PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED AIRPLANE

FLIGHT MANUAL

Commander®
AIRCRAFT COMPANY

114TC

Serial No. 20005
Registration No. N595TC

THIS AIRPLANE IS FAA APPROVED IN THE NORMAL CATEGORY BASED ON FAR 23. THIS DOCUMENT MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE FEDERAL AVIATION REGULATIONS FAR 23 AND ADDITIONAL INFORMATION PROVIDED BY COMMANDER AIRCRAFT COMPANY, AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL. THIS HANDBOOK SHOULD NOT BE USED FOR OPERATIONAL PURPOSES UNLESS IT IS MAINTAINED IN A CURRENT STATUS.

This handbook complies with GAMA Specification No. 1, Specification for Pilot's Operating Handbook, dated September 1, 1984.

Approved:

By: Michele M Owsley

Michele M. Owsley
Manager, Airplane Certification Office
Federal Aviation Administration
Fort Worth, Texas 76193-0150

Date: August 4, 1995

COMMANDER AIRCRAFT COMPANY
Wiley Post Airport
7200 N.W. 63rd Street
Bethany, Oklahoma 73008

P/N FTR-114TC-100

LIST OF EFFECTIVE PAGES

THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 197 CONSISTING OF THE FOLLOWING. THIS TOTAL DOES NOT INCLUDE THE SUPPLEMENTS PROVIDED IN SECTION 9.

Page	Date	Page	Date
Title	8/4/95	3-5	10/9/95
i	11/14/97	3-6	8/4/95
ii	11/14/97	3-7	8/4/95
iii	11/14/97	3-8	8/4/95
iv	11/14/97	3-9	8/4/95
v	8/4/95	3-10	10/9/95
vi	8/4/95	3-11	8/4/95
1-1	8/4/95	3-12	8/4/95
1-2	8/4/95	3-13	8/4/95
1-3	10/9/95	3-14	8/4/95
1-4	8/4/95	3-15	8/4/95
1-5	10/9/95	3-16	8/4/95
1-6	8/4/95	3-17	8/4/95
1-7	10/9/95	3-18	8/4/95
1-8	10/9/95	3-19	8/4/95
1-9	10/9/95	3-20	8/4/95
1-10	10/9/95	3-21	8/4/95
2-1	8/4/95	3-22	8/4/95
2-2	8/4/95	3-23	10/9/95
2-3	8/4/95	3-24	11/14/97
2-4	8/4/95	3-25	10/9/95
2-5	10/9/95	3-26	10/9/95
2-6	10/9/95	3-27	10/9/95
2-7	10/9/95	3-28	10/9/95
2-8	10/9/95	3-29	10/9/95
2-9	8/4/95	3-30	10/9/95
2-10	11/14/97	3-31	11/14/97
2-11	10/9/95	3-32	11/14/97
2-12	10/9/95	4-1	8/4/95
2-13	10/9/95	4-2	10/9/95
2-14	8/4/95	4-3	8/4/95
2-15	8/4/95	4-4	10/9/95
2-16	11/14/97	4-5	8/4/95
3-1	10/9/95	4-6	10/9/95
3-2	11/14/97	4-7	8/4/95
3-3	10/9/95	4-8	10/9/95
3-4	10/9/95	4-9	10/9/95

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 197 CONSISTING OF THE FOLLOWING. THIS TOTAL DOES NOT INCLUDE THE SUPPLEMENTS PROVIDED IN SECTION 9.

Page	Date	Page	Date
4-10	10/9/95	5-24	10/9/95
4-11	10/9/95	5-25	10/9/95
4-12	10/9/95	5-26	10/9/95
4-13	8/4/95	5-27	10/9/95
4-14	8/4/95	5-28	10/9/95
4-15	8/4/95	5-29	10/9/95
4-16	10/9/95	5-30	10/9/95
4-17	8/4/95	5-31	10/9/95
4-18	10/9/95	5-32	10/9/95
4-19	10/9/95	5-33	10/9/95
4-20	10/9/95	5-34	10/9/95
4-21	10/9/95	5-35	10/9/95
4-22	10/9/95	5-36	10/9/95
4-23	10/9/95	5-37	10/9/95
4-24	10/9/95	5-38	10/9/95
5-1	10/9/95	5-39	10/9/95
5-2	10/9/95	5-40	10/9/95
5-3	10/9/95	6-1	10/9/95
5-4	10/9/95	6-2	8/4/95
5-5	10/9/95	6-3	10/9/95
5-6	10/9/95	6-4	10/9/95
5-7	10/9/95	6-5	10/9/95
5-8	10/9/95	6-6	8/4/95
5-9	10/9/95	6-7	10/9/95
5-10	10/9/95	6-8	10/9/95
5-11	10/9/95	6-9	8/4/95
5-12	10/9/95	6-10	10/9/95
5-13	10/9/95	6-11	10/9/95
5-14	10/9/95	6-12	10/9/95
5-15	10/9/95	6-13	10/9/95
5-16	8/4/95	6-14	10/9/95
5-17	10/9/95	7-1	10/9/95
5-18	10/9/95	7-2	10/9/95
5-19	10/9/95	7-3	10/9/95
5-20	10/9/95	7-4	8/4/95
5-21	10/9/95	7-5	8/4/95
5-22	10/9/95	7-6	10/9/95
5-23	10/9/95	7-7	10/9/95

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 197 CONSISTING OF THE FOLLOWING. THIS TOTAL DOES NOT INCLUDE THE SUPPLEMENTS PROVIDED IN SECTION 9.

Page	Date
7-8	10/9/95
7-9	10/9/95
7-10	8/4/95
7-11	10/9/95
7-12	8/4/95
7-13	10/9/95
7-14	10/9/95
7-15	10/9/95
7-16	10/9/95
7-17	10/9/95
7-18	10/9/95
7-19	10/9/95
7-20	10/9/95
7-21	10/9/95
7-22	10/9/95
7-23	10/9/95
7-24	10/9/95
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8-2	8/4/95
8-3	10/9/95
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8-5	10/9/95
8-6	10/9/95
8-7	10/9/95
8-8	10/9/95
8-9	10/9/95
8-10	10/9/95
8-11	10/9/95
8-12	10/9/95
8-13	10/9/95
8-14	10/9/95

Original Issue	8/4/95
Change 1	10/9/95
Change 2	11/14/97

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

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THE PAGES LISTED BELOW INCLUDE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE FEDERAL AVIATION REGULATIONS IN AN FAA APPROVED AIRPLANE FLIGHT MANUAL.

Page	Date
2-1	8/4/95
2-2	8/4/95
2-3	8/4/95
2-4	8/4/95
2-5	10/9/95
2-6	10/9/95
2-7	10/9/95
2-8	10/9/95
2-9	8/4/95
2-10	8/4/95
2-11	10/9/95
2-12	10/9/95
2-13	10/9/95
2-14	8/4/95
2-15	8/4/95
3-1	11/14/97
3-2	11/14/97
3-3	10/9/95
3-4	10/9/95
3-5	10/9/95
3-6	8/4/95
3-7	8/4/95
3-8	8/4/95
3-9	8/4/95
3-11	8/4/95
3-12	8/4/95
3-13	8/4/95
3-14	8/4/95
3-15	8/4/95
3-16	8/4/95
3-17	8/4/95
3-18	8/4/95
3-19	8/4/95
3-20	8/4/95
3-21	8/4/95
3-22	8/4/95
3-23	10/9/95
3-24	11/14/97
4-3	8/4/95
4-5	8/4/95
4-6	10/9/95
4-7	8/4/95
4-8	10/9/95
4-9	10/9/95
4-10	10/9/95
4-11	10/9/95
4-12	10/9/95
4-13	8/4/95
4-14	8/4/95
4-22	10/9/95
4-23	10/9/95
4-24	10/9/95
5-9	10/9/95
5-10	10/9/95
5-11	10/9/95
5-12	10/9/95
5-15	10/9/95
5-16	8/19/94
5-17	10/9/95
5-18	10/9/95
5-19	10/9/95

Approved:

By: Michele M Owsley

Michele M. Owsley
Manager, Airplane Certification Office
Federal Aviation Administration
Fort Worth, TX 76193-0150

Date: Nov. 14, 1997

TABLE OF CONTENTS

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SECTION 1
GENERAL

TABLE OF CONTENTS — Page

In this handbook the following is used to highlight especially important information:

NOTE
Information of special importance to pilot.

CAUTION
Information which could prevent damage to equipment.

WARNING
Information which could prevent personnel injury or loss of life.

REVISING THE HANDBOOK

The "List of Effective Pages" contains a list of all pages in Sections 1 thru 8 of this handbook, and their issue date. When a page of the handbook is revised or changed, the "List of Effective Pages" will reflect the date of that revision. Upon receipt of revised pages from Commander Aircraft Company, the revised pages must be inserted in the handbook and the obsolete pages removed and destroyed.

NOTE
It is the responsibility of the pilot to assure this handbook is current when using it to operate the Commander 114TC.

THREE VIEW

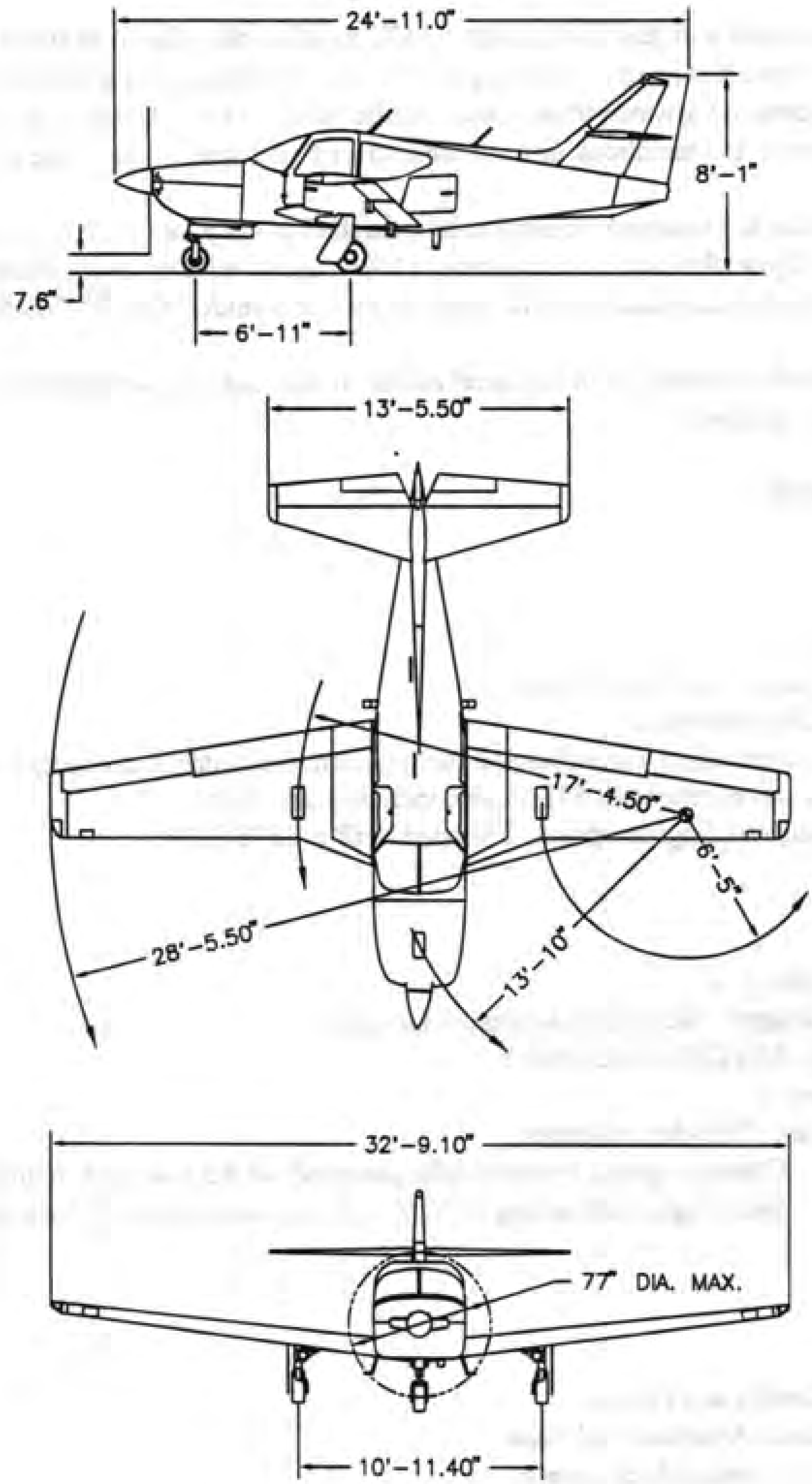

Figure 1-1

NOTES:
1. Dimensions based on standard empty weight & proper gear & tire inflation.
2. Max height with nose gear compressed.
3. Wing area is 152.0 sq. ft.

INTRODUCTION

This handbook is provided with the Commander 114TC to allow the pilot to attain as much knowledge about the airplane and its operation as possible. It is not intended as a textbook on basic flying techniques but is oriented towards those areas specific to the 114TC. The pilot should become familiar with the contents of this handbook and use them to guide his operations of the airplane.

This handbook includes the material required to be furnished to the pilot by FAR 23 and constitutes the Approved Airplane Flight Manual. Pages containing FAA Approved data are so noted at the bottom of each page. It also includes additional material supplied by Commander Aircraft Company.

Section 1 provides basic information of a general nature. It also contains definitions of terms and abbreviations used in the handbook.

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1
Engine Manufacturer: Textron Lycoming
Engine Model: TIO-540-AG1A
Engine Type: Reciprocating, turbocharged, fuel injected, direct drive, air-cooled, horizontally opposed, six-cylinder engine with 541.5 cubic inch displacement.
Horsepower Rating and Engine Speed: 270 rated BHP at 2575 RPM.

PROPELLER

Number of Propellers: 1
Propeller Manufacturer: McCauley Accessory Division
Propeller Model: B3D32C419/82NHA-5
Number of Blades: 3
Propeller Diameter: 77 inches diameter.
Propeller Type: Constant speed, hydraulically governed, with a low pitch setting of 14.8° ± .2° and a high pitch setting of 33.9° ± .5° measured at the 30 inch blade station.

FUEL

Approved Fuel Grades and Colors:
100LL Grade Aviation Fuel - blue
100 Grade Aviation Fuel - green
Total Capacity: 90 gallons
Usable Fuel: 88 gallons

DESCRIPTIVE DATA (con't)

OIL

Oil Specification: In accordance with Textron Lycoming Service Instruction 1014.
Ashless Dispersant oil: MIL-L-22851

Oil Grades (Recommended):

Ambient Temperatures	Ashless Dispersant Oil
All	SAE 15W-50 or 20W-50
Above 80°F (27°C)	SAE 60
Above 60°F (16°C)	SAE 40 or 50
30°F to 90°F (-1°C to 32°C)	SAE 40
0°F to 70°F (-18°C to 21°C)	SAE 30, 40, or 20W-40
Below 10°F (-12°C)	SAE 30 or 20W-30

NOTE: The ambient ground air temperatures listed in the chart are meant only as a guide.

Oil Capacity:
Total Sump Capacity - 10 quarts

MAXIMUM CERTIFICATED WEIGHTS

Takeoff Weight:	3305 lbs.
Landing Weight:	3140 lbs.
Zero Fuel Weight:	3000 lbs.
Weight in Baggage Compartment:	200 lbs.

STANDARD AIRPLANE WEIGHTS

Empty Weight Typically Equipped:	2245 lbs.
Useful Load Typically Equipped:	1060 lbs.

NOTE
A typically equipped aircraft, in addition to required and standard equipment, includes; stereo intercom, dual comm/nav, transponder with blind encoder, second nav indicator, DME, ADF and indicator, GPS, digital clock, fuel totalizer, Graphic Engine Monitor, Stormscope or Strikefinder, avionics cooling, autopilot with yaw damper, compass system, and HSI, autopilot nav source select switching, and all necessary antennas.

CABIN AND ENTRY DIMENSIONS

Maximum Cabin Width:	47 in.	Minimum Entry Width:	18 in.
Maximum Cabin Length:	75 in.	Minimum Entry Height:	34 in.
Maximum Compartment Height:	49 in.	Minimum Door Sill Height:	11 in

DESCRIPTIVE DATA (con't)

BAGGAGE SPACES AND ENTRY DIMENSIONS

Compartment Width:	44 in. Front	Compartment Volume:	22 cu. ft.
	40 in. Rear	Minimum Entry Width:	21 in.
Compartment Length:	28 in.	Minimum Entry Height:	18 in
Compartment Height:	36 in.		

SPECIFIC LOADINGS

Wing Loading:	21.8 lbs./sq. ft.
Power Loading:	12.2 lbs./hp

SYMBOLS, ABBREVIATIONS, AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS **Knots Calibrated Airspeed** is indicated airspeed corrected for position and instrument errors. KCAS is equal to KTAS in a standard atmosphere at sea level.

KIAS **Knots Indicated Airspeed** is the airspeed shown on the airspeed indicator. All KIAS values in this handbook assume no instrument error.

KTAS **Knots True Airspeed** is the actual airspeed relative to the air mass. In zero wind conditions KTAS is equal to ground speed.

V_A **Maneuvering Speed** is the maximum speed at which application of maximum available control is permitted.

V_{FE} **Maximum Flap Extended Speed** is the maximum speed permissible with the wing flaps in a prescribed extended position.

V_{LE} **Maximum Landing Gear Extended Speed** is the maximum speed at which the airplane can be safely flown with the landing gear extended.

V_{LO} **Maximum Landing Gear Operating Speed** is the maximum speed at which the landing gear can be safely extended or retracted.

SYMBOLS, ABBREVIATIONS, AND TERMINOLOGY (con't)

V_{NE} **Never Exceed Speed** is the speed limit that may not be exceeded at any time.

> NOTE
>
> In this airplane, V_{NE} varies with altitude.

V_{NO} **Maximum Structural Cruising Speed** is the speed that should not be exceeded except in smooth air and then, only with caution.

> NOTE
>
> In this airplane, V_{NO} varies with altitude.

V_S **Stalling Speed** or minimum steady flight speed at which the airplane is controllable.

V_{SO} **Stalling Speed** or minimum steady flight speed at which the airplane is controllable in the landing configuration at the most forward center of gravity.

V_x **Best Angle of Climb Speed** is the speed which results in the greatest gain of altitude in a given horizontal distance.

V_y **Best Rate of Climb Speed** is the speed which results in the greatest gain of altitude in a given time.

METEOROLOGICAL TERMINOLOGY

ISA **International Standard Atmosphere** is that in which:

1) The air is a dry perfect gas
2) The temperature at sea level is 59°F (15°C)
3) The pressure at sea level is 29.92 inches Hg (1013.2 millibars)
4) The temperature lapse rate with altitude is -3.57°F (–2°C) per thousand feet over the altitude capability of this airplane.

OAT **Outside Air Temperature** is the free air static temperature expressed in either °C or °F.

Pressure Altitude **Pressure Altitude** is the altitude read from an altimeter when the altimeter's barometric scale has been set to 29.92 inches Hg (1013.2 mb) corrected for position error. This handbook assumes all indicated altitudes to be free of instrument error.

SYMBOLS, ABBREVIATIONS, AND TERMINOLOGY (con't)

ENGINE POWER TERMINOLOGY

BHP	**Brake Horsepower** is the power developed by the engine.
Critical Altitude	**Critical Altitude** is the maximum altitude at which manifold pressure can be maintained at a given throttle setting.
MAP	**Manifold Air Pressure** is the absolute pressure of the air in the intake manifold as set by the throttle.
Recom-mended Mixture	**Recommended Mixture** is the mixture strength used to formulate the cruise, range, and endurance performance in this handbook. This mixture corresponds to operation at 1650°F TIT or peak TIT.
MCP	**Maximum Continuous Power** is that power approved for use without time limitation. This power corresponds to full throttle, 2575 RPM, and full rich mixture.
RPM	**Revolutions Per Minute** refers to the engine and propeller rotational speed.
TIT	**Turbine Inlet Temperature** is the temperature of the exhaust gases entering the turbine of the turbocharger. TIT changes reflect mixture changes.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demonstrated Crosswind Velocity	**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. The value shown is not considered to be limiting.
G	**G** is the acceleration due to gravity. It is also used to express load factor applied to the airframe.
Usable Fuel	**Usable Fuel** is the fuel available for flight planning.

WEIGHT AND BALANCE TERMINOLOGY

Arm	**Arm** is the horizontal distance from the reference datum along the airplane fuselage to the center of gravity of an item.
Basic Empty Weight	**Basic Empty Weight** is the standard empty weight plus the weight of optional equipment.

SYMBOLS, ABBREVIATIONS, AND TERMINOLOGY (con't)

Center of Gravity	**Center of Gravity** (C.G.) is the point at which an airplane, or item of equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight.
C.G. Arm	**Center of Gravity Arm** is the arm obtained by adding the airplane's component moments and dividing by the sum of its component weights.
C.G. Limits	**Center of Gravity Limits** are the extreme center of gravity locations within which the airplane must be operated. These limits vary with airplane weight.
Maximum Landing Weight	**Maximum Landing Weight** is the maximum weight approved for landing touchdown.
Maximum Takeoff Weight	**Maximum Takeoff Weight** is the maximum weight approved for the start of the takeoff roll.
Maximum Zero Fuel Weight	**Maximum Zero Fuel Weight** is the maximum weight approved exclusive of fuel.
Minimum Flying Weight	**Minimum Flying Weight** is the minimum weight approved for flight operations.
Moment	**Moment** is the product of the weight of an item multiplied by its arm.
Reference Datum	**Reference Datum** is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Standard Empty Weight	**Standard Empty Weight** is the weight of a standard airplane, including unusable fuel, full operating fluids, and full engine oil.
Station	**Station** is a location along the airplane fuselage given in terms of the distance, in inches, from the reference datum.
Tare	**Tare** is the weight of chocks, blocks, stands, etc. used when weighing an airplane, included in the scale readings. Tare must be deducted from the scale reading(s) to obtain the actual airplane weight.
Unusable Fuel	**Unusable Fuel** is the quantity of fuel that can not be safely used in flight.

SYMBOLS, ABBREVIATIONS, AND TERMINOLOGY (con't)

Useful Load	**Useful Load** is the difference between maximum takeoff weight and the basic empty weight.

SECTION 2
LIMITATIONS

TABLE OF CONTENTS Page

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INTRODUCTION

This section presents the airplane operating limitations, required instrument markings and the significance thereof, and the required placards. All material included in this section has been approved by the Federal Aviation Administration. Observance of all operating limitations is required by the Federal Aviation Regulations. Similarly, all required instrument markings and placards must be maintained in a legible and usable condition on the airplane.

Limitations associated with selected standard equipment and optional systems can be found in Section 9 Supplements.

AIRSPEED

AIRSPEED LIMITATIONS

The following table summarizes the airspeed limitations applicable to this airplane:

SPEED	SYMBOL	KCAS	KIAS	SIGNIFICANCE
Never Exceed S.L.-12500 ft * 15000 ft 17500 ft 20000 ft 22500 ft 25000 ft	V_{NE}	 186 176 167 158 150 141	 187 176 167 157 149 139	Do not exceed this speed in any operation.
Maximum Structural Cruise S.L. -12500 ft * 15000 ft 17500 ft 20000 ft 22500 ft 25000 ft	V_{NO}	 162 153 145 138 130 122	 162 152 144 136 128 121	Do not exceed this speed except in smooth air,and then only with caution.
Maneuvering * 3305 lbs 3000 lbs 2491 lbs	V_A	 118 112 102	 117 112 102	Do not make full or abrupt control movements above this speed.
Maximum Flap Extended To: To 20° flap 20° to 25° flap 25° to 35° flap	V_{FE}	 150 120 109	 149 121 112	Do not exceed these speeds with the given flap deflection.
Maximum Landing Gear Operating **	V_{LO}	130	129	Do not extend or retract the landing gear above this speed.
Maximum Landing Gear Extended	V_{LE}	186	187	Do not exceed this speed with landing gear extended.
Maximum Vent Windows Open	—	130	129	Do not exceed this speed with the vent windows(s) open.

Note: * Straight line variation between points given.
** Do not exceed V_{NE} schedule

AIRSPEED INDICATOR MARKINGS

The following markings must be on the airspeed indicator face:
Note: Airspeed Indicator Markings based on KCAS.

MARKING	KCAS VALUE OR RANGE	SIGNIFICANCE
White Arc	59 ~ 109	Full Flap Operating Range. Lower limit is maximum weight zero thrust stall speed in the landing configuration. Upper limit is maximum speed allowable with flaps fully extended.
Green Arc	66 ~ 162	Normal Operating Range. Lower limit is maximum weight zero thrust stall speed with flaps and landing gear retracted. Upper limit is maximum structural crusing speed at altitudes below 12,500 ft.
Yellow Arc	162 ~ 186	Caution Range. Operations must be conducted with caution and only in smooth air. Applicable below 12500 ft only. See placard for higher altitude speed restrictions.
Red Radial Line	186	Never Exceed Speed. Maximum speed for all operations. Applicable below 12500 ft only. See placard for higher altitude speed restrictions.

POWERPLANT

POWERPLANT LIMITATIONS

Engine Manufacturer: Textron Lycoming

Engine Model: TIO-540-AG1A

Maximum Power: 270 BHP Rating

Engine Operating Limits for Takeoff and Continuous Operations

Maximum Allowable Manifold Pressure:

S.L.-16000'	**39"**
20000'	**38"**
22000 ft	**37"**
23500'	**35"**
25000'	**33"**

Maximum Engine Speed:		2575 RPM
Maximum Cylinder Head Temperature:		500°F (260°C)
Maximum Oil Temperature:		245°F (118°C)
Oil Pressure, Minimum:	25 psi	
Maximum:	115 psi	
Fuel Injector Inlet Pressure,	Minimum:12 psi (idling)	
	Maximum: 55 psi	

Fuel Grade: See Fuel Limitations

Oil Grade: In accordance with Textron Lycoming Service Instruction No. 1014. MIL-L-22851 ashless dispersant oil.

Propeller Manufacturer: McCauley Accessory Division

Propeller Model: B3D32C419/82NHA-5

Propeller Diameter, Maximum: 77 inches
Minimum: 75.5 inches

Propeller Blade Angle at the 30 Inch Blade Station,
Low: 14.8° ± .2°
High: 33.9° ± .5°

POWERPLANT (con't)

Turbine Inlet Temperature, Maximum: 1650° F

Airstarts prohibited above 23,000 ft. altitude.

POWERPLANT INSTRUMENT MARKINGS

Powerplant instruments must be marked as follows:

INSTRUMENT	RED LINE Min. Limit	YELLOW ARC Caution Range	GREEN ARC Normal Range	YELLOW ARC Caution Range	RED LINE Max. Limit
Manifold Pressure Gage - inches Hg	--	--	10 ~ 29	--	39
Tachometer - RPM	--	--	2200 ~ 2400	--	2575
Fuel Flow Gage-GPH (Pressure - psi)	--	--	5 ~ 23	--	--
Fuel Pressure - psi	12	--	20 ~ 55	--	55
Cylinder Head Temperature - °F	--	--	200 ~ 500	--	500
Oil Pressure - psi	25	25 ~ 55	55 ~ 95	95 ~ 115	115
Oil Temperature - °F	--	--	160 ~ 245	--	245

MISCELLANEOUS INSTRUMENT MARKINGS

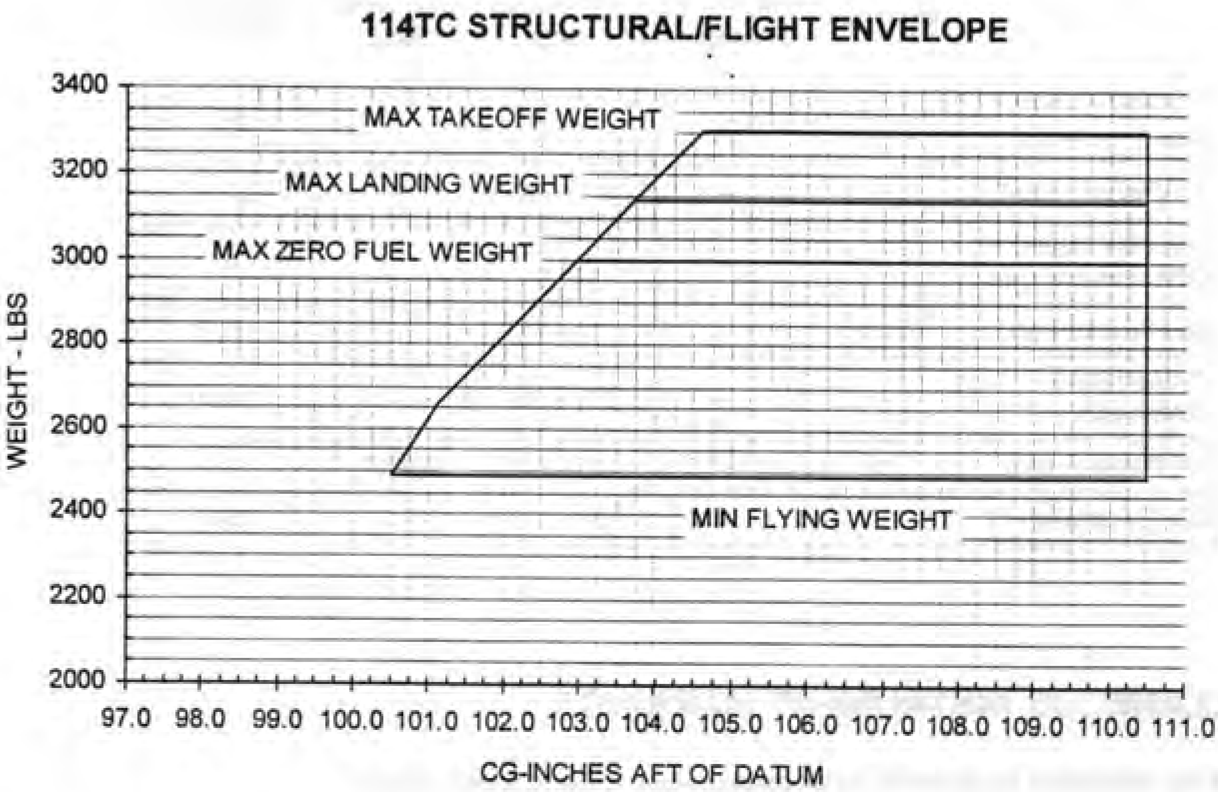
The following additional instruments must display the markings listed below:

INSTRUMENT	RED LINE Min. Limit	YELLOW ARC Caution Range	GREEN ARC Caution Range	YELLOW ARC Caution Range	RED LINE Max. Limit
Fuel Gages - gallons	0-2	--	--	--	--
Suction Gage-inches Hg	4.5	--	4.5 - 5.2	--	5.2

WEIGHT LIMITS

Maximum Takeoff Weight:	3305 lbs.
Maximum Landing Weight:	3140 lbs.
Maximum Zero Fuel Weight:	3000 lbs.
Maximum Weight in Baggage Compartment:	200 lbs.
Minimum Flying Weight:	2491 lbs.

CENTER OF GRAVITY LIMITS



Center of Gravity Range - Takeoff:

Forward: 100.5 inches aft of datum at 2491 lbs., with straight line variation to 101.1 inches aft of datum at 2658 lbs. to 104.6 inches aft of datum at 3305 lbs.
Aft: 110.50 inches aft of datum at all weights above 2491 lbs.

Center of Gravity Range - Landing:

Forward: 100.5 inches aft of datum at 2491 lbs., with straight line variation to 101.1 inches aft of datum at 2658 lbs. to 103.7 inches aft of datum at 3140 lbs.
Aft: 110.50 inches aft of datum at all weights between 2491 lbs. and 3140 lbs.

CENTER OF GRAVITY LIMITS (con't)

Center of Gravity Range - Zero Fuel:

Forward: 100.5 inches aft of datum at 2491 lbs., with straight line variation to 101.1 inches aft of datum at 2658 lbs. to 103.0 inches aft of datum at 3000 lbs.
Aft: 110.50 inches aft of datum at all weights between 2491 lbs. and 3000 lbs.

Center of Gravity Range - Minimum Flying Weight:

100.5 inches aft of datum at 2491 lbs. with straight line variation to 110.5 in. aft of datum at 2491 lbs.

Datum Location: Fuselage Station 0 in. (62.50 in. forward of firewall)

MANEUVER LIMITS

This airplane is certificated in the Normal Category. The Normal Category is applicable to airplanes intended for non-aerobatic operations. This includes any maneuver incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and steep turns in which the angle of bank is not greater than 60°.

Inverted maneuvers are prohibited.

Aerobatic maneuvers are prohibited.

Intentional spins are prohibited.

FLIGHT LOAD FACTOR LIMITS

Load Factor Limits: Flaps 0° - +3.8 Gs to -1.52 Gs
Flaps 35°- +2.0 Gs to 0 Gs

KINDS OF OPERATION LIMITS

This airplane has been certificated in accordance with FAR 23, Amendment 7 for day, night, VFR, and IFR operations.

Flight into known icing conditions is prohibited.

KINDS OF OPERATION LIMITS (con't)

The following list summarizes the equipment required by FAR 23 for airworthiness for the particular kind of operation. Those minimum items of equipment necessary under the operating rules are defined in FAR 91 and FAR 135 as applicable.

INSTRUMENT, SYSTEM, OR EQUIPMENT	KINDS OF OPERATION		
	DAY	NIGHT	IFR
Alternate engine induction air system	X	X	X
Alternate static air source	X	X	X
Alternator (1 min)	X	X	X
Ammeter	X	X	X
Auxiliary fuel pump	X	X	X
Battery	X	X	X
Circuit breakers	X	X	X
Clock w/sweep second hand or digital presentation	--	--	X
Compass	X	X	X
Cowl flap	X	X	X
Cowl flap position light	X	X	X
Gage, cylinder head temperature	X	X	X
Gage, fuel pressure	X	X	X
Gage, fuel quantity (2)	X	X	X
Gage, oil pressure	X	X	X
Gage, oil temperature	X	X	X
Gear system, emergency	X	X	X
Gear warn light	X	X	X
Gear warning horn system	X	X	X
Gyro, attitude	--	--	X
Gyro, directional	--	--	X
Gyro, turn rate	--	--	X
Indicator, airspeed	X	X	X
Indicator, altimeter, sensitive	X	X	X
Indicator, flap position	X	X	X
Indicator, tachometer	X	X	X
Indicator, turbine inlet temperature	X	X	X
* Light(s), anti-collision; (Three Position Strobes)	--	X	--
Lights, instrument panel	--	X	--
Lights, position (3)	--	X	--
Pilot's Operating Handbook & FAA Approved Airplane Flight Manual	X	X	X
Propeller governor	X	X	X
Propeller spinner	X	X	X
Seat belt systems, all occupants	X	X	X
Stall warning system	X	X	X
Steering system, nose wheel	X	X	X
Switch, alternator master	X	X	X
Switch, battery master	X	X	X
Trim indicator, elevator	X	X	X
Trim indicator, rudder	X	X	X
Trim system, elevator	X	X	X
Trim system, rudder	X	X	X
Vacuum system (1 min)	--	--	X
Voltage regulator	X	X	X
Voltmeter	X	X	X

* NOTE: The beacon strobe is a supplemental light only and does not meet the field of coverage requirements of an anti-collision light alone. Only the three position anti-collision strobes qualify as anti-collision lights under Part 91 Night Operations.

FUEL LIMITATIONS

Two Tanks: 45 U.S. Gallons Each

Total Fuel: 90 U.S. Gallons
Usable Fuel: 88 U.S. Gallons
Unusable Fuel: 2 U.S. Gallons

Takeoff and land with the fuel selector in the BOTH position.

Approved Fuel Grades and Colors:
100LL Grade Aviation Fuel, Blue
100 Grade Aviation Fuel, Green

MAXIMUM OPERATING ALTITUDE LIMIT

Certificated maximum operating altitude -- 25,000 feet.

OTHER LIMITATIONS

ELECTRICAL SYSTEM LIMITS

Maximum allowable system voltage is 30 volts.
Maximum standard alternator current is 80 amps.

EXHAUST GAS (TURBINE INLET) TEMPERATURE LEANING LIMITS

Leaning is prohibited as powers in excess of 75%.
Maximum allowable turbine inlet temperature (T.I.T.) is 1650° F.

NOTE
For aircraft equipped with the optional Graphic Engine Monitor (G.E.M.): The G.E.M. indicates 1/10th times T.I.T. (i.e. indicated times 10 = T.I.T.)

Operation on the lean side of peak exhaust gas temperature is prohibited, except briefly to establish peak TIT when peak TIT occurs below 1650°F.

FLAP LIMITS

Approved Takeoff Range: 0° to 20°
Approved Landing Range: 0° to 35°

PLACARDS

The following information must be displayed in the form of individual or combined placards:

1. In full view of the pilot:

> **OPERATING LIMITATIONS**
>
> **THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH OPERATING LIMITATIONS STATED IN THE AIRPLANE FLIGHT MANUAL.**
>
> **NO ACROBATIC MANEUVERS ARE APPROVED. INTENTIONAL SPINS ARE PROHIBITED.**
>
> **THIS AIRPLANE IS APPROVED FOR FLIGHT IN DAY/NIGHT VFR/IFR WHEN EQUIPPED IN ACCORDANCE WITH FAR 91. FLIGHT INTO KNOWN ICING CONDITIONS IS PROHIBITED.**

2. On the inside of the baggage door:

> **MAX. BAGGAGE COMPARTMENT**
> **CAPACITY 200 LBS**

3. Near the airspeed indicator:

> **MANEUVERING SPEED, 3305 LBS 118 KCAS**
> **MAX. GEAR OPERATING SPEED 130 KCAS**
> **SEE POH FOR ADDITIONAL V_A LIMITATIONS**

4. Near the alternator master switch:

> **80 AMP CAPACITY**
> **DO NOT TURN ALTERNATOR OFF IN**
> **FLIGHT EXCEPT IN CASE OF EMERGENCY**

5. Near the voltmeter: **30.0 VOLTS MAX**

6. Near the upper center of the instrument panel: **NO SMOKING**

PLACARDS (con't)

7. On the tailcone, near each static source:

STATIC AIR - KEEP CLEAN

8. Near the external power plug on the tailcone:

EXTERNAL POWER
28 VOLT DC

PUSH
HERE

9. On the face of each electric gyro (if not similarly marked by the gyro manufacturer):

ELEC

10. On the face of each vacuum gyro (if not similarly marked by the gyro manufacturer):

VAC

11. On top of each front seatback:

HEADRESTS TO BE IN PLACE
DURING TAKEOFF & LANDING

12. At the fuel selector valve:

44 GAL. USEABLE EACH TANK
USE BOTH T.O. & LANDING

13. At the vent window(s):

MAXIMUM SPEED
WINDOW OPEN
130K

14. At the fuel filler ports:

AVGAS
100 OR 100 LL MIN
AVIATION GRADE FUEL
USABLE US GAL
44
32

PLACARDS (con't)

15. On each main gear strut:

WARNING RELEASE AIR IN STRUT BEFORE DISASSEMBLY

16. On Control Lock:

CONTROL LOCK REMOVE BEFORE FLIGHT

17. Near the magnetic compass:

    A calibration card must give the accuracy of the compass in 30° increments.

18. At the oil filler port:

OIL 10 QTS

19. At the emergency gear extension knob:

LANDING GEAR EMERGENCY DOWN PULL OUT AND PUSH DOWN

20. On each flap inboard end:

NO STEP

21. On ELT access panel on aft cabin bulkhead:

EQUIPPED WITH DOWNED AIRCRAFT LOCATOR BATTERY REPLACEMENT DATE ________

22. In clear view of pilot.

FIRE EXTINGUISHER LOCATED UNDER CO-PILOT'S SEAT

23. Above the exterior light switches:

SEE POH FOR INFORMATION ON BCN USAGE

PLACARDS (con't)

23. On standard equipment Halon fire extinguisher.

WARNING

IMMEDIATELY AFTER DISCHARGING FIRE EXTINGUISHER, FLUSH THE CABIN OF TOXIC BY-PRODUCTS BY OPENING ALL VENTILATION PORTS AS FOLLOWS:

1. **CABIN AIR AND VENT CONTROLS — FULL ON**
2. **CABIN HEAT AND DEFROSTER CONTROLS — FULL ON**
3. **VENT WINDOW — OPEN (REDUCE SPEED TO 130 KIAS)**

25. Near the airspeed indicator:

ABOVE 12500 FEET - KCAS

ALTITUDE	V_{NO}	V_{NE}
15000'	153	176
17500'	145	167
20000'	138	158
22500'	130	150
25000'	122	141

26. In clear view of pilot.

MAX ALLOWABLE MANIFOLD PRESSURE

S.L.-16000'	39"
20000'	38"
22000'	37"
23500'	35"
25000'	33"

SEE POH FOR ADDITIONAL LIMITATIONS

27. Below Turbine Inlet Temperature indicator.

MAX T.I.T. 1650° F
G.E.M. INDICATES
1/10TH X T.I.T.

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SECTION 3
EMERGENCY PROCEDURES

TABLE OF CONTENTS — Page

TABLE OF CONTENTS (con't)

INTRODUCTION

Emergencies caused by airplane or engine malfunctions are rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered. Should an emergency arise, the basic guidelines described in this section are to be applied as necessary to alleviate the problem. The procedures contained herein are not intended to constitute basic flight instruction but are intended to supplement those principles relating to emergencies that each pilot acquires in the process of learning to fly and obtaining FAA pilot certification. Emergency procedures associated with selected standard equipment and optional systems can be found in Section 9.

Checklists are provided to assist a pilot where it would be reasonable for a pilot to refer to one. Where reference to a checklist would be impractical, or where the material is not amenable to a checklist form, or where additional material is helpful, amplified procedures are provided following the checklist section.

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:
- Wing Flaps Up .... 85 KIAS
- Wing Flaps 20° .... 80 KIAS

Maneuvering Speed:
- 3305 Lbs .... 117 KIAS
- 3000 Lbs .... 113 KIAS
- 2491 Lbs .... 103 KIAS

Maximum Glide:
- 3305 Lbs .... 85 KIAS
- 3000 Lbs .... 81 KIAS
- 2491 Lbs .... 74 KIAS

Precautionary Landing With Engine Power .... 75 KIAS

Landing Without Engine Power:
- Wing Flaps UP .... 85 KIAS
- Wing Flaps 35° .... 75 KIAS

Emergency Descent:
- Smooth Air:
  - 25000 feet .... 139 KIAS
  - 22500 feet .... 149 KIAS
  - 20000 feet .... 157 KIAS
  - 17500 feet .... 167 KIAS
  - 15000 feet .... 176 KIAS
  - 12500 feet and below .... 187 KIAS
- Rough Air:
  - 3305 pounds .... 117 KIAS
  - 3000 pounds .... 112 KIAS
  - 2491 pounds .... 102 KIAS

OPERATIONAL CHECKLISTS

ENGINE FAILURES

DURING TAKEOFF ROLL

1. Throttle — IDLE
2. Brakes — APPLY
3. Wing Flaps — RETRACT
4. Mixture — IDLE CUT-OFF
5. Ignition Switch — OFF
6. Battery Master Switch — OFF

IN FLIGHT (Restart Procedures; below 23000 ft.)

WARNING

Do not attempt restarts above 23000 feet altitude due to reduced dielectric constant at high altitudes and the effect on magneto operation.

1. Airspeed — 85 KIAS.

NOTE
If propeller stops, use normal starting procedures as outlined in Section 4

2. Fuel Selector -- FULLEST TANK

NOTE
To minimize restart time, select the fuller tank. Do not use the BOTH position.

3. Auxiliary Fuel Pump — ON
4. Ignition Switch — BOTH

If engine does not start:

5. Mixture — IDLE CUT-OFF
6. Mixture — ADVANCE SLOWLY until start occurs

ENGINE FAILURES (con't)

If engine still does not start:

7. Alternate Induction Air — PULL ON
8. Mixture — IDLE CUT-OFF
9. Mixture — ADVANCE SLOWLY until start occurs

If engine still does not start:

10. PROCEED TO PAGE 3-7 **EMERGENCY LANDING WITHOUT ENGINE POWER**

After engine has restarted:

11. Throttle -- ADJUST
12. Auxiliary Fuel Pump -- OFF
13. Mixture -- LEAN as required.

TURBOCHARGER FAILURES

WARNING

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

NOTE

A turbocharger malfunction at altitudes above 12000 feet will be indicated by a loss in manifold pressure which will result in a partial power loss. A rough running engine or a complete loss of engine power are also possible.

COMPLETE LOSS OF ENGINE POWER

If a suspected turbocharger or turbocharger waste gate control system failure (other than a loose, disconnected or burned through exhaust) results in a complete loss of engine power the following procedure is recommended:

1. Mixture — IDLE CUTOFF
2. Throttle — CRUISE POSITION
3. Propeller -- FULL FORWARD
4. Mixture -- ADVANCE slowly until engine re-starts
5. Continue Flight -- LAND AS SOON AS POSSIBLE

ENGINE FAILURES (con't)

PARTIAL LOSS OF ENGINE POWER

If turbocharger waste gate control fails in the OPEN position or the hose connecting the turbocharger compressor and the throttle intake fails, a partial loss of engine power may result. The following procedure is recommended if a suspected turbocharger/wastegate control failure results in a partial loss of engine power.

1. Throttle — AS REQUIRED
2. Propeller -- AS REQUIRED
3. Mixture -- AS REQUIRED
4. Continue Flight -- LAND AS SOON AS POSSIBLE

ENGINE POWER OVERBOOST

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

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

> **NOTE**
> Expect manifold pressure response to throttle movements to be sensitive

2. Propeller -- AS REQUIRED
3. Mixture -- AS REQUIRED
4. Continue Flight -- LAND AS SOON AS POSSIBLE

EMERGENCY LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

1. Seatbacks — UPRIGHT
2. Seats, Seat Belts, Shoulder Harnesses — SECURE
3. Loose Objects — SECURE
4. Radio — TRANSMIT MAYDAY to ATC or on 121.5 MHz (if time permits)
5. Emergency Locator Transmitter — ON
6. Transponder — CODE 7700
7. Airspeed — 85 KIAS (flaps UP)
   75 KIAS (flaps 35°)
8. Auxiliary Fuel Pump — OFF
9. Fuel Selector — OFF
10. Landing Gear — DOWN

> NOTE
> If the landing site has an extremely soft surface, it is recommended that the landing gear remain retracted.

11. Mixture — IDLE CUT-OFF
12. Ignition Switch — OFF
13. Wing Flaps — 35° (recommended)
14. Battery & Alternator Master Switches — OFF when landing assured.

> **CAUTION**
> **Stall warning will not be available with electrical system turned off.**

15. Touchdown — TAIL LOW
16. Brakes — AS REQUIRED

EMERGENCY LANDINGS (con't)

PRECAUTIONARY LANDING WITH ENGINE POWER

1. Seatbacks — UPRIGHT
2. Seats, Seat Belts, Shoulder Harnesses — SECURE
3. Loose Objects — SECURE
4. Radio — TRANSMIT MAYDAY to ATC or on 121.5 MHz (if circumstances so warrant)
5. Emergency Locator Transmitter — ON
6. Transponder — CODE 7700 (if circumstances so warrant)
7. Airspeed — 90 KIAS (flaps UP)
8. Selected Landing Site — FLY OVER, noting terrain & obstructions
9. All Switches (except battery & alternator masters & ignition) — OFF
10. Auxiliary Fuel Pump — OFF
11. Fuel Selector — BOTH
12. Landing Gear -- DOWN

> NOTE
> If the landing site has an extremely soft surface, it is recommended that the landing gear remain retracted.

13. Mixture — FULL RICH
14. Propeller Control — FULL INCREASE RPM
13. Wing Flaps — 35° (recommended)
14. Power — AS REQUIRED
15. Airspeed — 75 KIAS
16. Battery & Alternator Master Switches — OFF when landing assured.

> **CAUTION**
> **Stall warning will not be available with electrical system turned off.**

17. Touchdown — TAIL LOW
18. Brakes — AS REQUIRED
29. Mixture — IDLE CUT-OFF
20. Ignition Switch — OFF

EMERGENCY LANDINGS (con't)

DITCHING

> NOTE
> This airplane has not been tested in an actual ditching. The following procedure is based on the best judgment of Commander Aircraft Co.

1. Seatbacks — UPRIGHT
2. Occupant Flotation Gear (if available) — DON
3. Seats, Seat Belts, Shoulder Harnesses — SECURE
4. Loose Objects — SECURE
5. Radio — TRANSMIT MAYDAY to ATC or on 121.5 MHz
6. Emergency Locator Transmitter — ON
7. Transponder — CODE 7700
8. Airspeed — 85 KIAS (flaps UP)
   80 KIAS (flaps 20°)
9. Auxiliary Fuel Pump — OFF
10. Fuel Selector — BOTH
11. Landing Gear — UP
12. Mixture — FULL RICH
13. Propeller Control — FULL INCREASE RPM
14. Wing Flaps — 20° (recommended)
15. Cowl Flap -- CLOSED
16. Power -- ESTABLISH 300 FT/MIN DESCENT AT 80 KIAS

> NOTE
> If no power is available, approach at 85 KIAS with 10° flaps or 20° flaps.

17. Approach - High Winds, Heavy Seas — INTO THE WIND
    Light Winds, Heavy Swells — PARALLEL TO SWELLS
18. Touchdown — LEVEL ATTITUDE AT 300 FT/MIN DESCENT. Do not flare.
19. Airplane — EVACUATE. If necessary, open vent window(s) and flood cabin to equalize pressure so that cabin doors can be opened.
20. Life Vests, Raft (if available) — INFLATE outside aircraft

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FIRES

ENGINE FIRE DURING START (On Ground)

1. Ignition Switch — START (continue cranking to obtain start)
2. Auxiliary Fuel Pump — OFF

If engine starts:

3. Throttle -- 1700 RPM for a few minutes
4. Engine — SHUTDOWN and inspect for damage

If engine fails to start:

3. Cranking — CONTINUE while fuel is cutoff.
4. Mixture — IDLE CUT-OFF
5. Fuel Selector — OFF
6. Ignition Switch — OFF
7. Battery & Alternator Switches — OFF
8. Airplane — EVACUATE
9. Fire — EXTINGUISH using fire extinguisher, wool blanket, or dirt.
10. Fire Damage — INSPECT, repair damage before conducting another flight.

FIRE DURING TAKEOFF ROLL

1. Throttle — IDLE
2. Brakes — APPLY
3. Flaps — UP
4. Aux. Fuel Pump — OFF
5. Mixture — IDLE CUT-OFF
6. Fuel Selector — OFF
7. Ignition Switch — OFF
8. Battery & Alternator Switches — OFF
9. Airplane — EVACUATE after coming to stop

10. Fire — EXTINGUISH using fire extinguisher, wool blanket, or dirt.
11. Fire Damage — INSPECT, repair damage before conducting another flight.

FIRES (con't)

ENGINE FIRE IN FLIGHT

1. Mixture — IDLE CUT-OFF
2. Fuel Selector — OFF
3. Ignition Switch — OFF
4. Battery & Alternator Switches -- OFF

WARNING

The stall warning will be deactivated when the Battery & Alternator Switches are OFF

5. Cabin Heat & Defrost Controls — OFF
6. Airspeed — INCREASE as required to find an airspeed which will provide an incombustible mixture. Do not exceed V_{NE}.
7. Forced Landing — EXECUTE (as described in Emergency Landing Without Engine Power)

NOTE
Battery switch may be turned on momentarily for gear and flap extension.

WARNING

Do not attempt to restart engine.

ELECTRICAL FIRE IN FLIGHT

1. Battery & Alternator Master Switches — OFF

WARNING

The stall warning will be deactivated when the Battery & Alternator Switches are OFF

2. Cabin Heat & Defrost Controls — OFF
3. Fresh Air Vents — CLOSED
4. Fire Extinguisher — ACTIVATE (if available)

FIRES (con't)

WARNING

Immediately after discharging fire extinguisher, flush the cabin of toxic by-products by opening all ventilation ports as follows:

5. Cabin Air and Vent Controls —FULL ON
6. Cabin Heat and Defroster Controls – FULL ON
7. Vent Window — OPEN (Reduce speed to 130 KIAS)

If fire appears out and electrical power is necessary for continuance of flight, activate the minimum equipment needed as follows:

8. Avionics Master Switch — OFF
9. All Avionics Individual Power Switches — OFF
10. All Electrical Switches (except Ignition) — OFF
11. Circuit Breakers — CHECK for "popped" breaker. Do not reset.
12. Battery and Alternator Master Switches — ON
13. Avionics Power Switch -- ON
14. Radio and Electrical Switches — ON one at a time, with a delay after each to be sure item of equipment is not at fault. Activate **minimum** amount of equipment for continuance of flight.
15. Cabin Heat, Defrost, & Vent Controls — AS DESIRED .
16. Airplane — LAND AS SOON AS PRACTICAL. Repairs must be completed prior to further flight.

FIRES (con't)

CABIN FIRE

1. Battery & Alternator Master Switches — OFF
2. Cabin Heat & Defrost Controls — OFF
3. Cabin Air Vents — CLOSED
4. Fire Extinguisher — ACTIVATE (if available)

WARNING

Immediately after discharging fire extinguisher, flush the cabin of toxic by-products by opening all ventilation ports as follows:

5. Cabin Air and Vent Controls —FULL ON
6. Cabin Heat and Defroster Controls — FULL ON
7. Vent Window — OPEN (Reduce speed to 130 KIAS)

If the fire has been extinguished:

8. Cabin Heat, Defrost, & Vent Controls — AS DESIRED

If the fire is determined to be of other than electrical origin,

9. Electrical Power — AS NEEDED for continued flight.
10. Airplane — LAND AS SOON AS PRACTICAL to inspect for damage.

WING FIRE

1. Pitot Heat Switch — OFF
2. Anti-Collision Lights Switch — OFF
3. Position Lights Switch — OFF
4. Taxi Lights Switch — OFF
5. Landing Lights Switch — OFF

WARNING

Perform a sideslip to keep visible flames away from cockpit until extinguished.

7. Airplane — LAND AS SOON AS PRACTICAL.

ICING

INADVERTENT ICING ENCOUNTER

1. Pitot Heat — ON
2. Defrost Control — FULL ON
3. Engine RPM — INCREASE TO 2575 (enrichen mixture as required)
4. Course — REVERSE OR ALTER as required to avoid icing.

> **WARNING**
>
> **Evasive action should be initiated immediately when icing conditions are encountered.**

5. Altitude — CHANGE to an altitude less conducive to icing.

> NOTE
>
> A climb is usually favored, if possible.

If icing conditions cannot be escaped:

6. Manifold Pressure — MONITOR for signs of intake system blockage.
7. Alternate Air — PULL ON if intake system is blocked.
8. Airplane — LAND AT NEAREST AIRPORT. With extremely rapid ice build-up, plan for an off-airport forced landing.
9. Approach Speed — INCREASE 5 TO 20 KIAS depending on ice accumulation.

OBSTRUCTED STATIC SOURCE

1. Alternate Static Source — ON
2. Heat & Defrost Controls — ON
3. Cabin Air Vents — CLOSED

> NOTE
>
> Refer to Alternate Static Source Airspeed Calibration and Altimeter Correction charts in Section 5 for corrections to apply to altimeter and airspeed readings.

ICING (con't)

OBSTRUCTED PITOT SOURCE

1. Pitot Heat Switch — ON

> NOTE
> Use familiar pitch attitude/power settings to achieve desired airspeeds if airspeed indicator readings appear to remain unreliable.

LANDING GEAR MALFUNCTION PROCEDURES

LANDING GEAR FAILS TO RETRACT (Green Gear Locked And/Or Red Gear Warn Lights Remain On)

1. Gear Mtr Circuit Breaker — IN
2. Emergency Gear Extension Valve Knob — CHECK FULL UP
3. Ldg Gear Switch — RECYCLE

If landing gear still fails to retract:

4. Ldg Gear Switch — DN
5. Landing Gear Lights — VERIFY 3 GREEN
6. Airplane — LAND AS SOON AS PRACTICAL for repairs.

LANDING GEAR FAILS TO EXTEND (Green Gear Locked Light(s) Fails To Illuminate And Red Gear Warn Light Remains On)

1. Gear Light Press-To-Test Switch — CHECK green light bulb integrity (if red gear warn light not on).
2. Gear Mtr Circuit Breaker — IN
3. Landing Gear Switch — RECYCLE

If an unsafe indication persists, proceed as follows:

4. Gear Motor Circuit Breaker — PULL
5. Landing Gear Switch — CHECK DN
6. Wing Flaps -- 35°

> NOTE
> Gear Warning horn will activate as flaps exceed approximately 20°

LANDING GEAR MALFUNCTION PROCEDURES (con't)

7. Power — MINIMUM FOR FLIGHT CONDITIONS
8. Airspeed — REDUCE TO 80 KIAS.
9. Emergency Extension Valve Knob - PULL OUT & PUSH DOWN
10. Landing Gear Lights — VERIFY 3 GREEN

> NOTE
> If the nose gear fails to extend, it may be necessary to cycle the rudder pedals, reduce power, and/or reduce the airspeed.

GEAR WARN LIGHT ILLUMINATES (Gear Up Selected)

1. Gear Motor — CHECK AUDIBLY for operation.
2. Airspeed — CHECK for normal gear retracted performance.
3. Gear Mtr Circuit Breaker -- PULL if gear appears to be retracted and flight is to be continued to a maintenance facility.

> NOTE
> For landing gear extension at destination reset the Gear Mtr Circuit Breaker.

GEAR WARN LIGHT ILLUMINATES (Gear Dn Selected)

1. Landing Gear Locked Lights — CHECK 3 GREEN
2. Gear Motor — CHECK AUDIBLY for operation.
3. Gear Mtr Circuit Breaker -- PULL until just prior to landing, then RESET.

LANDING GEAR MALFUNCTION PROCEDURES (con't)

GEAR UP LANDING

1. Seatbacks — UPRIGHT
2. Seats, Seat Belts, Shoulder Harnesses -- SECURE
3. Loose Objects — SECURE
4. Radio -- TRANSMIT MAYDAY to ATC or on 121.5 MHz (if circumstances so warrant)
5. Emergency Locator Transmitter — ON (if circumstances so warrant)
6. Transponder — CODE 7700 (if circumstances so warrant)
7. Airspeed — 85 KIAS (flaps UP)
   80 KIAS (flaps 20°)
8. Fuel Selector Valve — BOTH (OFF if power is off)
9. Mixture — FULL RICH (IDLE CUT-OFF if power is off)
10. Propeller Control — FULL INCREASE RPM
11. Wing Flaps — 20° (recommended)
12. Touchdown -- TAIL LOW
13. Elevator Control — FULL AFT
14. Mixture -- IDLE CUT-OFF
15. Fuel Selector Valve — OFF
16. Airplane — EVACUATE after coming to stop.

LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

1. Before Landing Checklist -- COMPLETE
2. Loose Objects -- SECURE
3. Gear Mtr Circuit Breaker -- IN
4. Approach -- NORMAL (full flap)
5. Landing -- TAIL LOW as SMOOTHLY as possible
6. Braking -- MINIMUM necessary.
7. Taxi -- SLOWLY clear of runway.
8. Engine -- SHUTDOWN before inspecting landing gear system.

LANDING GEAR MALFUNCTION PROCEDURES (con't)

LANDING WITH ONE RETRACTED OR UNLOCKED MAIN GEAR (Or Flat Main Tire)

1. Before Landing Checklist — COMPLETE

> NOTE
> If it is suspected that a tire is defective prior to retraction, it is recommended that the gear remain extended.

2. Loose Objects — SECURE
3. Approach — NORMAL (full flap)

> NOTE
> Select a runway with a crosswind component from the same side as the good main gear/tire.

4. Touchdown — ON GOOD MAIN GEAR FIRST
5. Aileron — BANK AWAY FROM DEFECTIVE GEAR/TIRE as long as possible.

If one main gear was still retracted, or the airplane begins to lower the wing on the defective gear side toward the ground:

6. Mixture — IDLE CUT-OFF
7. Fuel Selector — OFF
8. Battery & Alternator Master Switches — OFF

LANDING GEAR MALFUNCTION PROCEDURES (con't)

LANDING WITH A DEFECTIVE NOSE GEAR (Or Flat Nose Tire)

1. Before Landing Checklist — COMPLETE

> NOTE
> If it is suspected that a tire is defective prior to retraction, it is recommended that the gear remain extended.

2. Loose Objects — SECURE
3. Approach — NORMAL (full flap)
4. Touchdown — SLIGHTLY TAIL LOW
5. Rollout — NOSE HIGH

If the nose gear was still retracted, or the airplane begins to lower the nose toward the ground:

6. Mixture -- IDLE CUT-OFF
7. Fuel Selector — OFF
8. Battery & Alternator Master Switches — OFF

ELECTRICAL SYSTEM EMERGENCIES

EXCESSIVE CHARGING INDICATED ON AMMETER (+ Amps on Ammeter)
OR EXCESSIVE VOLTAGE INDICATED ON VOLMETER (Greater than 28.8 volts)

1. Alternator Master Switch — OFF
2. Alternator Pwr Circuit Breaker — PULL
   or
   Alternator Master Switch — OFF
3. All Non-Essential Electrical Equipment — OFF
4. Flight -- TERMINATE as soon as practical.

BATTERY DISCHARGE INDICATED ON AMMETER (Red Low Volts Light Illuminated)

1. Alternator Master Switch — CHECK IF ON
2. All Non-Essential Electrical Equipment — OFF
3. Voltmeter -- CHECK between 24 & 28.8 volts.
4. Ammeter — CHECK. If ammeter now shows charging, alternator is now back on line. Electrical equipment may be turned on as desired.

If ammeter continues to show discharge:

5. Alternator Master Switch — CYCLE OFF & BACK ON

> NOTE
> Battery power may be required to excite alternator. Keep battery master switch ON.

6. Voltmeter — CHECK between 24 & 28 volts.
7. Ammeter — CHECK. If ammeter now shows charging, alternator is now back on line. Electrical equipment may be turned on as desired.

If ammeter continues to show discharge:

8. Alternator Master Switch — OFF
9. All Non-Essential Electrical Equipment — OFF
10. Flight — TERMINATE as soon as practical.

> NOTE
> Excessive load on alternator, or alternator failure, will cause discharge indications on the ammeter and a continuous reduction in voltage on the voltmeter.

ELECTRICAL SYSTEM EMERGENCIES (con't)

CIRCUIT BREAKER/CIRCUIT BREAKER SWITCH TRIPPING

1. Affected Circuit Breaker -- RESET

If circuit breaker/circuit breaker switch continues to trip:

2. Circuit Breaker — LEAVE TRIPPED
3. Affected Equipment — OFF

If avionics master circuit breaker switch has tripped:

4. All Avionics Individual Power Switches — OFF
5. Individual Avionics Circuit Breakers — CHECK FOR TRIPPED BREAKER. Do not reset this circuit breaker.
6. Avionics Master Switch — RESET ON
7. Individual Avionics Switches — ON, one at a time (most essential avionics first).

> **NOTE**
> When radio at fault is turned on, the avionics master circuit breaker switch may again trip.

8. Faulty Radio -- TURN OFF
9. Avionics Master Switch -- RESET ON

AVIONICS MASTER SWITCH FAILURE

1. Avionics Master Switch — OFF
2. Energy Saver Switch — ON
3. Radios — USE # 1 COM/NAV and aircraft speakers for remainder of flight.

ELECTRICAL SYSTEM EMERGENCIES (con't)

ELECTRIC COWL FLAP FAILURE

If Cowl Flap Annunciator switch is not illuminated:

1. Lamp Test Switch — PRESS TO TEST Cowl Flap Annunciator. If bulb is burned out, replace bulb as soon as practical after landing.

If Cowl Flap position is known to be open:

2. Cowl Flap Switch — DO NOT PRESS
3. Flight — CONTINUE TO DESTINATION. Repair prior to further flight.

If Cowl Flap position is known to be closed:

2. Cowl Flap Switch — PRESS ONCE
3. Engine Temperature gauges — MONITOR, use higher speeds for climb
4. Flight — CONTINUE TO DESTINATION. Repair prior to further flight.

MISCELLANEOUS ABNORMALITIES

EXTREME TURBULENCE ENCOUNTER

1. Airspeed — MANEUVERING SPEED (observe speed for flight weight)
2. Flaps — UP
3. Landing Gear -- RETRACTED
4. Seat Belts & Shoulder Harnesses — SECURED
5. Loose Objects — SECURE

MISCELLANEOUS ABNORMALITIES (con't)

EMERGENCY DESCENT

SMOOTH AIR:

1. Landing Gear — DOWN below 130 KIAS
2. Flaps — UP
3. Throttle — IDLE
4. Prop Control — HIGH RPM
5. Airspeed — NEVER EXCEED (observe speed for flight altitude)

ROUGH AIR:

1. Airspeed — MANEUVERING SPEED (observe speed for flight weight)
2. Flaps — 25° below 121 KIAS
3. Landing Gear -- DOWN below 130 KIAS
4. Seat Belts & Shoulder Harnesses — SECURED
5. Loose Objects — SECURE

CABIN DOOR OPENS IN FLIGHT

1. Airplane – MAINTAIN CONTROL until reaching safe altitude or until completing a landing to secure the door.
2. Airspeed — 130 KIAS or below
3. Cabin Door — PULL CLOSED, then RELATCH

> NOTE
> If the top latch cannot be engaged, a landing should be made as soon as practical to secure this latch. Do not exceed 130 KIAS until door is secured.

VACUUM PUMP FAILURE INDICATED BY ILLUMINATION OF FAILURE INDICATOR(S)

If failure on one vacuum pump indicated:

1. Flight — CONTINUE.

If failure on both vacuum pumps indicated:

1. Flight
   If in VFR conditions — CONTINUE
   If in IFR conditions — Revert to standard partial panel procedures

AMPLIFIED EMERGENCY PROCEDURES

The following Amplified Procedures elaborate upon information contained in the Operational Checklists portion of this section. These procedures also contain information not readily adaptable to a checklist format and material to which a pilot could not be expected to refer in resolution of a specific emergency.

ENGINE FAILURE

If an engine failure occurs during the takeoff run, the pilot's main concern should be to stop the airplane on the remaining runway. Those extra items in the checklist are to add protection should the runway be too short for the resulting rollout.

In flight, prompt reduction of pitch attitude to obtain and maintain a proper glide speed upon experiencing an engine failure is paramount. If the failure has occurred shortly after takeoff, a landing should be planned straight ahead with only small changes in direction to avoid obstructions. If the failure has occurred at altitude, the best glide speed as shown in Figure 3-1 should be acquired with the gear and flaps retracted.

> NOTE
> Under some engine failure scenarios increased glide range can be achieved by pulling the propeller aft to the full decrease rpm position.

While gliding towards a forced landing site, time and altitude permitting, an effort should be made to determine the cause of the power loss and correct it. If the cause cannot be determined then an emergency landing without engine power must be accomplished.

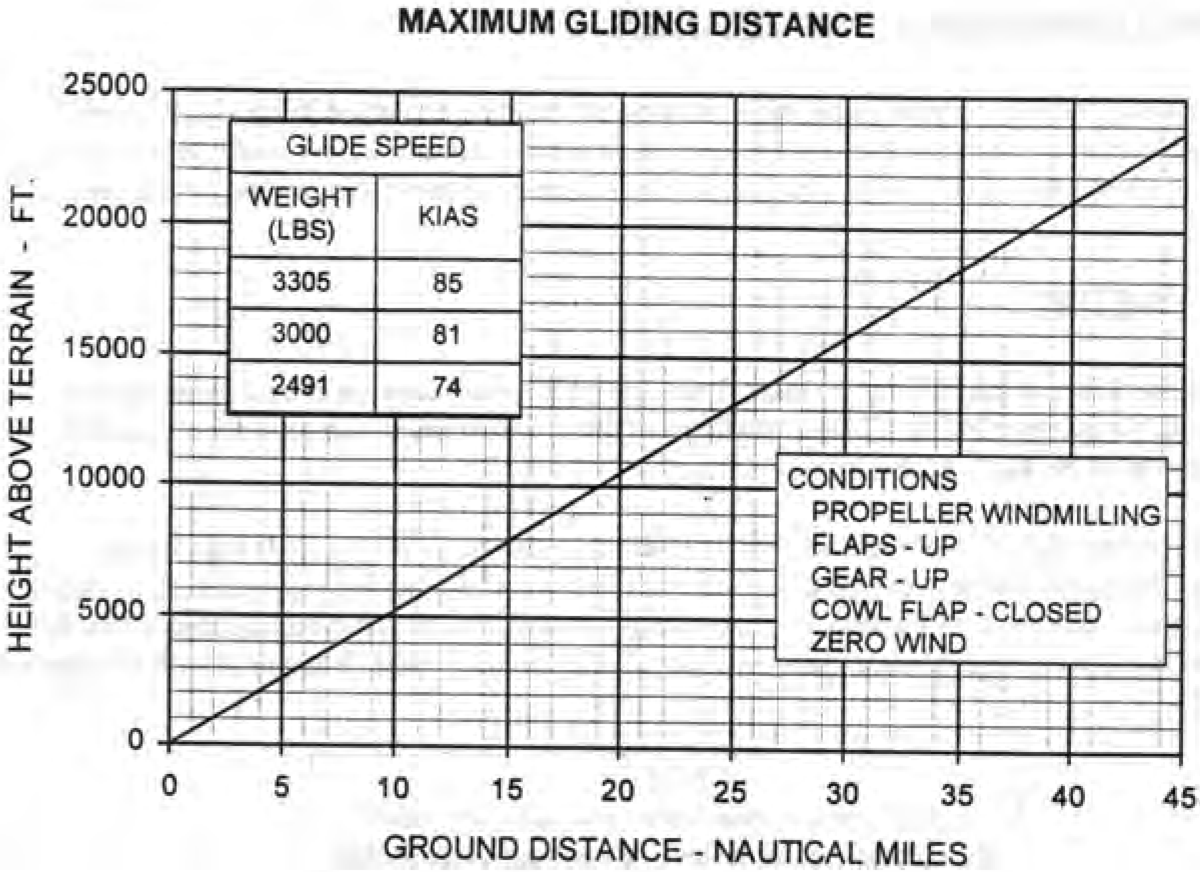


Figure 3-1

EMERGENCY LANDINGS

If all attempts to restart the engine fail, continue towards the previously selected forced landing site and prepare for the landing as outlined under the Emergency Landing Without Engine Power checklist.

WARNING

During a forced landing it is incumbent on the pilot to continue to fly the airplane. Damage and/or injuries can be minimized if the pilot exerts control over the airplane until it comes completely to a stop.

If an off-airport precautionary landing is elected by the pilot, for whatever reason, he has an advantage over the pilot who has experienced an engine failure. He should use this advantage to complete as normal a landing as possible, generally following the Precautionary Landing With Engine Power checklist.

EMERGENCY LANDINGS (con't)

LANDING WITHOUT ELEVATOR CONTROL

In the event of loss of primary pitch control (elevator) a landing may still be made through the use of pitch trim and power controls. Using these controls, the airplane should be established on a long final approach. Establish horizontal flight at approximately 100 KIAS, then extend the landing gear and 20° flaps. Adjust the power and elevator trim to maintain level flight at 90 to 100 KIAS. Initiate a descent for landing upon reaching a normal descent point by reducing power appropriately. Slight adjustments of trim may be needed to maintain airspeed. Upon reaching flare height slowly reduce power while adding small amounts of nose up trim to allow touchdown on the main gear.

FIRES

Engine fires in flight are extremely rare in properly maintained airplanes. However, the appropriate checklist procedures should be followed if one is encountered. After the fire is extinguished, execute a forced landing. Do not attempt to restart the engine to avoid regenerating the fire.

Electrical fires are usually signaled by the odor of burning insulation. Deactivate the airplane electrical system and refer to the applicable checklist for resolution of this emergency.

EMERGENCY OPERATION IN CLOUDS

Depending upon the specific equipment installed, a total vacuum failure or a total electrical failure may cause a loss of some gyro instruments. If the failure affects the primary gyros, the attitude and directional gyros, the turn and bank indicator or turn coordinator can be referenced while exiting the clouds. The 114TC is equipped with two vacuum pumps. The failure of one pump will not affect the operation of the vacuum driven instruments. A failed pump should be replaced prior to further IFR operation.

The airplane is quite stable in pitch and roll, and these attributes should be fully utilized to help the pilot, who may not be fully proficient in partial panel instrument flight, out of this circumstance. The airplane should be controlled in pitch by small inputs of the elevator trim. Turns should be shallow and should be initiated and stopped by application of rudder. The aircraft clock or the pilot's watch may be used to time turns. Altitude changes are accomplished by power changes and, if needed, adjustment of the pitch trim.

INADVERTENT FLIGHT INTO ICING CONDITIONS

Flight into known icing conditions is prohibited. In the event of an inadvertent icing encounter it is imperative that action be initiated to vacate these conditions, immediately. A 180° turn and, often, a climb is appropriate. In any case, the pilot must take prompt action to get out of the icing conditions. If the icing conditions persist and cannot be escaped, then the airplane should be flown to the nearest suitable airport and landed. If airframe ice builds extremely rapidly, the pilot should plan for an off-airport forced landing. Approach speeds should be increased 5 to 20 KIAS depending upon icing severity.

INADVERTENT FLIGHT INTO ICING CONDITIONS (con't)

STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter, and vertical speed) are suspected, the alternate static source should be selected, thereby supplying cabin static pressure to these instruments. To avoid excessive errors on these instruments, the heater and defroster should be on and the overhead vents should be closed. (Calibration Charts in Section 5 are provided to illustrate airspeed and altitude errors associated with the use of the alternate static source.

SPINS

Intentional spins are prohibited in this airplane. Should an inadvertent spin occur, the following recovery technique should be employed:

1. Retard throttle to idle position.
2. Place ailerons in neutral position.
3. Apply and **HOLD** full rudder opposite to the direction of rotation.
4. Just **AFTER** the rudder reaches the stop, move the control wheel **BRISKLY FULL FORWARD.**
5. **HOLD** these control inputs until a **DEFINITE NOSE DOWN PITCHING MOTION IS OBSERVED AND ROTATION STOPS.**

> NOTE
> As sufficient nose down pitching motion is developed for a spin recovery, the pilot will become noticeably light in his seat or be thrown against his seat belt/shoulder harness.

6. As rotation stops, neutralize the rudder, and make smooth recovery from the resulting dive.

> NOTE
> If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane of the turn coordinator or the needle of the turn and bank indicator may be referred to for this information.

ENGINE ABNORMALITIES OR LOSS OF POWER

INDUCTION SYSTEM ICING

An unexplained drop in engine manifold pressure may result from the formation of ice on the induction air filter sufficient to prevent the turbocharging system from maintaining the selected manifold pressure. If this happens, pull the engine alternate air control full on. At high altitudes, some loss of manifold pressure may persist. Reset the manifold pressure to regain as much manifold pressure as is available through the alternate air system and readjust the mixture to account for the warmer induction air.

ENGINE ABNORMALITIES OR LOSS OF POWER (con't)

SPARK PLUG FOULING

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from the BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the recommended lean cruise setting. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single magneto.

MAGNETO MALFUNCTION

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if continued operation on BOTH magnetos is possible. If not, switch to the good magneto and proceed to the nearest airport for repairs. Do not attempt restarts above 23000 feet altitude due to reduced dielectric constant at high altitudes and the effect on magneto operation.

ENGINE DRIVEN FUEL PUMP FAILURE

A failure of the engine driven fuel pump will be shown by a sudden reduction in the unmetered fuel pressure indication (and in the fuel flow indication) immediately prior to a loss of power while operating on a tank containing adequate fuel. Activation of the auxiliary fuel pump will restore engine power. Proceed to the nearest airport for repairs.

EXCESSIVE FUEL VAPOR

Operation at higher altitudes brings with it, as a natural characteristic, the potential for formation of fuel vapor in the fuel system. This vapor formation will be indicated by increased fluctuations in the fuel flow (metered pressure downstream of the fuel injector servo) or fuel pressure (unmetered pressure upstream of the fuel injector servo) indications. If fluctuations are greater than normal, they may be stabilized by turning on the auxiliary fuel pump. At the completion of a climb to higher altitudes, it is recommended that cruising flight be established with cruise power settings for 10 to 15 minutes prior to selecting a single fuel tank. Whenever switching fuel tanks, monitor the metered fuel pressure (fuel flow gage) and use the auxiliary fuel pump if any drop in pressure is observed.

ENGINE ABNORMALITIES OR LOSS OF POWER (con't)

LOW OIL PRESSURE

If a low oil pressure indication is accompanied by normal oil temperature, there is a possibility that the oil pressure transducer or relief valve is malfunctioning. A landing should be made at the nearest airport to inspect for the source of the low indication.

CAUTION

If a total loss of oil pressure is accompanied by a rise in oil temperature, an engine failure is probably imminent. Reduce to the minimum engine power and execute a precautionary landing while power still exists.

HIGH CYLINDER HEAD/OIL TEMPERATURE

If high cylinder head and/or oil temperature indications are experienced, open the cowl flap, enrichen the mixture, increase airspeed if practical, and/or reduce power. If temperatures remain excessive, proceed to the nearest airport to investigate the cause.

PROPELLER OVERSPEED

If the propeller governor should fail, allowing the propeller pitch to flatten, the engine will overspeed. In this instance, close the throttle immediately and reduce airspeed. As the situation stabilizes, use the throttle to control engine speed as though the propeller had a fixed pitch. Proceed to the nearest airport at reduced airspeed and power, observing the engine rpm limits.

LANDING GEAR MALFUNCTIONS

There are several checks that should be made in the event of a landing gear malfunction. Check that the landing gear circuit breakers are in; reset if necessary. Check inoperative gear position light for possible bulb failure using the press-to-test switch.

If a positive gear down and locked indication cannot be obtained with normal extension procedures repeated one additional time, proceed with emergency gear extension procedures. A positive gear extension is indicated by: 1) 3 green locked lights, 2) absence of red gear warn light, and 3) absence of gear warning horn with throttle idle or flaps full down.

ELECTRICAL SYSTEM MALFUNCTIONS

After periods of heavy usage, such as prolonged cold weather starts or extended periods of taxiing, the battery charge level will have dropped low enough to accept higher than normal charge rates during the initial part of the flight. However, after approximately 30 minutes, the ammeter indication should have decreased steadily toward a zero reading, and the voltmeter should indicate between 24.5 and 28.8 volts. If the charging rate remains above this value for an extended period of time, there is a possibility that the battery may overheat and evaporate electrolyte at an excessive rate. To preclude the possibility of an overcharging condition affecting the battery, the alternator master switch should be turned off and the flight terminated. Electrical load should be reduced to an essential minimum if an immediate landing is impractical.

NOTE
A negative (-) reading on the ammeter indicates battery discharge.
A positive (+) reading on the ammeter indicates battery charging.

A continuous discharge rate, shown on the ammeter during flight accompanied by the eventual illumination of the LOW VOLTS annunciator, generally indicates:

1) alternator and/or voltage regulator malfunction, or
2) excessive load on the electrical system.

First, the electrical load must be reduced. If the ammeter continues to show a discharge, the alternator master switch should be turned off to isolate the alternator from the electrical system. With the alternator off the entire electrical load is placed on the battery and all nonessential electrical equipment should be turned off to reduce the discharge rate of the battery.

When operating with both the battery master and alternator master switches **OFF**, it should be remembered that certain electrical equipment will be inoperative, such as:

1. Wing flaps
2. Landing gear operating system (except emergency extension system)
3. Landing gear lights and warning system
4. Fuel gages
5. Engine temperature gages
6. Oil pressure gage
7. Manifold pressure gage
8. Tachometer
9. Stall warning system
10. Gyros, part (depends on specific equipment)
11. All lighting, interior and exterior
12. All avionics (except ELT)
13. Vacuum pump failure indicators (S/N 20018 and subsequent)

VACUUM SYSTEM MALFUNCTION

Suction to operate the direction gyro and attitude indicator is provided by two engine-driven vacuum pumps. A suction gauge monitors the system for indication of correct suction pressure. Normal suction pressure is 5.1 (± .1) inches of mercury. Directly below the suction gauge are two vacuum pump failure indicators. These indicators are either mechanical (S/N 20001 thru 20017) or electrical (S/N 20018 and subsequent). A vacuum pump failure will be indicated when the suction of that pump drops to 3.5 inches of mercury.

If the failure of one vacuum pump is indicated, then flight may be continued under VFR, night, and IFR conditions. One vacuum pump is adequate to provide suction for the direction gyro and attitude indicator , however, vacuum pump redundancy is lost. The inoperative pump should be repaired as soon as practical to return that redundancy.

If the failure of both vacuum pumps is indicated, then the direction gyro and attitude indicator should be considered inoperative. In VFR and night conditions, flight may be continued. If the failure of both pumps is indicated in IFR conditions then standard partial panel procedures should be followed and the aircraft landed as soon a practical. The aircraft cannot be flown again in IFR conditions until at least one of the vacuum pumps has been repaired.

SECTION 4
NORMAL PROCEDURES

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (con't) Page

AMPLIFIED PROCEDURES (con't)

INTRODUCTION

This section provides basic guidelines for normal operation of this airplane. The procedures contained herein are not intended to constitute basic flight instruction but are intended to supplement those principles relating to normal flight operations that each pilot acquires in the process of learning to fly and obtaining FAA pilot certification.

Normal procedures associated with selected standard equipment and optional systems can be found in Section 9.

Checklists are provided to assist a pilot where it would be reasonable for a pilot to refer to one. Where reference to a checklist would be impractical, or where the material is not amenable to a checklist form, or where additional material is helpful, amplified procedures are provided following the checklist section.

AIRSPEEDS FOR NORMAL OPERATION

Except as noted, the following speeds are based on a maximum weight of 3305 pounds and may be used at any lesser weight.

Takeoff:
- Normal Initial Climb .... 90 - 100 KIAS
- Short Field Takeoff, Flaps 20°, Speed at 50' .... 75 KIAS

Enroute Climb, Flaps and Gear Retracted:
- Normal .... 100 - 120 KIAS
- Best Rate of Climb, Sea Level to 6000 Feet .... 100 KIAS
- Best Rate of Climb, 10000 Feet .... 99 KIAS
- Best Rate of Climb, 15000 Feet .... 97 KIAS
- Best Angle of Climb, Sea Level .... 75 KIAS
- Best Angle of Climb, 8000 Feet .... 78 KIAS

Landing Approach:
- Normal Approach, Flaps Up .... 90 - 100 KIAS
- Normal Approach, Flaps 35° .... 80 - 90 KIAS
- Short Field Approach, Flaps 35° .... 75 KIAS

Balked Landing:
- Maximum Power, Flaps 20° .... 75 - 80 KIAS

Maximum Recommended Turbulent Air Penetration Speed:
- 3305 Lbs .... 117 KIAS
- 3000 Lbs .... 112 KIAS
- 2491 Lbs .... 102 KIAS

Maximum Demonstrated Crosswind Velocity:
- Takeoff or Landing .... 19 Knots

PREFLIGHT INSPECTION

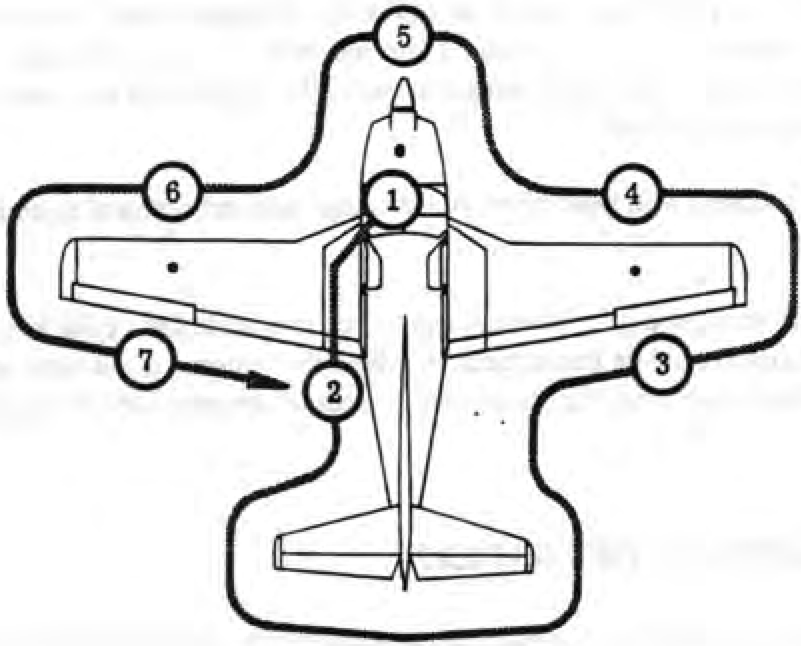


Figure 4–1

> NOTE
> The airplane's general condition should be noted during a walk-around preflight inspection. In cold weather, all traces of ice, snow, and frost should be removed from the wing, empennage, and all control surfaces. Make sure that no ice, snow, or debris of any type is trapped inside control surfaces. Prior to any night flight, verify operation of all lights and have a flashlight available as a backup.

OPERATIONAL CHECKLISTS

PREFLIGHT INSPECTION

WARNING

Remove any accumulation of ice, snow, and/or frost from airplane prior to flight.

(1) COCKPIT

1. Pilot's Operating Handbook — AVAILABLE TO PILOT
2. Airplane Documents — REVIEWED
3. Weight and Balance — CHECKED
4. Controls Lock — REMOVED
5. Parking Brake — SET
6. Landing Gear Selector Switch — DN
7. Alternate Static Source — NORMAL
8. Ignition Switch — OFF
9. Electrical Switches — OFF
10. Avionics Master Switch — OFF
11. Circuit Breakers — SET
12. Battery Master Switch — ON

WARNING

Do not activate the airplane's electrical system when anyone is within or near the propeller's arc to prevent potential injury which could result from an electrical malfunction.

13. Landing Gear Locked Lights — 3 GREEN
14. Fuel Quantity Gauge — CHECK

NOTE
Usable fuel quantities above approximately 28 U.S. gallons per tank are not gaugeable.

15. Cowl Flap — OPEN
16. Battery Master Switch — OFF
17. Rudder Trim — SET
18. Elevator Trim — SET
19. Fuel Selector Valve — BOTH
20. Emergency Gear Extension Valve Knob — UP

PREFLIGHT INSPECTION (con't)

(2) LEFT SIDE OF TAILCONE AND EMPENNAGE

1. Baggage Door — CLOSED & LOCKED
2. Static Port — UNOBSTRUCTED
3. Empennage — INSPECT
4. Rudder & Elevator — CHECK freedom of movement & security.
5. Trim Tabs — CHECK position & security
6. Rudder Gust Lock (if installed) — REMOVE
7. Tail Tie-Down — REMOVE

(3) RIGHT SIDE OF TAILCONE AND RIGHT WING TRAILING EDGE

1. Static Port — UNOBSTRUCTED
2. Airconditioner Intake Door (if installed) — CLOSED
3. Wing Flap — INSPECT
5. Aileron — CHECK freedom of movement & security.

(4) RIGHT WING LEADING EDGE

1. Fuel Vent — UNOBSTRUCTED
2. Fuel Quantity — CHECK VISUALLY for level & agreement with gauge.

> NOTE
> A reduced fuel indicator is located in the fuel filler neck to show a useable fuel quantity of approximately 32 gallons.

3. Fuel Filler Cap — SECURE
4. Wing Tie-Down — REMOVE
5. Fuel Tank Sump — DRAIN AT LEAST 1 CUPFUL, visually inspect fluid for water, sediment, proper grade (color). Check valve CLOSED.

> **WARNING**
>
> **All fuel system drains should be sampled daily, and after each refueling, to assure proper fuel and lack of contamination. If contamination is found continue draining from all sample points until fuel is clean.**

6. Right Main Gear, Tire, & Wheel Well — INSPECT
7. Gear Safety & Stall Warn Disable Squat Switch — INSPECT
8. Landing Gear Limit Switches (2) — INSPECT
9. Chocks — REMOVE
10. Right Wheel Well Fuel Drain — DRAIN AT LEAST 1 CUPFUL, visually inspect fluid for water, sediment, proper grade (color). Check valve CLOSED.

PREFLIGHT INSPECTION (con't)

(5) NOSE

1. Cowl Flap — CHECK POSITION & SECURITY
2. Fuel Gascolator — DRAIN AT LEAST 1 CUPFUL, visually inspect fluid for water, sediment, proper grade (color). Check valve CLOSED.
3. Nose Gear, Tire, & Wheel Well — INSPECT
4. Nose Gear Limit Switches (2) — INSPECT
5. Chocks — REMOVE
6. Right Engine Cooling Air Inlet — UNOBSTRUCTED
7. Engine Induction Air Inlet — CLEAR
8. Left Engine Cooling Air Inlet — UNOBSTRUCTED
9. Propeller & Spinner — INSPECT
10. Heater Air Inlet — CLEAR
11. Oil Quantity — CHECK, minimum 7 quarts
12. Exhaust Tailpipe — CHECK SECURE

(6) LEFT WING LEADING EDGE

1. Left Wheel Well Fuel Drain — DRAIN AT LEAST 1 CUPFUL, visually inspect fluid for water, sediment, proper grade (color). Check valve CLOSED.
2. Left Main Gear, Tire, & Wheel Well — INSPECT
3. Landing Gear Limit Switches (2) — INSPECT
4. Chocks — REMOVED
5. Fuel Tank Sump — DRAIN AT LEAST 1 CUPFUL, visually inspect fluid for water, sediment, proper grade (color). Check valve CLOSED.
6. Stall Warning Vane — CHECK freedom of movement (gently) & horn activation

> NOTE
> The aircraft battery master switch must be ON to check stall horn. Then move the STALL CKT switch in the left wheel well from the NORM to the spring loaded TEST position while the stall vane is moved upwards.

7. Wing Tie-Down — REMOVE
8. Fuel Quantity — CHECK VISUALLY for level & agreement with gage.

> NOTE
> A reduced fuel indicator is located in the fuel filler neck to show a useable fuel quantity of approximately 32 gallons.

9. Fuel Filler Cap — SECURE
10. Pitot Port (on mast) — UNOBSTRUCTED
11. Fuel Vent — UNOBSTRUCTED

PREFLIGHT INSPECTION (con't)

(7) LEFT WING TRAILING EDGE

1. Aileron — CHECK freedom of movement & security.
2. Wing Flap — INSPECT

BEFORE STARTING ENGINE

1. Preflight Inspection — COMPLETE
2. Seats, Seat Belts, & Shoulder Harnesses — ADJUST & SECURE
3. Landing Gear Selector Switch — DN
4. Electrical Switches — OFF
5. Avionics Master Switch — OFF
6. Energy Saver Switch — OFF

> **CAUTION**
>
> Failure to keep avionics master and energy saver switch OFF during engine starts may cause damage to avionics.

7. Circuit Breakers — SET
8. Fuel Selector Valve — BOTH
9. Brakes — TEST & SET

STARTING ENGINE

NORMAL START

1. Throttle — OPEN 1/2 INCH
2. Propeller Control — HIGH RPM
3. Mixture — IDLE CUT-OFF
4. Alternate Induction Air — PUSH OFF
5. Propeller Area — "CLEAR"
6. Battery Master & Alternator Master Switches — ON

> NOTE
>
> For external power assisted start, alternator master switch should be left OFF until external power is disconnected.

7. Landing Gear Locked Lights — 3 GREEN
8. Cowl Flap — OPEN
9. Voltmeter — CHECK battery up, 20 - 24 volts.
10. Auxiliary Fuel Pump Switch
    For cold start: Auxiliary Fuel Pump Switch — ON and proceed with steps 11 and 12
    For hot start: Auxiliary Fuel Pump Switch — OFF and proceed to Step 12
11. Fuel Pressure — GREEN ARC (20 - 65 psi)

STARTING ENGINE (con't)

12. Mixture —
    For cold start: FULL RICH for 4 - 6 seconds, then IDLE CUT-OFF
    For hot start: LEAVE IN IDLE CUT-OFF
13. Auxiliary Fuel Pump Switch — OFF
14. Ignition Switch — START
15. Ignition Switch — RELEASE TO BOTH as engine starts.

> NOTE
> Cranking should be limited to 10 to 12 seconds and several minutes allowed between cranking periods to allow starter cooling.

16. Mixture — ADVANCE SLOWLY TO FULL RICH as engine starts or after approximately 5 seconds of cranking.
17. Throttle — SET FOR 800 - 1000 RPM
18. Oil Pressure — CHECK
19. Alternator Master Switch (External Power Start) — ON after External Power disconnected
20. Ammeter — CHECK for charging indication.
21. Voltmeter — CHECK for 28 volt nominal.
22. Low Volts Annunciator — OFF

FLOODED START

1. Throttle — FULL OPEN
2. Propeller Control — HIGH RPM
3. Mixture — IDLE CUT-OFF
4. Alternate Induction Air — PUSH OFF
5. Propeller Area — "CLEAR"
6. Battery Master & Alternator Master Switches — ON

> NOTE
> For external power assisted start, alternator master switch should be left OFF until external power is disconnected.

7. Landing Gear Locked Lights — 3 GREEN
8. Cowl Flap — OPEN
9. Voltmeter — CHECK battery up, 20 - 24 volts.
10. Auxiliary Fuel Pump Switch — OFF
11. Ignition Switch — START
12. Ignition Switch — RELEASE TO BOTH as engine starts.
13. Throttle — RETARD to 800 - 1000 RPM as engine starts.
14. Mixture — ADVANCE SLOWLY TO FULL RICH as engine starts.

STARTING ENGINE (con't)

> NOTE
> Cranking should be limited to 10 to 12 seconds and several minutes allowed between cranking periods to allow starter cooling.

15. Throttle — SET FOR 800 - 1000 RPM
16. Oil Pressure — CHECK
17. Alternator Master Switch (External Power Start) — ON after External Power disconnected
18. Ammeter — CHECK for charging indication.
19. Voltmeter — CHECK for 28 volt nominal.
20. Low Volts Annunciator — OFF

BEFORE TAXI

1. Beacon — ON
2. Avionics Master Switch — ON
3. Radios — SET
4. Parking Brake — RELEASE

TAXI

1. Brakes — CHECK
2. Nose Wheel Steering — CHECK
3. Compass — CHECK against known taxiway heading.

BEFORE TAKEOFF

1. Parking Brake — SET
2. Seats, Seat Belts, Shoulder Harnesses — CHECK SECURE
3. Flight Controls — FREE & CORRECT movement.
4. Instruments — CHECK & SET
5. Fuel Quantity — RECHECK adequate for planned flight
6. Auxiliary Fuel Pump Switch — ON
7. Mixture — FULL RICH
8. Fuel Selector Valve — BOTH
9. Rudder Trim — SET for takeoff.
10. Elevator Trim — SET for takeoff.

BEFORE TAKEOFF (con't)

11. Throttle — 2000 RPM
    a. Magnetos — CHECK (R, BOTH, L, BOTH)

> NOTE
> RPM drop should not exceed 175 on either magneto nor 50 differential between the magnetos.

    b. Propeller Control — CYCLE from HIGH RPM to LOW RPM; return to HIGH RPM (full forward)

    c. Alternate Induction Air Control — PULL full ON, then push OFF

> NOTE
> A very slight reduction in engine rpm may be noted when the control is full ON.

    d. Engine Instruments — CHECK
    e. Suction Gauge — CHECK vacuum & operation of both pumps.
12. Throttle — 1000 RPM
13. Quadrant Friction — SET
14. Cowl Flap — RECHECK OPEN
15. Wing Flaps — SET per takeoff checklist.
16. Cabin Doors — CLOSED & LATCHED (both lower & upper latches)
17. Anti-Collision Lights — ON
18. Brakes — RELEASE

TAKEOFF

NORMAL TAKEOFF

1. Wing Flaps — 10° (recommended)
2. Power — FULL THROTTLE & 2575 RPM
3. Mixture — FULL RICH
4. Elevator Control — ROTATE AT 70 KIAS
5. Initial Climb Speed — 90 to 100 KIAS
6. Brakes — APPLY momentarily.
7. Landing Gear — RETRACT
8. Wing Flaps — RETRACT (if extended)

TAKEOFF (con't)

SHORT FIELD TAKEOFF

1. Wing Flaps — 20°
2. Brakes — APPLY & HOLD
3. Power — FULL THROTTLE & MAX RPM
4. Mixture — FULL RICH
5. Brakes — RELEASE
6. Elevator Control — ROTATE AT 70 KIAS
7. Climb Speed — 75 KIAS until obstacles cleared, then increase.
8. Brakes — APPLY momentarily.
9. Landing Gear — RETRACT after obstacles cleared.
10. Wing Flaps — RETRACT after airspeed reaches 80 KIAS.

ENROUTE CLIMB

NORMAL CLIMB

1. Airspeed — 100 to 120 KIAS
2. Power — 29 IN. HG & 2400 RPM
3. Mixture — 23 GPH or FULL RICH
4. Cowl Flap — OPEN as required.

MAXIMUM PERFORMANCE CLIMB

1. Airspeed — 100 KIAS at sea level to 6000 ft.
2. Power — FULL THROTTLE & 2575 RPM
3. Mixture — FULL RICH
4. Cowl Flap — OPEN

CRUISE

1. Power — 15 to 29 IN. HG & 2200 to 2400 RPM
2. Mixture — LEAN (with power at or below 75%) to peak T.I.T. or 1650° whichever is less
3. Elevator & Rudder Trim — ADJUST
4. Auxiliary Fuel Pump Switch — OFF, check fuel pressure.
5. Cowl Flap — CLOSED, unless engine temperatures are excessive.
6. Fuel Selector Valve — AS REQUIRED to maintain lateral trim.

DESCENT

1. Power — AS DESIRED
2. Mixture — ADJUST if required for smooth operation
3. Cowl Flap — CLOSED
4. Wing Flaps — AS DESIRED (0° to 20° below 149 KIAS, 20° to 25° below 121 KIAS, 25° to 35° below 112 KIAS)

> NOTE
> The landing gear may be extended below 129 KIAS to increase descent rate. Further increase may be achieved by accelerating to V_{NE} with the gear down and flaps fully retracted.

BEFORE LANDING

1. Seats, Seat Belts, Shoulder Harnesses — SECURE
2. Auxiliary Fuel Pump Switch — ON
3. Fuel Selector Valve — BOTH
4. Landing Gear — EXTEND, 3 GREEN
5. Mixture — FULL RICH
6. Propeller — HIGH RPM

LANDING

NORMAL LANDING

1. Airspeed — 90 to 100 KIAS, flaps 0°
2. Wing Flaps — AS DESIRED (35° recommended)
3. Airspeed — 80 to 90, flaps 35°
4. Trim — ADJUST as required.
5. Gear — CHECK 3 GREEN
6. Touchdown — MAIN WHEELS FIRST
7. Braking — MINIMUM required.

LANDING (con't)

SHORT FIELD LANDING

1. Airspeed — 90 to 100 KIAS, flaps 0°
2. Wing Flaps — 35°
3. Airspeed — 75' KIAS

CAUTION
This airspeed is recommended in smooth air only. Increase as required for actual conditions. Expect increased landing distances.

4. Trim — ADJUST as required.
5. Gear — CHECK 3 GREEN
6. Power — REDUCE TO IDLE at or before crossing obstacle.
7. Touchdown — MAIN WHEELS FIRST
8. Braking — HEAVY
9. Wing Flaps — RETRACT for maximum braking.

BALKED LANDING

1. Power — FULL THROTTLE & 2575 RPM
2. Wing Flaps — RETRACT TO 20°
3. Airspeed — 75 to 80 KIAS

When positive rate of climb is established:

4. Landing Gear — RETRACT
5. Wing Flaps — RETRACT SLOWLY as airspeed is increased to normal climb speed.
6. Cowl Flap — OPEN

AFTER LANDING

1. Auxiliary Fuel Pump Switch — OFF
2. Strobe Lights — OFF
3. Cowl Flaps — OPEN
4. Wing Flaps — UP

SHUTDOWN

> NOTE
> Allow engine to idle for 2 to 3 minutes prior to engine shut down to prevent coking and allow turbocharger to cool.

1. Throttle — IDLE
2. Parking Brake — SET
3. Electrical Equipment — OFF
4. Avionics Master Switch — OFF
5. Mixture — IDLE CUT-OFF
6. Ignition Switch — OFF
7. Battery Master & Alternator Master Switches — OFF
8. Control Lock — INSTALL
9. Fuel Selector Valve — OFF

AMPLIFIED PROCEDURES

PREFLIGHT INSPECTION

The Preflight Inspection Checklist is recommended prior to any series of flights by one pilot on any given day. Prior to any flight at least fuel and oil quantity should be checked and the fuel purity and type verified.

After major maintenance has been performed, all control surfaces and the elevator trim tabs should be examined closely for security and for proper direction of travel in response to control inputs. All inspection plates should be checked for reinstallation and security. If the airplane has been waxed the static ports should be checked for blockage.

If the airplane has been stored outside for any period of time the engine area and other points of entry should be checked for evidence of bird or insect occupancy. The induction air filter should be inspected and cleaned if needed. The pitot and static ports and fuel tank vents should be checked for blockage by dirt, insects, or other residue. Fuel tanks should be carefully checked for water or other contamination by draining generous samples at all drain points in the fuel system. All control surfaces and control surface travel stops should be examined for wind damage.

If the airplane has been operated from muddy or slushy fields, the landing gear wheel wells, limit switches, and the squat switch should be examined for cleanliness and serviceability. If operations have included gravel fields, the propeller leading edges should have any nicks dressed out as they are discovered.

Fuel caps should be inspected for any deterioration periodically to avoid fuel leakage in flight or water infiltration while parked.

If night flight is contemplated, the operation of all lighting, interior and exterior, should be checked and a flashlight with fresh batteries should be carried in a location readily available to the pilot.

In cold weather, remove all traces of ice, snow, or frost from all flying surfaces. Be sure that no accumulations of ice or slush have formed inside any control surfaces. Check the static and pitot ports and both fuel vents for blockage by ice.

STARTING ENGINE

Cold starts are typically accomplished with a 5 to 6 second prime using the auxiliary fuel pump. Hot starts, and starts with a suspected flooded engine, should not include any prime at all.

Weak intermittent firing followed by puffs of black smoke from the exhaust stack is an indication of overpriming or flooding. If the engine is underprimed it will not fire at all. However, neither will any firing be evident for some period of cranking during a hot or flooded start.

If prolonged cranking is necessary, allow the starter motor to cool after approximately 10 to 12 seconds of cranking. Excessive cranking will build heat enough to damage the starter motor.

STARTING ENGINE (con't)

After starting, if oil pressure is not indicated within 30 seconds under normal atmospheric temperatures stop the engine and investigate. In cold conditions somewhat longer time will be required to build oil pressure. Lack of oil pressure, if uncorrected, can lead to serious engine damage.

TAXIING

When taxiing, move at a safe speed using the minimum power necessary to sustain that speed without dragging the brakes. If taxiing over gravel surfaces use the minimum engine power necessary to avoid damage to propeller leading edges.

While taxiing, the airplane controls should be positioned to minimize any potential overturning tendency brought on by winds or prop/jet blast from nearby aircraft. Into a headwind, use slight up elevator to lighten the nose gear load and hold ailerons into any crosswind component. Taxiing downwind, keep the elevator down to prevent any lifting tendency at the tail and hold the ailerons away from any crosswind component, again to prevent any lifting of the upwind wing.

BEFORE TAKEOFF

WARM-UP

The engine is closely cowled to produce minimum drag in cruising flight. However, except under the most extreme conditions, no special procedures are necessary during ground operations. Maximum power runups are not recommended except as necessary to correct maintenance discrepancies.

MAGNETO CHECK

Check the operation of the magnetos at 2000 RPM. When operating on a single magneto the drop in engine speed should not exceed 175 RPM. The difference in engine speed while operating on each single magneto should be no more than 50 RPM. If there is reason to question the magneto check, the mixture may be leaned to peak power and the magnetos rechecked. At higher altitudes this leaning may be required for a smooth magneto check. If doubt still remains, a magneto check at a higher power, say 2000 to 2200 RPM, should confirm the presence or absence of a problem. If a magneto problem is present, do not fly the airplane until the problem is corrected.

An absence of an apparent drop in engine speed during a magneto check may be an indication of faulty grounding of one side of the ignition system and should be checked because of the hazard this condition presents to ground personnel in the vicinity of the airplane while parked.

ALTERNATOR CHECKS

Alternator function can be verified prior to flight by noting ammeter and voltmeter indications. The ammeter should be showing a gradually decreasing charge indication as the battery recovers from the engine start. The voltmeter will show a nominal 28 volts if the alternator is on line or a nominal 24 volts if only the battery is functioning.

BEFORE TAKEOFF (con't)

> NOTE
> A negative (-) reading on the ammeter indicates battery discharge.
> A positive (+) reading on the ammeter indicates battery charging.

TAKEOFFS

POWER APPLICATION

Power should be checked early in the takeoff run for adequacy. Manifold pressure should be 35 to 36 inHg on a standard day, depending on altitude. On warmer days this may increase to near the 39 inHg limit while on colder days the value may properly be as low as 33 to 34 inHg. Engine speed should increase to 2575 RPM early in the takeoff roll.

> NOTE
> The engine speed should be 2550 to 2565 RPM while the airplane is static with full throttle applied in a no wind condition because of the propeller low pitch stop setting. This should increase to and stabilize at 2575 RPM in the takeoff roll as the propeller is unloaded and the governor takes control.

Lack of achievement of the above power levels or any indication of sluggish engine response or other abnormality is reason to abort the takeoff and determine the reason(s).

If the runway surface is gravel, the power should be applied slowly, consistent with field length constraints, to minimize the chance of gravel being sucked into the propeller and the resulting damage.

Following application of power for takeoff, recheck and reset (if needed) the quadrant friction knob to maintain power control settings.

MIXTURE SETTINGS

For all takeoff operations the mixture should be full rich.

WING FLAP SETTINGS

Takeoff is approved with flap settings from 0° to 20°. For normal takeoffs a setting of 10° is recommended to provide a shorter ground roll than will be achieved with no flaps and a better initial climb than will result with 20°

The use of 20° flaps is recommended for obstacle clearance takeoffs in accordance with the Short Field Takeoff chart in Section 5 or for any minimum ground run takeoff.

TAKEOFFS (con't)

CAUTION
Due to low climb performance available, flap settings greater than 20° are not approved for takeoff.

FUEL

The fuel selector valve should be in the BOTH position for all takeoffs. The pilot must determine the adequacy of the fuel on board to complete the planned flight in accordance with all FAR 91 requirements. The pilot must also determine that, with the airplane loaded and fueled for flight, the operation will be conducted within weight and balance limits.

WARNING
Takeoffs with less than 11 gallons of usable fuel are not recommended.

TAKEOFF TECHNIQUE

Crosswind and soft field takeoff procedures are conventional in all respects.

NOTE
Maximum demonstrated crosswind is 19 knots

Short field takeoff procedures are conventional and takeoffs should be conducted in accordance with the conditions specified on the Short Field Takeoff charts of Section 5 in order to achieve the performance included in the chart. The pilot must judge, based on his experience, whether the available runway is adequate for a normal takeoff. If question exists then the short field procedures should be used following conservative verification of field length adequacy using the performance charts.

LANDING GEAR RETRACTION

Landing gear should normally be retracted after reaching the point down the runway beyond which a wheels down landing on the remaining runway could no longer be made. Before initiating the retraction cycle, tap the brakes to stop all main wheel rotation. After retraction is complete verify that the gear locked lights are out and the gear warn light is out.

ENROUTE CLIMB

Climbs can be conducted at 100 to 120 KIAS with the power set to 29 inHg, 2400 rpm, and mixture set to 23 gallons per hour or full rich. These settings correspond to approximately 75% power and are represented for quick reference by the upper extent of the green arc markings on the manifold pressure gauge, tachometer, and fuel flow gauge. This combination provides a reasonable combination of rate of climb, visibility over the nose, cabin noise level, and speed over the ground for climbs to moderate altitudes.

To obtain the maximum rate of climb, or to climb to higher altitudes, the best rate of climb speed should be used along with maximum available power. Best rate of climb speed is 100 KIAS at sea level to 6000 feet decreasing above that altitude in accordance with the schedule shown in Figures 5-9A thru 5-9C. Maximum power for climb is with full throttle, 2575 rpm, and mixture set full rich.

If a nearby obstruction requires a steeper climb angle, the best angle of climb speed should be used along with maximum available power. Best angle of climb speed is 75 KIAS at sea level to 78 KIAS at 8000 feet. This type of climb should only be of short duration to avoid overheating the engine.

CRUISE

Normal cruising is conducted at 75% power and below. At higher powers the mixture may not be leaned, thereby producing inefficient fuel flow. At power settings of 75% and below the mixture should be leaned. The cruise, range, and endurance performance provided in Section 5 is based upon a "recommended mixture" which is achieved by leaning in accordance with the procedures discussed herein. At powers of 75% and below, a 1650°F T.I.T. limit shall be observed. At lower powers, peak T.I.T. may be used when conditions allow which produces lower fuel flows than reflected in the charts located in Section 5 for some power settings.

> NOTE
> Cruising should be done at 65% to 75% power until a total of 50 hours has accumulated or oil consumption has stabilized. This is to insure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

LEANING BY REFERENCE TO THE T.I.T. GAUGE

Turbine inlet temperature is a very accurate reflection of mixture setting in an operating piston engine. This absolute accuracy is reduced slightly by the realities of uneven mixture distribution between cylinders and other anomalies associated with manufactured hardware, but T.I.T. remains as the most accurate and simplest method of leaning the engine under all atmospheric conditions.

To lean this engine to "recommended mixture" strength, and to achieve the fuel flows reflected in the Section 5 cruise, range, and endurance data, and to remain within the operating limitations of the turbocharger, move the mixture control to produce an indicated fuel flow of 2 to 3 gph greater than predicted for your power setting (in the cruise charts). Allow the T.I.T. indication to stabilize. Slowly lean until the T.I.T. indication either peaks and begins to fall or reaches 1650°F T.I.T. If the T.I.T.

CRUISE (con't)

peaks below 1650°F, enrichen the mixture until the T.I.T. again peaks. If the peak T.I.T. is not reached prior to achieving 1650°F, set the mixture control to maintain 1650°F T.I.T.

> NOTE
> Leaning to peak T.I.T. will usually only be possible at lower power settings.

At some power setting combinations in some airplanes engine roughness may occur before peak T.I.T. is achieved. In this case set the mixture just rich enough for smoothness. As always monitor fuel consumption as the flight progresses.

The cylinder head temperature gauge should be monitored in cruise and the cowl flap used to maintain temperatures in the green arc range. The cowl flap may have to be open for cruise at altitudes above 18000 feet.

STALLS

Stall characteristics for this airplane are entirely conventional with flaps up and down. An aural warning of an approaching stall is provided when the airplane angle of attack is equivalent to that in unaccelerated flight as the airspeed comes to within 5 to 10 KCAS of the stall.

Power off stall speeds at maximum weight are presented in Section 5.

DESCENT

In smooth air an airspeed equivalent to the never exceed speed (V_{NE}) for the flight altitude can be used for descent if desired. For increased rates of descent, with airspeed limited to 149 KIAS (or the never exceed speed whichever is less) up to 20° of flaps may be used. If still greater rates of descent are desired, the airplane may be slowed to landing gear operating speed and the gear extended, after which the speed may be increased to the never exceed speed or flap speed applicable for the flight altitude and flap deflection.

> NOTE
> Descent from higher altitudes should be initiated well in advance of the destination to allow a gradual rate of descent <u>without</u> excessive power reduction to avoid rapid over-cooling of the engine. A minimum of 20 to 22 inHg manifold pressure is recommended whenever practical.

The airplane is equipped with an altimeter which displays a striped warning flag which comes into view as the airplane descends below 10,000 feet as an aid to altitude awareness.

BEFORE LANDING

The flap and landing gear speeds on the airplane provide the pilot with good speed control for blending with traffic at today's airports. It is suggested that 10° flaps is a suitable arrival flap setting. The landing gear should be extended on downwind, or passing the final approach fix on an instrument approach. Then on short final the effective flaps on the airplane can provide a steep descent capability over any surrounding obstructions.

Gear extension should be confirmed by three (3) green locked lights, an absence of the red gear warn light, and an absence of the gear warning horn when the throttle is moved to idle and/or the flaps are fully extended.

LANDING

FUEL

The fuel selector valve should be in the BOTH position for all landings. The auxiliary fuel pump should be ON for landing.

MIXTURE SETTINGS

For all landing operations the mixture should be full rich.

WING FLAP SETTINGS

Landing is approved with flap settings from 0° to 35°. For normal landings a setting of 35° is recommended to provide a slower touchdown, shorter ground roll, and less brake wear than will be achieved with any lesser flap setting.

LANDING TECHNIQUE

Crosswind and soft field landing procedures are conventional in all respects.

NOTE
Maximum demonstrated crosswind is 19 knots

Short field landing procedures are conventional and landings should be conducted in accordance with the conditions specified on the Short Field Landing charts of Section 5 in order to achieve the performance included in the chart. The pilot must judge, based on his experience, whether the available runway is adequate for a normal landing. If question exists then the short field procedures should be used following conservative verification of field length adequacy using the performance charts.

BALKED LANDING

If a go-around is necessary, the wing flaps should be reduced to 20° immediately after full power is applied. If obstacle clearance is not a factor and the airplane will remain in the traffic pattern for another landing approach it is recommended that the landing gear remain extended.

COLD WEATHER OPERATION

STARTING

Prior to starting on a cold morning, and after assuring that the ignition is "OFF", pull the propeller through several "blades" by hand to break loose the cold components and to save some battery energy.

WARNING

Whenever in the vicinity of a propeller, assume the ignition switch is turned on. When pulling the propeller through the airplane should be chocked and tied down and the mixture should be in Idle Cut-Off.

Whenever possible and for cold weather starts the use of preheat and an external power source are recommended.

OPERATION

During cold weather, an oil temperature indication may remain low through all pre-takeoff preparations. After a reasonable warm-up period (approximately 5 minutes) at 1000 rpm accelerate the engine several times to a higher speed. If the engine accelerates smoothly and the oil pressure remains normal, the engine is ready for takeoff.

HOT WEATHER OPERATION

No special procedures are required in hot weather. Avoid prolonged engine operation on the ground. Monitor engine temperatures during all operations.

NOISE CHARACTERISTICS

The certificated maximum noise level for the Commander 114TC under FAR 36 procedures is 77.7 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.

Despite the fact that the Commander 114TC noise level is below established noise level limits, all pilots can demonstrate a concern for environmental improvement by application of the following flight procedures:

1. Even though flights below 2000 feet may be consistent with Federal Aviation Regulations under VFR conditions, pilots should make an effort to avoid such flights over recreational areas or outdoor assemblies of people in order to minimize the effect of aircraft noise on the public.

NOISE CHARACTERISTICS (con't)

2. During departure or approach over public areas, every effort should be made to avoid prolonged flight at low altitude.

> NOTE
> These recommendations do not apply where they would conflict with Air Traffic Control instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary for him to be able to see and avoid other aircraft.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS Page

TABLE OF CONTENTS (con't)

INTRODUCTION

The performance data charts and graphs in this section are provided so that a pilot may plan his flights with confidence. The data are based on flight tests of an airplane in good service condition. The corrections shown for other than standard atmospheric conditions are based upon physical relationships and conform to accepted practice. Factors which have not been accounted for include humidity, runway slope, and runway surface condition (wetness, snow, roughness, etc.).

The performance data presented are representative of the general level of performance which can be achieved with any Commander 114TC. However, the normal variations inherent in any complicated manufactured product can cause some differences from one example to the next. Variations in pilot technique can cause further differences. The condition of the airplane, propeller, and engine, and the presence of external optional equipment and after-market items can influence performance. These and other indeterminate variables caused by atmospheric turbulence, unforecast wind conditions, etc. make it imperative for the pilot to be conservative in his flight planning.

Use the charts for guidance but don't plan a takeoff or landing when only 100 feet excess runway is predicted or don't plan a trip with less than a 10 gallon margin. Pilot training for FAA airman certification, experience in the particular airplane, good judgment, conservative planning, and attention to all FAR rules applicable to the flight will all contribute to a safe and enjoyable trip.

This section first provides a sample flight planning problem to illustrate the use of each chart. This is followed by the performance charts themselves.

CAUTION

Takeoff and landing distance data is based upon flight tests conducted at lower altitudes. The resulting performance has been corrected to cover the altitude and temperature extremes by accepted methods.

SAMPLE FLIGHT PLANNING PROBLEM

The following typical trip planning example will be used to show the use of the material in this section.

THE TRIP:

Distance from departure airport to destination airport -	625 nmi
Selected cruise altitude -	12500 ft.
Forecast winds aloft -	10 kt headwind
Forecast OAT in cruise -	-5°C

THE AIRPLANE:

Takeoff weight -	3275 lbs.
Usable fuel on board -	88 gal

SAMPLE FLIGHT PLANNING PROBLEM (con't)

DEPARTURE AIRPORT:	
Field pressure altitude -	3200 ft
Surface OAT -	77°F
Takeoff wind component -	15 kt headwind
Takeoff runway length -	5000 ft
DESTINATION AIRPORT:	
Field elevation -	5700 ft
Forecast surface OAT -	80°F
Forecast landing wind component -	5 kt headwind
Landing runway length -	6200 ft

PRELIMINARY RANGE CHECK

The RANGE PROFILE graph, Figure 5-14, will provide the pilot with preliminary estimates as to altitude selection and power necessary or allowable for the trip. Entering the graph at the bottom with the 625 nmi distance for the sample problem the following is apparent:

The trip can be made with a 45 minute reserve without restriction on altitude or cruise power setting under no wind conditions except at very high altitude. This allows selection of approximately 75% MCP as a cruise power and 12500 feet as a cruise altitude. In the face of stronger headwinds and/or longer trip lengths a lower power would be required.

ENDURANCE CHECK

With a cruise power and a cruise altitude selected, 75% and 12500 feet, the ENDURANCE PROFILE graph, Figure 5-15, provides the following:

With a 75% MCP cruise power, properly leaned, the airplane can fly for approximately 4.2 hours and an additional 45 minutes at the same power settings at a cruise altitude of 12500 feet.

TAKEOFF FIELD LENGTH PREFLIGHT CHECK

The TAKEOFF DISTANCE chart, Figure 5-8, should be consulted to determine the takeoff performance available using a short field technique. The chart should initially be entered at the next higher altitude and temperature as compared to the departure airport actual conditions. This is more convenient and more conservative than the more tedious interpolation procedure which can be used when question exists. Procedures for interpolating data are identical to those learned for pilot certification and will not be covered here.

In this sample, using a pressure altitude of 4000 ft, and an OAT of 30°C (86°F), the takeoff distances are predicted to be:

Ground roll — 2100 feet
Total distance to clear a 50 foot obstacle — 3880 feet

SAMPLE FLIGHT PLANNING PROBLEM (con't)

In the sample problem the ground roll and total distances are clearly within the available field length. If any obstacles are a factor at the departure airport then the effect of the wind may be checked and short field techniques should be employed in accordance with the conditions on the TAKEOFF DISTANCE chart. A correction for the effect of the wind may be made in accordance with Note 3 on the chart:

15 kt / 12 kt x 10% = 12.5% decrease

This results in the following takeoff distances corrected for wind:

Ground Roll, no wind	2100 feet	Total distance to clear a 50 foot obstacle, no wind	3880 feet
Reduction in ground roll (2100 ft x 12.5%)	-263 feet	Reduction in total distance (3880 ft x 12.5%)	-485 feet
Corrected ground roll	1837 feet	**Corrected total distance to clear a 50 foot obstacle**	3395 feet

CLIMB PREFLIGHT PLANNING

Although unnecessarily complex for shorter flights at lower altitudes, consideration of the climb segment is warranted for higher altitude flights and to understand its effect on time, fuel, and distance. Referring to the TIME, FUEL, AND DISTANCE TO CLIMB chart, Figure 5-10, develop the requirements for climb from the departure airport to the selected cruise altitude as follows:

	Time	Fuel	Distance
Climb - Sea level to 13000 feet at MCP & Vy	14 min	8.0 gal	26 nm
Climb - Sea level to 3000 feet at MCP & Vy	-3 min	-2.0 gal	-5 nm
Start, taxi, & run up fuel	----	3.0 gal	----
Climb requirements - Departure airport to cruise altitude	11 min	9.0 gal	21 nm

SAMPLE FLIGHT PLANNING PROBLEM (con't)

These results are for a standard atmosphere and no wind which is generally adequate for most preflight planning for this class of airplane. However, if strong winds are present, additional allowances should made as follows:

Average headwind component in climb:	12 kts
Time to climb:	11 min
Distance to climb, no wind:	21 nm
Distance to climb with wind: 21 nm - (11 min / 60 min/hr x 12 kts)	19 nm

Therefore, the wind corrected climb requirements are:

	Time	Fuel	Distance
Wind corrected climb requirements - Departure airport to cruise altitude	**11 min**	**9.0 gal**	**19 nm**

CRUISE PREFLIGHT PLANNING

The cruising altitude should be selected based on a consideration of trip length (as discussed above under Preliminary Range Check), winds aloft forecasts, and weather. For this sample trip an altitude of 12500 feet and a power setting of 75% were selected. Referring to the CRUISE PERFORMANCE charts, specifically Figure 5-11G, a set of power settings may be selected to achieve the desired 75% MCP cruise power. The forecast OAT at the planned cruise altitude is -5°C, which is 4° above ISA. Therefore, use the [Standard Temperature] data set to select, say:

1) 2400 RPM,

2) 29 in Hg manifold pressure, and

3) Approximately 16.3 GPH fuel flow.

All three of these settings constitute the power setting and all three must be properly set to achieve the approximate speed and corresponding range values presented in this section.

For the sample problem the predicted cruise airspeed is: 167 KTAS

The cruise distance is:

Trip distance - climb distance	=	cruise distance
625 nm -19 nm	=	606 nm

The cruise time in no wind is:

Cruise distance/cruise speed	=	cruise time
606 nm / 167 kts	=	3.6 hr

SAMPLE FLIGHT PLANNING PROBLEM (con't)

However, with the forecast 10 kt headwind the cruise time is predicted to be:

Cruise distance / ground speed = cruise time with wind
606 nm / (167kts - 10 kts) = 3.9 hr

The cruise fuel required is:

Cruise time x cruise fuel flow = cruise fuel
3.9 hr x 16.3 GPH = 63.3 gal

The cruise requirements are summarized:

	Time	Fuel	Distance
Wind corrected cruise - 12500 feet at 75%	**3.9 hr**	**63.6 gal**	**606 nm**

RESERVE FUEL

FAR 91 establishes reserve fuel requirements based upon the type of flight conditions - VFR day or night, or IFR. For this day VFR sample problem the reserve fuel requirement is 30 minutes minimum, or:

30 min / 60 min/hr x cruise fuel flow = **reserve fuel**
0.5 hr x 16.3 GPH = **8.2 gal**

DESCENT

For this class airplane a separate descent calculation for preflight planning is unneeded since the descent is typically just a higher speed or lower power (more miles per gallon) portion of the cruise distance. Hence assuming cruise conditions to the destination is a practical conservative assumption for planning.

TRIP REQUIREMENTS ESTIMATES

	Time	Fuel	Distance
Start, taxi, & runup fuel	----	3.0 gal*	----
Wind corrected climb requirements - Departure airport to cruise altitude	11 min	6.0 gal*	19 nm
Wind corrected cruise - 12500 feet at 75%	3.9 hr	63.6 gal	606 nm
Reserve - 30 min at 75%	----	8.2 gal	----
Trip Requirements	**4.1 hr**	**80.8 gal**	**625 nm**

* The taxi fuel allowance has been separated from the climb fuel here for illustrative purposes.

SAMPLE FLIGHT PLANNING PROBLEM (con't)

This summary clearly shows that adequate fuel is available for the trip. Once the flight is underway the pilot should monitor the progress of the flight through groundspeed checks and prepare to divert if unexpected headwinds (or, of course, adverse weather) develop.

LANDING FIELD LENGTH CHECK

The LANDING DISTANCE chart, Figure 5-16, should be consulted to determine the expected field length requirements at the destination for the time of arrival using short field technique. The chart should initially be entered at the next higher altitude and temperature as compared to forecast arrival conditions. This is more convenient and more conservative than the more tedious interpolation procedure which can be used if any question exists concerning landing performance.

In this sample, using the destination airport altitude of 5700 ft for planning estimates and an expected OAT of 80°F, enter the chart at 6000 ft and 30°C (86°F). The landing distances are predicted to be:

Ground roll	**964 feet**
Total distance to clear a 50 foot obstacle	**1683 feet**

In this sample problem the field length available is clearly adequate without further examination under the forecast conditions. As the pilot approaches his destination he should review actual conditions for any differences in conditions from those forecast. If changes are evident then a quick review of the LANDING PERFORMANCE chart is suggested using the conservative entry method described above with the field pressure altitude and actual OAT to recheck the field requirements. If desired, a correction for the wind may be made in accordance with Note 3 on the chart using the same procedure as discussed under the takeoff performance section above.

ADDITIONAL PERFORMANCE CHARTS

The above sample flight planning problem illustrates the use of those performance charts useful to the pilot in planning a typical flight. Additional performance related charts are provided for informational and/or operational use as the pilot may desire. These charts are:

AIRSPEED CALIBRATION, Normal Static Source, Figure 5-1
AIRSPEED CALIBRATION, Alternate Static Source, Figure 5-2
ALTIMETER CORRECTION, Alternate Static Source, Figure 5-3
TEMPERATURE CONVERSION CHART, Figure 5-4
STANDARD TEMPERATURES, Figure 5-5
STALL SPEEDS, Figure 5-6
WIND COMPONENTS, Figure 5-7
MAXIMUM RATE OF CLIMB, Figure 5-9
LEVEL FLIGHT CRUISE PERFORMANCE, 3305 POUNDS, ISA CONDITIONS, Figure 5-12
LEVEL FLIGHT CRUISE PERFORMANCE, 3050 POUNDS, ISA CONDITIONS, Figure 5-13

These Figures are all self explanatory and simple to use and will not be described further.

DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for the airplane with an outside air temperature of 23°C above standard. This is not considered to be an operating limitation. Reference should be made to Section 2 for engine operating limitations.

AIRSPEED CALIBRATION
NORMAL STATIC SOURCE

CONDITIONS:
3305 pounds.
Power for level flight or maximum power descent.

FLAPS UP							
KIAS	60	80	100	120	140	160	180
KCAS	58	79	100	121	141	161	179
FLAPS 20°							
KIAS	60	80	100	120	140		
KCAS	58	78	98	119	141		
FLAPS 35°							
KIAS	55	65	75	85	95	105	
KCAS	52	62	72	82	92	102	

Figure 5–1

AIRSPEED CALIBRATION
ALTERNATE STATIC SOURCE

CONDITIONS:
Vents closed.
Heater and defroster on.

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	59	81	102	124	145	166	187
FLAPS 20°							
NORMAL KIAS	60	80	100	120	140		
ALTERNATE KIAS	57	79	100	121	142		
FLAPS 35°							
NORMAL KIAS	55	65	75	85	95	105	
ALTERNATE KIAS	51	63	74	84	94	103	

Figure 5–2

ALTIMETER CORRECTION
ALTERNATE STATIC SOURCE

CONDITIONS:
Vents closed.
Heater and defroster on.

NOTE:
Add correction from chart to desired altitude to obtain indicated altitude to fly.

CONFIGURATION	CORRECTION TO BE ADDED KIAS (Alternate)						
	80	90	100	110	120	130	140
FLAPS UP							
Sea Level	+10	+15	+20	+25	+30	+40	+50
5000 Feet	+10	+15	+25	+30	+40	+50	+60
10000 Feet	+15	+20	+30	+35	+45	+60	+70
15000 Feet	+15	+25	+30	+45	+55	+70	+80
20000 Feet	+20	+30	+40	+50	+65	+80	+95
25000 Feet	+25	+30	+45	+60	+75	+90	+115
FLAPS 20°							
Sea Level	+10	+15	+20	+20	+20	+20	+15
5000 Feet	+10	+20	+20	+20	+25	+20	+20
10000 Feet	+15	+20	+25	+25	+25	+25	+20
FLAPS 35°							
Sea Level	+15	+15	+15	+10	---	---	---
5000 Feet	+20	+20	+15	+10	---	---	---
10000 Feet	+20	+25	+20	+10	---	---	---

Figure 5–3

TEMPERATURE CONVERSION CHART

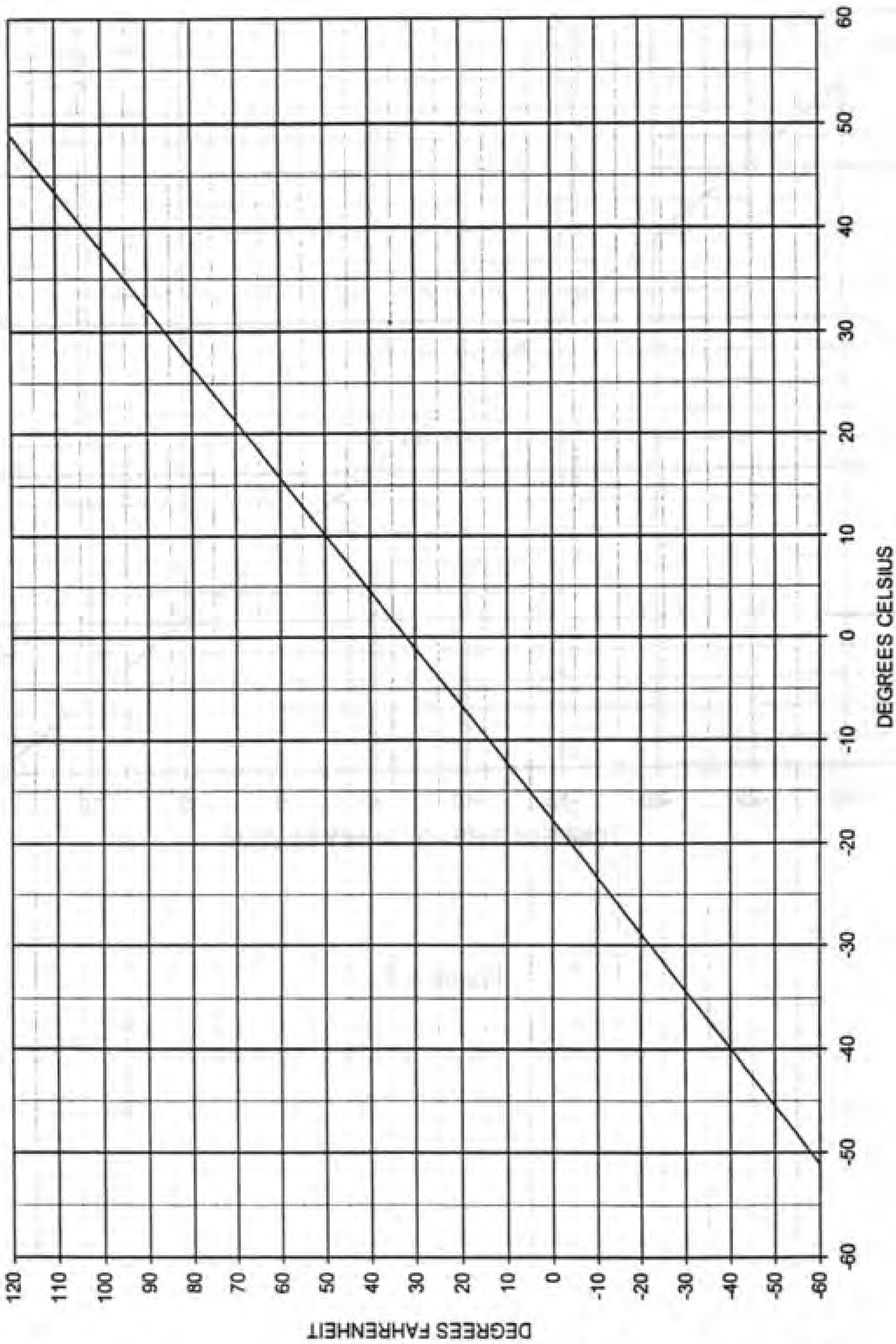


Figure 5–4

STANDARD TEMPERATURES

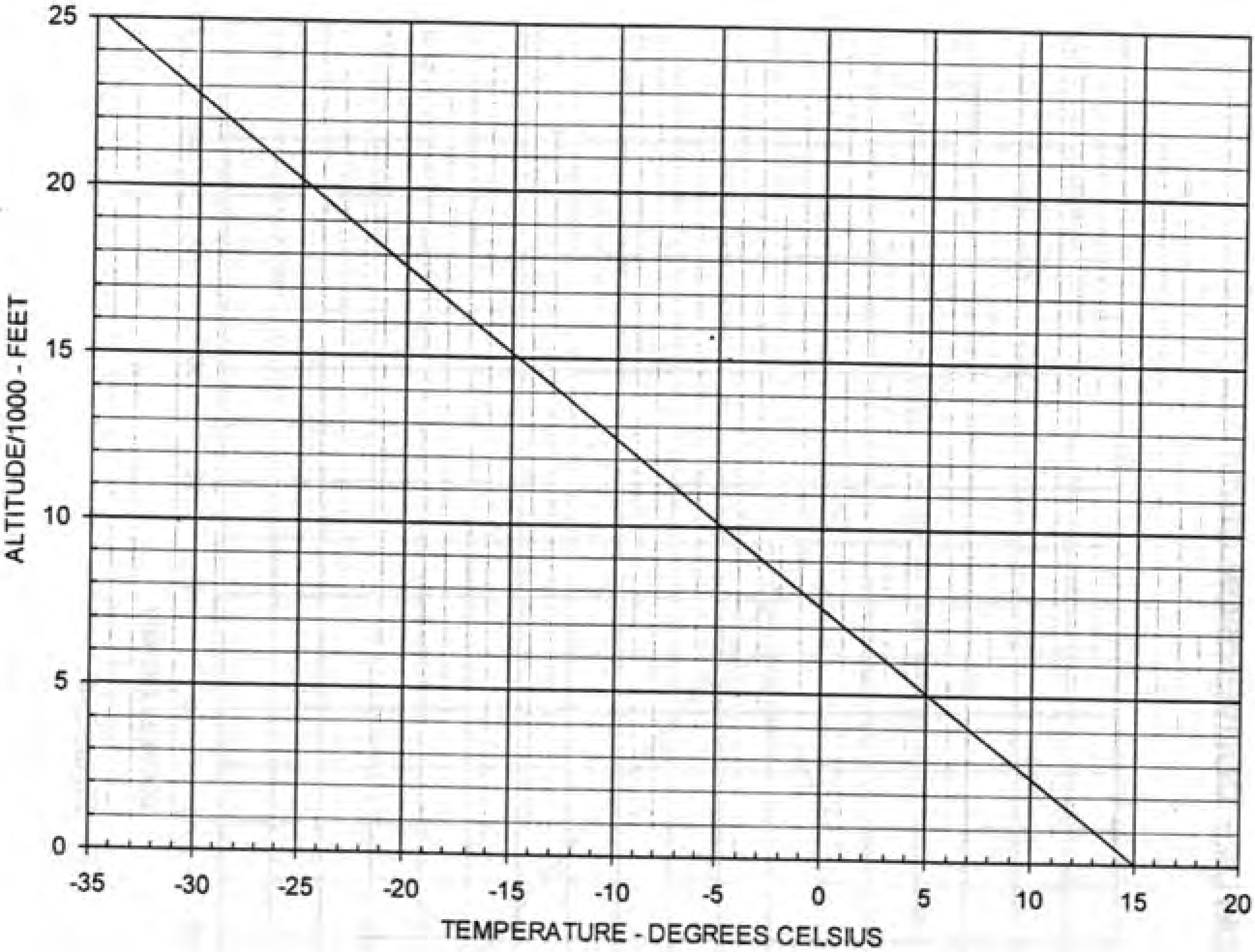


Figure 5–5

STALL SPEEDS

CONDITIONS:
Power idle
Gear down
Deceleration rate – 1kt/sec

NOTES:

1. Demostrated maximum altitude loss during a wings level stall and recovery — 500 ft. At altitudes above 20000 ft, altitude loss may exceed 700 ft.
2. KIAS values maybe unreliable at stall.
3. Aft movement of center of gravity will reduce stall speeds at a given weight by up to 2.5 KCAS at maximum aft C.G. location. Forward movement of center of gravity will increase stall speeds at a given weight by up to 9 KCAS when loading approaches the most forward approved at lighter weights.

MOST FORWARD CENTER OF GRAVITY(AT MAXIMUM WEIGHT)-104.62 INCHES

WEIGHT LBS	FLAP POSITION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3305	UP	68	66	73	71	81	79	96	94
	20°	65	62	70	67	77	74	92	88
	35°	64	59	69	64	76	71	91	84
3000	UP	65	63	70	68	77	75	92	89
	20°	62	59	67	63	74	70	88	84
	35°	61	57	66	61	73	67	86	80
2491	UP	61	58	66	62	73	68	86	81
	20°	57	54	61	58	68	64	81	76
	35°	56	52	60	55	67	61	79	73

Figure 5-6

WIND COMPONENTS

NOTE:
Maximum demonstrated crosswind velocity is 19 kts (not a limitation).

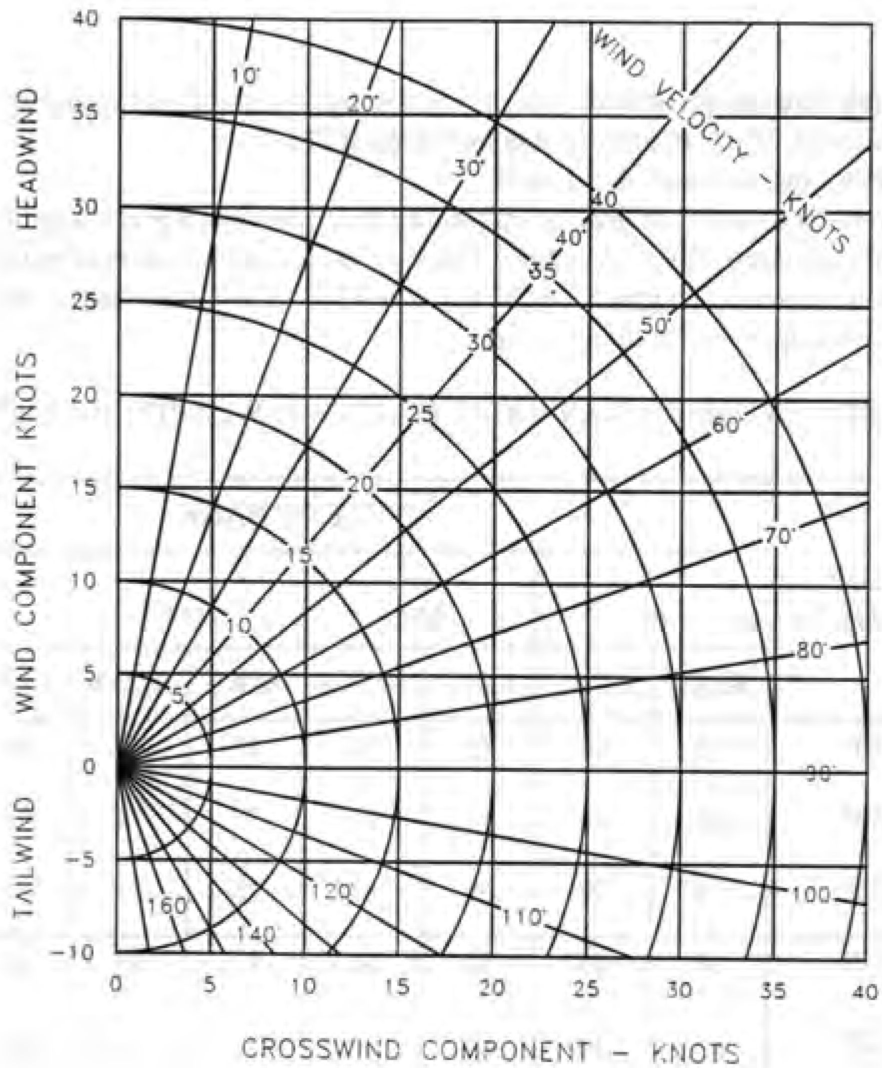


Figure 5–7

TAKEOFF DISTANCE
SHORT FIELD

CONDITIONS:
Flaps 20°
Gear down until obstacle cleared
Cowl flap open
Power max prior to brake release
  Full throttle
  Max rpm
  Full rich mixture
Runway paved, dry, level
Wind calm

NOTES:

1. Short field technique as described in Section 4.
2. For short, dry grass runway, increase the distances by 27% of the ground roll distance.
3. Decrease distances 10% for each 12 knots headwind. For operation with tailwinds up to10 knots, increase distances by 10% for each 4 knots.
4. The symbol (>) in the following chart signifies that the takeoff distance is greater than the following chart entry.

TAKEOFF DISTANCE
SHORT FIELD

WEIGHT LBS	TAKE OFF SPEED - KIAS		PRESSURE ALTITUDE FT	0 °C		10 °C		20 °C		30 °C		40 °C	
	LIFT OFF	AT 50 FT		GND ROLL FT	TOTAL OVER 50 FT OBS FT	GND ROLL FT	TOTAL OVER 50 FT OBS FT	GND ROLL FT	TOTAL OVER 50 FT OBS FT	GND ROLL FT	TOTAL OVER 50 FT OBS FT	GND ROLL FT	TOTAL OVER 50 FT OBS FT
3305	72	77	0	1247	2003	1350	2144	1455	2301	1563	2479	1674	2683
			1000	1347	2130	1456	2287	1569	2463	1684	2663	1802	2897
			2000	1454	2297	1571	2479	1690	2688	1813	2931	1939	3219
			3000	1569	2517	1693	2741	1820	3003	1951	3316	2085	3696
			4000	1693	2818	1825	3106	1960	3454	2100	3880	2242	4413
			5000	1825	3237	1966	3628	2110	4112	2259	4722	2411	5502
			6000	1968	3836	2118	4387	2272	5086	2430	5988	2592	7164
			7000	2120	4697	2280	5496	2445	6531	2614	7890	2787	9690
			8000	2285	5941	2456	7118	2631	>8000	2811	>10000	2996	13502

Standard Day - 15°C, Pressure Altitude - S.L. Ground Roll - 1350 ft Total to Clear 50 ft obstacle - 2070 ft

Figure 5–8

MAXIMUM RATE OF CLIMB
WEIGHT 3305 LBS

CONDITIONS:
Gear Retracted
Flaps 0°
Cowl Flap Open
Full Throttle, 2575 RPM, Full Rich Mixture

WEIGHT	PRESS ALT	CLIMB SPEED	RATE OF CLIMB - FPM			
LBS	FT	KIAS	-20°	0°C	+20°	+40°
3305	0	100	1120	1075	1045	1010
	2000	100	1080	1040	1000	970
	4000	100	1040	1000	960	925
	6000	100	1000	960	920	875
	8000	99	960	920	870	830
	10000	99	915	870	825	775
	12000	98	865	820	765	746
	14000	98	815	755	690	644
	16000	97	755	685	610	447
	18000	96	699	570	378	121
	20000	94	565	333	75	--
	22000	93	394	96	--	--
	24000	89	208	--	--	--
Standard Day - 15°C, Pressure Altitude - S.L. Rate of Climb - 1050 FPM						

Figure 5–9A

MAXIMUM RATE OF CLIMB
WEIGHT 3000 LBS

CONDITIONS:
Gear Retracted
Flaps 0°
Cowl Flap Open
Full Throttle, 2575 RPM, Full Rich Mixture

WEIGHT	PRESS ALT	CLIMB SPEED	RATE OF CLIMB - FPM			
LBS	FT	KIAS	-20°	0°C	+20°	+40°
3000	0	100	1333	1287	1257	1222
	2000	100	1292	1252	1212	1182
	4000	100	1252	1212	1172	1137
	6000	100	1212	1172	1132	1087
	8000	99	1173	1134	1083	1043
	10000	99	1129	1084	1039	988
	12000	98	1079	1034	979	962
	14000	98	1030	969	902	857
	16000	97	970	898	821	646
	18000	96	917	780	574	296
	20000	94	777	527	249	--
	22000	93	598	276	--	--
	24000	89	408	115	--	--

Figure 5-9B

MAXIMUM RATE OF CLIMB
WEIGHT 2491 LBS

CONDITIONS:
Gear Retracted
Flaps 0°
Cowl Flap Open
Full Throttle, 2575 RPM, Full Rich Mixture

WEIGHT	PRESS ALT	CLIMB SPEED	RATE OF CLIMB - FPM			
LBS	FT	KIAS	-20°	0°C	+20°	+40°
2941	0	100	1777	1729	1700	1664
	2000	100	1735	1694	1652	1623
	4000	100	1694	1653	1611	1576
	6000	100	1652	1612	1571	1523
	8000	99	1615	1576	1522	1481
	10000	99	1571	1525	1479	1425
	12000	98	1521	1475	1416	1404
	14000	98	1471	1407	1335	1289
	16000	97	1410	1333	1249	1047
	18000	96	1360	1205	967	641
	20000	94	1207	917	592	288
	22000	93	1007	631	302	--
	24000	89	802	462	151	--

Figure 5-9C

TIME, FUEL, AND DISTANCE TO CLIMB
MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps up
Gear up
Power Max
Full Throttle
2575 RPM
Full rich mixture
Cowl flap open
Standard temperature

NOTES:

1. Add 3 gal. of fuel for engine start, taxi, and takeoff allowance.
2. Increase time, fuel, and distance by 10 - 12% for each 10°C above standard temperature.
3. Distances shown are based on zero wind.

WT	PRESSURE ALTITUDE	TEMP.	CLIMB SPEED	RATE OF CLIMB	FROM SEA LEVEL		
					TIME	FUEL USED	DISTANCE
LBS	FT	°C	KIAS	FPM	MIN.	GAL.	NM
3305	S.L.	15	100	1050	0	0	0
	1000	13	100	1035	1	1	2
	2000	11	100	1020	2	1	3
	3000	9	100	1005	3	2	5
	4000	7	100	990	4	2	7
	5000	5	100	970	5	3	9
	6000	3	100	950	6	3	10
	7000	1	100	930	7	4	12
	8000	-1	99	910	8	4	14
	9000	-3	99	895	9	5	17
	10000	-5	99	875	10	6	19
	11000	-7	99	855	12	6	21
	12000	-9	98	835	13	7	23
	13000	-11	98	815	14	8	26
	14000	-13	97	790	15	8	28
	15000	-15	97	770	17	9	31
	16000	-17	96	740	18	10	34
	17000	-19	96	720	19	10	36
	18000	-21	95	685	21	11	39
	19000	-23	95	650	22	12	43
	20000	-25	94	615	24	13	46
	21000	-27	93	575	25	14	50
	22000	-29	93	520	27	15	54
	23000	-31	92	450	29	16	58
	24000	-33	89	360	32	17	64
	25000	-35	87	250	35	19	71

Figure 5–10

CRUISE PERFORMANCE
PRESSURE ALTITUDE SEA LEVEL

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -5			STANDARD TEMPERATURE - °C 15			20°C ABOVE STANDARD TEMP - °C 35		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	--	--	--	79	154	17.3	75	153	16.4
	29.0	77	149	16.8	72	148	15.8	69	146	15.0
	27.0	69	142	15.1	65	140	14.2	62	136	13.5
	25.0	61	133	13.2	57	131	12.5	55	128	11.8
	23.0	54	124	11.7	51	121	11.0	48	118	10.4
	21.0	47	113	10.1	45	109	9.6	42	103	9.1
2300	31.0	80	152	16.2	75	151	15.4	72	149	14.7
	29.0	73	146	15.0	69	145	14.3	66	143	13.6
	27.0	66	138	13.6	62	136	12.9	59	134	12.3
	25.0	58	130	12.2	55	128	11.6	52	125	11.0
	23.0	51	120	10.7	48	116	10.2	46	112	9.7
	21.0	45	110	9.6	43	105	9.1	41	97	8.7
2200	31.0	76	148	14.2	72	147	13.7	68	146	13.1
	29.0	70	143	13.4	66	141	12.8	63	139	12.3
	27.0	62	134	12.2	59	132	11.7	56	130	11.2
	25.0	56	127	11.2	53	124	10.7	50	121	10.2
	23.0	48	115	9.8	45	111	9.4	43	105	8.9
	21.0	44	107	9.1	41	101	8.6	39	89	8.3

Figure 5–11A

CRUISE PERFORMANCE
PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -9			STANDARD TEMPERATURE - °C 11			20°C ABOVE STANDARD TEMP - °C 31		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	—	—	—	79	157	17.4	75	155	16.5
	29.0	77	152	16.9	73	151	16.0	69	149	15.1
	27.0	70	145	15.3	66	143	14.4	63	141	13.6
	25.0	62	136	13.5	59	134	12.7	56	131	12.1
	23.0	55	128	12.0	52	125	11.3	50	121	10.7
	21.0	49	117	10.5	46	112	9.9	44	106	9.4
2300	31.0	80	155	16.3	76	154	15.5	72	152	14.8
	29.0	74	149	15.2	70	147	14.4	66	146	13.7
	27.0	67	141	13.8	63	139	13.1	60	137	12.5
	25.0	60	133	12.5	56	131	11.8	54	128	11.3
	23.0	53	123	11.0	50	120	10.5	47	115	10.0
	21.0	47	113	9.9	44	108	9.4	42	100	8.9
2200	31.0	77	152	14.4	73	150	13.8	69	149	13.2
	29.0	71	145	13.5	67	144	12.9	63	142	12.4
	27.0	63	138	12.4	60	136	11.8	57	133	11.4
	25.0	57	130	11.4	54	127	10.9	51	124	10.4
	23.0	50	119	10.1	47	114	9.6	44	109	9.2
	21.0	45	110	9.3	42	103	8.8	40	89	8.4

Figure 5–11B

CRUISE PERFORMANCE
PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -13			STANDARD TEMPERATURE - °C 7			20°C ABOVE STANDARD TEMP - °C 27		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	80	160	17.6	76	159	16.6
	29.0	78	155	17.1	74	153	16.1	70	152	15.2
	27.0	71	148	15.4	67	146	14.5	63	144	13.8
	25.0	63	140	13.8	60	137	13.0	57	134	12.3
	23.0	57	131	12.4	54	128	11.6	51	124	11.0
	21.0	50	121	10.8	47	116	10.2	45	109	9.7
2300	31.0	–	–	–	77	157	15.7	73	155	15.0
	29.0	75	152	15.3	71	150	14.6	67	149	13.9
	27.0	68	144	14.0	64	142	13.3	61	140	12.6
	25.0	61	136	12.7	58	134	12.0	55	131	11.5
	23.0	54	127	11.4	51	124	10.8	49	119	10.3
	21.0	48	117	10.2	46	112	9.7	43	103	9.2
2200	31.0	78	155	14.5	74	153	13.9	70	152	13.4
	29.0	72	149	13.7	68	147	13.1	64	145	12.5
	27.0	65	141	12.6	61	139	12.0	58	136	11.5
	25.0	59	133	11.6	55	130	11.1	52	127	10.6
	23.0	52	123	10.5	49	119	10.0	46	114	9.6
	21.0	46	113	9.6	44	107	9.1	42	93	8.7

Figure 5–11C

CRUISE PERFORMANCE
PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
3305
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -17			STANDARD TEMPERATURE - °C 3			20°C ABOVE STANDARD TEMP - °C 23		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	81	163	17.7	76	161	16.7
	29.0	78	157	17.1	74	156	16.1	70	154	15.2
	27.0	71	150	15.6	67	148	14.7	64	146	13.9
	25.0	65	143	14.1	61	140	13.2	58	137	12.5
	23.0	58	134	12.6	55	131	11.9	52	127	11.2
	21.0	52	124	11.1	49	119	10.5	46	112	9.9
2300	31.0	–	–	–	77	160	15.8	73	158	15.0
	29.0	75	154	15.4	71	153	14.6	67	151	13.9
	27.0	69	148	14.2	65	145	13.4	61	143	12.8
	25.0	62	140	12.9	59	137	12.2	56	134	11.6
	23.0	56	131	11.7	53	127	11.1	50	122	10.5
	21.0	50	120	10.5	47	114	9.9	44	105	9.4
2200	31.0	79	158	14.6	74	156	14.0	70	154	13.4
	29.0	72	151	13.7	68	150	13.1	65	147	12.6
	27.0	66	145	12.8	62	142	12.2	59	139	11.7
	25.0	60	136	11.8	56	133	11.3	53	130	10.8
	23.0	53	127	10.7	50	122	10.2	48	116	9.8
	21.0	48	116	9.8	45	109	9.3	43	92	8.9

Figure 5–11D

CRUISE PERFORMANCE
PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -21			STANDARD TEMPERATURE - °C -1			20°C ABOVE STANDARD TEMP - °C 19		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	--	--	--	81	166	17.7	76	164	16.7
	29.0	79	160	17.2	74	159	16.2	70	156	15.3
	27.0	72	154	15.8	68	152	14.9	65	149	14.0
	25.0	66	146	14.3	62	144	13.5	59	140	12.7
	23.0	59	138	12.9	56	134	12.1	53	129	11.5
	21.0	53	128	11.5	50	123	10.8	48	115	10.2
2300	31.0	--	--	--	78	163	15.8	74	161	15.1
	29.0	76	158	15.5	72	156	14.7	68	153	14.0
	27.0	70	151	14.3	66	148	13.6	62	146	12.9
	25.0	63	143	13.1	60	140	12.5	57	136	11.8
	23.0	57	134	11.9	54	130	11.3	51	125	10.7
	21.0	51	124	10.7	48	118	10.2	46	107	9.7
2200	31.0	79	161	14.7	75	159	14.1	71	157	13.5
	29.0	73	155	13.9	69	153	13.3	65	150	12.7
	27.0	67	148	12.9	63	145	12.3	60	142	11.8
	25.0	61	140	12.0	57	136	11.4	54	132	10.9
	23.0	55	130	11.0	51	126	10.4	49	119	10.0
	21.0	49	119	10.0	46	111	9.5	43	104	9.0

Figure 5–11E

CRUISE PERFORMANCE
PRESSURE ALTITUDE 10000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -25			STANDARD TEMPERATURE - °C -5			20°C ABOVE STANDARD TEMP - °C 15		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	81	168	17.7	76	166	16.7
	29.0	79	163	17.3	74	161	16.3	70	159	15.4
	27.0	73	157	16.0	69	155	15.0	65	152	14.2
	25.0	67	149	14.5	63	146	13.7	60	143	12.9
	23.0	61	141	13.2	57	138	12.4	54	133	11.7
	21.0	55	132	11.9	52	126	11.2	49	118	10.5
2300	31.0	–	–	–	78	165	15.9	74	163	15.1
	29.0	76	161	15.6	72	158	14.8	68	156	14.1
	27.0	70	154	14.5	66	151	13.7	63	148	13.0
	25.0	66	149	13.7	62	146	12.9	59	142	12.3
	23.0	58	137	12.2	55	133	11.5	52	127	10.9
	21.0	52	127	11.0	49	120	10.4	46	108	9.8
2200	31.0	80	164	14.7	75	162	14.1	71	160	13.5
	29.0	74	158	13.9	70	155	13.3	66	153	12.8
	27.0	68	151	13.1	64	148	12.5	60	144	11.9
	25.0	65	148	12.7	62	145	12.1	58	141	11.6
	23.0	56	133	11.1	52	128	10.6	50	120	10.1
	21.0	49	121	10.1	47	112	9.6	44	106	9.1

Figure 5-11F

CRUISE PERFORMANCE
PRESSURE ALTITUDE 12000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -29			STANDARD TEMPERATURE - °C -9			20°C ABOVE STANDARD TEMP - °C 11		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	–	–	–	76	169	16.7
	29.0	79	166	17.4	75	164	16.3	70	161	15.4
	27.0	73	160	16.1	69	157	15.1	65	154	14.2
	25.0	68	153	14.8	64	149	13.9	60	145	13.1
	23.0	62	144	13.4	58	140	12.6	55	134	11.9
	21.0	56	135	12.1	53	129	11.3	50	119	10.7
2300	31.0	–	–	–	78	168	15.9	74	165	15.1
	29.0	77	163	15.7	72	161	14.8	68	158	14.1
	27.0	71	157	14.6	67	154	13.8	63	150	13.1
	25.0	65	149	13.4	61	145	12.7	58	141	12.1
	23.0	59	141	12.4	56	136	11.7	53	129	11.1
	21.0	53	129	11.1	50	122	10.5	47	106	10.0
2200	31.0	80	167	14.8	75	165	14.2	71	162	13.6
	29.0	74	161	14.0	70	158	13.4	66	155	12.8
	27.0	69	154	13.2	65	151	12.6	61	147	12.0
	25.0	62	145	12.2	58	141	11.6	55	135	11.1
	23.0	57	137	11.4	54	131	10.8	51	123	10.3
	21.0	50	123	10.2	47	113	9.7	45	109	9.3

Figure 5–11G

CRUISE PERFORMANCE
PRESSURE ALTITUDE 14000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -33			STANDARD TEMPERATURE - °C -13			20°C ABOVE STANDARD TEMP - °C 7		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	–	–	–	76	171	16.6
	29.0	79	169	17.4	75	166	16.3	70	163	15.4
	27.0	74	162	16.2	69	160	15.2	66	156	14.3
	25.0	69	156	14.9	64	152	14.0	61	148	13.2
	23.0	62	147	13.6	59	142	12.7	55	136	12.0
	21.0	57	138	12.4	54	132	11.6	51	121	11.0
2300	31.0	–	–	–	78	170	15.9	74	168	15.1
	29.0	77	166	15.7	72	163	14.8	68	160	14.1
	27.0	71	159	14.7	67	156	13.9	63	152	13.2
	25.0	66	152	13.6	62	148	12.9	58	143	12.2
	23.0	60	143	12.5	56	138	11.8	53	130	11.2
	21.0	54	132	11.4	51	124	10.8	48	102	10.2
2200	31.0	80	169	14.8	75	167	14.1	71	164	13.5
	29.0	74	163	14.0	70	160	13.4	66	156	12.8
	27.0	69	156	13.2	65	153	12.6	61	148	12.1
	25.0	63	148	12.3	59	143	11.7	56	137	11.2
	23.0	57	138	11.4	54	132	10.9	51	122	10.3
	21.0	51	126	10.4	48	114	9.9	46	107	9.4

Figure5–11H

CRUISE PERFORMANCE
PRESSURE ALTITUDE 16000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.

		20°C BELOW STANDARD TEMP - °C -37			STANDARD TEMPERATURE - °C -17			20°C ABOVE STANDARD TEMP - °C 3		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	–	–	–	76	173	16.5
	29.0	80	172	17.5	75	169	16.4	71	166	15.4
	27.0	74	165	16.3	70	162	15.2	66	158	14.3
	25.0	69	158	15.0	65	154	14.1	61	149	13.2
	23.0	63	149	13.7	59	144	12.8	56	136	12.1
	21.0	58	141	12.6	54	133	11.8	51	120	11.1
2300	31.0	–	–	–	78	172	15.8	73	169	15.0
	29.0	77	169	15.7	72	166	14.9	68	162	14.1
	27.0	72	162	14.8	68	159	14.0	64	154	13.2
	25.0	66	154	13.6	62	149	12.9	58	143	12.2
	23.0	60	145	12.6	57	136	11.9	54	130	11.3
	21.0	55	134	11.5	52	124	10.9	49	118	10.3
2200	31.0	80	172	14.8	75	169	14.1	71	166	13.5
	29.0	74	165	14.0	70	162	13.4	66	158	12.8
	27.0	70	159	13.3	65	155	12.7	62	150	12.1
	25.0	63	149	12.3	59	144	11.7	56	136	11.2
	23.0	58	141	11.5	55	134	11.0	52	121	10.5
	21.0	52	127	10.5	49	110	10.0	46	107	9.5

Figure 5–11I

CRUISE PERFORMANCE
PRESSURE ALTITUDE 18000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.
Cowl flap may have to be open for engine temperature control. Speeds in chart correspond to cowl flap open performance. Speeds are 7 to 9 KTAS faster with cowl flap closed. See Figure 5-14 for effect of cowl flap on range.

		20°C BELOW STANDARD TEMP - °C -41			STANDARD TEMPERATURE - °C -21			20°C ABOVE STANDARD TEMP - °C -1		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	–	–	–	75	166	16.5
	29.0	80	167	17.5	75	163	16.4	71	159	15.4
	27.0	74	160	16.3	70	156	15.2	66	151	14.3
	25.0	69	153	15.1	65	148	14.2	61	142	13.3
	23.0	63	144	13.8	60	137	12.9	56	127	12.2
	21.0	58	134	12.6	55	125	11.8	–	–	–
2300	31.0	–	–	–	77	167	15.8	73	163	15.0
	29.0	77	164	15.7	72	160	14.8	68	155	14.1
	27.0	72	157	14.8	68	153	14.0	64	147	13.2
	25.0	66	148	13.7	62	143	12.9	59	134	12.2
	23.0	61	140	12.7	57	132	12.0	54	119	11.4
	21.0	55	128	11.6	52	114	11.0	–	–	–
2200	31.0	80	167	14.8	75	164	14.1	71	160	13.5
	29.0	74	160	14.0	70	156	13.4	66	151	12.8
	27.0	70	154	13.4	65	149	12.7	62	142	12.1
	25.0	63	143	12.3	59	136	11.7	56	125	11.1
	23.0	59	135	11.6	55	126	11.1	–	–	–
	21.0	53	120	10.6	–	–	–	–	–	–

Figure 5-11J

CRUISE PERFORMANCE
PRESSURE ALTITUDE 20000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.
Cowl flap may have to be open for engine temperature control. Speeds in chart correspond to cowl flap open performance. Speeds are 7 to 9 KTAS faster with cowl flap closed. See Figure 5-14 for effect of cowl flap on range.

		20°C BELOW STANDARD TEMP - °C -45			STANDARD TEMPERATURE - °C -25			20°C ABOVE STANDARD TEMP - °C -5		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	–	–	–	75	168	16.4
	29.0	80	169	17.5	75	165	16.4	70	160	15.4
	27.0	74	162	16.3	70	158	15.2	66	151	14.3
	25.0	70	156	15.2	65	150	14.2	62	142	13.4
	23.0	64	146	13.9	60	138	13.0	57	126	12.3
	21.0	59	136	12.8	55	124	12.0	–	–	–
2300	31.0	–	–	–	77	169	15.8	73	164	15.0
	29.0	77	166	15.7	72	161	14.8	68	156	14.0
	27.0	72	159	14.8	68	154	14.0	64	147	13.2
	25.0	67	150	13.8	62	144	13.0	59	134	12.3
	23.0	62	141	12.8	58	132	12.1	54	113	11.4
	21.0	56	129	11.8	53	111	11.1	–	–	–
2200	31.0	80	170	14.8	75	166	14.1	71	161	13.5
	29.0	74	162	14.0	70	157	13.3	66	151	12.7
	27.0	70	156	13.4	65	150	12.7	62	142	12.1
	25.0	63	145	12.4	59	137	11.8	56	123	11.2
	23.0	59	136	11.7	55	125	11.1	–	–	–
	21.0	53	121	10.8	–	–	–	–	–	–

Figure 5–11K

CRUISE PERFORMANCE
PRESSURE ALTITUDE 22000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.
Cowl flap may have to be open for engine temperature control. Speeds in chart correspond to cowl flap open performance. Speeds are 7 to 9 KTAS faster with cowl flap closed. See Figure 5-14 for effect of cowl flap on range.

		20°C BELOW STANDARD TEMP - °C -49			STANDARD TEMPERATURE - °C -29			20°C ABOVE STANDARD TEMP - °C -9		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	79	173	17.3	74	168	16.3
	29.0	79	171	17.4	74	167	16.3	70	161	15.3
	27.0	74	164	16.3	70	159	15.2	66	151	14.3
	25.0	70	158	15.3	66	151	14.3	62	141	13.4
	23.0	64	148	14.0	60	139	13.1	57	121	12.3
	21.0	59	136	12.8	55	121	12.0	–	–	–
2300	31.0	–	–	–	77	170	15.7	72	165	14.9
	29.0	76	167	15.6	72	162	14.7	67	155	13.9
	27.0	72	161	14.8	67	155	13.9	64	146	13.2
	25.0	66	152	13.7	62	144	12.9	59	130	12.2
	23.0	62	142	12.9	58	131	12.1	–	–	–
	21.0	56	128	11.8	–	–	–	–	–	–
2200	31.0	80	172	14.8	75	167	14.1	70	161	13.4
	29.0	74	163	13.9	69	157	13.2	65	150	12.6
	27.0	70	157	13.3	65	150	12.7	61	140	12.1
	25.0	63	145	12.3	59	135	11.7	–	–	–
	23.0	59	136	11.7	55	121	11.1	–	–	–
	21.0	53	117	–	–	–	–	–	–	–

Figure 5–11L

CRUISE PERFORMANCE
PRESSURE ALTITUDE 24000 FEET

CONDITIONS:
3305 Pounds
Mixture set to 1650°F TIT or peak TIT, whichever occurs first when leaning.
Cowl flap may have to be open for engine temperature control. Speeds in chart correspond to cowl flap open performance. Speeds are 7 to 9 KTAS or more faster with cowl flap closed. See Figure 5-14 for effect of cowl flap on range.

		20°C BELOW STANDARD TEMP - °C -53			STANDARD TEMPERATURE - °C -33			20°C ABOVE STANDARD TEMP - °C -13		
RPM	MAP	%BHP	KTAS	GPH	%BHP	KTAS	GPH	%BHP	KTAS	GPH
2400	31.0	–	–	–	79	175	17.2	74	169	16.2
	29.0	79	173	17.3	74	167	16.2	70	160	15.2
	27.0	74	166	16.3	70	160	15.2	66	151	14.3
	25.0	71	161	15.5	66	153	14.5	63	142	13.6
	23.0	65	149	14.1	61	138	13.2	–	–	–
	21.0	60	137	12.9	56	112	12.1	–	–	–
2300	31.0	–	–	–	76	171	15.6	72	165	14.8
	29.0	76	169	15.5	71	162	14.6	67	154	13.8
	27.0	72	162	14.7	67	155	13.9	63	144	13.1
	25.0	67	154	13.8	63	144	13.0	59	126	12.3
	23.0	62	143	12.9	58	128	12.1	–	–	–
	21.0	57	127	11.9	–	–	–	–	–	–
2200	31.0	79	173	14.7	74	168	14.0	70	161	13.4
	29.0	73	164	13.8	68	157	13.1	64	147	12.5
	27.0	69	157	13.3	65	149	12.6	61	135	12.0
	25.0	63	145	12.3	59	132	11.7	–	–	–
	23.0	59	135	11.7	–	–	–	–	–	–
	21.0	54	112	10.8	–	–	–	–	–	–

Figure 5–11M

LEVEL FLIGHT CRUISE PERFORMANCE
3305 POUNDS, ISA CONDITIONS

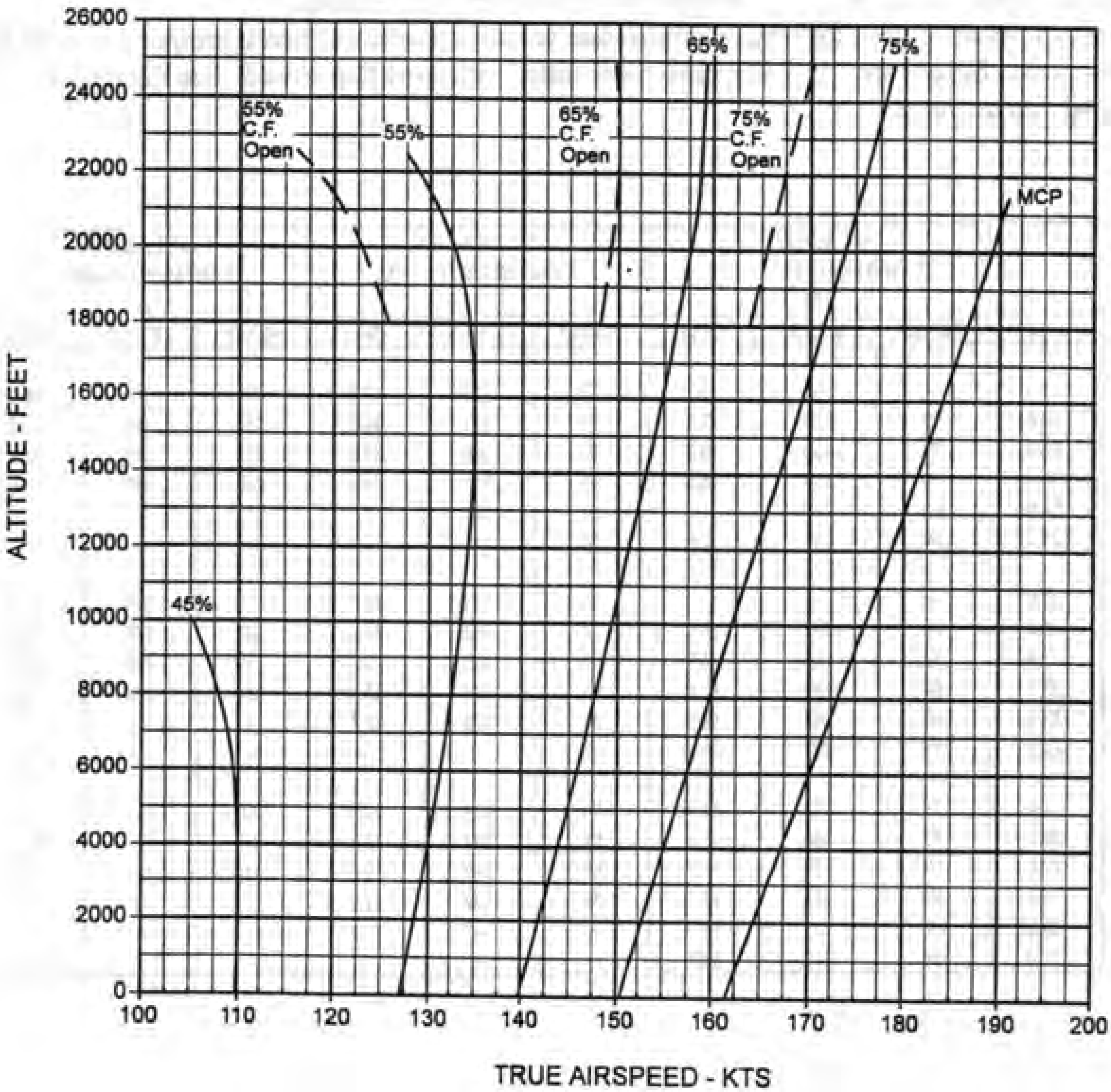


Figure 5-12

LEVEL FLIGHT CRUISE PERFORMANCE
3050 POUNDS, ISA CONDITIONS

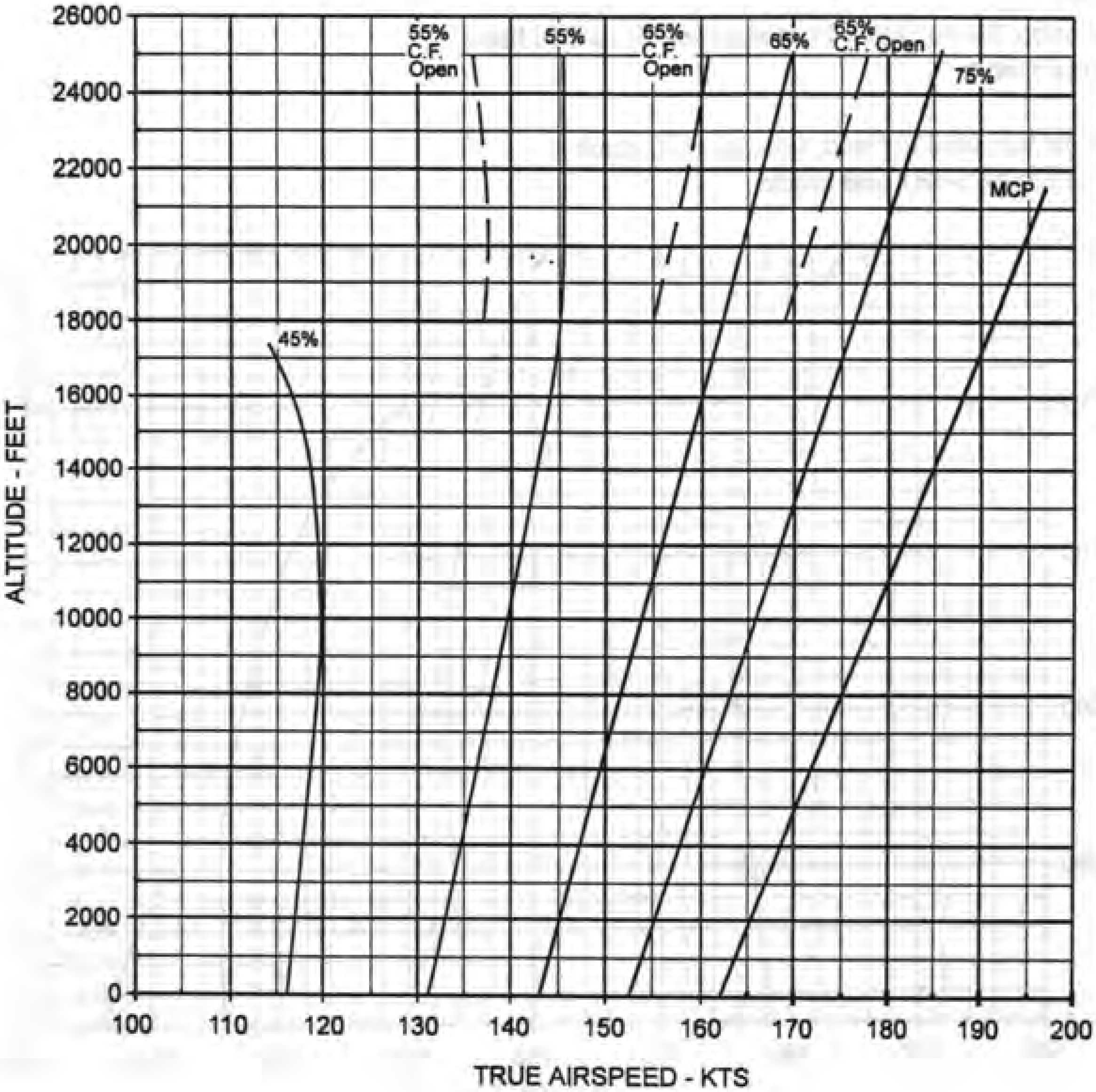


Figure 5-13

RANGE PROFILE
45 MINUTES RESERVE
88 GALLONS USABLE FUEL

CONDITIONS:
3305 Lbs
1650° TIT or PTIT
Cowl Flaps Open Above 18000 Ft as signified by dashed lines
Standard Atmosphere
No Wind
Chart allow for fuel used for start, taxi, takeoff, climb at
MCP (See Figure 5-9B), and cruise

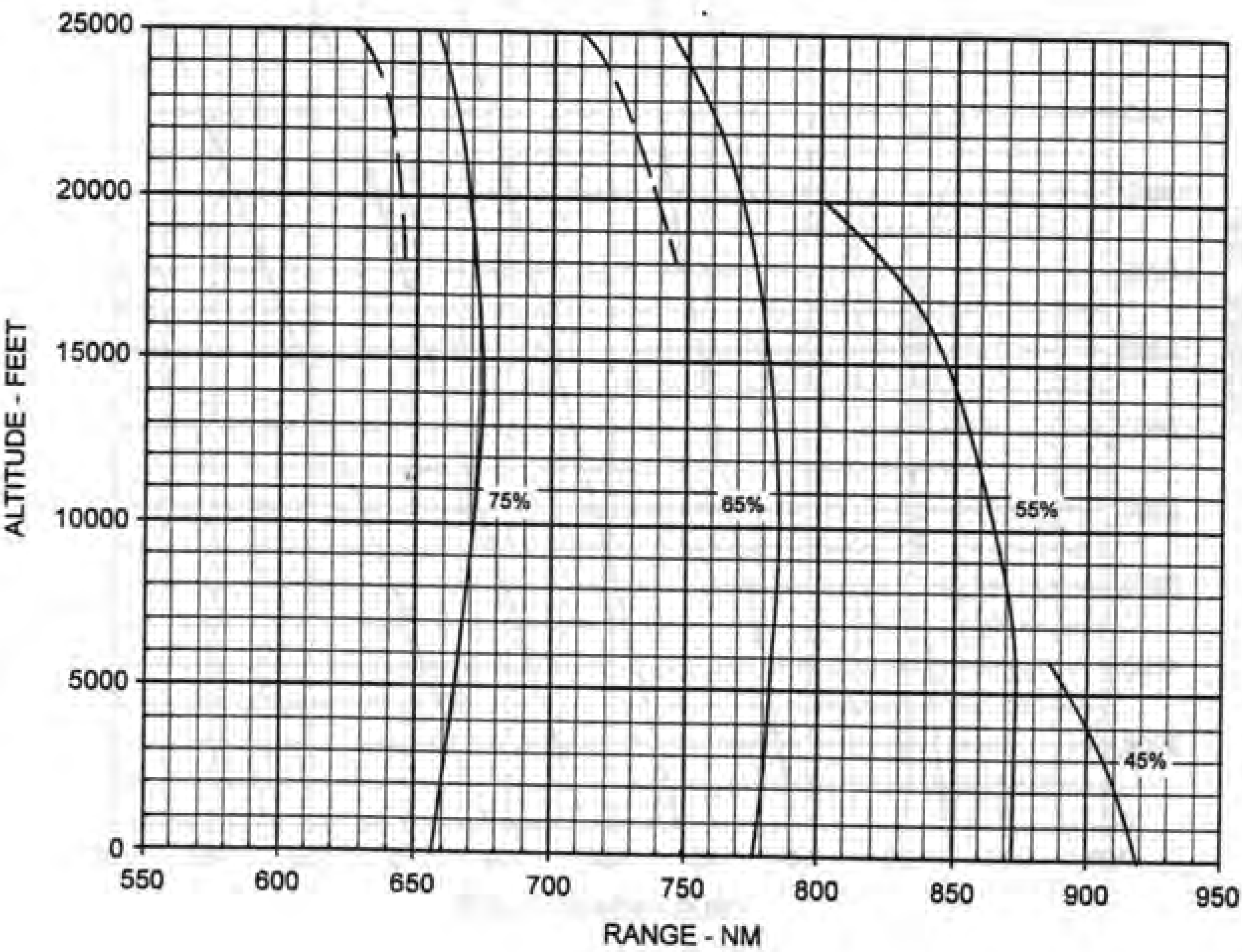


Figure 5–14

ENDURANCE PROFILE
45 MINUTES RESERVE
88 GALLONS USABLE FUEL

CONDITIONS:
3305 Lbs
1650° TIT or PTIT
Standard Atmosphere
Chart allows for fuel used for start, taxi, takeoff, climb at MCP (See Figure 5-9B), and cruise
Reserve fuel is based upon 45 minutes at cruise power.

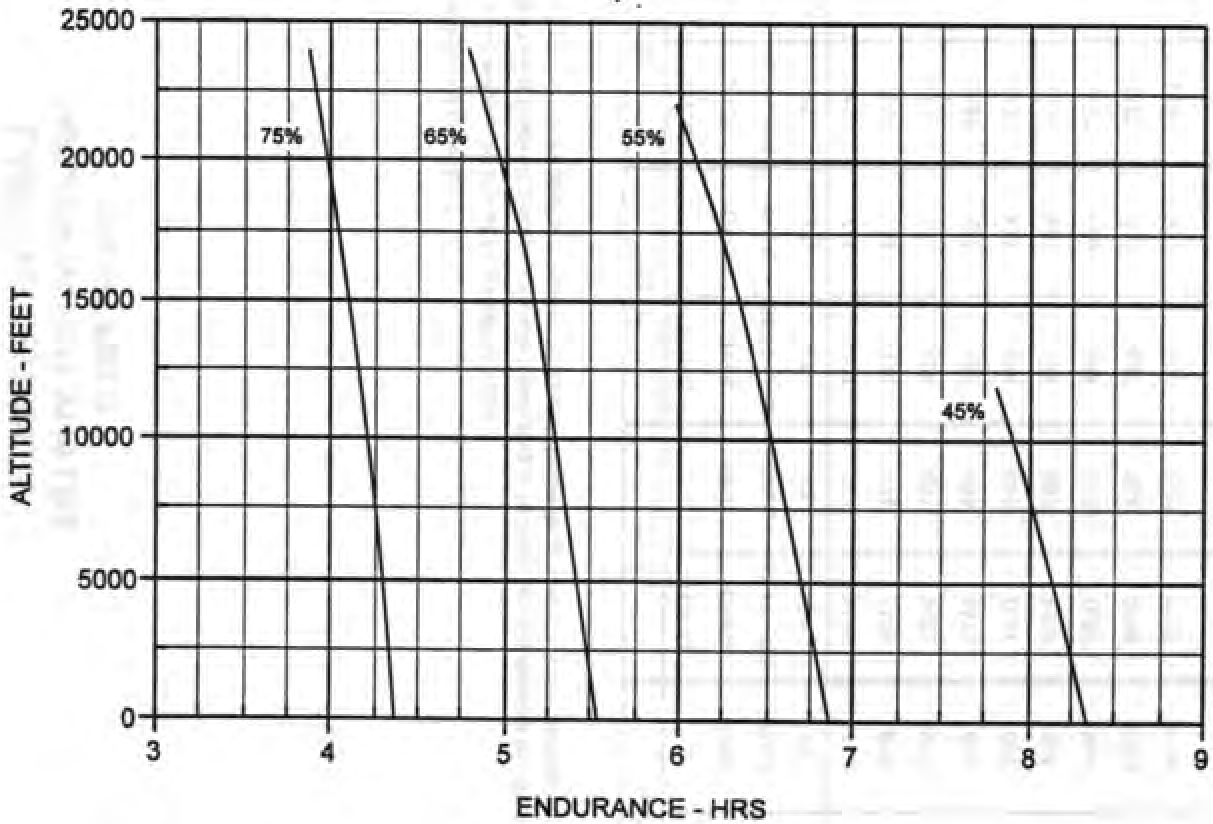


Figure 5–15

LANDING DISTANCE
MAXIMUM WEIGHT 3140 LBS
SHORT FIELD

CONDITIONS:
Flaps 35
Gear down
Throttle idle
Maximum braking
Runway paved, dry, level
Wind calm

NOTES:

1. Based on short field technique as described in Section 4.
2. For short, dry, grass runway, increase distances by 25% of the ground roll figures.
3. Decrease distances 10% for each 12 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 4 knots.
4. If a landing with flaps up is necessary, increase the approach speed by 10 KIAS and allow for at least 35% longer distances.

WEIGHT LBS	APPROACH SPEED AT 50 FT KIAS	PRESSURE ALTITUDE FT	0 °C GND ROLL FT	0 °C TOTAL OVER 50 FT OBS FT	10 °C GND ROLL FT	10 °C TOTAL OVER 50 FT OBS FT	20 °C GND ROLL FT	20 °C TOTAL OVER 50 FT OBS FT	30 °C GND ROLL FT	30 °C TOTAL OVER 50 FT OBS FT	40 °C GND ROLL FT	40 °C TOTAL OVER 50 FT OBS FT
3140	79	0	696	1253	721	1292	747	1333	772	1373	798	1414
		1000	721	1293	748	1334	774	1376	801	1419	827	1461
		2000	748	1335	776	1379	803	1422	831	1466	858	1511
		3000	776	1380	805	1425	833	1471	862	1517	890	1563
		4000	806	1426	835	1474	865	1521	894	1569	924	1618
		5000	836	1476	867	1525	897	1575	928	1625	959	1675
		6000	868	1527	900	1579	932	1631	964	1683	995	1736
		7000	902	1582	935	1636	968	1690	1001	1745	1034	1800
		8000	937	1639	971	1696	1005	1752	1040	1809	1074	1867

Figure 5–16

SECTION 6
WEIGHT AND BALANCE/EQUIPMENT LIST

TABLE OF CONTENTS Page

MODEL 114TC

EPAS 105001-503

Appendix C, Page C-1

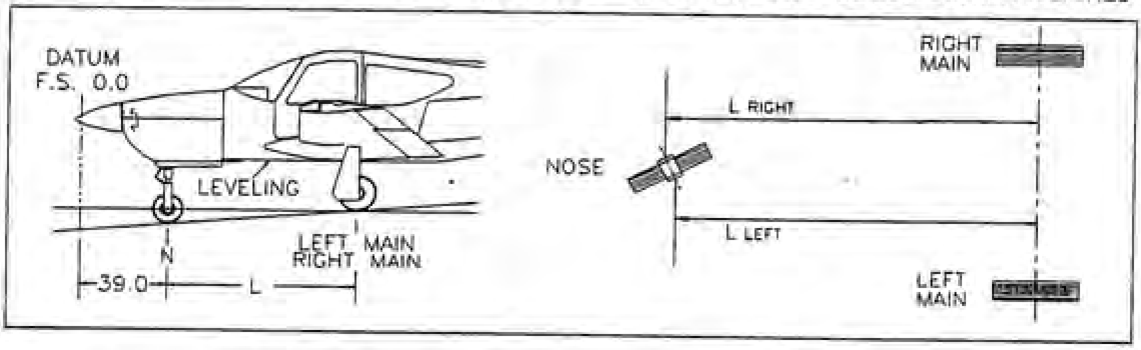
Commander
AIRCRAFT COMPANY

SERIAL NUMBER
20005

AIRPLANE WEIGHT AND BALANCE STATEMENT

AIRPLANE AS WEIGHED CONDITION:

1) FUEL = FULL 2) OIL = FULL 3)HYDRAULIC FLUID = FULL 4) AIRPLANE MUST BE LEVEL WHEN WEIGHED



WEIGHT RECORDING: REACTION		WEIGHT LBS	TARE LBS	NET WT LBS
N=NOSE WHEEL		629.0	0.0	629.0
LM=LEFT MAIN WHEEL		1074.0	0.0	1074.0
RM=RIGHT MAIN WHEEL		1065.0	0.0	1065.0
W=NET WEIGHT		2768.0	0.0	2768.0

DISTANCE FROM NOSE GEAR TO MAIN GEAR CTR LINE:		L(left) INCHES	L(right) INCHES	L INCHES
L = (Lleft+Lright)/2		81.75	81.63	81.69

CENTER OF GRAVITY CALCULATION:		D INCHES	CG INCHES
CG = D-{(N*L)/W} WHERE D = 39.00 + L		120.6875	102.12

AIRPLANE WEIGHT AND CENTER OF GRAVITY CALCULATIONS:		WEIGHT	ARM INCHES	MOMENT IN.LBS/1000
AIRPLANE AS WEIGHED ON (DATE)				
PER AIRCRAFT REV...			102.12	282.68
MINUS USABLE FU...			108.60	-57.34
BASIC EMPTY WEIG...			100.60	225.34
MINUS DRAINABLE ...			43.00	-0.80
MINUS UNDRAINABL...		-4.0	48.60	-0.19
MINUS UNUSABLE FU...		-12.0	112.20	-1.35
MINUS HYDRAULIC FL...		-3.6	137.50	-0.50
DRY EMPTY WEIGHT (AS EQUIPPED)		2201.9	101.05	222.51

Date 7-20-17 Tach. 814.3

I certify that this Aircraft Weight and Balance has been performed this date, as equipped.

New Aircraft Weight **New Aircraft Weight C.G.**

Charles Roberts AP3396294 IA

Charles Roberts

USEFUL LOAD CALCULATION:		MAX GROSS WEIGHT	BEW	USEFUL LOAD
USEFUL LOAD = MAX GROSS WEIGHT - BEW		3305.0	2240.0	1065.0

NOTE: It is the responsibility of the airplane owner and the pilot to ensure that the airplane is loaded properly. The Basic Empty Weight, Basic Empty Weight CG, and Useful Load are noted on this page for this airplane as delivered from the factory. If the airplane has been altered, refer to the latest approved Repair and Alteration Form (FAA-337) and/or Airframe Log Book for revisions to this Statement.

CAC-ENGR-020 (8-93)

SERIAL NUMBER
20005

COMMANDER AIRCRAFT COMPANY
AIRPLANE WEIGHT AND BALANCE STATEMENT

LIST OF REQUIRED EQUIPMENT
INCLUDED IN BASIC EMTPY WEIGHT

X = ITEMS INSTALLED AT TIME OF FACTORY CERTIFICATION

X	ITEM	WT (LBS)	ARM (IN.)
	1.0 PROPELLER AND ACCESSORIES		
	1.1 Propeller Assembly		
X	McCauley B3D32C419 82NHA-5	70.7	15.0
	1.2 Governor Assembly		
X	McCauley D-20309-40	2.6	24.6
	1.3 Spinner Assembly		
X	615220-501	6.5	12.0
	2.0 ENGINE AND ACCESSORIES		
	2.1 Starter		
X	Lycoming 31B21064	11.4	26.5
	2.2 Oil Cooler		
X	46194-7	2.6	51.7
	2.3 Aux. Electric Fuel Pump		
X	Weldon A8121-B	2.6	59.2
	2.4 Alternator		
X	Electrosystems ES-4024	10.7	25.0
	2.5 Oil Filter		
X	Champion CH48110	0.6	55.0
	3.0 LANDING GEAR AND BRAKES		
	3.1 Main Wheel		
X	Cleveland 40-75H (Qty 2)	12.8	122.0
	3.2 Main Wheel Tires		
X	Type III, 6.00x6, 6 Ply (Qty 2)	15.2	122.0
	3.3 Nose Wheel		
X	Cleveland 40-77	2.6	39.0
	3.4 Nose Wheel Tire		
X	Type III, 5.00x5, 6Ply	5.5	39.0
	3.5 Brake Assembly		
X	Cleveland 30-52H (Qty 2)	5.4	122.0

X	ITEM	WT (LBS)	ARM (IN.)
	4.0 ELECTRICAL EQUIPMENT		
	4.1 Voltage Regulator		
X	Electrosystems VR515G	0.5	74.5
	4.2 Battery		
	Gill G243	26.0	188.8
X	Concorde RG-24-11M	26.5	188.8
	4.3 Taxi Lights		
X	General Electric 4626 (Qty 1)	0.5	120.0
	4.4 Landing Lights		
X	General Electric 4596 (Qty 2)	1.0	95.6
	4.5 Hydraulic Power Pack		
X	795101-501	7.2	183.4
	5.0 INTERIOR EQUIPMENT		
X	5.1 Pilot's Operating Handbook and		
	Factory Supplied Documents	15.0	178.0
X	5.2 Fire Extinguisher	6.0	95.0
X	5.3 Cargo Net	1.0	178.0
	6.0 MISCELLANEOUS EQUIPMENT		
X	6.1 Heated Pitot Tube	0.4	122.6
X	6.2 Lift Detector	0.2	95.6

SERIAL NUMBER
20005

COMMANDER AIRCRAFT COMPANY
AIRPLANE WEIGHT AND BALANCE STATEMENT

LIST OF OPTIONAL EQUIPMENT
INCLUDED IN BASIC EMPTY WEIGHT

X = ITEMS INSTALLED AT TIME OF FACTORY CERTIFICATION

X	DWG No	ITEM	WT (LBS)	ARM (IN.)
		1.0 AUDIO COMPONENTS		
X	845020-501	KMA 24 AUDIO SELECTOR PANEL	1.7	77.3
	845020-503	KMA 24H AUDIO SELECTOR PANE	1.7	77.3
X	825190-503	403d STEREO INTERCOM	0.4	78.0
	825104-501	COMPACT DISC PLAYER	5.0	74.5
	825107-501	BOSE INTERFACE MODULE - L/H	0.3	86.0
	825107-501	BOSE INTERFACE MODULE - R/H	0.3	86.0
		2.0 NAV/COMM AVIONICS		
X	845045-503	KN 64 DISTANCE MEASURING EQ	2.6	75.4
	845045-501	KN 62A DISTANCE MEASURING E	2.6	75.4
	845046-501	KN 63DISTANCE MEASURING EQU	3.6	75.4
X	845110-505	KLN 90A GLOBAL POS SYS W/NA	6.3	74.4
	845110-507	KLN 90A GLOBAL POS SYS W/INT	6.3	74.4
	845110-509	KLN 90B GLOBAL POS SYS W/NA	7.1	74.4
	845110-511	KLN 90B GLOBAL POS SYS W/INT	7.1	74.4
X	845027-501	KR 87 AUTO DIRECTION FINDER	3.2	75.1
	845068-501	KNS 81 AREA NAV SYS W/GS	5.0	74.6
	845068-502	KNS 81 AREA NAV SYS W/O GS	5.0	74.6
	845067-501	KN 72 NAV CONVERTER	1.3	205.0
		3.0 VHF NAV/COMM TRNSCVR		
	845024-501	KX 155 NAV/COMM W/GS	5.3	75.2
X	845024-503	KX 155 NAV/COMM W/O GS	4.7	75.2
X	845024-507	KX 165 NAV/COMM W/GS	5.7	75.2
		4.0 VOR/LOC/GS NAV IND		
	845040-502	KI 209 NAV INDICATOR W/GS	1.2	77.1
X	845039-501	KI 208 NAV INDICATOR W/O GS	1.0	77.1
X	845034-501	KI 227-00 ADF INDICATOR W/O SY	0.7	78.6
	845034-502	KI 227-01 ADF INDICATOR W/SYN	1.8	78.6
	845042-503	KI 204 NAV INDICATOR W/O SYNC	1.7	77.0
	845025-501	KI 203 NAV INDICATOR W/O SYNC	1.6	77.0
	845050-501	ARGUS 5000 MOVING MAP DISP	4.0	76.0
	845030-501	KI 229 RMI	2.8	76.0
		5.0 ANTENNAS		
X	845010-505	NAV ANTENNA	0.4	280.0
X	845013-501	DIPLEXER/COUPLER	0.2	62.5
X	845010-501	COM #1 ANTENNA	0.5	181.7
X	845010-502	COM #2 ANTENNA	0.5	126.7
	845013-502	TRIPLEXER/COUPLER	0.5	62.5
X	845110-505	KLN 90A ANTENNA	0.6	153.6
	-509-511	KLN 90B ANTENNA	0.3	153.6
X	845015-501	ADF ANTENNA	2.8	151.8

X	DWG No	ITEM	WT (LBS)	ARM (IN.)
		6.0 INSTRUMENTS		
X	825170-501	CLOCK (DIGITAL)	0.3	80.0
X	825175-509	ALTIMETER (IN/MIL)	1.8	77.0
	825175-511	ALTIMETER (IN/ML) W/POST LT	1.9	77.0
	845031-503	ENCODING ALTIMETER	1.8	77.0
	845036-501	ATTITUDE INDICATOR	1.8	77.0
X	825160-501	VSI INDICATOR	0.7	77.5
	845056-501	IVSI INDICATOR	1.4	77.5
X	48265-507	TIT	0.5	80.0
X	825166-503	GEM W/TIT	3.0	76.0
X	845052-503	FUEL FLOW TOTALIZER (HOSKI	0.5	77.7
	845069-501	ELECTRIC GYRO	2.5	77.0
		7.0 SYSTEMS		
X	845028-501	WX 900 STORM SCOPE		
		DISPLAY	1.6	76.2
		ANTENNA	0.9	217.8
	845028-502	WX 1000 STORM SCOPE		
		DISPLAY	2.3	75.8
		PROCESSOR & TRAY	6.7	205.0
		ANTENNA	2.0	217.8
	845028-503	WX 1000+ STORM SCOPE		
		DISPLAY	2.3	75.8
		PROCESSOR & TRAY	6.7	205.0
		ANTENNA	2.0	217.8
	845074-501	STRIKE FINDER		
		DISPLAY	1.2	77.0
		ANTENNA	0.5	217.8
		8.0 TRANSPONDERS		
X	845026-501	KT 76 TRANSPONDER	3.1	74.7
X	845029-501	AT 3000 BLIND ENCODER	0.1	62.5
	845032-501	KT 70 TRANSPONDER	3.9	74.7
	845032-503	KT 71 TRANSPONDER	3.9	74.7
		9.0 MISC EQUIP		
X	845120-501	AVIONICS OVERRIDE SWITCH	0.1	78.0
X	825105-503	AVIONICS COOLING	1.4	65.5
X	865022-501	OXYGEN SYSTEM	17.9	136.0
	845070-501	SPC-5 INVERTER	3.1	193.3
X	825159-503	STARTER ENGAGE LIGHT	0.3	78.0
	865068-501	LUMBAR SUPPORT	3.0	112.0
X	175108-509	WING LANDING LIGHTS	1.0	95.6

SERIAL NUMBER
20005

LIST OF OPTIONAL EQUIPMENT
INCLUDED IN BASIC EMPTY WEIGHT (CONT'D)

X = ITEMS INSTALLED AT TIME OF FACTORY CERTIFICATION

X	DWG No	ITEM	WT (LBS)	ARM (IN.)
		10.0 FLIGHT CONTROL SYSTEM		
	845051-501	KING KFC 200 AUTO PILOT	SEE 10.1	
	845063-503	S-TEC S50 AUTO PILOT	SEE 10.2	
	845066-501	S-TEC S60 AUTO PILOT	SEE 10.3	
X	845061-501	S-TEC YAW DAMPER	SEE 10.4	
X	845073-501	S-TEC S55 AUTO PILOT	SEE 10.5	
X	845051-503	KCS 55A SLAVED HSI W/SYNC	SEE 10.6	
	845060-507	NAV TRANSFER (LORAN)	0.3	78.0
X	845060-505	NAV TRANSFER (GPS)	0.3	78.0
	845051-501	**10.1 KFC 200 AUTO PILOT**		
		PITCH & PITCH TRIM BRACKET	0.8	202.3
		ROLL BRACKET	0.8	128.5
		LOWER RADIO SHELF	3.6	193.3
		KMT 275 ROLL SERVO MOUNT	1.0	126.5
		KMT 275 PITCH SERVO MOUNT	1.0	202.3
		KMT 276 PITCH TRIM SERVO MOU	1.0	202.3
		KS 271A ROLL SERVO	2.2	128.5
		KS 270A PITCH SERVO	2.2	202.3
		KS 272A TRIM SERVO	2.2	202.3
		KC 295 AUTO PILOT COMPUTER	5.4	205.0
		KI 256 FLIGHT DIRECTOR	3.3	77.0
		KC 290 MODE CONTROLLER	0.5	80.0
		KA 285 ANNUNCIATOR	0.5	80.0
	845063-503	**10.2 S-TEC S50 AUTO PILOT**		
		PROGRAMMER/COMPUTER	2.8	76.6
		ROLL SERVO	2.9	126.0
		ROLL BRACKET	0.8	128.5
		PITCH SERVO	2.9	242.0
		TRIM SERVO	2.9	242.0
		TRANSDUCER	0.2	205.0
		PITCH & PITCH TRIM BRACKET	0.8	202.3
		DIRECTIONAL GYRO	3.4	76.0
		TURN COORDINATOR	1.6	77.2
	856066-501	**10.3 S-TEC S60 AUTO PILOT**		
		TURN COORDINATOR	1.8	77.2
		DIRECTIONAL GYRO	3.4	75.9
		ROLL SERVO	2.9	128.5
		ROLL COMPUTER	3.3	205.0
		S/CUE FLIGHT DIRECTOR	3.0	76.5
		PITCH COMPUTER	3.3	205.0
		PITCH SERVO/TRIM SNR	2.9	265.0
		ALT/VERT SPEED PRESELECT	0.5	78.5

X	DWG No	ITEM	WT (LBS)	ARM (IN.)
X	845061-501	**10.4 S-TEC YAW DAMPER**		
		S-TEC YAW DAMPER SWITCH	0.1	80.0
		YAW AMPLIFIER	0.9	249.5
		YAW SERVO	2.9	252.5
X	845073-501	**10.5 S-TEC S55 AUTO PILOT**		
		PROGRAMMER/COMPUTER	3.0	76.5
		ROLL SERVO	2.9	126.0
		ROLL BRACKET	0.8	128.5
		PITCH SERVO	2.9	242.0
		TRIM SERVO	2.9	242.0
		TRANSDUCER	0.2	205.0
		TURN COORDINATOR	1.8	77.2
		ANNUNCIATOR	0.8	77.0
		KI 256 FLIGHT DIRECTOR	3.3	77.0
		ALT/VERT SPEED PRESELECT	0.5	78.5
X	845051-503	**10.6 KCS55A SLAVED HSI W/SYNC**		
		KG 102A DIRECTIONAL GYRO	4.3	205.0
		KI 525A CRS INDICATOR	3.9	77.0
		KA 51B SLAVING ACCESSORY	0.2	80.0
		KMT 112 FLUX VALVE	0.6	240.5
		KMT 112 FLUX VALVE BRACKET	0.3	240.5
	895010-501	**11.0 MODULAR AIRCOND SYS**		
		REMOVABLE COMPONENTS		
		A/C CONDENSER/COMPRESSO	50.0	174.1
		A/C EVAPORATOR	11.5	182.8
		A/C AIR DIVIDER	1.0	192.0
		A/C PLUMBING	2.0	190.0
		NON-REMOVABLE COMPONENTS		
		ALTERNATOR #2 (130 AMP) MTG BRACKET & HDWR	23.0	25.7
		VOLT REG #2 w/BRKT	0.8	76.0
		ALT TRANS RELAY	1.6	63.3
		A/C SW PANEL & COMPONENT	0.2	80.0
		A/C WIRING	9.5	133.0
		A/C COND/COMP COVER	1.5	173.0
		A/C INTAKE DUCT	0.9	169.0
		A/C EXHAUST DUCT	5.0	200.0
		A/C EVAPORATOR SUPPORT	0.3	178.6
		A/C EVAPORATOR SUPPORT	0.1	186.0
		A/C DUCTS	2.5	172.5
		INTERIOR PIECES	5.0	178.0
		OVERHEAD PIECE	1.0	165.5

MODEL 114TC

EPAS 105001-503

Appendix C, Page C-1

Commander
AIRCRAFT COMPANY

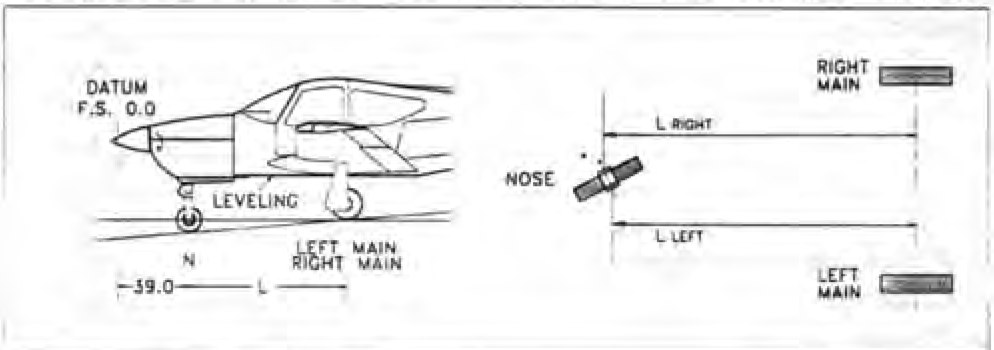
SERIAL NUMBER
05

BEW= 2240

AIRPLANE WEIGHT AND BALANCE STATEMENT

AIRPLANE AS WEIGHED CONDITION:

1) FUEL = FULL 2) OIL = FULL 3)HYDRAULIC FLUID = FULL 4) AIRPLANE MUST BE LEVEL WHEN WEIGHED



WEIGHT RECORDING: REACTION	WEIGHT LBS	TARE LBS	NET WT LBS
N=NOSE WHEEL			
LM=LEFT MAIN WHEEL			
RM=RIGHT MAIN WHEEL			
W=NET WEIGHT			

DISTANCE FROM NOSE GEAR TO MAIN GEAR CTR LINE:	L(left) INCHES	L(right) INCHES	L INCHES
L = (Lleft+Lright)/2			

CENTER OF GRAVITY CALCULATION:	D INCHES		CG INCHES
CG = D-((N*L)/W) WHERE D = 39.00 + L			

AIRPLANE WEIGHT AND CENTER OF GRAVITY CALCULATIONS:	WEIGHT LBS	ARM INCHES	MOMENT IN.LBS/1000
AIRPLANE AS WEIGHED ON __________ (DATE) **PER AIRCRAFT ORDER REV __________**			
MINUS USABLE FUEL	-528.0	108.60	-57.34
BASIC EMPTY WEIGHT(BEW)			
MINUS DRAINABLE OIL	-18.5	43.00	-0.80
MINUS UNDRAINABLE OIL	-4.0	48.60	-0.19
MINUS UNUSABLE FUEL	-12.0	112.20	-1.35
MINUS HYDRAULIC FLUID	-3.6	137.50	-0.50
DRY EMPTY WEIGHT (AS EQUIPPED)			

USEFUL LOAD CALCULATION:	MAX GROSS WEIGHT	BEW	USEFUL LOAD
USEFUL LOAD = MAX GROSS WEIGHT - BEW	3305.0		

NOTE: It is the responsibility of the airplane owner and the pilot to ensure that the airplane is loaded properly. The Basic Empty Weight, Basic Empty Weight CG, and Useful Load are noted on this page for this airplane as delivered from the factory. If the airplane has been altered, refer to the latest approved Repair and Alteration Form(FAA-337) and/or Airframe Log Book for revisions to this Statement.

Figure 6-1

INTRODUCTION

This section provides procedures for establishing the airplane's basic empty weight and center of gravity (C.G.). A sample Airplane Weighing form, Figure 6-1, is included.

In addition, a Weight and Balance Record, Figure 6-2, is included for use in keeping track of changes to the airplane which affect weight and balance (such as the removal or installation of optional equipment).

A discussion of the procedures the pilot must use to determine that the weight and balance of the airplane is within safe limits for every flight is provided. A Sample Loading example, Figure 6-3, is included to illustrate the process with blanks on the form to allow the pilot to calculate loadings for his specific airplane.

WARNING

The airplane must not be operated in violation of its approved weight and balance limitations to assure safe flying qualities and structural margins.

Finally, a separate Weight and Balance Statement is provided with each aircraft at the time of delivery from the factory to define the basic empty weight and a list of the installed equipment included in that weight for each specific airplane. This Statement may be inserted at the end of this section to keep all weight and balance information handy to the pilot.

AIRPLANE WEIGHING PROCEDURES

It will be necessary to weigh and balance the airplane on occasion to keep the basic empty weight accurate. The following procedures may be used.

AIRPLANE CONFIGURATION

Configure the airplane as follows:

1. Oil - service the oil to obtain a full dipstick reading (10 quarts). Total engine oil is 18.7 pounds at a fuselage station of 43.0 inches. Undrainable oil is 4.5 pounds at F.S. 48.6.
2. Fuel - aircraft should be weighed with full fuel.
3. Hydraulic Fluid - service the brake and landing gear hydraulic fluid to a full level.
4. Wing flaps - retract (0°).
5. Doors - all doors must be closed.
6. Parking Brake - release the parking brake.
7. Control Lock - insert control lock. Remove any external gust locks.

AIRPLANE WEIGHING PROCEDURES (con't)

8. Front Seats - position both front seats in the 7th position from the front with seat backs fully erect.
9. Installed Equipment - all equipment should be checked against the airplane equipment list and/or superceding forms. All equipment must be in its proper location during weighing.

SCALES

Scale criteria are:

1. Capacity - Each main wheel - at least 1200 pound capacity. Nose wheel - at least 700 pound capacity.
2. Calibration - the scales should be properly calibrated and certified.
3. Location - weighing should be accomplished in an enclosed area which is free of air currents.

LEVELING

Leveling must be accomplished as follows after scales are in place under each wheel:

1. Lateral - place a spirit level (or other type) across the lower outside surface of the fuselage between fuselage stations 62.5 and 97.6. Deflate the tire or strut on the high side of the airplane as needed for a level indication.
2. Longitudinal - place a spirit level along the lower fuselage between fuselage stations 62.5 and 97.6 in a fore and aft direction. Deflate/inflate the nose tire or strut as needed for a level indication.

MEASUREMENTS

Measure the distance between the main and nose gears after the airplane has been leveled as follows:

1. Stretch a line between the centers of the main gear (from the centerline of the left axle to the centerline of the right axle).
2. Measure directly fore and aft parallel to the airplane centerline from the taut line to each side of the nose wheel axle centerline. Average these two measurements to obtain the measurement, ("L" shown on Figure 6-1).

WEIGHING

With the airplane still level, record wheel weights as follows:

1. Record the three scale readings in the blocks provided on Figure 6-1, the Airplane Weighing form.
2. Record any scale indication error and/or tare in the applicable tare blocks on the form.
3. Subtract any tare and add/subtract any scale error to/from the scale readings to obtain the net wheel weights, LM, RM, and N. Total these three weights to obtain the **Total Net Weight,** W.

AIRPLANE WEIGHING PROCEDURES (con't)

CENTER OF GRAVITY

Determine center of gravity as follows:

1. Add measurement L, the wheel distance, to 39, the fuselage station of the intersection of the nose wheel axle centerline and the fuselage centerline vertical plane. This defines the fuselage station, and arm, of the main wheel axle centerline and is entered as "D" on Figure 6-1.

> NOTE
> All measurements should be in inches.

2. As shown on Figure 6-1, insert the applicable values and solve the resulting equation as follows:

$$\text{As weighed C.G.} = D - [(N \times L) / W]$$

where,

L = longitudinal distance between main and nose gears, in inches
N = nose gear weight, lbs.
W = total net weight, lbs.

BASIC EMPTY WEIGHT AND BASIC EMPTY C.G.

1. To obtain the Basic Empty Weight and C.G., subract the total usable fuel weight from the total net weight to determine the **Basic Empty Weight (BEW)**. Subtract the Moment of the usable fuel from the Aircraft Moment. Divide this moment by the BEW to obtain the **Basic Empty C.G.**

2. As shown in Figure 6-1, solve the resulting equation as follows:

$$\text{Basic Empty C.G.} = (W \times \text{Arm}) / 1000$$

where,

W = total net weight, lbs.
Arm = C.G.

WEIGHT AND BALANCE RECORD

At the time of initial aircraft delivery, Commander Aircraft Company provides the weight and balance data necessary to compute individual loadings. If changes in equipment are made subsequently, corresponding changes must be made in the weight and balance data to reflect the new basic empty weight and balance.

WEIGHT AND BALANCE RECORD

AIRPLANE MODEL				SERIAL NUMBER				PAGE NUMBER			
DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						RUNNING BASIC EMPTY WEIGHT	
				ADDED (+)			REMOVED (-)				
	IN	OUT		WT. (lbs)	ARM (in)	MOMENT /1000	WT. (lbs)	ARM (in)	MOMENT /1000	WT. (lbs)	MOMENT /1000

Figure 6-2

Figure 6-2, Weight and Balance Record, may be used to keep a running record of weight and balance changes handy for pilot reference in computing individual flight loadings.

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

> **WARNING**
>
> **To assure safe stability, control, performance, and structural margins, the pilot must control all flight loadings to remain within the approved weight and balance limits.**

This section will discuss procedures which may be used by the pilot to confirm that a satisfactory loading exists for his planned flight. Figure 6-3, Weight and Balance Calculation, illustrates a weight and balance calculation for a typical flight in a typical airplane. The figure also includes a blank form which may be used by the pilot for his planned flight. A few key items are discussed below:

Item 1. Basic Empty Weight - This information will come from the current weight and balance data for the airplane. If the Weight and Balance Record, Figure 6-2, has been kept up to date, the latest entry should be the current basic empty weight and balance.

Items 2 & 3. Pilot and Front Passenger - Determine the weights of the pilot and front seat passenger for the flight. Using the Loading Graph, Figure 6-4, determine the applicable moments.

> NOTE
>
> The moment values shown for the pilot and front passenger on Figure 6-4 are based on a nominal front seat fuselage station location of 99 inches. If the seats are to be located differently the moment can be determined as follows:

a. Approximate the front seat location with respect to the range of locations as shown in the Cabin Station Diagram, Figure 6-5.

b. The moment is determined by multiplying the occupant weight by the seat station.

> NOTE
>
> The moment values shown for rear seat passengers and baggage on Figure 6-4 are based on a fixed location. See Figure 6-5.

Items 4 & 5. Rear Seat Passengers - Determine the weights of the rear seat occupants for the flight. Using the Loading Graph, Figure 6-4, determine the applicable moments.

Item 6. Baggage - Determine the weight of baggage to be carried on the flight. If the baggage is secured centrally in the baggage area (F.S. 164), use the Loading Graph, Figure 6-4, to determine the moment. If, however, baggage is carried elsewhere in the cabin or baggage compartment the moment should be determined by multiplying the weight of the item by its location. All of the baggage weights and moments should then be summed and entered on the calculation form.

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (con't)

ZERO FUEL WEIGHT AND BALANCE - Add the Weight and Moment columns to obtain the zero fuel weight and moment values for the planned flight. If desired, the zero fuel C.G. location may be determined by dividing the moment total by the weight total. These values should be compared to the zero fuel limits as shown in the Approved Flight Envelope, Figure 6-6. Any weight to be carried in excess of the limiting zero fuel weight at any C.G. must be in the form of fuel. If the calculations at this point show that the zero fuel limits have been exceeded, the load **must** be redistributed or removed to stay within limits.

Item 7. Fuel - Determine the fuel required for the flight. Refer to the Loading Graph, Figure 6-4, to determine the fuel moment.

> NOTE
>
> Maximum gross weight limits may limit the amount of fuel that can be carried.

TAKEOFF WEIGHT AND BALANCE - The takeoff C.G. location can be determined by dividing the takeoff moment by the takeoff weight. These values should be compared to the takeoff limits as shown in the Approved Flight Envelope, Figure 6-6. If takeoff limits are exceeded, the load **must** be redistributed or reduced as applicable to remain within limits.

> WARNING
>
> **Takeoffs with the weight and/or moment outside the flight or zero fuel limits are prohibited.**

Item 8. Estimated Fuel to Destination - From preflight trip planning material, enter the estimated trip fuel weight (6 lbs/gal) and moment as read from the Loading Graph, Figure 6-4. Alternatively determine the moment by multiplying the fuel weight by the fuel station of 108.6 inches.

LANDING WEIGHT AND BALANCE - Subtract the trip fuel weight and moment estimates from the takeoff weight and moment totals. The landing C.G. location can be determined by dividing the landing moment by the landing weight. These values should be compared to the landing limits as shown in the Approved Flight Envelope, Figure 6-6. If landing limits are forecast to be exceeded, the load must be redistributed or additional fuel must be consumed prior to landing as applicable.

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (con't)

CAUTION
Approximately 27.5 gal of fuel must be consumed following a full fuel maximum gross weight departure prior to landing to assure full compliance with the maximum landing weight limitations.

$M \div WT = C.G.$

WEIGHT AND BALANCE CALCULATION

ITEM	TYPICAL AIRPLANE		
	WEIGHT (lbs)	ARM (in)	MOMENT (in lbs/1000)
1. Basic Empty Weight	2245	102.50	230.11
2. Pilot	185	99.00	18.32
3. Front Passenger	150	102.00	15.30
4. Aft Passenger	115	136.00	15.64
5. Aft Passenger	110	136.00	14.96
6. Baggage	125	164.00	20.50
*ZERO FUEL WEIGHT & BALANCE	2930	107.45	314.83
7. Fuel - 62 gal usable	372	108.60	40.40
****TAKEOFF WEIGHT AND BALANCE**	3302	107.58	355.23
8 Estimated Fuel To Destination - (45 gal)	-270	108.60	-29.32
*****LANDING WEIGHT AND BALANCE**	3032	107.49	325.91

* Notes - See Sheet 2 of this figure all notes.

Figure 6-3, Sheet 1

WEIGHT AND BALANCE CALCULATION

ITEM	YOUR AIRPLANE		
	WEIGHT (lbs)	ARM (in)	MOMENT (in lbs/1000)
1. Basic Empty Weight	2240	100.60	225.34
2. Pilot			
3. Front Passenger			
4. Aft Passenger			
5. Aft Passenger			
6. Baggage			
*ZERO FUEL WEIGHT & BALANCE	2201.9	101.05	222.51
7. Fuel - ___ gal usable			
**TAKEOFF WEIGHT AND BALANCE			
8. Estimated Fuel To Destination - (___ gal)			
***LANDING WEIGHT AND BALANCE			

NOTES ON WEIGHT & BALANCE CALCULATION

* The zero fuel weight and balance must be compared to the zero fuel limits as shown on Figure 6-6. In this example all limits are met.

** The takeoff weight and balance must be compared to the takeoff limits as shown on Figure 6-6. In this example all limits are met.

*** The landing weight and balance must be compared to the landing limits as shown on Figure 6-6. In this example all limits are met.

Figure 6-3, Sheet 2

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (con't)

LOADING GRAPH

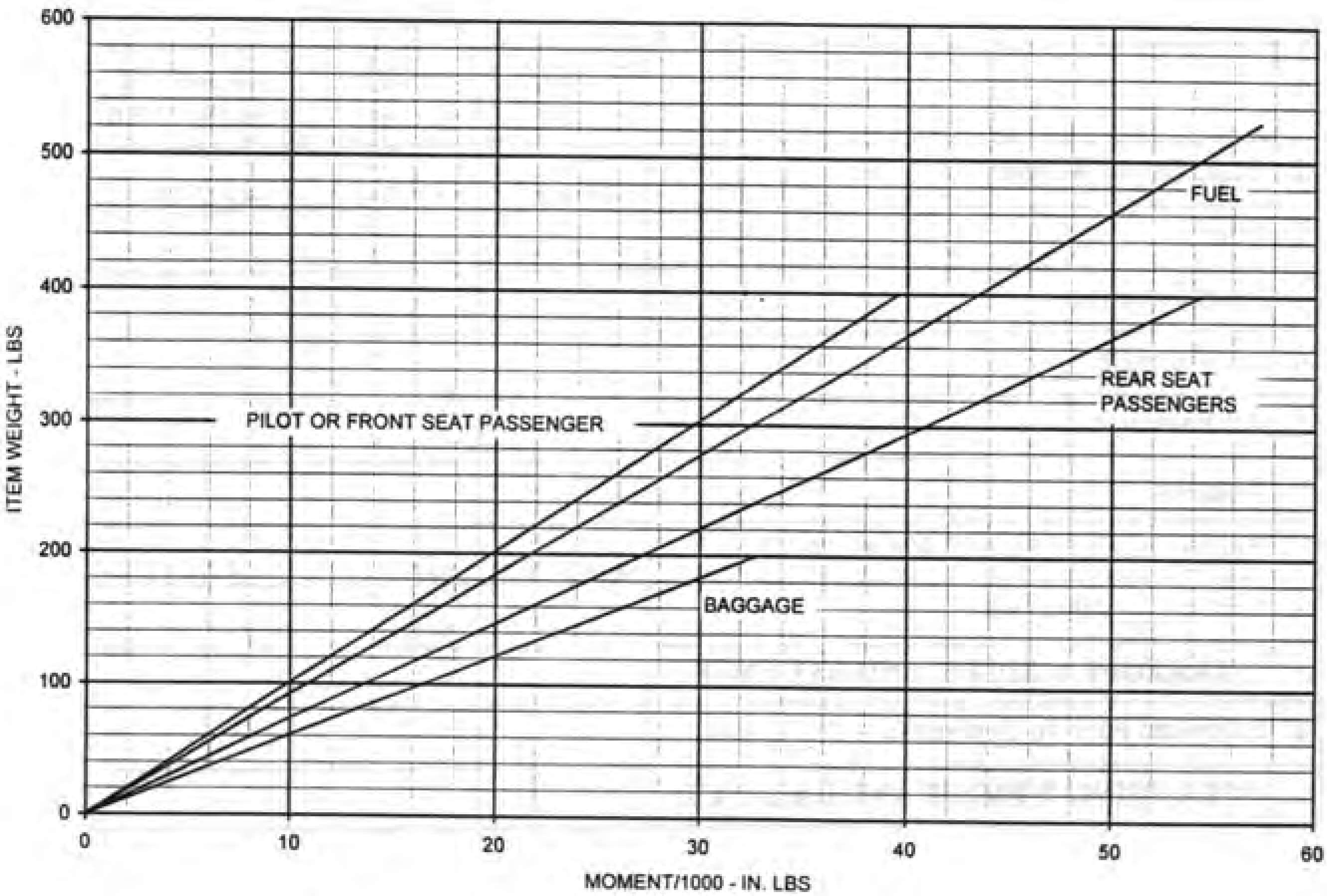


Figure 6-4

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (con't)

CABIN STATION DIAGRAM

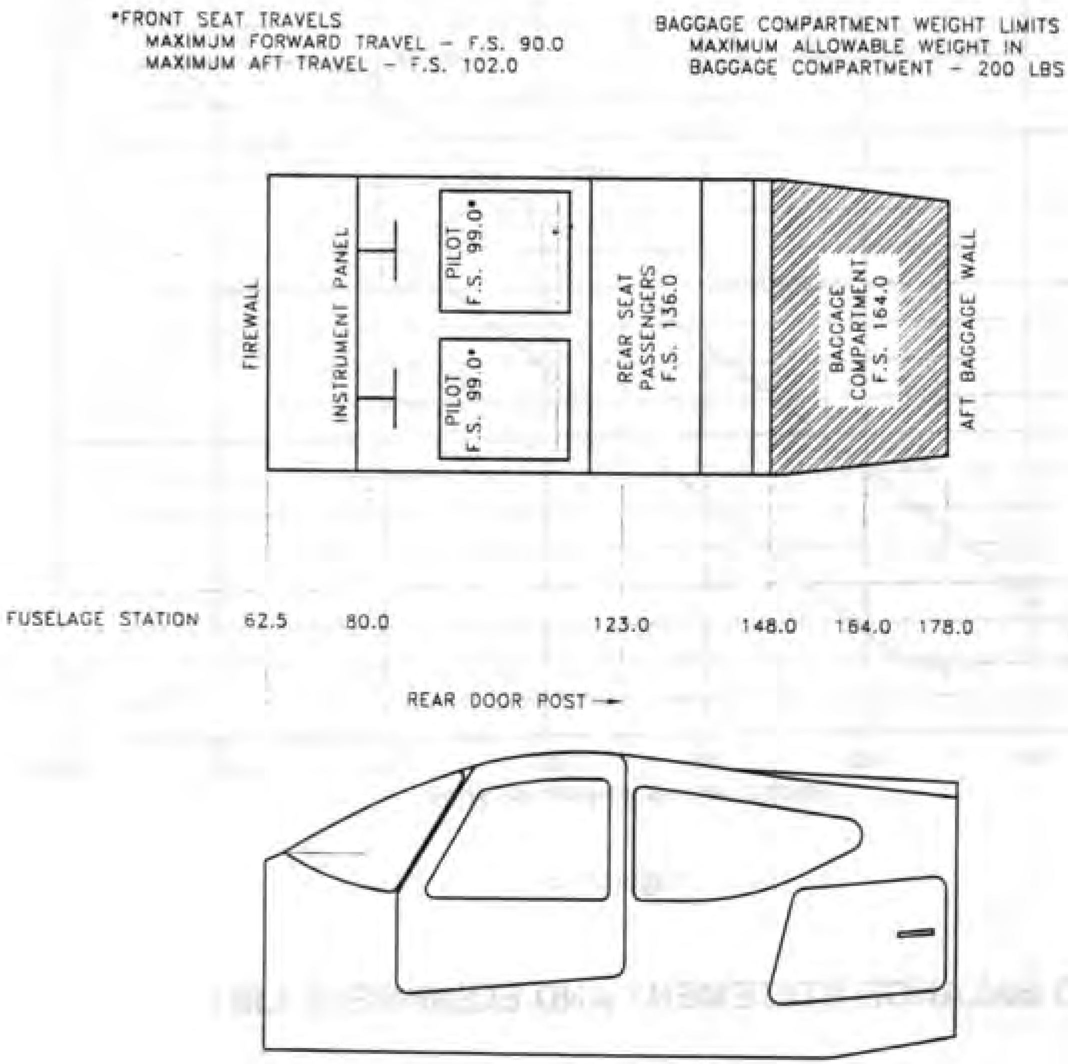


Figure 6-5

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (con't)

APPROVED FLIGHT ENVELOPE

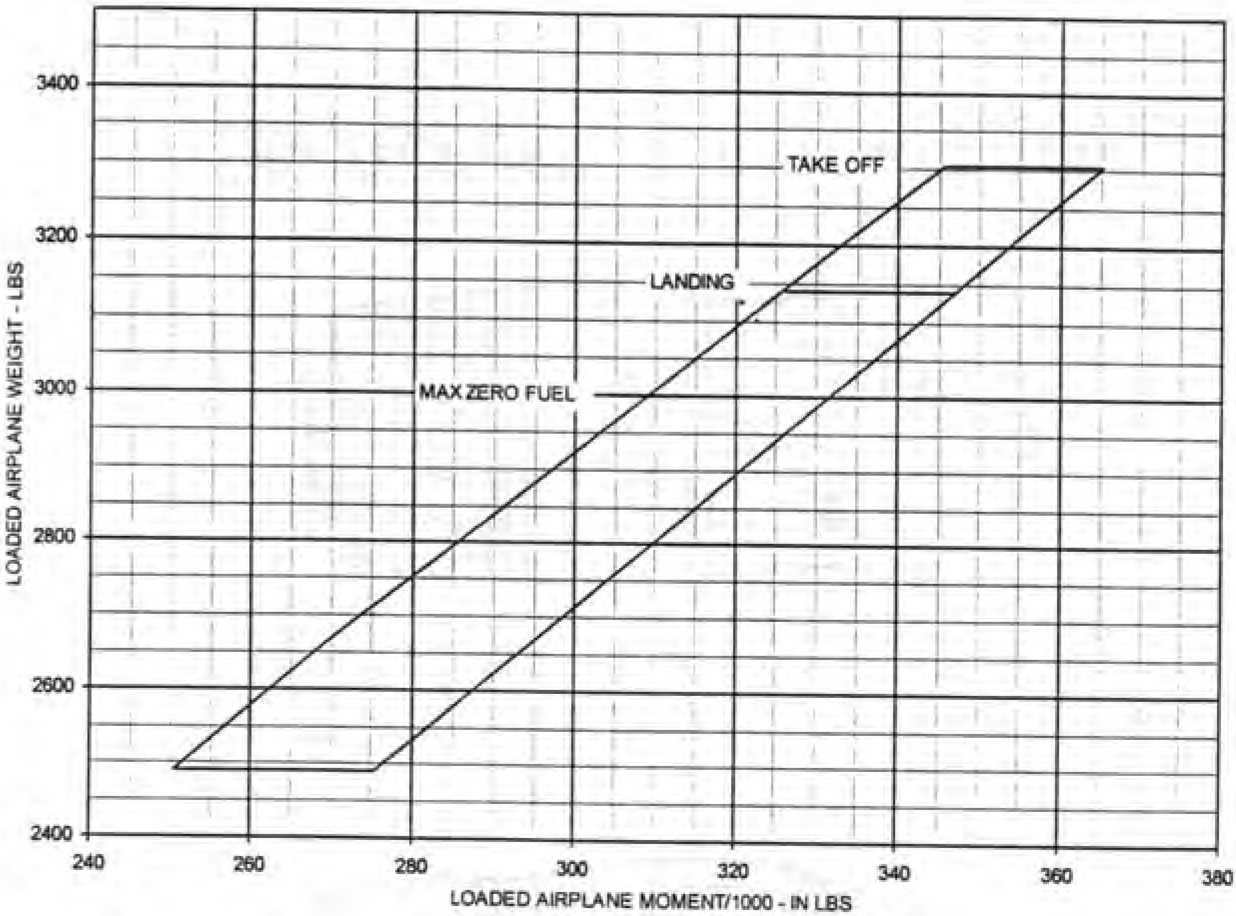


Figure 6-6

WEIGHT AND BALANCE STATEMENT AND EQUIPMENT LIST

The Weight and Balance Statement, which includes a list of equipment initially installed in the airplane, furnished with each aircraft may be inserted following this page.

SECTION 7
AIRPLANE AND SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

Page

TABLE OF CONTENTS

Page

INTRODUCTION

This section provides a description of the airplane and its systems. Additional systems and equipment descriptions are provided in the specific supplements of Section 9.

GENERAL

The Model 114TC is a four place, low wing, all-metal, retractable gear airplane powered by a six cylinder, turbocharged, fuel injected Lycoming engine that is equipped with a McCauley all-metal three blade, constant speed propeller. Access to the cabin is through two lockable cabin doors, one on each side of the airplane and a lockable baggage door on the left side of the fuselage. The cabin interior is provided with four seats. The airplane is equipped with a retractable tricycle landing gear system and incorporates a steerable nose wheel and toe-operated hydraulic disc brakes.

AIRFRAME

FUSELAGE

The fuselage consists of the nose section, center section and aft section. The nose section, extending from fuselage station 22.00 to 62.50, houses the powerplant and retractable nose landing gear. Nose landing gear doors, which open and close as the gear is extended or retracted, form an aerodynamically smooth nose section during flight. The nose section is joined to the center fuselage section at fuselage station 62.50, which is also the location of the engine firewall. The center fuselage, which contains the main cabin area and baggage compartment, extends from fuselage station 62.50 to 178.00 where it is jointed to the aft fuselage section. The center fuselage section houses the seats for pilot and three passengers, and has two doors that afford access to the airplane from either side. The pilot area is equipped with a wide-vision windshield and large door windows. The aft fuselage section, extending from fuselage station 178.00 to 263.00, is permanently secured to the center fuselage section and provides structural attachment points for the empennage flight surfaces and controls. This section houses the battery, hydraulic power pack unit and various control surface cables. Aluminum flooring supported by longitudinal beams and bulkheads extends from the firewall aft through the baggage compartment. The center wing structure is attached to the fuselage so that a part of the wing torque is absorbed by the fuselage structure. The aft tailcone is capped by a stinger containing mounts for a tail navigation light and strobe light. A tail tie-down ring is mounted in the ventral fin portion of the tailcone closeout fairing.

WINGS

Each wing is of all-metal stressed-skin construction incorporating spars, formed ribs and an integral fuel tank contained in a five-rib section, forward of the main spar. The main spar of each wing is joined together at the center of the fuselage with spar cap splices. The wing is installed in the lower center fuselage section. It is secured to the fuselage load-bearing frames and fittings by bolts and nuts at stations 85.00, 123.00 and forward of station 148.00. Access plates located at various points on the lower skin of the wing provide access for inspection and repair of the fuel system and the flight control

AIRFRAME (con't)

cabling. Landing gear fitting/retraction mechanisms are installed in the basic wing structure to provide attach points for the main landing gear. An opening in the inboard leading edge of each wing serves as a ram air intake for the lower cabin ventilation system. An electrically operated wing flap is installed between the fuselage and aileron on each wing. The flaps are attached to the aft wing spar by hinge assemblies. Metal ailerons, extending outboard from the flaps to wing station 189.00, are attached to the aft wing spar by hinge assemblies.

EMPENNAGE

The empennage consists of the vertical and horizontal stabilizers, rudder, and elevators. The vertical fin assembly is made of two separate components; an upper assembly which is mated at the horizontal stabilizer, and a lower stub assembly which is integral with the aft tailcone structure. A rudder control surface is attached to the vertical stabilizer at two hinge points. A fin cap contains provisions for mounting the VHF navigation antenna and enclosing the flashing beacon. A flush air intake on the right side of the dorsal fin provides air for in-flight cabin ventilation. The horizontal stabilizer, consisting of a fixed stabilizer and movable elevator surface, is attached to the lower vertical stabilizer stub assembly. The horizontal and vertical stabilizers utilize stressed and beaded skin construction to provide maximum strength with minimum structural components. The horizontal tail is of single unit construction with a fixed forward surface and a hinged elevator control surface. The elevator provides mounting attachment for a tip-fairing at each outboard end for streamlined appearance.

FLIGHT CONTROLS

AILERON CONTROL SYSTEM

The aileron control wheels are mechanically interconnected through a series of control chains, sprockets and cables. Control cables extend aft from the control column passing under the floor structure and through idler pulleys to a bracket assembly. The cables are then routed through the bracket assembly and out through the wing to the aileron bellcranks. Adjustable push-pull rods connect the aileron bellcranks to the ailerons. An aileron balance assembly is mounted on the outboard end of each aileron. The aileron and rudder control systems are interconnected by springs, providing improved stability.

AILERON TRIM TAB

A fixed-position trim tab is attached to the left aileron. A right wing heavy condition may be corrected by bending the trim tab down. Bending the tab up will correct a left wing heavy condition. Use forming block when bending tab, and do not bend more than 20° in either direction.

FLIGHT CONTROLS (con't)

ELEVATOR CONTROL SYSTEM

The elevator is of all metal construction. It consists of two segments connected by a torque tube and is attached to the aft spar of the horizontal stabilizer. Each segment has three hinge points. The elevators are operated by the fore and aft movement of the control column. Elevator arms, attached to the control column in the console tunnel, are connected to the control cables which are routed through a series of pulleys to the elevator bellcrank. The bellcrank is connected to the elevator horn with a push-pull rod. When the control wheel is moved forward or aft, the cables move in opposite directions, turning the bellcrank, which in turn pushes or pulls the control rod, causing the elevators to move up or down. Two turnbuckles, installed in the elevator control system between fuselage stations 205.00 and 230.50, permit control cable tension adjustment.

ELEVATOR TRIM SYSTEM

Controllable trim tabs, located on the inboard trailing edge of each elevator segment, are operated by an elevator trim tab control wheel installed in the center console. A portion of the trim tab control wheel extends through the center console, and when rotated, actuates the trim tab through a mechanical linkage consisting of cables, chains, jackscrew assembly and push rods that attach to the trim tab. Turnbuckles are utilized for rigging and adjusting cable tensions. An indicator strip, visible through a slot in the console, indicates neutral, nose up or nose down positions. Rotating the wheel forward, toward the nose-down indicator will provide nose down trim; rotation in the opposite direction produces nose-up trim. As the elevator is moved up and down, the position of the tabs changes in a trailing edge up or down direction respectively for improved longitudinal stability.

RUDDER CONTROL SYSTEM

Dual rudder-brake control pedals enable the pilot or co-pilot to control the rudder, brakes, and nose wheel steering. The rudder control system consists of mechanical linkage and cables connecting the rudder pedals to the rudder. The rudder pedals are connected to rudder bars, which in turn are connected to the rudder bellcrank with push-pull rods. Cables are attached to the bell crank and are routed aft through a series of pulleys to the rudder horn. When force is applied to one rudder pedal, the cables move in opposite directions, turning the rudder horn and rudder. The pedals are connected to the nose wheel steering system with cables and bungee assemblies which act as return springs for the rudder pedals. The rudder pedals are interconnected to the aileron controls as outlined in the aileron control system for improved lateral stability.

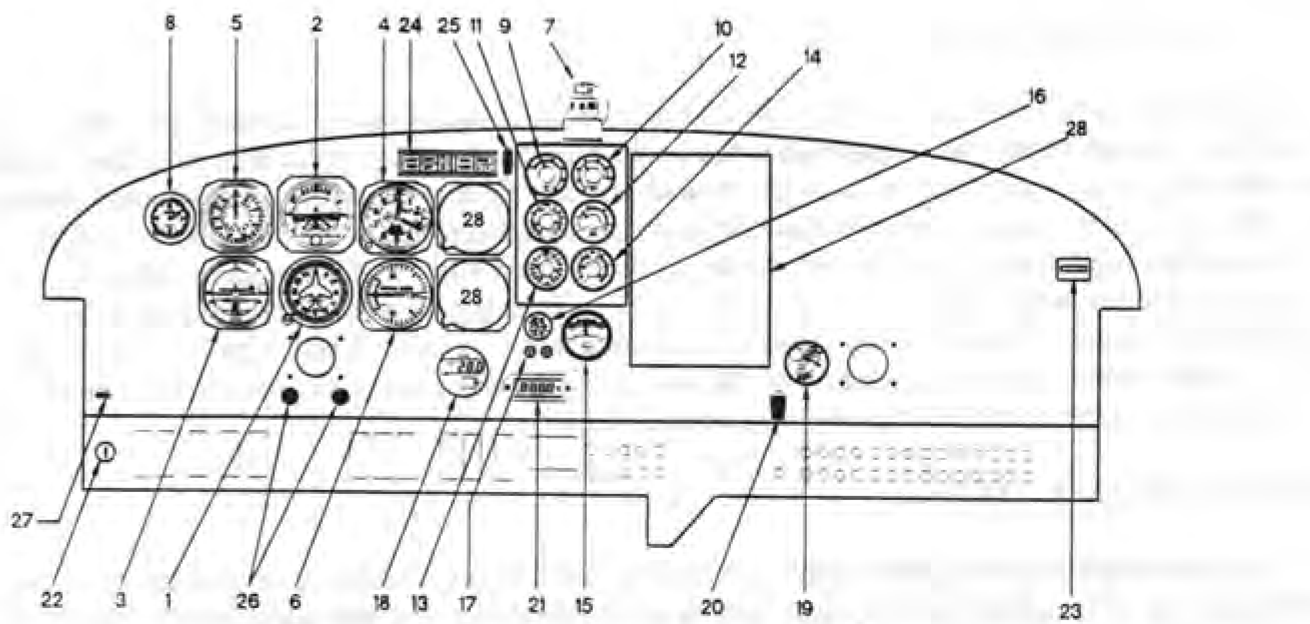
RUDDER TRIM SYSTEM

A rudder trim control knob, labeled RUDDER TRIM is mounted to the left of the console, below the lower edge of the instrument panel, and provides manual control of trim around the vertical axis. Directional trimming results from the inputs to the rudder control system of the rudder trim bungee spring which is biased by the position of the trim knob. Rotation of knob clockwise will yaw the airplane to the right, opposite rotation will yaw the airplane to the left. An indicator is incorporated in the switch panel above the trim knob to indicate rudder trim position

INSTRUMENT PANEL

The instrument panel (see Figure 7-1) is designed around the basic "Tee" configuration. The gyros are located immediately in front of the pilot in a vertical array. The airspeed indicator and altimeter are located to the left and right, respectively, of the upper gyro. The remainder of the flight instruments are grouped conventionally around the "Tee". Power instrumentation is mounted on a separate subpanel immediately to the right of the flight instruments. All power instruments are two inch electric gages. Avionics occupy the center area of the panel. Main electrical system control switches are at the left end of the lower switch subpanel. Circuit breaker switches to control various items of electrical equipment are arrayed across the switch subpanel in front of the pilot. Circuit breakers continue across this panel to the right side (See Figure 7-2).

INSTRUMENT PANEL



FLIGHT INSTRUMENTS

1. DIRECTIONAL GYRO
2. ATTITUDE GYRO
3. TURN COORDINATOR
4. ALTIMETER GAGE
5. AIRSPEED INDICATOR
6. VERTICAL SPEED INDICATOR
7. MAGNETIC COMPASS
8. CLOCK

ENGINE INSTRUMENTS

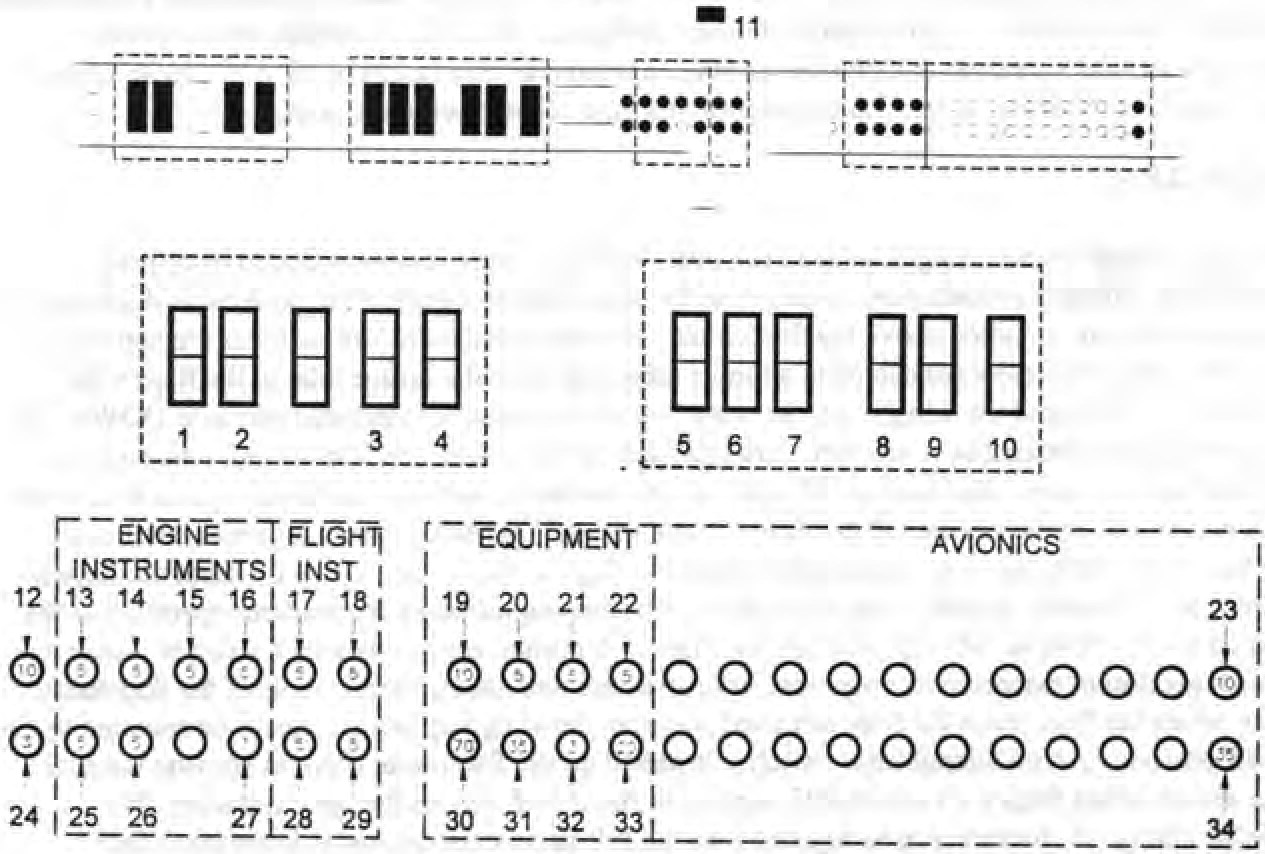
9. MANIFOLD PRESSURE
10. TACHOMETER INDICATOR
11. FUEL FLOW/FUEL PRESSURE INDICATOR
12. CYLINDER HEAD TEMPERATURE INDICATOR
13. FUEL QUANTITY INDICATORS
14. OIL PRESSURE/OIL TEMPERATURE INDICATOR

OTHER

15. TURBINE INLET TEMPERATURE INDICATOR
16. SUCTION GAGE
17. VACUUM INDICATORS
18. VOLT/AMP INDICATOR
19. FLAP POSITION INDICATOR
20. FLAP SWITCH
21. FUEL TOTALIZER
22. IGNITION SWITCH
23. ENGINE HOUR METER
24. ANNUNCIATOR PANEL
25. LANDING GEAR SWITCH
26. PANEL LIGHTING CONTROL
27. ALTERNATE STATIC SOURCE SWITCH
28. OPTIONAL AVIONICS

Figure 7-1

SUB PANEL



SWITCHES

1. BATTERY MASTER
2. ALTERNATOR MASTER
3. PITOT HEATER
4. PANEL LIGHTS
5. ANTI-COLLISION LIGHTS
6. POSITION LIGHTS
7. BEACON LIGHT
8. TAXI LIGHT
9. LANDING LIGHT
10. AUX FUEL PUMP
11. AVIONICS MASTER /ENERGY SAVER

CIRCUIT BREAKERS

12. START SWITCH
13. MANIFOLD PRESSURE
14. TACHOMETER
15. FUEL QUANTITY
16. OIL PRESSURE/TEMP

CIRCUIT BREAKERS (CON'T)

17. TURN COORDINATOR #1
18. ATTITUDE GYRO #2
19. VOLTAGE REGULATOR
20. GEAR WARNING LIGHTS AND HORN
21. STALL WARNING
22. INTERIOR LIGHTS
23. ENERGY SAVER
24. COWL FLAP
25. FUEL FLOW/PRESSURE
26. CYLINDER HEAD TEMPERATURE
27. FUEL TOTALIZER
28. TURN COORDINATOR #2
29. FLAP POSITION
30. ALTERNATOR
31. GEAR MOTOR
32. GEAR SWITCH AND RELAY
33. FLAP MOTOR
34. AVIONICS MASTER

Figure 7-2

GROUND CONTROL

The nose wheel steering system is tied in with the rudder trim system and is controlled by movement of the rudder/brake pedals. A combination of cables, bungees, bellcranks, turnbuckles and pulleys operate the nose wheel steering and give the airplane a minimum turn radius of 28' 5.5". Nose wheel steering limit is ± 30° from center. Do not exceed this limit when towing the airplane.

WING FLAPS

Long span single slotted wing flaps are provided. Wing flap position is controlled by a three-position switch mounted immediately to the left of the right control wheel. Flap position is displayed on an electrical indicator mounted above the flap switch. Power from the electric motor is transmitted to the flaps through a jackscrew connected to a torque tube, and from the torque tube to the flaps with push-pull rods. To extend the wing flaps, the wing flap switch must be depressed and held DOWN until the desired degree of extension is reached. After the desired flap extension is obtained, releasing the switch allows it to return to the center OFF position. When flap retraction is necessary, place the switch up. The switch will remain in the UP position without manual assistance due to an over-center design within the switch. With the flaps extended in flight, placing the flap switch UP will retract the flaps in approximately 7 seconds. Gradual flap retraction can be accomplished by intermittent operation of the flap switch to UP. Normal full flap extension in flight will require approximately 7 seconds. After the flaps reach maximum extension or retraction, limit switches will automatically shut off the flap motor; however, when the flaps reach the fully retracted position, the wing flap switch should be returned to the center-off position. An additional limit switch is installed on the flap motor drive to activate the gear warning system when flaps are extended 25 degrees or more with the landing gear retracted. No appreciable change in elevator trim is required over the full flap extension range, however, minor changes in trim may be required depending on airspeed and airplane loading. Normally there will be a slight nose down trim change.

LANDING GEAR

The airplane is equipped with a retractable hydraulically operated, tricycle landing gear that includes a steerable nose wheel and self-adjusting disc brakes on the main landing gear wheels. Landing shocks are absorbed in the nose gear by a conventional oleo strut assembly, and by an oleo strut connecting rod arrangement connected to the trailing arm of the main landing gear. Nose wheel steering is controlled by a cable-pulley system attached to the nose gear and to the rudder/brake pedal and is actuated by depressing the rudder/brake pedals from either pilot's position. The single-disc, dual piston, hydraulic brakes are operated by individual master brake cylinders attached to the rudder/brake pedals. The brakes are actuated by applying toe pressure to the top of the rudder/brake pedals. The airplane is also equipped with a parking brake system which operates from the master brake cylinders and is actuated by a parking brake control knob. A shimmy damper is attached to the fixed and movable portions of the nose gear strut to provide a dampening action on the gear. An emergency extension valve, located on the left side of the center console, is used for emergency extension of the gear. This valve bypasses hydraulic fluid directly to the reservoir, allowing the gear to drop by gravity; gear extension is assisted by down springs. The emergency gear extension knob is spring-loaded to prevent accidental operation and must be pulled out and then pushed down to operate.

LANDING GEAR (con't)

The main landing gear retracts inward and upward into wheel wells in the lower side of the wing. The nose landing gear retracts aft and upward into the wheel well. Mechanically operated doors, connected to the landing gear by link assemblies, open and close during the extension and retraction cycle. A flat surface on the fixed portion of the nose gear keeps the landing gear centered when the gear is retracted. Retraction and extension of the landing gear is controlled by an electrohydraulic power pack that is actuated by the position of the landing gear selector switch mounted on the instrument panel. When the landing gear selector switch is placed in the UP position, the landing gear retracts until the gear up pressure switch is actuated. When the gear up pressure switch is actuated, the hydraulic power pack pump is shut off and all three gears are retained in the up position by hydraulic pressure. A loss of approximately 250 psi hydraulic pressure will energize the hydraulic power pack and build up pressure to the pressure switch setting. When the landing gear selector switch is placed in the DOWN position, the hydraulic pressure lock is released and hydraulic fluid is directed to the down side of the landing gear actuator cylinders extend the gear until the gear down pressure switch is actuated. When the pressure switch is actuated, the hydraulic power pack pump is shut off and all three gear are held in the down position by overcenter braces assisted by trapped hydraulic pressure. A ground contact switch, on the right main gear, assists in preventing landing gear retraction while on the ground caused by an unintentional positioning of the landing gear selector switch to the UP position.

Landing gear position indicators and a warning horn system are provided to alert the pilot when the landing gear is in the up, or down and locked position. Position indicators, are included in the annunciator panel installed in front of the pilot to the left of the gear switch. The gear down position is indicated by three green annunciators; the unsafe red (GEAR WARN) annunciator indicates the gear is in transit or not fully down and locked. There is no electrical indication of gear being fully retracted other than all gear annunciators being extinguished. When the landing gear extends to the full down position, three landing gear down switches are actuated causing the green annunciators to illuminate, indicating the gear is down and locked.

BAGGAGE COMPARTMENT

The baggage compartment is located in the aft portion of the cabin area. Access is through the baggage door on the left side of the airplane, or through the cabin area behind the rear passenger seats. Volume of the baggage compartment is twenty two (22) cubic feet and maximum allowable baggage weight is two hundred (200) pounds. When loading the airplane, refer to the Weight and Balance section of the Pilots Operating Handbook to assure that airplane loading meets all requirements and restrictions. All loads should be securely fastened using the cargo net and the tie-down rings (4) located in the corners of the baggage compartment to prevent movement during airplane operations.

CAUTION
Maximum allowable baggage weight is two hundred (200) pounds.

SEATS, SEAT BELTS, AND SHOULDER HARNESSES

SEATS

Pilot and passenger seats are bucket type with individually adjustable backrests. The recliner control handle is located on the lower, aft, outboard corner of each seat. To reposition backrest, lift handle and simultaneously move backrest to desired position, then release handle. In addition to the adjustable backrests, the pilot and front passenger seats are adjustable fore and aft. The seats rise slightly when moved forward. To reposition seats, lift handle located in the center of and just below each seat, move seat to desire position, and release handle. When repositioning seats and/or backrests always check to ascertain that locking mechanisms have properly engaged after adjustments have been completed. The seat backs for the front seats must be in upright position during takeoff and landing.

SEAT BELTS AND SHOULDER HARNESSES

Lap belts incorporate quick release metal to metal buckles and length adjustments on the outboard half of belt. Belts should be adjusted to position buckle over inboard hip of wearer. Lap belts may be released by lifting upper half of the buckle.

WARNING

Lap Belts are not to be shared by two or more occupants.

Inertia reel-type shoulder harnesses are installed on the pilot's and front passenger seats, The inertia restraint system provides pilot and passenger mobility without undue restriction or constant adjustment of the harnesses. After the harness strap is extended from the seat back and secured to the seat belt, the inertia reel will permit free movement so long as a sudden forward movement is not attempted.. Sudden forward movement will automatically lock the inertia reel and shoulder harness to provide restraint. To check the inertia reel locking device, give the shoulder harness a quick jerk. Relaxing forward pressure will unlock the inertia reel. To secure the shoulder harness, refer to Figure 7-3, fasten the seat belt first. Extend the harness strap over the shoulder and lengthen sufficiently to allow the harness end to reach the seat belt. Secure by snapping the harness end plate over the metal stud located on the slotted half of the seat belt. To release the harness assembly quickly, simply unlatch the seat belt and allow the inertia reel to retain the harness and seat belt portion against the seat back.

CHILD RESTRAINT SYSTEMS

Children smaller than 40 lbs. or 40 inches should be secured in the aircraft using a child restraint system meeting the requirement of Federal Motor Vehicle Safety Standard (FMVSS) 213. Child restraint systems meeting this requirement have a label which states "This restraint is certified for use in Motor Vehicles and Aircraft" and meets FAA/DOT approval criteria. For more information on the use of child restraint systems, see FAA Advisory Circular 91-62, "Use of Child/Infant Seats in Aircraft, Section 6. PRECAUTIONS (GENERAL AVIATION OPERATIONS)".

SEATS, SEAT BELTS, AND SHOULDER HARNESSES (con't)

SHOULDER HARNESS

Figure 7-3

DOORS AND WINDOWS

CABIN DOORS

The airplane is equipped with two all-metal cabin doors. Each door has three latch points. The center and lower latches are bayonet-type pins which extend into receptacles in the door frame in the latched position. These pins are extended and retracted by a lever operated, overcenter, cam type mechanism. The upper latch is a cam-actuated overcenter latch, and the latch handle must be rotated aft to engage the latch.

Exterior main door handles are recessed and must be lifted out and rotated up to retract the bayonet-type pins. When opening the door, unlatch the upper latch before releasing the lower latches; **when closing the door, engage the lower pins first, before engaging the upper latch.**

To close the doors from the inside, pull door closed using assist grip, hold door in closed position, and rotate black lever arm forward and down to engage the pins. It is not necessary to slam the door. With lower pins engaged, rotate the upper latch handle to the CLOSE position.

A sliding knob, located at the aft end of the armrest on the right door, may be used to lock the door from the inside. Sliding the knob aft with the door closed and latched, mechanically locks both the inner and outer door handles in the closed position. The knob must be in the forward position for the door to be opened. It is recommended that the knob be left in the forward (unlocked) position during all ground operation and during takeoff and landing.

DOORS AND WINDOWS (con't)

To open the doors from the inside, rotate upper latch handle to the OPEN position and rotate the black lever up. A locking mechanism, controlled by a spring-loaded plunger type pin, prevents moving the exterior door handle, or the interior lever, to the latched position when the door is open. The plunger releases the locking mechanism when the door is closed.

A key operated lock is located in the pilot's entrance door. The right entrance door must be locked from the inside using the sliding knob.

BAGGAGE DOOR

The baggage door is of all-metal construction, and is located aft of the wing on the left side of the airplane. The door is equipped with a spring-loaded latch assembly, plus a keyed rotary-type lock. The key can be removed in either the locked or unlocked position.

NOTE
If the baggage door is to remain open for an extended period of time, the baggage door light circuit breaker on the aft bulkhead should be pulled to prevent depleting the battery.

VENT WINDOWS

Small openable windows located in the forward lower area of the door side windows are provided for ground ventilation. They should not be opened in flight at speeds above 130 KIAS.

CONTROL LOCK

A control lock is provided for the pilot's control column which locks the aileron and elevator surfaces. The control lock pin and flag assembly should be inserted through the instrument panel control column mount and the control column, after holes have been aligned. When properly installed, the flag on the control lock will cover the starter switch. The control lock should be removed before the key is inserted in the starter switch, and no attempt should be made to defeat the purpose of the flag.

WARNING

Under no circumstances should any device, other than the flagged lock pin provided, be inserted in the lock pin hole.

ENGINE

The airplane is equipped with a Textron Lycoming TIO-540-AG1A turbocharged, fuel-injected, horizontally-opposed, 6 cylinder engine. The engine includes its own oil supply and distribution system and utilizes a separate oil cooler assembly. The engine is rated at 270 HP at 2575 RPM at sea level, and can maintain that power to an altitude of approximately 21,500 feet on a standard day. It is certificated to operate on a minimum of 100LL (blue) or 100 (green) Grade aviation fuel. A Lycoming Engine Operator's Manual is supplied with each aircraft and should be consulted for complete engine specifications.

ENGINE CONTROLS

The powerplant controls are located on the forward end of the center console (see Figure 7-4) and rotate fore and aft. The control levers are color and shape-coded to assist in identification. Functions of the control are, proceeding from left to right: Cowl Flap (square push-button switch/annunciator), controls position of cowl flap; Throttle (black/round), controls manifold pressure; Propeller Control (blue/crowned) regulates engine RPM; and the Mixture Control (red/hexagonal), manually controls the fuel/air ratio. A cam type friction control knob is mounted on each side of the control quadrant to permit locking the control levers at a desired setting.

ENGINE CONTROL PEDESTAL

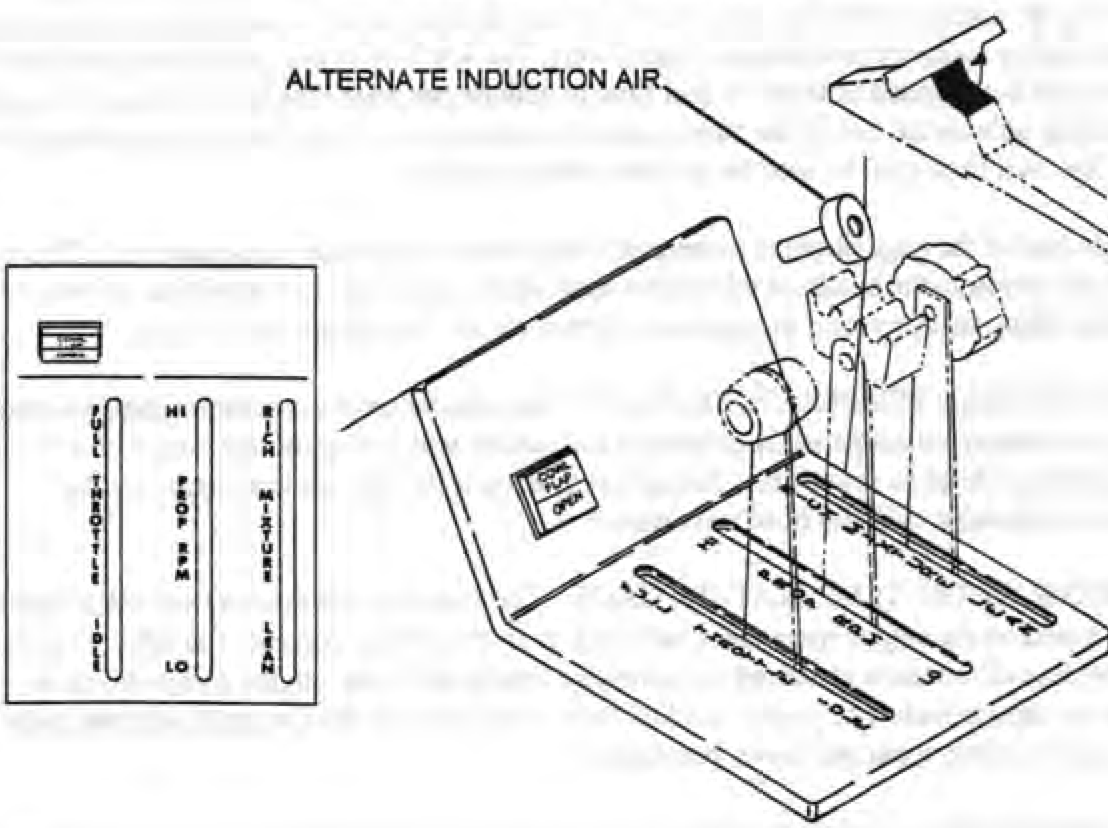


Figure 7-4

ENGINE (con't)

Immediately to the right of the console, below the circuit breaker subpanel is the engine alternate induction air control. This control is a push-pull control with pull to select alternate air.

ENGINE INSTRUMENTS - Refer to Figure 7-1

MANIFOLD PRESSURE GAGE - The manifold pressure gage, located on the engine instrument subpanel, is an electric instrument which displays the output of an engine compartment mounted pressure transducer which senses intake manifold absolute pressure and presents this in inches of mercury (in Hg). The upper extent of the green arc marking reflects one of the three enroute climb power settings which approximate 75% MCP. The red line at 39 inHg represents the maximum allowable manifold pressure. This pressure will only be approached in a climb on a hot day in the 8000 to 10000 foot altitude area with a properly adjusted wastegate controller.

TACHOMETER - The engine tachometer, located on the engine instrument subpanel, is an electric instrument which displays the output of a magneto-mounted Hall effect transducer in terms of propeller RPM. The upper extent of the green arc marking reflects the second of the three enroute climb power settings which approximate 75% MCP. The red line at 2575 RPM represents the maximum allowable operating speed.

FUEL FLOW/FUEL PRESSURE GAGE - The combined fuel flow and fuel pressure gage, located on the engine instrument subpanel, is an electric instrument which displays the output of separate engine compartment pressure transducers. The left half of the gage displays metered fuel pressure and is calibrated in terms of fuel flow in gallons per hour. The upper extent of its green arc marking reflects the last of the three enroute climb power settings which approximate 75% MCP. This fuel flow may be used for a cruise climb condition.

The right half of the gage displays unmetered fuel pressure in pounds per square inch. This gage essentially monitors the health of the engine driven fuel pump. The lower red line reflects the minimum idling fuel pressure; the green arc represents the normal operating range.

CYLINDER HEAD TEMPERATURE GAGE - The cylinder head temperature gage, located on the engine instrument subpanel, is an electric instrument which displays the output of a sensor at the hot cylinder head as determined during certification tests. The red line represents the maximum allowable cylinder head temperature.

OIL PRESSURE/OIL TEMPERATURE GAGE - The combined oil pressure and oil temperature gage, located on the engine instrument subpanel, is an electric instrument. The left half of the gage displays oil pressure as sensed by a pressure transducer in the engine compartment in pounds per square inch. The gage is marked with color codes to show normal and cautionary ranges and limiting upper and lower pressures.

The right half of the gage displays temperature as sensed by a thermistor in the oil cooler outlet line in degrees Fahrenheit. The gage is marked with color codes to represent normal and limiting temperatures.

ENGINE (con't)

TURBINE INLET TEMPERATURE (TIT) GAGE - A single-point EGT gage, located just below the engine instrument subpanel, is an electric instrument which displays the output of a thermocouple located in the turbocharger turbine inlet in degrees Fahrenheit.

The optional Graphic Engine Monitor (GEM) is a 7-point EGT, CHT, and TIT gage. The EGT temperatures are displayed in bargraph form in vertical columns which also display individual cylinder head temperatures. The higher the bar, the higher the temperature. Reference marks for EGT are provided on the **left** side of the scale. These bars do not represent an absolute temperature. The CHT temperatures are displayed in negative single bar format. During normal operation it shows as an unilluminated bar in the lower half of the bar column. Calibrated reference markers (2, 3, 4, 5), located on the **right** side of the scale, represent hundreds of degrees Fahrenheit and each column bar represents 25°F. The turbine inlet temperature is displayed digitally at the **top** of the gage and does represent an absolute temperature. The reading is displayed numerically in tens of degrees Fahrenheit. For example, a display reading of 159 indicates a TIT of 1590°F. As noted in the placard adjacent to the gage, this TIT must be monitored during leaning operations to comply with the established TIT limit.

PROPER OPERATION AND CARE OF THE ENGINE

BREAK-IN - All new engines have been tested and run-in before leaving the Textron Lycoming factory, and require no further break-in period.

> NOTE
> Cruising should be done at 65% to 75% power until a total of 50 hours has accumulated or oil consumption has stabilized. This is to insure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The airplane was delivered from the factory with ashless dispersant oil installed. The TIO-540-AG1A engine must be operated with ashless dispersant oil only.

> **CAUTION**
> DO NOT use a mineral-type (non detergent) oil in this engine.

After the first twenty-five (25) hours of operation, perform an inspection on the engine, check the belt tensions (refer to Textron Lycoming Service Information No. 1129), drain engine oil, clean suction and oil filter screens and replace filter elements. Refill the sump with detergent oil conforming to specification.

CONTINUING OPERATION - When operating the airplane, the engine should never be allowed to exceed the speed and power ranges specified in this manual. This will prolong engine life and ensure reliability.

ENGINE (con't)

In addition to proper operation, preflight and periodic inspections should be performed, and any indications of leaks or malfunctions should be corrected before they can develop into major problems. Careful attention should be given when checking oil and fuel systems, and any problems should be corrected before next flight. When servicing airplane, the proper fuels and lubricating oils should always be used. Aviation Fuel with a minimum grade of 100 Grade (green color) or 100LL Grade (blue color) must be used. Under no circumstances should automotive fuel (regardless of octane rating) be used. When preflight check indicates low oil level, service with aviation grade engine oil in accordance with Section 8 of this handbook. Single or multi viscosity aviation grade oils conforming to current Lycoming Service Instruction #1014 must be used.

ENGINE LUBRICATION

The oil supply and distribution system is integral with the basic engine except for an independent oil cooler assembly mounted on the right rear baffle. The amount of oil directed through the cooler is regulated by a thermostatic flow control/pressure relief valve that regulates oil temperature.

The oil pump draws oil through the oil sump pick-up screen, and directs it to the oil cooler through a flexible line or through a bypass as directed by the thermostatic/pressure relief valve. Cooled oil or the bypassed oil is then routed to the flow control oil pressure relief valve installed in the oil filter adapter on the rear of the engine.

An engine oil suction screen is installed in the oil sump to filter out any sizeable metal particles or heavy sludge from the oil before it is directed through the oil pump. An oil pressure screen is installed in the thermostatic/oil pressure screen housing located on the upper-center section of the accessory case. The oil pressure screen filters any small solid particles that may have passed through the oil suction screen to the oil pump.

IGNITION SYSTEM

The engine is equipped with dual pressurized magnetos for improved high altitude operation. The two magnetos provide two independent ignition systems for the engine. Each ignition system has a shielded harness assembly and a set of radio shielded spark plugs. Each cylinder utilizes two (2) spark plugs. The left magneto fires the bottom spark plugs in cylinders one (1) three (3) and five (5), and the top plugs in cylinders two (2) and four (4) and six (6). The right magneto provides spark for the opposite spark plugs.

INDUCTION AIR SYSTEM

Induction ram air for the engine comes through an inlet scoop in the right engine cooling air inlet. This air flows through ducts to an airbox which holds an air filter and then through further ducts to the turbocharger inlet. The induction air is compressed by the turbocharger compressor and ducted to the engine throttle body. Heated engine cooling air below the cylinders can be routed to the induction system through a door downstream of the filter. This door is controlled by the pilot with the ALT AIR push-pull control to provide an alternate source of air to the engine should the filter become blocked. The power

ENGINE (con't)

available through the alternate air system with the primary system blocked is full rated power up to an altitude of approximately 13000 feet depending upon ambient conditions, above which the manifold pressure drops at about 1 inHg per 1000 feet.

EXHAUST SYSTEM

The engine is equipped with a crossover exhaust system feeding the turbocharger and then a single tailpipe which protrudes through the lower left cowling at the firewall. Stainless steel exhaust stacks are flange-mounted to each cylinder exhaust port. A heat muff assembly which shrouds the crossover exhaust manifold below the forward engine area provides warmed air for cabin heating and windshield defrosting. At the turbocharger, a wastegate controller directs the exhaust flow, depending upon the commands of the pilot through throttle position and the automatic controllers, either through the turbocharger or through a bypass exhaust pipe which joins the tailpipe downstream of the turbocharger.

FUEL INJECTION SYSTEM

Filtered air from the turbocharger compressor outlet is introduced into the engine through the servo regulator body and then flows into the air intake riser where it is delivered to each cylinder. The amount of air entering the engine is controlled by a throttle valve (butterfly) located in the body of the servo regulator. The manifold pressures set by the throttle valve are generated by the turbocharging system as described in a later section. Fuel is metered and distributed to the individual cylinders by the servo regulator and fuel flow divider valve. The fuel-air ratio is determined by the position of the mixture setting and the position of the throttle valve and air sensing functions of the servo regulator. Fuel and air are mixed within the cylinder. The fuel injection system consists of the air flow sensing and fuel control subsystems. Components of the injection system are: the servo valve, fuel control unit, fuel flow divider valve, and fuel nozzles referenced to upper deck pressure (compressor outlet pressure). The servo valve and fuel control unit are contained within the throttle body casting, installed on the engine accessory section. Priming is provided by the fuel injection system.

ENGINE COOLING SYSTEM

COWLING - The cowling consists of two molded fiberglass assemblies which have contoured inlets to control expansion of cooling air as it enters, a fixed opening around the tailpipe, and a single cowl flap on the right lower side of the cowl to control airflow through the cooling system. The cowl flap position is controlled by the pilot using the cowl flap push-button annunciator switch on the center console.

BAFFLE INSTALLATION - Sheet metal baffles are installed on the engine to provide optimum cooling airflow around the engine cylinders and accessory components. Ductwork is provided off the aft right baffle to direct cooling air to the oil cooler. Silicon rubber seals are used to stop air leaks where the inner cowl surfaces meet the baffles and assure that the cooling air moves properly. These baffles, seals, and ducts are carefully designed and positioned to maintain proper cooling efficiency. Their alteration or damage may cause improper air circulation and engine or accessory overheating.

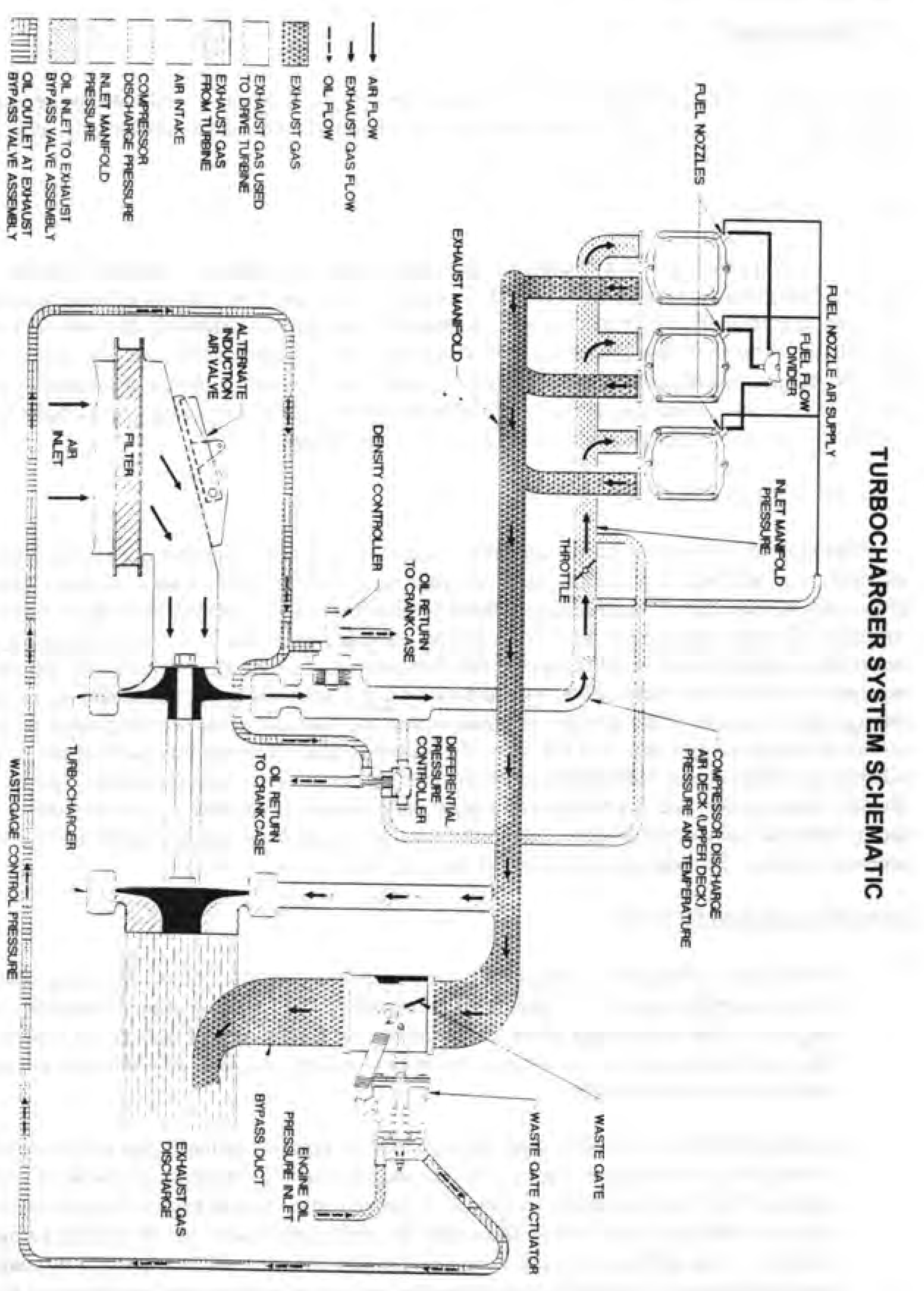

TURBOCHARGER SYSTEM SCHEMATIC
FUEL NOZZLES
FUEL NOZZLE AIR SUPPLY
FUEL FLOW DIVIDER
INLET MANIFOLD PRESSURE
THROTTLE
EXHAUST MANIFOLD
COMPRESSOR DISCHARGE AIR DECK (UPPER DECK) PRESSURE AND TEMPERATURE
DENSITY CONTROLLER
OIL RETURN TO CRANKCASE
ALTERNATE INDUCTION AIR VALVE
FILTER
AIR INLET
DIFFERENTIAL PRESSURE CONTROLLER
OIL RETURN TO CRANKCASE
TURBOCHARGER
WASTEGATE CONTROL PRESSURE
WASTE GATE
WASTE GATE ACTUATOR
ENGINE OIL PRESSURE INLET
BYPASS DUCT
EXHAUST GAS DISCHARGE
AIR FLOW
EXHAUST GAS FLOW
OIL FLOW
EXHAUST GAS
EXHAUST GAS USED TO DRIVE TURBINE
EXHAUST GAS FROM TURBINE
AIR INTAKE
COMPRESSOR DISCHARGE PRESSURE
INLET MANIFOLD PRESSURE
OIL INLET TO EXHAUST BYPASS VALVE ASSEMBLY
OIL OUTLET AT EXHAUST BYPASS VALVE ASSEMBLY

Figure 7-5

ENGINE (con't)

TURBOCHARGING SYSTEM

The incorporation of turbocharging brings with it some changes in engine behavior as compared to a normally aspirated engine. The following paragraphs describe the system and the operating characteristics to be expected from the system. See Section 4 of this handbook for Normal Operating Procedures.

The turbocharging system of the Commander 114TC is schematically illustrated in Figure 7-5. As shown the system is comprised of several components:

1. Turbocharger with compressor wheel, turbine wheel, and their housing with air and lubrication passages.
2. Wastegate and oil pressure driven wastegate actuator.
3. Density controller for wastegate.
4. Differential pressure controller for wastegate.
5. Exhaust ducting with bypass.

As shown in Fig 7-5, air enters the system from the induction air inlet in the right cooling air opening, flows to the airbox, through the filter past the alternate induction air valve to the compressor inlet. The compressor, logically, compresses the air after which it is ducted to the throttle valve and on into the engine cylinders through the engine induction manifolds. The air is combined with fuel and the mixture is burned in the cylinders and exhausted to the engine exhaust system and finally to the turbine where all or a portion of the exhaust gases drive the turbine which in turn drives the compressor. The exhaust gases from the turbine and any that have been bypassed are discharged through the exhaust tailpipe.

The wastegate and its actuator are provided as a means to regulate the output of the turbocharger in response to direction from the controllers discussed below. Oil pressure is used to close the wastegate. As the wastegate closes, additional exhaust flow is directed through the turbine, rather than the bypass, thereby increasing the speed of the turbine and compressor and thus increasing the compressor outlet (upper deck) pressure.

The turbocharger has the capability of producing manifold pressures in excess of the limiting manifold pressure of 39 inHg. To provide automatic regulation of rated power or a selected power setting to reduce pilot work load, two manifold pressure controllers are provided. The density controller senses compressor outlet pressure and temperature, hence density. This controller can regulate oil pressure to the wastegate actuator and attempts to maintain a constant density in the upper deck (in the induction system between the compressor outlet and the throttle valve) by setting the proper deck pressure to accompany the prevailing deck temperature. This function sets the full throttle manifold pressure such that rated power is achieved under almost all low altitude conditions and this power can be maintained to an altitude above 21000 feet on a standard day.

The second controller is the differential pressure controller. This controller senses upper deck pressure and manifold pressure, hence differential pressure. This controller, too, can regulate oil pressure to the wastegate actuator and attempts to maintain approximately a 2 in Hg difference between deck and

ENGINE (con't)

manifold pressure with the deck pressure the higher. This function is able to maintain part throttle manifold pressure settings as commanded by the pilot across a broad range of altitudes.

The two manifold pressure controllers are plumbed in parallel in the turbocharger system as shown in Figure 7-5. During normal operations, the pilot should select full throttle for takeoff. Under this condition, since the difference between deck pressure and manifold pressure is small due to the wide open throttle butterfly, the differential pressure controller will be blocking oil flow from the wastegate actuator in an effort to raise the deck pressure. However, simultaneously the density controller is allowing some oil to return to the engine from the wastegate controller, thereby regulating full throttle takeoff manifold pressure to that appropriate for the existing altitude (compressor discharge or deck pressure) and temperature (compressor discharge temperature). It will be noted that a takeoff conducted on a hot day will be accompanied by a higher manifold pressure than will a takeoff conducted on a cold day at the same altitude.

When the pilot retards the throttle setting for cruise power, the density controller blocks oil flow from the wastegate actuator in an effort to maintain the maximum power manifold pressure. At the same time the differential controller begins to modulate wastegate oil pressure to maintain a fixed difference between deck and manifold pressure thereby maintain the pilot's power setting across a range of altitudes.

At higher altitudes, with partial throttle settings, or with lower engine speeds, the engine exhaust flow may not be capable of turning the turbine/compressor fast enough to satisfy the demands of the controllers and the wastegate will go to its closed stop to force almost all exhaust gas through the turbine. When this occurs, the engine enters into what is known as a "bootstrap" mode of operation where any change of flow through the turbine will cause a change in one or more of the engine operating parameters as described below:

MANIFOLD PRESSURE AND ENGINE RPM

When the wastegate is not fully closed, the 114TC engine will operate similarly to a normally aspirated engine as the RPM is varied - when the RPM is reduced the MAP will increase slightly and vice versa. When the wastegate is closed, the engine will bootstrap and a decrease in RPM will be accompanied by a decrease in MAP as the mass flow through the turbocharger is reduced. An increase in RPM will cause the opposite reaction.

MANIFOLD PRESSURE AND AIRSPEED

When the wastegate is open MAP is essentially independent of airspeed as the controllers adjust oil pressure at the wastegate actuator to maintain the set power. When the wastegate is closed, the engine will bootstrap and an increase in airspeed will produce an increase in MAP as the compressor inlet ram pressure increase is magnified through the compression ratio of the compressor.

ENGINE (con't)

MANIFOLD PRESSURE AND FUEL FLOW

When the wastegate is open MAP is essentially independent of fuel flow as the controllers adjust oil pressure at the wastegate actuator to maintain the set power even as mass flow through the turbine changes. When the wastegate is closed, the engine will bootstrap and an increase in fuel flow will produce an increase in MAP as the mass flow through the turbine increases its speed and that of the compressor thereby increasing the compressor outlet pressure and ultimately the MAP at a given throttle position.

In addition to these "bootstrapping" effects several other characteristics of the turbocharged airplane should be noted:

MANIFOLD PRESSURE AND ALTITUDE

At full throttle the density controller will try to maintain maximum rated power by commanding an appropriate MAP for the altitude (compressor discharge pressure) and temperature (compressor discharge temperature). This means that higher manifold pressures will be evident on a warm day than on a cold day. MAP may vary as much as ±3 in Hg from a standard day to a hot(+) or cold (-) day. The turbocharger is capable of maintaining this MAP to above 16000 feet on a hot day. Above 16000 feet the pilot should reduce MAP, if necessary, to comply with the placarded schedule to retain good margins with respect to engine detonation and turbine speed limitations.

At part throttle, the turbocharger is capable of maintaining the MAP for 75% MCP at 2400 RPM to 25000 feet altitude. At other part throttle manifold pressure and RPM settings the MAP will remain approximately as set by the pilot until the airplane reaches the critical altitude for that setting. As the airplane climbs further the desired manifold pressure may be maintained by continuing advancement of the throttle until full throttle is achieved.

TRANSIENTS

Rapid throttle movement, especially with cold oil, can cause overshoots in desired manifold pressure settings. These are not considered detrimental as long as they are momentary and do not exceed the limiting MAP significantly. To avoid overshoot, application of throttle should be smooth and positive by the pilot. If full throttle produces a manifold pressure in excess of the marked redline the MAP should be limited to that value. If this occurs on other than a hot day in the 8000 ft. to 15000 ft. altitude range, the turbocharging system adjustment should be checked as soon as practical.

FUEL PRESSURES AT ALTITUDE

Inherent in the higher altitude operations with the attendant lower atmospheric pressures is the natural tendency for additional formation of vapor in the fuel system. Several things can be done

ENGINE (con't)

to minimize the effects of this tendency. Monitor the fuel pressure indicators for abnormal fluctuations. If any are noted turn the boost pump ON until the fluctuations reach normal levels with the pump turned OFF. Operate with the fuel selector in the BOTH position until at least 10 minutes after establishing cruise flight. When selecting a different fuel tank monitor fuel pressure and use the boost pump if necessary to counter any momentary drop in pressure.

> NOTE
> See Section 3 for procedures regarding turbocharger failure.

ACCELERATION AT HIGH ALTITUDE

Engine acceleration from idle power at high altitude is normally only slightly slower than at low altitude. However, under some conditions of idle throttle and full rich mixture at high altitude, it may be necessary to lean the mixture for proper acceleration. Reset the mixture as the selected power is established.

STARTER

A light weight Lycoming starter is installed on the lower left front side of the engine. The starter drive pinion engages the engine flywheel ring gear to provide direct cranking of the engine. The starter relay, installed on the battery box in the tailcone, is energized by a key-operated, spring-loaded ignition-starter switch. When starting the engine, avoid energizing the starter for more than 10 to 12 seconds, and allow at least 5 minutes between cranking periods to permit the starter to cool.

ACCESSORIES

FUEL PUMP - A gear type, engine driven fuel pump is installed on the engine accessory housing. This pump provides a continuous flow of fuel to the engine. The pump design allows the auxiliary pump to move fuel through it to the engine in the event the engine driven pump becomes inoperative and for the purpose of initial engine priming and starting.

VACUUM PUMPS - Suction to operate the directional and attitude gyros is provided by two engine driven vane type vacuum pumps. See **VACUUM SYSTEM** description later in this section.

ENGINE MOUNT

The engine mount is a welded tubular structure attached to the firewall at five (5) points. The structure serves as an engine mount and nose gear mount. The mount has four (4) points that the engine attaches to and uses two rubber shockmounts at each point. The bonded rubber and metal shockmounts are designed to reduce the transmission of engine vibrations to the airframe.

FUEL SYSTEM SCHEMATIC

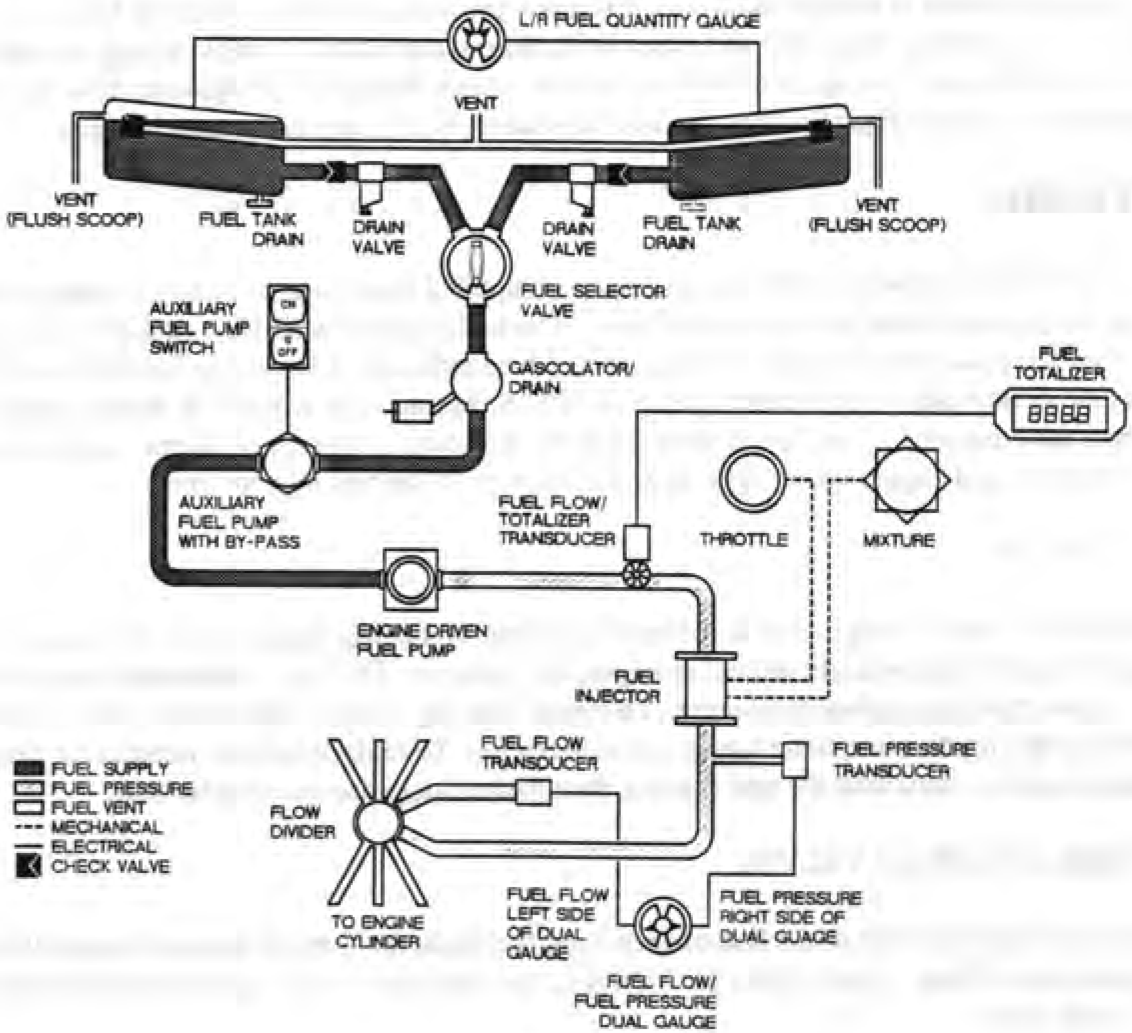


Figure 7-6

PROPELLER SYSTEM

PROPELLER

The Model 114TC is equipped with a McCauley, all metal B3D32C419/82NHA-5, constant speed, three-blade propeller. Maximum diameter is 77 inches; field cutoff to 75.5 inches is allowed.

The constant speed propeller is a single-acting type in which oil pressure from the engine, boosted and regulated by a governor, is used to increase blade pitch. The natural centrifugal twisting moment of the rotating blades and the force of a spring are used to decrease blade pitch.

PROPELLER SYSTEM (con't)

GOVERNOR

The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch. A single-acting governor uses oil pressure to effect a pitch change in only one direction; a pitch change in the opposite direction results from a combination of centrifugal twisting moment of rotating blades and compressed springs.

FUEL SYSTEM

Aviation fuel (100LL (blue) or 100 (green) Grade) is supplied to the engine by two (2) integral fuel tanks, one in the forward center section of each wing. The fuel capacity is 45 U.S. gallons for each wing tank, 44 of which are considered usable. A reduced fuel load indicator is located in the filler neck. This indicator is used to indicate a usable fuel capacity of 32 U.S. gallons with airplane in normal flight attitude. From the wing tanks, fuel flow is directed through a selector valve, gascolator, electric fuel pump (with bypass), and engine-driven fuel pump for delivery to the fuel injector unit.

FUEL FILLER CAPS

The filler necks of each wing fuel tank incorporate an anti-siphoning flapper valve to prevent loss of fuel in flight if a cap is inadvertently left off or improperly secured. The caps are secured to the valve plates by a quarter turn, spring-loaded plunger. To remove the cap, simply depress the fastener in the center of the cap and rotate one-quarter turn counterclockwise. To replace the cap, depress the fastener, rotate counterclockwise until until the unit catches, then rotate clockwise one-quarter turn.

FUEL FILTERS AND DRAIN VALVES

Fuel filters are located in the outlet line of each wing fuel tank, the firewall mounted gascolator and the fuel injector inlet fitting. Drain valves are located in the wing tank sumps, gascolator and wheel wells (see Figure 7-6).

FUEL SELECTOR VALVE AND FUEL TANK PLACARD

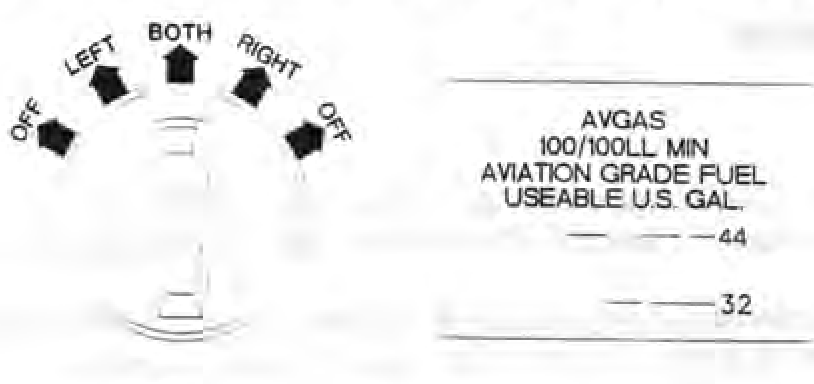


Figure 7-7

FUEL SYSTEM (con't)

FUEL SELECTOR VALVE

A five position fuel selector valve (See Figure 7-7) is installed in the aft section of the center console. The valve handle controls selection of; OFF, LEFT tank, BOTH tanks, RIGHT tank, and a second OFF position. Depress the red tab at the rear of the selector to select either OFF position.

AUXILIARY FUEL PUMP

The electric auxiliary fuel pump is located on the right forward side of the firewall, and is controlled by a two-position rocker circuit breaker switch labeled AUX PUMP. The auxiliary fuel pump is used as a boost pump in starting and in the event of engine-driven fuel pump failure, and for vapor suppression as needed. For further Fuel System information refer to the Maintenance Manual.

FUEL MANAGEMENT

It is the pilot's responsibility to ascertain that there is sufficient fuel on board the airplane to safely complete the planned flight. A visual check of each fuel tank should be made, and this should be compared with quantity indicated on the fuel tank gages. Remember that fuel amounts between 28 gallons and 45 gallons are not gageable. If installed, a fuel totalizer can help the pilot manage the fuel on board. When fuel quantities are checked, the airplane should be level to assure that any fuel quantity indication, either visual or electrical, will be accurate. During cruise, alternate fuel tanks, if necessary, to maintain lateral trim. When planning flight, allow enough reserve fuel for safe completion of flight and to assure compliance with FAR 91 reserve requirements.

> NOTE
> Readings between the fuel flow gage and the Hoskins Fuel Totalizer will vary by 2 to 3 GPH.

FUEL CONTAMINATION

To avoid fuel contamination always service the airplane from fuel facilities that utilize proper filter systems to remove impurities and water accumulations from the bulk fuel. If filtering facilities are not available, filter the fuel through a quality grade chamois. Fuel tanks should be serviced after the last flight of each day to reduce condensation and allow any entrapped water accumulations to settle to the fuel system drains prior to the next flight. Prior to the first flight of the day, and after each refueling, the wing tank sumps, wheel well drains, and the gascolator should be drained to assure proper fuel and lack of contamination. If contamination is present in the fuel sample, continue to drain all sample points until fuel is clear.

FUEL TANK VENT SYSTEM

The fuel tanks are vented to atmosphere through vent scoops on the lower outboard wing surfaces and under the center fuselage. These vents must be free of obstructions and should be checked prior to the first flight of the day. Should a vent become obstructed it could result in fuel starvation and possible engine stoppage.

FUEL SYSTEM (con't)

FUEL QUANTITY INDICATOR

The fuel quantity indicating system consists of a dual fuel quantity indicator located on the engine instrument subpanel, electrically connected to the fuel quantity transmitter installed in each fuel tank. The fuel quantity indicating circuit is equipped with two damping resistors within the transmitter. These resistors dampen indicator needle oscillations, caused by irregular movement of the transmitter float, during flight through rough air. The fuel quantity transmitters and indicators have been calibrated at the factory and should not require recalibration; however, if the system does require recalibration, this should be done by a licensed A& P mechanic in accord with the current Maintenance Manual.

Ungageable fuel begins above 28 gallons. The battery and/or alternator master switches must be ON for the fuel quantity indicator to function.

HYDRAULIC SYSTEMS

LANDING GEAR EXTENSION/RETRACTION SYSTEM (See Figure 7-8)

The hydraulic power supply is an integrated hydraulic pack containing a reversible, electric motor-driven hydraulic pump, a reservoir, pressure control valves, a thermal relief valve and a gear up check valve. The power pack is located in the left forward area of the fuselage tail cone and is accessible through the left aft baggage compartment panel. The sole function of the hydraulic power pack is to raise and lower the tricycle landing gear.

OPERATION, RETRACTION

When the landing gear selector switch is pulled out slightly to clear the detent and placed in the UP position, hydraulic fluid, under pressure, is directed to the UP side of the landing gear actuators, causing the gear to start to retract. Fluid on the DOWN side of the actuator flows back to the reservoir. Movement of the gear from the DOWN and LOCKED position deactivates a down position switch, located on each gear drag link, causing the three gear DOWN and LOCKED lights to extinguish, illuminating the red GEAR WARNING light. As each gear is fully retracted, it activates a gear up position switch. When all three gear up switches have activated, the GEAR WARNING light extinguishes. A pressure switch, located in the UP hydraulic line, actuates when the pressure in the line reaches 1650 (± 50) psi and shuts off the hydraulic motor. A gear up check valve in the gear up line of the hydraulic pack closes, trapping pressure in the line, causing a hydraulic lock which holds the gear up. A loss of approximately 250 psi of pressure in the UP line will be sensed by the pressure switch, which will allow the hydraulic pump to run and build the pressure back up the 1650 (±50) psi.

OPERATION, EXTENSION

Placing the gear selector switch in the DOWN position, directs hydraulic fluid to the down side of the actuator. Fluid in the UP line flows back to the reservoir and the gear extends. As the gear starts down, the up position switches deactivate and the GEAR WARNING light

HYDRAULIC SYSTEMS (con't)

illuminates. When the gear is fully extended with the drag links over center, the down position switches activate, illuminating the three green DOWN and LOCKED lights, and the red GEAR WARNING light extinguishes. A pressure switch in the down line shuts off the hydraulic pack when pressure in the line reaches 500 (±50) psi. A "pilot" check valve in the down line closes, trapping hydraulic pressure, locking the gear down with a hydraulic lock in the down line, plus a mechanical over center lock. If any one of the three down position switches fails to actuate when the gear is fully extended, that gear's corresponding green light will not illuminate, the GEAR WARNING light will remain illuminated, the down pressure switch will be bypassed electrically, and the hydraulic pump will continue to operate.

A high pressure control valve limits system pressure to 1800-2000 psi during the retraction cycle and a low pressure control valve limits system pressure to 600-700 psi during the extension cycle. A thermal relief valve limits system pressure to 2025-2424 psi when pump is not operating.

An emergency gear extension system is provided. Placing the emergency gear extension valve in the GEAR DOWN position opens the emergency dump valve and bypasses the fluid from the up side of the gear actuators back to the reservoir. This relieves the hydraulic lock which holds the gear up and allows gravity, assisted by a spring on each gear, to extend the gear.

> NOTE
> The gear cannot be retracted with the emergency dump valve open, since the pressure will continually be relieved through the valve.

GEAR LOCKED LIGHTS AND GEAR WARN LIGHT

Three green gear locked annunciator lights, in the annunciator panel mounted adjacent to the gear selector switch, provide an electrical indication that each main and nose landing gear is down and locked. A press-to-test annunciator switch is provided in the annunciator panel to verify bulb integrity.

A red gear WARN annunciator light is installed in the annunciator panel and indicates the gear is not up fully, is not down and locked, or in transit. Gear up is indicated by the gear WARN annunciator and the three gear locked annunciators being out.

As a reminder that the gear is retracted, the gear warning horn will sound and the red gear WARN annunciator will illuminate whenever the throttle is retarded below approximately the 14 in Hg position (at low altitude) with the gear still retracted, or when flaps are extended 25 degrees or more with the gear retracted (regardless of throttle position). The battery and/or alternator master switches must be on for gear warning.

LANDING GEAR SELECTOR SWITCH - The wheel shaped landing gear selector switch is located at the top of the main instrument panel towards the right side and moves vertically through two positions - above center for gear UP and below center for gear DOWN. From the

HYDRAULIC SYSTEM SCHEMATIC
GEAR RETRACTED

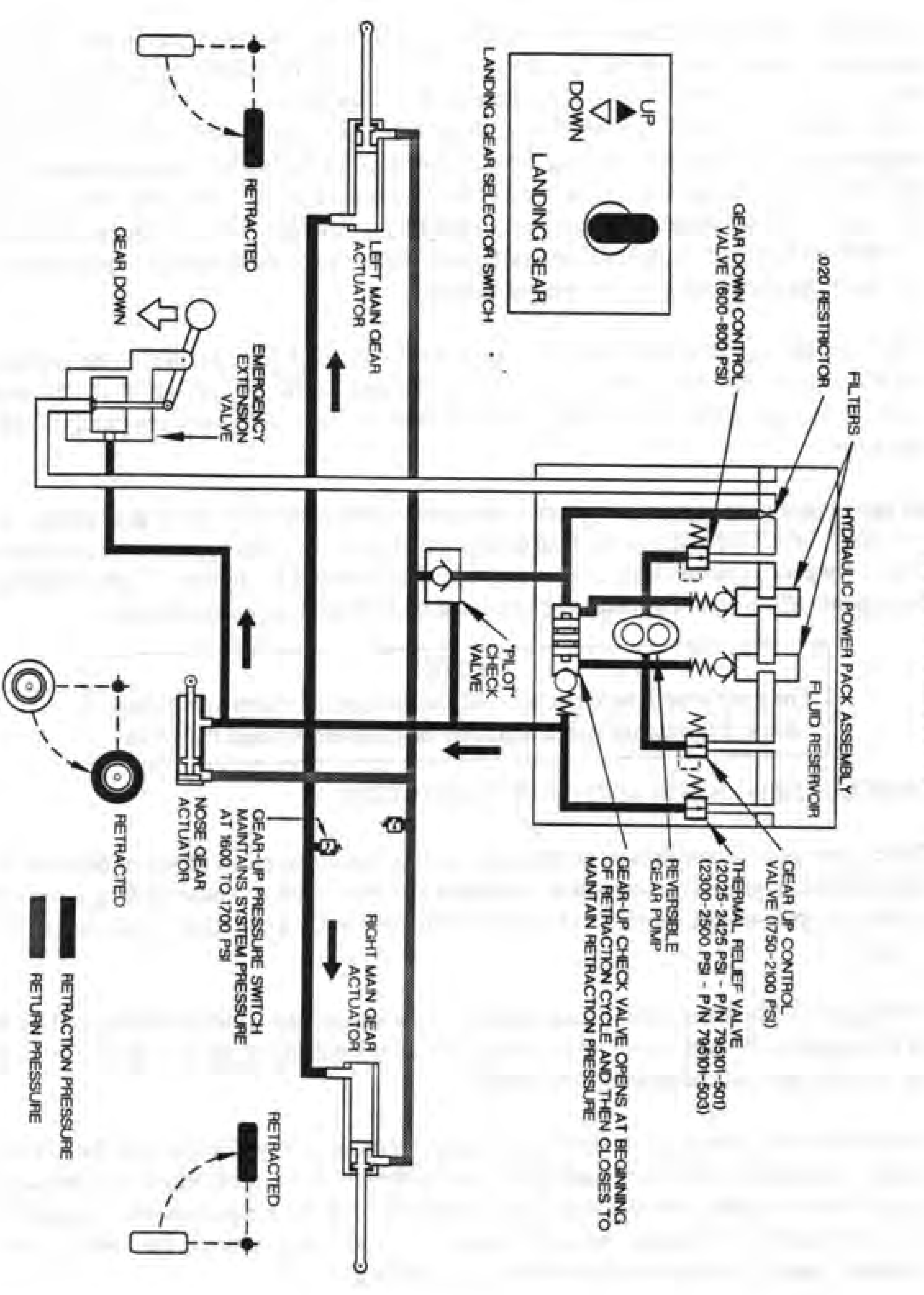


Figure 7-8
Sheet 1 of 3

HYDRAULIC SYSTEM SCHEMATIC
GEAR EXTENDED

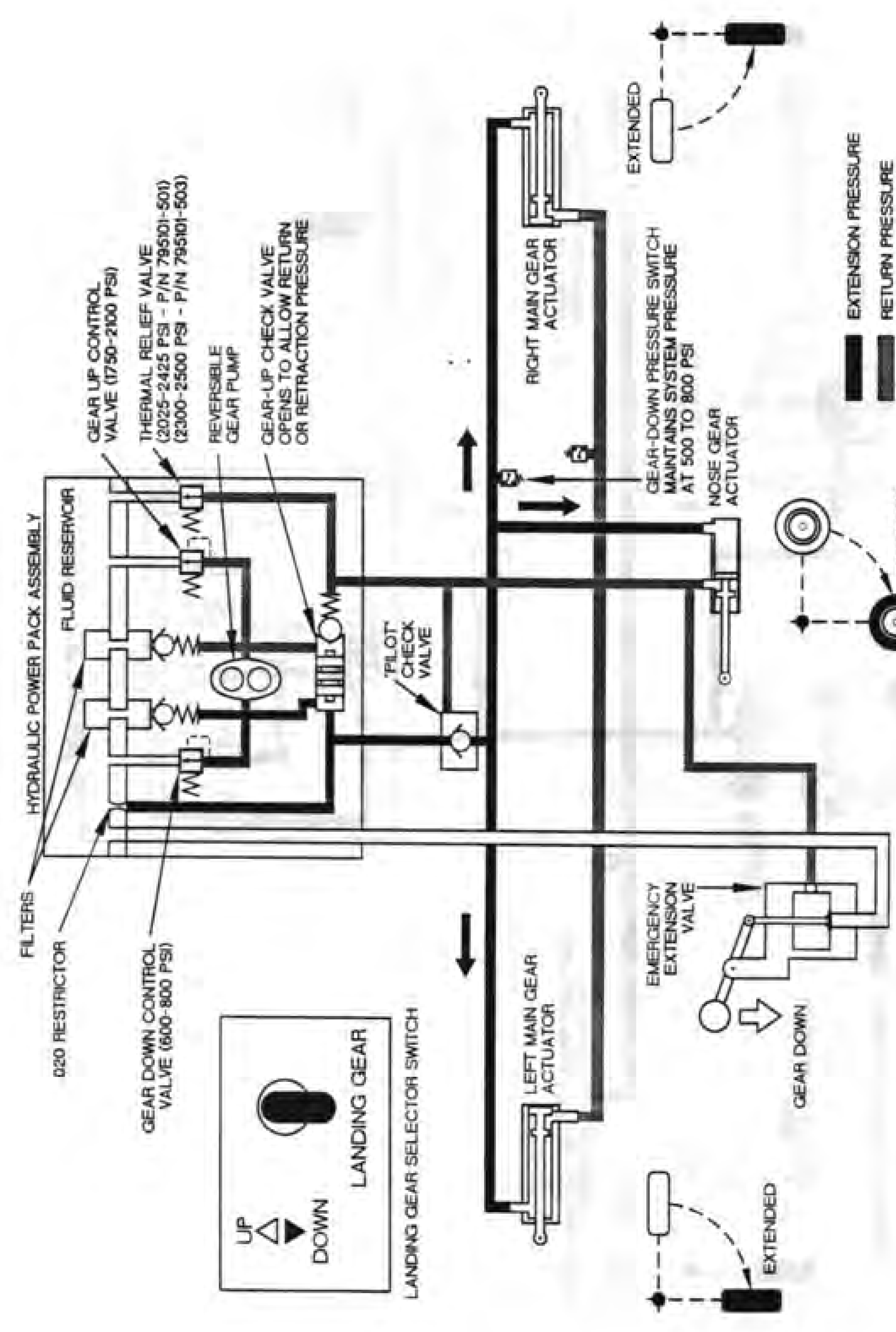


Figure 7-8
Sheet 2 of 3

HYDRAULIC SYSTEM SCHEMATIC
EMERGENCY GEAR EXTENSION

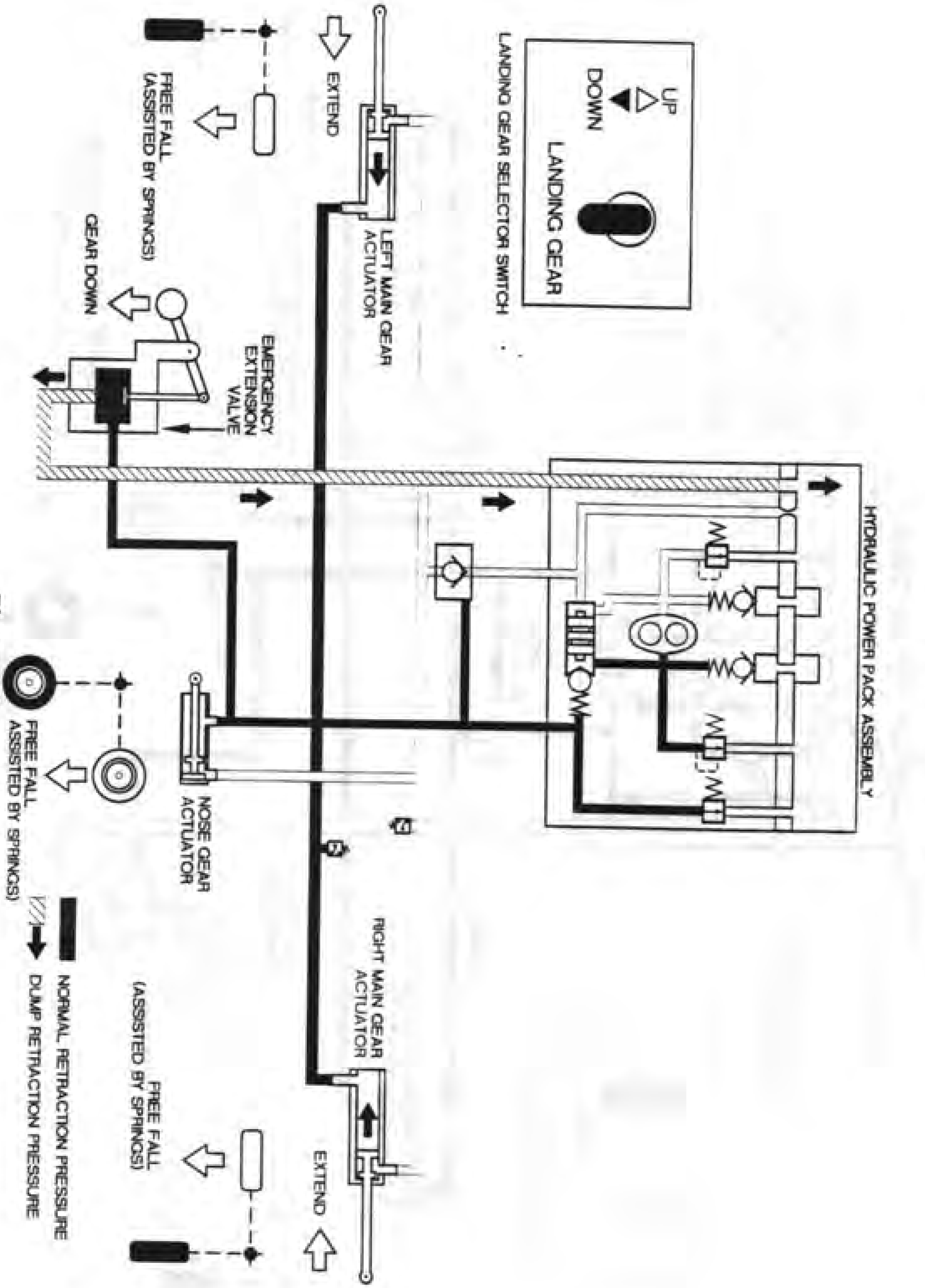


Figure 7-8
Sheet 3 of 3

HYDRAULIC SYSTEMS (con't)

DOWN position, the gear handle must be pulled out slightly to clear a detent before it can be positioned UP. After the gear handle is placed in the desired position, hydraulic pressure is directed within the gear system to retract or extend the gear to the position selected.

GEAR DOWN GROUND CONTACT (SQUAT) SWITCH - The gear down ground contact (squat) switch is located on the right main landing gear trunnion. This switch is adjusted so that the switch is actuated within the last quarter of an inch of gear strut extension. The squat switch deactivates the circuit to the UP side of the hydraulic pump and helps prevent accidental gear retraction when the airplane is on the ground.

EMERGENCY GEAR EXTENSION VALVE - A red emergency gear extension knob (installed in the forward left side of the center console) is provided for use in the event of a total electrical system or hydraulic pump failure. The valve relieves pressure which normally retains the landing gear in the up position, allowing spring assisted gravity free fall to extend the gear. To operate, pull knob out and push down. Knob must be in up position for normal gear operation.

BRAKE SYSTEM

HYDRAULIC BRAKES - The two main wheels are equipped with self-adjusting, single-disc, dual piston hydraulic brakes which are actuated by individual master cylinders attached to the rudder pedals. A brake fluid reservoir, located in the engine compartment, supplies system fluid to the pilot's master cylinders. The pilot's master brake cylinders supply fluid to the co-pilot's brakes. The brakes are actuated by applying toe pressure to the tops of the rudder pedals.

PARKING BRAKES The parking brake system uses a panel mounted control knob and cable connected to a dual park brake valve. To apply the parking brakes, depress the tops of the rudder pedals and pull the control knob (labeled PARK BRAKE) straight out, trapping hydraulic pressure to the brakes. Toe pressure may then be released. To release the parking brake, depress the tops of the rudder pedals and push control knob to the full-in position, releasing hydraulic pressure. Excessive force applied to the parking brake control knob will **not** increase parking brake pressure.

ELECTRICAL SYSTEM

The airplane is equipped with a 28 volt direct current electrical system powered by an engine driven alternator. A 24 volt lead-acid battery provides power for engine starting. Electrical power is supplied to airplane circuits through a main bus, a circuit breaker switch bus, and an avionics bus (see Figures 7-8 and 7-9). An overvoltage relay protects electrical equipment from harmful transient voltages.

ELECTRICAL SYSTEM (con't)

BATTERY

A 24 volt, 10 ampere-hour low maintenance battery or a 24 volt, 11 ampere-hour, maintenance free battery provides power for engine starting and acts as a backup power source. The battery is located in the aft fuselage section and is accessible through the baggage compartment.

ALTERNATOR

A 28 volt, 80 amp alternator is installed on the forward lower right side of the engine. A belt from the alternator pulley, to a pulley which is integral with the aft propeller flange, drives the alternator at 3.2 times the speed of the engine.

MASTER SWITCHES

Two rocker switches control the electrical system and are located at the left end of the lower switch panel. The left switch, labeled BATT MASTER, controls battery power to the airplane. The right switch, labeled ALT MASTER, controls alternator output.

For normal operations, both master switches should be ON. With the ALT MASTER turned OFF, the entire electrical load is placed on the battery. Therefore, all nonessential electrical equipment should be turned off and the flight should be terminated as soon as practical when operating with the ALT switch OFF. Use the Emergency Gear Extension procedure when extending gear with the alternator off.

VOLT/AMMETER

The panel mounted digital volt/ammeter will indicate current flow, in amperes, from the alternator to the battery, or from the battery to the electrical system. With the engine operating and both the battery and alternator master switches ON, the ammeter should indicate on the charge (+) side. In the event of an alternator malfunction, or if the electrical load demand exceeds the alternator output, the ammeter will indicate on the discharge (-) side. When the ammeter continues to display on discharge side, electrical load must be reduced until ammeter indicates on charge side.

The volt/ammeter also allows the pilot to monitor buss voltage, and when used in conjunction with the ammeter, provides an excellent indication for electrical system operation. When system is operating normally, voltmeter will read between 24.5 and 30 volts, generally at approximately 28 volts.

A low voltage reading (less than 24.5 volts) or a slow decrease in the voltage reading, accompanied by a negative charging reading on the ammeter, indicates the alternator is becoming overloaded. If this situation occurs, reduce the load by turning off nonessential equipment or increase the engine RPM.

ELECTRICAL SYSTEM SCHEMATIC

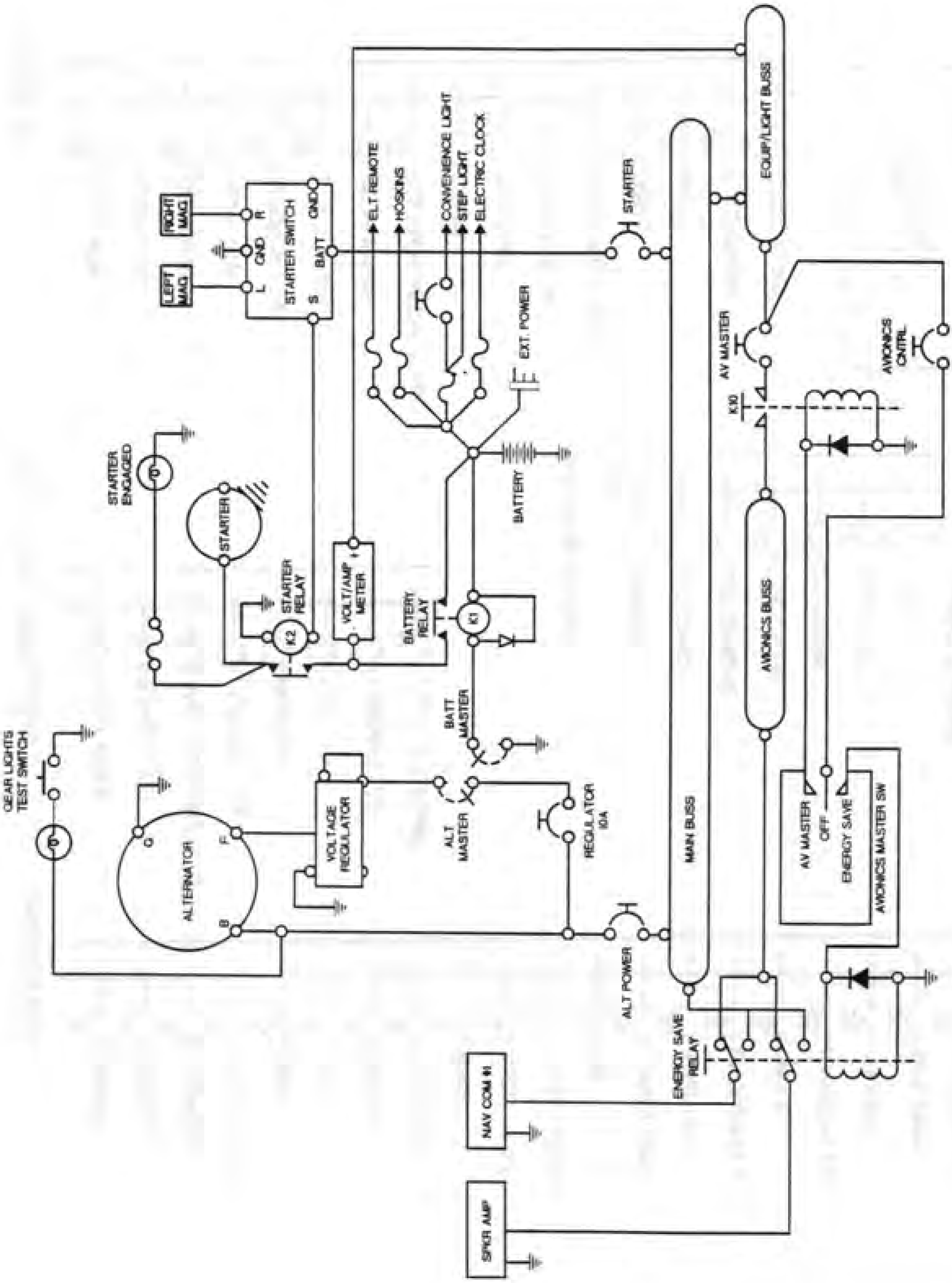


Figure 7-9

CIRCUIT BREAKER SCHEMATIC

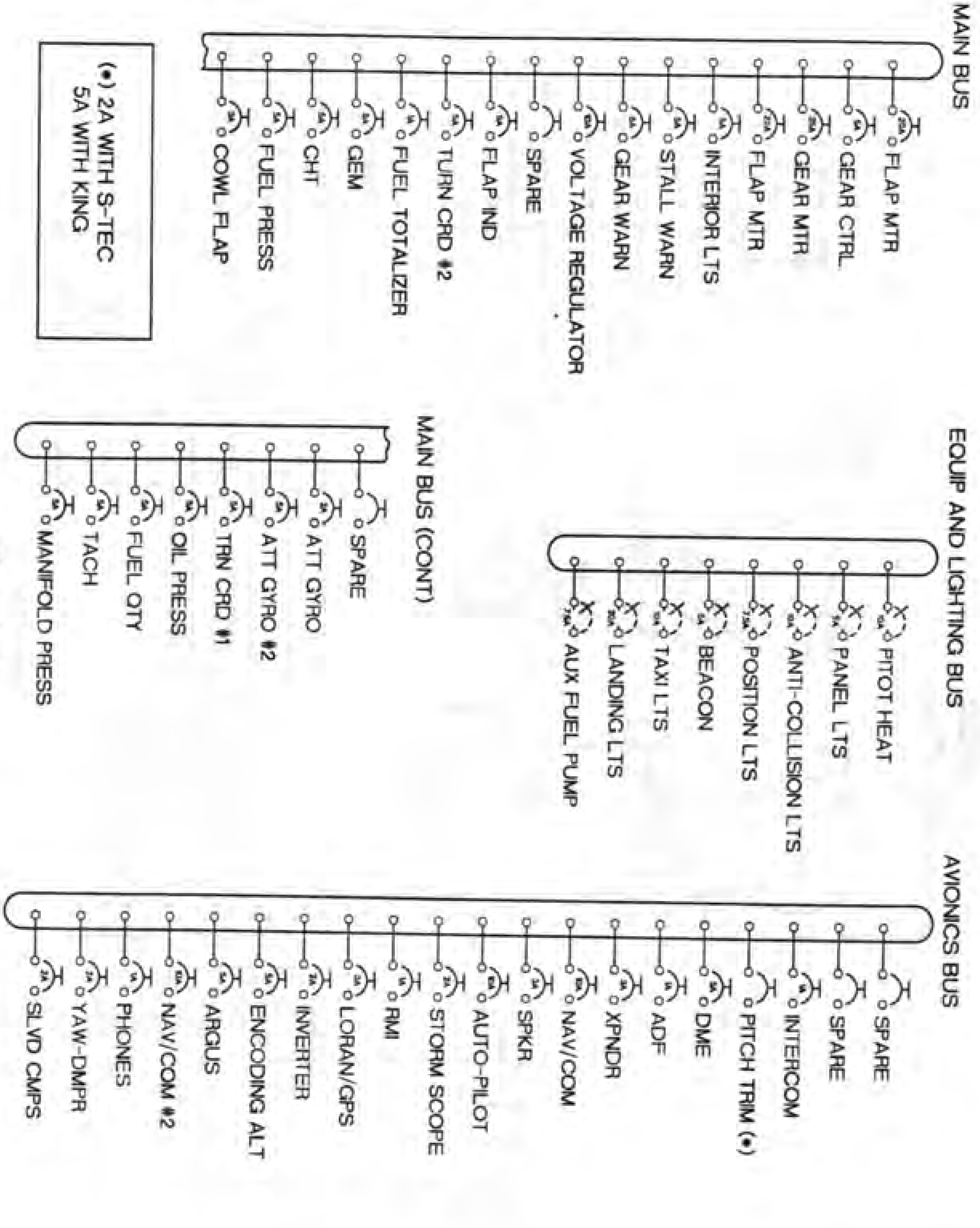


Figure 7-10

ELECTRICAL SYSTEM (con't)

Voltmeter reading should return to normal (approximately 28 volts) and the ammeter reading should increase. If this occurs, proceed with flight, but use caution in increasing electrical load. A low voltage reading (less than 24.5 volts) or a slowly decreasing voltmeter reading, accompanied by a discharge reading on the ammeter, indicates the alternator is not on the line and the battery is carrying the entire load. This situation will result in a complete loss of electrical power when the battery becomes discharged. To correct the condition, immediately reduce the electrical load to the minimum essential for safe operation. Place ALT master switch OFF and back to ON. If voltmeter reading returns to normal (approximately 28 volts) and ammeter shows a charge, alternator is on the line and operating normally. Place deactivated equipment back in operation, one unit at a time, while monitoring voltmeter and ammeter for abnormal indications, and continue normal operation.

Low voltage in the system will also be indicated by the illumination of the VOLTS annunciator located in the annunciator panel adjacent to the gear selector switch. This annunicator will illuminate when the voltage provided to the bus by the voltage regulator drops below 24.5 volts or when the alternator is off line.

NOTE
The VOLTS annunciator may illuminate at low engine RPM's.

If voltmeter reading does not return to normal and the ammeter continues to show discharge, a fault exists in the alternator system and it may become necessary to take the alternator off line and reset it. It is essential to reduce the electrical load as much as possible prior to attempting to reset the alternator. If an overload caused the alternator to drop off line initially, the alternator will not come back on the line until the overload condition is corrected. To reset the alternator, place ALT master switch to the OFF position then back to the ON position. If the alternator does not reset, refer Section 3 - Emergency Procedures, the Electrical System Emergencies Section.

Heavy electrical usage, such as prolonged cold weather engine starts or extended periods of ground operation, may reduce the battery charge enough for it to accept higher than normal charging rates during the initial part of the flight. This will be indicated by higher than normal ammeter readings. After reasonable period of time (approximately thirty minutes), ammeter readings should return to normal. If high ammeter readings continue after this time period, there is a possibility the battery may overheat and evaporate electrolyte at an excessive rate. To preclude the possibility of damaging the battery, turn ALT switch OFF, reduce electrical load to the essential minimum, and terminate flight as soon as practical.

CIRCUIT BREAKERS

Push-to-reset, push-pull, and rocker-type circuit breaker switches are used to protect electrical circuits in the airplane.

The main circuit breaker panel is located in the lower right instrument subpanel (see Figure 7-2). All general system and avionics circuit breakers in this area of the subpanel are the push-to-reset type. Exterior and instrument lighting, pitot heat, and the auxiliary fuel pump circuits are protected by circuit

ELECTRICAL SYSTEM (con't)

breakers built directly into the back of the individual rocker switch. A convenience circuit breaker is installed on the aft cabin bulkhead for the baggage compartment light and the step lights. Fuses are installed to protect some circuits. There are no provisions for replacing fuses in flight.

EXTERNAL POWER

A DC power receptacle, located aft of the battery on the left side of the fuselage, provides a means for connecting external power to the airplane electrical system. To conserve battery life, external power should always be used for starting a cold soaked engine when ambient temperature is below 32°F or when performing maintenance requiring electrical power. Voltage setting on external power should not exceed 28 volts.

CAUTION
Ensure power switch on external power units is OFF when connecting power unit to, or disconnecting power unit from, airplane. Failure to do so may cause arcing between the power unit plug and the airplane receptacle.

The positions of the master switches are important during an external power assisted start. Before connecting external power to the airplane the BATT MASTER and ALT MASTER switches should be OFF. Turn the BATT MASTER switch ON to apply external power to the airplane electrical system. After the engine has started, disconnect the external power. The ALT MASTER should then be turned ON to allow normal electrical system operation. Do not use external power to charge airplane battery.

LIGHTING

EXTERIOR LIGHTING

ANTI-COLLISION LIGHTS - Strobe lights are installed at each wing tip and at the aft end of the tail cone. The lights are controlled by the ANTI COLLISION lights circuit breaker switch and satisfy the night lighting anti-collision light requirements.

NOTE
Strobe lights should not be used when flying through clouds, haze, or snow to avoid disorientation due to the flashback. Also as a courtesy to other pilots, the strobe lights should be left OFF during taxi.

POSITION LIGHTS - Conventional navigation lights are installed on each wing tip and on the aft end of the tailcone. The lights are controlled by the POS lights circuit breaker switch.

ELECTRICAL SYSTEM (con't)

FLASHING BEACON LIGHT - A red flashing beacon light is installed on the top of the vertical fin. The light is controlled by the BCN light circuit breaker switch. This light does not satisfy night lighting anti-collision light requirements.

> NOTE
> The flashing beacon light should not be used when flying through clouds, haze, or snow to avoid disorientation due to the flashback.

LANDING AND TAXI LIGHTS - One landing light and one taxi light are mounted on the left and right main gear strut respectively. These lights are controlled by the LDG light and TAXI light circuit breaker switches.

Optional wing mounted landing lights are mounted on both wing leading edges near the wing tip. With this option, a taxi light is mounted on each main landing gear strut. It is acceptable to use the taxi lights in flight to supplement the landing lights, however, under some atmospheric conditions, some reflection from the propeller will be evident.

COURTESY LIGHTING - A unique independent set of exterior courtesy lights is provided. One light is mounted on each lower side of the aft fuselage to illuminate the wing steps. This light system is "independent" in the sense that it receives its power directly from the battery (without the master switch being on), and operates through a three (3) minute time-delay circuit to automatically turn the lights off after night boarding and de-planeing operations. The left forward cabin reading light and baggage compartment light also operate off this three (3) minute time delay circuit. The lights are activated by a remote switch button on the left entrance step attach plate or a switch button located on the center overhead console between the forward cabin reading lights. Depressing either of these switches activates the lights and holding relay to provide approximately three minutes of illumination before the lights go off automatically. Lights can be reset if additional time is needed. Also, whenever the baggage door is opened, the baggage compartment courtesy light illuminates, and remains illuminated, until the baggage door is closed.

INTERIOR LIGHTING

INSTRUMENT PANEL LIGHTING - Instrument panel illumination is provided by blue-white flood light units installed on the under side of the glare-shield. The switch subpanel is illuminated with a combination of postlights and backlit switch labels. The magneto switch is illuminated by a blue-white flood light installed above the switch subpanel. The magnetic compass and radio installations contain integral lighting. Instrument panel lighting intensity is controlled by a rheostat control knob labeled INSTR; radio and engine instrument light intensity is controlled by a second rheostat knob labeled AVIONICS. Rotating either rheostat control clockwise will increase light intensity. Both rheostat controls are located on the instrument panel directly below the pilot's control column.

ELECTRICAL SYSTEM (con't)

MAP LIGHTS - A map light is installed on the bottom edge of the pilot's and co-pilot's control wheel to provide convenient chart illumination during night operation. The light is turned on and off by a slide-type switch on the under side of the control wheel. Move left for off and right for on.

READING LIGHTS - The individual reading lights are controlled by a push button on/off type switch. The baggage compartment light, located in the ceiling aft of the rear seats, is controlled automatically by a plunger-type switch in the baggage door. Lamp bulb removal is accomplished by pulling the lens cover off and inserting a pencil in lamp unit and pressing pencil eraser on bayonet type bulb, while turning counterclockwise.

HEATING, VENTILATION, AND DEFROSTING SYSTEMS

Three ventilation systems provide interior comfort control which can be suited to individual pilot and passenger preference.

The cabin heating system consists of an intake, on the left front baffle, a muffler shroud to heat the incoming air, and three (3) air box assemblies to direct the heated air to two (2) windshield defroster outlets or to four (4) cabin floor side outlets for cabin heating.

CABIN HEAT AND VENTILATION SCHEMATIC

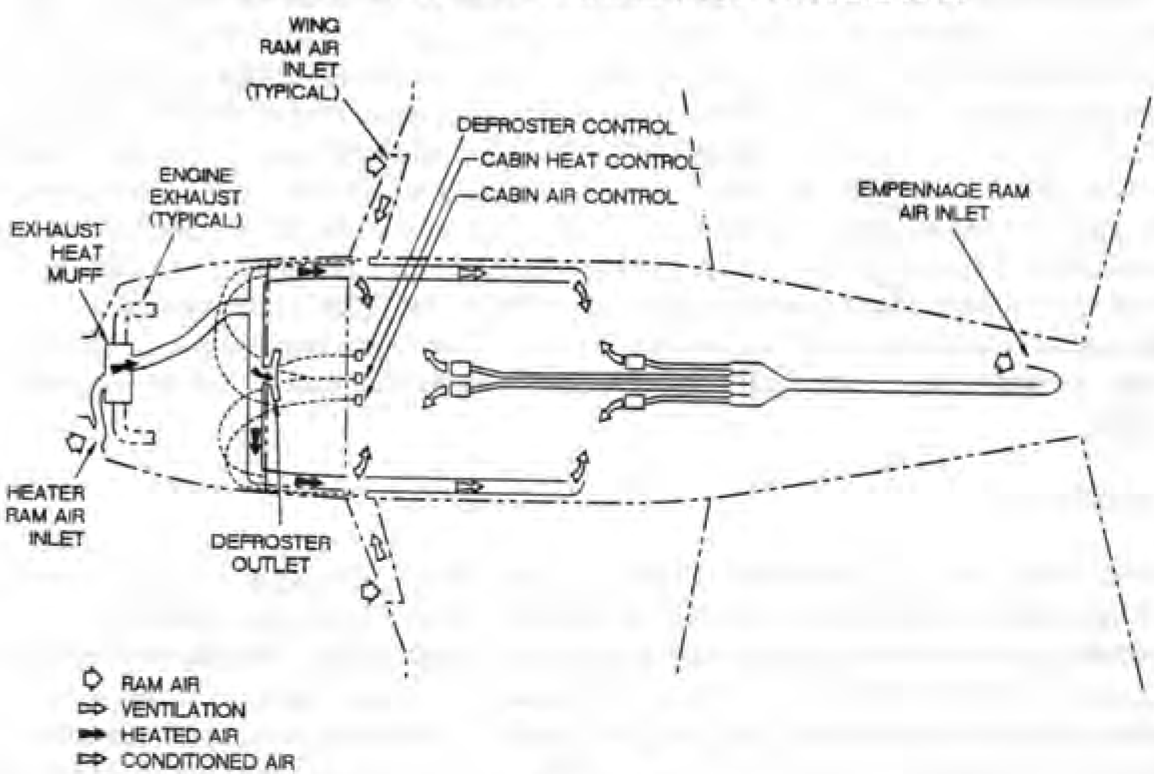


Figure 7-11

HEATING, VENTILATION, AND DEFROSTING SYSTEMS (con't)

Two separate knobs control adjustment and routing of the heated air; one labeled DEFROST, controls windshield defrosting, and one labeled HEAT controls cabin heating. The heat and ventilation control knobs are located above and to the right of the engine controls on the instrument subpanel. Pulling the control knobs out to full extension will provide the maximum amount of heated airflow, intermediate settings will provide an adjustment in air temperature for individual requirements.

> NOTE
> The HEAT and AIR controls can be use simultaneously to mix hot and cool air.

Two separate systems provide maximum air intake for cabin ventilation. Four individually adjustable outlets in the overhead console utilize a fresh air inlet in a flush NACA scoop on the dorsal fin. The second system utilizes one intake in the inboard leading edge of each wing to supply four adjustable outlets at cabin floor level. Ventilation airflow is controlled by a knob labeled AIR, located adjacent to the HEAT and DEFROST controls. Pulling knob to full extension provides maximum ventilation airflow.

PITOT PRESSURE SYSTEM

Impact pressure (pitot pressure) is sampled by a heated pitot tube installed near the center of the left wing on the lower surface. Pitot system tubing is routed from the pitot head, aft of the spar structure, inboard to the wing root and into the cabin. A drain plug is located eight inches left of airplane centerline, immediately aft of the spar. From the drain plug, the tubing runs forward through the center console, to the instrument panel where it is connected to the airspeed indicator. The pitot heat is controlled by a circuit breaker switch, labeled PITOT HEAT, on the switch panel to the left of the pilot's control wheel.

STATIC PRESSURE SYSTEMS

SHIP'S STATIC

Static ports are located on both sides of the aft fuselage at station 205.00. Tube routing from the static pressure ports is up to a tee at the airplane centerline, then forward, under the upper cabin upholstery, to the windshield area. The line is then routed to the alternate static valve (which doubles as a drain), then to the instrument panel where it is coupled to the altimeter, airspeed and vertical speed indicators.

ALTERNATE STATIC

A toggle-type alternate static source valve is installed at the far lower left of the instrument panel. In the event the static ports become obstructed, causing erroneous static pressure instrument readings, the alternate static source valve should be placed in the ON position to provide an alternate source of static pressure. When the alternate source valve is in the ON position, the normal static port lines are isolated and static pressure for the airspeed indicator, altimeter and vertical speed indicator is supplied from inside the cabin.

STATIC PRESSURE SYSTEMS (con't)

It is recommended that side windows be closed when operating on alternate static source. See Airspeed and Altimeter Calibration charts (Alternate Static Source) is Section 5 of this Handbook when using alternate static source.

STALL WARNING SYSTEM

A stall warning lift detector switch is located in the leading edge of the left wing. The lift detector switch is set to close the circuit and will cause the stall warning horn to sound out a constant high pitched alarm at 5 to 10 knots above aircraft stall speed. The stall warning horn is located on the firewall in the cabin area. The stall warning lift detector switch is interconnected to the ground contact switch to prevent inadvertent actuation of the stall warning horn with aircraft on the ground.

VACUUM SYSTEM

Suction to operate the directional and attitude gyros is provided by two engine driven vane type vacuum pumps. The pumps, installed on the engine accessory housing, are gear driven through spline couplings. A vacuum regulator is used to control system pressure. A vacuum gage, located below the engine instrument subpanel, indicates the system pressure level. Two failure indicators, located directly below the vacuum gage, give the pilot prompt notification of the failure of either vacuum pump.

VACUUM SYSTEM SCHEMATIC

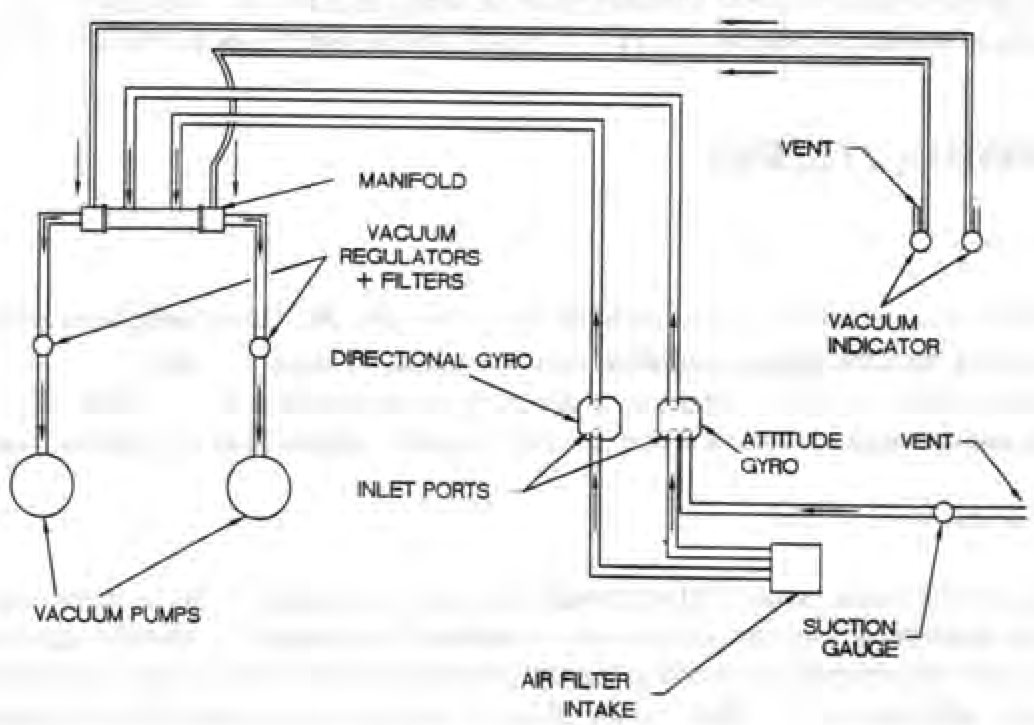


Figure 7-12

SECTION 8
HANDLING, SERVICING, AND MAINTENANCE

TABLE OF CONTENTS Page

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INTRODUCTION

Some general procedures covering ground handling, servicing, and lubrication should be included in the pilots general knowledge of the airplane. Those procedures most likely to be encountered or accomplished by a pilot are included in this section. Adherence to the procedures outlined in this section can save many hours of maintenance and down time.

It is recommended that service or maintenance required on the airplane, that cannot be accomplished by a certificated pilot, be taken to a Commander Authorized Sales and Service Representative (ASSR) or certified service station. Your ASSR will have available all service publications and FAA Airworthiness Directives pertaining to your airplane, as well as trained personnel, thus ensuring maximum utility and safety from your airplane.

It is the responsibility of the owner and/or operator of the airplane to ensure that the airplane is maintained by qualified mechanics and conforms to all airworthiness requirements established for this airplane.

To ensure a prompt reply, and correct information from Commander Aircraft Company, it is important to include the airplane serial number in any correspondence concerning service or maintenance on this airplane. The serial number appears on the identification plate attached to the left side of the ventral fin adjacent to the tailcone tie-down ring.

AIRPLANE INSPECTION PERIODS

1. FAA Required Annual Inspections
2. See "Servicing" section of Maintenance Manual.

PREVENTIVE MAINTENANCE THAT MAY BE ACCOMPLISHED BY A CERTIFICATED PILOT

Those items of maintenance which may be performed by a certified pilot are listed in Part 43 of Federal Aviation Regulations. Before attempting to perform any maintenance, refer to FAR, Part 43. All other maintenance must be performed by properly licensed personnel.

> NOTE
> All maintenance must be accomplished in accordance with current Maintenance Manual.

ALTERATIONS OR REPAIRS TO AIRPLANE

All alterations or repairs to airplanes must be accomplished by licensed personnel. The FAA should be contacted prior to any unapproved alternations on the airplane to ensure the airworthiness of the airplane is not violated.

GROUND HANDLING

GENERAL PRECAUTIONS

The following precautionary measures should be taken when handling the airplane on the ground:

1. Do not use parking brake to hold unattended airplane.
2. Do not set parking brake if brakes are wet and ambient air is 32°F (0°C) or less as there is a possibility of moisture accumulation freezing in brake assembly.
3. When operating the engine, remove all towing equipment and observe the following:
   a. Head airplane into the wind and chock wheels.
   b. Remove all control locks.
   c. All personnel, work stands, and equipment shall be clear of danger areas.
   d. Set parking brake.
   e. Position nose wheel straight ahead and hold rudder pedals in neutral position when operating engine at high power
   f. Perform engine ground runup in clear area to prevent foreign object damage to engine and propeller.

TOWING

Movement of the airplane on the ground may be accomplished by the following methods:

1. Pulling and guiding with nose gear tow bar. The nose wheel may be turned a maximum of 30° degrees to the left or right of center. Nose wheel tow limits must be strictly observed to prevent nose gear damage.
2. Rotating airplane overcenter on main landing gear to clear nose gear of ground and towing backwards. The main wheels are near the center of balance, and two people can lower the tail and move the airplane with little effort.
3. Attaching rope harness to main landing gear. This method is to be used when towing airplane forward through snow and over soft or muddy ground. Use tow bar to steer airplane.

TOWING PRECAUTIONS

1. Never push, pull, or lift airplane by use of control surfaces.
2. Never use nose gear strut body or tail cone tie-down ring as an attach point for towing.
3. Never place undue strain on airplane when towing, and avoid jerky motions.
4. Do not use ropes attached to main gear for towing airplane backward through mud or snow

PARKING

Head airplane into wind and set parking brake. Do not set parking brake if brakes are overheated or if brakes are wet and ambient air is 32°F (0°C) or less as there is a possibility of moisture accumulation

GROUND HANDLING (con't)

freezing brake assembly. Close cowl flaps, install internal control lock, place chocks under wheels, and release parking brake.

TIE DOWN

It is recommended that the airplane be hangared when not in use to minimize the deteriorating effect of weather and high winds. The airplane may be secured on outside tie-down by nylon or manila rope. If manila rope is used for tie-down, allow enough slack to compensate for contraction of the rope fiber. Tie-down procedures are as follows:

1. Turn airplane into wind, if possible, and install control wheel lock.
2. Chock both sides of each wheel and tie chocks together.
3. Place a rope around the nose gear strut near the base and, using a half-hitch, allow the two ends of the rope to extend an equal distance on each side of the nose wheel. Secure the ropes to tie-down points.
4. Secure a rope to the tail cone tie-down ring and secure to a point aft of the tail.

It is strongly recommended that exterior control surface locks be locally fabricated and installed at any time the airplane is tied down. Also, soft foam rubber intake opening plugs will prevent foreign matter from accumulating inside the engine cowling.

TIE DOWN

Figure 8-1

GROUND HANDLING (con't)

JACKING

Airplane jacking should be accomplished in a hangar unless wind is calm. To jack the airplane for landing gear maintenance, etc., refer to Figure 8-2 and proceed as follows:

1. Place jacks under jack pads on the underside of both wings and nose jack pad near the gear wheel well.
2. Attach a tail support stand to the tail tie-down fitting, and ballast as required.
3. Raise nose and wing jacks evenly until all three wheels are clear of the floor and struts have fully extended. Provide adequate clearance from floor surface if landing gear cycle tests are planned.

CAUTION
Check that parking brake is released prior to lowering the airplane after maintenance.

The nose gear may be raised without the use of jacks. By lowering aft fuselage and securing with weighted tail stand.

JACKING

Figure 8-2

SERVICING

BATTERY

The 24-volt battery is installed in the left side of the tail cone, and is accessible through the baggage compartment. Loosen and remove the thermoplastic battery box cover for battery inspection and, if required, electrolyte level checks. A built-in plastic carry strap is provided for convenience in handling the battery if it becomes necessary to remove it from the battery box.

The Commander 114TC comes from the factory supplied with a maintenance free battery. Should the battery be changed to a battery that is not maintenance free, the battery electrolyte level should be checked frequently, especially during hot weather. If visual check shows low cell level, add distilled water to bring the cell(s) up to proper level. Periodic hydrometer check for proper specific gravity of electrolyte is recommended. Battery charging and specific gravity requirements are defined in the Maintenance Manual.

TIRES

The nose and main gear tires and struts should be checked periodically for proper inflation.

	TIRE PRESSURE	STRUT PRESSURE
Nose Gear (5.00 x 5, 6 Ply)	50 PSI	120 PSI
Main Gear (6.00 x 6, 6 Ply)	38 PSI	405 PSI

The wheels and tires are balanced assemblies and the red dot on tire must align with yellow mark on tube. If tires are suspected of being out of balance, they may be balanced on automotive type balancing equipment.

When cleaning the tires, use only soap and water. Do not use solvents for cleaning, as they may produce harmful effects on sidewall rubber, etc. Tires should be rotated frequently whenever the airplane is stored for extended periods to prevent flat-spotting.

SHOCK STRUTS

Maintain nose strut air pressure at 120 PSI and main strut pressure at 405 PSI. Check the landing gear daily for general cleanliness, security of mounting, and hydraulic leaks. Keep polished surfaces of shock struts clean to avoid excessive ware and eventual failure.

ENGINE OIL

The oil level should be checked prior to each flight. Maintain a minimum of 7 quarts and fill to 10 quarts for extended duration flight. The oil may be changed every 100 hours of operation, provided that the filter element is changed every 50 hours. Oil that becomes dirty and contains sludge deposits should be changed regardless of time since last oil change. When preflight check indicates low oil level, service with aviation grade engine oil as shown in Figure 8-3.

SERVICING (con't)

TEMPERATURE	ASHLESS DISPERSANT OIL
All	SAE 15W-50 or 20W-50
Above 80°F (27°C)	SAE 60
Above 60°F (16°C)	SAE 40 or 50
30°F to 90°F (1°C to 32°C)	SAE 40
0°F to 70°F (-18°C to 21°C)	SAE 30, 40, or 20W-40
Below 10°F (-12°C)	SAE 30 or 20W-30

Figure 8-3

Detergent or "ashless-dispersant" oil, conforming to current Lycoming Service Instruction No. 1014 must be used.

NOTE
This airplane was delivered from the factory with ashless dispersant oil installed. TIO-540-AG1A engines must be broken-in and operated with ashless dispersant oil only. **DO NOT** use a mineral-type (non detergent) oil in this engine during the break in period.

After the first 25 hours of operation, drain engine oil, clean suction and oil pressure screens and replace the filter element. Refill the sump with detergent detergent oil conforming to specifications listed above. Check the belt tension, per Textron Lycoming Service Instruction No. 1129.

FUEL

The fuel tank filler caps are located on the upper outboard surface of each wing tank and contain anti-siphoning flapper valves. Do not service the airplane with a lower Grade of fuel than 100 LL (blue) or 100 (green).

REFUELING AIRCRAFT - To refuel airplane proceed as follows:

1. Verify battery switch OFF.
2. Verify fuel selector is in OFF position.
3. Remove filler cap and service with 100 (green)/100LL (blue) octane rated fuel until level rises to filler opening.
4. Replace filler cap and check if for security.
5. Wash any spilled fuel from wings with clean water.
6. Repeat for opposite fuel tank.

SERVICING (con't)

FUEL DRAINS

After servicing, all fuel drains (see Figure 8-4) should be checked for the presence of water or other impurities in the fuel system.

Drain check the fuel system as follows:

1. Drain a fuel sample from the wing tank sumps on the inboard underside area of each tank.
2. Drain a fuel sample from drain located in each main gear wheel well.
3. Drain fuel from gascolator.
4. Visually check that all drain valves close after draining.

If water is observed in the drain samples, there is a possibility that the tank sumps and lines contain additional water. Therefore, a complete re-draining check should be made.

FUEL DRAINS

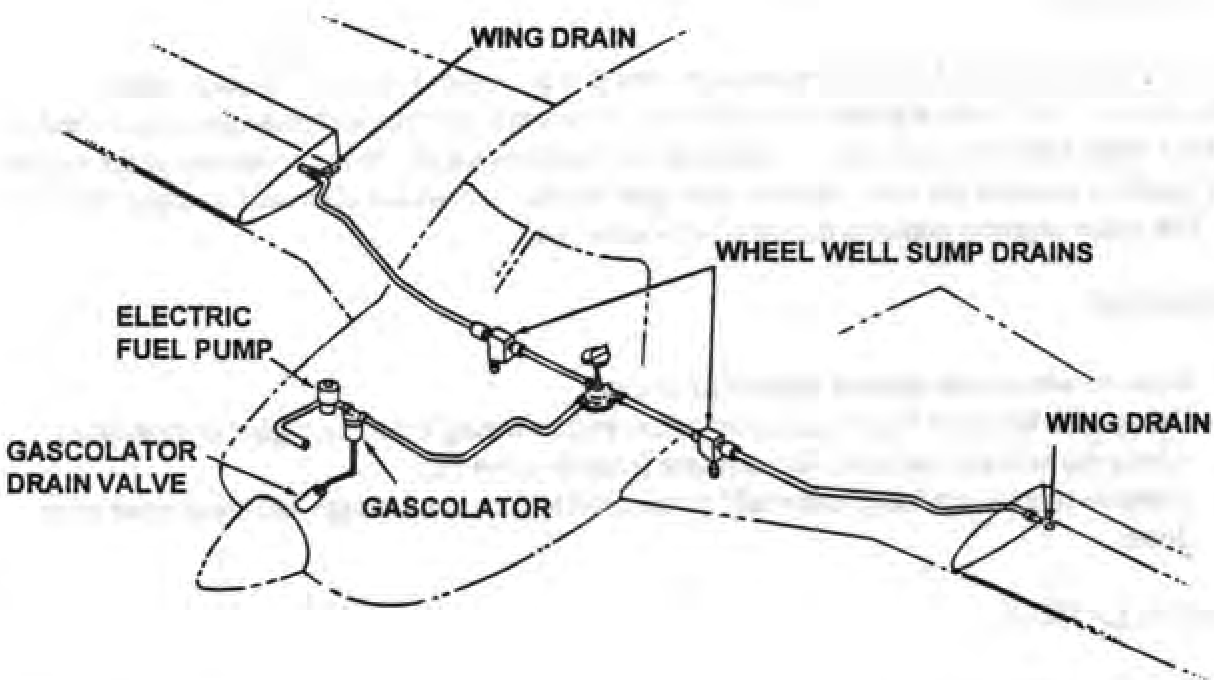

Figure 8-4

SERVICING (con't)

HYDRAULICS

LANDING GEAR POWER PACK

To check the hydraulic power unit fluid level, remove the left side baggage compartment sidewall by releasing Velcro fastener. Remove the filler from the top of the power unit, and check fluid level. Service with MIL-H-5606 hydraulic fluid. See Maintenance Manual if MIL-H-5606 hydraulic fluid is not available.

BRAKES

The pilot's and copilot's brake cylinders are supplied fluid from a separate fluid reservoir, located on the left forward side of the firewall. Before removing the filler plug, clean the top of the reservoir to prevent dirt from entering the reservoir. Service reservoir to the bottom of the filler plug opening with MIL-H-5606 hydraulic fluid.

If bleeding of brakes is required, refer to the Maintenance Manual.

ENGINE COWLING

The engine cowling consists of two fiberglass segments that are easily removed for quick access to all parts of the engine. The lower segment is attached to the forward fuselage with machine screws and is removed only when removing the engine or performing maintenance on the lower portion of the engine. The lower segment contains the cowl flap and nose gear doors. Screws are also used to attach the upper segment. The upper segment contains the oil filler access door.

REMOVAL

a. Remove screws and remove upper half of cowl.
b. Disconnect the cowl flap annunciator micro switch wiring from the engine compartment wiring harness and the cowl flap actuator from the cowl flap.
c. Remove screws attaching lower half of the cowl to forward fuselage and along nose gear doors.

INSTALLATION

To install the cowling, reverse the removal procedures. Before and after installation of the upper half of the cowl, every effort should be made to ensure that the baffle seals are not misaligned and do not gap.

LUBRICATION

See Figure 8-5 for miscellaneous lubrication requirements.

LUBRICATION CHART

APPLICATION SYMBOL	SPECIFICATIONS AND TYPE OF LUBRICATION
(HF) CLOTH WIPE	MIL-H-5606 HYDRAULIC FLUID
HAND PACK	MIL-G-3545 HIGH TEMPERATURE AIRCRAFT GREASE MIL-G-23827 AIRCRAFT GREASE (TOP OF NOSE GEAR TRUNNION ONLY)
LUBRICATION GUN	MIL-G-81322 AIRCRAFT GREASE
OIL CAN	MIL-L-7870 LOW TEMPERATURE GENERAL PURPOSE LUBRICATING OIL
	50 HRS. 100 HRS. AS REQD.

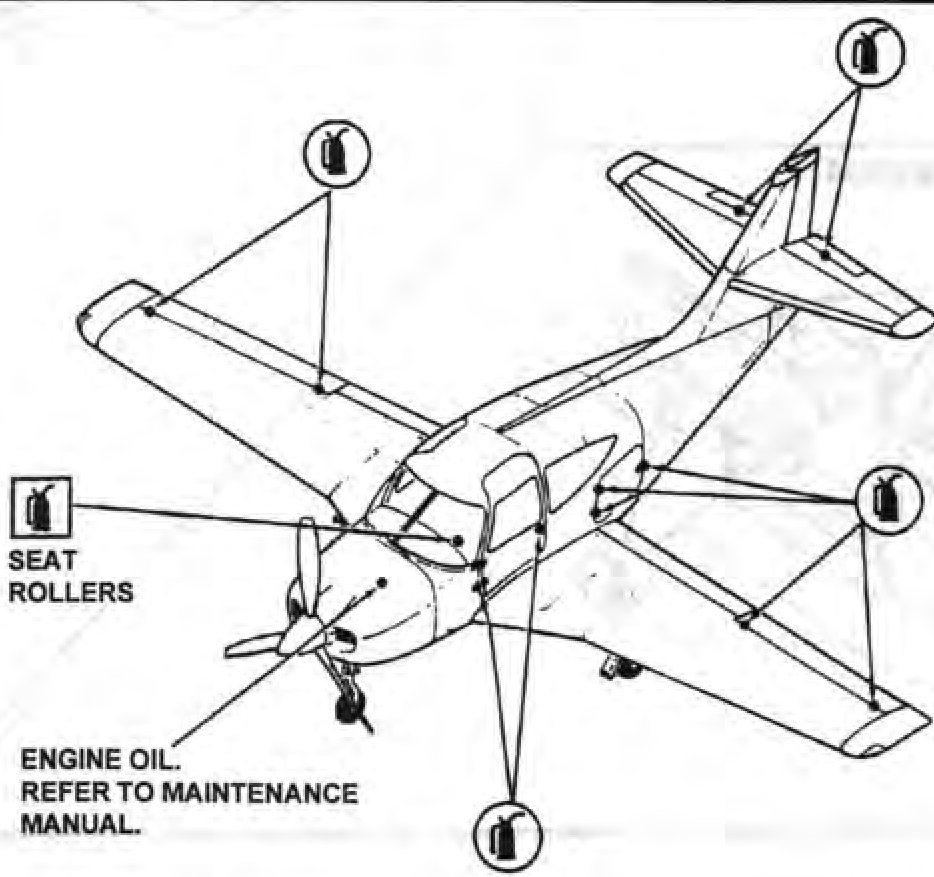

Figure 8-5
Sheet 1 of 2

LUBRICATION CHART

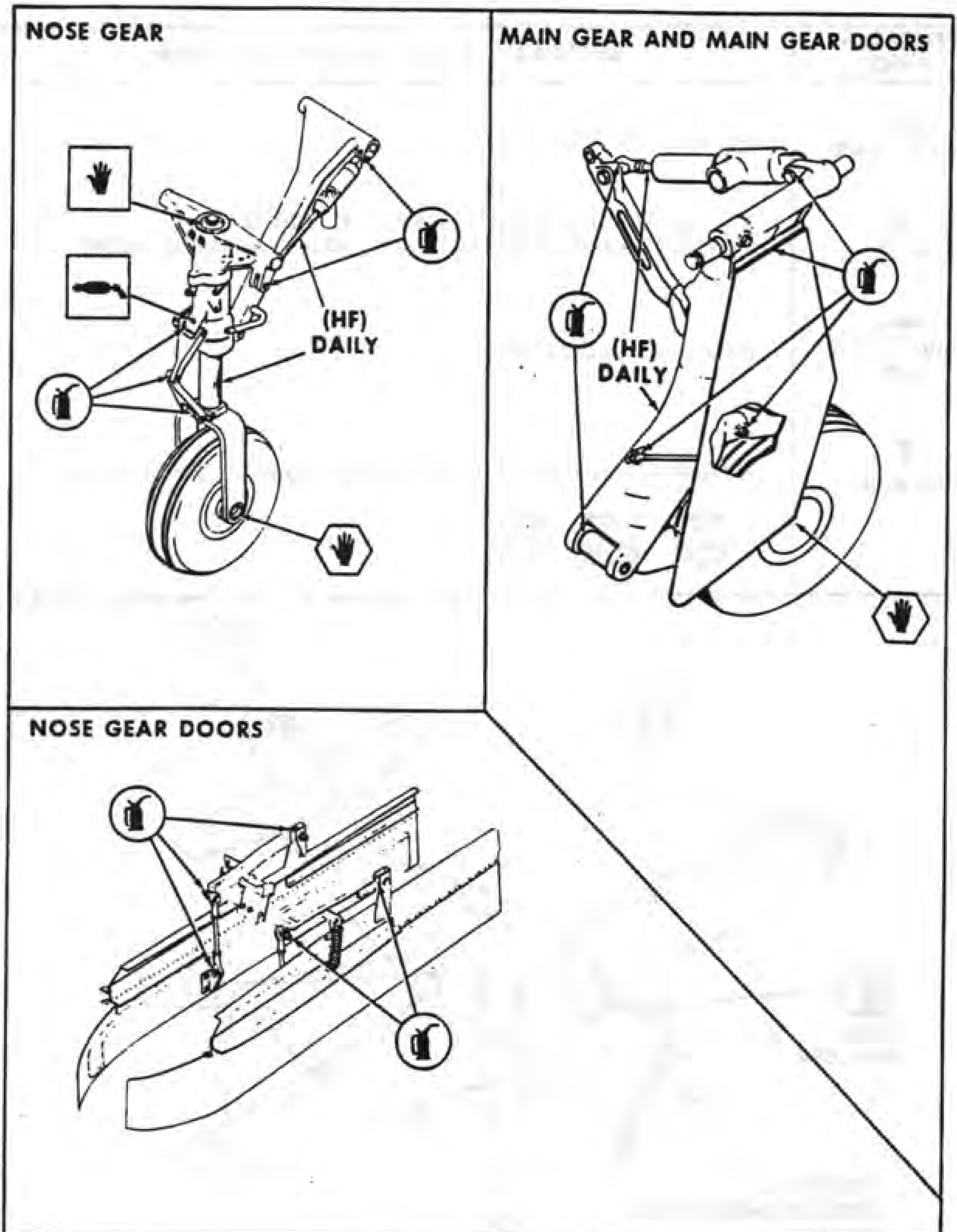

Figure 8-5
Sheet 2 of 2

CLEANING AND CARE

EXTERIOR CLEANING

Climate and operating conditions will determine the extent and frequency of cleaning required. Frequent washing when operating near salt water areas will help to minimize corrosion. Prior to cleaning the exterior of the airplane cover the wheels, making certain the brake discs are covered. Securely install plugs or mask off all openings. Be particularly careful to mask off both static air sources before washing or waxing. Do not apply wax or polish to the exterior surface of the airplane for a period of 90 days after delivery, as waxes and polishes seal the paint from the air and prevent curing. If it is necessary to clean the painted surfaces before the expiration of the 90 day curing period, use cold or luke warm water and a mild soap. Never use hot water or detergents. Any rubbing of the painted surface should be gentle and held to a minimum to avoid damaging the paint film. Use a mild commercial soap to wash the airplane and rinse with clean water. Loose dirt should be flushed away with clean water before soap is applied. Harsh or abrasive soaps or detergents may cause corrosion or scratches and should never be used. Soft cleaning clothes or a chamois should be used to prevent scratches when cleaning and polishing. The exterior surfaces may be waxed with a quality grade automotive past wax after allowing adequate curing time.

WINDSHIELD AND WINDOW CLEANING

The windshield and cabin side windows are made from plastic; therefore, care must be exercised when servicing the airplane to prevent scratching or otherwise damaging the window surfaces. The windshield and cabin windows may be cleaned by carefully washing with a mild commercial soap and clean water.

CAUTION
Do not use an ammonia based cleaning product on the windshield or the cabin windows.

ENGINE CLEANING

Engine and cowling may be cleaned with any standard engine solvent approved for this purpose. Prior to cleaning engine, cover all openings to prevent solvent from entering engine. Spray or brush solvent over engine and wipe dry. Blow excess cleaning solution from engine with compressed air.

CAUTION
Do not allow commercial cleaning solvents to enter magnetos, starter, alternator, vacuum/dry air pumps, or any primary component housing. Protect engine components by wrapping in suitable plastic or otherwise covering areas to prevent solvent contact.

CLEANING AND CARE (con't)

LANDING GEAR AND WHEEL WELL CLEANING

Clean landing gear and wheel wells with a compound containing an emulsifying agent to remove oil, grease, and surface dirt. The emulsion is removed by rinsing with water or spraying with a petroleum solvent. Cover the wheel and brake during landing gear and wheel well cleaning. If a water rinse is used in cold weather, blow all water from wheel well with an air hose, to prevent freezing. Emulsion type cleaners usually contain solvents which are injurious to rubber if allowed to remain in contact for any length of time; therefore, rinse affected area immediately with water. After cleaning landing gear, wipe exposed strut piston with a clean cloth moistened with MIL-H-5606 hydraulic fluid. To clean tires, rinse with water and scrub with a brush. Tire surface may be brightened after washing by rubbing with glycerine or applying a brush coat of commercial tire paint.

NOTE
Assure that ground contact (squat) switch and all landing gear limit switches are dry prior to flight.

PROPELLER CLEANING

Check propeller blades and hub periodically for oxidation, corrosion, cracks and nicks. Brush oxidized or corroded area with a phosphating agent to remove superficial corrosion, then remove etched and pitted area by buffing smooth with an aluminum polish. Small nicks, particularly near the prop tips and on the leading edges, should be dressed out as soon as practical since these nicks can produce stress concentration.

INTERIOR CLEANING

Seats, rugs, upholstery panels, and instrument panels should be vacuumed frequently to remove surface dust. Spots and stains should be removed with products specifically manufactured for this purpose. Clean the airplane interior with commercial cleaning compounds designated for plastic, vinyls and rug materials. Such products can be purchased locally. Do not use water to clean fabric surfaces, since it will spot upholstery and remove the flame-resistant chemical impregnated in the cloth. Before applying any cleaner, carefully read the directions and test the cleaner on an obscure piece of material to check its compatibility and cleaning reaction.

SECTION 9
SUPPLEMENTS

TABLE OF CONTENTS

Page

INTRODUCTION

This section contains a series of Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Supplements applicable to specific equipment which may be installed in the airplane. Each supplement is formatted similarly with General, Limitations, Emergency Procedures, Normal Procedures, and Performance sections.

These supplements contain material required to be furnished to the pilot by FAR 23 and additional information provided by Commander Aircraft Company and are a part of the FAA Approved Airplane Flight Manual. Limitations contained in these Supplements are FAA approved. Observance of these operating limitations is required by Federal Aviation Regulations.

Although no supplement is provided for many types of avionics, a small cruise speed decrease should be expected to result from the accompanying external antennae.

Approved Flight Manuals or Flight Manuals Supplements for avionics and/or other equipment installed under an STC should be inserted in this section.

FAA APPROVED FLIGHT MANUAL SUPPLEMENT

ASPEN EVOLUTION 2500

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

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.

This document and the required ESV Quick Reference document (see Section 2.1) describe the operating procedures for the Aspen Evolution Synthetic Vision System when it has been installed in accordance with the Aspen document 900-00003-001, EFD1000 and EFD500 Software Version 2.X Installation Manual Revision AE or subsequent.

For limitations, procedures, and performance data not contained in this Supplement, consult the Airplane Flight Manual or other operating information.

Airplane Make: Rockwell Commander

Airplane Model: 114 TC

Airplane Registration Number: N595TC

Airplane Serial Number: 20005

FAA APPROVED By: for [signature]

S. Frances Cox, Manager
Ft. Worth Special Certification Office
Federal Aviation Administration
Fort Worth, TX 76137-4298

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DOCUMENT REVISIONS

Document Revision	Pages Revised	Description of Change	FAA Approval	ECO
( )	All	Internal Release.		1775
A	All	Initial Release for FAA Approval.	9/28/2009	1784
B	All	See ECO	12/10/2009	1847
C	All	See ECO	4/12/2010	1950
D	All	See ECO	Not submitted	2074
E	All	See ECO	7/6/2010	2092
F	All	See ECO	7/14/2010	2113
G	All	See ECO	Not submitted	2147
H	All	See ECO	10/5/2010	2251
J	All	See ECO	12/3/2010	2317
K	All	See ECO	Not Submitted	2626
L	All	Added configuration of the EA100 to the Installed Equipment Configuration Matrix. Removed reference to the EA100 configuration in the body of the document. Added sentence regarding the EBB to the Limitations Section. Replaced section 2.1 Pilot Guide Limitations with a Table of Acceptable Pilot Guides	7/20/2011	2675
M	All	Updated Limitations section with the requirements for Synthetic Vision.	Not Submitted	2769
N	All	Added PFD PRO C3 column to 3.14 Warning, Caution, Advisory Summary Table. Improved SV information.	9/20/2011	2803
P	All	Added Altitude Preselector and Autopilot Source Select information	11/03/2011	2890
Q	All	Added Connected Gateway information. Removed Pilot version block diagram. Corrected typographical errors and removed a redundant paragraph in section 2.12.5.	Not Submitted for approval	3246
R	All	Added bullet in Paragraph 3.13. Corrected CG100 annunciations table.	8/7/2012	3307
S	All	Added Limitation to CG100 section: Aircraft registered in countries under EASA authority are not eligible for installation of the CG100 under this STC. Added "Aspen" to the Connected Gateway nomenclature to improve consistency in terms.	7/29/2013 Bal	3755

Prepared By:	WCB	Reviewed By:	PH	See ECO Record For Release Authorization

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TABLE OF CONTENTS

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1 General

1.1 System Description

This Airplane Flight Manual Supplement (AFMS) applies to aircraft installations of the following possible display combinations:

- EFD1000 Level B PFD Pro (C3) or EFD1000 PFD Pro
- EFD1000 Level B PFD Pro (C3) or EFD1000 PFD Pro, and EFD500 MFD
- EFD1000 Level B PFD Pro (C3) or EFD1000 PFD Pro, and EFD1000 MFD
- EFD1000 Level B PFD Pro (C3) or EFD1000 PFD Pro, and EFD1000 MFD and EFD500 MFD
- EFD1000 PFD Pilot
- EFD1000 PFD Pilot and EFD500 MFD

The Evolution Flight Display System is a multi-display, highly capable Electronic Flight Instrument System (EFIS) with integral Micro Electromechanical Systems (MEMS)-based Air Data Attitude and Heading Reference System (ADAHRS) with either internal backup battery or external Emergency Backup Battery (EBB). The system offers a state-of-the art Primary Flight Display (PFD) with an optional Flight Director, an optional Evolution Synthetic Vision System that includes a Flight Path Marker and Terrain Warning System (TWS), and optional satellite weather, traffic and Stormscope® overlays. When combined with the optional EFD1000 MFD and/or EFD500 MFD, the system offers a multi-panel, Multi-Function Display (MFD) solution that displays high resolution moving maps with Jeppesen® enroute and terminal data, satellite weather information, Stormscope data, traffic sensor data, relative terrain depictions, secondary attitude information, optional Evolution Synthetic Vision System that includes Flight Path Marker and Terrain Warning System (TWS) and a secondary HSI display. In addition, at the push of a button the EFD1000 MFD can instantly revert to a fully-functional primary flight display generated from ADAHRS data completely independent of that generated by the PFD. When combined with the optional Emergency Backup Battery the EFD1000 PFD and MFD combination provides an unsurpassed level of reliability and safety, and has FAA approval to replace mechanical airspeed and altitude instruments traditionally required with previous generation EFIS systems.

The EFD1000 Pilot PFD is a Primary Flight Display (PFD) with Attitude indicator, heading indicator and moving map. The Pilot PFD does not interface with weather or traffic data, and cannot be installed with an EFD1000MFD.

The Level B EFD1000 PFD (C3) provides a higher level of software integrity, primarily for certification on higher-performance (Class III[1]) aircraft. The C3 PFD does not interface with weather data, and can be installed with an EFD1000 MFD and/or an EFD500.

The EFD500 is a fully functional MFD with all the capability of the EFD1000 MFD except reversion, HSI, Remote Sensor Module (RSM), Emergency Backup Battery, Cross Link information (receive only) and the air data, attitude and heading features.

The standard internal battery in the EFD1000 or EFD500 is capable of providing 30 or more minutes of operation at typical cockpit temperatures if aircraft power to the system fails. An optional Emergency Backup Battery (EBB) available for the EFD1000 MFD provides a guaranteed 30 minutes of emergency operation, even under extreme environmental conditions, when maintained as required by the Instructions for Continued Airworthiness (Document 900-00012-001). Typical EBB endurance at 25°C is two or more hours, depending on the backlight intensity.

---

[1] FAA Advisory Circular 23-1309-1D defines a Class III aircraft as typically Single Reciprocating Engine, Single Turbine Engine, Multiple Reciprocating Engine and Multiple Turbine Engine equal or over 6000 pounds Maximum Certificated Gross Takeoff Weight.

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When the EFD1000 MFD with Emergency Backup Battery is used to replace backup altimeter and airspeed indicators the battery condition must be verified prior to each flight.

The EA100 Autopilot AHRS (A/P AHRS) optionally provides attitude information to the autopilot.

The Connected Panel System (Aspen Gateway) provides controlled wireless access to the cockpit avionics through the CG100 and the EFD1000 or EFD500 MFD.

Table 1 Installed Equipment Configuration, identifies the configuration for this aircraft.

Figure 1 provides a block diagram of a complete EFD1000/500 system installation, including optional interfaces. See Section 1.2 for a list of equipment installed in your aircraft.

The installed Aspen Evolution Synthetic Vision System complies with AC 20-167 performance criteria for situation awareness.

For detailed information on the operation of the EFD1000 PFD refer to Aspen Avionics document 091-00005-001, EFD1000 PFD Pilot's Guide. For additional information about the EFD1000/500 MFD, refer to Aspen Avionics document 091-00006-001, EFD1000/500 MFD Pilot's Guide. These documents must be carried in the aircraft whenever an EFD1000 PFD and/or EFD1000/EFD500 MFD are installed in the airplane.

EFD1000 Pilot Features. Refer to the Pilot's Guide for detailed information:

- Airspeed and Altitude Tapes
- Integral Altitude Alerter (visual only; no audible alert)
- Slaved heading indicator with heading Bug
- Base map with flight plan legs and waypoints
- 360° and arc view
- GPS Groundspeed, OAT and TAS
- Display of calculated winds aloft
- Integral Air data computer and Attitude Heading Reference System (ADAHRS)
- Built in backup battery and available emergency GPS
- Brilliant Display
- The Pilot can only be configured for only one GPS navigator

The EFD1000 Pro Features include the features of the EFD Pilot plus:

- Full slaved Electronic HSI with dual bearing pointers in lieu of the slaved heading indicator
- Integrates with most GA autopilot and Flight Director systems
- Dual GPS, dual ADF and dual VHF Nav support
- Built-in GPS Steering, (with compatible GPS navigator)
- Radar Altimeter display and DH annunciation
- Approach minimums alerting
- Optional Traffic and Weather interfaces
- Integration with EA100 Autopilot AHRS Adapter (A/P AHRS Adapter), providing attitude data to compatible autopilot systems. See Table 1.
- Optional Evolution Synthetic Vision with Flight Path Marker and Aspen Terrain Warning System (TWS)

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1.2 Installed Equipment Configuration Matrix

The table below records the equipment and optional interfaces installed in your aircraft, and will be completed during installation by the installation facility. The table is marked with the specific equipment that is installed in your aircraft, and shows what external interfaces have been installed, such as traffic and weather, and to which EFD the data is provided.

Please refer to this sheet to determine which portions of this AFMS are applicable to your specific aircraft installation:

NOTE: These tables are to be completed by the Avionics Installer.	EFD500 MFD	EFD1000 PFD PRO	EFD1000 PFD PILOT	Level B EFD1000 C3 PFD	EFD1000 MFD
Installed Evolution Flight Displays					
RSM with GPS	Not Available				
RSM without GPS	Not Available				
EBB Emergency Backup Battery	Not Authorized	Not Authorized	Not Authorized	Not Authorized	
Traffic Interface			Not Available		
Stormscope® Interface			Not Available	Not Available	
XM Weather Interface (Requires optional EWR50)			Not Available	Not Available	
Charts		Not Available	Not Available	Not Available	
EA100 Autopilot AHRS Connection	Not Available		Not Available		
Evolution Synthetic Vision with Flight Path Marker and Aspen Terrain Warning System (TWS)			Not Available	Not Available	
Aspen Terrain Warning System (TWS) audible and textual alerts. The audible and textual alerts are only available if TAWS is not installed.			Not Available	Not Available	
Aspen Gateway (GTWY) Not Authorized for EASA-registered aircraft. See Section 2.16, CG100 Aspen Connected Gateway Limitations.		Not Available	Not Available	Not Available	
Altitude Preselector Function					
A/P Source Select					

Table 1 Installed Equipment Configuration

Type of backup Attitude Indicator in this aircraft:	Mechanical backup attitude (this is required)	
Type of Standby Airspeed Indicator in this aircraft:	EFD1000 MFD*	Mechanical Airspeed
Type of Standby Altimeter in this aircraft:	EFD1000 MFD*	Mechanical Altimeter

Table 2 Backup Instruments Configuration

*An operational EBB Emergency Backup Battery connected to an EFD1000 MFD is required unless a standby Airspeed indicator and a standby Altimeter are installed. See Section 1.1 and Table 4

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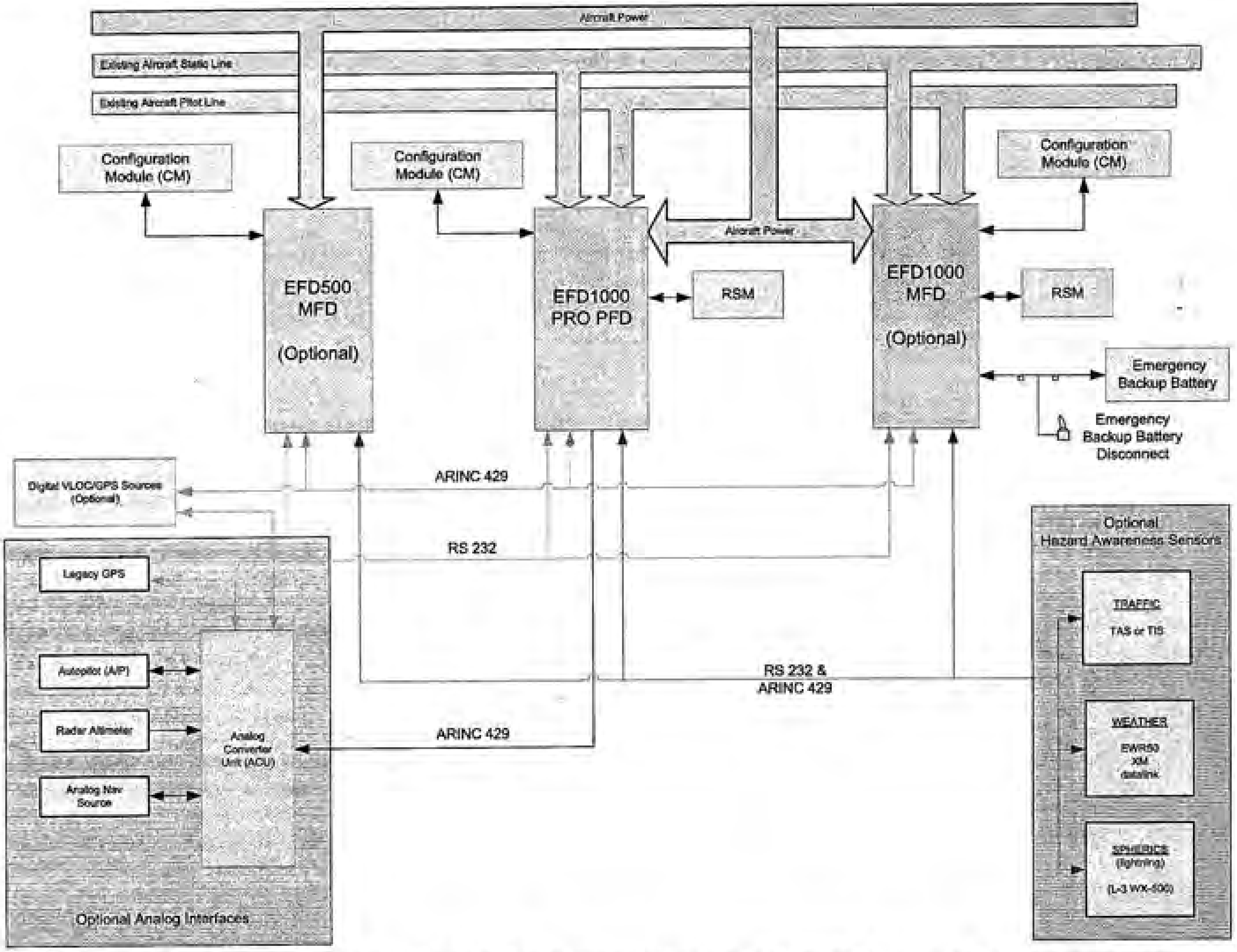

Figure 1 – Block Diagram of the EFD1000 Pro PFD, EFD1000MFD and EFD500MFD System with Optional Interfaces.

NOTE: The EA100 (shown in Figure 2) provides pitch and roll data to the autopilot. The ASPEN GTWY (shown in Figure 2) provides communication between the EFD100/500 MFD and certain wireless portable devices. See Table 1 Installed Equipment Configurations.

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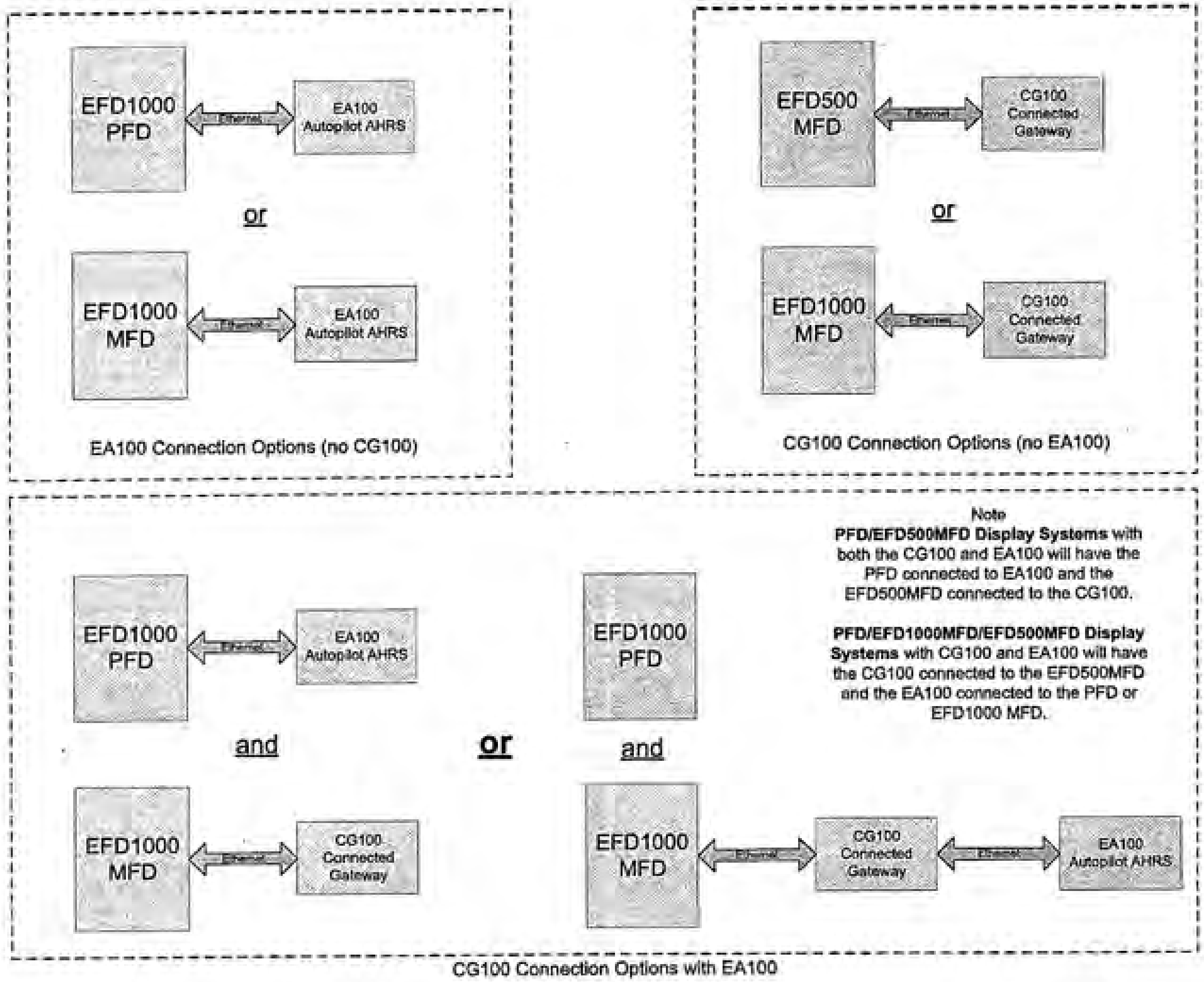

Figure 2– Block Diagram of CG100 and EA100 options. See Table 1 for the configuration of this aircraft.

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2 Limitations

2.1 Pilot's Guide

Limitation: For EFD1000 PFD installations:

- The Aspen Avionics document 091-00005-001, *EFD1000 PFD Pilot's Guide*, Revision A or subsequent must be carried in the aircraft and available to the flight crew.
- For EFD1000 C3 PFD installations, Aspen Avionics document 091-00019-001, *EFD1000 C3 Pro PFD Pilot's Guide* Revision ( ) or subsequent must be carried in the aircraft and available to the flight crew.
- For Synthetic Vision operation, document 091-00032-001 *Evolution Synthetic Vision ESV Quick Reference* Revision ( ) or subsequent must be carried in the aircraft and available to the flight crew.

The latest revision of these documents can be downloaded at the www.aspenavionics.com Customer Port or the Dealer Ramp, or contact Aspen Avionics.

Limitation: For installations that include the optional EFD1000 MFD or EFD500 MFDs:

- Aspen Avionics document 091-00006-001, *EFD1000/500 MFD Pilot's Guide Revision ( ) or subsequent* must be carried in the aircraft and available to the flight crew.
- For Synthetic Vision operation, document 091-00032-001 *Evolution Synthetic Vision ESV Quick Reference* Revision ( ) or subsequent must be carried in the aircraft and available to the flight crew.

The latest revision of these documents can be downloaded at the www.aspenavionics.com Customer Port or the Dealer Ramp, or contact Aspen Avionics.

2.2 Software Versions

Limitation: The EFD1000/500 display and associated hardware must use the software versions listed below, or later FAA approved versions.

The EFD1000 and EFD500 use identical software source code. A license key "image" stored in the unit Configuration Module determines the associated operating mode (i.e. PFD, MFD) and enabled features (i.e. weather, traffic) of the connected EFD hardware. The EFD software version is displayed on the Main Menu System Status page. Refer to Table 1 Installed Equipment Configuration, to determine the configuration of this aircraft.

System Component	Software Name	Version 2.X Software Version (or subsequent)	Notes
EFD1000 (PFD or MFD) and EFD500 MFD	MAP	2.1 2.4.1 for Evolution Synthetic Vision	The EFD1000 PFD or MFD must be at MAP Version 2.2.2 (or subsequent) when using the EA100 A/P AHRS

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System Component	Software Name	Version 2.X Software Version (or subsequent)	Notes
	IOP	2.0 2.0.2 for Evolution Synthetic Vision	The EFD1000 PFD or MFD must be at IOP Version 2.0.1 (or subsequent) when using the EA100 A/P AHRS
EFD1000 Level B Pro (PFD) C3	MAP	B2.1 B2.3.2 for Evolution Synthetic Vision	The EFD1000 C3 PFD must be at MAP Version B2.2.3.1 (or subsequent) when using the EA100 A/P AHRS
	IOP	B2.0 2.0.2 for Evolution Synthetic Vision	The EFD1000 C3 PFD must be at IOP Version B2.0.2 (or subsequent) when using the EA100 A/P AHRS

2.3 Airspeed Limitation

Limitation:	The maximum approved operating airspeed for this system is 270 KIAS (311 MPH IAS).

2.4 Pitot Obstruction Monitor

Limitation:	For aircraft with two EFD1000 displays, an IFR GPS must be operable for dispatch under IFR.

NOTE:

This limitation applies only to aircraft with both an EFD1000 PFD and an EFD1000 MFD, regardless of the standby instrument configuration

Most light aircraft have a single pitot and static system. The pitot and static inputs are shared among the EFD1000 PFD, EFD1000 MFD, the backup altimeter and the airspeed indicator. Should pitot or static become blocked, then both the EFD1000 PFD and the EFD1000 MFD, along with any standby indicators of airspeed and altitude, could display erroneous attitude, airspeed and altitude information.

When connected to a GPS, the EFD1000 system compares airspeed and groundspeed to identify a blocked pitot system.

The EFD1000 PFD automatically removes attitude and heading and replaces them with red-X indications shortly (~5 seconds) after the airspeed reduces to less than 30 KIAS when the GPS groundspeed remains above 50 knots (the EFD1000MFD will show ADAHRS FAIL). The EFD1000 attitude will gradually pitch up until the attitude indication is automatically removed. This is a detectable condition that is directly linked to the airspeed loss.

When an EFD1000 is connected to an EA100 A/P AHRS and the autopilot is engaged, a pitot block causes the autopilot to gradually pitch down until the autopilot is manually or automatically disengaged. The red-X indication and "CHECK PITOT HEAT" from the connected EFD1000 PFD (or ADAHRS FAIL from the connected MFD) will cause the autopilot to automatically disengage and the A/P AHRS FAIL

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lamp to illuminate. The autopilot cannot be reengaged until the attitude on the EFD1000 is restored and the A/P AHRS FAIL lamp is extinguished.

NOTE:

> **When the autopilot is engaged, the most apparent indication of an attitude malfunction due to a blocked pitot may be the simultaneous decrease in pitch attitude and the airspeed decreasing below expected values.**
>
> **The autopilot should be manually disengaged during a blocked pitot condition. In a blocked pitot condition, the autopilot will automatically disengage five seconds after the airspeed reduces to less than 30 knots.**
>
> **When the autopilot is not engaged, the most apparent indication of an attitude malfunction due to a blocked pitot may be the simultaneous change in pitch attitude indication and the airspeed decreasing below expected values.**

Once the system detects that the pitot obstruction has been cleared, the "CHECK PITOT HEAT" annunciation is removed and the system automatically performs an ADAHRS in-flight reset.

Should a GPS failure be experienced in flight, the Pitot Obstruction Monitor (POM) continues to operate in a fail safe mode and will continue to detect blockages in the pitot system that might occur. The POM remains active after touchdown. As the airplane slows below 30 KIAS the system will post red-X indications in place of the attitude and heading information and display the "CHECK PITOT HEAT" message. In this circumstance, restoring the GPS system, or cycling power to the affected EFD1000 will restore normal POM operation and attitude indications.

In some aircraft with very low stall speeds it may be possible to activate the Pitot Obstruction Monitor when performing slow flight at indicated airspeeds below 30 KIAS. Under these circumstances if the groundspeed exceeds 50kts the POM will activate. Should this occur, fly by reference to the standby attitude indicator or the visual horizon. To restore normal ADAHRS operation, increase the indicated airspeed to a value greater than 30 KIAS; the affected display will then perform an automatic reset.

This Pitot Obstruction Monitor is not available in installations without a GPS. An IFR approved GPS configuration is required for installations with two EFD1000 displays or when an EA100 system is installed.

2.5 Databases (EFD1000/500 MFD Only)

There are several databases available (see Table 3). Jeppesen provides terrain, NavData®, cultural information and obstacle data. The intended function of each of these databases for the Terrain (TERR) moving map selection on the MFD and for the NAV Map selection on the MFD is to provide a background graphical depiction of the surrounding map features used to improve the flight crew awareness of the aircraft ownship position relative to other items depicted on the moving maps. The background graphical depiction of the surrounding map features is not to be used for navigation and must not be used as a basis for maneuvering.

The overlaid flight plan originates from the GPS and can be used for navigation within the limitations of the GPS approval.

The EFD1000 PFD and MFD use the Jeppesen databases with Evolution Synthetic Vision and the associated features of the Flight Path Marker and the Terrain Warning System.

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Limitation:	Database currency date must be acknowledged on the EFD1000 MFD and EFD500 MFD prior to each flight. Flight with an expired database is not recommended. Any out of date data displayed on the EFD must either a) be verified to be correct by the flight crew before use or b) not be used.

Limitation:	Legend information, as well as climb and descent tables, MLS frequency pairing and general data that are found in the NACO paper Terminal Procedures Volumes are not provided in the Charts Database. The operator is responsible for access to this information as required by regulation.

The Jeppesen NavData©, Cultural database and Obstacle database are all combined into a single download from Jeppesen. Terrain data is loaded at the factory and does not require periodic updating. The terrain database is available from Jeppesen.

The Terminal Procedures Charts (Charts) database updates are provided by Seattle Avionics.

Data base valid dates for Jeppesen and Charts are displayed at power up and require a pilot action to acknowledge. Database valid date information can also be accessed via the main menu of the MFD.

NOTE:

Flight with an expired database is not recommended.
An expired database does not prevent terrain or other Nav Map features from being displayed on the MFD.

Database Type	Includes	Update Cycle	Database Provider	Limitations
Terrain	High resolution terrain data for Americas, International, or Worldwide geographic regions. Terrain depiction is limited to the region between 65 deg N latitude to 65 deg South latitude	Delivered with unit, updated intermittently as announced by Jeppesen	Jeppesen mail order	These databases are intended to improve flight crew awareness and are not to be used for navigation.
NavData	Includes Navaids, Controlled Airspace, Restricted, Prohibited and Special Use Airspace, Airports, etc.	28 day update cycle	Jeppesen JSUM©	
Cultural	Includes Roads, Rivers, Railroads, Political boundaries, Cities, etc.	28 day update cycle	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	Jeppesen JSUM©	

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Database Type	Includes	Update Cycle	Database Provider	Limitations
Charts	NACO Terminal Procedures Charts	28 day update cycle	Seattle Avionics	

Table 3 Database Listing and Descriptions

2.6 RSM GPS Usage (if installed)

Limitation:	The RSM GPS is limited to EMERGENCY USE ONLY.

The EFD1000 RSM can optionally include a non-certified GPS receiver. This GPS can provide positioning data when all other approved sources of GPS data have failed. Position data from the RSM GPS will only become available for use following a loss of position information from all other connected GPS system(s). When the RSM GPS is in use, the current flight plan leg will be shown in white rather than magenta, and a message is presented limiting the RSM GPS to EMERGENCY USE ONLY.

2.7 Operation on Internal Battery or EBB

Limitation:	Takeoff with aircraft voltage (as indicated on the EFD) below 12.3V (14V electrical system) or 24.6V (28V electrical system) is NOT AUTHORIZED.

Each EFD1000 or EFD500 is equipped with either an internal battery, or an external Emergency Backup Battery. Battery operation and logic is the same regardless of which battery is connected to your display. The Emergency Backup Battery has a wider operating temperature envelope than the internal battery, and will provide battery capacity for a significantly longer time than the internal battery.

The EFD system incorporates sophisticated power logic to determine when to transition to battery. On the ground, the system will turn on and turn off with the application or removal of aircraft power. In the air, the system will transition to battery if aircraft power is removed or degraded, or if an overvoltage is detected. Transition thresholds and times will vary as a function of the input voltage to the display, which can be observed via the Menu Power Settings Page. Battery operation should be expected any time the aircraft charging system is unable to maintain a voltage at the EFD of 12.3 V (14V electrical system) or 24.6V (28V electrical system). Under these circumstances, should the aircraft dispatch the EFD will transition to battery shortly after reaching flying speed.

2.8 Emergency Backup Battery (EFD1000 MFD Only)

Limitation:	Dispatch when EBB charge status of less than 80% is NOT AUTHORIZED if the EBB is required by the KOEL in section 2.14. Dispatch with a cabin temperature below -20°C is NOT AUTHORIZED if the EBB is required by the KOEL in section 2.14. When the EFD1000 MFD with Emergency Backup Battery is used to replace backup altimeter and airspeed indicators the battery condition must be verified prior to each flight

The Emergency Backup Battery is an approved emergency power source for the EFD1000 MFD. When installed, the EBB enables the EFD1000 MFD to be the approved backup instrument to the EFD1000 PFD, and authorizes removal of independently-powered standby airspeed and altitude instruments. When maintained in accordance with the Installation Manual (annual check and scheduled replacement

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per 900-00003-001) and the EFD1000 MFD shows a charge status of 80%, the EBB will provide at least 30 minutes operation when cold-soaked to -20°C and the display is operated at the default maximum backlight intensity. Battery operation below this temperature is not assured. The EBB charge status must be verified prior to each flight where the EBB is required by the KOEL in section 2.14. The minimum dispatch limit is 80% when the EBB is required.

At cold temperatures it takes 10 minutes for the EFD1000 system to calculate an accurate EBB charge status. On the ground when the battery is colder than 0°C, a timer will run for 10 minutes before EBB charge status is displayed. In the air, the charge status will be indicated after a 15 second delay. When the battery is cold (<0°C) the % remaining value will initially decrease rapidly for several minutes, but will subsequently increase and stabilize at the correct value. This stabilization process may take as long as 10 minutes. During this period the pilot should consider the charge status determined during the pre-flight checks to be the battery charge state.

> **NOTE: The limitations in this section apply only to those installations with an EBB installed without mechanical standby airspeed and altitude instruments. See section 2.12.7 for the Kinds of Operation Equipment List.**

2.9 Geographic Limitation

> **Limitation:** Use of the EFD1000 for IFR operations in the region within 750 nautical miles of the magnetic North or South Pole, based solely upon the attitude and heading data provided by the EFD1000, is NOT AUTHORIZED.

The ADAHRS solution in the EFD1000 uses multiple inputs, including the earth's magnetic field, to determine aircraft heading, pitch and roll. The system must be able to periodically sense the earth's magnetic vector to be able to correctly resolve heading and stabilize the ADAHRS attitude solution.

All magnetic sensors, including the one in the EFD1000, will experience degraded performance in the vicinity of the earth's magnetic poles. When the horizontal component of the earth's magnetic field is no longer strong enough to provide reliable heading data, the EFD1000 will detect this condition and compensate for the reduced magnetic fields. The system can continue to operate for a short time without reference to magnetic North, but must be able to periodically resolve the magnetic vector to continue operations.

If the EFD1000 is unable to resolve the earth's magnetic field for two minutes, the system will switch to and annunciate Free Gyro Mode. In this mode, the ADAHRS continues to provide attitude and heading data based on gyro-only operating logic. This will be accompanied by a "FREE GYRO MODE" message posted on the HSI, and a "CROSS CHECK ATTITUDE" annunciation posted on the attitude indicator. Under these circumstances, increased vigilance and instrument cross check is required.

If the weak magnetic conditions persist, and the EFD1000 is unable to resolve the magnetic vector for six minutes or greater, then the attitude and heading solution will be considered failed and will be removed (i.e. red X indication). The ADAHRS solution will automatically restore once the magnetic vector can again be resolved.

Within a region approximately 750 nautical miles from the magnetic pole, the conditions described above are expected to be persistent. In the Northern Hemisphere, this distance approximately equates to operations in the Arctic Islands found north of continental North America.

2.10 Placards and Decals

When the EBB has been installed and independently-powered airspeed and altitude instruments have

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been removed, the following placard must be shown on the instrument panel in plain view of the flight crew:

EMER BAT DISPATCH LIMIT 80% **SEE EFD AFMS**

When an EA100 A/P AHRS is installed an amber annunciator lamp is installed in the Pilot's Primary Field of View. The lamp is labeled with the following:

A/P AHRS FAIL

2.10.1 MFD Initialization placard

The following electronic placard is displayed during initialization of the MFD (the SV message is displayed when SV is 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.

2.10.2 PFD Initialization placard

The following electronic placard is displayed during initialization of the PFD (when SV is configured):

> **CAUTION:**
> Synthetic Vision information and terrain information are for awareness Only. Do not maneuver based solely on this information.

2.11 Seaplane Operation

Limitation:	If the ADAHRS is unable to align due to wave action, departure under IMC or IFR is PROHIBITED.

The EFD1000s may not be able to align when on water as a function of the wave action being experienced by the aircraft. When aligning on water, always perform a visual verification of the attitude reference with a secondary source, such as a mechanical gyro or the horizon. If the alignment is not successful, it is acceptable to depart under VFR/VMC and, while maintaining VFR/VMC, perform an ADAHRS in-flight alignment per Section 3.5.

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2.12 Hazard Awareness Limitations (EFD1000 PFD PRO and MFDs ONLY)

2.12.1 Terrain and Obstacle Display Limitation (MFD)

Limitation:	Maneuvering based solely on the EFD1000 terrain and obstacle depiction is not authorized. The Pilot In Command has the responsibility to use accepted visual and instrument procedures to avoid terrain and obstacles.

The EFD1000/500 MFD display of terrain and obstacle information colorizes the terrain based on the aircraft proximity to the terrain or obstacles.

The EFD1000/500 MFD display of terrain and obstacle information on the dedicated (TERR) view and the Navigation Map is advisory only. In addition, the MFD Terrain and Obstacle view does not provide terrain or obstacle alerts. Not all obstacles within a given region will be charted. The pilot is responsible for terrain and obstacle avoidance by visual means, or by following approved instrument procedures. At system start up the pilot must acknowledge this operational limitation by pressing either MODE/SYNC knob.

The terrain and obstacle information is based on barometric altitude compared to the altitude of the terrain and obstacles in the databases. The altitude is not temperature-compensated. Incorrect or inaccurate barometric pressure, or very cold temperatures can significantly affect the accuracy of the displayed elevations. See the FAA Aeronautical Information Manual Section 7-2-3 for more information.

> **WARNING:** The Terrain and Obstacle depictions are dependent on accurate barometric altitude. An inaccurate altimeter setting will cause an incorrect depiction of the elevation of terrain and obstacles. Very cold temperatures can also cause significant errors in altimetry. The Pilot In Command has the responsibility to use accepted visual and instrument procedures to avoid terrain and other obstacles.

The terrain and obstacle databases may contain errors. Obstacles less than 200 feet AGL are not displayed.

Terrain and obstacle information is intended to assist the flight crew in fulfilling the responsibility to avoid terrain and obstructions through visual means or by following instrument procedures.

NOTE: The optional Evolution Synthetic Vision System includes a Terrain Warning System that is consistent with the terrain and obstacle display. See section 2.13.

2.12.2 Traffic Display Limitation:

Limitation:	Maneuvering based solely on the EFD1000 traffic display is not authorized. The Pilot In Command has the responsibility to see and avoid traffic.

The EFD1000/500 MFD and EFD1000 PFD will display traffic information when connected to a TIS, TAS or TCAS I system. Traffic information is presented to assist the pilot in visually identifying nearby aircraft.

2.12.3 XM Datalink Information Limitation:

Limitation:	Datalink information (e.g. NEXRAD, METAR, TFR, etc.) shown on the PFD or MFD displays is supplemental to data available from official sources.

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The EFD1000/500 MFD and EFD1000 PFD may be connected to an optional EWR50 XM weather receiver. Datalink information displayed on the EFD1000 system is supplemental to the out of the cockpit view and weather information from approved sources.

The XM service and reporting area includes the United States, Southern Canada and Puerto Rico.

The maximum wind speed capable of being shown is 180 knots. Wind speeds greater than 180 knots will be shown as 180 knots.

2.12.4 Electronic Map Display Limitation:

Limitation:	The EFD1000/500 moving map display is not a substitute for approved maps or charts required by the operating rules.

The EFD1000 Moving Map Display is not a substitute for approved aeronautical maps or charts from approved sources. Approved maps and charts must be carried in the aircraft, as required by the applicable operating regulations.

2.12.5 Aerodrome Moving Map Display (AMMD) Limitation:

Limitation:	The aircraft ownship position presented on the Airport Diagrams may be inaccurate – reference to ownship position for navigation or maneuvering is prohibited.

The intended function of Aerodrome Moving Map Display (AMMD) is to help flight crew orient themselves on the airport surface and improve pilot positional awareness during taxi operations. AMMD function is not sufficient to be used as the basis for maneuvering and shall not be used for navigation. This application is limited to ground operations only.

This function is a Class 3 Electronic Flight Bag Type C application. See FAA AC 91-78 for more information.

The intersection of the wings and fuselage of the aircraft ownship symbol on the AMMD corresponds to the ownship's actual position.

2.12.6 Terminal Procedures Charts ("Charts") Limitation (no Ownship Depiction)

Limitation:	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 aircraft. This function does not replace any system or equipment required by the regulations.

The intended function of the Terminal Procedures Charts depiction without the aircraft ownship depicted on the chart is to provide a convenient location to view portions of the Terminal Procedures Charts information.

The Terminal Procedures Charts depiction is not sufficient to be used as the basis for maneuvering and must not be used for navigation.

This function is a Class 3 Electronic Flight Bag Type B application. For most 14 CFR Part 91 operations, the in-flight use of an Electronic Flight Bag/Electronic Chart Display in lieu of paper reference material is the decision of the aircraft operator and the pilot in command. For Part 91 subpart K, Part 91 subpart F and Part 135, Part 121 and Part 125 operations, consult your Operating Specifications. See FAA AC 91-78 for more information.

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2.12.7 Terminal Procedures Charts ("Charts") Limitation (with Ownship Depiction)

Limitation:	The aircraft ownship position presented on the Terminal Procedures Charts may be inaccurately portrayed due to errors in the charts – reference to the ownship position for navigation or maneuvering is prohibited.
Limitation:	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 aircraft. This function does not replace any system or equipment required by the regulations.

The intended function of the display of terminal procedures with the ownship position is to provide a graphical depiction of the approach chart used to improve the flight crew awareness of the aircraft ownship position relative to other items depicted on the chart.

The Terminal Procedures Charts depiction is not sufficient to be used as the basis for maneuvering and must not be used for navigation.

2.13 Synthetic Vision and Terrain Warning System Limitation:

Limitation:	Navigation or maneuvering based solely on the EFD1000 or MFD500 Synthetic Vision background display and associated Terrain Warning System (TWS) is not authorized. The Pilot In Command has the responsibility to use accepted visual and instrument procedures to avoid terrain and other obstacles.

NOTE:

Note: Flight with an expired database is not recommended. An expired database does not prevent terrain or other Synthetic Vision features from being displayed.

The EFD1000/500 Evolution Synthetic Vision System provides a computer-derived perspective view of the nearby terrain, obstacles and airports. The Flight Path Marker graphically presents the aircraft vertical speed and the GPS track converted to an angular direction. The Terrain Warning System (TWS) uses the Flight Path Marker to present an estimated time-to-collision function for terrain and obstacles combined with a terrain proximity view that colorizes nearby terrain based on the relative aircraft height. Unless inhibited by the pilot, TWS operates even when SV is turned off.

The EFD1000/500 display of synthetic vision information is advisory only. The pilot is responsible for terrain and obstacle avoidance by visual means, or by following approved instrument procedures. At system start up the pilot must acknowledge this operational limitation by pressing either MODE/SYNC knob.

Evolution Synthetic Vision is a computer-generated image of the external scene topography from the perspective of the flight deck, derived from aircraft altitude, high-precision navigation solution, and database of terrain, obstacles and cultural features, such as runways. Evolution Synthetic Vision creates an image relative to terrain, obstacles and airports within the limits of the navigation source, altimetry and databases. Evolution Synthetic Vision provides situation awareness, but no operational credit. The intended function is flight crew awareness of the external scene topography.

The Aspen Evolution Synthetic Vision System uses 9 arc-second resolution data enhanced with 3 arc-second data to provide better depiction of the terrain. The depiction of terrain is most like the outside view in the narrow FOV1 view, and a more expansive view of the horizon is available in FOV2. The

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terrain depicted in FOV2 is closer than it appears.

The intended function of the Flight Path Marker is to display the current vertical and lateral path of the aircraft based on two parameters, barometric vertical speed and GPS track. These parameters lag during dynamic maneuvers. Therefore the Flight Path Marker should only be used during steady state, non-accelerated flight. It is not intended to provide accurate information during turns or transitions to climb or descent.

The intended function of the Terrain Warning System associated with the Evolution Synthetic Vision application is to provide warnings when the system predicts a collision with the terrain or an obstacle. The Flight Path Marker is an integral part of this system and changes in shape and color if the aircraft continues on the collision path. In addition, the terrain is colored based on the aircraft proximity to the terrain; yellow when the aircraft is within 500 feet vertically of the terrain or obstacle, and red when the aircraft is within 100 feet vertically.

> **WARNING:** Synthetic Vision and the associated Terrain Warning System are dependent on accurate barometric altitude. An inaccurate altimeter setting will cause an incorrect depiction of the elevation of terrain and obstacles. Very cold temperatures can also cause significant errors in altimetry. The Pilot In Command has the responsibility to use accepted visual and instrument procedures to avoid terrain and other obstacles.

Obstacles less than 200 feet AGL are not displayed. Terrain and obstacle information is intended to assist the flight crew in fulfilling the responsibility to avoid terrain and obstructions through visual means or by following instrument procedures.

Pressing menu and selecting "TWS INH" will inhibit the Terrain Warning System. An annunciator will indicate that TWS is inhibited. TWS can be inhibited for all applications except Synthetic Vision by selecting "SV ONLY". When TWS is inhibited, no terrain warning is provided.

Terrain/obstacle caution and warning messages are generated due to nearby terrain or obstacles. See the references in Section 2.1 for more information. On a precision approach, terrain cautions or warnings are not anticipated. On a non-precision approach a terrain caution or warning is probable depending on the rate of descent toward the terrain.

Landings at most airports do not generate an alert. Some airports with unusual topography may generate alerts when the flight path marker points toward nearby higher terrain.

2.14 Kinds of Operations Equipment List (KOEL)

The EFD1000/500 system must be installed and maintained in accordance with the STC. The system is approved for day/night IFR and VFR operations in accordance with 14 CFR Part 91. The system is generally suitable for Part 135 operations, but must be evaluated in accordance with the regulations and the limitations of the Part 135 certificate.

Table 4 below shows the minimum equipment required for dispatch based on the kind of flight operation being conducted. Any other system limitations, such as the minimum battery charge detailed within this AFMS, must also be adhered to when that equipment is required for the kinds of flight operation being conducted.

The minimum equipment required for dispatch, based on the kind of flight operation conducted, must include all of the components shown in at least one of the columns in Table 4. If all of the equipment in a particular column is installed and serviceable, then the type of operation indicated at the top of that column is authorized.

Additionally, VFR day/night operations are authorized with any of the minimum IFR equipment configurations.

For example, in a single PFD installation, if the PFD is inoperative, but a whiskey compass, altimeter and airspeed indicator are available, then the flight may proceed if conducted under day/night VFR.NOTE:

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The numbers in the table refers to the quantity of items required.

Kinds of Operations Equipment Requirements (see 14 CFR Part 91.213(d))	Day VFR	Day/ Night VFR	Day/ Night VFR	IFR	IFR	IFR
EFD1000 PFD	1	1		1	1	1
EFD1000 MFD with EBB		1		1		
EFD1000 MFD with Internal Battery					1	
Magnetic Compass	1	1	1	1	1	1
Standby Attitude Indicator				1	1	1
Standby Airspeed Indicator			1		1	1
Standby Altimeter			1		1	1
IFR Approved GPS				1	1	
Analog Converter Unit	As needed for navigation. Deactivated and placarded if inoperative and not required					

Table 4 – Minimum Equipment Required for Dispatch Based on the Kind of Flight Operations being Conducted.

2.15 EA100 Autopilot AHRS Limitations

The EA100 Autopilot AHRS (A/P AHRS) optionally provides attitude information to the autopilot. When installed, the EFD1000MFD supplies the EA100 with the data used to generate the attitude solution. If an EFD1000MFD is not installed, the EFD1000 PFD supplies the data. Table 1 Installed Equipment Configuration, identifies the configuration for this aircraft.

An amber panel annunciator labeled A/P AHRS FAIL illuminates, the autopilot automatically disconnects and the flight director goes out of view when any of the following conditions exist:

- The EA100 A/P AHRS detects an internal failure
- Power is removed from the EA100 A/P AHRS
- When the EFD1000 connected to the EA100 is turned off
- The EFD1000 PFD connected to the EA100 A/P AHRS displays an ATTITUDE FAIL (red-X) indication (A CROSS CHECK ATTITUDE condition does not cause an A/P AHRS FAIL annunciation)
- The EFD1000 connected to the EA100 A/P AHRS is manually reset (this also resets the A/P AHRS)
- The EFD1000 MFD connected to the EA100 A/P AHRS displays an ADAHRS FAIL indication (A CHECK AHRS annunciation on the EFD1000 MFD does not disconnect the autopilot or cause an A/P AHRS FAIL annunciation)
- The ASPEN GTWY is powered off (Only when both the EA100 and the CG100 are installed and connected to the EFD1000 MFD. See Table 1 Installed Equipment Configuration for the configuration of this aircraft.)

The autopilot and the flight director cannot be restored until the A/P AHRS annunciator is extinguished. It is possible to activate the autopilot/flight director modes using the Autopilot Mode Controller or CWS, however the only response will be illumination of the corresponding elements on the Mode Annunciator Panel until the A/P AHRS annunciator is extinguished.

2.16 CG100 Aspen Connected Gateway Limitations

The optional CG100 (ASPEN GTWY) allows wireless portable devices to send information to and receive information from panel-mounted avionics through an EFD1000/500 MFD. Table 1 Installed Equipment Configuration, identifies the configuration for this aircraft.

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Limitation:	Aircraft registered in countries under EASA authority are not eligible for installation of the CG100 under this STC

Limitation:	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.

The CG100 installation was checked to assure non-interference in the aircraft, however the operator must assure that the wireless devices do not interfere with the aircraft. See 14 CFR 91.21.

The Flight Plan Review Map on the Gateway Flight Plan review page is a map designed to assist in pilot verification of the Candidate Flight Plan. It is not for navigation.

Limitation:	The Flight Plan Review Map is not to be used for navigation.

The Aspen GTWY permits loading a flight plan into compatible Garmin WAAS systems, automating the manual loading of flight plan waypoints. This automation carries the same limitations as adding route waypoints into the Garmin navigators individually. Specifically, when flight plans are sent to the EFD1000/500 for review, careful examination of each waypoint compared to the expected fix is required.

Loading of the individual fixes that pertain to a SID or STAR procedure via the wireless device can result in incorrect flight plan depictions because headings and altitude restrictions are not provided. SID and STAR procedures must be loaded as complete named procedures selected from the database of the IFR Approved GPS Navigator, and the published procedure must be flown.

Limitation:	Departure Procedures (such as a SID) and Standard Terminal Arrival Routes (STAR) must be loaded as complete named procedures selected from the database of the IFR Approved GPS Navigator.

Limitation:	Instrument approach procedures must be loaded as a complete named procedure selected from the database of the IFR Approved GPS Navigator. Loading instrument approach procedure waypoints by any other means is not authorized.

The named approach procedure in the navigator is the authorized approach procedure. Loading waypoints by any other means is not an approach procedure and is not authorized.

Limitation:	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).

It is essential that the flight plan be reviewed for accuracy and correct order. The EFD1000 system only checks the fixes against a known database. Verifying the position and order of the fixes, that no fixes are added or dropped, and that the fixes are correct is the Pilot's responsibility.

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3 Emergency and Abnormal Procedures/Conditions

3.1 Pitot/Static System Blockage

If a blocked pitot or static line is suspected or annunciated, proceed as follows:

PITOT HEAT .... ON

ALTERNATE STATIC SOURCE .... SELECT OPEN

AUTOPILOT .... MANUALLY DISCONNECT

NOTE: For installations with the EA100 A/P AHRS, the autopilot will automatically disconnect five seconds after the indicated airspeed decreases below 30 knots.

ATTITUDE .... Maintain straight and level flight by reference to standby sources of attitude.

Consider exiting IMC

CAUTION:

Most light aircraft have only a single pitot and static pneumatic system available for flight instrument use. Should the static line become blocked, the standby and the EFD1000 (PFD and MFD) altimeters and airspeed indicators will be erroneous. If the pitot line is blocked, the airspeed indication will be erroneous on all indicators.

The EFD1000 (PFD and MFD) also uses pitot and static pressures as part of the attitude and heading solution. Loss or corruption of this data will affect the accuracy or availability of attitude and heading information.

For installations with GPS, if the pitot system is blocked in flight, the EFD1000 PFD and MFD will present red "X"s over the attitude and heading indicators, and display an amber "CHECK PITOT HEAT" annunciation. The EFD1000 MFD will display an amber "ADAHRS FAIL" annunciation.

For installations with the EA100 A/P AHRS, the ATTITUDE FAIL (red-X) condition resulting from a CHECK PITOT HEAT indication on the EFD1000 will cause the autopilot to automatically disconnect.

3.2 CROSS CHECK ATTITUDE Message

Persistent or frequent CROSS CHECK ATTITUDE annunciations during normal maneuvers are indicative of a degraded ADAHRS solution. CROSS CHECK ATTITUDE on the EFD1000 does not cause an autopilot disconnect.

ATTITUDE .... Maintain by reference to other instruments or the visible horizon

Consider exiting IMC

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NOTE:

The CROSS CHECK ATTITUDE message indicates that the statistical confidence in the ADAHRS solution is degraded. Momentary annunciations may be seen during aggressive maneuvers, such as 60-degree turns or aerobatics, which are normal.

3.3 ADAHRS Attitude Disagreement

Should differences be observed between one or more EFD1000 displays and/or the standby instruments, monitor all available attitude, airspeed, and altitude information to diagnose faulty indicator(s).

CAUTION:

When the EFD1000 PFD and MFD share a common pitot/static system, their otherwise independent attitude solutions would be similarly affected by pitot/static faults.

ATTITUDE .... Maintain straight and level flight

If an EFD1000 ADAHRS is suspected as faulty, proceed as follows:

AUTOPILOT .... MANUALLY DISCONNECT

MENU .... Select "GENERAL SETTINGS" Page

"ADAHRS: RESET?" LINE SELECT KEY .... PRESS

"ADAHRS: RESET?" LINE SELECT KEY .... PRESS AGAIN TO CONFIRM RESET

Consider exiting IMC

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3.4 MFD Reversionary Mode Operation (EFD1000 MFD only)

To select REV mode and to change the autopilot source from the PFD to the MFD (if configured), proceed as follows:

Autopilot	DISCONNECT
EFD1000 MFD REV Button	MOMENTARY PRESS
REVERSIONARY PFD Display	Select XFILL as desired
BARO SETTING	Verify
If the Autopilot Source Select is installed (see Section 1.2)	
A/P Source Select	MFD
Autopilot	CONNECT AS DESIRED
The reverted MFD will be the heading and nav source for the autopilot.	

NOTE:

Press and hold the REV key for 5 seconds to shut off the unit. The REV button is located on the EFD bezel, marked with "REV" in red text.

NOTE:

When reversion mode is selected, it is possible to crossfill (XFILL) the PFD data by pressing the XFILL button. After crossfill the pilot should verify that the display is configured as necessary. Crossfill transfers the Altitude Bug, Airspeed Bug, Minimums, CDI Nav Source, Selected Course and Heading, ARC/360 Mode, Map configuration, Traffic and Weather as appropriate.

EFD1000 MFD can revert to PFD operation in order to mitigate the effects of a failure of the PFD, including the loss of ADC or ADAHRS functions. With a single press and release of the red text REV key located on the MFD bezel, the MFD will immediately change to the PFD operating mode. The system provides the option to crossfill (XFILL) the PFD data to the MFD if desired. To return to the MFD operating mode, press the REV key again. In the MFD Reversionary PFD mode, operation is identical to the PFD except the optional tone generator does not function (altitude alerter). In addition, selection of the REV mode does not switch autopilot outputs to the MFD.

Information that is not related to Primary Flight Information (e.g. navigation configuration data such as navigation source, selected course, selected heading, altitude bug, minimums bug, airspeed bug) is only passed when the XFILL button is pressed. XFILL is a useful function that can be used prior to entering critical phases of flight. After configuring the MFD REV mode, the unit may be returned to normal MFD operation. This simple step will ensure that the MFD is ready to assume all of the duties performed by the PFD should that equipment experience a failure.

Autopilot Source Select (A/P Source)
The autopilot source select is intended to provide the ability to connect the autopilot heading and nav functions to an EFD1000 MFD that is reverted to a PFD. An EFD1000 that is not reverted to a PFD cannot be used to drive the autopilot because there would be no visual guidance to permit the pilot to monitor the autopilot operation.
The A/P Source is controlled by a momentary toggle switch that permits selection of the MFD only when the EFD is in reversion mode. Indicator lights annunciate which display is providing data to the Autopilot.

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If the reverted MFD is changed back to an MFD, the A/P source connection will automatically return to the EFD1000 PFD and the annunciation will change accordingly.

3.5 In-Flight ADAHRS Reset

To reset an EFD1000 ADAHRS proceed as follows:

ATTITUDE	MAINTAIN STRAIGHT AND LEVEL FLIGHT by visual reference, or by standby instruments
AUTOPILOT	MANUALLY DISCONNECT
MENU	Select "GENERAL SETTINGS" Page A
"ADAHRS: RESET?" LINE SELECT KEY	PRESS
"ADAHRS: RESET?" LINE SELECT KEY	PRESS AGAIN TO CONFIRM ADAHRS RESET
	Activate any other control to cancel the reset

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NOTE:

When an EFD1000 ADAHRS is manually reset in flight, it performs an abbreviated initialization that usually takes less than 30 seconds.

During the initialization, the attitude and direction information are removed and replaced with red "X"s and the annunciations, "ATTITUDE FAIL" and "DIRECTION INDICATOR FAIL" are presented.

Gentle maneuvering during the initialization is permitted.

The ADAHRS reset is considered complete when the EFD1000 attitude and heading are once again displayed and the attitude display is stable and correct with respect to other sources of attitude information.

When the EFD1000 connected to the EA100 A/P AHRS is reset, A/P AHRS will also reset, the autopilot will disconnect and the A/P AHRS FAIL annunciation on the instrument panel will illuminate. The annunciation will extinguish when the A/P AHRS reset is complete.

The EFD1000 ADAHRS is normally stable, self-correcting, and accurate. The pilot may elect to manually reset it if pitch and roll indications disagree with the standby attitude indicator, or the ADAHRS is suspected to be inaccurate (e.g., following aerobatic maneuvers). The ADAHRS reset function is analogous to "caging" a gyroscopic attitude indicator.

3.6 Alternator or Generator Failure, or ON BAT Annunciation

UNRESTORABLE LOSS OF AIRCRAFT POWER (Alternator or Generator failure) IS AN EMERGENCY SITUATION

Aircraft Electrical Power .... Follow AFM procedures to restore power

If unable to restore aircraft alternator or generator

EFD1000/500 Circuit Breaker / Switch .... OPEN for each display

LAND AS SOON AS PRACTICAL

CAUTION:

If the aircraft alternator or generator fails and 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.

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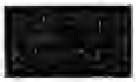
NOTE:

> **The internal battery normally provides 30-60 minutes of operation at 20°C and warmer. At very cold temperatures internal battery operation is not assured.**
>
> **The Emergency Backup Battery will provide at least 30 minutes of operation with 80% indicated charge when at -20°C. A fully charged EBB at +20°C or warmer will typically provide power for two or more hours of operation.**
>
> **When operating "ON BAT" the maximum "auto" backlight setting is 40% and the maximum manual backlight setting is 70%. Changing the backlight setting changes battery endurance, reflected by the % remaining indication.**
>
> **A fully charged battery will indicate a charge level of 99% for some time before beginning to show discharge. Once discharge is indicated the charge level will decrease in a steady manner with a slight acceleration nearing 0%.**
>
> **The "ON BAT" annunciation and estimated charge remaining, is displayed in the upper half of each EFD whenever the system is operating from battery.**
>
> 
>
> **The internal battery (or EBB) provides power for both the EFD and optional RSM GPS.**

If aircraft generated power to the EFD is degraded or fails, such as from an aircraft alternator or generator failure, each EFD will begin an automatic load-shed routine, and will disconnect from the power bus two minutes after input power degrades, or immediately if the input power fails.

To complete the load-shed process, the pilot must open each EFD Circuit Breaker / Switch. This may be done as soon as the degraded power is noticed.

These actions prevent the EFD from automatically restarting from connected external power should the flight continue until the EFD battery is fully depleted. If it is desired to reconnect the EFD to the aircraft power bus, close the associated Circuit Breaker / Switch and select EXT Power from the Power Settings Menu.

3.7 Abnormal Shutdown Procedure

In the event of an EFD malfunction requiring in-flight shut down of the equipment, proceed as follows

<u>EFD1000 MFD (with EBB)</u>

EFD Circuit Breaker / Switch .... OFF / PULL

EBB Disconnect Switch .... DISC

- OR -

<u>EFD1000/500 display with internal battery</u>

EFD Circuit Breaker / Switch .... OFF / PULL

REV Button .... PUSH AND HOLD UNTIL DISPLAY BLANKS

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NOTE:

Heading and navigation inputs to the autopilot are provided by the PFD. Turning off the PFD may affect selected or available autopilot modes.

NOTE:

For installations with the EA100 A/P AHRS, turning off the EFD1000 connected to the EA100 will cause automatic disconnection of the autopilot and removes the flight director display on the remaining EFD1000.

NOTE:

Each EFD 1000/500 has a labeled circuit breaker and optional master switch or a combined circuit breaker / switch. These switches are mounted on or adjacent to the instrument panel and within the pilot's reach.

NOTE:

If the EFD1000/500 MFD associated with the Aspen Connected Gateway is shut down, crossfill between the Garmin navigators will be inoperative.

3.8 EBB Disconnect (EFD1000 MFD only)

To isolate the EBB in the event of an EBB or EFD1000 MFD malfunction, proceed as follows:

EBB Switch .... Select DISC

NOTE:

When in the "DISC" position, the EBB isolation relay is powered from the EBB. When the switch is in the disconnect position the Emergency Backup Battery will gradually discharge.

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The EBB is protected by thermal and short-circuit sensing circuitry to prevent battery overheating or damage. The battery is normally connected to its EFD1000 MFD. If it is desired to remove battery power from the EFD1000 MFD, or to otherwise isolate the EBB, the EBB includes an externally activated isolation relay integral to the EBB aluminum housing. The EBB Disconnect switch installed in the instrument panel activates this relay.

The EBB Emergency Disconnect switch is either a guarded or lever-lock switch mounted on or adjacent to the instrument panel and within the pilot's reach. The switch should be left in the NORM position at all times, including when away from the aircraft. When it is desired to disconnect the EBB from the EFD1000 MFD display, move the switch to the DISC position.

3.9 Power Override

In the event that the pilot wishes to override the automatic power configuration of the equipment, proceed as follows:

MENU	"POWER SETTINGS" Page
<u>To switch FROM aircraft power to Battery:</u>	
"BATTERY" LINE SELECT KEY	PRESS
<u>To switch FROM Battery TO aircraft power:</u>	
"EXT PWR" LINE SELECT KEY	PRESS

3.10 EFD1000/500 Intercommunications Failure

In the event of a "CROSS LINK FAILURE" message, verify that barometric altimeter setting information is correctly transferred between the displays. On the EFD1000 MFD, the barometric altimeter setting can only be set from the MFD REV mode.

BARO SETTING	VERIFY
If the EFD1000 Baro Setting must be set	
EFD1000 MFD REV Button	PRESS TO DISPLAY PFD
BARO SETTING	SET

CAUTION:

Relative terrain is based on the barometric altitude from the EFD1000 displays. BARO setting may not be shared between the EFD1000 displays during this Cross Link Failure condition. It is necessary to set BARO individually on both EFD1000 displays to prevent the display of erroneous relative terrain.

The Barometric Pressure Setting is shown on the EFD1000/500 MFD Data Bar*.

* The Data Bar is a segment of the MFD that shows barometric pressure, waypoint information, GPS selection and track direction information.

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An intercommunications link exists between the EFD1000 PFD, EFD1000 MFD, and EFD500 MFD to share various information, including barometric setting, heading, airspeed and altitude information. The EFD1000 PFD and EFD1000 MFD both receive and transmit data to each other, and each also transmits data to the EFD500 MFD. The EFD500 MFD only receives data, but does so from each installed EFD1000 display.

In the event of an intercommunication failure between the EFD1000 PFD, EFD1000 MFD, or EFD500 MFD, a CROSS LINK FAILURE annunciation will be presented in the affected PFD/MFD's Data Bar. When this occurs, the altimeter's barometric pressure setting may not be communicated between EFDs. It will be necessary to confirm if the baro setting information is being transferred. If it is not, the pilot should manually adjust the BARO setting on the affected display. For the EFD1000 MFD, this is accomplished in the PFD Reversion Mode.

In a three display configuration it is possible for the EFD500 MFD to display this message, but still maintain synchronization. This indicates that only one of the intercommunications buses to the EFD500 has failed.

3.11 Loss of GPS effect on the Moving Map

CAUTION:

In the event of complete GPS failure, the Nav Map stops moving and orients North Up, the airplane symbol is removed and reverts to a stationary map with an accompanying "GPS POS FAILED" annunciation. In this case, the Nav Map may be manually panned to correlate to the estimated aircraft position determined by other means.

Position and flight plan data for the PFD and MFD is provided from aircraft GPS equipment. The EFD displays may be configured to receive data from one or two external GPS systems. In addition, when an RSM connected to the EFD includes an emergency GPS, this information may be used if the aircraft GPS system(s) fail.

The Nav Map function in either the PFD or MFD follows an automatic position reversion scheme to determine which GPS is the position source for the map. The primary GPS is always the one selected by the pilot, either by the associated CDI nav source (PFD), or via the menus (MFD). If the selected GPS fails, the EFD automatically switches to another GPS (when installed), and will annunciate "GPS# Reversion", where # represents the GPS source providing position data.

If all external GPS systems fail, and an RSM GPS is connected to that display, the EFD will use position data from the RSM and annunciate RSM GPS REVERSION EMER USE ONLY." In this case, the map data is approved for emergency use only.

Whenever the map has reverted to an alternate position source, all map features and capabilities are retained, including the display of the flight plan from the selected GPS. However, when the GPS position source is different from the source that generated the flight plan, the flight plan is presented without showing an active (magenta) leg. The flight plan and map data from each external GPS is retained independently. If two external GPS were connected prior to, and if each had a different flight plan at the time of failure, both of these flight plans are retained and can be viewed by the pilot.

In the unlikely event that there is a complete loss of all GPS data to an MFD, including loss of the RSM GPS (if installed), the NAV Map is retained, the flight plan is removed, and the map is no longer updated with aircraft position information. An annunciation of "GPS POS FAILED" is presented in the center of the map, the airplane symbol is removed, the map changes to a North-up orientation and the map will no longer move with the aircraft. Manual panning is still possible and all map features that are not GPS position dependent continue to remain available, including relative terrain overlays.

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GPS groundspeed is compared to airspeed to determine if a pitot blockage has occurred. When the GPS is inoperative, the attitude and heading indications will be replaced by red-X indications when the aircraft slows after landing.

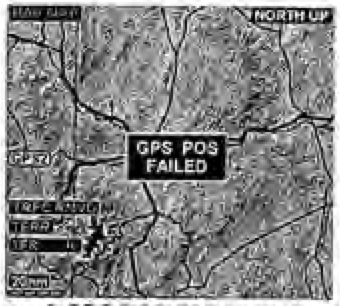

Figure 3 GPS POS FAILED indication

3.12 Loss of MFD or PFD Database Card

Each EFD1000 and EFD500 includes a microSDHC (SD card, High Capacity) card slot that can accept a database card. The database card must remain in the EFD display.

Generally, when the microSDHC database card is removed from the card slot, or communications with the card fails, the MFD and PFD will continue to operate using the last data that was loaded into memory. As the aircraft position changes, the software will attempt to access the data card to retrieve additional data for the new location. When this occurs, if the data card cannot be detected, an annunciation of "DATABASE FAILURE" is displayed. In the case of the MFD, new data is not available and in the case of the PFD, Synthetic Vision reverts to SV off operation and the Synthetic Vision display will not be selectable. When the data card is restored, restarting the EFD will reinitialize the database.

3.13 Automatic Autopilot Disconnect (EA100 A/P AHRS Installations)

An amber panel annunciator labeled A/P AHRS FAIL illuminates and the autopilot automatically disconnects when any of the following conditions exist:

- The EA100 A/P AHRS detects an internal failure
- Power is removed from the EA100 A/P AHRS
- When the EFD1000 connected to the EA100 is turned off
- The EFD1000 PFD connected to the EA100 A/P AHRS displays an ATTITUDE FAIL (red-X) indication (A CROSS CHECK ATTITUDE condition does not cause an A/P AHRS FAIL annunciation)
- The EFD1000 connected to the EA100 A/P AHRS is manually reset (this also resets the A/P AHRS)
- The EFD1000 MFD connected to the EA100 A/P AHRS displays an ADAHRS FAIL indication (A CHECK AHRS annunciation on the EFD1000 MFD does not disconnect the autopilot or cause an A/P AHRS FAIL annunciation)
- The ASPEN GTWY (CG100) is powered off. (Only when both the EA100 and the CG100 are installed and connected to the EFD1000 MFD, see Table 1)

The autopilot cannot be re-engaged until the connected EFD1000 attitude resets and the amber A/P AHRS annunciator lamp is extinguished.

3.14 Loss of Synthetic Vision

Evolution Synthetic Vision (EVS) requires a proper database input, proper GPS input and proper altitude input. If any of these inputs are missing or detected as erroneous, Synthetic Vision is

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removed from the display. In the case of the MFD, the screen is replaced with a message indicating the nature of the problem. In the case of the PFD, the system will present the normal attitude and heading display and EVS cannot be selected. All navigation and attitude presentations remain in view and permit the pilot to conduct the flight operation normally. The autopilot operation will continue with no interruption, unless the issue causing the removal of Synthetic Vision also causes disconnection of the autopilot.

3.15 Continuous EFD1000 or EFD500 System Reset (does not apply to the C3 PFD)

The EFD systems have been tested to assure that there are no conditions that could cause multiple resets. In the event of an unexpected condition that causes the system to continually reset, there are some steps that can be accomplished to remove external inputs to the system and restore functionality:

Steps to remove external inputs to the system and restore functionality in the event of a continuous reset:

Remove the following external inputs, if installed:

REMOVE THE DATABASE CARD .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:

TURN OFF THE Aspen GTWY SWITCH .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:

PULL THE XM WEATHER CIRCUIT BREAKER.............. PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:

PULL THE STORMSCOPE CIRCUIT BREAKER .... PERMIT THE SYSTEM TO REINITIALIZE.

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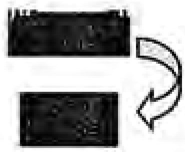
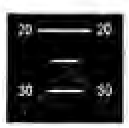
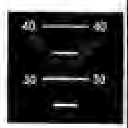
3.16 Warning, Caution, and Advisory Summary

Warning W Caution C Advisory A

	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
W	✓	✓	✓	✓	✓	✓		Red annunciations 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
W	✓	✓	✓	✓	✓		 	Red-X annunciation presented whenever the EFD1000 determines that the associated function is invalid or failed. On the EFD1000 MFD SAI and SHSI, only the "ATTITUDE FAIL" and DIRECTION INDICATOR FAIL" annunciations are presented. These indications are also presented when the ADAHRS system is re-initializing after a manual or automatic reset. Fly by reference to standby sources of attitude, altitude and airspeed, such as the EFD1000 MFD, standby instruments, or the visible horizon. In this circumstance GPSS operation is still possible. In addition, the LDI and VDI will continue to remain available and display either GPS approach lateral and vertical deviations, or localizer lateral deviation information, which may be manually flown. For installations with the EA100 A/P AHRS, all conditions that result in a red-X annunciation automatically disconnect the autopilot.
W	✓	✓	✓	✓	✓		 	Red chevrons displayed on the Attitude Indicator's pitch scale to indicate extreme pitch up and down attitudes and the appropriate fly-to direction to restore level flight.

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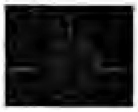
Applicability						Annunciation	Description
EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
	✓		✓	✓	✓		A red flight path marker indicates that the Evolution Synthetic Vision System has generated a warning alert predicting conflict with terrain or an obstacle within 30 seconds.
	✓		✓	✓	✓	WARNING – TERRAIN, TERRAIN or WARNING – OBSTACLE, OBSTACLE	Red textual message indicating the Evolution Synthetic Vision System has generated a warning alert predicting conflict with terrain or an obstacle within 30 seconds. In the event of a Warning alert when SV is not displayed, a "TERR" message is presented over the lower center button. Press the button to instantly display the SV image.
	✓		✓	✓	✓	 	Small Tower (<1000' AGL) or group of small obstructions (<1000' AGL) above or within 100' below the ownship altitude.
	✓		✓	✓	✓	 	Tall Tower (>1000' AGL) or group of tall obstructions (>1000' AGL) above or within 100' below the ownship altitude.

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	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C							Panel Mounted Indicator Lamp  **A/P AHRS Fail** or **A/P AHRS FAIL**	An amber panel annunciator labeled A/P AHRS FAIL illuminates and the autopilot automatically disconnects when any of the following conditions exist: • The EA100 A/P AHRS detects an internal failure • Power is removed from the EA100 A/P AHRS • When the EFD1000 connected to the EA100 is turned off • The EFD1000 PFD connected to the EA100 A/P AHRS displays an ATTITUDE FAIL (red-X) indication (A CROSS CHECK ATTITUDE condition does not cause an A/P AHRS FAIL annunciation) • The EFD1000 connected to the EA100 A/P AHRS is manually reset (this also resets the A/P AHRS) • The EFD1000 MFD connected to the EA100 A/P AHRS displays an ADAHRS FAIL indication (A CHECK AHRS annunciation on the EFD1000 MFD does not disconnect the autopilot or cause an A/P AHRS FAIL annunciation) • The ASPEN GTWY (CG100) is powered off. (Only when both the EA100 and the CG100 are installed and connected to the EFD1000 MFD, see Table 1) Illumination of the annunciator indicates that the autopilot cannot be engaged.
C	✓	✓	✓	✓	✓		CROSS CHECK ATTITUDE	Amber annunciation centered in the upper half of the attitude indicator whenever the EFD1000 ADAHRS internal integrity monitor determines that attitude is potentially degraded. If a steady CROSS CHECK ATTITUDE annunciation is presented, cross check attitude, airspeed and altitude indications against alternate sources.

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	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C					✓		ADAHRS FAIL	Amber annunciation displayed in the Data Bar of the EFD1000 MFD when its internal ADAHRS reports a failure (e.g. during ADAHRS Reset). For installations with the EA100 A/P AHRS, this condition automatically disconnects the autopilot.
C					✓		CHECK AHRS	Amber annunciation presented on the EFD1000 MFD when its internal ADAHRS reports a "CROSS CHECK ATTITUDE" condition.
C					✓	✓	CROSS LINK FAILURE	Amber annunciation presented in the EFD1000 MFD Data Bar when it loses communication with the PFD, and in the EFD500 MFD Data Bar when it loses communication with either the PFD or the EFD1000 MFD.
C					✓	✓	(HDG FAIL)	Amber annunciation presented on the MFD in the Charts, Nav Map and WX applications when heading has failed.
C	✓	✓	✓	✓	✓		CHECK PITOT HEAT	Amber annunciation accompanied by an "ATTITUDE FAIL" annunciation. Presented when the software detects an obstruction in the pitot system that could potentially degrade the attitude solution This annunciation is removed when the detected condition is resolved, which would be followed by an automatic ADAHRS reset. A GPS system configuration is required for this monitor to be enabled. For installations with the EA100 A/P AHRS, this results in an autopilot disconnect.

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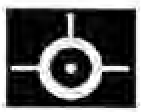
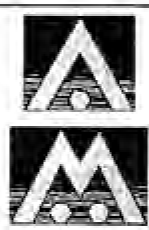
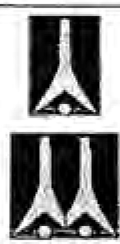
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C	✓	✓	✓*	✓	✓	✓	GPS1 GPS2 RSM GPS GPS1 REVERSION GPS2 REVERSION RSM GPS REVERSION	Amber annunciations presented when a connected GPS is invalid or not available. GPS# or RSM REVERSION (optional) annunciations indicate the current GPS basemap source. Note: the EFD500 MFD cannot revert to RSM GPS since it is not configured with an RSM. *GPS2 is not applicable to the PFD Pilot. "GPS1", "RSM GPS" and "RSM GPS REVERSION" are the only annunciations of this type that apply to the PFD Pilot.
C		✓		✓	✓	✓		A bold amber flight path marker indicates that the Evolution Synthetic Vision System has generated a caution alert predicting conflict with terrain or an obstacle within 45 seconds.
C		✓		✓	✓	✓	CAUTION – TERRAIN, TERRAIN Or CAUTION – OBSTACLE, OBSTACLE	An amber textual message indicates that the Evolution Synthetic Vision System has generated a Caution alert predicting conflict with terrain or an obstacle within 45 seconds. In the event of a Caution alert when SV is not displayed, a "TERR" message is presented over the lower center button. Press the button to instantly display the SV image.
C		✓		✓	✓	✓		Small Tower (<1000' AGL) or group of small obstructions (<1000' AGL) is between 500' and 100' below the ownship altitude.
C		✓		✓	✓	✓		Tall Tower (>1000' AGL) or group of tall obstructions (>1000' AGL) is between 500' and 100' below the ownship altitude.

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	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C					✓	✓	GPS POS FAILED	Amber annunciation presented in the center of the NAV Map when all GPS sources have failed. When presented, the map changes to a North-up orientation and the map no longer moves with the aircraft. Manual panning is still possible and all map features that are not GPS position dependent continue to remain available, including relative terrain overlays.
C	✓	✓	✓	✓	✓		INTEG	Amber annunciation presented whenever the selected GPS source indicates that GPS integrity is degraded. See the applicable GPS AFMS for more information.
C	✓	✓		✓			MIN 10010	Amber annunciation presented when the aircraft reaches, or is below the set MINIMUMS. Will be accompanied by a one-second stuttered tone when the optional tone generator is installed.
C	✓	✓	✓*	✓			9940	Amber flag presented to indicate the aircraft is reaching (steady) or deviating (flashing) the selected altitude. Will be accompanied by a one-second steady tone when the optional tone generator is installed. *The tone is not available on the PFD Pilot or the EFD1000MFD.
C	✓	✓		✓			DH	Amber "DH" annunciation presented when a connected radar altimeter indicates the aircraft has reached the radar altitude set by the pilot. See the radar altimeter's AFMS for more information.
C	✓	✓		✓			A HDG GPSS1 / GPSS	GPSS annunciation that indicates the previously selected GPSS source is invalid (e.g. the flight plan was deleted) or a different GPSS has been selected by pilot. Commands the autopilot to roll the aircraft to wings level until GPSS is re-engaged, or a valid GPSS signal is available.

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	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C					✓	✓	TERRAIN FAIL	Amber annunciation presented on the dedicated terrain display when any of the information needed to render the map (position, altitude, or heading) is detected as invalid.
C		✓		✓	✓	✓	TRAFFIC 	A "TRAFFIC" Advisory annunciation is presented in the Data Bar whenever a connected traffic system generates a Traffic Advisory and a dedicated traffic view is not being displayed. In the event of a Traffic Alert when traffic is not displayed on the PFD, a "TRFC" message is presented over the lower center button. Press the button to instantly display a plan view of Traffic.
C	✓	✓		✓	✓	✓	TRFC UNAV TRFC UNAVAILABLE	Amber annunciations provided when Traffic data is reported as unavailable by the connected traffic sensor.
C	✓	✓		✓	✓	✓	TRFC RMVD AGE: ##	Amber annunciation that indicates that the traffic data has not been refreshed within 6 seconds. The Primary Flight Display shows only TRFC RMVD. The PFD does not display the AGE.
C					✓	✓	TRFC FAIL	Amber annunciation that indicates a traffic sensor failure.
C					✓	✓	TEST INIT FAIL	Amber annunciation presented when the spherics (lightning) sensor reports that the self-test response has not been received within 10 seconds of the test request.
C					✓	✓	FAIL	Amber annunciation presented when the spherics (lightning) sensor reports a failed self-test, an unrecoverable fault, or an undefined fault.
C					✓	✓	ERROR	Amber annunciation presented when the spherics (lightning) sensor reports an undefined but recoverable error

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	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C					✓	✓	ERROR ANT ERROR	Amber annunciation presented when the spherics (lightning) sensor reports a recoverable antenna error
C					✓	✓	ERROR MIC INHIBIT STUCK	Amber annunciation presented when the spherics (lightning) sensor reports a recoverable inhibit line stuck microphone error
C					✓	✓	ERROR ANT JUMP CHG	Amber annunciation presented when the spherics (lightning) sensor reports a recoverable changed antenna jumper error.
C					✓	✓	FAIL HDG INVALID	Amber annunciation presented when the spherics (lightning) sensor reports no heading data. Accompanied by removal of spherics (lightning) sensor data.
C					✓	✓	FAIL NO LINK	Amber annunciation presented when the spherics (lightning) sensor reports that the sensor is enabled but no data is detected
C		✓		✓	✓	✓	NXRD : LTNG : SIG : AIR : AGE : TFR :	Datalink weather product data not received.
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.
C	✓	✓	✓	✓	✓	✓	BAT: FAILED	Annunciation presented in the menus when the connected EFD1000 battery is not detected or failed

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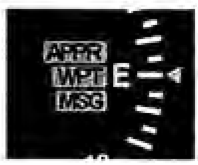
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
A	✓	✓	✓			✓		Annunciation presented when the EFD1000 PFD's or EFD500 MFD's "REV" button is pressed.
A				✓	✓			Annunciation presented when the EFD1000 MFD's "REV" button is pressed.
A	✓	✓		✓				Green annunciations provided whenever GPSS is enabled and the GPS source is valid. Either "GPSS1" or "GPSS2" may be annunciated depending on aircraft configuration.
A	✓	✓		✓	✓			GPS annunciations provided by an active GPS source. TERM may also be displayed in the same location as APPR. See the GPS AFMS for additional information on the meaning of these annunciations.
A	✓	✓		✓	✓	✓		Green annunciation that indicates that the traffic sensor is enabled.
A					✓	✓		Green annunciation that indicates that the traffic sensor is in standby.
A	✓	✓		✓	✓	✓		Green annunciation that indicates that the traffic sensor is in the self-test mode.
A	✓	✓		✓	✓	✓		Green annunciation that indicates that the TIS traffic data has not been refreshed within 6 seconds.
A		✓		✓	✓	✓		Lightning (spherics) Strike display mode selected. The rate indicates the approximate number of lightning strikes detected per minute.
A		✓		✓	✓	✓		Lightning (spherics) Cell clustering display mode selected. The rate indicates the approximate number of lightning strikes detected per minute.
A		✓		✓	✓	✓		Self-test mode annunciation that replaces spherics (lightning) Strike / Cell rate information.

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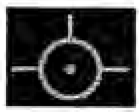
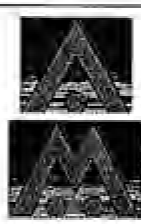
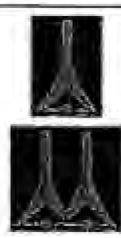
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
A					✓	✓	TEST INIT	Lightning (spherics) Self-test mode selected.
A					✓	✓	TEST	Annunciation that replaces aircraft ownship symbol during a spherics (lightning) self-test.
A		✓		✓	✓	✓	AGE :05 AIR :02 SIG :11 NXRD :08 LTNG :03	A data age annunciation is presented for datalink weather products when the XM receiver is operational. The elapsed time since last data update is expressed in minutes (e.g.:05). NOTE: The data may be several minutes older than the time shown. It is not real-time data.
A		✓		✓	✓	✓		A green flight path marker indicates that full TWS alerts are available, and the ownship position is outside the proximate region of a runway (more than two miles from a runway on approach or climbing from the runway on departure).
A		✓		✓	✓	✓		Small Tower (<1000' AGL) or group of small obstructions (<1000' AGL) is between 900' and 500' below the ownship altitude.
A		✓		✓	✓	✓		Tall Tower (>1000' AGL) or group of tall obstructions (>1000' AGL) is between 900' and 500' below the ownship altitude.
A		✓		✓	✓	✓	+RATE	A horizontal red line through the spherics (lightning) rate legend that indicates the data is no longer detected.
A	✓	✓		✓	✓	✓	LTNG : NXRD TRFC	A horizontal red line through the legend of selected data indicates that the data is invalid, unavailable, or for datalink products, that the data product is expired. (TRFC only for PFD PRO C3)

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	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
A	✓	✓		✓			LOC1 / VOR1	A horizontal red line through the source legend of selected data indicates that the data is invalid or unavailable.
A	✓	✓		✓	✓		GPS1	A horizontal red line through the selected navigation source indicates that the data is invalid or unavailable. HSI and SHSI only.
A	✓	✓		✓			RA	A horizontal red line through the Radar Altitude display indicates that the data is invalid or unavailable.
A					✓	✓	DATABASE FAILURE	Annunciation presented at the bottom center of the Nav Map or the Charts application if the software is unable to access the data base stored to the microSDHC memory card.
A					✓	✓	LOAD 11/11 AIRWAYS	Annunciation presented at the bottom center of the Nav Map when data is being loaded from the micro SD card at start up. The current data type and total number of data types to be loaded is identified (i.e. "11/11"), along with an indication of the type of data that is currently being loaded (i.e. "AIRWAYS").
A					✓	✓	OWNSHIP NOT AVAILABLE	Annunciation presented at the top center of the CHARTS application when the OWN hotkey is selected and the aircraft ownship cannot be displayed because the chart is not geo-referenced.
A					✓	✓	OWNSHIP OFF CHART	Annunciation presented at the top center of the CHARTS application when the displayed chart is geo-referenced, the OWN hotkey is selected and the aircraft position is not on the chart.
A		✓		✓	✓	✓	SV UNAVAILABLE - ADAHRS FAIL	Attitude, altitude or heading becomes invalid.
A		✓		✓	✓	✓	SV POSITION INVALID	Position or magnetic variation is not received from an externally configured GPS unit.

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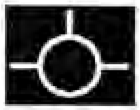
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
A		✓		✓	✓	✓	DATABASE FAIL	Jeppesen database failure.
A		✓		✓	✓	✓	DATABASE INIT	Presented during initialization of the data base.
A		✓		✓	✓	✓	SV DATABASE UNAVAILABLE	Ownship is located outside the valid database area.
A		✓		✓	✓	✓	SV LOADING...	When synthetic vision data is loading.
A		✓		✓	✓	✓	MAP LOADING...	When SV3 horizontal situation indicator data is loading.
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).

The following advisory messages can appear on the EFD1000/500 MFD in connection with the Aspen Connected Gateway System (Aspen GTWY):

Connected Gateway Message	Description
CG100: DETECTING DEVICE...	The EFD1000/500 is in the process of detecting the CG100
CG100: LINKED	The EFD1000/500 is linked to the CG100. This is the normal Link Status
CG100: NOT LINKED	The EFD1000/500 is not linked to the CG100. This is an abnormal Link Status
CG100: INVALID FLIGHT PLAN RECEIVED Invalid Flight Plan Received Resend the Flight Plan to try again	This indicates that the Flight Plan received from the Wireless device was not valid.
CG100: RECEIVING FPL	This indicates that a new flight plan is being received from the Wireless device through the CG100.
CG100: FPL PENDING...	This indicates that a newly-sent flight plan is in process and will be displayed when the current EFD1000 process is completed.
GPS1: NOT AVAILABLE GPS2: NOT AVAILABLE	The GPS unit that is configured for the Connected Gateway is not available (for example, it is turned off).
GPS1: SENDING FPL... GPS2: SENDING FPL...	The Flight Plan is being sent from the EFD1000/500 to the Garmin Devices.

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GPS1: VERIFYING FPL GPS2: VERIFYING FPL	The Flight Plan information received from the Garmin System is being checked against what was sent from the EFD1000/500.
GPS1: FPL VERIFIED GPS2: FPL VERIFIED	The Flight Plan information received from the Garmin System matched what was sent from the EFD1000/500.
GPS1: FPL VERIFICATION FAILED GPS2: FPL VERIFICATION FAILED	The Flight Plan information received from the Garmin System did not match what was sent from the EFD1000/500.
GPS1: READY GPS2: READY	Indicates that the GPS systems are ready to accept flight plans.
GPS1: Waiting for CG100 GPS2: Waiting for CG100	Displayed when the EFD1000/500 is waiting for database status information from the CG100. This should be a momentary indication, if at all.
Databases Incompatible	When the Database in the CG100 was not updated and the Garmin Databases were updated. If the Garmin database is updated and the indexed database is not, the CG100 system will present all waypoints as unverified, i.e. all will have + signs appended to the names.
GPS1 and GPS2 FPL Verification Failed: Use BOTH key to resend, CLR to Clear	The Flight Plan information received from both Garmin Systems did not match what was sent from the EFD1000/500.
GPS1 Flight Plan FPL Verification Failed: Use GPS1 key to resend, CLR to Clear	The Flight Plan information received from the GPS 1 Garmin System did not match what was sent from the EFD1000/500.
GPS2 Flight Plan FPL Verification Failed: Use GPS2 key to resend, CLR to Clear	The Flight Plan information received from the GPS 2 Garmin System did not match what was sent from the EFD1000/500.
<Location Mismatch>	Identifies a waypoint position that was not correlated with the Navigation Database. The fix name will be appended with a '+' symbol.
<User Defined WPT>	Identifies a User-defined waypoint from the Wireless Device. The fix name will be appended with a '+' symbol.
X Waypoints Not Validated	X is the number of Waypoints not validated. This message indicates how many waypoints were not correlated with the Navigation Database.
New Flight Plan Available	Indication on the MFD or reverted PFD Data Bar to indicate that a flight plan is available for review on the Connected Gateway Candidate Flight Plan Page.
GTWY	Press this button to quickly access the Connected Gateway Candidate Flight Plan page.

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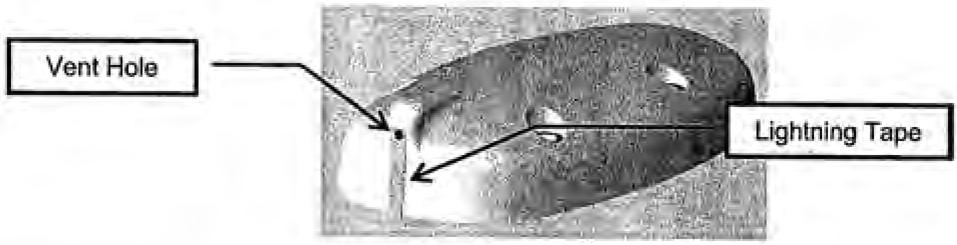
4 Normal Procedures

4.1 Exterior Inspection

RSM(s)	Check condition and security
RSM Vent Hole	Check clear of obstructions
RSM Lightning Tape	Check condition and security



4.2 Before Taxi Checks

Alternate Static Source	CHECK
EBB Switch (if installed)	Verify set to NORM
EFD MASTER SWITCHES (If installed)	ON
Avionics and Instruments	SET as desired
A/P AHRS FAIL lamp	CHECK

CAUTION:

The EFD1000 MFD Reversionary PFD display references, bugs, navigation sources, etc. must be configured or verified as necessary for takeoff and departure. This will reduce pilot workload should the MFD reversion mode be required.

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NOTE:

ADAHRS alignment begins at power up. Avoid movement during ADAHRS alignment as this will delay and degrade the ADAHRS initialization. Attitude and heading data is presented once alignment is complete.

NOTE:

When in the "DISC" position, the EBB isolation relay is powered from the EBB. When the switch is in the disconnect position the Emergency Backup Battery will gradually discharge.

NOTE:

MFD database features load incrementally after power up. Loading progress is indicated at the bottom of the Nav Map.

4.3 Before Take-Off Checks

MENU .... "POWER SETTINGS" Page

EXT PWR: (Aircraft Input Voltage) .... Check > 12.3V/24.6V

BAT: .... Verify battery status is not shown as "FAIL" (normally this shows "CHARGING" or "READY")

PFD .... Configure for departure

EFD1000 MFD (if installed) .... Select REV and press XFILL. Review the Crossfill parameters and accept the change.

In addition, if an EFD1000 MFD with EBB is installed, perform the following steps from the Power Settings Page:

EFD1000 MFD .... Select "BATTERY"

EFD1000 MFD .... Verify Battery charge is above 80%

EFD1000 MFD .... Select EXT PWR

MENU .... Press the MENU button to return to normal operation

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CAUTION:

If an EFD is required by the Kinds Of Operations Equipment List, takeoff with indicated aircraft voltage (as displayed in the EFD Power Settings Menu) below 12.3V (14 Volt aircraft) or 24.6V (28Volt aircraft) is NOT AUTHORIZED **If the indicated aircraft voltage is below 12.3V (14V Electrical System) or 24.6V (28V Electrical System) the EFD will automatically switch to battery shortly after takeoff.** **Indicated aircraft voltages below these thresholds are indicative of an aircraft electrical system charging problem that must be resolved before flight.**

CAUTION:

If the EBB is required by the Kinds Of Operations Equipment List (See section 2.12.7), the minimum EBB charge permitted for dispatch is 80%

CAUTION:

If the EBB temperature is below -20°C the battery may not power the EFD1000 until warmed. When an EBB is required by the kinds of operations limitations (See section 2.12.7), the cabin temperature must be above -20°C before departure

NOTE:

If the EBB temperature is below 0°C, it will take 10 minutes or longer to determine the "BATTERY" charge. Indicated battery charge may rise from the initial indication as the battery warms. **The internal or EBB battery will not charge until the battery temperature is above 0°C. The battery will have to be allowed to warm to accept a charge.**

4.4 Synthetic Vision Normal Procedures

Normal Operating Procedures	Refer to the Aspen ESV Quick Reference
Pilot's ESV Display	Refer to the Aspen ESV Quick Reference
Flight Director/Autopilot Coupled Operation	There is no change to the operation of the Flight Director or Autopilot Coupled operation.

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4.5 Altitude Preselect Normal Procedures

Altitude Alerter	Set as desired
PRESEL	Press for ARMED
To deselect:	
PRESEL	Press to Disarm

The altitude preselector is intended to automatically engage the altitude hold function on the autopilot when the aircraft reaches the altitude alerter setting in the EFD1000 PFD. The preselector will engage the autopilot at the moment the aircraft crosses the preset altitude, therefore some overshoot is expected, depending on the autopilot performance and the vertical speed. High rate vertical speed will result in a sudden level off just as if the pilot selected altitude hold.

The preselector toggles the autopilot altitude hold function. If the altitude hold is manually engaged just prior to reaching the preselected altitude and the aircraft overshoots to the selected altitude, the preselector will toggle and the altitude hold will disengage. Recommended best practice is to permit the preselector to accomplish the function it is armed for.

4.6 Terrain Coloring on the MFD Moving Map and the Terrain View

When the aircraft is within 1900 feet AGL and two miles of a runway, the terrain coloring thresholds are removed except terrain that is more than 100 feet above the runway elevation.

4.7 Before Approach Checks

EBB Switch (if installed)	Verify set to NORM
Avionics and Instruments	SET as desired
PFD	Configure for arrival
EFD1000 MFD (if installed)	Select REV and press XFILL. Review the Crossfill parameters and accept the change.

CAUTION:

The EFD1000 MFD Reversionary PFD display references, bugs, navigation sources, etc. must be configured or verified as necessary for landing and missed or final approach. This will reduce pilot workload should the MFD reversion mode be required. This is accomplished by pressing the XFILL button, which is available when REV is pressed.

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4.8 Shutdown Checks

EFD1000/EFD500 Circuit Breaker / Switches	OFF
EBB Switch (if installed)	Verify set to NORM

NOTE:

The EBB disconnect switch should be left in the NORM position, except during an abnormal condition. When in the "DISC" position the EBB energizes a relay that is powered from the EBB. When the switch is in the DISC position the EBB will gradually discharge.

NOTE:

Each EFD display includes either an internal battery or external EBB. On the ground the EFD will initiate a shut down sequence when aircraft power is removed. If this sequence is interrupted, the EFD will continue to operate from battery until the battery is depleted.

To avoid inadvertently discharging the EFD battery, confirm that each EFD is completely powered down before leaving the aircraft.

5 Performance

No change to basic Airplane Flight Manual or other performance information or placards.

6 Weight & Center of Gravity

See current weight and balance records.

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7 EFD1000/500 System Operation

Refer to Section 2.1 in this document for references to detailed operating information for the EFD1000 PFD, EFD1000 MFD, and EFD500 MFD systems.

NOTE:

Although intuitive to operate, a reasonable degree of familiarity is required to effectively use the EFD1000/500 system.

Study this AFMS, the Pilot's Guides, and seek instruction from a competent instructor to gain and maintain familiarity and competence with this system.

Gain experience with the system under VMC before flying in IMC.

Practice often.

Go Fly!

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8 List of Acronyms and Abbreviations

A/P .... Autopilot
ACU .... Analog Converter Unit
ADAHRS .... Air Data Attitude Heading Reference System
AHRS .... Attitude Heading Reference System
AFMS .... Airplane Flight Manual Supplement
AMMD .... Aerodrome Moving Map Display
ASPEN GTWY .... See GTWY
BARO .... Barometric Pressure Setting
BAT .... Battery
CG100 .... Connected Gateway remote LRU
CM .... Configuration Module
CWS .... (autopilot) Control Wheel Steering
DH .... Decision Height
EA .... Evolution Adapter
EBB .... Emergency Backup Battery
EFB .... Electronic Flight Bag
EFD .... Evolution Flight Display
EFIS .... Electronic Flight Instrument System
EOC .... Executable Object Code
EWR .... Evolution Weather Receiver
FPM .... Flight Path Marker
FOV .... Field of View
GTWY .... Aspen Connected Gateway, including
.... the CG100
GPS .... Global Positioning System
GPSS .... GPS Steering
HDG .... Heading
HSI .... Horizontal Situation Indicator
IAS .... Indicated Airspeed
IFR .... Instrument Flight Rules
IMC .... Instrument Meteorological Conditions
IOP .... Input-Output Processor
KOEL .... Kinds of Operations Equipment List
LRU .... Line replaceable Unit
MAP .... Main Application Processor
MEMS .... Micro Electromechanical Systems
MFD .... Multi-Function Display
NACO .... National Aeronautical Charting Office
OAT .... Outside Air Temperature
PFD .... Primary Flight Display
POM .... Pitot Obstruction Monitor
REV .... Reversion
RMVD .... Removed
RSM .... Remote Sensor Module
SAI .... Secondary Attitude Indicator
SDHC .... Secure Digital, High-Capacity
SHSI .... Secondary Horizontal Situation Indicator
SID .... Standard Instrument Departure
STAR .... Standard Terminal Arrival Route
SV .... Synthetic Vision
TAS .... True Airspeed
TAS .... Traffic Advisory System

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TIS .... Traffic Information System
TWS .... Terrain Warning System
TRFC .... Traffic
VFR .... Visual Flight Rules
VMC .... Visual Meteorological Conditions
VOR .... VHF Omni-directional Radio Range
VLOC .... VOR / Localizer

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Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for
Garmin GNS 480 (CNX 80) SYSTEM INSTALLATION
as installed in

COMMANDER 114TC

Make and Model Airplane

Registration Number: N595TC Serial Number: 20005

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped with the Garmin GNS 480. This document must be carried in the airplane at all times when the Garmin GNS 480 is installed in accordance with Supplemental Type Certificate No. SA01229SE.

The information contained in this document supplements or supersedes the information made available to the operator by the manufacturer in the form of clearly stated placards, markings, or manuals or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic placards, markings, or manuals or the basic FAA approved Airplane Flight Manual.

FAA Approved By:

Michael Warren
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 10-APR-2015

Rev	Rev. Date	Description	By	FAA Apvl	Date Approved
--	4/23/03	Original Release	dfs	none	
A	5/30/03	Added clarification note of oceanic operations in paragraph 1.2, added Navigation subparagraph to Limitations.	dfs	none	
B	6/5/03	Corrected typo of DR in paragraph 3.2.	dfs	none	
C	6/25/03	Remove reference to CAR in cover statement, change GPS Approach statement (3.2.b). Add requirement for external annunciation check (2.5). Correct datacard part number (2.3). Correct typos.	dfs pad mak	none	
D	6/26/03	Added limitation for backup CNX used to originate a flight plan	pad	Steve O'Neal	6/27/03
E	10/27/03	Changed company name to Garmin AT, update mission planning tool (1.2.1), generalize sensors (1.2.1a), clarify Part 91 (1.2.1b), update for software version 1.2 (2.1, 2.2), clarify IFR installation status (2.1), clarify pilot action (2.5a), specify location of DR and LOI annunciations (3.2a, 3.2b), remove "transport aircraft" as FMS descriptor (4.).	mak, pad	Donald Wilson	11/26/03
--	7/15/04	Changed model name to GNS 480, added Gamma 2, 3 precision approach capability and traffic sources for V2.0 software. Document major revision to -01 Rev-.	pad	none	
A	8/26/04	Added wording regarding approaches with vertical guidance in section 4.1	pad	Thomas E. Archer	9/15/04
B	8/11/05	Correct typo in STC number (cover, 1.2). Update Pilot's Guide revision to latest approved Rev B (2.1)	mak	Donald Wilson	8/18/05
C	3/7/06	Updated Pilot's Guide revision; Application SW revision updated to 2.1 Added Section 2.7 GDL 90 Control	msf	Donald Wilson	3/29/06
D	9/26/06	Update route planning software and manual (1.2.1). Add WAAS TSO deviation limitation (2.4). Add checkbox for GDL 90 control (2.7).	mak	Donald Wilson	10/05/06
E	1/17/07	Add checkbox for GA 35 WAAS antenna (2.4).	mak	Ed Kolano	6/08/07
F	6/23/08	Revise limitations for GPS WAAS engine software v3.1 and application software v2.3. Added limitations for flight plan displays. Added note regarding holding at FAF.	pad	Donald Wilson	9/10/08
G	10/31/08	Revise GPS WAAS engine software 3.2 to address northern latitude operations and minor changes to language in Limitations section for clarity.	pad	Ed Kolano	11/19/08
H	4/10/15	Changed format, removed outdated web links, added LP +V.	jrl	See Page 1	See Page 1

Table of Contents

Section 1. GENERAL

1.1 Garmin GNS 480 GPS/WAAS Nav Com

The Garmin GNS 480 GPS/WAAS Nav Com is a panel-mounted product that contains a GPS/WAAS receiver for GPS approved primary navigation, VHF Com, and VHF Nav in an integrated unit with a moving map and color display. The GNS 480 can also control a remote transponder, and may display TIS-A traffic, or Skywatch traffic data. The previously approved Garmin CNX80 is an equivalent unit with only a bezel and model name change, and all data in this AFMS applies to both models.

The GNS 480 uses a high-resolution color display to provide information about the different functions. Information and "smart keys" unique for each mode of operation are displayed.

When you press the COM, VOR, or XPDR keys on the left side of the display, the display area for that function will be outlined and the information active for editing will be highlighted. The labels for the bottom row of smart keys will change for each function selected. Pressing the CDI key toggles between GPS and VOR/ILS/LOC. The operation of the smart keys across the bottom changes depending on the function selected.

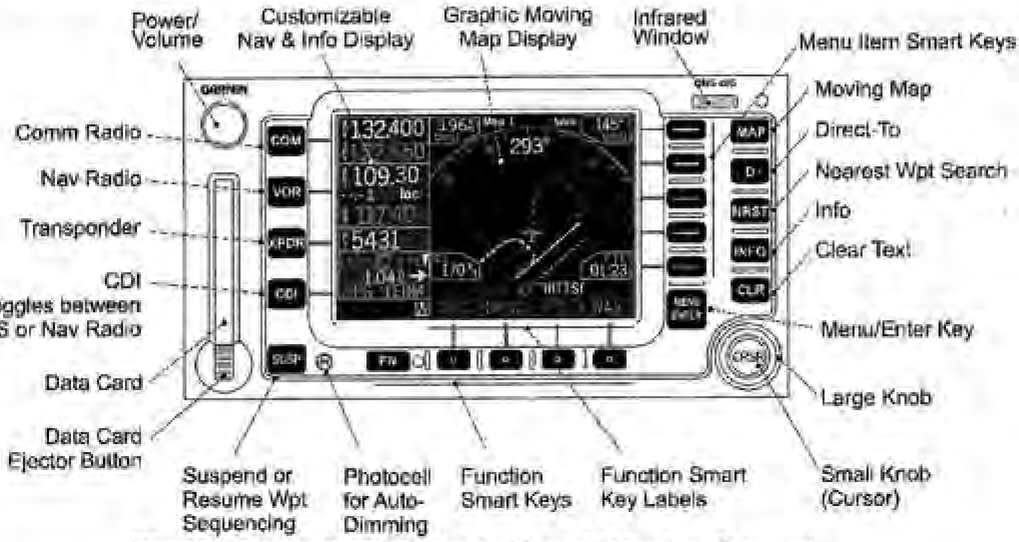

Figure 1 – GNS 480 Control and Display Layout

1.2 Operation

GPS/WAAS TSO-C146a Class 3: The Garmin GNS 480, when installed in accordance with STC SA01229SE, uses GPS and WAAS (within the coverage of a Space-Based Augmentation System complying with ICAO Annex 10) for en route, terminal area, precision and non-precision approach operations (including "GPS", "or GPS", and "RNAV" approaches).

Navigation information is referenced to WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent. Waypoints that are not compliant to WGS-84 are noted in the GNS 480 database, and annunciated if embedded in the system's flight plan.

1.2.1 Class II Oceanic, Remote, and other Operations

The Garmin GNS 480, as installed, has been found to comply with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace, when used in conjunction with Garmin AT Route Planning Software, P/N 139-0370-020 (or later FAA approved Version, which is included with the Predictor Program P/N 006-A0154-02 or later FAA approved Version and the Route Planning User's Guide P/N 560-0180-01 or later FAA approved Revision on the P/N 140-0056-004 GNS 480 Product CD). Oceanic operations are supported when GNS 480 annunciates Enroute operations. This provides an alarm limit of 2 nm and a mask angle of 5° (degrees). The GNS 480 also has the ability to predict RAIM availability at any waypoint in the database if WAAS corrections are expected to be absent or disabled. This does not constitute an operational approval for Oceanic or remote area operations. Additional equipment installations or operational approvals may be required.

a) Use for oceanic navigation requires an additional approved long range oceanic and/or remote area navigation system with independent display, sensors, antenna, and power source.

b) Use of the GNS 480 for other than U.S. 14 CFR Part 91 operations requires redundant VHF Com and VHF Nav systems. Other limitations may be applicable for Canadian operations.

c) For FAR 91 operations, the RAIM prediction function may be used in lieu of the prediction software if WAAS corrections are unavailable.

d) Operations approval may be granted for the use of the GNS 480 RAIM prediction function in lieu of the Route Planning Software for operators requiring this capability. Refer to your appropriate civil aviation authorities for these authorizations.

Section 2. LIMITATIONS

2.1 Pilot's Guide

The Garmin GNS 480 Pilot's Guide, part number and revision listed below (or later FAA approved revisions), must be immediately available to the flight crew whenever navigation is predicted on the use of the Garmin GNS 480.

- Pilot's Guide P/N 560-0984-01 Rev. D or later for software version 2.3 or later

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval, which is beyond the scope of this installation.

If a second redundant GNS 480 is installed outside the acceptable field of view, it should be utilized as a backup system and not the primary source of navigation, unless the primary unit fails. A backup system should not be utilized to originate a flight plan for navigation.

2.2 System Software

The system must utilize the software version listed below (or later FAA approved versions). The software version can be displayed in System Mode Screen on the display. This can be accessed, once the unit is initialized, by depressing the **FN** key twice and selecting **SYS**, followed by **VERS**. Software versions support different functions, check the GNS 480 Pilot's Guide for further information.

Software Item	Approved Software Version *(or later FAA approved versions)*	
	SW Version	As displayed on GNS 480
Airborne SW	2.4	02.40.00

Table 1 – Approved Software Versions

2.3 Database

The GNS 480 Database Card P/N 138-0329-051 Rev. -- (or later FAA approved version) must be installed.

a) IFR enroute and terminal navigation is prohibited, unless the pilot verifies the currency of the database or verifies each selected waypoint for accuracy by reference to current approved data.

b) Instrument approaches using the GNS 480 are prohibited, unless GNS 480 approach data is verified by the pilot or crew to be current. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are loaded from the GNS 480 database.

2.4 Navigation

No navigation is authorized north of 89° (degrees) latitude or south of 89° (degrees) latitude.

Limitations in sections a through d below **are not applicable** if the GNS 480 installation has been upgraded to include GPS WAAS engine software version 3.2,(or later approved) airborne software version 2.3 (or later FAA approved), and either the A33W, GA35, GA36, or GA37 antennas have been installed on the aircraft. The software versions may be verified on the SYS/VERS page on the GNS 480.

The antenna installed in this installation is (one antenna to be checked by installer):

☐ A-33 (575-9 / 590-1104)	☐ GA56A (011-01154-00)
☐ GA35 (013-00235-00)	☐ A-34 (575-93 / 590-1112
☐ GA56W (011-01111-00)	☐ GA57 (011-01032-00)
☐ A33W (013-00261-00)	☐ GA36 (013-00244-00)
☐ GA37 (013-00245-00)	

Previously FAA approved software and antenna combinations that are not fully TSO-C146a compliant may conduct GPS or WAAS operations under Instrument Flight Rules (IFR) if:

a) Aircraft using the GPS or WAAS capability of the GNS 480 navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation appropriate to the flight with the exception of oceanic and remote operations.

b) For flight planning purposes, if an alternate airport is required, it must have an approved instrument approach procedure other than GPS or RNAV that is anticipated to be operational and available at the estimated time of arrival. All equipment required for this procedure must be installed and operational.

c) For flight planning purposes, Garmin Prediction Program part number 006-A0154-02 (with the installed antenna part number selected) should be used to confirm the availability of RAIM for the intended flight in accordance with the local aviation authority guidelines for TSO-C129a equipment. WAAS NOTAMs (or their absence) and generic prediction tools do not provide an acceptable indication of the availability for the GNS 480 equipment.

d) When flight planning an LNAV/VNAV or LPV approach, operators should use the Garmin Prediction Program part number 006-A0154-02 (with the installed antenna part number selected) in addition to any NOTAMs issued for the approach.

2.5 Approaches

a) During GPS approaches, the pilot must verify the GNS 480 is operating in the approach mode.
b) When conducting approaches referenced to true North, a manual magnetic variation setting of zero degrees must be used.
c) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR approach, or any other type of approach not approved for GPS overlay, is not authorized with GPS navigation guidance.
d) Use of the GNS 480 VOR/LOC/GS receiver to fly approaches not approved for GPS requires VOR/LOC/GS navigation data to be present on the external indicator.
e) For aircraft with remote source selection annunciation installed for the CDI/HSI, conducting IFR approaches is prohibited if the remote annunciation is found inoperative during pre-flight. (This limitation does not prohibit the conduct of an IFR approach if the required remote annunciation fails during flight, and the indicator provided on the GNS 480 display may be used as a backup).
f) Unless in emergency conditions, IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view and access to the GNS 480.
g) Instrument approaches using GPS guidance may only be conducted when the GNS is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, LPV, LP, or LP +V)

NOTE

Advisory vertical guidance deviation is provided when the GNS annunciates LNAV+V or LP +V. The controlling minimums remain LNAV or LP even when advisory vertical guidance is provided. Advisory 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 in accordance with the LNAV or LP approach procedure.

2.6 Traffic Display

Traffic may be displayed on the GNS 480 when connected to an L-3 Avionics Systems Skywatch, or when the GNS 480 is connected to either a Garmin GTX 33 or GTX 330 series Mode S Transponder providing Traffic Information Services (TIS-A).

Both systems are capable of providing traffic monitoring and alerting to the pilot. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering. Operations and display of this traffic data is described in the GNS 480 Pilot's Guide.

2.7 GDL 90 Control

The GNS 480 in this installation ☐IS configured ☐is NOT configured to control a GDL 90. If the GNS 480 is configured to control a compatible transponder (SL70, SL70R, GTX 32, GTX 327, GTX 33, or GTX 330) and the transponder provides control to a GDL 90 UAT Datalink Sensor:

a) The GDL 90 does not replace any required equipment.

b) The GDL 90 UAT datalink is approved for Air Traffic Control (ATC) ADS-B Surveillance Services in the United States. For areas where ATC Surveillance Services are provided, the UAT equipment shall broadcast aircraft position, velocity, barometric altitude information, flight identification and/or a 4096 squawk code.

c) When directed by ATC to turn "off" the ADS-B transmission, pilots should use the GNS 480 transponder standby function (press XPDR, then STBY) to stop ADS-B transmissions while airborne or on the surface.

UAT datalink is also used to receive Traffic Information Services-Broadcast (TIS-B) and Flight Information Services-Broadcast (FIS-B) information. To receive TIS-B and FIS-B information, a display will be needed.

2.8 Flight Plan Display Limitations

The GNS 480 serial 429 data output has been evaluated with the Sandel 3500 series EHSI and Bendix King 40/50 series EFIS system.

For Bendix King 40/50 series EFIS installations, the serial data output must be set according to the GNS 480 installation manual. The display is limited to the types of flight plan legs that can be displayed. Holding patterns, procedure turns, DME arcs, and heading legs cannot be displayed on the system. Pilot Nav legs cannot be displayed. Refer to the GNS 480 for display of the active leg type and guidance.

For Sandel 3500 EFIS HSI installations, the GNS 480 serial data output must be set in accordance with the installation manual. The display is limited to the types of flight plan legs that can be displayed. Heading legs cannot be displayed. Pilot Nav legs cannot be displayed. Refer to the GNS 480 for display of the active leg type and guidance.

2.9 Holding at the Final Approach Fix

The GNS 480 can automatically or manually insert holding patterns at any waypoint. In the event that a course reversal or holding is accomplished at the designated approach FAF, holding patterns within 6.5 degrees of the inbound course will be adjusted for local magnetic variation at the FAF. Depending upon the degree of variation, this will cause the inbound course on the flight plan page to vary slightly. The automatically or manually inserted hold guidance will function normally. Holding patterns at other waypoints will use the locally calculated magnetic variation.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No change.

3.2 Abnormal Procedures

a) If the Garmin GNS 480 GPS navigation information is not available, or is invalid, internal VHF navigation function may be used, or utilize other remaining operational navigation equipment installed in the airplane as appropriate. If the GNS 480 loses GPS position and reverts to Dead Reckoning mode (indicated by the annunciation "DR" above the groundspeed indication on the moving map display), then the moving map will continue to be displayed. Aircraft position will be based upon the last valid GPS position and estimated by Dead Reckoning methods. Changes in airspeed or winds aloft can affect the estimated position substantially. Dead Reckoning mode terminates at the first Pilot Navigation leg in the flight plan.

b) If a "Loss of Integrity" (LOI) message is displayed (above the groundspeed indication on the moving map display) during:
   - Enroute/Terminal; continue to navigate using GPS equipment and periodically cross-check the GPS guidance to other approved means of navigation.
   - GPS Approach; GPS approaches are not authorized under LOI, revert to alternate means of navigation. This may be the internal VOR/LOC/GS or other remaining operational navigation equipment as appropriate.

c) If loss of the VHF Navigation radio message (NAV flag) is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. GPS position and VHF Comm radio functions are not affected unless annunciated as failed.

d) If the VHF Comm radio fails (as indicated by the display and associated message), then use another installed VHF Comm radio in the aircraft. GPS position and VHF Navigation radio functions are not affected unless annunciated as failed.

e) If the GNS 480 transponder control function fails at any time, the SL70 remote transponder will automatically revert to Mode S/C operation and squawk the last code assigned. A GTX 32 or 33 series transponder will retain the last mode of operation at the time of control function failure.

f) During a GPS LPV precision approach, or GPS LNAV/VNAV approaches, the GNS 480 will downgrade the approach if the Horizontal or Vertical Alarm Limits are exceeded. This will cause the vertical guidance to flag unavailable. The procedure may be continued using LNAV only minimums.

g) During any GPS approach in which precision and non-precision alarm limits are exceeded, the GNS 480 will revert to terminal operations alarm limits. The GNS 480 will indicate the approach must be aborted in this case. The GNS 480 may be utilized for terminal navigation or other means of primary navigation may be used.

Section 4. NORMAL PROCEDURES

Refer to the GNS 480 Pilot's Guide defined in paragraph 2.1 on page 6 of this document for normal operating procedures.

GNS 480 functionality and user interface is similar to a Flight Management System (FMS). Although intuitive and user friendly, a reasonable degree of familiarity is required to use the GNS 480 without becoming too engrossed in GNS 480 operation at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Pilot workload will be higher for pilots with limited familiarity in using the GNS 480 in an IFR environment, particularly without the autopilot engaged. Garmin AT provides excellent GNS 480 training tools with the Pilot's Guide, the Computer Based Training CD ROM with PC based GNS 480 simulator, and the GNS 480 Simulator Mode. Pilots should take full advantage of these training tools to enhance system familiarization. Use of autopilot is strongly encouraged when using the GNS 480 in IMC conditions.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

Refer to the GNS 480 Pilot's Guide defined in paragraph 2.1 on page 6 of this document for a complete description of the GNS 480 System.

FAA APPROVED FLIGHT MANUAL SUPPLEMENT

JP INSTRUMENTS

EDM 930

J. P Instruments
PO Box 7033
Huntington Beach CA 92646

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT OR SUPPLEMENTAL AIRPLANE FLIGHT MANUAL (FOR THOSE AIRCRAFT WITHOUT A BASIC AIRPLANE FLIGHT MANUAL)

EDM-930 PRIMARY ENGINE DATA MANAGEMENT SYSTEM

Airplane Flight Manual Supplement No. 930-0001 Rev. C

For

Reciprocating Engine Powered Aircraft as listed on STC SA01435SE

REG. NO. N595TC

SER. NO. 20005

This Supplement must be attached to the FAA Approved Airplane Flight Manual when the J.P. Instruments EDM-930 is installed in accordance with Supplemental Type Certificate SA01435SE. For those airplanes without a basic Airplane Flight Manual, this Supplemental AFM must be in the aircraft when the EDM-930 is installed.

The information contained in this Airplane Flight Manual Supplement/ Supplemental Aircraft Flight Manual supplements or supersedes the basic manual/ placards only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic manuals, markings, and placards.

FAA APPROVED:

For Manager
Seattle Aircraft Certification Office
Federal Aviation Administration
Transport Airplane Directorate

Date: DEC 10 2004

HUNTINGTON BEACH, CA 92646

Revision	Description	Affected Pages	Approval
C	Complete Flight Manual Supplement for EDM-930	1 thru 4	Manager Seattle Aircraft Certification Office Federal Aviation Administration Date DEC 10 2004

HUNTINGTON BEACH, CA 92646

GENERAL

The EDM-930 is a combined electronic indicating system which simultaneously displays to the pilot powerplant and aircraft systems operating parameters. It includes the following indicating systems; replacing all previous primary digital and/or analog instruments (The label of the parameter shown on the instrument is indicated in the first parenthesis);[the acronym shown in the alarm displays is shown in the second parenthesis]:

1. Engine rotational speed (RPM)(RPM)
2. Engine Manifold Pressure (MAP)(MAP)
3. Engine Cylinder Head Temperature (CHT)((CHT)
4. Engine Exhaust Gas Temperature (EGT)(EGT)
5. Engine Oil Temperature(OIL-T) (O-T)
6. Engine Oil Pressure (OIL-P)(O-P)
7. Fuel Pressure(FUEL-P)(F-P)
8. Fuel Flow (FF)(FF)
9. Fuel Quantity (QTY-LF and QTY-RT) (None)
10. Alternator/Generator Output – Volts (VOLTS)(BUS) and Amps(AMPS)(AMP).
11. Outside Air Temperature (OAT)(None)
12. Turbocharger Compressor Discharge Temperature – {Primary on some turbocharged engines} (CDT)(CDT).
13. Turbine Inlet Temperature - {Primary on some turbocharged engines} (TIT)(TIT)
14. Induction Air Temperature (IAT)(IAT) or Carburetor inlet temperature (CARB)(CRB)

Display

Non-primary functions Induction air temperature, carburetor inlet temperature, EGT Span, bus voltage and Amps, Shock Cooling, Fuel Remaining, Fuel Required, Fuel Reserve, MPG, Endurance, and Fuel Used have programmable alarm limits. CHT, TIT, EGT, F-P, FF, and MAP may not be primary on some installations. Any of these non-primary functions are programmable.

The right hand side of the EDM-930 display has 9 vertical scale columns with a digital value below each column. The nine functions are: OIL-T, OIL-P, FUEL-P, OAT, VOLTS (or CDT, for engine installations having a primary compressor discharge temperature), AMPS, FF, and two fuel tank quantities (QTY-LF, QTY-RT). The engine RPM and MAP are presented in the upper left corner of the instrument. The EGT, CHT and TIT are presented in the lower left corner. Below the EGT/CHT columns is a message center that displays the digital values of the EGT/CHT/TIT and additional functions like shock cooling and caution and limit alarm messages.

Specific values for each parameter are displayed digitally above the vertical scale displays of EGT, CHT, and TIT. The highlighted indicator below the columns indicates which cylinder's digital information is presently displayed as an alarm in the message center or when manually or automatically stepping through the parameters.

Programming

Depressing the LF and STEP buttons simultaneously enters the program mode to enter fuel quantities, display scan rate, OAT display to °F or °C, EGT digital display resolution to 1 or 10° and other setup parameters. Exit by depressing STEP. If either the STEP or LF buttons are not pushed for three minutes, the EDM-930 will revert to automatic scan mode. Depressing the STEP button will stop the automatic mode and revert to manual mode. Refer to the EDM-930 Pilot's Guide Rev. B or later for additional operating information. This Pilot's Guide must be available to the pilot for all flight operations.

Remote Alarm Display (RAD)

The RAD is a 0.2" high, 8 character independent display. The RAD will still function if the main display is inoperable. An alarm such as the CHT on cylinder number 2 is 480 is displayed as 480CHT2. The label CHT2 will flash whenever an over-temperature exists and will extinguish when the temperature falls below the limit temperature. Other alarms would be displayed as, for example: 2780 RPM, 15 O-P, 34 F-P, 240 O-T.

The RAD is located directly in front of the pilot and displays digital caution and limit excedances when any of the parameters has reached its preset trigger point. Whenever limit alarms are not triggered, the RAD continuously displays MAP and RPM.
On initial startup or whenever power is turned on, the words "EDM-930 PRIMARY" is displayed, followed by the make and model of the aircraft for which the primary limits are set.

Alarm Limits

Whenever a parameter reaches the programmed *caution* trigger point, the main display will flash the *amber colored* word ALERT and the parameter acronym. Tapping the STEP button extinguishes these warnings.
Similarly, whenever a parameter reaches a programmed *limit* value, the display and the RAD will flash the *red colored* word ALERT and the acronym. Tapping the STEP button will extinguish the red display warnings on the main display but the RAD will also continue to flash the acronym until the parameter is not at or beyond the limit value.

Primary alarm *limits* for each specific aircraft model are set by JPI and are not programmable by the pilot. These include some or all of the following: CHT, CDT, EGT, O-T, O-P, F-P, QTY-LF, QTY-RT, MAP, RPM, FF, IAT, CARB, and TIT. The primary functions for your installation are shown on the Primary label on the back of the instrument and are identical to those specified in the FAA Approved Airplane Flight Manual/Pilot's Operating Handbook.

For caution alarms, primary digits and acronyms are flashed in *amber* at the original manufacturer's published caution points or, if none is specified, at a specific temperature below the programmed limit. For example, O-T and CDT alarms will flash 20°F before the actual factory limit. CHT will flash 40°F below, and TIT 50°F below the programmed limits. Fuel and oil pressure caution alarms will only flash if there is a published caution range

When a *caution* range is reached, the pilot can momentarily depress the STEP button to extinguish the particular flashing alarm acronyms. If another parameter has also reached its limit, that label will then begin to flash. The pilot should continue to monitor the affected functions as he would if a conventional analog display had reached a limit. The bar graph functions of CHT, EGT, and TIT remain displayed at all times.

Dimming

Automatic dimming is provided to dim both the panel display and the remote alarm display. Dimming can also be accomplished manually. Tapping the far right hand button (labeled Brightness) decreases brightness. Continuously holding this button increases brightness. Manual dimming overrides the automatic dimming feature. When switching electrical power off and on, the system defaults to automatic dimming.

II OPERATING LIMITATIONS

a. The EDM-930 may replace any existing RPM, MAP, EGT, CHT, CDT, TIT, O-T, O-P, F-P, FF, and Fuel Quantity indicators required by the aircraft type design or operating limits.
b. The EDM-930 cannot be used as primary if the RAD is not working.

III. EMERGENCY PROCEDURES

A. Loss of individual display element:
   1. Continue normal engine operation by referring to the remaining parameters displayed.

B. Loss of all displays (Electrical Failure):
   1. Avoid high engine power settings and rapid power changes;
   2. Enrichen Mixture to maintain smooth engine operation;
   3. Arrange to terminate the flight safely and as soon as practicable.

IV. NORMAL PROCEDURES

a. PRIMARY FUNCTIONS

Before each flight, verify that the RAD is working. Whenever main electrical power is turned on the EDM-930 performs a self-test procedure which identifies by the message center any inoperative parameters. During engine start, there may be a power interruption to the EDM-930 while the starter is engaged.

b. ENGINE MIXTURE LEANING

After establishing desired cruise-power depress the LF button to activate the Lean Find Mode. As the mixture is leaned, one cylinder's column will begin blinking; indicating the EGT for that cylinder has peaked. Continue with the leaning procedure, enriching as recommended by the aircraft manufacturer while monitoring the primary engine instruments. Once the leaning procedure has been completed, depress the STEP button briefly to exit the Lean Find Mode and enter the Monitor Mode.

CAUTION

Comply with manufacturer's Airplane Flight Manual leaning procedure.
Do not exceed applicable engine or aircraft limitations.

APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR

GARMIN SL30 NAV/COM

Serial No. 20006

Registration No. N595TC

The information contained herein supplements the approved Airplane Flight Manual only in those areas listed herein.

For limitations, procedures, and performance information not contained in this document, consult the Approved Airplane Flight Manual.

Approved:

for Melvin D. Taylor, Manager
Atlanta Aircraft Certification Office
Federal Aviation Administration

Date:

MAR 18 2008

GARMIN SL30 NAV/COM
LOG OF REVISIONS

Rev.	To Pages	Description	EASA Approval Signature and Date

SECTION 1 - GENERAL

Garmin SL30 Nav Com

The Garmin SL30 is a 760 channel VHF communication transceiver with 200 channel VOR, Localizer and Glide slope receivers. The SL30 has the ability to monitor standby by Com and Nav frequencies. The SL30 VHF Nav receiver operates from 108MHz to 117.95 MHz decoding both the VHF Omni Range and Localizer navigation signals. A built in glide slope receiver automatically tunes the corresponding glide slope paired frequencies (328 MHz to 335 MHz) when the localizer is tuned. The SL30 Com includes an 8 watt transmitter. All pilot controls and displays are presented on the SL30 front panel as indicated in Figure 1 below.

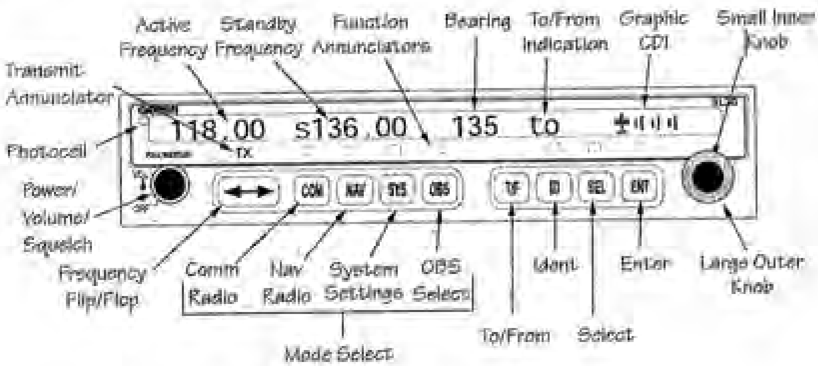

Figure 1: SL30 Front Panel Controls

Operation

The SL30 is certified for communication and navigation operations by

FAA TSO-C37d/JTSO 2C37e for Comm transmit
FAA TSO-C38d/JTSO 2C38e for Comm receive
FAA TSO-C128/JTSO 2C128 for unintentional transmission (stuck mic)
FAA TSO-C34e/JTSO C34e for ILS Glideslope receive
FAA TSO-C36e/JTSO C36e for ILS Localizer receive
FAA TSO-C40c/JTSO 2C40c for VOR receive
FAA TSO-C66c/JTSO 2C66b for DME display

compliance with the following:

Navigation Receiver Configuration

The SL30 can be installed in several configurations in the XL-2 based on avionics options selected. This includes installations with or without a course deviation indicator. In configurations with CDI a model MD200-306 CDI will be used. Navigation audio signals are passed on to the pilot through the avionics system audio panel. Refer to the audio panel section of AFM 135A-970-005 for operational details.

Comm Transceiver Configuration

SL30 Comm. connections are made to microphone and headphone interfaces through the avionics system audio panel. Transmit key signals are also passed through audio panel interfaces. Refer to the audio panel section of AFM 135A-970-005 for operational details.

Display

The SL30 Nav/Com uses a single line by 32-character 5x7 dot matrix alphanumeric display. A photocell is located in the top left corner of the front panel display. The photocell automatically controls the light intensity of the display LEDs from low brightness at night to high brightness during daylight operation. The lens is polarized to reduce reflections. Using polarized sunglasses may make it difficult to view the display.

TX

A transmit (TX) indicator located above the **FLIP/FLOP** button lights when the Com radio is transmitting.

Controls

Power On/Off - Volume - Squelch

The knob on the left side of the SL30 controls power on/off, volume, and squelch test. Rotate the knob clockwise (CW) past the detent to turn the power on. Continuing to rotate the knob to the right increases speaker and headphone amplifier volume level. Rotate the knob to the left to reduce the volume level. Pull the knob out to disable automatic squelch. The SL30 may be configured to have the volume knob control Nav and intercom volume, as well as Com volume .

Large/Small knobs

The dual concentric knobs on the right side of the SL30 are used to select frequencies, to view the features available within a function, or make changes. Details are provided in the appropriate sections.

Controls

Flip/Flop

Press the **FLIP/FLOP** button to switch between the active (left-most) and standby (right-most) frequency. Switching between Com frequencies is disabled while you are transmitting.

Com

Press **COM** to select the Com radio mode. The annunciator will light above the button when you are in Com mode. Press **COM** a second time to monitor the Standby frequency. See the Advanced Operation section for more about monitoring frequencies.

NAV

Press **NAV** to select the Nav radio mode. The annunciator above the button will light when you are in Nav mode. Press **NAV** a second time to monitor the Standby frequency. See the Advanced Operation section for more about monitoring frequencies.

SYS

Press **SYS** to reach the System mode. The annunciator above the button will light when you are in the System mode.

OBS

Press **OBS** to see the current OBS setting and graphic CDI. If the annunciator above the **OBS** button lights, you may use the **LARGE** and **SMALL** knobs to change the displayed OBS values.

If your system is configured with an external CDI/HSI, the OBS radial of your remote display will be decoded and displayed on the screen of the SL30.

T/F

Press **T/F** to toggle between the bearing TO or radial FROM the active VOR. The **T/F** button does not operate for Localizer frequencies.

ID

Press **ID** to select the Nav audio and toggle between VOICE or IDENT. Pressing **ID** will cancel the VOR monitor function. Selecting the monitor function will suspend the ID function until the monitor function is disabled.

SEL

Press **SEL** to choose from a list of channel types or to change values. In Com or Nav modes, press **SEL** to choose frequencies from the available lists. Press **SEL** again if you want to cancel the selection process. The annunciator will light above the button when this function is active.

ENT

Press **ENT** to save selected values, to confirm a prompt, or to save the Standby frequency.

Operation Summary

Power On

Turn the SL30 on. Either turn the Power/Volume knob clockwise to turn the power on or, if installed, turn on the master switch that powers the radios.

The SL30 will go through a short initialization routine and then briefly display the last VOR check date. If you turn the SL30 off for less then 15 seconds and then back on, it will bypass the initialization process and return to the last used display.

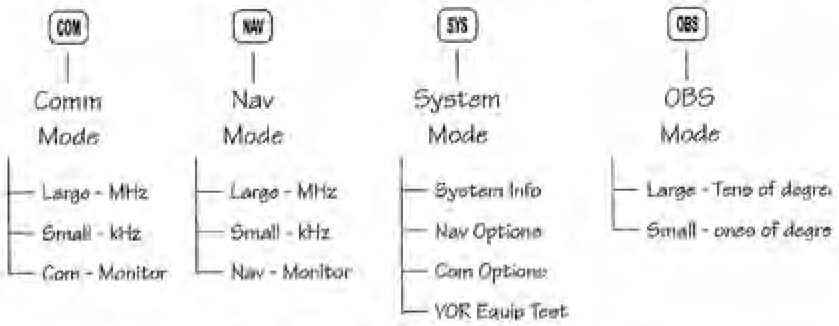

Figure 2: System Function Summary

SECTION 2 - LIMITATIONS

The Garmin SL30 Pilot's Guide, part number and revision listed below (or later EASA approved revisions), must be immediately available to the flight crew whenever navigation is predicted on the use of the Garmin SL30.

SL30 Pilots Guide	Garmin P/N 190-00486-00 Garmin AT P/N 560-0403-01

System Software

SL30 software versions may be viewed by placing the units in System Mode as shown below:

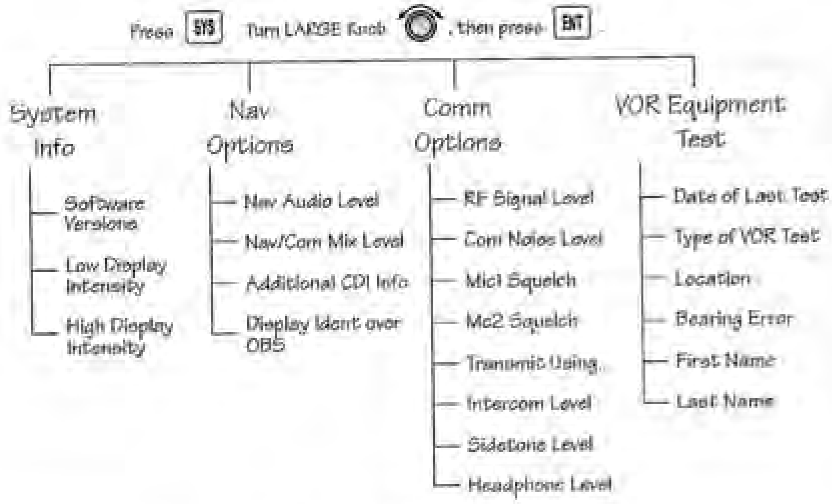

Figure 3: Software Version Display

SECTION 3 - EMERGENCY PROCEDURES

Emergency Channel Selection

The standard emergency channel (121.5 MHz) is stored in the Com memory of the SL30. Access the emergency channel as follows:

1. Press COM, if you are not in Com mode already. Press SEL. Turn the LARGE knob to the Emergency channel, one position counter-clockwise will reach it the fastest.
   EXAMPLE:
   119.10 s124.55 emrgncy 121.50
2. Press the FLIP/FLOP button to make the emergency channel the active channel
3. Listen, or key Mic to send your message.

SECTION 4 - NORMAL PROCEDURES

Refer to the SL30 Pilot's Guide for a complete set of procedures.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

See current weight and balance data.

SECTION 7 - AIRPLANE AND SYSTEM DESCRIPTION

See Garmin SL30 Pilot's Guide for a complete description.

SECTION 8 - AIRPLANE HANDLING, SERVICE, AND MAINTENANCE

In the event of a problem refer to the troubleshooting chart below for possible causes and corrective actions.

Problem	Possible Cause	Action
SL30 does not power on	No power to the SL30	Check power connections, breakers, and main avionics switch
	Faulty electrical wiring or connection	Contact your dealer to perform electrical system test
No Nav audio	Output disabled or set to a low level	Check System page, Nav options, Nav Audio Level
Nav audio in Com	Mixed with Com feature	Check System page, Nav Options, Mix Nav Audio with Com
SL30 does not transmit	Weather channel is selected	Select a different frequency, transmit on Weather channel not allowed
	No power to Com	Check power connections
	Mic key connection	Check Mic key input connection
Sidetone level is too low or too high	Wrong type of headsets, or level needs adjustment	Check System page, Nav Options, Sidetone level

Problem	Possible Cause	Action
Intercom doesn't function	Input not connected	Check connections
	No voice activation, or must talk too loud	Check System page, Com Options, Intercom level
Can't change active frequency	Com Radio not communicat-ing	Contact dealer
OBS readout displays "---"	Resolver failure	Contact dealer
	Calibration error	Recalibrate resolver
Display shows "Incorrect Calibration Check-sum" at start-up	Corrupted system calibration parameters	Contact factory

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTX 33X and GTX 3X5 Transponders with ADS-B
as installed in

COMMANDER 114TC
Make and Model Airplane

Registration Number: N595TC Serial Number: 20005

This document serves as an FAA Approved Airplane Flight Manual Supplement or Supplemental Airplane Flight Manual when the GTX 33X or GTX 3X5 with ADS-B is installed in accordance with Supplemental Type Certificate SA01714WI. 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 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:

Michael Warren
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 08-MAR-2016

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	05/01/2013	All	Complete Supplement	*Robert Murray* Robert Murray ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 05/01/2013
2	03/08/2016	All	New supplement format with GTX 3X5 added.	See cover page

Table of Contents

Section 1. GENERAL

1.1 GTX 33X

The Garmin GTX 33X family consists of the GTX 330 ES and GTX 33 ES (Non-Diversity Mode S Transponders) and the GTX 330D ES and GTX 33D ES (Diversity Mode S Transponders). The ES option of any of the transponders provides ADS-B extended squitter functionality.

All Garmin GTX 33X transponders are a radio transmitter/receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. Each unit is equipped with IDENT capability and will reply to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Interfaces to the GTX 33X are shown in the following block diagrams.

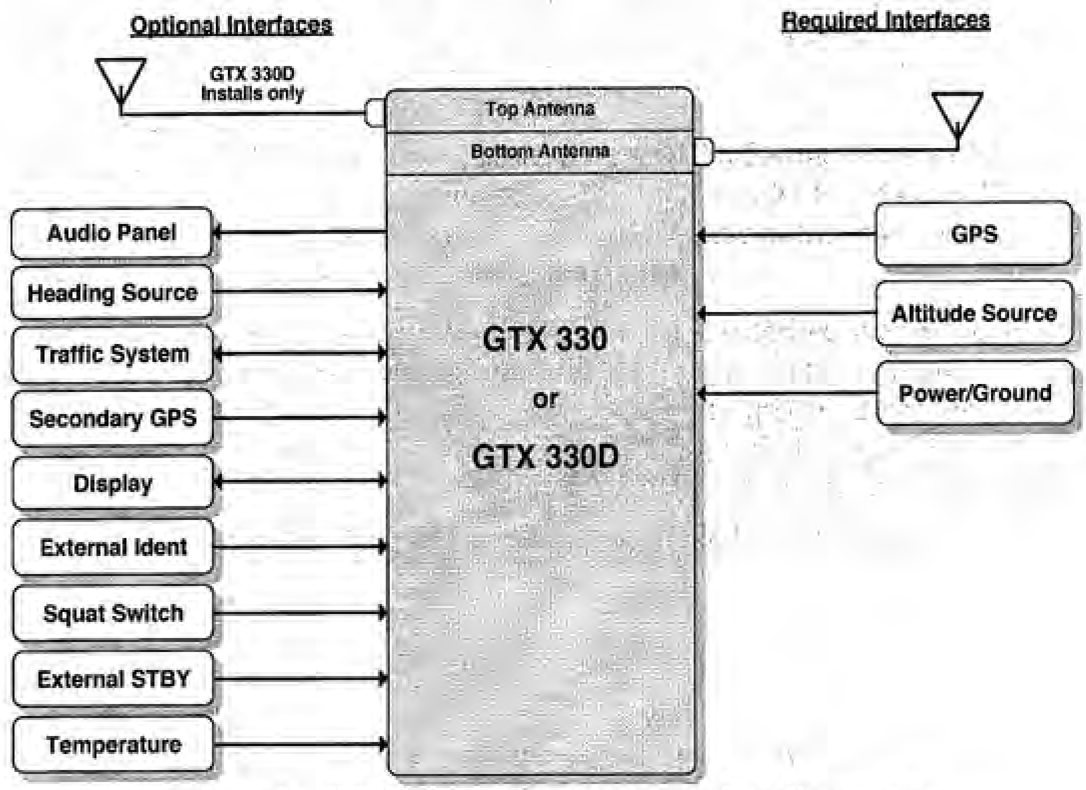

Figure 1 – GTX 330 or GTX 33D Interface Summary

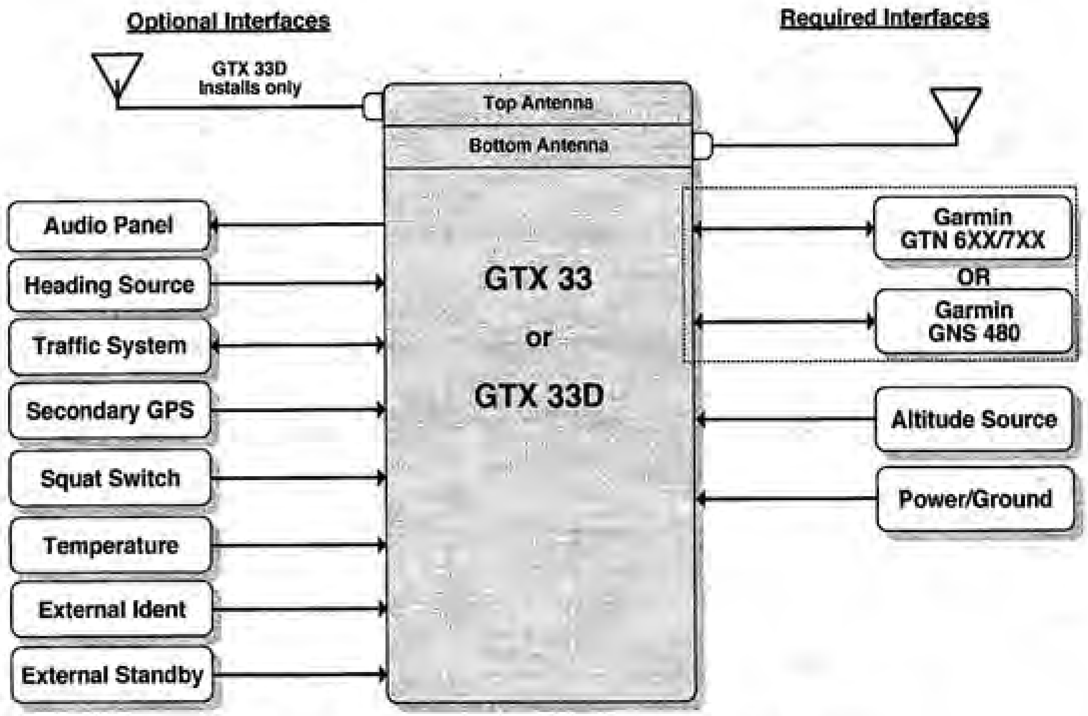

Figure 2 – GTX 33 or GTX 33D Interface Summary

The GTX 33X performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090ES) (1090 MHz)
    - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
        - GPS Position, Altitude, and Position Integrity
        - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
        - Air Ground Status
        - Flight ID, Call Sign, ICAO Registration Number
        - Capability and Status Information
        - Transponder Squawk Code, IDENT, and Emergency Status
    - Pressure Altitude Broadcast Inhibit
- Reception of TIS-A traffic data from a ground station
- Provide TIS-A traffic alerting to the pilot via interfaced display and audio output

1.2 GTX 3X5

The Garmin GTX 3X5 family consists of the GTX 335, 335R, 345, and 345R transponders. The functional differences between each of these transponders are described in Table 1.

Function	GTX 335	GTX 335 w GPS	GTX 335R	GTX 335R w GPS	GTX 345	GTX 345 w GPS	GTX 345R	GTX 345R w GPS
Panel mount	x	x			x	x		
Remote mount			x	x			x	x
Mode S	x	x	x	x	x	x	x	x
ADS-B (out)	x	x	x	x	x	x	x	x
ADS-B Traffic					x	x	x	x
FIS-B					x	x	x	x
Internal GPS		x		x		x		x
Bluetooth					x	x	x	x
Optional Garmin Altitude Encoder	x	x	x	x	x	x	x	x

Table 1 – GTX 3X5 Unit Configurations

Interfaces to the GTX 3X5 are shown in Figure 3.

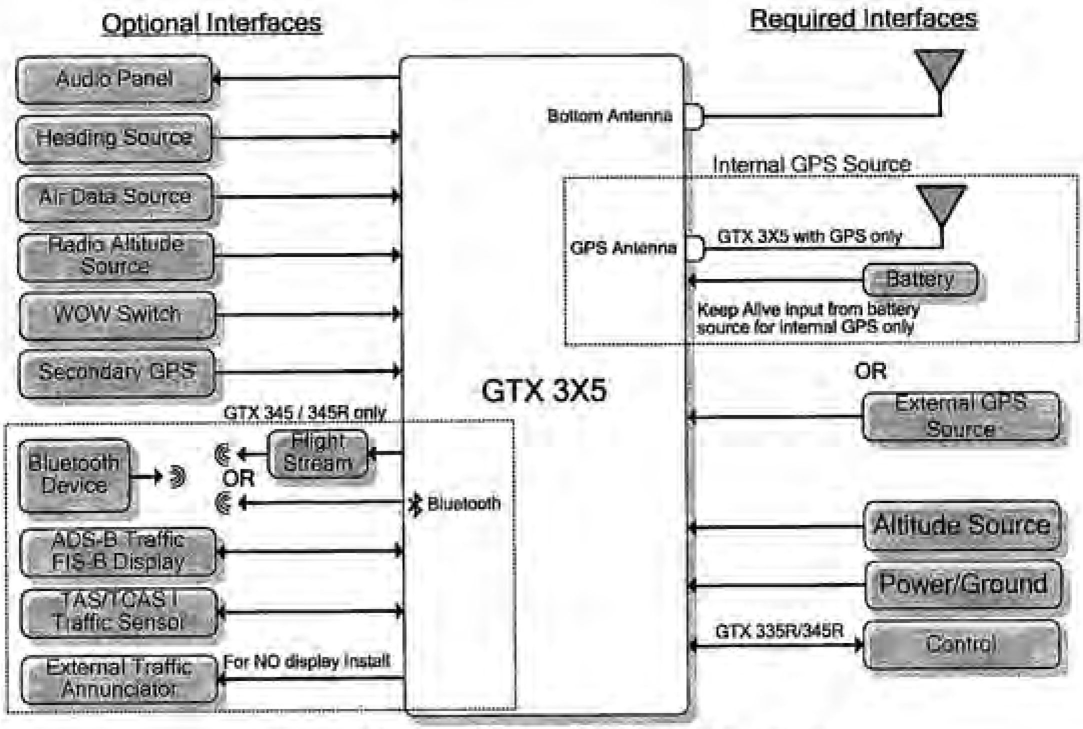

Figure 3 – GTX 3X5 Interface Summary

The GTX 3X5 performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090ES) (1090 MHz)
    - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
        - GPS Position, Altitude, and Position Integrity
        - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
        - Air Ground Status
        - Flight ID, Call Sign, ICAO Registration Number
        - Capability and Status Information
        - Transponder Squawk Code, IDENT, and Emergency Status
    - Pressure Altitude Broadcast Inhibit

The GTX 335 performs the following additional functions:

- Reception of TIS-A traffic data from a ground station
- Provide TIS-A traffic alerting to the pilot via interfaced display and audio output.

The GTX 345 performs the following additional functions:

- Reception of ADS-B In data on 1090 MHz
    - ADS-B (Data directly from another transmitting aircraft)
    - ADS-R (Rebroadcast of ADS-B data from a ground station)
- Reception of ADS-B In data on UAT (978 MHz)
    - ADS-B (Data directly from another transmitting aircraft)
    - ADS-R (Rebroadcast of ADS-B data from a ground station)
    - TIS-B (Broadcast of secondary surveillance radar) (SSR) derived traffic information from a ground station.
    - FIS-B (Broadcast of aviation data from a ground station)
- Provide ADS-B traffic information and alerting to the pilot via an interfaced display
    - Correlation and consolidation of traffic data from multiple traffic sources
    - Aural and visual traffic alerting
- Provide FIS-B data to the pilot via an interfaced display
    - Graphical and textual weather products
        - NEXRAD
        - PIREPs
        - AIRMET/SIGMETs
        - METARs
        - TAFs
        - Winds Aloft
    - Aviation Data
        - TFRs
        - NOTAMs

1.3 Capabilities

The Garmin GTX 33X and GTX 3X5 as installed in this aircraft have been shown to meet the equipment requirements of 14 CFR § 91.227 when operating in accordance with sections 2.1 and 2.2 of this supplement.

1.4 Installation Configuration

This aircraft is equipped with a GTX 33X and/or GTX 3X5 with the following interfaces/ features:

Equipment Installed:

Transponder #1

- ☐ GTX 330
- ☐ GTX 330D
- ☐ GTX 33
- ☐ GTX 33D
- ☐ GTX 335
- ☐ GTX 335R
- ☒ GTX 345
- ☐ GTX 345R

Transponder #2 (if installed)

- ☐ GTX 330
- ☐ GTX 330D
- ☐ GTX 33
- ☐ GTX 33D
- ☐ GTX 335
- ☐ GTX 335R
- ☐ GTX 345
- ☐ GTX 345R

Interfaced GPS/SBAS Position Source(s):

GPS #1

- ☐ Internal
- ☐ GTN 6XX/7XX Series
- ☐ GNS 400W/500W Series
- ☒ GNS 480
- ☐ GIA 63
- ☐ GDL 88 (GTX 330 only)

GPS #2 (if installed)

- ☐ Internal
- ☐ GTN 6XX/7XX Series
- ☐ GNS 400W/500W Series
- ☐ GNS 480
- ☐ GIA 63
- ☐ GDL 88 (GTX 330 only)

Interfaced Pressure Altitude Source:

Pressure Altitude Source #1

- ☒ ASPEN EFD 1000
- ☐ Garmin Altitude Encoder

Pressure Altitude Source #2 (if installed)

- ☐ ______________
- ☐ Garmin Altitude Encoder

Interfaced Remote Control Display (Required for remotely mounted GTX variants):

Transponder #1 Remote Control Display	Transponder #2 Remote Control Display (if installed)
☐ GTN 6XX/7XX	☐ GTN 6XX/7XX
☐ GNS 480	☒ GNS 480
☐ G950/1000 Display	☐ G950/1000 Display

Interfaced Active Traffic System:

☐ None

☐ TCAD

☐ TAS/TCAS

NOTE

If the system includes all of the following components:

- GTX 345R,
- G950/1000 Display, and
- TCAD or TAS/TCAS

Then the aircraft is no longer equipped with a TSO compliant active TCAD, TAS or TCAS system. Any operational requirement to be equipped with such system is no longer met.

1.5 Definitions

The following terminology is used within this document:

ADS-B:	Automatic Dependent Surveillance-Broadcast
AFM:	Airplane Flight Manual
AFMS:	Airplane Flight Manual Supplement
ATCRBS:	Air Traffic Control Radar Beacon System
CFR:	Code of Federal Regulations
ES:	Extended Squitter
GNSS:	Global Navigation Satellite System
GNS:	Garmin Navigation System
GPS:	Global Positioning System
GTX:	Garmin Transponder
GTN:	Garmin Touchscreen Navigator
ICAO:	International Civil Aviation Organization
LRU:	Line Replaceable Unit
PABI:	Pressure Altitude Broadcast Inhibit
POH:	Pilot Operating Handbook
SBAS:	Satellite-Based Augmentation System
SW:	Software
TCAS:	Traffic Collision Avoidance System
TIS:	Traffic Information Service
TX:	Transmit

Section 2. LIMITATIONS

2.1 Minimum Equipment

The GTX 33X and GTX 3X5 must have the following system interfaces fully functional in order to be compliant with the requirements for 14 CFR 91.227 ADS-B Out operations:

Interfaced Equipment	Number Installed	Number Required
Uncorrected Pressure Altitude Source	1	1
GPS SBAS Position Source	1 or more	1
Remote Control Display (for remotely mounted transponders)	1 or more	1

Table 2 – Required Equipment

2.2 ADS-B Out

The GTX 33X and GTX 3X5 only comply with 14 CFR 91.227 for ADS-B Out when all required functions are operational. When the system is not operational, ADS-B Out transmit failure messages will be present on the remote control display interface, or the GTX 330 or GTX 3X5 panel display.

2.3 TIS Traffic Display with User Navigation Angle

Display of TIS traffic from a GTX 33/330 or GTX 335 is not permitted with an interfacing display configured for a navigation angle of "user".

2.4 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main GTX software version is displayed on the splash screen during start up for the GTX 330 and GTX 3X5 panel mounted units, and the External LRU or System page on the interfaced remote control display for remotely mounted GTX transponders.

Software Item	**Software Version** *(or later FAA Approved versions for this STC)*
GTX 33X Main SW Version	8.02
GTX 3X5 Main SW Version	2.02

Table 3 - Software Versions

2.5 Pressure Altitude Broadcast Inhibit (PABI)

Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control while operating within airspace requiring an ADS-B Out compliant transmitter per 14 CFR 91.227. PABI is enabled by selecting the GTX to ON mode.

2.6 Datalinked Weather Display (GTX 345 Only)

Do not use datalink weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by datalink weather products may not accurately depict current weather conditions.

Do not use the indicated datalink weather product age to determine the age of the weather information shown by the datalink weather product. Due to time delays inherent in gathering and processing weather data for datalink transmission, the weather information shown by the datalink weather product may be significantly older than the indicated weather product age.

Do not rely solely upon datalink services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information.

2.7 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.23 or any other operational regulation regarding portable electronic devices.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No Change.

3.2 Abnormal Procedures

3.2.1 LOSS OF AIRCRAFT ELECTRICAL POWER GENERATION

XPDR Circuit Breaker .... **PULL**

Transponder and ADS-B Out functions will no longer be available.

NOTE

> This guidance is supplementary to any guidance provided in the POH or AFM for the installed aircraft for loss of power generation.

3.2.2 LOSS OF GPS/SBAS POSITION DATA

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GTX will no longer be transmitting ADS-B Out data.

For GTX 330 installations:

NO ADSB annunciator illuminated:

Interfaced GPS position sources .... **VERIFY VALID POSITION**

For GTX 3X5 installations:

NO 1090ES TX annunciator illuminated:

Interfaced GPS position sources .... **VERIFY VALID POSITION**

For GTX 33 and GTX 3X5R installations:

Reference Display Device documentation for applicable annunciation:

Interfaced GPS position sources .... **VERIFY VALID POSITION**

3.2.3 Dual GTX 3X5R Transponders in a G950/1000 installation

If Transponder #1 fails and Transponder #2 is activated by the pilot, the G1000 display will provide nuisance alerts unless power is removed from Transponder #1.

Transponder #1 Failed, Transponder #2 Active

Transponder #1 Circuit Breaker .... **PULL**

Section 4. NORMAL PROCEDURES

The procedures described below are specific only to the panel mounted GTX 330 or GTX 3X5 transponders. Cockpit Reference Guides and Pilot Guides for interfaced remote control displays will provide additional operating information specific to the displays or other traffic systems.

ADS-B Out functionality resides within the GTX transponders thereby providing a single point of entry for Mode 3/A code, Flight ID, IDENT functionality and activating or deactivating emergency status for both transponder and ADS-B Out functions. Details on performing these procedures are located in the GTX 330/330D Pilot's Guide and GTX 3X5 Series Transponder Pilot's Guide.

4.1 Unit Power On

For GTX 330 installations:

GTX Mode .... **VERIFY ALT**
NO ADSB .... **CONSIDERED**

For GTX 3X5 installations:

GTX Mode .... **VERIFY ALT**
NO 1090ES TX .... **CONSIDERED**

NOTE

The NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) may illuminate as the unit powers on and begins to receive input from external systems, to include the SBAS position source.

4.2 Before Takeoff

For GTX 330 installations:

ADS-B TX .... **VERIFY ON**
NO ADSB .... **EXTINGUISHED**

For GTX 3X5 installations:

1090ES TX CTL .... **VERIFY ON**
NO 1090ES TX .... **EXTINGUISHED**

NOTE

The ADS-B TX or 1090ES TX CTL must be turned on and the NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) must be **EXTINGUISHED** for the system to meet the requirements specified in 14 CFR 91.227. This system must be operational in certain airspaces after January 1, 2020 as specified by 14 CFR 91.225.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTION

The Garmin GTX 330 and GTX 3X5 Pilot's Guides, part numbers, and revisions listed below contain additional information regarding GTX system description, control, and function.

Title	Part Number	Revision
GTX 330 Pilot's Guide GTX 3X5 Pilot's Guide	190-00207-00 190-01499-00	Rev. G (or later) Rev. A (or later)

Pilot's Guides for interfaced displays, part numbers and revisions listed below, provide additional operating information for the Garmin GTX 33 and GTX 3X5R.

Title	Part Number	Revision
Garmin GTN 725/750 Pilot's Guide	190-01007-03	Rev. E (or later)
Garmin GTN 625/635/650 Pilot's Guide	190-01004-03	Rev. E (or later)
GNS 480 Pilot's Guide	190-00502-00	Rev. D (or later)
GTX 3X5 Series Transponder G1000 Pilot's Guide	190-01499-01	Rev. A (or later)

7.1 GTX TIS Behavior

The TIS Standby/Operate controls for GTX 33/330 and GTX 335 units only function when the aircraft is airborne.

7.2 GTX 345R and G950/1000 No Bearing Traffic Alerts

No visual indication is provided for no bearing traffic alerts. Only an aural indication of the no bearing traffic alert is provided. If an aural alert for no bearing traffic has been previously issued, a "no bearing traffic clear" aural indication will be provided once all traffic alerts are resolved.

All aural alerts are inhibited below 500' AGL, therefore a "no bearing traffic clear" aural may not be heard in a landing or touch and go flight scenario.

Rocky Top Leasing, Inc.
Chattanooga, Tennessee

Rocky Top Leasing, Inc.

FAA-APPROVED
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for
Rockwell Commander 114 Model Airplanes with
Rocky Top Leasing, Inc. FW15001 Air-Conditioner System

Registration No N595TC
Aircraft Serial No. 20005

The information in this Supplemental Flight Manual is FAA approved material, which along with the basic markings and placards is applicable to the operation of the airplane when modified by the installation of a Rocky Top Leasing, Inc. FW15001 Air-Conditioner system in accordance with FAA Form 337 dated ____________________.

The information in this Supplemental Flight Manual supersedes or adds to that of the basic markings and placards as well as other approved airplane data, only where covered in the items contained herein. For limitations, procedures, and performance not contained in this Manual, consult the basic markings. placards or other approved airplane data.

FAA APPROVED Grant Eaton
For Manager
Atlanta Aircraft Certification Office
Federal Aviation Administration
Atlanta, GA

P/N: AFMS15001, REV I/R
FAA APPROVED
Date: JUL 13 2016

LOG OF REVISIONS

Rev No.	Description	Page	Approved By	Date
I/R	AFMS	ALL	GE	7/13/2016

SECTION 1
GENERAL

INTRODUCTION:

The owner and operator should read this AFM Supplement carefully in order to become familiar with the operation of the airplane with a Rocky Top Leasing, Inc. model FW15001 air-conditioner installed. It contains limitations, operating procedures, performance information, and systems descriptions that are essential information for the pilot to properly operate the aircraft. As specified, this supplement must accompany the Airplane Flight Manual and be available to the pilot at any time during flight.

REVISING THE AFM SUPPLEMENT

Each time this supplement is revised or reissued, a new Log of Revision page is provided along with the pages containing corresponding data or changes. In the lower left comer of each page is shown the approval date and revision letter (when applicable). When updating this supplement to a later FAA Approved revision level, remove the Log or Revision page and the pages to be replaced and insert the new Log of Revision page and revised pages. That portion of text or an illustration, which has been revised by the addition of, or change in, information is denoted by a solid revision bar adjacent to the area of change, and placed along the outside margin of a page. Revision bars show only the information changed within the latest revision.

SECTION 2
LIMITATIONS

POWERPLANT LIMITATIONS:

The A/C switch must be in the "OFF' position for take-off and landing.

ELECTRICAL SYSTEM LIMITATIONS:

The A/C switch must be in the "OFF" position whenever the power receptacle is in use.

PLACARDS:

The following placards must be installed on the instrument panel.

This placard is located on the instrument panel in the pilot's field of view near the A/C controller.

A/C SWITCH MUST BE OFF FOR TAKEOFF/LAND

This placard is located on the instrument panel in close proximity to the power monitor LED.

AIR COND PWR LOW

SECTION 3
EMERGENCY PROCEDURES

REFRIGERANT GAS LEAK:

If a faint ether-like odor is detected, this indicated a possible refrigerant gas-leak. Move A/C switch to the "OFF' position and OPEN cabin vents to provide ventilation.

GENERATOR/ALTERNATOR FAILURE:

If a failure of the generator/alternator occurs. move A/C switch to the "OFF" position.

SMOKE/FIRE:

If smoke or fire is detected, move A/C switch to the "OFF" position.

AIR CONDITIONER BLOWER FAILURE:

If air conditioner blower fails to run, turn A/C switch to the "OFF" position.

SECTION 4
NORMAL PROCEDURES

BEFORE STARTING ENGINE:

A/C switch - "OFF"

BEFORE TAKEOFF:

A/C switch — "OFF"

LANDING:

NC switch — "OFF"

NOTE:

- The air conditioner may be on for ground taxi, en route climb, and cruise.
- Automatic load shedding is provided through the use of an active power monitoring system which continually monitors available power. A flashing blue LED provides an initial warning if low power condition persists. After approximately ten seconds, power is automatically interrupted to air conditioner. See section 7 for further details.

SECTION 5
PERFORMANCE

NO CHANGE

SECTION 6
WEIGHT & BALANCE

Because the components of this system are installed in the fuselage aft of the baggage compartment, the center of gravity of the empty airplane will be slightly more aft. As always, the pilot should verify that the center of gravity and weight of the loaded airplane are within limits before every flight. For current airplane empty weight and center of gravity location, see the revised aircraft weight and balance record.

NOTE:

Installing this air conditioner system does not change the airplane weight and center of gravity limits.

SECTION 7
SYSTEM DESCRIPTION

The Rocky Top Leasing, Inc. model FW15001 Air-Conditioner system for the Rockwell Commander 114 airplane is a vapor cycle type system, using compressed R134 refrigerant gas. The installation consists of pallet-mounted equipment behind the aft baggage compartment bulkhead in the tail cone. Cool air is ejected from the evaporator blower directly into the aircraft cabin by way of air duct.

A digital air conditioner control unit is mounted in the instrument panel at a convenient location to the pilot. The control unit consists of an ON/OFF pushbutton, fan speed UP/DOWN buttons, a digital temperature display, temperature selection UP/DOWN buttons, and a compressor indicator light labeled "AC".

The air conditioner system includes an automatic power monitoring device which prevents air conditioner operation when insufficient power is available. A blue LED is mounted in the pilot's field of view. When the aircraft bus voltage falls below 26vdc and/or current is being discharged from the aircraft battery, the LED begins to flash. If the low power condition persists for approximately 10 seconds, the air conditioner will automatically shut down and must be manually reengaged after the situation is resolved.

The digital control unit ON/OFF switch is located at the upper left and operates as a push ON/OFF. The fan speed is selected using the UP/DOWN pushbuttons underneath the ON/OFF button. Fan speeds are Low (F1), Med (F2), and High (F3). When a speed is selected, the digital display will briefly indicate this speed then revert back to cabin temp.

Thermostat temperature selection is accomplished by using the UP/DOWN pushbuttons on the right. Pressing either button will change temperature selection by one degree per press. With each press, the display will briefly show the temperature selection then will revert back to cabin temperature. The cabin temp probe is located in the return air stream at the inlet filter. The AC light will illuminate when selected temperature is at least 2 degrees below current cabin temp and will remain on until cabin cools to 2 degrees below thermostat setting.

The compressor power is provided by a 60-amp fuse located in the aircraft relay box. The condenser fan is powered though a 10-amp inline fuse connected to the compressor motor terminal. Evaporator power is provided by a 15-amp circuit breaker located in a vacant spot in the circuit breaker panel. Control unit power is applied by means of a 3-amp inline fuse attached to the 15-amp circuit breaker.

SECTION 8
HANDLING, SERVICING, AND MAINTENANCE

No change except as outlined in the General Operating, Service and Maintenance Manual, P/N: FW 9800C206MM REV B. for "Zephyr" Airborne R-134A Air Conditioning Systems, Chapter 12.0. Component Inspection. Servicing and/or Maintenance Schedules provided with the installation kit. All items of the air conditioner installation are permanently mounted in the airplane.

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REV. NO.	PAGES AFFECTED	DESCRIPTION	APPROVED	DATE

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MINERAL WELLS, TEXAS 76067

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PILOT'S OPERATING HANDBOOK AND/OR
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR

08/10/95 08:57 TX/RX NO.4788 P.005

SECTION II

OPERATING LIMITATIONS

1. Autopilot use prohibited above the following speeds:
   a. Up to 12,500' ft. autopilot maximum operating speed is 165 KCAS.
   b. Above 12,500' ft. autopilot maximum operating speed is reduced by 3.6 KTS per 1000'.
2. Flap extension or retraction limited to 20° down during autopilot operations.
3. Autopilot coupled missed approach or go-around maneuver not authorized.
4. Autopilot operation prohibited during take-off and landing.
5. Category I operations only.
6. Autopilot use prohibited below 200' AGL during coupled approach operations.

SECTION III

EMERGENCY OPERATING PROCEDURES

In the event of an autopilot malfunction, or anytime the autopilot is not performing as expected or commanded, do not attempt to identify the system problem. Immediately regain control of the aircraft by overpowering the autopilot as necessary and then immediately disconnect the autopilot. Do not re-engage the autopilot until the problem has been identified and corrected.

1. The autopilot may be disconnected by:
   a. Depressing the "AP Disconnect" Switch on the left horn of the pilot's control wheel.
   b. Placing the "AP Master Switch" in the "OFF" position.

2. TRIM:
   a. In the event of a trim failure, manually control aircraft and DEPRESS AND HOLD "Trim Interrupt/AP Disconnect Switch" on control wheel.
   b. Place trim master switch in "OFF" position, pull circuit breaker, release interrupt switch.
   c. Retrim aircraft. Leave trim system OFF until corrected.

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FOR
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3. Altitude loss during a malfunction and recovery:

a. The following altitude losses and bank angles were recorded after a malfunction with a 3 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Climb	60°/-200'
Cruise	60°/-350'
Descent	58°/-400'

b. The following altitude losses and bank angles were recorded after a malfunction with a 1 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Maneuvering	15°/-120'
Approach (Coupled or Uncoupled)	12°/ -60'

The above values are the worst case for all the models covered by this document.

SECTION IV

NORMAL OPERATING PROCEDURES

For detailed normal operating procedures, including system description, pre-flight and inflight procedures refer to S-TEC System 55 Pilot's Operating Handbook, P/N 8747, dated 9-93.

ELECTRIC TRIM SYSTEM (IF INSTALLED)

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

ELECTRIC TRIM CHECK (IF OPTIONAL AUTOTRIM IS INSTALLED)

Manual Electric Trim - Test Prior to Each Flight

a. Trim Switch and A/P Master Switch - ON
b. Operate Trim Switch (Both Knob Sections) - Nose DN - Check trim moves nose and trim in motion indicator ("TRIM") in A/P Programmer flashes. Operate trim switch - Nose UP - Check trim moves nose up and for "in motion" trim light.

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FOR
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c. With trim operating Nose UP and DN - grasp manual trim control and overpower electric trim to stop trim action.
d. Operate each half of the trim switch separately - trim should not operate unless both switch knob segments are moved together.
e. With Trim Operating - Depress trim interrupt switch - Trim motion should stop while interrupt switch is depressed - when released trim should operate normally.

Autotrim

a. Engage HDG and VS modes of the autopilot.
b. Grasp control and apply forward pressure (NOSE DOWN) - After approximately three (3) seconds trim should run NOSE UP.
c. Apply aft pressure (NOSE UP) to control wheel - after approximately three (3) seconds trim should run NOSE DOWN.
d. Move manual trim switch UP or DN - Autopilot should disconnect and trim operates in the commanded direction. (Trim Switch will disconnect autopilot only when pitch is engaged.)
e. Reengage autopilot HDG and VS Modes and depress Trim Interrupt/AP Disconnect Switch - Autopilot should disconnect.
f. Retrim aircraft for take-off - Check all controls for freedom of motion and to determine that the autopilot and trim have disconnected.

If either the manual electric or autotrim fails any portion of the above check procedure, move the Trim Master Switch "OFF" and do not attempt to use the trim system until the fault is corrected. With the Trim Master Switch "OFF" the autopilot trim indicators and audio system will return to operation. If the electric trim system suffers a power failure in flight the system will automatically revert to the indicator lights and audio horn. If this occurs turn the Trim Master Switch "OFF" and trim manually, using the indicators until the fault can be located and corrected.

GLIDE SLOPE FLIGHT PROCEDURE

Approach the GS intercept point (usually the OM) with the flaps set to approach deflection of 10° - 20° down at 90-100 KTS (See Limitations Section) and with the aircraft stabilized in altitude hold mode. At the glide slope intercept, lower the landing gear and adjust power for the desired descent speed. For best tracking results make power adjustments in small, smooth increments to maintain desired airspeed. At the missed approach point or the decision height, disconnect the autopilot for landing or for the go-around maneuver (See Limitations Section). If a missed approach is required, the autopilot may be reengaged after the aircraft has been reconfigured for and established in a stabilized climb.

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OPTIONAL EQUIPMENT

ALTITUDE SELECTOR/VERTICAL SPEED SELECTOR P/N 0114(OPTIONAL)

The altitude selector option operates in conjunction with an altitude encoder and transponder. For pre-flight and normal operating procedures refer to the "Pilot's Operating Handbook for Altitude Selector and Altitude Vertical Speed Selector", P/N 8702, dated 2-91. This option does not affect the limitations or emergency procedures section of this supplement.

ALTITUDE SELECTOR/ALERTER/VERTICAL SPEED SELECTOR P/N 0140 (OPTIONAL)

The altitude selector/alerter option is a digital device providing a digital liquid crystal display of the selected altitude, the vertical speed and other functions. The altitude selector function operates in conjunction with an altitude encoder and transponder. For pre-flight and normal operating procedures refer to the "Pilot's Operating Handbook for Altitude Selector/Alerter", P/N 8716, dated 10-93. This option does not affect the limitations or emergency procedures section of this supplement.

NOTE: **When using either of the above referenced Altitude Selectors with the System 55 Autopilot, the pilot should always program the desired altitude and vertical speed into the altitude selector before simultaneously pressing ALT and VS modes on the System 55 Autopilot programmer. This action will isolate the VS selector knob on the autopilot and the aircraft will respond only to the respective altitude selector commands until capturing the desired altitude.**

SECTION V

OPERATIONAL DATA

The text of this Section not affected by the installation of this equipment.

SECTION VI

REQUIRED OPERATING EQUIPMENT

The text of this Section not affected by installation of this equipment.

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SECTION VII

WEIGHT AND BALANCE

The text of this Section not affected by installation of this equipment.

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WITH
S-TEC YAW DAMPER SYSTEM
(28 VOLT SYSTEM)

REG. NO. N595TC

SER. NO. 20005

This Supplement must be attached to the applicable FAA Approved Airplane Flight Manual, Pilot's Operating Handbook or Pilot's Operating Handbook and FAA Approved Airplane Flight Manual modified by the installation of S-TEC Yaw Damper System Model ST-482 installed in accordance with STC SA7817SW-D. The information contained herein supplements the information of the basic POH and/or AFM; for limitations, procedures and performance information not contained in this supplement, consult the basic POH and/or AFM.

SECTION I

GENERAL

This manual is to acquaint the pilot with the features and functions of the S-TEC Yaw Damper System and to provide operating instructions for the system when installed in the listed aircraft model(s). The aircraft must be operated within the limitations herein provided when the yaw damper is in use.

FAA/DAS APPROVED ____________
Walter F. Davis

S-TEC CORPORATION
DAS 5 SW
P/N: 891188
DATE: 8-9-95

S-TEC CORPORATION
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LOG OF REVISIONS

REV. NO.	PAGE AFFECTED	DESCRIPTION	APPROVED	DATE

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FOR
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SECTION II

OPERATING LIMITATIONS

1. Yaw Damper use prohibited above 186 KCAS (VNE) up to 12,500'. Reduce yaw damper operation by 3.6 KTS per 1000' above 12,500.

SECTION III

EMERGENCY OPERATING PROCEDURES

In the event of abnormal operation of the Yaw Damper System, do not attempt to trouble shoot the system. Immediately stabilize the aircraft by application of manual rudder control to overpower the rudder servo and disengage the yaw damper. Do not attempt further operation of the system until the problem has been identified and corrected.

1. For abnormal operation, conduct the following procedure:

   a. Manually stabilize the aircraft by application of rudder controls.
   b. Mode Selector Switch - OFF.
   c. Yaw Damper Circuit Breaker - PULL. (This removes all electrical power to the system.)
   d. Retrim aircraft as necessary.

2. Altitude loss during a Yaw Damper System malfunction:

   a. A Yaw Damper malfunction during climb, cruise or descent with a three second delay in recovery initiation could result in 4° of yaw and 20° bank and 80 ft. altitude loss.
   b. A Yaw Damper malfunction during an approach with a one second delay in recovery initiation could result in a slight yaw and no significant altitude loss.

A Yaw Damper malfunction during autopilot operation may result in yaw/bank angle and altitude losses less than those listed due to the corrections provided by the autopilot.

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SECTION IV

NORMAL OPERATING PROCEDURES

4-1 SYSTEM DESCRIPTION

The S-TEC Yaw Damper System consists of a yaw acceleration computer-amplifier unit, a rudder servo and an instrument panel mounted control switch and trim adjustment unit. The sensor is a small mechanical accelerometer which is used to sense yaw motion and also aircraft yaw trim. Aside from the accelerometer and the rudder servo, the system contains no other moving parts. The panel mounted control switch (as shown in Figure 1) provides an AUTO (engage-disengage) position, an OFF position and an ON position. The computer is powered directly from the system circuit breaker. The control panel provides engagement-disengagement control of the rudder servo. (See Figure 2 and accompanying note for Yaw Damper use with S-TEC System 65 autopilot.)

4-2 COCKPIT CONTROLS AND FUNCTIONS

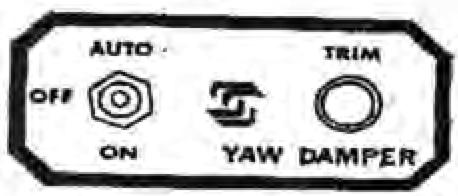

Figure 1

1. Control Unit - Contains the Yaw Damper Mode Selector Switch and the Yaw Damper Potentiometer providing pilot controlled trim adjustments.

2. Mode Selector Switch - This control provides the following mode functions:

   a. OFF - The center switch position labeled OFF, disengages the rudder servo by inhibiting power to the servo engagement solenoid mechanism.

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b. ON - This switch position engages the rudder servo and provides full time operation of the system.

c. AUTO - The auto, or automatic, mode is an optional method of operation which operates in conjunction with an installed autopilot system. If the Yaw Damper System is interconnected to the installed autopilot and with the mode switch in the AUTO position, the yaw damper will engage automatically when the roll axis of the autopilot is engaged. If the installed autopilot provides a control wheel mounted disconnect switch, the yaw damper will disengage when the switch is used to disconnect the autopilot. This mode will be the normal operating mode when used in conjunction with an autopilot.

3. Yaw Trim - The Yaw Trim knob may be used by the pilot to effect small yaw trim changes to center the "ball" in the turn-slip instrument. Once adjusted for center, further adjustments will rarely be necessary. Clockwise rotation will provide a right rudder input and counter-clock-wise will provide a left rudder input. When making an adjustment, rotate knob in small increments and allow 3-5 seconds for the adjustments to take effect. Normal changes in trim required during airspeed changes will be accomplished automatically for 1/8 to 1/4 ball deflections.

SYSTEM 65 PROGRAMMER

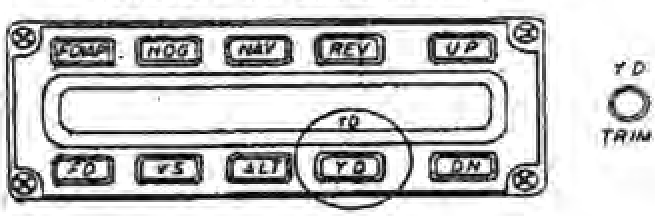

FIGURE 2

NOTE: In those cases when the Yaw Damper is used in conjunction with an S-TEC System 65 Autopilot the Yaw

Damper is automatically engaged with autopilot actuation and may be randomly disengaged or engaged at will by pushing the integral "YD" Mode button as shown in Figure 2. The programmer employs liquid crystal display panels for mode annunciation and provides back-lighted mode buttons for adequate visibility during day or night operations.

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The Yaw Damper Trim adjustment knob is panel mounted in close proximity to the programmer for convenient use.

4-3 PRE-FLIGHT (FIGURE 1)

NOTE: During system functional checks the system must be provided adequate system voltage (14 VDC or 28 VDC as appropriate).

1. Mode Selector Switch - Move to ON position, feel for engagement of the rudder servo by moving rudder pedals. Depress right and left rudder pedals alternately to assure override capability - rudder will require more than normal ground operating force to overpower the servo. No unusual play, rough pedal action or noise should be detected during the check.

2. Mode Selector Switch - OFF - Rudder Servo should disconnect from Rudder Control System, freeing pedal action.

3. Mode Selector Switch - AUTO - (If Yaw Damper System is interconnected to installed autopilot.)

   a. Autopilot Disengaged - no action or engagement of rudder servo should occur.
   b. Engage Autopilot (Roll Section minimum) - rudder servo should engage.
   c. Disengage Autopilot - rudder servo should disengage.

4. During Taxi - check yaw damper operation as follows.

   a. Move mode selector switch - ON.
   b. Alternately tap right and left brake, yaw damper response will be felt in the rudder pedals as aircraft responds in yaw to individual brake application.
   c. Mode Selector Switch - OFF - Move rudder pedals to determine that rudder servo has disconnected.

4-4 PRE-FLIGHT (FIGURE 2)

NOTE: During system functional checks the system must be provided adequate system voltage (14 VDC or 28 VDC as appropriate).

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1. Push "YD" Mode Button - Feel for engagement of the rudder servo by moving rudder pedals. Depress right and left pedals alternately to assure override capability - rudder will require more than normal ground operating force to overpower the servo. No unusual play, rough pedal action or noise should be detected during the check.

2. Push "YD" Mode Button - "YD" annunciation should extinguish and rudder servo should disconnect from rudder system, freeing pedal action.

3. Check AUTO engage feature.

   a. Autopilot OFF - No action or rudder servo engagement should occur.
   b. Push "FD/AP" and "HDG" Buttons - Rudder servo should engage.
   c. Disconnect autopilot - Rudder servo should disengage.

4. During Taxi - Check Yaw Damper operation as follows:
   a. Push "YD" Mode Button - Yaw Damper engages.
   b. Alternately tap right and left brake, Yaw Damper response will be felt in the rudder pedals as aircraft responds in yaw to individual brake application.
   c. Push "YD" Button - Move rudder pedals to determine that rudder servo disconnects.

4-5 IN-FLIGHT

1. Trim aircraft for existing flight conditions.
2. Engage Yaw Damper as desired.
3. Disconnect Yaw Damper for landing.
4. During an approach operation in turbulence there will be some rudder feedback. If this feedback is objectionable, disengage the Yaw Damper System.

SECTION V

OPERATIONAL DATA

Text of this Section not affected by installation of this equipment.

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SECTION VI

REQUIRED OPERATING EQUIPMENT

Text of this Section not affected by installation of this equipment.

SECTION VII

WEIGHT AND BALANCE

Text of this Section not affected by installation of this equipment.

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

ASPEN EVOLUTION 2500

ASPEN AVIONICS

EFD1000 and EFD500

Instructions

for

Continued Airworthiness

AIRCRAFT MAKE: Rockwell Commander

AIRCRAFT MODEL: 114 TC

AIRCRAFT SERIAL NUMBER: 20005

Modification of an aircraft under the EFD1000 AML Supplemental Type Certificate obligates the aircraft operator to include the maintenance information provided by this document in the operator's ICA, Aircraft Maintenance Manual and operator's Aircraft Scheduled Maintenance Program.

Aspen Document # 900-00012-001 Revision T

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ICA - RECORD OF REVISION

Revision	Description of Change	ECO
ICA Revision IR	INITIAL RELEASE – for TSO Approval	Part of Installation Manual
ICA Revision A	Made the ICA document stand-alone	Part of Installation Manual
ICA Revision B	Added bonding checks. Added pagination.	Part of Installation Manual
ICA Revision C	Added Procedures for System Testing During Ground Running FAA Accepted	Part of Installation Manual
ICA Revision D	Increased battery replacement interval to three years or 800 hours, section D9 FAA Accepted	Part of Installation Manual
ICA Revision E	Added EA100 Adapter information, clarified several headings and expanded the Wiring and Component Location Data information requirements.	Part of Installation Manual
ICA Revision F	Removed "Inspection," from first row of the table in Section D4. Added -004 EFD to section D.9.	Part of Installation Manual
ICA Revision G	Updated the Installation Manual references to the latest revision.	Part of Installation Manual
ICA Revision H	Fixed typographical error on EA100 mounting hardware. Changed from 6-32 to 8-32. Added optional ACU2 Analog Converter Unit. **Re-formatted as a stand-alone document independent of the Installation Manual.**	2546
I	Rev I not released	N/A
J	Incorporated resolutions to FAA comments.	2614
K	Incorporated resolutions to additional FAA comments.	2636
L	Added obstacle and navigation database currency requirements.	2752
M	Added APS4A altitude preselect requirements.	2934
N	Removed date on cover page and removed dates in record of revision table.	2961
O	Rev O not released	N/A
P	Expounded on EFD Battery Replacement Instructions to include both the 409-00003-001 and 413-00001-001. Added consumables List to Introduction Maintenance or Preventative Maintenance Chart. Added requirement to test the optional A/P Source Select switch annually. Update references to rev of Installation Manual	3025
Q	Added CG100 requirements	3230
R	Added Operator Security safeguards information	3262
S	Improved Security Safeguards information. Presented checklist suggestions in Sections 11 and 12.	3298
T	Based on the EFD Extended Life Battery Test Report (Aspen document number 037-00042-001) extended internal and external (EB858) battery life to 2200hrs or 3 years	3360

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Table of Contents

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1 Introductory Information

These Instructions for Continued Airworthiness (ICA) provides instructions necessary for authorized personnel to inspect and maintain the EFD500 and EFD1000 system installed by the EFD1000 AML-STC.

This document must be printed and included with the aircraft Instructions for Continued Airworthiness, and arranged for easy and practical use.

Description of the Appliances and its Systems and Installations:
The Aspen Avionics EFD1000 and EFD500 systems are multi-purpose displays. The EFD1000 contains an internal Air Data and Heading Reference System (ADAHRS) that is used to provide attitude, heading and air data for the display. The EFD500 is a variant of the EFD1000 and does not contain the internal ADAHRS. The EFD1000 and the EFD500 come standard with an internal battery to provide a nominal 30 minute operation in the event of power loss. These batteries are not designed to provide 30 minute operation under all foreseeable operating conditions, such as extreme cold temperatures where battery operation is not assured. An optional Emergency Backup Battery (EBB) is available that will provide at least 30 minutes of operation under all foreseeable operating conditions. Typical EBB endurance at 25 deg C will exceed two hours when the battery is fully charged. When a Primary Flight Display (PFD) is installed, and the Emergency Backup Battery is connected to an EFD1000 Multi-Function Display (MFD), the legacy standby altimeter and airspeed indicators may be removed from the aircraft.

Additional equipment is normally installed in support of the displays, including the Remote Sensor Module (RSM), Configuration Module (CM), optional Emergency Backup Battery (as noted above) and optional Analog Converter Unit (ACU). Several external sensors can optionally be connected to the displays, including GPS systems, the Aspen EWR50 XM weather receiver, the Aspen CG100 Gateway, WX-500 Stormscope, GTX330 and certain other ARINC 735A protocol TAS and TCAS I systems. The Avionik Straubing APS4A Altitude Preselect System can be installed for Altitude Preselect capability.

The EFD1000 system can be configured as a PFD or MFD. In the PFD configuration, the EFD1000 provides display of attitude, airspeed, altitude, direction of flight, vertical speed, turn rate, and turn quality. The system can provide display of navigation information, pilot-selectable indices ("bugs"), and annunciations to increase situational awareness and enhance flight safety.

The "Pro" and "Pilot" configuration are available in software version 2.1 and later. The Pro System can display WX-500 data, XM datalink weather products and traffic information from ARINC 735 compatible traffic systems. The Pilot System provides a moving map; however it does not provide an HSI or second GPS navigation.

The EFD1000 can also be purchased in a multi-function display configuration with reversion capability to a Primary Flight Display. The EFD500 is a variant of the EFD family that does not include an ADAHRS. The EFD500 may only be purchased in a multi-function display configuration, and does not include reversion capability.

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For additional information, refer to Section 3 of the EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003-001 Rev AE or later.

The following data may be necessary for maintenance or preventive maintenance:

Replacement Parts:	See Section 1 of the EFD1000 and EFD500 SW v2.X Installation Manual, document 900-00003-001 Rev AE or later for Aspen replacement parts. For the APS4A Altitude Preselect System, contact: Avionik Straubing Entwicklungs GmbH Flugplatzstr. 5 Atting D-94348 Germany www.avionik.de
Software Version Compatibility	Class III aircraft (typ. >6000 lbs. Maximum Gross Takeoff Weight (MGTOW), see AC 23.1309-1X) require a PFD containing RTCA DO-178B Level B software. Verify the software level on the PFD Data tag before installation. See Section 5.2, "Software Version" of the EFD1000 and EFD500 SW v2.X Installation Manual, document 900-00003-001 Rev AE or later.
Operating Instructions:	See the EFD1000 Aircraft Flight Manual Supplement (AFMS), document 900-00008-001
Wire Routing Locations:	See attachment to this document (part of the permanent aircraft records).
Wiring Diagrams:	See attachment to this document (part of the permanent aircraft records).
Special Tools	For bonding checks, use a milliohm meter such as an Extech 380460 Portable Precision Milliohm Meter or equivalent.
	It may be required to align the EA100 Adapter to the autopilot computer using a KTS-150 Test Set, a KTS-158 Test Set, a KTS-154 Test Set or equivalent and following the autopilot manufacturer's procedure for aligning the gyro (KI-256) to the autopilot computer (these Test Sets are normally available at autopilot-qualified Bendix-King dealers). The EA100 Alignment Tool (acquired through the dealer ramp Section of the Aspen.com web site, see Tech Note 2010-10) will be used to manipulate the gyro pitch and roll signals and the autopilot Test Set will be used to measure the autopilot demodulated gyro voltages. In the case of the KFC225 the Remote Terminal Interface (normally available at autopilot-qualified Bendix-King dealers) will be required in place of the test sets. See Appendix F of the EFD1000 and EFD500 SW v2.X Installation Manual, document 900-00003-001 Rev AE or later for detailed information.
	It may be required to receive a WiFi signal from the CG100. A wireless-enabled device such as a laptop computer, iPad, iPhone or Android device will be suitable for this purpose.
Consumables	Loctite® 242® Threadlocker or equiv Dow Corning 738, MIL-A-46146 or equiv

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	Pro-Seal PS 870B-1/2, MIL-PRF-81733D or equiv

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2 System Description and Information about the Interface of the EFD1000/500 System with the Aircraft

The EFD1000 PFD system is comprised of the Primary Flight Display (PFD), Remote Sensor Module (RSM), Configuration Module (CM) and optional Analog Converter Unit (ACU or ACU2). Optionally one or two MFD displays of either the EFD500 or EFD1000 may be installed. An optional EA100 Adapter (autopilot attitude adapter) may be installed.

The EFD1000 PFD system provides display of attitude, airspeed, altitude, direction of flight, vertical speed, turn rate, and turn quality. The system may optionally provide display of navigation information through interfaces to GPS Receivers and/or VHF Navigation Receivers.

When interfaced with a compatible autopilot, the EFD1000 system provides heading and course datum information to the autopilot, which enables the autopilot to follow the Course and Heading values set by the pilot on the EFD1000 PFD.

If optional MFD displays are installed they can present terrain, traffic, XM weather, and WX-500 Stormscope data to the flight crew. The EFD1000 MFD can be used as backup instruments to the PFD supporting reversionary capabilities. The EFD500 presents MFD data, but cannot be used for backup or reversion.

The optional EA100 supplies pitch and roll stabilization signals to the autopilot. The article has no direct pilot controls.

The Avionik Straubing TSO'd APS4A is integrated with the EFD1000 and provides Altitude Preselect capability.

The CG100 Gateway allows mobile devices to interface to other avionics through an EFD1000 MFD or EFD500 MFD.

3 Description of How the EFD1000 System Operates and is Controlled, Including Special Procedures and Limitations

The EFD1000 system is controlled by a switch marked "EFD1000 PFD" or PFD, and, (if installed) EFD1000 MFD. The system is ready to be operated when the initialization screen disappears, and the EFD1000 attitude and heading display is shown. See the Aircraft Flight Manual Supplement (AFMS), document 900-00008-001 regarding which appliances are installed, how the EFD1000 system operates, and is controlled, and special procedures and limitations.

An EBB58 Emergency Backup Battery may be required in some EFD1000 MFD installation configurations if it is being used as any required secondary instruments.

See the attachment to this document (part of permanent aircraft records) for detailed interface information.

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3.1 Maintaining Security Safeguards With the Aspen Connected Panel

The Aspen Connected Gateway is an appliance not required by 14 CFR Part 23 that permits bi-directional communication of data between wireless devices and the EFD1000 MFD. Security of the communication link to the EFD1000 MFD is important and appropriate for these instructions. Generally, the system automatically controls the security aspects of the communication link, however the operator has responsibility to assure adequate security when it comes to the human interaction. There are four topics that can be addressed:

3.1.1 Physical Security

The Connected Gateway System can be linked to several wireless devices at the same time. Only devices that are within range of the Wi-Fi signal can be linked. Therefore the devices that can be linked while in flight are limited to the devices in the aircraft. Physical security does not require maintenance or assurance for continued airworthiness. This is an operator consideration.

3.1.2 Operational Security

When the aircraft is in operation, only those systems used for Connected Gateway should be linked. Keep the password confidential. The operator should assure that only authorized devices have access to the Connected Gateway. Operational security does not require maintenance or assurance for continued airworthiness. This is an operator consideration. The password for the Connected Gateway Wi-Fi for a particular aircraft should be safeguarded and only supplied to those who are trusted. If an unexpected device is connected and a flight plan is sent, the choice is simply to reject the flight plan.

3.1.3 Security Safeguards Monitoring

If there are attempts to violate security rules while in flight, as shown by an unexpected candidate flight plan, reject the flight plan and turn off Aspen GTWY by the switch. Do not operate it until the security breach is addressed. Security safeguards monitoring does not require maintenance or assurance for continued airworthiness. This is an operator consideration.

3.1.4 Management Procedures

Measures should be established to prevent malicious introduction of unauthorized modifications to the wireless device, including the operating system, the hosted applications and the databases or data links. This might include maintaining a separate wireless device that is exclusively for aircraft use and limiting the number of applications loaded to those that are known to be non-malicious. Management procedures do not require maintenance or assurance for continued airworthiness. This is an operator consideration.

3.1.5 Maintenance Procedures for Maintaining Security Safeguards

With the EFD1000 or EFD500 MFD and the CG100 operating, display the CG100 status by going to the MFD Gateway page. Verify that Device: LINK STATUS CG100: is reported as LINKED. Use a wireless enabled device to search for the SSID of the installed Gateway. By default, the SSID is

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ASPENCG100. Verify that access requires a password. This also checks the functionality of the CG100 Gateway software and hardware.

4 System Operation and Procedures for System Testing During Ground Running

Refer to the EFD1000 AFMS, document 900-00008-001 for instructions on system operation. For System Testing refer to Section 10, Appendix E (EA100), Appendix F (A/P Source Select), Appendix G (APS4A) and Appendix H (CG100) of the EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003-001 Rev AE or later.

NOTE: Appendix H of document 900-00008-001 directs the user to another supporting document (900-000023-001, see "System Checkout") information for the CG100. This is because the primary document for the STC is document 900-00003-001, and information regarding support documentation will be in this document.

To check the functionality of the CG100 Gateway software and hardware, see Section 3.1.5.

5 Servicing and Scheduling Information

The PFD, MFD, RSM, ACU, ACU2, CM, EA100, APS4A, CG100, and EBB58 have no field serviceable components. Return defective units to Aspen Avionics or an authorized dealer. No equipment is required for servicing.

Recommended times for cleaning, inspecting, testing lubricating and adjusting each component of the EFD1000 System. See the Periodic Maintenance and Calibration Section.	
EA100	Verify the operation of the internal autopilot disconnect relay annually (See Section 11)
Internal backup battery	Inspection every twelve months (See Section 11)
EBB58 Emergency Backup Battery	Inspection every twelve months (See Section 11)
A/P Source Select switch	Verify operation annually (See Section 11)
All other components	Refer to Section 12 for inspection requirements.

6 Overhaul Period

None required.

7 Commercial Parts

There are no commercial parts in the installed EFD1000/500 system.

8 Special Tools

For bonding checks, use a milliohm meter such as an Extech 380460 Portable Precision Milliohm Meter or equivalent.

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It may be required to align the EA100 Adapter to the autopilot computer using a KTS-150 Test Set, a KTS-158 Test Set, a KTS-154 Test Set or equivalent and following the autopilot manufacturer's procedure for aligning the gyro (KI-256) to the autopilot computer. The EA100 Alignment Tool will be used to manipulate the gyro pitch and roll signals and the autopilot Test Set will be used to measure the autopilot demodulated gyro voltages. In the case of the KFC225 the Remote Terminal Interface will be required in place of the test sets.

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9 Airworthiness Limitations

There are no Airworthiness limitations associated with the installation of this appliance. The Airworthiness Limitations Section is FAA approved and specifies maintenance required under 14 CFR § 43.16 and § 91.403 unless an alternate program has been FAA approved.

10 Distribution of Revisions

Notification of changes to this ICA will be sent to all owners on record. The changed document will then be available in the Dealer Ramp section at www.aspenavionics.com. Paper copies are available on request, contact Aspen Avionics at www.aspenavionics.com.

11 Periodic Maintenance and Calibration and Storage Limitations

All maintenance is considered "ON CONDITION" unless otherwise noted in this ICA. The EFD Internal battery and the Emergency Backup Battery must be replaced in the interval identified below. There are no other storage limitations.

EBB58 Emergency Backup Battery (use with MFD P/N 910-00001-002)

The EBB58 Emergency Backup Battery when installed must be visually inspected and tested as described below once every 12 months to ensure it meets the minimum 30-minute requirement for powering the EFD1000 MFD under all foreseeable conditions. The EBB58 must be replaced every 3 years (from the date of installation) or 2200 flight hours (from the time of installation) (whichever occurs first), or if it fails the following visual or operational tests.

Remove the EBB from the tray and visually inspect for the following:

- Leakage from the battery especially around the metal seams
- Evidence of water contamination
- Evidence of corrosion

If any of the above issues are noted return the EBB58 to Aspen Avionics for repair.

Re-install the battery and check the battery capacity as follows: (this test must be run at room temperature approximately 25° C)

Turn on the EFD1000 MFD

- Press MENU Key
- Select POWER SETTINGS, Main Menu page
- Press the BATTERY line select key

BAT LEVEL IN --.-- will be displayed for a short period of time as battery capacity is being measured. This could take up to 10 minutes if the ambient temperature is below 0° C.

[redacted]

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Once the capacity is measured ON BAT XX% REM will be displayed.

The "ON BAT" indication must read a minimum of 80% to continue. If the battery capacity is below 80% then the battery should be charged by returning the MFD to aircraft power. The EBB will charge as long as the MFD is turned on and aircraft power is supplied.

With the battery displaying greater than 80% charge set a timer for one (1) hour. After the one hour time has elapsed the MFD must still be operating on battery. If the EBB will not supply the minimum 1 hour operating time or fails to charge above 80% return the battery to Aspen Avionics for repair.

Instructions for battery replacement are contained in Section 12.

Following the battery endurance test and while operating on battery power, switch the "EBB EMER DISC" switch to "DISC"; verify the display powers OFF. Return the "EBB EMER DISC" switch to "NORM"; verify the display powers ON and is on battery power.

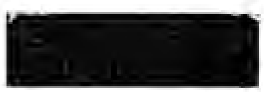
Switch the MFD back to aircraft power and recharge the EBB to 80% or greater prior to release to service.

EFD Internal Battery (EFD P/N 910-00001-001, -003, and -004)
The internal back-up battery in the EFD must be tested once every 12 months to ensure it operates properly. Each EFD with an internal battery must have the battery replaced every 3 years or 2200 hours, or if it fails the following operational test.

This test must be run at room temperature approximately 25° C.

- Turn on the EFD1000 or EFD500
- Press MENU Key
- Select POWER SETTINGS page from the Main Menu
- Press the BATTERY line select key

BAT LEVEL IN --.-- will be displayed for a short period of time as battery capacity is being measured. This could take up to 10 minutes if the ambient temperature is below 0° C.



Once the capacity is measured ON BAT XX% REM will be displayed.

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The "ON BAT" indication must read a minimum of 80% to continue. If the battery capacity is below 80% then the battery should be charged by returning the EFD to aircraft power. The battery will charge as long as the MFD is turned on and aircraft power is supplied.

With the battery displaying greater than 80% charge set a timer for 30 minutes. After the 30 minute time has elapsed the EFD must still be operating on battery. If the internal battery will not supply the minimum 30 minutes operating time or fails to charge above 80%, replace the battery and return the failed battery to Aspen Avionics.

Instructions for battery replacement are contained in Section 14.

Switch the EFD back to aircraft power and recharge the internal battery to 80% or greater prior to release to service.

Instructions for battery replacement are contained in Section 14. Contact customer service at Aspen Avionics or an authorized Aspen Avionics Dealer for a replacement battery.

EA100 Autopilot Disconnect (If the EA100 is installed)
The ability of an EA100 to disconnect the autopilot must be tested annually. The test is accomplished in the following manner:

Turn on the PFD and all MFD systems. Verify the "A/P AHRS FAIL" light extinguishes. Engage the autopilot and then pull the "A/P AHRS" circuit breaker. If the autopilot disengages immediately and the A/P AHRS light simultaneously illuminates, then the test was successful. Restore the circuit breaker. If the autopilot fails to disengage then arrange for repair of the EA100 or associated wiring.

A/P Source Select (if installed)
The switch must be tested annually. The test is accomplished in the following manner:

Turn on the PFD and all MFD systems. Engage the autopilot and verify the PFD heading bug will steer the HDG mode of the autopilot. Disconnect the autopilot. Press the MFD "REV" button and then momentarily push the A/P Source Select switch to the MFD REV position. Engage the autopilot and verify the reverted MFD heading bug will steer the HDG mode of the autopilot.

EFD Display Backlight
The EFD display backlight has a median expected life of 50,000 operating hours. Replacement of the lamp is on-condition as it may last longer or shorter than 50,000 hours. It is up to the operator to determine whether the backlighting has become too dim for its intended use.

ACU, ACU2, RSM, APS4A, CM, CG100
The ACU, ACU2, RSM, APS4A, CG100 and the Configuration Module require no periodic maintenance or calibration.

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11.1 Inspection Checklist

FAR 43.15, Additional performance rules for inspections, Para. (c)(1) Annual and 100-hour inspections, requires "Each person performing an annual or 100-hour inspection shall use a checklist while performing the inspection." Depending on the options and thus the associated complexity, it may be advantageous to prepare a checklist to be used when performing an Annual or 100-hour inspection. For all installations, the information will be found in Sections 11 and 12 of this document. Those items marked "If Installed" means that the inspection should only be conduced if the equipment is installed in the aircraft. Refer to the EFD1000 Aircraft Flight Manual Supplement, document 900-0008-001 for this aircraft to determine the equipment installed.

Section 11 Checklist

1. Check the EBB58 battery (if installed) in accordance with Section 11 of this document.
2. Check the EFD internal battery in accordance with Section 11 of this document. Note that each EFD has a battery, unless the EFD1000 MFD has an EBB58 battery.
3. Check the EA100 Autopilot disconnect switch (if installed) in accordance with Section 11 of this document.
4. Check the A/P Source Select switch (if installed) in accordance with Section 11 of this document.
5. Verify Security Safeguards in accordance with Section 3.1.5 of this document.

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12 Unit and Wiring Inspection

All units, brackets, installation hardware and wiring of the EFD1000 system should be checked as defined below during annual inspection. Items found to be defective should be repaired or replaced prior to returning the aircraft to service. The performance of this inspection should not create the need for additional protective treatment (Alodine, paint, etc) of surfaces within the aircraft.

EFD Inspection

The EFD(s) should be inspected for damage and their operation should be verified using documents identified in Section 1 of these ICA's. The EFD wiring, pneumatic tubing, and quick disconnects should be checked for integrity, damage, chafing, or excessive wear. The EFD braided bonding strap should be checked for proper termination at the EFD and aircraft grounding point to maintain HIRF and Lightning compliance.

Verify ≤ 3 milliohms from EFD ground stud to airframe ground. The installation of the EFD should be inspected for corrosion on the EFD and the structure it is mounted on. The fasteners should be inspected for tightness and general condition.

ACU/ACU2 Inspection - if installed

The ACU should be inspected for damage and its operation should be verified using documents identified in Section 1 of these ICA's. ACU wiring should be checked for damage, chafing, or excessive wear. Verify ACU chassis bonding from the face of the unit (connector side) to airframe ground is ≤ 3 milliohms to maintain HIRF and Lightning compliance. The installation of the ACU should be inspected for corrosion on the ACU and the structure it is mounted on. The fasteners should be inspected for tightness and general condition.

RSM Inspection

The RSM(s) should be visually inspected for damage and wear on the lightning strip. RSM wiring should be checked for damage, chafing, or excessive wear. Verify RSM doubler plate bonding from the ground stud to airframe ground is ≤ 3 milliohms to maintain HIRF and Lightning compliance. The RSM installation and doubler should be inspected for corrosion on the RSM, the RSM shim (optional), the fuselage skin, and the doubler. The installation should be inspected for cracks in the fuselage, and loose or damaged fasteners.

Configuration Module Inspection

The Configuration Module(s) should be checked for damage. The Configuration Module wiring should be checked for damage, chafing, or excessive wear.

EA100 Inspection - if installed

The EA100 should be inspected for damage and its operation should be verified using documents identified in Section 1 of this document. The EA100 wiring should be checked for damage, chafing, or excessive wear. Verify EA100 chassis bonding from the face of the unit (connector side) to airframe ground is ≤ 3 milliohms to maintain HIRF and Lightning compliance. The

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installation should be inspected for corrosion on the EA100 and the structure it is mounted on. The fasteners should be inspected for tightness and general condition.

EBB58 Inspection -if installed

The EBB58 Emergency Backup Battery should be inspected for damage to the battery and mounting tray. Battery operation should be verified using Section 9 of this ICA. Verify ≤ 3 milliohms from mounting tray to airframe ground. The wiring should be checked for damage, chafing, or excessive wear.

APS4A Inspection- If installed

The APS4A should be inspected for damage and its operation should be verified using documents identified in Section 4 of this document. The APS4A wiring should be checked for damage, chafing, or excessive wear. Verify APS4A chassis bonding from one of the cover retaining cap screws to airframe ground is ≤ 3 milliohms to maintain HIRF and Lightning compliance. The installation should be inspected for corrosion on the APS4A and the structure it is mounted on. The fasteners should be inspected for tightness and general condition.

CG100 Inspection- If installed

The CG100 should be inspected for damage and its operation should be verified using documents identified in Section 4 of this document. The CG100 wiring should be checked for damage, chafing, or excessive wear. Verify CG100 chassis bonding from face of the unit (connector side) to airframe ground is ≤ 3 milliohms to maintain HIRF and Lightning compliance. The installation should be inspected for corrosion on the CG100 and the structure it is mounted on. The fasteners should be inspected for tightness and general condition.

12.1 Inspection Checklist

FAR 43.15, additional performance rules for inspections, Para. (c)(1) Annual and 100-hour inspections, requires "Each person performing an annual or 100-hour inspection shall use a checklist while performing the inspection." Depending on the options and thus the associated complexity, it may be advantageous to prepare a checklist to be used when performing an Annual or 100-hour inspection. For all installations, the information will be found in Sections 11 and 12 of this document. Those items marked "If Installed" means that the inspection should only be conduced if the equipment is installed in the aircraft. Refer to the EFD1000 Aircraft Flight Manual Supplement, document 900-00008001 for this aircraft to determine the equipment installed.

Section 12 Checklist

1. Inspect the EFD(s) for damage and their operation in accordance with Section 12 of this document.
2. Inspect the ACU or ACU2 (if installed) for damage and its operation in accordance with Section 12 of this document.
3. Inspect the RSMs for damage and wear in accordance with Section 12 of this document.

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4. Inspect the Configuration Module(s) for damage in accordance with Section 12 of this document.
5. Inspect the EA100 (if installed) for damage and its operation in accordance with Section 12 of this document.
6. Inspect the EBB58 (if installed) for damage in accordance with Section 12 of this document.
7. Inspect the APS4A (if installed) for damage and its operation in accordance with Section 12 of this document.
8. Inspect the CG100 (if installed) for damage and its operation in accordance with Section 12 of this document.

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13 Troubleshooting

NOTE: For more information about recognizing malfunctions, see the checkout procedure in the EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003-001 Rev AE or later, Sections 10 and 11.

EFD1000 Startup Page Faults (SW v2.0 and above)

Malfunction & How to Recognize the Malfunction	Cause	Remedy
IOP initialization failure	a) Fail b) System reboots after IOP test	a) Replace EFD b) Replace EFD
ARINC initialization failure	a) Fail	a) Replace EFD
RS232 initialization failure	a) Fail	a) Replace EFD
Config Module initialization failure	a) Fail b) Wrong CM version c) System reboots after Config Module Test d) displays "Initializing" for more than 20 seconds	a) Check Config Module wiring. Replace Config Module. b) Install correct SW version CM. c) v2.0 or v2.1 display installed with a v2.2 CM. Install correct CM or EFD. d) Config Module unplugged or mis-wired.
RSM initialization failure	a) Fail (x)	a) Check RSM to PFD wiring for shorts or opens. Repair or replace RSM. Repair or replace PFD.
IMU initialization failure	a) Fail	a) Replace EFD
ADC initialization failure	a) Fail	a) Replace EFD
ADAHRS initialization failure	a) Fail b) "Initializing" for more than 3 minutes c) "Initializing" for more than 3 minutes with a RSM Fail above.	a) Replace EFD b) Remove Pitot and Static line from back of EFD and reboot. If problem still exists then replace the EFD. If problem clears then repair Pitot or Static obstruction/kink. c) Repair RSM wiring or replace RSM.

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EFD1000 General Faults (SW v2.0 and above)

Malfunction & How to Recognize the Malfunction	Cause	Remedy
Display does not power on (Note: there can be up to a 20 second delay from the application of power to a visible display)	a) PFD missing A/C power b) PFD may have been improperly shut down c) PFD missing A/C ground d) PFD is defective	a) Check PFD circuit breaker, PFD on/off switch on panel, wiring, and A/C battery voltage > 11.5 volts. b) Switch unit off using "REV" button or "SHUT DOWN" command from Main Menu page 6. c) Check wiring to PFD d) Repair or replace PFD
Display does not power off (Note: PFD will switch to internal battery if airspeed is greater than 30kts.)	a) Airspeed is above 30kts b) PFD may have been switched to internal battery c) PFD may have been improperly shut down d) PFD is defective	a) Normal operation b) Switch unit off using "REV" button or "SHUT DOWN" command from Main Menu page 6. c) Hold "REV" button for 20 seconds or unplug PFD internal battery for 3 seconds d) Repair or replace PFD
Display flashes on/off, black/white or blue/white repetitively	a) Configuration Module unplugged or miswired b) RSM or CM wiring short c) Configuration module defective d) PFD defective	a) Check CM plug and wiring from PFD to CM b) Verify RSM pin 6 or CM pin 1 is not shorted to aircraft ground or another pin. c) Repair or replace CM d) Repair or replace PFD
"CONFIG MODULE LINK FAIL" message (SW v1.X)	a) Configuration Module unplugged or mis-wired b) Configuration module defective c) PFD defective	a) Check CM plug and wiring from PFD to CM b) Repair or replace CM c) Repair or replace PFD
"INITIALIZING" message for more than 60 seconds (SW v1.X)	a) RSM to PFD communication lost b) RSM failed c) PFD failed	a) Check RSM to PFD wiring for shorts or opens. b) Repair or replace RSM c) Repair or replace PFD
"RSM LINK FAIL" message (SW v1.X)	a) RSM to PFD communication lost b) RSM failed c) PFD failed	a) Check RSM to PFD wiring for shorts or opens. b) Repair or replace RSM c) Repair or replace PFD
"WRONG CONFIG MODULE" message (SW v1.X)	a) PFD is at one software level and config module is at a different software level	a) Convert config module per appropriate service bulletin.

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Malfunction & How to Recognize the Malfunction	Cause	Remedy
ALTIMETER, AIRSPEED, VSI FAIL (RED-X)	a) Air data sensor has not had sufficient warm-up time. b) Pitot/static lines reversed c) Air data sensor failed	a) Allow up to 20 minutes at temps below -20°C for flags to clear b) Connect pitot line to "P" port and static line to "S" port on PFD c) Repair or replace PFD
ATTITUDE FAIL or DIRECTION FAIL (RED-X) (Note: Attitude flags could take up to 3 minutes to clear at temps below -20 °C)	a) AHRS sensor has not completed initialization. b) RSM failed/data missing. c) Pitot and/or Static lines crossed, unplugged, or blocked. d) PFD is defective	a) Allow up to 3 minutes for AHRS to initialize. b) Check RSM to PFD wiring. Repair or replace RSM. c) Correct pitot/static plumbing issue. d) Repair or replace PFD.
ATTITUDE FAIL and DIRECTION FAIL associated with "CHECK PITOT HEAT" message	a) In Flight, Normal if pitot blockage due to ice or other. b) On Ground, Normal if GPS reception is marginal and GPS GS ramps above 50Kts intermittently.	a) Use pitot heat or check pitot system for blockage. b) No further action required unless message is due to faulty GPS system, then repair GPS system.
CROSS CHECK ATTITUDE message (yellow) (also see sluggish AHRS performance troubleshooting)	a) If it occurred on system start. b) Normal after abrupt maneuvers on ground or in air	a) RESET AHRS b) RESET AHRS

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Malfunction & How to Recognize the Malfunction	Cause	Remedy
Red Slash through Navigation Sensor (i.e., GPS1, NAV2)	a) GPS or VLOC receiver turned off. b) GPS does not have a valid "TO" waypoint and position c) GPS or VLOC receiver failed d) ACU not powered e) Wiring fault between sensor and ACU or PFD f) ACU to PFD wiring fault. g) ACU is defective. h) PFD is defective.	a) Turn on GPS or VLOC receiver b) Allow GPS to acquire a position and enter a flight plan or Direct To c) See GPS/VLOC manufacturer's instructions for troubleshooting d) Check ACU circuit breaker e) Check wiring between GPS/VLOC and ACU or PFD f) Check ACU circuit breaker, check ACU to PFD A429 wiring and ACU to sensor wiring g) Repair or replace ACU h) Repair or replace PFD
GPS1 or GPS2 selection not available on Display (GNS430/GNS530/GNS480 only)	a) GPS receiver turned off b) GPS does not have a valid "TO" waypoint and position c) GNS CDI is selected to VLOC. d) GPS to PFD A429 wiring issue. e) GPS defective. f) PFD defective.	a) Turn on GPS and initialize b) Allow GPS to acquire a position and enter a flight plan or Direct To c) Verify the GNS CDI is selected to GPS. d) Check A429 wiring for shorts, opens or crossed A and B lines. e) Repair or replace GPS f) Repair or replace PFD
Autopilot or analog NAV/GPS inoperative	a) ACU chassis not grounded b) ACU not powered c) ACU to sensor wiring d) ACU to PFD wiring e) ACU fault f) PFD fault	a) Ground ACU chassis to airframe ground b) Check ACU circuit breaker and power/grounds c) Check ACU to sensor wiring d) Check ACU to PFD A429 wiring e) Repair or replace ACU f) Repair or replace PFD

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Malfunction & How to Recognize the Malfunction	Cause	Remedy
"ERRONEOUS CALIBRATION VALUES" message during RSM Cal (SW v2.0 and later) or Excessive Heading errors in one quadrant, or errors that are higher than actual in some quadrants and lower than actual in other quadrants.	a) RSM is tilted more than allowed per Section 6 of this manual b) Poor RSM calibration c) RSM calibrated too close to buildings or ferrous objects d) Ferrous hardware used to mount RSM e) Airframe or external magnetic interference	a) Shim RSM to within limits defined in Section 6 of this manual b) Re-run RSM calibration at constant rate turns on flat ground. c) Re-run RSM calibration away from buildings and other ferrous objects d) Only non-ferrous screws, nuts, washers may be used on RSM e) Check for magnetized areas on airframe close to RSM. Verify no ferrous hardware is near RSM. Degauss magnetized area(s)
Sluggish or Poor AHRS (ADI) performance Poor AHRS performance in steep bank turns Sluggish compass card (Note: may or may not be associated with "Cross Check Attitude" message)	a) RSM magnetic interference b) RSM has become magnetized. c) "Pitch Attitude Trim" or "Panel Tilt Pitch Compensation" adjustment made without performing a subsequent RSM Calibration. d) Pitot and/or Static line connections at PFD blocked, kinked, or unplugged. e) Normal after abrupt maneuvers.	a) Survey RSM location using handheld compass per Section 6.9.1. Verify there are no cabin speakers within 3ft of RSM. Degauss any areas found to be magnetized or remove magnetism by other methods. b) With power removed from EFD1000 system degauss RSM and general area using degausser. c) Perform an RSM Calibration per Section 10.5.2 d) Check pitot/static connections and plumbing for blockage. Check IAS and ALT sensor per Section 10. e) Perform AHRS Reset
Excessive Heading Lead / Lag during or after turns (>7°)	Magnetic Interference	Verify that all steps have been accomplished to remove magnetic interference (see section 6.9.4), then contact an Aspen Field Service Engineer

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Malfunction & How to Recognize the Malfunction	Cause	Remedy
Autopilot has lateral offset in GPSS or APPR mode (HDG Bug may also be out of center)	a) Autopilot roll "null" centering out of adjustment	a) Follow the autopilot manufacturer's guidelines for adjusting roll "null" centering
Century II/III autopilot performance poor in all modes	a) Value of R1 set incorrectly	a) Follow the autopilot manufacturer's instructions for checking NAV intercept angle. Larger value for R1 will raise angle and smaller value of R1 will lower intercept angle. See Tech Note 2009-06.
OAT Display dashed	a) Wiring fault between PFD and RSM b) RSM is defective	a) Check wiring b) Repair or replace RSM
WIND vector, velocity, and direction display dashed (Note: wind readout will dash when velocity is < 10 kts)	a) Groundspeed < 20kts b) No GPS ground track c) Airspeed failed	a) Normal operation b) GPS not computing GTK c) See AIRSPEED FAIL troubleshooting procedure
OBS mode inoperative on GPS	a) GPS A429 IN bus configured wrong b) ARINC 429 "A" and "B" lines reversed	a) See Figure 9.27 for GPS configuration notes b) Correct wiring error to GPS A429 IN bus
"CROSS LINK FAILURE" message	a) PFD or MFD not powered up b) PFD or MFD inter-system bus wiring fault c) PFD or MFD is defective	a) Power up all EFD displays b) Check wiring per diagrams in Section 9 c) Repair or Replace defective EFD
"DATABASE FAILURE" message	a) Data Card (microSD) is not inserted in MFD display. b) Wrong Data Card inserted c) Data Card is bad d) MFD card slot is defective	a) Insert Data Card in display b) Insert correct Data Card See Section 1 for authorized database part numbers c) Replace data card with new d) Repair or replace MFD display
"Database Init" message	a) Database is missing or files are missing from card	a) Insert functional database card

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Malfunction & How to Recognize the Malfunction	Cause	Remedy
"TERRAIN FAIL" message	a) Data Card not inserted b) Data Card failed c) Heading fail d) GPS position fail e) Altitude fail	a) Insert valid MFD Database b) Insert valid MFD Database c) Verify EFD1000 MFD Direction Indicator is valid and repair if needed. EFD500 MFD inter-communication bus to PFD may have failed or is not configured. d) Verify GPS has good position data e) Verify EFD1000 Altitude is valid. EFD500 MFD intercommunication bus to PFD may have failed or is not configured.
"TRFC FAIL" message	a) Traffic sensor is configured but not valid.	a) Verify traffic processor is turned on and is operational.
Dedicated Traffic Display page messages	See AFMS or pilots guide	
Dedicated WX500 Display page messages	See AFMS or pilots guide	
Dedicated XM Weather Display page messages	See AFMS or pilots guide	
"RSM GPS" message	a) Message is on MFD and a -002 or -003 RSM is installed. b) New RSM installation. c) Wiring issue between EFD and RSM. d) RSM GPS engine has failed.	a) Set RSM GPS Enable to DISABLE in installation menu. b) New RSM installations may need to acquire an almanac and could require up to 15 minutes to clear. c) Check RSM pins 1 and 2 for continuity to EFD. d) Replace RSM.

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System Troubleshooting -continued

Fault	Cause	Corrective Action
	EA100	
A/P AHRS FAIL lamp is never illuminated when the EA100 circuit breaker is engaged and the circuit is closed and energized (press to test fails)	a) Probable lamp failure. The A/P AHRS FAIL lamp power source is the autopilot circuit.	a) Verify the autopilot circuit breaker is not tripped. b) Check wiring for the lamp and autopilot circuit breaker. If OK, replace the A/P AHRS FAIL lamp.
A/P AHRS FAIL lamp is illuminated whenever the EA100 circuit breaker is engaged and the circuit is closed and energized.	a) EA100 is not functioning.	a) Verify the EFD1000 IP ADDR/SUBNET MASK/PORT is set correctly (see "Configuration" in Appendix E of this manual). b) Verify the EFD1000 has software version 2.2.2 or later. c) Verify the A/P AHRS circuit breaker is not tripped. Check the wiring to the EA100. If OK, replace the EA100. d) Normal operation if EA100 Alignment Tool is in use. Use "Engage Relay" to close relay contact and turn off light.
Autopilot has lateral offset in GPSS or APPR mode (HDG Bug may also be out of center)	a) Autopilot roll "null" centering out of adjustment.	a) Follow the autopilot manufacturer's guidelines for adjusting roll "null" centering.
	APS4A	
Altitude Preselect function is inoperative when the autopilot altitude hold function is correct.	a) Failure of the APS4A, or b) Failure of the EFD1000 ground assert to the APS4A when the altitude alerter reaches the selected altitude.	a) Verify the APS4A circuit breaker is not tripped. b) Check wiring and the presence of the ground assert when the altitude alerter reaches the selected altitude. Use ground elevation for the altitude alerter selection.
Altitude Preselect function is inoperative when the autopilot altitude hold function is not correct.	a) Failure of the autopilot.	a) Refer to autopilot troubleshooting procedures.
	CG100	
The SSID "AspenCG100" not broadcast	a) CG100 not powered on	a) Repair wiring/switch/circuit breaker.

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	b) CG100 antenna disconnected c) CG100 is defective	b) Verify antenna is connected or coax is ok if using remote antenna. c) Before replacing the CG100 check to see if the LEDs are lit under the SD card cover. If the LEDs are not lit then the CG100 has malfunctioned. Replace CG100.
The wireless device does not link to the CG100.	Wrong password	If the correct password cannot be located, the CG100 must be returned to Aspen for repair.
MFD will not communicate with CG100 • "Not Linked" message on MFD Gateway Page • GTWY Version Number reports UNKNOWN	a) CG100 IP Address wrong b) MFD IP Address wrong c) Ethernet wiring bad	a) Use the "Aspen Flight Connect App" to set IP Address b) Set MFD IP Address to 192.168.28.12 for MFD1000 or 192.168.28.10 for MFD500 c) Check Ethernet wiring
GPS will not communicate with CG100 • GPS1 or GPS2 "Not Available" message on MFD Gateway Page	a) GPS turned off or not beyond Test Page b) Wrong MFD RS232 Ports configured for GPS Type 4/5 c) RS232 wiring issue between MFD and GPS	a) Turn on GPS and press "OK" twice b) Verify the MFD has GPS TYPE 4 or 5 set on the proper RS232 ports. c) Check GPS to MFD wiring.

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14 Removal and Replacement

This section provides instructions for removal and replacement of LRUs that have been previously installed in the aircraft. No special tools are required for the removal and replacement of any system LRUs. If an LRU is found to be defective it should be removed and returned to Aspen Avionics for repair or replacement.

Fastener Identification and Discard Recommendations:
The fasteners for the components identified below are identified in the EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003-001 Rev AE, section or later. If the fasteners are deformed in any way they should be replaced.

EFD Removal
Verify power is off. Carefully insert a flat blade screwdriver into the locking mechanism on the top center of the EFD. While gently prying pull back the top of the EFD and extract from bracket. Remove nut securing braided ground strap to EFD. Remove pitot and static quick connectors (EFD1000 only) by pulling back outer spring loaded locking sleeve while unplugging connectors. To remove 44 pin D-sub connector unscrew both jackscrews fully and pull connector straight back.

EFD Replacement
Verify power is off. Install 44 pin D-sub connector and tighten jackscrews until connector is fully seated. Install pitot and static lines (EFD1000 only) to back of EFD by firmly pressing the fitting until fully seated (pitot and static quick connectors are keyed and cannot be crossed). Gently pull on connector to ensure proper connection. Connect braided bonding strap to EFD with nut. Insert bottom of EFD into bracket and pivot top forward until it locks into place on bracket.

Using section 10.6 of the EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003-001 Rev AE or later, verify all system interfaces are functional. Verify proper bonding per Section 10.1.2 Perform a System Leak Test (Section10.6.3, EFD1000 systems only) and Sonalert Test (Section 10.6.11, PFD only).

EFD Battery Replacement
EFD battery replacement must only be performed by a properly certified individual or facility.

There are two types of replacement batteries each with its' own unique connector:

- Battery Assy 413-00001-001 is specifically for the EFD1000 A-05-110-00 Rev A and the 910-00001-001 Rev ( ).
- Internal Battery Pack 409-00003-001 is for all other internal battery EFDs.

Remove the EFD from the aircraft panel as described above. Remove the two screws (one on each end) securing the oval-shaped battery cover plate to the rear of the EFD.

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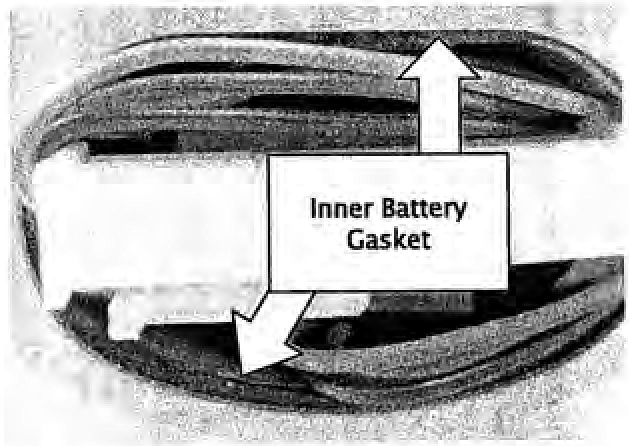
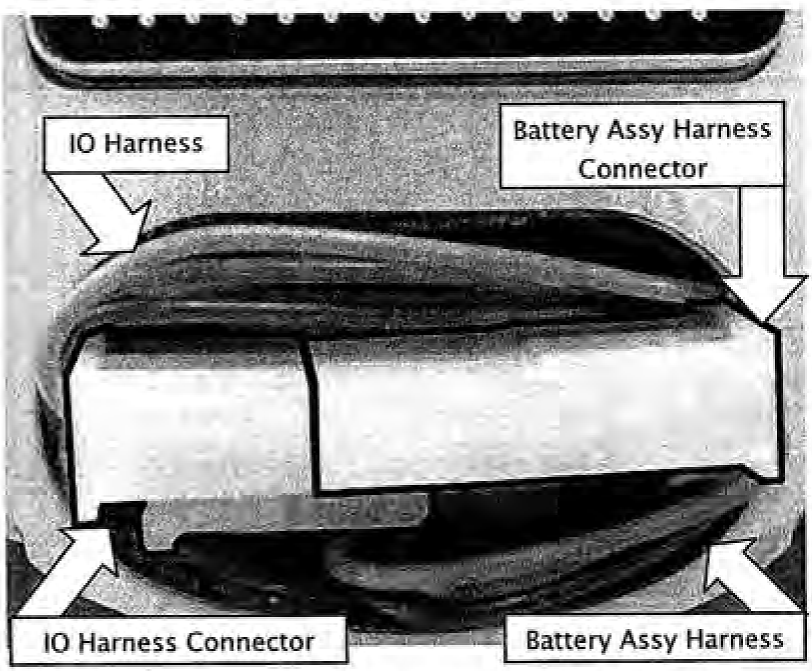
Use caution when removing the battery:

The Inner Battery Gasket may extend partially into the battery cavity as shown in the image below. Carefully remove the battery to not disturb the gasket. *If damaged, the Inner Battery Gasket cannot be replaced in the field and the unit must be returned to the factory.*



Unplug the battery connector from the IO Harness connector. Remove the old battery and install the new battery in the EFD. Then plug in the battery connector to the IO Battery Harness connector.

See the images below for connector placement and wire routing for each Battery type. To prevent pinching/shorting of wires, the wires must be routed as shown.



409-00003-001 Internal Battery Pack Connector & Wire Positioning

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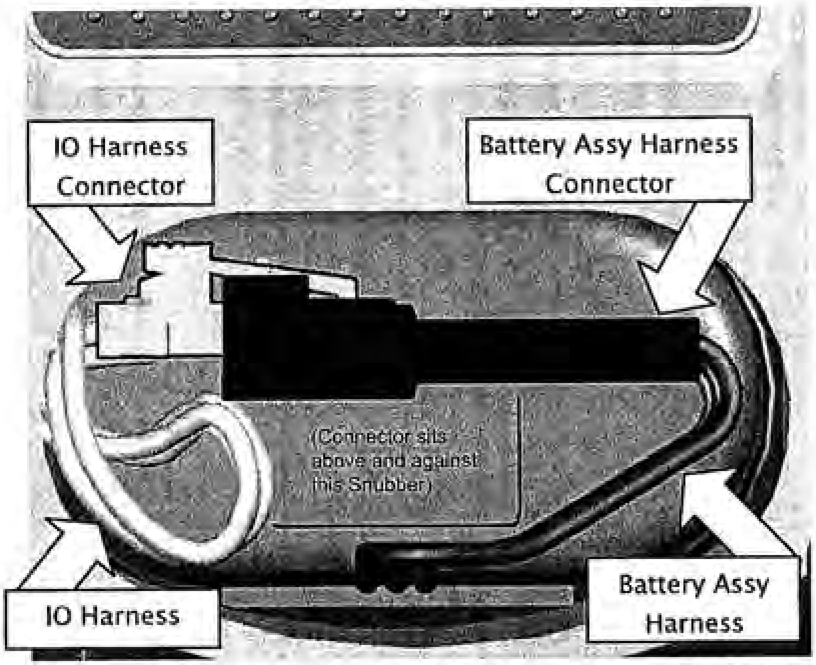

413-00001-001 Battery Assy Connector & Wire Positioning

Clean the threads of the two screws used to secure the battery cover. Place a small amount of Loctite® 242 on the threads of the cover screws, then position the cover plate, install the cover screws and torque to 12 in-lbs. Reinstall into panel as instructed in the EFD Replacement section above and then test the EFD.

ACU/ACU2 Removal

Verify power is off. Remove ACU by unscrewing the jackscrews of all D-sub connectors. Gently remove the connectors by pulling straight out. Remove the six (6) 6-32 mounting screws securing the ACU to the aircraft and remove unit from aircraft.

ACU/ACU2 Replacement

Verify power is off. Install ACU in mounting location and install six (6) 6-32 mounting screws through holes in ACU mounting tabs. Tighten to 12 in-lbs. Install all D-sub connectors securing each with the two jackscrews per connector.

Verify proper bonding per Section 10.1.2, then perform post installation tests in Sections 10.6.6, 10.6.7, 10.6.9, 10.6.10 of the EFD1000 and EFD500 SW v2.X Installation Manual 900-00003-001 Rev AE or later.

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CAUTION: The RSM is very sensitive to local magnetic fields. Do not use a magnetic tipped screw driver when removing and replacing the RSM.

RSM Removal

Verify power is off. It will be necessary to gain access to the underside of the RSM mounting location in order to unplug the RSM connector. Unscrew RSM electrical connector from inside and undo shield ground wire from ground stud. Remove sealant from around base of RSM and on mounting screws. Remove four (4) 8-32 non-ferrous mounting screws from RSM and remove RSM from aircraft taking care to guide 24 inch "pigtail" connector out through ½ inch hole in aircraft skin.

RSM Replacement

Verify power is off. Replace the O-ring on the RSM. Contact Aspen Avionics for replacement O-ring (256-00001-001). Verify RSM shim is installed between aircraft skin and RSM if required. Feed circular connector down through ½ inch hole in aircraft skin and mount RSM (vent hole faces aft) with four (4) 8-32 non-ferrous screws. Tighten to 12-15 in-lbs. It is critical that the screws be non-ferrous to prevent the introduction of compass errors. Connect the circular electrical connector and cable tie harness to prevent chaffing and interference. Connect shield ground wire to ground stud. For RSM locations that are external or in a wet environment seal around base and on top of four mounting screws of the RSM using one of the following non-corrosive sealants:

Non-pressure vessel mounting	Dow Corning 738, MIL-A-46146 or equiv.
Pressure vessel mounting	Pro-Seal PS 870B-1/2, MIL-PRF-81733D, or equiv.

Verify proper bonding per Section 10.1.2, and perform RSM Calibration per Section 10.5 of the EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003-001 Rev AE or later. Also check OAT operation per Section 10.6.4 and check RSM GPS operation per Section 10.6.6.

CM Removal

Verify power is off. Cut the two (2) cable ties affixing the CM to the PFD wiring harness. Unplug the Molex connector by pressing down on the locking tab and gently pulling the connector from the module.

CM Replacement

Verify power is off. Plug the Molex connector into the module until it clicks. Cable tie the module to the PFD wiring harness.

Perform the Installation Menu Unit Configuration per section 10.4.5 of the EFD1000 Installation Manual, 900-00003-001 Rev AE or later.

Perform RSM Calibration per Section 10.5 of the EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003- 001 Rev AE or later.

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EA100 Removal

Verify power is off. Remove the EA100 by unscrewing the jackscrews of both D-sub connectors. Gently remove the connectors by pulling straight out. Remove the six (6) 6-32 mounting screws securing the EA100 to the aircraft and remove unit from aircraft.

EA100 Replacement

Verify power is off. Install EA100 in mounting location and install six (6) 8-32 mounting screws through holes in EA100 mounting tabs. Tighten to 12 in-lbs. Install both D-sub connectors, securing each with the two jackscrews per connector.

Verify EA100 bonding per the Mechanical Installation section and perform post installation tests in the EFD1000 and EFD500 SW v2.X Installation Manual 900-00003-001 Rev AE or later, Appendix E.

If the EA100 being installed is a replacement then configure it using the EA100 Alignment Tool and set the values to those recorded on the configuration table in the permanent aircraft records.

EBB58 Removal

Verify power is off. Unscrew two jackscrews that secure the D-sub connector to the battery and then unplug the connector. Spread battery tray hold down clips outward to release battery and slide battery out of tray.

EBB58 Replacement

Verify power is off. Slide battery into tray until hold down clips lock into place. Install D-sub connector and secure with both jackscrews.

NOTE: ***If the spring clip(s) are sprung so the pins do not fully seat, the mounting bracket must be replaced.***

Turn on the EFD1000 MFD and switch unit to battery. Verify charge of 80% or greater. If battery is below 80% then charge battery to above 80% by switching MFD back to aircraft power. EBB58 battery will recharge as long as MFD is powered up on aircraft power.

EBB58 Tray Removal

Verify power is off. Remove the battery. Remove the four screws securing the tray to the airframe.

EBB58 Tray Replacement

Replace the four screws securing the tray to the airframe. Tighten to 12 in-lbs. Verify proper bonding per Section 10.1.2 of the EFD1000 Installation Manual, 900-00003-001 Rev AE or later.

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APS4A Removal

Verify power is off. Remove the APS4A by unscrewing the jackscrews of the D-sub connector. Gently remove the connector by pulling straight out. Remove the four mounting screws securing the APS4A to the aircraft and remove unit from aircraft.

APS4A Replacement

Verify power is off. Install APS4A in its mounting location and install four 6-32 mounting screws through holes in APS4A mounting tabs. Tighten to 12 in-lbs. Install the D-sub connector, securing with two jackscrews per connector.

Verify APS4A bonding per the Mechanical Installation section and perform post installation tests in accordance with Appendix G - EFD1000 Installation Manual, 900-00003-001 Rev AE or later.

CG100 Removal

Verify power is off. Remove the CG100 by unscrewing the jackscrews of the D-sub connectors. Gently remove the connectors by pulling straight out. Remove the six mounting screws securing the CG100 to the aircraft and remove unit from aircraft.

CG100 Replacement

Verify power is off. Install CG100 in its mounting location and install six 6-32 mounting screws through holes in CG100 mounting tabs. Tighten to 12 in-lbs. Install the D-sub connectors, securing with two jackscrews per connector. Note – it may be necessary to remove the antenna from the old CG100 and install it on to the SMA connector of the replacement CG100.

Verify CG100 bonding per the Mechanical Installation section and perform post installation tests in accordance with Appendix H - EFD1000 Installation Manual, 900-00003-001 Rev AE or later.

NOTE: Appendix H of document 900-00008-001 directs the user to another supporting document (900-000023-001, see "CG100 Installation, and "System Checkout") information for the CG100. This is because the primary document for the STC is document 900-00003-001, and information regarding support documentation will be in this document.

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15 Wiring and Component Location Data

INSTRUCTIONS:

NOTE: The wire routing information placed here by the installer must be detailed enough to enable maintenance personnel to troubleshoot, repair, and service the electrical system. These diagrams must also include a method of determining connector type (if other than the connectors supplied by Aspen Avionics in the Installation Kits), wire type, and wire size. The system wiring diagrams are descriptive data of the systems used on the aircraft, and are part of the ICA.

a) Draw in the locations of the EFD1000 system, including the PFD, MFD(s), RSM, optional ACU/ACU2, EBB58, EA100, CG100 and autopilot locations (Figures 1 and 2).
b) Draw in the circuit breaker and switch locations on instrument panel (Figure 3).
c) Draw in the PFD and MFD to RSM cable routing, including wire type and wire size.
d) Draw in the ACU to PFD and ACU to autopilot cable routing, including wire type and wire size.
e) Draw in the optional EA100 to EFD and EA100 to autopilot cable routing, including wire type and wire size.
f) Draw in the optional CG100 to MFD cable routing.
g) Draw in the optional CG100 USB port locations.
h) Show the location of access panels for inspection and servicing the EFD1000 system, including diagrams of the access plates and any information necessary to gain access when access plates are not provided.

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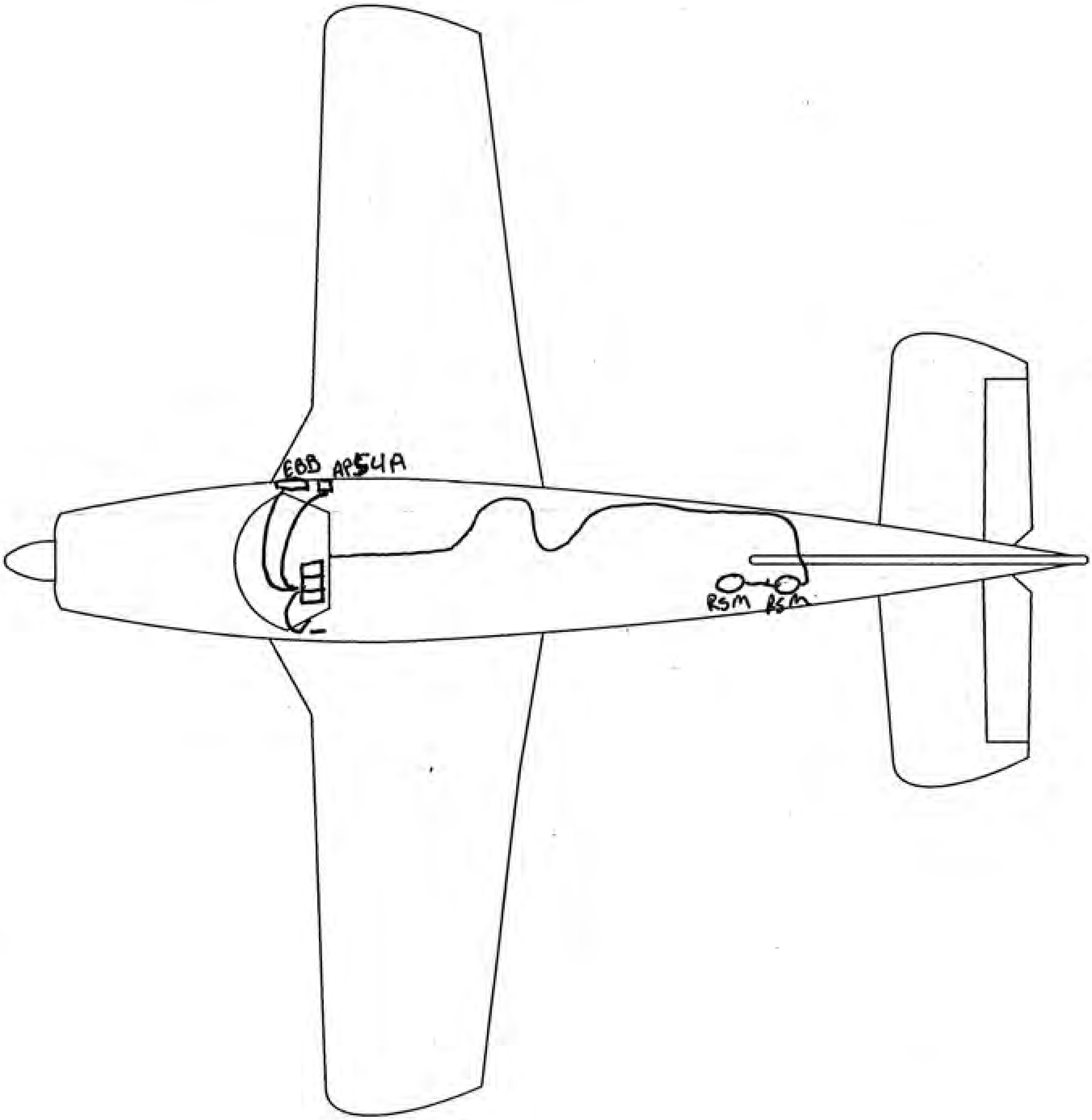

Figure 1 - EFD1000 Components and cable routing (top view)

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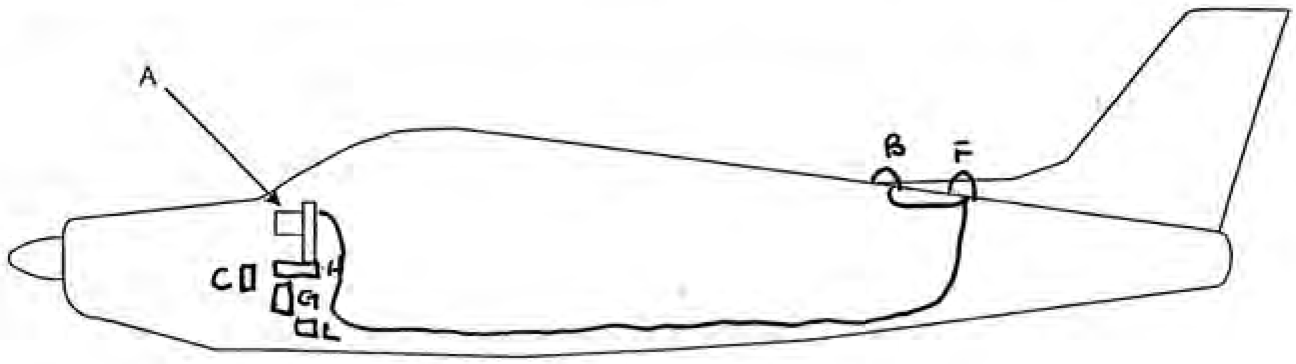

Figure 2 - EFD1000 Components and cable routing (side view)

LRU Definitions

A. PFD (CM is wired within 6" of PFD)
B. RSM (PFD)
C. ACU/2 #1 - optional equipment
D. ACU/2 #2 - optional equipment
E. MFD#1 and MFD#2 -optional
F. RSM (MFD) - optional
G. EBB58 - optional equipment
H. Autopilot computer location -optional equipment
J. EWR50 location - optional equipment
K. EA100 location - optional equipment
L. APS4A location - optional equipment
M. CG100 - optional equipment

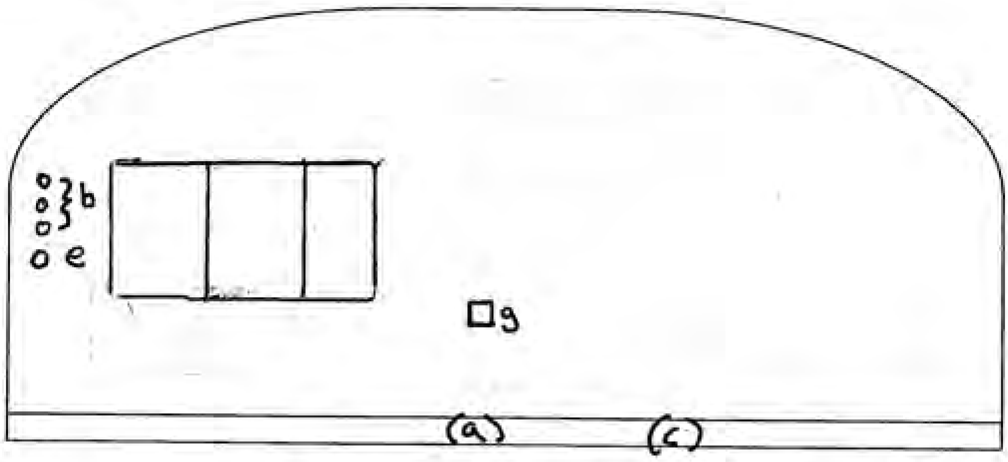

Figure 3 - Circuit Breaker and Switch Locations

Circuit Breaker and Switch Definitions

a) PFD/MFD circuit breakers
b) PFD/MFD switch(s)
c) ACU circuit breaker(s) - optional
d) A/P AHRS circuit breaker -w/opt. EA100
e) EBB58 Emergency Disconnect Switch - w/opt. EA100
f) A/P AHRS FAIL light - w/ opt. EA100
g) PRESEL/(ARMED) switch - optional
h) A/P Source switch - optional
i) GTWY circuit breaker - optional
j) ASPEN GTWY switch - optional

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INSERT WIRING DIAGRAMS AFTER THIS PAGE

(The drawings must include detailed information on the interface of the EFD1000 system suitable for system troubleshooting)

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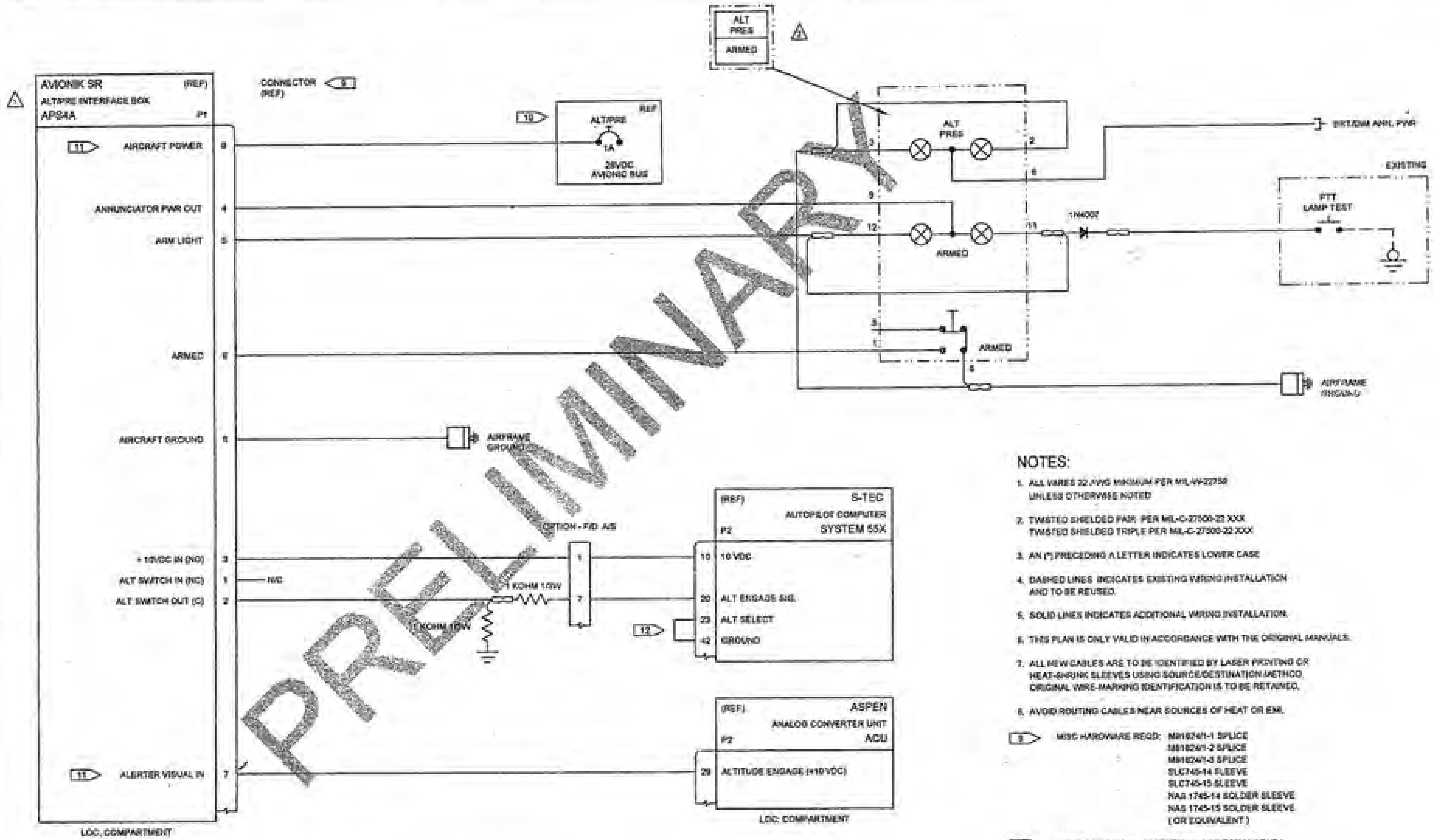

NOTES:

1. ALL WIRES 22 AWG MINIMUM PER MIL-W-22759 UNLESS OTHERWISE NOTED
2. TWISTED SHIELDED PAIR PER MIL-C-27500-22 XXX
   TWISTED SHIELDED TRIPLE PER MIL-C-27500-22 XXX
3. AN (*) PRECEDING A LETTER INDICATES LOWER CASE
4. DASHED LINES INDICATES EXISTING WIRING INSTALLATION AND TO BE REUSED.
5. SOLID LINES INDICATES ADDITIONAL WIRING INSTALLATION.
6. THIS PLAN IS ONLY VALID IN ACCORDANCE WITH THE ORIGINAL MANUALS.
7. ALL NEW CABLES ARE TO BE IDENTIFIED BY LASER PRINTING OR HEAT-SHRINK SLEEVES USING SOURCE/DESTINATION METHOD. ORIGINAL WIRE-MARKING IDENTIFICATION IS TO BE RETAINED.
8. AVOID ROUTING CABLES NEAR SOURCES OF HEAT OR EMI.

9 > MISC HARDWARE REQD: M81824/1-1 SPLICE
M81824/1-2 SPLICE
M81824/1-3 SPLICE
SLC745-14 SLEEVE
SLC745-15 SLEEVE
NAS 1745-14 SOLDER SLEEVE
NAS 1745-15 SOLDER SLEEVE
(OR EQUIVALENT)

10 > CIRCUIT BREAKER, P/N 7277-X-X (OR EQUIVALENT)

11 > INTERNALLY CONFIGURED BY JUMPER

12 > JUMPER AUTOPILOT P2 (39122-()) PIN42 AND PIN23 OR OPTION FLAP COMP/CWS CONNECTOR PIN1 AND PIN2 REF ORIGINAL MANUAL S-TEC DWG NO: 1099

7.2.13 Autopilot Wiring

Wire the autopilot to ACU as shown in Section 9. Remove any existing connections and switching between GPS and NAV receivers to autopilot. Only ARINC 429 wiring may remain between the GPS and autopilot for NAV mode GPSS. The ACU will perform all switching functions to autopilot for GPS1, GPS2, NAV1, and NAV2.

7.2.14 EBB58 Wiring

The EBB58 Wiring harness comes prefabricated with connectors both at the battery and the MFD end. The twisted pair for the Emergency Battery Disconnect switch should be cut to length and connected across the required SPST locking toggle type emergency battery disconnect switch. Optionally a SPST switch and integral guard may be installed in place of the locking toggle switch. The guard would be installed so the switch is normally open. When the guard is lifted and the switch is enabled, the switch will close, disconnecting the relay in the EBB. The shield is not grounded at the switch end.

The switch must be installed in a position so that is accessible to the pilot while seated. Be sure the switch guard can remain open so the guard does not return to the resting position and inadvertently open the switch.

NOTE: When in the DISC position, the EBB Emergency Disconnect switch energizes a relay powered by the EBB. Thus, when the switch is in the DISC position, the Emergency battery will gradually discharge through the relay.

Plug prefabricated wiring harness in to EBB58 and secure the connector by tightening the jackscrews. Connect the other end to the back of the EFD1000 MFD (P/N 910-00001-002 only) and secure the connector by tightening the jackscrews. The EBB battery cable must be routed separately from the MFD main power wiring and the PFD RSM wiring.

CAUTION: The EBB harness connector at the MFD1000 end has 3 symmetrical contacts and it can inadvertently be plugged in upside down. Make sure the label on the backshell marked "TOP" is facing up or damage to the MFD and EBB could occur.

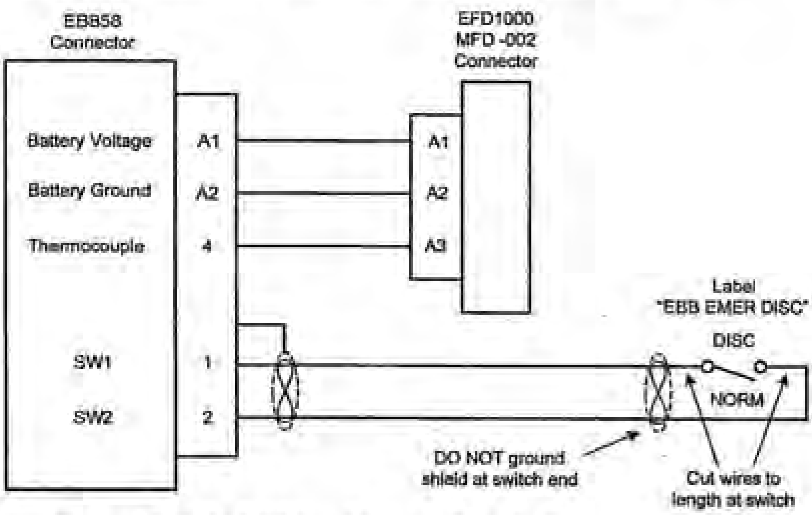

Figure 7-7: EBB Wiring Harness Switch Connections

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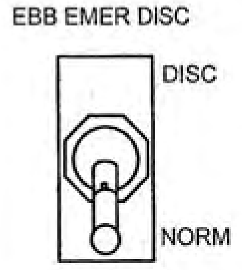

Figure 7-8: EBB EMER DISC switch labeling

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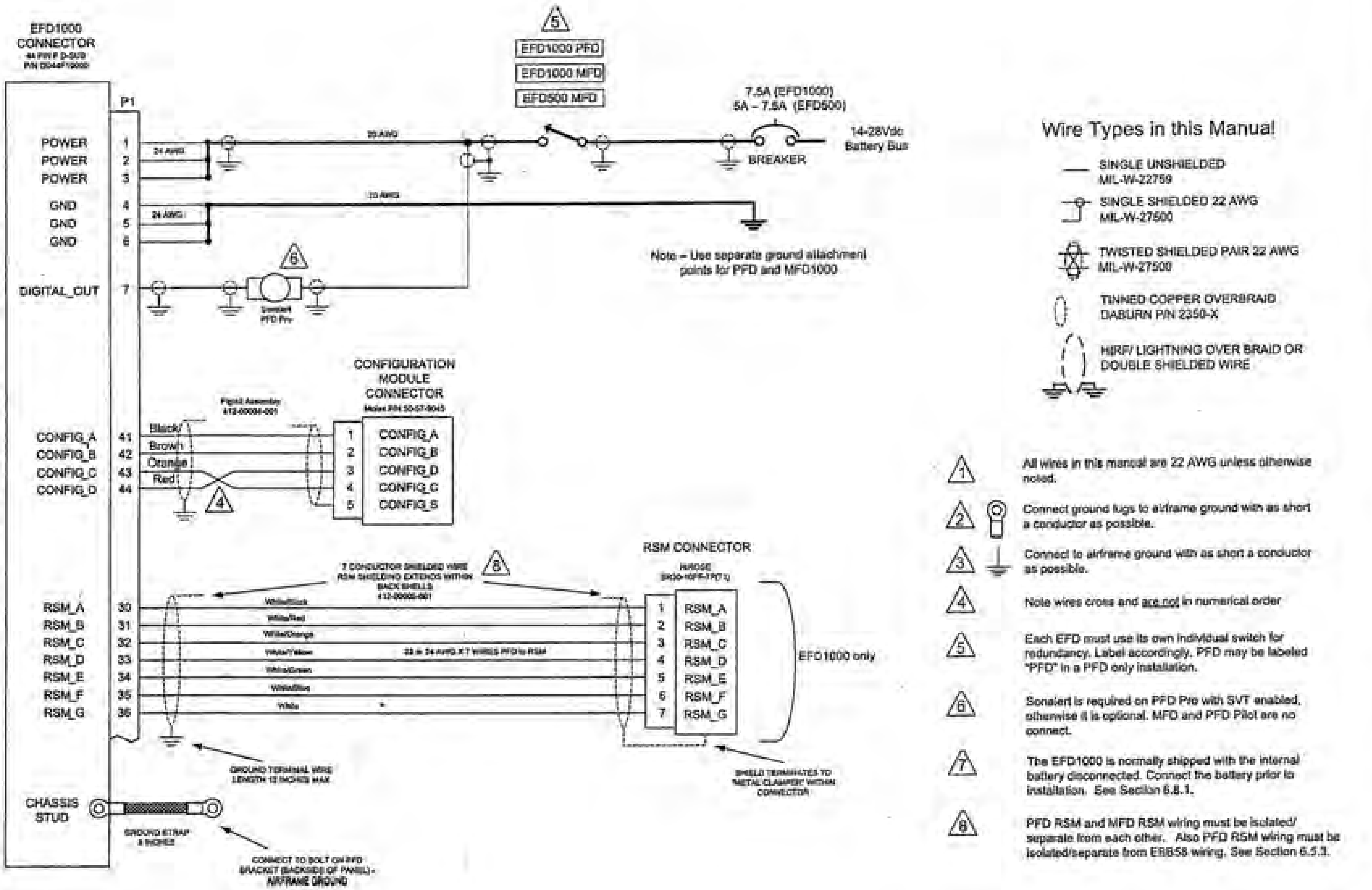

Figure 9–1: EFD1000/500 Main Connections

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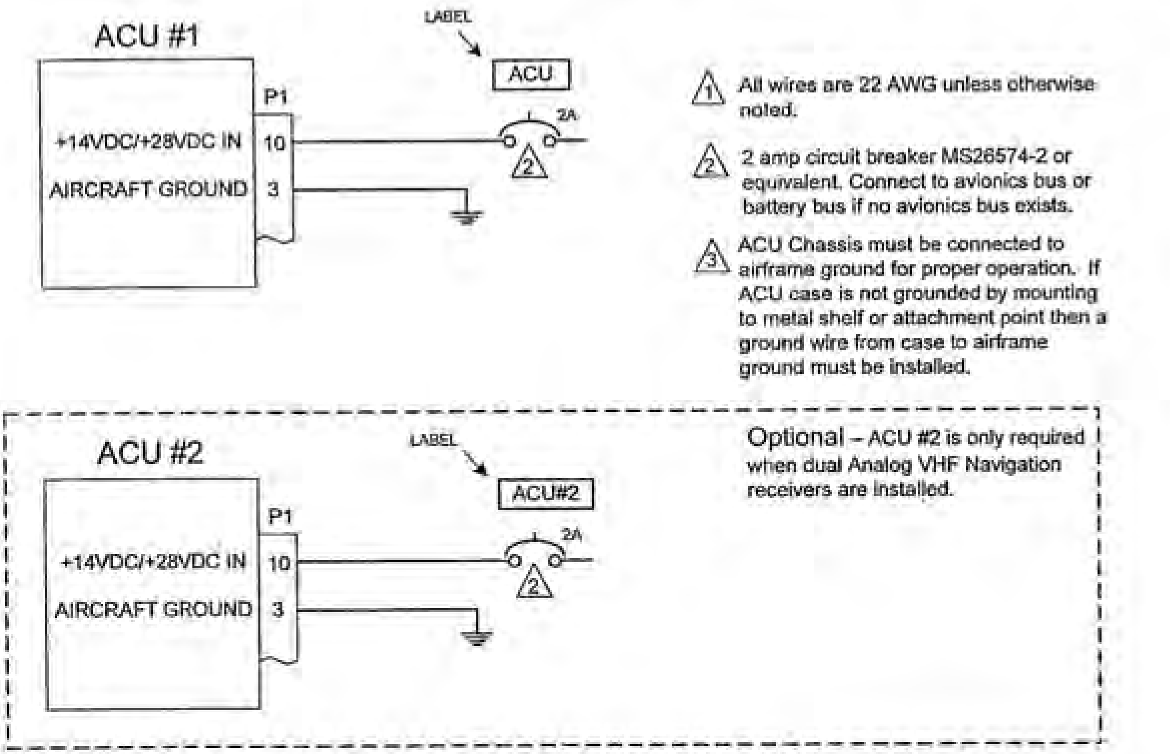

Figure 9-2: ACU/ACU2 Input Power

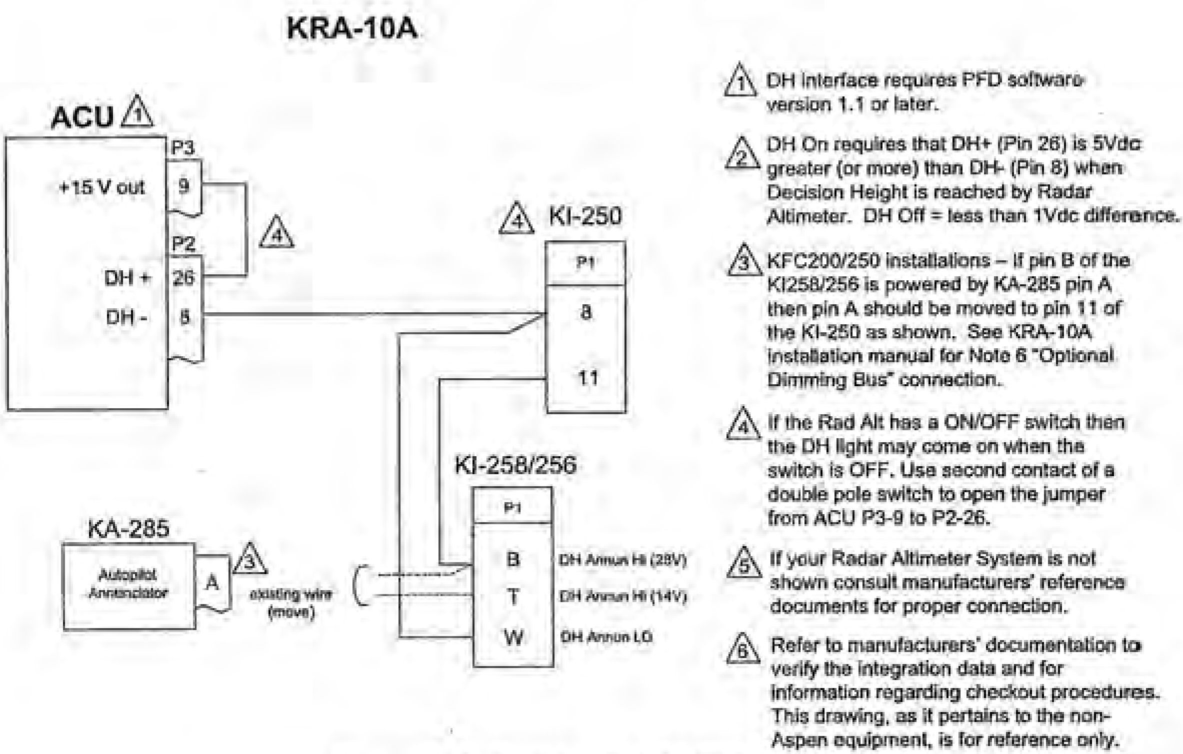

Figure 9-3: Decision Height (DH) Interface

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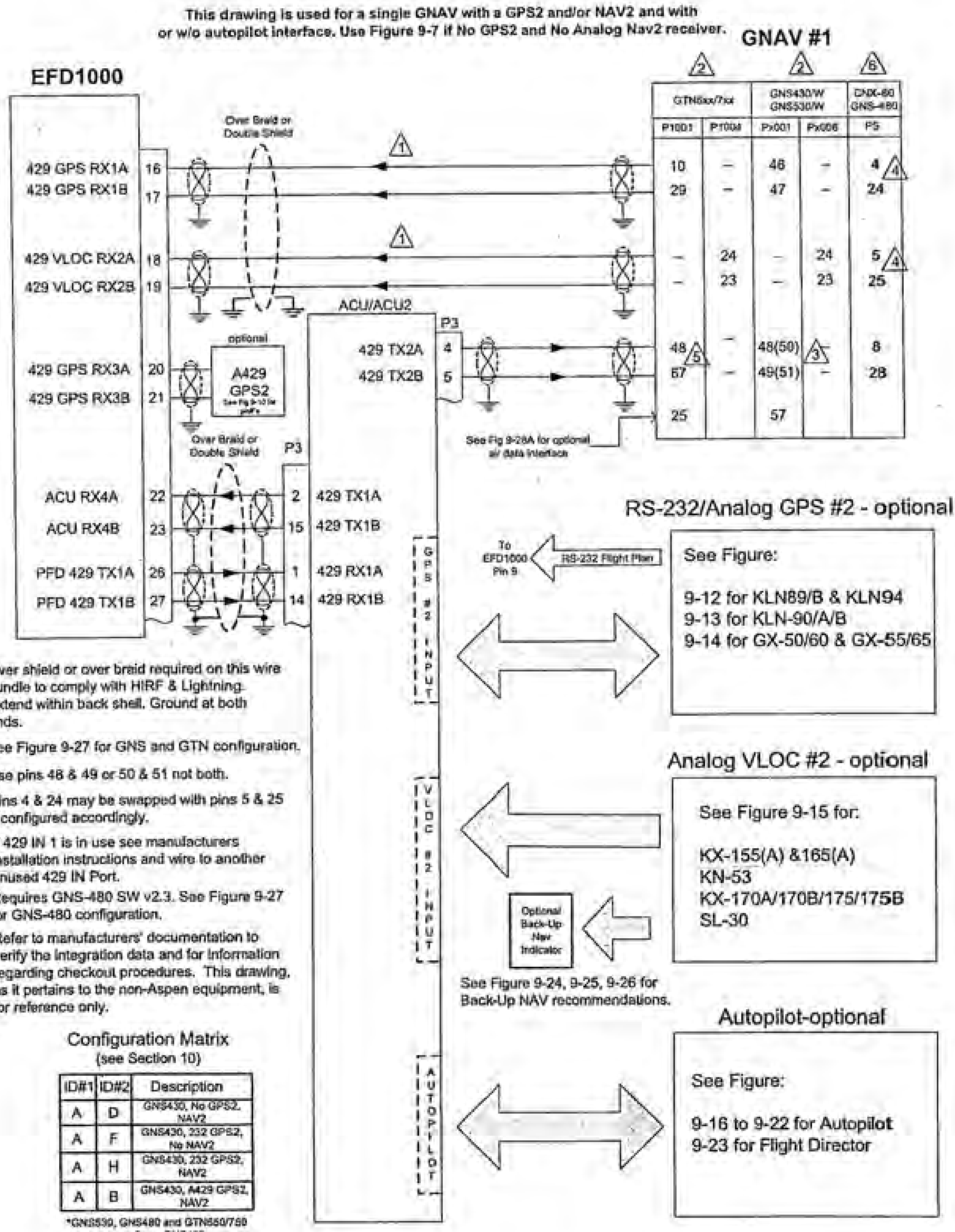

1. Over shield or over braid required on this wire bundle to comply with HIRF & Lightning. Extend within back shell. Ground at both ends.
2. See Figure 9-27 for GNS and GTN configuration.
3. Use pins 48 & 49 or 50 & 51 not both.
4. Pins 4 & 24 may be swapped with pins 5 & 25 if configured accordingly.
5. If 429 IN 1 is in use see manufacturers installation instructions and wire to another unused 429 IN Port.
6. Requires GNS-480 SW v2.3. See Figure 9-27 for GNS-480 configuration.
7. Refer to manufacturers' documentation to verify the integration data and for information regarding checkout procedures. This drawing, as it pertains to the non-Aspen equipment, is for reference only.

Configuration Matrix
(see Section 10)

ID#1	ID#2	Description
A	D	GNS430, No GPS2, NAV2
A	F	GNS430, 232 GPS2, No NAV2
A	H	GNS430, 232 GPS2, NAV2
A	B	GNS430, A429 GPS2, NAV2

*GNS530, GNS480 and GTN650/750 use same config as GNS430

Figure 9-8: PRO Digital & Analog Mix with ACU/ACU2

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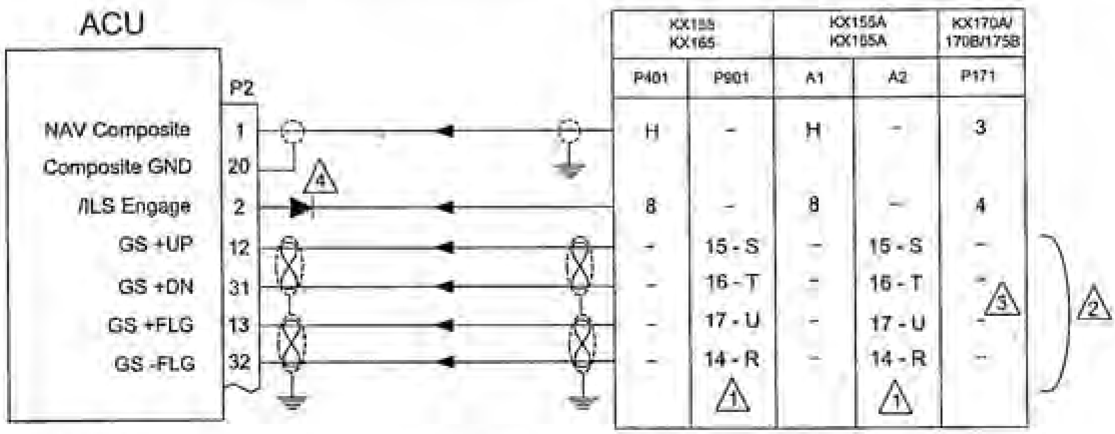


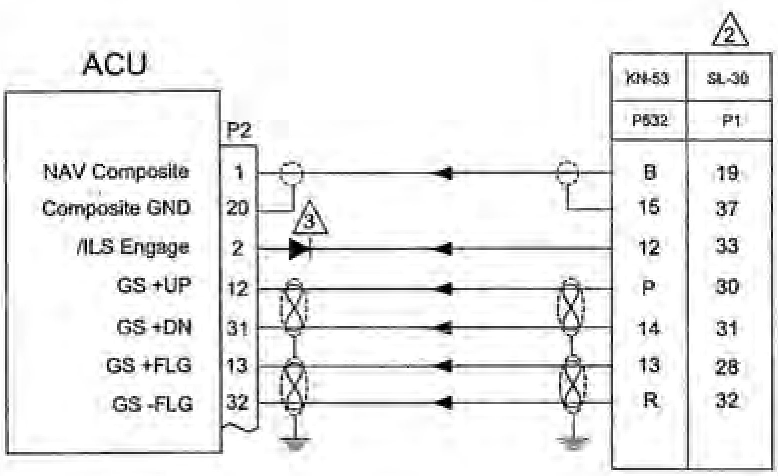
1. KX155/165 Nav units have dual GS outputs. Use "Numbered" or Lettered pins, not both. Use unused pins independent from those driving a backup NAV indicator if possible. Otherwise parallel as close to NAV receiver as possible (see Figure 9-24 & 9-25)

2. Glideslope interface is for units with GS option.

3. See manufacturers' documentation for KN-70/73/75 Glideslope connections.

4. Diode required when paralleling ILS Energize wire with backup NAV indicator. See Figure 9-24. Use 1N4005.

5. Refer to manufacturers' documentation to verify the integration data and for information regarding checkout procedures. This drawing, as it pertains to the non-Aspen equipment, is for reference only.



1. If paralleling GS signals with backup NAV indicator then splice wires as close to NAV receiver as possible. Do not parallel at back of NAV indicator (see Figures 9-24 & 9-25)

2. See Figure 9-27 for SL-30 configuration.

3. Diode required when paralleling ILS Energize wire with backup NAV indicator. See Figure 9-24. Use 1N4005.

4. Refer to manufacturers' documentation to verify the integration data and for information regarding checkout procedures. This drawing, as it pertains to the non-Aspen equipment, is for reference only.

Figure 9-15: Analog NAV Interface

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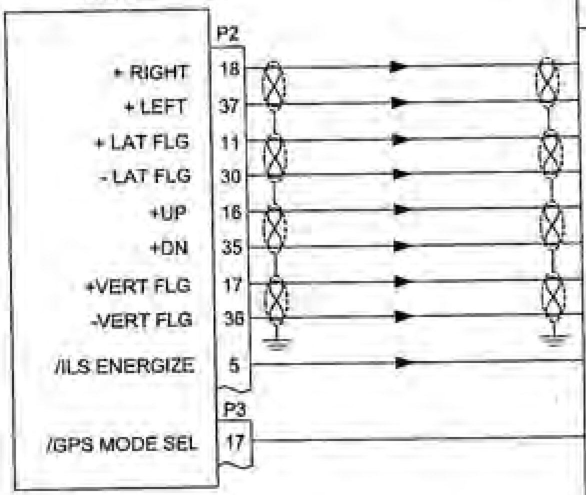
Must also make HDG/CRS connections per Figure 9-17A or 9-17B



SYSTEM 20/30	SYSTEM 40/50	SYSTEM 55		SYSTEM 55X		SYSTEM 60-2/65	
P1	P1	P1	P2	P1	P2	109	110
10	13	30	–	30	–	21	–
9	14	31	–	31	–	23	–
–	–	13	–	13	–	24	–
–	–	14	–	14	–	6	–
–	–	–	18	–	18	–	46
–	–	–	19	–	19	–	45
–	–	–	1	–	1	–	77
–	–	–	2	–	2	–	58
–	–	32	–	32	–	16	–
42	26	49	–	49	–	–	–
–	–	–	–	–	38 (3)	–	–

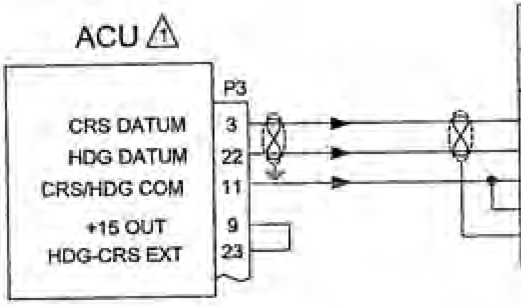
(1) Autopilot can only be connected to ACU #1 in a dual ACU configuration.

(2) See Flight Director section Figure 9-23 for command bar interface.

(3) P2-38 is GPSS SELECT which is grounded when there is an A429 GPSS direct connection between GPS and 55X. When using the EFD1000 GPSS only, this pin is left open.

(4) Refer to autopilot manufacturers' documentation for autopilot-side integration information (including autopilot STC compliance data) and for autopilot and flight director checkout procedures. This drawing, as it pertains to the non-Aspen equipment, is for reference only.

Figure 9-17: STEC Autopilot to ACU Interface (minus HDG/CRS Datum)



SYSTEM 20/30	SYSTEM 40/50	SYSTEM 55		SYSTEM 55X		SYSTEM 60-2/65	
P1	P1	P1	P2	P1	P2	109	110
–	–	11	–	11	–	20	–
8	31	28	–	28	–	19	–
7	29	29	–	29	–	13	–
–	–	12	–	12	–	–	–
35	46	44	–	44	–	37	–

(1) CRS/HDG Datum is wired to simulate a KI-525A HSI. If existing HSI is other than KI-525A then autopilot needs to be modified to accept KI525A inputs. See Figure 9-17B for NSD-360 interface.

(2) If existing installation used a DG then a DG Select jumper may need to be removed. Refer to S-TEC reference material.

(3) If the existing DG/HSI is to remain in the aircraft do not parallel HDG/CRS Datum with ACU. Cap and Stow at DG/HSI.

(4) Refer to autopilot manufacturers' documentation for autopilot-side integration information (including autopilot STC compliance data) and for autopilot and flight director checkout procedures. This drawing, as it pertains to the non-Aspen equipment, is for reference only.

Configuration Matrix
(see Section 10)

ACU HSI TYPE = 0

Figure 9-17A: KI525A Emulation (STEC Autopilot)

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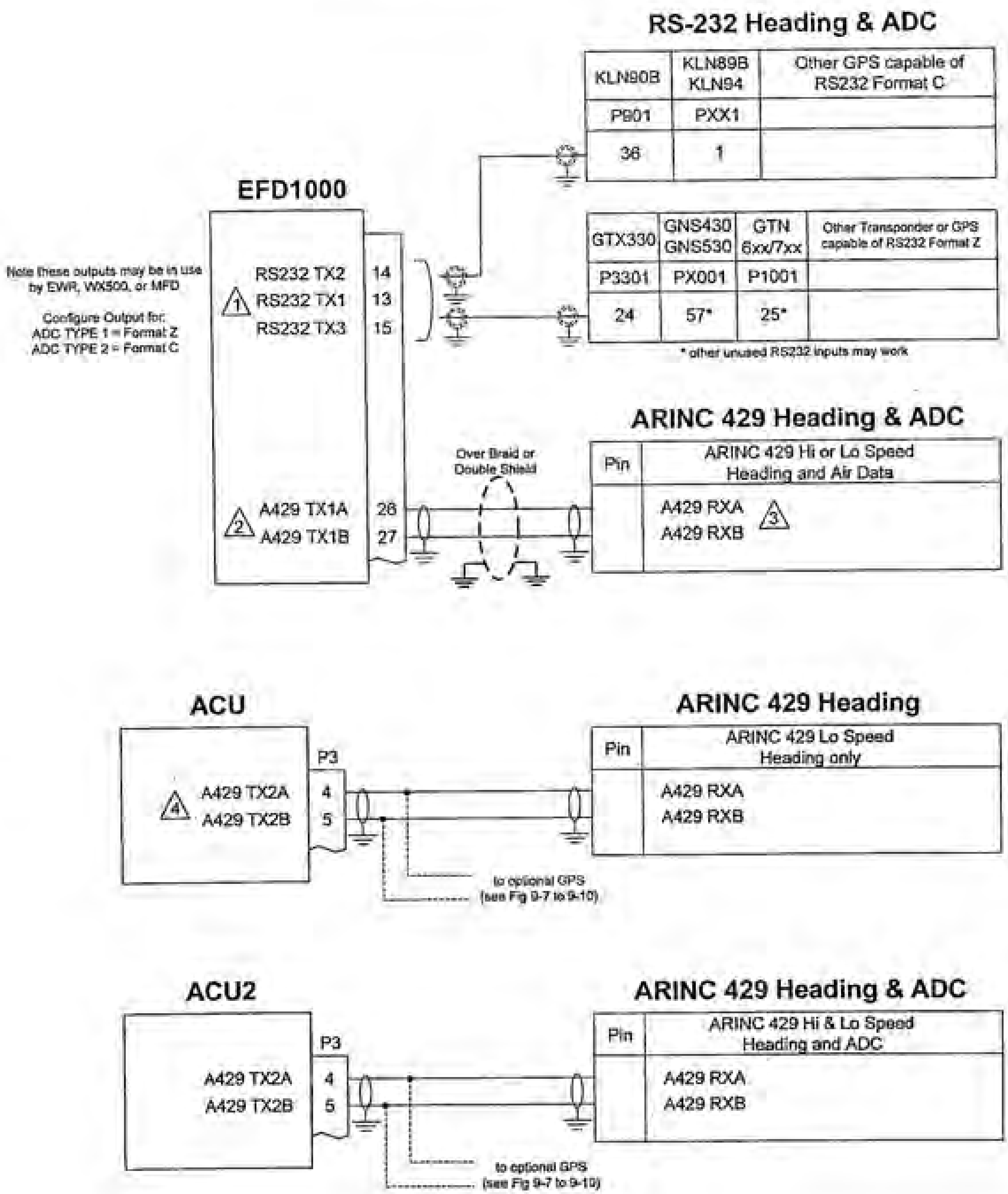

1. If the EFD1000 pin 8 is connected to an EWR50, then pin 13 cannot be used as an ADC Output.
2. This output only available when no ACU is installed. ACU/ACU2 installations should use A429 output from ACUs.
3. Note – Hi Speed A429 requires EFD software v2.3 or later.
4. ACU transmits low speed 429 only.
5. Refer to manufacturers' documentation to verify the integration data and for information regarding checkout procedures. This drawing, as it pertains to the non-Aspen equipment, is for reference only.

Figure 9-28A: Digital Heading Outputs

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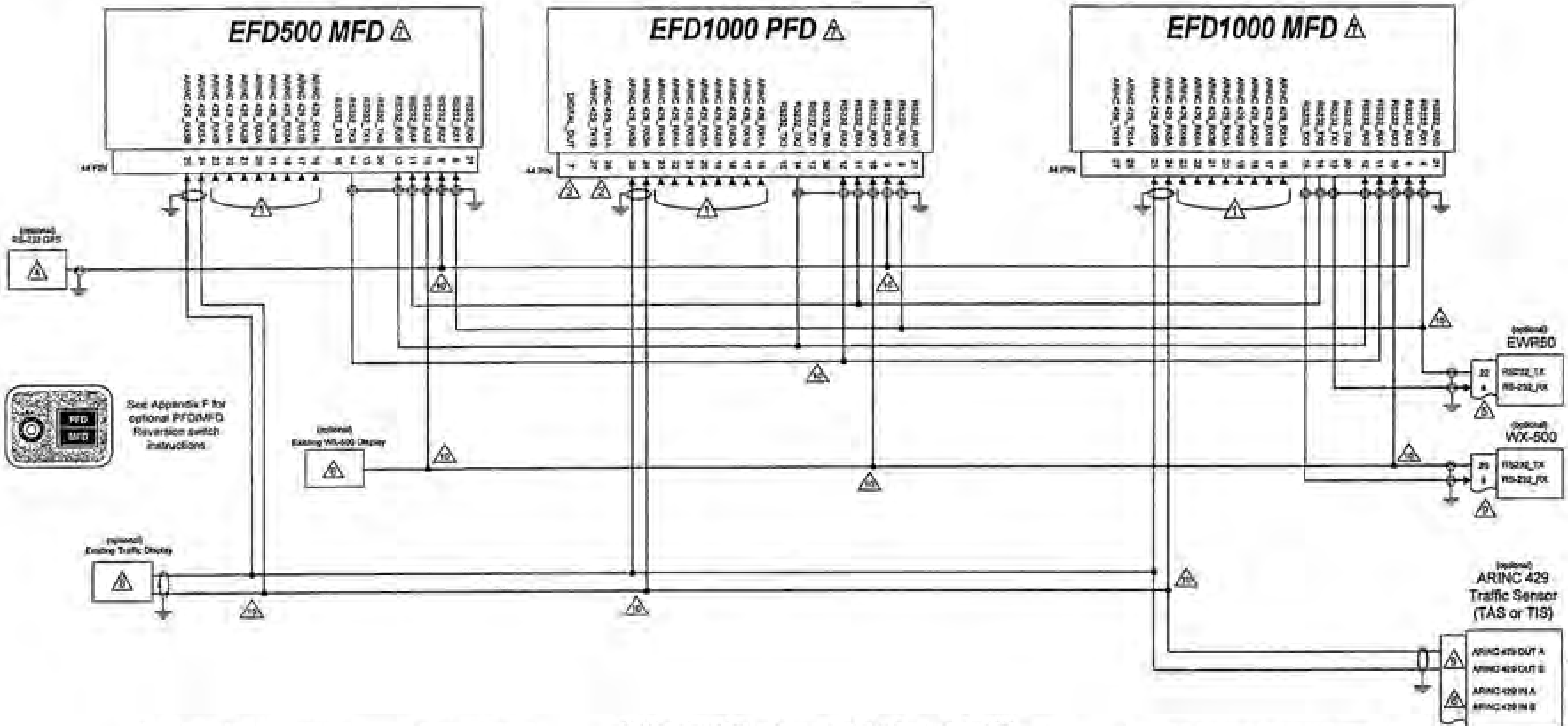
PFD with EFD1000 MFD and EFD500 MFD



1. See Figures 9-6 to 9-11 for GPS/NAV connections. Parallel connections to both the PFD and MFD from all A429 GPS/NAV and the ACU pins 2 &15.
2. ARINC 429 TX to the ACU or GPS A429 IN. See the EFD1000 Installation Manual Figures 9-6 to 9-10 for connections.
3. See the EFD1000 Installation Manual Figure 9-1 for Sonalert option.
4. Note, pre-existing RS232 GPS installations may be connected to PFD pin 8. These must be re-pinned to PFD pin 9 when installing XM weather.
5. See EWR50 Installation Manual for complete interface to aircraft.
6. PFD or ACU A429 TX may be connected to the traffic sensor for Label 320 "Magnetic Heading" only. No traffic control panel functions are output by EFD1000 system.
7. See Figure 9-1 for CM and RSM wiring connections.
8. See the existing Display's Installation Manual for specifications.
9. See the existing Sensor's Installation Manual for pin connections and complete interface to aircraft.
10. Carry shielding though all wire splices. RS232 wiring only - Optionally a twisted pair (22TG2V64) may be used with the second conductor grounded at both ends in lieu of single conductor shown.

Inter-System Bus Configuration

DISPLAY	RS232 PORT	PORT SETTING
PFD	232 IN PORT 4	EFD1000 MFD
	232 IN PORT 5	EFD500 MFD
	232 OUT PORT 2	EFD
MFD 1000	232 IN PORT 4	EFD500 MFD
	232 IN PORT 5	EFD1000 PFD
	232 OUT PORT 2	EFD
MFD 500	232 IN PORT 4	EFD1000 MFD
	232 IN PORT 5	EFD1000 PFD
	232 OUT PORT 2	EFD

Figure 9-30A: Three Display System PFD/MFD1000/MFD500, Generic

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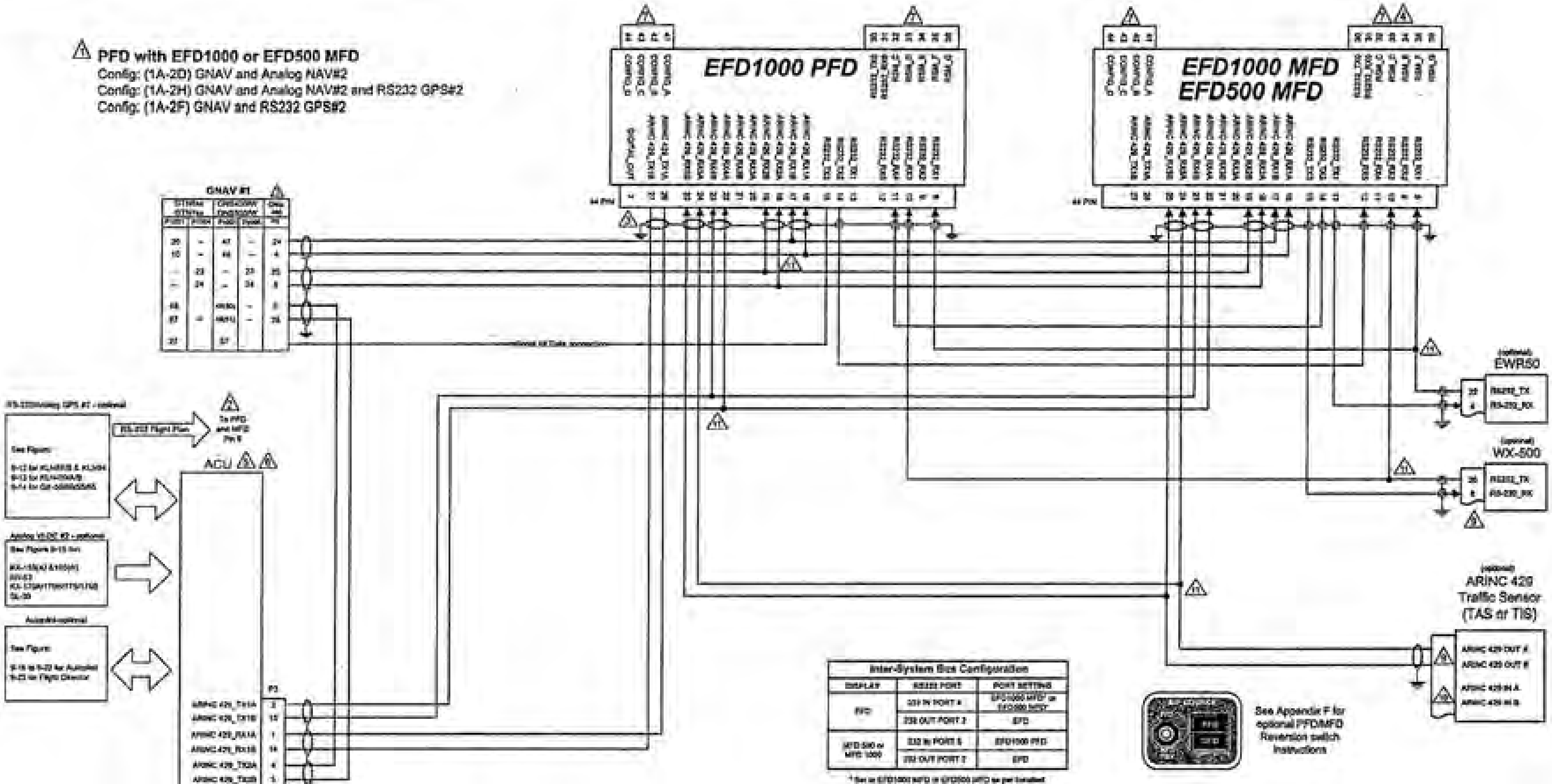

- This drawing is used for existing PFD installations that wired to Figure 9-8 or have one GNAV with Analog NAV and/or GPS. Other configurations must use their appropriate drawing.
- Existing PFD installation may have used pin 8 for the RS232 GPS connection. This wire must be moved to pin 9 when adding the optional EWR50 XM receiver
- See the EFD1000 Installation Manual for Sonalert option
- EFD500 installations do not use an RSM.
- See Figure 9-2 for ACU power and ground connections
- See Figure 9-3 for DH wiring connections
- See Figure 9-1 for PFD/MFD power and CM/RSM wiring connections
- See the existing Display's Installation Manual for specifications
- See the existing Sensor's Installation Manual for pin connections and complete interface to aircraft
- ACU A429 TX2 (pins 4,5) may be connected to the traffic sensor for Label 320 "Magnetic Heading" only. No traffic control panel functions are output by EFD1000 system
- Carry shielding though all wire splices. RS232 wiring only - Optionally a twisted pair (22TG2V64) may be used with the second conductor grounded at both ends in lieu of single conductor shown.

Figure 9-31: Two Display System PFD/MFD, GNAV1 and Analog NAV#2 or GPS#2 Configurations (1A-2D) or (1A-2H) or (1A-2F)

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INSERT THE FOLLOWING AFTER THIS PAGE

(All inserts are from EFD1000 and EFD500 SW v2.X Installation Manual, 900-00003-001 Rev AE or later)

COMPLETED - CONFIGURATION CHART - Section 10.4.6 & 10.4.7

COMPLETED - PRE-MODIFICATION CHECKLIST - TABLE 5.1 & 5.2

COMPLETED - OPERATOR CONFIGURATION CHECKLIST FROM APPENDIX C

COMPLETED - EFD1000/500 INSTALLATION FINAL CHECKSHEET FROM APPENDIX B

COMPLETED - EA100 FLIGHT TEST and CONFIGURATION TABLE FROM APPENDIX E

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10.4.6 EFD1000 Installation Menu Configuration

Use this form for both the EFD1000 PFD and EFD1000 MFD

INSTALLATION MENU Configuration - EFD1000

Installation Date: 6/24/14	
Aircraft Model: Commander	EFD1000 S/N: 14285, 14442, 2937
Aircraft Type: 114TC	RSM S/N: 15809, 1739
Aircraft S/N: 20005	ACU S/N: 14185
	CM S/N: 15485, 15454, 15421

WARNING: Only an appropriately rated mechanic or repairman (14 CFR 43.3) may set the values on the IAS Config A and B menu pages. The values must match the certified speeds in the Aircraft Flight Manual (AFM), Pilot Operating Handbook (POH), or other legal form of documentation (e.g., Placard).

The following menus are based on software version 2.5. Previous software levels do not have all shown options below and some items have been moved to another menu page.

10.4.6.1 Installation Menu Page - IAS CONFIG A

Aircraft that use a Vmo/Mmo airspeed indicator are shown in Table 10-1 (Section 10.4.8.1) and will set the MOL TYPE to 2 thru 6. See Table 10-1 for MOL TYPE and MOL Parameter values. Set the MOL MARKER/BAND to either a BARBER POLE or REDLINE depending on existing airspeed indicator marking. MACH DSPL TYPE may be set to operator preference. This setting determines when the airspeed tape changes from Vmo to Mmo, either at an Altitude or at a Speed.

All standard airspeed indicators (that use a Vne) will set the MOL TYPE to 1 and then enter the Vne in the MOL PARAM VALUE field.

INSTALLATION MENU PAGE - IAS CONFIG A		SW v2.3 and above
Feature	**Options**	**Actual Setting**
MOL TYPE	1,2,3,4,5,6	1
MOL PARAM SEL	See instructions in table below	VNE
MOL PARAM VALUE	See instructions in table below	186
MOL MARKER/BAND	BARBER POLE, REDLINE	RED LINE
MACH DSPL TYPE	ALTITUDE, SPEED	ALTITUDE
Notes:		

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10.4.6 EFD1000 Installation Menu Configuration

Use this form for both the EFD1000 PFD and EFD1000 MFD

INSTALLATION MENU Configuration - EFD1000

Installation Date: 6/24/14	
Aircraft Model: Commander	EFD1000 S/N: 14285, 14442, 2937
Aircraft Type: 114TC	RSM S/N: 15809, 1739
Aircraft S/N: 20005	ACU S/N: 14185
	CM S/N: 15485, 15454, 15421

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All standard airspeed indicators (that use a Vne) will set the MOL TYPE to 1 and then enter the Vne in the MOL PARAM VALUE field.

INSTALLATION MENU PAGE - IAS CONFIG A		SW v2.3 and above
Feature	**Options**	**Actual Setting**
MOL TYPE	1,2,3,4,5,6	1
MOL PARAM SEL	See instructions in table below	VNE
MOL PARAM VALUE	See instructions in table below	186
MOL MARKER/BAND	BARBER POLE, REDLINE	REDLINE
MACH DSPL TYPE	ALTITUDE, SPEED	ALTITUDE
Notes:		

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10.4.6.2 Installation Menu Page - IAS CONFIG B

Set Speed Bands per Aircraft Flight Manual. Note- Vne is set on previous page.

OVERSPEED ALERT-A setting of DISABLE is the only valid configuration allowed under the STC at this time.

INSTALLATION MENU PAGE - IAS CONFIG B		SW v2.3 and above
Feature	**Options**	**Actual Setting**
OVERSPEED ALERT	DISABLE, ENABLE	DISABLE
Vno	0 to 450	162
Vfe	0 to 450	109
Vs	0 to 450	N/A
Vso	0 to 450	N/A
Notes:		

10.4.6.3 Installation Menu Page - IAS CONFIG C

Set Speed Markers per Aircraft Flight Manual.

INSTALLATION MENU PAGE - IAS CONFIG C		SW v2.0 and above
Feature	**Options**	**Actual Setting**
Vyse	0 to 450	N/A
Vmc	0 to 450	N/A
Triangle	0 to 450	N/A
Not Used		
Not Used		
Notes:		

10.4.6.4 Installation Menu Page - IAS CONFIG D

NOTE: These selections are rotorcraft only and are grayed out.

Does not apply to EFD1000

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10.4.6.5 Installation Menu Page – IAS CONFIG E

This menu is used to select the color of the airspeed tape speed bands so that they can exactly match the existing airspeed indicator.

SPD Band 2 – Maximum structural cruising speed (Vno) to the never exceed speed (Vne). Yellow is the default for piston engine aircraft. Set as required to match existing IAS indicator.

SPD Band 3 – No flap stall speed (Vs) to the maximum structural cruising speed (Vno). Green is the default for piston engine aircraft. Set as required to match existing IAS indicator.

SPD Band 4 – Full flap stall speed (Vso) to the maximum flap extend speed (Vfe). White is the default for piston engine aircraft. Set as required to match existing IAS indicator.

Note: "CLEAR" will render a tape marking (Speed Band) with no color, which will replicate certain Vmo/Mmo mechanical airspeed indicators such as ones with a black background with white tick marks and numbers.

INSTALLATION MENU PAGE – IAS CONFIG E		SW v2.3 and above
Feature	**Options**	**Actual Setting**
SPD Band 2	YELLOW, CLEAR	YELLOW
SPD Band 3	GREEN, WHITE, CLEAR	GREEN
SPD Band 4	WHITE, CLEAR	WHITE
Not Used		
Not Used		
Notes:		

10.4.6.6 Installation Menu Page – IAS CONFIG F

IAS UNITS – Set per Aircraft Flight Manual.

TAPES – Configure based on Flowchart in Figure 10-4.

VPSD EDIT – Set based on "Operator Configuration Checklist" of Appendix C or to owner/operator preference.

INSTALLATION MENU PAGE – IAS CONFIG F		SW v2.0 and above
Feature	**Options**	**Actual Setting**
IAS UNITS	kts, mph	KTS
TAPES	UNLOCKED, LOCK OFF, LOCK ON	Lock ON
VSPD EDIT	UNLOCKED, LOCKED	UNLOCKED
Not Used		
Not Used		
Notes:		

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10.4.6.7 Installation Menu Page - IAS CONFIG G (SW v2.2 and above)

IAS DISPLAY - DISABLE will remove the airspeed bug from the tape, the upper left window, and the left knob. The window will continue identify the units (KTS or MPH) displayed on the airspeed tape.

ALT DISPLAY - DISABLE will remove the altitude bug from the tape, the upper right window, and the right knob. It also removes the MIN field.

BARO DISPLAY - When disabled will remove the BARO setting from the right knob and the BARO display from the center Databar. The Disable setting will also remove the baro-corrected altitude label from the A429 and RS232 busses.

VSI DISPLAY (added sw 2.2.3) - Always On means the tape will always be displayed. Always Off means the tape is always turned off. AUTO means the tape will declutter when the vertical speed is between +/-100fpm. ALWAYS ON or AUTO are the only settings permitted under this STC.

CAUTION: Setting BARO DISPLAY to DISABLE may only be used when the TAPES are Locked Off and it is a stand-alone PFD. PFD/MFD installations must be set to ENABLE.

INSTALLATION MENU PAGE - IAS CONFIG G		SW v2.2 and above
Feature	Options	Actual Setting
IAS DISPLAY	DISABLE, ENABLE	ENABLE
ALT DISPLAY	DISABLE, ENABLE	ENABLE
BARO DISPLAY	DISABLE1, ENABLE 1(read Caution above)	—
VSI DISPLAY	ALWAYS ON, ALWAYS OFF, AUTO*	AUTO
Not Used		
Notes: * ALWAYS ON or AUTO are the only permitted settings under this AML-STC		

10.4.6.8 Installation Menu Page - NAV SETUP A

The following menu will be used to configure the EFD1000 system for the installed GPS, NAV and autopilot interfaces. The installation wiring diagrams in Section 9 have a Configuration Matrix table that will be used to set ID#1 and ID#2.

INSTALLATION MENU PAGE - NAV SETUP A		SW v2.3 and above
Feature	Options	Actual Setting
GPS/NAV #1	NONE,A,B,C,D,E,F,G,H,I,J,K,L,M,P,Q,R,S	A
GPS/NAV #2	NONE,A,B,C,D,E,F,G,H,I,J,K,L,M	D
Not Used		
Not Used		
Not Used		
If no GPS or NAV's are installed but the ACU is installed, then use Config 1S-2NONE		

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10.4.6.9 Installation Menu Page – NAV SETUP B

The following menu will pre-fill based on the GPS/NAV #1/2 selections made on the previous page. No changes required here unless it is required to change the GPS1/GPS2/NAV1/NAV2 order to accommodate parallel connection of the EFD1000 and a second EFIS system running GPS and NAV at mixed A429 speeds (see Figure 9-9B and 9-9C for these connections).

INSTALLATION MENU PAGE – NAV SET UP B		SW v2.3 and above
Feature	Options	Actual Setting
429 IN PORT 1	NONE, GPS1, VLOC1, VLOC1+ACU, GPS1+ACU, GPS1+ACU+VLOC1, GPS2, VLOC2, VLOC2+ACU, GPS2+ACU, GPS2+ACU+VLOC2	GPS1
429 IN PORT 2	Same as IN PORT 1 options	VLOC1
429 IN PORT 3	Same as IN PORT 1 options	NONE
429 IN PORT 4	Same as IN PORT 1 options	VLOC 2+ACU
429 IN PORT 5	NONE, TRAFFIC*	TRAFFIC
* If setting is grayed out it is because this feature requires a "Unlock" card on PFD.		

10.4.6.10 Installation Menu Page – NAV SETUP C

A429 input ports will be set to HIGH or LOW. ADF/RAD ALT/remote OAT require high speed to the ACU2. The standard ACU only operates low speed. Set the appropriate number of ADF receivers installed. Set NAV#2 Position Source to GPS1 if it is desired to have GPS1 map data displayed when VLOC#2 is selected. Set to GPS2 if GPS2 map data is to be displayed when VLOC#2 is selected. Single GPS installations set to GPS1.

INSTALLATION MENU PAGE – NAV SET UP C		SW v2.3 and above
Feature	Options	Actual Setting
429 OUT PORT SPEED	HIGH, LOW(1)	LOW
429 IN PORTS 1 & 2 SPEED	HIGH, LOW(1)	LOW
429 IN PORTS 3 & 4 SPEED	HIGH, LOW(1)	LOW
ADF CONFIG	NONE, 1, 2	NONE
NAV #2 POSITION SOURCE	GPS1, GPS2	GPS1
(1) ACU set to LOW. ACU2 set to HIGH if using ADF, RAD ALT, or remote OAT, Otherwise it could be set to low.		

NOTE: Power to the ACU2 should be reset after configuring the EFD because if it was running low speed when powered up, it will continue to run low speed even if changed to high above until it boots back up. ADF/RAD/ALT/RMT OAT will not function in this case.

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10.4.6.11 Installation Menu Page – RS232 CONFIG A

The following menu is used to configure the RS-232 RX IN sensor ports. Options include GPS TYPE X, WX500, XM Weather, RSM, EFD1000 PFD, EFD1000 MFD, and EFD500 MFD inter-system communication. Note – some ports do not include all interface options. (See wiring diagrams in sections 9 to determine how each port was wired and configure port accordingly.)

NOTE – Setting and wiring RS232 TX0 or RS232 TX1 to DFC A/P 1 or DFC A/P 2 requires the associated RS232 RX port (0 or 1) to be wired/configured as DFC A/P or unused. For example, using 232 TX0 for DFC A/P 1 will require 232 RX0 to be wired to DFC90 P2-24 or unused. No other 232 RX0 configuration options are available. RS232 TX2 and TX3 do not have this restriction.

NOTE – Use of the "DFC A/P" settings not approved under AML-STC SA10822SC. See Avidyne DFC-90 STC installation instructions for setting of these values.

INSTALLATION MENU PAGE – RS232 CONFIG A		SW v2.0 and above
Feature	**Options**	**Actual Setting**
232 IN PORT 0	NONE, RSM, GPS TYPE 4, GPS TYPE 5, DFC A/P	RSM
232 IN PORT 1	NONE, GPS TYPE 1, GPS TYPE 2, GPS TYPE 3, GPS TYPE 4, GPS TYPE 5, XM[1], DFC A/P	NONE
232 IN PORT 2	NONE, GPS TYPE 1, GPS TYPE 2, GPS TYPE 3, GPS TYPE 4, GPS TYPE 5, DFC A/P	NONE
232 IN PORT 3	NONE, WX500, GPS TYPE 4, GPS TYPE 5, DFC A/P	NONE
232 IN PORT 4	NONE, EFD1000 MFD, EFD1000 PFD, EFD500 MFD	EFD 500 MFD
Notes: GPS TYPE 1= KLN94/90B "standard", GPS TYPE 2= KLN94 Enhanced, GPS TYPE 3= GX50/55/60/65, GPS TYPE 4 & GPS TYPE 5 – not used at this time. DFC A/P is selected when the DFC-90 autopilot is connected to this port. [1] If XM is selected then ADC type 1 or 2 cannot be selected for 232 OUT PORT 1		

10.4.6.12 Installation Menu Page – RS232 CONFIG B

The following menu is used to configure the RS-232 RX IN 5 sensor port and the four RS-232 TX OUT ports. Options include XM Weather, WX500, ADC (two types) and PFD or MFD inter-system communications. Note – some ports do not include all interface options. (See wiring diagrams in sections 9 to determine how each port was wired and configure port accordingly.)

NOTE – Setting and wiring RS232 TX0 or RS232 TX1 to DFC A/P 1 or DFC A/P 2 requires the associated RS232 RX port (0 or 1) to be wired/configured as DFC A/P or unused. For example, using 232 TX0 for DFC A/P 1 will require 232 RX0 to be wired to DFC90 P2-24 or unused. No other 232 RX0 configuration options are available. RS232 TX2 and TX3 do not have this restriction.

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NOTE – Use of the "DFC A/P" settings not approved under AML-STC SA10822SC. See Avidyne DFC-90 STC installation instructions for setting of these values.

INSTALLATION MENU PAGE – RS232 CONFIG B		SW v2.0 and above
Feature	**Options**	**Actual Setting**
232 IN PORT 5	NONE, EFD1000 MFD, EFD1000 PFD, EFD500 MFD	EFD 1000 PFD
232 OUT PORT 0	NONE, RSM, GPS TYPE 4, GPS TYPE 5, DFC A/P 1, DFC A/P 2	RSM
232 OUT PORT 1	NONE, XM, ADC TYPE 1[1], ADC TYPE 2[1], GPS TYPE 4, GPS TYPE 5, DFC A/P 1, DFC A/P 2	NONE
232 OUT PORT 2	NONE, EFD, ADC TYPE 1, ADC TYPE 2, GPS TYPE 4, GPS TYPE 5, DFC A/P 1, DFC A/P 2	EFD
232 OUT PORT 3	NONE, WX500, ADC TYPE 1, ADC TYPE 2, GPS TYPE 4, GPS TYPE 5, DFC A/P 1, DFC A/P 2	ADC TYPE 1
Notes: ADC TYPE 1="Z" (Shadin) format, ADC TYPE 2="C" (Bendix King C) format		
Notes: EFD is any PFD or MFD, GPS TYPE 4 & GPS TYPE 5 not used at this time. DFC A/P 1 is selected when DFC-90 P2-26 is connected to this port. DFC A/P 2 is selected when DFC-90 P2-25 is connected to this port. [1] If XM was selected for 232 IN PORT 1 then ADC type 1 or 2 cannot be selected for 232 OUT PORT 1		

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10.4.6.13 Installation Menu Page - RS232 CONFIG C

For PFD only installations these are grayed out. For PFD/MFD installations set all three to HIGH after configuring the inter-system buss in the previous two menu pages.

INSTALLATION MENU PAGE - RS232 CONFIG C		SW v2.5 and above
Feature	**Options**	**Actual Setting**
232 IN PORT 4 SPEED	LOW, HIGH	LOW
232 IN PORT 5 SPEED	LOW, HIGH	LOW
232 OUT PORT 2 SPEED	LOW, HIGH	LOW
Not Used		
Not Used		
Note: These port settings are grayed out unless a PFD/MFD installation and the inter-system buss is configured.		

10.4.6.14 Installation Menu Page - ACU CONFIG A

The following menu configures the emulation modes for the Flight Director and HDG and CRS Datum interfaces. The installation wiring diagrams in Section 9 have a Configuration Matrix table that will be used to set ACU HSI TYPE and ACU FD TYPE. (See Section 10.4.8 for example). Flight Director display pitch and roll offset adjustments are also made.

INSTALLATION MENU PAGE - ACU CONFIG A		SW v2.3 and above
Feature	**Options**	**Actual Setting**
ACU HSI TYPE	0,1,2,3	0
ACU FD TYPE	0,1,2,3,4,5,6,7 (8,9,10,11,12)(1)	1
ACU DATUM	NORMAL,REVERSED	NORMAL
FD PITCH OFFSET ADJ	-10.0 to +10.0 (degrees)	0
FD ROLL OFFSET ADJ	-10.0 to +10.0 (degrees)	0
Notes: (1) FD TYPES 8-12 require optional "Unlock" card.		

10.4.6.15 Installation Menu Page - ACU CONFIG B

The ACU/ACU2 transmit buss speed to the GPS receiver and receive buss speed from the digital VLOC receiver will be configured. For ACU set both to LOW. ACU2 may change these to HIGH if required but most configurations as shown in Section 9 use Low speed settings.

INSTALLATION MENU PAGE - ACU CONFIG B		SW v2.3 and above
Feature	**Options**	**Actual Setting**
Digital Nav Tx Speed	HIGH. LOW	LOW
Digital Nav Rx Speed	HIGH, LOW	LOW
Not Used		
Not Used		
Not Used		
Notes: Tx Speed is ACU P3 pins 4&5, Rx Speed is ACU P1 pins 1&2		

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10.4.6.16 Installation Menu Page - MISC CONFIG A

RSM Orientation- TOP (A-05-111-00, -001, and -002 RSM), BOTTOM (-003 RSM)

RSM GPS Enable - ENABLE if A-05-111-00 RSM or -001 RSM and RSM has view of satellites. Set to INTERCOM if MFD1000 using a -002 or -003 RSM or -001 RSM is internal with no view of satellites. Set to DISABLE if a PFD is using a -002 or -003 RSM or has no view of satellites. INTERCOM setting was added in software v2.3 and later.

RAD ALT CONFIG -Set to NONE unless Radio Altimeter is installed, then set to correct type per table in Section 8.

RSM GPS USAGE - EMER ONLY is the only permitted setting under the STC.

WIND DISPLAY (added SW v2.2.3) - ENABLE>=30KIAS is default setting. DISABLE removes the wind vector/speed/direction from databar. Maybe set per operator preference.

***Caution:** Use of the MODE 2 selection affects the certification of the EFD1000 system and is prohibited.*

INSTALLATION MENU PAGE - MISC CONFIG A		SW 2.3 and above
Feature	**Options**	**Actual Setting**
RSM Orientation	TOP, BOTTOM (Inverted orientation)	TOP
RSM GPS Enable	DISABLE, ENABLE, INTERCOM	ENABLE
RSM GPS USAGE	EMER ONLY/ MODE 2 (read Caution above)	EMER ONLY
RAD ALT CONFIG	NONE, TYPE 1, TYPE 2, TYPE 3, TYPE 4, TYPE 5, TYPE 6, TYPE 7	NONE
WIND DISPLAY	DISABLE, ENABLE>=30KIAS, ENABLE>=40KIAS, ENABLE>=50KIAS, ENABLE>=60KIAS, ENABLE>=70KIAS, ENABLE>=80KIAS, ENABLE>=90KIAS	ENABLE>=30KIAS
Notes: The standard EFD1000 MFD RSM (-002) does not include a GPS.		

10.4.6.17 Installation Menu Page - MISC CONFIG B

The following menu will be used to set the aircraft electrical system voltage. EFD Battery Config will be set to INTERNAL for all -001 EFDs and REMOTE for all -002 EFDs. The Panel Tilt Pitch Adj is aligned for tilted instrument panels and the Panel Roll Adj is adjusted to compensate for slightly misaligned EFD mounting in the instrument panel. See Section 10.4.8for instructions on setting the Panel Tilt Pitch Adj, Panel Roll Adj, and Attitude Ref Symbol adjustments.

INSTALLATION MENU PAGE - MISC CONFIG B		SW 2.0 and above
Feature	**Options**	**Actual Setting**
ELEC SYSTEM	14 VOLT, 28 VOLT	28
EFD BATTERY CONFG:	INTERNAL, REMOTE*	INTERNAL
ATTITUDE REF SYMBOL ADJ:	-5.0 to +5.0 degrees	0
PANEL TILT PITCH ADJ	-10.0 to +20.0 degrees	+0.4
PANEL ROLL ADJ	-2.0 to +2.0 degrees	-0.3
Notes: * REMOTE is for EFD1000 MFD (-002) with EBB58 only		

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10.4.6.18 Installation Menu Page – MISC CONFIG C

COMPOSITE PHASE (VOR1,2) - If the analog NAV receiver has a 180° phase shifted output (i.e.,RT-385) then select 180 for VOR1 or 2 or both.

GPSS GAIN – 1.0 is default, Rate Based autopilots may need a setting of up to 2.0.

CRS SDI - For a dual A429 GPS interface set to NAV 1/2 and set GPS1 for SDI=LNAV1 and GPS2 for SDI=LNAV2. All other GPS configurations set to COMMON. See Figure 9.27.

OBS DISPLAY - Set to ENABLE (this is a user preference item and can be set to disable).

INSTALLATION MENU PAGE - MISC CONFIG C		SW 2.0 and above
Feature	**Options**	**Actual Setting**
COMPOSITE PHASE (VOR1,2)	(0,0) (180,0) (0,180) (180,180)	0,0
GPSS GAIN:	0.5 to 2.0 (0.1 increments)	1.00
CRS SDI	COMMON, NAV 1/2 (SW v2.2 and above)	COMMON
OBS DISPLAY	DISABLE, ENABLE (SW v2.2 and above)	ENABLE
Not Used		
Notes:		

10.4.6.19 Installation Menu Page – MISC CONFIG D

OAT Source - If a PFD only install, and the RSM is internally mounted or in an area that affects OAT accuracy then set to NONE. If the RSM is externally mounted then set to RSM. If using a remote OAT probe connected to the ACU2 then set to PROBE. If a multi display install, and the connected RSM does not have accurate OAT and another EFD does then set to INTERCOM and this EFD will use the other EFD's OAT information.

OAT BIAS – Should the OAT display on the PFD be in error on the high side it may be lowered by up to 8 degrees C. Note the adjustment is done in degrees C only. If configured for degrees F then perform the conversion and lower the value in C then required amount.

***Caution:** Do not adjust the OAT BIAS without comparing it to a calibrated temperature source.*

Adjustment procedure:

1) Make sure the aircraft has been in a hangar for long enough that the skin temperature has reached that of the surrounding air temperature or the aircraft and RSM are not being influenced by radiant heat (such as the Sun or radiant heaters).
2) Turn on the EFD1000 system and allow it to run for a minimum 20 minutes.
3) Using the reading from a calibrated temperature gauge located in the immediate vicinity of the RSM, compare it to the OAT reading on the PFD.
4) If the OAT reading on the PFD is high by up to 8 degrees it can be adjusted by entering -1 to -8 in the OAT BIAS field.

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SV ALERT CONFIG – There are 5 options but only two are permitted under the STC. Set to Option 1 if the aircraft does not have a TAWS installed, set to Option 3 if it does have a TAWS installed. FPM is Flight Path Marker.

1= Alert Tone, Alert Annunciations, FPM Alert Colors, and Terrain Coloring are configured

2= Only Alert Annunciations, FPM Alert Colors, and Terrain Coloring are configured

3= Only FPM Alert Colors, and Terrain Coloring are configured

4= Only Terrain Coloring is configured

5= None of the Above

DISPLAY FPM – There are 3 settings and the "PFD/MFD" setting is recommended.

DISABLE = FPM is not displayed

PFD ONLY= FPM is displayed on the PFD, not on the MFD

PFD/MFD= FPM is displayed on both the PFD and MFD

AIRCRAFT REF SYMBOL – Option 1 is recommended.

1= Ref Symbol Type 1

2= Ref Symbol Type 2

3= Ref Symbol Type 3

INSTALLATION MENU PAGE – MISC CONFIG D		SW v2.4 and above
Feature	**Options**	**Actual Setting**
OAT SOURCE	NONE, RSM, PROBE, INTERCOM	RSM
OAT BIAS	0 to –8 degrees	0
SV ALERT CONFIG	1,2,3,4,5	3
DISPLAY FPM	DISABLE, PFD ONLY, PFD/MFD	MFD/PFD
AIRCRAFT REF SYMBOL	1,2,3	1
Notes:		

10.4.6.20 Installation Menu Page – RSM CALIBRATION

The following menu will be used in the next section to calibrate and validate the magnetometer in the RSM. Heading errors of up to +/– 6.0° can be calibrated at 30° increments beginning with North. (Follow RSM Cal procedure in Section 10.5.)

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INSTALLATION MENU PAGE – RSM CALIBRATION	SW v2.0 and above
Feature	Options
START CALIBRATION	Press to Initiate
ACCEPT CALIBRATION?	Press to ACCEPT Cal
REJECT CALIBRATION?	Press to REJECT Cal
HDG SEL	030° to 360° (in 30° increments)
HDG ADJ	-6.0 to +6.0 (degrees)
Notes:	

This table is used to record the HDG ADJ values used to bring the compass heading values in to specification.

RSM CALIBRATION (PFD Software 1.1 and later)	PAGE 12	Options	Actual Setting
HDG SEL: 030	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 060	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 090	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 120	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 150	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 180	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 210	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 240	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 270	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 300	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 330	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	
HDG SEL: 360	KEY 4		
HDG ADJ:	KEY 5	Editable: -6 to +6	

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10.4.6.21 Installation Menu Page – ACCEL BIAS CAL

This page is for Factory Calibration only and has no installation purpose.

10.4.6.22 Installation Menu Page – WX-500

The following menu is used for WX-500 configuration, system status, and system test. HEAD TYPE is configuration status. It will display NONE if there is no WX-500 connection, DISPLAY when a RS232 RX Port is set to WX500, and CONTROL when a RS232 TX Port is set to WX500.

INSTALLATION MENU PAGE – WX-500		SW v2.0 and above
Feature	**Options**	**Actual Setting**
HEAD TYPE	NONE, DISPLAY, CONTROL	NONE
SYSTEM DATA	PAGE1,PAGE2,PAGE3,PAGE4	
STRIKE TEST	Press to Initiate	
NOISE MONITOR	Press to Initiate	
ANTENNA MOUNT	TOP,BOTTOM	
Notes: The HEAD Type menu entry is status only. It is necessary to exit and re-enter the menu to view the updated information.		

10.4.6.23 Installation Menu Page – DFC A/P CONFIG PAGE A

INSTALLATION MENU PAGE – DFC A/P CONFIG PAGE A		SW v2.6 and above
Feature	**Options**	**Actual Setting**
Aircraft Configuration	1 or 2 (1=non-Cirrus, 2= Cirrus)	2
Pitch Servo Type	0-255	1
Pitch Linkage Type	0-255	1
Pitch Trim Servo Type	0-255	1
Turn Coordinator Configuration	1 or 2 (1=installed, 2= not installed)	2
Notes: Use of these settings not approved under AML-STC SA10822SC. See Avidyne DFC-90 STC installation instructions for setting of these values.		

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10.4.6.24 Installation Menu Page – DFC A/P CONFIG PAGE B

INSTALLATION MENU PAGE – DFC A/P CONFIG PAGE B		SW v2.6 and above
Feature	**Options**	**Actual Setting**
Roll Servo Type	0-255	1
Pitch Linkage Type	0-255	1
Buzzer Volume	0-11	6
Push to Test Buzzer	Action	—
Maximum Autopilot Speed	0-450	185
Notes: Use of these settings not approved under AML-STC SA10822SC. See Avidyne DFC-90 STC installation instructions for setting of these values.		

10.4.6.25 Installation Menu Page – NETWORK PAGE

This menu is for diagnostic purposes only, unless an EA100 is installed.

For EA100 installations verify the following:

1) IP ADDR is set to **192.168.28.12**
2) SUBNET MASK to **255.255.255.0**
3) GATEWAY to **0**
4) PORT to **8550**

Use the line select key next to IP ADDR and the right knob to set the value. Subsequent pushes of the line select key will advance the cursor to the right so that each set of digits between the decimal points may be entered.

INSTALLATION MENU PAGE – NETWORK PAGE	SW v2.0 and above
Feature	**Options**
IP ADDR	0-255
SUBNET MASK	0-255
GATEWAY	0-255
PORT	0-9999
Not Used	
Notes: Repeated presses of top 3 line select keys will select one of 4 selectable fields	

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10.4.6.24 Installation Menu Page - DFC A/P CONFIG PAGE B

INSTALLATION MENU PAGE - DFC A/P CONFIG PAGE B		SW v2.6 and above
Feature	**Options**	**Actual Setting**
Roll Servo Type	0-255	1
Pitch Linkage Type	0-255	1
Buzzer Volume	0-11	6
Push to Test Buzzer	Action	—
Maximum Autopilot Speed	0-450	185
Notes: Use of these settings not approved under AML-STC SA10822SC. See Avidyne DFC-90 STC installation instructions for setting of these values.		

10.4.6.25 Installation Menu Page - NETWORK PAGE

This menu is for diagnostic purposes only, unless an EA100 is installed.

For EA100 installations verify the following:

1) IP ADDR is set to **192.168.28.12**
2) SUBNET MASK to **255.255.255.0**
3) GATEWAY to **0**
4) PORT to **8550**

Use the line select key next to IP ADDR and the right knob to set the value. Subsequent pushes of the line select key will advance the cursor to the right so that each set of digits between the decimal points may be entered.

INSTALLATION MENU PAGE - NETWORK PAGE	SW v2.0 and above
Feature	**Options**
IP ADDR	0-255
SUBNET MASK	0-255
GATEWAY	0-255
PORT	0-9999
Not Used	
Notes: Repeated presses of top 3 line select keys will select one of 4 selectable fields	

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10.4.7 EFD500 MFD Installation Menu Configuration

INSTALLATION MENU Configuration – EFD500

Installation Date: 6/24/14	
Aircraft Model: Commander	EFD500 S/N: 2937
Aircraft Type: 114TC	RSM S/N: N/A
Aircraft S/N: 20005	ACU S/N: 14185
	CM S/N: 15421

NOTE: Some menus are grayed out as they do not apply to the EFD500 MFD. The EFD500 is depopulated of the ADC and AHRS sensors.

10.4.7.1 INSTALLATION MENU PAGE – IAS CONFIG A

Does not apply to EFD500

10.4.7.2 Installation Menu Page – IAS CONFIG B

Does not apply to EFD500

10.4.7.3 Installation Menu Page – IAS CONFIG C (SW v2.2 and above)

NOTE: This page is not shown in SW v2.0 and v2.1.

Does not apply to EFD500

10.4.7.4 Installation Menu Page – IAS CONFIG D

NOTE: These selections are rotorcraft only and are grayed out.

Does not apply to EFD500

10.4.7.5 Installation Menu Page – IAS CONFIG E

Does not apply to EFD500

10.4.7.6 Installation Menu Page – IAS CONFIG F

Does not apply to EFD500

10.4.7.7 Installation Menu Page – IAS CONFIG G

Does not apply to EFD500

10.4.7.8 Installation Menu Page – NAV SET UP A

The following menu will be used to configure the EFD500 system for the installed GPS, NAV and autopilot interfaces. The installation wiring diagrams in Section 9 have a Configuration Matrix table that will be used to set ID#1 and ID#2.

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INSTALLATION MENU PAGE - NAV SET UP A		SW v2.3 and above
Feature	Options	Actual Setting
GPS/NAV #1	NONE,A,B,C,D,E,F,G,H,I,J,K,L,M,P,Q,R,S	A
GPS/NAV #2	NONE,A,B,C,D,E,F,G,H,I,J,K,L,M	D
Not Used		
Not Used		
Not Used		
If no GPS or NAV's are installed but the ACU is installed, then use Config 1S-2NONE		

10.4.7.9 Installation Menu Page - NAV SET UP B

The following menu will pre-fill based on the GPS/NAV #1/2 selections made on the previous page. No changes required here unless it is required to change the GPS1/GPS2/NAV1/NAV2 order to accommodate parallel connection of the EFD1000 and a second EFIS system running GPS and NAV at mixed A429 speeds (see Figure 9-11A and 9-11B for these connections).

INSTALLATION MENU PAGE - NAV SET UP B		SW v2.3 and above
Feature	Options	Actual Setting
429 IN PORT 1	NONE, GPS1, VLOC1, VLOC1+ACU, GPS1+ACU, GPS1+ACU+VLOC1, GPS2, VLOC2, VLOC2+ACU, GPS2+ACU, GPS2+ACU+VLOC2	GPS1
429 IN PORT 2	Same as IN PORT 1 options	VLOC1
429 IN PORT 3	Same as IN PORT 1 options	NONE
429 IN PORT 4	Same as IN PORT 1 options	VLOC2+ACU
429 IN PORT 5	NONE, TRAFFIC*	TRAFFIC
* If setting is grayed out it is because this feature requires a "Unlock" card on PFD.		

10.4.7.10 Installation Menu Page - NAV SET UP C

A429 input ports will be set to HIGH or LOW. Set NAV#2 Position Source to GPS1 if it is desired to have GPS1 map data displayed when VLOC#2 is selected. Set to GPS2 if GPS2 map data is to be displayed when VLOC#2 is selected. Single GPS installations set to GPS1.

INSTALLATION MENU PAGE - NAV SET UP C		SW v2.3 and above
Feature	Options	Actual Setting
429 OUT PORT SPEED(2)	HIGH, LOW	LOW
429 INPUT PORTS 1 & 2 SPEED	HIGH, LOW(1)	LOW
429 INPUT PORTS 3 & 4 SPEED	HIGH, LOW(1)	LOW
ADF CONFIG	Does not apply to EFD500	NONE
NAV #2 POSITION SOURCE	GPS1, GPS2	GPS1
(1)Set the same as PFD config. (2) EFD500 has no usable A429 labels on the TX1 output.		

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10.4.7.11 Installation Menu Page – RS232 CONFIG A

The following menu is used to configure the RS-232 RX IN sensor ports. Options include GPS TYPE X, WX500, XM Weather, RSM, EFD1000 PFD, EFD1000 MFD, and EFD500 MFD inter-system communication. Note – some ports do not include all interface options. (See wiring diagrams in sections 9 to determine how each port was wired and configure port accordingly.

INSTALLATION MENU PAGE – RS232 CONFIG A		SW v2.0 and above
Feature	**Options**	**Actual Setting**
232 IN PORT 0	NONE, RSM, GPS TYPE 4, GPS TYPE 5	NONE
232 IN PORT 1	NONE, GPS TYPE 1, GPS TYPE 2, GPS TYPE 3, GPS TYPE 4, GPS TYPE 5, XM	NONE
232 IN PORT 2	NONE, GPS TYPE 1, GPS TYPE 2, GPS TYPE 3, GPS TYPE 4, GPS TYPE 5	NONE
232 IN PORT 3	NONE, WX500, GPS TYPE 4, GPS TYPE 5	NONE
232 IN PORT 4	NONE, EFD1000 MFD, EFD1000 PFD, EFD500 MFD	EFD 1000 MFD
Notes: GPS TYPE 1= KLN94/90B "standard", GPS TYPE 2= KLN94 Enhanced, GPS TYPE 3= GX50/55/60/65, GPS TYPE 4 & GPS TYPE 5 – not used at this time		

10.4.7.12 Installation Menu Page – RS232 CONFIG B

The following menu is used to configure the RS-232 RX IN 5 sensor port and the four RS-232 TX OUT ports. Options include XM Weather, WX500, and PFD or MFD inter-system communications. Note – some ports do not include all interface options. (See wiring diagrams in sections 9 to determine how each port was wired and configure port accordingly.)

INSTALLATION MENU PAGE – RS232 CONFIG B		SW v2.0 and above
Feature	**Options**	**Actual Setting**
232 IN PORT 5	NONE, EFD1000 MFD, EFD1000 PFD, EFD500 MFD	EFD 1000 PFD
232 OUT PORT 0	NONE, RSM, GPS TYPE 4, GPS TYPE 5	NONE
232 OUT PORT 1	NONE, XM, ADC TYPE 1, ADC TYPE 2, GPS TYPE 4, GPS TYPE 5	NONE
232 OUT PORT 2	NONE, EFD, ADC TYPE 1, ADC TYPE 2, GPS TYPE 4, GPS TYPE 5	EFD
232 OUT PORT 3	NONE, WX500, ADC TYPE 1, ADC TYPE 2, GPS TYPE 4, GPS TYPE 5	ADC TYPE 1
Notes: ADC TYPE 1="Z" (Shadin) format, ADC TYPE 2="C" (Bendix King C) format		
Note: EFD is any PFD or MFD, GPS TYPE 4 & GPS TYPE 5 not used at this time		

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10.4.7.13 Installation Menu Page - RS232 CONFIG C

For PFD only installations these are grayed out. For PFD/MFD installations set all three to HIGH after configuring the inter-system buss in the previous two menu pages.

INSTALLATION MENU PAGE - RS232 CONFIG C		SW v2.5 and above
Feature	**Options**	**Actual Setting**
232 IN PORT 4 SPEED	LOW, HIGH	LOW
232 IN PORT 5 SPEED	LOW, HIGH	LOW
232 OUT PORT 2 SPEED	LOW, HIGH	LOW
empty		
empty		
Note: These port settings are grayed out unless a PFD/MFD installation and the inter-system buss is configured.		

10.4.7.14 Installation Menu Page - ACU CONFIG A

Does not apply to EFD500

10.4.7.15 Installation Menu Page - ACU CONFIG B

Does not apply to EFD500

10.4.7.16 Installation Menu Page - MISC CONFIG A

RSM GPS Enable - Set to INTERCOM. If the PFD does not have the RSM GPS enabled then set to DISABLE. INTERCOM setting was added in software v2.3 and later.

RSM GPS USAGE - EMER ONLY is the only permitted setting under the STC.

***Caution:* Use of the MODE 2 selection affects the certification of the EFD1000 system and is prohibited.**

WIND DISPLAY (added SW v2.2.3) - ENABLE>=30KIAS is default setting. DISABLE removes the wind vector/speed/direction from databar. Maybe set per operator preference.

INSTALLATION MENU PAGE - MISC CONFIG A		SW 2.3 and above
Feature	**Options**	**Actual Setting**
RSM Orientation	Does not apply to EFD500	TOP
RSM GPS Enable	DISABLE, ENABLE, INTERCOM[1]	DISABLE
RSM GPS USAGE	EMER ONLY/ MODE 2 (read Caution above)	EMER ONLY
RAD ALT CONFIG	Does not apply to EFD500	NONE
WIND DISPLAY	DISABLE, ENABLE>=30KIAS, ENABLE>=40KIAS, ENABLE>=50KIAS, ENABLE>=60KIAS, ENABLE>=70KIAS, ENABLE>=80KIAS, ENABLE>=90KIAS	ENABLE >=30 KIAS
[1]Notes: The EFD500 MFD does not include a RSM. Set to INTERCOM so the MFD can use the PFD or MFD1000 RSM GPS.		

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10.4.7.17 Installation Menu Page – MISC CONFIG B

ELEC SYSTEM – Set to aircraft charging system voltage.

EFD BATTERY CONFIG – Set to INTERNAL

INSTALLATION MENU PAGE – MISC CONFIG B		SW 2.0 and above
Feature	**Options**	**Actual Setting**
ELEC SYSTEM	14 VOLT, 28 VOLT	28
EFD BATTERY CONFG:	INTERNAL, REMOTE	INTERNAL
Panel Tilt Pitch Adjustment	Does not apply to EFD500	
Panel Roll Adjustment	Does not apply to EFD500	
Not Used		

10.4.7.18 Installation Menu Page – MISC CONFIG C

COMPOSITE PHASE (VOR1, 2) – If the analog NAV receiver has a 180º phase shifted output (i.e., RT-385) then select 180 for VOR1 or 2 or both.

CRS SDI – For a dual GNAV interface set to NAV 1/2 and set GNAV1 for SDI=1 and GNAV2 for SDI=2. For single GNAV/GPS set to COMMON.

OBS DISPLAY – Set to ENABLE (this is a user preference item and can be set to disable).

INSTALLATION MENU PAGE – MISC CONFIG C		SW 2.0 and above
Feature	**Options**	**Actual Setting**
COMPOSITE PHASE (VOR1,2)	(0,0) (180,0) (0,180) (180,180)	0,0
GPSS GAIN:	Does not apply to EFD500	—
CRS SDI	COMMON, NAV 1/2 (SW v2.2 and above)	COMMON
OBS DISPLAY	DISABLE, ENABLE (SW v2.2 and above)	ENABLE
Not Used		
Notes:		

10.4.7.19 Installation Menu Page – MISC CONFIG D

INSTALLATION MENU PAGE – MISC CONFIG D		SW v2.4 and above
Feature	**Options**	**Actual Setting**
OAT SOURCE	Set to INTERCOM	INTERCOM
OAT BIAS	Does not apply to EFD500	
SV ALERT CONFIG	Set the same as PFD	3
DISPLAY FPM	Set the same as PFD	MFD/PFD
AIRCRAFT REF SYMBOL	Set the same as PFD	1
Notes:		

10.4.7.20 Installation Menu Page – RSM CALIBRATION

Does not apply to EFD500

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SV ALERT CONFIG - There are 5 options but only two are permitted under the STC. Set to Option 1 if the aircraft does not have a TAWS installed, set to Option 3 if it does have a TAWS installed. FPM is Flight Path Marker.

1= Alert Tone, Alert Annunciations, FPM Alert Colors, and Terrain Coloring are configured
2= Only Alert Annunciations, FPM Alert Colors, and Terrain Coloring are configured
3= Only FPM Alert Colors, and Terrain Coloring are configured
4= Only Terrain Coloring is configured
5= None of the Above

DISPLAY FPM - There are 3 settings and the "PFD/MFD" setting is recommended.

DISABLE = FPM is not displayed
PFD ONLY= FPM is displayed on the PFD, not on the MFD
PFD/MFD= FPM is displayed on both the PFD and MFD

AIRCRAFT REF SYMBOL - Option 1 is recommended.

1= Ref Symbol Type 1

2= Ref Symbol Type 2

3= Ref Symbol Type 3

INSTALLATION MENU PAGE - MISC CONFIG D		SW v2.4 and above
Feature	**Options**	**Actual Setting**
OAT SOURCE	NONE, RSM, PROBE, INTERCOM	RSM
OAT BIAS	0 to -8 degrees	0.0
SV ALERT CONFIG	1,2,3,4,5	3
DISPLAY FPM	DISABLE, PFD ONLY, PFD/MFD	MFD/PFD
AIRCRAFT REF SYMBOL	1,2,3	1
Notes:		

10.4.6.20 Installation Menu Page - RSM CALIBRATION

The following menu will be used in the next section to calibrate and validate the magnetometer in the RSM. Heading errors of up to +/- 6.0° can be calibrated at 30° increments beginning with North. (Follow RSM Cal procedure in Section 10.5.)

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10.4.7.21 Installation Menu Page – ACCEL BIAS CAL

Does not apply to EFD500

10.4.7.22 Installation Menu Page – WX500

The following menu is used for WX-500 configuration, system status, and system test. HEAD TYPE is configuration status. It will display NONE if there is no WX-500 connection, DISPLAY when a RS232 RX Port is set to WX500, and CONTROL when a RS232 TX Port is set to WX500.

INSTALLATION MENU PAGE - WX-500		SW v2.0 and above
Feature	**Options**	**Actual Setting**
HEAD TYPE	NONE, DISPLAY, CONTROL	NONE
SYSTEM DATA	PAGE1,PAGE2,PAGE3,PAGE4	
STRIKE TEST	Press to Initiate	
NOISE MONITOR	Press to Initiate	
ANTENNA MOUNT	TOP,BOTTOM	
Notes: The HEAD Type menu entry is status only. It is necessary to exit and re-enter the menu to view the updated information.		

10.4.7.23 Installation Menu Page – DFC A/P CONFIG PAGE A

Does not apply to the EFD500

10.4.7.24 Installation Menu Page – DFC A/P CONFIG PAGE B

Does not apply to the EFD500

10.4.7.25 Installation Menu Page – NETWORK PAGE

This menu is for diagnostic purposes only.

INSTALLATION MENU PAGE - NETWORK PAGE	SW v2.0 and above
Feature	**Options**
IP ADDR	0-255
SUBNET MASK	0-255
GATEWAY	0-255
PORT	0-9999
Not Used	
Note: Repeated presses of top 3 line select keys will select one of 4 selectable fields	

10.4.7.26 Installation Menu Page – DIAGNOSTICS

This menu is for diagnostic purposes only.

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5 Pre-Modification Planning

NOTE: The installer must provide the aircraft operator with copies of wiring diagrams (copy from Section 9 or draft ones not shown) and equipment locations (completed Figure 1 in the ICA) that are suitable for system troubleshooting.

5.1 Pre-Modification Checklist

Complete Table 5-1 and Table 5-2 (if installing MFD) to insure that the aircraft to be modified is a suitable candidate for installation of the EFD1000 PFD/MFD system(s) using this AML-STC. It is required to have a PASS or NA for all rows in order to use this AML-STC as the certification basis for the EFD1000 installation. NA means Not Applicable because no interface is made to that device. Only items designated with "- NA if no " may use NA in the PASS column.

PRIMARY FLIGHT DISPLAY - PFD		
ITEM	CRITERIA	PASS
1	Is the aircraft to be modified on the Approved Model List (AML)?	✓
2	Does aircraft have sufficient electrical capacity to supply all required equipment given the current draw in Table 7-1?	✓
3	Is there an acceptable location to mount or relocate the required standby instruments in the pilot's field of view? (see Figures 4-7 and 4-8) See Section 4 to determine the required standby instruments.	✓
4	Do the standby instruments meet the requirements of Figure 4-5 and 4-6?	✓
5	Is there acceptable clearance between the control column (yoke or stick) and the PFD when the flight controls are in the full nose down position.	✓
6	If removing an EFIS system - does the EFD1000 replace all required instrumentation previously displayed on the removed EFIS? - NA if no EFIS	N/A
7	Is a backup navigation indicator required (see section 4.5.3) - NA if no Backup NAV indicator is required. If a backup indicator is required, is there an acceptable location to mount or relocate a required backup NAV Indicator in the pilot's field of view? (see Figure 4-8)	✓
8	Is there an acceptable location to mount the RSM? (see Section 6.9)	✓
9	Is there a location to mount the necessary circuit breakers that will be accessible to the pilot while seated?	✓
10	Are there suitable locations to mount the necessary switches that are accessible to the pilot while seated? - NA if not installed.	✓
11	Does the aircraft have a compatible GPS receiver or will one be installed? (see Electrical Interface Section 8 to determine compatibility) - NA if no GPS interface.	✓
12	Does the aircraft have a compatible Navigation receiver or will one be installed? (see Electrical Interface Section 8 to determine compatibility) - NA if no NAV interface.	✓
13	If the aircraft is equipped with an autopilot - is the Autopilot compatible? (see Electrical Interface Section 8 to determine heading and nav compatibility, and Appendix E to determine attitude input (KI-256 replacement compatibility) - NA if no autopilot interface.	✓

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PRIMARY FLIGHT DISPLAY – PFD		
ITEM	CRITERIA	PASS
14	If the aircraft is limited to VFR, is there a placard or other acceptable means, stating "Operation of This Aircraft is Limited to VFR Only", or similar phraseology acceptable to the FAA, as required by § 23.1525, § 23.1559 and § 91.9. Since the kinds of operations are limited to VFR, this placard or other acceptable means should already be in place, but should be verified.	N/A
15	If the aircraft is Class III, is the PFD software level B?	N/A

Table 5-1: PFD Pre-Modification Checklist

MULTI FUNCTION DISPLAY – MFD		
ITEM	CRITERIA	PASS
1	If an EFD1000 MFD is installed and the standby airspeed and/or altimeter are to be removed, is there an acceptable location to mount the required EBB58 Emergency Backup Battery? (see Section 6.12) NA if no backup instruments removed.	✓
2	If an EFD1000 or EFD500 MFD is installed, does the aircraft have an IFR GPS installed? NA if EFD1000 MFD not installed.	✓
3	If an EFD1000 MFD is installed, does the aircraft have an alternate static source?	✓
4	Does the aircraft have a standby attitude indicator in the pilot's primary maximum field of view (See Figure 4-7)?	✓
5	Does the aircraft have a Vmo or barber pole type airspeed indicator installed? If yes, do not remove the existing airspeed indicator.	N/A
6	If the standby airspeed indicator and altimeter are to be removed, is there an acceptable location to mount the required placard reading "EMER BAT DISPATCH LIMIT 80% – SEE EFD AFMS"? NA if EBB not required to be installed.	N/A
7	Is there an acceptable location to mount and label the EBB emergency disconnect switch? NA if EBB not required to be installed.	✓
8	Does aircraft have sufficient electrical capacity to supply all required equipment given the current draw in Table 7-1?	✓
9	Is there an acceptable location to mount or relocate the required standby airspeed and altitude instruments, collocated with the standby attitude indicator, all within the pilot's primary maximum field of view? (see Figure 4-7 and 4-8)	✓
10	Do the standby instruments meet the requirements of Figure 4-5 and 4-6?	✓
11	Is there acceptable clearance between the control column (yoke or stick) and the MFD(s) when the flight controls are in the full nose down position?	✓
12	Is there an acceptable location to mount the EFD1000 MFD RSM? (see Section 6) – NA if EFD500 only installation	✓
13	Is there a location to mount the MFD circuit breaker(s) that will be accessible to the pilot while seated?	✓
14	Is there a location to mount the MFD switch(s) that is accessible to the pilot while seated?	✓

Table 5-2: MFD Pre-Modification Checklist

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MOL Type	MOL Parameter Selection Options (Known Values)	Description And Example
1	Vne	For this type, Vne is displayed as a fixed value. Set MOL TYPE = 1 Example: If Vne = 180Kts, enter 180 in the MOL PARAM VALUE field.
2	Vmo	For this type, Vmo is displayed as a fixed value. Set MOL TYPE =2 Example: If Vmo = 210Kts, enter 210 in the MOL PARAM VALUE field.
3	Vmo Mmo MAX ALT	For this type, Vmo and Mmo are known values. MAX ALT is the service ceiling of the aircraft. Set MOL TYPE=3. Push line select key next to MOL PARAM SEL and scroll to Vmo. Press line select next to MOL PARAM VALUE and rotate right knob until Vmo value is correct. Repeat for Mmo and MAX ALT
4	Vmo1 ALT 1 KNOTS or MPH *(depending on the setting on the IAS UNIT installation menu setting)* ALT 2 MAX ALT	For this type, Vmo is displayed as a fixed value to a known altitude and then Vmo decreases by # knots per # feet (were # is a number) Example: Vmo is 226 KIAS to 15,500 feet and then Vmo decreases 4 KIAS per 1,000 feet Known values: Vmo=226, ALT1=15500, KNOTS=4, ALT2=1000, MAX ALT = A/C service ceiling. Use MOL PARAM SEL to select Vmo/ALT1/KNOTS/ALT2 Use MOL PARAM VALUE to enter 226/15500/4/1000
5	Vmo 1 ALT 1 Vmo2 ALT 2 Vmo 3 ALT 3 Vmo 4 ALT 4 Vmo 5 ALT 5 Vmo 6 ALT 6	For this type, the aircraft has multiple Vmo's (Vmo x) that depend on different altitudes (ALT x). Example: Vmo = 160 KIAS from 0 ft. to 5000 ft. Vmo = 155 KIAS from 5000 ft. to 10000 ft. Vmo = 145 KIAS from 10000 ft. to 15000 ft. In this example Vmo1=160, ALT1=5000, Vmo2=155, ALT2=10000, Vmo3=145, ALT3=15000 This type can support up to 6 Vmo's.
6	Vmo 1	For this type, Vmo (Vmo1) is displayed as a fixed value to a known altitude (ALT1) and then Vmo decreases in a straight-line variation between the Vmo1 altitude and a Vmo2 altitude (ALT2). ALT2 = aircraft maximum altitude. Example: Vmo = 197 KIAS from 0 ft. to 15000 ft. Vmo = 160 KIAS at 25000 ft. In this example Vmo1=197, ALT1=15000, Vmo2=160, ALT2=25000

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Appendix B: Installation Final Check Sheet

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EFD1000/500 Installation Final Check Sheet

Aircraft Type: Commander 114TC Date: 6/24/14

Aircraft Serial Number: 20005 Tail Number: N595TC

The following five pages must be printed and used during checkout. The Section number refers to the section in the manual where the test is performed. This form must be included in document package to be included in aircraft maintenance records.

Complete by performing test of Section 10.5.4(EFD1000 only)

Calibrated Heading Source	Tolerance	Actual PFD Heading	Actual MFD Heading	Calibrated Heading Source	Tolerance	Actual PFD Heading	Actual MFD Heading
30	+/- 4	30	30	210	+/- 4	210	210
60	+/- 4	60	60	240	+/- 4	240	240
90	+/- 4	90	90	270	+/- 4	270	270
120	+/- 4	120	120	300	+/- 4	300	300
150	+/- 4	150	150	330	+/- 4	330	330
180	+/- 4	180	180	360	+/- 4	360	360

Complete by performing test of Section 10.6.1(EFD1000 only)

IAS Setting	Band Color	Band Range	Description	Pass
Vne =	Red	>Vne	Red arc displayed at all speeds above Vne	✓
Vno =	Yellow	Vno - Vne	Yellow arc extending from Vno to Vne	✓
Vs =	Green	Vs - Vno	Green arc extending from Vs to Vno	✓
Vfe =	White	Vso - Vfe	Top of White arc	✓
Vso =	White		Bottom of White Arc	N/A
Vyse =	Blue Marker	= Vyse	Blue Marker at Vyse	
Vmc =	Red Marker	= Vmc	Red Marker at Vmc	
◀ =	Triangle (White)	= ◀	White triangle at initial flap extension airspeed	

> **NOTE**
> **Single engine aircraft and aircraft with no flaps will not use all parameters above.**

Aircraft with Vmo/Mmo Airspeed Indicator (EFD1000 only)

Test	Description	Pass
Barber Pole or Redline Position	Verify the Barber Pole or Redline appears at the correct airspeeds as shown in Table 10-1.	✓

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EFD1000/500 Installation Final Check Sheet

SECTION	POST INSTALLATION TESTS	PASS	FAIL
10.5.1.1*	Second Phase RSM Location Evaluation - Aircraft "Z" component within NOAA determined Z range?	✓	
10.5.4*	Heading Accuracy Check (from Page 1)	✓	
10.5.5*	Heading Interference Test	✓	
10.6.1*	Indicated Airspeed Test	✓	
10.6.2*	Altitude Display Test	✓	
10.6.3*	System Leak Test	✓	
10.6.4*	OAT- Outside Air Temperature Test (if ENABLED)	✓	
10.6.5*	AHRS (attitude solution) Test	✓	
10.6.6	GPS Sensor Test - GPS1 (if installed)	✓	
10.6.6	GPS Sensor Test - GPS2 (if installed)	+	
10.6.6*	RSM GPS Sensor Test (if ENABLED)	✓	
10.6.7*	NAV Receiver Sensor Test - NAV1 (if installed)	✓	
10.6.7*	NAV Receiver Sensor Test - NAV2 (if installed)	+	
10.6.8*	Back-up NAV Indicator Test (if installed)	+	
10.6.9*	Autopilot/FD Sensor Test (if installed)	✓	
10.6.10.1*	ADF Test (if installed)	+	
10.6.10.2*	Radio Altimeter Test (if installed)	+	
10.6.11*	PFD Sonalert Test (when required on a Synthetic Vision enabled PFD or MFD)	✓	
10.6.12*	Decision Height Test (if installed)	+	
10.6.13	Traffic Display Test (if installed)	+	
10.6.14	XM Weather Display and Control Test (if installed)	+	
10.6.15	WX-500 Display and Control Test (if installed)	+	
10.6.16* 10.6.17*	Ancillary Equipment Heading and Air Data (if connected) List equipment interfaced:	+	
10.6.18	EFD Inter-System Communication Check (if multi-display)	✓	
10.6.19	Battery Capacity Check - EBB and Internal batteries > 80% Charge	✓	
10.6.20*	TAPES Configuration Check	✓	
10.6.21	EMI Test	✓	
10.6.22*	Flight Control Interference Check	✓	

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EFD1000/500 Installation Final Check Sheet

SECTION	POST INSTALLATION TESTS	PASS	FAIL
10.6.23 or .24 or .25*	OBS Mode Check	—	

* Does not apply to an EFD500

SECTION	COMPLIANCE CHECK	PASS	FAIL
6.4	Weight and Balance performed		
7.1	Electrical Load Analysis performed for each EFD	✓	
4.4	For aircraft not limited to VFR, a Standby Attitude indicator must be installed in accordance with section 4.4	✓	
4.4	Standby Airspeed, Altimeter must be installed in accordance with section 4.4	✓	
4.4.3	Is the EBB58 Emergency Backup Battery installed for installations that removed standby Airspeed Indicator and/or Altimeter and replaced them with the MFD1000.	+	
4.4.3	If the EBB58 is installed, is the required placard installed?	+	
7.2.14	If the EBB58 is installed, is the required Emergency Disconnect switch installed and properly labeled?	✓	
7.2.14	Verify the EBB58 wiring harness and the EFD1000 MFD's RSM wiring is isolated/separated from the EFD1000 PFD's RSM wiring to provide independence.	✓	
5.1.6	For aircraft limited to VFR, a placard or other acceptable means, stating "Operation of This Aircraft is Limited to VFR Only", or similar phraseology acceptable to the FAA. Note: This placard should be pre-existing under TC or STC. (This verifies that the placard is still present)	+	
5.1.7	Cessna 190/195 Aircraft s/n 16083 and below only, verify the TAPES are configured to LOCKED OFF, and the original airspeed indicator and altimeter are in the standard "T" arrangement.	+	
4.5.3	Backup Nav Indicator (if required) connected to a nav source installed in pilot's field of view. The indicator must function if the PFD and/or ACU circuit breaker is pulled	+	
7.2	Circuit breaker installed for each EFD and each ACU.	✓	
6.9.4	RSM location(s) are <2 degrees of needle deflection on hand held compass within 18"x18"x18" survey area	✓	
10.1.2	Each EFD braided ground strap is installed between unit and panel, RSM ground wire attached to ground stud, RSM doubler/mounting plate bonded to airframe ground and ACU(s) chassis bonded to airframe ground. All measure no greater than .003 ohms to ground.	✓	
7.2	Wires, cables, and connectors clearly marked or stamped	✓	

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EFD1000/500 Installation Final Check Sheet

SECTION	COMPLIANCE CHECK	PASS	FAIL
7.2, 5.1.5	When installed, EFD1000/500 master switch(s) and/or circuit breakers and "EBB58 EMER DISC" switch must be easily accessible to flight crew and clearly marked. One switch exists for each display.	✓	
1.1.1	If the aircraft is Class III, does the PFD contain Level B software?		
11	Post Installation Flight Test	✓	
11.4	Document successful completion of flight test in aircraft log book per FAR 91.407b	✓	
4.4.3	In aircraft with independent pitot/static systems each EFD1000 must be connected to different systems.	+	
4.2	If an EFD1000 MFD is installed then each EFD1000 display is connected to an IFR GPS	✓	
6.8.5	EFD1000 PFD and EFD1000 MFD (if installed) do not share the same ground strap location.	✓	
6.6	Dual RSMs harness shielding (if installed) does not share the same ground path (bonding strap location).	✓	
6.8.6	If an EFD1000 MFD is installed there is an alternate static source available to the pilot.	✓	
4.3	In multi-EFD installations, all EFD must be at software version 2.0 or above.	✓	
7.2.14	The EBB58 may only be installed in a multiple display configuration and may only be connected to an EFD1000 MFD no other connections are permitted.	✓	
6.3	Log book entry stating aircraft has been modified in accordance with EFD1000 AML-STC.	✓	
1.10	Update warranty records on Aspen Avionics website at www.aspenavionics.com/dealerramp	✓	
Misc	Complete the Installed Equipment Configuration Matrix in Section 1.2 of the EFD1000 AFMS (900-00008-001) and insert the completed AFMS in the Airplane Flight Manual. (See sample Appendix C)	✓	
Misc	Complete wire routing diagram Figure 1&2 in Aspen Avionics document #900-00012-001 Rev P or later, Instructions for Continued Airworthiness. Complete circuit breaker and switch location diagram Figure 3 in the ICA document.	✓	
Misc	Copy of Aspen Avionics document #900-00012-001 Rev P or later, Instructions for Continued Airworthiness with copy of wiring diagrams (Section 9 or installer drafted), copy of Configuration Pages Section 10.4.6 and 10.4.7 for each installed EFD, and copy of Pre-Modification Checklist Table 5-1 and 5-2 inserted. This data package is to be given to owner/operator for inclusion in aircraft permanent records.	✓	

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EFD1000/500 Installation Final Check Sheet

SECTION	COMPLIANCE CHECK	PASS	FAIL
EA100 Adapter Installations Only:			
Appendix E	IFR GPS installed and connected to EFD1000(s)	N/A	
Appendix E	"A/P AHRS FAIL" annunciator installed in the pilot primary field of view.		
Appendix E	"A/P AHRS FAIL" annunciator powered from the autopilot main breaker so that the light is illuminated whenever the autopilot is powered but the EA100 is not.		
Appendix E	Insert AFMS 900-00008-001 Rev H or later with section 1.2 completed in the Airplane Flight Manual, which must be furnished.		
Appendix E	Post EA100 Test Flight resulted in similar or better performance than the Pre EA100 Test Flight.		

Inspected by: (print & sign)

Jerry Huntley

Installer / Inspector

Date 6/24/14

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CNX-80/ GNS-480 (software 2.0 and below)

This configuration is not authorized. The GNS-480 should be upgraded to software version 2.3 (see below)

CNX-80/ GNS-480 (software 2.3)

GND MAINT - ARINC 429 SETUP

CH_IN	SEL	SPEED	SDI
2	EFIS	LOW	See Note 1

CH_OUT	SEL	SPEED	SDI
1	*GAMA 429 GFX Int	LOW(2)	See Note 1
2	VOR/ILS	LOW(2)	SYS1 or SYS2

*GAMA 429 GFX Int – this configuration has Flight Plan information.

GND MAINT – MISCELLANEOUS SETUP

CDI SELECT: **USE**

With this configuration the EFD1000 will read the GNS480 CDI logic state on the A429 bus and toggle between GPS and VLOC on the PFD when pressing the GNS480 CDI button.

EFD1000 will use GPS/NAV ID's A and B

GNS-430/530(W) & GPS-400/500(W)

MAIN ARINC 429 CONFIG Page

IN 1 LOW Honeywell EFIS (when using pins 48/49) or EFIS or EFIS/ADC*
IN 2 As required
OUT LOW(2) GAMA 429 Graphics w/INT

SDI See Note 1
VNAV ENABLE LABELS (W models only)

VOR/LOC/GS ARINC 429 CONFIG Page

SPEED LOW(2) RX LOW(2) TX
SDI COMMON
* Note – Some GPS units require the EFIS config. ACU2 installs can use the EFIS/ADC config.

GTN650/750 and GTN625/635/725

ARINC 429 CONFIG Page

IN 1 LOW EFIS Format 3 or EFIS Format 2 if ACU2 installed and using EFD1000 Air Data.
IN 2 As required
OUT LOW(2) GAMA Format 3

SDI See Note 1

VOR/LOC/GS ARINC 429 CONFIG Page

SPEED LOW(2) RX LOW(2) TX
SDI COMMON

LOW(2)

The GPS/VOR buss speeds are typically set to low but if the ACU2 is used or it is required to use HS A429 for other devices these settings may need to be set i.e HI (Note if set to HI then the appropriate settings in the EFD1000 must be set to HIGH)

NOTE 1 – GPS SDI Setting

EFD1000 SW is v2.1 or below:
Set the SDI to COMMON on all single and dual 430/530 and SYS1 or SYS2 for all single and dual GNS480.

EFD1000 SW is 2.2 and above:
Single GNS/GTN set to COMMON, Single 480 set to SYS1 or SYS2.
Dual GNS/GTN - Set to LNAV1(SYS1) for GPS1 and LNAV2(SYS2) for GPS2.

GPS 155XL

429 IN = SELECTED COURSE
429 OUT = KING EFS 40/50

KLN-94

MAINTENANCE PAGE 7: *STANDARD RS-232 or *ENHANCED RS-232
*See Table 5-3 for details

Garmin SL-30

The SL-30 can be connected to the EFD1000 in one of two ways. The Resolver configuration is preferred.

Resolver: The composite output from the SL-30 to the PFD will become invalid whenever VOR monitor mode or localizer back course is selected on the SL-30. The navigation source will show as failed on the PFD if either of these two modes is entered and the SL-30 is the selected navigation source. If connected, the backup NAV indicator will continue to function if either of these two modes is selected.

Converter: VOR monitor mode or localizer back course mode are disabled from selection on the SL-30. A backup NAV indicator (GI-106) cannot be connected without a KN-72 between the SL-30 and indicator due to the fact that the OBS resolver inputs become invalid with this configuration.

GTX-330 (When used as a Data Concentrator)

The ARINC channel that is connected to the EFD1000 (i.e. receiving the ARINC labels from the EFD1000) must be set to "AHRS" on the GTX-330.

Transponder or GPS using RS232 ADC Output

GTX-330 – configure for ADC W/ALT if using the EFD1000 as the encoding source. Configure for ADC NO ALT if EFD1000 is not to supply encoding source but is used for OAT/TAS and other labels.
GNS430/530 – configure for Shadin-adc or Shadin.
GTN6xx/7xx – configure for Airdata Format 1 or Altitude Format 3 as desired.
KLN90B - no config required
KLN89B/94 – Set RS232 Air Data = Y in Maintenance Pages.

Figure 9-27: Non-Aspen Equipment Configuration Notes

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