Technical Standard Order C44b

Your application dated November 29, 2000, requesting the issuance of a Technical Standard Order (TSO) authorization in accordance with the procedural requirements of 14 Code of Federal Regulations (14 CFR) Part 21, Subpart O, has been reviewed. Based upon your data and statement of conformance certifying your article(s) has met the requirements of 14 CFR Part 21, Subpart O, and the minimum performance standards of TSO C44b (Ref. 14 § 21.305, authorization is hereby granted for the following.

MODEL NO.	DESCRIPTION
FS-450	450000( ) Fuel Flowmeter

The technical data submitted with your application have been accepted to fulfill the requirements for your TSO authorization and will be retained in our files. For your information the conditions and tests required for TSO authorization are minimum performance standards. The article(s) may be installed on or within a specific type or class of aircraft only if further evaluation by the user/installer documents an acceptable installation that is approved by the Administrator.

The quality control procedures contained in your quality control manual, currently on file at the Los Angeles Manufacturing Inspection District Office, and your statement that those procedures will be applied to the manufacture of the subject articles at the above address, are considered adequate in accordance with 14 CFR § 21.143.

Effective this date, your authorization to use TSO procedures is extended to include the subject article(s). You may identify this article(s) with the applicable TSO markings as required by TSO C44b.

TSO-C44b Report No 440 11/26/00

	Regulation	Method of Compliance
2) Scope	Types: Type I Type II	Type II – Counter type instrument that indicates both fuel consumed and quantity remaining.
3) General Requirements	3.1.1 materials	
	3.1.2 Workmanship	
	3.2 Identification	
	3.3 Environmental	See section 5, 6, 7
	3.3.1 Temperature	Instrument Location: Power Plant Compartment PASSED
	3.3.2 Humidity:	PASSED
	3.3.3 Vibration	Power Plant Mounted: PASSED
	3.3.4 Altitude	PASSED
	3.4 Radio Interference	PASSED Additional testing see section 6.0
	3.5 Magnetic Effect	PASSED
	4.0 Detail Req.	
	4.1.1 Indicating Method	Type II instrument with a counter to indicate both fuel consumed and quantity remaining.
	4.2 Dial Markings	
	4.2.1 Finish	PASSED
	4.2.2 Numerals	PASSED
	4.2.3 Graduations	PASSED
	4.2.4 Counters	PASSED
	4.2.5 Visibility	PASSED
	4.3 Flow Direction	PASSED
	4.4 fuel Characteristics	All transmitters are specifically designed to operate with all aviation fuel.
	4.5 Power Variations	PASSED
	4.6 Safety Provision	PASSED
	5.0 to 5.5	PASSED.
	6.0 Individual performance req. Additional testing: DO-160D, Section 21, Emission of Radio Frequency Energy	Tested to Category "M". This category may be suitable for equipment and associated interconnecting wiring located in the electronic bay of an aircraft. Section 21.3 Conducted RF Emission a). Passed category M b). Passed category M Section 21.4 Radiated RF Emission Passed category M
	6.1 Scale Error	PASSED
	6.2 Dielectric	Not Applicable
	6.2.1 Insulation res.	Not Applicable
	6.2.2 Overpotential	Not Applicable
	6.2.2.1 Hermetically sealed	
	6.3 Leak test	PASSED
	7.1 Low and High temperature	PASSED
	7.2 Extreme Temperature Exposure	PASSED
	7.3 Magnetic Effect	PASSED
	7.4 Humidity	PASSED
	7.5 Vibration 7.5.1 Resonance:	PASSED
	7.5.2 Cycling:	PASSED
	7.6 Locked rotor	PASSED

J.P. INSTRUMENTS FAA AP[illegible]OVED MODEL LIST (AML) FOR:

1. INSTALLATION OF THE EGT 701 SER[illegible] FUEL FLOW TRANSDUCER STC SA00432SE

2. INSTALLATION OF THE (FS-450) 450000 SERIES STC SA00861SE FUEL FLOW INSTRUMENT and TRANSDUCER

STC SA00432SE Issue Date: May 2, 1997

STC SA00861SE Issue Date: December 18, 2000

ITEM	AIRCRAFT MAKE	AIRCRAFT MODEL A. SINGLE ENGINE AIRCRAFT (ITEMS 1-94) B. TWIN ENGINE AIRCRAFT (ITEMS 95-127)	TYPE CERTIFICATE NUMBER	CERTIFICATION BASIS FOR ALTERATION	AML REVISION DATE
		SINGLE ENGINE			
1.	AERMACCHI S.p.A. *(SIAI Marchetti)*	F.260, F.260B, F.260C, F.260D, F.260E, F,260F	A10EU	CAR 3 FAR 23	12-18-2000
2.	Aero Commander *(Dynac)*	100-180	1A21	CAR 3	05-31-2001
3.	Interceptor *(Aero Commander)* *(Meyers)*	200B, 200C, 200D	3A18	CAR 3	04-09-2002
4.	Rogers *(Aeronca)*	15AC	A-802	CAR 3	03-26-2013
5.	Air Tractor	AT-301 with STC SA01583CH (OE600A engine)	A9SW	FAR 21.25(a)(1)	03-26-2013
6.	Air Tractor	AT-401, AT-401A, AT-401B, AT-402, AT-402A, AT-402B with STC SA01583CH (OE600A engine)	A17SW	FAR 21.25(a)(1)	03-26-2013
7.	GA 8 Airvan (Pty) Ltd	GA8-TC320	A00011LA	FAR 23	03-26-2013
8.	American Champion	8GCBC, 8KCAB	A21CE	FAR 23	03-26-2013
9.	American Champion	7AC, 7DC, 7ECA, 7GCBC, 7GCAA, 7GCBA, 7KCAB	A-759	CAR 4a	03-26-2013
10.	Varga *(Augustair)*	2150A	4A19	CAR 3	07-06-2009
11.	Aviat Aircraft Inc *(Sky International)*	A-1, A-1A, A-1B, A-1C-180, A-1C-200	A22NM	FAR 23	03-26-2013
12.	Hawker Beechcraft *(Beech)*	D17S	A-649	CAR 3	11-30-2005
13.	Hawker Beechcraft *(Beech)*	G17S	TC 779	Aero Bulletin 7A & CAR 4	03-26-2013
14.	Hawker Beechcraft *(Beech)*	19A, B19, A23-19, M19A, A24R, B24R, C24R, B23, C23	A1CE	CAR 3	03-26-2013
15.	Hawker Beechcraft *(Beech)*	35, A35, B35, C35, D35, E35, F35, 35R, G35	A-777	CAR 3	12-18-2000
16.	Hawker Beechcraft *(Beech)*	35-33, 35-A33, 35-B33, 35-C33, 35-C33A, E33, E33A,E33C, F33, F33A, F33C, G33, H35, J35, K35, M35, N35, P35, S35, V35, V35A, V35B, 36, A36, G36, A36TC, and B36TC	3A15	CAR 3	03-26-2013
17.	Hawker Beechcraft *(Beech)*	A45 (T-34A, B-45), D45 (T-34B), 45 (YT-34), Cont. E-225-8	5A3	CAR 3	12-18-2000
18.	Alexandria Aircraft *(Bellanca)*	14-19-2, 14-19-3, 17-30, 17-31	1A3	CAR 3	03-26-2013
19.	Alexandria Aircraft *(Bellanca)*	17-30A, 17-31A, 17-31ATC	A18CE	FAR 23	03-26-2013
20.	Cessna *(Regal Air)*	305A (USAF 0-1A), 305C (USAF 0-1E), 305D (USAF 0-1G), 305F	5A5	CAR 3	03-26-2013
21.	Cessna	120, 140	A-768	CAR 4a	5-31-2001
22.	Cessna	140A	5A2	CAR 3	5-31-2001
23.	Cessna	150, 150A, 150B, 150C, 150D, 150E, 150F, 150G, 150H, 150J, 150K, 150L, 150M, A150K, A150L, A150M, 152, A152	3A19	CAR 3	4-9-2002

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2. INSTALLATION OF THE (FS-450) 450000 SERIES STC SA00861SE FUEL FLOW INSTRUMENT and TRANSDUCER

STC SA00432SE Issue Date: May 2, 1997
STC SA00861SE Issue Date: December 18, 2000

TEM	AIRCRAFT MAKE	AIRCRAFT MODEL A. SINGLE ENGINE AIRCRAFT (ITEMS 1-94) B. TWIN ENGINE AIRCRAFT (ITEMS 95-127)	TYPE CERTIFICATE NUMBER	CERTIFICATION BASIS FOR ALTERATION	AML REVISION DATE
4.	Cessna	170, 170A, 170B	A-799	CAR 3	12-18-2000
5.	Cessna	FR172E, FR172F, FR172G, FR172H, FR172J	A18EU	CAR 3 FAR 21.29	03-26-2013
[illegible]	Cessna	172, 172A, 172B, 172C, 172D, 172E, 172F, 172G, 172H, 172I, 172K, 172L, 172M, 172N, 172P, 172Q, 172R, 172S	3A12	CAR 3 FAR 23	03-26-2013
[illegible]	Cessna	172RG, R172E, R172F, R172G, R172H, R172J, R172K, 175, 175A, 175B, 175C, P172D	3A17	CAR 3	12-18-2000
[illegible]	Cessna	177, 177A, 177B	A13CE	FAR 23	12-18-2000
[illegible]	Cessna	177RG	A20CE	FAR 23	12-18-2000
[illegible]	Cessna	180, 180A, 180B, 180C, 180D, 180E, 180F, 180G, 180H, 180J, 180K	5A6	CAR 3	12-18-2000
[illegible]	Cessna	182, 182A, 182B, 182C, 182D, 182E, 182F, 182G, 182H, 182J, 182K, 182L, 182M, 182N, 182P, 182Q, 182R, 182S, 182T, T182T, R182, TR182, T182	3A13	CAR 3	03-26-2013
[illegible]	Cessna	185, 185A, 185B, 185C, 185D, 185E, A185E, A185F	3A24	CAR 3	12-18-2000
[illegible]	Cessna	188, 188A, 188B, A188, A188A, A188B, T188C	A9CE	FAR 21	12-18-2000
[illegible]	Cessna	190, 195, 195A, 195B	A-790	CAR 3	03-26-2013
[illegible]	Cessna	206, U206, U206A, U206B, U206C, U206D, U206E, U206F, U206G, 206H, T206H, P206, P206A, P206B, P206C, P206D, P206E, TP206A, TP206B, TP206C, TP206D, TP206E , TU206A, TU206B, TU206C, TU206D, TU206E, TU206F, TU206G	A4CE	CAR 3	03-26-2013
[illegible]	Cessna	207, 207A, T207, T207A	A16CE	FAR 23	12-18-2000
[illegible]	Cessna	210, 210A, 210B, 210C, 210D, 210E, 210F, 210G, 210H, 210J, 210K, 210L, 210M, 210N, 210R, P210N, P210R, T210F, T210G, T210H, T210J, T210K, T210L, T210M, T210N, T210R. 210-5 (205), 210-5A (205A)	3A21	CAR 3	03-26-2013
[illegible]	Cirrus Design Corporation	SR20, SR22	A00009CH	FAR 23	03-26-2013
[illegible]	CPAC, Inc. *(Commander, Rockwell)*	112,112B, 112TC, 112TCA, 114, 114A, 114B, 114TC	A12SO	FAR 23	12-18-2000
[illegible]	Cub Crafters	CC18-180, CC18-180A	A00006SE	FAR 23	03-26-2013
[illegible]	Viking Air Limited *(De Havilland)*	DHC-2 Mk I	A-806	CAR 3 CAR 10	07-06-2009
[illegible]	Viking Air Limited *(De Havilland)*	DHC-3	A-815	CAR 3 CAR 10	03-26-2013
[illegible]	DeHavilland Support Limited *(Beagle)*	B.121 Series 1, B.121 Series 2, B.121 Series 3	A22EU	FAR 21.29 FAR 23	02-09-2004
[illegible]	Diamond	DA40, DA40F	A47CE	FAR.21.29	03-26-2013
[illegible]	Diamond	DA20-A1, DA20-C1	TA4CH	FAR 23 FAR.21.29	03-26-2013

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STC SA00432SE Issue Date: May 2, 1997
STC SA00861SE Issue Date: December 18, 2000

ITEM	AIRCRAFT MAKE	AIRCRAFT MODEL A. SINGLE ENGINE AIRCRAFT (ITEMS 1-94) B. TWIN ENGINE AIRCRAFT (ITEMS 95-127)	TYPE CERTIFICATE NUMBER	CERTIFICATION BASIS FOR ALTERATION	AML REVISION DATE
46.	Enstrom *(Helicopter)*	F-28A	HICE	CAR 6	07-06-2009
47.	EXTRA	EA-400	A43CE	FAR 23	04-09-2002
48.	EXTRA	EA-300, EA-300S, EA-300L, EA-300/200	A67EU	FAR 21.29 FAR 23	12-18-2000
49.	Fairchild	24R46A (Army UC-61K)	A-706	CAR 4a	03-26-2013
50.	Found Aircraft Canada, Inc.	FBA-2C2	A7EA	FAR 23	03-26-2013
51.	GENERAL AVIA	F22B, F22C	A75EU	FAR 23	12-18-2000
52.	Globe *(Swift)*	GC-1B	A-766	CAR 4a	07-06-2009
53.	Waco Classic Aircraft Corporation *(Great Lakes)*	2T-1A-1, 2T-1A-2	A18EA	AERO BULL 7-A,FAR 23	07-06-2009
54.	True Flight Holdings LLC *(Grumman American)*	AA-1, AA-1A, AA-1B, AA-1C	A11EA	FAR 23	04-09-2002
55.	True Flight Holdings LLC *(Grumman American)*	AA-5, AA-5A, AA-5B, AG-5B	A16EA	FAR 23	12-18-2000
56.	Helio	H-295, HT-295, H-395, H-391, H-391B, H-800	1A8	CAR 3	03-26-2013
57.	Howard *(Jobmaster Company)*	DGA-15P (Army UC-70, Navy GH-1, GH-2, GH-3, NH-1)	A-717	CAR 4a	12-18-2000
58.	Sikorsky *(Hughes) (Schweizer)*	269A, 269A-1, 269B, 269C	4H12	CAR 6	07-06-2009
59.	Interstate *(STOL Aviation)*	S-1B1 (Army L-6, XL-6)	A-754	CAR 04	03-26-2013
60.	Revo, Inc. *(Lake)*	LA-4, LAKE Model 250, LAKE LA-4-200	1A13	CAR 3 FAR 23	12-18-2000
1.	Cessna Company *(Lancair/Columbia)*	LC40-550FG, LC41-550FG	A00003SE	FAR 23	03-26-2013
2.	Maule.	M-4-210, M-4-210C, M-4-210S, M-4-210T, M-4-220, M-4-220C, M-4-220S, M-4-220T, M-5-180C, M-5-200, M-5-210C, M-5-235C, M-6-235, MT-7-235, MT-7-260 , M-7-235, M-7-235A, M-7-235B, M-7-235C, M-7-260, MX-7-180, MX-7-180A, MX-7-180B, MX-7-180C, MX-7-180AC, MX-7-235, MXT-7-160, MXT-7-180, MXT-7-180A, M-7-260C	3A23	CAR 3	03-26-2013
3.	MICCO Aircraft Co., Inc.	MAC-145A, MAC-145B	3A1	FAR 23	07-06-2009
4.	Mooney	M20A, M20B, M20C, M20D, M20E, M20F, M20G, M20J, M20K, M20L, M20M, M20R, M20S, M20TN	2A3	CAR 3, FAR 23	03-26-2013
5.	Mooney	M22	A6SW	CAR 3	12-18-2000
6.	Zlin Aircraft a.s. *(Moravan)*	Z-143L, Z-242L	A76EU	FAR 23	03-26-2013

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7.	Navion *(Sierra Hotel Aero)*	Navion (Army L-17A), Navion A (Army L-17B and L-17C), Navion B, Navion D, Navion E, Navion F, Navion G, Navion H. Also Navion A, (Army L-17B and L-17C), Navion B with IO-470 Series Engine	A-782	CAR 3	12-18-2000
8.	Boeing (NORTH AMERICAN)	BC-1A, AT-6 (SNJ-2), AT-6A (SNJ-3), AT-6B, AT-6C (SNJ-4), AT-6D (SNJ-5), AT-6F (SNJ-6), SNJ-7, T-6G	A-2-575	CAR 4a	03-26-2013
9.	FS 2003 Corp. *(Piper)*	PA-12, PA-12S	A-780	CAR 3	04-09-2002
0.	Piper Aircraft, Inc.	PA-18A (Restricted), PA-18A "135" (Restricted), PA-18A "150" (Restricted)	AR-7	CAR 8.10b	05-31-2001
71.	Piper Aircraft, Inc.	PA-18, PA-18S, PA-18 "105" (Special), PA-18S "105" (Special) PA-18A, PA-18 "125" (Army L-21A) PA-18S "125", PA-18AS "125", PA-18 "135" (Army L-21B), PA-18A "135", PA-18S "135", PA-18AS "135", PA-18 "150", PA-18A "150", PA-18S "150", PA-18AS "150"	1A2	CAR 3	05-31-2001
72.	Piper Aircraft, Inc.	PA-20, PA-20S, PA-20"115", PA-20S"115", PA-20"135", PA-20S"135"	1A4	CAR 3	12-18-2000
73.	Piper Aircraft, Inc.	PA-22, PA-22-108, PA-22-135, PA-22S-135, PA-22-150, PA-22S-150, PA-22-160, PA-22S-160	1A6	CAR 3	03-26-2013
74.	Piper Aircraft, Inc.	PA-24, PA-24-250, PA-24-260, PA-24-400	1A15	CAR 3	12-18-2000
75.	LAVIA S.A. *(Piper)*	PA-25-235, PA-25-260	2A8	CAR 3	02-09-2004
76.	Piper Aircraft, Inc.	PA-28-140, PA-28-150, PA-28-151, PA-28-160, PA-28-161, PA-28-180, PA-28-181, PA-28R-180, PA-28R-200, PA-28R-201, PA-28RT-201, PA-28-201T, PA-28R-201T, PA-28RT-201T, PA-28-235, PA-28-236, PA28S-160, PA28S-180	2A13	CAR 3	12-18-2000
77.	Piper Aircraft, Inc.	PA-32-260, PA-32-300, PA-32R-300, PA-32S-300, PA-32-301, PA-32R-301 (HP), PA-32R-301 (SP), PA-32-301T, PA-32RT-300, PA-32RT-300T, PA-32R-301T	A3SO	CAR 3	03-26-2013
78.	Piper Aircraft, Inc.	PA-36-285, PA-36-375, PA-36-300	A9SO	FAR 23	03-26-2013
79.	Piper Aircraft, Inc.	PA-38-112	A18SO	FAR 23	07-06-2009
80.	Piper	PA-46-310P, PA-46-350P, PA-46R-350T	A25SO	FAR 23	03-26-2013
81.	Aviat Aircraft, Inc. *(Pitts) (Sky Int'l)*	S-2B	A8SO	FAR 23	07-06-2009
82.	STOL *(Republic) (Sky Enterprises)*	RC-3	A-769	CAR 3	12-18-2000
83.	Robinson *(Helicopter)*	R22, R22 ALPHA, R22 BETA, R22 MARINER	H10WE	FAR 27	12-18-2000
84.	Robinson *(Helicopter)*	R44	H11NM	FAR 27	12-18-2000
85.	Robinson *(Helicopter)*	R44 II	H11NM	FAR 27	07-06-2009

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86.	Ruschmeyer	R90-230RG	A77EU	FAR 21.29, FAR 23	03-26-2013
87.	SOCATA	TB 9, TB 10, TB 20, TB 21, TB 200	A51EU	FAR 21.29	03-26-2013
88.	SOCATA	Rallye 235E, MS894A	7A14	CAR 3 CAR 10	03-26-2013
89.	Boeing *(Stearman)*	75, A75, E75, A75L300, A75, B75, 75N1, A75J1, A75L3, IB75A, E75N1, B75N1, D75N1	A-743	CAR 4a	03-26-2013
90.	Univair *(Stinson)*	108, 108-1, 108-2, 108-3, 108-5	A-767	CAR 3	07-06-2009
91.	Symphony Aircraft Industries, Inc.	SA 160	A46CE	FAR 23	03-26-2013
92.	Waco	YMF, F5, F5C	ATC 542	Aero Bulletin 7A	03-26-2013
93.	Waco	UPF-7, VPF-7	A-642	Aero Bulletin 7A	03-26-2013
94.	Waco	YKC, YKC-S, YKC-6, ZKS-6	A-533	Aero Bulletin 7A	03-26-2013
		TWIN ENGINE			
95.	Triton Aerospace LLC *(Adam)*	A500	A00009DE	FAR 23	03-26-2013
96.	Hawker Beechcraft *(Beech)*	D18C, D18S, H18, E18S, E18S-9700, G18S, C-45G, TC-45G, C-45H, TC-45H, TC-45J or UC-45J (SNB-5), RC-45J (SNB-5P), JRB-6, 3N, 3NM, 3TM	A-765	CAR 3	03-26-2013
97.	Hawker Beechcraft *(Beech)*	B50, C50, D50, D50C	5A4	CAR 3	03-26-2013
98.	Hawker Beechcraft *(Beech)*	D55, E55, E55A, 95, B95, 95-55, 95-A55, 95-B55, 95-B55A, 95-B55B, 95-C55, 95-C55A, 95-D55A, B95A, D95A, E95, 56TC, A56TC, 58, 58A, G58	3A16	CAR 3	03-26-2013
99.	Beech	58P, 58PA, 58TC, 58TCA	A23CE	FAR 23	12-18-2000
100.	Hawker Beechcraft *(Beech)*	60, A60, B60	A12CE	FAR 23	01-27-2003
101.	Hawker Beechcraft *(Beech)*	65-80, 65-A80, 65-A80-8800, 65-B80, 65-88	3A20	CAR 3	07-06-2009
102.	Hawker Beechcraft *(Beech)*	76	A29CE	FAR 23	01-27-2003
103.	B-N Group Ltd. *(Britten-Norman)*	BN-2, BN-2A, BN-2A-2, BN-2A-3, BN-2A-6, BN-2A-8, BN-2A-9, BN-2A-20, BN-2A-21, BN-2A-26, BN-2A-27, BN-2B-20, BN-2B-21, BN-2B-26, BN-2B-27	A17EU	FAR 21.29 FAR 23	03-26-2013
104.	Cessna	T303	A34CE	FAR 23	01-27-2003
105.	Cessna	310, 310A, 310B, 310C, 310D, 310E, 310F, 310G, 310H, 310I, 310J, 310K, 310L, 310N, 310P, 310Q, 310R, T310P, T310Q, T310R, 310J-1, E310H, E310J, 310J-1	3A10	CAR 3	12-18-2000
106.	Cessna	320, 320A, 320B, 320C, 320D, 320E, 320F, 320-1, 335, 340, 340A	3A25	CAR 3	12-18-2000
107.	Cessna	336	A2CE	CAR 3	12-18-2000
108.	Cessna	337, 337A, 337B, 337C, 337D, 337E, 337F, 337G, 337H, T337B, T337C, T337D, T337E, T337F, T337G, T337H, M337B, P337H, T337H-SP	A6CE	CAR 3 FAR 23	12-18-2000

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09.	Cessna	404	A25CE	FAR 23	02-09-2004
10.	Cessna	401, 401A, 401B, 402, 402A, 402B, 402C, 411, 411A, 414, 414A, 421, 421A, 421B, 421C	A7CE	CAR 3	12-18-2000
11.	Diamond	DA 42, DA 42 NG, DA 42 M-NG	A57CE	FAR 21	03-26-2013
12.	General Avia	F20 "Pegaso"	A38EU	CAR 3	12-18-2000
113.	Buehn *(Grumman)*	HU-16C	A23NM	FAR 21.25	01-27-2003
114.	Gulfstream American *(Grumman)*	G-44, G-44A, SCAN type 30	A-734	CAR 4a	03-26-2013
115.	Grumman	G-21, G-21A	654	Aero. Bulletin 7A	03-26-2013
116.	SOCATA, S.A. *(Grumman)*	GA-7	A17SO	FAR 23	05-31-2001
117.	Vulcanair S.p.A *(Partenavia Construzioni Aeronauticas)*	P68, P68B, P68C, P68 Observer, P68 Observer 2	A31EU	FAR 23	03-26-2013
118.	Piaggio & C.	P.136-L2	A-813	CAR 10	03-26-2013
119.	Aerostar *(Piper)*	PA-60-600, PA-60-601, PA-60-601P, PA-60-602P, and PA-60-700P	A17WE	FAR 23	12-18-2000
120.	Piper Aircraft, Inc.	PA-23, PA-23-160, PA-23-235, PA-23-250, PA-23-E23-250	1A10	CAR 3	03-26-2013
121.	Piper Aircraft, Inc.	PA-30, PA-39, PA-40	A1EA	CAR 3	12-18-2000
122.	Piper Aircraft, Inc.	PA-31, PA-31-325, PA-31-350	A20SO	CAR 3 FAR 23	03-26-2013
123.	Piper Aircraft, Inc.	PA-31P, PA-31P-350	A8EA	CAR 3 FAR 23	03-26-2013
124.	Piper Aircraft, Inc.	PA-34-200, PA-34-200T, PA-34-220T	A7SO	FAR 23	12-18-2000
125.	Piper Aircraft, Inc.	PA-44-180, PA-44-180T	A19SO	FAR 23	12-18-2000
126.	Twin Commander	500-A, 500-B. Also 500-B, 500-S, 500-U	6A1	CAR 3	03-26-2013
127.	Twin Commander	680FL, 685	2A4	CAR 3	03-26-2013

FAA Approved: ______________________
Acting Manager, Seattle Aircraft
Certification Office

AMENDED: 06-23-1997; 10-09-1997; 07-16-1999; 06-05-2000; 05-31-2001; 04-19-2002; 01-27-2003; 02-09-2004; 11-30-2005; 07-06-2009; 04-12-2013

REISSUED:

SECTION 10
OPERATING TIPS

SECTION 10
OPERATING TIPS

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 operationof the Saratoga II HP.

10.3 OPERATING TIPS

(a) Learn to trim for takeoff so that only a very light back pressure on the control wheel is required to lift the airplane off the ground.

(b) Use the best speed for takeoff as found in chapter 5 of this manual. Keep in mind that trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of engine failure.

(c) Flaps may be lowered at airspeeds up to 108 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the "UP" position before they will lock and support weight on the step.

(d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

(e) Before starting the 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.

(f) Anti-collision lights should not be operating when flying through cloud, 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.

(g) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of his feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedal or operating the toe brakes.

(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) Prolonged slips or skids which result in excess of 2000 ft. 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 tank being used is not full.

KLN 90B Memory Jogger

Left Page Summary

NAV
- 1†- CDI, DIS, GS, ETE, BRG
- 2- Present position
- 3- DTK, TK, XTK, MSA, ESA
- 4- VNAV
- 5†- Moving map

FPL
- 0- Active flight plan
- 1-25 Stored flight plans

MODE
- 1‡- LEG mode status and change CDI scale factor
- 2‡- OBS mode status and change CDI scale factor

TRIP
- 0- Enter TAS and wind.
- 1- P. Pos to wpt-DIS, BRG, ETE, fuel
- 2- P.Pos to wpt-ESA, SUA
- 3- Wpt to wpt- DIS, BRG, ETE, fuel
- 4- Wpt to wpt-ESA, SUA
- 5- For any FPL- DIS, ETE, fuel
- 6- For any FPL- ESA, SUA

CALC
- 1- Pressure/Density altitude
- 2- TAS
- 3- Computes wind info
- 4- VNAV angle or vert. speed
- 5- Conversions
- 6- Time zone conversions
- 7- Sunrise/Sunset

STAT
- 1- Satellite condition
- 2- Estimated position error
- 3- Software versions
- 4- Operation time & cycles
- 5- RAIM prediction

SETUP
- 0- Update database
- 1- Initialize postion
- 2- Set system time and date
- 3- Nearest airport criteria
- 4- Flight timer operation
- 5- Height above airport alert
- 6- Turn anticipation on/off
- 7- Barometric units
- 8- Airspace alert on/off
- 9- Aural alert volume

OTHER
- 1- Nearest FSS freqs.
- 2- Nearest Center freqs.
- 3- User waypoint list
- 4- List of airports w/remarks
- 5*- Fuel reqd., fuel on board
- 6*- Fuel specifics
- 7*- Fuel flow rates
- 8*- Fuel used (totalizer)
- 9*- TAS/Mach display
- 10*- SAT, TAT, Pressure alt., Density alt.

† *With both right and left pages set to these pages the screen will change to show a larger picture.*

‡ *These pages also support mode changing if no external GPS CRS switch is installed in the aircraft.*

* *Page only displayed if appropriate equipment is interfaced with the KLN 90B.*

AlliedSignal General Aviation Avionics
400 North Rogers Road
Olathe, Kansas 66062-1212
TELEX 669916 KINGRAD • FAX 913-791-1302
TELEPHONE (913) 768-3000

12/94 006-08785-0000 5K Printed in USA

AlliedSignal AEROSPACE

KLN 90B Memory Jogger

Right Page Summary

NAV
- 1†- CDI, DIS, GS, ETE, BRG
- 2- Present position
- 3- DTK, TK, XTK, MSA, ESA
- 4- VNAV
- 5†- Moving map

D/T
- 1- Distance, ETE
- 2- Distance, ETA
- 3- Distance, DTK
- 4- Dep. time, present time, ETA, flight time, ETE

ACTV

Shows information on flight plan waypoints or D→ wpts.

REF

Inserts reference waypoints into flight plan.

CTR
- 1- Inserts CTR wpts into FPL.
- 2- Displays CTR wpts.

† *With both right and left pages set to these pages the screen will change to show a larger picture.*

APT
- 1- ID, airport name, lat/long
- 2- ID, City name, elevation, time from UTC, IAP
- 3- Runway info
- 4- Comm frequency lists
- 5- User remarks
- 6- Customs, fuel, oxygen, fees
- 7- Select SID or STAR
- 8- Select approach and IAF

VOR

ID, DME capability, name, class, freq., mag. variation, lat/long.

NDB

ID, name, frequency, lat/long position

INT

ID, location relative to VOR, lat/long position

SUPL

ID, location relative to VOR, lat/long position

Summary of Operation

- Emergency Nearest Airport Search - Press [MSG] then [ENT].
- Operation of left and right knobs - Cursor on
  - Press desired [CRSR] button. With the cursor on, outer knob controls cursor location and inner knob selects the character.
  - With the inner knob in, make selection character by character.
  - With inner knob out, make selection by scanning through the database alphabetically. (Right side only)
- Operation of left and right knobs - Cursor off
  - Outer knob selects page type (APT, VOR, etc.)
  - Inner knob selects specific page (APT 1, APT 2, etc.)
- Direct To operation
  - Press [D→] once. Enter desired wpt using left concentric knobs, press [ENT] to view wpt info, press [ENT] to confirm.
  - Alternatively, display desired waypoint on right hand page or highlight desired wpt in flight plan then press [D→] then press [ENT] to confirm.
  - To center D-bar. With non-wpt page displayed press [D→] then [ENT].
  - To cancel direct to operation press [D→] then [CLR] then [ENT].

/ JOGGER

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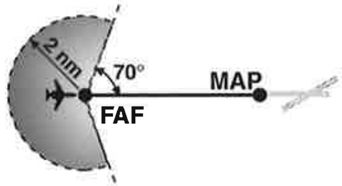
TIPS (Continued)

10. If the approach includes a DME arc, the DME arc intercept point will be a) on your present position radial off the arc VOR when you select an arc IAF, or b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a radar vector, bring up the first waypoint of the arc in the **Super NAV 5** page scanning field (or under the cursor on the **FPL 0** page), press CLR, then ENT. Fly the arc in LEG. Adjust the HSI or CDI course pointer with reference to the desired track value on the **Super NAV 5** page (it will flash when the pointer needs to be adjusted). Left/right D-bar information is relative to the arc. Displayed distance is not along the arc but straight to the active waypoint. (The **ARC** radial is also displayed on the **Super NAV 5** page.)
11. Two nm from the FAF inbound and in LEG, the KLN 90B will go into APR **ACTV** and the D-bar scaling will change from ±1.0 nm to ±0.3 nm.
12. APR **ARM** to APR **ACTV** is automatic provided all of the following are satisfied:
    a. In APR **ARM** (normally automatic).
    b. <u>In **LEG** mode!</u>
    c. <u>FAF is the active waypoint!</u>
    d. Within 2 nm of the FAF.
    e. Outside the FAF.
    f. Inbound to the FAF.
    g. RAIM is available. (For early prediction go to STA 5 page.)



13. RAIM availability is mandatory for approach operation.
14. APR **ACTV** mode is mandatory for approach operation.
15. DIRECT-TO operation between the FAF and MAP cancels approach **ACTV**. Fly the missed approach in APR **ARM**.
16. Flagged navigation inside the FAF may usually be restored by pressing the external GPS APR button to change from **ACTV** to **ARM**. Fly the missed approach procedure.
17. Instrument approaches using the KLN 90B may be essentially automatic starting 30 nm out (with manual baro setting update) or it may require judicious selection of the OBS and LEG modes.
18. APR **ARM** may be cancelled at any time by pressing the GPS APR button. (A subsequent press will reselect it.)

C. PAGE MESSAGES - Messages that could appear during approach operations. Refer to the Pilot's Guide for a complete list of messages.

ACTV ANNUNCIATOR FAIL Indicates an annunciator drive circuit failure. A maintenance write-up. Cross check the KLN 90B display for status.

ADJUST NAV IND CRS TO XXX° Manually adjust the mechanical HSI or CDI to the indicated value.

ARM ANNUNCIATOR FAIL Indicates an annunciator drive circuit failure. A maintenance write-up. Cross check the KLN 90B display for status.

PAGE MESSAGES (Continued)

ARM GPS APPROACH Manually arm approach mode. (A reminder given 3 nm from the FAF if the approach mode was disarmed manually.)

BAD SATELLITE GEOMETRY
AND RAIM NOT AVAILABLE Can appear in approach ACTV mode only. Integrity monitoring is lost and satellite geometry is degraded. Can be followed by a NAV flag.

BAD SATELLITE GEOMETRY
SEE EPE ON STA 2 PAGE Integrity monitoring is lost and the estimated position error is greater than allowed for the current phase of flight. Cross check the position with other on-board equipment every 15 minutes.

CHECK ACTV ANNUNCIATOR Indicates an overcurrent condition in the annunciator circuit. A maintenance write-up. Cross check the KLN 90B display for approach mode status.

CHECK ARM ANNUNCIATOR Indicates an overcurrent condition in the annunciator circuit. A maintenance write-up. Cross check the KLN 90B display for approach mode status.

IF REQUIRED SELECT OBS Use OBS mode for holding patterns or procedure turns. Appears 4 nm from a waypoint that normally would require the OBS mode.

PRESS ALT TO SET BARO A reminder given 30 nm from the destination airport to update the barometric setting.

PRESS GPS APR FOR NAV After a NAV flag in approach ACTV mode, press GPS APR button to restore navigation for the missed approach. (Integrity monitoring is less critical in approach ARM mode so navigation may be restored.)

RAIM NOT AVAILABLE
APR MODE INHIBITED
PREDICT RAIM ON STA 5 RAIM is predicted to not be available at either the FAF or the MAP. Determine when RAIM will be available on the STA 5 page. Integrity monitoring is required for approach operation.

RAIM NOT AVAILABLE
CROSS CHECK POSITION Integrity monitoring is absent. Compare the GPS position with other on-board navigation equipment.

RAIM POSITION ERROR
CROSS CHECK POSITION RAIM has detected a problem with a satellite. Compare the GPS position with other on-board navigation equipment.

REDUNDANT WPT IN FPL
EDIT ENROUTE WPTS
AS NECESSARY Examine the active flight plan and remove those waypoints that occur both in the enroute and the approach or SID/STAR sections of the flight plan.

LOADMASTERS

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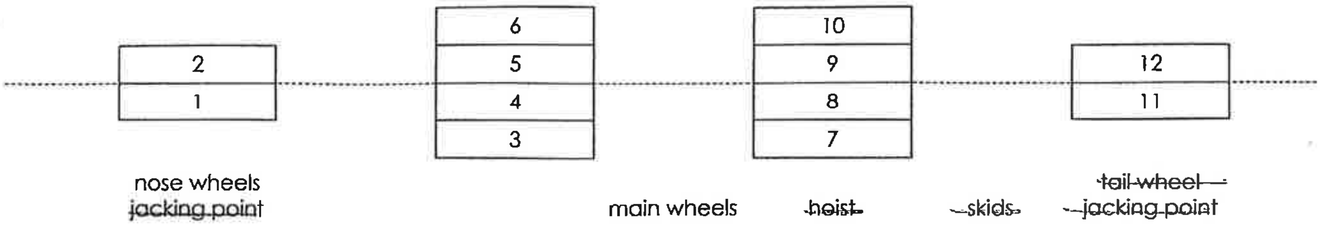
WEIGHING RECORD **Ref. no.** 18OC11409 Issue 1

Aircraft	Piper PA 32R-301	Registration	G-ELLA	Serial no.	32-46050
Place	Hurn	Date	02-Oct-18	Weighed by	M.Pitcher
Equipment	Platforms AC1-25				

Aircraft attitude. LEVEL ~~degrees Nose Up / Down~~



All Weights in lb / ~~kg~~

Pos'n	S/No	Weight (Each reaction)		Weight (Totals)	Arm in	Moment lb.in
1	375		752	752	13.65	10,265
2						
3						
4	413		1,154	2,279	109.15	248,753
5	403		1,125			
6						
7						
8						
9						
10						
11						
12						
AS WEIGHED				3,031	85.46	259,018
Total Subtractions (~~see over~~)			Usable Fuel (102 USG)	612.0	94.00	57,528
Total Additions (~~see over~~)						0
AIRCRAFT WEIGHT				2,419	83.29	201,490

REMARKS:

The Aircraft Weight with the fuel tanks empty (~~completely~~/but including unusable fuel), engine oil full, systems primed and equipped as per Airtime Check List dated 02-Oct-18 is 2,419 lb

The Centre of Gravity (Arm) is 83.29 in aft of the datum

Certified that the above mentioned aircraft has been weighed in accordance with the terms of the order applicable thereto and unless otherwise stated above conforms fully to the standards/specifications quoted hereon and the requirement of the C.A.A. or other regulating authority.

Signed: [signature]
for and on behalf of Loadmasters
C.A.A. Approval ref. AI/9901/04

LM001 18-6-02

Ref. no. 18OC11409 Issue 1

Subtractions Items weighed but not part of Basic Weight	Weight lb ~~kg~~	Arm in ~~m~~	Moment lb.~~kg~~.in.~~m~~
Nil	0	0.00	0
Total	0		0

Additions Items not in aircraft when weighed			
Nil	0	0.00	0
Total	0		0

Notes:

Gama Aviation	Gama Aviation (Engineering) Ltd	FRM.MO.067A

Weight & Change to Centre of Gravity

A/C TYPE	PA-32R-301	REG NO.	G-ELLA	INSP. REF	FRKA287

DETAILS OF WORK	WEIGHT (lbs)	ARM ±(inches)	MOMENT (lbs/ins)
Empty Weight as Part 'A' of Schedule dated: 22/SEPT/16	2,406	84.59	203,531
ITEMS REMOVED			
GNS430 NAV/COM.GPS	6.20	64.10	397.42
EGT GAUGE	1.90	66.60	126.54
FRONT INTERCOM PM1000	0.6	65.5	39.3
REAR INTERCOM PM2000	0.6	201.00	120.6
ITEMS ADDED			
GTN750 NAV/COM/GPS	9.30	64.10	596.13
TA102 USB PORT	0.20	66.60	13.32
EDM 830 ENGINE MONITOR	1.12	66.60	74.59
GMA35 AUDIO PANEL	2.1	65.0	136.50
TOTAL CHANGE	1.72		25.33
TOTALS / NEW VALUES	**2407.72**	**84.54**	**203,556**
EASA Approval No : - UK.145.01341			

SIGNATURE		APPROVAL No.	GAEL 63 INSP	DATE	20th Aug 2018

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WEIGHING RECORD **Ref. no.** 16SE9722 Issue 1

Aircraft	Piper PA32R-301	Registration	G-ELLA	Serial no.	3246050
Place	White Waltham	Date	22-Sep-16	Weighed by	P.BAKER
Equipment	Platforms AC1-25				

Aircraft attitude..LEVEL.....~~degrees Nose Up~~ / ~~Down~~

2	6	10	12
1	5	9	11
	4	8	
	3	7	
nose wheels ~~jacking point~~	main wheels	~~hoist~~ ~~skids~~	~~tail wheel~~ ~~jacking point~~

All Weights in lb / ~~kg~~

Pos'n	S/No	Weight (Each reaction)		Weight (Totals)	Arm in ~~m~~	Moment lb.~~kg~~.in.~~m~~
1	959		647	647	13.80	8,929
2						
3						
4	403		882	1,729	110.90	191,746
5	409		847			
6						
7						
8						
9						
10						
11						
12						
AS WEIGHED				2,376	84.46	200,675
Total Subtractions (~~see over~~)			Nil	0		0
Total Additions (~~see over~~)			Unusable Fuel 5USG	30	95.20	2,856
AIRCRAFT WEIGHT				2,406	84.59	203,531

REMARKS:

The Aircraft Weight with the fuel tanks empty (~~completely~~/but including unusable fuel), engine oil full, systems primed and equipped as per ...White Walthsm Engineering........

Check List dated ....22-Sep-16 is ....2,406 lb......

The Centre of Gravity (Arm) is ....84.59 in....................... aft of the datum

Certified that the above mentioned aircraft has been weighed in accordance with the terms of the order applicable thereto and unless otherwise stated above conforms fully to the standards/specifications quoted hereon and the requirement of the C.A.A. or other regulating authority.

Signed: ....

for and on behalf of Loadmasters

C.A.A. Approval ref. AI/9901/04

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WEIGHT AND CENTRE OF GRAVITY SCHEDULE

REF. NUMBER LW 9722 Issue. 1

PART B: VARIABLE LOAD

The weight and lever arms of the crew and equipment which form the Variable Load for the particular role , are shown below.

ITEM	WEIGHT (lb)	ARM (in)	MOMENT (lb.in)
Pilot	actual	85.50	actual wt. x 85.50

PART C: LOADING INFORMATION (DISPOSABLE LOAD)

The appropriate lever arms are:-

ITEM	WEIGHT	ARM	MOMENT
Fuel 102 USG	612 max. usable	94.00	actual wt. x 94.00
Front Passenger	actual	85.50	actual wt. x 85.50
Centre Passenger	actual	119.10	actual wt. x 119.10
Rear Passenger	actual	157.60	actual wt. x 157.60
Baggage Forward Compartment	100 maximum	42.00	actual wt. x 42.00
Baggage Aft Compartment	100 maximum	178.70	actual wt. x 178.70

Fuel density is 6lb/USG

Note: To obtain the total loaded weight of the aircraft, add to the Basic Weight the weights of the Variable and Disposable Load items to be carried for the particular role.

This schedule was prepared for and on behalf of White Waltham Engineering on 22-Sep-16 and supersedes all previous issues.

Signed

P.Baker For and on behalf of Loadmasters Ltd CAA Approval ref. AI/9901/04

Note: The Commander of the aircraft shall satisfy himself before take-off that the load is of such a weight and is so distributed and secured that it may safely be carried on the intended flight.

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WEIGHT AND CENTRE OF GRAVITY SCHEDULE

REF. NUMBER	LW 9722	Issue. 1
AIRCRAFT DESIGNATION		Piper PA32R-301
NATIONALITY & REGISTRATION MARK		G-ELLA
CONSTRUCTOR		Piper Aircraft Inc
CONSTRUCTOR'S SERIAL NUMBER		3246050
MAXIMUM AUTHORISED WEIGHT	Ramp	3,615 lb
	Takeoff	3,600 lb
CENTRE OF GRAVITY LIMITS	Refer to Flight Manual	

PART A: BASIC WEIGHT

The Basic Weight of the aircraft as calculated from LOADMASTERS
Weighing Report 16SE9722 ,dated 22-Sep-16 is: 2,406 lb
The Centre of Gravity of the aircraft in the same condition
at this weight and with the landing gear extended is: 84.59 inches aft of datum
The total moments about this datum in this condition are: 203,531 lb.in

Note: The datum is the one to which the limits in the Certificate of Airworthiness or Flight Manual refer and is defined as 78.4 inches forward of the wing leading edge at the junction of the straight and taper section.

The Basic Weight includes the weight of the total quantity of unusable fuel and full oil and the weight of the following items which comprise the list of Basic Equipment:-

Radio - as listed in separate aircraft equipment list.
Flight Instruments - as listed in separate aircraft equipment list.
Fire Extinguisher
First Aid kit

The following is a list of standard and optional equipment for the PA-32R-301 Saratoga II HP. Optional equipment items marked with an X are installed on the airplane. All items are as described below at the time of licensing by the manufacturer. The New Piper Aircraft, Inc. will not revise this equipment list after the aircraft is licensed. It is the owner's responsibility to retain and amend this equipment list to reflect changes in equipment installed in this airplane.

Unless otherwise indicated, the installation certification basis for the equipment included in this list is the aircraft's approved type design.

THE NEW PIPER AIRCRAFT, INC. PA-32R-301, SARATOGA II HP

SERIAL NO. 3246050 **REGISTRATION NO.** N9279Q **DATE** 9/30/96

Item	Item	Weight	Arm (In.)	Moment
	(a) Propeller and Propeller Accessories			
1.	Propeller, Hartzell HC-I3YR-1RF/F7663DR, Cert. Basis - TC P33EA	74.5	-14.1	-1050.5
3.	Spinner, Hartzell, C-3575-1(P)	4.2	-15.2	-63.8
5.	Propeller Governor, (Hartzell V-5-4) Cert. Basis -TC P33EA	3.6	-3.1	-11.2
	(b) Engine and Engine Accessories, Fuel and Oil Systems			
9.	Engine, Lycoming Model IO-540-K1G5, Cert. Basis-TC 1E4	467.0	11.3	5253.8
11.	Engine Driven Fuel Pump, Lycoming P/N 75247, Cert. Basis - TC 1E4 (Included in dry engine weight)	1.7	27.6	46.9
13.	Electric Fuel Pump, Airborne P/N 1B5-6	3.0	112.6	337.8
15.	Fuel Valve, Piper Dwg. 69735-5 (Cameron or Airborne P/N 1-H65-5)	2.4	110.8	265.9
17.	Oil Coolers (2), (Harrison P/N 8543897) or (Niagara P/N N.D.M.20014A)	4.2	22.5	94.5
19.	Air Filter, Fram P/N CA-161PL (PMA 638873)	1.0	16.0	16.0
21.	Starter, Lycoming P/N 76211 (Prestolite P/N MZ 4218) Cert. Basis - TC 1E4 (Included in dry Engine Weight)	18.0	0.7	12.6
23.	Oil Filter, Lycoming P/N 63459, Cert. Basis - TC 1E4 (Included in dry engine weight)	1.6	43.5	69.6
25.	Alternator, Piper Dwg. 87415-6 (Electro Systems Inc., ES4011-1 (28v DC))	15.9	-2.5	-39.7

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(c) Landing Gear and Brakes			
33.	Main Wheel Assemblies Heavy Duty Group No. 1 (a) Cleveland Aircraft Products Wheel Assy. 40-120C (2) PS50035- 14 Brake Assy. 30-83 (2) PS50121-5, Cert. Basis - TSO C62 6.00 x 6 Ribbed Type III 8 Ply Rating Tire with Tubes (2) PS50119-7A, Cert. Basis - TSO C62	40.6	109.7	4455.0
35.	Nose Wheel Assembly (a) Cleveland Aircraft Products Wheel Assy. No. 40-77B PS50035-24, Cert. Basis - TSO C26a	3.0	14.3	42.9
	(b) 5.00 - 5 Type III 6 Ply Rating Tire with Regular Tube PS50119-8A, Cert. Basis - TSO C62	5.6	14.3	80.7
37.	Handbrake Master Cylinder, Cleveland Aircraft Products No. 10-22	0.6	60.9	36.5
39.	Toe Brake Cylinders a. Cleveland Aircraft Products No. 10-27	0.7	55.1	38.6
	b. Gar-Kenyon Instruments 17000	0.4	55.1	22.0
41.	Landing Gear Hydraulic Pump (Oildyne 636294), Piper Dwg. 38998-5	9.0	46.6	419.4
43.	Main Gear Hydraulic Cylinders (2), (Syncro Devices SFA 232-3)	2.2	108.0	237.6
45.	Nose Gear Hydraulic Cylinder (Gar Kenyon 94951), Piper Dwg. 35797-2	2.0	41.8	83.6
	(d) Electrical Equipment			
47.	Battery Master Relay, Cutler Hammer P/N 6041H202A	0.8	47.0	37.6
49.	Voltage Regulator, Piper Dwg. 68804-5	0.4	19.4	7.8
51.	Battery, Gill G-243, Piper Dwg. 85504-2	28	36.7	1027.6
53.	Starter Relay - Piper Dwg. 26898-3	0.8	32.4	25.9
55.	Stall Warning Lift Detectors, Safe Flight 148-7, Piper Dwg. 85455-2	0.4	85.9	34.4
57.	Stall Warning Horn (Safe Flight P/N 35214) Piper Dwg. 85455-2	0.2	62.8	12.6
59.	Radio Master Switch Relay, 6041H299, Piper Dwg. 39870-10	0.5	62.6	31.3
61.	Instrument Panel Lights Instl., Piper Dwg.85455-2	0.3	67.8	20.3
63.	Cockpit Flood Light (2), Whelen A300-W-28, Piper Dwg. 95229-5	0.2	99.0	19.8
65.	Reading Lights (4), Piper Dwg. 85311-4	0.6	133.0	79.8
67.	Courtesy Lights Instl., Piper Dwg. 87348-5	0.4	125.2	50.1
69.	Forward Baggage Light, Piper Dwg. 87348-5	0.2	43.5	8.7
71.	Nose Landing Light, Piper Dwg. 85347-3 (G.E. Model 4594)	0.8	24.9	19.9

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(d) Electrical Equipment (cont)			
73.	Navigation Lights (Wings) (2) Red/White and Green/White With White Strobe, Whelen, Piper Dwg. 85505-2 Left, Whelen Part No. 90071-00, Right, Whelen Part No. 90071-01	6.6	106.6	703.7
75.	Wing Tip Landing/Taxi Lights (2), G.E. Model 4594	1.6	94.1	150.6
77.	Heated Pitot Head, Piper Dwg. 46609-0 (AN Headed)	0.9	115.12	102.5
79.	Auxiliary Power Receptacle, Piper Dwg. 85504-2	2.6	43.4	112.8
81.	Lighter, Casco P/N 208083-28 Volt, Piper Dwg. 38453-18	0.2	67.9	13.6
	(e) Instruments			
83.	Altimeter, Piper PS50008-10-2 (United Instruments U15934-PD-I) Cert. Basis - TSO C10b	0.9	65.9	59.3
85.	True speed, Airspeed Indicator, Piper PS50049-65T (United Instruments 8125-B.765), Cert. Basis - TSO C2b	0.6	66.8	40.1
89.	Manifold & Fuel Flow Indicator, Piper PS50031-16 (United Instruments 6331-H.95), Cert. Basis - TSO C45 & C47	1.2	66.2	79.4
91.	Compass, Piper Dwg. 67462-9 (Airpath P/N C-2200-L4-1B), Cert. Basis TSO C7c	0.9	64.9	58.4
93.	Tachometer, PS50048-15-1	0.7	66.2	46.3
95.	Oil press./Cyl temp./Oil temp./PS50160-5 Rochester Gauges Inc., 6246-00674	1.0	67.1	67.1
97.	Fuel Quantity Indicator PS50161-7, Rochester Gauges Inc., 6246-00694	0.5	67.1	33.6
99.	Altitude Reporter, (Narco AR-850), Piper Dwg. 69875-7, Cert. Basis - TSO C88	0.7	56.2	39.3
101.	Rate of Climb, Piper Dwg. 99010-5 (United Instruments P/N UI-7000), Cert. Basis-TSO C8b	0.7	65.9	46.1
103.	Alternate Static Source Installation, Piper Dwg. 85462-2	0.4	66.0	26.4
105.	Turn Coordinator, Piper PS50030-3-5 (Electric Gyro Corp.1394T100-7Z) Cert. Basis - TSO C8b	1.1	65.9	72.5
107.	Ammeter, Non-Linear Systems PM-349 (548-885)	0.2	66.0	9.9
109.	Engine Hour Meter, P/N 550-580	0.3	67.3	20.2
111.	Clock, DVR-300i-XT - Piper Dwg. 87347-5	0.9	67.4	60.7
113.	Outside Air Temperature Gauge (Rockwell Gauge 1592-70062), Piper Dwg. 87702-5	0.3	77.6	21.7
115.	Gyro Suction Gauge, (Airborne P/N 1G10-1) Piper Dwg. 99480-3	0.5	67.2	33.6
117.	Vacuum Regulator, Airborne P/N 2H3-19	0.6	53.2	31.9

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(e) Instruments (cont)			
119.	Vacuum Filter, Airborne P/N 1J7-1 (Piper Dwg. 66673-0)	0.3	53.5	16.1
121.	Auxiliary Vacuum System, (Piper Dwg. 87778-4)	11.0	44.0	484.0
123.	Vacuum Pump (Airborne P/N 211CC), Piper Dwg. 79399-0	2.1	27.4	57.5
125.	Exhaust Gas Temperature Gauge, (PS50159-4-1)	0.6	69.4	43.7
	(f) Cabin Interior			
129.	Pilot Adjustable Seat (leather) with headrest, armrest and lumbar support - Piper Dwg. 89026-12	29.1	91.2	2656.7
131.	CoPilot Adjustable Seat (leather) with headrest, armrest and lumbar support - Piper Dwg. 89026-13	29.7	91.2	2705.9
133.	Center Club Seat (leather) - (right) with headrest, Piper Dwg. 89036-2	21.7	112.8	2447.8
135.	Center Club Seat (leather) - (left) with headrest, Piper Dwg. 89036-2	21.7	112.8	2447.8
137.	Aft Seat (leather) - (left) with headrest, Piper Dwg. 89046-2	18.2	163.4	2975.5
139.	Aft Seat (leather) - (right) with headrest and center armrest, Piper Dwg. 89046-2	20.8	162.2	3378.6
141.	Front Seat Belts (2), Piper PS50039-4-46 and -4-52, Cert. Basis - TSO C22f	1.8	91.2	164.1
143.	Center Seat Belts (2) aft facing, Piper PS50039-4-50 and -4-52, Cert. Basis - TSO C22f	1.7	113.2	195.8
145.	Aft Seat Belts (2), Piper PS50039-4-46 and 4-52, Cert. Basis - TSO C22f	1.8	163.4	294.2
147.	Shoulder Harness - Inertia Front (2), Piper PS50039-4-39	1.5	120.1	180.2
149.	Shoulder Harness - Center (aft) (2), Piper PS50039-4-45	0.9	108.9	100.2
151.	Shoulder Harness - Inertia (Rear) (2), Piper PS50039-4-41	1.4	181.5	261.4
153.	Refreshment Console with dividers, 79750-0	7.4	118.5	878.1
155.	Executive Writing Table, Piper Dwg. 85366-2	2.9	142.1	413.5
157.	Window Shades Installation, Piper Dwg. 85293-2	7.8	143.6	1120.1
159.	Assist Straps, Piper Dwg. 79455-0	0.3	120.0	36.0
161.	Baggage Straps, Piper Dwg. 66804-0	1.3	177.0	230.1

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(g) Autopilot			
165.	Bendix/King KFC-150 Autopilot with KCS 55A Compass System, Piper Dwg. 39880-28, Cert. Basis - STC SA1575CE-D	30.2	159.1	4804.8
	(h) Standard Avionics Equipment			
167.	Bendix/King KX 165-25 VHF Comm/Nav with Glide Slope Receiver (#1) Cert. Basis - TSO C37b, C38b, C40a, C36a	4.4	63.0	277.2
169.	Bendix/King KX 165-25 VHF Comm/Nav with Glide Slope Receiver (#2) Cert. Basis - TSO C37b, C38b, C40a, C36a	4.4	63.0	277.2
171.	Bendix/King KI-206 - Nav Indicator Cert. Basis - TSO C34c, C36c, C40a	1.2	66.0	79.2
173.	Bendix/King KN-62A DME, Cert. Basis - TSO C66g	3.3	63.3	208.9
175.	Bendix/King KLN 90B GPS/RNAV Navigation System Instl., Cert. Basis - TSO C129	6.0	63.1	378.6
177.	Bendix/King KMA-24-03 Audio Control Panel	1.5	65.3	98.0
179.	Bendix/King KR-87 ADF Receiver			
	a. Receiver/ Cert. Basis - TSO C47c	2.9	64.0	185.6
	b. KA 44b Antenna			
	(1) Single (weight includes cable)	3.8	179.1	680.6
181.	Bendix/King KI-227-01 Slaved Indicator	0.7	66.7	46.7
189.	Bendix/King KT 71 Transponder (weight includes antenna and cable) Cert. Basis - TSO 74c	3.8	62.6	237.9
191.	Antenna and Cable			
	a. Nav Receiving AV-12PPR	0.4	209.4	83.8
	b. #1 VHF Comm PS50040-18	0.8	146.3	109.7
	c. #2 VHF Comm PS50040-18	0.8	181.1	135.8
	d. Antenna Coupler - Dual G/S Comant CI-1125	0.3	58.8	14.7
	e. Bendix/King KA-60 Transponder Antenna (P/N 071-1174-00), Piper Dwg. 37864	0.2	60.2	12.0
193.	Bendix/King GPS-KA-91 Antenna, Piper Dwg. 39737-5	0.6	96.1	57.7

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(h) Standard Avionics Equipment (cont)			
195.	Marker Beacon Antenna, Comant CI 102, Piper Dwg. 39737-6 (weight includes antenna coax wire to Marker Beacon Receiver)	1.2	199.0	238.8
197.	Emergency Locator Transmitter			
	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
	b. Antenna and Coax	0.2	255.4	51.1
	Cert. Basis - TSO-C91a			
199.	Pilot's Headset, - Telex Comm P/N 61650-03	0.5	85.5	42.8
200.	PS Engineering Intercom System, Piper Drawing 85497-2			
	a. PS Engineering PM-1000 II Instrument Panel Mounted	.5	65.88	32.9
	b. PS Engineering PM2	1.1	193.0	212.3
	c. PS Engineering Headsets (2) - center	2.4	113.2	271.7
	d. PS Engineering Headsets (2) - aft	2.4	163.4	392.2
201.	Pilot's Microphone - Telex Acoustics P/N 62800-04 (Model 100T/NH) Single-	0.3	70.8	21.2
203.	Cabin Speaker, Piper Dwg. 85430-2 (2)	1.4	97.5	136.5
205.	Radio Shelf, Piper Dwg. 67367-0	2.3	201.8	464.1
207.	Avionics Cooling Fan (Bendix/King KA-33, 14v), Piper Dwg. 85317-2	0.9	52.4	47.2
211.	Dual Mike and Phone jacks	0.5	66.8	33.4
213.	Static Wicks (4) - Wing	0.1	139.9	14.8
	Static Wicks (3) - Empennage	0.1	303.7	24.0
	Piper Dwg. 78947-12			
215.	Ground Clearance Installation, Piper Dwg. 87458-4	0.3	63.0	18.9
	(i) Miscellaneous			
217.	Locking Fuel Caps, Piper Dwg. 39824-2 (2)	0.9	94.1	85.6
219.	Fire extinguisher installation - 100801-3			
	a. Saber Halon 1211-1301 fire extinguisher model 600 and instl. hardware.	2.5	103.6	259.1
221.	Tow Bar, Piper Dwg. 69975-2	2.3	193.9	446.0

END OF STANDARD EQUIPMENT

GARMIN

GTX™ 330

Mode S Transponder

pilot's guide

This manual is written for software version 4.06 or later, and is not suitable for earlier software versions. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

Software License Agreement

BY USING THE GTX 330, YOU AGREE TO BE BOUND BY THE TERMS AND CONDITIONS OF THE FOLLOWING SOFTWARE LICENSE AGREEMENT. PLEASE READ THIS AGREEMENT CAREFULLY.

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***CAUTION:** The GTX 330 should be turned off before starting or shutting down aircraft engine(s).*

***NOTE:** The GTX 330D Diversity Mode S Transponder requires top and bottom mounted antennas.*

***NOTE:** Contact a Garmin dealer for software updates.*

January 2007 Part Number 190-00207-00 Rev. D Printed in USA

Limited Warranty

This Garmin product is warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within this period, Garmin will at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL GARMIN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you.

Garmin retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

To obtain warranty service, contact your local Garmin Authorized Service Center. For assistance in locating a Service Center near you, call Garmin Customer Service at one of the numbers shown below.

Garmin International, Inc.		Garmin (Europe) Ltd.	
1200 East 151st Street		Unit 5, The Quadrangle, Abbey Park	
Olathe, Kansas 66062, U.S.A.		Industrial Estate, Romsey, SO51 9DL, U.K.	
Phone:	913/397.8200	Phone:	44/0870.8501241
FAX:	913/397.8282	FAX:	44/0870.8501251

***NOTE:** The GTX 330D owner accepts all responsibility for obtaining the proper licensing before using the transponder.*

***NOTE:** The coverage you can expect from the GTX 330 is limited to "line of sight". Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude. It may be possible to minimize antenna shielding by locating the antenna where dead spots are only noticed during abnormal flight attitudes.*

*The GTX 330 transponder is powered on by pressing the **STBY**, **ALT** or **ON** keys, or by a remote avionics master switch (if applicable). After power on, a start-up page is displayed while the unit performs a self test.*

Mode Selection Keys

OFF — Powers off the GTX 330. Pressing **STBY**, **ON** or **ALT** key powers on the transponder displaying the last active identification code.

STBY — Selects the standby mode. When in standby mode, the transponder will not reply to any interrogations.

ON — Selects Mode A. In this mode, the transponder replies to interrogations, as indicated by the Reply Symbol (R). Replies do not include altitude information.

ALT — Selects Mode A and Mode C. In **ALT** mode, the transponder replies to identification and altitude interrogations as indicated by the Reply Symbol (R). Replies to altitude interrogations include the standard pressure altitude received from an external altitude source, which is not adjusted for barometric pressure. The **ALT** mode may be selected in aircraft not equipped with an optional altitude encoder; however, the reply signal will not include altitude information.

Any time the function **ON** or **ALT** is selected the transponder becomes an active part of the Air Traffic Control Radar Beacon System (ATCRBS). The transponder also responds to interrogations from TCAS equipped aircraft.

Code Selection

Code selection is done with eight keys (**0 – 7**) providing 4,096 active identification codes. Pushing one of these keys begins the code selection sequence. Digits that are not yet entered appear as dashes. The new code is activated when the fourth digit is entered. Pressing the **CLR** key moves the cursor back to the previous digit. Pressing the **CLR** key when the cursor is on the first digit of the code, or pressing the **CRSR** key during code entry, removes the cursor and cancels data entry, restoring the previous code. You may press the **CLR** key up to five seconds after code entry is complete to return the cursor to the fourth digit. The numbers 8 and 9 are not used for code entry, only for entering a Count Down time, and contrast and display brightness.

Important Codes:

1200— The VFR code for any altitude in the US (Refer to ICAO standards elsewhere)

7000— The VFR code commonly used in Europe (Refer to ICAO standards)

7500— Hijack code (Aircraft is subject to unlawful interference)

7600— Loss of communications

7700— Emergency

7777— Military interceptor operations (Never squawk this code)

0000— Military use

Avoid selecting codes 0000, 7500, and all codes in the 7600-7777 range. These codes trigger special indicators in automated facilities. An aircraft's transponder code is used for ATC tracking purposes, therefore exercise care when making routine code changes!

Keys for Other GTX 330 Functions

IDENT— Pressing the **IDENT** key activates the Special Position Identification (SPI) Pulse for 18 seconds, identifying your transponder return from others on the air traffic controller's screen. The word 'IDENT' will appear in the upper left corner of the display while the IDENT mode is active.

VFR— Sets the transponder code to the pre-programmed VFR code selected during installation configuration (this is set to 1200 at the factory). Pressing the **VFR** key again restores the previous identification code. If the **VFR** Key is pressed when disabled (dependent upon installation configuration) a 'VFR Key Disabled' message appears to indicate that no operation took place.

FUNC— Changes the page shown on the right side of the display. Display data includes Pressure Altitude, Flight Time, Altitude Monitor, Count Up and Count Down timers. Also displays Outside Air Temperature, Density Altitude, Contrast, and Display (dependent upon installation configuration).

START/STOP— Starts and stops the Altitude Monitor, Count Up, Count Down and Flight timers.

CRSR— Initiates starting time entry for the Count Down timer and cancels transponder code entry.

CLR— Resets the Count Up, Count Down and Flight timers. Cancels the previous keypress during code selection and Count Down entry. Returns cursor to the fourth code digit within five seconds after entry.

8— Reduces Contrast and Display Brightness when the respective fields are displayed (dependent upon installation configuration) and enters the number eight into the Count Down timer.

9— Increases Contrast and Display Brightness when the respective fields are displayed (dependent upon installation configuration) and enters the number nine into the Count Down timer.

Function Display

PRESSURE ALT: Displays the altitude data supplied to the GTX 330 in feet, hundreds of feet (i.e., flight level), or meters (dependent upon installation configuration).

FLIGHT TIME: Timer start is configured as either Manual or Automatic. When Manual, displays the Flight Time, controlled by the **START/STOP** and **CLR** keys. When Automatic, the timer begins when take off is sensed.

ALTITUDE MONITOR: Controlled by **START/STOP** key. Activates a voice alarm and warning annunciator when altitude limit is exceeded.

OAT/DALT: Displayed when the GTX 330 is configured with temperature input. Displays Outside Air Temperature and Density Altitude.

COUNT UP TIMER: Controlled by **START/STOP** and **CLR** keys.

COUNT DOWN TIMER: Controlled by **START/STOP**, **CLR**, and **CRSR** keys. The initial Count Down time is entered with the **0** – **9** keys.

CONTRAST: This page is only displayed if manual contrast mode is selected during installation configuration. Contrast is controlled by the **8** and **9** keys.

DISPLAY: This page is only displayed if manual backlighting mode is selected during installation configuration. Backlighting is controlled by the **8** and **9** keys.

Altitude Trend Indicator

When the 'PRESSURE ALT' page is displayed, an arrow may be displayed to the right of the altitude, indicating that the altitude is increasing or decreasing. One of two sizes of arrows may be displayed depending on the vertical speed rate. The sensitivity of these arrows is set by your authorized Garmin Aviation Service Center.

The GTX 330's options are normally set at time of installation. To request any changes of the GTX 330 parameters, contact your authorized Garmin Aviation Service Center.

Timer Operation

To operate the Flight Timer:

1. Press the **FUNC** key until 'FLIGHT TIME' is displayed.
2. If the GTX 330 is configured with Automated Airborne Determination, the timer begins automatically when the unit senses that the aircraft has become airborne. The timer may be reset to zero at every take off, continue accumulating time at take off or may be controlled manually.
3. If desired, you may press **START/STOP** to pause or restart the timer.
4. Press **CLR** to reset the timer to zero.
5. If the timer is configured to start automatically it will stop when the Automated Airborne Determination senses that the aircraft is on the ground.

To operate the Count Up timer:

1. Press the **FUNC** key until 'COUNT UP' is displayed.
2. If necessary, press **CLR** to reset the Count Up timer to zero.
3. Press **START/STOP** to begin count up.
4. Press **START/STOP** again to pause the timer.
5. Press **CLR** to reset the timer to zero.

To operate the Count Down timer:

1. Press the **FUNC** key until 'COUNT DOWN' is displayed.
2. Press **CRSR** and use the **0 - 9** keys to set the initial time. All digits must be entered (use the 0 key to enter leading zeros).
3. Press **START/STOP** to begin count down.
4. Press **START/STOP** again to pause the timer.
5. When the Count Down timer expires, the 'COUNT DOWN' banner is replaced with a flashing 'EXPIRED', and the time begins counting up.
6. Press **CLR** to reset the timer to the initial time value.

Automatic ALT/GND Mode Switching

If the GTX 330 is configured for Automated Airborne Determination, normal operation begins when take off is sensed. When the aircraft is on the ground the screen automatically displays GND. The transponder does not respond to ATCRBS interrogations when GND is annunciated. When a delay time is set (dependent upon installation configuration), the GTX 330 waits a specified length of time after landing before changing to GND mode.

Failure Annunciation

If the unit detects an internal failure, the screen displays FAIL. When FAIL is annunciated no transponder data is transmitted.

Mode S Data Transmission

In addition to 4096 code and pressure altitude, the GTX 330 is capable of transmitting aircraft identification, transponder capability and maximum speed range. "Aircraft Identification" is commonly referred to as **FLT ID** (Flight Identification). The GTX 330 may be configured by the installer to allow the flight crew to enter **FLT ID** for each flight. An example is when air-carrier service requires changing the **FLT ID**.

The **FLT ID** may consist of the aircraft registration or a flight number as agreed upon with the local aviation authority. In either case, the **FLT ID** must be the same aircraft identification that appears in the flight plan to correlate the aircraft identification seen on ATC radar with the correct voice call sign for the aircraft. If no flight plan is filed with the aviation authority (as may be permitted by regulations), the **FLT ID** entered is the aircraft registration marking.

When flight crew entry of the **FLT ID** is not required, the installer configures the system to report the aircraft identification according to local aviation requirements. In this configuration, alteration of the **FLT ID** by the flight crew is not possible.

Entering a Flight ID Number

When configured for **FLT ID PWR-UP ENTRY** at installation, the flight crew must enter the Flight ID before the GTX 330 will operate. After the flight crew enters the correct Flight ID, the aircraft identification that is transmitted in response to ATC radar interrogations is properly correlated with the associated call sign for voice communication with the aircraft.

If the **FLT ID PWR-UP ENTRY** is required but does not appear at power up, contact a Garmin authorized service center for GTX 330 configuration.

No space is needed when entering Flight ID characters. When a Flight ID contains a space, the GTX 330 automatically removes the spaces upon completion of Flight ID entry.

At system power-up the **FLT ID** may appear with no number (as shown) or with the last **FLT ID** entered. The cursor covers the entire **FLT ID** field.

If the Flight ID appearing at turn-on is correct, press the **CRSR** key to move the cursor to the "OK?" field. Press **CRSR** again to accept the **FLT ID**. The transponder then begins normal operation.

When no **FLT ID** appears or the **FLT ID** must be changed, press the number keys corresponding to the alphanumeric character entry. For example, to enter the letter "R" press the **5** key four times.

Each time an alphanumeric character is entered, press the **CRSR** key to move the cursor to the next blank field. Pressing the **CLR** key moves the cursor back to the previous character. After the complete **FLT ID** is entered, press the **CRSR** key to move the cursor to the "OK?" field. Press **CRSR** again to accept the **FLT ID**.

When **FLT ID** entry is complete the transponder begins normal operation.

If you make an error entering a **FLT ID**, you can press the **CLR** key to back up to any point, including highlighting the "OK?" field. If an incorrect **FLT ID** is discovered after the unit begins operation, turn the GTX 330 off. Then turn it back on again and reenter the correct **FLT ID**.

GTX 330 Mode S Transponder Features

Traffic Information Service

The GTX 330 Mode S transponder provides a data link for Traffic Information Service (TIS). TIS is derived through a Mode S transponder data link and viewed on a multifunction display. ATC radar sends a traffic picture within a radius of 55 miles from select sites. The TIS protected area is a cylinder of 7-mile radius, extending 3500' above and 3000' below your aircraft. Refer to the AIM Chapter 1 for more details.

TIS provides a graphic display of traffic information in the cockpit for non-TCAS equipped aircraft. Transponder-equipped aircraft can be displayed within the coverage volume within range of your position on indicators such as a Garmin 430 or 530, GNS 480 and MX20. Aircraft without an operating transponder are invisible to TIS. Refer to 400/500 series, GNS 480 or MX20 pilot literature for details.

Audio Alerts

(Setting options; male/female voice or tone, and volume level.)

- "Leaving Altitude" Altitude deviation is exceeded.
- "Traffic" TIS traffic alert is received.
- "Traffic Not Available" TIS service is not available or out of range.
- "Timer Expired" for countdown time.

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