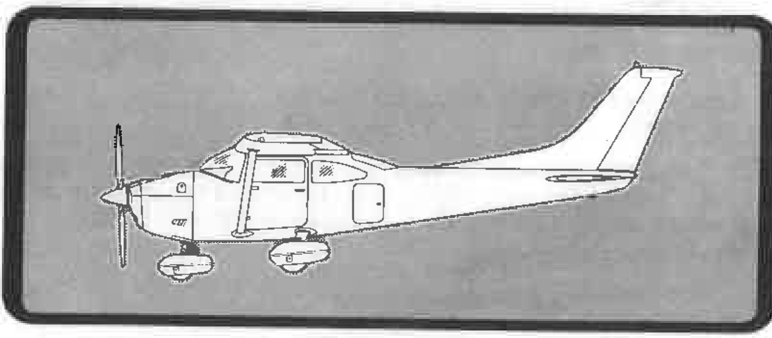
PILOT'S OPERATING HANDBOOK

Cessna®



SKYLANE

1977 MODEL 182Q

Serial No. 18265404

Registration No. N735GC

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR PART 3

CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS, USA

D1087-13
(RGI-150-7/97)

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES: DISPOSE OF SUPERSEDED PAGES.

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THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 262, CONSISTING OF THE FOLLOWING. THIS TOTAL INCLUDES THE SUPPLEMENTS PROVIDED IN SECTION 9 WHICH COVER OPTIONAL SYSTEMS AVAILABLE IN THE AIRPLANE.

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CONGRATULATIONS . . . .

Welcome to the ranks of Cessna owners! Your Cessna has been designed and constructed to give you the most in performance, economy, and comfort. It is our desire that you will find flying it, either for business or pleasure, a pleasant and profitable experience.

This Pilot's Operating Handbook has been prepared as a guide to help you get the most pleasure and utility from your airplane. It contains information about your Cessna's equipment, operating procedures, and performance; and suggestions for its servicing and care. We urge you to read it from cover to cover, and to refer to it frequently.

Our interest in your flying pleasure has not ceased with your purchase of a Cessna. Worldwide, the Cessna Dealer Organization backed by the Cessna Customer Services Department stands ready to serve you. The following services are offered by most Cessna Dealers:

- THE CESSNA WARRANTY, which provides coverage for parts and labor, is available at Cessna Dealers worldwide. Specific benefits and provisions of warranty, plus other important benefits for you, are contained in your Customer Care Program book, supplied with your airplane. Warranty service is available to you at authorized Cessna Dealers throughout the world upon presentation of your Customer Care Card which establishes your eligibility under the warranty.

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- FACTORY APPROVED SERVICE EQUIPMENT to provide you efficient and accurate workmanship.

- A STOCK OF GENUINE CESSNA SERVICE PARTS on hand when you need them.

- THE LATEST AUTHORITATIVE INFORMATION FOR SERVICING CESSNA AIRPLANES, since Cessna Dealers have all of the Service Manuals and Parts Catalogs, kept current by Service Letters and Service News Letters, published by Cessna Aircraft Company.

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A current Cessna Dealer Directory accompanies your new airplane. The Directory is revised frequently, and a current copy can be obtained from your Cessna Dealer. Make your Directory one of your cross-country flight planning aids; a warm welcome awaits you at every Cessna Dealer.

PERFORMANCE - SPECIFICATIONS

SPEED:
- Maximum at Sea Level . . . . 148 KNOTS
- Cruise, 75% Power at 8000 Ft . . . . 144 KNOTS

CRUISE: Recommended Lean Mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45% power.

75% Power at 8000 Ft	Range	520 NM
56 Gallons Usable Fuel	Time	3.7 HRS
75% Power at 8000 Ft	Range	735 NM
75 Gallons Usable Fuel	Time	5.2 HRS
Maximum Range at 10,000 Ft	Range	640 NM
56 Gallons Usable Fuel	Time	5.7 HRS
Maximum Range at 10,000 Ft	Range	910 NM
75 Gallons Usable Fuel	Time	8.1 HRS

RATE OF CLIMB AT SEA LEVEL . . . . 1010 FPM

SERVICE CEILING . . . . 16,500 FT

TAKEOFF PERFORMANCE:
- Ground Roll . . . . 705 FT
- Total Distance Over 50-Ft Obstacle . . . . 1350 FT

LANDING PERFORMANCE:
- Ground Roll . . . . 590 FT
- Total Distance Over 50-Ft Obstacle . . . . 1350 FT

STALL SPEED (CAS):
- Flaps Up, Power Off . . . . 56 KNOTS
- Flaps Down, Power Off . . . . 50 KNOTS

MAXIMUM WEIGHT . . . . 2950 LBS

STANDARD EMPTY WEIGHT:
- Skylane . . . . 1717 LBS
- Skylane II . . . . 1781 LBS

MAXIMUM USEFUL LOAD:
- Skylane . . . . 1233 LBS
- Skylane II . . . . 1169 LBS

BAGGAGE ALLOWANCE . . . . 200 LBS

WING LOADING: Pounds/Sq Ft 16.9

POWER LOADING: Pounds/HP 12.8

FUEL CAPACITY: Total
- Standard Tanks . . . . 61 GAL.
- Long Range Tanks . . . . 80 GAL.

OIL CAPACITY . . . . 12 QTS

ENGINE: Teledyne Continental O-470-U
230 BHP at 2400 RPM

PROPELLER: Constant Speed, Diameter . . . . 82 IN.

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SECTION 1
GENERAL

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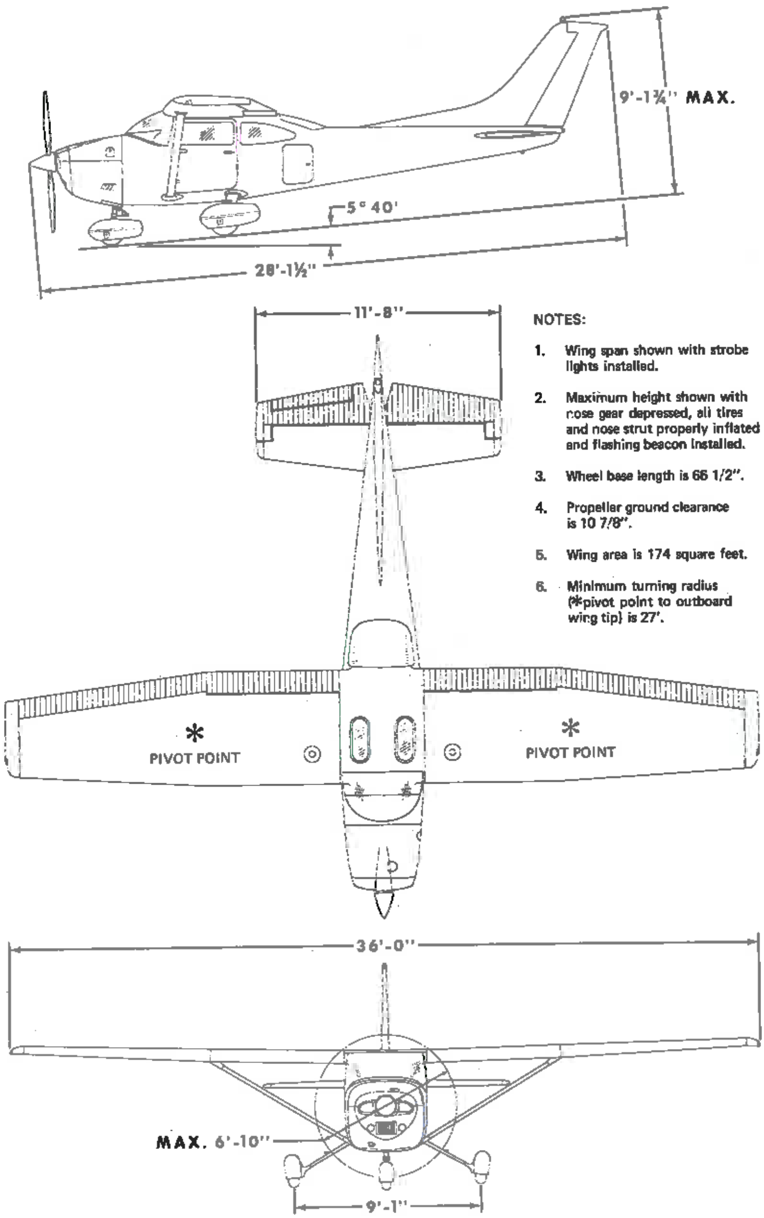

NOTES:

1. Wing span shown with strobe lights installed.
2. Maximum height shown with nose gear depressed, all tires and nose strut properly inflated and flashing beacon installed.
3. Wheel base length is 66 1/2".
4. Propeller ground clearance is 10 7/8".
5. Wing area is 174 square feet.
6. Minimum turning radius (*pivot point to outboard wing tip) is 27'.

Figure 1-1. Three View

INTRODUCTION

This handbook contains 9 sections, and includes the material required to be furnished to the pilot by CAR Part 3. It also contains supplemental data supplied by Cessna Aircraft Company.

Section 1 provides basic data and information of general interest. It also contains definitions or explanations of symbols, abbreviations, and terminology commonly used.

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1.
Engine Manufacturer: Teledyne Continental.
Engine Model Number: O-470-U.
Engine Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, carburetor-equipped, six-cylinder engine with 470 cu. in. displacement.
Horsepower Rating and Engine Speed: 230 rated BHP at 2400 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: C2A34C204/90DCB-8.
Number of Blades: 2.
Propeller Diameter, Maximum: 82 inches.
Minimum: 80.5 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 15.0° and a high pitch setting of 29.4° (30 inch station).

FUEL

Approved Fuel Grades (and Colors):
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).

Fuel Capacity:

Standard Tanks:

Total Capacity: 61 gallons.

Total Capacity Each Tank: 30.5 gallons.

Total Usable: 56 gallons.

Long Range Tanks:

Total Capacity: 80 gallons.

Total Capacity Each Tank: 40 gallons.

Total Usable: 75 gallons.

NOTE

To ensure maximum fuel capacity when refueling, place the fuel selector valve in either LEFT or RIGHT position to prevent cross-feeding.

OIL

Oil Grade (Specification):

MIL-L-6082 Aviation Grade Straight Mineral Oil: Use to replenish supply during first 25 hours and at the first 25-hour oil change. Continue to use until a total of 50 hours has accumulated or oil consumption has stabilized.

NOTE

The airplane was delivered from the factory with a corrosion preventive aircraft engine oil. This oil should be drained after the first 25 hours of operation.

Continental Motors Specification MHS-24A, Ashless Dispersant Oil: This oil <u>must be used</u> after first 50 hours or oil consumption has stabilized.

Recommended Viscosity For Temperature Range:

SAE 50 above 4°C (40°F).

SAE 10W30 or SAE 30 below 4°C (40°F).

NOTE

Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting in cold weather.

Oil Capacity:

Sump: 12 Quarts.

Total: 13 Quarts (if oil filter installed).

MAXIMUM CERTIFICATED WEIGHTS

Takeoff: 2950 lbs.
Landing: 2950 lbs.
Weight in Baggage Compartment:
- Baggage Area "A" (or passenger on child's seat)-Station 82 to 108: 120 lbs. See note below.
- Baggage Area "B" and Hatshelf-Station 108 to 136: 80 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas A and B, including the hatshelf, is 200 lbs. The maximum hatshelf load is 25 lbs.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight,	Skylane:	1717 lbs.
	Skylane II:	1781 lbs.
Maximum Useful Load,	Skylane:	1233 lbs.
	Skylane II:	1169 lbs.

CABIN AND ENTRY DIMENSIONS

Detailed dimensions of the cabin interior and entry door openings are illustrated in Section 6.

BAGGAGE SPACE AND ENTRY DIMENSIONS

Dimensions of the baggage area and baggage door opening are illustrated in detail in Section 6.

SPECIFIC LOADINGS

Wing Loading: 16.9 lbs./sq. ft.
Power Loading: 12.8 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS	Knots Calibrated Airspeed is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.
KIAS	Knots Indicated Airspeed is the speed shown on the airspeed indicator and expressed in knots.
KTAS	Knots True Airspeed is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.
V_A	Maneuvering Speed is the maximum speed at which you may use abrupt control travel.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air, then only with caution.
V_{NE}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{S_O}	Stalling Speed or the 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 in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

OAT	Outside Air Temperature is the free air static temperature. It is expressed in either degrees Celsius (formerly Centigrade) or degrees Fahrenheit.

Standard Tempera-ture	Standard Temperature is 15°C at sea level pressure altitude and decreases by 2°C for each 1000 feet of altitude.
Pressure Altitude	Pressure Altitude is the altitude read from an altimeter when the altimeter's barometric scale has been set to 29.92 inches of mercury (1013 mb).

ENGINE POWER TERMINOLOGY

BHP	Brake Horsepower is the power developed by the engine.
RPM	Revolutions Per Minute is engine speed.
MP	Manifold Pressure is a pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demon-strated Crosswind Velocity	Demonstrated Crosswind Velocity is the velocity of the cross-wind 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.
Usable Fuel	Usable Fuel is the fuel available for flight planning.
Unusable Fuel	Unusable Fuel is the quantity of fuel that can not be safely used in flight.
GPH	Gallons Per Hour is the amount of fuel (in gallons) consumed per hour.
NMPG	Nautical Miles Per Gallon is the distance (in nautical miles) which can be expected per gallon of fuel consumed at a specific engine power setting and/or flight configuration.
g	g is acceleration due to gravity.

WEIGHT AND BALANCE TERMINOLOGY

Reference Datum	Reference Datum is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	Station is a location along the airplane fuselage given in terms of the distance from the reference datum.

Arm	Arm is the horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	Moment is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this handbook to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	Center of Gravity is the point at which an airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	Center of Gravity Arm is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	Center of Gravity Limits are the extreme center of gravity locations within which the airplane must be operated at a given weight.
Standard Empty Weight	Standard Empty Weight is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	Basic Empty Weight is the standard empty weight plus the weight of optional equipment.
Useful Load	Useful Load is the difference between takeoff weight and the basic empty weight.
Gross (Loaded) Weight	Gross (Loaded) Weight is the loaded weight of the airplane.
Maximum Takeoff Weight	Maximum Takeoff Weight is the maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum Landing Weight is the maximum weight approved for the landing touchdown.
Tare	Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

SECTION 2
LIMITATIONS

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INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section have been approved by the Federal Aviation Administration. When applicable, limitations associated with optional systems or equipment are included in Section 9.

NOTE

The airspeeds listed in the Airspeed Limitations chart (figure 2-1) and the Airspeed Indicator Markings chart (figure 2-2) are based on Airspeed Calibration data shown in Section 5 with the normal static source. If the alternate static source is being used, ample margins should be observed to allow for the airspeed calibration variations between the normal and alternate static sources as shown in Section 5.

Your Cessna is certificated under FAA Type Certificate No. 3A13 as Cessna Model No. 182Q.

AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in figure 2-1.

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	172	179	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	139	143	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed:			Do not make full or abrupt control movements above this speed.
	2950 Pounds	109	111	
	2450 Pounds	99	100	
	1950 Pounds	89	89	
V_{FE}	Maximum Flap Extended Speed:			Do not exceed these speeds with the given flap settings.
	To 10° Flaps	137	140	
	10° - 40° Flaps	95	95	
	Maximum Window Open Speed	172	179	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color code significance are shown in figure 2-2.

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	45 - 95	Full Flap Operating Range. Lower limit is maximum weight V_{S_O} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	48 - 143	Normal Operating Range. Lower limit is maximum weight V_S at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	143 - 179	Operations must be conducted with caution and only in smooth air.
Red Line	179	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Teledyne Continental.
Engine Model Number: O-470-U.
Engine Operating Limits for Takeoff and Continuous Operations:
  Maximum Power: 230 BHP.
  Maximum Engine Speed: 2400 RPM.
  Maximum Cylinder Head Temperature: 238°C (460°F).
  Maximum Oil Temperature: 116°C (240°F).
  Oil Pressure, Minimum: 10 psi.
    Maximum: 100 psi.
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: C2A34C204/90DCB-8.
Propeller Diameter, Maximum: 82 inches.
  Minimum: 80.5 inches.
Propeller Blade Angle at 30 Inch Station, Low: 15.0°.
  High: 29.4°.

POWER PLANT INSTRUMENT MARKINGS

Power plant instrument markings and their color code significance are shown in figure 2-3.

INSTRUMENT	RED LINE MINIMUM LIMIT	GREEN ARC NORMAL OPERATING	YELLOW ARC CAUTION RANGE	RED LINE MAXIMUM LIMIT
Tachometer	- - -	2100 - 2400 RPM	- - -	2400 RPM
Manifold Pressure	- - -	15-23 in. Hg	- - -	- - -
Oil Temperature	- - -	100° - 240°F	- - -	240°F
Cylinder Head Temperature	- - -	200° - 460°F	- - -	460°F
Oil Pressure	10 psi	30-60 psi	- - -	100 psi
Carburetor Air Temperature	- - -	- - -	-15° to 5°C	- - -

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

Maximum Takeoff Weight: 2950 lbs.
Maximum Landing Weight: 2950 lbs.
Maximum Weight in Baggage Compartment:
  Baggage Area "A" (or passenger on child's seat) -
    Station 82 to 108: 120 lbs. See note below.
  Baggage Area "B" and Hatshelf -
    Station 108 to 136: 80 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas A and B, including the hatshelf, is 200 lbs. The maximum hatshelf load is 25 lbs.

CENTER OF GRAVITY LIMITS

Center of Gravity Range:
Forward: 33.0 inches aft of datum at 2250 lbs. or less, with straight line variation to 39.5 inches aft of datum at 2950 lbs.
Aft: 48.5 inches aft of datum at all weights.
Reference Datum: Front face of firewall.

MANEUVER LIMITS

This airplane is certificated in the normal category. The normal category is applicable to aircraft intended for non-aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and steep turns in which the angle of bank is not more than 60°.

Aerobatic maneuvers, including spins, are not approved.

FLIGHT LOAD FACTOR LIMITS

Flight Load Factors:
*Flaps Up: +3.8g, -1.52g
*Flaps Down: +2.0g

*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

KINDS OF OPERATION LIMITS

The airplane is equipped for day VFR and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instrumentation and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time of Airworthiness Certificate issuance.

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

2 Standard Tanks: 30.5 U.S. gallons each.
  Total Fuel: 61 U.S. gallons.
  Usable Fuel (all flight conditions): 56 U.S. gallons.
  Unusable Fuel: 5.0 U.S. gallons.

2 Long Range Tanks: 40 U.S. gallons each.
  Total Fuel: 80 U.S. gallons.
  Usable Fuel (all flight conditions): 75 U.S. gallons.
  Unusable Fuel: 5.0 U.S. gallons.

NOTE

To ensure maximum fuel capacity when refueling, place the fuel selector valve in either LEFT or RIGHT position to prevent cross-feeding.

NOTE

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

Approved Fuel Grades (and Colors):
  100LL Grade Aviation Fuel (Blue).
  100 (Formerly 100/130) Grade Aviation Fuel (Green).

PLACARDS

The following information is displayed in the form of composite or individual placards.

(1) In full view of the pilot: (The "DAY-NIGHT-VFR-IFR" entry, shown on the example below, will vary as the airplane is equipped.)

> This airplane must be operated as a normal category airplane in compliance with the operating limitations as stated in the form of placards, markings, and manuals.
>
> —— MAXIMUMS ——
>
> MANEUVERING SPEED (IAS) . . . . 111 knots
> GROSS WEIGHT . . . . 2950 lbs.
> FLIGHT LOAD FACTOR . . Flaps Up . . +3.8, -1.52
> Flaps Down . +2.0
>
> No acrobatic maneuvers, including spins, approved. Altitude loss in a stall recovery - 160 ft. Flight into known icing conditions prohibited. This airplane is certified for the following flight operations as of date of original airworthiness certificate:
>
> DAY - NIGHT - VFR - IFR

(2) On control lock:

> Control lock - remove before starting engine.

(3) On the fuel selector valve plate (standard tanks):

> Off
> Left - 29 gal. Level flight only.
> Both - 56 gal. All flight attitudes. Both on for takeoff and landing.
> Right - 29 gal. Level flight only.

On the fuel selector valve plate (long range tanks):

> Off
> Left - 37 gal. Level flight only.
> Both - 75 gal. All flight attitudes. Both on for takeoff and landing.
> Right - 37 gal. Level flight only.

(4) On the baggage door:

> FORWARD OF BAGGAGE DOOR LATCH
> 120 POUNDS MAXIMUM
> BAGGAGE AND/OR AUXILIARY PASSENGER
>
> AFT OF BAGGAGE DOOR LATCH
> 80 POUNDS MAXIMUM
> BAGGAGE INCLUDING 25 LBS MAXIMUM IN BAGGAGE WALL HATSHELF
>
> MAXIMUM 200 POUNDS COMBINED
> FOR ADDITIONAL LOADING INSTRUCTIONS SEE WEIGHT AND BALANCE DATA

(5) On flap control indicator:

0° to 10°	(Partial flap range with blue color code and 140 kt callout; also, mechanical detent at 10°.)
10° to 20° to FULL	(Indices at these positions with white color code and 95 kt callout; also, mechanical detent at 10° and 20°.)

(6) Forward of fuel tank filler cap (standard tanks):

> Service this airplane with 100/130 minimum aviation grade gasoline. Capacity 30.5 gal.

Forward of fuel tank filler cap (long range tanks):

Service this airplane with 100/130 minimum aviation grade gasoline. Capacity 40.0 gal.

(7) On aft panel of baggage compartment (all models with oxygen):

OXYGEN REFILL

SECTION 3
EMERGENCY PROCEDURES

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INTRODUCTION

Section 3 provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely 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. However, should an emergency arise the basic guidelines described in this section should be considered and applied as necessary to correct the problem. Emergency procedures associated with the ELT and other optional systems can be found in Section 9.

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS
Maneuvering Speed:	
2950 Lbs	111 KIAS
2450 Lbs	100 KIAS
1950 Lbs	89 KIAS
Maximum Glide:	
2950 Lbs	70 KIAS
Precautionary Landing With Engine Power	65 KIAS
Landing Without Engine Power:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS

OPERATIONAL CHECKLISTS

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF RUN

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

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

(1) Airspeed -- 70 KIAS (flaps UP).
65 KIAS (flaps DOWN).
(2) Mixture -- IDLE CUT-OFF.
(3) Fuel Selector Valve -- OFF.
(4) Ignition Switch -- OFF.
(5) Wing Flaps -- AS REQUIRED (40° recommended).
(6) Master Switch -- OFF.

ENGINE FAILURE DURING FLIGHT

(1) Airspeed -- 70 KIAS.
(2) Carburetor Heat -- ON.
(3) Fuel Selector Valve -- BOTH.
(4) Mixture -- RICH.
(5) Ignition Switch -- BOTH (or START if propeller is stopped).
(6) Primer -- IN and LOCKED.

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

(1) Airspeed -- 70 KIAS (flaps UP).
65 KIAS (flaps DOWN).
(2) Mixture -- IDLE CUT-OFF.
(3) Fuel Selector Valve -- OFF.
(4) Ignition Switch -- OFF.
(5) Wing Flaps -- AS REQUIRED (40° recommended).
(6) Master Switch -- OFF.
(7) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
(8) Touchdown -- SLIGHTLY TAIL LOW.
(9) Brakes -- APPLY HEAVILY.

PRECAUTIONARY LANDING WITH ENGINE POWER

(1) Wing Flaps -- 20°.
(2) Airspeed -- 65 KIAS.
(3) Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
(4) Radio and Electrical Switches -- OFF.
(5) Wing Flaps -- 40° (on final approach).
(6) Airspeed -- 65 KIAS.
(7) Master Switch -- OFF.

(8) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
(9) Touchdown -- SLIGHTLY TAIL LOW.
(10) Ignition Switch -- OFF.
(11) Brakes -- APPLY HEAVILY.

DITCHING

(1) Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions.
(2) Heavy Objects (in baggage area) -- SECURE OR JETTISON.
(3) Flaps -- 20° - 40°.
(4) Power -- ESTABLISH 300 FT/MIN DESCENT at 60 KIAS.
(5) Approach -- High Winds, Heavy Seas -- INTO THE WIND.
Light Winds, Heavy Swells -- PARALLEL TO SWELLS.

NOTE

If no power is available, approach at 70 KIAS with flaps up or at 65 KIAS with 10° flaps.

(6) Cabin Doors -- UNLATCH.
(7) Touchdown -- LEVEL ATTITUDE AT ESTABLISHED DESCENT.
(8) Face -- CUSHION at touchdown with folded coat.
(9) Airplane -- EVACUATE through cabin doors. If necessary, open window to flood cabin to equalize pressure so doors can be opened.
(10) Life Vests and Raft -- INFLATE.

FIRES

DURING START ON GROUND

(1) Cranking -- CONTINUE, to get a start which would suck the flames and accumulated fuel through the carburetor and into the engine.

If engine starts:

(2) Power -- 1700 RPM for a few minutes.
(3) Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

(4) Throttle -- FULL OPEN.
(5) Mixture -- IDLE CUT-OFF.

(6) Cranking -- CONTINUE.
(7) Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
(8) Engine -- SECURE.
  a. Master Switch -- OFF
  b. Ignition Switch -- OFF.
  c. Fuel Selector Valve -- OFF.
(9) Fire -- EXTINGUISH using fire extinguisher, wool blanket, or dirt.
(10) Fire Damage -- INSPECT, repair damage or replace damaged components or wiring before conducting another flight.

ENGINE FIRE IN FLIGHT

(1) Mixture -- IDLE CUT-OFF.
(2) Fuel Selector Valve -- OFF.
(3) Master Switch -- OFF.
(4) Cabin Heat and Air -- OFF (except overhead vents).
(5) Airspeed -- 100 KIAS (If fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture).
(6) Forced Landing -- EXECUTE (as described in Emergency Landing Without Engine Power).

ELECTRICAL FIRE IN FLIGHT

(1) Master Switch -- OFF.
(2) All Other Switches (except ignition switch) -- OFF.
(3) Vents/Cabin Air/Heat -- CLOSED.
(4) Fire Extinguisher -- ACTIVATE (if available).

WARNING

After discharging an extinguisher within a closed cabin, ventilate the cabin.

If fire appears out and electrical power is necessary for continuance of flight:

(5) Master Switch -- ON.
(6) Circuit Breakers -- CHECK for faulty circuit, do not reset.
(7) Radio/Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.
(8) Vents/Cabin Air/Heat -- OPEN when it is ascertained that fire is completely extinguished.

CABIN FIRE

(1) Master Switch -- OFF.
(2) Vents/Cabin Air/Heat -- CLOSED (to avoid drafts).
(3) Fire Extinguisher -- ACTIVATE (if available).

WARNING

After discharging an extinguisher within a closed cabin, ventilate the cabin.

(4) Land the airplane as soon as possible to inspect for damage.

WING FIRE

(1) Navigation Light Switch -- OFF.
(2) Strobe Light Switch (if installed).-- OFF.
(3) Pitot Heat Switch (if installed) -- OFF.

NOTE

Perform a sideslip to keep the flames away from the fuel tank and cabin, and land as soon as possible using flaps only as required for final approach and touchdown.

ICING

INADVERTENT ICING ENCOUNTER

(1) Turn pitot heat switch ON (if installed).
(2) Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
(3) Pull cabin heat control full out and rotate defroster control clockwise to obtain maximum defroster airflow.
(4) Increase engine speed to minimize ice build-up on propeller blades.
(5) Watch for signs of carburetor air filter ice and apply carburetor heat as required. An unexplained loss in manifold pressure could be caused by carburetor ice or air intake filter ice. Lean the mixture if carburetor heat is used continuously.
(6) Plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
(7) With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for significantly higher stall speed.

(8) Leave wing flaps retracted. With a severe ice build-up on the horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.
(9) Open the window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
(10) Perform a landing approach using a forward slip, if necessary, for improved visibility.
(11) Approach at 80 to 90 KIAS, depending upon the amount of ice accumulation.
(12) Perform a landing in level attitude.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

(1) Alternate Static Source Valve -- PULL ON.
(2) Airspeed -- Consult appropriate table in Section 5
(3) Altitude -- Cruise 50 feet higher and approach 30 feet higher than normal.

LANDING WITH A FLAT MAIN TIRE

(1) Approach -- NORMAL.
(2) Wing Flaps -- FULL DOWN.
(3) Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible with aileron control.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

OVER-VOLTAGE LIGHT ILLUMINATES

(1) Master Switch -- OFF (both sides).
(2) Master Switch -- ON.
(3) Over-Voltage Light -- OFF.

If over-voltage light illuminates again:

(4) Flight -- TERMINATE as soon as practical.

AMMETER SHOWS DISCHARGE

(1) Alternator -- OFF.
(2) Nonessential Electrical Equipment -- OFF.
(3) Flight -- TERMINATE as soon as practical.

C/L C/B

AMPLIFIED PROCEDURES

ENGINE FAILURE

If an engine failure occurs during the takeoff run, the most important thing to do is stop the airplane on the remaining runway. Those extra items on the checklist will provide added safety during a failure of this type.

Prompt lowering of the nose to maintain airspeed and establish a glide attitude is the first response to an engine failure after takeoff. In most cases, the landing should be planned straight ahead with only small changes in direction to avoid obstructions. Altitude and airspeed are seldom sufficient to execute a 180° gliding turn necessary to return to the runway. The checklist procedures assume that adequate time exists to secure the fuel and ignition systems prior to touchdown.

After an engine failure in flight, the best glide speed as shown in Figure 3-1 should be established as quickly as possible. While gliding toward a suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in the checklist. If the engine cannot be restarted, a forced landing without power must be completed.

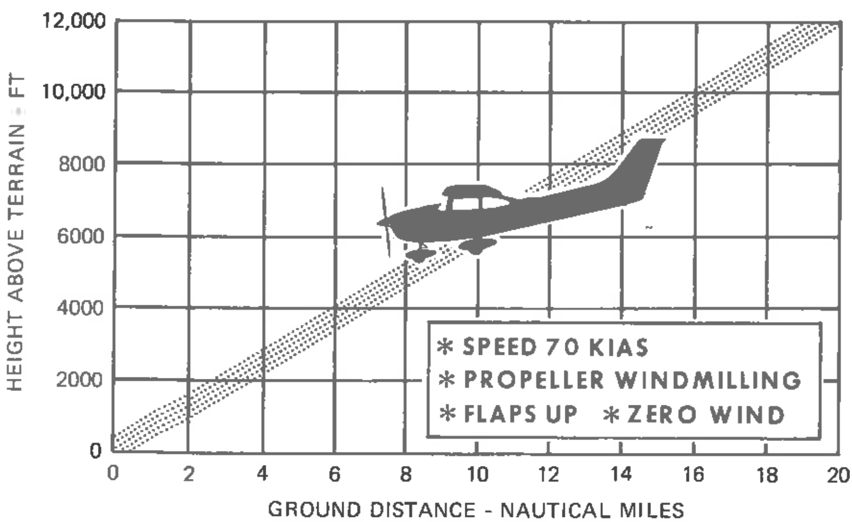


Figure 3-1. Maximum Glide

FORCED LANDINGS

If all attempts to restart the engine fail and a forced landing is imminent, select a suitable field and prepare for the landing as discussed in the checklist for Emergency Landing Without Engine Power.

Before attempting an "off airport" landing with engine power available, one should drag the landing area at a safe but low altitude to inspect the terrain for obstructions and surface conditions, proceeding as discussed under the Precautionary Landing With Engine Power checklist.

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area and collect folded coats for protection of occupants' face at touchdown. Transmit Mayday message on 121.5 MHz giving location and intentions.

LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight with an airspeed of approximately 80 KIAS by using throttle and elevator trim control. Then do not change the elevator trim control setting; control the glide angle by adjusting power exclusively.

At flareout the nose-down moment resulting from power reduction is an adverse factor and the airplane may hit on the nose wheel. Consequently, at flareout, the elevator trim control should be adjusted toward the full nose-up position and the power adjusted so that the airplane will rotate to the horizontal attitude for touchdown. Close the throttle at touchdown.

FIRES

Although engine fires are extremely rare in flight, the steps of the appropriate checklist should be followed if one is encountered. After completion of this procedure, execute a forced landing. Do not attempt to restart the engine.

The initial indication of an electrical fire is usually the odor of burning insulation. The checklist for this problem should result in elimination of the fire.

EMERGENCY OPERATION IN CLOUDS
(Vacuum System Failure)

In the event of a vacuum system failure during flight in marginal weather, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator or the turn and bank indicator if he inadvertently flies into clouds. The following instructions assume that only the electrically-powered turn coordinator or the turn and bank indicator is operative, and that the pilot is not completely proficient in instrument flying.

EXECUTING A 180° TURN IN CLOUDS

Upon inadvertently entering the clouds, an immediate plan should be made to turn back as follows:

(1) Note the time of the minute hand and observe the position of the sweep second hand on the clock.
(2) When the sweep second hand indicates the nearest half-minute, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.
(3) Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
(4) If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
(5) Maintain altitude and airspeed by cautious application of elevator control. Avoid overcontrolling by keeping the hands off the control wheel as much as possible and steering only with rudder.

EMERGENCY DESCENT THROUGH CLOUDS

If conditions preclude reestablishment of VFR flight by a 180° turn, a descent through a cloud deck to VFR conditions may be appropriate. If possible, obtain radio clearance for an emergency descent through clouds. To guard against a spiral dive, choose an easterly or westerly heading to minimize compass card swings due to changing bank angles. In addition, keep hands off the control wheel and steer a straight course with rudder control by monitoring the turn coordinator. Occasionally check the compass heading and make minor corrections to hold an approximate course. Before descending into the clouds, set up a stabilized let-down condition as follows:

(1) Apply full rich mixture.
(2) Apply full carburetor heat.
(3) Reduce power to set up a 500 to 800 ft./min. rate of descent.
(4) Adjust the elevator and rudder trim control wheels for a stabilized descent at 80 KIAS.
(5) Keep hands off control wheel.

(6) Monitor turn coordinator and make corrections by rudder alone.
(7) Adjust rudder trim to relieve unbalanced rudder force, if present.
(8) Check trend of compass card movement and make cautious corrections with rudder to stop turn.
(9) Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

(1) Close the throttle.
(2) Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
(3) Cautiously apply elevator back pressure to slowly reduce the indicated airspeed to 80 KIAS.
(4) Adjust the elevator trim control to maintain an 80 KIAS glide.
(5) Keep hands off the control wheel, using rudder control to hold a straight heading. Use rudder trim to relieve unbalanced rudder force, if present.
(6) Apply carburetor heat.
(7) Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
(8) Upon breaking out of clouds, resume normal cruising flight.

FLIGHT IN ICING CONDITIONS

Flight into icing conditions is prohibited. An inadvertent encounter with these conditions can best be handled using the checklist procedures. The best procedure, of course, is to turn back or change altitude to escape icing conditions.

STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter and rate-of-climb) are suspected, the alternate static source valve should be pulled on, thereby supplying static pressure to these instruments from the cabin. Cabin pressures will vary with open ventilators or windows and with airspeed. To avoid the possibility of large errors, the windows should not be open when using the alternate static source.

NOTE

In an emergency on airplanes not equipped with an alternate static source, cabin pressure can be supplied to the static pressure instruments by breaking the glass in the face of the rate-of-climb indicator.

A calibration table is provided in Section 5 to illustrate the effect of the alternate static source on indicated airspeeds. With the windows and vents closed the airspeed indicator may typically read as much as 3 knots faster and the altimeter 45 feet higher in cruise. With the vents open, this variation reduces to zero. If the alternate static source must be used for landing, the normal indicated approach speed may be used since the indicated airspeed variations in this configuration are 2 knots or less.

SPINS

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

(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 WHEEL BRISKLY FORWARD FAR ENOUGH TO BREAK THE STALL.
(5) HOLD THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend the recovery.
(6) AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

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

ROUGH ENGINE OPERATION OR LOSS OF POWER

CARBURETOR ICING

An unexplained drop in manifold pressure and eventual engine roughness may result from the formation of carburetor ice. To clear the ice, apply full throttle and pull the carburetor heat knob full out until the engine runs smoothly; then remove carburetor heat and readjust the throttle.

If conditions require the continued use of carburetor heat in cruise flight, use the minimum amount of heat necessary to prevent ice from forming and lean the mixture for smoothest engine operation.

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 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 setting for cruising flight. 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 for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of single ignition position.

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 practicable. If not, switch to the good magneto and proceed to the nearest airport for repairs.

LOW OIL PRESSURE

If low oil pressure is accompanied by normal oil temperature, there is a possibility the oil pressure gage or relief valve is malfunctioning. A leak in the line to the gage is not necessarily cause for an immediate precautionary landing because an orifice in this line will prevent a sudden loss of oil from the engine sump. However, a landing at the nearest airport would be advisable to inspect the source of trouble.

If a total loss of oil pressure is accompanied by a rise in oil temperature, there is good reason to suspect an engine failure is imminent. Reduce engine power immediately and select a suitable forced landing field. Use only the minimum power required to reach the desired touchdown spot.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and over-voltage warning light; however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is most likely the cause of alternator failures, although other factors could cause the problem. A damaged or improperly adjusted voltage regulator can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The following paragraphs describe the recommended remedy for each situation.

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than two needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate. Electronic components in the electrical system could be adversely affected by higher than normal voltage if a faulty voltage regulator setting is causing the overcharging. To preclude these possibilities, an over-voltage sensor will automatically shut down the alternator and the over-voltage warning light will illuminate if the charge voltage reaches approximately 16 volts. Assuming that the malfunction was only momentary, an attempt should be made to reactivate the alternator system. To do this, turn both sides of the master switch off and then on again. If the problem no longer exists, normal alternator charging will resume and the warning light will go off. If the light illuminates again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. If the emergency occurs at night, power must be conserved for later operation of the wing flaps and possible use of the landing lights during landing.

INSUFFICIENT RATE OF CHARGE

If the ammeter indicates a continuous discharge rate in flight, the alternator is not supplying power to the system and should be shut down since the alternator field circuit may be placing an unnecessary load on the system. All nonessential equipment should be turned off and the flight terminated as soon as practical.

SECTION 4
NORMAL PROCEDURES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

INTRODUCTION

Section 4 provides checklist and amplified procedures for the conduct of normal operation. Normal procedures associated with Optional Systems can be found in Section 9.

SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 2950 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section 5 for takeoff distance, the speed appropriate to the particular weight must be used.

Takeoff:
- Normal Climb Out . . . . 70-80 KIAS
- Short Field Takeoff, Flaps 20°, Speed at 50 Feet . . . . 57 KIAS

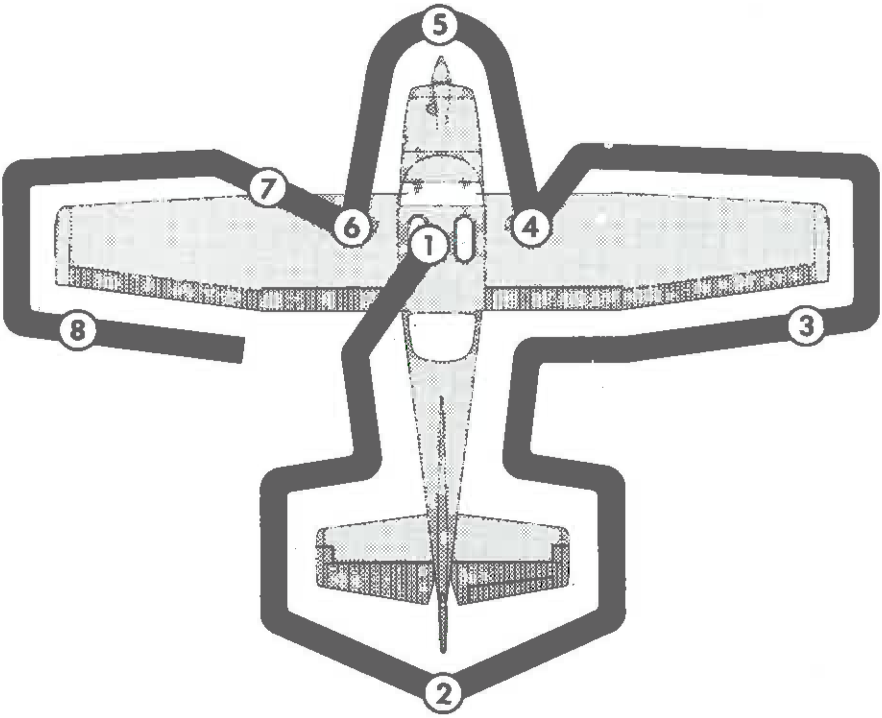
Enroute Climb, Flaps Up:
- Normal . . . . 85-95 KIAS
- Best Rate of Climb, Sea Level . . . . 78 KIAS
- Best Rate of Climb, 10,000 Feet . . . . 72 KIAS
- Best Angle of Climb, Sea Level . . . . 54 KIAS
- Best Angle of Climb, 10,000 Feet . . . . 62 KIAS

Landing Approach:
- Normal Approach, Flaps Up . . . . 70-80 KIAS
- Normal Approach, Flaps 40° . . . . 60-70 KIAS
- Short Field Approach, Flaps 40° . . . . 60 KIAS

Balked Landing:
- Maximum Power, Flaps 20° . . . . 55 KIAS

Maximum Recommended Turbulent Air Penetration Speed:
- 2950 Lbs . . . . 111 KIAS
- 2450 Lbs . . . . 100 KIAS
- 1950 Lbs . . . . 89 KIAS

Maximum Demonstrated Crosswind Velocity:
- Takeoff . . . . 20 KNOTS
- Landing . . . . 15 KNOTS



NOTE

Visually check airplane for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and controls surfaces. Also, make sure that the control surfaces contain no internal accumulations of ice or debris. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-1. Preflight Inspection

CHECKLIST PROCEDURES

PREFLIGHT INSPECTION

① CABIN

(1) Control Wheel Lock -- REMOVE.
(2) Ignition Switch -- OFF.
(3) Master Switch -- ON.
(4) Fuel Quantity Indicators -- CHECK QUANTITY.
(5) Master Switch -- OFF.
(6) Fuel Selector Valve -- BOTH.
(7) Baggage Door -- CHECK for security, lock with key if child's seat is to be occupied.

② EMPENNAGE

(1) Rudder Gust Lock -- REMOVE.
(2) Tail Tie-Down -- DISCONNECT.
(3) Control Surfaces -- CHECK freedom of movement and security.

③ RIGHT WING Trailing Edge

(1) Aileron -- CHECK freedom of movement and security.

④ RIGHT WING

(1) Wing Tie-Down -- DISCONNECT.
(2) Main Wheel Tire -- CHECK for proper inflation.
(3) Before first flight of the day and after each refueling, use sampler cup and drain small quantity of fuel from fuel tank sump quick-drain valve to check for water, sediment and proper fuel grade.
(4) Fuel Quantity -- CHECK VISUALLY for desired level.
(5) Fuel Filler Cap -- SECURE and vent unobstructed.

⑤ NOSE

(1) Static Source Openings (both sides of fuselage) -- CHECK for stoppage.
(2) Propeller and Spinner -- CHECK for nicks, security and oil leaks.
(3) Landing Lights -- CHECK for condition and cleanliness.
(4) Carburetor Air Filter -- CHECK for restrictions by dust or other foreign matter.

(5) Nose Wheel Strut and Tire -- CHECK for proper inflation.
(6) Nose Tie-Down -- DISCONNECT.
(7) Engine Oil Level -- CHECK. Do not operate with less than nine quarts. Fill to twelve quarts for extended flight.
(8) Before first flight of the day and after each refueling, pull out strainer drain knob for about four seconds to clear fuel strainer of possible water and sediment. Check strainer drain closed. If water is observed, the fuel system may contain additional water, and further draining of the system at the strainer, fuel tank sumps, and fuel selector valve drain plug will be necessary.

6 LEFT WING

(1) Main Wheel Tire -- CHECK for proper inflation.
(2) Before first flight of the day and after each refueling, use sampler cup and drain small quantity of fuel from fuel tank sump quick-drain valve to check for water, sediment, and proper fuel grade.
(3) Fuel Quantity -- CHECK VISUALLY for desired level.
(4) Fuel Filler Cap -- SECURE and vent unobstructed.

7 LEFT WING Leading Edge

(1) Pitot Tube Cover -- REMOVE and check opening for stoppage.
(2) Fuel Tank Vent Opening -- CHECK for stoppage.
(3) Stall Warning Vane -- CHECK for freedom of movement while master switch is momentarily turned ON (horn should sound when vane is pushed upward).
(4) Wing Tie-Down -- DISCONNECT.

8 LEFT WING Trailing Edge

(1) Aileron -- CHECK for freedom of movement and security.

BEFORE STARTING ENGINE

(1) Preflight Inspection -- COMPLETE.
(2) Seats, Belts, Shoulder Harnesses -- ADJUST and LOCK.
(3) Fuel Selector Valve -- BOTH.
(4) Radios, Autopilot, Electrical Equipment -- OFF.
(5) Brakes -- TEST and SET.
(6) Cowl Flaps -- OPEN (move lever out of locking hole to reposition).
(7) Circuit Breakers -- CHECK IN.

STARTING ENGINE

(1) Mixture -- RICH.
(2) Propeller -- HIGH RPM.
(3) Carburetor Heat -- COLD.
(4) Throttle -- OPEN 1/2 INCH.
(5) Prime -- AS REQUIRED.
(6) Master Switch -- ON.
(7) Propeller Area -- CLEAR.
(8) Ignition Switch -- START (release when engine starts).

NOTE

If engine has been overprimed, start with throttle 1/4 to 1/2 open. Reduce throttle to idle when engine fires.

(9) Oil Pressure -- CHECK.

BEFORE TAKEOFF

(1) Cabin Doors and Windows -- CLOSED and LOCKED.
(2) Parking Brake -- SET.
(3) Flight Controls -- FREE and CORRECT.
(4) Flight Instruments -- SET.
(5) Fuel Selector Valve -- BOTH.
(6) Mixture -- RICH.
(7) Elevator and Rudder Trim -- TAKEOFF.
(8) Throttle -- 1700 RPM.
a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
b. Propeller -- CYCLE from high to low RPM; return to high RPM (full in).
c. Carburetor Heat -- CHECK for RPM drop.
d. Engine Instruments and Ammeter -- CHECK.
e. Suction Gage -- CHECK.
(9) Radios -- SET.
(10) Autopilot (if installed) -- OFF.
(11) Flashing Beacon, Navigation Lights and/or Strobe Lights -- ON as required.
(12) Throttle Friction Lock -- ADJUST.

TAKEOFF

NORMAL TAKEOFF

(1) Wing Flaps -- 0° - 20°.

(2) Carburetor Heat -- COLD.
(3) Power -- FULL THROTTLE and 2400 RPM.
(4) Elevator Control -- LIFT NOSE WHEEL at 50 KIAS.
(5) Climb Speed -- 70 KIAS (flaps 20°).
80 KIAS (flaps UP).

SHORT FIELD TAKEOFF

(1) Wing Flaps -- 20°.
(2) Carburetor Heat -- COLD.
(3) Brakes -- APPLY.
(4) Power -- FULL THROTTLE and 2400 RPM.
(5) Brakes -- RELEASE.
(6) Elevator Control -- MAINTAIN SLIGHTLY TAIL LOW ATTITUDE.
(7) Climb Speed -- 57 KIAS (until all obstacles are cleared).
(8) Wing Flaps -- RETRACT slowly after reaching 70 KIAS.

ENROUTE CLIMB

NORMAL CLIMB

(1) Airspeed -- 85-95 KIAS.
(2) Power -- 23 INCHES Hg and 2400 RPM.
(3) Fuel Selector Valve -- BOTH.
(4) Mixture -- FULL RICH (mixture may be leaned above 5000 feet).
(5) Cowl Flaps -- OPEN as required.

MAXIMUM PERFORMANCE CLIMB

(1) Airspeed -- 78 KIAS at sea level to 72 KIAS at 10,000 feet.
(2) Power -- FULL THROTTLE and 2400 RPM.
(3) Fuel Selector Valve -- BOTH.
(4) Mixture -- FULL RICH (mixture may be leaned above 5000 feet).
(5) Cowl Flaps -- FULL OPEN.

CRUISE

(1) Power -- 15-23 INCHES Hg, 2100-2400 RPM (no more than 75% power).
(2) Elevator and Rudder Trim -- ADJUST.
(3) Mixture -- LEAN.
(4) Cowl Flaps -- CLOSED.

DESCENT

(1) Power -- AS DESIRED.
(2) Carburetor Heat -- AS REQUIRED to prevent carburetor icing.
(3) Mixture -- ENRICHEN as required.
(4) Cowl Flaps -- CLOSED.
(5) Wing Flaps -- AS DESIRED (0° - 10° below 140 KIAS, 10° - 40° below 95 KIAS).

BEFORE LANDING

(1) Seats, Belts, Shoulder Harnesses -- ADJUST and LOCK.
(2) Fuel Selector Valve -- BOTH.
(3) Mixture -- RICH.
(4) Carburetor Heat -- ON (apply full heat before closing throttle).
(5) Propeller -- HIGH RPM.
(6) Autopilot (if installed) -- OFF.

LANDING

NORMAL LANDING

(1) Airspeed -- 70-80 KIAS (flaps UP).
(2) Wing Flaps -- AS DESIRED (0°- 10° below 140 KIAS, 10°- 40° below 95 KIAS).
(3) Airspeed -- 60 - 70 KIAS (flaps DOWN).
(4) Trim -- ADJUST.
(5) Touchdown -- MAIN WHEELS FIRST.
(6) Landing Roll -- LOWER NOSE WHEEL GENTLY.
(7) Braking -- MINIMUM REQUIRED.

SHORT FIELD LANDING

(1) Airspeed -- 70-80 KIAS (flaps UP).
(2) Wing Flaps -- 40° (below 95 KIAS).
(3) Airspeed -- MAINTAIN 60 KIAS.
(4) Trim -- ADJUST.
(5) Power -- REDUCE to idle as obstacle is cleared.
(6) Touchdown -- MAIN WHEELS FIRST.
(7) Brakes -- APPLY HEAVILY.
(8) Wing Flaps -- RETRACT for maximum brake effectiveness.

BALKED LANDING

(1) Power -- FULL THROTTLE and 2400 RPM.
(2) Carburetor Heat -- COLD.
(3) Wing Flaps -- RETRACT to 20°.
(4) Climb Speed -- 55 KIAS.
(5) Wing Flaps -- RETRACT slowly after reaching 70 KIAS.
(6) Cowl Flaps -- OPEN.

AFTER LANDING

(1) Wing Flaps -- UP.
(2) Carburetor Heat -- COLD.
(3) Cowl Flaps -- OPEN.

SECURING AIRPLANE

(1) Parking Brake -- SET.
(2) Radios, Electrical Equipment, Autopilot -- OFF.
(3) Throttle -- IDLE.
(4) Mixture -- IDLE CUT-OFF (pulled full out).
(5) Ignition Switch -- OFF.
(6) Master Switch -- OFF.
(7) Control Lock -- INSTALL.
(8) Fuel Selector Valve -- RIGHT.

AMPLIFIED PROCEDURES

STARTING ENGINE

Ordinarily the engine starts easily with one or two strokes of the primer in warm temperatures to six strokes in cold weather with the throttle open approximately 1/2 inch. In extremely cold temperatures it may be necessary to continue priming while cranking. Weak intermittent firing followed by puffs of black smoke from the exhaust stack indicate overpriming or flooding. Excess fuel can be cleared from the combustion chambers by the following procedure: Set the mixture control full lean and the throttle full open; then crank the engine through several revolutions with the starter. Repeat the starting procedure without any additional priming.

If the engine is underprimed (most likely in cold weather with a cold engine) it will not fire at all. Additional priming will be necessary for the next starting attempt. As soon as the cylinders begin to fire, open the throttle slightly to keep it running.

If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the armature.

After starting, if the oil gage does not begin to show pressure within 30 seconds in the summertime and about twice that long in very cold weather, stop engine and investigate. Lack of oil pressure can cause serious engine damage. After starting, avoid the use of carburetor heat unless icing conditions prevail.

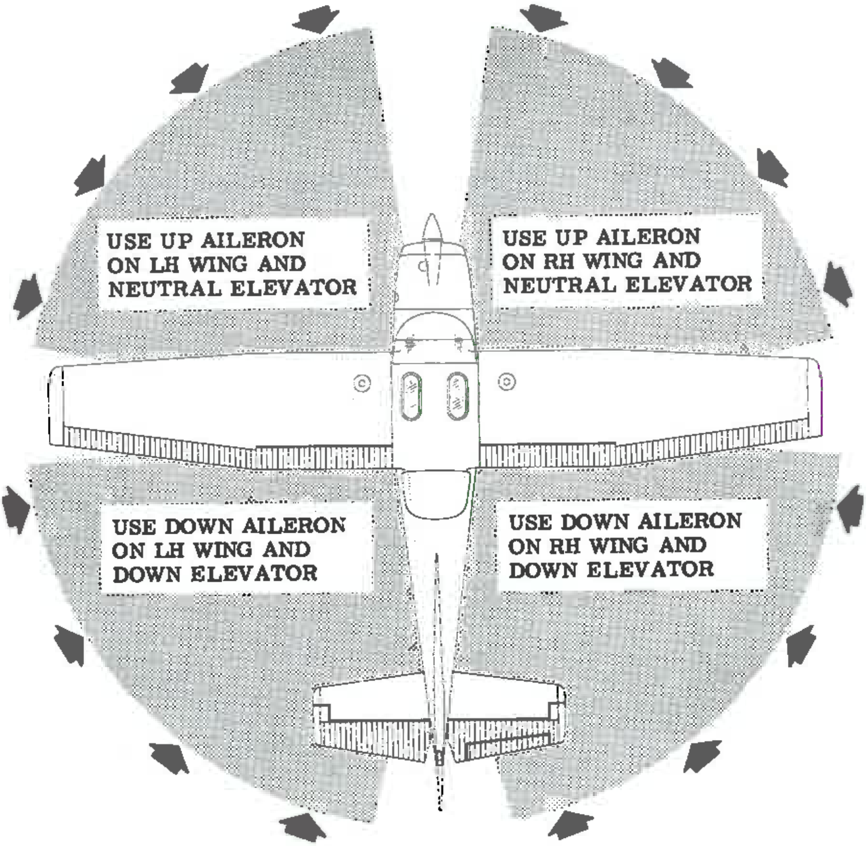
NOTE

Additional details concerning cold weather starting and operation may be found under COLD WEATHER OPERATION paragraphs in this section.

TAXIING

When taxiing, it is important that speed and use of brakes be held to a minimum and that all controls be utilized (see Taxiing Diagram, figure 4-2) to maintain directional control and balance.

The carburetor heat control knob should be pushed full in during all ground operations unless heat is absolutely necessary for smooth engine



CODE

WIND DIRECTION ➡

NOTE

Strong quartering tail winds require caution. Avoid sudden bursts of the throttle and sharp braking when the airplane is in this attitude. Use the steerable nose wheel and rudder to maintain direction.

Figure 4-2. Taxiing Diagram

operation. When the knob is pulled out to the heat position, air entering the engine is not filtered.

Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips.

BEFORE TAKEOFF

WARM-UP

Since the engine is closely cowled for efficient in-flight cooling, precautions should be taken to avoid overheating on the ground. Full throttle checks on the ground are not recommended unless the pilot has good reason to suspect that the engine is not turning up properly.

MAGNETO CHECK

The magneto check should be made at 1700 RPM as follows. Move ignition switch first to R position, and note RPM. Next move switch back to BOTH to clear the other set of plugs. Then move switch to L position, note RPM and return the switch to the BOTH position. RPM drop should not exceed 150 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speed will usually confirm whether a deficiency exists.

An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system or should be cause for suspicion that the magneto timing is set in advance of the setting specified.

ALTERNATOR CHECK

Prior to flight where verification of proper alternator and voltage regulator operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (3 to 5 seconds) with the landing light during the engine runup (1700 RPM). The ammeter will remain within a needle width of the initial reading if the alternator and voltage regulator are operating properly.

TAKEOFF

POWER CHECK

It is important to check full-throttle engine operation early in the takeoff run. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff.

Full-throttle runups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it. When unavoidable small dents appear in the propeller blades they should be corrected immediately as described in Section 8 under Propeller Care.

After full throttle is applied, adjust the throttle friction lock clockwise to prevent the throttle from creeping back from a maximum power position. Similar friction lock adjustment should be made as required in other flight conditions to maintain a fixed throttle setting.

WING FLAP SETTINGS

Normal takeoffs are accomplished with wing flaps 0° to 20°. Using 20° wing flaps reduces the ground run and total distance over an obstacle by approximately 20 per cent. Flap deflections greater than 20° are not approved for takeoff.

If 20° wing flaps are used for takeoff, they should be left down until all obstacles are cleared and a safe flap retraction speed of 70 KIAS is reached. To clear an obstacle with wing flaps 20°, an obstacle clearance speed of 57 KIAS should be used.

Soft field takeoffs are performed with 20° flaps by lifting the airplane off the ground as soon as practical in a slightly tail-low attitude. If no obstacles are ahead, the airplane should be leveled off immediately to accelerate to a safer climb speed.

With wing flaps retracted and no obstructions ahead, a climb-out speed of 80 KIAS would be most efficient.

CROSSWIND TAKEOFF

Takeoffs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. The airplane is accelerated to a speed slightly higher than normal, then pulled off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

ENROUTE CLIMB

Normal climbs are performed at 85-95 KIAS with flaps up, 23 In. Hg. or full throttle (whichever is greater) and 2400 RPM for the best combination of engine cooling, rate of climb and forward visibility. If it is necessary to climb rapidly to clear mountains or reach favorable winds at high altitudes, the best rate-of-climb speed should be used with maximum power. This speed is 78 KIAS at sea level, decreasing to 72 KIAS at 10,000 feet.

If an obstruction ahead requires a steep climb angle, a best angle-of-climb speed should be used with flaps up and maximum power. This speed is 54 KIAS at sea level, increasing to 62 KIAS at 10,000 feet.

The mixture should be full rich during climb at altitudes up to 5000 feet. Above 5000 feet, the mixture may be leaned for smooth engine operation and increased power.

CRUISE

Normal cruising is performed between 55% and 75% power. The corresponding power settings and fuel consumption for various altitudes can be determined by using your Cessna Power Computer or the Data in Section 5.

NOTE

Cruising should be done at 75% power as much as practical until a total of 50 hours has accumulated or oil consumption has stabilized. This is to ensure 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 Cruise Performance Table, figure 4-3, illustrates the true airspeed and nautical miles per gallon during cruise for various altitudes and percent powers. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip. The selection of cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

For reduced noise levels, it is desirable to select the lowest RPM in the green arc range for a given percent power that will provide smooth engine operation. The cowl flaps should be opened, if necessary, to maintain the cylinder head temperature at approximately two-thirds of the normal operating range (green arc).

Cruise performance data in this handbook and on the power computer is based on a recommended lean mixture setting which may be established as follows:

(1) Lean the mixture until the engine becomes rough.
(2) Enrichen the mixture to obtain smooth engine operation; then further enrichen an equal amount.

For best fuel economy at 65% power or less, the engine may be operated at the leanest mixture that results in smooth engine operation. This will result in approximately 5% greater range than shown in this handbook accompanied by approximately 3 knots decrease in speed.

Any change in altitude, power or carburetor heat will require a change in the recommended lean mixture setting and a recheck of the EGT setting (if installed).

Carburetor ice, as evidenced by an unexplained drop in manifold pressure, can be removed by application of full carburetor heat. Upon regaining the original manifold pressure indication (with heat off), use the minimum amount of heat (by trial and error) to prevent ice from forming. Since heated air causes a richer mixture, readjust the mixture setting when carburetor heat is used continuously in cruising flight.

	75% POWER		65% POWER		55% POWER	
ALTITUDE	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
4000 Feet	139	10.8	131	11.8	121	12.8
6000 Feet	141	11.0	133	12.0	123	13.0
8000 Feet	144	11.2	135	12.2	125	13.2
10,000 Feet	- - -	- - -	138	12.4	127	13.4
Standard Conditions						Zero Wind

Figure 4-3. Cruise Performance Table

The use of full carburetor heat is recommended during flight in very heavy rain to avoid the possibility of engine stoppage due to excessive water ingestion. The mixture setting should be readjusted for smoothest operation.

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the optional Cessna Economy Mixture Indicator may be used as an aid for mixture leaning in cruising flight at 75% power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by a desired increment based on figures in the table below.

Continuous operation at peak EGT is authorized only at 65% power or less. This best economy mixture setting results in approximately 5% greater range than shown in this handbook accompanied by approximately 3 knots decrease in speed.

NOTE

Operation on the lean side of peak EGT is not approved.

When leaning the mixture under some conditions, engine roughness may occur before peak EGT is reached. In this case, use the EGT corresponding to the onset of roughness as the reference point instead of peak EGT.

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilots Operating Handbook and Power Computer)	50°F Rich of Peak EGT
BEST ECONOMY (65% Power or Less)	Peak EGT

Figure 4-4. EGT Table

STALLS

The stall characteristics are conventional and aural warning is provided by a stall warning horn which sounds between 5 and 10 knots above the stall in all configurations.

Power-off stall speeds at maximum weight for both forward and aft c.g. positions are presented in Section 5.

LANDING

NORMAL LANDING

Landings should be made on the main wheels first to reduce the landing speed and the subsequent need for braking in the landing roll. The nose wheel is lowered gently to the runway after the speed has diminished to avoid unnecessary nose gear load. This procedure is especially important in rough field landings.

SHORT FIELD LANDING

For a short field landing, make a power-off approach at 60 KIAS with 40° flaps and land on the main wheels first. Immediately after touchdown, lower the nose gear to the ground and apply heavy braking as required. For maximum brake effectiveness after all three wheels are on the ground, retract the flaps, hold full nose up elevator and apply maximum possible brake pressure without sliding the tires.

CROSSWIND LANDING

When landing in a strong crosswind, use the minimum flap setting required for the field length. Although the crab or combination method of drift correction may be used, the wing-low method gives the best control. After touchdown, hold a straight course with the steerable nose wheel and occasional braking if necessary.

BALKED LANDING

In a balked landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. After all obstacles are cleared and a safe altitude and airspeed are obtained, the wing flaps should be retracted.

COLD WEATHER OPERATION

STARTING

Prior to starting on a cold morning, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy.

NOTE

When pulling the propeller through by hand, treat it as if the ignition switch is turned on. A loose or broken ground wire on either magneto could cause the engine to fire.

In extremely cold (-18°C and lower) weather, the use of an external preheater and an external power source are recommended whenever possible to obtain positive starting and to reduce wear and abuse to the engine and the electrical system. Pre-heat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures. When using an external power source, the position of the master switch is important. Refer to Section 7, paragraph Ground Service Plug Receptacle, for operating details.

Cold weather starting procedures are as follows:

With Preheat:

(1) With ignition switch turned off, mixture full rich and throttle open 1/2 inch, prime the engine four to eight strokes as the propeller is being turned over by hand.

NOTE

Use heavy strokes of the primer for best atomization of fuel. After priming, push primer all the way in and turn to the locked position to avoid the possibility of the engine drawing fuel through the primer.

(2) Propeller -- CLEAR.
(3) Master Switch -- ON.
(4) Ignition Switch -- START (release to BOTH when engine starts).
(5) Pull carburetor heat on after engine has started, and leave on until the engine is running smoothly.

Without Preheat:

(1) Prime the engine six to eight strokes while the propeller is being turned by hand with mixture full rich and throttle open 1/2 inch. Leave the primer charged and ready for stroke.
(2) Propeller -- CLEAR.
(3) Master Switch -- ON.

(4) Ignition Switch -- START.
(5) Pump throttle rapidly to full open twice. Return to 1/2 inch open position.
(6) Release ignition switch to BOTH when engine starts.
(7) Continue to prime the engine until it is running smoothly, or alternately, pump the throttle rapidly over the first 1/4 of total travel.
(8) Oil Pressure -- CHECK.
(9) Pull carburetor heat on after engine has started. Leave on until the engine is running smoothly.
(10) Primer -- LOCK.

NOTE

If the engine does not start during the first few attempts, or if engine firing diminishes in strength, it is probable that the spark plugs have been frosted over. Preheat must be used before another start is attempted.

CAUTION

Pumping the throttle may cause raw fuel to accumulate in the intake air duct, creating a fire hazard in the event of a backfire. If this occurs, maintain a cranking action to suck the flames into the engine. An outside attendant with a fire extinguisher is advised for cold starts without preheat.

OPERATION

During cold weather operations, no indication will be apparent on the oil temperature gage prior to takeoff if outside air temperatures are very cold. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and the oil pressure remains normal and steady, the airplane is ready for takeoff.

Rough engine operation in cold weather can be caused by a combination of an inherently leaner mixture due to the dense air and poor vaporization and distribution of the fuel-air mixture to the cylinders. The effects of these conditions are especially noticeable during operation on one magneto in ground checks where only one spark plug fires in each cylinder.

For optimum operation of the engine in cold weather, the appropriate use of carburetor heat is recommended. The following procedures are indicated as a guideline:

(1) Use carburetor heat during engine warm-up and ground check.

Full carburetor heat may be required for temperatures below -12°C whereas partial heat could be used in temperatures between -12°C and 4°C.

(2) Use the minimum carburetor heat required for smooth operation in take-off, climb, and cruise.

NOTE

Care should be exercised when using partial carburetor heat to avoid icing. Partial heat may raise the carburetor air temperature to 0° to 21° C range where icing is critical under certain atmospheric conditions.

(3) If the airplane is equipped with a carburetor air temperature gage, it can be used as a reference in maintaining carburetor air temperature at or slightly above the top of the yellow arc by application of carburetor heat.

HOT WEATHER OPERATION

The general warm temperature starting information in this section is appropriate. Avoid prolonged engine operation on the ground.

NOISE ABATEMENT

Increased emphasis on improving the quality of our environment requires renewed effort on the part of all pilots to minimize the effect of airplane noise on the public.

We, as pilots, can demonstrate our concern for environmental improvement, by application of the following suggested procedures, and thereby tend to build public support for aviation:

(1) Pilots operating aircraft under VFR over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.

(2) During departure from or approach to an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas.

NOTE

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

The certificated noise level for the Model 182Q at 2950 pounds maximum weight is 69.1 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.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION

Performance data charts on the following pages are presented so that you may know what to expect from the airplane under various conditions, and also, to facilitate the planning of flights in detail and with reasonable accuracy. The data in the charts has been computed from actual flight tests with the airplane and engine in good condition and using average piloting techniques.

It should be noted that the performance information presented in the range and endurance profile charts allows for 45 minutes reserve fuel based on 45% power. Fuel flow data for cruise is based on the recommended lean mixture setting. Some indeterminate variables such as mixture leaning technique, fuel metering characteristics, engine and propeller condition, and air turbulence may account for variations of 10% or more in range and endurance. Therefore, it is important to utilize all available information to estimate the fuel required for the particular flight.

USE OF PERFORMANCE CHARTS

Performance data is presented in tabular or graphical form to illustrate the effect of different variables. Sufficiently detailed information is provided in the tables so that conservative values can be selected and used to determine the particular performance figure with reasonable accuracy.

SAMPLE PROBLEM

The following sample flight problem utilizes information from the various charts to determine the predicted performance data for a typical flight. The following information is known:

AIRPLANE CONFIGURATION	
Takeoff weight	2850 Pounds
Usable fuel	75 Gallons
TAKEOFF CONDITIONS	
Field pressure altitude	1500 Feet
Temperature	28°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	3500 Feet

CRUISE CONDITIONS	
Total distance	720 Nautical Miles
Pressure altitude	7500 Feet
Temperature	16°C (16°C above standard)
Expected wind enroute	10 Knot Headwind
LANDING CONDITIONS	
Field pressure altitude	2000 Feet
Temperature	25°C
Field length	3000 Feet

TAKEOFF

The takeoff distance chart, figure 5-4, should be consulted, keeping in mind that the distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 2950 pounds, pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	930 Feet
Total distance to clear a 50-foot obstacle	1800 Feet

These distances are well within the available takeoff field length. However, a correction for the effect of wind may be made based on Note 3 of the takeoff chart. The correction for a 12 knot headwind is:

$$\frac{12 \text{ Knots}}{9 \text{ Knots}} \times 10\% = 13\% \text{ Decrease}$$

This results in the following distances, corrected for wind:

Ground roll, zero wind	930
Decrease in ground roll (930 feet × 13%)	121
Corrected ground roll	809 Feet

Total distance to clear a 50-foot obstacle, zero wind	1800
Decrease in total distance (1800 feet × 13%)	234
Corrected total distance to clear a 50-foot obstacle	1566 Feet

CRUISE

The cruising altitude should be selected based on a consideration of trip length, winds aloft, and the airplane's performance. A cruising altitude and the expected wind enroute have been given for this sample problem. However, the power setting selection for cruise must be determined based on several considerations. These include the cruise performance characteristics presented in figure 5-7, the range profile chart presented in figure 5-8, and the endurance profile chart presented in figure 5-9.

The relationship between power and range is illustrated by the range profile chart. Considerable fuel savings and longer range result when lower power settings are used.

The range profile chart indicates that use of 65% power at 7500 feet yields a predicted range of 795 nautical miles with no wind. The endurance profile chart shows a corresponding 5.9 hours. Using this information, the estimated distance can be determined for the expected 10 knot headwind at 7500 feet as follows:

Range, zero wind	795
Decrease in range due to wind (5.9 hours × 10 knot headwind)	59
Corrected range	736 Nautical Miles

This indicates that the trip can be made without a fuel stop using approximately 65% power.

The cruise performance chart for 8,000 feet pressure altitude is entered using 20° C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The power setting chosen is 2200 RPM and 21 inches of manifold pressure, which results in the following:

Power	65%
True airspeed	137 Knots
Cruise fuel flow	11.0 GPH

The power computer may be used to determine power and fuel consumption more accurately during the flight.

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, figure 5-6 shows that a normal climb from 2000 feet to 8000 feet requires 2.8 gallons of fuel. The corresponding distance during the climb is 15 nautical miles. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

$$\frac{16°C}{10°C} \times 10\% = 16\% \text{ Increase}$$

With this factor included, the fuel estimate would be calculated as follows:

Fuel to climb, standard temperature	2.8
Increase due to non-standard temperature (2.8 ×16%)	0.4
Corrected fuel to climb	3.2 Gallons

Using a similar procedure for the distance during climb results in 17 nautical miles.

The resultant cruise distance is:

Total distance	720
Climb distance	-17
Cruise distance	703 Nautical Miles

With an expected 10 knot headwind, the ground speed for cruise is predicted to be:

137
-10
127 Knots

Therefore, the time required for the cruise portion of the trip is:

$$\frac{703 \text{ Nautical Miles}}{127 \text{ Knots}} = 5.5 \text{ Hours}$$

The fuel required for cruise is:

5.5 hours × 11.0 gallons/hour = 60.5 Gallons

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	1.7
Climb	3.2
Cruise	60.5
Total fuel required	65.4 Gallons

This will leave a fuel reserve of:

$$
\begin{array}{r}
75.0 \\
\underline{-65.4} \\
9.6
\end{array}
\text{ Gallons}
$$

Once the flight is underway, ground speed checks will provide a more accurate basis for estimating the time enroute and the corresponding fuel required to complete the trip with ample reserve.

LANDING

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-10 presents landing distance information for the short field technique. The distances corresponding to 2000 feet pressure altitude and a temperature of 30°C are as follows:

Ground roll	670 Feet
Total distance to clear a 50-foot obstacle	1480 Feet

A correction for the effect of wind may be made based on Note 2 of the landing chart using the same procedure as outlined for takeoff.

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

FLAPS UP													
KIAS	50	60	70	80	90	100	110	120	130	140	150	160	---
KCAS	60	64	71	80	89	99	108	117	127	136	145	155	---
FLAPS 20°													
KIAS	40	50	60	70	80	90	95	---	---	---	---	---	---
KCAS	52	57	64	72	81	90	95	---	---	---	---	---	---
FLAPS 40°													
KIAS	40	50	60	70	80	90	95	---	---	---	---	---	---
KCAS	51	56	63	72	81	91	95	---	---	---	---	---	---

Figure 5-1. Airspeed Calibration (Sheet 1 of 2)

AIRSPEED CALIBRATION

ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP											
NORMAL KIAS	60	70	80	90	100	110	120	130	140	150	160
ALTERNATE KIAS	59	70	80	91	102	112	122	133	143	153	163
FLAPS 20°											
NORMAL KIAS	50	60	70	80	90	95	---	---	---	---	---
ALTERNATE KIAS	51	62	72	82	92	97	---	---	---	---	---
FLAPS 40°											
NORMAL KIAS	40	50	60	70	80	90	95	---	---	---	---
ALTERNATE KIAS	43	51	60	71	81	90	95	---	---	---	---

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP											
NORMAL KIAS	60	70	80	90	100	110	120	130	140	150	160
ALTERNATE KIAS	60	70	80	90	100	110	120	130	140	150	160
FLAPS 20°											
NORMAL KIAS	50	60	70	80	90	95	---	---	---	---	---
ALTERNATE KIAS	50	60	70	79	89	93	---	---	---	---	---
FLAPS 40°											
NORMAL KIAS	40	50	60	70	80	90	95	---	---	---	---
ALTERNATE KIAS	41	49	59	68	78	87	92	---	---	---	---

Figure 5-1. Airspeed Calibration (Sheet 2 of 2)

TEMPERATURE CONVERSION CHART

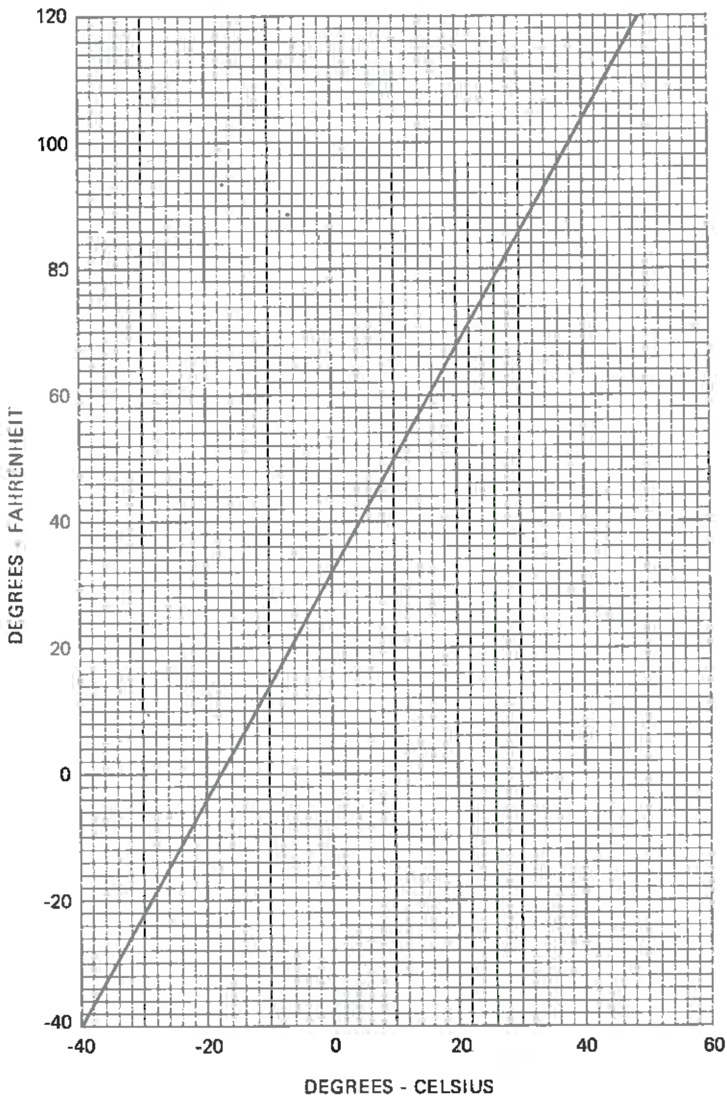


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:
Power Off

NOTES:
1. Maximum altitude loss during a stall recovery may be as much as 160 feet.
2. KIAS values are approximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2950	UP	41	56	44	60	49	67	58	79
	20°	38	51	41	55	45	61	54	72
	40°	38	50	41	54	45	59	54	71

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2950	UP	48	59	52	63	57	70	68	83
	20°	47	55	51	59	56	65	66	78
	40°	45	54	48	58	54	64	64	76

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE

MAXIMUM WEIGHT 2950 LBS

SHORT FIELD

CONDITIONS:
Flaps 20°
2400 RPM and Full Throttle Prior to Brake Release
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind

NOTES:
1. Short field technique as specified in Section 4.
2. Prior to takeoff from fields above 5000 feet elevation, the mixture should be leaned to give maximum power in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
4. Where distance value has been deleted, climb performance after lift-off is less than 150 fpm at takeoff speed.
5. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2950	49	57	S.L.	635	1220	680	1305	730	1395	780	1490	835	1590
			1000	690	1335	745	1430	795	1530	850	1635	910	1745
			2000	755	1465	810	1565	870	1680	930	1800	995	1925
			3000	825	1605	890	1725	950	1850	1020	1985	1090	2130
			4000	905	1770	970	1905	1045	2050	1120	2205	1195	2370
			5000	995	1965	1065	2115	1145	2280	1230	2460	1315	2655
			6000	1090	2185	1175	2360	1260	2555	1350	2765	1450	3005
			7000	1200	2450	1290	2655	1390	2885	1490	3145	---	---
			8000	1325	2765	1425	3015	1530	3300	---	---	---	---

Figure 5-4. Takeoff Distance (Sheet 1 of 2)

TAKEOFF DISTANCE

2700 LBS AND 2400 LBS

SHORT FIELD

REFER TO SHEET 1 FOR APPROPRIATE CONDITIONS AND NOTES.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2700	47	55	S.L.	520	1000	555	1065	595	1135	635	1210	680	1285
			1000	565	1085	605	1160	650	1235	695	1320	740	1405
			2000	615	1185	660	1265	710	1355	760	1445	810	1540
			3000	675	1295	725	1385	775	1485	830	1585	885	1695
			4000	735	1425	790	1525	850	1630	910	1745	970	1870
			5000	805	1565	865	1680	930	1800	995	1930	1065	2075
			6000	885	1730	950	1860	1020	1995	1095	2150	1170	2310
			7000	970	1920	1045	2065	1120	2225	1205	2400	1290	2595
			8000	1070	2140	1150	2310	1235	2500	1325	2705	1420	2935
2400	44	52	S.L.	395	775	425	825	455	875	485	930	520	990
			1000	430	840	465	895	495	950	530	1010	565	1075
			2000	470	915	505	975	540	1035	575	1105	615	1175
			3000	515	995	550	1060	590	1130	630	1205	675	1285
			4000	560	1085	600	1160	645	1235	690	1320	735	1405
			5000	615	1185	655	1270	705	1355	755	1445	805	1545
			6000	670	1300	720	1395	770	1490	825	1595	885	1705
			7000	735	1435	790	1535	845	1645	905	1765	970	1890
			8000	810	1585	870	1700	930	1825	1000	1960	1070	2105

Figure 5-4. Takeoff Distance (Sheet 2 of 2)

RATE OF CLIMB

MAXIMUM

CONDITIONS:
Flaps Up
2400 RPM
Full Throttle
Cowl Flaps Open

NOTE:
Mixture leaned above 5000 feet for smooth engine operation and increased power.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
2950	S.L.	78	1155	1070	990	910
	2000	76	1020	945	865	790
	4000	75	890	815	740	670
	6000	74	760	690	620	550
	8000	73	635	565	500	430
	10,000	72	510	440	375	- - -
	12,000	71	385	320	255	- - -

Figure 5-5. Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
2400 RPM
Full Throttle
Cowl Flaps Open
Standard Temperature

NOTES:
1. Add 1.7 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 5000 feet for smooth engine operation and increased power.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2950	S.L.	15	78	1010	0	0	0
	1000	13	77	955	1	0.3	1
	2000	11	76	900	2	0.7	3
	3000	9	76	845	3	1.1	4
	4000	7	75	790	5	1.5	6
	5000	5	75	735	6	1.9	8
	6000	3	74	680	7	2.3	10
	7000	1	74	625	9	2.8	12
	8000	-1	73	570	11	3.2	14
	9000	-3	72	515	12	3.8	17
	10,000	-5	72	460	15	4.3	20
	11,000	-7	71	405	17	4.9	23
	12,000	-9	71	350	20	5.6	27

Figure 5-6. Time, Fuel, and Distance to Climb (Sheet 1 of 2)

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 90 KIAS

CONDITIONS:
Flaps Up
2400 RPM
23 Inches Hg or Full Throttle
Cowl Flaps Open
Standard Temperature

NOTES:
1. Add 1.7 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 5000 feet for smooth engine operation and increased power.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED GALLONS	DISTANCE NM
2950	S.L.	15	670	0	0	0
	1000	13	670	1	0.4	2
	2000	11	670	3	0.8	5
	3000	9	670	4	1.2	7
	4000	7	670	6	1.7	9
	5000	5	670	7	2.1	12
	6000	3	640	9	2.6	14
	7000	1	575	11	3.0	17
	8000	-1	510	13	3.6	20
	9000	-3	450	15	4.2	24
	10,000	-5	385	17	4.8	28
	11,000	-7	320	20	5.6	33
	12,000	-9	260	24	6.5	39

Figure 5-6. Time, Fuel, and Distance to Climb (Sheet 2 of 2)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
2950 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy at 65% power or less, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	22	77	134	13.1	74	135	12.6	71	136	12.2
	21	72	131	12.3	69	132	11.8	67	133	11.4
	20	67	128	11.5	65	128	11.1	63	129	10.7
	19	62	124	10.7	60	124	10.3	58	125	10.0
2300	23	78	135	13.3	75	136	12.8	72	137	12.4
	22	73	132	12.5	70	133	12.0	68	133	11.6
	21	68	128	11.7	66	129	11.3	64	130	10.9
	20	64	125	10.9	62	125	10.5	60	126	10.2
2200	23	73	132	12.5	70	133	12.0	68	133	11.6
	22	69	129	11.7	66	129	11.3	64	130	10.9
	21	64	125	11.0	62	126	10.6	60	126	10.2
	20	60	121	10.2	58	122	9.9	56	122	9.6
2100	23	68	128	11.6	66	129	11.2	64	130	10.8
	22	64	125	10.9	62	126	10.5	60	126	10.2
	21	60	121	10.2	58	122	9.9	56	122	9.6
	20	56	118	9.6	54	118	9.3	52	118	9.0
	19	52	113	9.0	50	114	8.7	48	113	8.5
	18	47	109	8.4	46	109	8.1	44	108	7.9

Figure 5-7. Cruise Performance (Sheet 1 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
2950 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy at 65% power or less, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -13°C			STANDARD TEMPERATURE 7°C			20°C ABOVE STANDARD TEMP 27°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	22	---	---	---	76	139	13.0	73	140	12.5
	21	74	135	12.6	71	136	12.1	69	136	11.7
	20	69	131	11.8	66	132	11.3	64	133	11.0
	19	64	127	10.9	62	128	10.6	60	128	10.2
2300	23	---	---	---	76	140	13.1	74	141	12.6
	22	75	135	12.8	72	136	12.3	70	137	11.9
	21	70	132	12.0	68	133	11.5	65	134	11.2
	20	66	128	11.2	63	129	10.8	61	130	10.4
2200	23	75	135	12.8	72	136	12.3	70	137	11.9
	22	70	132	12.0	68	133	11.6	66	134	11.2
	21	66	129	11.3	64	129	10.9	61	130	10.5
	20	62	125	10.5	59	126	10.2	57	126	9.8
	19	57	121	9.8	55	121	9.5	53	121	9.2
2100	23	70	132	11.9	67	133	11.5	65	133	11.1
	22	66	128	11.2	63	129	10.8	61	130	10.4
	21	62	125	10.5	59	126	10.1	57	126	9.8
	20	57	121	9.8	55	121	9.5	53	122	9.3
	19	53	117	9.2	51	117	8.9	50	117	8.7
	18	49	112	8.6	47	112	8.3	46	112	8.1
	17	45	107	8.0	43	107	7.8	42	106	7.6

Figure 5-7. Cruise Performance (Sheet 2 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
2950 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE
For best fuel economy at 65% power or less, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	22	---	---	---	77	143	13.3	75	144	12.8
	21	75	138	12.9	73	139	12.4	70	140	12.0
	20	71	135	12.1	68	136	11.6	66	136	11.2
	19	66	131	11.2	64	132	10.8	61	132	10.5
2300	22	77	139	13.1	74	140	12.6	71	141	12.2
	21	72	136	12.3	69	137	11.8	67	137	11.4
	20	67	132	11.5	65	133	11.1	63	133	10.7
	19	63	128	10.7	60	129	10.3	58	129	10.0
2200	22	72	136	12.3	69	137	11.9	67	137	11.5
	21	68	132	11.6	65	133	11.1	63	134	10.8
	20	63	129	10.8	61	129	10.4	59	130	10.1
	19	59	125	10.1	57	125	9.7	55	125	9.5
2100	22	67	132	11.5	65	133	11.1	63	133	10.7
	21	63	129	10.8	61	129	10.4	59	129	10.1
	19	55	121	9.5	53	121	9.2	51	121	8.9
	18	51	116	8.8	49	116	8.6	47	115	8.3
	17	47	111	8.2	45	110	8.0	43	109	7.8

Figure 5-7. Cruise Performance (Sheet 3 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
2950 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy at 65% power or less, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -21°C			STANDARD TEMPERATURE -1°C			20°C ABOVE STANDARD TEMP 19°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	21	77	142	13.3	74	143	12.7	72	144	12.3
	20	72	139	12.4	70	139	11.9	67	140	11.5
	19	68	135	11.5	65	135	11.1	63	136	10.7
	18	63	130	10.7	60	131	10.3	58	131	10.0
2300	21	74	139	12.6	71	140	12.1	69	141	11.7
	20	69	136	11.8	66	137	11.3	64	137	11.0
	19	64	132	11.0	62	132	10.6	60	133	10.2
	18	60	127	10.2	58	128	9.9	56	128	9.6
2200	21	69	136	11.8	67	137	11.4	65	137	11.0
	20	65	132	11.1	63	133	10.7	60	133	10.3
	19	61	128	10.3	58	129	10.0	56	129	9.7
	18	56	124	9.7	54	124	9.3	52	124	9.1
2100	21	65	132	11.1	63	133	10.7	60	133	10.3
	20	61	129	10.4	59	129	10.0	57	129	9.7
	19	57	124	9.7	54	124	9.4	53	124	9.1
	18	52	120	9.1	50	120	8.8	49	119	8.5
	17	48	115	8.5	46	114	8.2	45	113	8.0

Figure 5-7. Cruise Performance (Sheet 4 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
2950 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> NOTE
> For best fuel economy at 65% power or less, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -25°C			STANDARD TEMPERATURE -5°C			20°C ABOVE STANDARD TEMP 15°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	20	74	142	12.7	71	143	12.2	69	144	11.8
	19	69	138	11.8	67	139	11.4	64	140	11.0
	18	65	134	11.0	62	135	10.6	60	135	10.2
	17	60	129	10.2	57	130	9.8	55	130	9.5
2300	20	71	140	12.1	68	140	11.6	66	141	11.2
	19	66	136	11.3	64	136	10.9	61	136	10.5
	18	61	131	10.5	59	131	10.1	57	132	9.8
	17	57	126	9.7	55	126	9.4	53	126	9.1
2200	20	67	136	11.4	64	137	11.0	62	137	10.6
	19	62	132	10.6	60	132	10.2	58	133	9.9
	18	58	128	9.9	56	128	9.6	54	128	9.3
	17	53	123	9.2	51	123	8.9	50	122	8.7
2100	20	63	132	10.7	60	133	10.3	58	133	9.9
	19	58	128	10.0	56	128	9.6	54	128	9.4
	18	54	123	9.3	52	123	9.0	50	123	8.8
	17	50	118	8.7	48	118	8.4	46	116	8.2
	16	46	112	8.1	44	111	7.8	42	109	7.6

Figure 5-7. Cruise Performance (Sheet 5 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
2950 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy at 65% power or less, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -29°C			STANDARD TEMPERATURE -9°C			20°C ABOVE STANDARD TEMP 11°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	18	66	138	11.3	64	139	10.9	61	139	10.5
	17	61	133	10.5	59	133	10.1	57	133	9.8
	16	56	128	9.7	54	128	9.4	52	127	9.1
	15	51	122	9.0	50	121	8.7	48	120	8.4
2300	18	63	135	10.8	61	135	10.4	59	135	10.0
	17	58	130	10.0	56	130	9.7	54	130	9.4
	16	54	125	9.3	52	125	9.0	50	124	8.7
	15	49	119	8.6	47	118	8.3	45	116	8.1
2200	18	59	131	10.2	57	131	9.8	55	131	9.5
	17	55	126	9.5	53	126	9.2	51	125	8.9
	16	51	121	8.8	49	120	8.5	47	119	8.3
	15	46	114	8.2	44	113	7.9	43	111	7.7
2100	18	56	127	9.6	54	127	9.3	52	126	9.0
	17	51	122	8.9	49	121	8.7	48	120	8.4
	16	47	116	8.3	45	115	8.1	44	113	7.8

Figure 5-7. Cruise Performance (Sheet 6 of 6)

RANGE PROFILE
45 MINUTES RESERVE
56 GALLONS USABLE FUEL

CONDITIONS:
2950 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 6 gallons.

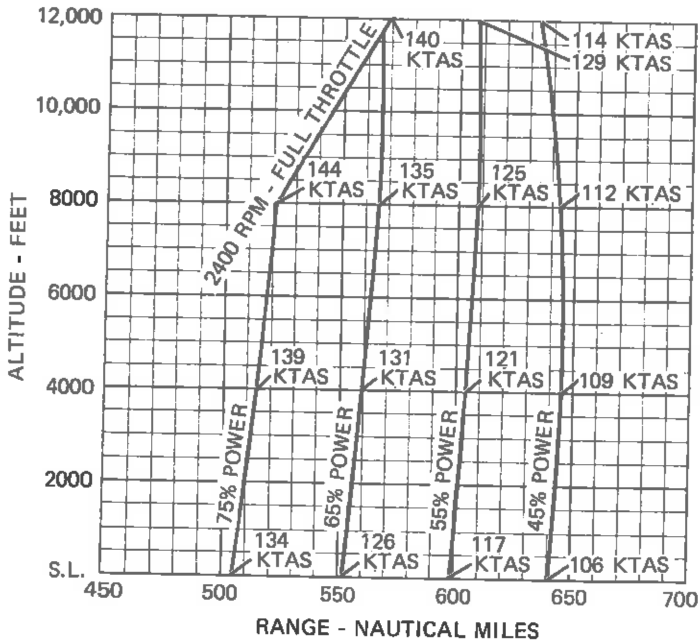


Figure 5-8. Range Profile (Sheet 1 of 2)

RANGE PROFILE
45 MINUTES RESERVE
75 GALLONS USABLE FUEL

CONDITIONS:
2950 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 6 gallons.

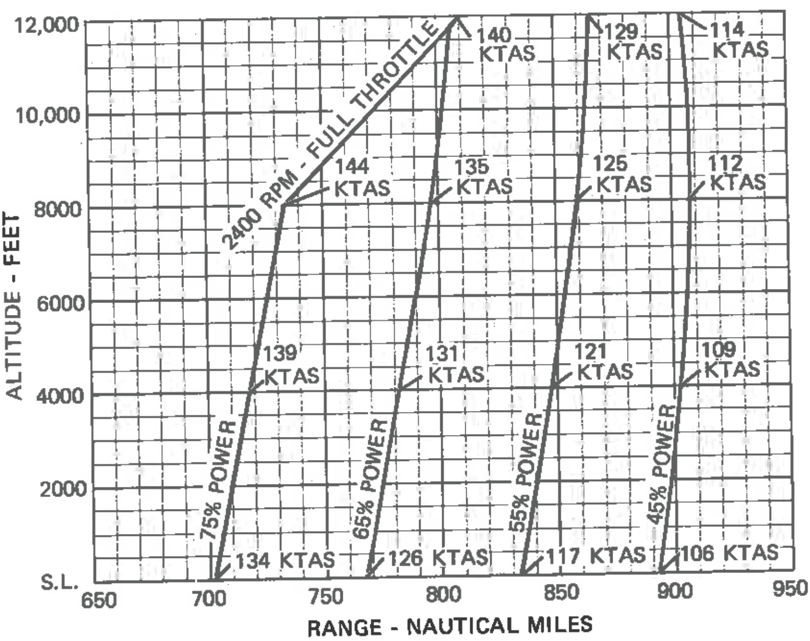


Figure 5-8. Range Profile (Sheet 2 of 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
56 GALLONS USABLE FUEL

CONDITIONS:
2950 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 6 gallons.

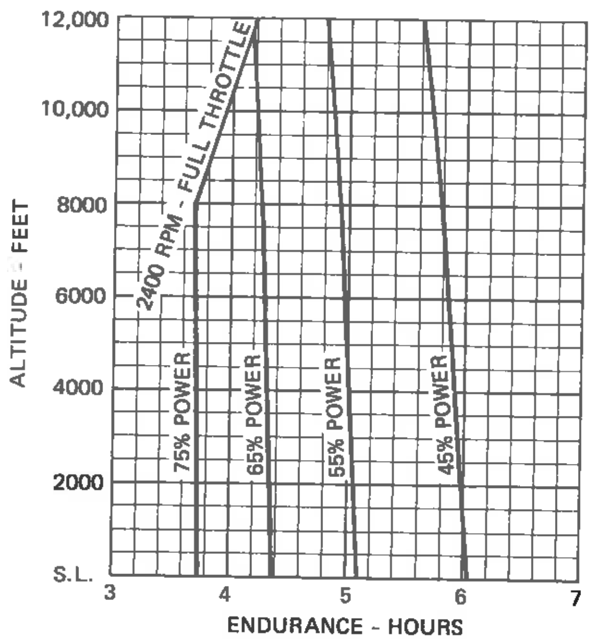


Figure 5-9. Endurance Profile (Sheet 1 of 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
75 GALLONS USABLE FUEL

CONDITIONS:
2950 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 6 gallons.

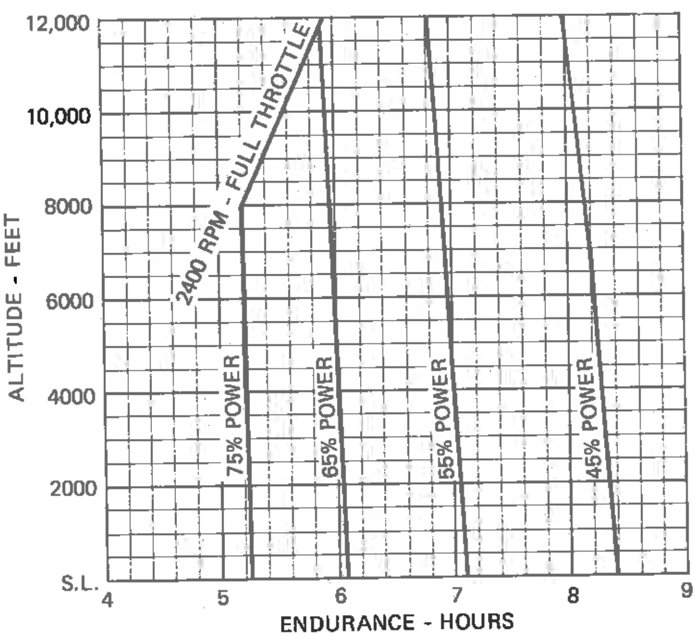


Figure 5-9. Endurance Profile (Sheet 2 of 2)

LANDING DISTANCE

SHORT FIELD

CONDITIONS:
Flaps 40°
Power Off
Maximum Braking
Paved, Level, Dry Runway
Zero Wind

NOTES:
1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on a dry, grass runway, increase distances by 40% of the "ground roll" figure.

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2950	60	S.L.	560	1300	580	1335	600	1365	620	1400	640	1435
		1000	580	1335	600	1365	620	1400	645	1440	665	1475
		2000	600	1370	625	1405	645	1440	670	1480	690	1515
		3000	625	1410	645	1445	670	1485	695	1525	715	1560
		4000	650	1450	670	1485	695	1525	720	1565	740	1600
		5000	670	1485	695	1525	720	1565	745	1610	770	1650
		6000	700	1530	725	1575	750	1615	775	1660	800	1700
		7000	725	1575	750	1615	780	1665	805	1710	830	1750
		8000	755	1625	780	1665	810	1715	835	1760	865	1805

Figure 5-10. Landing Distance

SECTION 6
WEIGHT & BALANCE/ EQUIPMENT LIST

TABLE OF CONTENTS

L 660

R 620

N 665

[illegible]

INTRODUCTION

This section describes the procedure for establishing the basic empty weight and moment of the airplane. Sample forms are provided for reference. Procedures for calculating the weight and moment for various operations are also provided. A comprehensive list of all Cessna equipment available for this airplane is included at the back of this section.

It should be noted that specific information regarding the weight, arm, moment and installed equipment list for this airplane can only be found in the appropriate weight and balance records carried in the airplane.

AIRPLANE WEIGHING PROCEDURES

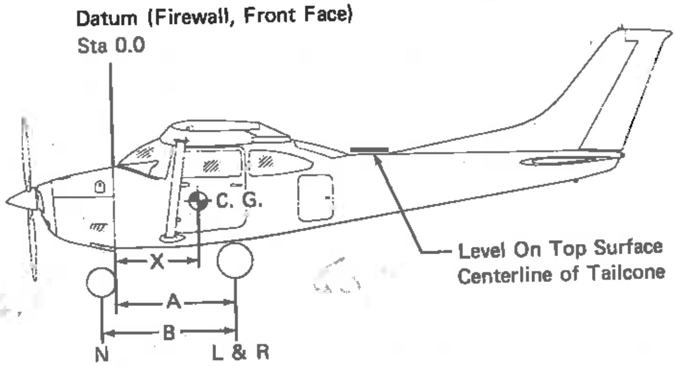
(1) Preparation:
a. Inflate tires to recommended operating pressures.
b. Remove the fuel tank sump quick-drain fittings and fuel selector valve drain plug to drain all fuel.
c. Remove oil sump drain plug to drain all oil.
d. Move sliding seats to the most forward position.
e. Raise flaps to the fully retracted position.
f. Place all control surfaces in neutral position.

(2) Leveling:
a. Place scales under each wheel (minimum scale capacity, 1000 pounds).
b. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level (see Figure 6-1).

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

(4) Measuring:
a. Obtain measurement A by measuring horizontally (along the airplane center line) from a line stretched between the main wheel centers to a plumb bob dropped from the firewall.
b. Obtain measurement B by measuring horizontally and parallel to the airplane center line, from center of nose wheel axle, left side, to a plumb bob dropped from the line between the main wheel centers. Repeat on right side and average the measurements.

(5) Using weights from (3) and measurements from (4) the airplane weight and C. G. can be determined.



Scale Position	Scale Reading	Tare	Symbol	Net Weight
Left Wheel			L	
Right Wheel			R	
Nose Wheel			N	
Sum of Net Weights (As Weighed)			W	

$$X = \text{ARM} = (A) - \frac{(N) \times (B)}{W};\quad X = (\qquad) - \frac{(\qquad) \times (\qquad)}{(\qquad)} = (\qquad)\ \text{IN.}$$

Item	Weight (Lbs.)	X C.G. Arm (In.) =	Moment/1000 (Lbs.-In.)
Airplane Weight (From Item 5, page 6-3)			
Add Oil:			
No Oil Filter (12 Qts at 7.5 Lbs/Gal)		-15.0	
With Oil Filter (13 Qts at 7.5 Lbs/Gal)		-15.0	
Add Unusable Fuel:			
Std. Tanks (5 Gal at 6 Lbs/Gal)		46.0	
L.R. Tanks (5 Gal at 6 Lbs/Gal)		46.0	
Equipment Changes			
Airplane Basic Empty Weight			

Figure 6-1. Sample Airplane Weighing

SAMPLE WEIGHT AND BALANCE RECORD

(Continuous History of Changes in Structure or Equipment Affecting Weight and Balance)

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. (lb.)	Arm (In.)	Moment /1000	Wt. (lb.)	Arm (In.)	Moment /1000	Wt. (lb.)	Moment /1000

Figure 6-2. Sample Weight and Balance Record

(6) Basic Empty Weight may be determined by completing Figure 6-1.

WEIGHT AND BALANCE

The following information will enable you to operate your Cessna within the prescribed weight and center of gravity limitations. To figure weight and balance, use the Sample Problem, Loading Graph, and Center of Gravity Moment Envelope as follows:

Take the basic empty weight and moment from appropriate weight and balance records carried in your airplane, and enter them in the column titled YOUR AIRPLANE on the Sample Loading Problem.

NOTE

In addition to the basic empty weight and moment noted on these records, the c.g. arm (fuselage station) is also shown, but need not be used on the Sample Loading Problem. The moment which is shown must be divided by 1000 and this value used as the moment/1000 on the loading problem.

Use the Loading Graph to determine the moment/1000 for each additional item to be carried; then list these on the loading problem.

NOTE

Loading Graph information for the pilot, passengers, baggage/cargo and hatshelf is based on seats positioned for average occupants and baggage/cargo or hatshelf items loaded in the center of these areas as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft c.g. range limitation (seat travel and baggage/cargo or hatshelf area limitation). Additional moment calculations, based on the actual weight and c.g. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph.

Total the weights and moments/1000 and plot these values on the Center of Gravity Moment Envelope to determine whether the point falls within the envelope, and if the loading is acceptable.

BAGGAGE AND CARGO TIE-DOWN

A nylon baggage net having six tie-down straps is provided as standard equipment to secure baggage in the area aft of the rear seat and on the hatshelf. Six eyebolts serve as attaching points for the net. Two eyebolts for the forward tie-down straps are mounted on the cabin floor near each sidewall just forward of the baggage door approximately at station 92; two center eyebolts mount on the floor slightly inboard of each sidewall just aft of the baggage door approximately at station 109; the two aft eyebolts secure at the top of the rear baggage wall at station 124. If a child's seat is installed, only the center and aft eyebolts will be needed for securing the net in the area remaining behind the seat. A placard on the baggage door defines the weight limitations in the baggage areas.

A cargo tie-down kit consisting of nine tie-down attachments is available if it is desired to remove the rear seat (and child's seat, if installed) and utilize the rear cabin area to haul cargo. Two tie-down attachments clamp to the aft end of the two outboard front seat rails and are locked in place by a bolt which must be tightened to a minimum of fifty inch pounds. Seven tie-down attachments bolt to standard attach points in the cabin floor, including three rear seat mounting points. The seven attach points are located as follows: two are located slightly inboard and just aft of the rear doorposts approximately at station 69; two utilize the aft outboard mounting points of the rear seat; one utilizes the rearmost mounting point of the aft center attach point for the rear seat approximately at station 84 (a second mounting point is located just forward of this point but is not used); and two are located just forward of the center baggage net tie-down eyebolts approximately at station 108. The maximum allowable cabin floor loading of the rear cabin area is 200 pounds/square foot; however, when items with small or sharp support areas are carried, the installation of a 1/4" plywood floor is recommended to protect the airplane structure. The maximum rated load weight capacity for each of the seven tie-downs is 140 pounds and for the two seat rail tie-downs is 100 pounds. Rope, strap, or cable used for tie-down should be rated at a minimum of ten times the load weight capacity of the tie-down fittings used. Weight and balance calculations for cargo in the area of the rear seat, baggage and hatshelf area can be figured on the Loading Graph using the lines labeled 2nd Row Passengers or Cargo and/or Baggage or Passengers on Child's Seat.

LOADING ARRANGEMENTS

*Pilot or passenger center of gravity on adjustable seats positioned for average occupant. Numbers in parentheses indicate forward and aft limits of occupant center of gravity range.

**Arms measured to the center of the areas shown.

NOTE:
The aft baggage wall (approximate station 124) can be used as a convenient interior reference point for determining the location of baggage area fuselage stations.

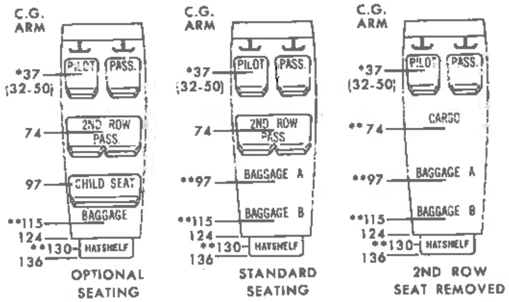
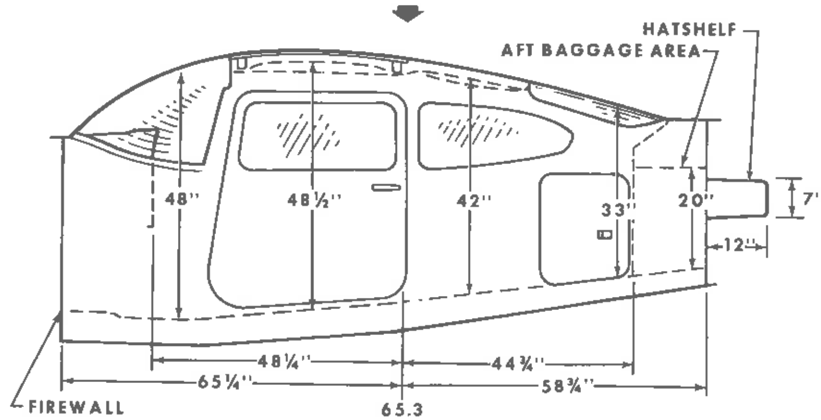


Figure 6-3. Loading Arrangements

CABIN HEIGHT MEASUREMENTS



DOOR OPENING DIMENSIONS

	WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (REAR)
CABIN DOOR	32"	36½"	41"	38½"
BAGGAGE DOOR	15¾"	15¾"	22"	20½"

WIDTH
● LWR WINDOW LINE
* CABIN FLOOR

CABIN WIDTH MEASUREMENTS

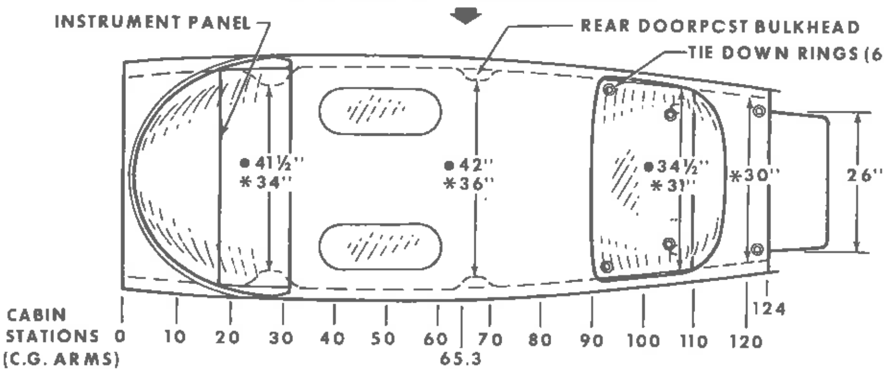
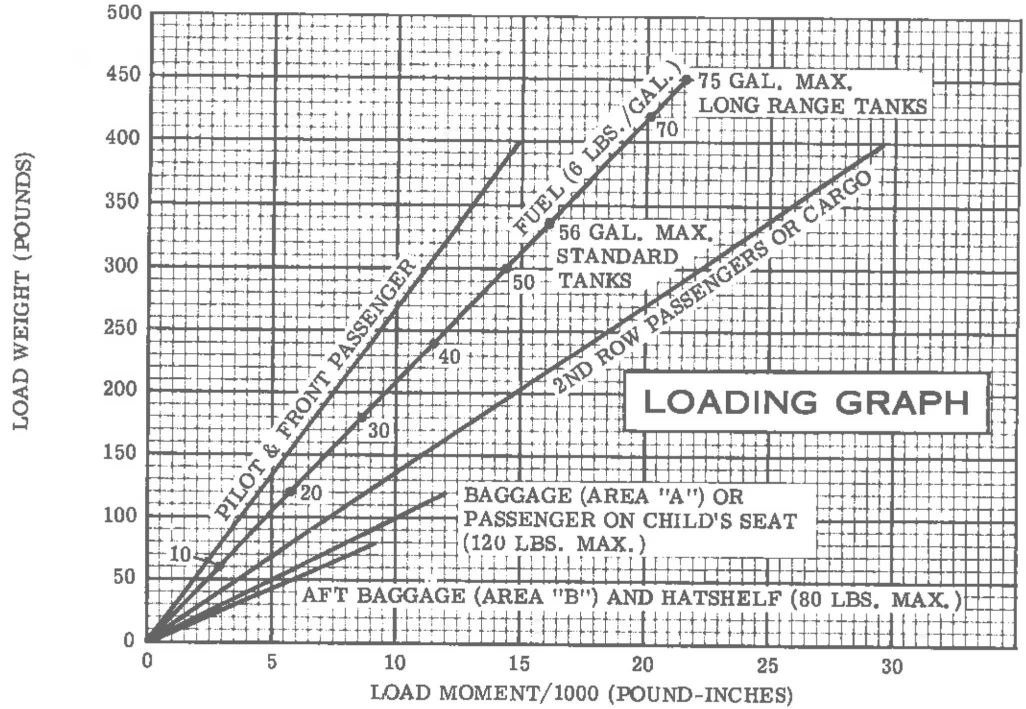


Figure 6-4. Internal Cabin Dimensions

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil)	1800	63.3		
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (56 Gal. Maximum)	336	16.1		
Long Range Tanks (75 Gal. Maximum)				
3. Pilot and Front Passenger (Sta. 32 to 50)	340	12.6		
4. Second Row Passengers	340	25.2		
Cargo Replacing Second Row Seats (Station 65 to 82)				
5. Baggage (Area "A") or Passenger on Child's Seat (Station 82 to 108) 120 Lbs. Maximum	120	11.6		
6. Baggage - Aft (Area "B") and Hatshelf (Station 108 to 136) 80 Lbs. Maximum	14	1.6		
7. TOTAL WEIGHT AND MOMENT	2950	130.4		

8. Locate this point (2950 at 130.4) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable.

Figure 6-5. Sample Loading Problem



NOTES: (1) Line representing adjustable seats shows pilot and front seat passenger center of gravity on adjustable seats positioned for an average occupant. Refer to the Loading Arrangements diagram for forward and aft limits of occupant c.g. range.
(2) Hatshelf Maximum Load 25 Lbs.

Figure 6-6. Loading Graph

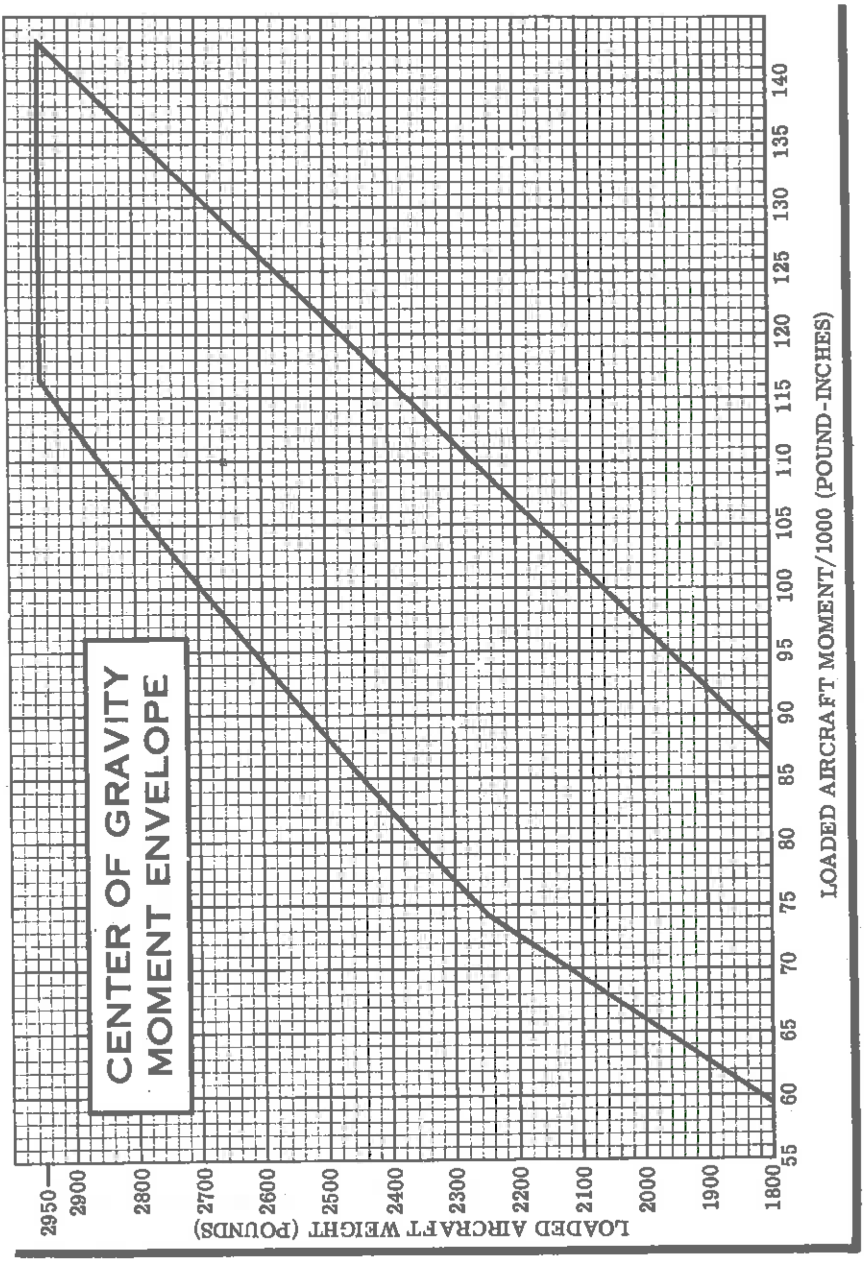


Figure 6-7. Center of Gravity Moment Envelope

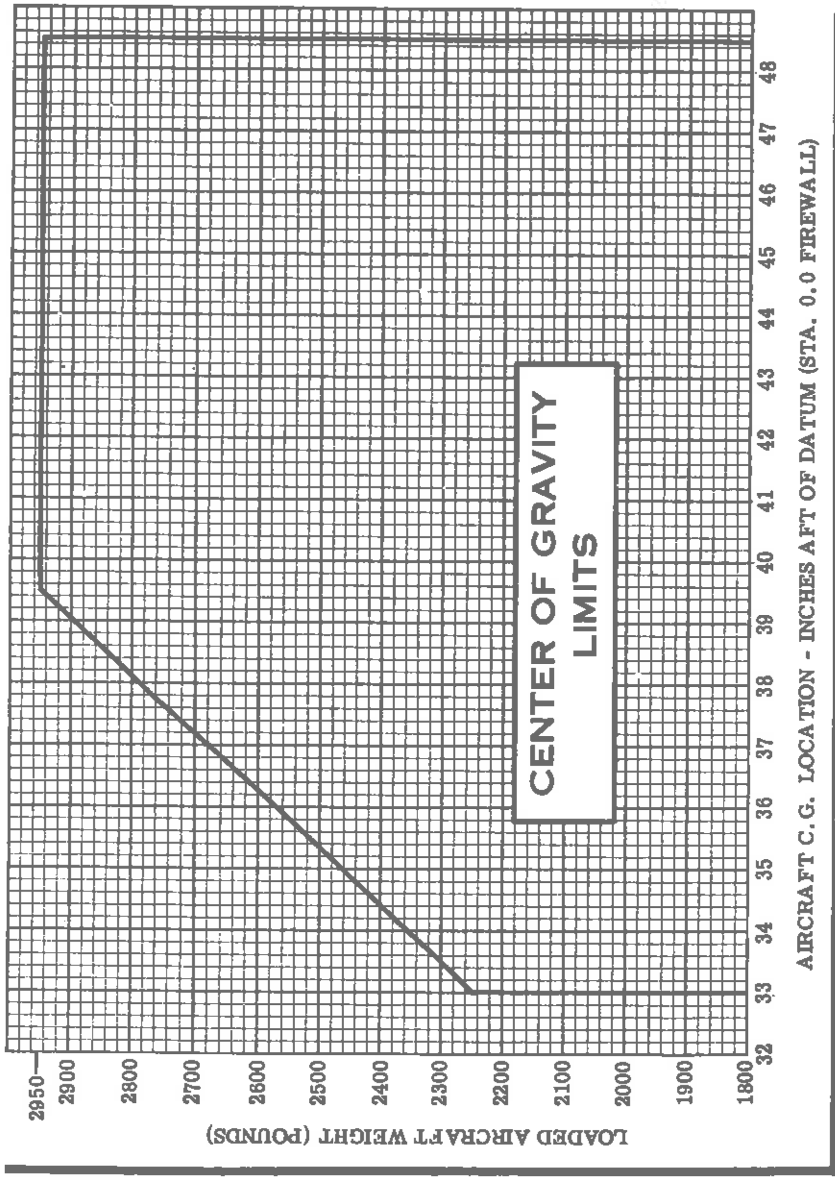


Figure 6-8. Center of Gravity Limits

EQUIPMENT LIST

The following equipment list is a comprehensive list of all Cessna equipment available for this airplane. A separate equipment list of items installed in your specific airplane is provided in your aircraft file. The following list and the specific list for your airplane have a similar order of listing.

This equipment list provides the following information:

An item number gives the identification number for the item. Each number is prefixed with a letter which identifies the descriptive grouping (example: A. Powerplant & Accessories) under which it is listed. Suffix letters identify the equipment as a required item, a standard item or an optional item. Suffix letters are as follows:

- -R = required items of equipment for FAA certification
- -S = standard equipment items
- -O = optional equipment items replacing required or standard items
- -A = optional equipment items which are in addition to required or standard items

A reference drawing column provides the drawing number for the item.

NOTE

If additional equipment is to be installed, it must be done in accordance with the reference drawing, accessory kit instructions, or a separate FAA approval.

Columns showing weight (in pounds) and arm (in inches) provide the weight and center of gravity location for the equipment.

NOTE

Unless otherwise indicated, true values (not net change values) for the weight and arm are shown. Positive arms are distances aft of the airplane datum; negative arms are distances forward of the datum.

NOTE

Asterisks (*) after the item weight and arm indicate complete assembly installations. Some major components of the assembly are listed on the lines immediately following. The summation of these major components does not necessarily equal the complete assembly installation.

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	A. POWERPLANT & ACCESSORIES			
A01-R	ENGINE, CONTINENTAL O-470-U SPEC. 1	0750201	446.0*	-17.6*
	TWO MAGNETOS WITH IMPULSE COUPLING	SLICK 662	12.9	-12.0
	OIL COOLER-HARRISON	TCM 627392	4.6	-31.5
	TWELVE 18MM X 3/4 20-3A SPARK PLUGS	SH 200A	2.8	-19.0
	STARTER, 12 VOLT PRESTOLITE MCL 6501	TCM 634592	17.8	-4.5
	CARBURETOR, MARVEL SCHEBLER	MA-4-5	5.8	-9.6
A05-R	FILTER, CARBURETOR AIR	0750038-4	1.0	-33.0
A09-R	ALTERNATOR, 14 VOLT, 60 AMP	C611501-0102	11.5	-5.5
A17-O	OIL COOLER, NON-CONGEAL MODINE 1E-1605-D REPLACES OIL COOLER ON ITEM A01-R AND CHANGES ENGINE DESIGNATION TO O-470-U SPECIFICATION 2 (NET CHANGE)	TCM639171	1.5	-31.5
A21-A	FILTER INSTALLATION, FULL FLOW ENGINE OIL	0750606-11	4.5	-3.4*
	ADAPTOR ASSEMBLY	1250922-3	1.5	-4.2
	FILTER CAN ASSEMBLY (AC 6436992)	C294505-0101	1.8	-3.0
	FILTER ELEMENT KIT	C294505-0102	0.3	-3.0
A33-R	PROPELLER, MCCAULEY C2A34C204/90DCB-8	C161009-0106	53.0	-41.6
A37-R	GOVERNOR, PROPELLER (MCCAULEY C290-D3T/14)	C161031-0107	3.0	-32.5
A41-R	SPINNER INSTALLATION, PROPELLER	0752637	3.0*	-42.0*
	SPINNER DOME	0752637-11	1.7	-44.2
	FORWARD SPINNER SUPPORT	1250412-1	0.2	-46.5
	AFT SPINNER BULKHEAD	0752637-1	1.1	-37.8
A61-S	VACUUM SYSTEM, ENGINE DRIVEN	0706003-1	4.5*	0.0*
	VACUUM PUMP (AV. OF 4)		2.8	-3.3
	SUCTION GAGE	C668540-0101	0.3	16.7
A70-A	PRIMING SYSTEM, SIX CYLINDER	0750125	1.0	-15.0
A73-A	OIL QUICK DRAIN VALVE (NET CHANGE)	1701015-4	NEGL	- -
	B. LANDING GEAR & ACCESSORIES			
B01-R-1	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN (2)	1241156-138	39.8*	58.6*
	WHEEL ASSY, CLEVELAND 40-113 (EACH)	C163001-0104	7.4	58.9
	BRAKE ASSY, CLEVELAND 30-75 (LEFT)	C163030-0113	1.9	55.5
	BRAKE ASSY, CLEVELAND 30-75 (RIGHT)	C163030-0114	1.9	55.5
	TIRE, 6-PLY RATED BLACKWALL (EACH)	C262003-0204	8.4	58.9
	TUBE (EACH)	C262023-0102	1.9	58.9
B01-R-2	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN (2)	C163015-0207	39.0*	58.6*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	WHEEL ASSY, MCCAULEY (EACH)	C163003-0102	6.3	58.9
	BRAKE ASSY, MCCAULEY C-30018 (LEFT)	C163032-0109	1.8	55.5
	BRAKE ASSY, MCCAULEY C-30018 (RIGHT)	C163032-0108	1.8	55.5
	TIRE, 6-PLY RATED BLACKWALL (EACH)	C262003-0204	8.7	58.9
	TUBE (EACH)	C262023-0102	1.9	58.9
B04-R-1	WHEEL & TIRE ASSY, 5.00X5 NOSE	1241156-104	9.7*	-7.1*
	WHEEL ASSY, CLEVELAND 40-77	1241156-12	2.8	-7.1
	TIRE, 6-PLY RATED BLACKWALL	C262003-0202	5.0	-7.1
	TUBE	C262023-0101	1.2	-7.1
B04-R-2	WHEEL & TIRE ASSY, 5.00X5 NOSE	C163015B0111	9.9*	-7.1*
	WHEEL ASSY, MCCAULEY C-30053	C163003-0401	3.0	-7.1
	TIRE, 6-PLY RATED BLACKWALL	C262003-0202	5.0	-7.1
	TUBE	C262023-0101	1.2	-7.1
B10-S	FAIRING INSTALLATION, WHEEL (SET OF 3)	0741638	18.4*	45.9*
	NOSE WHEEL FAIRING	0543079	3.9	-6.0
	MAIN WHEEL FAIRING (EACH)	0541223	5.7	60.2
	BRAKE DISC FAIRING (EACH)	0741641	0.6	58.0
B16-R	AXLE, STANDARD DUTY MAIN GEAR (SET OF 2)	0541124-1	2.6	58.9
B16-O	AXLE, HEAVY DUTY MAIN GEAR (SET OF 2)	1441003-1	4.5	58.9
	C. ELECTRICAL SYSTEMS			
C01-R	BATTERY, 12 VOLT, 33 AMP HR	0712605-1	26.5	130.5
C04-R	REGULATOR, 14 VOLT, 60 AMP ALTERNATOR	C611001-0201	0.5	-0.7
C07-A	GROUND SERVICE PLUG RECEPTACLE	0701019-1	3.2	-2.6
C10-A	ELECTRIC ELEVATOR TRIM INSTL	0760134-1	3.8*	217.7*
	ELECTRIC DRIVE ASSEMBLY		3.3	221.0
C19-O	HEATING SYSTEM, PITOT & STALL WARNING SWITCH	0770724-1	0.5	26.5
C22-A	LIGHTS, INSTRUMENT POST	0713333-7	0.5	17.5
C25-A	MAP LIGHT, CONTROL WHEEL MOUNTED	0760020-19	0.1	27.0
C31-A	LIGHTS, COURTESY (NET CHANGE)	0700615-9	0.5	61.7
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF 2)	0701013	NEGL	- -
C43-A	OMNI FLASHING BEACON LIGHT	0701042-1	1.8*	208.6*
	LIGHT ASSY (IN FIN TIP)	C621001-0106	0.7	253.0
	FLASHER ASSY (IN FIN TIP)	C594502-0101	0.4	253.0
	LOADING RESISTOR	OR95-1.5	0.2	212.0
C46-A	STROBE LIGHTS, WHITE (EACH WING TIP)	0701018-1	2.6*	44.4*
	POWER SUPPLY (AERO-FLASH 73-140)(2)	C622007-0101	2.3	46.7
	LIGHT ASSY. (AERO-FLASH 73-145)(2)	C622006-0101	0.3	42.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
C49-S	LIGHT INSTL, COWL MOUNTED LANDING & TAXI	0770771	1.6*	-25.3*
	LIGHT BULBS (SET OF 2)	GE-4509	1.0	-32.5
	D. INSTRUMENTS			
D01-R	INDICATOR, AIRSPEED	C661064-0212	0.6	16.0
D01-O	INDICATOR, TRUE AIRSPEED (NET CHANGE)	1201108-7	0.2	16.5
D04-A	STATIC ALTERNATE AIR SOURCE	0701028-1	0.3	14.4
D07-R	ALTIMETER, SENSITIVE	C661071-0101	1.0	15.3
D07-O-1	ALTIMETER, SENSITIVE (FEET & MILLIBARS)	C661071-0102	1.0	15.3
D07-O-2	ALTIMETER, SENSITIVE (20 FT. MARKINGS)	C661025-0102	1.0	15.3
D10-A	ALTIMETER INSTALLATION (2ND UNIT)	1213681	1.0	16.0
D16-A-1	ENCODING ALTIMETER (REQUIRES RELOCATING STANDARD TYPE ALTIMETER)	1213732	3.0	14.0
D16-A-2	ENCODING ALTIMETER, FEET AND MILLIBARS (REQUIRES RELOCATING STANDARD TYPE ALTIMETER)	1213732	3.0	14.0
D16-A-3	ENCODING ALTIMETER, BLIND (INSTRUMENT PANEL INSTALLATION NOT REQUIRED)	0701099-1	1.5*	13.6*
D22-A	GAGE, CARBURETOR AIR TEMPERATURE	0750610-1	1.0	5.5
D25-S	CLOCK, ELECTRIC (0770771)	C664508-0101	0.4	16.6
D28-R	COMPASS, MAGNETIC & MOUNT	1213679-2	1.1	20.5
D34-R	INSTRUMENT CLUSTER, ENGINE & FUEL	C669502-0202	1.3	16.5
D49-A	INDICATOR INSTALLATION, ECONOMY MIXTURE	0750609-2	0.7*	8.2*
	EGT INDICATOR	C668501-0211	0.4	17.1
	THERMOCOUPLE PROBE	C668501-0204	0.1	-20.5
	THERMOCOUPLE LEAD WIRE (IC)	C668501-0206	0.1	-0.3
D64-S	GYRO SYSTEM INSTL. (NON AUTO-PILOT)	0701030-1	5.9*	13.3*
	DIRECTIONAL INDICATOR (AV. OF 4)		2.7	14.1
	ATTITUDE INDICATOR (AV. OF 3)		2.2	14.4
	HOSES, FITTINGS, SCREWS, CLAMPS ETC.		1.0	11.1
D64-D	GYRO SYSTEM INSTL. FOR NAV-O-MATIC 300A AUTOPILOT	0701038-1	6.7*	13.0*
	DIRECTIONAL INDICATOR (AV. OF 2)	40760	3.2	13.0
	ATTITUDE INDICATOR (AV. OF 3)		2.2	14.4
D64-O-2	DIRECTIONAL INDICATOR WITH MOVABLE HEADING INDEX POINTER, NON AUTOPILOT (USED WITH D64-S AND REPLACES STD DIRECTIONAL INDICATOR)	1201126	3.1	14.1
D67-A	HOURMETER, INSTALLATION	1200744	0.5*	7.6*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	RECORDING INDICATOR	C664502-0101	0.1	17.5
	OIL PRESSURE SWITCH	S1711-1	0.2	-1.0
D73-R	GAGE, MANIFOLD PRESSURE	C662035-0101	0.9	15.8
D82-S	GAGE, OUTSIDE AIR TEMPERATURE	C668507-0101	0.1	28.5
D85-R	TACHOMETER INSTALLATION, ENGINE	0706006	0.9*	13.8*
	RECORDING TACH INDICATOR	C668020-0117	0.7	16.9
	TACH FLEXIBLE SHAFT (ASES 1605-24)	S-1605-2	0.2	3.0
D88-S	INDICATOR, TURN COORDINATOR	C661003-0504	1.3	16.0
D88-O-1	INDICATOR, TURN COORDINATOR (FOR N.O.M.'S)	42320-0014	1.9	14.2
D88-O-2	INDICATOR, TURN & BANK	S-1413-2	2.0	15.5
D91-S	INDICATOR, RATE OF CLIMB	C661080-0101	1.0	15.4
	E. CABIN ACCOMMODATIONS			
E05-R	SEAT, ADJUSTABLE FORE & AFT - PILOT	0714019-21	13.0	44.0
E05-O	SEAT, ARTICULATING VERT. ADJ. - PILOT	0714019-23	24.0	41.5
E07-S	SEAT, ADJUSTABLE FORE & AFT - CO-PILOT	0714019-21	13.0	44.0
E07-O	SEAT, ARTICULATING VERT. ADJ. - CO-PILOT	0714020-24	24.0	41.5
E09-S	SEAT, 2ND ROW BENCH	0714021-33	23.0	80.5
E11-A	SEAT INSTALLATION, AUXILIARY (CHILDS)	0501009-5	8.2*	104.2*
	SEAT ASSY, FOLDAWAY (120 LB MAX CAP.)	0714022-4	6.9	104.4
	BELT ASSY, LAP	S1746-5	0.9	101.1
E15-R	BELT ASSY, LAP (PILOT SEAT)	S2275-103	1.0	37.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S2275-201	0.6	37.0
E19-O	PILOT & CO-PILOT INERTIA REEL INSTL. (NET CHANGE)	0701077	3.6	92.0
E23-S	BELT & SHOULDER HARNESS ASSY, CO-PILOT	S2275-3	1.6	37.0
E27-S	BELT ASSY, 2ND ROW OCCUPANTS (SET OF 2)	S-1746-1	1.6	74.5
E27-O	BELT & SHOULDER HARNESS ASSY, 2ND ROW	S-2275-7	3.2	74.5
E35-A-1	INTERIOR, VINYL SEAT COVERS (NET CHANGE)	CES-1154	0.0	- -
E35-A-2	INTERIOR, LEATHER SEAT COVERS (NET CHANGE)	CES-1154	2.0	62.3
E37-O	OPENABLE RH CABIN DOOR WINDOW (NET CHANGE)	0701065-4	2.3	47.0
E39-A	WINDOWS, OVERHEAD CABIN TOP (NET CHANGE)	0701017-1	0.6	45.5
E43-A	VENTILATION SYSTEM, 2ND ROW SEATING	0701084-1	3.6	62.3
E45-S	CURTAIN, REAR WINDOW	0700707-12	1.5	112.0
E47-A	OXYGEN SYSTEM, 4 PORT	0701091-1	34.0*	125.2*
	OXYGEN CYLINDER-EMPTY	C166001-0601	25.0	128.3
	OXYGEN - 48 CU FT @ 1800 PSI		4.0	128.3
E49-A	CUP HOLDER, RETRACTABLE (SET OF 2)	1201124	0.1	16.0
E50-A	HEADREST, 1ST ROW (INSTALLED ARM) (EACH)	1215073-1	0.9	47.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
E51-A	HEADREST, 2ND ROW (INSTALLED ARM) (EACH)	1215073-1	0.9	87.0
E53-A	MIRROR, REAR VIEW	1201041	0.3	16.0
E55-S	SUN VISORS (SET OF 2)	0701024-1	1.0	33.0
E59-A	APPROACH PLATE HOLDER	0715046-1	0.1	27.5
E65-S	BAGGAGE TIE DOWN NET	1215042-1	0.5	108.0
E71-A	CARGO TIE DOWN LATCHES & SEAT RAIL CLAMPS	0701029-1	1.2	
	(USE INSTALLED CARGO ARM)(STOWED)			
E75-A	STRETCHER INSTALLATION, BOXED (CUSTOM AIR)	0700164-3	- -	- -
	(USE ACTUAL INSTALLED WEIGHT AND ARM)			
E85-A	CONTROLS INSTALLATION, DUAL (CO-PILOT)	0760101-2	8.7	16.1
	WHEEL, PEDALS & TOE BRAKES	0760650-3		
E89-A	CONTROL WHEEL, PILOT ALL-PURPOSE (NET CHG)	0760020-21	NEGL	- -
E93-R	HEATING SYSTEM, CABIN & CARBURETOR AIR	0750201	18.0	-16.0
	(INCLUDES EXHAUST SYSTEM)			
	F. PLACARDS & WARNING			
F01-R	PLACARD, OPERATIONAL LIMITATIONS-VFR DAY	0705186	NEGL	- -
F01-O-1	PLACARD, OPERATIONAL LIMITATIONS-VFR DAY-NIGHT	0705186	NEGL	- -
F01-O-2	PLACARD, OPERATIONAL LIMITATIONS-IFR DAY-NIGHT	0705186	NEGL	- -
F04-R	INDICATOR, STALL WARNING HORN-AUDIBLE	S-2077-5	1.0	17.5
	G. AUXILIARY EQUIPMENT			
G01-A	TAILCONE LIFT HANDLES (SET OF 2)	0712033-1	1.0	186.5
G04-A	TOW HOOK, INSTALLED ARM SHOWN	0712643-1	0.5	231.0
G07-A	HOISTING RINGS, AIRPLANE	0700612-1	1.5	45.6
G13-A	CORROSION PROOFING, INTERNAL	07600C7-1	7.0	70.0
G16-A	STATIC DISCHARGERS (SET OF 10)	1201131-2	0.4	130.5
G19-A	STABILIZER ABRASION BOOTS	1200032-3	2.7	206.0
G22-S	TOWBAR, AIRCRAFT (STOWED ARM SHOWN)	0501019-1	1.6	97.0
G25-S	PAINT, OVERALL COVER-EXTERIOR	0704035	11.8*	92.3*
	OVERALL WHITE BASE (102773 SQ IN)		11.2	92.2
	COLORED STRIPE		0.5	94.4
G31-A	CABLES, CORROSION RESISTANT (NET CHANGE)	0760007-1	0.0	- -
G55-A-1	FIRE EXTINGUISHER, HAND TYPE (FOR USE WITH	0701014-1	3.0	35.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	STANDARD PILOT SEAT)			
G55-A-2	FIRE EXTINGUISHER, HAND TYPE (FOR USE WITH	0701014-3	3.0	29.0
	VERTICAL ADJUSTING PILOT SEAT)			
G89-A	WINTERIZATION KIT, ENGINE	0752647-2	1.1*	-29.9*
	WINTER FRONT INSTALLED ARM SHOWN		0.5	-34.3
G92-A	WINGS, EXTENDED RANGE FUEL (NET CHANGE)	0720700	7.0	56.5
	H. AVIONICS & AUTOPILOTS			
H01-A-1	CESSNA 300 ADF WITH BFO	3910159-1	7.3*	23.6*
	RECEIVER WITH BFO (R-546E)	41240-0101	2.3	13.0
	GONIOMETER INDICATOR (IN-346A)	40980-1001	0.9	16.0
	ADF LOOP ANTENNA & ASSOC. WIRING	3960104-1	2.1	33.4
	ADF SENSE ANTENNA	0770750-608	0.3	96.2
	MOUNTING BOX & MISC ITEMS		1.7	17.0
H01-A-2	CESSNA 400 ADF (W/BFO)	3910160-1	8.4*	21.6*
	ADF RECEIVER WITH BFO (R-446A)	43090-1114	3.4	11.5
	GONIOMETER INDICATOR (IN-346A)	40980-1001	0.9	16.0
	ADF LOOP ANTENNA & ASSOC. WIRING	3960104-1	2.1	33.4
	ADF SENSE ANTENNA	0770750-608	0.3	96.2
	MOUNTING BOX & MISC ITEMS		1.7	17.0
H04-A	DME INSTALLATION, NARCO	3910166-6	6.0*	14.4*
	RECEIVER (DME 190)	3312-400	4.9	11.0
	MOUNTING BOX		0.6	11.0
	ANTENNA	UDA-3	0.2	88.4
H07-A	CESSNA 400 GLIDESLOPE	3910119-6	3.9*	102.2*
	RECEIVER (R-443B)	42100-0000	2.1	130.1
	ANTENNA (MOUNTED ON UPPER WINDSHIELD)	1270098-1	0.2	29.6
H10-A	PANTRONICS HF TRANSCEIVER 1ST UNIT	3910156-3	27.2*	77.3*
	PT10-A TRANSCEIVER & MOUNT	C582103-0101	3.8	11.7
	PT-10PS-14 REMOTE POWER SUPPLY	C582103-0201	8.6	130.1
	DX-10RL-14 REMOTE ANTENNA LOAD BOX	C589502-0101	4.2	117.0
	ANTENNA INSTALLATION, 351 INCH LONG	3960117	0.3	152.1
	MICROPHONE INSTALLATION - HAND HELD	0770750-701	0.3	19.4
	HEADSET INSTALLATION	0770750-704	0.2	14.3
	CABIN SPEAKER INSTALLATION	0770750-741	1.9	45.1
	ENGINE NOISE FILTER	3940148-1	0.1	-6.0
	RADIO COOLING	3930152-5	1.0	12.5
	AUDIO CONTROL SYSTEM	3970130-1	1.9	13.0
H11-A-1	PANTRONICS HF TRANSCEIVER 2ND UNIT	3910156-4	19.8*	98.0*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	PT10-A TRANSCEIVER (HIGH FREQUENCY	C582103-0101	3.8	11.7
	PT-10PS-14 REMOTE POWER SUPPLY	C582103-0201	8.6	130.1
	DX-10RL-14 REMOTE ANTENNA LOAD BOX	C589502-0101	4.2	117.0
	ANTENNA INSTL 351 INCHES LONG	3960117	0.3	152.1
H11-A-2	SUNAIRE SSB HF TRANSCEIVER 2ND UNIT	3910109-3	23.2*	96.1*
	RE-1000 SINGLE SIDE BAND XCVR (ASB-125)	99680	5.3	11.7
	PA1010A REMOTE POWER AMPLIFIER	99682	8.5	138.0
	CU-110 ANTENNA COUPLER (LOAD BOX)	99816	5.2	117.0
	ANTENNA INSTL 351 INCHES LONG	3960117	0.3	152.1
H13-A	CESSNA 400 MARKER BEACON	3910142-5	2.5*	67.4*
	RECEIVER (R-402A)	42410-5114	0.7	11.0
	ANTENNA, FLUSH MOUNTED IN TAILCONE	1270720-1	1.0	133.4
H16-A-1	CESSNA 300 TRANSPONDER	3910127-6	3.6*	27.1*
	RECEIVER-TRANSMITTER (RT-359A)	41420-1114	2.7	12.5
	ANTENNA (A-109A)	41530-0001	0.1	167.0
H16-A-2	CESSNA 400 TRANSPONDER	3910128-2	3.6*	27.1*
	RECEIVER-TRANSMITTER (RT-459A)	41470-1114	2.8	12.5
	ANTENNA (A-109A)	41530-0001	0.1	167.0
H22-A-1	CESSNA 300 NAV/COM 360 CHANNEL COM VOR/LOC	3910151-5	16.3*	32.6*
	1ST UNIT INSTALLATION			
	RECEIVER-TRANSMITTER (RT-308C)	42450-1114	6.4	11.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	16.3
	NOTE-- 1ST UNIT INSTL COMPONENTS			
	ARE AS LISTED			
	ANTENNA & CABLE, LH VHF COM		0.8	47.4
	ANTENNA & CABLE, VOR/LOC NAV		1.5	176.9
	MICROPHONE INSTALLATION HAND HELD	0770750-701	0.3	19.4
	HEADSET INSTALLATION	0770750-704	0.2	14.3
	SPEAKER INSTALLATION	0770750-741	1.9	45.1
	RADIO COOLING	3930152-5	1.0	12.5
	ENGINE NOISE FILTER	3940148-2	0.1	-6.0
	AUDIO CONTROL SYSTEM	3970130-1	1.9	13.0
	MOUNTING BOX, WIRING & ASSOC HARDWARE		1.6	10.8
H22-A-2	CESSNA 300 NAV/COM 720 CHANNEL COM VOR/LOC	3910150-9	16.8*	32.0*
	1ST UNIT INSTALLATION			
	RECEIVER-TRANSMITTER (RT-328T)	43340-1124	6.9	11.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	16.3
	INSTL COMPONENTS SAME AS H22-A-1			
H22-A-3	CESSNA 300 NAV/COM 720 CHANNEL COM VOR/ILS	3910152-11	16.9*	31.9*
	1ST UNIT INSTALLATION			
	RECEIVER-TRANSMITTER (RT-328T)	43340-1124	6.9	11.0
	VOR/ILS INDICATOR (IN-525B)	45010-2000	0.7	16.3

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	INSTL COMPONENTS SAME AS H22-A-1			
H25-A-1	CESSNA 300 NAV/COM 360 CHANNEL COM VOR/LOC 2ND UNIT INSTALLATION	3910151-6	9.7*	14.4*
	RECEIVER-TRANSMITTER (RT-308C)	42450-1114	6.4	11.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	16.3
	INSTL COMPONENTS--2ND UNIT NAV/COM			
	ANTENNA & CABLE, RH VHF COM		0.8	47.4
	ANTENNA COUPLER & CABLES (VOR-OMNI)	S2212-1	0.2	5.0
	MOUNTING BOX, WIRING & MISC ITEMS		1.6	10.8
H25-A-2	CESSNA 300 NAV/COM 720 CHANNEL COM VOR/LOC 2ND UNIT INSTALLATION	3910150-10	10.2*	14.3*
	RECEIVER-TRANSMITTER (RT-328T)	43340-1124	6.9	11.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	16.3
	INSTL COMPONENTS SAME AS H25-A-1			
H28-A-1	EMERGENCY LOCATOR TRANSMITTER	0770135-1	2.0*	134.6*
	TRANSMITTER ASSEMBLY	C589510-0209	1.8	134.5
	ANTENNA ASSY.	C589510-0203	0.1	137.8
H28-A-2	EMERGENCY LOCATOR TRANSMITTER (USED IN CANADA)	0770135-2	1.8*	134.6*
	TRANSMITTER ASSY	C589510-0212	1.6	134.5
	ANTENNA	C589510-0203	0.1	137.8
H31-A-1	NAV-O-MATIC 200A INSTALLATION (AF-295B)	3910162-21	12.2*	47.5*
	CONTROLLER-AMPLIFIER	43610-1000	1.1	15.0
	TURN COORDINATOR (D88-O-1)(NET CHANGE)	42320-0014	0.6	11.2
	WING SERVO INSTALLATION	0700215	7.8	66.5
H31-A-2	NAV-O-MATIC 300A INSTALLATION (AF-395-A)	3910162-21	13.0*	45.2*
	CONTROLLER-AMPLIFIER (C-395A)	42660-1000	1.6	13.0
	GYRO INSTALLATION (NET CHANGE)	0701038	0.8	10.8
	TURN COORDINATOR (D88-O-1)(NET CHANGE)	42320-0014	0.6	11.2
	WING SERVO INSTALLATION	0700215	7.8	66.5
H44-A	REVERSE SENSING SWITCH INSTL.	3910154-85	0.2	16.0
H46-A	ADF ANTI PRECIP SENSE ANTENNA	3910154-64	0.8	141.8
H52-A	AVIONICS OPTION G (FLUSH MTD COM ANTENNA) (FLUSH MTD IN LEADING EDGE VERTICAL FIN	3910154-63	1.4	184.6
H55-A	HEADSET-MIKE COMBINATION	3970111-1	0.2	12.0
	J. SPECIAL OPTION PACKAGES			
J01-A	SKYLANE II KIT	0700800	64.1*	40.7*
	C07-A GROUND SERVICE RECEPTICLE	0701019-1	3.2	-2.6

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	C19-0 HEATED PITOT & STALL WARNING	0770724-1	0.5	26.5
	C31-A COURTESY ENTRANCE LIGHTS (2)	0700615-9	0.5	61.7
	C40-A NAV LIGHT DETECTORS	0701013	NEGL	--
	C43-A FLASHING BEACON LIGHT	0701042-1	1.8	208.6
	D01-0 TRUE AIRSPEED IND. (NET CHANGE)	1201008-7	0.2	16.5
	D04-A STATIC ALTERNATE AIR SOURCE	0701028-1	0.3	14.4
	E85-A DUAL CONTROLS	0760101-2	8.7	16.1
	G92-A LONG RANGE WINGS	0720700	7.0	56.5
	H01-A-1 CESSNA 300 ADF (R-546E)	3910159-1	7.3	23.6
	H16-A-1 CESSNA 300 TRANSPONDER (RT359A)	3910127-6	3.6	27.1
	H22-A-2 CESSNA 300 NAV/COM (RT-328T)	3910150-9	16.8	32.0
	H28-A-1 EMERGENCY LOCATOR TRANSMITTER	0770135-1	2.0	134.6
	H31-A-1 CESSNA 200A AUTO-PILOT	3910140-21	12.2	47.5
J04-A	NAV-PAC (SKYLANE II ONLY) (NET CHANGE)	3910138-5	16.7*	42.8*
	H07-A 400 GLIDESLOPE (R-443B)	3910119-6	3.9	102.2
	H13-A 400 MARKER BEACON (R-402A)	3910142-5	2.5	67.4
	H22-A-2 NAV/COM 328T VOR/LOC 1ST UNIT DELETED	3910150-9	-16.8	32.0
	H22-A-3 NAV/COM 328T VOR/ILS 1ST UNIT ADDED	3910152-11	16.9	31.9
	H25-A-2 NAV/COM 328T VOR/LOC 2ND UNIT ADDED	3910150-10	10.2	14.3

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Weight and Balance Report and Equipment List Amendment

A/C #: N735GC Model #: Cessna 182Q S/N: 18266404

Reference Amended Weight & Balance		WEIGHT	ARM	MOMENT
Dated 10/1/2012		1,890.60	36.00	68,052.41
DATE	DESCRIPTION	WEIGHT	ARM	MOMENT
08/28/17	MK-1700 NAV/COM receiver	-7.50	12.00	-90.00
08/28/17	Garmin GNC-155 XL GPS	-2.75	12.00	-33.00
08/28/17	GPS antenna	-0.20	36.00	-7.20
08/28/17	Garmin GTX-320 transponder	-2.30	12.00	-27.60
08/28/17	King KI-201C Indicator	-2.80	14.00	-39.20
08/28/17	Garmin GTN-650 NAV/COM/GPS	7.00	12.00	84.00
08/28/17	Garmin GA-35 GPS/WAAS antenna	0.75	36.00	27.00
08/28/17	Garmin GTX-345 ADS/B transponder	3.12	12.00	37.44
08/28/17	New Weight and Balance	1,885.92	36.06	68,003.85
	Conditions Affecting Weight:			
	Engine Oil undrainable oil			
	Fuel Drained unusable fuel			
	Pilot Supplies N/A			
08/28/17	Take off Gross Weight	2,950.00		
08/28/17	New Empty Weight	1,885.92		
08/28/17	Useful Load	1,064.08		
08/28/17	New Empty C.G.	36.06		

Name Todd Ott

AP3653363

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

INTRODUCTION

This section provides description and operation of the airplane and its systems. Some equipment described herein is optional and may not be installed in the airplane. Refer to Section 9, Supplements, for details of other optional systems and equipment.

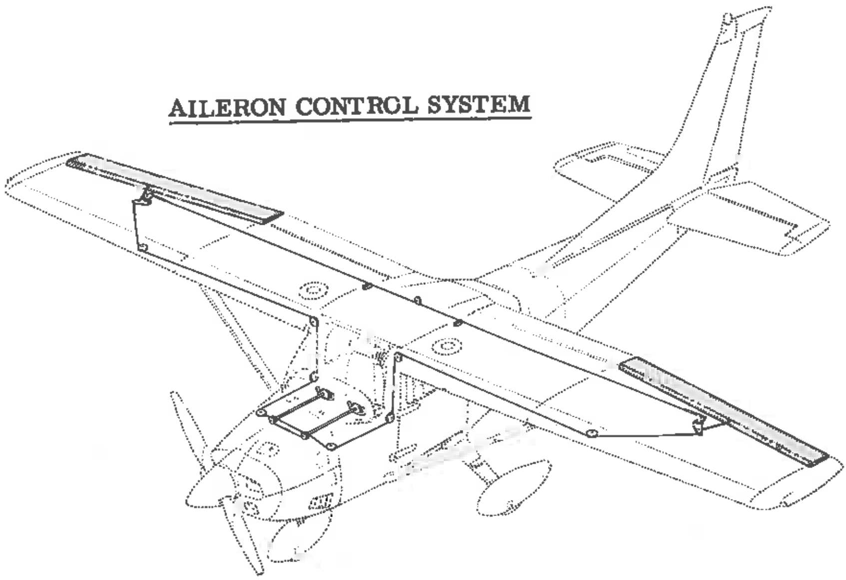
AIRFRAME

The construction of the fuselage is a conventional formed sheet metal bulkhead, stringer, and skin design referred to as semi-monocoque. Major items of structure are the front and rear carry-through spars to which the wings are attached, a bulkhead and forgings for main landing gear attachment at the base of the rear doorposts, and a bulkhead with attaching plates at the base of the forward doorposts for the lower attachment of the wing struts. Four engine mount stringers are also attached to the forward doorposts and extend forward to the firewall.

The externally braced wings, containing the fuel tanks, are constructed of a front and rear spar with formed sheet metal ribs, doublers, and stringers. The entire structure is covered with aluminum skin. The front spars are equipped with wing-to-fuselage and wing-to-strut attach fittings. The aft spars are equipped with wing-to-fuselage attach fittings, and are partial-span spars. Conventional hinged ailerons and single-slot type flaps are attached to the trailing edge of the wings. The ailerons are constructed of a forward spar containing a balance weight, formed sheet metal ribs and "V" type corrugated aluminum skin joined together at the trailing edge. The flaps are constructed basically the same as the ailerons, with the exception of the balance weight, and the addition of a formed sheet metal leading edge section.

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a forward and aft spar, formed sheet metal ribs and reinforcements, four skin panels, formed leading edge skins, and a dorsal. The rudder is constructed of a forward and aft spar, formed sheet metal ribs and reinforcements, and a wrap-around skin panel. The top of the rudder incorporates a leading edge extension which contains a balance weight. The horizontal stabilizer is constructed of a forward and aft spar, ribs and stiffeners, center upper and lower skin panels, and two left and two right wrap-around skin panels which also form the leading edges. The horizontal stabilizer also contains the elevator trim tab actuator. Construction of the elevator consists of formed leading edge skins, a forward spar, ribs, torque tube and bellcrank, left upper and lower "V" type corrugated skins, and right upper and lower "V" type corrugated

AILERON CONTROL SYSTEM



RUDDER AND RUDDER TRIM
CONTROL SYSTEMS

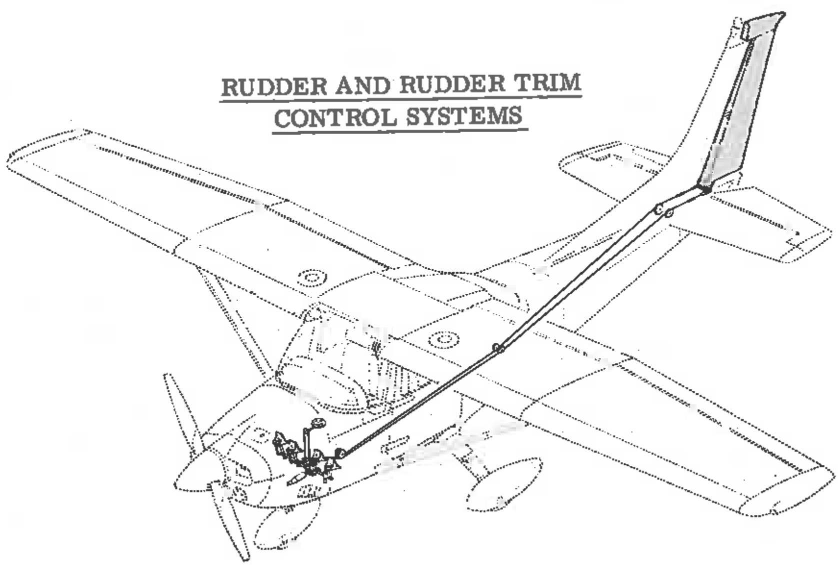
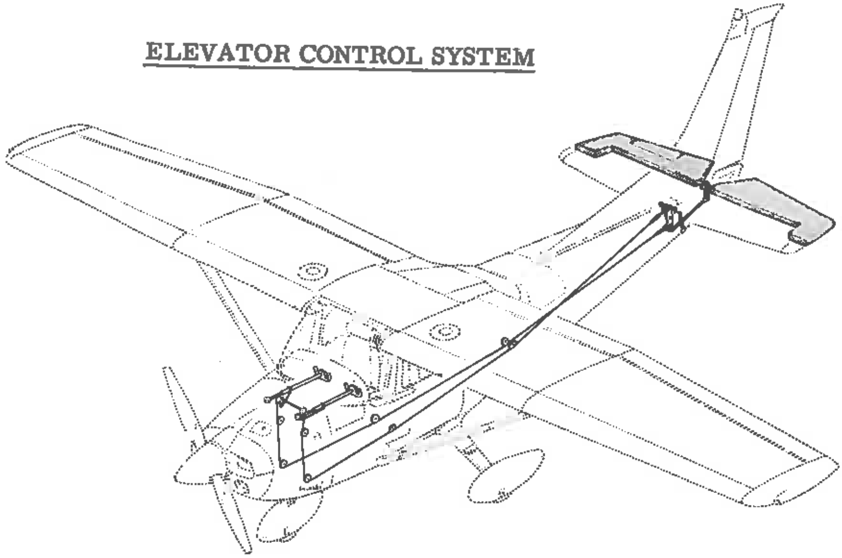


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

ELEVATOR CONTROL SYSTEM



ELEVATOR TRIM
CONTROL SYSTEM

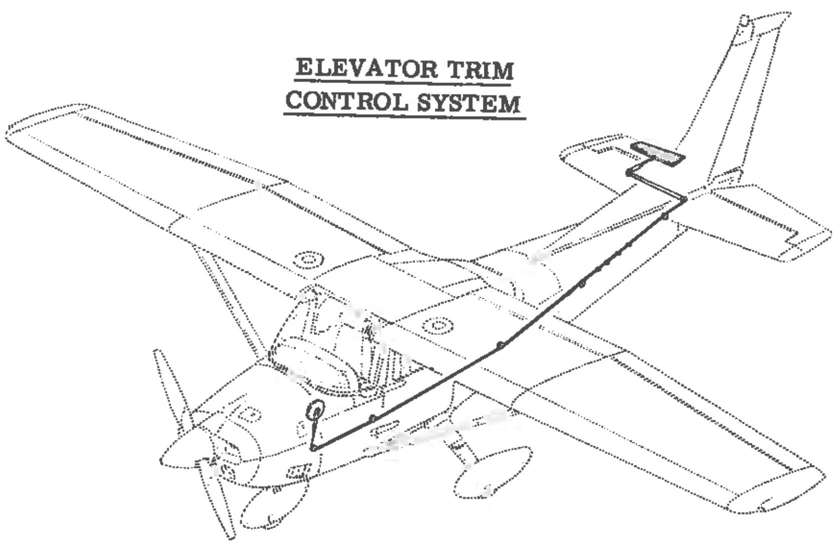


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

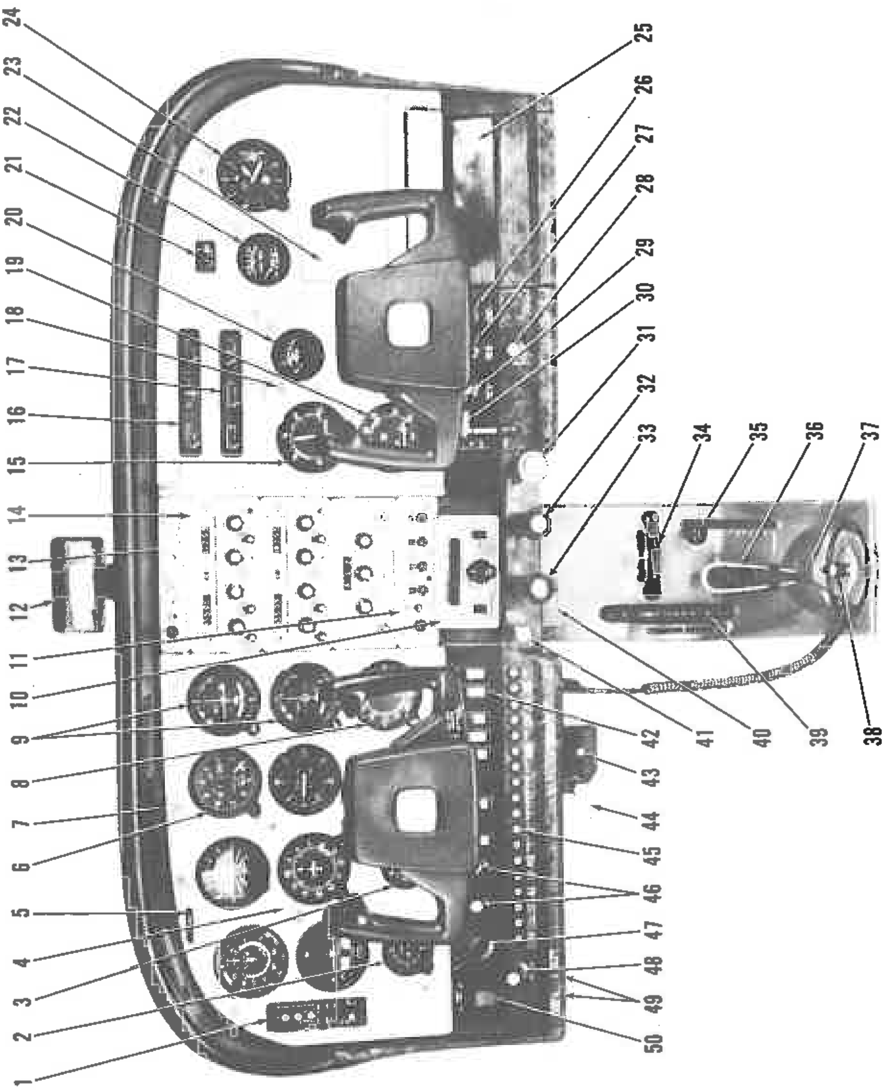


Figure 7-2. Instrument Panel (Sheet 1 of 2)

1. Marker Beacon Indicator Lights and Switches
2. Clock
3. Suction Gage
4. Flight Instrument Group
5. Airplane Registration Number
6. Encoding Altimeter
7. Approach Plate Light and Switch
8. ADF Bearing Indicator
9. Omni Course Indicators
10. Autopilot Control Unit
11. Transponder
12. Rear View Mirror
13. Audio Control Panel
14. Radios
15. Manifold Pressure Gage
16. Fuel Quantity Indicators and Ammeter
17. Cylinder Head Temperature, Oil Temperature, and Oil Pressure Gages
18. Over-Voltage Warning Light
19. Tachometer
20. Economy Mixture Indicator
21. Flight Hour Recorder
22. Carburetor Air Temperature Gage
23. Additional Radio and Instrument Space
24. Secondary Altimeter
25. Map Compartment
26. Defroster Control Knob
27. Cabin Air Control Knob
28. Cigar Lighter
29. Cabin Heat Control Knob
30. Wing Flap Switch and Position Indicator
31. Mixture Control Knob
32. Propeller Control Knob
33. Throttle (With Friction Lock)
34. Rudder Trim Control Wheel
35. Cowl Flap Control Lever
36. Microphone
37. Fuel Selector Light
38. Fuel Selector Valve Handle
39. Elevator Trim Control Wheel
40. Control Pedestal Light
41. Carburetor Heat Control Knob
42. Electrical Switches
43. Static Pressure Alternate Source Valve
44. Parking Brake Handle
45. Circuit Breakers
46. Instrument and Radio Dial Light Rheostat Control Knobs
47. Ignition Switch
48. Primer
49. Auxiliary Mike Jack and Phone Jack
50. Master Switch

Figure 7-2. Instrument Panel (Sheet 2 of 2) skins incorporating a trailing edge cut-out for the trim tab. The elevator trim tab consists of a spar and upper and lower "V" type corrugated skins. Both elevator tip leading edge extensions incorporate balance weights.

FLIGHT CONTROLS

The airplane's flight control system consists of conventional aileron, rudder, and elevator control surfaces (see figure 7-1). The control surfaces are manually operated through mechanical linkage using a control wheel for the ailerons and elevator, and rudder/brake pedals for the rudder. The elevator control system is equipped with downsprings which provide improved stability in flight.

TRIM SYSTEMS

Manually-operated rudder and elevator trim is provided. Rudder trimming is accomplished through a bungee connected to the rudder control system and a trim control wheel mounted on the control pedestal. Rudder trimming is accomplished by rotating the horizontally mounted trim control wheel either left or right to the desired trim position. Rotating the trim wheel to the right will trim nose-right; conversely rotating it to the left will trim nose-left. Elevator trimming is accomplished through the elevator trim tab by utilizing the vertically mounted trim control wheel. Forward rotation of the trim wheel will trim nose-down; conversely, aft rotation will trim nose-up. The airplane may also be equipped with an electric elevator trim system. For details concerning this system, refer to Section 9, Supplements.

INSTRUMENT PANEL

The instrument panel (see figure 7-2) is designed around the basic "T" configuration. The gyros are located immediately in front of the pilot, and are arranged vertically. The airspeed indicator and altimeter are located to the left and right of the gyros, respectively. The remainder of the flight instruments are located around the basic "T". Avionics equipment is stacked approximately on the centerline of the panel, with the right side of the panel containing the wing flap switch and indicator, manifold pressure gage, tachometer, map compartment, and space for additional instruments and avionics equipment. The engine instrument cluster and fuel quantity indicators are on the right side of the avionics stack near the top of the panel. A switch and control panel, at the lower edge of the instrument panel, contains most of the switches, controls, and circuit breakers necessary to operate the airplane. The left side of the panel contains the master switch, engine primer, ignition switch, light intensity controls, electrical switches, and circuit breakers. The center area contains the carburetor heat control, throttle, propeller control, and mixture control. The right side of the panel contains the cabin heat, cabin air, and defroster control knobs and the cigar lighter. A pedestal extending from the switch and control panel to the floorboard, contains the elevator and rudder trim control wheels, cowl flap control lever, and microphone bracket. The fuel selector valve handle is located at the base of the pedestal. A parking brake handle is mounted under the switch and control panel, in front of the pilot. An alternate static source valve control knob may also be installed beneath the switch and control panel.

For details concerning the instruments, switches, circuit breakers, and controls on this panel, refer in this section to the description of the systems to which these items are related.

GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring-loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 11° each side of center. By applying either left or right brake, the degree of turn may be increased up to 29° each side of center.

Moving the airplane by hand is most easily accomplished by attaching a tow bar to the nose gear strut. If a tow bar is not available, or pushing is required, use the wing struts as push points. Do not use the vertical or horizontal surfaces to move the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel more than 29° either side of center or structural damage to the nose gear could result.

The minimum turning radius of the airplane, using differential braking and nose wheel steering during taxi, is approximately 27 feet. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down on a tailcone bulkhead just forward of the horizontal stabilizer to raise the nose wheel off the ground.

WING FLAP SYSTEM

The wing flaps are of the single-slot type (see figure 7-3), and are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position. The switch lever is moved up or down in a slotted panel that provides mechanical stops at the 10° and 20° positions. For flap settings greater than 10°, move the switch lever to the right to clear the stop and position it as desired. A

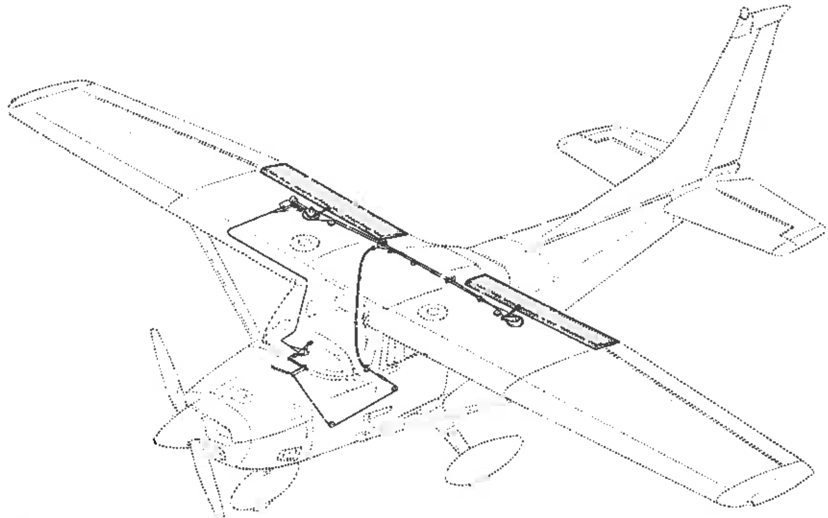


Figure 7-3. Wing Flap System

scale and pointer on the left side of the switch lever indicates flap travel in degrees. The wing flap system circuit is protected by a 15-ampere circuit breaker, labeled FLAP, on the left side of the instrument panel.

LANDING GEAR SYSTEM

The landing gear is of the tricycle type with a steerable nose wheel, two main wheels, and wheel fairings. Shock absorption is provided by the tubular spring-steel main landing gear struts and the air/oil nose gear shock strut. Each main gear wheel is equipped with a hydraulically actuated disc-type brake on the inboard side of each wheel, and an aerodynamic fairing over each brake.

BAGGAGE COMPARTMENT

The baggage compartment consists of the area from the back of the rear passenger seats to the aft cabin bulkhead. Mounted to the aft cabin bulkhead, and extending aft of it, is a hatshelf. Access to the baggage compartment and the hatshelf is gained through a lockable baggage door on the left side of the airplane, or from within the airplane cabin. A baggage net with six tie-down straps is provided for securing baggage and is attached by tying the straps to tie-down rings provided in the airplane. A cargo tie-down kit may also be installed. For further information on baggage and cargo tie-down, refer to Section 6. When loading the airplane, children should not be placed or permitted in the baggage compartment, and any material that might be hazardous to the airplane or occupants should not be placed anywhere in the airplane. For baggage area and door dimensions, refer to Section 6.

SEATS

The seating arrangement consists of two separate adjustable seats for the pilot and front passenger, a split-backed fixed seat in the rear, and a child's seat (if installed) aft of the rear seats. The pilot's and front passenger's seats are available in two different designs: four-way and six-way adjustable.

Four-way seats may be moved forward or aft, and the seat back angle changed. To position either seat, lift the tubular handle under the center of the seat, slide the seat into position, release the handle, and check that the seat is locked in place. The seat back is spring-loaded to the vertical position. To adjust its position, lift the lever under the right front corner of the seat, reposition the back, release the lever, and check that the back is locked in place. The seat backs will also fold full forward.

The six-way seats may be moved forward or aft, adjusted for height, and the seat back angle is infinitely adjustable. Position the seat by lifting the tubular handle, under the center of the seat bottom, and slide the seat into position; then release the lever and check that the seat is locked in place. Raise or lower the seat by rotating a large crank under the right corner of the left seat and the left corner of the right seat. Seat back angle is adjustable by rotating a small crank under the left corner of the left seat and the right corner of the right seat. The seat bottom angle will change as the seat back angle changes, providing proper support. The seat backs will also fold full forward.

The rear passenger's seats consist of a fixed one-piece seat bottom with individually adjustable seat backs. Two adjustment levers, on the left and right rear corners of the seat bottom, are used to adjust the angle of the respective seat backs. To adjust either seat back, lift the adjustment lever and reposition the back. The seat backs are spring-loaded to the vertical position.

A child's seat may be installed aft of the rear passenger seats, and is held in place by two brackets mounted on the floorboard. The seat is designed to swing upward into a stowed position against the aft cabin bulkhead when not in use. To stow the seat, rotate the seat bottom up and aft as far as it will go. When not in use, the seat should be kept in the stowed position.

Headrests are available for any of the seat configurations except the child's seat. To adjust the headrest, apply enough pressure to it to raise or lower it to the desired level. The headrest may be removed at any time by raising it until it disengages from the top of the seat back.

SEAT BELTS AND SHOULDER HARNESSES

All seat positions are equipped with seat belts (see figure 7-4). The pilot's and front passenger's seats are also equipped with separate shoulder harnesses; separate shoulder harnesses are also available for the rear seat positions. Integrated seat belt/shoulder harnesses with inertia reels can be furnished for the pilot's and front passenger's seat positions if desired.

SEAT BELTS

The seat belts used with the pilot's and front passenger's seats, and the child's seat (if installed), are attached to fittings on the floorboard. The buckle half is inboard of each seat and the link half is outboard of each seat. The belts for the rear seat are attached to the seat frame, with the link halves on the left and right sides of the seat bottom, and the buckles at the center of the seat bottom.

To use the seat belts for the front seats, position the seat as desired, and then lengthen the link half of the belt as needed by grasping the sides of the link and pulling against the belt. Insert and lock the belt link into the buckle. Tighten the belt to a snug fit. Seat belts for the rear seats, and the child's seat, are used in the same manner as the belts for the front seats. To release the seat belts, grasp the top of the buckle opposite the link and pull upward.

SHOULDER HARNESSES

Each front seat shoulder harness is attached to a rear doorpost above the window line and is stowed behind a stowage sheath above the cabin door. To stow the harness, fold it and place it behind the sheath. When rear seat shoulder harnesses are furnished, they are attached adjacent to the lower corners of the aft side windows. Each rear seat harness is stowed behind a stowage sheath above an aft side window. No harness is available for the child's seat.

To use a front or rear seat shoulder harness, fasten and adjust the

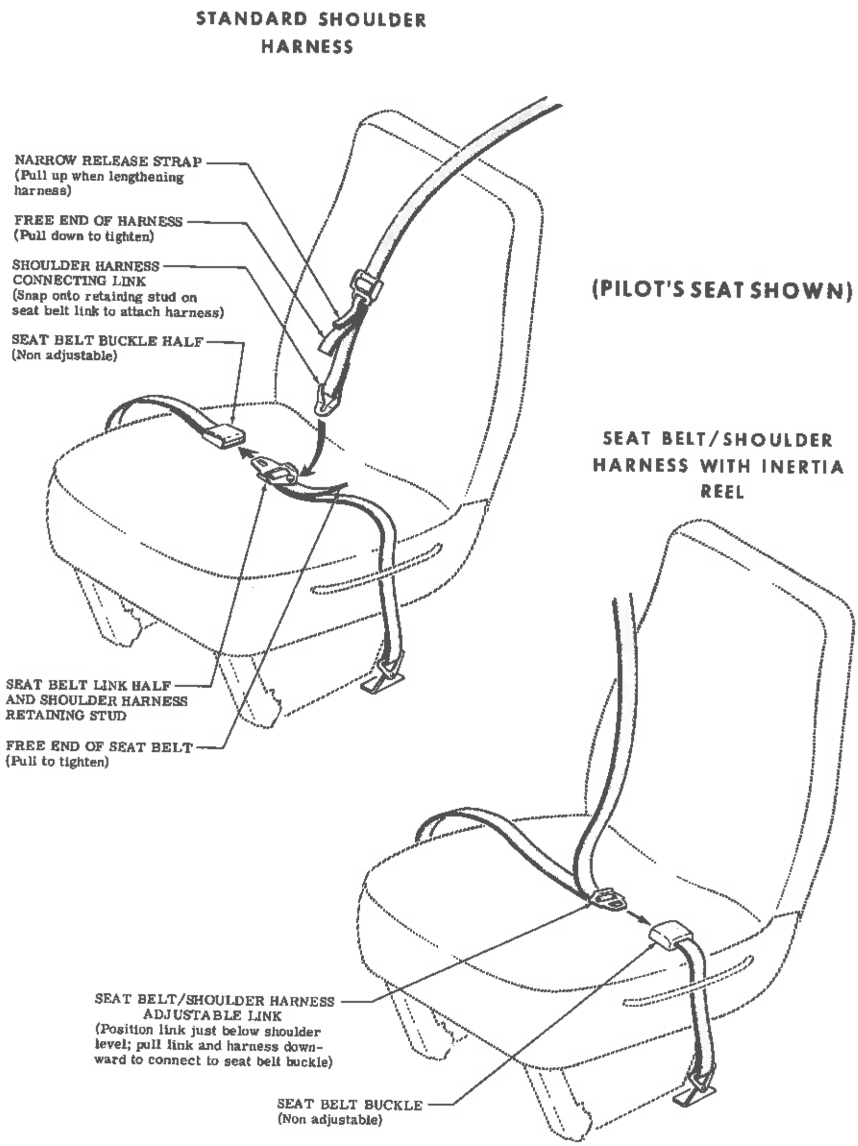


Figure 7-4. Seat Belts and Shoulder Harnesses

seat belt first. Lengthen the harness as required by pulling on the connecting link on the end of the harness and the narrow release strap. Snap the connecting link firmly onto the retaining stud on the seat belt link half. Then adjust to length. A properly adjusted harness will permit the occupant to lean forward enough to sit completely erect, but prevent excessive forward movement and contact with objects during sudden deceleration. Also, the pilot will want the freedom to reach all controls easily.

Removing the shoulder harness is accomplished by pulling upward on the narrow release strap, and removing the harness connecting link from the stud on the seat belt link. In an emergency, the shoulder harness may be removed by releasing the seat belt first and allowing the harness, still attached to the link half of the seat belt, to drop to the side of the seat.

INTEGRATED SEAT BELT/SHOULDER HARNESSES WITH INERTIA REELS

Integrated seat belt/shoulder harnesses with inertia reels are available for the pilot and front seat passenger. The seat belt/shoulder harnesses extend from inertia reels located in the cabin top structure, through slots in the overhead console marked PILOT and COPILOT, to attach points inboard of the two front seats. A separate seat belt half and buckle is located outboard of the seats. Inertia reels allow complete freedom of body movement. However, in the event of a sudden deceleration, they will lock automatically to protect the occupants.

To use the seat belt/shoulder harness, position the adjustable metal link on the harness at about shoulder level, pull the link and harness downward, and insert the link in the seat belt buckle. Adjust belt tension across the lap by pulling upward on the shoulder harness. Removal is accomplished by releasing the seat belt buckle, which will allow the inertia reel to pull the harness inboard of the seat.

ENTRANCE DOORS AND CABIN WINDOWS

Entry to, and exit from the airplane is accomplished through either of two entry doors, one on each side of the cabin at the front seat positions (refer to Section 6 for cabin and cabin door dimensions). The doors incorporate a recessed exterior door handle, a conventional interior door handle, a key-operated door lock (left door only), a door stop mechanism, and an openable window in the left door. An openable right door window is also available.

To open the doors from outside the airplane, utilize the recessed door handle near the aft edge of each door. Depress the forward end of the handle to rotate it out of its recess, and then pull outboard. To close or open the doors from inside the airplane, use the combination door handle and arm rest. The inside door handle has three positions and a placard at its base which reads OPEN, CLOSE, and LOCK. The handle is spring-loaded to the CLOSE (up) position. When the door has been pulled shut and latched, lock it by rotating the door handle forward to the LOCK position (flush with the arm rest). When the handle is rotated to the LOCK position, an over-center action will hold it in that position. Both cabin doors should be locked prior to flight, and should not be opened intentionally during flight.

NOTE

Accidental opening of a cabin door in flight due to improper closing does not constitute a need to land the airplane. The best procedure is to set up the airplane in a trimmed condition at approximately 80 knots, open a window, momentarily shove the door outward slightly, and forcefully close and lock the door.

Exit from the airplane is accomplished by rotating the door handle from the LOCK position, past the CLOSE position, aft to the OPEN position and pushing the door open. To lock the airplane, lock the right cabin door with the inside handle, close the left cabin door, and using the ignition key, lock the door.

The left cabin door is equipped with an openable window which is held in the closed position by a lock button equipped over-center latch on the lower edge of the window frame. To open the window, depress the lock button and rotate the latch upward. The window is equipped with a spring-loaded retaining arm which will help rotate the window outward and hold it there. An openable window is also available for the right door, and functions in the same manner as the left window. If required, either window may be opened at any speed up to 179 knots. The cabin top windows (if installed), rear side windows, and rear window are of the fixed type and cannot be opened.

CONTROL LOCKS

A control lock is provided to lock the ailerons and elevator control surfaces in a neutral position and prevent damage to these systems by wind buffeting while the airplane is parked. The lock consists of a shaped steel rod with a red metal flag attached to it. The flag is labeled CONTROL LOCK, REMOVE BEFORE STARTING ENGINE. To install the control lock, align the hole in the top of the pilot's control wheel shaft with the hole in the top of the shaft collar on the instrument panel and insert the rod into the aligned holes. Proper installation of the lock will place the red flag over the ignition switch. In areas where high or gusty winds occur, a control surface lock should be installed over the vertical stabilizer and rudder. The control lock and any other type of locking device should be removed prior to starting the engine.

ENGINE

The airplane is powered by a horizontally-opposed, six-cylinder, overhead-valve, air-cooled, carbureted engine with a wet sump oil system. The engine is a Continental Model O-470-U and is rated at 230 horsepower at 2400 RPM. Major accessories include a propeller governor on the front of the engine and dual magnetos, starter, belt-driven alternator, and vacuum pump on the rear of the engine. Provisions are also made for a full flow oil filter.

ENGINE CONTROLS

Engine manifold pressure is controlled by a throttle located on the lower center portion of the instrument panel. The throttle operates in a conventional manner; in the full forward position, the throttle is open, and in the full aft position, it is closed. A friction lock, which is a round knurled disk, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it.

The mixture control, mounted near the propeller control, is a red knob with raised points around the circumference and is equipped with a lock button in the end of the knob. The rich position is full forward, and full aft is the idle cut-off position. For small adjustments, the control may be moved forward by rotating the knob clockwise, and aft by rotating the knob counterclockwise. For rapid or large adjustment, the knob may be moved forward or aft by depressing the lock button in the end of the control, and then positioning the control as desired.

ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: oil pressure gage, oil temperature gage, cylinder head temperature gage, tachometer, and manifold pressure gage. An economy mixture (EGT) indicator and carburetor air temperature gage are also available.

The oil pressure gage, located on the right side of the instrument panel, is operated by oil pressure. A direct pressure oil line from the engine delivers oil at engine operating pressure to the oil pressure gage. Gage markings indicate that minimum idling pressure is 10 PSI (red line), the normal operating range is 30 to 60 PSI (green arc), and maximum pressure is 100 PSI (red line).

Oil temperature is indicated by a gage adjacent to the oil pressure gage. The gage is operated by an electrical-resistance type temperature sensor which receives power from the airplane electrical system. Oil temperature limitations are the normal operating range (green arc) which is 38°C (100°F) to 116°C (240°F), and the maximum (red line) which is 116°C (240°F).

The cylinder head temperature gage, under the left fuel quantity indicator, is operated by an electrical-resistance type temperature sensor on the engine which receives power from the airplane electrical system. Temperature limitations are the normal operating range (green arc) which is 93°C (200°F) to 238°C (460°F) and the maximum (red line) which is 238°C (460°F).

The engine-driven mechanical tachometer is located on the lower right side of the instrument panel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter below the center of the tachometer dial records elapsed engine time in hours and tenths. Instrument markings include a normal operating range (green arc) of 2100 to 2400 RPM, and a maximum (red line) of 2400 RPM.

The manifold pressure gage is located on the right side of the instrument panel above the tachometer. The gage is direct reading and indicates induction air manifold pressure in inches of mercury. It has a normal operating range (green arc) of 15 to 23 inches of mercury.

An economy mixture (EGT) indicator is available for the airplane and is located on the right side of the instrument panel. A thermocouple probe in the right exhaust stack assembly measures exhaust gas temperature and transmits it to the indicator. The indicator serves as a visual aid to the pilot in adjusting cruise mixture. Exhaust gas temperature varies with with fuel-to-air ratio, power, and RPM. However, the difference between the peak EGT and the EGT at the cruise mixture setting is essentially constant and this provides a useful leaning aid. The indicator is equipped with a manually positioned peak EGT reference pointer.

A carburetor air temperature gage may be installed on the right side of the instrument panel to help detect carburetor icing conditions. The gage is marked in 5° increments from -30°C to +30°C, and has a yellow arc between -15°C and +5°C which indicates the temperature range most conducive to icing in the carburetor. A placard on the lower half of the gage face reads KEEP NEEDLE OUT OF YELLOW ARC DURING POSSIBLE CARBURETOR ICING CONDITIONS.

NEW ENGINE BREAK-IN AND OPERATION

The engine underwent a run-in at the factory and is ready for the full range of use. It is, however, suggested that cruising be accomplished at

75% power until a total of 50 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the rings.

The airplane is delivered from the factory with corrosion preventive oil in the engine. If, during the first 25 hours, oil must be added, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082.

ENGINE OIL SYSTEM

Oil for engine lubrication and propeller governor operation is supplied from a sump on the bottom of the engine. The capacity of the sump is 12 quarts (one additional quart is required if a full flow oil filter is installed). Oil is drawn from the sump through a filter screen on the end of a pickup tube to the engine-driven oil pump. Oil from the pump passes through an oil pressure screen (full flow oil filter, if installed), a pressure relief valve at the rear of the right oil gallery, and a thermostatically controlled oil cooler. Oil from the cooler is then circulated to the left gallery and propeller governor. The engine parts are then lubricated by oil from the galleries. After lubricating the engine, the oil returns to the sump by gravity. If a full flow oil filter is installed, the filter adapter is equipped with a bypass valve which will cause lubricating oil to bypass the filter in the event the filter becomes plugged, or the oil temperature is extremely cold.

An oil dipstick is located at the rear of the engine on the left side, and an oil filler tube is on top of the crankcase near the front of the engine. The dipstick and oil filler are accessible through doors on the engine cowling. The engine should not be operated on less than nine quarts of oil. To minimize loss of oil through the breather, fill to 10 quarts for normal flights of less than three hours. For extended flight, fill to 12 quarts (dipstick indication only). For engine oil grade and specifications, refer to Section 8 of this handbook.

The oil cooler may be replaced by a non-congealing oil cooler for operations in temperatures consistently below -7°C (20°F). The non-congealing oil cooler provides improved oil flow at low temperatures. Once installed, the non-congealing oil cooler is approved for permanent use in both hot and cold weather.

An oil quick-drain valve is available to replace the drain plug on the bottom of the oil sump, and provides quicker, cleaner draining of the engine oil. To drain the oil with this valve, slip a hose over the end of the valve and push upward on the end of the valve until it snaps into the open position. Spring clips will hold the valve open. After draining, use a suitable tool to snap the valve into the extended (closed) position and remove the drain hose.

IGNITION-STARTER SYSTEM

Engine ignition is provided by two engine-driven magnetos, and two spark plugs in each cylinder. The right magneto fires the lower left and upper right spark plugs, and the left magneto fires the lower right and upper left spark plugs. Normal operation is conducted with both magnetos due to the more complete burning of the fuel-air mixture with dual ignition.

Ignition and starter operation is controlled by a rotary type switch located on the left switch and control panel. The switch is labeled clockwise, OFF, R, L, BOTH, and START. The engine should be operated on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. When the switch is rotated to the spring-loaded START position (with the master switch in the ON position), the starter contactor is energized and the starter will crank the engine. When the switch is released, it will automatically return to the BOTH position.

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through an intake in the lower front portion of the engine cowling. The intake is covered by an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an airbox. After passing through the airbox, induction air enters the inlet in the carburetor which is under the engine, and is then ducted to the engine cylinders through intake manifold tubes. In the event carburetor ice is encountered or the intake filter becomes blocked, alternate heated air can be obtained from a shroud around an exhaust riser through a duct to a valve, in the airbox, operated by the carburetor heat control on the instrument panel. Heated air from the exhaust riser shroud is obtained from unfiltered air inside the cowling. Use of full carburetor heat at full throttle will result in a loss of approximately one to two inches of manifold pressure.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies to a muffler and tailpipe. The muffler is constructed with a shroud around the outside which forms a heating chamber for cabin heater air.

CARBURETOR AND PRIMING SYSTEM

The engine is equipped with an up-draft, float-type, fixed jet carburetor mounted on the bottom of the engine. The carburetor is equipped with an enclosed accelerator pump, simplified fuel passages to prevent vapor locking, an idle cut-off mechanism, and a manual mixture control. Fuel is delivered to the carburetor by gravity flow from the fuel system. In the carburetor, fuel is atomized, proportionally mixed with intake air, and delivered to the cylinders through intake manifold tubes. The proportion of atomized fuel to air is controlled, within limits, by the mixture control on the instrument panel.

For easy starting in cold weather, the engine is equipped with a manual primer. The primer is actually a small pump which draws fuel from the fuel strainer when the plunger is pulled out, and injects it into the intake manifold when the plunger is pushed back in. The plunger knob, on the instrument panel, is equipped with a lock, and after being pushed full in, must be rotated either left or right until the knob cannot be pulled out.

COOLING SYSTEM

Ram air for engine cooling enters through two intake openings in the front of the engine cowling. The cooling air is directed around the cylinders and other areas of the engine by baffling, and is then exhausted through cowl flaps on the lower aft edge of the cowling. The cowl flaps are mechanically operated from the cabin by means of a cowl flap lever on the right side of the control pedestal. The pedestal is labeled OPEN, COWL FLAPS, CLOSED. During takeoff and high power operation, the cowl flap lever should be placed in the OPEN position for maximum cooling. This is accomplished by moving the lever to the right to clear a detent, then moving the lever up to the OPEN position. Anytime the lever is repositioned, it must first be moved to the right. While in cruise flight, cowl flaps should be adjusted to keep the cylinder head temperature at approximately two-thirds of the normal operating range (green arc). During extended let-downs, it may be necessary to completely close the cowl flaps by pushing the cowl flap lever down to the CLOSED position.

A winterization kit is available and consists of two baffles which attach to the air intakes in the cowling nose cap, a restrictive cover plate for the induction air inlet, a placard to be installed on the instrument panel, and insulation for the crankcase breather line. This equipment should be installed for operations in temperatures consistently below -7°C (20°F). Once installed, the crankcase breather insulation is approved for permanent use in both hot and cold weather.

PROPELLER

The airplane has an all-metal, two-bladed, constant-speed, governor-regulated propeller. A setting introduced into the governor with the propeller control establishes the propeller speed, and thus the engine speed to be maintained. The governor then controls flow of engine oil, boosted to high pressure by the governing pump, to or from a piston in the propeller hub. Oil pressure acting on the piston twists the blades toward high pitch (low RPM). When oil pressure to the piston in the propeller hub is relieved, centrifugal force, assisted by an internal spring, twists the blades toward low pitch (high RPM).

A control knob on the lower center portion of the instrument panel is used to set the propeller and control engine RPM as desired for various flight conditions. The knob is labeled PROP PITCH, PUSH INCR RPM. When the control knob is pushed in, blade pitch will decrease, giving a higher RPM. When the control knob is pulled out, the blade pitch increases, thereby decreasing RPM. The propeller control knob is equipped with a vernier feature which allows slow or fine RPM adjustments by rotating the knob clockwise to increase RPM, and counterclockwise to decrease it. To make rapid or large adjustments, depress the button on the end of the control knob and reposition the control as desired.

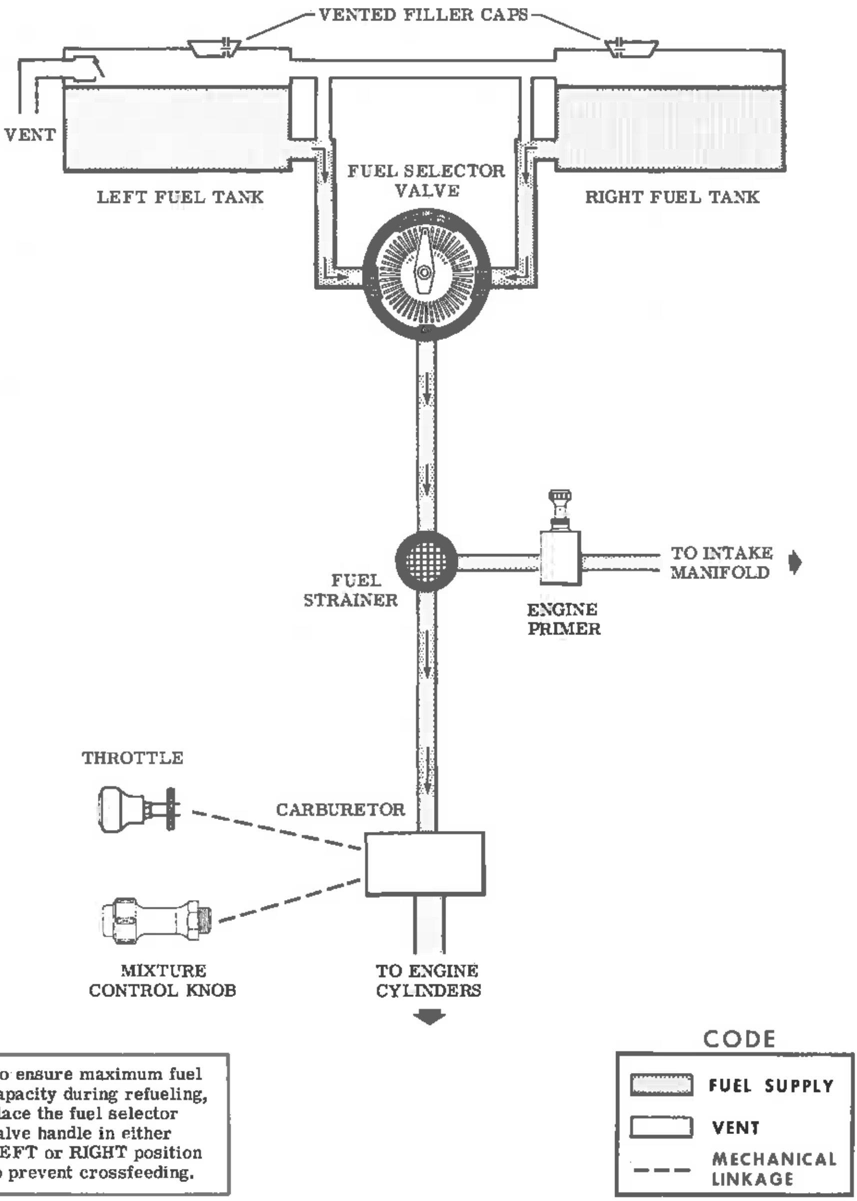
FUEL SYSTEM

The airplane may be equipped with either a standard fuel system or a long range system (see figure 7-6). Both systems consist of two vented fuel tanks (one in each wing), a four-position selector valve, fuel strainer, manual primer, and carburetor. Refer to figure 7-5 for fuel quantity data for both systems.

Fuel flows by gravity from the two wing tanks to a four-position selector valve, labeled BOTH, RIGHT, LEFT, and OFF. With the selector valve in either the BOTH, LEFT, or RIGHT position, fuel flows through a strainer to the carburetor. From the carburetor, mixed fuel and air flows to the cylinders through intake manifold tubes. The manual primer draws its fuel from the fuel strainer and injects it into the intake manifold.

FUEL QUANTITY DATA (U. S. GALLONS)			
TANKS	TOTAL USABLE FUEL ALL FLIGHT CONDITIONS	TOTAL UNUSABLE FUEL	TOTAL FUEL VOLUME
STANDARD (30.5 Gal. Each)	56	5	61
LONG RANGE (40 Gal. Each)	75	5	80

Figure 7-5. Fuel Quantity Data



To ensure maximum fuel capacity during refueling, place the fuel selector valve handle in either LEFT or RIGHT position to prevent crossfeeding.

Figure 7-6. Fuel System (Standard and Long Range)

Fuel system venting is essential to system operation. Complete blockage of the venting system will result in collapsing of the bladder cells, a decreasing fuel flow and eventual engine stoppage. Venting of the right tank is accomplished by an interconnecting line from the left tank. The left fuel tank is vented overboard through a vent line which is equipped with a check valve, and protrudes from the bottom surface of the left wing near the wing strut attach point. The fuel filler caps are equipped with vacuum operated vents which open, allowing air into the tanks, should the fuel tank vent line become blocked.

Fuel quantity is measured by two float-type fuel quantity transmitters (one in each tank) and indicated by two electrically-operated fuel quantity indicators on the right side of the instrument panel. An empty tank is indicated by a red line and the letter E. When an indicator shows an empty tank, approximately 2.5 gallons remain in a standard tank, or 3 gallons remain in a long range tank as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips, or unusual attitudes. If both indicator pointers should rapidly move to a zero reading, check the cylinder head temperature and oil temperature gages for operation. If these gages are not indicating, an electrical malfunction has occurred.

The fuel selector valve should be in the BOTH position for takeoff, climb, landing, and maneuvers that involve prolonged slips or skids. Operation from either LEFT or RIGHT tank is reserved for cruising flight.

NOTE

When the fuel selector valve handle is in the BOTH position in cruising flight, unequal fuel flow from each tank may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the tank in the "heavy" wing.

NOTE

It is not practical to measure the time required to consume all of the fuel in one tank, and, after switching to the opposite tank, expect an equal duration from the remaining fuel. The airspace in both fuel tanks is interconnected by a vent line and, therefore, some sloshing of fuel between tanks can be expected when the tanks are nearly full and the wings are not level.

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. The system should be examined before the first flight of every day and after each refueling, by using the sampler cup provided to drain fuel from the wing tank sumps, and by utilizing the fuel strainer drain under an access panel on the left side of the engine cowling. The fuel tanks should be filled after each flight to prevent condensation.

BRAKE SYSTEM

The airplane has a single-disc, hydraulically-actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (copilot's) set of rudder pedals, which are interconnected. When the airplane is parked, both main wheel brakes may be set by utilizing the parking brake which is operated by a handle under the left side of the instrument panel. To apply the parking brake, set the brakes with the rudder pedals, pull the handle aft, and rotate it 90° down.

For maximum brake life, keep the brake system properly maintained, and minimize brake usage during taxi operations and landings.

Some of the symptoms of impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If, during taxi or landing roll, braking action decreases, let up on the pedals and then re-apply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder, as required, to offset the good brake.

ELECTRICAL SYSTEM

Electrical energy (see figure 7-7) is supplied by a 14-volt, direct-current system powered by an engine-driven, 60-amp alternator. The 12-volt, 33-amp hour battery is located in the tailcone aft of the baggage compartment wall. Power is supplied to all electrical circuits through a split bus bar, one side containing electronic system circuits and the other side having general electrical system circuits. Both sides of the bus are on at all times except when either an external power source is connected or the starter switch is turned on; then a power contactor is automatically activated to open the circuit to the electronic bus. Isolating the electronic circuits in this manner prevents harmful transient voltages from damaging the transistors in the electronic equipment.

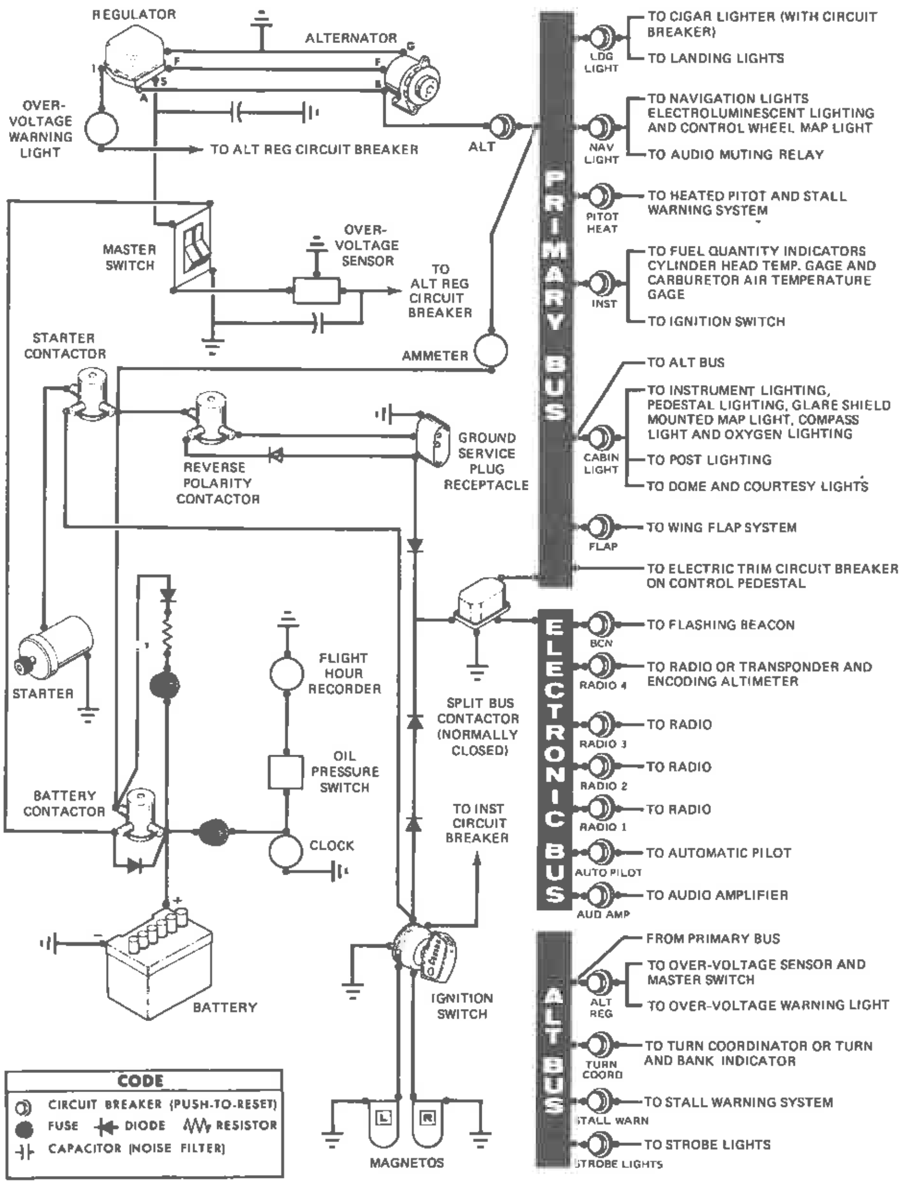


Figure 7-7. Electrical System

MASTER SWITCH

The master switch is a split-rocker type switch labeled MASTER, and is ON in the up position and OFF in the down position. The right half of the switch, labeled BAT, controls all electrical power to the airplane. The left half, labeled ALT, controls the alternator.

Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned ON separately to check equipment while on the ground. The ALT side of the switch, when placed in the OFF position, removes the alternator from the electrical system. With this switch in the OFF position, the entire electrical load is placed on the battery. Continued operation with the alternator switch in the OFF position will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

AMMETER

The ammeter indicates the flow of current, in amperes, from the alternator to the battery or from the battery to the airplane electrical system. When the engine is operating and the master switch is turned on, the ammeter indicates the charging rate applied to the battery. In the event the alternator is not functioning or the electrical load exceeds the output of the alternator, the ammeter indicates the battery discharge rate.

OVER-VOLTAGE SENSOR AND WARNING LIGHT

The airplane is equipped with an automatic over-voltage protection system consisting of an over-voltage sensor behind the instrument panel and a red warning light, labeled HIGH VOLTAGE, near the manifold pressure gage.

In the event an over-voltage condition occurs, the over-voltage sensor automatically removes alternator field current and shuts down the alternator. The warning light will then turn on, indicating to the pilot that the alternator is not operating and the battery is supplying all electrical power.

The over-voltage sensor may be reset by turning the master switch off and back on again. If the warning light does not illuminate, normal alternator charging has resumed; however, if the light does illuminate again, a malfunction has occurred, and the flight should be terminated as soon as practical.

The warning light may be tested by momentarily turning off the ALT portion of the master switch and leaving the BAT portion turned on.

CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" circuit breakers mounted on the left side of the instrument panel. Exceptions to this are the battery contactor closing (external power) circuit, clock, and flight hour recorder circuits which have fuses mounted near the battery. The control wheel map light is protected by the NAV LIGHT circuit breaker on the instrument panel, and a fuse behind the panel. The cigar lighter is equipped with a manually reset circuit breaker, on the back of the lighter, and is also protected by the LDG LIGHTS circuit breaker.

GROUND SERVICE PLUG RECEPTACLE

A ground service plug receptacle may be installed to permit the use of an external power source for cold weather starting and during lengthy maintenance work on the airplane electrical system (with the exception of electronic equipment). The receptacle is located behind a door on the left side of the fuselage near the aft edge of the cowling.

NOTE

Electrical power for the airplane electrical circuits is provided through a split bus bar having all electronic circuits on one side of the bus and other electrical circuits on the other side of the bus. When an external power source is connected, a contactor automatically opens the circuit to the electronic portion of the split bus bar as a protection against damage to the transistors in the electronic equipment by transient voltages from the power source. Therefore, the external power source can not be used as a source of power when checking electronic components.

Just before connecting an external power source (generator type or battery cart), the master switch should be turned on.

The ground service plug receptacle circuit incorporates a polarity reversal protection. Power from the external power source will flow only if the ground service plug is correctly connected to the airplane. If the plug is accidentally connected backwards, no power will flow to the electrical system, thereby preventing any damage to electrical equipment.

The battery and external power circuits have been designed to completely eliminate the need to "jumper" across the battery contactor to close it for charging a completely "dead" battery. A special fused circuit in the external power system supplies the needed "jumper" across the contacts so that with a "dead" battery and an external power source applied, turning on the master switch will close the battery contactor.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and tail stinger, and dual landing lights are installed in the cowl nose cap. Additional lighting is available and includes a strobe light on each wing tip, a flashing beacon on top of the vertical stabilizer, and two courtesy lights, one under each wing, just outboard of the cabin door. The courtesy lights are operated by a switch located on the left rear door post. All exterior lights, except the courtesy lights, are controlled by rocker type switches on the left switch and control panel. The switches are ON in the up position and OFF in the down position.

The flashing beacon should not be used when flying through clouds or overcast; the flashing light reflected from water droplets or particles in the atmosphere, particularly at night, can produce vertigo and loss of orientation.

The two high intensity strobe lights will enhance anti-collision protection. However, the lights should be turned off when taxiing in the vicinity of other aircraft, or during night flight through clouds, fog or haze.

INTERIOR LIGHTING

Instrument and control panel lighting is provided by flood, electroluminescent, and integral lighting, with post lighting also available. All light intensity is controlled by one dual rheostat, with concentric control knobs, and one single rheostat, labeled LWR PANEL, ENG-RADIO, and INSTRUMENTS respectively. Both the dual and single rheostat controls rotate clockwise from dim to bright, and are located on the left switch and control panel. If post lighting is installed, a rocker-type selector switch next to the INSTRUMENTS rheostat control is used to select either post lighting or flood lighting. The switch is labeled LIGHTS, POST, FLOOD.

The marker beacon control panel, and switches and controls on the lower part of the instrument panel are lighted by electroluminescent panels which do not require light bulbs for illumination. To utilize this lighting, turn on the NAV LIGHT switch and adjust light intensity with the small (inner) control knob of the concentric control knobs labeled LWR PANEL, ENG-RADIO. Electroluminescent lighting is not affected by the selection of post or flood lighting.

Instrument panel flood lighting consists of four red flood lights on the underside of the anti-glare shield, and two red flood lights in the forward part of the overhead console. To use flood lighting, place the POST-FLOOD selector switch (if installed) in the FLOOD position and adjust light intensity with the INSTRUMENTS rheostat control knob.

The instrument panel may be equipped with post lights which are mounted at the edge of each instrument or control and provide direct lighting. The lights are operated by placing the POST-FLOOD selector switch in the POST position and adjusting light intensity with the INSTRUMENTS rheostat control knob. Switching to post lights will automatically turn off flood lighting.

The engine instrument cluster, radio equipment, and magnetic compass have integral lighting and operate independently of post or flood lighting. The light intensity of instrument cluster and radio equipment lighting is controlled by the large (outer) control knob of the concentric control knobs labeled LWR PANEL, ENG-RADIO. Magnetic compass lighting intensity is controlled by the INSTRUMENTS rheostat control knob.

The airplane is equipped with a dome light aft of the overhead console. The light is operated by a slide-type switch, aft of the light lens, which turns the light on when moved to the right.

The control pedestal has two integral lights and, if the airplane is equipped with oxygen, the overhead console is illuminated by post lights. Pedestal and console light intensity is controlled by the large (outer) control knob of the concentric control knobs labeled LWR PANEL, ENG-RADIO.

Map lighting is provided by overhead console map lights and an anti-glare shield mounted map light. The airplane may also be equipped with a control wheel map light. The overhead console map lights operate in conjunction with instrument panel flood lighting and consist of two openings just aft of the red instrument panel flood lights. The map light openings have sliding covers controlled by small round knobs which uncover the openings when moved toward each other. The covers should be kept closed unless the map lights are required. A map light and toggle switch, mounted in front of the pilot on the underside of the anti-glare shield, is used for illuminating approach plates or other charts when using a control wheel mounted approach plate holder. The switch is labeled MAP LIGHT, ON, OFF and light intensity is controlled by the INSTRUMENTS control knob. A map light mounted on the bottom of the pilot's control wheel (if installed) illuminates the lower portion of the cabin in front of the pilot, and is used for checking maps and other flight data during night operation. The light is utilized by turning on the NAV LIGHT switch, and adjusting light intensity with the rheostat control knob on the bottom of the control wheel.

The most probable cause of a light failure is a burned out bulb; however, in the event any of the lighting systems fail to illuminate when turned on, check the appropriate circuit breaker. If the circuit breaker has opened (white button popped out), and there is no obvious indication of a short circuit (smoke or odor), turn off the light switch of the affected lights, reset the breaker, and turn the switch on again. If the breaker opens again, do not reset it.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow into the cabin can be regulated to any degree desired by manipulation of the push-pull CABIN HEAT and CABIN AIR control knobs (see figure 7-8). Both control knobs are the double button type with locks to permit intermediate settings.

NOTE

For improved partial heating on mild days, pull out the CABIN AIR knob slightly when the CABIN HEAT knob is out. This action increases the airflow through the system, increasing efficiency, and blends cool outside air with the exhaust manifold heated air, thus eliminating the possibility of overheating the system ducting.

Front cabin heat and ventilating air is supplied by outlet holes spaced across a cabin manifold just forward of the pilot's and copilot's feet. Rear cabin heat and air is supplied by two ducts from the manifold, one extending down each side of the cabin to an outlet at the front door post at floor level. Windshield defrost air is also supplied by a duct leading from the cabin manifold to an outlet on top of the anti-glare shield. Defrost air flow is controlled by a rotary type knob labeled DEFROST.

For cabin ventilation, pull the CABIN AIR knob out, with the CABIN HEAT knob pushed full in. To raise the air temperature, pull the CABIN HEAT knob out until the desired temperature is attained. Additional heat is available by pulling the knob out farther; maximum heat is available with the CABIN HEAT knob pulled out and the CABIN AIR knob pushed full in.

Separate adjustable ventilators supply additional ventilation air to the

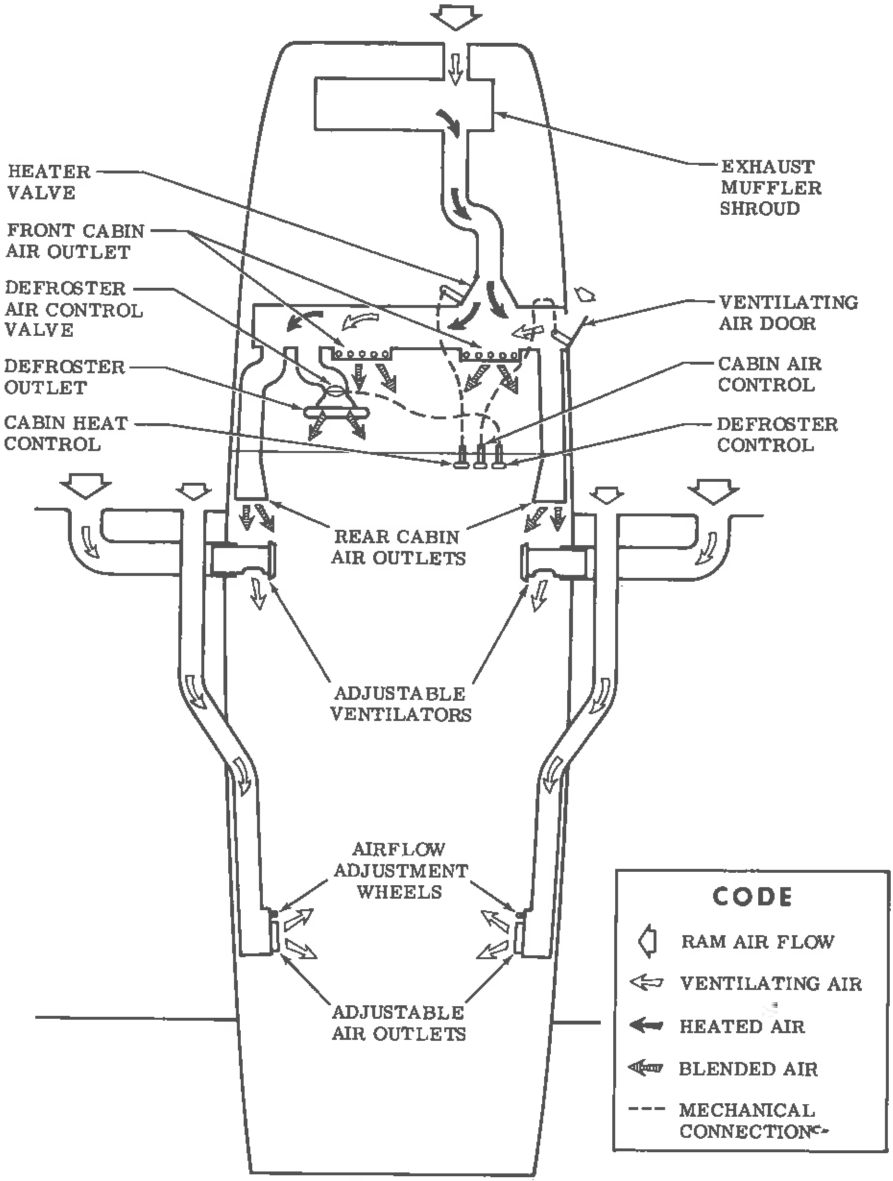


Figure 7-8. Cabin Heating, Ventilating, and Defrosting System

cabin. One near each upper corner of the windshield supplies air for the pilot and copilot, and two ventilators are available for the rear cabin area to supply air to the rear seat passengers. Each rear ventilator outlet can be adjusted in any desired direction by moving the entire outlet to direct the airflow up or down, and by moving a tab protruding from the center of the outlet left or right to obtain left or right airflow. Ventilation airflow may be closed off completely, or partially closed according to the amount of airflow desired, by rotating an adjustment wheel adjacent to the outlet.

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, rate-of-climb indicator and altimeter. The system is composed of either an unheated or heated pitot tube mounted on the lower surface of the left wing, two external static ports on the lower left and right sides of the forward fuselage, and the associated plumbing necessary to connect the instruments to the sources.

The heated pitot system consists of a heating element in the pitot tube, a rocker-type switch labeled PITOT HEAT, a 15-amp circuit breaker on the switch and control panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required.

A static pressure alternate source valve may be installed adjacent to the parking brake for use when the external static source is malfunctioning. This valve supplies static pressure from inside the cabin instead of the external static ports.

If erroneous instrument readings are suspected due to water or ice in the pressure line going to the standard external static pressure source, the alternate static source valve should be pulled on.

Pressures within the cabin will vary with open cabin ventilators and windows. Refer to Sections 3 and 5 for the effect of varying cabin pressures on airspeed and altimeter readings.

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings include the white arc (45 to 95 knots), green arc (48 to 143 knots), yellow arc (143 to 179 knots), and a red line (179 knots).

If a true airspeed indicator is installed, it is equipped with a rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer. To operate the indicator, first rotate the ring until pressure altitude is aligned with outside air temperature in degrees Fahrenheit. Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, momentarily set the barometric scale on the altimeter to 29.92 and read pressure altitude on the altimeter. Be sure to return the altimeter barometric scale to the original barometric setting after pressure altitude has been obtained. Having set the ring to correct for altitude and temperature, then read the airspeed shown on the rotatable ring by the indicator pointer. For best accuracy, this indication should be corrected to calibrated airspeed by referring to the Airspeed Calibration chart in Section 5. Knowing the calibrated airspeed, read true airspeed on the ring opposite the calibrated airspeed.

RATE-OF-CLIMB INDICATOR

The rate-of-climb indicator depicts airplane rate of climb or descent in feet per minute. The pointer is actuated by atmospheric pressure changes resulting from changes of altitude as supplied by the static source.

ALTIMETER

Airplane altitude is depicted by a barometric type altimeter. A knob near the lower left portion of the indicator provides adjustment of the instrument's barometric scale to the current altimeter setting.

VACUUM SYSTEM AND INSTRUMENTS

An engine-driven vacuum system (see figure 7-9) provides the suction necessary to operate the attitude indicator and directional indicator. The system consists of a vacuum pump mounted on the engine, a vacuum relief valve and vacuum system air filter on the aft side of the firewall below the instrument panel, and instruments (including a suction gage) on the left side of the instrument panel.

ATTITUDE INDICATOR

The attitude indicator gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which has index marks at 10°, 20°, 30°, 60°, and 90° either side of the center mark. Pitch and roll attitudes are presented by a miniature airplane in relation to the horizon bar. A knob at the bottom of the instrument is provided for in-flight adjustment of the miniature airplane to the horizon bar for a more accurate flight attitude indication.

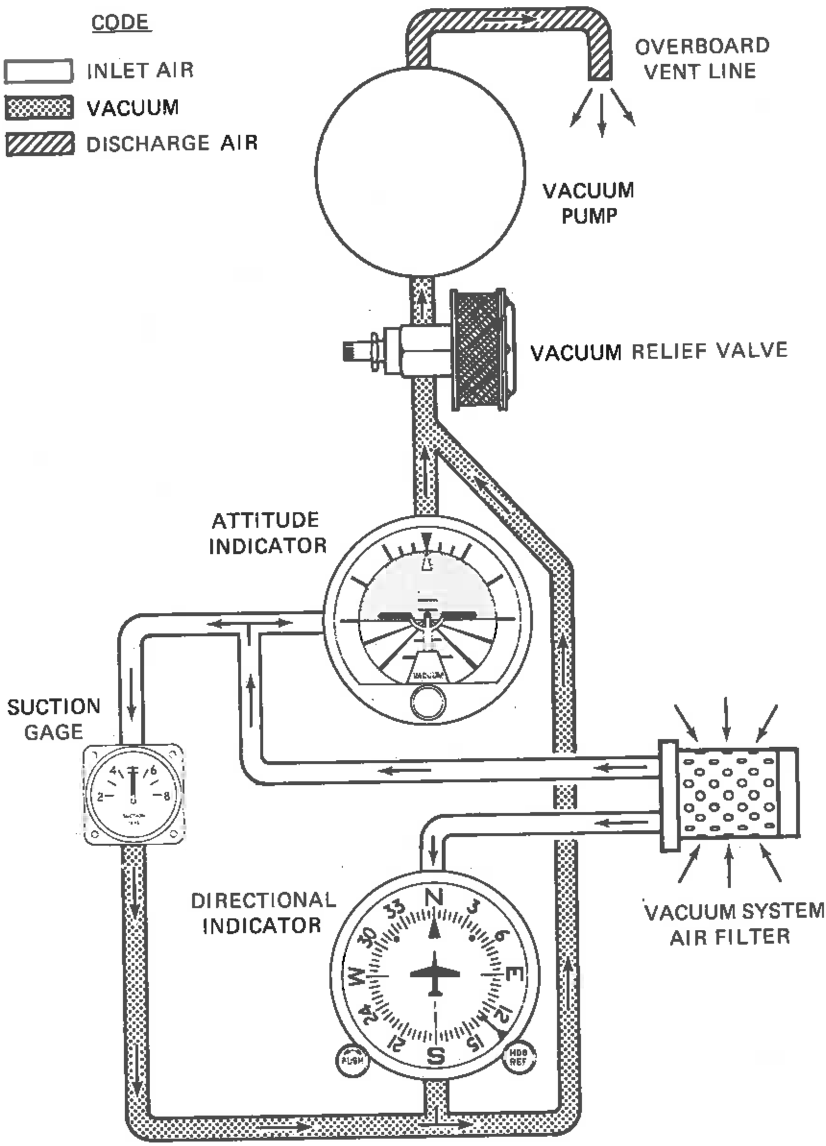


Figure 7-9. Vacuum System

DIRECTIONAL INDICATOR

A directional indicator displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator will precess slightly over a period of time. Therefore, the compass card should be set in accordance with the magnetic compass just prior to takeoff, and occasionally re-adjusted on extended flights. A knob on the lower left edge of the instrument is used to adjust the compass card to correct for any precession.

SUCTION GAGE

The suction gage is located on the left side of the instrument panel and indicates, in inches of mercury, the amount of suction available for operation of the attitude indicator and directional indicator. The desired suction range is 4.6 to 5.4 inches of mercury. A suction reading below this range may indicate a system malfunction or improper adjustment, and in this case, the indicators should not be considered reliable.

STALL WARNING SYSTEM

The airplane is equipped with a vane-type stall warning unit, in the leading edge of the left wing, which is electrically connected to a stall warning horn under the map compartment. A 5-amp circuit breaker protects the stall warning system. The vane in the wing senses the change in airflow over the wing, and operates the warning horn at airspeeds between 5 and 10 knots above the stall in all configurations.

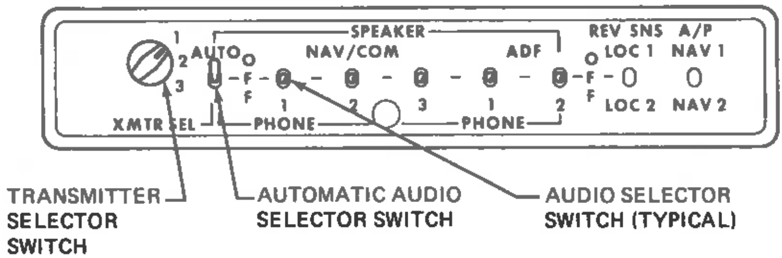
If the airplane has a heated stall warning system, the vane and sensor unit in the wing leading edge is equipped with a heating element. The heated part of the system is operated by the PITOT HEAT switch, and is protected by the PITOT HEAT circuit breaker.

The stall warning system should be checked during the pre-flight inspection by momentarily turning on the master switch and actuating the vane in the wing. The system is operational if the warning horn sounds as the vane is pushed upward.

AVIONICS SUPPORT EQUIPMENT

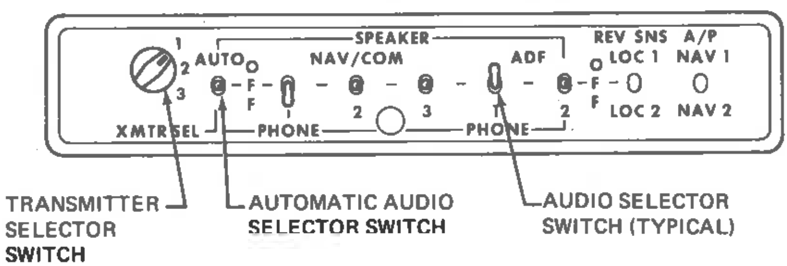
The airplane may, at the owner's discretion, be equipped with various types of avionics support equipment such as an audio control panel, microphone-headset, and static dischargers. The following paragraphs discuss these items.

AUTOMATIC AUDIO SELECTION



As illustrated, the number 1 transmitter is selected, the AUTO selector switch is in the SPEAKER position, and the NAV/COM 1, 2 and 3 and ADF 1 and 2 audio selector switches are in the OFF position. With the switches set as shown, the pilot will transmit on the number 1 transmitter and hear the number 1 NAV/COM receiver through the airplane speaker.

INDIVIDUAL AUDIO SELECTION



As illustrated, the number 1 transmitter is selected, the AUTO selector switch is in the OFF position, the number 1 NAV/COM receiver is in the PHONE position, and the number 1 ADF is in the SPEAKER position. With the switches set as shown, the pilot will transmit on the number 1 transmitter and hear the number 1 NAV/COM receiver on a headset; while the passengers are listening to the ADF audio through the airplane speaker. If another audio selector switch is placed in either the PHONE or SPEAKER position, it will be heard simultaneously with either the number 1 NAV/COM or number 1 ADF respectively.

Figure 7-10. Audio Control Panel

AUDIO CONTROL PANEL

Operation of radio equipment is covered in Section 9 of this handbook. When one or more radios are installed, a transmitter/audio switching system is provided (see figure 7-10). The operation of this switching system is described in the following paragraphs.

TRANSMITTER SELECTOR SWITCH

A rotary type transmitter selector switch, labeled XMTR SEL, is provided to connect the microphone to the transmitter the pilot desires to use. To select a transmitter, rotate the switch to the number corresponding to that transmitter. The numbers 1, 2 and 3 on the right side of the switch correspond to the top, second and third transceivers in the avionics stack.

An audio amplifier is required for speaker operation, and is automatically selected, along with the transmitter, by the transmitter selector switch. As an example, if the number 1 transmitter is selected, the audio amplifier in the associated NAV/COM receiver is also selected, and functions as the amplifier for ALL speaker audio. In the event the audio amplifier in use fails, as evidenced by loss of all speaker audio, select another transmitter. This should re-establish speaker audio. Headset audio is not affected by audio amplifier operation.

AUTOMATIC AUDIO SELECTOR SWITCH

A toggle switch, labeled AUTO, can be used to automatically match the appropriate NAV/COM receiver audio to the transmitter being selected. To utilize this automatic feature, leave all NAV/COM receiver switches in the OFF (center) position, and place the AUTO selector switch in either the SPEAKER or PHONE position, as desired. Once the AUTO selector switch is positioned, the pilot may then select any transmitter and its associated NAV/COM receiver audio simultaneously with the transmitter selector switch. If automatic audio selection is not desired, the AUTO selector switch should be placed in the OFF (center) position.

NOTE

Using Cessna 300 Series Radios, sidetone (monitoring of the operator's own audio transmission) can be heard in the headset by placing the AUTO selector switch in the PHONE position. No sidetone will be heard with the AUTO selector switch in either the SPEAKER (speaker operation) or OFF (center) position.

AUDIO SELECTOR SWITCHES

The audio selector switches, labeled NAV/COM 1, 2 and 3 and ADF 1 and 2, allow the pilot to initially pre-tune all NAV/COM and ADF receivers, and then individually select and listen to any receiver or combination of receivers. To listen to a specific receiver, first check that the AUTO selector switch is in the OFF (center) position, then place the audio selector switch corresponding to that receiver in either the SPEAKER (up) or PHONE (down) position. To turn off the audio of the selected receiver, place that switch in the OFF (center) position. If desired, the audio selector switches can be positioned to permit the pilot to listen to one receiver on a headset while the passengers listen to another receiver on the airplane speaker.

The ADF 1 and 2 switches may be used anytime ADF audio is desired. If the pilot wants only ADF audio, for station identification or other reasons, the AUTO selector switch (if in use) and all other audio selector switches should be in the OFF position. If simultaneous ADF and NAV/COM audio is acceptable to the pilot, no change in the existing switch positions is required. Place the ADF 1 or 2 switch in either the SPEAKER or PHONE position and adjust radio volume as desired.

NOTE

If the NAV/COM audio selector switch corresponding to the selected transmitter is in the PHONE position with the AUTO selector switch in the SPEAKER position, all audio selector switches placed in the PHONE position will automatically be connected to both the airplane speaker and any headsets in use.

MICROPHONE-HEADSET

The microphone-headset combination consists of the microphone and headset combined in a single unit and a microphone keying switch located on the left side of the pilot's control wheel. The microphone-headset permits the pilot to conduct radio communications without interrupting other control operations to handle a hand-held microphone. Also, passengers need not listen to all communications. The microphone and headset jacks are located near the lower left corner of the instrument panel.

STATIC DISCHARGERS

If frequent IFR flights are planned, installation of wick-type static dischargers is recommended to improve radio communications during flight through dust or various forms of precipitation (rain, snow or ice crystals). Under these conditions, the build-up and discharge of static electricity from the trailing edges of the wings, rudder, elevator, propeller tips and radio antennas can result in loss of usable radio signals on all communications and navigation radio equipment. Usually the ADF is first to be affected and VHF communication equipment is the last to be affected.

Installation of static dischargers reduces interference from precipitation static, but it is possible to encounter severe precipitation static conditions which might cause the loss of radio signals, even with static dischargers installed. Whenever possible, avoid known severe precipitation areas to prevent loss of dependable radio signals. If avoidance is impractical, minimize airspeed and anticipate temporary loss of radio signals while in these areas.

SECTION 8
AIRPLANE HANDLING, SERVICE & MAINTENANCE

TABLE OF CONTENTS

INTRODUCTION

This section contains factory-recommended procedures for proper ground handling and routine care and servicing of your Cessna. It also identifies certain inspection and maintenance requirements which must be followed if your airplane is to retain that new-plane performance and dependability. It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered in your locality.

Keep in touch with your Cessna Dealer and take advantage of his knowledge and experience. He knows your airplane and how to maintain it. He will remind you when lubrications and oil changes are necessary, and about other seasonal and periodic services.

IDENTIFICATION PLATE

All correspondence regarding your airplane should include the SERIAL NUMBER. The Serial Number, Model Number, Production Certificate Number (PC) and Type Certificate Number (TC) can be found on the Identification Plate, located on the left forward doorpost. Located adjacent to the Identification Plate is a Finish and Trim Plate which contains a code describing the interior color scheme and exterior paint combination of the airplane. The code may be used in conjunction with an applicable Parts Catalog if finish and trim information is needed.

OWNER FOLLOW-UP SYSTEM

Your Cessna Dealer has an Owner Follow-Up System to notify you when he receives information that applies to your Cessna. In addition, if you wish, you may choose to receive similar notification, in the form of Service Letters, directly from the Cessna Customer Services Department. A subscription form is supplied in your Customer Care Program book for your use, should you choose to request this service. Your Cessna Dealer will be glad to supply you with details concerning these follow-up programs, and stands ready, through his Service Department, to supply you with fast, efficient, low-cost service.

PUBLICATIONS

Various publications and flight operation aids are furnished in the airplane when delivered from the factory. These items are listed below.

- CUSTOMER CARE PROGRAM BOOK
- PILOT'S OPERATING HANDBOOK/SUPPLEMENTS FOR YOUR
  - AIRPLANE
  - AVIONICS AND AUTOPILOT
- PILOT'S CHECKLISTS
- POWER COMPUTER
- SALES AND SERVICE DEALER DIRECTORY
- DO'S AND DON'TS ENGINE BOOKLET

The following additional publications, plus many other supplies that are applicable to your airplane, are available from your Cessna Dealer.

- SERVICE MANUALS AND PARTS CATALOGS FOR YOUR
  - AIRPLANE
  - ENGINE AND ACCESSORIES
  - AVIONICS AND AUTOPILOT

Your Cessna Dealer has a Customer Care Supplies Catalog covering all available items, many of which he keeps on hand. He will be happy to place an order for any item which is not in stock.

AIRPLANE FILE

There are miscellaneous data, information and licenses that are a part of the airplane file. The following is a checklist for that file. In addition, a periodic check should be made of the latest Federal Aviation Regulations to ensure that all data requirements are met.

A. To be displayed in the airplane at all times:

(1) Aircraft Airworthiness Certificate (FAA Form 8100-2).
(2) Aircraft Registration Certificate (FAA Form 8050-3).
(3) Aircraft Radio Station License, if transmitter installed (FCC Form 556).

B. To be carried in the airplane at all times:

(1) Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
(2) Equipment List.

C. To be made available upon request:

(1) Airplane Log Book.
(2) Engine Log Book.

Most of the items listed are required by the United States Federal Aviation Regulations. Since the Regulations of other nations may require other documents and data, owners of airplanes not registered in the United States should check with their own aviation officials to determine their individual requirements.

Cessna recommends that these items, plus the Pilot's Operating Handbook, Pilot's Checklists, Power Computer, Customer Care Program book and Customer Care Card, be carried in the airplane at all times.

AIRPLANE INSPECTION PERIODS

FAA REQUIRED INSPECTIONS

As required by Federal Aviation Regulations, all civil aircraft of U.S. registry must undergo a complete inspection (annual) each twelve calendar months. In addition to the required ANNUAL inspection, aircraft operated commercially (for hire) must have a complete inspection every 100 hours of operation.

The FAA may require other inspections by the issuance of airworthiness directives applicable to the airplane, engine, propeller and components. It is the responsibility of the owner/operator to ensure compliance with all applicable airworthiness directives and, when the inspections are repetitive, to take appropriate steps to prevent inadvertent noncompliance.

In lieu of the 100 HOUR and ANNUAL inspection requirements, an airplane may be inspected in accordance with a progressive inspection schedule, which allows the work load to be divided into smaller operations that can be accomplished in shorter time periods.

The CESSNA PROGRESSIVE CARE PROGRAM has been developed to provide a modern progressive inspection schedule that satisfies the complete airplane inspection requirements of both the 100 HOUR and ANNUAL inspections as applicable to Cessna airplanes. The program assists the owner in his responsibility to comply with all FAA inspection requirements, while ensuring timely replacement of life-limited parts and adherence to factory-recommended inspection intervals and maintenance procedures.

CESSNA PROGRESSIVE CARE

The Cessna Progressive Care Program has been designed to help you realize maximum utilization of your airplane at a minimum cost and downtime. Under this program, your airplane is inspected and maintained in four operations at 50-hour intervals during a 200-hour period. The operations are recycled each 200 hours and are recorded in a specially provided Aircraft Inspection Log as each operation is conducted.

The Cessna Aircraft Company recommends Progressive Care for airplanes that are being flown 200 hours or more per year, and the 100-hour inspection for all other airplanes. The procedures for the Progressive Care Program and the 100-hour inspection have been carefully worked out by the factory and are followed by the Cessna Dealer Organization. The complete familiarity of Cessna Dealers with Cessna equipment and factory-approved procedures provides the highest level of service possible at lower cost to Cessna owners.

Regardless of the inspection method selected by the owner, he should keep in mind that FAR Part 43 and FAR Part 91 establishes the requirement that properly certified agencies or personnel accomplish all required FAA inspections and most of the manufacturer recommended inspections.

CESSNA CUSTOMER CARE PROGRAM

Specific benefits and provisions of the CESSNA WARRANTY plus other important benefits for you are contained in your CUSTOMER CARE PROGRAM book supplied with your airplane. You will want to thoroughly review your Customer Care Program book and keep it in your airplane at all times.

Coupons attached to the Program book entitle you to an initial inspection and either a Progressive Care Operation No. 1 or the first 100-hour inspection within the first 6 months of ownership at no charge to you. If you take delivery from your Dealer, the initial inspection will have been performed before delivery of the airplane to you. If you pick up your airplane at the factory, plan to take it to your Dealer reasonably soon after you take delivery, so the initial inspection may be performed allowing the Dealer to make any minor adjustments which may be necessary.

You will also want to return to your Dealer either at 50 hours for your first Progressive Care Operation, or at 100 hours for your first 100-hour inspection depending on which program you choose to establish for your airplane. While these important inspections will be performed for you by any Cessna Dealer, in most cases you will prefer to have the Dealer from whom you purchased the airplane accomplish this work.

PILOT CONDUCTED PREVENTIVE MAINTENANCE

A certified pilot who owns or operates an airplane not used as an air carrier is authorized by FAR Part 43 to perform limited maintenance on his airplane. Refer to FAR Part 43 for a list of the specific maintenance operations which are allowed.

NOTE

Pilots operating airplanes of other than U. S. registry should refer to the regulations of the country of certification for information on preventive maintenance that may be performed by pilots.

A Service Manual should be obtained prior to performing any preventive maintenance to ensure that proper procedures are followed. Your Cessna Dealer should be contacted for further information or for required maintenance which must be accomplished by appropriately licensed personnel.

ALTERATIONS OR REPAIRS

It is essential that the FAA be contacted prior to any alterations on the airplane to ensure that airworthiness of the airplane is not violated. Alterations or repairs to the airplane must be accomplished by licensed personnel.

GROUND HANDLING

TOWING

The airplane is most easily and safely maneuvered by hand with the tow-bar attached to the nose wheel. When towing with a vehicle, do not exceed the nose gear turning angle of 29° either side of center, or damage to the gear will result. If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose strut does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose tire or deflated strut will also increase tail height.

PARKING

When parking the airplane, head into the wind and set the parking brakes. Do not set the parking brakes during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated.

Close the cowl flaps, install the control wheel lock and chock the wheels. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

TIE-DOWN

Proper tie-down procedure is the best precaution against damage to the parked airplane by gusty or strong winds. To tie-down the airplane securely, proceed as follows.

(1) Set the parking brake and install the control wheel lock.
(2) Install a surface control lock over the fin and rudder.
(3) Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing and tail tie-down fittings and secure each rope to a ramp tie-down.
(4) Tie a rope (no chains or cables) to the nose gear torque link and secure to a ramp tie-down.
(5) Install a pitot tube cover.

JACKING

When a requirement exists to jack the entire airplane off the ground, or when wing jack points are used in the jacking operation, refer to the Service Manual for specific procedures and equipment required.

Individual main gear may be jacked by using the jack pad which is incorporated in the main landing gear strut step assembly. When using the individual gear strut jack pad, flexibility of the gear strut will cause the main wheel to slide inboard as the wheel is raised, tilting the jack. The jack must then be lowered for a second jacking operation. Do not jack both main wheels simultaneously using the individual main gear jack pads.

If nose gear maintenance is required, the nose wheel may be raised off the ground by pressing down on a tailcone bulkhead, just forward of the horizontal stabilizer, and allowing the tail to rest on the tail tie-down ring.

NOTE

Do not apply pressure on the elevator or outboard stabilizer surfaces. When pushing on the tailcone, always apply pressure at a bulkhead to avoid buckling the skin.

To assist in raising and holding the nose wheel off the ground, weight down the tail by placing sand-bags, or suitable weights, on each side of the horizontal stabilizer, next to the fuselage. If ground anchors are available, the tail should be securely tied down.

NOTE

Ensure that the nose will be held off the ground under all conditions by means of suitable stands or supports under weight supporting bulkheads near the nose of the airplane.

LEVELING

The reference point for leveling the airplane longitudinally is the top of the tailcone between the rear window and the vertical fin. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level. Corresponding points on both upper door sills may be used to level the airplane laterally.

FLYABLE STORAGE

Airplanes placed in non-operational storage for a maximum of 30 days or those which receive only intermittent operational use for the first 25 hours are considered in flyable storage status. Every seventh day during these periods, the propeller should be rotated by hand through five revolutions. This action "limbers" the oil and prevents any accumulation of corrosion on engine cylinder walls.

WARNING

For maximum safety, check that the ignition switch is OFF, the throttle is closed, the mixture control is in the idle cut-off position, and the airplane is secured before rotating the propeller by hand. Do not stand within the arc of the propeller blades while turning the propeller.

After 30 days, the airplane should be flown for 30 minutes or a ground runup should be made just long enough to produce an oil temperature within the lower green arc range. Excessive ground runup should be avoided.

Engine runup also helps to eliminate excessive accumulations of water in the fuel system and other air spaces in the engine. Keep fuel tanks full to minimize condensation in the tanks. Keep the battery fully charged to prevent the electrolyte from freezing in cold weather. If the airplane is to be stored temporarily, or indefinitely, refer to the Service Manual for proper storage procedures.

SERVICING

In addition to the PREFLIGHT INSPECTION covered in Section 4, COMPLETE servicing, inspection, and test requirements for your airplane are detailed in the Service Manual. The Service Manual outlines all items which require attention at 50, 100, and 200 hour intervals plus those items which require servicing, inspection, and/or testing at special intervals.

Since Cessna Dealers conduct all service, inspection, and test procedures in accordance with applicable Service Manuals, it is recommended that you contact your Cessna Dealer concerning these requirements and begin scheduling your airplane for service at the recommended intervals.

Cessna Progressive Care ensures that these requirements are accomplished at the required intervals to comply with the 100-hour or ANNUAL inspection as previously covered.

Depending on various flight operations, your local Government Aviation Agency may require additional service, inspections, or tests. For these regulatory requirements, owners should check with local aviation officials where the airplane is being operated.

For quick and ready reference, quantities, materials, and specifications for frequently used service items are as follows.

ENGINE OIL

GRADE -- Aviation Grade SAE 50 Above 4°C (40°F).
Aviation Grade SAE 10W30 or SAE 30 Below 4°C (40°F).
Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting in cold weather. Ashless dispersant oil, conforming to Continental Motors Specification MHS-24A, must be used.

NOTE

Your Cessna was delivered from the factory with a corrosion preventive aircraft engine oil. If oil must be added during the first 25 hours, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082.

CAPACITY OF ENGINE SUMP -- 12 Quarts.
Do not operate on less than 9 quarts. To minimize loss of oil through breather, fill to 10 quart level for normal flights of less than 3 hours. For extended flight, fill to 12 quarts. These quantities refer to oil

dipstick level readings. During oil and oil filter changes, one additional quart is required when the filter element is changed.

OIL AND OIL FILTER CHANGE --
After the first 25 hours of operation, drain engine oil sump and clean the oil pressure screen. If an oil filter is installed, change the filter element at this time. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to dispersant oil. On aircraft not equipped with an oil filter, drain the engine oil sump and clean the oil pressure screen each 50 hours thereafter. On aircraft which have an oil filter, the oil change interval may be extended to 100-hour intervals, providing the oil filter element is changed at 50-hour intervals. Change engine oil at least every 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

FUEL

APPROVED FUEL GRADES (AND COLORS) --
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).

CAPACITY EACH STANDARD TANK -- 30.5 Gallons.

CAPACITY EACH LONG RANGE TANK -- 40.0 Gallons.

NOTE

To ensure maximum fuel capacity during refueling, place the fuel selector valve handle in either LEFT or RIGHT position to prevent cross-feeding.

LANDING GEAR

NOSE WHEEL TIRE PRESSURE -- 49 PSI on 5.00-5, 6-Ply Rated Tire.

MAIN WHEEL TIRE PRESSURE -- 42 PSI on 6.00-6, 6-Ply Rated Tires.

NOSE GEAR SHOCK STRUT --
Keep filled with MIL-H-5606 hydraulic fluid and inflated with air to 55-60 PSI.

OXYGEN

AVIATOR'S BREATHING OXYGEN -- Spec No. MIL-O-27210.
MAXIMUM PRESSURE (cylinder temperature stabilized after filling) -- 1800 PSI at 21°C (70°F). Refer to Oxygen Supplement (Section 9) for filling pressures.

CLEANING AND CARE

WINDSHIELD-WINDOWS

The plastic windshield and windows should be cleaned with an aircraft windshield cleaner. Apply the cleaner sparingly with soft cloths, and rub with moderate pressure until all dirt, oil scum and bug stains are removed. Allow the cleaner to dry, then wipe it off with soft flannel cloths.

If a windshield cleaner is not available, the plastic can be cleaned with soft cloths moistened with Stoddard solvent to remove oil and grease.

NOTE

Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, fire extinguisher or anti-ice fluid, lacquer thinner or glass cleaner to clean the plastic. These materials will attack the plastic and may cause it to craze.

Follow by carefully washing with a mild detergent and plenty of water. Rinse thoroughly, then dry with a clean moist chamois. Do not rub the plastic with a dry cloth since this builds up an electrostatic charge which attracts dust. Waxing with a good commercial wax will finish the cleaning job. A thin, even coat of wax, polished out by hand with clean soft flannel cloths, will fill in minor scratches and help prevent further scratching.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated since the cover may scratch the plastic surface.

PAINTED SURFACES

The painted exterior surfaces of your new Cessna have a durable, long lasting finish and, under normal conditions, require no polishing or buffing. Approximately 15 days are required for the paint to cure completely; in most cases, the curing period will have been completed prior to delivery of the airplane. In the event that polishing or buffing is required within the curing period, it is recommended that the work be done by someone experienced in handling uncured paint. Any Cessna Dealer can accomplish this work.

Generally, the painted surfaces can be kept bright by washing with water and mild soap, followed by a rinse with water and drying with cloths or a chamois. Harsh or abrasive soaps or detergents which cause corrosion or scratches should never be used. Remove stubborn oil and grease with a cloth moistened with Stoddard solvent.

Waxing is unnecessary to keep the painted surfaces bright. However, if desired, the airplane may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings and tail and on the engine nose cap and propeller spinner will help reduce the abrasion encountered in these areas.

When the airplane is parked outside in cold climates and it is necessary to remove ice before flight, care should be taken to protect the painted surfaces during ice removal with chemical liquids. A 50-50 solution of isopropyl alcohol and water will satisfactorily remove ice accumulations without damaging the paint. A solution with more than 50% alcohol is harmful and should be avoided. While applying the de-icing solution, keep it away from the windshield and cabin windows since the alcohol will attack the plastic and may cause it to craze.

PROPELLER CARE

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to clean off grass and bug stains will assure long, trouble-free service. Small nicks on the propeller, particularly near the tips and on the leading edges, should be dressed out as soon as possible since these nicks produce stress concentrations, and if ignored, may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with carbon tetrachloride or Stoddard solvent.

ENGINE CARE

The engine may be cleaned with Stoddard solvent, or equivalent, then dried thoroughly.

CAUTION

> Particular care should be given to electrical equipment before cleaning. Cleaning fluids should not be allowed to enter magnetos, starter, alternator and the like. Protect these components before saturating the engine

with solvents. All other openings should also be covered before cleaning the engine assembly. Caustic cleaning solutions should be used cautiously and should always be properly neutralized after their use.

INTERIOR CARE

To remove dust and loose dirt from the upholstery and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

If your airplane is equipped with leather seating, cleaning of the seats is accomplished using a soft cloth or sponge dipped in mild soap suds. The soap suds, used sparingly, will remove traces of dirt and grease. The soap should be removed with a clean damp cloth.

The plastic trim, headliner, instrument panel and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with Stoddard solvent. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

SECTION 9
SUPPLEMENTS
(Optional Systems Description & Operating Procedures)

TABLE OF CONTENTS

INTRODUCTION

This section consists of a series of supplements, each covering a single optional system which may be installed in the airplane. Each supplement contains a brief description, and when applicable, operating limitations, emergency and normal procedures, and performance. Other routinely installed items of optional equipment, whose function and operational procedures do not require detailed instructions, are discussed in Section 7.

SUPPLEMENT

EMERGENCY LOCATOR TRANSMITTER (ELT)

SECTION 1

GENERAL

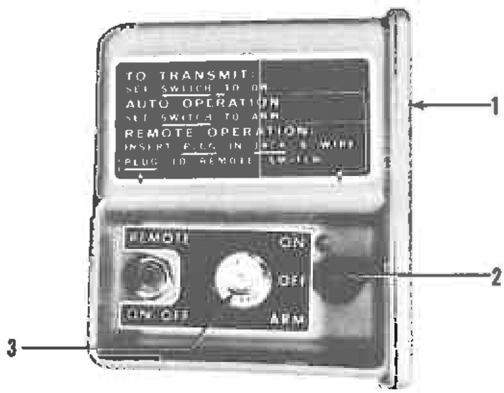
The ELT consists of a self-contained dual-frequency radio transmitter and battery power supply, and is activated by an impact of 5g or more as may be experienced in a crash landing. The ELT emits an omni-directional signal on the international distress frequencies of 121.5 and 243.0 MHz. (Some ELT units in export aircraft transmit only on 121.5 MHz.) General aviation and commercial aircraft, the FAA, and CAP monitor 121.5 MHz, and 243.0 MHz is monitored by the military. Following a crash landing, the ELT will provide line-of-sight transmission up to 100 miles at 10,000 feet. The duration of ELT transmissions is affected by ambient temperature. At temperatures of +21° to +54°C (+70° to +130°F), continuous transmission for 115 hours can be expected; a temperature of -40°C (-40°F) will shorten the duration to 70 hours.

The ELT is readily identified as a bright orange unit mounted behind the baggage compartment wall in the tailcone. To gain access to the unit, remove the baggage compartment wall. The ELT is operated by a control panel at the forward facing end of the unit (see figure 1).

SECTION 2

LIMITATIONS

There is no change to the airplane limitations when this equipment is installed.



1. COVER - Removable for access to battery.

2. FUNCTION SELECTOR SWITCH (3-position toggle switch):

   ON - Activates transmitter instantly. Used for test purposes and if "g" switch is inoperative.

   OFF - Deactivates transmitter. Used during shipping, storage and following rescue.

   ARM - Activates transmitter only when "g" switch receives 5g or more impact.

3. ANTENNA RECEPTACLE - Connection to antenna mounted on top of the tailcone.

Figure 1. ELT Control Panel

SECTION 3
EMERGENCY PROCEDURES

Immediately after a forced landing where emergency assistance is required, the ELT should be utilized as follows.

(1) ENSURE ELT ACTIVATION: Turn a radio transceiver ON and select 121.5 MHz. If the ELT can be heard transmitting, it was activated by the "g" switch and is functioning properly. If no emergency tone is audible, gain access to the ELT and place the function se-

lector switch in the ON position.

(2) PRIOR TO SIGHTING RESCUE AIRCRAFT: Conserve airplane battery. Do not activate radio transceiver.

(3) AFTER SIGHTING RESCUE AIRCRAFT: Place ELT function selector switch in the OFF position, preventing radio interference. Attempt contact with rescue aircraft with the radio transceiver set to a frequency of 121.5 MHz. If no contact is established, return the function selector switch to ON immediately.

(4) FOLLOWING RESCUE: Place ELT function selector switch in the OFF position, terminating emergency transmissions.

SECTION 4
NORMAL PROCEDURES

As long as the function selector switch remains in the ARM position, the ELT automatically activates following an impact of 5g or more over a short period of time.

Following a lightning strike, or an exceptionally hard landing, the ELT may activate although no emergency exists. To check your ELT for inadvertent activation, select 121.5 MHz on your radio transceiver and listen for an emergency tone transmission. If the ELT can be heard transmitting, place the function selector switch in the OFF position and the tone should cease. Immediately place the function selector switch in the ARM position to re-set the ELT for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance data when this equipment is installed.

SUPPLEMENT

ELECTRIC ELEVATOR TRIM SYSTEM

SECTION 1
GENERAL

The electric elevator trim system provides a simple method of relieving pitch control pressures without interrupting other control operations to adjust the manual elevator trim wheel. The system is controlled by a slide-type trim switch on the top of the left control wheel grip and a disengage switch located on the left side of the control wheel pad. Pushing the trim switch to the forward position, labeled DN, moves the elevator trim tab in the "nose down" direction; conversely, pulling the switch aft to the UP position moves the tab in the "nose up" direction. When the switch is released, it automatically returns to the center off position, and elevator trim tab motion stops. The disengage switch, labeled ELEC TRIM DISENGAGE, removes all electrical power from the system when placed in the DISENGAGE position.

A servo unit (which includes a motor and chain-driven, solenoid-operated clutch) actuates the trim tab to the selected position. When the clutch is not energized (trim switch off) the electric portion of the trim system freewheels so that manual operation is not affected. The electric trim system can be overridden at any time by manually rotating the elevator trim wheel, thus overriding the servo that drives the trim tab.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this trim system is installed.

SECTION 3

EMERGENCY PROCEDURES

(1) Elevator Trim Disengage Switch -- DISENGAGE.

NOTE

For maximum altitude loss during an electric trim malfunction, refer to placarding on the instrument panel.

(2) Manual Trim -- AS REQUIRED.

SECTION 4

NORMAL PROCEDURES

To operate the electric elevator trim system, proceed as follows:

(1) Master Switch -- ON.
(2) Elevator Trim Disengage Switch -- ON.
(3) Trim Switch -- ACTUATE as desired.
(4) Elevator Trim Position Indicator -- CHECK.

NOTE

To check the operation of the disengage switch, actuate the elevator trim switch with the disengage switch in the DISENGAGE position. Observe that the manual trim wheel and indicator do not rotate when the elevator trim switch is activated.

SECTION 5

PERFORMANCE

There is no change to the airplane performance when this trim system is installed.

SUPPLEMENT

OXYGEN SYSTEM (MODEL 182)

SECTION 1

GENERAL

A four-place oxygen system provides the supplementary oxygen necessary for continuous flight at high altitude. In this system, an oxygen cylinder, located behind the rear baggage compartment wall, supplies the oxygen. Cylinder pressure is reduced to an operating pressure of 70 psi by a pressure regulator attached to the cylinder. A shutoff valve is included as part of the regulator assembly. An oxygen cylinder filler valve is located on the left side of the rear baggage compartment wall. Cylinder pressure is indicated by a pressure gage located in the overhead oxygen console.

Four oxygen outlets are provided; two in the overhead oxygen console and two in the cabin ceiling just above the side windows, one at each of the seating positions. One permanent, microphone-equipped mask is provided for the pilot, and three disposable type masks are provided for the passengers. All masks are the partial-rebreathing type equipped with vinyl plastic hoses and flow indicators.

NOTE

The hose provided for the pilot is of a higher flow rate than those for the passengers; it is color-coded with an orange band adjacent to the plug-in fitting. The passenger hoses are color-coded with a green band. If the airplane owner prefers, he may provide higher flow hoses for all passengers. In any case, it is recommended that the pilot use the larger capacity hose. The pilot's mask is equipped with a microphone to facilitate use of the radio while using oxygen. An adapter cord is furnished with the microphone-equipped mask to mate the mask microphone lead to the auxiliary microphone jack located under the left side of the instrument panel. To connect the oxygen mask microphone, connect the mask lead to the adapter cord and plug the cord into the auxiliary microphone jack. (If an optional microphone-headset combination has been in use, the microphone lead from this equipment is already plugged into the auxiliary microphone jack. It will be necessary to disconnect this lead from the auxiliary microphone jack so that the adapter cord from the oxygen mask microphone can be plugged into the jack.) A switch is incorporated on the left hand control wheel to operate the microphone.

A remote shutoff valve control, located adjacent to the pilot's oxygen outlet, is used to shut off the supply of oxygen to the system when not in use. The control is mechanically connected to the shutoff valve at the cylinder. With the exception of the shutoff function, the system is completely automatic and requires no manual regulation for change of altitude.

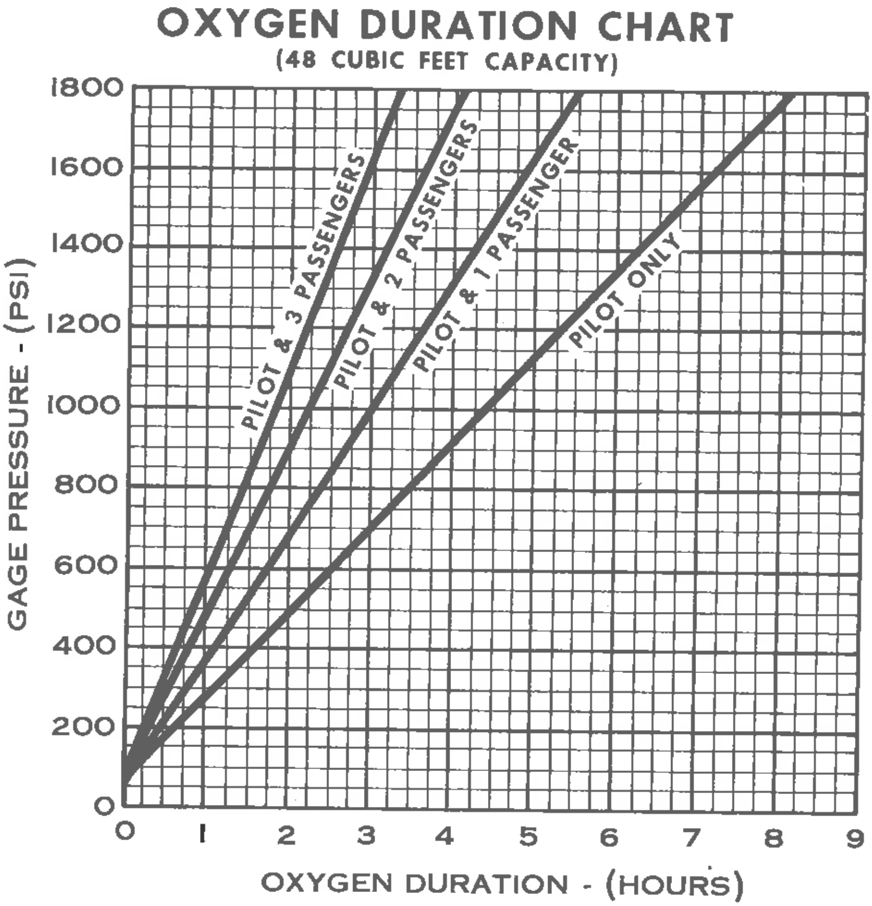
The oxygen cylinder, when fully charged, contains approximately 48 cubic feet of oxygen, under a pressure of 1800 psi at 21°C (70°F). Filling pressures will vary, however, due to the ambient temperature in the filling area, and because of the temperature rise resulting from compression of the oxygen. Because of this, merely filling to 1800 psi will not result in a properly filled cylinder. Fill to the pressures indicated on the table below for ambient temperature.

WARNING

Oil, grease or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided when handling oxygen equipment.

AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG	AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG
0	1600	50	1825
10	1650	60	1875
20	1700	70	1925
30	1725	80	1975
40	1775	90	2000

Figure 1. Oxygen Filling Pressures



NOTE: This chart is based on a pilot with an orange color-coded oxygen line fitting and passengers with green color-coded line fittings.

Figure 2. Oxygen Duration Chart

For FAA requirements concerning supplemental oxygen, refer to FAR 91.32. Supplemental oxygen should be used by all occupants when cruising above 10,000 feet. As described in the Cessna booklet "Man At Altitude," it is often advisable to use oxygen at altitudes lower than 10,000 feet under conditions of night flying, fatigue, or periods of physiological or emotional disturbances. Also, the habitual and excessive use of tobacco or alcohol will usually necessitate the use of oxygen at less than 10,000 feet.

The Oxygen Duration Chart (figure 2) should be used in determining the usable duration (in hours) of the oxygen supply in your airplane. The following procedure outlines the method of finding the duration from the chart.

(1) Note the available oxygen pressure shown on the pressure gage.
(2) Locate this pressure on the scale on the left side of the chart, then go across the chart horizontally to the right until you intersect the line representing the number of persons making the flight. After intersecting the line, drop down vertically to the bottom of the chart and read the duration in hours given on the scale.
(3) As an example of the above procedure, 1400 psi of pressure will safely sustain the pilot only for nearly 6 hours and 15 minutes. The same pressure will sustain the pilot and three passengers for approximately 2 hours and 30 minutes.

NOTE

The Oxygen Duration Chart is based on a standard configuration oxygen system having one orange color-coded hose assembly for the pilot and green color-coded hoses for the passengers. If orange color-coded hoses are provided for pilot and passengers, it will be necessary to compute new oxygen duration figures due to the greater consumption of oxygen with these hoses. This is accomplished by computing the total duration available to the pilot only (from PILOT ONLY line on chart), then dividing this duration by the number of persons (pilot and passengers) using oxygen.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when oxygen equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when oxygen equipment is installed.

SECTION 4
NORMAL PROCEDURES

Prior to flight, check to be sure that there is an adequate oxygen supply for the trip, by noting the oxygen pressure gage reading, and referring to the Oxygen Duration Chart (figure 2). Also, check that the face masks and hoses are accessible and in good condition.

WARNING

For safety reasons, no smoking should be allowed in the airplane while oxygen is being used.

When ready to use the oxygen system, proceed as follows:

(1) Mask and Hose -- SELECT. Adjust mask to face and adjust metallic nose strap for snug mask fit.
(2) Delivery Hose -- PLUG INTO OUTLET nearest to the seat you are occupying.

NOTE

When the oxygen system is turned on, oxygen will flow continuously at the proper rate of flow for any altitude without any manual adjustments.

(3) Oxygen Supply Control Knob -- ON.
(4) Face Mask Hose Flow Indicator -- CHECK. Oxygen is flowing if the indicator is being forced toward the mask.
(5) Delivery Hose -- UNPLUG from outlet when discontinuing use of oxygen. This automatically stops the flow of oxygen.
(6) Oxygen Supply Control Knob -- OFF when oxygen is no longer required.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when oxygen equipment is installed.

SUPPLEMENT

CESSNA 300 NAV/COM

(COM/VOR, No LOC - Type RT-308C)

SECTION 1

GENERAL

The Cessna 300 Nav/Com (Type RT-308C), shown in Figure 1, consists of a panel-mounted receiver-transmitter (RT-308C) and a single needle course deviation indicator (IN-514R or IN-514B). The RT-308C Receiver-Transmitter includes a 360-channel VHF communication receiver-transmitter and a 160-channel VHF navigation receiver, both of which may be operated simultaneously.

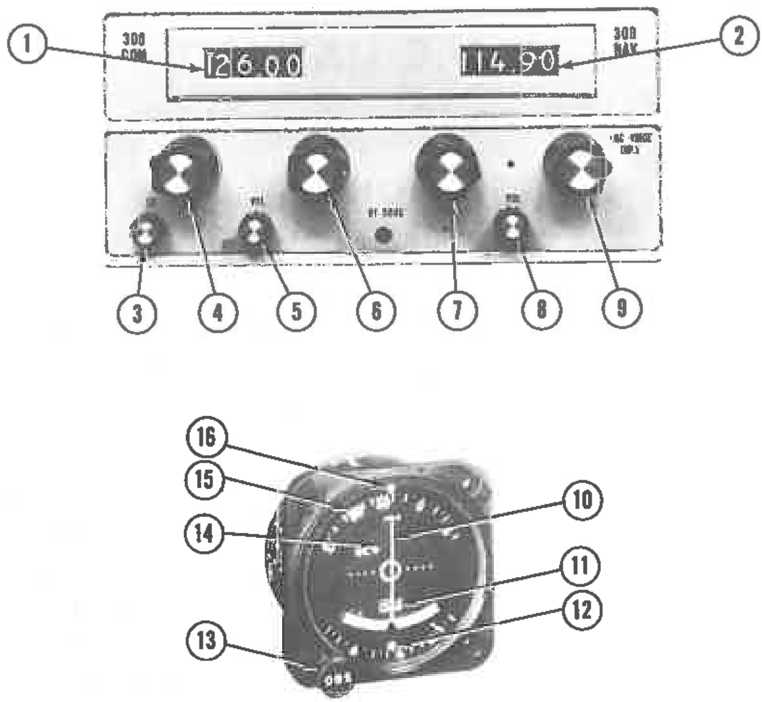
The communication receiver-transmitter receives and transmits signals between 118.00 and 135.95 MHz in 50 kHz steps. The navigation receiver receives and interprets VHF omnidirectional range (VOR) signals between 108.00 and 117.95 MHz. Although localizer signals (all odd-tenth frequencies between 108.1 and 111.9 MHz) can also be received, the navigation receiver does not include the necessary circuits to interpret the signals for localizer indications. However, the audio portion of the localizer is audible so that flight information, such as that broadcast in certain areas on selected localizer frequencies by the Automatic Terminal Information Service (ATIS), may be heard.

All controls for the Cessna 300 Nav/Com (Type RT-308C), except the omni bearing selector (OBS), are mounted on the front panel of the receiver-transmitter. The course selector and the navigation indicators are included in the course deviation indicator. The communication receiver-transmitter and the navigation receiver are synthesizer-controlled and are tuned automatically when the frequency is selected. In addition, when two or more radios are installed, a transmitter selector switch and a speaker-phone selector switch are provided. Each control function is described in Figure 1.

SECTION 2

LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.



1. RECEIVER-TRANSMITTER FREQUENCY INDICATOR.

2. NAVIGATION RECEIVER FREQUENCY INDICATOR.

3. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate communication receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.

4. COMMUNICATION RECEIVER-TRANSMITTER MEGA-HERTZ SELECTOR - Selects communication receiver-transmitter frequency in 1-MHz steps between 118 and 135 MHz.

Figure 1. Cessna 300 Nav/Com (Type RT-308C) - VOR only (Sheet 1 of 2)

5. OFF/ON VOLUME CONTROL - Turns complete set on and controls volume of audio from communication receiver. Clockwise rotation increases audio level.

6. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MEGAHERTZ SELECTOR - Selects communication receiver-transmitter fractional frequency in 0.05 MHz steps between 0.00 and 0.95 MHz.

7. NAVIGATION RECEIVER MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 1-MHz steps between 108 and 117 MHz.

8. NAVIGATION RECEIVER VOLUME CONTROL - Controls volume of audio from navigation receiver only. Clockwise rotation increases audio level.

9. NAVIGATION RECEIVER FRACTIONAL MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 0.05 MHz steps between 0.00 and 0.95 MHz.

10. COURSE DEVIATION POINTER - Indicates deviation from selected omni bearing.

11. OFF/TO-FROM (OMNI) INDICATOR - Operates only with VOR signal. "OFF" position (flag) indicates unreliable signal or no signal (shows OFF when localizer frequency is selected). When "OFF" position disappears, indicator shows whether selected course is "TO" or "FROM" VOR station.

12. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.

13. OMNI BEARING SELECTOR (OBS) - Selects desired course to or from a VOR station.

14. BACK COURSE (BC) INDICATOR LIGHT (On IN-514B Only) - Not used with this radio.

15. BEARING DIAL - Rotated by OBS to select course at index.

16. COURSE INDEX - Indicates selected VOR course.

Figure 1. Cessna 300 Nav/Com (Type RT-308C) - VOR only (Sheet 2 of 2)

SECTION 3

EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4

NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

(1) OFF/VOL Control -- TURN ON and adjust to desired listening level.
(2) XMTR SEL Switch -- SET to desired transceiver.
(3) SPEAKER/PHONE (or AUTO) Switch -- SET to desired mode.
(4) COM Frequency Selector Knobs -- SELECT desired operating frequency.
(5) SQ Control -- ROTATE counterclockwise to decrease background noise as required.
(6) Mike Button:
  a. To Transmit -- DEPRESS and SPEAK into microphone.
  b. To Receive -- RELEASE.

NAVIGATION RECEIVER OPERATION:

(1) COM OFF/VOL Control -- TURN ON.
(2) SPEAKER/PHONE (or AUTO) Switch -- SET to desired mode.
(3) NAV Frequency Selector Knobs -- SELECT desired operating frequency.
(4) NAV VOL Control -- ADJUST to desired listening level.
(5) OBS Knob -- SELECT desired course.

SECTION 5

PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 300 NAV/COM

(720-Channel - Type RT-328T)

SECTION 1

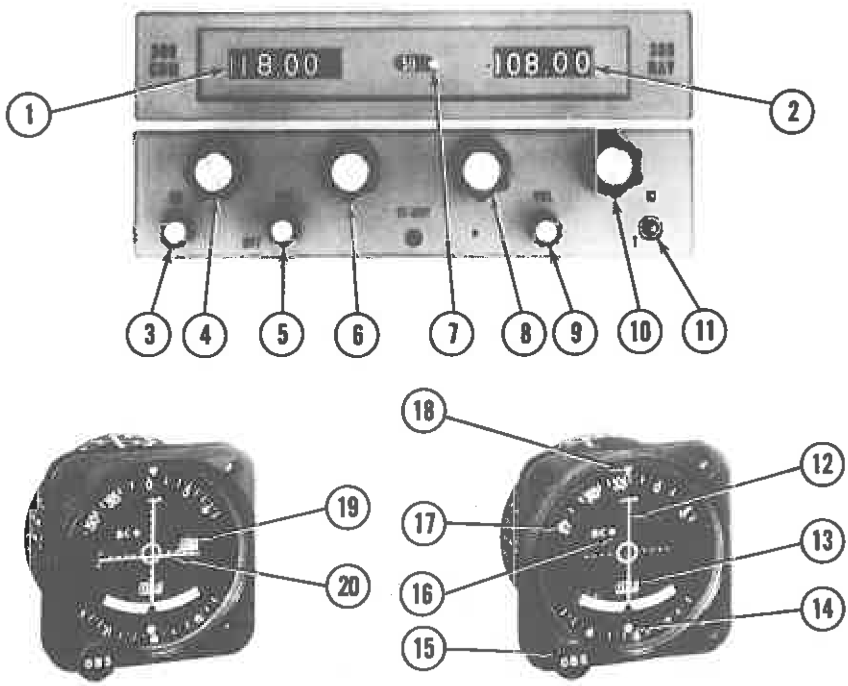
GENERAL

The Cessna 300 Nav/Com (Type RT-328T), shown in Figure 1, consists of a panel-mounted receiver-transmitter and a single- or dual-pointer remote course deviation indicator (CDI). The set includes a 720-channel VHF communication receiver-transmitter and a 200-channel VHF navigation receiver, both of which may be operated simultaneously.

The communication receiver-transmitter receives and transmits signals between 118.000 and 135.975 MHz in 25-kHz steps. The navigation receiver receives and interprets VHF omnidirectional and localizer signals between 108.00 and 117.95 MHz in 50-kHz steps. The communication receiver-transmitter and the navigation receiver are synthesizer-controlled and are tuned automatically when the frequency is selected.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Cessna 300 Nav/Com set for automatic selection of the associated DME or GS frequency. When a VOR frequency is selected on the Nav/Com, the associated VORTAC or VOR-DME station frequency will also be selected automatically; likewise, if a localizer frequency is selected, the associated glide slope frequency will be selected automatically.

All controls of the Cessna 300 Nav/Com, except the omni bearing selector knob (OBS), which is located on the course indicator, are mounted on the front panel of the receiver-transmitter. The course indicator includes either a single pointer and related OFF flag for VOR/LOC indication only, or dual pointers and related OFF flags for both VOR/LOC and glide slope indications. The course indicator also incorporates a back-course lamp (BC) which lights when optional back-course operation is selected. Each control function is described in Figure 1, and the audio control panel supplied with this equipment is shown and described in Section 7 of this handbook.



1. RECEIVER-TRANSMITTER FREQUENCY INDICATOR.

2. NAVIGATION RECEIVER FREQUENCY INDICATOR.

3. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate communication receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.

4. COMMUNICATION RECEIVER-TRANSMITTER MEGAHERTZ SELECTOR - Selects communication receiver-transmitter frequency in 1-MHz steps between 118 and 135 MHz.

5. OFF/ON VOLUME CONTROL - Turns set on and controls volume of audio from communications receiver.

6. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MEGAHERTZ SELECTOR - Selects communication receiver-transmitter fractional frequency in .05-MHz steps between .000 and .950 MHz or between .025 and .975 MHz depending on position of 50-25 MHz selector switch (7).

Figure 1. Cessna 300 Nav/Com (Type RT-328T) (Sheet 1 of 2)

7. 50-25 FRACTIONAL MHz SELECTOR SWITCH - In "50" position, enables communication whole MHz frequency readout to display and communication fractional MHz control to select fractional part of frequency in .05-MHz steps between .000 and .950 MHz. In "25" position, frequency display and coverage is in .05-MHz steps between .025 and .975.

NOTE

The third-decimal-place digit is not shown on the receiver-transmitter frequency readout.

8. NAVIGATION RECEIVER MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 1-MHz steps between 108 and 117 MHz; simultaneously selects paired glide slope frequency or DME channel.

9. NAVIGATION RECEIVER VOLUME CONTROL - Controls volume of audio from navigation receiver only. Clockwise rotation increases audio level.

10. NAVIGATION RECEIVER FRACTIONAL MEGAHERTZ SELECTOR - Selects navigation receiver frequency in .05-MHz steps between .00 and .95 MHz; simultaneously paired glide slope frequency or DME channel.

11. COMBINED IDENTIFIER SIGNAL SELECTOR AND VOR SELF-TEST SELECTOR SWITCH (ID-T SWITCH) - With VOR or LOC station selected, in ID position, station identifier is audible; in center (unmarked) position, identifier is off; in T (momentary on) position, tests VOR navigation circuits.

12. COURSE DEVIATION POINTER - Indicates deviation from selected omni bearing or localizer centerline.

13. OFF/TO-FROM (OMNI) INDICATOR - Operates only with VOR or localizer signal. "OFF" position (flag) indicates unreliable signal. When "OFF" position disappears, indicator shows whether selected VOR course is "TO" or "FROM" the station (if LOC frequency is selected, indicator will only show "TO").

14. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.

15. OMNI BEARING SELECTOR (OBS) - Selects desired course to or from a VOR station.

16. BC - During LOC operation, when optional Back-Course operation is selected, amber lamp illuminates to alert the pilot that CDI indication is reversed.

17. BEARING DIAL - Rotated by OBS to select course at index.

18. COURSE INDEX - Indicates selected VOR course.

19. GLIDE SLOPE "OFF" FLAG - When visible, indicates unreliable glide slope signal or no glide slope signal. The flag disappears when a reliable glide slope signal is being received.

20. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from normal glide slope.

Figure 1. Cessna 300 Nav/Com (Type RT-328T) (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the pilot should be aware that on many Cessna airplanes equipped with the windshield mounted glide slope antenna, pilots should avoid use of 2700 ±100 RPM (or 1800 ±100 RPM with a three bladed propeller) during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

(1) OFF/VOL Control -- TURN ON and adjust to desired listening level.
(2) XMTR SEL Switch -- SET to desired transceiver.
(3) SPEAKER PHONE (or AUTO) Switch -- SET to desired mode.
(4) 50-25 Fractional MHz Selector Switch -- SELECT desired frequency (does not affect navigation frequencies).
(5) COM Frequency Selector Knobs -- SELECT desired operating frequency.
(6) SQ Control -- ROTATE counterclockwise to decrease background noise as required.
(7) Mike Button:
   a. To Transmit -- DEPRESS and SPEAK into microphone.
   b. To Receive -- RELEASE.

NAVIGATION RECEIVER OPERATION:

(1) COM OFF/VOL Control -- TURN ON.
(2) SPEAKER/PHONE (or AUTO) Switch -- SET to desired mode.
(3) NAV Frequency Selector Knobs -- SELECT desired operating frequency.

(4) NAV VOL Control -- ADJUST to desired audio level.
(5) ID-T Switch:
   a. To Identify Station -- SET to ID to hear navigation station identifier (Morse Code) signal.
   b. To Filter Out Station Identifier Signal -- SET to CENTER (unmarked) position to include filter in audio circuit.
(6) OBS Knob -- SELECT desired course.

TO SELF TEST VOR NAVIGATION CIRCUITS:

(1) COM OFF/VOL Control -- TURN ON.
(2) NAV Frequency Selector Switches -- SELECT usable VOR station signal.
(3) OBS Knob -- SET for 0° course at index; CDI pointer centers or deflects left or right, depending on bearing of signal; OFF/TO-FROM indicator shows TO or FROM.
(4) ID-T Switch -- PRESS to T and HOLD at T; CDI pointer should center and OFF/TO-FROM indicator should show FROM.
(5) OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID-T switch at T); CDI pointer should deflect full scale in direction corresponding to course displacement. OFF/TO-FROM indicator should still show FROM.

NOTE

This test does not fulfill the requirements of FAR 91.25.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 300 ADF

(Type R-546E)

SECTION 1
GENERAL

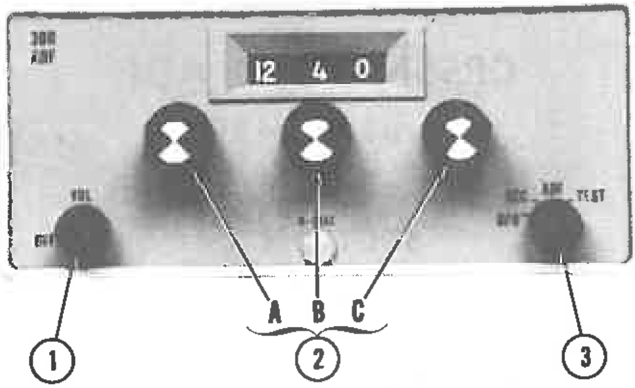
The Cessna 300 ADF is a panel-mounted, digitally tuned automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1,699 kHz and eliminates the need for mechanical band switching. The system is comprised of a receiver, loop antenna, bearing indicator and a sense antenna. In addition, when two or more radios are installed, speaker-phone selector switches are provided. Each control function is described in Figure 1.

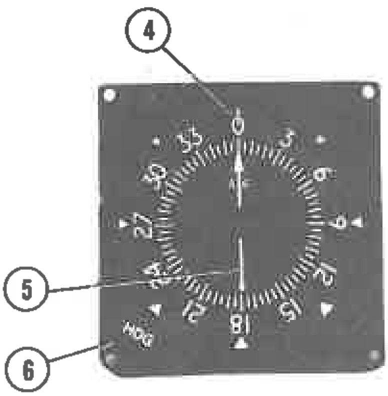
The Cessna 300 ADF can be used for position plotting and homing procedures, and for aural reception of amplitude-modulated (AM) signals.

With the function selector knob at ADF, the Cessna 300 ADF provides a visual indication, on the bearing indicator, of the bearing to the transmitting station relative to the nose of the airplane. This is done by combining signals from the sense antenna with signals from the loop antenna.

With the function selector knob at REC, the Cessna 300 ADF uses only the sense antenna and operates as a conventional low-frequency receiver.

The Cessna 300 ADF is designed to receive transmission from the following radio facilities: commercial broadcast stations, low-frequency range stations, FAA radio beacons, and ILS compass locators.





1. OFF/VOL CONTROL - Controls primary power and audio output level. Clockwise rotation from OFF position applies primary power to receiver; further clockwise rotation increases audio level.

2. FREQUENCY SELECTORS - Knob (A) selects 100-kHz increments of receiver frequency, knob (B) selects 10-kHz increments, and knob (C) selects 1-kHz increments.

Figure 1. Cessna 300 ADF Operating Controls and Indicators (Sheet 1 of 2)

3. FUNCTION SWITCH:

   BFO: Selects operation as communication receiver using only sense antenna and activates 1000-Hz tone beat frequency oscillator to permit coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.

   REC: Selects operation as standard communication receiver using only sense antenna.

   ADF: Set operates as automatic direction finder using loop and sense antennas.

   TEST: Momentary-on position used during ADF operation to test bearing reliability. When held in TEST position, slews indicator pointer clockwise; when released, if bearing is reliable, pointer returns to original bearing position.

4. INDEX (ROTATABLE CARD) - Indicates relative, magnetic, or true heading of aircraft, as selected by HDG control.

5. POINTER - Indicates station bearing in degrees of azimuth, relative to the nose of the aircraft. When heading control is adjusted, indicates relative, magnetic, or true bearing of radio signal.

6. HEADING CONTROL (HDG) - Rotates card to set in relative, magnetic, or true bearing information.

Figure 1. Cessna 300 ADF Operating Controls and Indicators (Sheet 2 of 2)

SECTION 2

LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3

EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4

NORMAL PROCEDURES

TO OPERATE AS A COMMUNICATIONS RECEIVER ONLY:

(1) OFF/VOL Control -- ON.
(2) Function Selector Knob -- REC.
(3) Frequency Selector Knobs -- SELECT operating frequency.
(4) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position as desired.
(5) VOL Control -- ADJUST to desired listening level.

TO OPERATE AS AN AUTOMATIC DIRECTION FINDER:

(1) OFF/VOL Control -- ON.
(2) Frequency Selector Knobs -- SELECT operating frequency.
(3) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.
(4) Function Selector Knob -- ADF position and note relative bearing on indicator.
(5) VOL Control -- ADJUST to desired listening level.

TO TEST RELIABILITY OF AUTOMATIC DIRECTION FINDER:

(1) Function Selector Knob -- ADF position and note relative bearing on indicator.
(2) Function Selector Knob -- TEST position and observe that pointer moves away from relative bearing at least 10 to 20 degrees.
(3) Function Selector Knob -- ADF position and observe that pointer returns to same relative bearing as in step (1).

TO OPERATE BFO:

(1) OFF/VOL Control -- ON.
(2) Function Selector Knob -- BFO.
(3) Frequency Selector Knobs -- SELECT operating frequency.
(4) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.
(5) VOL Control -- ADJUST to desired listening level.

NOTE

A 1000-Hz tone is heard in the audio output when a CW signal (Morse Code) is tuned in properly.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 300 TRANSPONDER

(Type RT-359A)

AND

OPTIONAL ENCODING ALTIMETER

(Type EA-401A)

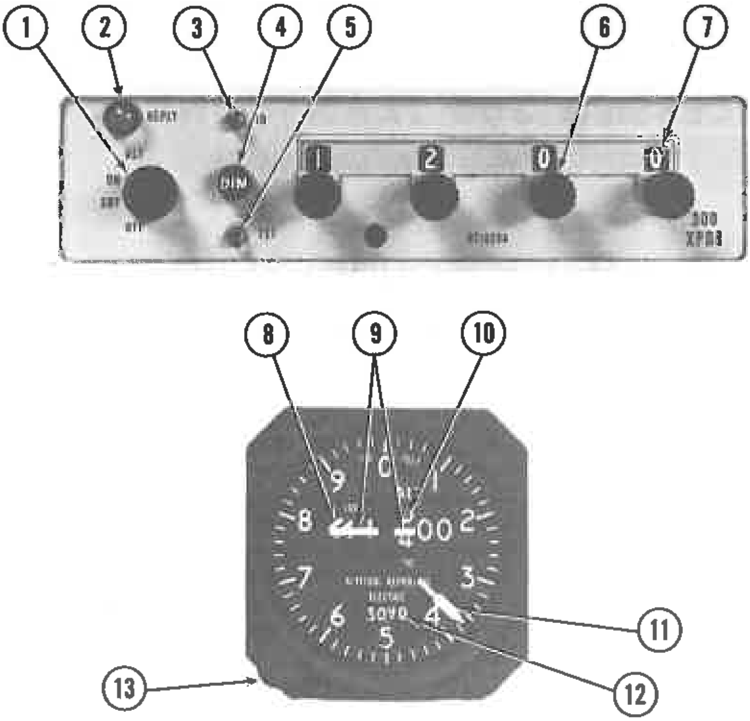
SECTION 1

GENERAL

The Cessna 300 Transponder (Type RT-359A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radar-scope more readily.

The Cessna 300 Transponder consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogating pulse signals on 1030 MHz and transmits coded pulse-train reply signals on 1090 MHz. It is capable of replying to Mode A (aircraft identification) and Mode C (altitude reporting) interrogations on a selective reply basis on any of 4,096 information code selections. When an optional panel-mounted EA-401A Encoding Altimeter (not part of a standard 300 Transponder system) is included in the avionic configuration, the transponder can provide altitude reporting in 100-foot increments between -1000 and +35,000 feet.

All Cessna 300 Transponder operating controls, with the exception of the optional altitude encoder's altimeter setting knob, are located on the front panel of the unit. The altimeter setting knob is located on the encoding altimeter. Functions of the operating controls are described in Figure 1.



1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode, as follows:
   - OFF - Turns set off.
   - SBY - Turns set on for equipment warm-up.
   - ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   - ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply Lamp will also glow steadily during initial warm-up period.)

Figure 1. Cessna 300 Transponder and Encoding Altimeter (Sheet 1 of 2)

3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply Lamp will glow steadily during duration of IDENT pulse transmission.)

4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.

5. SELF-TEST (TST) SWITCH -- When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply Lamp will glow steadily to verify self test operation.)

6. REPLY-CODE SELECTOR KNOBS (4) - Select assigned Mode A reply code.

7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.

8. 1000-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 1000-foot increments between -1000 feet and +35,000 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in the 10,000 foot window.

9. OFF INDICATOR WARNING FLAG - Flag appears across altitude readout when power is removed from the altimeter to indicate that readout is not reliable.

10. 100-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 100-foot increments between 0 feet and 1000 feet.

11. 20-FOOT INDICATOR NEEDLE - Indicates altitude in 20-foot increments between 0 feet and 1000 feet.

12. ALTIMETER SETTING SCALE - DRUM TYPE - Indicates selected altimeter setting in the range of 27.9 to 31.0 inches of mercury on the standard altimeter or 950 to 1050 millibars on the optional altimeter.

13. ALTIMETER SETTING KNOB - Dials in desired altimeter setting in the range of 27.9 to 31.0 inches of mercury on the standard altimeter or 950 to 1050 millibars on the optional altimeter.

Figure 1. Cessna 300 Transponder and Encoding Altimeter (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT:

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Off Indicator Warning Flag -- VERIFY that flag is out of view on encoding altimeter.

(2) Reply-Code Selector Knobs -- SELECT assigned code.
(3) Function Switch -- ON.
(4) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, reply lamp flashes indicating transponder replies to interrogations.

(5) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (reply lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Off Indicator Warning Flag -- VERIFY that flag is out of view on encoding altimeter.
(2) Altitude Encoder Altimeter Setting Knob -- SET IN assigned local altimeter setting.
(3) Reply-Code Selector Knobs -- SELECT assigned code.
(4) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the encoding altimeter.

(5) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.
(2) Function Switch -- ON or ALT.

(3) TST Button -- DEPRESS and HOLD (reply lamp should light with full brilliance regardless of DIM control setting).
(4) TST Button -- Release for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 300 TRANSPONDER

(Type RT-359A)

AND

OPTIONAL ALTITUDE ENCODER (BLIND)

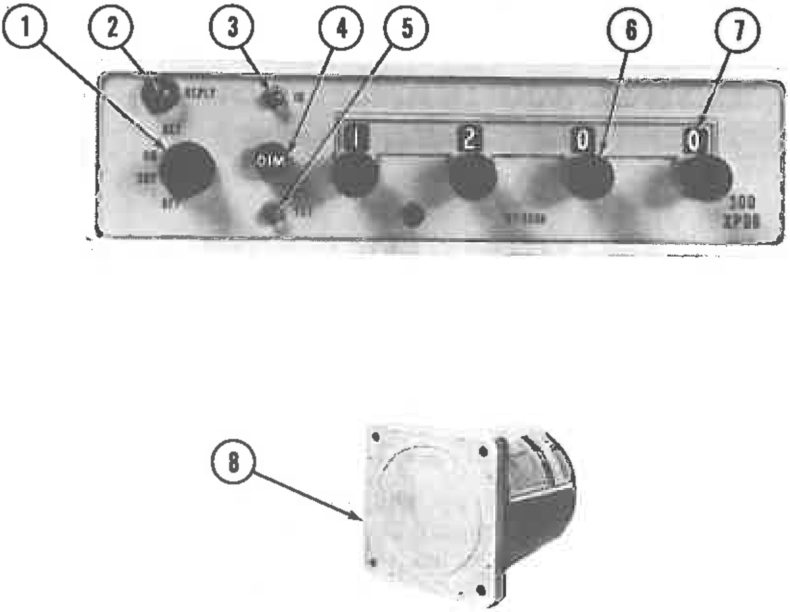
SECTION 1

GENERAL

The Cessna 300 Transponder (Type RT-359A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radarscope more readily.

The Cessna 300 Transponder system consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogation pulse signals on 1030 MHz and transmits pulse-train reply signals on 1090 MHz. The transponder is capable of replying to Mode A (aircraft identification) and also Mode C (altitude reporting) when coupled to an optional altitude encoder system. The transponder is capable of replying on both modes of interrogation on a selective reply basis on any of 4,096 information code selections. The optional altitude encoder system (not part of a standard 300 Transponder system) required for Mode C (altitude reporting) operation consists of a completely independent remote-mounted digitizer that is connected to the static system and supplies encoded altitude information to the transponder. When the altitude encoder system is coupled to the 300 Transponder system, altitude reporting capabilities are available in 100-foot increments between -1000 and +20,000 feet.

All Cessna 300 Transponder operating controls are located on the front panel of the unit. Functions of the operating controls are described in Figure 1.



1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode as follows:

   OFF - Turns set off.
   SBY - Turns set on for equipment warm-up or standby power.
   ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply lamp will also glow steadily during initial warm-up period.)

Figure 1. Cessna 300 Transponder and Altitude Encoder (Blind) (Sheet 1 of 2)

3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply lamp will glow steadily during duration of IDENT pulse transmission.)

4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.

5. SELF-TEST (TST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply lamp will glow steadily to verify self-test operation.)

6. REPLY-CODE SELECTOR KNOBS (4) - Select assigned Mode A reply code.

7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.

8. REMOTE-MOUNTED DIGITIZER - Provides an altitude reporting code range of -1000 feet up to the airplane's maximum service ceiling.

Figure 1. Cessna 300 Transponder and Altitude Encoder (Blind) (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, a placard labeled "ALTITUDE ENCODER EQUIPPED" must be installed near the altimeter.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Reply-Code Selector Knobs -- SELECT assigned code.

(2) Function Switch -- ON.
(3) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, reply lamp flashes indicating transponder replies to interrogations.

(4) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (reply lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Reply-Code Selector Knobs -- SELECT assigned code.
(2) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the aircraft altimeter.

(3) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.
(2) Function Switch -- ON or ALT.
(3) TST Button -- DEPRESS (reply lamp should light brightly regardless of DIM control setting).
(4) TST Button -- Release for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

DME

(Type 190)

SECTION 1
GENERAL

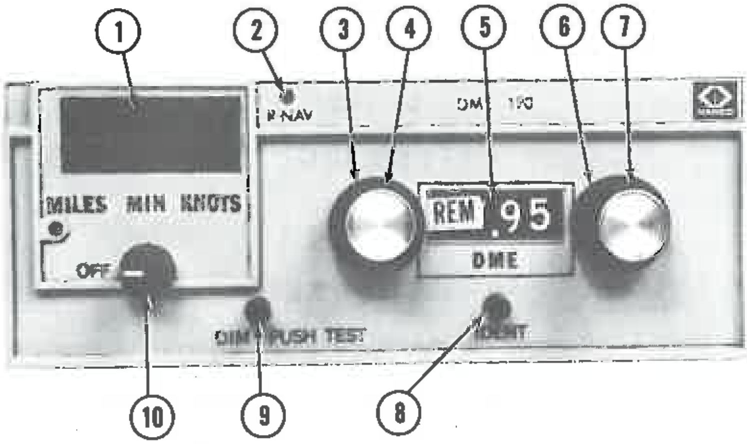
The DME 190 (Distance Measuring Equipment) system consists of a panel mounted 200 channel UHF transmitter-receiver and an externally mounted antenna. The transceiver has a single selector knob that changes the DME's mode of operation to provide the pilot with: distance-to-station, time-to-station, or ground speed readouts. The DME is designed to operate in altitudes up to a maximum of 50,000 feet at ground speeds up to 250 knots and has a maximum slant range of 199.9 nautical miles.

The DME can be channeled independently or by a remote NAV set. When coupled with a remote NAV set, the MHz digits will be covered over by a remote (REM) flag and the DME will utilize the frequency set by the NAV set's channeling knobs. When the DME is not coupled with a remote NAV set, the DME will reflect the channel selected on the DME unit. The transmitter operates in the frequency range of 1041 to 1150 MHz and is paired with 108 to 117.95 MHz to provide automatic DME channeling. The receiver operates in the frequency range of 978 to 1213 MHz and is paired with 108 to 117.95 MHz to provide automatic DME channeling.

All operating controls for the DME are mounted on the front panel of the DME and are described in Figure 1.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.



1. READOUT WINDOW - Displays function readout in nautical miles (distance-to-station), minutes (time-to-station) or knots (ground speed).

2. R-NAV INDICATOR LAMP - The green R-NAV indicator lamp is provided to indicate the DME is coupled to an R-NAV system. Since this DME is not factory installed with an R-NAV system on Cessna airplanes, the R-NAV indicator lamp should never be illuminated. However, if an R-NAV system is coupled to the DME, and when in R-NAV mode, the R-NAV lamp will light which indicates that the distance readout is to the "way point" instead of the DME station. The DME can only give distance (Miles) in R-NAV mode.

3. REMOTE CHANNELING SELECTOR - This knob is held stationary by a stop when not coupled to a remote NAV receiver. When coupled to a remote NAV receiver, a stop in the selector is removed and the selector becomes a two position selector. In the first position, the DME will utilize the frequency set by the DME channeling knobs. In the second position, the MHz digits will utilize the frequency set by the NAV unit's channeling knobs.

4. WHOLE MEGAHERTZ SELECTOR KNOB - Selects operating frequency in 1-MHz steps between 108 and 117 MHz.

5. FREQUENCY INDICATOR - Shows operating frequency selected on the DME or displays remote (REM) flag to indicate DME is operating on a frequency selected by a remote NAV receiver.

Figure 1. DME 190 Operating Controls (Sheet 1 of 2)

6. FRACTIONAL MEGAHERTZ SELECTOR KNOB - Selects operating frequency in 50 kHz steps. This knob has two positions, one for the 0 and one for the 5.

7. FRACTIONAL MEGAHERTZ SELECTOR KNOB - Selects operating frequency in tenths of a Megahertz (0-9).

8. IDENT KNOB - Rotation of this control increases or decreases the volume of the received station's Ident signal. An erratic display, accompanied by the presence of two Ident signals, can result if the airplane is flying in an area where two stations, using the same frequency, are transmitting.

9. DIM/PUSH TEST KNOB -

   DIM: Controls the brilliance of the readout lamp's segments. Rotate the control as desired for proper lamp illumination in the function window (The frequency window is dimmed by the aircraft's radio light dimming control).

   PUSH TEST: This control is used to test the illumination of the readout lamps, with or without being tuned to a station. Press the control, a readout of 188 8 should be seen with the mode selector switch in the MIN or KNOTS position. The decimal point along with 188. 8 will light in the MILES mode. When the control is released, and had the DME been channeled to a nearby station, the distance to that station will appear. If the station channeled was not in range, a "bar" readout will be seen (--. - or -- -).

10. MODE SELECTOR SWITCH -

   OFF: Turns the DME OFF.

   MILES: Allows a digital readout to appear in the window which represents slant range (in nautical miles) to or from the channeled station.

   MIN: Allows a digital readout (in minutes) to appear in the window that it will take the airplane to travel the distance to the channeled station. This time is only accurate when flying directly TO the station and after the ground speed has stabilized.

   KNOTS: Allows a digital readout (in knots) to appear in the window that is ground speed and is valid only after the stabilization time (approximately 2 minutes) has elapsed when flying directly TO or FROM the channeled station.

Figure 1. DME 190 Operating Controls (Sheet 2 of 2)

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO OPERATE:

(1) Mode Selector Switch -- SELECT desired DME function.
(2) Frequency Selector Knobs -- SELECT desired frequency and allow equipment to warm-up at least 2 minutes.

NOTE

If frequency is set on remote NAV receiver, place remote channeling selector in the REM position.

(3) PUSH TEST Control -- PUSH and observe reading of 188. 8 in function window.
(4) DIM Control -- ADJUST.
(5) IDENT Control -- ADJUST audio output in speaker.
(6) Mode Selector Functions:

MILES Position -- Distance-to-Station is slant range in nautical miles.
MIN Position -- Time-to-Station when flying directly to station.
KNOTS Position -- Ground Speed in knots when flying directly to or from station.

CAUTION

After the DME 190 has been turned OFF, do not turn it on again for 5 seconds to allow the protective circuits to reset.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

HF TRANSCEIVER

(Type PT10-A)

SECTION 1
GENERAL

The PT10-A HF Transceiver, shown in Figure 1, is a 10-channel AM transmitter-receiver which operates in the frequency range of 2.0 to 18.0 Megahertz. The transceiver is automatically tuned to the operating frequency by a Channel Selector. The operating controls for the unit are mounted on the front panel of the transceiver. The system consists of a transceiver, antenna load box, fixed wire antenna and associated wiring.

The Channel Selector Knob determines the operating frequency of the transmitter and receiver. The frequencies of operation are shown on the frequency chart adjacent to the channel selector.

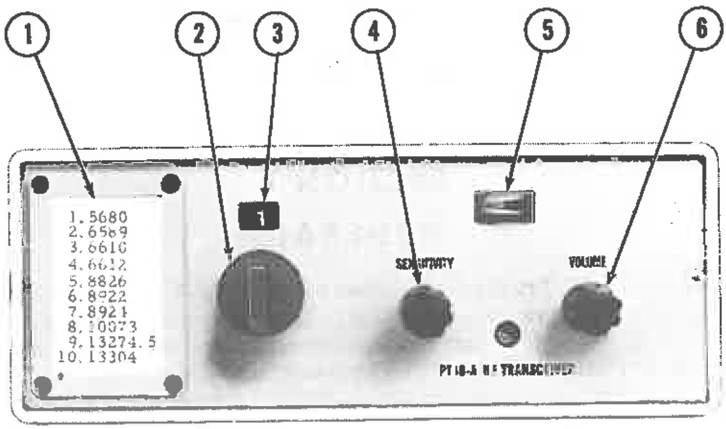
The VOLUME control incorporates the power switch for the transceiver. Clockwise rotation of the volume control turns the set on and increases the volume of audio.

The meter on the face of the transceiver indicates transmitter output.

The system utilizes the airplane microphone, headphone and speaker. When two or more radios are installed, a transmitter selector switch and a speaker-phone switch are provided.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.



1. FREQUENCY CHART - Shows the frequency of the channel in use (frequencies shown may vary and are shown for reference purposes only).

2. CHANNEL SELECTOR - Selects channels 1 thru 10 as listed in the frequency chart.

3. CHANNEL READOUT WINDOW - Displays channel selected in frequency chart.

4. SENSITIVITY CONTROL - Controls the receiver sensitivity for audio gain.

5. ANTENNA TUNING METER - Indicates the energy flowing from the transmitter into the antenna. The optimum power transfer is indicated by the maximum meter reading.

6. ON/OFF VOLUME CONTROL - Turns complete set on and controls volume of audio.

Figure 1. HF Transceiver (Type PT10-A)

SECTION 3

EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4

NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE (or AUTO) Switch -- SELECT desired mode.
(3) VOLUME Control -- ON (allow equipment to warm up and adjust audio to comfortable listening level).
(4) Frequency Chart -- SELECT desired operating frequency.
(5) Channel Selector -- DIAL in frequency selected in step 4.
(6) SENSITIVITY Control -- ROTATE clockwise to maximum position.

NOTE

If receiver becomes overloaded by very strong signals, back off SENSITIVITY control until background noise is barely audible.

NOTE

The antenna tuning meter indicates the energy flowing from the airplane's transmitter into the antenna. The optimum power transfer is indicated by the maximum meter reading.

(7) Mike Button:
a. To Transmit -- DEPRESS and SPEAK into microphone.
b. To Receive -- RELEASE.

SECTION 5

PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

SSB HF TRANSCEIVER

(Type ASB-125)

SECTION 1

GENERAL

The ASB-125 HF transceiver is an airborne, 10-channel, single side-band (SSB) radio with a compatible amplitude modulated (AM) transmitting-receiving system for long range voice communications in the 2 to 18 MHz frequency range. The system consists of a panel mounted receiver/exciter, a remote mounted power amplifier/power supply, an antenna coupler and an externally mounted, fixed wire, medium/high frequency antenna.

A channel selector knob determines the operating frequency of the transceiver which has predetermined crystals installed to provide the desired operating frequencies. A mode selector control is provided to supply the type of emission required for the channel, either sideband, AM or telephone for public correspondence. An audio knob, clarifier knob and squelch knob are provided to assist in audio operation during receive. In addition to the aforementioned controls, which are all located on the receiver/exciter, a meter is incorporated to provide antenna loading readouts.

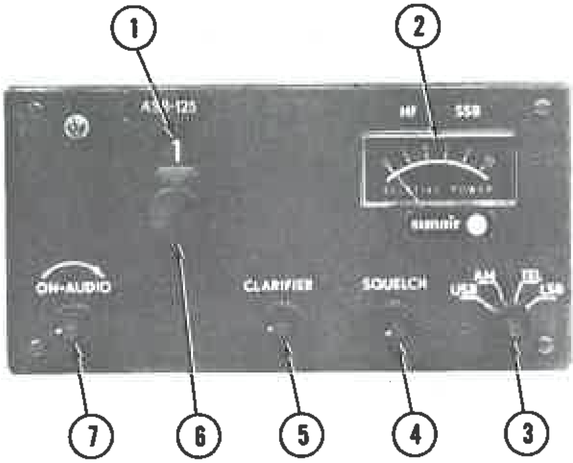
The system utilizes the airplane microphone, headphone and speaker. When two or more radios are installed, a transmitter selector switch and a speaker-phone switch are provided.

SECTION 2

LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the pilot should be aware of the two following radio limitations:

(1) For sideband operation in the United States, Canada and various



1. CHANNEL WINDOW - Displays selected channel.

2. RELATIVE POWER METER - Indicates relative radiated power of the power amplifier/antenna system.

3. MODE SELECTOR CONTROL - Selects one of the desired operating modes:
   - USB - Selects upper side band operation for long range voice communications.
   - AM - Selects compatible AM operation and full AM reception.
   - TEL - Selects upper sideband with reduced carrier, used for public correspondence telephone and ship-to-shore.
   - LSB - (Optional) Selects lower sideband operation (not legal in U.S., Canada and most other countries).

4. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.

5. CLARIFIER CONTROL - Used to "clarify" single sideband speech during receive while in USB mode only.

6. CHANNEL SELECTOR CONTROL - Selects desired channel. Also selects AM mode if channel frequency is 2003 kHz, 2182 kHz or 2638 kHz.

7. ON - AUDIO CONTROL - Turns set ON and controls receiver audio gain.

Figure 1. SSB HF Transceiver Operating Controls

other countries, only the upper sideband may be used. Use of lower side band is prohibited.

(2) Only AM transmissions are permitted on frequencies 2003 kHz, 2182 kHz, and 2638 kHz. The selection of these channels will automatically select the AM mode of transmission.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE (or AUTO) Switch -- SELECT desired mode.
(3) ON-AUDIO Control -- ON (allow equipment to warm up for 5 minutes for sideband or one minute for AM operation and adjust audio to comfortable listening level).
(4) Channel Selector Control -- SELECT desired frequency.
(5) Mode Selector Control -- SELECT operating mode.
(6) Squelch Control -- ADJUST the audio gain counterclockwise for normal noise output, then slowly adjust clockwise until the receiver is silent.
(7) Clarifier Control -- ADJUST when upper single sideband RF signal is being received for maximum clarity.
(8) Mike Button:
  a. To Transmit -- DEPRESS and SPEAK into microphone.
  b. To Receive -- RELEASE.

NOTE

Voice communications are not available in the LSB mode.

NOTE

Lower sideband (LSB) mode is not legal in the U.S., Canada, and most other countries.

SECTION 5

PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 GLIDE SLOPE

(Type R-443B)

SECTION 1
GENERAL

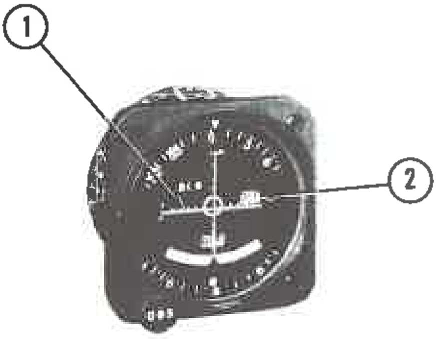
The Cessna 400 Glide Slope is an airborne navigation receiver which receives and interprets glide slope signals from a ground-based Instrument Landing System (ILS). It is used with the localizer function of a VHF navigation system when making instrument approaches to an airport. The glide slope provides vertical path guidance while the localizer provides horizontal track guidance.

The Cessna 400 Glide Slope system consists of a remote-mounted receiver coupled to an existing navigation system, a panel-mounted indicator and an externally-mounted antenna. The glide slope receiver is designed to receive ILS glide slope signals on any of 40 channels. The channels are spaced 150 kHz apart and cover a frequency range of 329.15 MHz through 335.0 MHz. When a localizer frequency is selected on the NAV receiver, the associated glide slope frequency is selected automatically.

Operation of the Cessna 400 Glide Slope system is controlled by the associated navigation system. The functions and indications of a typical 300 series glide slope indicator are pictured and described in Figure 1. For functions and indications of the optional 400 series indicator or HSI indicator, refer to the 400 NAV/COM (Type RT-428A) or HSI (Type IG-832A) write-ups if they are listed in this section as options.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the pilot should be aware that on many Cessna airplanes equipped with the windshield-mounted glide slope antenna, pilots should avoid use of 2700±100 RPM with a two-bladed propeller (or 1800±100 RPM with a three-bladed propeller) during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.



1. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from normal glide slope.

2. GLIDE SLOPE "OFF" FLAG - When visible, indicates unreliable glide slope signal or improperly operating equipment. The flag disappears when a reliable glide slope signal is being received.

CAUTION

Spurious glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope "OFF" flag to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope (ILS BC) is specified on the approach and landing chart.

Figure 1. Typical 300 Series VOR/LOC/ILS Indicator

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO RECEIVE GLIDE SLOPE SIGNALS:

(1) NAV Frequency Select Knobs -- SELECT desired localizer frequency (glide slope frequency is automatically selected).
(2) NAV/COM ID-T Switch -- SELECT ID position to disconnect filter from audio circuit.
(3) NAV VOL Control -- ADJUST to desired listening level to confirm proper localizer station.

CAUTION

When glide slope "OFF" flag is visible, glide slope indications are unusable.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.

SUPPLEMENT

CESSNA 400 ADF

(Type R-446A)

SECTION 1

GENERAL

The Cessna 400 ADF is an automatic direction finder set which provides continuous, visual bearing indications of the direction from which an RF signal is being received. It can be used for plotting position, for homing, and for aural reception of AM signals between 200 kHz and 1699 kHz. In addition, a crystal-controlled, beat frequency oscillator (BFO) permits coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.

The basic units of the Cessna 400 ADF are an R-446A Receiver with dual frequency selectors, a goniometer-indicator (IN-346A), and sense and loop antennas. The receiver and goniometer-indicator are panel-mounted units. The sense and loop antennas are mounted on the external airplane surfaces. Operating controls for the Cessna 400 ADF are mounted on the receiver front panel. The goniometer-indicator presents station bearing in degrees of azimuth. An automatic pointer-stow feature alerts the operator to non-ADF operation by slewing the pointer to the 3:00 o'clock position when the REC mode is selected.

The frequency range of the Cessna 400 ADF is electronically divided into three bands: 200-399 kHz, 400-799 kHz, and 800-1699 kHz. Frequency spacing within each band is in 1-kHz increments. The operating frequency and band are selected by a four-section Minilever switch which displays a digital readout of the frequency selected and supplies a binary code to control the logic circuits within the set. A secondary (standby) operating frequency is selected by another four-section Minilever switch. Frequency control of the ADF is switched to the primary or the secondary operating frequency by a toggle switch. The operating modes (ADF and REC) are selected by individual pushbutton switches. Additional pushbutton switches are used to select the BFO and to test signal reliability during ADF operation. Operating controls for the Cessna 400 ADF are shown and described in Figure 1.

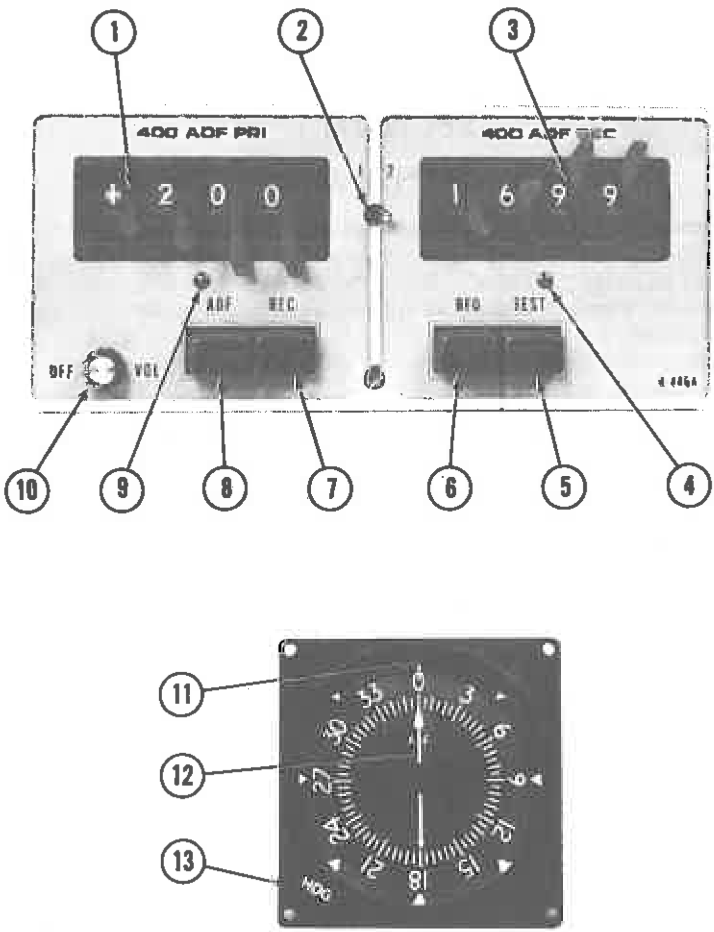


Figure 1. Cessna 400 ADF Operating Controls and Indicator
(Sheet 1 of 2)

1. PRI (PRIMARY FREQUENCY SELECTOR) - Selects and displays "primary" frequency.
2. 1-2 - The "1" position activates "primary" (PRI) frequency. The "2" position activates "secondary" (SEC) frequency.
3. SEC (SECONDARY FREQUENCY SELECTOR) - Selects and displays "secondary" frequency.
4. SECONDARY RESELECT LAMP - Lamp will flash only when "secondary" (SEC) frequency selection is outside of operating range of the receiver and 1-2 switch is in the "2" position.
5. TEST - Momentary-on switch used only with ADF function to test bearing reliability. When held depressed, slews indicator pointer; when released, if bearing is reliable, pointer returns to original position.
6. BFO - Pushed in: Activates beat frequency oscillator tone to permit coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.
7. REC - Pushed in: Selects receive mode (set operates as a standard communications receiver using sense antenna only).

NOTE

In this position an automatic pointer stow feature will alert the pilot to non-ADF operation by positioning and retaining the pointer at the 3:00 o'clock position when the 400 ADF is in the REC function.

8. ADF - Pushed in: Selects ADF mode (set operates as automatic direction finder using loop and sense antennas).
9. PRIMARY RESELECT LAMP - Lamp will flash only when "primary" (PRI) frequency selection is outside of operating range of the receiver and 1-2 switch is in the "1" position.
10. OFF-VOL - Turns set on or off and adjusts receiver volume.
11. INDEX - Fixed reference line for dial rotation adjustment.
12. POINTER - When HDG control is adjusted, indicates either relative, magnetic, or true bearings of a radio station.
13. HDG - Rotates dial to facilitate relative, magnetic, or true bearing information.

Figure 1. Cessna 400 ADF Operating Controls and Indicator
(Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO OPERATE AS A COMMUNICATIONS RECEIVER ONLY:

(1) OFF/VOL Control -- ON.
(2) REC Pushbutton -- PUSH in.

NOTE

ADF indicator pointer will stow at a 90-degree position to alert the pilot to non-ADF operation.

(3) PRI Frequency Selectors -- SELECT desired operating frequency.
(4) SEC Frequency Selectors -- SELECT desired operating frequency.
(5) 1-2 Selector Switch -- 1 position.

NOTE

1-2 selector switch can be placed in the 2 position for operation on secondary frequency. The re-select lamp will flash only when frequency selection is outside of operating range of the receiver.

(6) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.

(7) VOL Control -- ADJUST to desired listening level.

TO OPERATE AS AN AUTOMATIC DIRECTION FINDER:

(1) OFF/VOL Control -- ON.
(2) PRI Frequency Selectors -- SELECT desired operating frequency.
(3) SEC Frequency Selectors -- SELECT desired operating frequency.
(4) 1-2 Selector Switch -- 1 position.

NOTE

1-2 selector switch can be placed in the 2 position for operation on secondary frequency. The re-select lamp will flash only when frequency selection is outside of operating range of the receiver.

(5) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position as desired.
(6) ADF Pushbutton -- PUSH in and note relative bearing on ADF indicator.
(7) HDG Control -- SET goniometer-indicator dial so that index indicates 0°, magnetic, or true heading of airplane. Pointer then indicates relative, magnetic, or true bearing to station.
(8) VOL Control -- ADJUST to desired listening level.

NOTE

When switching stations, place function pushbutton in the REC position. Then, after station has been selected, place function pushbutton in the ADF position to resume automatic direction finder operation. (This practice prevents the bearing indicator from swinging back and forth as frequency dial is rotated.)

TO TEST RELIABILITY OF AUTOMATIC DIRECTION FINDER:

(1) ADF Pushbutton -- PUSH in and note relative bearing on indicator.
(2) TEST Pushbutton -- PUSH in and hold TEST button until indicator pointer slews off indicated bearing at least 10 to 20 degrees.
(3) TEST Pushbutton -- RELEASE and OBSERVE that indicator pointer returns to the same relative bearing as in step (1).

TO OPERATE BFO:

(1) OFF/VOL Control -- ON.

(2) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.
(3) BFO Pushbutton -- PUSH in.
(4) 1-2 Selector Switch -- SELECT 1 position to activate PRI frequency or 2 to activate SEC frequency that is transmitting keyed CW signals (Morse Code).
(5) VOL Control -- ADJUST to desired listening level.

NOTE

A 1000-Hz tone is heard in the audio output when CW signal (Morse Code) is tuned in properly.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 MARKER BEACON

(Type R-402A)

SECTION 1

GENERAL

The system consists of a 75 MHz marker beacon receiver, three indicator lights, one speaker/phone switch, a light dimming control, an ON/OFF/VOLUME control, and a 75 MHz marker beacon antenna. In addition, on 150, 182, 206, 207, 210 and 337 series models, a HI-LO sensitivity selector switch and a press-to-test button are provided. On all 172, 177, 177RG, 180 and 185 series models, a single, three position switch is provided for HI-LO sensitivity selection or test selection.

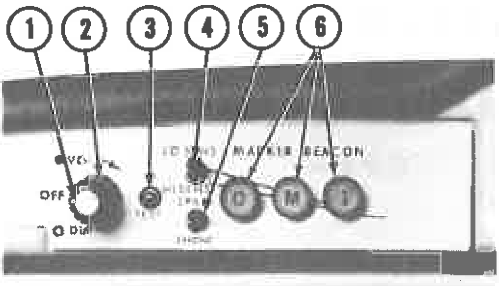
This system provides visual and aural indications of 75 MHz ILS marker beacon signals as the marker is passed. The following table lists the three most currently used marker facilities and their characteristics.

MARKER FACILITIES

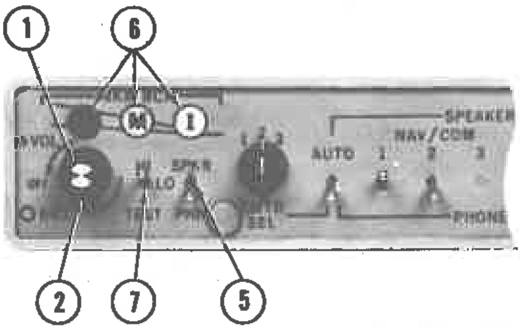
MARKER	IDENTIFYING TONE	LIGHT*
Inner	Continuous 6 dots/sec (3000 Hz)	White
Middle	Alternate dots and dashes (1300 Hz)	Amber
Outer	2 dashes/sec (400 Hz)	Blue

* When the identifying tone is keyed, the respective indicating light will blink accordingly.

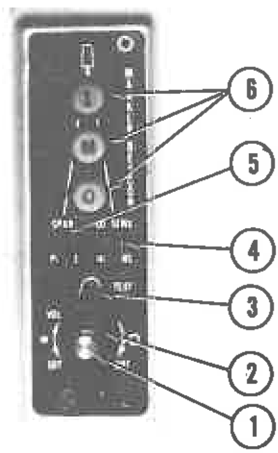
Operating controls and indicator lights are shown and described in Figure 1.



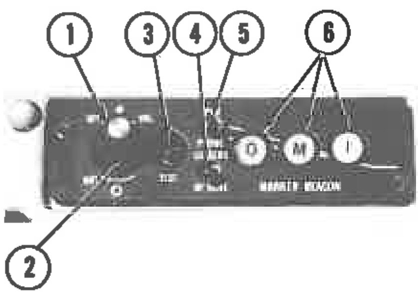
TYPICAL INSTALLATION
ON ALL 150 MODEL SERIES



TYPICAL INSTALLATION
ON ALL 172, 177, 177RG,
180 & 185 MODEL SERIES



TYPICAL INSTALLATION
ON ALL 182, 206, 207
& 210 MODEL SERIES



TYPICAL INSTALLATION
ON ALL 337 MODEL SERIES

Figure 1. Cessna 400 Marker Beacon Operating Controls
and Indicator Lights (Sheet 1 of 2)

1. OFF/VOLUME CONTROL - The small, inner control turns the set on or off and adjusts the audio listening level. Clockwise rotation turns the set on and increases the audio level.

2. DIM/BRT CONTROL - The large, outer control provides light dimming for the marker lights. Clockwise rotation increases light intensity.

3. TEST SWITCH - (150, 182, 206, 207, 210 & 337 Model Series Only) When the press-to-test switch button is depressed, the marker beacon lights will illuminate, indicating the lights are operational (the test position is a lamp test function only).

   NOTE

   Turn the set on, and rotate the DIM control clockwise (fully on) in order to view the marker beacon lights during test.

4. LO/HI SENS SWITCH - (150, 182, 206, 207, 210 & 337 Model Series Only) In the LO position (Up), receiver sensitivity is positioned for ILS approaches. In the HI position (Down), receiver sensitivity is positioned for airway flying.

5. SPEAKER/PHONE SWITCH - Selects speaker or phone for aural reception.

6. MARKER BEACON INDICATOR LIGHTS - Indicates passage of outer, middle and inner marker beacons. The OUTER light is blue, the MIDDLE light is amber and the INNER light is white.

7. HI/LO/TEST SWITCH - (172, 177, 177RG, 180 & 185 Model Series Only) In the HI position (Up), receiver sensitivity is positioned for airway flying. In the LO position (Center), receiver sensitivity is positioned for ILS approaches. In the TEST position (Down), the marker lights will illuminate, indicating the lights are operational (the test position is a lamp test function only).

   NOTE

   Turn the set on, and rotate the BRIGHT control clockwise (fully on) in order to view the marker beacon lights during test. The TEST position on the switch is spring loaded to return the switch to the LO SENS position when TEST position is released.

Figure 1. Cessna 400 Marker Beacon Operating Controls and Indicator Lights (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO OPERATE:

(1) OFF/VOL Control -- VOL position and adjust to desired listening level.
(2) LO/HI SENS Switch -- SELECT HI position for airway flying or LO position for ILS approaches.
(3) SPKR/PHONE Switch -- SELECT speaker or phone audio.
(4) TEST Switch -- PRESS and ensure that marker beacon indicator lights are operative.

NOTE

Ensure that BRT control is on enough to view the marker beacon during this test.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 TRANSPONDER

(Type RT-459A)

AND

OPTIONAL ENCODING ALTIMETER

(Type EA-401A)

SECTION 1

GENERAL

The Cessna 400 Transponder (Type 459A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radar scope more readily.

The 400 Transponder consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogating pulse signals on 1030 MHz and transmits coded pulse-train reply signals on 1090 MHz. It is capable of replying to Mode A (aircraft identification) and Mode C (altitude reporting) interrogations on a selective reply basis on any of 4,096 information code selections. When an optional panel mounted EA-401A Encoding Altimeter (not part of 400 Transponder System) is included in the avionic configuration, the transponder can provide altitude reporting in 100-foot increments between -1000 and +35,000 feet.

All Cessna 400 Transponder operating controls, with the exception of the optional altitude encoder's altimeter setting knob, are located on the front panel of the unit. The altimeter setting knob is located on the encoding altimeter. Functions of the operating controls are described in Figure 1.

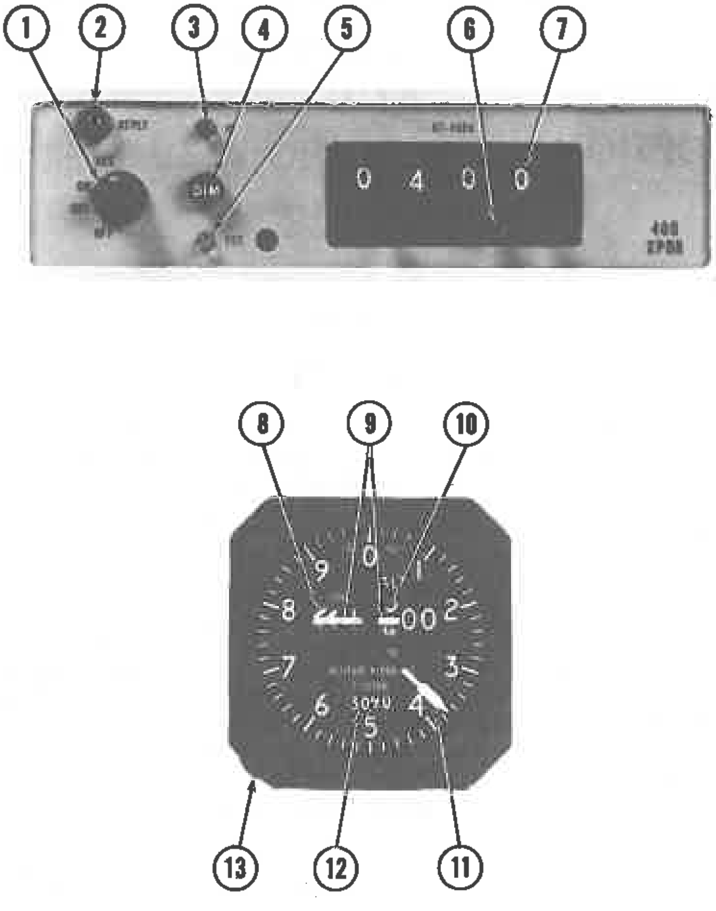


Figure 1. Cessna 400 Transponder and Encoding Altimeter
Operating Controls (Sheet 1 of 2)

1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode as follows:
   - OFF - Turns set off.
   - SBY - Turns set on for equipment warm-up or standby power.
   - ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   - ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.
2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply Lamp will also glow steadily during initial warm-up period.)
3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply Lamp will glow steadily during duration of IDENT pulse transmission.)
4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of Reply Lamp.
5. SELF-TEST (TST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply Lamp will glow steadily to verify self test operation.)
6. REPLY-CODE SELECTOR SWITCHES (4) - Select assigned Mode A Reply Code.
7. REPLY-CODE INDICATORS (4) - Display selected Mode A Reply Code.
8. 1000-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 1000-foot increments between -1000 feet and +35,000 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in the 10,000-foot window.
9. OFF INDICATOR WARNING FLAG - Flag appears across altitude readout when power is removed from altimeter to indicate that readout is not reliable.
10. 100-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 100-foot increments between 0 feet and 1000 feet.
11. 20-FOOT INDICATOR NEEDLE - Indicates altitude in 20-foot increments between 0 feet and 1000 feet.
12. ALTIMETER SETTING SCALE - DRUM TYPE - Indicates selected altimeter setting in the range of 28.1 to 30.99 inches of mercury on the standard altimeter or 946 to 1049 millibars on the optional altimeter.
13. ALTIMETER SETTING KNOB - Dials in desired altimeter setting in the range of 28.1 to 30.99 inches of mercury on standard altimeter or 946 to 1049 millibars on the optional altimeter.

Figure 1. Cessna 400 Transponder and Encoding Altimeter Operating Controls (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Off Indicator Warning Flag -- VERIFY that flag is out of view on encoding altimeter.

(2) Reply-Code Selector Switches -- SELECT assigned code.
(3) Function Switch -- ON.
(4) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, REPLY lamp flashes indicating transponder replies to interrogations.

(5) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (REPLY lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Off Indicator Warning Flag -- VERIFY that flag is out of view on encoding altimeter.
(2) Altitude Encoder Altimeter Setting Knob - SET IN assigned local altimeter setting.
(3) Reply-Code Selector Switches -- SELECT assigned code.
(4) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the encoding altimeter.

(5) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.

(2) Function Switch -- ON or ALT.
(3) TST Button -- DEPRESS and HOLD (Reply lamp should light with full brilliance regardless of DIM control setting).
(4) TST Button -- Release for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 TRANSPONDER

(Type RT-459A)

AND

OPTIONAL ALTITUDE ENCODER (BLIND)

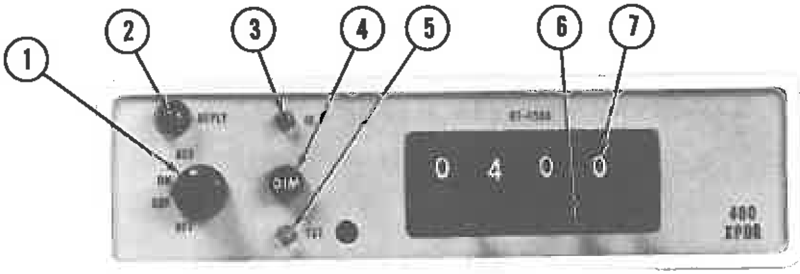
SECTION 1

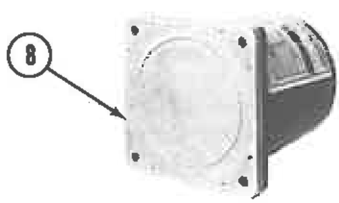
GENERAL

The Cessna 400 Transponder (Type RT-459A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radarscope more readily.

The Cessna 400 Transponder system consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogating pulse signals on 1030 MHz and transmits pulse-train reply signals on 1090 MHz. The transponder is capable of replying to Mode A (aircraft identification) and also to Mode C (altitude reporting) when coupled to an optional altitude encoder system. The transponder is capable of replying on both modes of interrogation on a selective reply basis on any of 4,096 information code selections. The optional altitude encoder system (not part of a standard 400 Transponder system) required for Mode C (altitude reporting) operation, consists of a completely independent remote-mounted digitizer that is connected to the static system and supplies encoded altitude information to the transponder. When the altitude encoder system is coupled to the 400 Transponder system, altitude reporting capabilities are available in 100-foot increments between -1000 feet and the airplane's maximum service ceiling.

All Cessna 400 Transponder operating controls are located on the front panel of the unit. Functions of the operating controls are described in Figure 1.





1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode as follows:

   OFF - Turns set off.
   SBY - Turns set on for equipment warm-up or standby power.
   ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply lamp will also glow steadily during initial warm-up period.)

Figure 1. Cessna 400 Transponder and Altitude Encoder (Blind) (Sheet 1 of 2)

3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply lamp will glow steadily during duration of IDENT pulse transmission.)

4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.

5. SELF-TEST (TST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply lamp will glow steadily to verify self-test operation.)

6. REPLY-CODE SELECTOR SWITCHES (4) - Select assigned Mode A reply code.

7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.

8. REMOTE-MOUNTED DIGITIZER - Provides an altitude reporting code range of -1000 feet up to the airplane's maximum service ceiling.

Figure 1. Cessna 400 Transponder and Altitude Encoder (Blind) (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, a placard labeled "ALTITUDE ENCODER EQUIPPED" must be installed near the altimeter.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Reply-Code Selector Switches -- SELECT assigned code.

(2) Function Switch -- ON.
(3) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, reply lamp flashes indicating transponder replies to interrogations.

(4) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (reply lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Reply-Code Selector Switches -- SELECT assigned code.
(2) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the aircraft altimeter.

(3) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.
(2) Function Switch -- ON.
(3) TST Button -- DEPRESS (reply lamp should light brightly regardless of DIM control setting).
(4) TST Button -- RELEASE for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA NAVOMATIC 200A AUTOPILOT

(Type AF-295B)

SECTION 1
GENERAL

The Cessna 200A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, an aileron actuator, and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light.

Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude.

The 200A Navomatic will also capture and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 200A Navomatic are located on the front panel of the computer-amplifier, shown in Figure 1. The primary function pushbuttons (DIR HOLD, NAV CAPT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the following autopilot limitation should be adhered to during airplane operation:

BEFORE TAKE-OFF AND LANDING:

(1) A/P ON-OFF Switch -- OFF.

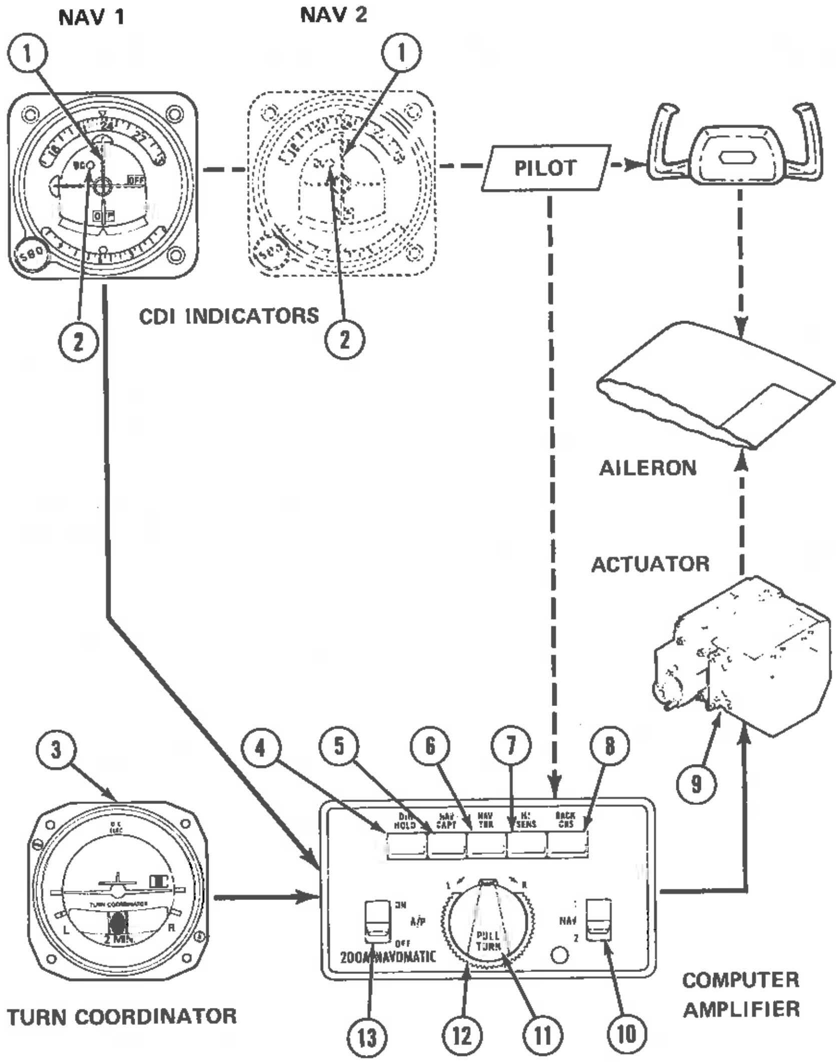


Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

1. COURSE DEVIATION INDICATOR - Provides VOR/LOC navigation inputs to autopilot for intercept and tracking modes.

2. LOCALIZER REVERSED INDICATOR LIGHT - Amber light, labeled BC, illuminates when BACK CRS button is pushed in (engaged) and LOC frequency selected. BC light indicates course indicator needle is reversed on selected receiver (when tuned to a localizer frequency). This light is located within the CDI indicator.

3. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.

4. DIR HOLD PUSHBUTTON - Selects direction hold mode. Airplane holds direction it is flying at time button is pushed.

5. NAV CAPT PUSHBUTTON - Selects NAV capture mode. When parallel to desired course, airplane will turn to and capture selected VOR or LOC course.

6. NAV TRK PUSHBUTTON - Selects NAV track mode. Airplane tracks selected VOR or LOC course.

7. HI SENS PUSHBUTTON - During NAV CAPT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low sensitivity position (pushbutton out), response to NAV signal is dampened for smoother tracking of enroute VOR radials; it also smooths out effect of course scalloping during NAV operation.

8. BACK CRS PUSHBUTTON - Used with LOC operation only. With A/P switch OFF or ON, and when navigation receiver selected by NAV switch is set to a localizer frequency, it reverses normal localizer needle indication (CDI) and causes localizer reversed (BC) light to illuminate. With A/P switch ON, reverses localizer signal to autopilot.

9. ACTUATOR - The torque motor in the actuator causes the ailerons to move in the commanded direction.

10. NAV SWITCH - Selects NAV 1 or NAV 2 navigation receiver.

11. PULL TURN KNOB - When pulled out and centered in detent, airplane will fly wings-level; when turned to the right (R), the airplane will execute a right, standard rate turn; when turned to the left (L), the airplane will execute a left, standard rate turn. When centered in detent and pushed in, the operating mode selected by a pushbutton is engaged.

12. TRIM - Used to trim autopilot to compensate for minor variations in aircraft trim or weight distribution. (For proper operation, the aircraft's rudder trim (if so equipped) must be manually trimmed before the autopilot is engaged.)

13. A/P Switch - Turns autopilot ON or OFF.

Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators (Sheet 2 of 2)

SECTION 3
EMERGENCY PROCEDURES

TO OVERRIDE THE AUTOPILOT:

(1) Airplane control Wheel -- ROTATE as required to override autopilot.

NOTE

The servo may be overpowered at anytime without damage.

TO TURN OFF AUTOPILOT:

(1) A/P ON-OFF Switch -- OFF.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKE-OFF AND LANDING:

(1) A/P ON-OFF Switch -- OFF.
(2) BACK CRS Button -- OFF (see Caution note under Nav Capture).

NOTE

Periodically verify operation of amber warning light(s), labeled BC on CDI(s), by engaging BACK CRS button with a LOC frequency selected.

INFLIGHT WINGS LEVELING:

(1) Airplane Trim -- ADJUST.
(2) PULL-TURN Knob -- CENTER and PULL out.
(3) A/P ON-OFF Switch -- ON
(4) Autopilot TRIM Control -- ADJUST for zero turn rate.

COMMAND TURNS:

(1) PULL-TURN Knob -- CENTER, PULL out and ROTATE.

DIRECTION HOLD:

(1) PULL-TURN Knob -- CENTER and PULL out.
(2) Turn Coordinator -- WINGS LEVEL INDICATION.
(3) DIR HOLD Button -- PUSH.
(4) PULL-TURN Knob -- PUSH in detent position.
(5) Autopilot TRIM Control -- READJUST to minimize heading drift.

NAV CAPTURE (VOR/LOC):

(1) PULL-TURN Knob -- CENTER and PULL out.
(2) NAV 1-2 Selector Switch -- SELECT desired VOR receiver.
(3) Nav Receiver OBS -- SET desired VOR course (if tracking omni).
(4) NAV CAPT Button -- PUSH.
(5) HI SENS Button -- PUSH for localizer and "close-in" omni intercepts.
(6) BACK CRS Button -- PUSH only if intercepting localizer front course outbound or back course inbound.

CAUTION

With BACK CRS button pushed in and localizer frequency selected, the CDI on selected nav radio will be reversed <u>even when the autopilot switch is OFF.</u>

(7) PULL-TURN Knob -- Turn airplane parallel to desired course.

NOTE

Airplane must be turned until heading is within ±5° of desired course.

(8) PULL TURN Knob -- CENTER and PUSH in. The airplane should then turn toward desired course at 45° ±10° intercept angle (if the CDI needle is in full deflection).

NOTE

If more than 15 miles from the station or more than 3 minutes from intercept, use a manual intercept procedure.

NAV TRACKING (VOR/LOC):

(1) NAV TRK Button -- PUSH when CDI centers and airplane is within ±5° of course heading.
(2) HI SENS BUTTON -- DISENGAGE for enroute omni tracking (leave ENGAGED for localizer).
(3) Autopilot TRIM Control -- READJUST as required to maintain track.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.

SUPPLEMENT

CESSNA NAVOMATIC 300A AUTOPILOT
(Type AF-395A)

SECTION 1
GENERAL

The Cessna 300A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, a directional gyro, an aileron actuator and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light.

Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. Deviations from the selected heading are sensed by the directional gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude or heading.

The 300A Navomatic will also intercept and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 300A Navomatic are located on the front panel of the computer-amplifier and on the directional gyro, shown in Figure 1. The primary function pushbuttons (HDG SEL, NAV INT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equip-

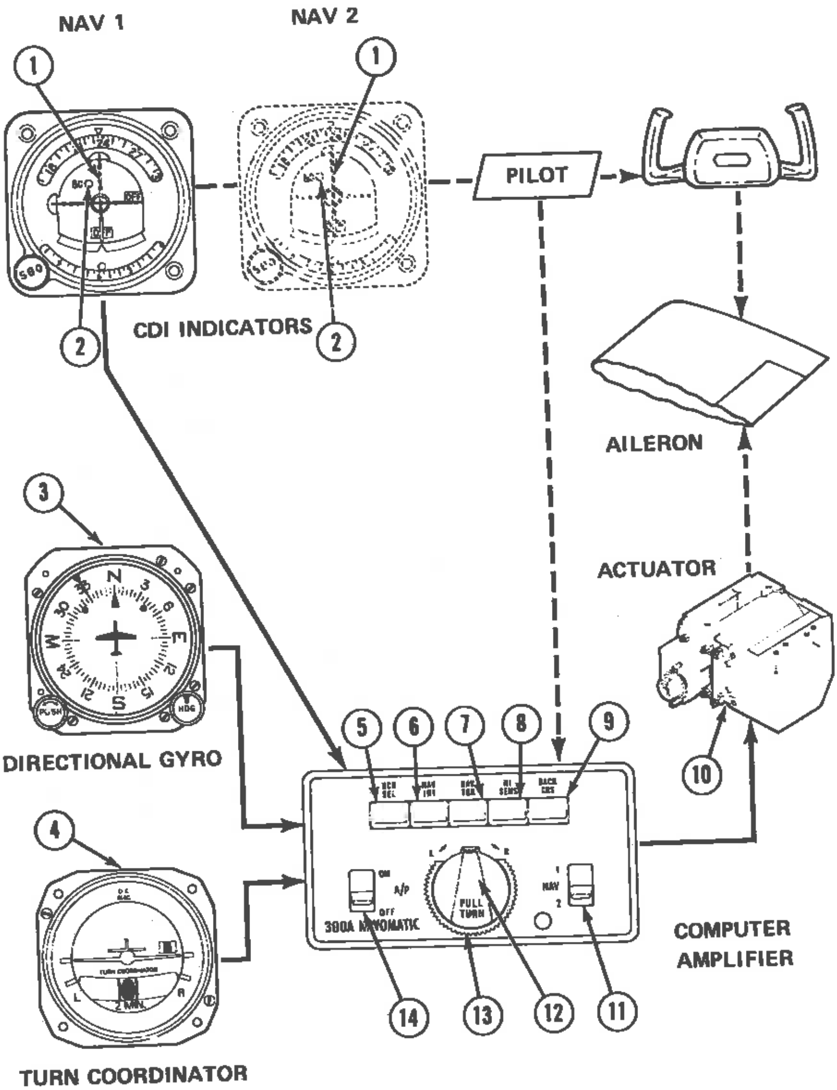


Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

1. COURSE DEVIATION INDICATOR - Provides VOR/LOC navigation inputs to autopilot for intercept and tracking modes.

2. LOCALIZER REVERSED INDICATOR LIGHT - Amber light, labeled BC, illuminates when BACK CRS button is pushed in (engaged) and LOC frequency selected. BC light indicates course indicator needle is reversed on selected receiver (when tuned to a localizer frequency). This light is located within the CDI indicator.

3. DIRECTIONAL GYRO INDICATOR - Provides heading information to the autopilot for heading intercept and hold. Heading bug on indicator is used to select desired heading or VOR/LOC course to be flown.

4. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.

5. HDG SEL PUSHBUTTON - Aircraft will turn to and hold heading selected by the heading "bug" on the directional gyro.

6. NAV INT PUSHBUTTON - When heading "bug" on DG is set to selected course, aircraft will turn to and intercept selected VOR or LOC course.

7. NAV TRK PUSHBUTTON - When heading "bug" on DG is set to selected course, aircraft will track selected VOR or LOC course.

8. HI SENS PUSHBUTTON - During NAV INT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low-sensitivity position (pushbutton out), response to NAV signal is dampened for smoother tracking of enroute VOR radials; it also smooths out effect of course scalloping during NAV operation.

9. BACK CRS PUSHBUTTON - Used with LOC operation only. With A/P switch OFF or ON, and when navigation receiver selected by NAV switch is set to a localizer frequency, it reverses normal localizer needle indication (CDI) and causes localizer reversed (BC) light to illuminate. With A/P switch ON, reverses localizer signal to autopilot.

10. ACTUATOR - The torque motor in the actuator causes the ailerons to move in the commanded direction.

11. NAV SWITCH - Selects NAV 1 or NAV 2 navigation receiver.

12. PULL TURN KNOB - When pulled out and centered in detent, airplane will fly wings-level; when turned to the right (R), the airplane will execute a right, standard rate turn; when turned to the left (L), the airplane will execute a left, standard rate turn. When centered in detent and pushed in, the operating mode selected by a pushbutton is engaged.

13. TRIM - Used to trim autopilot to compensate for minor variations in aircraft trim or lateral weight distribution. (For proper operation, the aircraft's rudder trim (if so equipped) must be manually trimmed before the autopilot is engaged.)

14. A/P SWITCH - Turns autopilot ON or OFF.

Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators
(Sheet 2 of 2)

ment is installed. However, the following autopilot limitation should be adhered to during airplane operation:

BEFORE TAKE-OFF AND LANDING:

(1) A/P ON-OFF Switch -- OFF.

SECTION 3
EMERGENCY PROCEDURES

TO OVERRIDE THE AUTOPILOT:

(1) Airplane Control Wheel -- ROTATE as required to override autopilot.

NOTE

The servo may be overpowered at any time without damage.

TO TURN OFF AUTOPILOT:

(1) A/P ON-OFF Switch -- OFF.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKE-OFF AND LANDING:

(1) A/P ON-OFF Switch -- OFF.
(2) BACK CRS Button -- OFF (see caution note under Nav Intercept).

NOTE

Periodically verify operation of amber warning light(s), labeled BC on CDI(s), by engaging BACK CRS button with a LOC frequency selected.

INFLIGHT WINGS LEVELING:

(1) Airplane Trim -- ADJUST.

(2) PULL-TURN Knob -- CENTER and PULL out.
(3) A/P ON-OFF Switch -- ON.
(4) Autopilot TRIM Control -- ADJUST for zero turn rate.

COMMAND TURNS:

(1) PULL-TURN Knob -- CENTER, PULL out and ROTATE.

HEADING SELECT:

(1) Directional Gyro -- SET to airplane magnetic heading.
(2) Heading Selector Knob -- ROTATE bug to desired heading.
(3) Heading Select Button -- PUSH.
(4) PULL-TURN Knob -- CENTER and PUSH.

NOTE

Airplane will turn automatically to selected heading: If airplane fails to hold the precise heading, readjust autopilot lateral TRIM knob as required or disengage autopilot and reset manual rudder trim (if installed).

NAV INTERCEPT (VOR/LOC):

(1) PULL-TURN Knob -- CENTER and PULL out.
(2) NAV 1-2 Selector Switch -- SELECT desired receiver.
(3) Nav Receiver OBS -- SET desired VOR course (if tracking omni).
(4) Heading Selector Knob -- ROTATE bug to selected course (VOR or localizer - inbound or outbound as appropriate).
(5) Directional Gyro -- SET for magnetic heading.
(6) NAV INT Button -- PUSH.
(7) HI SENS Button -- PUSH for localizer and "close-in" omni intercepts.
(8) BACK CRS Button -- PUSH only if intercepting localizer front course outbound or back course inbound.

CAUTION

With BACK CRS button pushed in and localizer frequency selected, the CDI on selected nav radio will be reversed <u>even when the autopilot switch is OFF</u>.

(9) PULL-TURN Knob -- PUSH.

NOTE

Airplane will automatically turn to a 45° intercept angle.

NAV TRACKING (VOR/LOC):

(1) NAV TRK Button -- PUSH when CDI centers (within one dot) and airplane is within ±10° of course heading.
(2) HI SENS Button -- Disengage for enroute omni tracking (leave engaged for localizer).

NOTE

If CDI remains steadily off center, readjust autopilot lateral trim control as required.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.

S-TEC CORPORATION
MINERAL WELLS, TEXAS 76067

FAA/DAS APPROVED
SUPPLEMENTAL FLIGHT MANUAL
FOR
Cessna models 182P;
and 182Q, S/N 18266590 and below
WITH
S-TEC SYSTEM 55/55X TWO AXIS
AUTOMATIC FLIGHT GUIDANCE SYSTEM
(14 Volt System)

REG. NO. 7356C

SER. NO. 18265404

The information in this manual is FAA Approved material which along with other approved documents is applicable to the operation of the airplane when modified by the installation of S-TEC System 55/55X Autopilot Model ST-587 installed in accordance with STC SA09007AC-D.

SECTION I

GENERAL

This manual is to acquaint the pilot with the features and functions of the System 55/55X Two Axis Autopilot 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 autopilot is in use.

FAA/DAS APPROVED ____________
Walter F. Davis

S-TEC CORPORATION
DAS 5 SW
P/N: 8911?1
DATE: 6-01-95

S-TEC CORPORATION
MINERAL WELLS, TEXAS 76067

FAA/DAS APPROVED
SUPPLEMENTAL FLIGHT MANUAL
FOR
Cessna models 182P;
and 182Q, S/N 18266590 and below

LOG OF REVISIONS				
REV. NO.	PAGES AFFECTED	DESCRIPTION	APPROVED	DATE
1	All	Added System 55X information. Removed Optional Equipment section. Updated supplement to latest format.	WFD	2-15-01

FAA/DAS APPROVED
SUPPLEMENTAL FLIGHT MANUAL
FOR
Cessna models 182P;
and 182Q, S/N 18266590 and below

SECTION II

OPERATING LIMITATIONS

1. S-TEC System 55 Pilot's Operating Handbook, P/N 8747, dated 10-16-00 or later, or S-TEC System 55X Pilot's Operating Handbook, P/N 87109, dated 11-08-00 or later, (as appropriate for your aircraft) must be carried in the aircraft and be available to the pilot while in flight.
2. Autopilot operation not authorized above 150 KIAS (173 MPH IAS).
3. Flap extension limited to 10° and 95 KIAS (109 MPH IAS) or below, when optional autotrim system is not installed.
4. Flap extension limited to 20° when optional autotrim system is installed and operating.
5. Go-arounds or missed approach maneuvers not authorized.
6. Maximum aft c.g. limited to 46.0 inches aft of datum when autopilot is installed.
7. Placard, P/N 5660, with c.g. limitation, to be located on instrument panel in clear view of pilot.
8. Autopilot use prohibited during take-off and landing.
9. Category I operations only.

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.
   c. Momentarily interrupting aircraft electrical power at the battery master switch.
   d. Pulling the autopilot circuit breaker.

2. Trim: (IF INSTALLED)

   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.

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	45°/-250'
Cruise	45°/-420'
Descent	35°/-580'

   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	12°/-150'
Approach (Coupled or Uncoupled)	12°/-100'

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 55/55X Pilot's Operating Handbook, P/N 8747, dated 10-16-00 or later, or S-TEC System 55X Pilot's Operating Handbook, P/N 87109, dated 11-08-00 or later, (as appropriate for your aircraft).

CAUTION: When S-TEC Flight Director is installed and operating, the Flight Director Autopilot should be disconnected using the control wheel disconnect switch only. Any other means of disconnect (breaker, ON-OFF switch, etc.) may leave steering bars in view, but inoperable.

S-TEC CORPORATION
MINERAL WELLS, TEXAS 76067

FAA/DAS APPROVED
SUPPLEMENTAL FLIGHT MANUAL
FOR
Cessna models 182P;
and 182Q, S/N 18266590 and below

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 down 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.
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° (See Limitations Section) and with the aircraft stabilized in altitude hold mode. At the glide slope intercept, 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.

SECTION V

PERFORMANCE

The text of this Section not affected by installation of this equipment.

SECTION VI

WEIGHT AND BALANCE

See Section II, Items 6 and 7 for weight and balance limitations.

SECTION VII

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

The text of this Section not affected by installation of this equipment.

SECTION VIII

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

The text of this Section not affected by installation of this equipment.

SECTION IX

SUPPLEMENTS

Refer to contents of this supplement for operation of the System 55/55X Automatic Flight Control System.

SECTION X

OPERATING TIPS

The text of this Section not affected by installation of this equipment.

SECTION VI.

APPENDIX

Carolina Avionics
3650 Airport Loop Road
Salisbury, N.C. 28147
R/S QCCR-389K

FAA Approved

SUPPLEMENTAL FLIGHT MANUAL
FOR
CESSNA MODELS 182P AND 182Q S/N 18266590 AND BELOW
WITH
S-TEC SYSTEM 55 TWO AXIS
AUTOMATIC FLIGHT GUIDANCE SYSTEM
(14 VOLT SYSTEM)

REG. NO. N735GC

SER. NO. 18265404

The information in this manual is FAA Approved material which along with other approved documents is applicable to the operation of the airplane when modified by the installation of S-TEC System 55 Autopilot Model ST-587 installed in accordance with STC SA09007AC-D.

SECTION I

GENERAL

This manual is to acquaint the pilot with the features and functions of the System 55 Two Axis Autopilot 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 autopilot is in use.

FAA Approved

SUPPLEMENTAL ~~FLIGHT~~ MANUAL
FOR
CESSNA MODELS 182P AND 182Q S/N 18266590 AND BELOW

LOG OF REVISIONS

REV. NO.	PAGES AFFECTED	DESCRIPTION	APPROVED	DATE

FAA Approved

SUPPLEMENTAL FLIGHT MANUAL
FOR
CESSNA MODELS 182P AND 182Q S/N 18266590 AND BELOW

SECTION II

OPERATING LIMITATIONS

1. Autopilot operation not authorized above 150 KIAS (173 MPH IAS).
2. Flap extension limited to 10° and 95 KIAS (109 MPH IAS) or below, when optional autotrim system is not installed.
3. Flap extension limited to 20° maximum and 10° between 140 KIAS and 95 KIAS, when optional autotrim system is installed and operating.
4. Go-arounds or missed approach maneuvers not authorized.
5. Maximum aft c.g. limited to 46.0 inches aft of datum when autopilot is installed.
6. Placard, P/N 5660, with c.g. limitation, to be located on instrument panel in clear view of pilot.
7. Autopilot use prohibited during take-off and landing.
8. Category I operations only.

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.
    c. Momentarily interrupting aircraft electrical power at the battery master switch.
    d. Pulling the autopilot circuit breaker.

2. Trim: (IF INSTALLED)

   a. In the event of a trim failure, manually control aircraft anc DEPRESS AND HOLD "Trim Interrupt/AP Disconnect Switch" o control wheel.
   b. Place trim master switch in "OFF" position, pull circui breaker, release interrupt switch.
   c. Retrim aircraft. Leave trim system OFF until corrected.

3. Altitude loss during a malfunction and recovery:

   a. The following altitude losses and bank angles were recorde after a malfunction with a 3 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Climb	45°/-250'
Cruise	45°/-420'
Descent	35°/-580'

   b. The following altitude losses and bank angles were recorde after a malfunction with a 1 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Maneuvering	12°/-150'
Approach (Coupled or Uncoupled)	12°/-100'

The above values are the worst case for all the models covered by thi 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' Operating Handbook, P/N 8747, dated 9-93.

ELECTRIC TRIM SYSTEM (IF INSTALLED)

The S-TEC Electric Trim System is designed to accept any singl failure, either mechanical or electrical, without uncontrolle operation resulting during operations in the Manual Electric Trim Mode During autotrim mode the system is designed to limit the effect of an failure causing trim operation. In order to assure proper operatio of these safeguards, it is necessary to conduct a simple pre-fligh test of the system. Following is the trim pre-flight test procedure:

[redacted]

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 down 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.
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° (See Limitations Section) and with the aircraft stabilized in altitude hold mode. At the glide slope intercept, 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.

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 <u>before</u> simultaneously pressing <u>ALT</u> and <u>VS</u> 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 command until capturing the desired altitude.**

[redacted]

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.

SECTION VII

WEIGHT AND BALANCE

See Section II, Items 5 and 6, for weight and balance limitations.

[redacted]

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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

Cessna 182Q
Make and Model Airplane

Registration Number: N735GC Serial Number: 18265404

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.

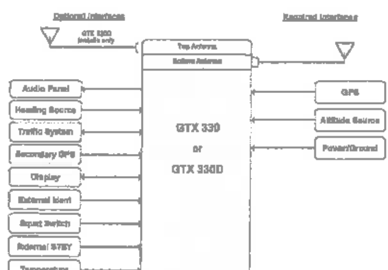

Figure 1 – GTX 330 or GTX 33D Interface Summary

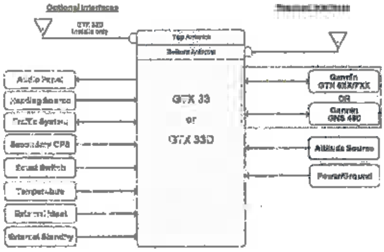

Figure 2 – GTX 33 or GTX 33D Interface Summary

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
  - o 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.

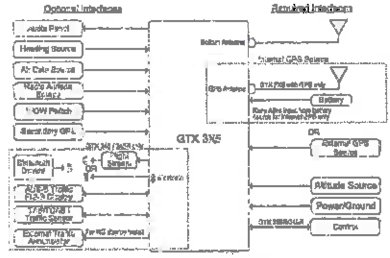

Figure 3 – GTX 3X5 Interface Summary

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
  - o 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	Transponder #2 (if installed)
☐ GTX 330	☐ GTX 330
☐ GTX 330D	☐ GTX 330D
☐ GTX 33	☐ GTX 33
☐ GTX 33D	☐ GTX 33D
☐ GTX 335	☐ GTX 335
☐ GTX 335R	☐ GTX 335R
☐ GTX 345	☐ GTX 345
☐ GTX 345R	☐ GTX 345R

Interfaced GPS/SBAS Position Source(s):

GPS #1	GPS #2 (if installed)
☐ Internal	☐ Internal
☐ GTN 6XX/7XX Series	☐ GTN 6XX/7XX Series
☐ GNS 400W/500W Series	☐ GNS 400W/500W Series
☐ GNS 480	☐ GNS 480
☐ GIA 63	☐ GIA 63
☐ GDL 88 (GTX 330 only)	☐ GDL 88 (GTX 330 only)

Interfaced Pressure Altitude Source:

Pressure Altitude Source #1	Pressure Altitude Source #2 (if installed)
☐ ______________	☐ ______________
☐ Garmin Altitude Encoder	☐ Garmin Altitude Encoder

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".

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.

No 11

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 sta[rt] for the GTX 330 and GTX 3X5 panel mounted units, and the External LRU 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 A[ir] Traffic Control while operating within airspace requiring an ADS-B Out compliant transmitter per 14 CFR 91.227. PABI is enabled by selecting the C[...] 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 produc[ts] 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 dela[ys] inherent in gathering and processing weather data for datalink transmission, th[e] weather information shown by the datalink weather product may be significan[tly] 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 device[s].

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**

NO 15

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	190-00207-00	Rev. G (or later)
GTX 3X5 Pilot's Guide	190-01499-00	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 GDL 88/1060 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.

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FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System
as installed in

CESSNA 182Q
Make and Model Airplane

Registration Number: N735GC Serial Number: 18265404

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02019SE-D for the installation and operation of the Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved by: [signature]

Michael Warren
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 16-SEP-2016

LOG OF REVISIONS

Revision Number	Page Date	Page Number	Description	FAA Approved
1	03/18/11	All	Complete Supplement	Robert Grove ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 03/18/2011
2	12/18/12		See Revision 3	Michael Warren ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 12/18/2012
3	03/26/13		See Revision 4	Michael Warren ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 04/12/2013
4	11/24/14	7 11 16 18 20 20 & 21 26 27 32 34	Table 1 • Added new functions Section 1.4 • New section Section 2.7 • Modified limitation Section 2.12 • Added wire obstacles Section 2.21 • Modified limitation Section 2.22 & 2.23 • Added limitations Section 3.2.10 • Added Flight Stream 210 to procedure Section 4.1 • Removed telephone audio deactivation procedure Section 7.5 • Added wire obstacles Section 7.9 • Added Flight Stream 210	Michael Warren ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 11/25/2014

LOG OF REVISIONS

Revision Number	Page Date	Page Number	Description	FAA Approved
		34 37	Section 7.10 • Added wire obstacles Section 7.17 • Added section	
5	02/25/16	All	All Sections • Reformatted and updated sections to better coincide with the VFR AFMS. Section 2 • Added RF leg description and limitations • Added QFE limitations • Added Autopilot limitations • Added polar operation limitation • Added text regarding new data fields in the GTN • Added Fuel Range Ring description and limitations • Added Flight Stream 210 limitation Section 4 • Added autopilot capability assessment regarding RF legs • Updated installer descriptions of configuration checkboxes • Added Search and Rescue autopilot note • Added RNP 1.0 installation options Section 7 • Added GMA 35c information • Removed references to GDL 88 and replaced with generic ADS-B	Michael Warren ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 02/25/2016

LOG OF REVISIONS

Revision Number	Page Date	Page Number	Description	FAA Approved
			• Added GWX 70 turbulence detection note • Added GTN crossfill information	
6	09/09/16	1 5 6-8 9 12 12 12 16 18 22 23 27 29	Table 1 • Added Flight Stream 510 data Section 1.2 • Removed text Section 1.5 • Added definitions Section 2.1 • Updated CRG Revisions Table 3 • Added Flight Stream 510 line Section 2.7 • MMC additions Section 2.8 • Added reference to section 2.29 Section 2.28 • Fixed error Sections 2.29-2.31 • New Sections Section 3.2.8 • Reworded and added additional text Sections 3.2.9-3.2.13 • New Sections • Renumbered sections Section 4.7 • New section Section 7.1 • New revision numbers	See Page i

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
		32	Section 7.9 • Added Flight Stream 510	
		33	Section 7.10 • Reworded	
		34	Table 6 • Added PTC	
		38	Section 7.19 • Flight Stream 510 control added	
		41-42	Sections 7.25-7.26 • New sections	

Table of Contents

Section 1. General

1.1 Garmin GTN Navigators

The Garmin GTN navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146c GTN 625, 635, 650, 725, or 750 navigator(s) and one or more Garmin approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

	GTN625	GTN635	GTN650	GTN725	GTN750
GPS/SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)	X	X	X	X	X
VHF Com Radio, 118.000 to 136.990 MHz, 8.33 or 25 kHz increments		X	X		X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		X
Moving map including topographic, terrain, obstacle, and geopolitical data	X	X	X	X	X
Display of datalink weather products, SiriusXM, FIS-B, Connext (all optional)	X	X	X	X	X
Control and display of airborne weather radar (optional)				X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data, including ADS-B (optional)	X	X	X	X	X
Display of StormScope® data (optional)	X	X	X	X	X
Display of marker beacon annunciations (optional)	X*	X*	X*	X	X
Remote audio panel control (optional)				X	X
Remote transponder control (optional)	X	X	X	X	X
Remote audio entertainment datalink control (optional)	X	X	X	X	X
TSO-C151c Class B TAWS (optional)	X	X	X	X	X
Supplemental calculators and timers	X	X	X	X	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X	X	X	X	X
Control of Flight Stream 210 (optional)	X	X	X	X	X
Control of Flight Stream 510 (optional)	X	X	X	X	X

* Display of marker beacon annunciations on the GTN 6XX is only possible when installed with a Garmin GMA 35c audio panel

Table 1 – GTN Functions

The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

Figure 1 - GTN 750 Control and Display Layout

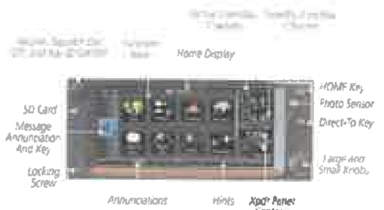

Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

This Flight Manual Supplement documents the installed capabilities of the GTN specific to the aircraft for which this manual is created.

NOTE

In sections which contain a square checkbox (☐) the installer will have placed an "X" in the boxes next to the capabilities applicable to the installation.

The GTN system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

- ☐ VHF Communication Radio
- ☐ Primary VHF Navigation
- ☐ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- ☐ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- ☐ TSO-C151c Terrain Awareness and Warning System – See section 2.15

GPS/SBAS TSO-C146c Class 3 Operation

The GTN complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR enroute, terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GTN navigator and antenna, and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV".

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures including procedures with RF legs subject to the limitations herein. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

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

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

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

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system consists of one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

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

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

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Advanced RNP Capabilities

The GTN includes 3 out of 6 of the features required for operations in airspace requiring Advance RNP based on the *ICAO document 9613 Performance Based Navigation (PBN) Manual, fourth edition, 2013* and is therefore not approved for Advanced RNP operations. The following table describes the six Advanced RNP capabilities and the GTN capabilities.

Advanced RNP Feature	GTN Capability
RF legs	Available if enabled for installation. See Section 2.12 for limitations.
Parallel offsets	Available.
Scalable RNP	GTN provides CDI scalability in compliance with TSO-C146c. RNP scalability is not available.
RNAV holding	Available.
Fixed radius transitions	Not available in GTN.
Time of arrival control (TOAC)	Not available in GTN.

1.3 Electronic Flight Bag

The GTN 750/725 are operationally suitable as Class 3 Hardware, Type B Software in accordance with AC 120-76B EFB electronic aeronautical information when using current FliteChart or ChartView data.

Use of the Flight Stream interface and data for the purpose of Electronic Flight Bag applications is not approved as part of this STC. Additional approval may be required to obtain operational approval for use of the Flight Stream and supplied data to supplement EFB systems.

1.4 Electronic Checklists

The GTN checklist functions are designed to DO-178B software design assurance level B and support a minor failure classification. While this STC does not grant operational approval for operators requiring such approval, there are no limitations precluding operators from obtaining their own operational approval for the checklist function.

1.5 Definitions

The following terminology is used within this document:

ADF: Automatic Direction Finder
ADS-B: Automatic Dependent Surveillance Broadcast
AEG: Aircraft Evaluation Group (FAA)
APR: Approach
CDI: Course Deviation Indicator
DME: Distance Measuring Equipment
EFB: Electronic Flight Bag
EGNOS: European Geostationary Navigation Overlay Service
EHSI: Electronic Horizontal Situation Indicator
FIS-B: Flight Information Services Broadcast
GAGAN: GPS Aided GEO Augmented Navigation
GNSS: Global Navigation Satellite System
GPS: Global Positioning System
GPSS: GPS Roll Steering
GTN: Garmin Touchscreen Navigator
HOT: Hazardous Obstacle Transmission wires
HSI: Horizontal Situation Indicator
IAP: Instrument Approach Procedure
IFR: Instrument Flight Rules
ILS: Instrument Landing System
IMC: Instrument Meteorological Conditions
LDA: Localizer Directional Aid

LNAV: Lateral Navigation
LNAV +V: Lateral Navigation with advisory Vertical Guidance
L/VNAV: Lateral/Vertical Navigation
LOC: Localizer
LOC-BC: Localizer Backcourse
LP: Localizer Performance
LPV: Localizer Performance with Vertical Guidance
LP +V: Localizer Performance with Advisory Vertical Guidance
MLS: Microwave Landing System
MMC: Multi-Media Card
NOTAM: Notice to Airmen
OBS: Omni Bearing Selector
PED: Portable Electronic Device
RAIM: Receiver Autonomous Integrity Monitoring
RF Leg: Radius-To-Fix Leg of a Charted Instrument Procedure
RMT: Remote
RNAV: Area Navigation
RNP: Required Navigational Performance
SAR: Search and Rescue
SBAS: Satellite Based Augmentation System
SD: Secure Digital
SDF: Simplified Directional Facility
SUSP: Suspend
TACAN: Tactical Air Navigation System
TAS: Traffic Advisory System
TAWS: Terrain Awareness and Warning System
TCAS: Traffic Collision Avoidance System
TFR: Temporary Flight Restriction
TIS: Traffic Information Service
VHF: Very High Frequency
VFR: Visual Flight Rules
VLOC: VOR/Localizer
VMC: Visual Meteorological Conditions

VOR: VHF Omnidirectional Range
VRP: Visual Reporting Point
WAAS: Wide Area Augmentation System
WFDE: WAAS Fault Data Exclusion
XFR: Transfer

Section 2. LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide, part number and revision listed below (or later revisions), must be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

- GTN 6XX Cockpit Reference Guide P/N 190-01004-04 Rev K
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev J

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations.

2.3 Minimum Equipment

The GTN must have the following system interfaces fully functional in order to be used for primary navigation during IFR operations:

Interfaced Equipment	Number Installed	Number Required for IFR
External HSI/CDI/EHSI	1 or more	1
External GPS Annunciator	See Note 1	1

Table 3 – Required Equipment

Note 1: Garmin installation requires an external GPS annunciator panel. If installed, this annunciator must be fully functional to use the GTN GPS navigator for IFR operations.

Single engine piston aircraft under 6000 lbs. maximum takeoff weight:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator

All other aircraft:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation. The separate source of VHF navigation must not be the primary GTN, but it may be a secondary GTN.

Operation in remote or oceanic operation requires two sources of GPS navigation.

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability.

- Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, Garmin part number 006-A0154-04 (included in GTN trainer) software version 3.00 or later approved version with Garmin approved antennas or the FAA's enroute and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station.
- Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.
- For other areas, use the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

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

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance

with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

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

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

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

2.5 System Use

In installations with two GTNs and an external GPS annunciator (See Table 2) the GTN connected to the external GPS annunciator must be used as the navigation source for all IFR operations.

The only approved sources of course guidance are on the external CDI, HSI, or EHSI display. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

2.6 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 3 can be viewed on the System – System Status or Connext Setup pages.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
Main SW Version	6.21
GPS SW Version	5.2
Com SW Version	2.20
Nav SW Version	6.02
Flight Stream 210	2.40
Flight Stream 510	2.10

Table 3 - Software Versions

2.7 MMC / SD Database Cards

It is required that the SD database card or Flight Stream 510 (MMC) be present in the GTN at all times. The SD or MMC device must not be removed or inserted during flight or while the GTN is powered on.

NOTE

Removal of the SD or MMC device will result in certain features and databases not being available and may slow system performance.

2.8 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended cha[rt] affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

See Section 2.29 for limitations regarding database update procedures.

2.9 Ground Operations

Do not use SafeTaxi or ChartView functions as the basis for ground maneuvering. SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport movi[ng] map display (AMMD). SafeTaxi and ChartView are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.10 Approaches

a) Instrument approaches using GPS guidance may only be conducted when [the] GTN is operating in the approach mode. (LNAV, LNAV +V, L/VNAV, LPV, LP, or LP +V)
b) When conducting instrument approaches referenced to true North, the NA[V] Angle on the System -Units page must be set to True.
c) The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LD[A], SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV i[n] the procedure title. When using the Garmin VOR/LOC/GS receivers to fl[y] the final approach segment, VOR/LOC/GS navigation data must be select[ed] and presented on the CDI of the pilot flying.
d) Advisory vertical guidance deviation is provided when the GTN annunci[ates] LNAV + V or LP +V. Vertical guidance information displayed on the VD[I in] this mode is only an aid to help flight crews comply with altitude restricti[ons]. When using advisory vertical guidance, the flight crew must use the prim[ary] barometric altimeter to ensure compliance with all altitude restrictions.
e) Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure mus[t be] loaded from the navigation database into the GTN system flight plan by i[ts] name. Pilots are prohibited from flying any approach path that contains manually entered waypoints.
f) IFR approaches are prohibited whenever any physical or visual obstructi[on] (such as a throw-over yoke) restricts pilot view or access to the GTN and the CDI.

2.11 Barometric Setting

The barometric altimeter setting used for any barometric corrected altitude source interfaced to the GTN must be set appropriate to the altitude type depicted on the procedure (QNH or QFE).

2.12 RF Legs

This STC does not grant operational approval for RF leg navigation for those operators requiring operational approval. Additional FAA approval may be required for those aircraft intending to use the GTN as a means to provide RNP 1 navigation in accordance with FAA Advisory Circular AC 90-105.

The following limitations apply to procedures with RF legs:

- Aircraft is limited to 180 KIAS while on the RF leg
- RF legs are limited to RNP 1 procedures. RNP AR and RNP <1 are not approved
- Primary navigation guidance on RF legs must be shown on an EHSI indicator with auto-slew capability turned ON
- GTN Moving Map, EHSI Map, or Distance to Next Waypoint information must be displayed to the pilot during the RF leg when flying without the aid of the autopilot or flight director.
- The active waypoint must be displayed in the pilot's primary field of view.

2.13 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

It is possible to create flight plan waypoint sequences, including Search and Rescue patterns, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance with regard to flight path deviation.

2.13.1 RNP 1.0 RF Leg Types

AC 90-105 states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot.

This STC has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the GTN installation complies with limitation set forth in Section 2.12 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is

not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

2.14 Terrain Proximity Function (All Units)

Terrain, point obstacle, and wire obstacle information appears on the map and terrain display pages as red and amber terrain, obstacles, or wires and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain, obstacle and wire information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.15 TAWS Function (Optional)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

TAWS shall be inhibited when landing at an airport that is not included in the airport database. .

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional in order to use the TAWS system.

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.16 Polar Operations

Use of the GTN for primary navigation for latitudes above 89.00° N and below 89.00° S is prohibited.

2.17 Datalink Weather Display (Optional)

This limitation applies to datalink weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88 or GTX 345, and Connext via a GSR 56

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

Datalink text weather is decoded for the convenience of the pilot, however it is possible that the decoding may be affected by anomalies in the data or differences in the units of measure between the decoding system and the text weather source. All text weather displayed on the GTN also includes the raw weather text for pilot review.

2.18 Traffic Display (Optional)

Traffic may be displayed on the GTN when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

Traffic is displayed in feet regardless of the unit settings for altitude. If the units for altitude are different than feet, a "FT" label will appear on the traffic icon on and main map page, and the dedicated traffic page will include an "ALT IN FT" notification.

2.19 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN is limited to supplemental use only. The use of the StormScope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited. StormScope® lightning data on the display is intended only as an aid to enhance situational awareness of hazardous weather, not penetration. It is the flight crew's responsibility to avoid hazardous weather using official weather data sources.

When the GTN StormScope® page is operating without a heading source, as indicated by the "HDG N/A" label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

2.20 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This is not a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination.

2.21 Fuel Range Rings

The fuel range rings displayed on the moving map are intended for situational awareness and do not represent a direct indication of endurance or fuel remaining. The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes by default. The reserve value can be changed from the GTN map setup menu.

Fuel range data is derived by the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

2.22 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GTN unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725, 750 or GTN 625, 635, 650 combinations

2.23 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.24 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750/725 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

2.25 Telephone Audio

Telephone audio must not be distributed to the pilot or co-pilot unless a phone call is active.

CAUTION

Failure to turn off telephone audio when the telephone is not in use may result in telephone ringer or text message aural notifications being received during critical phases of flight.

2.26 Multi Crew Aircraft (GMA 35 Only)*

For aircraft type certified with more than one required pilot, or operations requiring more than one pilot, the "Group Co-Pilot with Passenger" audio panel option shall not be activated. This option is found in the Intercom Setup Menu when a Garmin GMA 35 audio panel is installed.

2.27 Wire Obstacle Database

Only the "Obstacle/HOT Line" database may be used. Use of the "Obstacle/Wire" database is prohibited. The database version can be viewed on the start-up database verification or System- System Status pages.

2.28 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

The Flight Stream interface and data provided to a portable electronic device is not approved to replace any aircraft display equipment, including navigation or traffic/weather display equipment.

2.29 Database Updates

Database updates via MMC / SD card or Flight Stream wireless transfers must be done while the aircraft is on the ground and stationary. In-flight database transfers or updates are prohibited in flight unless part of the Database SYNC function that occurs in the background to move databases from one LRU to another.

2.30 Charts Database (Dual GTN7XX)

When the aircraft installation includes 2 GTNs capable of displaying charts (GTN 700, 725 or 750) and crossfill is enabled between the GTNs, the GTNs must have identical charts types (ChartView or FliteCharts) and charts cycles installed. Failure to have identical charts could affect the chart lookup features and automatic chart selection.

2.31 Automatic Speech Recognition

Pilots may not use the ASR function to operate the GTN/GMA unless they have completed the ASR Qualification Procedure located in the GTN Cockpit Reference Guide successfully. The ASR Qualification Procedure is specific to each pilot / headset / aircraft combination.

* Includes GMA 35 and GMA 35c Audio Panels

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural "PULL UP":

Autopilot .... DISCONNECT
Aircraft Controls .... INITIATE MAXIMUM POWER CLIMB
Airspeed .... BEST ANGLE OF CLIMB SPEED

After Warning Ceases:

Altitude .... CLIMB AND MAINTAIN SAFE ALTITUDE
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" or "LOI".

If the LOI annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the DR annunciation is displayed, the map will continue to be displayed with an amber "DR" overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation .... USE ALTERNATE SOURCES

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation .... USE GTN

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE:

Navigation .... FLY TOWARDS KNOWN VISUAL CONDITIONS

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a GPS LPV, LP +V, LNAV/VNAV, or LNAV +V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation accordingly from LPV, LP +V, L/VNAV, or LNAV +V to LNAV. The approach may be continued using the LNAV only minimums.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:

Communications .... USE ALTERNATE COM

If no alternate COM is available:

COM RMT XFR key (if installed)...... PRESS AND HOLD FOR 2 SECONDS

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GTN. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)†

Audio Panel Circuit Breaker .... PULL

NOTE

This procedure will force the audio panel into fail safe mode which provides only the pilot with communications and only on a single COM radio. If any non GTN 750 COM is installed, communication will be only on that radio. If only a GTN 750 is installed in the aircraft, then the pilot will have only the GTN 750 COM available. No other audio panel functions including aural alerting and the crew and passenger intercom will function.

† Includes GMA 35 and GMA 35c Audio Panels

.5 TAWS CAUTION (Terrain or Obstacle Ahead, Sink Rate, Don't ink)

hen a TAWS CAUTION occurs, take corrective action until the alert ceases. op descending or initiate either a climb or a turn, or both as necessary, based analysis of all available instruments and information.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

.2.6 TAWS INHIBIT

he TAWS Forward Looking Terrain Avoidance (FLTA) and Premature escent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. efer to GTN Cockpit Reference Guide for additional information.

o Inhibit TAWS:

ome Hardkey ....PRESS
errain Button ....PRESS
enu Button ....PRESS
AWS Inhibit Button ....PRESS TO ACTIVATE

.2.7 TER N/A and TER FAIL

f the amber TER N/A or TER FAIL status annunciator is displayed, the ystem will no longer provide TAWS alerting or display relative terrain and bstacle elevations. The crew must maintain compliance with procedures that nsure minimum terrain and obstacle separation.

3.2.8 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a heading source to the GTN, the following limitations apply:

- Roll steering will not be provided to the autopilot for heading legs. The autopilot must be placed in HDG mode for heading legs.
- Map cannot be oriented to Heading Up.
- Overlaying traffic data from a TAS/TCAS I or Garmin ADS-B-IN unit interfaced to an on board traffic system will not be displayed on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or Garmin ADS-B-IN traffic data.
- All overlaying StormScope® data on the main map display. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.
- Onboard weather radar overlay on the main map will not be displayed. The flight crew must utilize the dedicated weather radar page on the GTN system to view weather radar data from the onboard weather radar.

StormScope® must be operated in accordance with Section 7.8 when no heading is available.

3.2.9 ASR (VOICE COMMAND) SYSTEM FAILURES

In the event the ASR system fails and there is a need to disable the voice command inputs to the GTN:

To Disable ASR:

Home Hardkey ....PRESS
System Button ....PRESS
Voice Commands Button ....PRESS
Voice Commands Enable Button ....TOGGLE OFF

3.2.10 LOSS OF GTN TOUCH CONTROL

In the event the GTN becomes unusable due to uncommanded page changes, the ASR function may be the cause.

To Disable ASR:

Audio Panel Circuit Breaker ....PULL
Home Hardkey ....PRESS
System Button ....PRESS
Voice Commands Button ....PRESS
Voice Commands Enable Button ....TOGGLE OFF
Audio Panel Circuit Breaker ....PUSH

3.2.11 DATA SOURCE – PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a barometric corrected altitude source to the GTN, the following features will not operate:

- Automatic leg sequencing of legs requiring an altitude source. The flight crew must manually sequence altitude legs, as prompted by the system.

3.2.12 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 (NAV/GPS 2, COM 2) and the Flight Stream 210 (BT LINK), if installed.

3.2.13 IN-AIR RESTART OF GTN

In the event of a GTN restart in the air, the crew should utilize the CANCEL button if presented with the database update screen after the GTN is restarted. This will ensure restoration of the navigation functions as soon as possible.

Section 4. NORMAL PROCEDURES

Refer to the GTN Cockpit Reference Guide defined in Section 2.1 of this document or the Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Databases ....REVIEW DATES
Self-Test ....VERIFY OUTPUTS TO NAV INDICATORS
Self-Test - TAWS Remote Annunciator:
PULL UP ....ILLUMINATED
TERR ....ILLUMINATED
TERR N/A ....ILLUMINATED
TERR INHB ....ILLUMINATED
Self-Test - GPS Remote Annunciator:
VLOC ....ILLUMINATED
GPS ....ILLUMINATED
LOI or INTG ....ILLUMINATED
TERM ....ILLUMINATED
WPT ....ILLUMINATED
APR ....ILLUMINATED
MSG ....ILLUMINATED
SUSP or OBS ....ILLUMINATED

4.2 Before Takeoff

System Messages and Annunciators ....CONSIDERED

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GTN the pilot should rotate the course pointer as prompted on the GTN.

If an EHSI is used to display navigation data from the GTN the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

See Section 4.5 for RF leg capabilities related to EHSI

4.4 Autopilot Operation

The GTN may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in a roll steering mode.

The GTN supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GTN. This heading interface can also provide map orientation, traffic and StormScope heading data and wind calculations.

CAUTION

The GTN does not provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of roll steering when course deviation is not provided.

☐ This installation has a heading source. The GTN will provide roll steering on heading legs for the autopilot.

☐ This installation *does not have* a heading source. The crew cannot use the GTN roll steering to fly heading legs with the autopilot.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button .... PRESS
"Enable APR Output" Button .... PRESS

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot .... **ENGAGE APPROACH MODE**

☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will enable vertical guidance.

Vertical Guidance .... **CONFIRM AVAILABLE**
Autopilot .... **ENGAGE APPROACH MODE**

☐ The installation *does not* support any vertical capture or vertical tracking.

The GTN allows for the utilization of IFR procedures that include RF (Radius to Fix) legs as part of RNP 1.0 capabilities.

☐ This installation is equipped to support coupled RF leg navigation up to RNP 1.0.

☐ This installation is equipped to support *un-coupled* RF leg navigation up to RNP 1.0.

☐ This installation *does not* support RF leg navigation.

4.6 Coupling the Autopilot during Search and Rescue Operations

Search and Rescue (SAR) patterns created in the GTN flight plan may include turns that cannot be accomplished with standard autopilot turn rates. Monitor autopilot performance relative to the desired path if coupled when using Search and Rescue patterns.

4.7 Database Conflict Resolution

When a conflict occurs between databases on different GTNs that are utilizing Database SYNC the pilot should resolve that conflict by pressing the "Resolve Conflict" button on the GTN that has the desired databases. This would be the GTN with the newest database on the SD card or Flight Stream 510. After initiating the conflict resolution, the pilot can view the SYNC status of the database on the other GTN by viewing the System -> Standby Database page. Once the database SYNC is complete, the receiving GTN must be restarted to install the new database and complete the conflict resolution process.

NOTE

The databases on the receiving LRU will be overwritten by the databases from the LRU from which the "Resolve Conflicts" action was initiated.

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Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GTN 6XX or GTN 7XX Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control and function. The Pilot's Guides *do not* need to be immediately availab[le] to the flight crew.

- GTN 6XX Pilot's Guide P/N 190-01004-03 Rev K or later
- GTN 7XX Pilot's Guide P/N 190-01007-03 Rev M or later

7.2 Leg Sequencing

The GTN supports all ARINC 424 leg types. Certain leg types require altitu[de] input in order to sequence (course to altitude, for example). If a baromet[ric] corrected altitude source is not interfaced to the GTN, a popup will appe[ar] prompting the flight crew to manually sequence the leg once the altitu[de] prescribed in the procedure is reached.

☐ This installation *has* a barometric corrected altitude source. The GTN will automatically sequence altitude legs.

☐ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

7.3 Auto ILS CDI Capture

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.4 Activate GPS Missed Approach

☐ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activa[te] GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity and TAWS

CAUTION

Not all obstacles and wires are contained in the Obstacle/HOT Line database. The system provides depiction (and alerts, if TAWS is installed) only for obstacles and wires contained in the database.

NOTE

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

☐ This installation supports *Terrain Proximity*. *No aural or visual alerts* for terrain or obstacles are provided. Terrain Proximity *does not* satisfy the TAWS requirement of 91.223.

☐ This installation supports *TAWS B*. Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

Terrain on the dedicated terrain page or main map overlay is depicted in the following manner:

- Terrain more than 1,000 feet below the aircraft is not depicted, or depicted as black.
- Terrain between 1,000 feet and 100 feet below the aircraft is depicted as amber.
- Terrain within 100 feet below the aircraft, or above the aircraft, is depicted as red.

Obstacles and wires on the dedicated terrain page or main map are depicted in the following manner:

- Obstacles and wires more than 2,000 feet below the aircraft are not depicted.
- Obstacles and wires between 2,000 feet and 1,000 feet below the aircraft are depicted as white.
- Obstacles and wires between 1,000 feet and 100 feet below the aircraft are depicted as amber.
- Obstacles and wires within 100 feet below the aircraft, or above the aircraft, are depicted as red.

Multiple obstacles may be depicted using a single obstacle icon and an asterisk to indicate obstacle grouping is occurring. The color of the asterisk indicates the relative altitude of the tallest obstacle in the group. The asterisk does not indicate any information about the relative altitude or number of obstacles not being displayed in the obstacle group.

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding terrain and obstacle colors and grouped obstacle icons.

7.6 GMA 35/35c Audio Panel (Optional)

The GTN 725 and 750 can interface to a GMA 35/35c remotely mounted audio panel and marker beacon receiver. Controls for listening to various radios, activating the cabin speaker, clearance playback control, and marker beacon are accessed by pressing the "Audio Panel" button on the GTN display screen. Optional Bluetooth pairing functionality can be accessed from the associated System /Connext Setup page (GMA 35c only). Volume controls for the audio panel are accessed by pressing the "Intercom" button on the GTN display screen.

Aircraft alerting audio may be routed through the GMA 35/35c audio panel. There are no pilot controls for alert audio volumes. In the event of a loss of GMA35/35c function alert audio routed through the audio panel may not be heard.

7.7 Traffic System (Optional)

This system is configured for the following type of traffic system. The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding the functionality of the traffic device.

- ☐ No traffic system is interfaced to the GTN.
- ☐ A TAS/TCAS I traffic system is interfaced to the GTN.
- ☐ A TIS traffic system is interfaced to the GTN.
- ☐ A TCAD traffic system is interfaced to the GTN.
- ☐ A Garmin ADS-B traffic system is interfaced to the GTN.
- ☐ A Garmin ADS-B traffic system is interfaced to the GTN. The ADS-B traffic system is also interfaced to an on board traffic system

7.8 StormScope® (Optional)

When optionally interfaced to a StormScope® weather detection system, the GTN may be used to display the StormScope® information. Weather information supplied by the StormScope® will be displayed on the StormScope® page of the GTN system. For detailed information about the capabilities and limitations of the StormScope® system, refer to the documentation provided with that system

Heading Up mode:

If the GTN system is receiving valid heading information, the StormScope® page will operate in the heading up mode as indicated by the label "HDG UP" presented at the upper right corner of the display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft and is automatically rotated to the correct relative position as the aircraft turns.

Heading Not Available mode:

If the GTN system is not receiving valid heading information, either because a compatible heading system is not installed, or the interfaced heading system has malfunctioned, the StormScope® page will continue to operate without a heading source and indicate "HDG N/A" in the upper right corner of the GTN display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft but is not automatically rotated to the correct relative position as the aircraft turns. When operating in this mode, StormScope® strikes must be cleared after each turn the aircraft performs.

7.9 Power

- Power to the GTN is provided through a circuit breaker labeled NAV/GPS (1/2).
- Power to the optional GTN COM is provided through a circuit breaker labeled COM (1/2).
- Power to the optional GMA 35 is provided through a circuit breaker labeled AUDIO.
- Power to the optional Flight Stream 210 is provided through a circuit breaker labeled BT LINK.
- Power to the optional Flight Stream 510 is provided through the GTN MMC/SD card slot and protected via the GTN circuit breaker.

7.10 Databases and Flight Plan Waypoints/Procedures

Database versions (or cycles) and effective dates are displayed on the start-up database verification page immediately after power-on for those databases with an effective or expiration date. Databases with no effective or expiration date (e.g. - terrain database) are considered effective upon installation in the GTN. Database information can also be viewed on the System – System Status page.

The Obstacle Database has an area of coverage that includes the United States and Europe, and is updated as frequently as every 56 days. The HOT Line wire database only includes the continental United States and portions of Canada/Mexico.

Only the Obstacle/HOT Line wire database may be used in accordance with the limitation found in Section 2.27.

If a stored flight plan contains a waypoint or procedure that does not correspond to a waypoint or procedure in the navigation database in use, the waypoint or procedure will become locked (depicted as "Lockd") in the flight plan. Flight plans with locked waypoints may be placed in the active flight plan portion of the system but no navigation will be provided. The locked waypoint/procedure must be resolved by removing or replacing it with the correct waypoint/procedures in the flight plan before the system will provide navigation.

7.11 External Switches

External switches may be installed and interfaced to the GTN. These switches may be stand alone, or integrated with a TAWS or GPS annunciator. Table 4 lists the switches and function they perform:

Switch Label	Function
CDI	Toggles between GPS / VLOC sources. This switch may be part of an external annunciator panel.
COM CHAN DN	Toggles down through the preset com frequencies.
COM CHAN UP	Toggles up through the preset com frequencies.
COM RMT XFR	Transfers the COM active / standby frequencies.
NAV RMT XFR	Transfers the NAV active / standby frequencies.
OBS	Performs an OBS or SUSP function. This switch is part of an external annunciator panel and is placarded with the following: "Green OBS indicates OBS or SUSP mode – GTN annunciator bar indicates which is active. Push OBS button to change OBS or SUSP mode."
OBS/SUSP	Performs an OBS or SUSP function.
TERR INHB	Toggles the TAWS Inhibit function on/off. This switch is part of an external annunciator panel. The terrain display is still presented if TAWS is inhibited.
PTC	Push-to-Command switch for Voice Command input to the GMA and the GTN.

Table 4 - External Switches

7.12 Airspace Depiction and Alerts

The GTN aids the flight crew in avoiding certain airspaces with Smart Airspace and airspace alerts. Smart Airspace de-emphasizes depicted airspace that is not near the aircraft's current altitude. Airspace Alerts provide a message indication to the flight crew when the aircraft's current ground track will intercept an airspace type that has been selected for alerting.

NOTE

Smart Airspace and Airspace Alerts are separate features. Turning on/off Smart Airspace does not affect Airspace Alerts, and vice versa.

7.13 Garmin ADS-B Traffic System Interface (Optional)
A Garmin ADS-B traffic system may be interfaced to the GTN. The *nose* of the ownship symbol on both the GTN main map page and dedicated traffic page serves as the actual location of your aircraft. The *center* of the traffic target icon serves as the reported location for the target aircraft. Motion vectors for traffic may be displayed in either absolute or relative motion. The location of the traffic targets relative to the ownship are the same, regardless of the selected motion vector.

Absolute motion vectors are colored either cyan or white, depending on unit configuration. Absolute motion vectors depict the reported track of the traffic target referenced to the ground. An absolute motion vector pointed towards your ownship symbol *does not* necessarily mean the traffic target is getting closer to your aircraft.

Relative motion vectors are always colored green and depict the motion of the traffic target relative to your ownship symbol. The direction the traffic target is pointed may vary greatly from the motion vector and a target may be getting closer to your aircraft independent of the direction the target is pointed. A green relative motion vector pointed towards your ownship indicates that the traffic target *is* converging on your aircraft.

If more than one target is occupying the same area of the screen, the GTN will combine the two or more traffic targets into one traffic group. The presence of an asterisk to the left of a target indicates that traffic has been grouped. The highest priority traffic target in the group is displayed to the pilot. When applied to airborne targets the asterisk will be displayed in white or cyan depending on the traffic depiction color used in the installation. The asterisk will be brown for grouped ground targets. The asterisk will not turn amber, even if an alerted target is included in the group.

An alerted target may be placed in the same group as non-alerted targets. In this case, the alerted target will be displayed. Two alerted targets will not be placed in the same group. All alerted targets will be displayed on the screen.

Traffic targets displayed on the dedicated traffic page may be selected in order to obtain additional information about a traffic target or to view all targets in a grouped target. When a grouped target is selected, the "Next" button on the dedicated traffic page will cycle through all targets located in close proximity to where the screen has been touched.

7.14 GWX 70 Weather Radar (Optional)
The GWX 70 Weather Radar uses Doppler technology to optionally provide advanced features to the flight crew such as turbulence detection and ground clutter suppression. Turbulence detection can detect turbulence up to 40nm from the aircraft and will be displayed at radar ranges of 160nm or less.

NOTE
Turbulence detection does not detect all turbulence especially that which is occurring in clear air. The display of turbulence indicates the possibility of severe or greater turbulence, as defined in the Aeronautical Information Manual.

7.15 Charts (Optional)
The GTN 750/725 can display both procedure charts and weather data on the main map page at the same time. When datalink NEXRAD or Precipitation is overlaid on the main map page, the weather data is displayed *below* an overlaid procedure chart. When airborne weather radar is overlaid on the main map page, the radar data is displayed *above* an overlaid procedure chart.

7.16 Transponder Control (Optional)
The GTN can be interfaced to a Garmin transponder for control and display of squawk code, mode, and additional transponder functions. The activation of the "Enable ES" button on the transponder page does not indicate the aircraft is in full compliance with an ADS-B Out solution in accordance with TSO-C166b (1090ES). Consult your transponder documentation for additional information.

7.17 Telephone Audio (Optional)
Telephone audio distribution to the crew defaults to OFF on each power cycle of the GTN. Prior to utilizing the telephone function, the crew must distribute telephone audio to the desired recipients. If the crew is utilizing the telephone function it is required that the telephone audio be turned off upon completing telephone usage

7.18 Depiction of Obstacles and Wires

7.18.1 Dedicated Terrain Page
The dedicated Terrain page will always depict point obstacles at zoom scales 10 nm or less and depict wire obstacles at zoom scales of 5 nm or less. The obstacle or wire overlay icon (see Figure 3) will be shown near the bottom of display when the obstacle or wire depiction is active based on the zoom scal

NOTE
Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Terrain page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

Figure 3 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.18.2 Map Page
The Map page may be configured to depict point obstacles and wire obstacles various zoom scales by the pilot by using the Map page menu. The obstacle o wire overlay icon (see Figure 4) will be shown near the bottom of the display when the obstacle or wire overlay is active based on the current zoom scale an setting selected by the pilot.

The settings chosen by the pilot on the Map page menu (including obstacle an wire display ranges) are saved over a power cycle

NOTE
Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Map page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

NOTE
The Map page may be configured by the pilot to not show any obstacles or wires at any zoom scale.

Figure 4 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.19 Flight Stream 210/510 (Optional)
The Flight Stream product line uses a wireless transceiver to provide data to and from a GTN to personal electronic devices (PEDs).

The Flight Stream 210 is a remotely mounted unit that provides the capability to interface Portable Electronic Devices (PEDs) to the GTN via Bluetooth. The Flight Stream 510 is mounted in the GTN SD card slot and includes a Bluetooth and Wi-Fi transceiver.

Data such as traffic, flight plan, datalink weather, entertainment audio information, and attitude information is sent from the Flight Stream to the PED. The PED is capable of sending flight plans and databases (510 only) to the Flight Stream which will then be available on the GTN. Limitations regarding database operations are found in Section 2.29.

Garmin provides a list of tested and compatible devices that can be used with the Flight Stream. Connection to the Flight Stream may be possible with devices other than those on the supported device list, but Bluetooth® and/or Wi-Fi stability and wireless data integrity cannot be guaranteed.

For details about the Garmin supported devices and apps for use with the Flight Stream product line, please visit:

7.20 Map Page

7.20.1 Configuration
The moving map and weather pages are capable of displaying a large quantity and variety of data. Map data is layered to ensure that data which is typically more critical is drawn above less critical data, however at some zoom scales and configurations the map may be cluttered with large amounts of data. Controls are provided on the Map and Weather pages for the pilot to select which data displayed, the declutter level, and the zoom scales at which data is added to or removed from the display. It is the responsibility of the pilot to select settings for the map page that will provide the display of data most appropriate to the operation being conducted.

7.20.2 Flight Plan Depiction
The map page depicts the current active flight plan. When an off-route Direct To is active the flight plan will no longer be depicted on the map

7.20.3 Fuel Range Ring
The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes at the current aircraft groundspeed by default. The pilot may change the fuel reserve time value on the map setup menu. Changes to the fuel reserve time are persisted over GTN power cycles.

Visibility of the fuel range ring may be affected by the underlying map data selectable by the pilot. The pilot may make changes to the topographic or terrain data in order or more clearly observe the fuel range ring at any time.

Fuel range data is derived from the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

7.21 User Defined Waypoints
When a User Defined Waypoint is created a default name will automatically be provided and the pilot is given the option to provide a different name for the waypoint. Pages which have the autofill function will prevent some waypoint names from being used. If it is desired to name the waypoint with a subset of the name of an existing waypoint in the database then this must be accomplished on the Waypoint Info / User Waypoints page

Waypoints which are created when a Search and Rescue pattern is created are not considered User Waypoints and therefore functions associated with User Waypoints are not provided for these waypoints.

7.22 Times and Distances
Time and Distance data to the next waypoint is always calculated from the present position to that waypoint and does not account for the path which may be flown (such as intercepting a course) to reach the waypoint.

When navigating using GPS guidance most legs are TO type legs where distance to the next waypoint decreases along the route. However, some procedures include FROM type legs. When navigating on a leg that is a FROM leg indications that it is a FROM leg include the TO/FROM flag indicating FROM and distances increasing in distance fields.

7.23 GTN-GTN Crossfill
Certain data will sync between GTNs when installed in a dual GTN configuration. The following data will crossfill between the two GTNs with CROSSFILL ON or OFF:

- User Waypoints
- FPL Catalog
- Traffic Alerts
- Missed Approach Popups
- Altitude Leg Popups
- Heading
- Date/Time Conventions
- CDI Scale

The following unit changes will crossfill:

- Temperature
- NAV Angle
- Fuel

The following items are crossfilled only when the GTNs are set to CROSSFILL ON:

- User Holds
- Approaches
- Flight Plan Changes
- Direct-To
- Selected OBS Course Changes

7.24 Direct-To Operations
When conducting Direct-To operations the Flight Plan tab provides a list of waypoints in the flight plan for which Direct-To is available. Some entries in the flight plan such as Holds and Course Reversals are not eligible for Direct-To and the pilot must instead select the associated waypoint if Direct-To operation is desired.

7.25 Automatic Speech Recognition (ASR)
ASR allows the pilot to interact with the GMA and GTN via voice commands. Commands are constructed around the "Verb – Noun – (Suffix)" syntax for most ASR commands.

- "SHOW" Commands – Used to show pages or data fields on the GTN
- "SAY" Commands – Used to instruct the ASR engine to say certain phrases related to the flight
- "TUNE" Commands – Used to tune certain frequencies into the standby position of the ASR GTN (usually GTN #1)

The "Page" suffix is used in conjunction with the "Show" phrase to command pages to be displayed on the GTN. (e.g.- "Show Main Map Page")

Audio Panel commands are available to switch audio sources.

- "SELECT" to choose which radio the MIC will be selected
- "TOGGLE" to toggle the monitor of a specific NAV/COM radio
- "DISTRIBUTE" to change the source of audio for the respective seat positions
- "MUTE" to mute audio inputs on the audio panel for the respective seat positions

Supplemental commands that allow map zooming, and page navigation are also available.

- **"BACK"**
- **"CANCEL"**
- **"ZOOM IN"**
- **"ZOOM OUT"**

Each command is initiated via the Push-to-Command (PTC) switch. Aural tones will indicate to the pilot the status of the command. A positive tone (low to high) will indicate the system executed a command. A negative tone (high to low) will indicate the system did not understand the command or could not execute due to system state or configuration. "SAY" commands do not provide aural tones as feedback.

The pilot must maintain vigilance regarding ASR command information. Due to the nature of voice recognition, there are times when ASR will interpret a command differently than the pilot intended. The pilot should always cross check the ASR response to the information contained within the GTN as appropriate to ensure in-flight information is accurately understood. If a conflict exists between information gathered via ASR and that available in the GTN system, the pilot should defer to the GTN system information.

Prior to using ASR, the pilot must complete the ASR Qualification Procedure from the GTN Cockpit Reference Guide.

The Command History Page details the commands received by ASR for that power cycle. A full list of commands and a tips for using ASR can be found in the *GTN 6XX/7XX Telligence Voice Command Guide*, 190-01007-30.

When using ASR for "TUNE" commands, it is recommended that the pilot enable Reverse Frequency Lookup (RFL) on the associated GTN.

7.26 European Visual Reporting Points
If the GTN is interfaced with a G500/600 PFD/MFD, and a flight plan in the GTN contains a VRP, the G500/600 must have a database that contains the VRP in order to appropriately display the VRP on the MFD map. If the database on the PFD/MFD does not contain the VRP, the VRP will display on the MFD map as an intersection.

The G2 is NOT connected to the actual fuel tanks.
However, since it is connected to a sensor that measures the volume of fuel flow consumed, it is possible to calculate the rate of fuel consumption. If the user inputs the initial amount of fuel, the G2 can subtract the fuel used from the initial fuel to provide an estimate of the amount of fuel remaining. Since we know the current rate of fuel consumption, we can also estimate the endurance (amount of time remaining before all the fuel is consumed). Both fuel REMAINING and ENDURANCE depend on the correct value entered by the pilot for INITIAL FUEL.

Fuel Function Screens

The G2 was preset at factory with usable total fuel. It can be changed via the CONFIGURATION screen.

To reach TOTAL TOTALIZATION page, turn the PG knob to the right, until the FUEL ONBOARD screen appears.

Enter total Fuel Screen
(Defaults to fuel function screen when total fuel is set)

Set total FUEL ONBOARD before take-off

1- Push bottom button to highlight INITIIAL FUEL to yellow
2- Turn bottom knob to set gallons
3- Push bottom knob again to highlight SAVE & EXIT to yellow
4- Turn bottom knob to highlight YES from yellow to red
5- Push bottom button to save and FUEL TOTALIZATION page will appear

On next take-off if no fuel was added

1- Push bottom button to highlight INITIIAL FUEL to yellow
2- Push bottom knob again to highlight SAVE & EXIT to yellow
3- Turn bottom knob to highlight YES from yellow to red
4- Push bottom button to save and the FUEL TOTALIZATION page will appear

If fuel was added set new total fuel

1- Push bottom button to highlight INITIIAL FUEL to yellow
2- Turn bottom knob to set total gallons
3- Push bottom knob again to highlight SAVE & EXIT to yellow
4- Turn bottom knob to highlight YES from yellow to red
5- Push bottom button to save and FUEL TOTALIZATION page will appear

Fuel Function Screen

During flight, the FUEL TOTALIZATION page may be accessed by turning the PG knob.

INSIGHT

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

FLIGHT MANUAL SUPPLEMENT

FOR

INSIGHT INSTRUMENT GEM 610C
GRAPHIC ENGINE MONITOR
(G1, G2 and G3 Configurations)
Document No. 610C-FMS
Issue 3

APPROVAL NUMBER: STC SA09-30

This document serves as the TCCA-approved Flight Manual Supplement when the aircraft is equipped with Insight Instrument Graphic Engine Monitor GEM 610C.
This document must be carried in the aircraft at all times when the GEM 610C instruments are installed in accordance with Supplemental Type Certificate SA09-30.
The information contained herein supplements or supersedes the basic Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this document, consult the basic Airplane Flight Manual.

TCCA APPROVED

CANADA
DEPARTMENT OF TRANSPORT
AIRCRAFT CERTIFICATION
BRANCH
FEB 2 0 2012
APPROVED
BY
CERTIFICATE NO.
ISSUE NO. 3

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RECORD OF REVISIONS

Issue	Date	Comment
1	April 14, 2009	First Issue
2	May 10, 2010	Change STC Holder's Name
3	January 19, 2012	G1,G2 Configurations Added

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SECTION I

GENERAL

The Insight GEM 610C Graphic Engine Monitor (GEM) is capable of displaying an airplane engine's Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT) and Turbine Inlet Temperature (TIT), Carburetor Temperature (CARB), Manifold Pressure (MAP), Tachometer (RPM), Oil Pressure (OIL), Fuel Flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) on a Liquid Crystal Display (LCD).

There are three configurations of the GEM 610C, G1, G2 and G3. All configurations of the GEM 610C indicate temperatures that are displayed to one degree resolution in Fahrenheit or Celsius degrees. The temperature unit is displayed in the lower right corner of the display. The LCD dims automatically with the intensity of ambient light.

The white, green and red colour-coded bar graph and digital values in the central and lower part of the display may be used as primary indicators for EGT, CHT, and TIT. The cyan colour-coded values at the top of the display are supplementary, for reference only.

The EGT values are displayed as vertical white bar graphs (one per cylinder). Digital EGT values for each cylinder are indicated by white four-digit numeric displays below the bar graph. CHT is indicated by a vertical green bar graph (one per cylinder) while the CHT value is within normal CHT operating range, or by a red vertical bar graph if the CHT value exceeds the maximum CHT limit. A horizontal red line indicates the maximum allowable CHT. Digital CHT values are indicated by three-digit numeric displays below the bar graphs. The digital CHT values are show in green while within normal operating range or red if the CHT limit is exceeded. Turbine Inlet Temperature (of a turbocharger-equipped engine) is displayed by a green vertical bar graph and digital value on the right-hand side of the display while the TIT value is within normal operating range, or by a red bar graph and digital display if the TIT value exceeds the maximum TIT limit. A red horizontal line displays the maximum allowable TIT.

The GEM 610C instrument senses temperatures through thermocouple-type probes. The instrument is powered typically from the avionics bus and protected by a dedicated, trip-free, re-settable 1A circuit breaker. GEM instruments automatically accommodate both 14 and 28 VDC electrical systems.

Descriptions of the different configurations of the GEM 610C are included on pages 6 and 7 of this Flight Manual Supplement.

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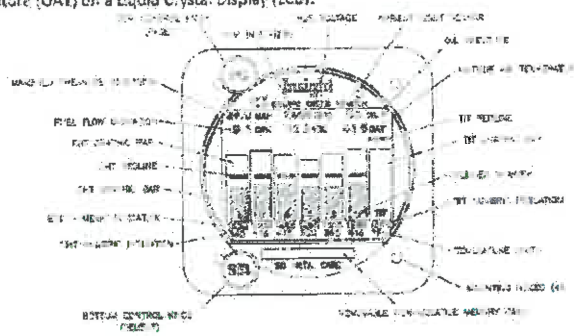
G3 CONFIGURATION

The G3 GEM 610C instrument configuration is shown below. The Insight G3 GEM 610C Graphic Engine Monitor (GEM) displays an airplane engine's Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT) and Turbine Inlet Temperature (TIT), Carburetor Temperature (CARB), Manifold Pressure (MAP), Tachometer (RPM), Oil Pressure (OIL), Fuel Flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) on a Liquid Crystal Display (LCD).



G2 CONFIGURATION

The G2 GEM 610C instrument configuration is shown below. The G2 configuration displays EGT, CHT, TIT, Carburetor Temperature, GPH, VDC and OAT on an LCD.

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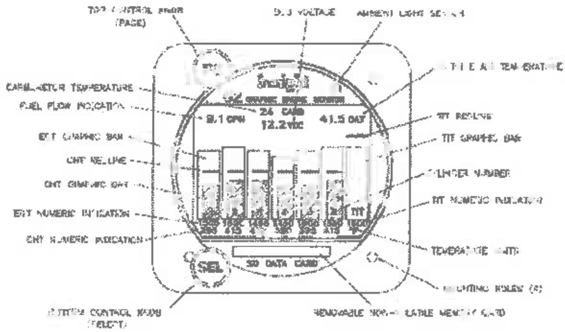
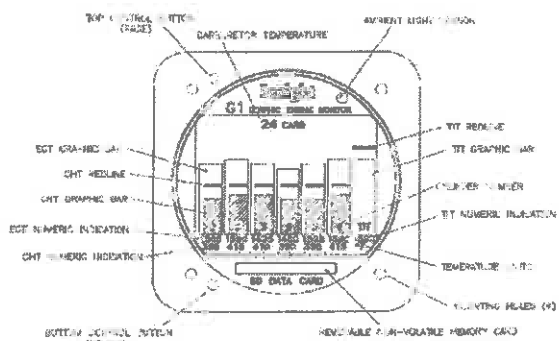


G1 CONFIGURATION

The G1 GEM 610C instrument configuration is shown below. The G1 configuration displays EGT, CHT, TIT and Carburetor Temperature (optional) on an LCD.



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SECTION II

LIMITATIONS

The GEM 610C Engine Monitor instruments **(G1, G2 and G3 configurations)** may replace any eligible aircraft Cylinder Head Temperature (CHT) indicator or Exhaust Gas Temperature (EGT) or Turbine Inlet Temperature (TIT) indicator. Single-engine airplanes utilize one GEM 610C instrument, while twin-engine airplanes need two.

The Manifold Pressure (MAP), Carburetor Temperature (CARB), Tachometer (RPM), Oil Pressure (OIL), Fuel flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) indications at the top of the display are supplementary information, for reference only.

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SECTION III

EMERGENCY PROCEDURES

None.

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SECTION IV
NORMAL PROCEDURES

Normal Operation

The GEM 610C continuously measures and displays EGT, CHT and TIT temperatures, Carburetor Temperature, Manifold Pressure, RPM, Oil Pressure, Fuel Flow, Bus Voltage and Outside Air Temperature.**(See configuration examples on pages 6 and 7)** Normal operating temperatures for CHT and TIT are displayed with green bar graphs and digital values. EGT operating temperatures are shown with white bar graphs and digital values. CHTs and TITs at an above maximum (redline) are displayed in red. All other values are supplementary and shown in cyan.

Cruise Leaning Procedure for Rich-of-Peak (ROP) Operation Using GEM 610C

1. Establish cruise power setting and mixture according to the engine and airframe manufacturers' instructions.
2. Set the desired lean threshold by pushing the lower button and turning the knob. Push the lower button to exit.**(Not applicable to G1 configuration)**
3. Lean mixture slowly until each cylinder reaches peak EGT and display the temperature difference in a box above each column. Reverse mixture control motion to enrich the mixture to obtain the fuel flow rate or EGT drop recommended by the engine and airframe manufacturer. The EGT drop is continuously displayed above the EGT column. **Reaching the desired EGT drop is annunciated by the temperature box turning from hollow to solid.(Applicable to G2 and G3 configurations only)**
4. The user may retry the procedure by setting the mixture well on the rich side and then pushing the lower button for 3 seconds to erase the temperature difference boxes. Then start from the beginning.

Cruise Leaning Procedure for Lean-of-Peak (LOP) Operation Using GEM 610C
(For aircraft approved for LOP mixture operation).

1. Establish cruise power setting and mixture according to the engine and airframe manufacturers' instructions.
2. Set the desired lean threshold by pushing the lower button and turning the knob. Push the lower button to exit. **(Not applicable to G1 configuration)**
3. Lean mixture slowly until all cylinders display peak EGT difference boxes. Continue leaning until all the temperature difference boxes indicate the engine manufacturers' recommended LOP temperature drop. **This point is annunciated by the temperature from hollow to solid.(Applicable to G2 and G3 configurations only)**
4. The user may retry the procedure by setting the mixture well on the rich side and then pushing the lower button for 3 seconds to erase the temperature difference boxes. Then start from the beginning.

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<u>CHT Limits</u>

Aircraft engine manufacturers' specify a maximum cylinder head operating temperature and define it as the CHT redline. This temperature will be documented in the operating limitations section of the Pilot Operating Handbook. This temperature is not recommended for continuous operation. It is instead the absolute maximum operating temperature that may be encountered under adverse conditions like steep climbs on a hot day. The pilot should avoid engine operation near the CHT redline for safe operations and long engine life.

<u>Note:</u> The CHT limit temperature is shown on the GEM 610C Instrument as a red line across the bar graphs. In the overheat conditions, the bar graph and digital value representing the overheating cylinder will change from green to red.

Causes of High Temperatures

High CHT values may result from poor pilot technique during adverse conditions or from a fault or abnormality of some kind.

The cause might be inadequate cooling air, inadequate lubrication, improper combustion or increased cylinder heat generation from an engine component failure. Regardless of the cause the pilot should take steps to reduce the temperature to within safe limits. If the cause is determined to be from a fault or abnormality then a precautionary landing should be considered.

Reducing High Temperatures

The pilot may use any of the following procedures to reduce CHT:

1. Open cowl flaps (if equipped)
2. Reduce climb angle to increase cooling airflow (if climbing)
3. Increase airspeed to increase cooling airflow
4. Enrich mixture
5. Reduce power setting
6. Shutdown engine (multi-engine only)

<u>TIT Limits</u>

Engine manufacturers do not specify a maximum Exhaust Gas Temperature (EGT). All references to EGT are relative to peak temperature. However in a turbo-charged airplane the EGT is measured collectively just prior to entering the turbo-charger and is called Turbine Inlet Temperature (TIT). The turbo has a definite temperature limit often near 1650 °F. The limit will be specified in the airplane's POH/AFM. For long turbo life pilots often operate 100 °F below the specified limit.

The flow of exhaust gas through the turbo is controlled by a valve called a waste gate. The tem waste gate is used because the vale opens to bypass or waste exhaust gas past the turbo. The waste gate may be fixed, manually controlled, linked to throttle motion or controlled automatically depending on the airplane. If the waste gate is a manual style, a second throttle-like knob is used as the primary control of turbo performance and temperature. With the other waste gate systems the pilot controls Turbo temperature primarily by mixture setting and to a lesser extent by power setting. Turbo aircraft are often leaned to control turbine inlet temperature only, rather than by reference to peak EGT. Failure of the waste gate control system or inability to control temperatures with normal limits may necessitate a precautionary landing.

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Keep in mind that uressurized piston-powered aircraft depend on the turbo to pressurize the cabin so the loss of turbo performance will result in a loss of cabin pressure as well.

Manual Brightness Adjustment

The instrument adjusts its brightness automatically, according to ambient lighting condition.

The G2 and G3 configurations may have minimum brightness adjusted. See Installation Instruction, Document No. 070906, latest revision.

SECTION V

PERFORMANCE

No change to Aircraft Flight Manual

SECTION VI

WEIGHT AND BALANCE

See current weight and balance data.

Note. The GEM 610C weight is 0.22kg.

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CHAPTER 4 – AIRWORTHINESS LIMITATIONS

General

The specified instrument is installed in the aircraft instrument panel. The installation is permitted only on eligible aircraft models equipped with compatible engine types.

The instrument is intended for use with engines that have 450 – 475°F CHT red lines. For the eligible aircraft/ engines refer to the STC-approved model list.

The GEM 610C instrument may be used as follows:

a) As additional, non-required EGT/CHT/TIT indicators, or

b) As primary EGT/CHT/TIT indicators instead of original factory-installed instruments, installed in the original instruments' locations (or another acceptable/ approved locations).

FAA Approval

The Airworthiness Limitations section is FAA-approved and specifies maintenance required under 43.16 and 91.403 of the Federal Aviation Regulation, unless an alternative program has been FAA approved.

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BRANCH

FEB 20 2012

APPROVED

BY
CERTIFICATE NO.
ISSUE NO.

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 Y or subsequent.

For limitations, procedures, and performance data not contained in this Supplement, consult the Airplane Flight Manual or other operating information.

Airplane Make: CESSNA

Airplane Model: 182Q

Airplane Registration Number: N735GC

Airplane Serial Number: 18265404

FAA APPROVED By: Gary L Sharon
for S. Frances Cox, Manager
Ft. Worth Special Certification Office
Federal Aviation Administration
Fort Worth, TX 76137-4298

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

Prepared By:	WCB	*Reviewed By:*	PAH	**See ECO Record For Release Authorization**

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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.

When the EFD1000 MFD with Emergency Backup Battery is used to replace backup altimeter and

---

[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.

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.

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)

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	
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

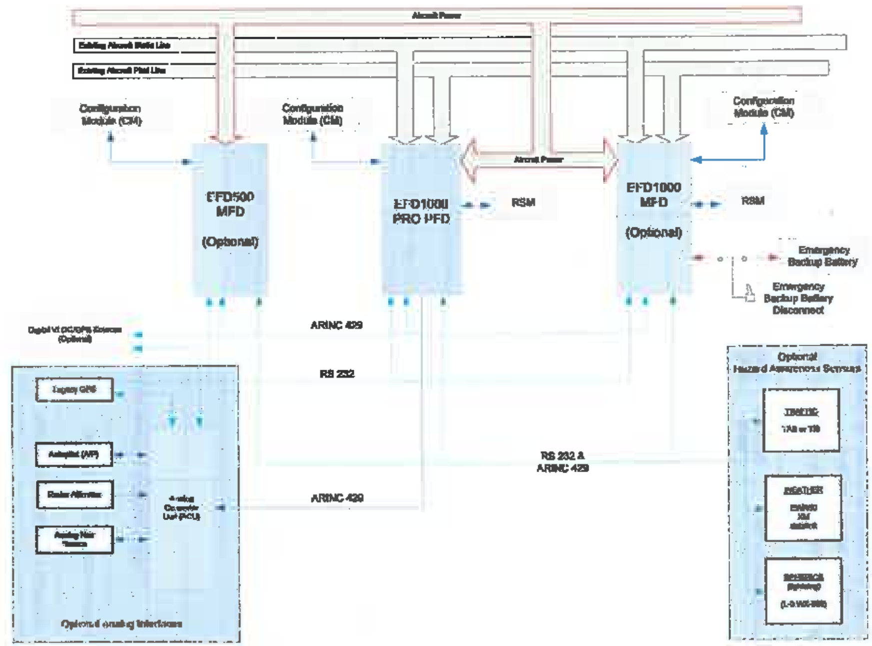


Figure 1 – Block Diagram of the EFD1000 Pro PFD, EFD1000MFD and EFD500MFD System with Optional Interfaces.
NOTE: The EA100 (not shown) pitch and roll data to the autopilot. The C3 EFD1000 PFD is not connected to the Optional Weather and Spherics Hazard Awareness Sensors

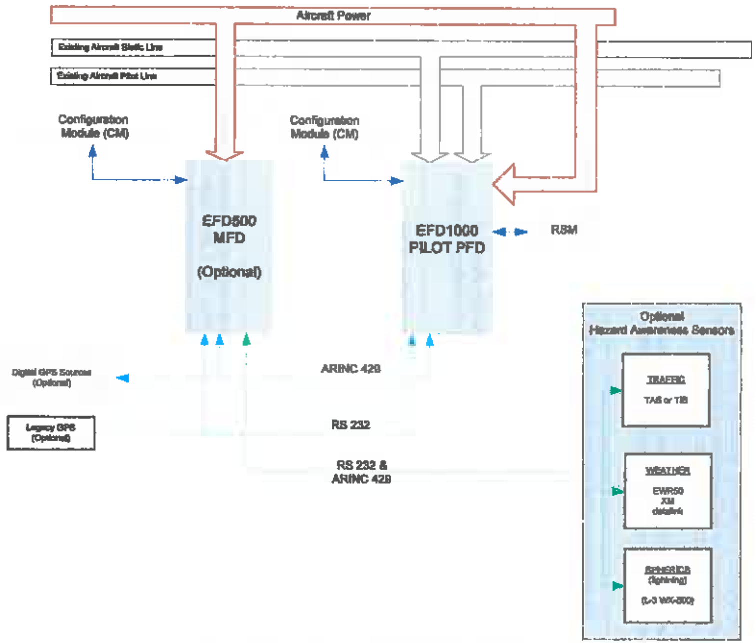


Figure 2 Block Diagram of EFD1000 Pilot PFD System with Optional EFD500

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 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

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 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.

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 EMD 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	28 day update cycle	Jeppesen JSUM©	

Database Type	Includes	Update Cycle	Database Provider	Limitations
	be available for all regions within the data card coverage area.			
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 significantly longer 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 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 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.

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.

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 EFB AMMD with an aircraft ownship position symbol is designed to assist flight crews in orienting themselves on the airport surface to improve pilot positional awareness during taxi operations. The AMMD function is not to be used as the basis for ground maneuvering. 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.

2.12.7 Terminal Procedures Charts ("Charts") Limitation (with Ownship Depiction)

<u>Limitation</u>:	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.
<u>Limitation</u>:	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:

<u>Limitation</u>:	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 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: 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 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.

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

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).

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	

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.**

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.

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

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.

3.8 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.**

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

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.

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.

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.

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.

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 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 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

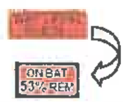
The EFD systems have been tested to assure that there are no conditions that could cause multiple resets. In the event of an unexpected condition that causes the system to continually reset, there are some steps that can be accomplished to remove external inputs to the system and restore functionality:

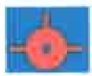
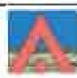
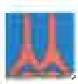
(Does not apply to the C3 PFD)

REMOVE DATABASE CARD	PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:
PULL XM WEATHER CIRCUIT BREAKER......................	PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then:
PULL THE STORMSCOPE CIRCUIT BREAKER	PERMIT THE SYSTEM TO REINITIALIZE.

3.16 Warning, Caution, and Advisory Summary

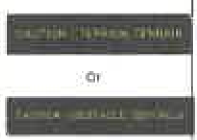
Warning **W** Caution **C** Advisory **A**

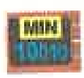
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
W	✓	✓	✓	✓	✓	✓		Red annunciations presented whenever the EFD1000 is operating on the internal battery or EBB. The countdown timer appears first, and is then 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.

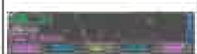
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
W		✓		✓	✓	✓		A red flight path marker indicates that the Evolution Synthetic Vision System has generated a warning alert predicting conflict with terrain or an obstacle within 30 seconds.
W		✓		✓	✓	✓	 or 	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.
W		✓		✓	✓	✓	 	Small Tower (<1000' AGL) or group of small obstructions (<1000' AGL) above or within 100' below the ownship altitude.
W		✓		✓	✓	✓	 	Tall Tower (>1000' AGL) or group of tall obstructions (>1000' AGL) above or within 100' below the ownship altitude.

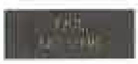
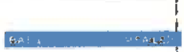
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C							Panel Mounted Indicator Lamp A/P AHRS Fail or A/P AHRS FAIL	An amber panel annunciator labeled A/P AHRS FAIL illuminates and the autopilot automatically 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) 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.

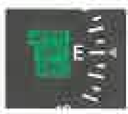
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C					✓		ADAHRS FAIL	Amber annunciation displayed in the Data Bar of the EFD1000 MFD when its internal ADAHRS reports a failure (e.g. during ADAHRS Reset). 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	✓	✓	✓	✓	✓		[illegible]	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.

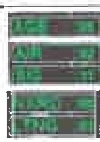
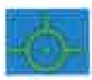
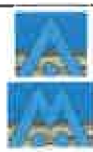
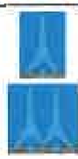
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C	✓	✓	✓*	✓	✓	✓	GPS1 GPS2 RSM GPS GPS1 REVERSION GPS2 REVERSION RSM GPS REVERSION	Amber annunciations presented when a connected GPS is invalid or not available. 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		✓		✓	✓	✓		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.

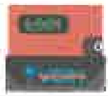
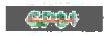
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
C					✓	✓	GPS POS FAILED	Amber annunciation presented in the center of the NAV Map when all GPS sources have failed. When presented, the map changes to a North-up 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	✓	✓		✓				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	✓	✓	✓*	✓				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	✓	✓		✓				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	✓	✓		✓			 G P S S	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.

	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		✓		✓	✓	✓	[illegible] 	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	✓	✓		✓	✓	✓	[illegible] [illegible]	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					✓	✓	[illegible]	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

	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					✓	✓		Amber annunciation presented when the spherics (lightning) sensor reports a recoverable antenna error
C					✓	✓		Amber annunciation presented when the spherics (lightning) sensor reports a recoverable inhibit line stuck microphone error
C					✓	✓		Amber annunciation presented when the spherics (lightning) sensor reports a recoverable changed antenna jumper error.
C					✓	✓		Amber annunciation presented when the spherics (lightning) sensor reports no heading data. Accompanied by removal of spherics (lightning) sensor data.
C					✓	✓		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	✓	✓	✓	✓	✓	✓		Annunciation presented in the menus when the connected EFD1000 battery is not detected or failed

	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	✓	✓		✓	✓	✓	 TRFC	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	✓	✓		✓	✓	✓	 TRFC COAST	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		✓		✓	✓	✓	 × TEST	Self-test mode annunciation that replaces spherics (lightning) Strike / Cell rate information.

	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					✓	✓		Lightning (spherics) Self-test mode selected.
A					✓	✓		Annunciation that replaces aircraft ownship symbol during a spherics (lightning) self-test.
A		✓		✓	✓	✓		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).
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 2500' and 500' below the ownship altitude.
A		✓		✓	✓	✓		Tall Tower (>1000' AGL) or group of tall obstructions (>1000' AGL) is between 2500' and 500' below the ownship altitude.
A		✓		✓	✓	✓		A horizontal red line through the spherics (lightning) rate legend that indicates the data is no longer detected.
A	✓	✓		✓	✓	✓		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)

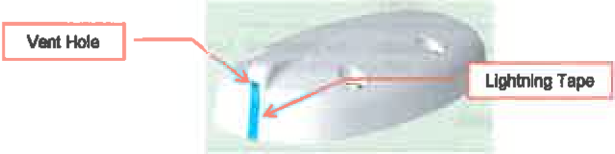
	Applicability						Annunciation	Description
	EFD 1000 PFD PRO C3	EFD 1000 PFD PRO	EFD 1000 PFD PILOT	EFD 1000 MFD REV	EFD 1000 MFD	EFD 500 MFD		
A	✓	✓		✓				A horizontal red line through the source legend of selected data indicates that the data is invalid or unavailable.
A	✓	✓		✓	✓			A horizontal red line through the selected navigation source indicates that the data is invalid or unavailable. HSI and SHSI only.
A	✓	✓		✓				A horizontal red line through the Radar Altitude display indicates that the data is invalid or unavailable.
A					✓	✓		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					✓	✓		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		✓		✓	✓	✓		Attitude, altitude or heading becomes invalid.
A		✓		✓	✓	✓		Position or magnetic variation is not received from an externally configured GPS unit.

	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		
		✓		✓	✓	✓		Jeppesen database failure.
		✓		✓	✓	✓		Presented during initialization of the data base.
		✓		✓	✓	✓		Ownship is located outside the valid database area.
		✓		✓	✓	✓		When synthetic vision data is loading.
		✓		✓	✓	✓		When SV3 horizontal situation indicator data is loading.
		✓		✓	✓	✓		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).

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.

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

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.

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.

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.

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.

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!

ASPEN AVIONICS

ASPEN AVIONICS

Aspen Avionics, Inc.
5001 Indian School NE
Albuquerque, NM 87110 USA

CONTROL # [illegible]

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

ASPEN AVIONICS EVOLUTION FLIGHT DISPLAY SYSTEM

EFD1000 PRIMARY FLIGHT DISPLAY

Optionally with

EFD1000 AND/OR EFD500 MULTI-FUNCTION DISPLAYS

or

Aspen Evolution Backup Display

The information contained in this Supplement must be attached to the FAA Approved Airplane Flight Manual or placed with the Pilot's Operating Handbook or other operating information when the Aspen EFD1000 PFD and optionally the Aspen EFD1000 MFD and/or EFD500 MFD are installed in accordance with AML STC SA10822SC. This document must be carried in the aircraft at all times.

The information in this Supplement supplements or supersedes the information in the FAA Approved Airplane Flight Manual or other operating information only as set forth herein.

For limitations, procedures and performance data not contained in this Supplement, consult the Airplane Flight Manual or other operating information.

Airplane Make

Airplane Model

Airplane Registration Number

Airplane Serial Number

FAA APPROVED By: [signature]

Manager, Aircraft Certification Office
Fort Worth, Texas

APPROVED: 12/8/2016

DOCUMENT REVISIONS FAA APPROVED PAGES

Document Revision	FAA Approved Pages Revised	Description of Change	FAA Approval Date	ECO
Earlier revisions are on file				
[illegible]	All	Complete rewrite, added APR [illegible]	[illegible]	[illegible]
[illegible]	All	Updated based on FAA comments. Added AOA functionality	None	[illegible]
[illegible]	All	Addressed FAA Comments	[illegible]	[illegible]
AA	All	[illegible] references to Pilot Guides from the Limitations section and moved references to the Pilot Guides to the Systems Description section. Updated Copyright to 2016. Added the [illegible]. Added [illegible] integration information	None	[illegible]
AE	All	Added [illegible] to Sections 7.8 & 7.11	8 March 2016	[illegible]
[illegible]	All	Added [illegible] integration to the Installed Equipment List table and [illegible] to correspond with the Installation Manual. Added [illegible] integration and new [illegible] abbreviations to the Acronyms & Abbreviations table and [illegible] some entries to correspond with the Installation Manual. Updated Pilot Guide [illegible], added reference to the [illegible] Pilot's Guide	[illegible]	[illegible]
AG	All	Added GTX 345 integration information	12/8/2016 [illegible]	[illegible]

Prepared By	[illegible]	Approved By	[illegible]	See ECO Record For Release Authorization

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1 General

1.1 System Overview

The Evolution Flight Display System consists of one or more integrated Electronic Flight Display (EFD1000 or EFD500) systems. The EFD1000 system can be configured as a primary flight display (PFD) or as a multi-function display (MFD) and the EFD500 system can only be configured as a MFD.

When the EFD1000 is configured as a PFD, the EFD1000 provides display of attitude, airspeed, altitude, vertical speed, turn rate, slip/skid and direction of flight. Depending on the optional equipment connected to the EFD1000 and the PFD version, the system can also provide display of lateral and vertical navigation deviations, flight director commands, synthetic vision, weather information, traffic information, and several other features. The following PFD versions are supported on the EFD1000: PFD PRO, PFD PRO C3, PFD VFR, PFD PILOT, PFD ESD Advanced and PFD ESD Basic.

When the EFD1000 is configured as an MFD, the EFD1000 provides navigation and weather information, terrain and obstacle data, and traffic information that can be displayed on a moving map. The EFD1000 MFD also provides PFD reversion capability, synthetic vision, terminal procedure charts, a secondary display of attitude, airspeed, and altitude, and several other features depending on the optional equipment that is connected to the EFD1000.

The EFD500 MFD provides all of the features of the EFD1000 MFD except for PFD reversion capability and a secondary display of attitude, airspeed and altitude.

1.2 Installed Equipment List

Table 1 shows the list of Aspen Equipment installed in this aircraft. Use the table to determine the parts of the AFMS that are applicable to this aircraft.

Table 1 - Installed Equipment List

[illegible]

[illegible]

Table 2 - Backup Instruments Configuration for the PFD PRO, PFD PRO C3, PFD PILOT or PFD VFR

[illegible]

1.3 List of Acronyms and Abbreviations

A	[illegible]
A/P	[illegible]
ACU	[illegible]
ADAHRS	[illegible]
ADI	[illegible]
ADS-B	[illegible]
AHRS	[illegible]
AFM	[illegible]
AFMS	[illegible]
AGL	[illegible]
AIR	[illegible]
ARINC	[illegible]
AML	[illegible]
AMMD	[illegible]
ANN	[illegible]
AOA	[illegible]
APPR	[illegible]
ASPEN GTWY	[illegible]
BARO	[illegible]
BAT	[illegible]
C	[illegible]
CJ	[illegible]
[illegible]	[illegible]
CHG	[illegible]
CM	[illegible]
CNLS	[illegible]
Config	[illegible]
CSA	[illegible]
CTL	[illegible]
CWS	[illegible]
DH	[illegible]
DISC	[illegible]
EA	[illegible]
EASA	[illegible]
EBB	[illegible]
EBD	[illegible]
EFD	[illegible]
EFB	[illegible]
EPD	[illegible]
EFIS	[illegible]
EMER	[illegible]
EOC	[illegible]
ESV	[illegible]
EWR	[illegible]
EXT PWR	[illegible]
FAA	[illegible]
FIS-B	[illegible]
FPL	[illegible]
FPM	[illegible]
FT	[illegible]
FOV	[illegible]
GEO-REFERENCED	[illegible]
GTWY	[illegible]
GPS	[illegible]
GPSS	[illegible]

TERR	Terrain
TFR	Temporary Flight Restriction
TIS	Traffic Information System
TWS	[illegible]
TFC	Traffic
TFCA	Traffic Altitude Filter Above
TFCB	Traffic Altitude Filter Below
TFCN	Traffic Altitude Filter Normal
TFCU	Traffic Altitude Filter Unrestricted
TRFC	Traffic
UAT	Universal Access Transceiver
UNAV	Unavailable
V	Volts
VECT	Vector
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omni-directional Radio Range
VLOC	VOR / Localizer
W	Warning
WPT	Waypoint
XFILL	Crossfill
XM	[illegible]

HDG	Heading
HORZ	Horizontal
HSI	Horizontal Situation Indicator
IAS	Indicated Airspeed
ID	Identification
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
INC	Incorporated
INFO	Information
INTEG	Integrity
IOP	Input-Output Processor
JSUM	Jeppesen Services Update Manager
KIAS	Knots Indicated Airspeed
KOEL	Kinds of Operations Equipment List
L3	L3 Communications
LRU	Line Replaceable Unit
LTNG	Lightning
LOC	Localizer
MAP	Main Application Processor
MEMS	Micro Electromechanical Systems
MFD	Multi-Function Display
MIC	Microphone
MIN	Minimums
MSG	Message
N/A	Not Applicable
NACO	National Aeronautical Charting Office
NAV	Navigation
NAVAIDS	Navigational Aids
NE	Northeast
NEXRAD	Next Generation Radar
NM	Nautical Miles
NORM	Normal
NOTAM	Notices To Airmen
NXRD	NEXRAD
OAT	Outside Air Temperature
PFD	Primary Flight Display
PCM	[illegible]
POS	Position
PRESEL	Altitude Preselect
RA	Radar Altitude
REV	Revision
REG	Register
RSVD	Reserved
RSM	Remote Sensor Module
SAI	Secondary Attitude Indicator
SDHC	Secure Digital High Capacity
SHSI	Secondary Horizontal Situation Indicator
SID	Standard Instrument Departure
SIG	SIGMET
SIGMET	Significant Meteorological Information
STAR	Standard Terminal Arrival Route
STC	Supplemental Type Certificate
STRK	Strikes/Strikerate
SV	Synthetic Vision
TAS	True Airspeed
TAS	Traffic Advisory System
TCAS	Traffic and Collision Avoidance System

2 Limitations

[illegible]

2.1 [illegible]

[illegible]

At minimum, one vertical column of equipment must be operational for flight. See Table 1 for the equipment installed in this aircraft.

[illegible]

Table 1 [illegible]

[illegible]

2.2 [illegible]

[illegible]

e. Cold temperatures affect the accuracy of the SV system.

For the Traffic and Weather options, the following limitations apply:

a. Maneuvering based solely on the traffic display is not authorized.

b. XM Weather information shown on the EFD1000 PFD is supplemental to data available from official sources.

c. NEXRAD data is limited to the contiguous United States.

d. FIS-B information is to be used for pilot planning decisions and pilot near-term decisions focused on avoiding areas of inclement weather that are beyond visual range or where poor visibility precludes visual acquisition of inclement weather.

e. FIS-B information, including weather information, NOTAMs, and TFR areas, are intended for the sole purpose of assisting in long- and near-term planning decision making. The system lacks sufficient resolution and updating capability necessary for aerial maneuvering associated with immediate decisions.

For IFR operations (if the aircraft is authorized for IFR operations) the following limitations apply. See the aircraft placard located on the flight deck to determine if the aircraft is authorized for Day/Night-VFR or IFR.

a. 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.

b. For aerodrome operation, if the ADAHRS is unable to align due to vibration, departure under IMC or IFR is PROHIBITED.

c. Takeoff with aircraft voltage (as indicated on the EFD) below 12.3V (14V electrical system) or 24.6V (28V electrical system) is NOT AUTHORIZED.

5. The RSM GPS is limited to EMERGENCY USE ONLY.

6. Barometric pressure must be set accurately for proper terrain depiction.

7. Cold temperatures affect the accuracy of the terrain depiction.

8. For the EFD1000 PFD VFR, flying coupled approaches with vertical guidance based solely on the EFD1000 PFD VFR is not authorized. The EFD1000 PFD VFR does not display vertical deviations for the pilot to monitor glide path performance.

9. For the AOA SYSTEM, the following limitations apply:

a. The AOA system is non-required and is to be used only as supplemental information to show the stall margin and trend toward stall. The AOA system is not a substitute for the certified aircraft stall warning system.

b. Airspeed failure or erroneous airspeed will result in erroneous AOA indications.

c. No operational credit may be taken for such items as reduced approach speed and shorter landing distances.

d. The AOA indications are not to be used for takeoff reference.

e. The AOA indications are not valid when the wings or empennage are frost or ice-contaminated.

f. The AOA indications are not valid when spoilers or speed brakes are deployed.

10. When the EFD1000 PFD EBB Advanced or EFD1000 PFD EBB Basic is required for operation, the following limitations apply:

a. When the EBB charge status is less than 80% or has failed, takeoff is NOT AUTHORIZED.

aircraft. This function does not replace any system or equipment required by the regulations.

10. For the Aspen CG100 Connected Gateway (CG100) option, the following limitations apply:

a. The Flight Plan Review Map is not to be used for navigation.

b. The pilot must verify that the flight plan as shown on the MFD is correct and authorized before sending the flight plan to the navigator(s).

c. The Aspen CG100 and the associated applications on the wireless portable device are only to be used as intended by Aspen Avionics. Any manipulation of the system or unauthorized access is prohibited.

11. For the AOA SYSTEM, the following limitations apply:

a. The AOA system is non-required and is to be used only as supplemental information to show the stall margin and trend toward stall. The AOA system is not a substitute for the certified aircraft stall warning system.

b. Airspeed failure or erroneous airspeed will result in erroneous AOA indications.

c. No operational credit may be taken for such items as reduced approach speed and shorter landing distances.

d. The AOA indications are not to be used for takeoff reference.

e. The AOA indications are not valid when the wings or empennage are frost or ice-contaminated.

f. The AOA indications are not valid when spoilers or speed brakes are deployed.

2.6 Placards

1. When the EBB is installed, the following placard must be installed in full view of the pilot:

EMER BAT DISPATCH LIMIT 80%
SEE EFD AFMS

2. When the EA100 is installed, the following placard must be installed in full view of the pilot:

A/P AHRS FAIL

3. When the EFD1000 VFR PFD is installed, the following placard must be installed in full view of the pilot:

No Vertical Deviation on PFD

b. When the cabin temperature is below -20°C, takeoff is NOT AUTHORIZED.

c. When the "ON BAT" annunciation is shown on any EFD display, takeoff is NOT AUTHORIZED.

d. Barometric pressure must be set on the EBD.

2.5 EFD1000 and EFD500 MFD System Limitations

1. Maneuvering based solely on the EFD1000 terrain and obstacle depiction is not authorized.

2. For the Evolution Synthetic Vision option, the following limitations apply:

a. Obstacles on the Synthetic Vision display can be concealed by overlaid indicators such as AOA.

b. Navigation or maneuvering based solely on the EFD1000 or MFD500 Synthetic Vision background display and associated Terrain Warning System (TWS) is not authorized.

c. Barometric pressure must be set accurately for proper operation.

d. Cold temperatures affect the accuracy of the SV system.

3. The moving map displays are not a substitute for approved maps or charts required by the operating rules.

4. The RSM GPS is limited to EMERGENCY USE ONLY.

5. Barometric pressure must be set accurately for proper terrain depiction.

6. Cold temperatures affect the accuracy of the terrain depiction.

7. When the EFD1000 MFD is used as the backup altimeter and/or airspeed indicator (see Table 2), the following limitations apply:

a. When the EBB charge status is less than 80% or has failed, takeoff is NOT AUTHORIZED.

b. When the cabin temperature is below -20°C, takeoff is NOT AUTHORIZED.

c. When the "ON BAT" annunciation is shown on any EFD display, takeoff is NOT AUTHORIZED.

8. For Traffic and Weather options, the following limitations apply:

a. Maneuvering based solely on the traffic display is not authorized.

b. XM Weather information is supplemental to data available from official sources.

c. NEXRAD data is limited to the contiguous United States.

d. FIS-B information is to be used for pilot planning decisions and pilot near-term decisions focused on avoiding areas of inclement weather that are beyond visual range or where poor visibility precludes visual acquisition of inclement weather.

e. FIS-B information, including weather information, NOTAMs, and TFR areas, are intended for the sole purpose of assisting in long- and near-term planning decision making. The system lacks sufficient resolution and updating capability necessary for aerial maneuvering associated with immediate decisions.

9. For the Terminal Procedure Charts option, the following limitations apply:

a. The aircraft ownship position presented on the Airport Diagrams and Terminal Procedures charts may be inaccurate – reference to ownship position for navigation or maneuvering is prohibited.

b. Except as provided for by regulation, the Terminal Procedures Charts depictions on the EFD are not substitutes for aeronautical charts required to be carried aboard the

4. During initialization of the EFD1000 MFD and EFD500 MFD, the following electronic placard is displayed if Synthetic Vision and instrument procedure charts are configured:

CAUTION:
Synthetic Vision information and terrain information are for awareness Only. Do not maneuver based solely on this information.

The aircraft ownship position presented on Instrument Procedure Charts and Airport Diagrams may be inaccurate. Reference to ownship position for navigation or maneuvering is prohibited.

5. During initialization of the EFD1000 PFD, the following electronic placard is displayed if Synthetic Vision is configured:

CAUTION:
Synthetic Vision information and terrain information are for awareness Only. Do not maneuver based solely on this information.

6. When the Aspen Synthetic Vision Demo is configured and the trial period is not expired, the following electronic placard is displayed:

CAUTION:
Aspen Synthetic Vision Demo
Time Remaining: 99 Hours 99 Minutes

Synthetic Vision information and Terrain information are for awareness Only. Do not maneuver based solely on this information.

7. When the Aspen Synthetic Vision Demo is configured and the trial period has expired, the following electronic placard is displayed:

CAUTION:
Aspen Synthetic Vision Demo has Expired
To Re-Enable SV, See your Authorized Dealer

8. During initialization of the EFD1000 PFD and EFD1000/500 MFD, the following electronic placard is displayed if the AOA System is configured:

CAUTION:
The AOA Indicator is not for use as a primary instrument for flight.

3 Emergency/Abnormal Procedures

3.1 Emergency Procedures

No Change to the aircraft procedures

3.2 Abnormal Procedures

3.2.1 Pitot Tube Icing resulting in Attitude Indicator Failure and Erroneous Airspeed Indication

[illegible]

4. Consider Exiting IMC

3.2.2 "ON BAT" Annunciation

The ON BAT annunciation is an indication that the alternator or generator has failed.

1. Aircraft Electrical Power .... Follow AFM Procedures to Restore Power. If unable to restore the alternator or generator proceed as follows:
2. EFD1000/500 Circuit Breaker / Switch .... Pull / Open (turn off) for each Display
3. Press MENU then turn the Left knob........ Reduce the Display brightness to the lowest [illegible] to conserve battery energy
4. Exit IMC as soon as practical

NOTE

The duration of the internal battery system (at 95% remaining) is less than 30 minutes. The duration of the Emergency Backup Battery (at 95% remaining) is more than 30 minutes.

CAUTION

When the EFD is operated until its battery is exhausted, the screen may fade to solid white for several seconds before blanking. To avoid this condition at night, manually turn off the EFD once the display shows 0% battery remaining.

3.2.3 EFD1000 MFD reversion to a PFD

[illegible]

NOTE

[illegible]

3.2.4 Attitude and Heading (AHRS) Reset

1. AUTOPILOT .... MANUALLY DISCONNECT
2. MENU .... Select the first page titled "GENERAL SETTINGS"
3. "AHRS RESET" LINE SELECT KEY .... PRESS
4. "AHRS RESET" LINE SELECT KEY .... PRESS AGAIN TO CONFIRM RESET

3.2.5 Turn Off the EFD in Flight

EFD1000 MFD with EBB, EFD1000 PFD EBB Advanced or EFD1000 PFD EBD Spec

1. EFD (Aspen) Circuit Breaker / Switch .... PULL / OFF
2. EBB Disconnect Switch .... DISC

EFD1000/500 PFD or MFD with Internal Battery

1. EFD Circuit Breaker / Switch .... PULL / OFF
2. REV Button .... Push and hold until the display turns off

3.2.6 Continuous EFD1000 or EFD500 System Reset (does not apply to C3 PFD)

[illegible]

1. REMOVE THE DATABASE CARD .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then
2. [illegible] .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then
3. PULL THE ADS-B CIRCUIT BREAKER .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then
4. PULL THE XM WEATHER CIRCUIT BREAKER .... PERMIT THE SYSTEM TO REINITIALIZE. If the condition persists, then
5. PULL THE [illegible] CIRCUIT BREAKER .... PERMIT THE SYSTEM TO REINITIALIZE

3.3 Warnings, Cautions and Advisories

The following table shows the Warning, Caution and Advisory indications of the EFD1000 and EFD500 and identifies the appropriate pilot action. General Warning, Caution and Advisory messages are dependent on the options and equipment installed in the airplane. Refer to Table 1 to determine the options and equipment installed in this airplane.

Table 4 - Warning, Caution and Advisory Annunciations

Warning | Caution | Advisory

[illegible]

								Annunciation	Description	Pilot Action
[illegible]						✓		[illegible]	MFD attitude could be degraded	[illegible]
[illegible]						✓	✓	[illegible]	No communication between PFD and MFD(s)	[illegible]
[illegible]						✓	✓	[illegible]	Failed heading on the MFD	[illegible]
[illegible]	✓	✓	✓	✓	✓	✓		[illegible]	[illegible]	[illegible]

Annunciation	Description	Pilot Action
[illegible]	[illegible]	[illegible]

Annunciation	Description	Pilot Action
[illegible]	[illegible]	[illegible]

Annunciation	Description	Pilot Action
[illegible]	[illegible]	[illegible]

Annunciation	Description	Pilot Action
[illegible]	[illegible]	[illegible]

4.2.4 EFD1000 PFD EBB Advanced or EFD1000 PFD EBB Basic

1. EBB Switch .... NORM
2. MENU .... Select POWER SETTINGS page
3. EXT PWR: (Aircraft input Voltage) .... Check > 12.3V/24.6V
4. BAT .... Verify battery status is not shown as "FAIL"
5. EFD1000 PFD EBB .... Select "BATTERY"
6. EFD1000 PFD EBB .... Verify battery charge is above 50%
7. EFD1000 PFD EBB .... Select EXT PWR
8. MENU .... Press the MENU button to return to normal operation
9. BARO .... Set

Except as instructed in Section 3.7.2, the EBB switch should be left in the NORM position at all times, including when away from the aircraft.

4.3 Avionik Straubing APS4A Altitude Preselector

1 Altitude Alerter .... Set as desired
2 PRESEL .... Press for ARMED

To deselect

3 PRESEL .... Press to Disarm

4.4 S-TEC 55X Altitude Preselect and Vertical Speed Control

Except as described here, refer to the S-TEC 55X AFMS and Pilot's Guide for S-TEC 55X information.

Preflight:

When the EFD1000 PFD displays "RDY", perform the following steps.

1. Select the STEC55X AP menu page on the EFD1000 PFD and change the VERT SPD CNTL option from PFD to STEC55X.
2. Conduct the S-TEC 55X Autopilot Tests per the FAA-approved Airplane Flight Manual Supplement for the autopilot system installation.
3. Select the STEC55X AP menu page on the EFD1000 PFD and change the VERT SPD CNTL option from STEC55X to PFD.

Operation:

To select a vertical speed and to preselect and capture a selected altitude:

1. Vertical Speed Bug .... Set as desired on the PFD.
2. Altitude Bug .... Set as desired on the PFD.
3. S-TEC 55X Programmer/Computer .... Engage the VS mode. For preselected altitude, engage ALT and VS simultaneously.

4 Normal Procedures

4.1 Exterior Inspection

1. RSM .... Check for condition and security
2. RSM Vent Hole .... Check Clear of obstructions
3. RSM Lightning Tape .... Check for condition and security

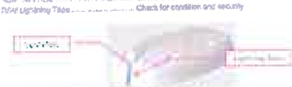

Figure 7 – RSM Lightning Tape/Vent Hole

4.2 Before Take-Off Checks

4.2.1 EFD1000 PFD PRO, EFD1000 PFD PRO C3, EFD1000 PFD PILOT, EFD1000 PFD VFR

1. PFD .... Configure for departure

4.2.2 EFD1000 MFD (without EBB) or EFD500 MFD

1. MFD .... Configure for departure

4.2.3 EFD1000 MFD with EBB

If an EFD1000 MFD with EBB is installed in lieu of a backup altimeter and/or airspeed indicator (see Table 2), perform the following:

1. EBB Switch .... NORM
2. MENU .... Select POWER SETTINGS page
3. EXT PWR: (Aircraft Input Voltage) .... Check > 12.3V/24.6V
4. BAT .... Verify battery status is not shown as "FAIL"
5. EFD1000 MFD .... Select "BATTERY"
6. EFD1000 MFD .... Verify battery charge is above 50%
7. EFD1000 MFD .... Select EXT PWR
8. MENU .... Press the MENU button to return to normal operation.
9. EFD1000 MFD .... Select REV mode (MFD XFILL). The MFD must be operated in the PFD reversion mode for takeoff.

Except as instructed in Section 3.7.2, the EBB switch should be left in the NORM position at all times, including when away from the aircraft.

4.5 ADS-B OUT Control

When the EFD1000 PFD displays "UAT CTL MENU", perform the following steps to set the squawk or IDENT:

To set the squawk:

1. Transponder .... Set the squawk
2. Press MENU .... Set the squawk. Press MENU to return

To IDENT:

1. Press MENU .... Press IDENT. Press MENU to return

4.6 Before Approach Checks

1. PFD .... Configure for arrival

If an EFD1000 MFD with EBB is installed in lieu of a backup altimeter and/or airspeed indicator (see Table 2), perform the following:

1. EFD1000 MFD .... Select REV mode (MFD XFILL). The MFD must be operated in the PFD reversion mode for landing.

4.7 Shutdown Checks

After conducting normal Shutdown checklist items, ensure the following.

1. EFD1000 / MFD Switches .... OFF

4.8 Turning the AOA System On, Off or Auto on the PFD

To turn the AOA system On, Off or Auto on the PFD, proceed as follows:

1. Press MENU to enter the menu pages
2. Rotate the right knob to select the GENERAL SETTINGS (1) menu page
3. Press the AOA DISPL button until the label turns magenta.
4. Rotate the right knob to select ON, OFF or AUTO.
5. Push the AOA DISPL button to return the selection.
6. Press MENU to exit the menu pages.

7 Systems Description

[illegible]

7.1 Evolution Flight Display

The Evolution Flight Display System consists of one or more integrated Electronic Flight Display (EFD1000 or EFD500) systems. The EFD1000 system can be configured as a Primary Flight Display (PFD) or as a multi-function display (MFD). The EFD500 system can be configured as an MFD only. The E5D Basic or the E5D Advanced are Primary Flight Displays used as backup to a non-Aspen Primary Flight Display.

The following Pilot Guides should be carried in the aircraft and available to the pilot [illegible] to the equipment installed in the airplane:

- For the EFD1000 PFD PILOT, PFD PRO, E5D Basic and E5D Advanced: Aspen Avionics document 091-00005-001, EFD1000 PFD Pilot's Guide, Revision [illegible] or subsequent revision
- For the EFD1000 MFD [illegible] Aspen Avionics document 091-00006-001 [illegible] MFD Pilot's Guide, Revision [illegible] or subsequent revision
- For the EFD1000 [illegible] Aspen Avionics document [illegible] Pilot's Guide Revision [illegible] or subsequent revision
- For the EFD1000 MFD or EFD500 MFD: Aspen Avionics document 091-00007-[illegible] EFD1000/500 MFD Pilot's Guide Revision B or subsequent revision

[illegible]

7.1.1 Internal Battery

[illegible]

7.1.2 Emergency Backup Battery (EBB)

The EBB is an external rechargeable battery for the EFD1000 MFD, the EFD1000 E5D Advanced and the EFD1000 E5D Basic. This is a larger battery that will provide at least 30 minutes operation (at 80% charge) in the event of complete loss of electrical power.

7.1.3 [illegible]

The EFD1000 PFD and the EFD1000/500 MFD intercommunicate barometric pressure and other data among these systems. The EFD1000 E5D does not intercommunicate barometric pressure with the non-Aspen Primary Flight display. It is necessary to adjust the barometric pressure directly on the Aspen EFD1000 E5D.

7.2 Databases

The following table provides information regarding the databases used by EFD.

Table [illegible] Databases

Database Name	Definition	Update Cycle	Used In	Database Provider	[illegible]
Terrain	High resolution terrain data for Americas, International, or [illegible] geographic regions. [illegible]	[illegible]	Synthetic Vision, Nav Maps and Terrain Maps	Jeppesen [illegible]	
Aviation	Includes Airspace, Controlled Airspace, Restricted, Prohibited and Special Use Airspace, Airports, etc.	28 day update cycle	Synthetic Vision and Nav Maps	Jeppesen [illegible]	
[illegible]	Includes Victor airways, Jet [illegible], etc.	28 day update cycle	Synthetic Vision and Nav Maps	Jeppesen [illegible]	[illegible]
Obstacles	Includes man-made obstacles greater than 200 ft. AGL. [illegible]	28 day update cycle	Synthetic Vision and Nav Maps and Terrain maps	Jeppesen [illegible]	
Charts	Americas Terminal Procedure Charts	28 day update cycle	Terminal Procedures with airport Diagrams	Seattle Avionics	

7.3 Remote Sensor Module (RSM)

The RSM provides heading information to the EFD1000 and is powered by the EFD1000. Some models have an internal GPS for emergency use that will automatically operate when the external GPS systems fail.

7.4 Traffic Display

There are several Traffic interfaces that are available. Table 1 Installed Equipment List identifies the equipment in the aircraft.

The traffic data can be displayed on the moving map or as a dedicated view on the MFD when connected to the approved TCAS I, TAS, TIS or ADS-B external sensor. The dedicated view is titled TFC.

Traffic data provides a graphical depiction of aircraft relative to the aircraft heading. When the traffic data is not displayed on the PFD's moving map, the traffic automatically displays during a Traffic Advisory. When the dedicated traffic view is not displayed on the MFD and a Traffic Advisory occurs, a traffic popup is displayed to allow quick selection to view the Traffic Advisory.

[illegible]

[illegible]

7.5 ADS-B

7.5.1 ADS-B OUT

The Aspen or FreeFlight ADS-B OUT system automatically transmits surveillance data to Air Traffic Control and other aircraft. The ADS-B OUT interfaces with an onboard altimeter and GPS to transmit the squawk, registration, altitude and position. When "UAT CTL" MENU is displayed on the PFD, then control of the squawk and IDENT is temporarily transferred to the PFD MENU.

If the ADS-B OUT system is turned off then ATC will not receive the surveillance data.

If the transponder is turned off, the UAT control will be transferred to the Aspen Display.

7.5.2 ADS-B IN

The Aspen PFD and MFD systems can display weather and traffic information when interfaced with a compatible ADS-B system.

7.6 [illegible]

[illegible]

7.7 [illegible]

[illegible]

7.8 [illegible]

The MFD supports a [illegible] charts view. The [illegible] view is titled CHARTS.

The dedicated charts view displays pre-composed terminal procedures from the Seattle Avionics Instrument Procedures Charts Database. The dedicated charts view allows the pilot to view [illegible] ownship on geo-referenced instrument approach procedures and airport diagrams. The ownship is only available for display on the airport diagram when the aircraft is on the ground.

The ownship position is centered at the intersection of the wings and fuselage.

The Terminal Procedures Charts require a database.

[illegible]

7.9 NAV and Terrain Maps

The PFD and MFD both support a moving map.

The PFD moving map is integrated into the navigation display on the bottom half of the PFD.

The MFD moving map is a dedicated view that displays NAVAIDs, Controlled Airspace, Restricted, Prohibited and Special Use Airspace, Airports, etc.

The terrain and obstacle data can be displayed on the moving map or as a dedicated view on the MFD. The dedicated view is titled TERR. The terrain and obstacle data is advisory only.

CAUTION
Accurate barometric pressure is essential for accurate terrain and obstacle data.

The terrain and obstacle data is advisory information based on the aircraft's proximity to terrain and obstacles. The aircraft's proximity to terrain and obstacles is determined by computing the altitude difference between the terrain and obstacles in the database and the aircraft's baro-corrected altitude.

The MFD Nav and Terrain maps require a database. The PFD moving map does not require a database.

7.10 [illegible]

[illegible]

7.11 Synthetic Vision and Terrain Warning System

The PFD and MFD can both support the display of Synthetic Vision. The display of the Synthetic Vision depiction is advisory only.

The Synthetic Vision depiction is a computer-derived perspective view of the nearby terrain, obstacles and airports. The Synthetic Vision depiction supports a flight path marker to display the vertical and lateral path of the aircraft based on two parameters, barometric vertical speed and GPS track. The Synthetic Vision depiction also supports a Terrain Warning System (TWS) that uses the flight path marker to present an estimated time-to-collision function for terrain and obstacles. Unless inhibited by the pilot, TWS operates even when Synthetic Vision is turned off.

The MFD Nav and Terrain maps require a database.

[illegible]

7.12 [illegible]

[illegible]

7.13 Radar Altitude

When installed and configured, Radar Altitude information can be presented on the PFD. When the height exceeds the Radar Altitude maximum height, the indication is suppressed. When the Radar Altitude is at or below the maximum height, the Radar Altitude is shown as a number marked RA on the PFD.

Separately, the Decision Height can be shown as an amber balloon on the PFD.

7.14 ADF Interface

When installed and configured, ADF #1, #2 or both can be shown on the needles controlled by the left and right lower buttons.

7.15 VHF Interface

When installed and configured, VLOC 1 or VLOC 2 [illegible] by the lower center button.

7.16 GPS Interface

When installed and configured, GPS1 or GPS2 can be selected using the lower center button.

7.17 Avionik Straubing APS4A Altitude Preselector

The Altitude Preselector is a remote altitude hold function. When armed, the altitude hold will be engaged at the selected altitude.

7.18 S-TEC 55X Vertical Speed Control/Altitude Preselect

When installed and configured, the PFD provides vertical speed command and altitude preselect for the S-TEC 55X autopilot.

7.19 Autopilot Source Select

[illegible]

7.20 AOA System

[illegible]

[illegible]

WARNING
[illegible]

[illegible]

NOTE:
[illegible]

[illegible]

[illegible]

Figure 3 - AOA Indicator

7.20.3 Pointer Definition

The following table shows the pointer definitions.

Table 9 - Pointer Definition

Pointers	Meaning
Upper Pointer (Flaps Up)	[illegible]
Lower Pointer (Flaps Down)	[illegible]

7.20.4 Color Band Definition

The color bands mean the following:

Table 10 - Color Band Definition

Color Band	Meaning
[illegible] band	[illegible]
Yellow band	[illegible]
Green band	AOA is well above stall
Blue band	[illegible]

7.20.1 AOA Display Modes

The PFD supports three AOA display modes, Auto, On and Off. The MFD supports one mode, On.

Table 6 - AOA Display Modes

Mode	Description
AUTO	[illegible]
ON	The AOA indicator is always displayed.
OFF	The PFD does not display the AOA indicator.

See Section 4.7 for information on how to select the modes of operation.

7.20.2 AOA Operation by Phase of Flight

The following tables describe the typical AOA indications in various phases of flight in the On and Auto modes.

Table 7 - AOA "ON" Mode

Phase of Flight	Description of the AOA Indicator
Taxi	The AOA indicator is displayed with no pointers.
Takeoff	[illegible]
Climb	[illegible]
Cruise	[illegible]
Descent	[illegible]
Approach	[illegible] [illegible]
Landing	[illegible]
Rollout	[illegible]

Table 8 - AOA "AUTO" Mode

Phase of Flight	Description of the AOA Indicator
Taxi	"AOA AUTO" is displayed.
Takeoff	[illegible]
Climb	[illegible]
Cruise	[illegible]
Descent	"AOA AUTO" is displayed.
Approach	[illegible] [illegible]
Landing	[illegible]
Rollout	[illegible]