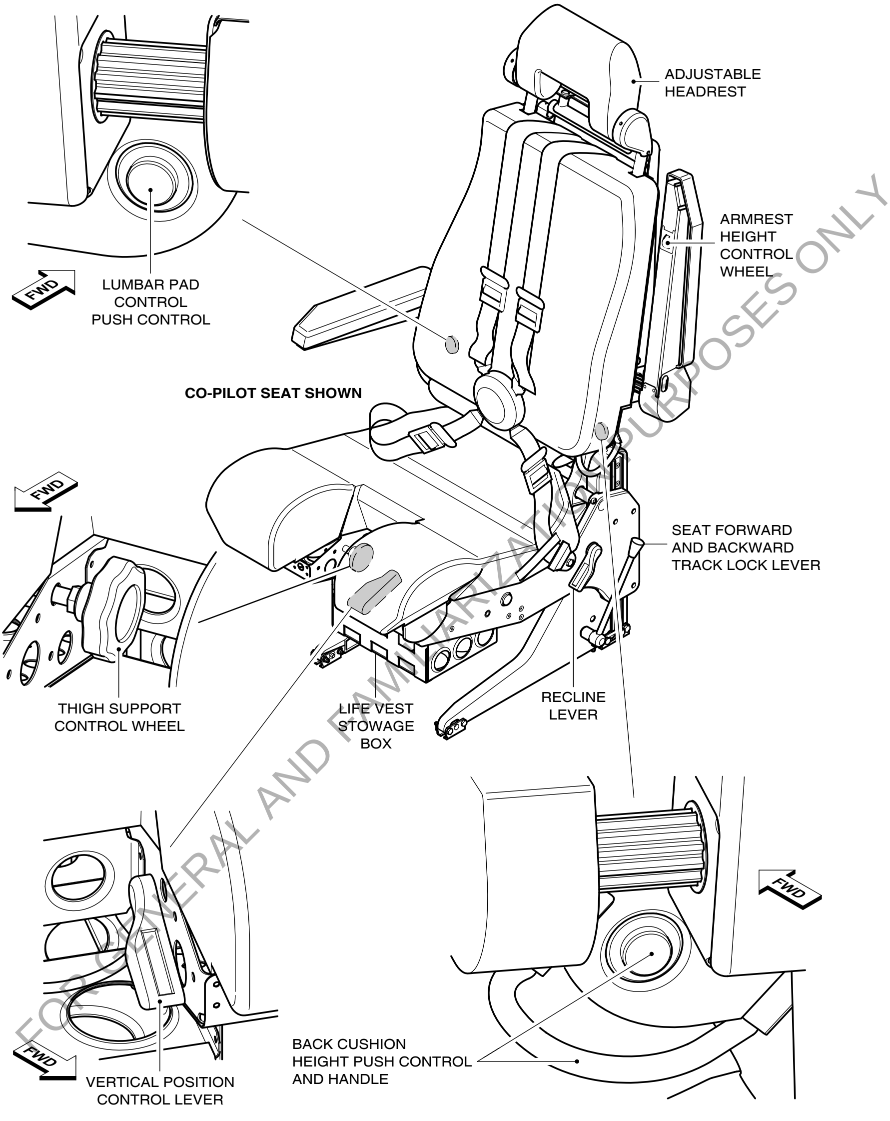

Figure 7-7-1: Crew Seat - Controls

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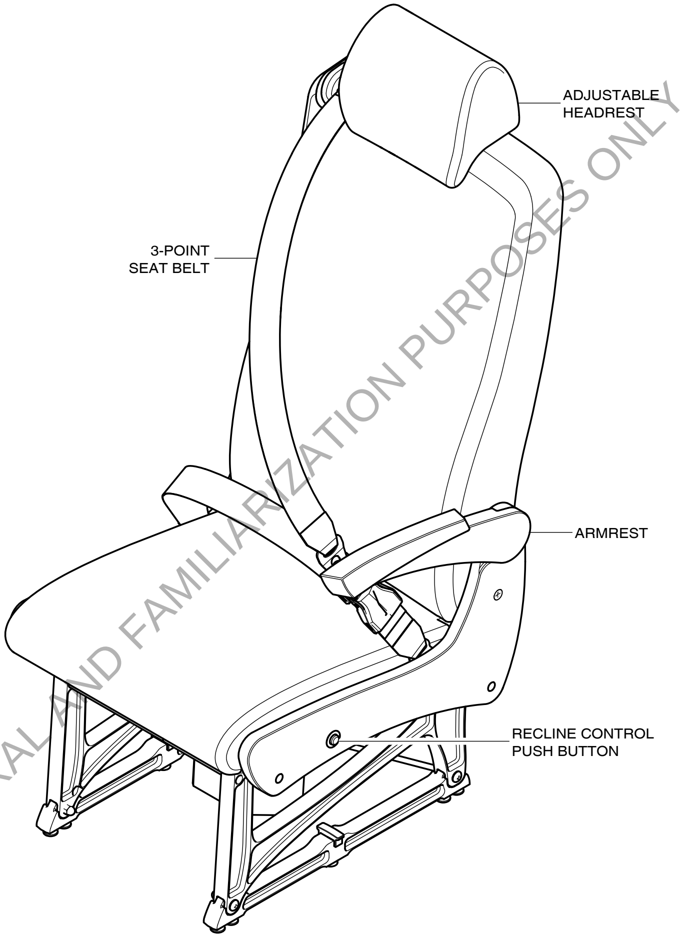

Figure 7-7-2: Commuter Seat - Typical

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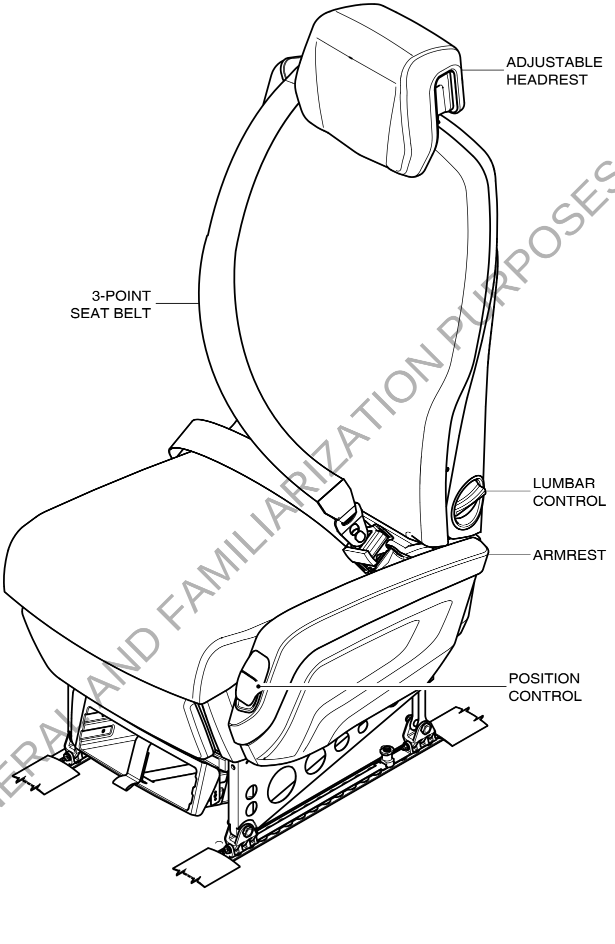


Figure 7-7-3: Executive Seat - Typical

7-7-3 Restraint Systems for Children

Pilatus supplies the optional CARES™ Restraint System for children who are older than 24 months and weigh 22 – 40 lb (10 - 20 kg).

7-7-3.1 Description

WARNING

DO NOT INSTALL THE CARES™ RESTRAINT SYSTEM IN ANY OTHER WAY THAN THE ONE DESCRIBED BELOW. DEATH OR INJURY MAY OCCUR IF THE RESTRAINT SYSTEM IS NOT INSTALLED PROPERLY.

WARNING

MAKE SURE AN ADULT WILL SIT IN THE SEAT NEXT TO THE SEAT WHERE THE CARES™ RESTRAINT SYSTEM IS INSTALLED. THE ADULT MUST BE ABLE TO REACH THE OXYGEN MASK FOR THE CHILD.

When you use the CARES™ Restraint System, make sure you follow these requirements:

- Only use the CARES™ Restraint System for children who are older than 24 months and weigh 22 - 40 lb (10 - 20 kg)
- Only install the CARES™ Restraint System on a forward facing seat in the following interior configurations:
  - Nine standard seats configuration (STD-9S)
  - Six executive seats configuration (EX-6S-2)
  - Eight executive seats configuration (EX-8S)
  - Six executive seats and two standard seats configuration (EX-6S-STD-2S)
  - Four executive seats and four standard seats configuration (EX-4S-STD–4S)

  Refer to Section 6, Interior Configurations, for more information on the various interior configurations.

7-7-3.2 Installation

Note

Refer to Section 6, Interior Configurations, for more information onto which seat the CARES™ Restraint System is allowed for installation.

Install the CARES™ Restraint System on the seat as follows:

1 Disconnect the shoulder belt from the lap belt connector and retract it into the seat backrest.

2 Install the CARES™ Restraint System on the seat and the lap belt connector as shown in Fig. 7-7-4.

Note

It remains the operator’s responsibility to get the required approval for operation from the local authority.

7-7-3.3 Removal

Remove the CARES™ Restraint System from the seat as follows:

1. Remove the CARES™ Restraint System from the seat and the lap belt connector as shown in Fig. 7-7-5.
2. Pull the shoulder belt out of the seat back rest and connect it to the lap belt connector.

7-7-3.4 Emergency Release

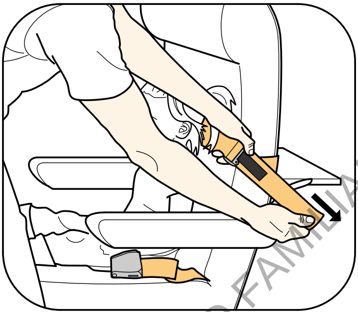
In case of an emergency the CARES™ Restraint System can be quickly released as follows (refer to Fig. 7-7-6):

1. Release the lap belt buckle.
2. Pull the shoulder straps over the child's head.

1

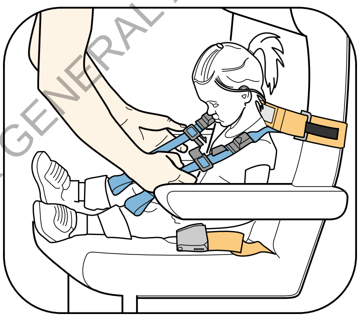
Put the child in the seat.
Install the belt on the back rest.

2



Pull the end of the belt until it is tight.

3



Put the shoulder straps over the child's shoulders.

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Figure 7-7-4: CARES™ Restraint System - Installation (Sheet 1 of 2)

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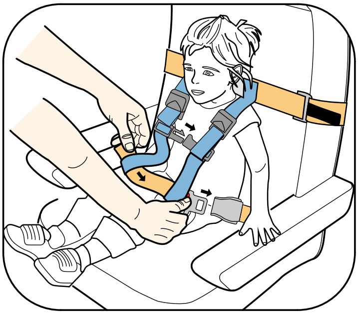
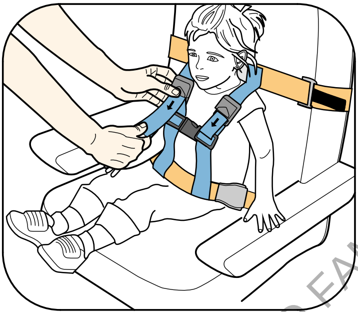
4



Put the lap belt through the two loops in the shoulder straps.
Connect the lap belt to the buckle.
Fasten the chest clip.

5



Pull the ends of the shoulder straps until they are tight.

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Figure 7-7-4: CARES™ Restraint System - Installation (Sheet 2 of 2)

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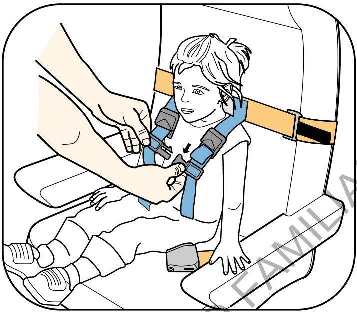
(1)

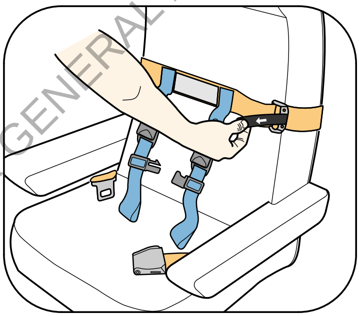
Release the lap belt from the buckle.
Remove the lap belt from the shoulder straps.

(2)



Disconnect the chest clip.
Remove the child from the seat.

(3)



Remove the belt from the back rest.

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Figure 7-7-5: CARES™ Restraint System - Removal

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Release the lap belt buckle.
Pull the shoulder straps
over the child's head.

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Figure 7-7-6: CARES™ Restraint System - Emergency Release

7-8 Doors, Windows and Exits

7-8-1 Passenger Door

The passenger door is located in the front left fuselage, immediately aft of the cockpit, and is 4 ft 5 in (1,35 m) high by 2 ft 0 in (0,61 m) wide. The door can be opened or closed from either side and is secured by six locking pins. These can be checked visually from inside the cabin to verify engagement. The door is hinged at the bottom and has an integral steps/handrail assembly which automatically extends and retracts as the door is opened or closed. A non-inflatable seal attached to the door seals the gap to allow the cabin to pressurize when the door is closed.

To open the door from the outside, push the button on the handle, and pull out the free end of the handle at the right hand side. Then pull outward on the door. As the door opens, the steps and the handrail will be pulled from the stowed position. Close the door by lifting the door into position, allowing the steps and handrail to fall into the stowed position. Then push in the free end of the handle.

To open the door from the inside, lift the latch and rotate the handle clockwise to the open position and push the door open. To close, pull the door closed and allow the steps and handrail to fall into the stowed position before rotating the handle counterclockwise.

The cabin door is an emergency exit and it must be accessible at all times.

The Crew Alerting System (CAS) will show **Passenger Door** when the door is not properly closed and locked. In the event that the cargo door is also not properly closed and locked, the CAS will show **Pax + Cargo Door**.

7-8-2 Cargo Door

The cargo door is located in the aft left fuselage and is 4 ft 4 in (1,32 m) high by 4 ft 5 in (1,35 m) wide. It is secured by locking pins which can be checked visually from outside the airplane to verify engagement. The door is hinged at the top and swings up out of the way to facilitate loading and unloading. A gas cylinder assists in door operation and holds the door in the open position. A non-inflatable seal attached to the door seals the gap to allow the cabin to pressurize when the door is closed.

To open the door from the outside, push the button and pull the handle outward and upward. The gas cylinder will assist in raising the door to the open position. An electrical motor and cable is installed to assist the closure of the cargo door. To operate, press and hold the switch located aft of the cargo door until the door has lowered to the near closed position. Push the door closed and push handle in until flush and the button pops back to the lock position. To open the door from the inside, remove the cover, lift the lever and pull handle to unlock and then push open the door. To close, pull down on the strap to bring the door almost closed and stow the strap. Pull the door closed and push handle down to the lock position.

The power supply to the electrical motor is from the HOT BAT BUS and is disconnected by a microswitch which is operated by the drive mechanism when the door is nearly closed. The door must be manually pushed and locked to the closed position.

The CAS will show **Cargo Door** when the door is not properly closed and locked. In the event that the passenger door is also not properly closed and locked the CAS will show **Pax + Cargo Door**.

7-8-3 Windows

A two-piece windshield and two side windows provide cockpit visibility. Both pilot and copilot windshields are laminated twin-layer mineral glass with an embedded polyvinyl butyral (PVB) layer. The windshield incorporates three electric heating elements for defogging and anti-icing capability. Both side windows are stretched acrylic with inner 2 mm thick double-glazed acrylic windows. A separate direct vision (DV) window, also stretched acrylic, is installed between the left windshield and the left side window. This can be opened to provide pilot visibility/smoke evacuation during emergencies and can be used to provide additional airflow during ground operations.

Windshield heat is controlled by two switches, LH WSHLD and RH WSHLD, both switches are marked HEAVY, LIGHT and OFF. The switches are located on the ICE PROTECTION section of the pilot's lower right switch panel. The HEAVY and LIGHT positions offer two heat levels and areas to be used as required for defog and anti-ice. The windshield is protected from an overheat condition by a temperature sensor. This sensor will remove current from the windshield heat circuit when the windshield surface temperature is above 60 °C.

The cabin has four windows on the left side and five on the right side. All of the windows are stretched acrylic with integral sliding shades.

7-8-4 Indication/Warning

In the event of a failure of a windshield heat system, the CAS will show **LH Windshield**, **RH Windshield** or **LH + RH Windshield**.

7-8-5 Emergency Exit

Refer to Fig. 7-8-1. Emergency Exit

The overwing emergency exit is located over the right wing and is 2 ft 2 in (0,68 m) high by 1 ft 6 in (0,49 m) wide. This exit contains a window and can be quickly opened from either inside or outside when required. A non-inflatable seal attached to the exit seals the gap to allow the cabin to pressurize when the exit is in place. To open the exit from inside, remove cover and pull handle to release exit locking mechanism and pull inward. To open from the outside, push on the release lever and push exit inward.

7-8-6 Aircraft Security

Refer to Fig. 7-8-1. Emergency Exit

To secure the aircraft when parked, install the lock pin in the emergency exit and lock the cargo and passenger door locks. Lock the service door under the rear fuselage, if a lock is installed.

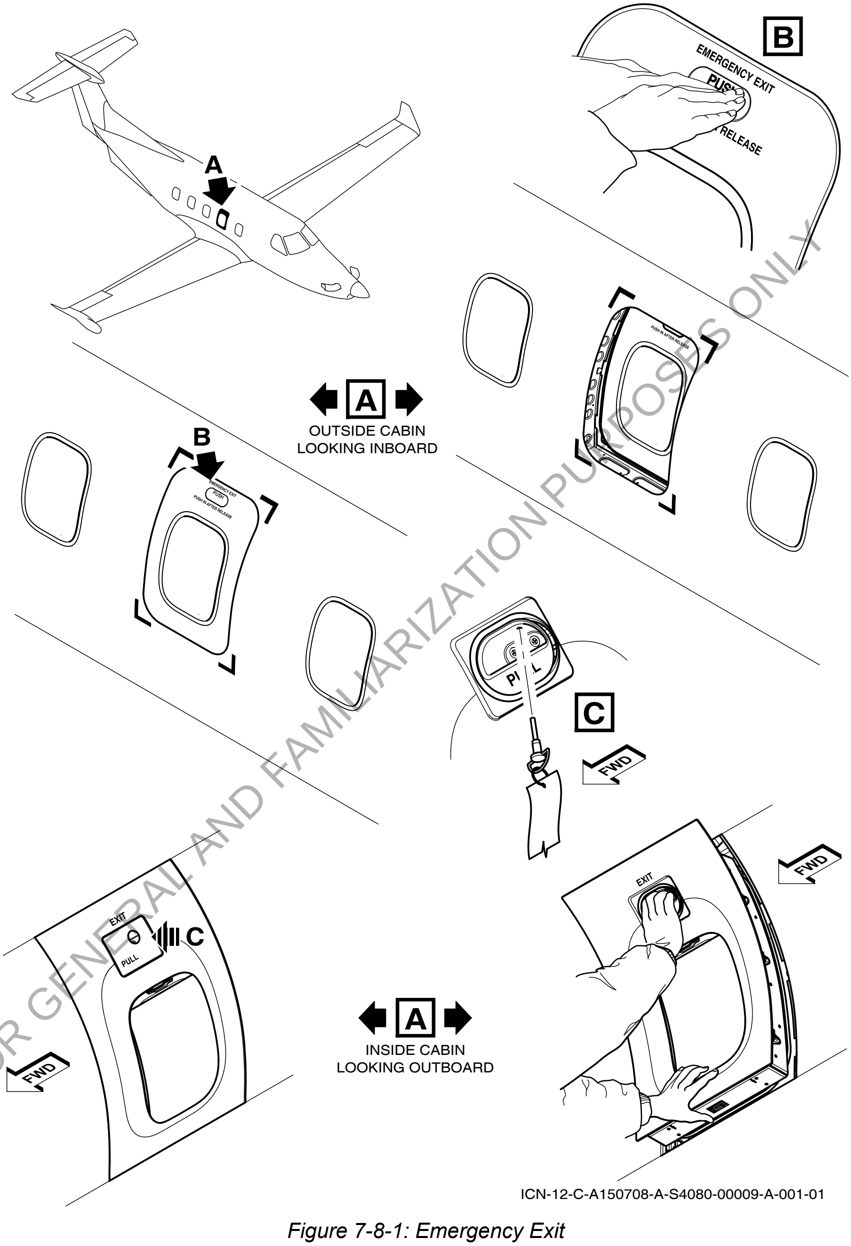

Figure 7-8-1: Emergency Exit

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7-9 Control Locks

7-9-1 Control Locks

The elevator and ailerons can be secured by placing a control lock through the hole in the collar and control column when the elevator is full down and the ailerons are neutral. For flight, the control lock is stowed in a stowage point located on the cockpit left sidewall to the rear of the pilots seat. The rudder is held in position by the mechanical connection with the nose wheel steering.

WARNING

THE CONTROL LOCK MUST BE REMOVED BEFORE TAKEOFF.

CAUTION

Make sure that the rudder/nose wheel is centered.

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7-10 Engine

7-10-1 Description and Operation

For the engine configuration, refer to Fig. 7-10-1, PT6E-67XP Engine

This airplane is powered by the Pratt & Whitney PT6E-67XP, which is a lightweight, reverse flow, free turbine engine and features an Engine and Propeller Electronic Control System (EPECS).

In addition to the gas generator section, the engine incorporates a power section with the power turbine and propeller reduction gearbox, an integral oil system, and an accessory gearbox for mountings for various accessories.

Air enters the compressor through an annular plenum chamber. The compressor consists of four axial stages and a single centrifugal stage. Stator vanes between each stage of compression diffuse the air, raise its static pressure, and direct it to the next stage of compression. From the centrifugal compressor, air flows through a diffuser tube, then changes direction 180 degrees as it flows into the combustion chamber. A compressor bleed valve is installed on the gas generator case at the 3 o'clock position. It automatically opens to spill interstage compressor air to prevent compressor stall.

The combustion chamber consists of two perforated annular sections bolted together with a large exit duct. Compressed air enters the combustion chamber through the perforations, where it is mixed with fuel and ignited. The rapidly expanding gas is directed through another 180 degree direction change into the turbine.

The turbine consists of a single stage compressor turbine and a two-stage power turbine. As the gas exits the combustion chamber, it is directed onto the compressor turbine, which powers the compressor. From the compressor turbine, the gas is directed to the two-stage power turbine which drives the propeller via the propeller reduction gearbox. engine Inter Turbine Temperature (ITT) is measured between the compressor and power turbines.

Gas flow is directed into the exhaust duct from the turbine. The exhaust duct has an annular inlet which leads exhaust gas to a bifurcated duct connected to two opposed exhaust ports. The exhaust duct is made from heat resistant nickel alloy metal and incorporates mounting flanges for the exhaust nozzles.

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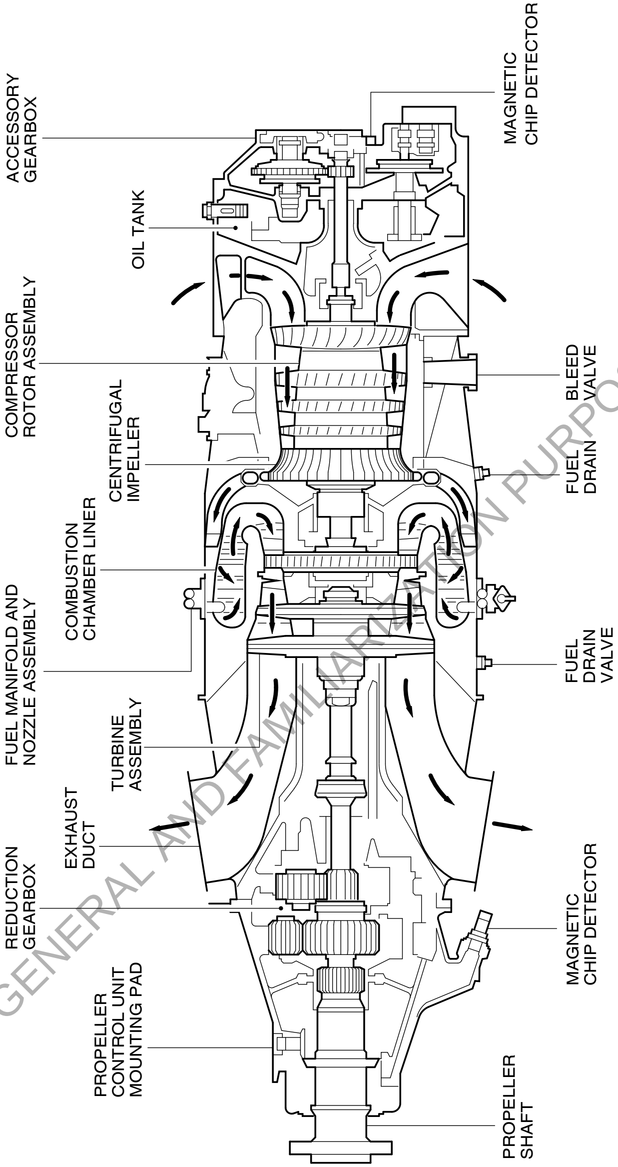

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Figure 7-10-1: PT6E-67XP Engine

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7-10-2 Air Induction

The air induction system is integrated into the front and rear lower cowlings and comprises of an air inlet and inlet duct, a plenum, and an inertial separator.

The air inlet consists of a crescent shaped metal leading edge through which hot exhaust is passed to prevent ice accumulation. The exhaust gas is extracted from the left hand side exhaust stub by the means of a 1.5 inch diameter pitot probe inserted into the stub itself. It then passes through the lip, consisting of a sealed chamber, before exiting into the right hand stub through a 1.5 inch discharge tube. The probes are connected to the exhaust lip by 1.5 inch diameter metal ducts complete with integral connectors. The inlet duct, which connects the inlet lip to the plenum, consists of a diverging nozzle following the same general shape as the inlet lip.

The plenum consists of a sealed circular metal canister surrounding the engine compressor inlet screen. It is here that the engine draws air to be compressed for combustion and services supply.

7-10-3 Inertial Separator

Refer to Fig. 7-10-2, Inertial Separator and Fig. 7-10-3, Engine Controls and Indications for the control switch and indicator.

The inertial separator is of the `fixed geometry´ design and provides engine induction system protection when operating in icing or Foreign Object Damage (FOD) conditions. It can be used for takeoff when operating in a FOD environment. It comprises of a fixed No. 2 mesh screen attached to the rear wall of the plenum covering a percentage of the inlet area, a moveable outlet door and electrical actuator situated directly above the oil cooler outlet exit, and a converging bypass duct.

In normal operations (non-icing, non-FOD) the outlet door is closed which seals the bypass and provides the induction air with a single flow path to the plenum and engine through the porous No. 2 screen.

In icing or FOD conditions the actuator is retracted to open the outlet door. This allows a flow path past the plenum to ambient and increases the pressure ratio across the inlet system. The increased pressure ratio has the effect of accelerating heavy particles present in the inlet air, which then go straight past the plenum and into the bypass duct before exiting through the outlet door. In icing conditions, the porous No. 2 screen ices to restrict the flow path of solid particles which cannot turn into the plenum and thus further assist in engine protection. However, the pressure of the air to the engine, with the inertial separator open, is also reduced with consequent reduction in available engine power at climb and cruise. Takeoff power is not affected by the inertial separator position.

The inertial separator outlet door operation is controlled by the ICE PROTECTION INERT SEP switch on the switch panel on the pilot’s lower right panel. The switch has two positions OPEN and CLOSED, when the switch is set to the OPEN position the inertial separator door opens and when fully open **INERT SEP** will come on in the ICE PROTECTION window of the systems Multi Function Display (MFD). When the door is selected to OPEN but does not reach its selected position, after 45 seconds the Crew Alerting System (CAS) will show **Inertial Separator** in the CAS window of the systems MFD. If EPECS detects a mismatch between the inertial separator command and the door position, it will select the higher power rating (for inertial separator closed) and the CAS will show **EPECS Fault** in flight and **EPECS Degraded** on ground. When the switch is set to CLOSED the door closes and the **INERT SEP** message will go off.

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After failure of the inertial separator, the aircrew should prepare for departure of icing conditions as soon as possible.

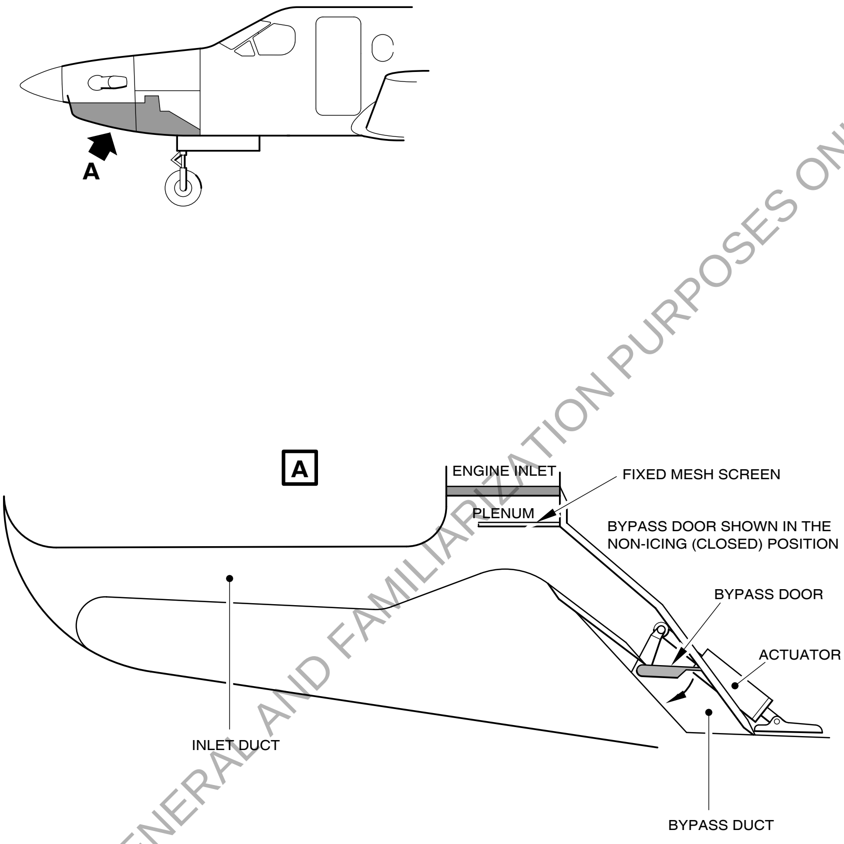

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Figure 7-10-2: Inertial Separator

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7-10-4 Controls

Refer to Fig. 7-10-3, Engine Controls and Indications

The Power Control Lever (PCL) and aircraft sensors provide inputs to the EPECS to control engine power.

7-10-4.1 Power Control Lever

The PCL selects the required engine power and propeller pitch. The flight operating range is forward of the idle detent. As the PCL is moved forward of the idle detent, the engine power and propeller pitch increases from idle and minimum propeller pitch. Propeller speed is held constant at 1700 rpm at higher engine power and/or aircraft airspeeds. The PCL can be set to the Maximum Climb Power (MCP) soft stop or Take Off (T/O) stop depending on the phase of flight. Cruise power is set manually by pilot command in order to operate the engine within limits.

When the PCL is at the idle detent, the gas generator is at idle and the propeller is at or above minimum pitch. A lifting action to raise the PCL over the detent is required to move the PCL into the ground operating/reverse range.

Control between ground and flight idle is automatic. The EPECS receives the aircraft air/ground status in order to schedule either ground or flight power settings. The scheduling is based on the signal received by the EEC channel in control. The air/ground signal does not affect the maximum achievable power but may affect the power setting for a specific PCL position.

WARNING

PCL OPERATION AFT OF THE IDLE DETENT IS NOT PERMITTED IN FLIGHT.

CAUTION

Do not leave the PCL stationary for more than 30 seconds in the beta range (aft of idle detent) to avoid an EPECS Degraded message on the CAS window.

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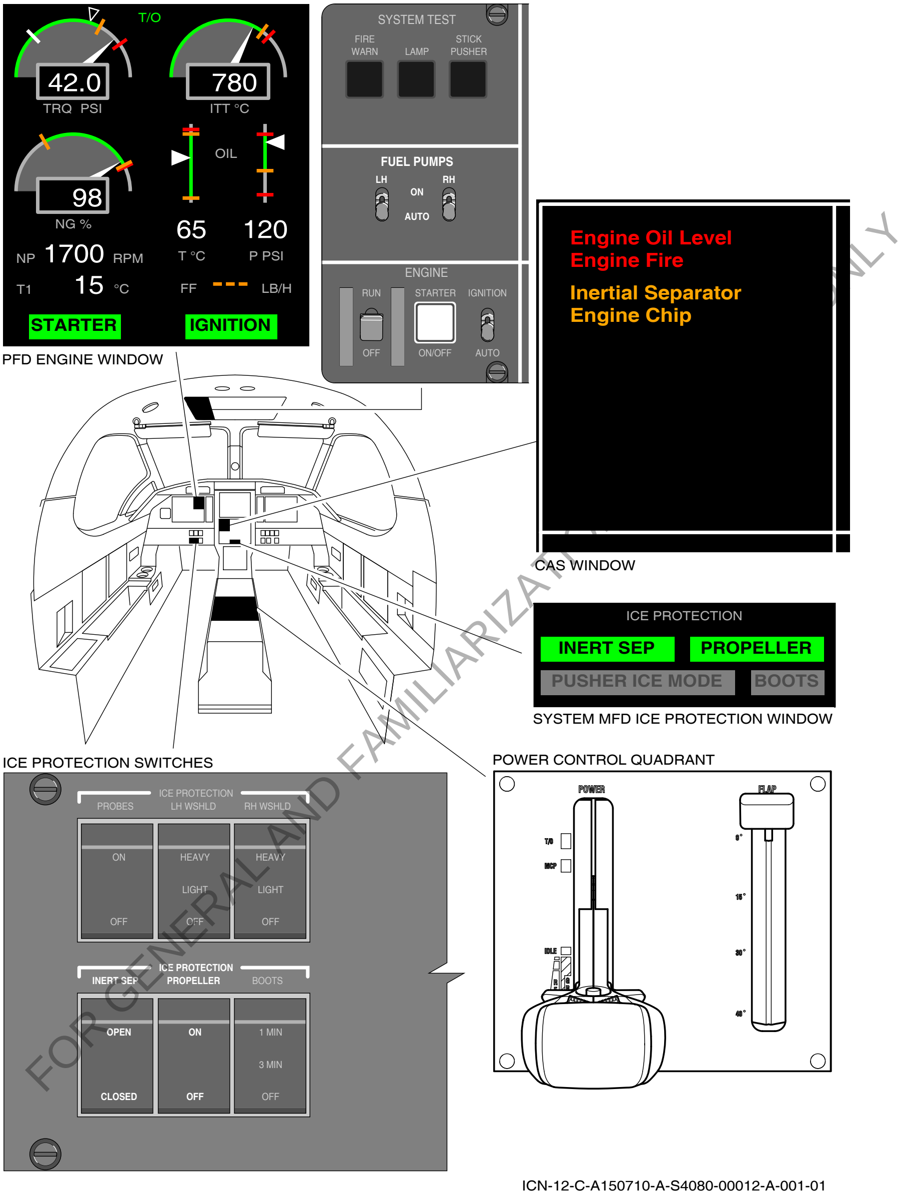

Figure 7-10-3: Engine Controls and Indications

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7-10-4.2 Engine and Propeller Electronic Control System

7-10-4.2.1 Introduction

The EPECS is a dual channel, dual processor full authority integrated engine and propeller control system.

The EPECS main function is to control the engine output power at a reference propeller speed in response to PCL command, air data (OAT, pressure altitude and air speed) and aircraft discrete inputs (air/ground, de-ice, Environmental Control System (ECS) and inertial separator status). The system controls the propeller speed by changing the blade angle in response to changes in engine power and aircraft conditions. When the engine is operating within predefined criteria, the EPECS controls the minimum blade angle and reverse blade angle of the propeller system. During flight operations the EPECS makes sure that the propeller blades do not go below the minimum allowable blade angle position uncommanded.

CAUTION

The EPECS does not prevent the engine to transition into the reverse range in flight if the PCL is intentionally lifted and moved into the reverse range.

CAUTION

The EPECS does not limit power in order to prevent exceedance of engine parameters in flight.

On ground only, the EPECS will abort an engine start to prevent ITT exceedance, if a hung start is detected or if no light-off is detected. For automation purposes the EPECS initiates a dry motoring cycle when an engine start is aborted.

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7-10-4.2.2 EPECS Components/Interfaces

The EPECS uses/interfaces with:

- The Electronic Engine Control (EEC) unit
- The Data Collection and Transmission Unit (DCTU)
- The Modular Avionics Unit (MAU)
- The engine ignition system
- The Throttle Quadrant Assembly (TQA)
- The Fuel Control Unit (FCU)
- The Propeller Control Unit (PCU)
- The Permanent Magnet Alternator (PMA)
- The engine torque pressure sensor
- The engine oil pressure sensors
- The engine oil temperature sensors
- The fuel pressure sensors
- The P3 pressure sensor
- The T1 temperature sensor
- The engine exhaust gas temperature (T5) sensors
- The Accessory Gearbox (AGB) and the Reduction Gearbox (RGB) chip detectors
- The Np/Beta position sensor
- The Ambient pressure sensor
- The engine oil level switch.

7-10-4.2.2.1 Electronic Engine Control (EEC) Unit

The EEC unit provides an electronic interface between the engine sensors, engine actuators, TQA, airframe discretes and avionics interface. The EEC, in conjunction with the FCU, the PCU and a network of sensors and actuators, controls the engine and propeller in response to the power demanded by the operator. The EEC also gives signal conditioning, control, protection and fault management functions.

The EEC unit will perform a built-in-test at power on to identify any condition that may result in a no-dispatch condition. After power-on, the EEC performs a continuous built-in test and the EEC will continuously monitor the health of the inputs it receives, the internal hardware functions and the external driver circuits.

7-10-4.2.2.2 Data Collection and Transmission Unit (DCTU)

The DCTU is a separate hardware component which interfaces with the EPECS and is part of the standard EPECS installation. The DCTU collects and stores EPECS data for a minimum of 50 flight hours. The stored data consists of approximately 100 parameters during the full flight based on commands from the EPECS.

The DCTU provides a wireless transmission/receiver capability in order to exchange data between the EEC and a ground station. It also provides a hard wired maintenance interface via an USB port. The DCTU communicates with ground based stations over public internet using cellular and/or wireless LAN access technologies. Transmission only occurs when the aircraft is on ground.

The stored EPECS data on the DCTU is used for engine diagnostics and maintenance.

The DCTU is also used by maintenance personnel to enable EEC software reprogramming and to display live engine data through a wireless connection. Reprogramming of the EEC software is only possible through a browser enabled device connected to the USB port on the DCTU.

7-10-4.2.3 EPECS Functions

Next to the engine power control functions, the EPECS performs the following monitoring and diagnostics functions:

- Engine start and shutdown
- Wet and dry motoring
- Engine parameter exceedance limiting (Np, Ng and Tq)
- Inter Turbine Temperature (ITT) limiting (during engine ground start only)
- Flameout detection
- Surge recovery
- Automated power (Tq) setting at takeoff and climb ratings
- Engine rating display for takeoff and climb
- Linear engine power (Tq) governing
- Gas generator speed (Ng) control at low power and idle operation
- Acceleration and deceleration control
- Variable propeller speed (Np) control
- Propeller pitch angle control
- Independent propeller flight fine pitch protection
- Independent propeller overspeed protection
- Fault detection, accommodation and annunciation
- Fault and event recording
- Time limited dispatch capabilities
- Maintenance indication
- Dual channel avionics communication (ARINC 429)
- Communication with ground support equipment
- Data collection and diagnostics
- Main oil pressure and temperature, fuel and oil filter differential pressure indication
- Accessory and reduction gear box chip detector monitoring
- Oil level status.

For the automatic limiting and recovery functions description, refer to Automatic Limiting and Recovery.

7-10-5 Engine Fuel

Low pressure fuel from the airframe is delivered to the engine low pressure pump, which increases the fuel pressure before the fuel enters the fuel/oil heat exchanger. The oil-to-fuel heat exchanger preheats the fuel, removing ice before it enters the fuel filter. The high pressure engine driven fuel pump delivers fuel to the remainder of the FCU components, to the fuel flow meter, to the flow divider and the fuel nozzles. The FCU provides heated, high pressure, regulated motive flow to the airframe fuel system.

The fuel control unit is controlled by the EPECS during normal and emergency operation. Fuel flows through the fuel flow meter on its way to the fuel flow divider and dump valve. The fuel flow meter converts fuel flow rate into an electrical signal which is then displayed in the engine window of the Primary Flight Display (PFD) and in the Fuel window of the systems Multi Function Display (MFD).

The fuel flow divider and dump valve serves two functions. First, it divides the fuel between the primary and secondary system. Secondly, during engine shut down it will shift position, allowing the FCU to extract the residual fuel from the manifolds, which is then directed to the airframe motive flow line. A total of 14 fuel nozzles are used in the primary and secondary manifolds.

7-10-6 Oil

For system configuration, refer to Fig. 7-10-4, Engine Oil System.

The engine oil system consists of pressure, scavenge and breather systems with the oil tank being an integral part of the engine compressor inlet case. Oil is supplied to the engine bearings, bushings, reduction gears, accessory drives, torquemeter and PCU. Oil is also used to cool the bearings. A filler neck with quantity dipstick and cap are located on top of the accessory gearbox. The quantity dipstick is marked in one US quart increments. A visual sight gauge is provided to determine oil quantity without removing the dipstick. If the oil level is in the green range of the sight gauge there is sufficient oil quantity for flight. If the oil level is below the green range, the oil system needs refilling according to the dipstick markings. If **Engine Oil Level** comes on, the oil level is not adequate for safe engine operation. It is not recommended to start a flight with the oil level below the green range on the sight glass. Total oil capacity is 3.6 US gal (13.6 liters) while usable oil quantity is 1.5 US gal (5.7 liters). The oil tank incorporates a drain plug.

An engine driven gear type pressure pump provides oil to the engine bearings, propeller bearings and reduction gears, torquemeter and PCU. Oil flows from the integral oil tank, through the pick-up screen, to the oil pump. Oil then goes through a pressure regulating valve which regulates oil pressure to between 90 and 135 psi (6.2 to 9.3 bar). A pressure relief valve opens when pressure exceeds 160 psi (11.0 bar), possibly during cold weather operations. Oil then goes through a cartridge type oil filter assembly, which incorporates a bypass valve and a spring loaded check valve. The bypass valve allows oil to bypass the filter in case the filter becomes clogged, however oil pressure drops to below 90 psi (6.2 bar) when the filter bypass valve is open. The check valve prevents gravity oil flow into the engine after shutdown and permits the oil filter to be changed without draining the oil tank. Oil is then directed throughout the engine and applicable accessories.

The oil scavenge system incorporates two double element pumps. The oil from the reduction gearbox is pumped directly through the airframe mounted oil cooler. All remaining oil passes through the oil to fuel heat exchanger and, depending on oil temperature, is directed back to the oil tank or through the oil cooler.

When the fuel temperature is low, warm oil flows through the oil to fuel heater. The scavenge system in the propeller reduction gearbox incorporates a magnetic chip detector that detects foreign matter in the system and causes the **Engine Chip** message in the CAS window to come on. The chip detector also acts as the propeller reduction gearbox oil drain. A second magnetic chip detector is installed in the accessory gearbox. It is also connected to the **Engine Chip** message and operates in parallel to the reduction gearbox chip detector.

The breather system allows air from the engine bearing compartments and the propeller reduction and accessory gearboxes to be vented overboard into the right exhaust stub, through the centrifugal breather in the accessory gearbox.

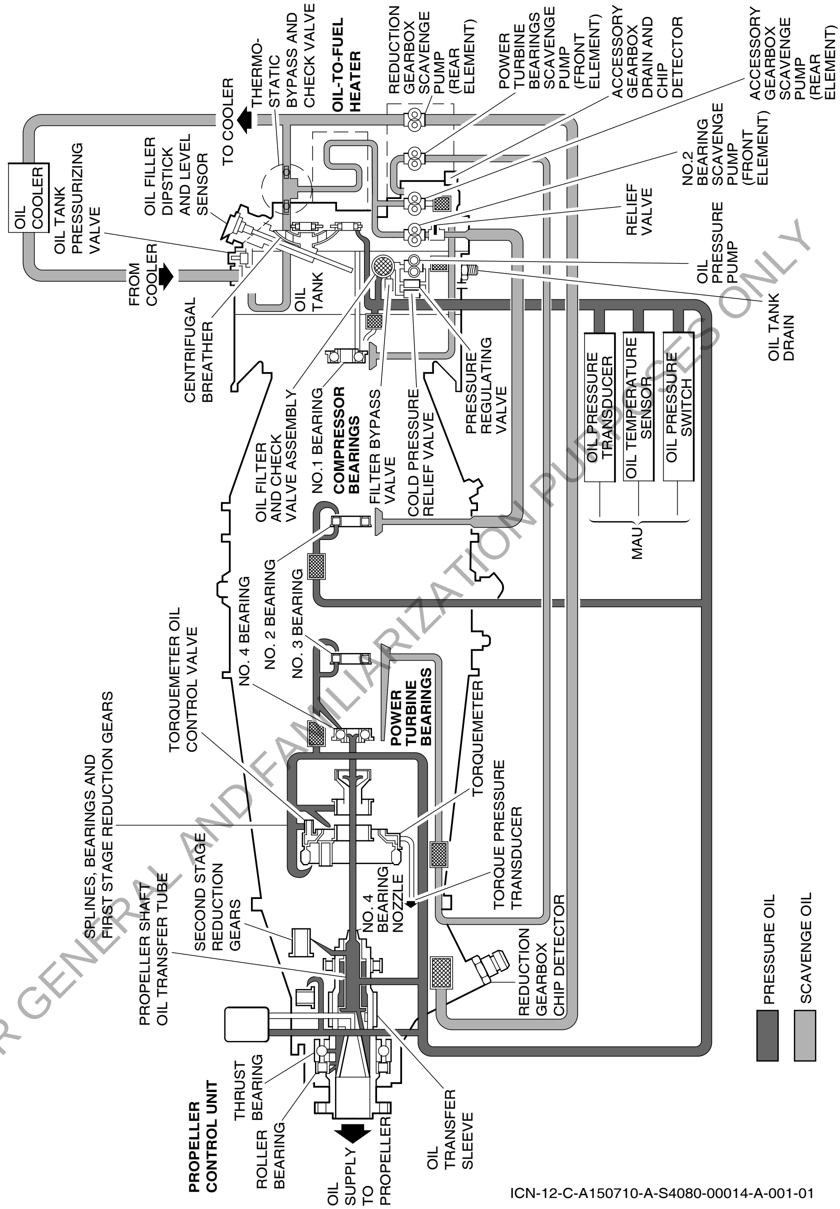

Figure 7-10-4: Engine Oil System

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7-10-7 Starting

Starting is provided by a starter/generator unit. Starter function is controlled by the STARTER switch in the ENGINE section of the overhead panel (Ref. Fig. 7-10-3, Engine Controls and Indications). After setting the Engine switch to RUN and pressing the STARTER switch momentarily, the STARTER annunciator in the PFD engine window comes on, and the EPECS energizes the starter. The starter will automatically disengage and the STARTER annunciator in the PFD goes off, when the engine Ng reaches ground idle or 80 seconds after the start sequence. Starter Engaged will show on the CAS window in the event a starter engage signal becomes active without the Modular Avionics Unit (MAU) generating the signal.

7-10-7.1 Start Abort

The start sequence can be interrupted at any time by the EPECS (automatic start abort) or by the pilot (pilot initiated start abort).

7-10-7.1.1 Automatic Start Abort

The automatic start abort functionality is only available on ground. The EPECS will automatically abort a ground start if the ITT starting limit is expected to be exceeded (abort will be commanded at 945 °C), or if a hung start is detected, or no light-off has occurred within 13 seconds after the fuel flow is commanded to ON.

During an automatic start abort the EPECS will command the ignitor(s) and fuel boost pumps to OFF, start a dry motoring cycle and DRY MOTORING will be shown on the CAS window.

Note
The automatic dry-motoring cycle which is part of the automatic start abort can be deactivated by the pilot by setting the Engine switch to OFF.

7-10-7.1.2 Manual Start Abort

The pilot can initiate a start abort by two different methods:

- Pressing the STARTER button again, or
- Setting the Engine switch to OFF.

Pressing the STARTER button during an on-ground engine start cycle will signal the EPECS to abort the start sequence. The EPECS will then command the ignitor(s) and fuel boost pumps to OFF and perform a dry motoring cycle for 30 seconds, indicated by STARTER on the PFD engine window and DRY MOTORING on the CAS window.

Setting the Engine switch to OFF will signal the EPECS to abort the start sequence. The EPECS will command the ignitor(s) and fuel boost pumps to OFF.

7-10-7.2 Electrical Power

Battery 2 provides the electrical power to the starter for starting the engine. Battery 1 provides electrical power to maintain the essential systems during engine start. On ground at either 10% Ng or 10 secs after starter activation, EPECS provides a discrete output to connect battery 1 to the starter circuit to further enhance the starter capability. If external power is connected and selected, engine starting will be done with external power.

7-10-8 Ignition

Ignition is provided by an ignition exciter and two spark igniter plugs. The ignition exciter is a sealed electronic unit mounted at the engine cowling and is operated by the aircraft 28 VDC system. Two spark igniter plugs, located at the 4 and 9 o'clock positions in the gas generator section, provide the spark to ignite the fuel/air mixture.

Ignition is controlled from the cockpit by the IGNITION switch, located in the ENGINE section of the overhead panel (Ref. Fig. 7-10-3, Engine Controls and Indications). The switch has two positions, IGNITION and AUTO. When set to IGNITION, ignition will occur continuously and an **IGNITION** annunciator in the engine section of the PFD will come on.

When set to AUTO, ignition will automatically activate during engine start and the **IGNITION** annunciator in the engine section of the PFD will come on. Ignition stops following successful engine start.

CAUTION

Ignition should be manually switched to IGNITION when operating in heavy precipitation.

7-10-9 Accessories

Engine accessories comprising the propeller, PCU and torque transducer are mounted on the front of the engine. The generator 1, starter/generator 2, fuel control unit and fuel/oil heat exchanger are mounted on the accessory gearbox.

7-10-10 Fire Detection

The system is composed of a sensor element and a responder. The sensor is a stainless steel capillary tube filled with helium and containing a central hydrogen-charged core which readily releases hydrogen gas when heated above a temperature threshold. The responder houses both the fire pressure switch and the integrity switch consisting of preformed metal diaphragms which snap over center to contact stationary pins under the effect of gas pressure.

Due to generalized temperature increase over the entire length of the sensor, the helium pressure increases and actuates the fire pressure switch triggering the alarm. Alternatively, when the sensor is heated up intensely over a short length, the core material releases hydrogen gas causing a pressure rise and actuates the fire pressure switch. The **Engine Fire** message will illuminate. Both the averaging and discrete functions are reversible.

When the sensor tube is cooled, the average gas pressure is lowered and the discrete hydrogen gas returns to the core material. The reduction of internal pressure allows the alarm switch to return to its normal position, opening the electrical alarm switch.

In addition to the pressure activated alarm switch, the integrity switch is held closed by the averaging gas pressure at all temperatures down to -55 °C. If a detector should develop a leak, the loss of gas pressure would allow the integrity switch to open activating the system fault caution. The **Fire Detector** message will illuminate when the Fire Detection system is inoperative.

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System integrity is checked by pressing the FIRE WARN switch in the SYSTEM TEST section of the overhead panel. When pressed, the availability of electrical power and circuit continuity is checked. Proper system function is indicated when both the **Engine Fire** and **Fire Detector** illuminate. If **Fire Detector** fails to illuminate during the test, the warning circuit is already closed and will not provide proper warning. In addition a backup power supply to the overhead panel is tested when the switch is pressed.

CAUTION

Due to the composite construction of the Engine Cowling and the possibility of toxic gasses, the airplane ACS must be shutoff when a fire condition is suspected.

7-10-11 Automatic Limiting and Recovery

7-10-11.1 Flameout Detection

The EPECS will detect an uncommanded engine flameout and give annunciation through the APEX system. **Flameout** will be displayed on the CAS window when the function is active.

7-10-11.2 Surge Recovery

The EPECS can detect engine surge (from the P3 pressure input) and automatically activate a surge recovery logic (no pilot action required) which will modulate the fuel flow appropriately.

7-10-11.3 Engine and Propeller Limiters

The EPECS provides engine and propeller exceedance protection by measuring, and if required, limiting the engine and/or propeller parameters and thus give a physical protection to both the engine and the propeller. This capability is intended to make sure that the maximum engine torque, gas generator speed, propeller speed and the ground start ITT limits are not exceeded during normal engine operation. The EPECS protection system mitigates certain failure conditions which could result in a propeller overspeed or uncommanded reverse by commanding the propeller to feather.

Note

These limiting functions have priority over any other form of engine and propeller control.

7-10-11.4 Autothrottle (option)

The optional Autothrottle System (part of the APEX system), when active, will send a Power Lever Angle (PLA) trim value to the EPECS. The EPECS will then use the PLA trim value to set the engine torque by moving the PCL to the required position.

7-10-12 Engine Indications, Cautions and Warnings

For the Engine Operating Limits, refer to Section 2, Power Plant Limitations.

Fig. 7-10-4, Engine Oil System

Fig. 7-10-5, Engine Indicating

Primary engine indications are shown on the upper right corner of the pilot's PFD and on the upper left corner of the copilots PFD when installed. The torque, ITT and Ng analog gauges have a 180° dial with a segmented perimeter, a moving pointer and a digital window. The oil gauges have a segmented vertical scale, a moving pointer and a digital window. The propeller speed, T1 and engine fuel flow are shown as a digital readout. The PCL position (T/O, MCP or IDL) is shown between the torque and ITT gauges.

Under normal operating conditions the analog gauges have semitransparent fan that is attached to a moving white pointer and the digital readouts are shown in white on a grey box.

On the analog torque gauge, a white mark at 15 is placed for better reference during power changes. A torque bug (white triangle) shows the maximum power rating when the PCL is set to T/O or MCP. The maximum power rating is calculated by EPECS from ambient pressure, OAT, airspeed, bleed extraction and inlet bypass door position

If there is missing data or the MAU senses that the data is invalid, the pointer and marks will be removed and an amber X will be shown on the gauge. The digital data will be replaced with amber dashes.

In a parameter caution condition, the analog gauge pointer and the fan segment in the caution range changes to amber and the digital window changes to amber with black text.

In a parameter warning condition, the analog gauge pointer and the fan segment in the warning range changes to red and the digital window changes to red with white text.

The engine indications for caution and warning conditions shown on the PFD have the same time delays as those shown on the CAS. Refer to the engine CAS Warnings and Cautions for details of the time limits.

The Monitor Warning System (MWS) monitors the EPECS discrete inputs and if caution and warning conditions are reached they will be shown on the CAS and the engine indications will be shown as given in Table 7-10-1.

Table 7-10-1: Engine Indications

Parameter/Range	Caution Indication	Warning Indication
Torque Digital range 0 to 70 psi Analog range 0 to 55 psi White mark at 15 psi Green arc from 0 to 40.63 psi Grey arc from 40.63 psi to max range Amber mark at 40.63 psi Red mark at 44.84 psi	Analog range changes to amber from red mark to max range and fan segment from red mark to pointer changes to amber	Analog range changes to red from red mark to max range and fan segment from red mark to pointer changes to red
ITT Digital range 0 to 1200 °C Analog range 400 to 1000 °C Green arc from 400 to 820 °C Grey arc from 820 °C to max range		

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Table 7-10-1: Engine Indications (continued from previous page)

Parameter/Range	Caution Indication	Warning Indication
Amber mark at 820 °C		
Red mark at 850 °C, 1000 °C during engine start	Analog range changes to amber from red mark to max range and fan segment from red mark to pointer changes to amber	Analog range changes to red from red mark to max range and fan segment from red mark to pointer changes to red
Np Digital range 0 to 1870 rpm	Black readout in amber box	White readout in red box
Ng Digital range 0 to 120% Analog range 0 to 120% White mark at 13% when starter engaged Grey arc from 0 to 64.5% Green arc from 64.5% to 104.3% Grey arc from 104.3% to max range		
Amber mark at 64.5%	Analog range changes to amber from 64.5% to minimum Ng and fan segment from amber mark to pointer changes to amber	
Amber mark at 104%	Analog range between 104 and 104.3% changes to amber	
Red mark at 104.3 %		Analog range changes to red from red mark to max range
Oil Pressure Digital range 0 to 175 psi Analog range 50 to 150 psi Green segment from 90 to 135 psi Grey segment from 50 to 90 psi Grey segment from 135 to 150 psi		
Amber mark at 90 psi	Analog range pointer changes to amber from 135 psi to max range when oil px above 135 psi Analog range pointer changes to amber from 60 to 90 psi when oil px below 90 psi (after 5 second delay)	

Table 7-10-1: Engine Indications (continued from previous page)

Parameter/Range	Caution Indication	Warning Indication
Red mark at 60 and 135 psi		Analog range pointer changes to red from 135 psi to max range when oil px above 135 psi Analog range pointer changes to red from 60 to min range when oil px below 60 psi and Ng is above 72%
Oil Temperature Digital range -45 to 120 °C Analog range 0 to 120 °C Green segment from 15 to 105 °C Grey segment from 0 to 15 °C Grey segment from 105 to 120 °C		
Amber mark at 15 and 105 °C	Analog range pointer changes to amber from 105 °C to110 °C when oil temp between 105 to 110 °C Analog range pointer changes to amber from 15 to min scale when oil temp below 15 °C	
Red mark at 110 °C		Analog range pointer changes to red from 110 °C to max range when oil temp greater than 110 °C Analog range pointer changes to red if oil temp remains between 105 °C and 110 °C for more than 10 minutes Analog range pointer changes to red from 15 to min scale when digital value below -40 °C
Fuel Flow Digital range - 0 to 800 lb/hr		

The CAS window of the systems MFD displays the following engine warnings and cautions for the engine parameters (refer to Table 7-10-2):

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Table 7-10-2: Engine - CAS Messages

CAS Message	Description
Engine Fire	Fire in the engine compartment
Engine ITT	850 to 900 °C (after 20 seconds), above 900 °C During engine start 900 to 1000 °C (after 5 seconds), above 1000 °C
Engine Torque	44.84 to 61 psi (after 20 seconds), above 61 psi
Engine Ng	Above 104% (after 20 seconds) Above 104.3%
Engine Np	1760 to 1870 rpm (after 20 seconds), above 1870 rpm Between 350 and 900 on ground and propeller not feathered (after 15 seconds)
Engine Oil Press	60 to 90 psi (after 90 seconds) and Ng above 72% and engine running 40 to 60 psi (after 20.5 seconds) and engine running 135 to 175 psi (after 20.5 seconds) Below 40 psi (after 0.5 seconds) and engine running
Engine Oil Temp	105 to 110 °C (after 10 minutes), above 110°C, below -40 °C (after 0.5 seconds)
Starter Engaged	Starter is engaged but not commanded by EPECS
Engine Oil Level	On ground after engine shut down only. Indicates engine oil level must be checked.
EPECS Fail	EPECS failed
EPECS Degraded	EPECS performance is degraded
Engine ITT	850 to 900 °C During engine start 900 to 1000 °C
Engine Torque	44.84 to 61 psi (after 5 seconds)
Engine Ng	Below 60% (engine running), 104 to 104.3% (engine running)
Engine Np	1760 to 1870 rpm Below 350 to 900 on ground and propeller not feathered (after 15 seconds)
Engine Oil Press	40 to 60 psi (after 0.5 seconds) or 60 to 90 psi and Ng above 72% (after 5.5 seconds) 135 to 175 psi (after 0.5 seconds)
Engine Oil Temp	105 to 110 °C, -40 to 15 °C (Ng above 72%)
Engine Chip	Oil chip detected in the engine oil system
Fire Detector Fail	A fault in the fire detection system is detected
EPECS Fault	Engine data from one EEC channel is not available for display or a fault has been determined which will not allow dispatch in the subsequent flight
Flameout	EPECS detected an uncommanded engine flameout
EPECS TLD	Engine is cleared for Time Limited Dispatch (TLD)
EPECS MAINT Mode	EPECS is in maintenance mode
Dry Motoring	Engine is dry motoring
Wet Motoring	Engine is wet motoring

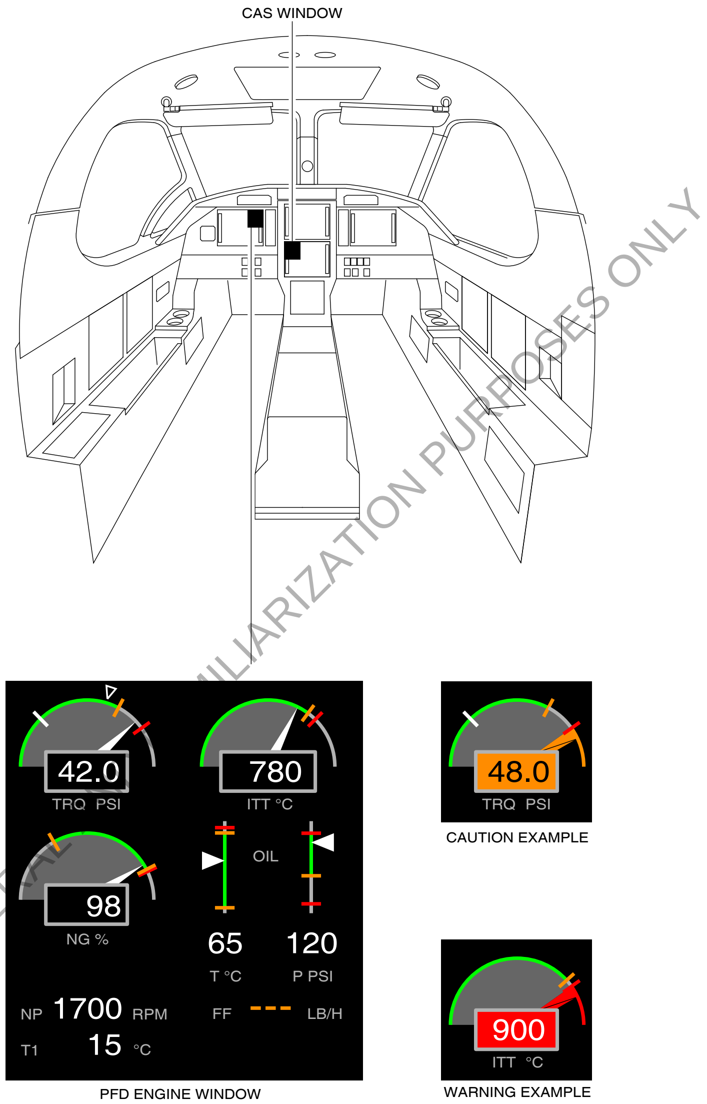

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Figure 7-10-5: Engine Indicating

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7-11 Propeller

7-11-1 General

Refer to Fig. 7-10-3, Engine Controls and Indications and Fig. 7-11-1, Propeller Pitch Mechanism.

The airplane is equipped with a Hartzell 105 in. (2,67 m), five blade, variable pitch, full feathering propeller which is driven by the engine power turbine through a reduction gearing. The propeller hub is made of aluminum. The five blades are of composite construction. An erosion strip protects the leading edge surface of the blades. Each blade incorporates an electric de-ice boot. The propeller includes a beta feedback ring which interfaces with the EPECS Np/beta sensors.

7-11-2 Description

The propeller is powered by the engine through the reduction gearbox. Propeller pitch is adjusted by engine oil pressure regulated through the Power Control Unit (PCU). Nominal propeller rpm during all phases of operation is 1700 rpm, except at low power settings at low speeds where there is insufficient energy available to rotate the prop at 1700 rpm.

The pitch change mechanism is mounted on the propeller front hub and consists of a fixed cylinder, a sliding piston, and a feathering spring. The piston is connected to each propeller blade by a fork assembly which engages a cam follower on the blade root. A counterweight is attached to each blade near its root in such a position that when the propeller is rotating the counterweight is transferred to the blade as a force tending to turn the blade to coarse pitch. The feathering spring within the cylinder also tends to move the blades towards coarse pitch and the feather position.

Oil pressure from the engine oil system is boosted to a higher pressure by a pump in the PCU. Oil pressure is then applied to the rear of the sliding piston, overcoming the force of the feathering spring and counterweights, to move the blades towards fine pitch. Thus, the blade angle is set by controlling the pressure of the oil supplied to the propeller.

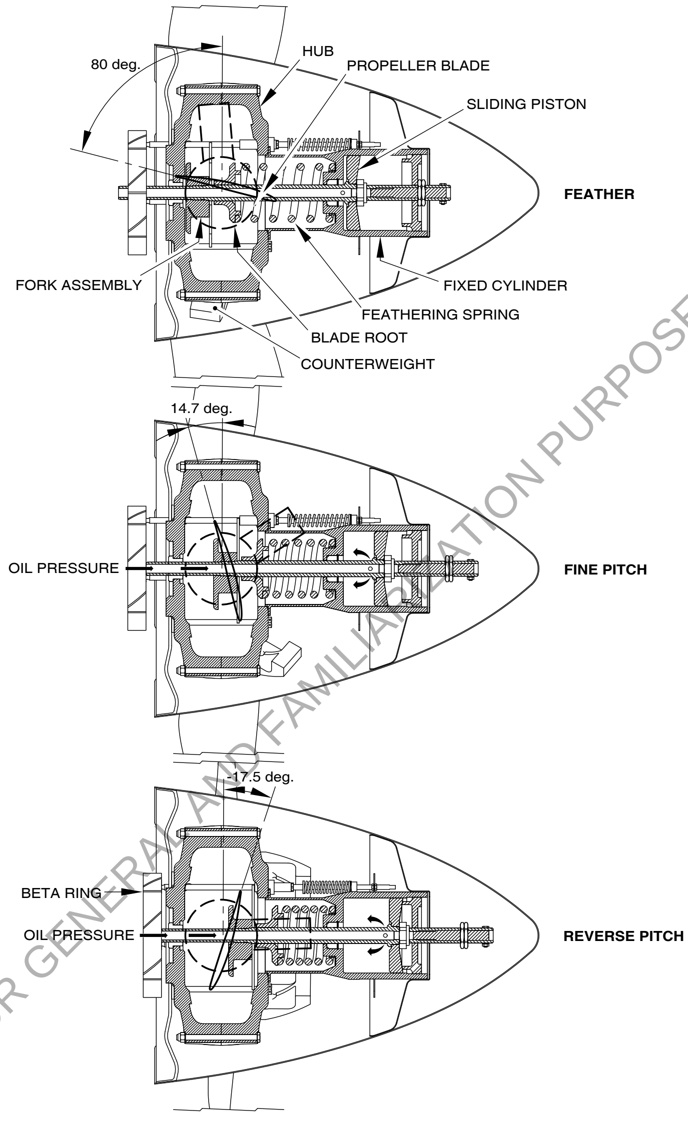

Figure 7-11-1: Propeller Pitch Mechanism

7-11-3 Operation

Refer to Fig. 7-11-1, Propeller Pitch Mechanism.

In normal operation the propeller unfeathers during engine start when oil pressure rises. On the ground at idle power the propeller rotates at approximately 1025 rpm. When power is increased the PCU will control propeller speed at 1700 rpm. In the air, at low speeds and idle power (F.I.) the propeller rpm may drop below 1700 rpm. When the Engine switch is set to OFF for engine shutdown, EPECS conducts a momentary propeller feather solenoid check. After the check is conducted, the propeller is completely feathered by the PCU. If the feather inhibit (optional) is selected, the propeller is driven to feather by the PCU at a slower rate.

Note
After 9 consecutive engine shutdowns using the propeller feather inhibit function, a normal engine shutdown must be performed (refer to Section 2, Limitations, Power Plant Limitations, Feather Inhibit (optional)).

The propeller is reversible for operation in the Ground Operating range during ground operations only. To achieve propeller pitch below the low pitch stop, lift up the triggers on either side of the PCL to clear the idle detent and pull aft. As the PCL moves aft, the propeller blade angle decreases to the maximum reverse blade angle.

WARNING
STABILIZED GROUND OPERATION WITH PROPELLER BELOW 900 RPM IS NOT PERMITTED.

7-11-4 Propeller De-ice

7-11-4.1 General

Each propeller blade has an electrically heated boot on the inboard upper and lower leading edge. 28 VDC power supply for the boots is taken directly from the Power Line. It is supplied to the propeller de-ice boots via a slip ring mounted on the rear of the spinner bulkhead and brush block mounted on a bracket on the engine. Protection against the effects of lightning strike is provided by a set of Metal Oxide Varistors (MOVs) mounted on the brush block assembly. The system is selected by the ICE PROTECTION PROPELLER switch on the pilot's lower right panel and the green PROPELLER advisory will come on in the ICE PROTECTION window of the systems Multi Function Display (MFD). The switch has the positions ON and OFF. When the PROPELLER switch is set to ON, the blades are heated in cycles. A de-ice timer unit selects automatically the appropriate cycle depending on the Indicated Outside Air Temperature (IOAT).

7-11-4.2 Timer Cycles

Each boot has an inner zone and outer zone.

The de-ice time unit selects power alternately to all blade inner zones followed by all blade outer zones to minimize asymmetric ice shedding

Table 7-11-1: Propeller De-ice - Timer Cycles

Mode	Propeller
Mode 1 (Warmer than 0 °C)	Timer in stand by
Mode 2 (0°C or colder, but not colder than -16 °C) • 45 sec • 45 sec • 90 sec	 All inner zones are heated All outer zones are heated Blade heating OFF
Mode 3 (Colder than -16 °C • 90 sec • 90 sec	 All inner zones are heated All outer zones are heated

The above cycles are repeated until the PROPELLER switch is set to OFF.

7-11-4.3 IOAT Sensing

IOAT sensing is by a sensor mounted under the left hand wing. This sensor is termed the controller and presents the principal control signal. A second sensor is mounted in an identical position under the right hand wing. This sensor is termed the comparator and allows the control sensor to be checked.

The Propeller De-ice Controller monitors the various system control functions and outputs a fault signal to the Modular Avionics Unit (MAU) if a failure is detected. The Crew Alerting System (CAS) shows a caution in the event of detected failures. The following functions are monitored:

- Inhibit input open
- Failure of IOAT sensor (Open or short sensor or unacceptable difference between IOAT control sensor and IOAT comparator sensor)
- Heater supply voltage out of tolerance
- Heater current out of tolerance
- Built in test for internal failure (power supply, oscillator, watchdog etc.).

When the system is on, if the MAU detects a failure, **Propeller De-ice** is shown on the CAS.

7-11-5 Indication / Warning

The propeller speed is displayed digitally in the engine window on the Primary Flight Display (PFD).

Propeller Low Pitch will be shown on the CAS when the propeller pitch is less than 6° (minimum pitch in flight) and the aircraft is not on the ground.

Upon selection of the de-ice system the de-ice timer performs a built in test function lasting approximately 20 seconds. A preflight test is performed in this manner. **Propeller De-ice** will be shown if the system electrical load is outside its limits.

7-12 Fuel

7-12-1 General

For system schematics and equipment layout, refer to Fig. 7-12-1, Fuel System.

Fuel is contained in two integral wing tanks and is supplied to the engine in excess pressure of that required for all ground and flight operations. Each wing tank contains drain valves. The transfer of fuel from the main tanks to the collector tanks is achieved using transfer ejectors. The delivery of fuel to the engine is achieved using delivery ejectors. Fuel is supplied to the engine Fuel Control Unit (FCU) which contains two pump stages (low pressure and high pressure). All aircraft ejectors are energized by heated, high pressure, regulated motive flow from the engine fuel system. Electric booster pumps provide pressure during the engine start sequence, as a standby function when the normal system cannot maintain adequate pressure and are used to balance the fuel level in each wing. Fuel symmetry is maintained automatically by the Fuel Control and Monitoring Unit (FCMU).

Refueling is accomplished using over-wing filler caps. Fuel quantity, fuel flow rate, fuel temperature at the engine, fuel endurance, fuel quantity burnt and booster pump operation are shown in the FUEL window of the systems Multi Function Display (MFD). Fuel flow rate is also shown in the engine window of the Primary Flight Display (PFD). Low fuel pressure, fuel temperature, fuel filter contamination stages, fuel pump fault status, low fuel quantity and fault conditions will be shown in the Crew Alerting System (CAS) window. In an emergency, fuel flow to the engine can be stopped by pulling the FUEL EMERG SHUT OFF handle, located at the aft end of the center console, left of the aircraft centerline.

7-12-2 Description

The fuel storage system includes integral wing tanks, fuel drains, refueling ports, and vents. The main fuel tank is between ribs 6 and 16, forward of the rear and main spars. A collector tank is forward of the main spar between ribs 3 and 6. Fuel drains are located in the lower wing-skins. These fuel drains allow the removal of water and other contaminants during preflight.

Refueling is accomplished through an overwing filler cap located at the outer, upper section of each wing. Each wing has a usable fuel capacity of 201 US gal (761 liters).

Each fuel tank is vented to atmosphere through a main vent line to the lower surface of the wing. The main vent consists of a flapper valve and a flame arrestor located at the outmost rib of the fuel tank. It is normally open to allow bidirectional air flow and will be closed by the flapper valve when in contact with fuel. In case of blockage of the main vent there are individual inward and outward vents. The outward vent outlet is located at the lower surface of the wing. The inward vent inlet is located at the trailing edge of the wing tank, in front of the aileron.

A check valve with strainer is installed in the motive flow line at each collector tank. The check valves stop fuel flow between the left and right wing tanks and prevent contamination of ejector nozzles.

The distribution system transfers fuel from left and right main tanks to the collector tank in each wing and delivers fuel from the collector tanks to the engine fuel control unit. Within the tanks are electric booster pumps, transfer ejectors, and delivery ejectors. From the collector tanks the fuel flows through a firewall shutoff valve to the engine fuel system. The engine fuel system includes a low pressure pump, Fuel Oil Heat Exchanger (FOHE), fuel filter with bypass, high pressure pump, etc. Excessive flow not required for combustion is routed to the motive flow regulator, which regulates motive flow pressure (pressure above engine inlet pressure) to the ejectors in the aircraft fuel tanks. The tanks in each wing contain four capacitance type fuel quantity probes that are connected to the fuel computer part of the FCMU. The resistance temperature detector type fuel low level sensors in the collector and main tanks are connected to the low level sensing part of the FCMU.

7-12-3 Operation

During normal operation with the engine running, fuel is delivered from the wings to the engine by a motive flow system. Fuel downstream of the engine high pressure pump is limited by the motive flow regulator and returned to the wings to provide motive flow, which energizes the transfer and delivery ejectors. Motive flow pipes are insulated to prevent large temperature drops and ensure operation without anti-icing additive. The transfer ejector transfers fuel from the main tank to the collector tank. The left hand and right hand delivery ejectors deliver fuel to a common manifold on the lower-left side of the fuselage. Fuel pressure is measured upstream of the firewall shutoff valve which communicates only with the Engine and Propeller Electronic Control System (EPECS).

The fuel then passes through the firewall shutoff valve to the low pressure engine driven fuel pump. The firewall shutoff valve is mechanically connected to the FUEL EMERG SHUT-OFF handle in the cockpit.

An electric booster pump, located within each collector tank, provides fuel pressure during engine start and is used to maintain system pressure and fuel balancing when required. Each booster pump LH and RH is controlled by a two position (ON or AUTO) switch located on the FUEL PUMPS section of the overhead panel. When set to ON, the booster pump will operate continuously. With the switch set to AUTO (the normal operating setting), the booster pump can be commanded by either the FCMU for fuel balancing or by the EPECS when required by the engine. This includes engine start and relight, engine wet motoring or if the fuel system pressure is not sufficient for engine operation. After correcting the low pressure situation the EPECS will command the booster pump to NOT ON after 10 seconds. The FCMU and EPECS cannot prevent the booster pump to be commanded ON by the overhead panel switch.

The green PUMP captions indicate that the electric booster pumps have been selected to ON, by the overhead panel switches or by the automatic fuel balancing or by the EPECS. The green PUMP captions remain ON when the electric booster pumps have reached the operating rpm, confirming operation of the electric booster pumps.

Refer to Engine Fuel System, for engine fuel supply.

Fuel symmetry is automatically maintained by the FCMU when the FUEL PUMPS switches are set to AUTO. Left and right fuel quantities are monitored to detect fuel asymmetry exceeding 68 lbs and will activate the fuel booster pump in the tank with the higher quantity. Fuel booster pump activation is delayed one minute (confirmation time) to avoid pump cycling during flight in turbulence. The fuel booster pump will continue to operate until the left and right fuel levels are sensed to be equal. Automatic activation of the fuel booster pumps will only occur when the engine switch is out of the OFF position.

A fuel imbalance (refueling errors) of up to 267 lbs can be automatically handled by the automatic fuel balance system. In the event of a system failure, the fuel load symmetry can be maintained by manually selecting the FUEL PUMPS switch to ON for the fuel tank with the higher quantity until a balanced fuel condition is restored and then setting the switch to AUTO. Monitor the fuel quantity gauges for fuel symmetry for the remainder of the flight.

Power for the FCMU fuel computer is taken from the ESSENTIAL BUS through the FUEL QTY circuit breaker. Power for the low level sensing part of the FCMU is from the MAIN BUS through the FUEL LOW LEVEL circuit breaker.

7-12-4 Indication / Warning

Fuel quantity and low level sensing data is sent to the Modular Avionics Unit (MAU) from the FCMU. A fuel flow sensor located forward of the engine FCU sends a signal to the MAU to indicate fuel flow. The MAU calculates and displays analog and digital readouts in the FUEL window of the systems MFD. The left and right tank fuel quantities are shown as analog and the total fuel quantity, fuel flow, endurance and fuel used values are shown digitally.

The analog fuel quantity and the digital fuel flow (FF) are real time data displays. The digital fuel quantity (QTY), endurance (END), and fuel used (USED) are calculated value displays. The values are derived from the stored fuel quantity at the time of FUEL RESET (see below) and the integrated fuel flow over time since reset.

The fuel quantity of the left and right wing fuel tanks is shown by white segments on a left and right analog scale in the FUEL window. The scales are marked from 0 to 4 (full) in units of quarters. Left and right booster pump selection is shown by a green PUMP indicator below the respective quantity scale.

The digital total computed left and right fuel tank quantity (QTY) is shown in the FUEL window in lbs (LB). The digital fuel quantity is calculated from the last RESET value, fuel as it is used will then be subtracted from this value. The fuel flow (FF) digital value is shown as pounds fuel used per hour (LB/H). The endurance display (END) range is the time in hours and minutes the aircraft can fly with the quantity of fuel that is calculated to be in the tanks at the current fuel flow. The digital fuel used (USED) value indicates fuel consumed in lbs (LB) based on fuel flow vs time (FF) of engine operation.

Tolerances of the fuel flow measurement system can lead to a conservative digital value of the measured fuel burn and the remaining fuel quantity. The pilot can, on longer flights, update the digital fuel quantity indication with the actual fuel value on board, by pressing the FUEL RESET soft key. Fuel reset in flight should only be used when the wings are level, pitch within ±3°, with unaccelerated flight and no turbulence present. Fuel reset will also reset the fuel used to zero.

A FUEL RESET softkey in the FUEL window is used to re-datum the total fuel quantity and fuel used value after each time fuel is added to the wing tanks. These values are stored in nonvolatile memory when power is removed. To reset the totalizer, either press the bezel key FUEL RESET or bring focus and use the Touch Screen Controller (TSC). After engine start, verify that the fuel quantity indication increases to the new fuel quantity and the fuel used indication is reset to zero. The FUEL RESET command is disabled if the FCMU computer detects a fault condition.

If a fuel low level indication condition becomes active all segments shown on the analog scale and the fuel scale outline will change to amber and a **LH Fuel Low**, or **RH Fuel Low** or **LH + RH Fuel Low** message will be shown in the CAS window of the systems MFD.

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If there is a fuel imbalance of more than 178 lbs, **Fuel Imbalance** will be shown in the CAS window. The segments of the fuel quantity bar representing the excess fuel on the fuller tank side will change to amber. The booster pump on the fuller tank side will operate automatically to balance the fuel. When on the ground takeoff is prohibited until the fuel is balanced.

If there is missing data or the MAU senses that the analog fuel sensing data is invalid, the analog fuel scales will be removed and an amber X will be shown on the scale. If the fuel flow status data becomes invalid or missing the digital data values will be replaced with amber dashes.

A low fuel pressure condition will be shown by a **Fuel Low Pressure** message in the CAS window.

An increase in the engine fuel filter delta pressure, indicating an impending fuel filter and/or FOHE blockage will be shown by a **Fuel IMP Bypass** message in the CAS window. Continued fuel filter blockage will lead to opening of the bypass valve.

When the engine fuel filter is blocked the bypass valve opens. This will be shown by a **Fuel Filter Blocked** message in the CAS window.

Fuel temperature is measured downstream of the FOHE and fuel filter. The fuel temperature signal is provided by the EPECS to the APEX fuel page. A low or high fuel temperature will be shown by a **Fuel TEMP** message in the CAS window.

If the fuel pressure sensor fails, the EPECS will automatically command the Electric Booster Pumps to ON. A failure of the fuel pressure sensor will be shown by a **Fuel PRESS SENS Fail** message in the CAS window.

If the command to and the feedback from the electric booster pump disagree, the **LH Fuel Pump Fail**, **RH Fuel Pump Fail** or **LH + RH Fuel Pump Fail** message will be shown in the CAS window.

The CAS window of the systems MFD displays the following caution and status (on ground only) messages for the fuel system (refer to Table 7-12-1):

Table 7-12-1: Fuel System - CAS Messages

CAS Message	Description
Fuel Quantity Fault	The FCMU is unable to determine fuel quantity
LH Fuel Low RH Fuel Low LH + RH Fuel Low	The fuel quantity in left, right or both tank(s) RH Fuel Low has reached less than 20 US gal (75 liters) (approximately 134 lb (60 kg) at 59 °F (15 °C))
Fuel Pressure Low	The fuel system pressure is lower than required for continuous engine operation
Fuel Balance Fault	FCMU automatic fuel balancing is not successful
Fuel Imbalance	A fuel imbalance of more than 178 lbs between LH and RH fuel quantity. Takeoff is prohibited until balanced. In flight this indicates a potential failure of the engine motive flow PRV.
Fuel IMP Bypass	Increased blockage of the fuel filter and/or fuel-oil heat exchanger resulting in an increased engine fuel filter delta pressure. Continued fuel filter blockage will lead to opening of the bypass valve. Flight can be completed provided that contamination levels in the tank are not excessive.
Fuel Filter Blocked	The engine fuel filter bypass valve is open
Fuel TEMP	The fuel temperature is below 12 °C or higher than 105 °C after the fuel filter
Fuel PRESS SENS Fail	The fuel pressure sensor has failed on both channels Booster pumps are automatically commanded to ON
LH Fuel Pump Fail RH Fuel Pump Fail LH+RH Fuel Pump Fail	One or both of the electric booster pumps has failed Automatic fuel balancing is not possible
FCMU Fault	The FCMU has detected an internal fault
Low Lvl Sense Fault	The FCMU has detected a fault with fuel low level sensing
Fuel Filter Replace	The EPECS has detected the first level of fuel filter contamination

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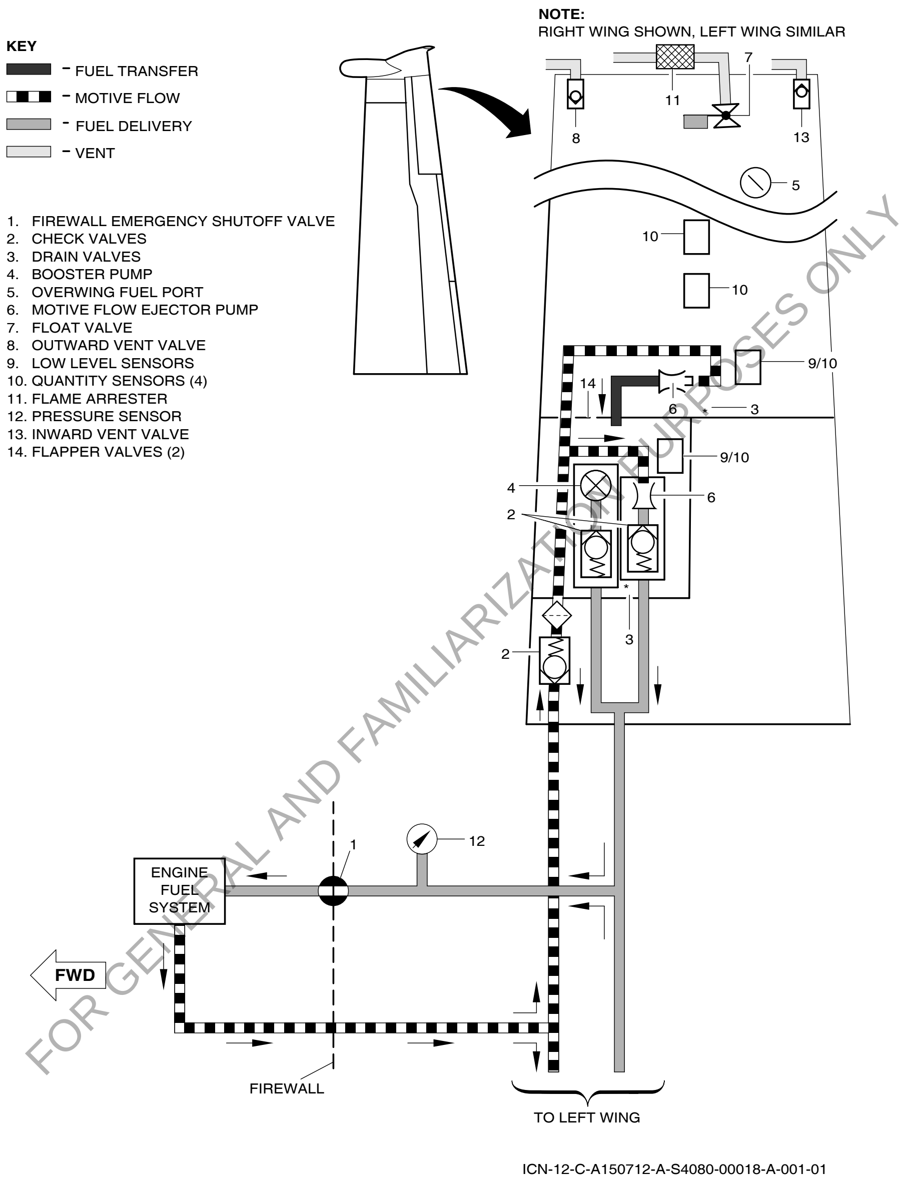

Figure 7-12-1: Fuel System (Sheet 1 of 4)

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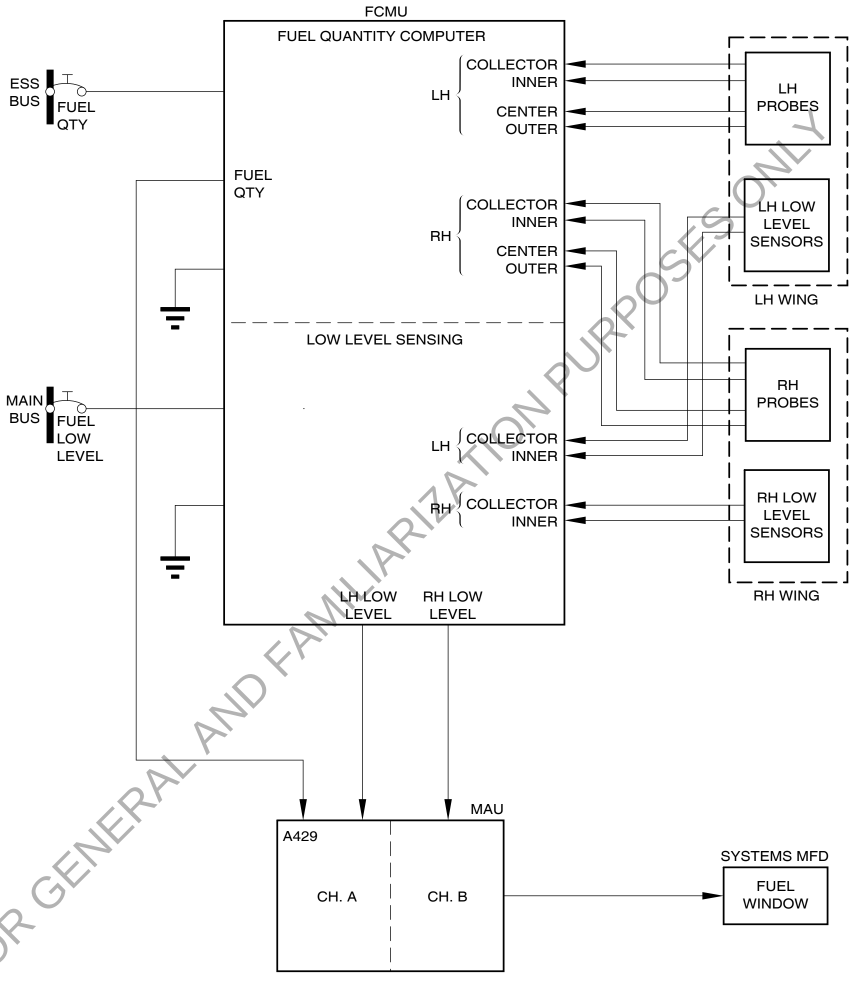

Figure 7-12-1: Fuel System (Sheet 2 of 4)

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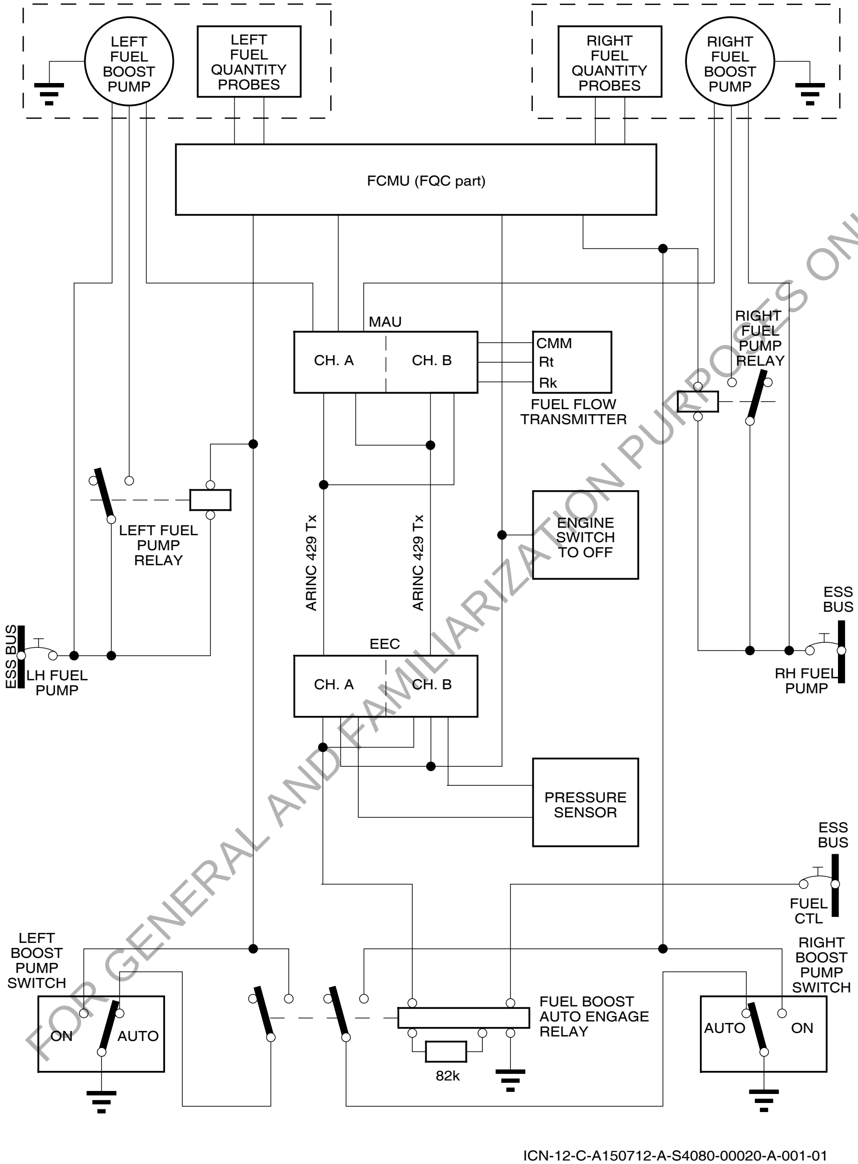

Figure 7-12-1: Fuel System (Sheet 3 of 4)

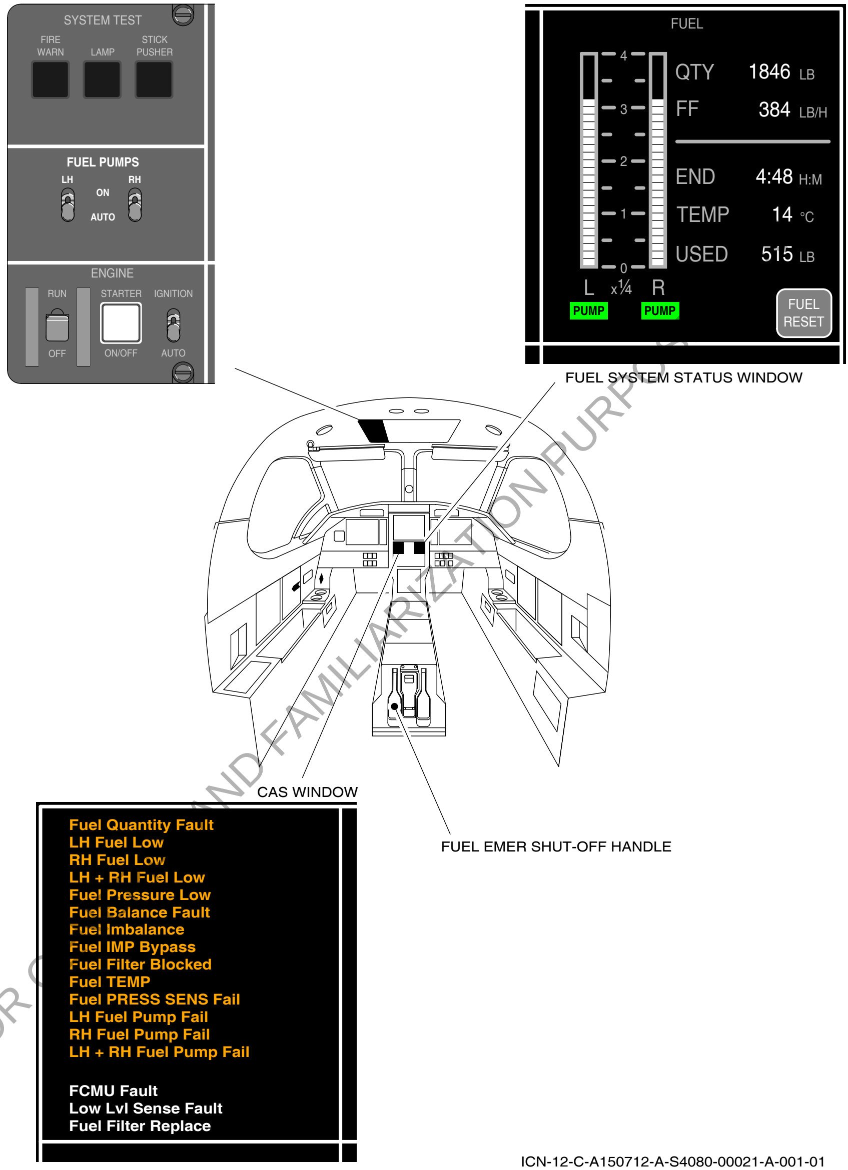

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Figure 7-12-1: Fuel System (Sheet 4 of 4)

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7-13 Electrical

7-13-1 General

For system schematics and equipment layout. refer to Fig. 7-13-4, PGDS - Layout

For system schematics, refer to Fig. 7-13-5, PGDS Normal Operation Condition - Both Generators On-Line

The PGDS is a dual channel 28 VDC power generation and distribution system, it has the following power sources:

- Generator 1, a 28 V, 300 A generator
- Generator 2, a 28 V, 300 A generator
- Two lead-acid batteries 24 V 42 Ah or two optional nickel-cadmium batteries 24 V 40Ah or two optional heated nickel-cadmium batteries 24 V 44 Ah
- Emergency Power Supply (EPS) a 24 V 5 Ah lead-acid battery unit.

Under PGDS normal operating condition (Fig. 7-13-5, PGDS Normal Operation Condition - Both Generators On-Line) the systems and circuits powered from Generator 1 are designated channel 1 and systems and circuits powered from Generator 2 are designated channel 2. The channels operate independently and the only connection is through a bus tie in the event of component failures. In the event of component failures, automatic switching and load shedding takes place for continued safe flight and landing under abnormal and emergency conditions.

The PGDS abnormal operating condition is when one generator has failed. High current consumption busses and systems are load shed if a Generator 1 or 2 fails. Refer to Fig. 7-13-6, PGDS Abnormal Operation Condition - Generator 1 Off-Line and Fig. 7-13-7, PGDS Abnormal Operation Condition - Generator 2 Off-Line which show a Generator 1 and 2 failure.

The PGDS emergency operating condition is when both generators have failed (i.e. engine flame out). Refer to Fig. 7-13-8, PGDS Emergency Operation Condition – Both Generators Off-Line for the busses and high current consumption systems that are load shed.

An external power socket permits DC power to be provided from a ground power unit.

7-13-2 Description

7-13-2.1 Power Supplies

When the engine is running, Generator 1 is the primary power source for the Channel 1 Power Line, and the Essential and Avionic 1 Buses. The Standby Bus is powered from the Avionic 1 Bus. If the Avionic 1 Bus is switched OFF, the Standby Bus is powered from the Hot Bat Bus provided the STBY BUS switch is set to on.

Generator 2 is the primary power source for the Channel 2 Secondary Power Line and the Main, Avionic 2, Non-Essential and Cabin Buses. Generator 2 is also the engine starter motor. If the engine STARTER switch is pushed and the engine Ng is less than 50%; the generators are automatically switched OFF.

Should either the Generator 1 or Generator 2 fail, the control relays in the PGDS automatically change and connect the remaining generator and both batteries to the Power and Secondary Power Lines. A caution will be displayed in the Crew Alert System (CAS) window. This is the PGDS abnormal operating condition.

Battery 1 and Battery 2 are installed in the rear fuselage. Each battery has an on/off switch on the Electrical Power Management (EPM) section of the overhead control panel. Battery 2 provides the power for starting the engine. Battery 1 provides power to maintain the essential systems during engine start and on ground supplements Battery 2 for engine starting at either above 10% Ng or after 10 sec after the starter is activated. In case of an engine or double generator failure, the batteries will supply the essential electrical systems after automatic load shedding for a maximum range glide and one attempted engine start. This is the PGDS emergency operating condition.

The optional in-flight heated Ni-Cad batteries support an extended range of aircraft operating temperatures, specifically cold weather. Heaters inside the battery case are supplied with 28 VDC when the aircraft electrical system is energized. Battery heater 1 is powered by the GENERATOR 1 BUS, and battery heater 2 is powered by the GENERATOR 2 BUS. The battery heater is capable of maintaining the battery temperature above 4°C at ambient temperatures down to −40°C.

Each generator and battery has a current and a voltage sensor. The Modular Avionics Unit (MAU) monitors the condition of the generators for under and over voltage and the batteries for under and over voltage and over current (discharge), and provides the appropriate cautions. The GDS status is displayed in the ELECTRICAL window and the cautions are displayed in the CAS window. Both windows are on the systems Multi Function Display (MFD) unit. Each generator has a three position control switch on the EPM section of the overhead control panel.

On ground the DC system can be powered by an external power unit which is connected under the rear fuselage left side. When the external power supply is connected to the aircraft, an AVAIL caption to the right of the EXT PWR switch on the overhead panel is illuminated to show that external power is available. To apply external power to the aircraft electrical system, the EXT PWR switch must be selected to EXT PWR. When the EXT PWR switch is set to EXT PWR, an ON caption to the right of the EXT PWR switch is illuminated. With both generators off-line the Bus Tie is closed and ground power is fed to all aircraft busses and both batteries. An External Power Controller (EPC) monitors external power supply and automatically isolates the aircraft systems if the voltage is outside the range 22 to 29.5 VDC. The EPC will disconnect external power if either generator is online.

In the event of a total power loss (both generators and batteries) the EPS battery will provide sufficient power through the EPS bus to the backup systems for 30 minutes. Under normal, abnormal and emergency conditions the EPS battery is connected to the Essential Bus to maintain a maximum charge. Following the loss of the Essential Bus the EPS Bus automatically switches to be supplied from the EPS battery. When the aircraft is powered down normally, the EPS switch on the overhead panel must be set to OFF to prevent discharge of the EPS battery.

7-13-2.2 Junction Boxes

There are two Power Junction Boxes (PJB), one for each generator. Generator 1 PJB is installed on the cockpit lower left wall and Generator 2 PJB is installed on the cockpit lower right wall. They contain the principal contactors, relays and other circuit protection devices. There is a Battery and External Power Junction Box (BEPJB) which contains the components for the batteries, external power functions, hot battery bus and associated circuit breakers. It also contains the necessary components to permit optional nickel cadmium batteries to be installed. The BEPJB is installed in the rear fuselage. There is also a Relay Module Panel (RMP) for power Channel 1 and 2, which contain terminal blocks and relays and are installed under the cabin floor on the left and right sides.

7-13-2.3 Bus Bars

The Generator 1 and 2 DC power supplies are distributed via a system of BUS BARS on each channel. A bus tie installed in the left PJB is monitored by the MAU and will close when either generator is off-line to allow the remaining generator to provide power to the other channel.

If both generators are off-line (PGDS emergency condition), both batteries are connected in parallel via the bus tie to power the left channel essential busses. The bus tie will open, if an excessive current condition on one channel is sensed, to isolate the left and right channels. A caution is displayed in the CAS window if the bus tie is in the wrong state for the PGDS configuration.

The Hot Battery Bus is powered directly from Battery 1. It supplies power to systems that must remain powered or available when the aircraft is powered down.

The Power Line is the primary source of electrical power with the highest level of integrity. It supplies the Essential and Avionic 1 Buses and power for the flaps, LH windshield de-ice, propeller de-ice and cabin heating.

The Essential Bus has the highest level of integrity and under normal conditions it is powered from Generator 1. It can be supplied with power from either generator or both batteries. This bus will always be powered under normal, abnormal and emergency conditions. There are no relays or contactors controlling the Essential Bus. The Essential Bus voltage is monitored by the MAU and a warning will be displayed in the CAS window if the voltage is outside the limits.

The Avionic 1 Bus has the highest level of integrity and under normal conditions it is powered from Generator 1. It can be supplied with power from either generator or both batteries. This bus will always be powered under normal, abnormal and emergency conditions. A contactor in the left PJB is controlled by the AV 1 BUS switch on the overhead panel. The Avionic 1 Bus voltage is monitored by the MAU and a caution will be displayed in the CAS window if the voltage is outside the limits.

The Secondary Power Line is the source of electrical power with the second highest level of integrity. It supplies the Main, Avionic 2, Non-Essential and Cabin Busbars and power for the landing gear system, RH windshield de-ice, Vapor Cycle Cooling System (VCCS) and under floor heating.

The Main Bus has the second highest level of integrity and under normal conditions it is powered from Generator 2. It can be supplied with power from either generator. This bus will always be powered under normal and abnormal conditions. The Main Bus contactor is normally closed and will automatically open under emergency conditions and load shed the Main Bus. The Main Bus voltage is monitored by the MAU and a caution will be displayed in the CAS window if the voltage is outside the limits. The caution is suppressed if both generators are offline.

The Avionic 2 Bus has the second highest level of integrity and under normal conditions it is powered from Generator 2. It can be supplied with power from either generator. This bus will always be powered under normal and abnormal conditions. A contactor in the right PJB is controlled by the AV 2 BUS switch on the overhead panel. The Avionic 2 Bus voltage is monitored by the MAU and a caution will be displayed in the CAS window if the voltage is outside the limits. The caution is suppressed if both generators are off-line or the AV 2 BUS switch on the overhead control panel is OFF.

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The Generator 1 Bus has the third highest level of integrity and under normal and abnormal (Generator 2 off-line) conditions it is powered from Generator 1. When the Generator 1 is off-line the Generator 1 Bus is unpowered. The Generator 1 Bus provides power to non-essential equipment that can be retained in the event of a Generator 2 failure. The Generator 1 Bus voltage is monitored by the MAU and a caution will be displayed in the CAS window if the voltage is outside the limits. The caution is suppressed if Generator 1 is off-line.

The Generator 2 Bus has the third highest level of integrity and under normal and abnormal (Generator 1 off-line) conditions it is powered from Generator 2. When the Generator 2 is off-line the Generator 2 Bus is unpowered. The Generator 2 Bus provides power to non-essential equipment that can be retained in the event of a Generator 1 failure. The Generator 2 Bus voltage is monitored by the MAU and a caution will be displayed in the CAS window if the voltage is outside the limits. The caution is suppressed if Generator 2 is off-line.

The Non Essential Bus has the fourth highest level of integrity and under normal conditions it is powered from Generator 2. When either generator is off-line the Non Essential Bus is unpowered. The Non Essential Bus provides power to equipment that may be shed in the event of a single generator failure. The Non Essential Bus voltage is monitored by the MAU and a caution will be displayed in the CAS window if the voltage is outside the limits. The caution is suppressed if either generator is off-line.

The Cabin Bus has the fourth highest level of integrity and under normal conditions it is powered from Generator 2. When either generator is off-line the Cabin Bus is unpowered. The Cabin Bus provides power for ancillary non-flight related services within the cabin. All these services are shed in the event of a single generator failure. A contactor in the right PJB is controlled by the CABIN BUS switch on the overhead control panel.

The Standby Power Bus provides power to specific avionic equipment to allow the pilot to perform preflight planning and ATC communication tasks without the need to power up the aircraft primary busses prematurely. The Standby Power Bus is controlled by the STBY BUS switch on the overhead control panel. When the switch is selected on before engine start, an ON indicator illuminates adjacent to the switch. When the Avionic 1 Bus becomes powered the Standby Power Bus ON indicator goes off. During emergency operation if additional load shedding is required the pilot can switch off the AV 1 BUS and retain the Standby Power Bus. The Standby Power Bus voltage is monitored by the MAU and a caution will be displayed in the CAS window if the voltage is outside the limits.

The Emergency Power Supply bus provides power to specific backup equipment following the loss of all electrical power (both generators and the aircraft batteries).

7-13-2.4 Circuit Breakers

Circuits supplied from the Bus Bars have circuit breakers on color coded panels on the left and right cockpit walls. The bus locations and color coding are as follows:

Panel	Bus	Color
LH Front	ESSENTIAL BUS	Cyan
LH Rear	AVIONIC 1 BUS EPS BUS STANDBY BUS GENERATOR 1	Ice blue Yellow Dove blue White
RH Front	MAIN BUS NON ESSENTIAL BUS	Green Pink
RH Rear	AVIONIC 2 BUS CABIN BUS GENERATOR 2	Light green Brown Gray

The circuit breakers for the high current consuming systems FLAP PWR, LH W/SHLD, PROP DE-ICE and CABIN HTG are all installed on the LH PJB. The circuit breakers for the high current consuming systems LDG GEAR PWR, RH W/SHLD, U/FLOOR HTR and optional FOOTWARMER are all installed on the RH PJB. The circuit breakers for the VCCS and optional LOGO LT are installed on the BEPJB.

The BUS TIE circuit breaker on the overhead control panel will open automatically if the current through the bus tie in the left PJB exceeds 200 amps. The bus tie in the left PJB can be opened manually and reset, if required, by pulling or pushing the control BUS TIE circuit breaker on the overhead control panel.

7-13-2.5 Controls and Indicators

Refer to Fig. 7-13-1, Power Generation and Distribution System (PGDS) - Controls

7-13-2.6 Overhead Panel

The electrical system is controlled from the ELECTRICAL POWER MANAGEMENT section of the overhead control panel. The panel has controls for the:

- Avionics busses (AV 1 and AV 2)
- Generators (GEN 1 and GEN 2)
- Batteries (BAT 1 and BAT 2)
- External power (EXT PWR)
- Standby bus (STBY BUS)
- Cabin bus (CABIN BUS)
- Master power (MASTER POWER)
- Emergency Power System (EPS)
- Bus Tie (BUS TIE).

The Power management system is designed to leave the GEN 1, GEN 2, AV 1 BUS, AV 2 BUS and CABIN BUS switches in the on position in normal operations (through power cycles).

The MASTER POWER EMERGENCY OFF switch is guarded to the on position. When the switch is selected off the Generator 1 and 2, Battery 1 and 2 and external power are disconnected from the distribution system. The Standby Power Bus is de-energized. The Hot Battery and Emergency Power busses remain energized.

The GEN 1, GEN 2, BAT 1, BAT 2, AV 1 and AV 2 switches are locking type switches. These switches must be pulled out before they can be moved from the on position. The GEN 1 and GEN 2 switches have three positions: ON, OFF and RESET. The reset position is used to allow the generator back on line following a voltage regulator trip.

The EPS switch has three positions: ARM, OFF and TEST. In the ARM position the EPS bus is powered and the red EPS ON indicator illuminates. In the TEST position an EPS battery capacity test is performed and if successful the green TEST indicator illuminates.

The GEN 1, GEN 2, BAT 1 and BAT 2 voltages and amperes indications are shown are in the ELECTRICAL status window of the systems MFD. A positive BAT current indicates battery charging rate. The indications are shown as amber dashes if a sensor reading is out of range.

The MAU provides monitoring of the battery voltage and current. The conditions that will result in a caution output to the CAS are:

- A decrease of battery voltage below 22.0 VDC will give a Battery caution
- An increase of battery current above 60 Amps discharge will give a Battery caution
- An increase of battery voltage above 30.3 VDC will give a Battery caution.

Continuous monitoring of the GEN 1 and GEN 2 voltages for close to limit cautions is provided by the MAU. The conditions that will result in a caution output to the CAS are:

- A decrease of generator voltage below 22.0 VDC will give a Generator caution
- A increase of generator voltage above 30.3 VDC will give a Generator caution.

7-13-3 Operation

CAUTION

Failure to follow the correct power up and power down sequence will trigger nuisance warnings and cautions, due to equipment not being correctly powered up and therefore resulting in a faulty status. Only performing a correct power up cycle will initialise equipment and systems to a correct state.

The correct power up sequence is STBY BUS switch ON, EPS switch test for 5 seconds then ON, BAT 1 and 2 switches ON and EXT PWR switch ON (if available). The correct power down sequence is EXT PWR switch OFF (if ON), STBY BUS switch OFF, EPS switch OFF and BAT 1 and BAT 2 switches OFF. To power up the aircraft expeditiously, the standby bus and the EPS can be switched ON prior to performing the outside check. Before sitting down, the pilot can switch BAT 1 and 2 switches ON, then, once seated and once the relevant checklist items have been performed, the system is ready for engine start.

When the STBY BUS switch on the overhead control panel is set to on, the blue ON indicator illuminates to show power is available from the Hot Battery bus. This allows the pilot to perform preflight planning and ATC communication tasks without powering up the whole aircraft. After engine start and the Avionic 1 bus becomes powered the blue ON indicator will go off.

The EPS should be checked prior to flight by moving the EPS switch on the overhead control panel to the TEST position. The green TEST indicator comes on to indicate a serviceable battery. The EPS switch is then set to the ARMED position and the red EPS ON comes on. Once either external power or the batteries are switched on the EPS ON indicator goes off.

Before applying external power make sure the BAT 1 and BAT 2 switches are in the ON position. Applying external power to the socket under the rear fuselage left side causes the green AVAIL indicator on the overhead control panel to illuminate. When the EXT PWR switch is set to EXT PWR the blue ON caption is illuminated and the external power is supplied to all busses and both batteries (Bus Tie closed). The external power voltage can be seen on the BAT 1 and BAT 2 indicators. The external power voltage is monitored and the external power supply will be automatically disconnected by the external power controller, if the voltage goes outside the limits. **External Power** is displayed in the CAS window if ground power is still connected and the aircraft is ready to taxi (i.e. engine running, both generators and both avionic busses are on).

Battery voltages and amperes can be seen on the BAT 1 and BAT 2 status indicators. After engine start and when the generators come online the Bus Tie will open (dual channel system) with the Generator 1 powering one channel and Generator 2 powering the other channel. This is the PGDS normal operating condition with all busses available. Disconnecting the external power from the aircraft will cause the overhead control panel green AVAIL indicator to go off.

The output voltages and load of the GEN 1 and GEN 2 and the voltages and load or charging current of BAT 1 and BAT 2 can be observed in the ELECTRICAL status window on the systems MFD.

The generator voltages are monitored by the MAU for under and over voltage conditions. The Generator Control Units (GCU) monitor the generators for over current conditions. The batteries are monitored for under, over voltage and over current conditions by the MAU. If an outside of acceptable limits condition arises the appropriate warnings or cautions are shown in the CAS window.

Failures within the PGDS follow a structured degradation of systems functionality. Should either the Generator 1 or Generator 2 fail, the appropriate control relays within the PGDS automatically reconfigure so that the remaining generator and both batteries are connected in parallel to the Power Line and the Secondary Power Line through the bus tie. A caution will be displayed in the CAS window. This is the PGDS abnormal operating condition and automatic load shedding takes place.

In the event of a dual generator failure the Bus Tie closes and both the batteries supply the Power Line. The Secondary Power Line will also be powered but apart from LDG GEAR PWR all the distribution busbars will be automatically load shed. A warning will be displayed in the CAS window. This is the PGDS emergency condition and automatic load shedding takes place. With the STBY BUS switch on, the Avionic 1 bus can be manually switched off with the AV 1 BUS switch to further reduce the electrical load.

If a battery failure condition is detected and shown in the CAS window the appropriate battery switch must be selected off by the crew to open the battery relay to isolate the failed battery. The position of all other relays and bus ties remain unchanged and there is no degradation of system performance.

Following the loss of generator and battery power to the Essential Bus the EPS battery will provide power to the standby instruments. The red EPS ON indicator on the overhead control panel will come on.

Refer to Section 3, Emergency Procedures, Electrical System Failures, for further information on emergency procedures.

7-13-4 Indication / Warning

PGDS status indication is displayed in the ELECTRICAL window of the systems MFD. Under normal operating conditions the PGDS readouts are given in white. If an out of limit condition arises the PGDS readout background will change to yellow for a caution or red for a warning together with the relevant CAS caution or warning.

The CAS window on the systems MFD displays the following WARNINGS and CAUTIONS for the PGDS (refer to Table 7-13-1):

Table 7-13-1: Electrical - CAS Messages

CAS Message	Description
Essential Bus	Indicates busbar voltage less than 22 VDC
Generators	Indicates both generators are off-line and engine is running
Battery 1 Hot Battery 2 Hot Battery 1 and 2 Hot	Indicates battery 1 or 2 or both batteries over temperature Battery 2 Hot (only operative with Ni-cad batteries installed) Accompanied by voice callout “Battery Hot”
External Power	External power connected with both generators online and both Avionic busses energized
Generator 1 Off	Generator 1 is off-line and engine is running
Generator 2 Off	Generator 2 is off-line and engine is running
Bus Tie	Indicates Bus Tie is in the incorrect position for the PGDS configuration
Avionics 1 Bus Avionics 2 Bus Avionics 1+2 Bus	Indicates Avionics 1 or 2 or both bus voltage is less than 22 VDC
Generator 1 Volts Generator 2 Volts Generator 1+2 Volts	Indicates Generator 1 or 2 or both voltage is less than 22 VDC or more than 30.3 VDC
Battery 1 Battery 2 Battery 1+2	Indicates battery 1 or 2 or both under and over voltage or current discharge condition
Battery 1 Off Battery 2 Off Battery 1+2 Off	Indicates battery 1 or 2 or both are off-line
Main Bus Generator 1 Bus Generator 2 Bus Generator 1+2 Bus Standby Bus Non Essential Bus	Indicates Generator 1+2 Bus a busbar voltage is less than 22 VDC

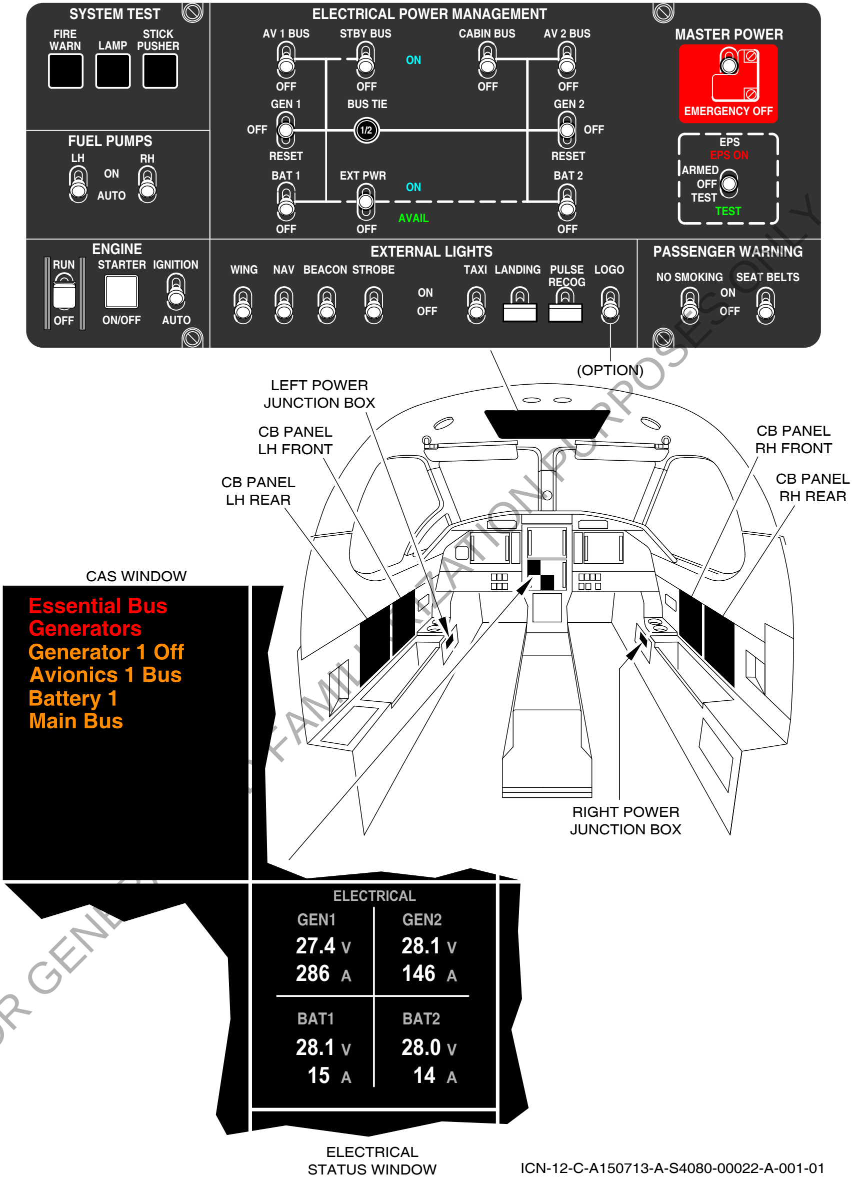

Figure 7-13-1: Power Generation and Distribution System (PGDS) - Controls

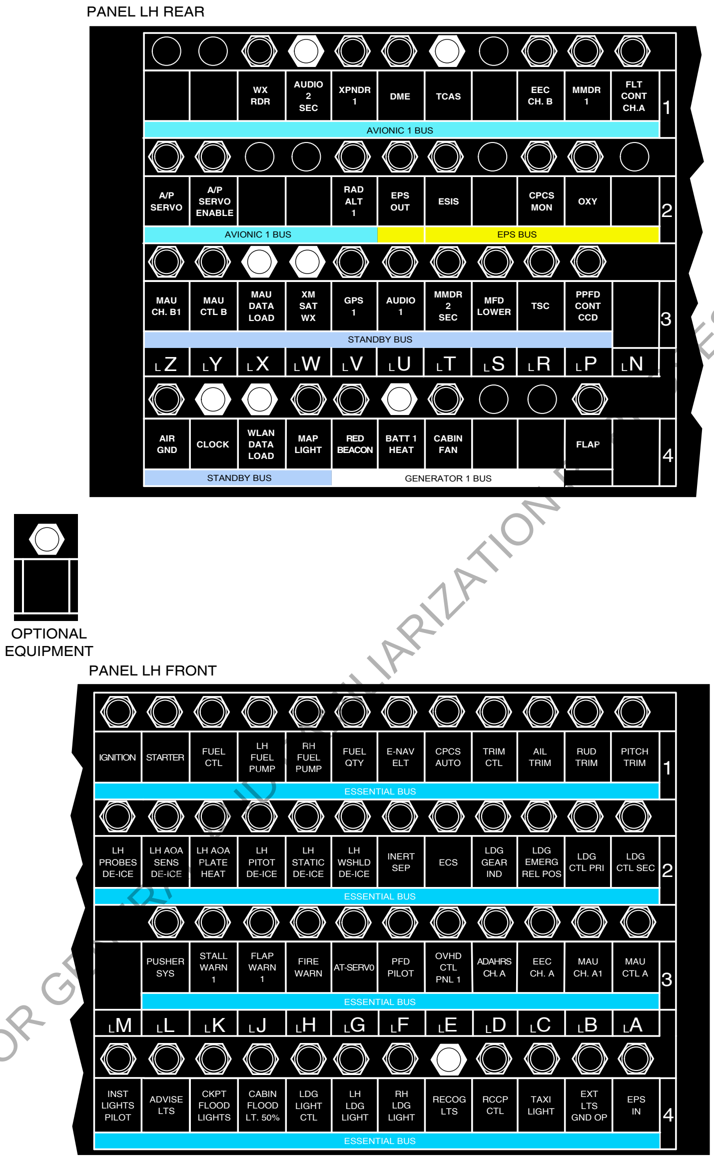

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Figure 7-13-2: PGDS LH Circuit Breaker Panels

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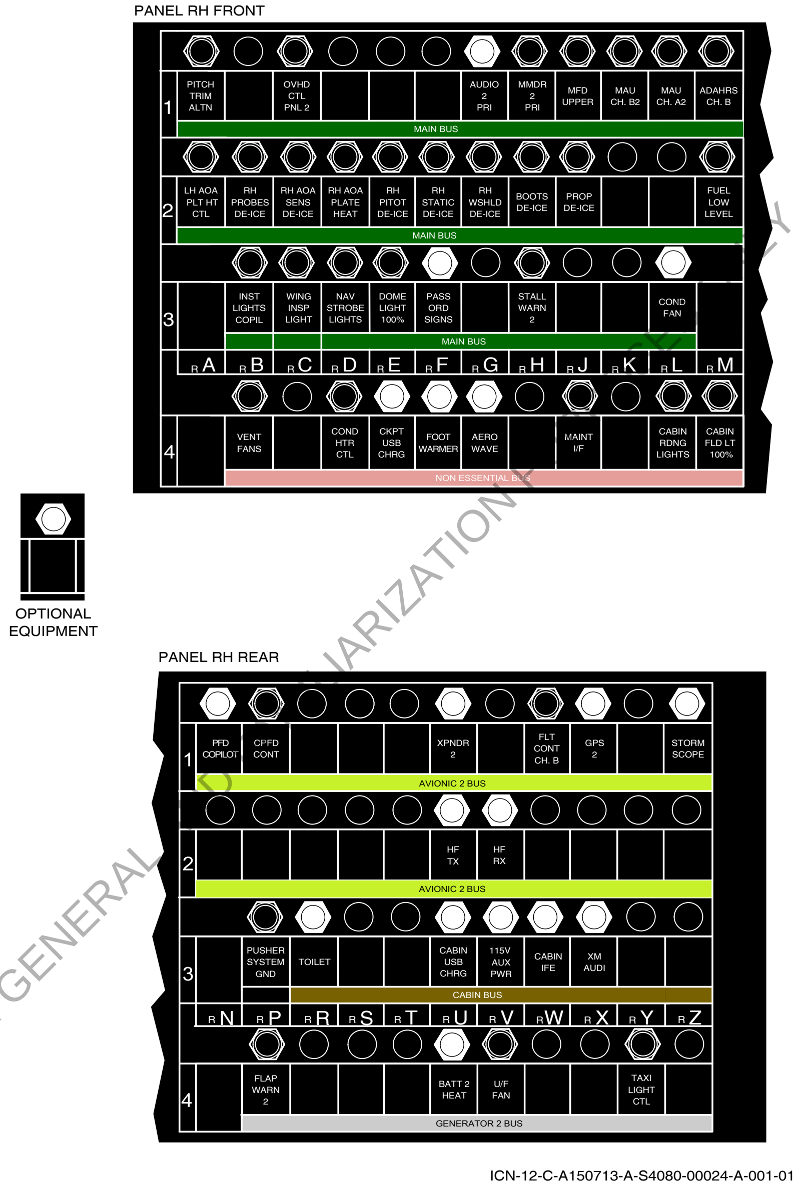

Figure 7-13-3: PGDS - RH Circuit Breaker Panels

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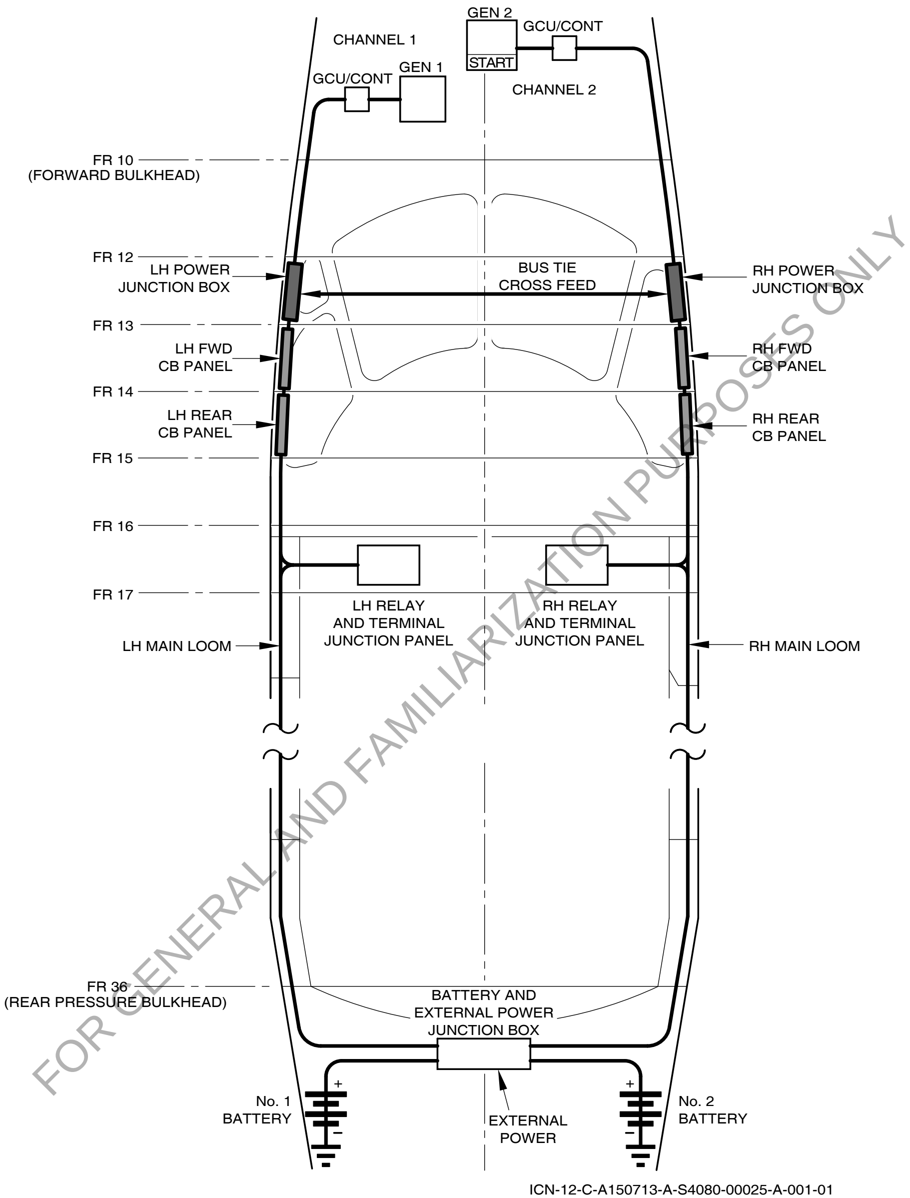

Figure 7-13-4: PGDS - Layout

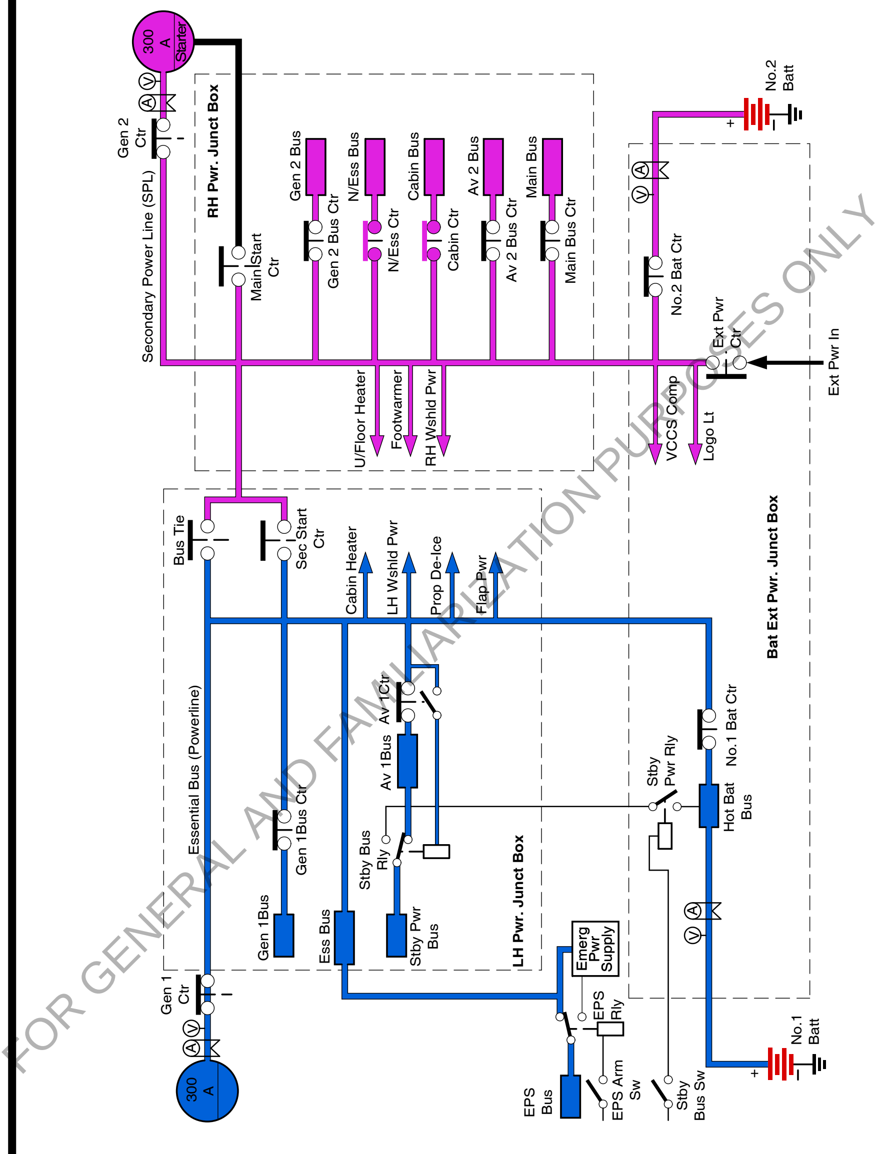

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Figure 7-13-5: PGDS Normal Operation Condition - Both Generators On-Line

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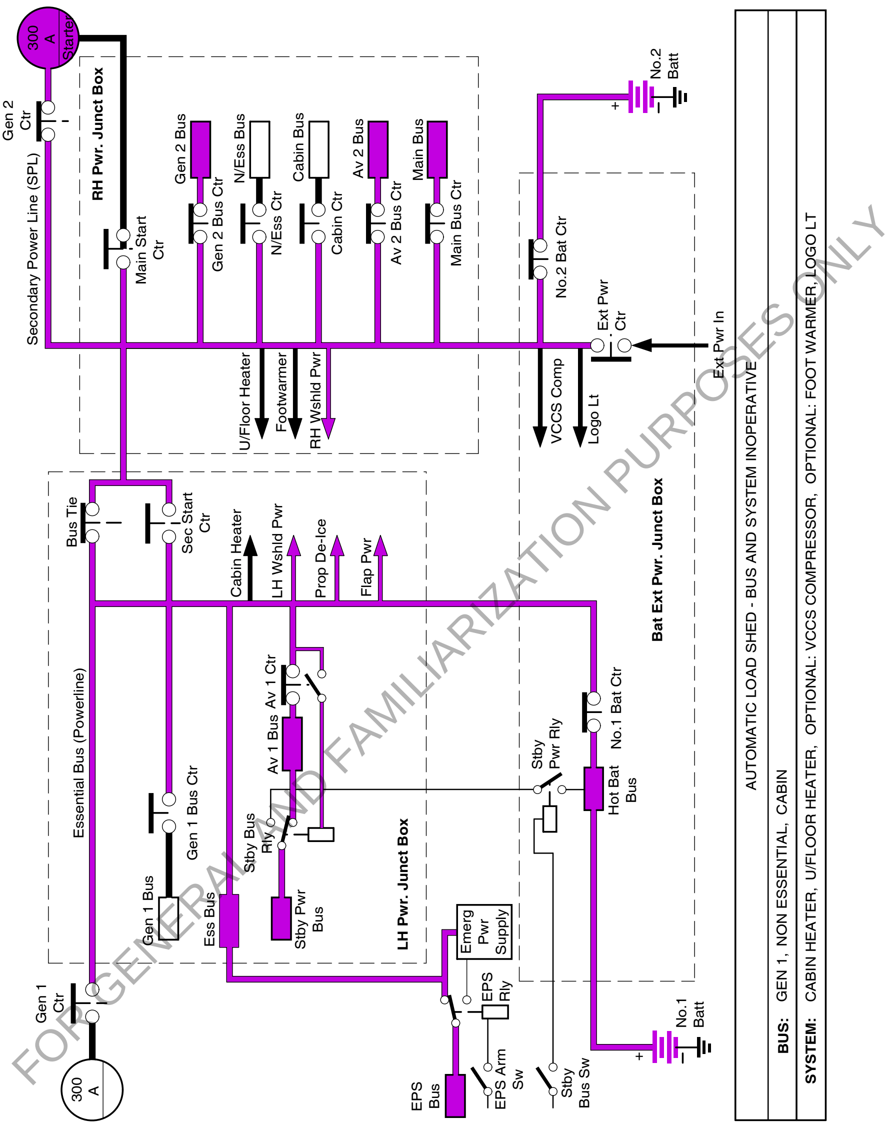

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Figure 7-13-6: PGDS Abnormal Operation Condition - Generator 1 Off-Line

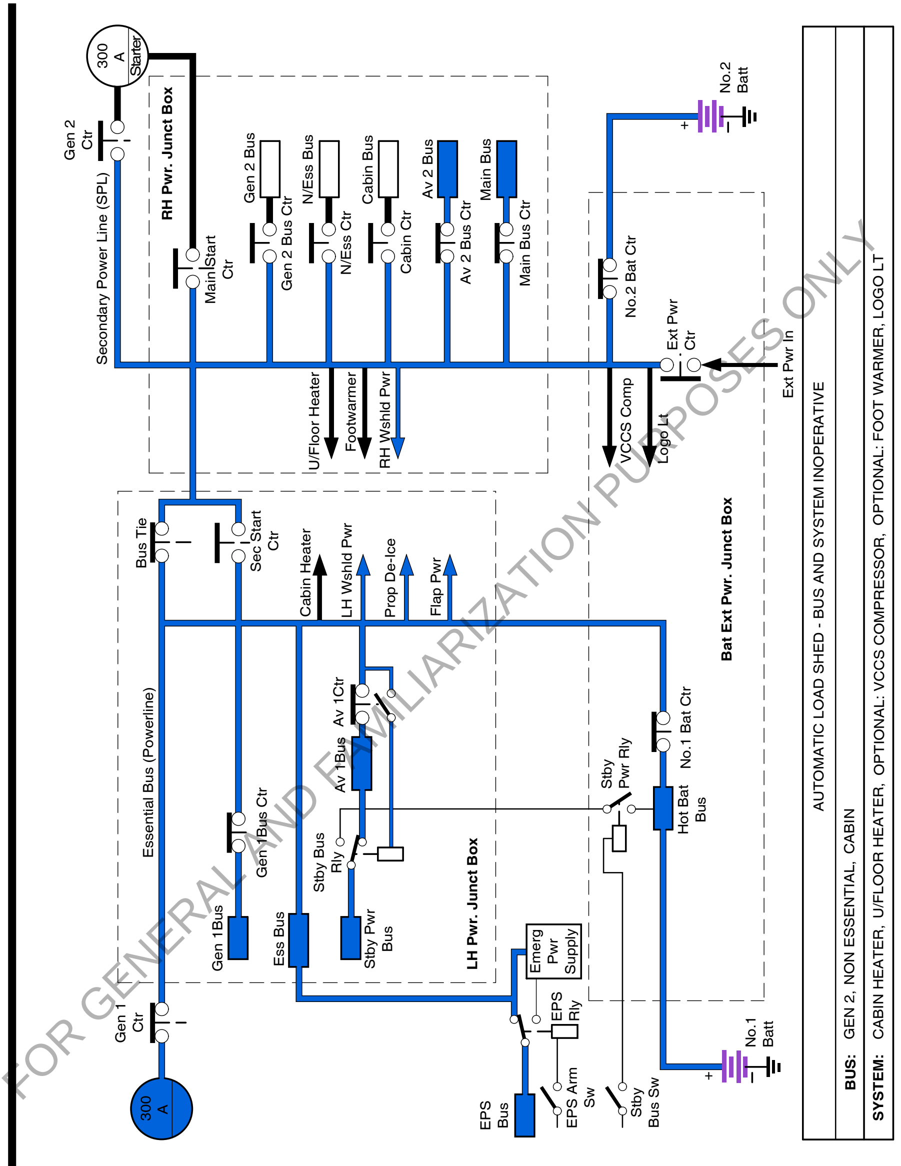

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Figure 7-13-7: PGDS Abnormal Operation Condition - Generator 2 Off-Line

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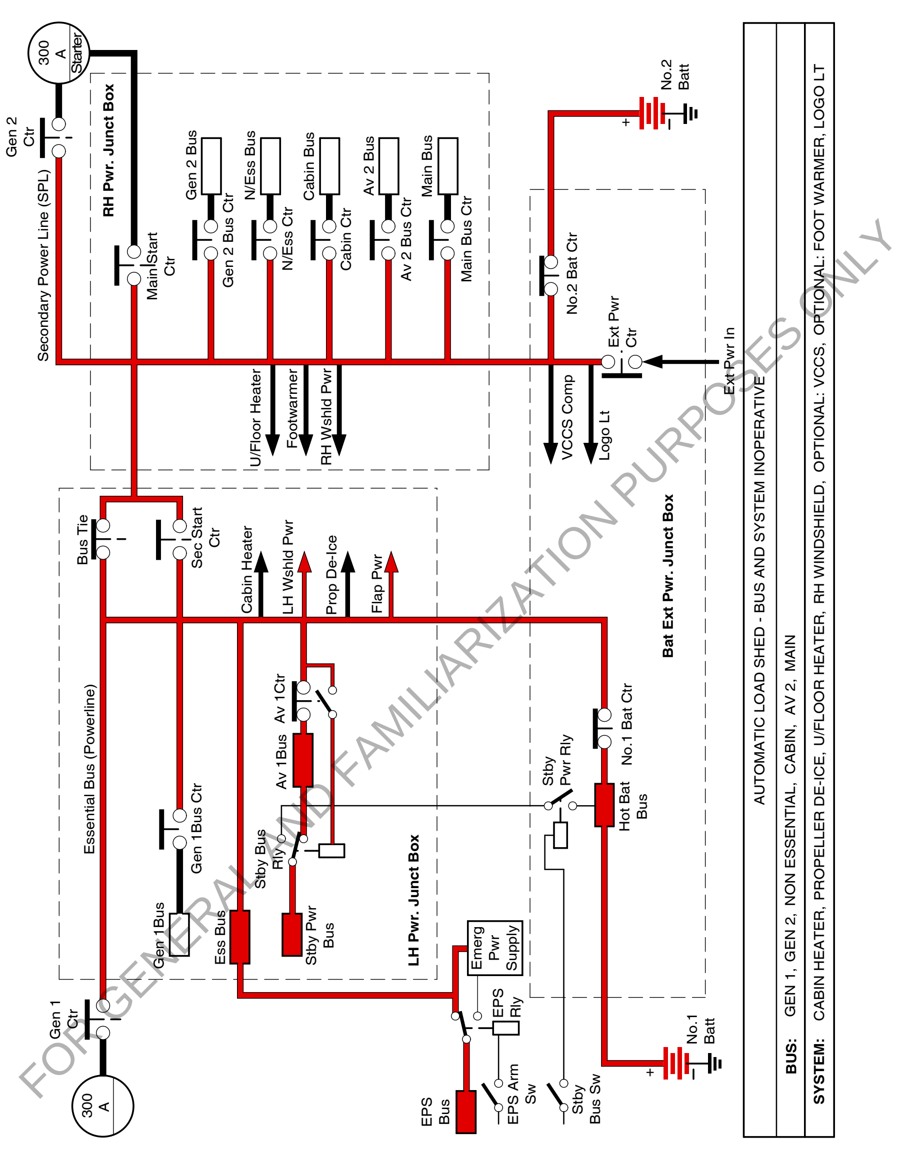

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Figure 7-13-8: PGDS Emergency Operation Condition - Both Generators Off-Line

7-14 Lighting

7-14-1 Interior

Cockpit lighting consists of internally lit cockpit displays, controllers, switch panels, instrument panel, circuit breaker panel mounted floodlights, map lights, and a cockpit dome light.

7-14-1.1 Cockpit lights

Light selection and brightness is controlled by rotary switches located near the aft end of the center console. The rotary switches control and adjust the brightness of the pilots and copilots cockpit flood lights and lighted panels and also to select night or day brightness of the advisory lights. The cabin flood lights are controlled by a stacked rotary switch.

Separate intensity control of the Primary Flight Display(s) (PFDs), Multi Function Display(s) (MFDs) and Touch Screen Controller (TSC) is controlled by rheostats located on the Display Reversionary Control Panel. The cockpit dome light can be set to two preset intensities of 50% or 100% brightness. The Master Caution/Master Warning lights are on a fixed dim circuit. The map light switches are on each control wheel and the brightness is controlled by a separate rheostat.

7-14-1.2 Cabin lights

A switch located on the forward edge of the passenger door (accessible when open) will activate a timer for the cockpit overhead panel, cockpit dome light and the passenger door light. When this switch is pressed, the overhead panel, passenger door light and 50% cockpit dome light will be on for 45 seconds to facilitate night preflight boarding. The 50% cabin flood lights and the stair lights are also activated by this switch. Cabin flood lights operate for 45 seconds. The stair lights remain active for approximately 4 minutes longer than the other lights.

The passenger door light illuminates the cabin airstairs and the baggage area has an overhead light. The main cabin is equipped with an overhead flood light system that can be set to 50% or 100% brightness as selected by the cockpit switch. Individual reading lights are provided for each passenger seat and are controlled by a switch near each seat.

A baggage compartment light is operated by a push switch installed on the bulkhead trim adjacent to the cargo door. The light stays on for five minutes when the switch is pushed. For continued lighting the switch must be pushed again.

7-14-2 Exterior

Exterior lighting consists of a combined ACL, navigation and tail light on each wing, a Light Emitting Diode (LED) landing light on each main landing gear, an LED taxi light on the nose landing gear and a wing inspection light mounted in the left fuselage forward of the passenger door. These lights are controlled by switches located on the EXTERNAL LIGHTS section of the overhead panel.

Red flashing LED beacon lights are installed on the top of the horizontal stabilizer fairing and on the lower center fuselage. They give recognition during ground operation and additional anti-collision protection in flight. The lights are controlled by a BEACON switch located on the EXTERNAL LIGHTS section of the overhead panel.

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7-14-2.1 Recognition Lights

Pulse recognition lights are installed in the left and right forward outer flap fairings. They provide forward illumination during taxiing and enhance the conspicuity of the aircraft in the traffic pattern or enroute. The lights can be on continuously or when set to pulse the lights illuminate alternately left and right approximately 45 times per minute. Power for the light control unit is supplied from the Essential bus through the RECOG LTS circuit breaker. If the aircraft has an optional Collision Avoidance System installed, the pulse recognition lights are activated automatically when:

- The strobe lights are ON
- A Traffic Alert signal is received by the Collision Avoidance System.

The recognition lights will operate in Pulse Mode while the Traffic Alert is present. Once the alert is no longer active, the pulse recognition lights will revert to the previously selected mode.

7-14-2.2 Logo Lights

Optional logo lights can be installed under each side of the horizontal stabilizer. They provide illumination of the vertical stabilizer to show the owner’s logo. The lights are controlled by a LOGO switch located on the EXTERNAL LIGHTS section of the overhead panel. Power for the lights is supplied from the Battery and External Power Junction Box (BEPJB) through the LOGO LIGHTS circuit breaker. The BEPJB is installed in the rear fuselage. Each logo light has two filaments. On the ground with battery power, external power or one generator on line, only one filament in each light is illuminated. When both generators are online all four filaments will illuminate. If either generator fails in flight, all filaments are automatically switched off.

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7-15 Environmental Control System

7-15-1 General

For the system controls and layout, refer to Fig. 7-15-1, ECS - Controls and Indications

The Environmental Control System (ECS) comprises:

- Air Cycle System (ACS)
- Auxiliary heaters
- Vapor Cycle Cooling System (VCCS), including Vent Fans (optional)
- Vent Fans (if VCCS not installed).

The ACS takes engine bleed air, reduces its temperature to that desired, and delivers it to the cabin air distribution system for pressurization and ventilation. The air cycle system cools a portion of the bleed air and then mixes it with hot bleed air to provide the correct temperature. A firewall shutoff valve can be closed to prevent contaminated air from entering the cabin in the event of an engine compartment fire.

One of the two auxiliary electrical heaters (cabin heater) is used to supplement the air cycle system during prolonged low temperature operations such as cruise at high altitude. The other heater (underfloor heater) heats the under-floor avionic and electrical equipment. Both heaters can also be used for pre-heating the cabin and under floor equipment on the ground when external power is connected.

The VCCS (when installed) is designed to operate on the ground from a 28 VDC ground power unit or aircraft electrical power when both generators are on. The electric motor driven system provides a means of precooling the cockpit and cabin areas prior to and during passenger boarding, providing comfort prior to engine start. The system will automatically be controlled during ground operations and in flight, based on temperature demand setting. It removes a large percentage of the moisture as well as dust and pollen particles from the cabin air. If the VCCS is not installed the two vent fans remain installed. The vent fans provide additional air circulation to the cockpit and cabin.

All environment control systems are controlled by an integrated ECS controller and temperature selections can be made and seen by the pilot on the systems Multi Function Display (MFD) ENVIRONMENT status window.

7-15-2 Air Cycle System

7-15-2.1 Description

The ACS consists of a flow control venturi, a heat exchanger, a cooling turbine, a temperature control valve, a water separator, high pressure shutoff valve, a primary shutoff valve, an air flow control valve and associated non return valves and control sensors.

The flow control venturi is sized to regulate flow and pressure.

The heat exchanger is an aluminum single pass, crossflow, plate and fin unit. The unit includes one charge air tap to assist the injection of water into the heat exchanger coolant intake. The evaporation of the water on contact with the heat exchanger surface increases the efficiency of the unit.

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The cooling turbine is a ball bearing turbo fan and consists of a radial turbine in a stainless steel assembly coupled to an axial flow fan. The turbine casing incorporates a containment ring.

The Temperature Control Valve (TCV) is three ported consisting of one inlet and two outlets and driven by a 28 VDC actuator. The valve body and rotating drum are aluminum. The actuator has gearing, limit switches, and magnetic brake to control the motor.

The water separator consists of an aluminum shell containing a coalescor and its support. The coalescor collects moisture from the passing air and forms large droplets which then enter a swirl section, where they are removed by centrifugal force. The separator has a spring loaded poppet valve which allows air to bypass the unit in the event of the coalescor becoming blocked.

The high pressure shutoff valve is solenoid operated and allows automatic selection between P3 and P2.5 compressor stages depending on flight condition to maintain the pressure schedule required for cabin pressurization.

A Firewall Shutoff Valve enables isolation of the system in emergency conditions such as an engine fire. Operation of the Firewall Shutoff Valve also opens a ram air scoop on the right fuselage underside which introduces ambient ventilation air through the distribution system. This is used in the event of smoke in the cockpit or cabin.

CAUTION

Due to the composite construction of the engine cowling and the possibility of toxic gases, the airplane ACS must be shutoff when a fire condition is suspected.

The air Flow Control Valve (FCV) at the cockpit outlet of the plenum chamber directs the ACS air to the cockpit and/or to the cabin, depending on the cockpit and cabin temperature settings.

Temperature data from the sensors in the cockpit and cabin is sent to the integrated ECS Controller. The integrated ECS Controller also receives signals from the control valves and duct temperature sensors.

The ACS has an ACS BLEED AIR switch on the switch panel located on the copilots lower left panel. The switch has the positions AUTO and INHIBIT.

7-15-2.2 Operation

During engine start (ECS switches in AUTO position) the Primary Shutoff Valve (PSOV) is automatically kept closed (no bleed air) and the auxiliary heaters and VCCS are inhibited. When the engine Ng reaches 62% the PSOV opens and bleed air becomes available.

Air is drawn from the P2.5 and P3 compressor bleed ports on the engine casing. This consists of a single port in the case of the P2.5 connection and two diametrically opposed ports for the P3 connections. The bleed air will be taken exclusively from the P2.5 port during normal operation. However, when the engine is at idle there is insufficient pressure to maintain cabin pressurization. When the P2.5 bleed air pressure falls below a specific value, a pressure sensor in the bleed air ducting opens the high pressure shutoff valve. This creates a back pressure on the non-return valve at the P2.5 port and closes the valve to shut off the P2.5 bleed. The bleed air then passes through the Primary Shutoff Valve and the Flow control venturi, which is sized to regulate the bleed air flow rate and pressure.

The air then passes on to the TCV. At the TCV the bleed air splits where variable amounts are either supplied to the Heat Exchanger or to a mix point downstream of the Cooling Turbine.

The heat exchanger is cooled by ambient air drawn from a NACA intake in the airplane skin. Cooling airflow is provided by the Heat Exchanger Cooling Fan located downstream of the heat exchanger.

From the heat exchanger, the bleed air is passed to the Cooling Turbine. As the bleed air passes through the Cooling Turbine, its pressure is reduced to delivery pressure and its temperature is, in many cases, close to 0°C. The energy extracted from the bleed air is used to power the Heat Exchanger Coolant Fan which is mechanically linked to the turbine by a shaft.

The duct downstream of the turbine is the mixing duct where the now-cooled turbine exhaust air is mixed with uncooled bleed air directed from the other port of the TCV. The mixing proportions are controlled by the TCV. The TCV is an electrically operated three port valve with one inlet and two outlet ports. Depending on the selected temperature the TCV modulates to either pass air through or bypass the Heat Exchanger and Cooling Turbine. The TCV operation is controlled by the ECS Controller. The TCV will move to allow more bleed air to bypass the Cooling Turbine if the cabin temperature is less than desired. Conversely it will move to pass more air through the Heat Exchanger and Cooling Turbine if the temperature is greater than desired.

The temperature of the duct downstream is monitored by a temperature sensor and will limit the movement of the TCV as required to keep the duct temperature within the maximum and minimum temperature limits.

From the mixing duct the conditioned air passes through a water separator. Moisture is removed from the conditioned air and drawn to the heat exchanger and sprayed into the heat exchanger intake. The conditioned air passes through the Firewall Shutoff Valve and the non-return valves to the cabin for distribution. The non-return valves prevent sudden depressurization in the event of a loss of cabin air supply.

The air enters a small plenum where it is distributed to the cabin and through the FCV controlled by the ECS Controller to the cockpit. Cockpit air is directed to outlets at the crews feet and adjustable outlets adjacent to the instrument panel. Air to the cabin is introduced through fixed outlets placed at floor level along both sides of the cabin.

The integrated ECS Controller adjusts the position of the TCV and FCV to give the warm/cold air mix for the system default temperature of 21 °C, or that set by the pilot, for the cockpit and cabin.

For a takeoff at limited power (hot and high) the ACS BLEED AIR switch can be set to INHIBIT and after takeoff the ACS BLEED AIR switch can then be set to AUTO.

The ACS will automatically shut down when the engine Ng is less than 62%.

Refer to ECS Operation for further information on the operation and for the control of the ACS.

7-15-3 Auxiliary Heating

7-15-3.1 Description

The system comprises two 28 VDC heating units each equipped with a 75 mm mixed flow fan. Each unit is cylindrical in form and contains two heating elements producing 1,625 kW/unit. The system therefore produces 3,25 kW in addition to that of the air cycle system. The units are situated under the cabin floor, one is dedicated to heating the cabin and the other to heating the under floor avionics bay. The cabin heater is supplied 28 VDC power from the powerline (left Power Junction Box) and the under floor heater is supplied from the secondary powerline (right Power Junction Box).

The under floor heater is located between frames 21 and 22. The fan scavenges its air supply from the general under floor zone, through a wire mesh inlet grill, and passes it over the heating element where its temperature is raised. The air is then distributed along the length of the under floor avionics bay by way of a longitudinal distribution duct.

The cabin heater is located between frames 29 and 30. The fan draws its air supply from the cabin, through a grill in the rear floor step. The heated air is then ducted directly to the ECS distribution duct in the right cabin sidewall and augments the ACS airflow. The airflow created by the cabin heater is effective in equalizing the temperature throughout the cabin.

Both heater units are equipped with an internal thermal protection system, which isolates the heater when the element temperature overheats. In the event of an over heat, the fans continue to run and the relevant CABIN HTR circuit breaker (located on the left PJB) or U/F HEATER HTR circuit breaker (located on the right PJB) will trip. The heater will remain isolated until the temperature falls within the heater allowing the circuit breaker to be reset by the pilot.

The power for the heater element circuits is interrupted when the landing gear moves or the cooling system (VCCS) is operating.

The heating capacity of the system is reduced while the engine is operating at P3 bleed in flight. The cabin heater and fan are inhibited while airborne and P3 bleed is extracted, the under floor heater and fan remain operating. While on the ground (WOW valid) the cabin heater and fan continue to operate when P3 is extracted. During engine start and for 10 seconds following engine start both heaters and fans are inhibited.

The function of the power inhibits are fully automatic and require no pilot input. Thermal protection, once tripped, will require pilot action to reset.

There is an ELECTRICAL HEAT/COOL switch on the switch panel located on the copilots lower left panel. The switch has the positions AUTO and INHIBIT.

7-15-3.2 Auxiliary Heating Operation

When the system is in operation the under floor fan runs continuously and the heater element is switched on when the under floor sensor reads below +5 °C and is switched off above +11 °C. The cabin fan runs continuously when the cabin heater is in operation as demanded by the ECS Controller. The cabin heater function is to automatically supplement the ACS cabin heating supply during prolonged low temperature operations such as cruise at high altitude.

Refer to ECS Operation, for the control and operation of the auxiliary heating system.

7-15-4 Vapor Cycle Cooling System

7-15-4.1 Description

A refrigerant gas is the media which absorbs heat and rejects heat from the cabin air. By continuous recirculation of cabin air, heat is absorbed in the evaporator modules and transferred to the outside through the system condenser.

The system is provided with safety interlock devices to prevent component damage and/or excessive power drain from the aircraft electrical system. The evaporator modules are equipped to prevent coil icing at all ambient conditions.

Cabin temperature control is by varying the airflow through each evaporator module rather than cycling the refrigerant compressor. If required the airflow can be reduced by the flight crew. The cabin is cooled by air ducted from the two evaporators (vent fans) located just forward of the aft pressure bulkhead and exhausted through adjustable individual outlets and a series of permanent spray outlets (30 on each side) down the left and right sides of the cabin overhead panel.

The cockpit is cooled by individual outlets located in the overhead panel. These outlets receive air ducted from the two evaporators (vent fans) in the cabin.

There are ELECTRICAL HEAT/COOL, FANS VENT and MAX switches on the switch panel located on the copilots lower left panel. The ELECTRICAL HEAT/COOL and MAX switches have the positions AUTO and INHIBIT. The FANS VENT switch has the positions AUTO and LOW.

7-15-4.2 Operation

When the system is activated, an electric motor drives the compressor at constant capacity which compresses the refrigerant gas to high pressure. The hot, high pressure gas then passes through the condenser coil where it is cooled and condensed into a warm liquid at constant pressure. The heat removed from the fluid is exhausted overboard through a vent in the right rear tail section aft of the pressure bulkhead. The warm liquid from the condenser is then routed into a receiver-dryer container where the liquid and any remaining gas are separated and any moisture in the liquid is absorbed. The warm dry, high quality liquid is then routed to the evaporator module expansion valve where the high pressure liquid is expanded to a low pressure. The large expansion process creates a super cool liquid which passes through the evaporator coil and absorbs heat from the warm cabin air. The cooled air is returned to the cabin. The gas, now warm, is returned to the compressor to repeat the cycle.

Moisture removed from the cabin air by each evaporator drains into a small holding tank below the rear baggage floor panel. The water is held in the tank until the cabin differential pressure is low enough for the tank outlet valve to open allowing the water to drain overboard.

The VCCS is controlled by the integrated ECS Controller and the operation is based on defined hysteresis band between the sensed cockpit/cabin temperatures and those set by the pilot. When the selected cabin temperature demands the cabin to be cooled the ECS Controller will select the appropriate fan speed and the VCCS on. For a small difference between the sensed and selected temperatures the vent fans will be set to low. For a larger difference the vent fans will be set to high and for a large temperature difference the vent fans will be set to MAX. If desired the pilot can set the FANS - VENT switch to LOW or the MAX switch to INHIBIT at any time to reduce noise and airflow.

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The vent fans blow cool air into the left and right overhead ducts. The overhead ducts are equipped with permanent spray outlets providing a continuous flow of cool air to the cabin. Individual outlets in the overhead panel are adjustable for local temperature control at each seat location.

When the VCCS is operating, the GEN 2 DC Indication will increase by approximately 80 amps for compressor and evaporator fans operation.

A temperature switch located in the rear fuselage prevents VCCS operation at ambient temperatures below -15 °C.

Refer to ECS Operation for the control and operation of the VCCS.

7-15-5 ECS Operation

The normal operation of the ECS is with all the switches in the AUTO position and with the adjustable air outlets open at the overhead and side positions. The ECS Controller then automatically controls the cockpit and cabin air temperatures as set by the pilot on the systems MFD ENVIRONMENT status window. The cockpit and cabin temperatures can be set by the bezel buttons, with the Cursor Control Device (CCD) or the Touch Screen Controller (TSC). The primary method of temperature adjustment is by pressing the bezel button adjacent to the CKPT TEMP or CAB TEMP soft key which then displays the up/down arrow legends. Press the adjacent up or down bezel button to move the slider bar left to a colder or right to a warmer position. Due to the system design only a temperature difference of up to a maximum of 5 °C between the cabin and cockpit can be set. After more than 5 °C movement of one slider bar the other slider bar will also move in the same direction. Temperature selection can be from full heating (both slider bars fully right) (ACS air to maximum allowable temperature and auxiliary heater on, VCCS and fans off) to full cooling (both slider bars fully left) (ACS air to minimum allowable temperature and auxiliary heater off, VCCS and fans on). The actual cockpit, cabin and underfloor (optional) temperature readings are displayed at the bottom left of the ENVIRONMENT status window.

After temperature adjustments have been made with the temperature slider bar, allow the system to stabilize for a few minutes and adopt the new setting. During descent, the system has a tendency to overheat the cockpit slowly, therefore the recirculation fans should be allowed to blow fresh air out of the overhead outlets into the cockpit. If the system is unable to reach the preselected temperature values, the aircraft could be operating in high ISA deviation temperatures outside the system performance capabilities or one of the system components may have failed.

The ECS Controller receives data signals from the:

- ACS TCV and FCV position, duct temperature conditions
- Auxiliary heater power supplies and thermal safety switch position
- VCCS compressor motor and the vent fan positions
- Temperature sensors in the cockpit, cabin and underfloor.

The ECS Controller sends and receives status signals to and from the Modular Avionics Unit (MAU) for the control switches and systems MFD ENVIRONMENT status and Crew Alert System (CAS) windows. It will also send a caution signal to the CAS window in the event of an ACS fault.

In the auto mode the ECS Controller adjusts the position of the ACS TCV and FCV to give the warm/cold air mix for the cockpit/cabin temperatures set on the ENVIRONMENT status window. If additional heating is required the cabin auxiliary heater and fan will be automatically selected on. If additional cooling is required the VCCS and fans will be automatically selected on.

The ECS Controller monitors the cabin underfloor temperature and will automatically select the underfloor heater on and off as necessary.

The VENT FANS can be selected from AUTO to LOW at any time with the ELECTRICAL HEAT/COOL switch in the AUTO mode. THE ACS BLEED AIR, ELECTRICAL HEAT/COOL and MAX can be selected off by setting the switches to INHIBIT.

The auxiliary heaters and VCCS can be operated in an ECS Ground Mode for preheating or cooling the aircraft before engine start. With the aircraft on ground and the engine not running, and with a 28 VDC external power supply connected and powered on the ECS Ground Mode can be entered by changing the CKPT or CAB TEMP selection with the TSC or by pressing the bezel buttons adjacent to the soft keys on the ENVIRONMENT status window.

7-15-6 Indication / Warning

Cockpit, cabin and underfloor (with optional cold weather kit) air temperatures are displayed in the ENVIRONMENT window of the systems MFD.

The CAS window on the systems MFD displays the following CAS messages for the ECS (refer to Table 7-15-1):

Table 7-15-1: ECS - CAS Messages

CAS Message	Description
ACS Low Inflow	Caution will illuminate when: – The ACS is automatically shutdown. Overpressure and overtemperature switches are installed to monitor the ACS system. If pressures greater than 40 psi are sensed in the bleed air line downstream of the flow control venturi, temperatures greater than 290°C in the bleed line upstream of the Primary Shutoff Valve, temperatures greater than 105°C are sensed in the air line downstream of the water separator, or if the Firewall Shutoff Valve is closed, the ACS will automatically shutdown. – The CPCS is not able to achieve the required cabin pressure (due to ACS switched to INHIBIT, or insufficient ACS airflow, or excessive cabin air leakage) the Cabin Pressure Control Unit will detect a “ACS Low Inflow”.
ECS Fault	Caution will illuminate when the ECS Controller has detected a critical fault or if the ECS Controller has lost data communication with the MAU.

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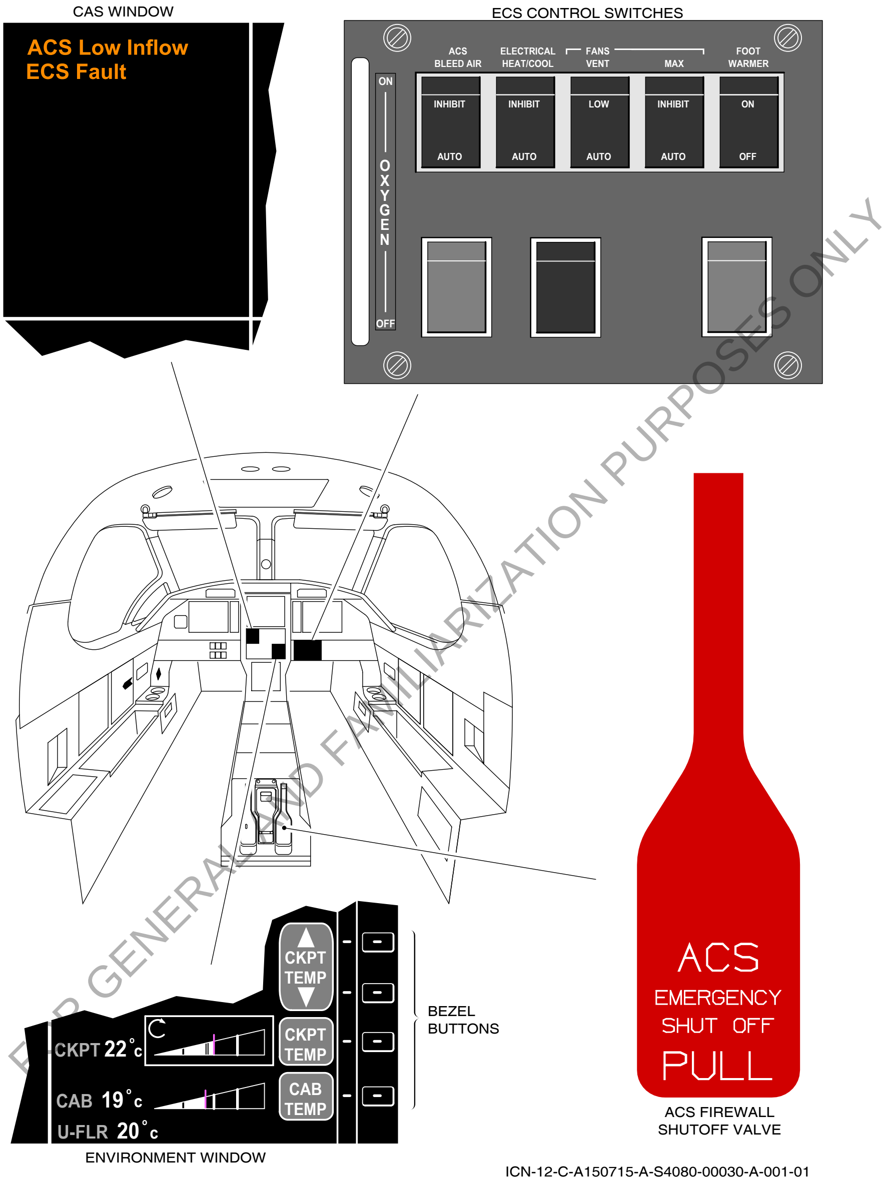

Figure 7-15-1: ECS - Controls and Indications

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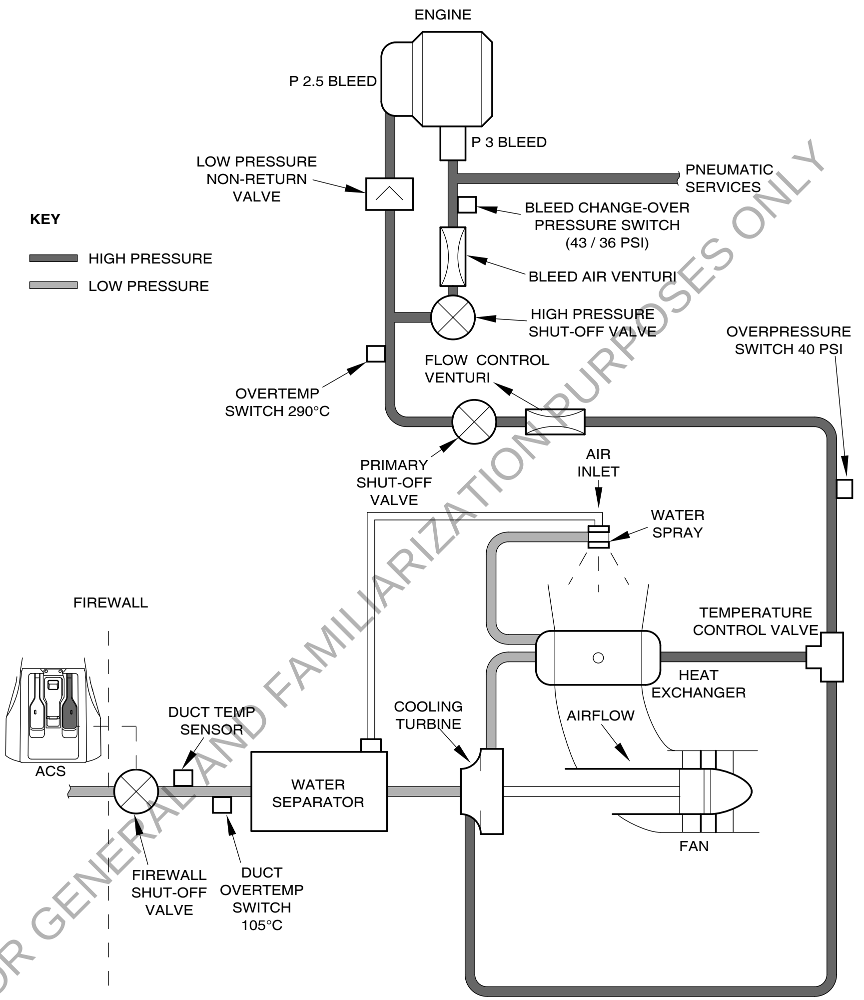

Figure 7-15-2: ECS - Air Cycle System (ACS)

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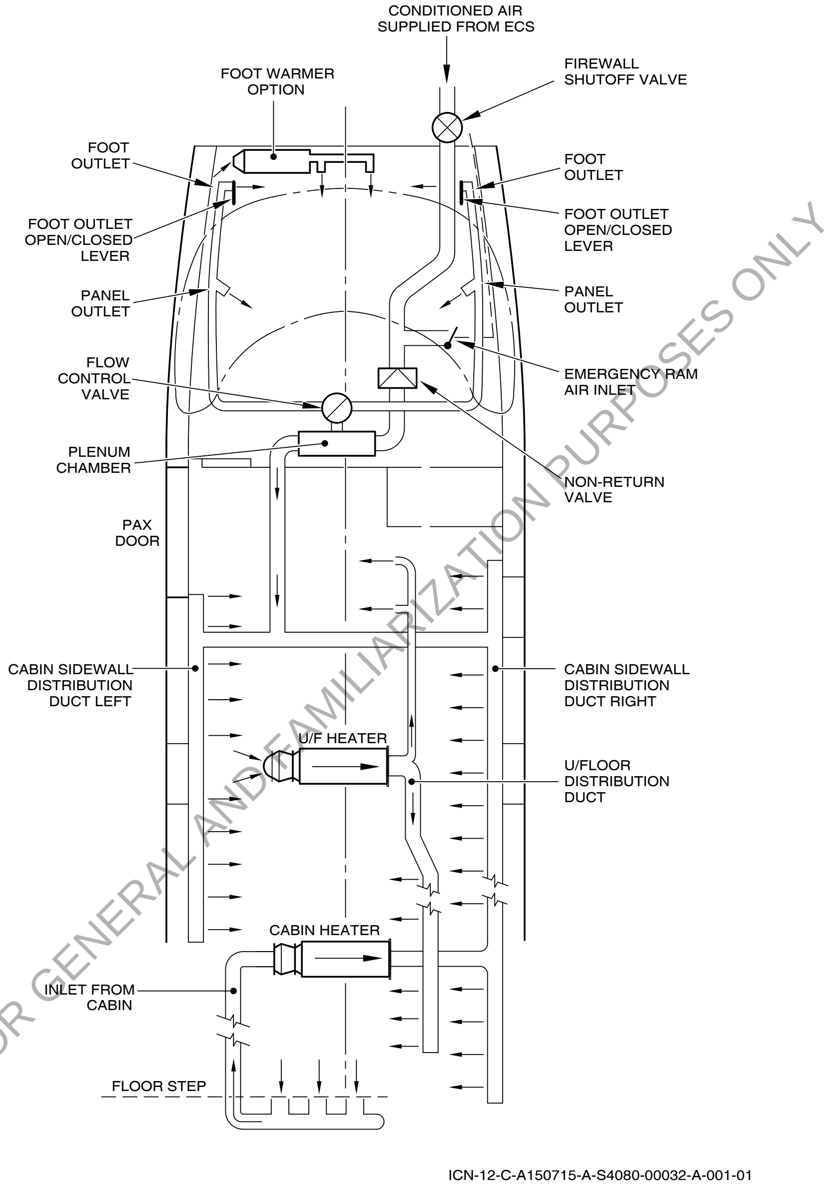

Figure 7-15-3: ECS - Auxiliary Heaters and Distribution Ducting

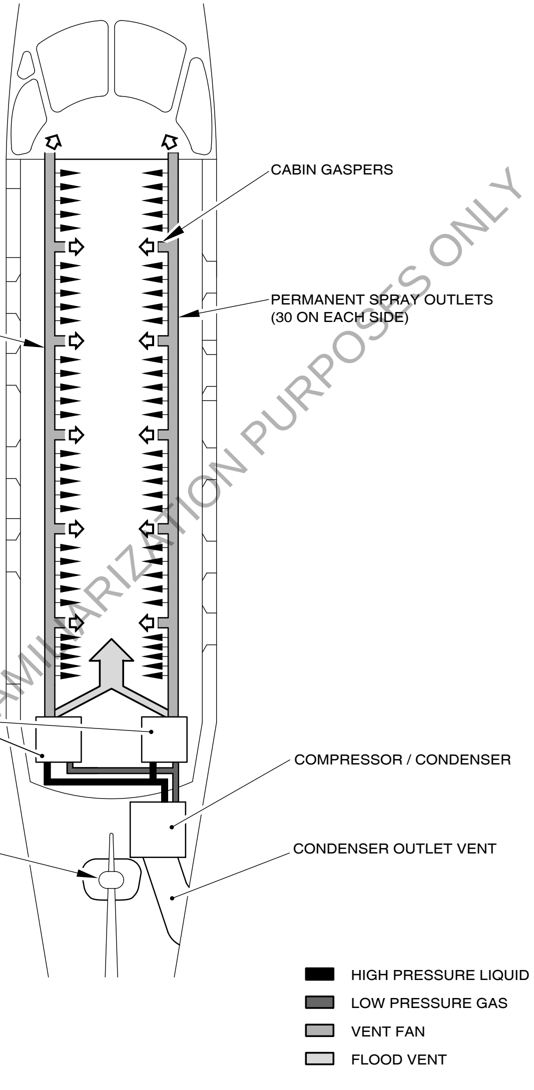

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Figure 7-15-4: ECS - Vapor Cycle Cooling System (VCCS)

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7-16 Foot Warmer System (Optional)

7-16-1 Description

The foot warmer system (when installed) comprises a 28 VDC 1kW heater installed forward above the cockpit floor. Ducting connects the heater to foot outlets at the pilot and copilot position. A FOOT WARMER switch is installed on the switch panel located on the copilot's lower left panel. It has the positions ON and OFF. Power is supplied from the secondary powerline to the heater relay and from the non-essential bus through the FOOT WARMER circuit breaker to the switch.

7-16-2 Operation

The foot warmer system operates from the aircraft electrical power or from external power. When the FOOT WARMER switch is set to ON, 28 VDC is supplied to the heater relay. The relay is energized and the heater and fan operates. The heated air is sent by the fan to the pilot and copilot foot outlets. If the temperature of the heater becomes too high the thermal protection switch operates and de-energizes the heater relay.

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7-17 Cabin Pressure Control System

7-17-1 General

For the system controls and functional diagram, refer to Fig. 7-17-1, CPCS - Controls and Indications and Fig. 7-17-2, CPCS - Functional Diagram.

The Cabin Pressure Control system (CPCS) comprises:

- A dual channel Cabin Pressure Electronic Control and Monitoring Unit (ECMU)
- An electrically driven Outflow Valve (OFV)
- A pneumatic safety Pressure Relief Valve (PRV)
- Two Negative Pressure Relief Valves (NPRV).

The systems Multi Function Display (MFD) has an ENVIRONMENT status window that allows the pilot to monitor and control the CPCS. Manual control of the CPCS functions for emergency operation are provided on the CPCS switch panel located on the copilots lower left panel.

The ECMU controls the rate of exhaust of the air that the Air Cycle System (ACS) supplies as conditioned air to the cockpit and cabin. It keeps cabin air pressure between safe and comfortable limits for the passengers and crew, and the aircraft structure.

Operation of the CPCS is fully automatic during normal operation. A semiautomatic mode called ‘Low Cabin’ is available, whereby the pilot can use Landing Field Elevation (LFE) as the target cabin altitude. The CPCS will then maintain the selected cabin altitude (as LFE) up to a maximum pressure differential of 5.75 psi.

7-17-2 Description

The ECMU is a dual channel controller and is installed in the under floor pressurized area. The ECMU channels sense cabin pressure and receive aircraft pressure altitude and rate of climb data from the Modular Avionics Unit (MAU). The cabin altitude, cabin rate of climb and cabin rate of descent and differential pressure are all automatically controlled by the ECMU controlling the exhaust airflow from the outflow valve. The cabin internal pressures and airflow rates are controlled within limitations for safe and comfortable flight. A “Low Cabin” mode can be used for more comfort (cabin at lower pressure altitude) for flight up to intermediate cruise levels. Also, panoramic flights (frequent altitude changes) will be more comfortable using the “Low Cab” mode, due to a constant rather than continuously adjusting cabin pressure.

In the event of a detected fault in the AUTO channel, **CPCS FAULT** will be annunciated and the pilot must switch the ECMU to the MANUAL channel. The AUTO channel of the ECMU is supplied with 28 VDC from the ESS Bus and the MANUAL channel is supplied from the EPS Bus.

The OFV has a circular butterfly plate that rotates in the valve body. The butterfly valve is operated by an actuator assembly which has two electrical motors and a gearbox. Each electrical motor is connected to and controlled by one of the two channels in the ECMU. The OFV is installed on the cabin forward pressure bulkhead and exhausts air out through louvers in the equipment bay doors.

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The PRV is a pneumatic poppet type control valve. The PRV contains a positive pressure relief metering section that senses differential pressure between the cabin and atmosphere. If the differential pressure exceeds the relief set point the valve will open to regulate the cabin to atmosphere differential pressure to below the maximum value. The PRV also has a negative pressure relief function and will open to allow atmosphere air to enter the cabin to prevent the atmosphere to cabin differential pressure from exceeding a given limit. The PRV is pneumatically actuated and is completely independent of the OFV and ECMU.

The two NPRV are nonreturn valves and are located in the rear pressure bulkhead. In case of negative pressure conditions they provide a second means to relieve cabin pressure.

The CPCS switch panel is located on the copilots lower left panel for control of the system. There is a guarded SYSTEM MODE switch with the positions AUTO and MANUAL, and a MANUAL CONTROL switch with the positions DESCENT and CLIMB.

There is also a guarded CABIN PRESSURE switch with the positions AUTO and DUMP. In case of emergency the switch can be selected to DUMP.

When the CPCS SYSTEM MODE switch is in the AUTO position, the ENVIRONMENT window on the systems MFD will show a digital display for cabin altitude, differential cabin pressure, cabin altitude rate of change and LFE. The LFE can be automatically provided when the destination airport had been entered in the Flight Management System and the field elevation for the destination airport is in the data base. The pilot can manually enter the LFE and/or switch to a “low cabin” fixed cabin pressure submode (Refer to Section 4, CPCS Low Cabin Mode Operation). When the CPCS SYSTEM MODE switch is selected to MANUAL no information associated with LFE will be displayed.

If the LFE data to the CPCS becomes unavailable or invalid (e.g. due to an FMS failure or a MAU interface error), the CPCS uses the default LFE of 10000 ft to determine the target cabin altitude. Therefore, the flight crew must manually reselect the LFE early enough to prevent over or under pressurization. Alternatively, the CPCS SYSTEM MODE switch may be selected to MANUAL for manual control of the cabin altitude.

In the event of a CPCS malfunction, warning and caution messages will be shown in the Crew Alerting System (CAS) window of the system Multi Function Display.

7-17-3 Operation

The CPCS automatically controls the cabin pressure to:

- Depressurize the cabin on the ground to allow for door opening and crew/passenger entry and exit
- Pre-pressurize the cabin during takeoff and landing to prevent pressure bump excursions
- Control the cabin altitude and rate of change during flight for passenger comfort
- Prevent the cabin to atmosphere differential pressure limit being exceeded and the cabin altitude from exceeding 10,000 feet for normal operation
- Close the OFV to provide an automatic altitude limiting function if the cabin exceeds 14,800 ft, automatic altitude limiting function.

The normal mode of operation is with the switches in the AUTO position. The CPCS Controller then, using data from the MAU, automatically controls the cabin air exhaust to optimize the cabin pressure comfort.

During climb the cabin pressure is controlled depending on aircraft altitude. During descent, the cabin pressure is controlled depending on aircraft altitude, rate and LFE.

The following table helps to understand the targeted cabin pressure altitudes for the automatic controlled scheduling in climb and descent mode. Refer to Table 7-17-1 below.

Table 7-17-1: CPCS - Altitude Target Values

A/C Altitude (ft)	Climb, Target Cabin Alt (in Flight)	Descent, Target Cabin Alt (in Flight)
30000	10000	10000
29000	9770	9770
28000	9074	9074
27000	8452	8452
26000	7890	7890
25000	7379	7379
24000	6908	6908
23000	6470	6470
22000	6060	6060
21000	5676	5676
20000	5315	5070
19000	4969	4447
18000	4633	3813
17000	4306	3170
16000	3989	2518
15000	3680	1857
14000	3379	1190
13000	3087	512
12000	2802	-175
11000	2523	-868
10000	2252	-1300
9000	1988	-1300
8000	1729	-1300
7000	1477	-1300
6000	1230	-1300
5000	989	-1300
4000	752	-1300
3000	520	-1300
2000	293	-1300
1000	69	-1300
0	-150	-1300
-2000	-2000	-2000

Note

The table shows the target values throughout the full operating range. For takeoff and landings, different control routines are followed to match the appropriate field elevation.

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If the aircraft descends more than 1,300 ft (from previous stable altitude), the CPCS goes into so-called descent mode, for which the cabin is controlled towards the ELEV pressure altitude. If the aircraft climbs more than 1,300 ft, (from previous stable altitude), the CPCS goes into so called climb mode, for which the cabin is controlled depending on aircraft altitude.

Before flight the pilot enters the Landing Field in the Flight Management System (FMS) and barometric correction on the Primary Flight Display (PFD), this information is then sent via the MAU to the CPCS. The Airport Identifier and Landing Field Elevation will be shown with an FMS ELEV legend in the ENVIRONMENT window. The CPCS also receives data from the MAU ref aircraft altitude, weight on wheels, takeoff power and doors closed. Ground mode Built-in Test (BIT) is continuously running on ground to make sure the system is ready to perform control for the next flight. On ground the OFV is controlled to full open.

If Landing Field information is not available from the FMS, the LFE can be set manually via the Touch Screen Controller or by the bezel button adjacent to the ELEV soft key on the systems MFD ENVIRONMENT status window. The LFE will be shown with an ELEV legend in the ENVIRONMENT window. If incorrect data is entered a DATA MISMATCH legend will be shown.

The Touch Screen Controller or the bezel button adjacent to the CAB MODE soft key can be used to select Low Cab mode. The green LOW CAB annunciator will be shown in the ENVIRONMENT window. The CPCS will control the cabin pressure to the selected pressure altitude (LFE) as long as the max Δ px (5.75 psid) is not exceeded.

During takeoff with ACS inflow air present, the OFV is moved to a more closed position and then changes its position to control the cabin pressure rate of change.

In case of an aborted takeoff the cabin will be automatically depressurized.

During climb the cabin altitude is scheduled to achieve 10,000 feet when the aircraft reaches 30,000 feet.

If a takeoff occurs at an airfield greater than 10,000 feet, the cabin is commanded to 10,000 feet or below just after takeoff at a fast rate so that the cabin altitude reaches 10,000 feet prior to the aircraft exceeding 25,000 feet. This is High Airfield Operation and the green HI FIELD annunciator will be shown in the ENVIRONMENT window until the aircraft climbs to above 25,000 feet.

When the aircraft reaches its cruising altitude and levels off, after a short period of time the commanded cabin pressure is held to a constant value for maximum stability. The CPCS has an automatic altitude limiting function that closes the OFV if the cabin pressure exceeds 14,800 feet.

During descent the cabin altitude is commanded towards the landing field elevation, limited by the differential pressure. If the landing field elevation exceeds 10,000 feet the cabin altitude is limited to 10,000 feet until the aircraft descends through 25,000 feet. The green HI FIELD annunciator will come on when descending through 25,000 feet and will remain on. On the ground, above 10,000 feet, the green HI FIELD annunciator will also come on.

A landing is made with slight differential pressure to reduce cabin pressure transients just before and during touchdown. Once landed the OFV is slowly moved to the open position to fully depressurize the cabin as the aircraft is taxiing.

The actual cabin altitude, cabin altitude rate of change and cabin to atmosphere differential pressure is displayed in the ENVIRONMENT window of the systems MFD. In the event of system malfunctions the ECMU will send warnings and caution alerts to the CAS. Procedures to clear CPCS CAS messages are given in Section 3, Cabin Environment Failures.

The cabin pressurized warning monitor in the Monitor Warning System continually monitors the cabin pressure when the aircraft is on the ground. If the cabin does become pressurized on the ground or does not depressurize on landing with the SYSTEM MODE switch selected to MANUAL, the monitor warning function will give a CAB PRESS alert on the PFD and an aural “Cabin” message. Pilot actions required in this event are given in Section 3, Cabin Pressure - 3-17-01.

In an emergency manual control can be selected by setting the SYSTEM MODE switch to the MANUAL position. This disables the automatic mode completely and an amber CPCS MANUAL CTRL status message will be shown at the top of the ENVIRONMENT window of the systems MFD. The MANUAL CONTROL CLIMB DESCENT switch becomes active. This switch is spring loaded to the center position, and can be held to the CLIMB or DESCENT position which then sends a signal to both ECMU channels and OFV drive motors to close or open the OFV. There will be a time delay between the switch operation and the change to the cabin altitude. Therefore, when setting a certain cabin altitude by use of the CLIMB/DESCENT switch, the switch should be pushed intermittently and cabin altitude monitored in order to avoid over or under shoots. If one of the ECMU channels fails the other channel will still operate the OFV. Once the CLIMB/DESCENT switch is released, no open or close command is given to the OFV. The ECMU altitude limit function will override the manual control by closing the outflow valve once the cabin altitude exceeds 14,800 ft.

Selection of the CABIN PRESSURE switch to the DUMP position will command the OFV to the fully open position with the effect of fully depressurizing the aircraft. DUMP will override the ECMU altitude limit function and will open the outflow valve at any cabin altitude.

If the Passenger oxygen control valve selector is set to AUTO, the CPCS will automatically select the passenger oxygen system on at a cabin altitude of 13,500 feet (or at a higher set point for high airfield operations). With the passenger oxygen system pressurized the green PAX OXY annunciator will be shown in the ENVIRONMENT window of the systems MFD.

7-17-4 Indication / Warning

Indications of the actual cabin altitude, cabin altitude rate of change and cabin to atmosphere differential pressure are displayed in the ENVIRONMENT window of the systems MFD. Under normal operating conditions the CPCS indications are given in white. If a cabin altitude or cabin pressure out of limits condition arises the CPCS indication will change to yellow for a caution or red for a warning condition with the relevant CAS caution or warning. All sensing, indications and warning outputs are created by the ECMU.

The CAS window of the systems MFD displays the following warnings (red) and cautions (amber) for the CPCS (refer to Table 7-17-2):

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Table 7-17-2: CPCS - CAS Messages

CAS Message	Description
Cabin Pressure	Cabin pressure differential exceeds 6.35 psi or drops below -0.25 psi
Cabin Altitude	Cabin altitude is above 10,500 feet or above 14,200 feet in High Airfield Operation Secondary backup warning provided by the avionics based on ECMU input detects a cabin altitude above 14,800 feet
Cabin Pressure	Cabin pressure differential is greater than 6.0 psi
ACS Low Inflow	Low airflow into cabin, or excessive cabin air leakage (OFV closed in the air, cabin altitude rate error more than 250 ft/min) (generated by the MAU)
CPCS Fault	ECMU AUTO channel has failed. Automatic control no longer available

The ENVIRONMENT window of the systems MFD displays the following annunciations (refer to Table 7-17-3) when:

Table 7-17-3: CPCS - Annunciations on Environment Window

Annunciation	Flight phase	Description
HI FIELD	Ground or Landing	The CPCS detects the aircraft is on the ground above 10,000 feet and the CPCS is in Ground or Landing mode
	Climb	Takeoff from airfield greater than 10,000 ft and aircraft altitude less than 25,000 ft and the CPCS is in Climb mode
	Descent	Selected landing field elevation is more than 10,000 ft and aircraft altitude less than 25,000 ft and the CPCS is in Descent mode
PAX OXY		Passenger oxygen system is pressurized
LOW CAB		Low cabin mode has been selected

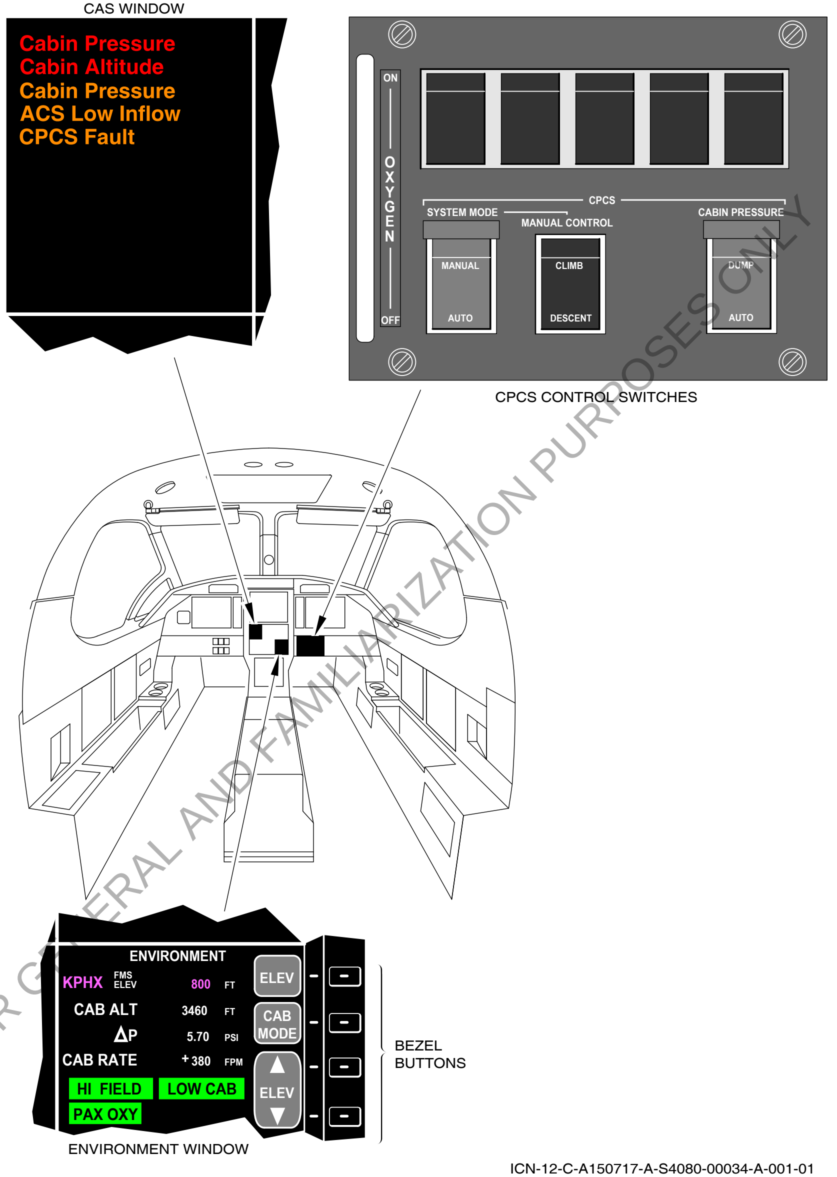

Figure 7-17-1: CPCS - Controls and Indications

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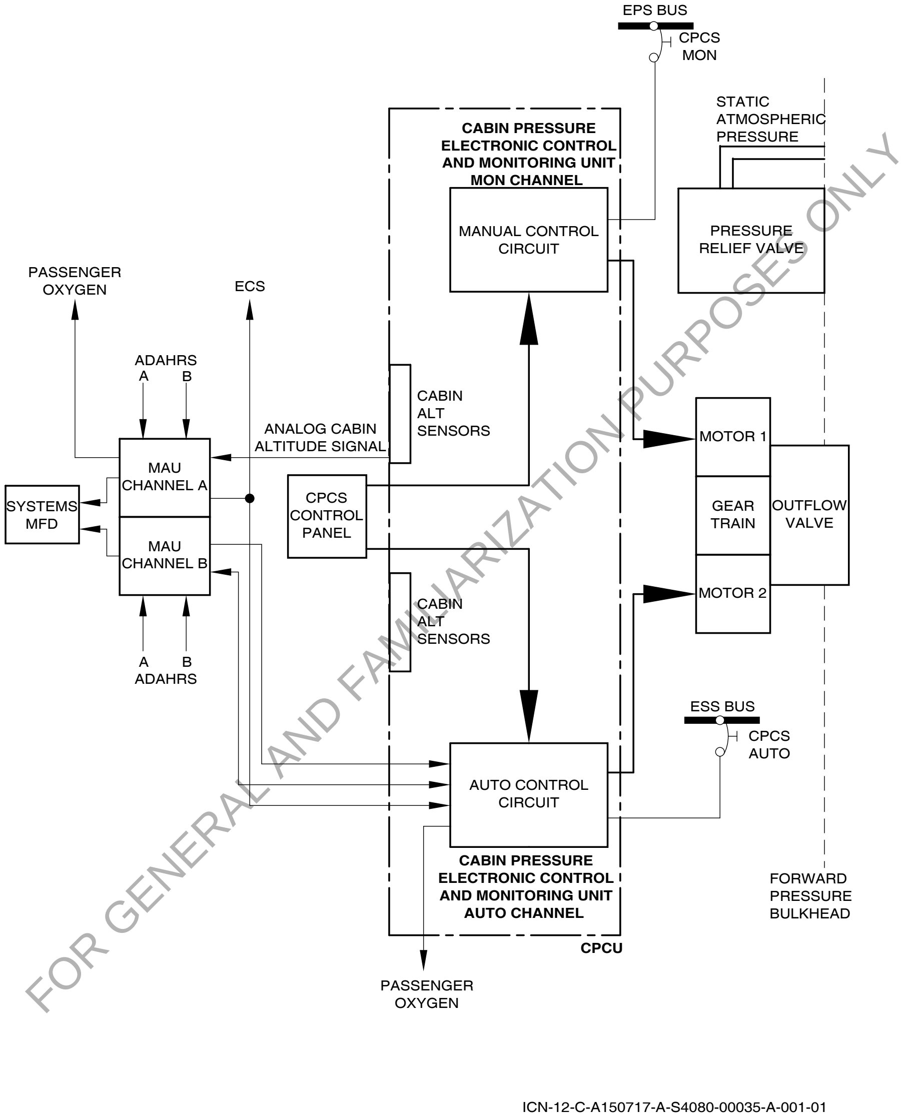

Figure 7-17-2: CPCS - Functional Diagram

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7-18 Oxygen System

7-18-1 General

The aircraft is equipped with an emergency oxygen system for use by the crew and passengers in the event of contaminated air being introduced into the cabin or a loss of pressurization with a rapid descent to lower altitudes.

The pilot and copilot masks are supplied with quick-donning diluter-demand masks which are permanently connected to outlets in the cockpit sidewalls.

A constant flow mask is provided at each passenger seat location in the cabin. In the Corporate Commuter interior configuration the nine masks must be connected to the bayonet outlets in the cabin sidewall before flight by the flight crew for flights above 10,000 ft. In the executive interior configuration the masks (the number is dependent on the interior variation) are located in boxes in the arm rests and are permanently connected for all flights. No connection action is required by the flight crew or passengers.

7-18-2 Description

An oxygen cylinder, made of composite material, is located in an external compartment in the right side of the fuselage forward of the main wing (outside the pressure area) from which the oxygen system is serviced and replenished (Refer to Section 8, Servicing, for servicing instructions).

Attached to the cylinder head is an isolation valve to permit cylinder removal and installation. The valve is connected by a push pull cable to a handle in the cockpit allowing the system to be isolated while the aircraft is on the ground. The valve is connected to the aircraft supply, ground charging valve, the contents pressure gauges and the overpressure relief valve.

Two gauges are provided, one in the service bay and one on the left cockpit side panel forward of the Test Panel. Overpressure protection is provided by a relief valve in the form of a green rupture disc located in the fuselage skin above the service bay door. This disc is designed to rupture at 2775 +50/-0 psi, discharging the cylinder contents overboard. Disc integrity is checked during the preflight inspection. If found ruptured and the contents pressure gauge indicates zero, proper maintenance must be performed on the system before flights above 10,000 ft altitude.

When filled, the storage cylinder should be charged to 1841 psi (126.9 bar) at 20 °C, with a minimum pressure of 265 psi (18.3 bar) for proper flow to the masks. A pressure reducing valve, adjacent to the oxygen cylinder reduces the oxygen pressure to a nominal 70 psi (4.8 bar), prior to entering the cabin. This is for safety reasons and to avoid excessive flow through the masks.

Two crew full-face masks of the diluter demand type are located in boxes on the front of the cockpit bulkhead behind each crew member. They are permanently connected to outlets in the cockpit sidewalls. Each mask which is of the diluterdemand type, is equipped with a microphone and an ON/OFF - AIRMIX/100% selector valve. Oxygen is provided to the crew masks at all times regardless of the PASSENGER OXYGEN selector position. Each mask has a PRESS TO TEST button and a flow indicator that shows when proper pressure is supplied to the mask. Turning the PRESS TO TEST button counterclockwise to the emergency position will supply 100% oxygen at a slight overpressure.

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The main OXYGEN lever is mounted to the copilots lower left panel. It is connected by a push pull cable to the isolation valve on the cylinder head. While the aircraft is on ground the lever is normally in the OFF position isolating the cylinder from the system and preventing prolonged leakage from the crew masks. Before engine start and as the first action associated with the oxygen system, the lever should be moved to the ON position.

The PASSENGER OXYGEN selector, located in the left cockpit sidewall, has three positions to control the operation of the passenger distribution system. The OFF position stops the flow to the passenger outlets. The ON position permits flow to the passenger masks. The AUTO position will permit automatic pressurization of the passenger oxygen system when the Cabin Pressure Control System (CPCS) senses a cabin altitude above 13,500 feet +/- 500 feet or when in HI FIELD mode the cabin altitude is sensed above takeoff/landing field elevation +2000 ft or 14,500 +/- 500 ft.

In the Corporate Commuter configuration the passenger constant flow oxygen masks are stored under or near each seat position. For flights below 10,000 ft altitude the masks need not be connected to the outlets in the lower cabin sidewalls. In the event of an emergency requiring oxygen use, the passengers are instructed to connect the mask bayonet type connector to the outlets themselves. For flights above 10,000 ft altitude the mask must be connected to the outlets by the flight crew before flight. When disconnected, the outlets are spring loaded closed to prevent oxygen leakage.

In the executive interior configuration the passenger constant flow oxygen masks are stowed under covers placarded OXYGEN MASK INSIDE in the cabin sidewall armrests. The masks are permanently connected to the outlets irrespective of the type of operation and flight altitude. The mask stowage compartments are located near to the seats. The masks have a red tape band which must be positioned to show from the cover in the direction accessible to the seat occupant. A placard PULL TAPE FOR OXYGEN MASK is attached to the armrest near each oxygen mask cover. An oxygen mask is installed in the lavatory. The mask is connected to the passenger oxygen system and is stowed in a box attached to the top of the lavatory sidewall. A visible red tape band is pulled to release the oxygen mask.

7-18-3 Operation

WARNING

TO PREVENT POSSIBLE FREEZING AND MALFUNCTIONING OF SYSTEM, MAKE SURE THAT SYSTEM IS ONLY SERVICED WITH APPROVED, AVIATION GRADE OXYGEN.

TO PREVENT POSSIBLE EXPLOSION AND/OR FIRE, MAKE SURE ALL OIL AND GREASE IS KEPT AWAY FROM OXYGEN SYSTEM COMPONENTS.

SMOKING IS STRICTLY PROHIBITED ANY TIME OXYGEN IS IN USE.

OILY, FATTY OR GREASY SUBSTANCES, INCLUDING SOAPS, LIPSTICK, AFTER SHAVE LOTION, MAKEUP ARE CAPABLE OF SPONTANEOUS COMBUSTION ON CONTACT WITH OXYGEN.

CAUTION

Pilots who fly at high altitude must be aware of the physiological problems associated with prolonged flights at such high altitudes. Dehydration and the slow onset of Hypoxia may be noticed in the passengers.

Passenger comfort may be increased by an occasional intake of fluids. Prolonged high altitude flights require warm clothing and monitoring of the cabin temperature and the physical state of the crew and passengers.

Normal system operation is with the three-position PASSENGER OXYGEN selector in the AUTO position, to provide oxygen immediately in the event of a depressurization. The crew will then don their own masks and order the passengers to don their masks. The masks in an executive interior aircraft can easily be removed from their stowage by pulling the red tape band showing from the cover marked OXYGEN MASK INSIDE. Oxygen availability to the cabin is verified by the oxygen pressure switch activating the PAX OXY annunciator in the ENVIRONMENT window of the systems Multi Function Display (MFD).

The ON position will be selected by the pilot, in the event of smoke or fumes being present in the cabin. The OFF position will be selected if the aircraft is being flown without passengers or is taken out of service for an extended time in order to conserve oxygen.

Note

When a full oxygen supply is stored, it will supply two crew and nine passengers for a minimum of ten minutes, in which time a descent from 30,000 ft to 10,000 ft is performed. Refer to the Oxygen Duration Chart (Table 4-20-1) in Section 4 to determine the minimum oxygen supply required for the number of occupants when operating at less than full oxygen pressure.

As the oxygen system is an emergency system, normal usage will consist only of periodic mask testing (both crew and passengers masks require testing) and of checking, and topping up, if necessary, the storage cylinder.

7-18-4 Indication / Warning

Oxygen system pressure is indicated on a gauge on the left cockpit sidewall. PAX OXY will show in the ENVIRONMENT window of the systems MFD when oxygen pressure is supplied to the passenger masks (Refer to the Cabin Pressure Control System section Operation for more information).

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7-18-5 Larger capacity oxygen system (optional)

7-18-5.1 Rear Left Side

The system has a 1965 liter gaseous oxygen cylinder installed in the top left side of the rear fuselage compartment, behind the rear pressure bulkhead. The large cylinder replaces the standard smaller oxygen cylinder. The cylinder head isolation valve is secured in the open position. System shut off, when the aircraft is on the ground, is by a rotary valve connected to the cable from the oxygen shutoff handle on the copilots lower left panel. The rotary valve is installed between frames 16 and 17 on the right side of the fuselage. A pressure transducer installed near the oxygen cylinder sends a pressure signal to the pressure gauge on the left side of the cockpit. The oxygen replenishment point comprising a charging valve and a system pressure gauge is installed at the bottom of the rear fuselage compartment. The system overpressure protection burst disc indicator is installed on the left side of the rear fuselage.

System controls and operation are the same as for the standard system. The system with full oxygen pressure will meet the Canadian Operational CAR 605.31 and CAR 605.32 requirements. Refer to the Oxygen Duration Chart (Table 4-20-1) in Section 4 to determine the minimum oxygen supply required for the number of occupants when operating at less than full oxygen pressure.

7-18-5.2 Rear Right Side

The right side larger capacity oxygen system has the same operation and components as the left side. The following components have a different location. The oxygen cylinder is installed in the top right side of the rear fuselage compartment. The oxygen replenishment point comprising a charging valve and a system pressure gauge is installed at the bottom right of the rear fuselage compartment. The system overpressure protection burst disc indicator is installed on the right side of the rear fuselage.

7-19 Cockpit Arrangement

7-19-1 General

For the Cockpit Layout, refer to Fig. 7-19-1, Cockpit - Layout

The cockpit avionics suite is based on a four Display Unit layout (the fourth DU is optional), arranged in a T configuration. All of the cockpit controls, switches, and displays are readily accessible to the pilot for single pilot operation. There is an overhead control panel which contains the switches for electrical power management and various systems. The sidewalls contain the circuit breaker panels. The center console contains the controls and switches.

7-19-2 Description

The overhead panel has ELECTRICAL POWER MANAGEMENT, SYSTEM TEST, FUEL PUMPS, ENGINE START, EXTERNAL LIGHTS and PASSENGER WARNING sections. These sections are fully described in their associated systems descriptions within this section.

The left Display Unit (DU) is the pilots Primary Flight Display (PFD) and the right optional DU is the copilot PFD. The center upper DU and center lower DU are the Multi Function Displays (MFD). The MFDs can be configured to situational awareness or systems MFD as required. To the left of the pilots PFD is the clock (if installed), the Emergency Locator Transmitter (ELT) Light Emitting Diode (LED) and the Electronic Standby Instrument System (ESIS), the main function of which is to display altitude, attitude and airspeed in the event of a total failure of the primary avionic system. The clock (if installed) is powered directly from the Standby Bus. The ELT LED indicates if the ELT is activated. To the right side of the pilots PFD (and to the left of the copilots PFD if installed) are the PFD and Radio control panels. Above the pilots PFD is the No. 1 Audio/Marker panel. Above the copilots PFD (if installed) is the No. 2 Audio/Marker panel (if installed). Above the center upper MFD is the Flight Guidance Control Panel and below the lower MFD is the Touch Screen Controller (TSC). A parking brake handle is located forward of the left bottom side panel below the instrument panel. An optional Feather Inhibit switch can be installed on the LH outer crossbar panel on the pilot’s side.

The lower right panel on the pilot's side contains switches for the ice protection systems and the landing gear selector. An optional Air Data Attitude Heading Reference System (ADAHRS) Heading Override push switch can be installed on the right side of the pilot’s lower left panel. The lower left panel on the copilot's side contains the Air Cycle System (ACS) and pressurization control switches and the main oxygen lever.

The center console contains the prop low speed (optional), the trim interrupt, the flap interrupt and the alternate stab trim switches, and the engine power control and flap lever. Further aft are the display reversionary control switches, the cockpit and cabin lighting controls and the Cursor Control Device (CCD) installed. The ACS and fuel firewall shutoff valve controls and the emergency gear extension lever can be found on the aft vertical surface of the console.

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On the rear left sidewall there is a panel which contains the flight time counter, oxygen pressure gauge, ELT remote control switch, MIC SELECT, AURAL WARN inhibit and EMERG COM 1 switches. When the optional 115 VAC power outlet system is installed a 115 VAC power outlet is also installed on the panel. At the rear of the panel are the pilot MIC, PHONE and the active noise reduction headset connections. Located in a recess at the rear of the left sidewall is the PASSENGER OXYGEN selector, and oxygen and mic connections for the crew oxygen mask. Above this area there is a storage point for the control wheel lock. On the lower left sidewall a removal panel gives access to the document stowage area and also provides storage for the Primus Apex software CD's. Further forward a map light is installed above the two circuit breaker panels in the sidewall. There is provision for document stowage and a cup holder built into the sidewall panel. At the top of the forward left sidewall there is a hand/mic in a stowage area. Below the hand/mic stowage area is the optional dual USB charging port. Lower down there is a recess in the sidewall to give access to the circuit breakers on the left Power Junction Box (PJB).

The right sidewall is similarly equipped but without the ELT remote control switch, control wheel lock, oxygen pressure gauge and control valve. The similar panel at the rear only has the MIC SELECT switch and the copilot MIC, PHONE and the active noise reduction headset connections. When the optional 115 VAC power outlet system is installed a 115 VAC power outlet is installed on the panel. There are two small removal panels on the right sidewall, they are used by maintenance for access to the brakes reservoir and the ground maintenance panel.

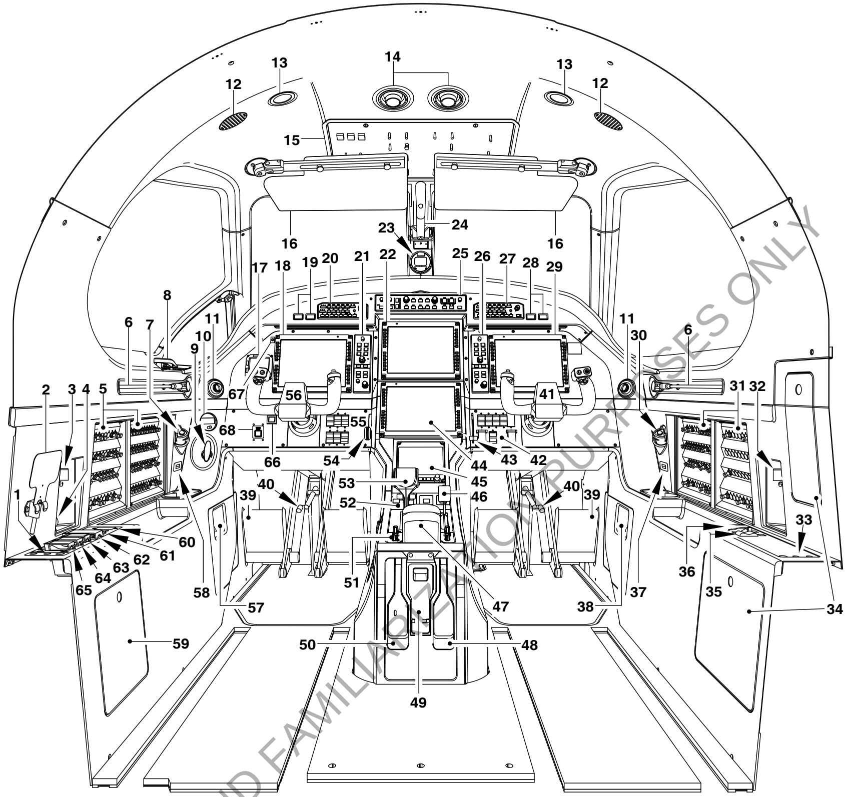
Adjustable air conditioning outlets are positioned on the head liner and the sidewalls. These outlets should be kept open to allow the environmental control system to regulate the temperature in the cockpit.

Divider walls are installed behind the pilot and copilot seats and a curtain or door fits between the walls to form a division between the cockpit and cabin.

On the forward side of each divider there are stowage cups for the pilot and copilot oxygen masks.

Smoke goggles (if equipped) enclosed in a stowage are provided for the pilot and copilot. They are located on the forward side of the cabin divider, behind the pilot seat. Instructions for donning the smoke goggles are shown on Fig. 7-19-2, Cockpit - Donning of Smoke Goggles.

A fire extinguisher is located on the forward side of the cabin divider behind the copilot seat.



1. HEADSET MIC/PHONE JACKS
2. CONTROL LOCK
3. MASK OXYGEN/MIC JACKS
4. PASSENGER OXYGEN SELECTOR
5. LEFT SIDEWALL CB PANELS
6. UTILITY LIGHT
7. HAND MICROPHONE
8. DIRECT VISION (DV) WINDOW
9. PARKING BRAKE HANDLE
10. CLOCK (OPTIONAL)
11. ECS SIDE AIR OUTLET
12. LOUDSPEAKER
13. DOME LIGHT
14. AIR VENTS
15. OVERHEAD ELECTRICAL CTRL PANEL
16. SUNVISOR
17. EMERG. STANDBY INSTR. SYS (ESIS)
18. PRIMARY FLIGHT DISPLAY (PFD)
19. MASTER CAUTION & WARNING LIGHTS
20. AUDIO/MARKER PANEL
21. PFD & RADIO CONTROL PANEL
22. UPPER MFD
23. MAGNETIC COMPASS (OPTIONAL)
24. GRAB HANDLE
25. AFCS CONTROL PANEL
26. CO PILOT PFD & RADIO CTRL PANEL
27. CO PILOT AUDIO/MARKER PANEL
28. MASTER CAUTION & WARNING LIGHTS
29. CO PILOT PFD
30. CO PILOT HAND MICROPHONE
31. RIGHT SIDEWALL CB PANELS
32. CO PILOT MASK OXYGEN/MIC JACKS
33. CO PILOT HEADSET MIC/PHONE JACKS
34. MAINTENANCE PANELS
35. CV ERASE / CVFDR TEST SWITCH & CVFDR TEST LED
36. CO PILOT MASK MIC/COMMS SWITCH
37. DUAL USB PORT (OPTIONAL)
38. RH POWER JUNCTION BOX
39. RUDDER PEDALS
40. RUDDER PEDAL ADJUSTMENT HANDLE
41. CONTOL WHEEL
42. ACS & CPCS CONTROL SWITCHES
43. MAIN OXYGEN LEVER
44. LOWER MFD
45. TOUCH SCREEN CONTROLLER
46. FLAP SELECTOR
47. CURSOR CONTROL DEVICE
48. ACS FIREWALL SHUTOFF CONTROL
49. EMERGENCY LANDING GEAR RELEASE
50. FUEL FIREWALL SHUTOFF CONTROL
51. DISPLAY REVERSIONARY/COCKPIT/CABIN LIGHTING CONTROL PANEL
52. TRIM INTERRUPT, ALT STAB TRIM, FLAP INTERRUPT, PROP LOW SPEED (OPTIONAL) SWITCHES
53. POWER CONTROL LEVER
54. LANDING GEAR HANDLE
55. ICE PROTECTION SWITCHES
56. CONTROL WHEEL
57. LH POWER JUNCTION BOX
58. DUAL USB PORT (OPTIONAL)
59. CD STOWAGE BOX
60. FLIGHT TIME COUNTER
61. OXYGEN PRESSURE INDICATOR
62. ELT REMOTE CONTROL SWITCH
63. MASK MIC/COMMS SWITCH
64. AURAL INHIBIT SWITCH
65. EMERG FREQ/NORM SWITCH
66. HDG/TRK OVERRIDE SWITCH (OPTIONAL)
67. ELT LED
68. FEATHER INHIBIT SWITCH (OPTIONAL)

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Figure 7-19-1: Cockpit - Layout

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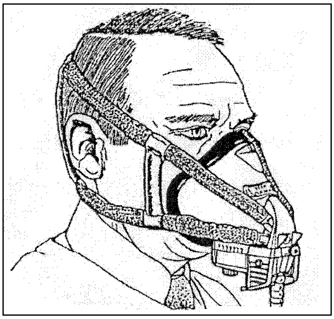
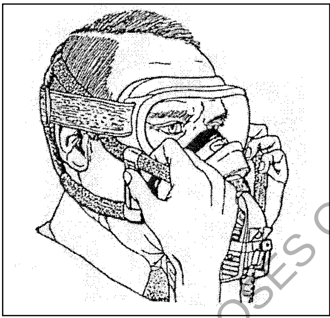
1



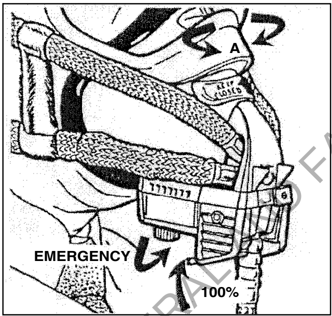
PUT MASK-REGULATOR ON HEAD.
Readjust eye-glasses, if necessary.

2



PLACE SMOKE GOGGLES ON HEAD
Readjust headband tension if necessary.
Pull upper tube of harness and reposition it over the lower side of goggles frame.
Push goggles downwards.

3

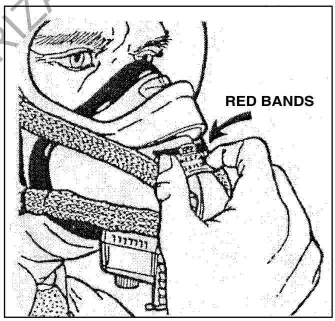


SET REGULATOR CONTROLS ON "100%" AND "EMERGENCY".

Depress "100%" rocker. Turn "EMERGENCY" knob counter-clockwise

Adjust goggles nose bridge shape to fit tightly against mask shell by pressing each side of the bridge inward (see Detail A)

4



OPEN VENT VALVE,
so that red bands are visible.

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Figure 7-19-2: Cockpit - Donning of Smoke Goggles

7-20 Pitot Static Systems

7-20-1 General

Dual pitot and static systems provide dynamic and static pressure to the Air Data Attitude Heading Reference System (ADAHRS) and the Emergency Standby Instrument System (ESIS).

Refer to Fig. 7-20-1, the Pitot and Static Systems Schematic.

7-20-2 Description

A heated pitot head is installed on the bottom of the left and right wings.

The pitot pressure sensed by the left (No. 1) pitot system is carried through lines within the wing and fuselage to the ADAHRS Channel A.

The pitot pressure sensed by the right (No. 2) pitot system is carried through lines within the wing and fuselage to the ADAHRS Channel B. The No. 2 pitot system also supplies pitot pressure to the ESIS.

Two dual heated static ports are installed, one on each side of the rear fuselage aft of the rear pressure bulkhead. Two pickups are used, one on each side, for each static system. The two pickups balance out the differences in static pressure caused by slight sideslips or skids.

The static pressure sensed by the forward left and rear right static ports is carried through lines within the fuselage to the ADAHRS Channel A. The static pressure sensed by the forward right and rear left static ports is carried through lines within the fuselage to the ADAHRS Channel B and to the ESIS.

If one or more of the pitot static systems malfunction, they should be checked for dirt, leaks or moisture. The holes in the sensors for pitot and static pressures must be fully open and free from blockage. Blocked sensor holes will give erratic or zero readings to the ADAHRS.

The heaters for the pitot heads and static ports are controlled by the PROBES switch on the ICE PROTECTION panel, installed on the pilot's lower right panel. Electrical power for left pitot and static port heating is supplied through the LH PITOT DE-ICE and LH STATIC DE-ICE circuit breakers on the Essential Bus. Electrical power for right pitot and static port heating is supplied through the RH PITOT DE-ICE and RH STATIC DE-ICE circuit breakers on the Main Bus.

7-20-3 Indication / Warning

The Crew Alerting System (CAS) window of the systems Multi Function Display (MFD) displays the following Cautions for the pitot and static systems (refer to Table 7-20-1):

Table 7-20-1: Pitot Static Systems - CAS Messages

CAS Message	Description
Probes Off	Indicates the ice protection probes switch is set to off and OAT < 10 °C
Pitot 1 Heat Pitot 2 Heat Pitot 1 + 2 Heat	Indicates No. 1 system, No. 2 system or both systems pitot head heater failure
Static Heat	Indicates one or both static port heater failure

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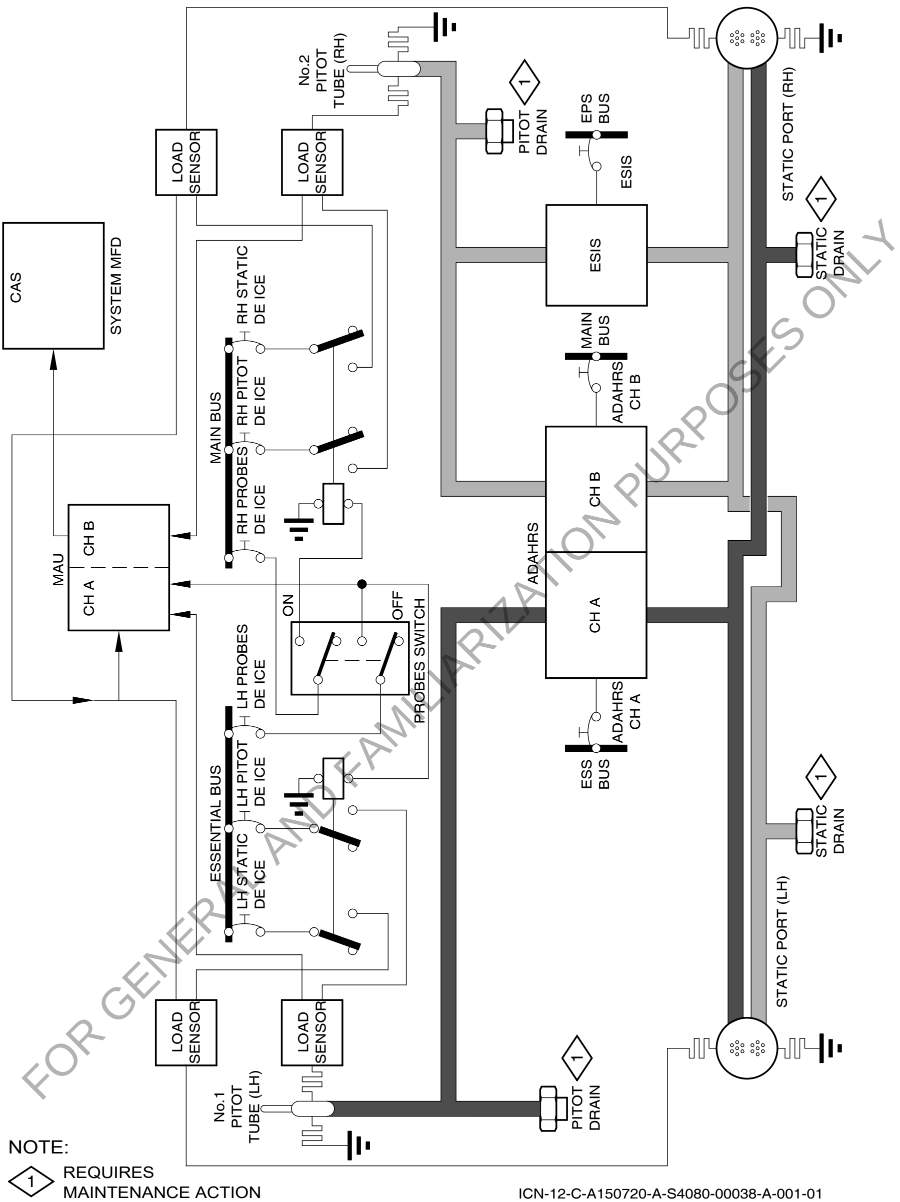

Figure 7-20-1: Pitot and Static Systems

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7-21 Stall Warning / Stick Pusher System

7-21-1 General

The airplane is equipped with a stick shaker-pusher system to improve aircraft handling in the low speed flight regime by preventing the airplane from inadvertently entering a stall condition. The stick shaker-pusher system contains two Angle-of-Attack (AOA) sensors, two computers, a single stick shaker and a single stick pusher. The two computers are connected in such a way that either computer can, independently, provide stall warning (stick shaker and stall warning) but both computers are required to actuate the stick pusher.

7-21-2 Description

For system operation, refer to Fig. 7-21-1, Stall Warning/Stick Pusher System.

The left and right hand Stick Pusher Computers are each provided power from the Essential and Main bus. Each computer receives inputs from its respective AOA vane and AIR/GND relay. Both computers receive inputs from the engine torque, flap position, and self-test. From these various inputs, each computer independently determines the "Defined Angle of Attack" for stall warning (stall warning and stick shaker activation), stick pusher activation, and stick pusher disengagement following an actual push. A digital serial output, from the left and right computers, provide data to the Modular Avionics Unit (MAU) for the Dynamic Speed Bug (DSB) on the airspeed tape of the Primary Flight Display(s) (PFDs). It is also used for the display of the Low Speed Awareness Indication adjacent to the Air Speed Tape.

The stick pusher, shaker, the Flight Alerting System (FAS) visual “Stall” and aural “Stall” warnings are disabled on the ground through the AIR/GND inputs, except for the self-test function. The stick pusher is inhibited for 5 seconds after liftoff. The shaker and the stall warning are operative immediately after liftoff.

The stick pusher actuator has a built-in g-switch which inhibits the stick-pusher when the airplane's normal acceleration becomes less than 0.5 g. The output torque of the stick-pusher actuator is electronically-limited to have a force of 60 to 65 lbf on the control wheel. A slip-clutch on the stick-pusher capstan allows control on the elevator with a force of 85 to 90 lbf on the control wheel, in the event of stick-pusher jam. The force on the control wheel is defined when the longitudinal control is pulled to 3/4 of its travel. This allows the pilot or copilot to override the stick-pusher in the instance of an inadvertent operation.

Each outboard control wheel horn is equipped with a PUSHER INTR push switch providing a means to quickly disengage the stick pusher actuator in the event of an inadvertent operation.

When operated in pusher Ice Mode (to provide protection in icing conditions), all the shaker and pusher actuating points measured by the angle of attack vanes are reduced by 8°. The pusher Ice Mode is set when the propeller de-icing system is switched ON and the inertial separator is set to OPEN. When both pusher computers are set in Ice Mode, **PUSHER ICE MODE** is shown in the ICE PROTECTION window of the systems Multi Function Display (MFD). If only one computer is set in Ice Mode, or if no computer is set in Ice Mode while conditions for ice mode are present, the **Pusher** message on the Crew Alerting System (CAS) is activated.

The system is provided with a self-test function that can be activated at any time by pressing and holding the STICK PUSHER switch located on the SYSTEM TEST section of the overhead panel. **PUSHER ICE MODE** is illuminated during the self-test after the pusher is first activated. The **Pusher** message on the CAS will remain illuminated until the self-test is passed.

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After engine start on the ground, the **Pusher** message will illuminate until the system test has been successfully tested. The test must be done before takeoff. The engine must be operating with the PCL out of idle, the flaps set to 15°, then press and hold the STICK PUSHER switch to initiate the test. If the test switch is pressed and the test sequence does not occur and/or the **Pusher** message remains illuminated, the system has failed the self-test and further flight before maintenance is not approved. If the test switch is pressed without the engine operating with the PCL out of idle and the flaps are not set to 15°, the **Pusher** message will remain illuminated, the "Stall" warning and the test sequence will not occur.

The system function may be tested in the air anytime the engine is operating with the flaps at any setting. Press and hold the test switch and observe the following sequence; **PUSHER ICE MODE**, "Stall" warning with stick shaker for 2 seconds followed by a 1 second pause, and "Stall" warning with stick shaker for 2 seconds. The pusher will not activate when the system is tested in flight. If the test switch is pushed and the test sequence does not occur and/or the **Pusher** message remains illuminated, the system has failed the self-test.

WARNING

STALLS MUST BE AVOIDED WHEN THE STICK PUSHER IS INOPERATIVE. EXCESSIVE WING DROP AND ALTITUDE LOSS MAY RESULT DURING STALL WITH FLAPS DOWN AND/OR WHEN POWER IS APPLIED.

The AOA vanes and mounting plates are electrically heated by internal heating elements. AOA vane and mounting plate heat is controlled by the PROBES switch located on the ICE PROTECTION switch panel. Refer to Fig. 7-21-1, Stall Warning/Stick Pusher System for system schematic.

7-21-3 Operation

The vane attached to the AOA probe aligns itself with the relative airflow. As it moves, it positions a wiper unit in the probe. This wiper unit adjusts the electrical output to its respective pusher computer. As the airplane approaches the artificial stall (5 to 10 knots before pusher actuator), the stick shaker and the "Stall" warning will activate when one of the AOA pusher computers senses the defined angle of attack for stall warning/stick shaker activation. If the "Stall" warnings are ignored and the approach to stall is continued, the stick pusher will activate when both AOA pusher computers sense the defined angle of attack for stick pusher activation. The stick shaker and "Stall" warning remain active during pusher operation.

Pusher operation will be stopped when either AOA computer senses an angle of attack lower than the angle of attack required to activate the pusher or when the airplane acceleration is less than 0.5 g.

If an inadvertent operation of the stick pusher occurs, push the PUSHER INTR switch on the control wheel outer horn to quickly disengage the stick pusher actuator.

Activation of the stick shaker disengages the autopilot if engaged, in order to give full authority to a possible stick pusher activation. The autopilot can be manually reconnected after the angle of attack is reduced and the stick shaker has ceased operation.

WARNING

IF ACCELERATED STALLS ARE PERFORMED IN THE LANDING CONFIGURATION WITH HIGH POWER AND SIDESLIP, A RAPID PITCH-DOWN MAY RESULT WITH AN ALTITUDE LOSS OF UP TO 500 FEET.

7-21-4 Indication / Warning

A digital serial output, from the left and right hand computers, provide data to the MAU for the Monitor Warning System (MWS), the Dynamic Speed Bug on the PFD Attitude Direction Indictor (ADI) and Low Speed Awareness indication on the PFD Air Speed Indicator (ASI).

The stick pusher system has an internal-fault monitoring system which will signal the MAU to illuminate the CAS **Pusher** message when one of the following events occur:

- A Built in Test (BIT) failure
- A push signal from only one computer that is longer than 3 seconds
- No output torque during a push
- If either of the pilot or copilot DISC switches is pressed
- If the aircraft normal acceleration is below 0.5 g for longer than 3 seconds
- Disparity between WOW inputs.

A malfunction in either pusher computer initiates a **Pusher** message to be shown on the CAS. This warns the pilot about a system malfunction and the pusher becoming inoperative.

The stick shaker and “Stall” warning devices may still be operational if the stick pusher is inoperative.

The CAS will show **AOA De Ice** when a malfunction is sensed in the AOA vane or mounting plate heater circuits (current sensing).

PUSHER ICE MODE will show in the ICE PROTECTION window of the systems MFD when the propeller de-ice system is set ON and the inertial separator is set OPEN. In the Ice Mode, the shaker and pusher activation points are reached 8° earlier than in the normal mode and the Dynamic Speed Bug and Low Speed Awareness indication are adapted accordingly.

If the Flap Control and Warning Unit (FCWU) detects a flap asymmetry, it:

- Sends a Flap caution to the MAU for display on the CAS
- Sends a signal to the stick pusher computer
- Sends the flap position to the stick pusher computer.

The stick pusher computer checks the flap position and flap asymmetry and if greater than 2° for 10 seconds or more, sends a **Pusher** message to the MAU for display on the CAS and goes into pusher safe mode. The MAU also signals the CAS to display the **Pusher Safe Mode** advisory. When in safe mode, the stall warning trigger thresholds operate at the 0° flap position settings irrespective of the flap position.

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The Dynamic Speed Bug and the Low Speed Awareness indication are based on the left flap position. As a result of setting 0° flap position when there is suspected asymmetry, the stick shaker and stick pusher will operate at higher airspeeds than would be normal for the actual flap position, but these higher airspeeds will not be reflected in the PFD indications. The difference between the PFD indications to the actual activation speeds varies with power and flap angle and can be as much as 5 KIAS faster. To allow for this, on approach the pilot must apply a 10 KIAS margin above the Dynamic Speed Bug.

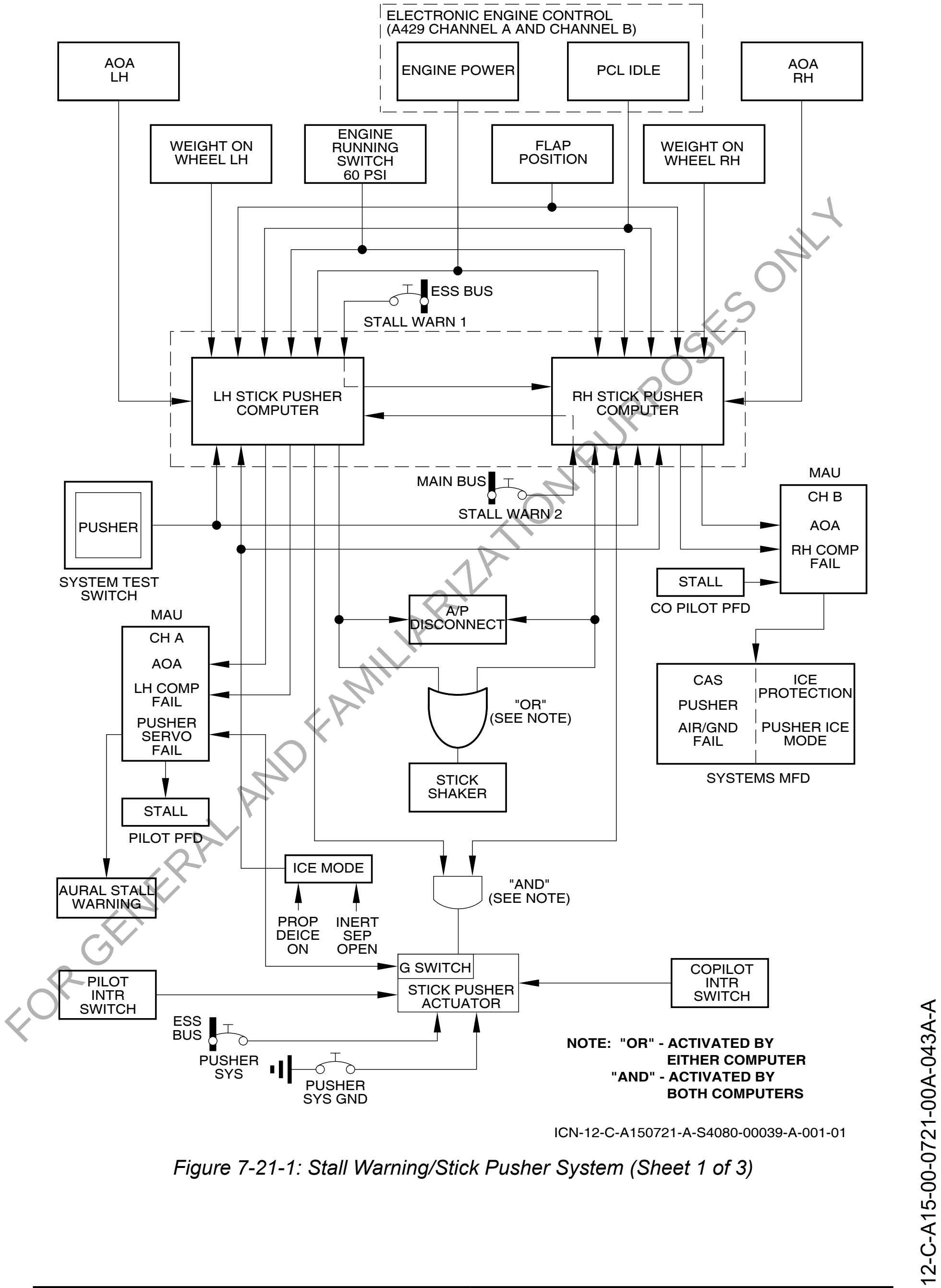

Figure 7-21-1: Stall Warning/Stick Pusher System (Sheet 1 of 3)

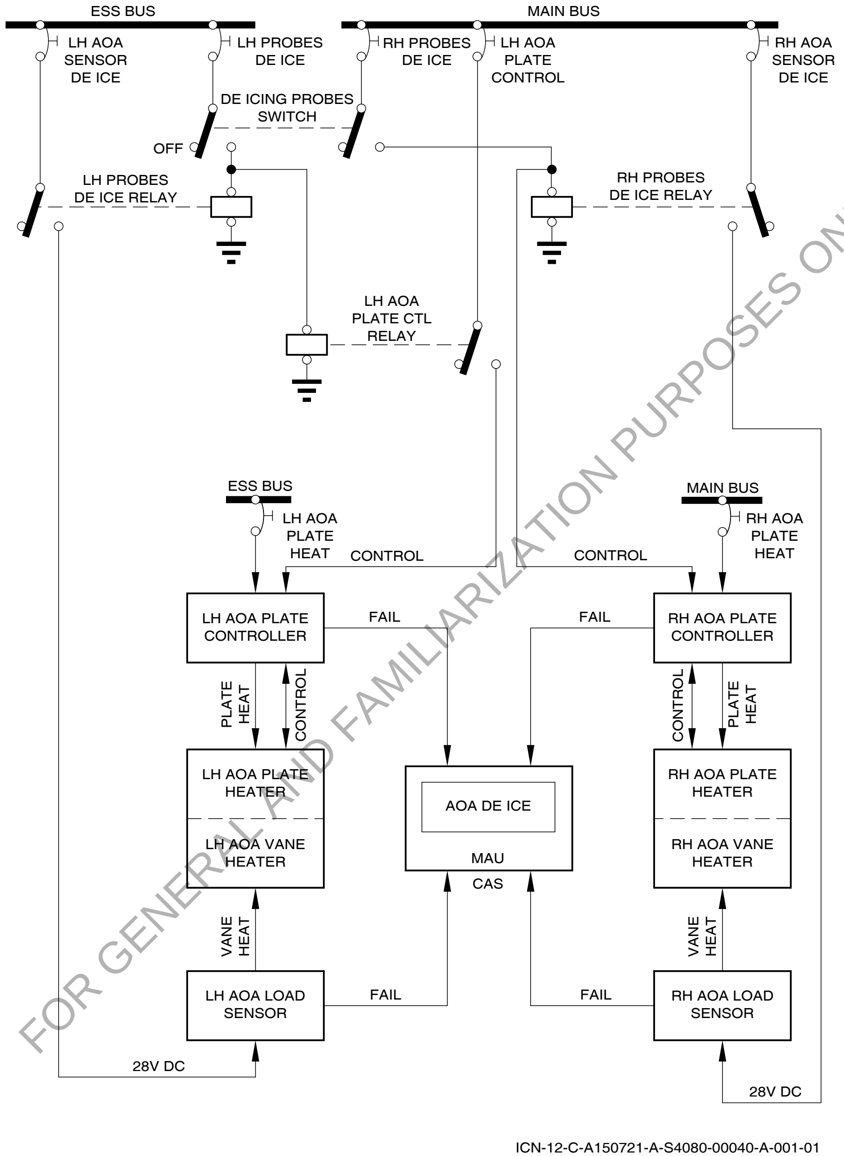

Figure 7-21-1: Stall Warning/Stick Pusher System (Sheet 2 of 3)

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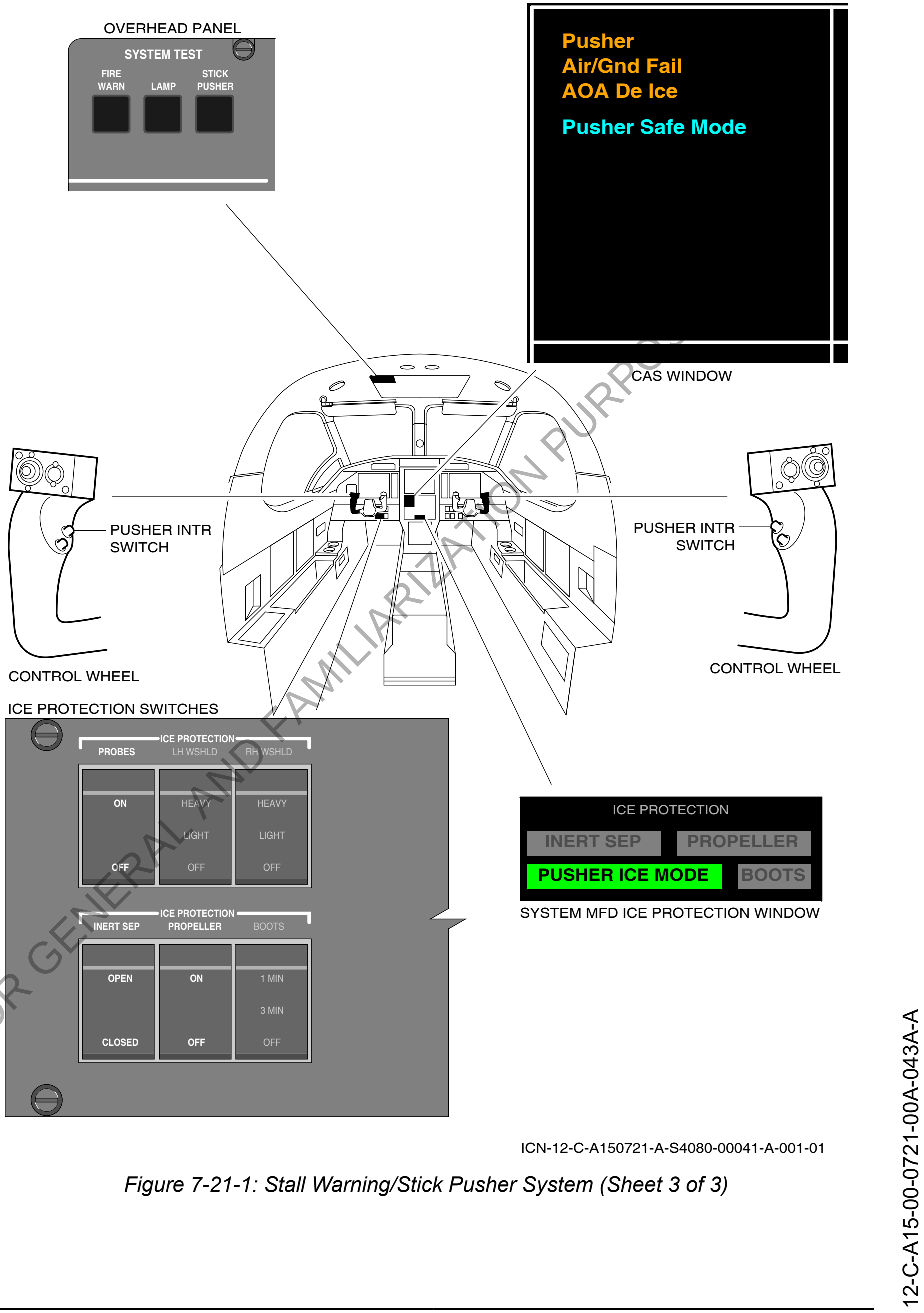

Figure 7-21-1: Stall Warning/Stick Pusher System (Sheet 3 of 3)

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7-22 Airfoil De-ice System

7-22-1 General

Inflatable neoprene boots are installed on the leading edges of the wings and horizontal tail surfaces. Their purpose is to inflate and dispense any ice which may accrete on their surface during flight in atmospheric icing conditions. When not in use, the boots have a vacuum applied to prevent partial inflation while in flight.

7-22-2 Description

The airplane is equipped with inflatable pneumatic de-icing boots fixed to the leading edges of the wings (two boots per wing - inboard and outboard) and the horizontal stabilizer. Air bled from the 3rd stage of the engine compressor section, is routed to the regulator-reliever valve of nominal 14 psi regulating pressure, then through a water separator to the ejector flow control valves. These valves, which are solenoid-operated, port air pressure to the de-icing boots in a prescribed sequence: first to the horizontal stabilizer de-icer, then to the lower portion of the inboard wing de-icers, the upper portion, the lower portion of the outboard wing de-icers, and finally the upper portion. Progression through this sequence is controlled by an electronic Timer/controller and monitored by low pressure sensing switches in each line, which are linked to the Modular Avionics Unit (MAU).

When pressure is not being applied to the de-icer boots a small airflow is allowed to pass through the ejector valves to impose a vacuum in the lines to the de-icing boots. This provides a negative air pressure at the boots ensuring the airfoil contour is maintained.

The pneumatic de-ice boot consists of a smooth neoprene and fabric blanket containing small spanwise de-icer tubes. Each wing de-icer has two air connections: one for the tubes on the lower surface and one for the tubes on the upper surface. The smaller boots on the horizontal stabilizer have one connection only.

The water separator is located upstream of the ejector control valves. Its function is to remove any condensation from the system and consists simply of a set of vanes which introduce a rotational swirl to the air that removes entrained water through centrifugal forces. A drain connection is fitted to the bottom of the housing to vent the moisture overboard.

The pressure-reliever valve consists of a spring and poppet valve which, at the required pressure, will open to allow air to pass from the inlet to the outlet port. The nominal regulating pressure is 14 psi. It also has an integral relief valve relieving at 18 psi.

7-22-3 Operation

Refer to Fig. 7-22-1, De-icing System.

In the off mode the system applies a continuous vacuum to the de-ice boots while the engine is running. The system is initiated by setting the switch labeled BOOTS on the ICE PROTECTION switch panel. The switch can be set to 3 MIN or 1 MIN and **BOOTS** is shown in the ICE PROTECTION window of the systems Multi Function Display (MFD).

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When activated the timer will start the de-icing cycle with a dwell period of 20 seconds (independent of which cycle has been selected), in order to allow the pilot to de-activate the system in case of inadvertent activation outside the operating limits of the pneumatic de-ice boots. The timer then actuates each ejector flow control valve (EFCV) in the prescribed sequence, for eight seconds. The time to inflate and deflate all of the de-icer units is thus 40 seconds. If the 'one minute cycle' has been selected the de-icing cycle is repeated immediately, if the 'three minute cycle' has been selected there is another 120 seconds dwell period before the de-icing cylce is repeated. If the control system is deactivated during the initial 20 seconds dwell period, the system will immediately be shutdown without inflating the boots.

Pressurization of each de-icer will cause the pressure switch to close, indicating proper operation. If there is a failure, the MAU will make the ICE PROTECTION **BOOTS** advisory go off and a **De Ice Boots** message will be shown on the Crew Alerting System (CAS). Operation of the wing boots can also be observed directly during ground checkout or from the airplane cabin. At night the left wing and boot operation can be observed using the wing inspection light. If the control system is deactivated during a de-icing cycle, the cycle will be completed prior to system shutdown.

CAUTION
Operation of the Pneumatic Wing De-ice System in ambient temperatures below -40°C or above 40°C may cause permanent damage to the de-icer boots.

7-22-4 Indicating / Warning

If the Outside Air Temperature (OAT) is outside the allowed limits of the wing de-ice system, the **Boots TEMP Limit** message is shown on the CAS and an aural gong will sound to indicate that the de-icer boots must be switched OFF to prevent damage to the pneumatic de-icer boots.

In icing conditions, the flaps are not allowed to be extended more than 15 degrees, or if the de-icer boots have failed, the flaps are not allowed to be extended. If the flap limits are exceeded, the **Flaps EXT Limit** message is shown on the CAS and an aural gong will sound.

With the BOOTS switch in the 3 MIN or 1 MIN position **BOOTS** is shown in the ICE PROTECTION window to show the system is set to on and working correctly. Should the inflation pressure at the individual pressure switches not reach the nominal filling pressure of 11 psi during the inflation sequence or an incorrect timing sequence, the MAU will make the **De Ice Boots** message show on the CAS and the green advisory goes off in the MFD ICE PROTECTION window.

After failure of the de-icing boots, the aircrew should prepare for departure of icing conditions as soon as possible.

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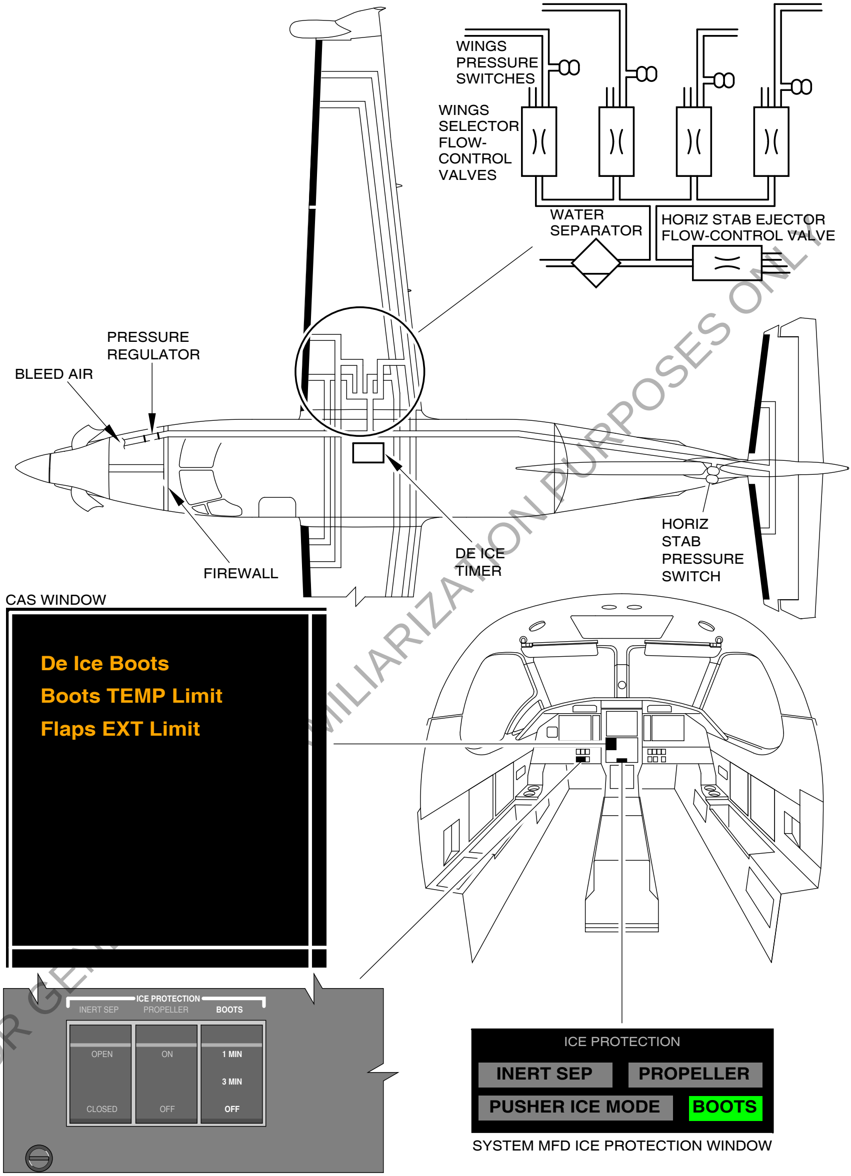

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Figure 7-22-1: Deicing System (Sheet 1 of 2)

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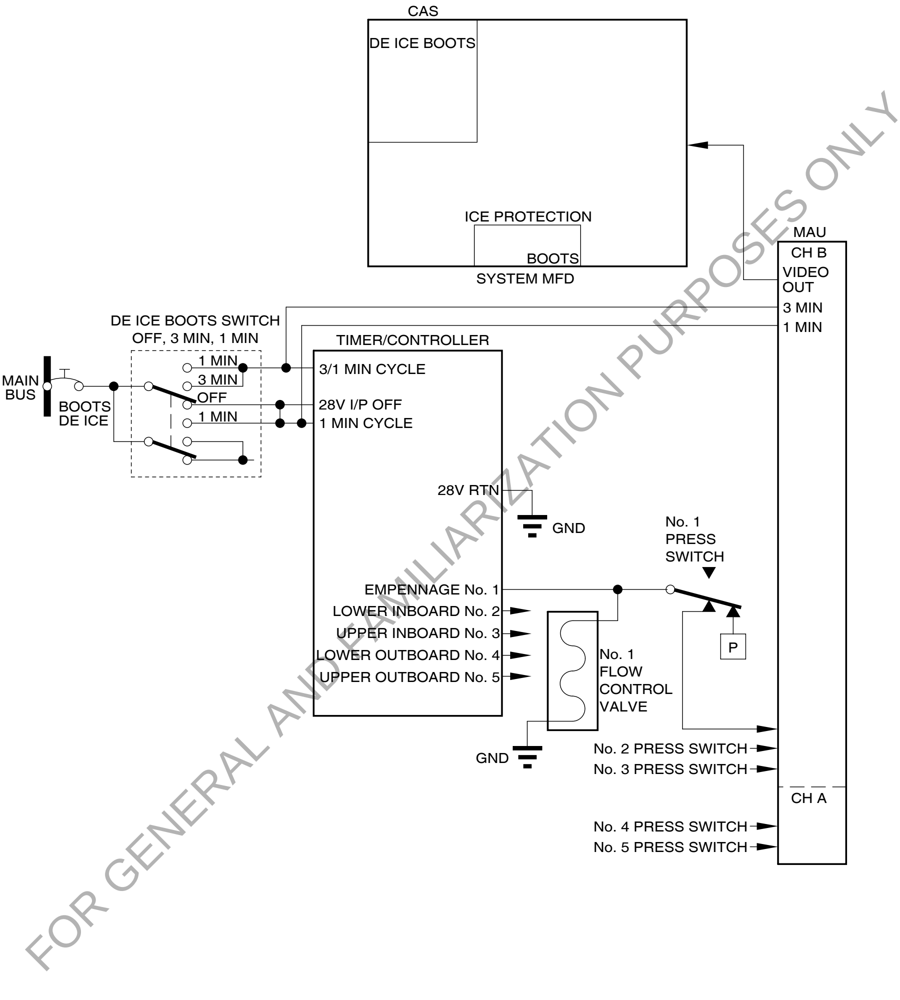

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Figure 7-22-1: Deicing System (Sheet 2 of 2)

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7-23 Comfort Features

7-23-1 General

Extra comfort for the pilot and copilot can be provided by optional equipment installed at build. For colder climates a Foot Warmer System (Optional) can be installed. Active Noise Reducing (ANR) headsets are installed in the place of normal headsets. Power for the ANR function is provided from the aircraft communications power supplies.

Passenger comfort is provided for by an Air Cycle System (ACS) and a Cabin Pressure Control System system. Additional comfort can be provided with the Vapor Cycle Cooling System (when installed). The fans installed at the rear of the cabin can be used to increase the general air circulation around the cabin. The switches for the fans are on the copilots lower left panel.

An optional 115 VAC power outlet system can be installed to give the facility to operate portable electronic equipment in the cockpit and cabin. Four power outlets are provided, one on the cockpit rear right switch panel, one on the left cabin sidewall and two on the right cabin sidewall. Electrical power to the 115 VAC static inverter is supplied through the 115V AUX PWR circuit breaker on the CABIN BUS. The maximum power output for the system is 500 Watt.

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7-24 Cabin Features

7-24-1 General

The PC-12 has a large cabin that offers a flexible interior configuration for passenger and cargo loading. There are two basic cabin configurations, a Corporate Commuter and an Executive interior. Variations to the two basic configurations are continually being developed, refer to Section 2, Maximum Passenger Seating Limits, for the variations that have been approved. See Section 6, Interior Configurations, for passenger seat locations, and see Section 6, General Loading Recommendations, for combi conversions and cargo loading information

Divider walls are installed behind the pilot and copilot seats and a curtain or door fits between the walls to form a division between the cockpit and cabin.

A fire extinguisher is located on the forward side of the cabin divider behind the copilot seat. Full operating instructions are given on the side of the extinguisher.

7-24-2 Corporate Commuter Interior

The standard Corporate Commuter Interior consists of two crew seats plus seating for up to nine passengers. The baggage compartment is situated at the rear of the cabin and a baggage net must be installed at frame 34 when baggage is stowed. An optional coat hanger can be installed in the baggage compartment.

7-24-3 Executive Interior

The standard executive interior aircraft consists of two crew seats plus executive seating for six passengers. The two forward passenger seats 1 and 2 face rearwards and the remainder face forwards. Extra passenger seating can be provided by using a combination of executive and standard passenger seats. Refer to Section 2, Maximum Passenger Seating Limits, for the various executive interiors that are approved and Section 6, Interior Configurations, for more information. An optional bulkhead and curtain assembly can be installed at frame 32 in front of the larger baggage net.

The baggage compartment is situated at the rear of the cabin and a baggage net must be installed at frame 34 when baggage is stowed. A coat hanger is installed in the baggage compartment.

Folding tables installed in the cabin sidewalls extend between the seats. Ashtrays, cupholders, table and overhead lighting switches are provided in the sidewall armrests adjacent to each seat. Individual reading lights and air outlets are installed in the headliner panel above each seat position.

A toilet compartment is installed in the front right hand side of the aircraft. The forward wall of the toilet compartment forms the cabin divider. Left and right storage cabinets are installed, the left cabinet fits against a small divider behind the passenger door and the right cabinet fits against the toilet compartment rear wall.

Passenger information no smoking/fasten seat belt illuminated signs are installed on the rear of the toilet compartment and above the baggage compartment. The signs are turned on and off by the pilot using the switches installed on the electrical overhead panel.

Various optional interior upgrade packages are available, contact Pilatus for further information and the determination any modification work required.

7-24-4 Combi/Cargo Interior

A Combi or a full cargo interior can be made by the removal of passenger seats from both the Corporate Commuter and Executive Interior aircraft. Cargo net attachment points are installed in the cabin walls at frame positions 24 and 27. Baggage net attachment points are installed at frame 34. Cargo restraining nets can be installed at the attachment points and allow lightweight cargo to be loaded without being secured with tie-down straps. A cargo securing kit contains the necessary items for the securing of heavyweight cargo.

7-25 Emergency Locator Transmitter

7-25-1 Kannad Integra ELT and ENAV Unit

7-25-1.1 Description

An Emergency Locator Transmitter (ELT) 406.037 is installed in the rear fuselage. It is connected to an antenna, which is installed on the top of the fuselage below the dorsal fairing, and has a battery pack that must be replaced after a specified time. The ELT will transmit on the international distress frequencies of 121.5 and 406.037 MHz. The ELT unit has a switch with the positions ARM, OFF and ON.

The ELT is also equipped with an internal 406/121.5 MHz antenna, this antenna is automatically activated if connection to the aircraft external antenna is lost.

The ELT is loaded with unique aircraft identity data to aid the search and rescue services. The unique aircraft identity data is loaded during installation by using a programming Dongle. If there is a change to the aircraft identity, the programming Dongle and ELT must be re-loaded with the unique aircraft identity data by an approved service center.

The ELT connects to the eNAV unit which is located on the same universal mounting bracket within the rear fuselage. The eNAV unit receives aircraft position information from the Global Positioning System (GPS) through the Modular Avionics Unit and provides it to the ELT for use within the 406.037 MHz data transmission. The eNAV is powered by a 28 VDC power supply sourced from the Hot Battery Bus. The ELT has a built in GPS to provide greater accuracy and an integral antenna in case of disconnection or damage to the external antenna.

There is an ELT remote control panel installed on the left hand sidewall panel. The panel has a guarded switch with the positions ON, ARMED and RESET/TEST and an indicator light.

There is a red ELT Light Emitting Diode indicator installed to the left of the pilot's Primary Flight Display (PFD).

7-25-1.2 Operation

The ELT is installed in the aircraft with the switch at the ARM position, this also makes the remote control panel active. For flight the remote control switch must be in the ARMED guarded position. In the ARMED mode the ELT is automatically operated at a specified g force by an internal g switch. The ELT will continuously transmit on the 121.5 MHz homing frequency for over 100 hours and will also transmit a digital message on the 406.037 MHz frequency every 50 seconds for the first 24 hours. The aircraft position is transmitted as part of the 406.037 MHz digital message.

Once the ELT is activated the internal GPS will attempt to acquire a valid position. If the built-in GPS acquires a valid position, the 406.037 MHz message will contain the true position of the built-in GPS in the next transmission. If the built-in GPS does not acquire a valid position, the message will contain the true position of the external GPS sourced from the eNAV unit. If neither the built-in GPS or the external GPS acquire a valid position the message will contain the default value (GPS position not valid). To avoid consumption the built-in GPS is not powered when the ELT switch is in the ARM position.

In an emergency, the remote switch can be selected to ON. The ELT will then immediately start the distress signal transmission. The red indicators will come on.

In the case of accidental transmission, the ELT can be reset by either selecting the guarded remote switch to RESET or the switch on the ELT unit to OFF.

The remote switch TEST position is used to check the battery voltage and transmission power of the ELT for maintenance purposes.

7-25-2 Low Frequency Underwater Locator Beacon (ULB) (if installed)

7-25-2.1 Description

A low frequency ULB (DK180) is installed in the rear fuselage near the ELT.

The ULB is a battery operated underwater acoustic pulse generator that is activated when the water switch end is immersed in either fresh or salt water.

The ULB is capable of functioning up to depths of 20,000 feet (6096 meters) and can be detected at a range of 7 to 12 NM (13 to 22 km) (depending on ambient noise levels).

7-25-2.2 Operation

When activated, the ULB will transmit at 8.80 kHz every 10 seconds for at least 90 days.

7-26 Primus APEX - Avionics Installation General

7-26-1 General

The aircraft is equipped with a Primus APEX ‘glass cockpit’ modular avionics system interconnected via various data buses. The APEX architecture design is configured to allow system options, system enhancements and feature upgrades via software. The integrated design approach facilitates a consistent display format across the cockpit display units, display controllers and provides a seamless operation for the pilot(s).

The Primus APEX Software and all parts thereof installed in the aircraft are the subject matter of various Honeywell proprietary rights. The Software License Agreement covers the aircraft owner/operator for the usage of the software installed in the aircraft and any updates, but only the functionality the customer has paid for. In accepting this License, Honeywell hereby grants the aircraft owner/operator a nonexclusive license to use one electronic copy of the Software, solely in conjunction with the installed avionics equipment, to operate the specific aircraft identified at the time this License was granted to the owner/operator. Any other uses, copying or distribution of the Software without prior written approval are strictly prohibited. Honeywell retains all title and interest in and to the Software.

The APEX system performs the following aircraft functions:

- Electronic Display System and Graphics Generation Function
- Configuration Management System (CMS)
- Automatic Flight Control System (AFCS)
- Flight Management System (FMS)
- Audio Control
- Monitor Warning Function (MWF) including Crew Alerting System (CAS)
- Data acquisition function
- Maintenance function
- Enhanced Ground Proximity Warning System (EGPWS)
- Interactive Navigation (INAV)
- Datalink
- Communication Management Function (CMF)
- Electronic Checklist and Charts (optional).

The APEX system interfaces with the following stand-alone equipment:

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- Air Data Attitude Heading Reference System (ADAHRS)
- Multi Mode Digital Radios (MMDR)
- Weather Radar System (Wx)
- Radar Altimeter System
- Global Positioning System (GPS)
- Mode S Transponder
- Stormscope (optional)
- Traffic Collision Avoidance System (TCAS) (optional)
- Distance Measuring Equipment (DME)
- Other aircraft systems.

An Electronic Standby Instrument System (ESIS) is installed and displays altitude, attitude, airspeed and magnetic heading. The ESIS is independent of the Primus Apex system.

Fig. 7-26-1, APEX Equipment - Bus Bar Distribution, shows a schematic of the APEX Equipment Bus Bar Distribution. The bus bar colors are shown similar to the colors on the cockpit circuit breaker panels.

Fig. 7-26-2, APEX Equipment - Antenna Locations, shows the APEX Equipment Antenna Locations.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for complete information on the description and operation of the APEX System.

7-26-2 APEX Builds

An overview of the various APEX builds and their corresponding Honeywell part number is given in the Front Matter, List of APEX Builds.

7-26-3 Acronyms and Abbreviations

The acronyms and abbreviations used in the Avionics Installation description are given in Table 7-26-1.

Table 7-26-1: APEX - Acronyms and Abbreviations

Abbreviation / Acronym	Description
ACMS	Aircraft Condition Monitoring System
ACS	Air Cycle System
ADAHRS	Air Data and Attitude Heading Reference System
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Direction Indictor
ADMS	Aircraft Diagnostic and Maintenance System
AFCS	Automatic Flight Control System
AGM	Advanced Graphics Module
AHRS	Attitude Heading Reference System

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Table 7-26-1: APEX - Acronyms and Abbreviations (continued from previous page)

Abbreviation / Acronym	Description
AIRMET	Airman’s Meteorological Advisories
AP	Autopilot
APM	Aircraft Personality Module
ASCB	Avionics Standard Communications Bus
AT	Autothrottle
BIT	Built-in Test
BARO	Barometric
CAN	Controller Area Network
CAS	Crew Alerting System
CAT	Clear Air Turbulence
CCD	Cursor Control Device
CKLST	Checklist (electronic)
CMC	Central Maintenance Computer
CMS	Configuration Management System
CONUS	Continental United States
CPCS	Cabin Pressure Control System
DB	Database
DEOS	Digital Engine Operating System
DME	Distance Measuring Equipment
DRCP	Display Reversion Control Panel
DU	Display Unit
ECS	Environmental Control System
EDM	Emergency Descent Mode
EGNOS	European Geostationary Navigation Overlay Service
EGPWF	Enhanced Ground Proximity Warning Function
EGPWS	Enhanced Ground Proximity Warning System
ESIS	Electronic Standby Instrument System
FAF	Final Approach Fix
FAS	Flight Alerting System
FC	Flight Controller
FD	Flight Director
FLC	Flight Level Change
FMS	Flight Management System
FMW	Flight Management Window
FPLN	Flight Plan
GA	Go Around
GFP	Graphical Flight Planning
GGF	Graphics Generation Function
GNSSU	Global Navigation Sensor System Unit
GPS	Global Positioning System
GS	Glideslope
HDG	Heading
HSI	Horizontal Situation Indicator

Table 7-26-1: APEX - Acronyms and Abbreviations (continued from previous page)

Abbreviation / Acronym	Description
INAV	Interactive Navigation
LAN	Local Area Network
LCD	Liquid Crystal Display
LPV	Localizer Performance with Vertical guidance
LSS	Lightning Sensor System
MAU	Modular Avionics Unit
METAR	Aviation Routine Weather Report
MFD	Multi Function Display
MW	Monitor Warning (miscompare condition)
MWF	Monitor Warning Function
NEXRAD	Next Generation Radar
NIC	Network Interface Controller
PDC	Pre Departure Clearance
PFD	Primary Flight Display
POF	Phase of Flight
PSA	Pre Selected Altitude
RA	Resolution Advisory
RAAS	Runway Awareness and Advisory System
RVSM	Reduced Vertical Separation Minimum
SBAS	Satellite Based Augmentation System
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
STAR	Standard Terminal Arrival Route
SSEC	Static Source Error Correction
SVS	Smartview System
TA	Traffic Advisory
TAF	Aviation Terminal Area Forecast
TAS	Traffic Advisory System
TAWS	Terrain Awareness and Warning System
TCAS	Traffic Collision Avoidance System
TCS	Touch Control Steering
TF	Tactile Feedback
TFR	Temporary Flight Restriction
TRK	Track
TSC	Touch Screen Controller
VGP	Vertical Glidepath
VNAV	Vertical Navigation
VSD	Vertical Situation Display
WAAS	Wide Area Augmentation System
WPT	Waypoint
Wx	Weather Radar
XPDR	Transponder
XM	Weather Satellite Receiver

Table 7-26-1: APEX - Acronyms and Abbreviations (continued from previous page)

Abbreviation / Acronym	Description
YD	Yaw Damper

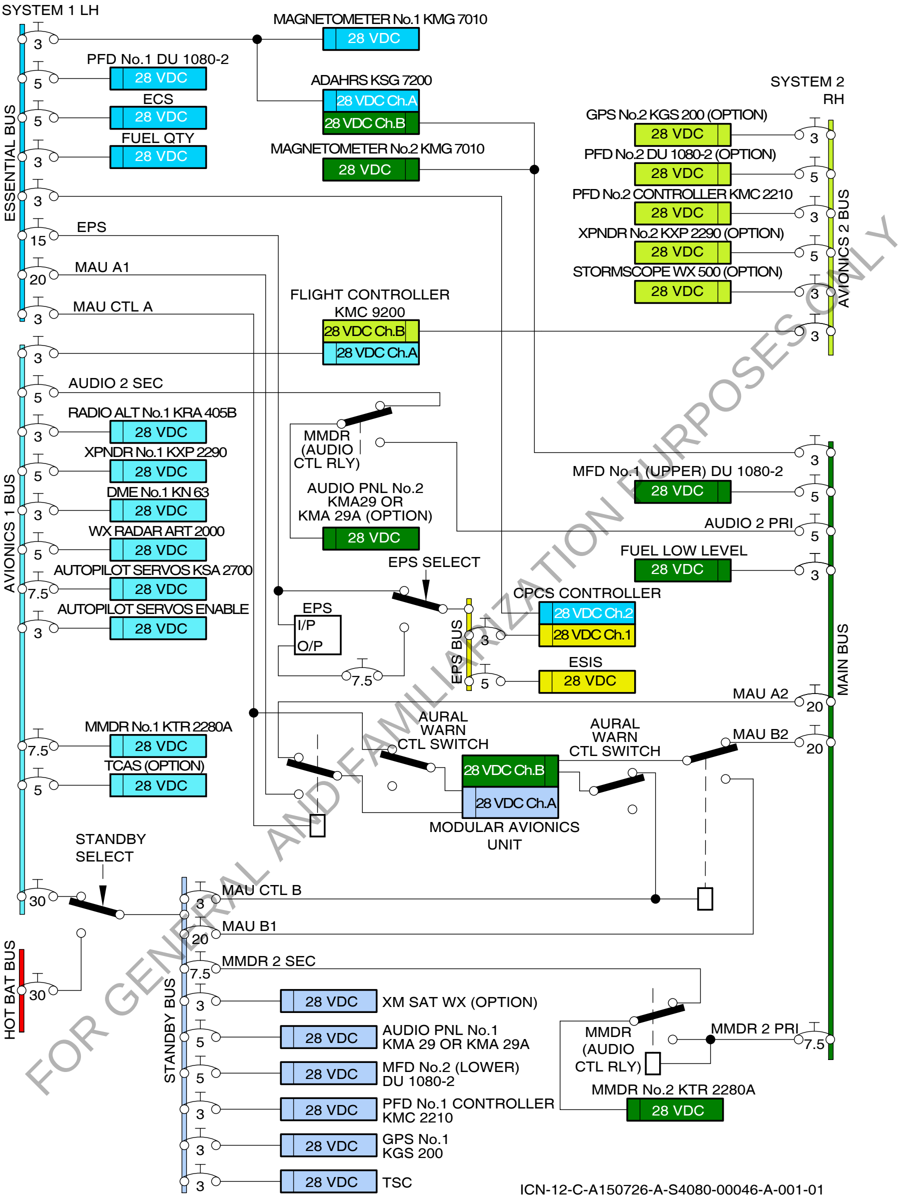

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Figure 7-26-1: APEX Equipment - Bus Bar Distribution

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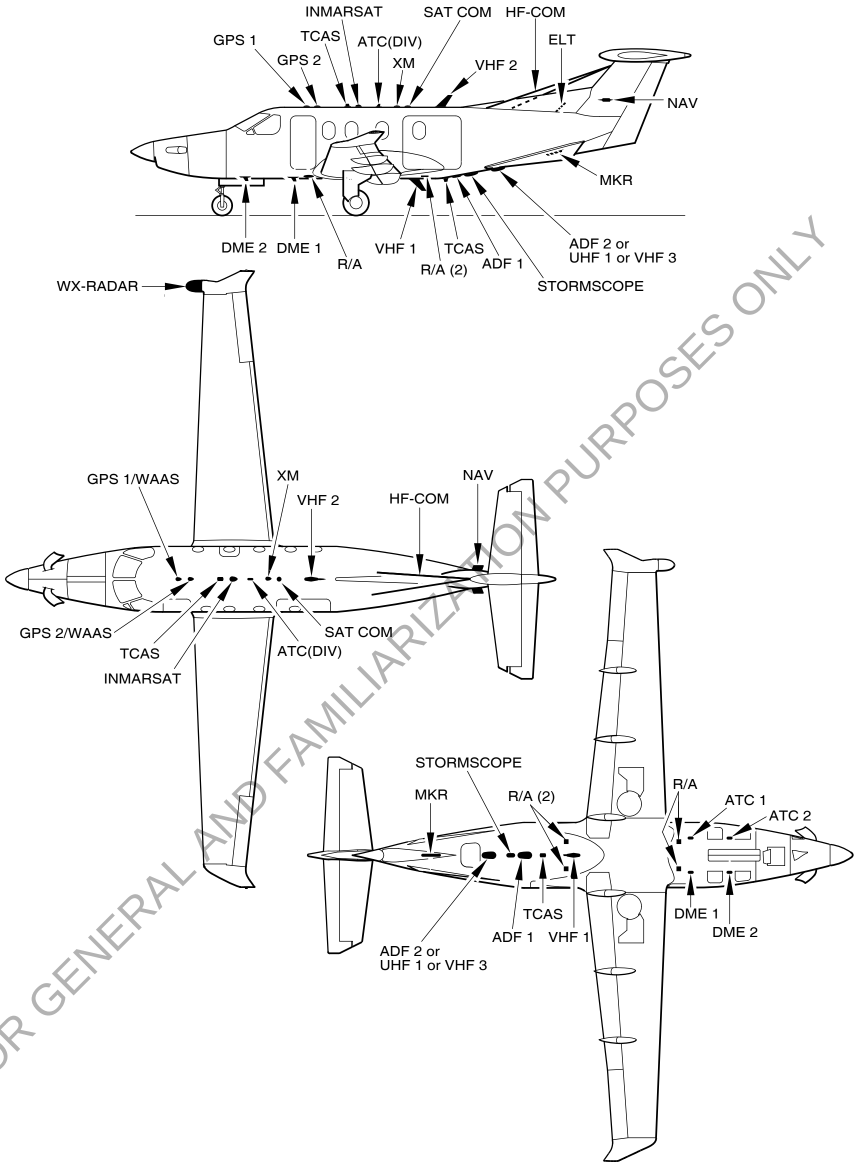

Figure 7-26-2: APEX Equipment - Antenna Locations

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7-27 Primus APEX

7-27-1 General

Refer to Fig. 7-27-1, APEX - MAU Configuration for APEX, MAU, displays and controls.

The Primus APEX system is implemented using standard concepts and modular components installed in a Modular Avionics Unit (MAU). Communication via the system components hosted in the MAU comprises a high integrity bus network called Avionics Standard Communication Bus (ASCB). Single channel APEX equipment is powered by a single circuit breaker and dual channel APEX equipment is powered by two circuit breakers connected independently to each channel of the equipment and powered from different aircraft electrical bus bars.

7-27-2 Description

The MAU installed under the cabin floor consists of a cabinet/chassis containing a backplane circuit card assembly, cooling fans and 14 user module slots that host a variety of line replaceable modules. The MAU cabinet is divided into two channels (A and B), each channel is electrically isolated from the other with its own power supply module, Network Interface Controller (NIC) module and data communications backplane. The dual channel architecture of the MAU allows system functions to be distributed between channels. The modules are field replaceable and field loadable with software. The user modules communicate to the ASCB via the NIC modules.

The ASCB consists of two independent busses, the left and right busses correspond to pilot and copilot side primary data. Each NIC in the system reads and writes to the on-side primary bus and reads from the cross-side primary bus.

The aircraft wiring interface to the MAU is segregated into systems, MAU Channel A to system 1 (left side aircraft wiring) and MAU Channel B to system 2 (right side aircraft wiring).

The communication mechanism that Line Replaceable Unit(s) (LRU's) in the APEX system use to communicate is called the Virtual Backplane. The Virtual Backplane comprises an ASCB and the software and hardware mechanisms within the LRU's that communicate on ASCB. LRU's connected to ASCB use a common interface bus control module called a NIC. The NIC provides a high integrity method for an LRU to interface with the ASCB.

A Local Area Network (LAN) provides a general purpose method of transferring data to any LRU in the APEX system. Typical use of the LAN is on-ground data transfer (software installation) and maintenance data transfer. The LAN is connected to each channel of the MAU and the maintenance panel.

Refer to Table 7-27-1 for a list of the line replaceable modules that are installed in the MAU cabinet.

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Table 7-27-1: MAU Cabinet - Line Replaceable Modules

Line Replaceable Module	Description
Power Supply (PS) module	A PS module is dedicated to each channel of the MAU. Either power supply can operate both of the MAU cabinet cooling fans. MAU channel A power supply module will normally be powered from the Essential Bus, following the loss of the essential bus power input, channel A would revert to being powered from the Main Bus. MAU channel B power supply module will normally be powered from the Standby Bus, following the loss of the Standby Bus power input, channel B would revert to being powered from the Main Bus. The module contains no processing or backplane communication capability
NIC module	The NIC module provides a gateway for the MAU modules to access ASCB and the LAN. Two NIC modules are installed, one for each channel of the MAU
Aircraft Personality Module (APM)	The APM is a memory storage device connected directly to the MAU NIC module. Two APM's are installed, one for each channel of the MAU. They contain APEX configuration data typically, System Identifier, Aircraft Type, Aircraft Serial Number, Installed Configuration Options and System settings
Advanced Graphics Module (AGM)	The AGM is a single channel module and one is installed for each channel of the MAU. The AGM performs general purpose processing as well as display processing and graphics generation. The Configuration Management System (CMS), charts function and maintenance functions (CMC, ACMS) are also hosted on the AGM module. AGM1 (MAU channel A) drives the Pilot PFD and Upper MFD and AGM2 (MAU channel B) drives the Copilot PFD and Lower MFD. A repeater capability will allow the Pilot PFD to be displayed on the Copilot PFD (and vice-versa) in the event of a single AGM failure. The display controllers, TSC and Display Reversion Control Panel (DRCP) are interfaced with the AGM's. AGM integrity is monitored by the Monitor Warning Function (MWF) which verifies that the data selected by the AGM for display generation has integrity
Generic I/O (GIO) Module	The GIO Module is a dual channel module, each module channel is connected to a different MAU backplane (channel A and B). The GIO module translates aircraft I/O data onto and off ASCB via the MAU's backplane
Custom I/O (CSIO) Module	The CSIO Module is a dual channel module, each module channel is connected to a different MAU backplane (channel A and B). The CSIO module also translates aircraft I/O data onto and off ASCB similar to the GIO module, but is more specialized to meet specific aircraft interface requirements

Table 7-27-1: MAU Cabinet - Line Replaceable Modules (continued from previous page)

Line Replaceable Module	Description
Actuator I/O Processor (AIOP) Module	The AIOP Module is a single channel module and one is installed for each channel of the MAU. The AIOP module is principally associated with the Automatic Flight Control System (AFCS). The Flight Management System (FMS) is hosted on AIOP B and the optional second FMS is hosted on AIOP A.
Processor (PROC) Module	The PROC Module is a single channel module. The PROC Module hosts the Communication Management Function (CMF), Aeronautical Telecommunication Network (ATN) and Enhanced Ground Proximity Warning Function (EGPWF).
Control I/O (CIO) Module	The CIO Module is a single channel input/output module that provides the primary input/output interface to support datalink functionality.

7-27-3 Operation

All the MAU modules use an operating system called Digital Engine Operating System (DEOS). The system provides time and space partitioning that allows functions of mixed criticality levels to coexist on the same processing platform and isolates application software from the underlying hardware used in many of the modules and units. Software objects that reside in DEOS are:

- Threads - that perform a sequence of executions that are time partitioned
- Process - a collection of threads and data that are space partitioned
- Application - a collection of one or more related processes
- Core Software - software that provides all the support functions for the hardware and application
- Boot Software - factory loaded software used to initialize the module and allow software loading.

The APEX operational software for the MAU will be installed for each specific aircraft during production and subsequently in the field for requisite software updates. APEX operational software will be distributed typically on a CD-ROM. Data loading from the CD-ROM is accomplished by using a PC laptop connected to the APEX system installed on the aircraft via a LAN connector on the aircraft Maintenance Panel.

The System Configuration and Data Loading window is a page selection on the systems MFD multi-function window. The Data Loading window is only available when on the ground.

The SYS CONFIG window displays configuration information for all installed software/data bases, including the Top Level System Part Number for the APEX System.

When the Data Loading window is displayed the Touch Screen Controller (TSC) is used to select one of the four selections to start the Data Load process.

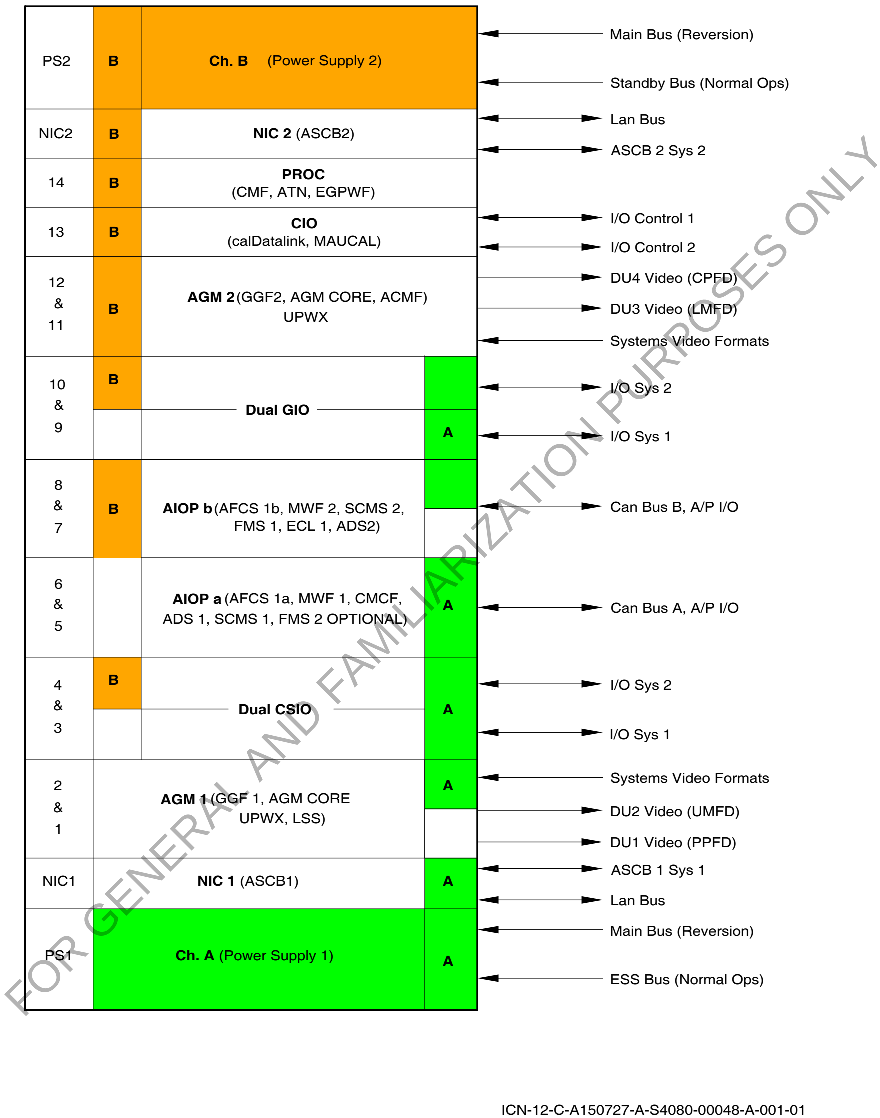

Figure 7-27-1: APEX - MAU Configuration

7-27-4 Display and Window Configuration

The APEX Avionics suite is based on a four Display Unit (DU) layout arranged in a T configuration to provide the pilot with quick easy access to avionic operations. The DUs are numbered:

- DU 1 is the pilot's PFD
- DU 2 is the upper MFD (default format is Situation Awareness Display MFD)
- DU 3 is the lower MFD (default format is Systems Display MFD)
- DU 4 is the copilot's PFD (when installed).

The DUs do not contain any flight operational software and are driven by the AGMs installed in the MAU. DUs 1 and 2 are driven by AGM1 and DUs 3 and 4 are driven by AGM2. The DU area of display is divided into 1/6th sections. These sections can be combined into larger sections to generate the required display functionality. These sections of the displays are referred to as windows.

Each DU has a default display/functionality configuration. The functionality is displayed using a 1/6th or 2/3rd window. The default window configurations are shown in Fig. 7-27-2, APEX - Displays. By utilizing the full area of display in the various configuration windows, multiple system operations/functionalities can be shown on a DU at the same time. Each window operates independently of the other windows. The only window size that can be changed is the waypoint list window in the Situation MFD. With the waypoint list window in focus pressing the Cursor Control Device (CCD) or TSC PAGE button changes the display to a 1/3rd window. Selecting FMW returns the 1/3rd window to a 1/6th window.

Window navigation comes under four areas:

- Window entry
- Window focus
- Page operation
- DU focus.

Entry and operation on the interactive windows, which are the Radio and HSI windows on the PFDs and windows colocated to bezel buttons on the MFD's, is by controllers and the DU bezel buttons.

There is a PFD controller which only operates on the PFD and a TSC which operates on the PFDs and the MFDs. The PFD controllers are installed on the inboard side of the PFDs and the TSC is installed in the center console.

The PFD controller push button controls for normal window navigation are:

DME	Shortcut key to the DME detail window on the radio window
DETAIL	Calls up a secondary window related to the current active window providing additional details related to the selected item
PFD	Allows PFD control to be transferred to the other PFD in the event of a controller failure, when in operation PFD Cross Control annunciations are displayed in amber along the bottom right side of the ADI

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Refer to the Primary Flight Display paragraph for a description of the controller controls for the PFD ADI/HSI displays and the Communication and Navigation - Controls section for the RADIO controls.

The TSC displays Quick Access (QA) buttons along the left side of the TSC display. The bezel of the TSC is equipped with inner and outer rotating knobs and soft buttons. Basic functionality of the buttons and knobs is given in Table 7-27-2.

Table 7-27-2: TSC knobs and buttons - Functionality

QA buttons	
Home	When the Home QA button is selected, the the TSC screen will show the home page. The home page shows these options: − Direct-To − Inhibits − MFD Format − Show Info − Timers − Settings − WX/LX/TAWS − Datalink (if installed) − Checklist (if installed).
DU & CCD	When the DU & CCD QA button is selected, the TSC screen will show buttons that allow the pilot to select a DU for cursor focus. The TSC screen also provides cursor control in the form of a cursor touchpad. To put cursor focus on a DU, select the desired DU from the buttons at the top of the display (Pilot PFD, Upper MFD, Lower MFD or Copilot PFD). The selected DU will also be highlighted on the DU & CCD QA button. The top right corner of the display shows a PAGE button. Pushing the PAGE button will bring up the dropdown menu for the window that has focus.
COM	When the COM QA button is selected, the TSC screen shows the COM dialog that is used to tune the COM frequencies. The current radio and frequency are shown on the top line of the screen. COM1 and COM2 selection buttons as well as a numpad and various execution buttons are also available.
NAV	When the NAV QA button is selected, the TSC screen shows the NAV dialog that is used to tune the NAV1, NAV2 and ADF radio frequencies. The current navigation source and frequency are shown on the top line of the screen.
XPDR	When the XPDR QA button is selected, the TSC screen shows the XPDR dialog that is used to set the transponder code. The current transponder code is shown on the top line of the screen.
Knobs and soft keys	
Rotating knobs	The TSC has two dual concentric knobs in the lower left and lower right corner of the bezel. The knobs can perform various functions depending on the associated annunciation/label on the TSC screen which is shown above the knob. Example: When **DU Scroll** is shown above a knob, rotating the inner or outer knob controls DU scrolling. When **COM1 Freq** is shown, rotating the inner or outer knob controls the COM frequency.

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Table 7-27-2: TSC knobs and buttons - Functionality (continued from previous page)

Soft keys	The TSC has three soft keys installed on the lower bezel. The soft key performs the function as indicated by the label shown above it. The labels available are: **Datalink** (if installed), **MFD Swap** and **Event** For example, when the **MFD Swap** soft key is pushed, the upper and lower MFDs swap position. The label will be greyed out and not selectable when both MFDs are powered off or have failed.

For more information and a description of the remainder of the TSC functions, refer to the relevant system and the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E.

For each interactive window there are adjacent bezel buttons on the outer edge of the DU. The operational bezel buttons have an adjacent soft key, pressing a bezel button without a soft key will have no effect. The bezel buttons are used for toggle operations and selections within a window without having to bring window focus (via the CCD or the TSC) to the area.

Window focus is only obtainable using the CCD or TSC, pressing a bezel button does not bring window focus to a window. The Map window is the default window focus except in composite mode. Only one window can be in focus across the displays. When focus is obtained a cyan border will be shown around the window. After an inactive period of 60 seconds the window focus will return to the Map window. When focus is brought to a new display the cursor will bloom for approximately 10 seconds.

When window focus is brought to a window that has data entry fields a cursor colored cyan will be placed on the first data entry field. The CCD or the TSC can then be used to position the cursor onto a required data entry field. At power up the cursor is placed in the upper left corner of the default Map window.

Page operation is accomplished by pressing the PAGE button on the CCD or the TSC when in an active window. A menu listing the available pages for the window will be displayed. To make a selection and display a new window, use the ENTER button on the CCD or the TSC touchpad tap (ENTER function). Pressing the PAGE button again or after 30 seconds of display the page menu is removed. There are two types of menus:

Page menus	To access pages of functions contained in the same window
Functionality menus	To show selection headings that remain the same regardless of the current mode of operation.

All menus once selected have cursor snapping, whereby the cursor snaps to the first item in the menu and to the subsequent items with trackball or touchpad operation. When an entry is made the cursor is caged inside the data field until the entry is completed by pressing the ENTER key or clearing the entry with the CLEAR or DELETE keys. If a TSC short cut key is pressed or the cursor time out period is reached the entry is considered not finished and reverts to the previous value.

The TSC has Quick Access (QA) buttons which can be used to quickly access functionality also available on the windows. Pressing a QA button will bring up the applicable dialog field on the TSC screen (refer to Table 7-27-2).

Pressing the Show Info button activates the WPT window (if not displayed) and transfers cursor focus to the waypoint information display box.

Pressing the Direct-To button opens the FMW (if not opened), activates the direct-to-page, and sets the cursor focus to the DIR field for subsequent entry of a direct-to-waypoint into the flight plan.

A CCD is installed on the top rear of the center console. It provides the crew with a more ergonomic means for controlling the cursor movement on the DUs. The CCD is connected to a Control Unit which provides the interface between the CCD and the Primus APEX Modular Avionics Unit (MAU). The Control Unit is powered through the Pilot PFD CONT/CCD circuit breaker from the Standby Bus and therefore the CCD can be used for preflight functions (engine not running). The CCD will continue to provide the same functionality as the TSC related controls, in the event of a TSC failure. The CCD has a trackball to select focus and drop down menus, and a scroll wheel. The scroll wheel can be pressed sideways (left) to operate the page function. On the left side of the CCD is an Enter pushbutton, on the right side a Focus pushbutton. The Focus pushbutton swaps display focus between the installed displays in a counterclockwise direction.

The Display Units each have a power supply from a different power bus. The pilots DU is powered from the Essential Bus, The upper MFD is powered by the Main Bus, the lower MFD is powered by the Standby Bus and the copilots DU (when installed) is powered by the Avionic 2 bus.

7-27-5 Display Reversion

The display system is capable of reverting the Display Units (DU) and Advance Graphics Module 1 and 2 (AGM) by pilot operation in the event of a display or AGM failure condition. A Display Reversion Control panel is installed on the center console between the throttle quadrant and the CCD.

The control panel has potentiometers for the PILOTS PFD, UPPER MFD, TSC, LOWER MFD and CO-PILOTS PFD (when installed). The potentiometers are used to adjust the individual DU brightness and to switch the displays to OFF/REV. At the OFF/REV position the DU goes blank and the display is moved to another display. In a reversion scenario (e.g. Pilot PFD displayed on Upper MFD) the navigation information displayed will be based on the Nav sensor selected on the source display. In some cases the PFD will go into a composite mode. The PFD composite format shows the ADI/HSI, up to twelve CAS messages, Systems Summary and Radio windows.

The PILOTS PFD and CO-PILOTS PFD (when installed) controls also have a rotating switch that can be used to select from the NORM position to the other AGM in the event of a primary AGM drive failure indicated by a red X displayed across the DU.

In the event of a Multi Function Display (MFD) failure, the Situation Awareness or the Systems data can be switched to the remaining MFD by pressing the MFD swap soft key on the TSC.

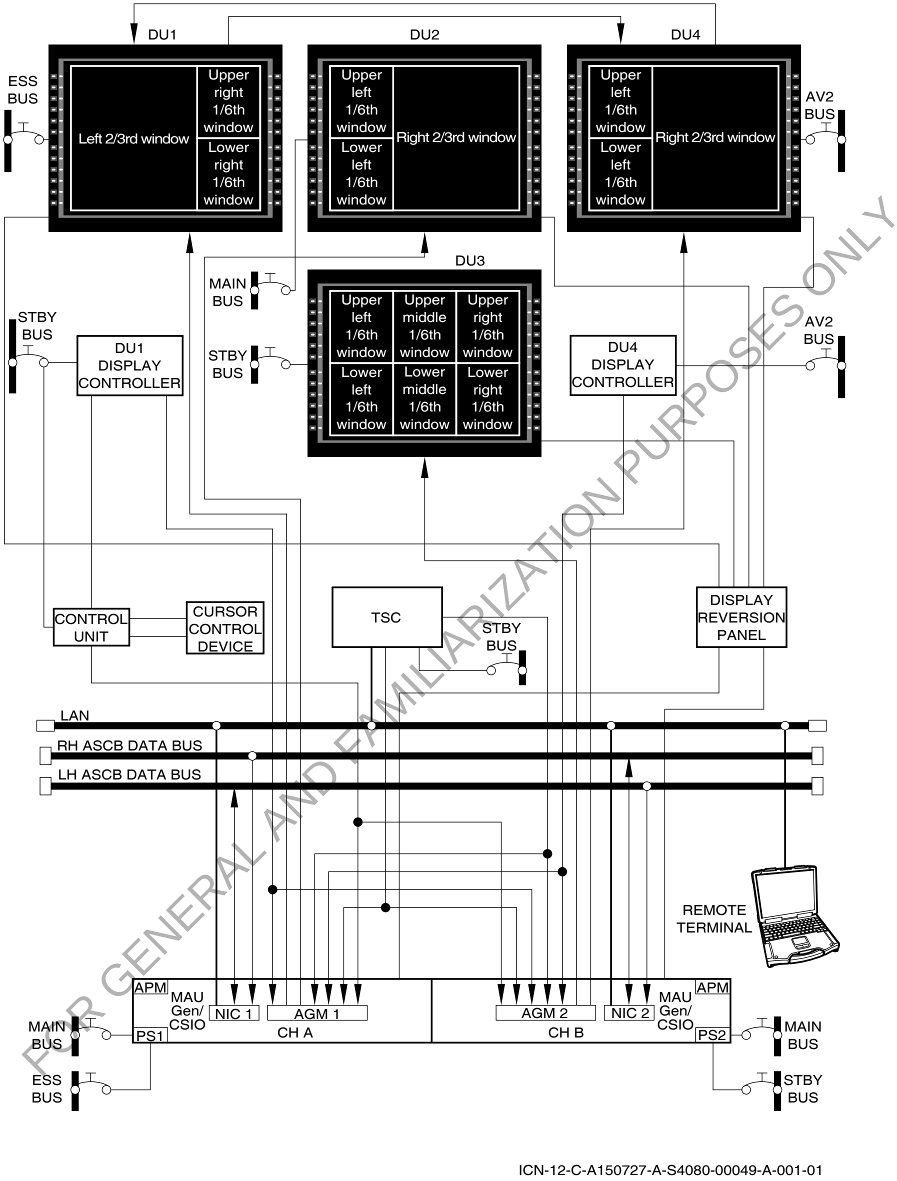

Figure 7-27-2: APEX - Displays

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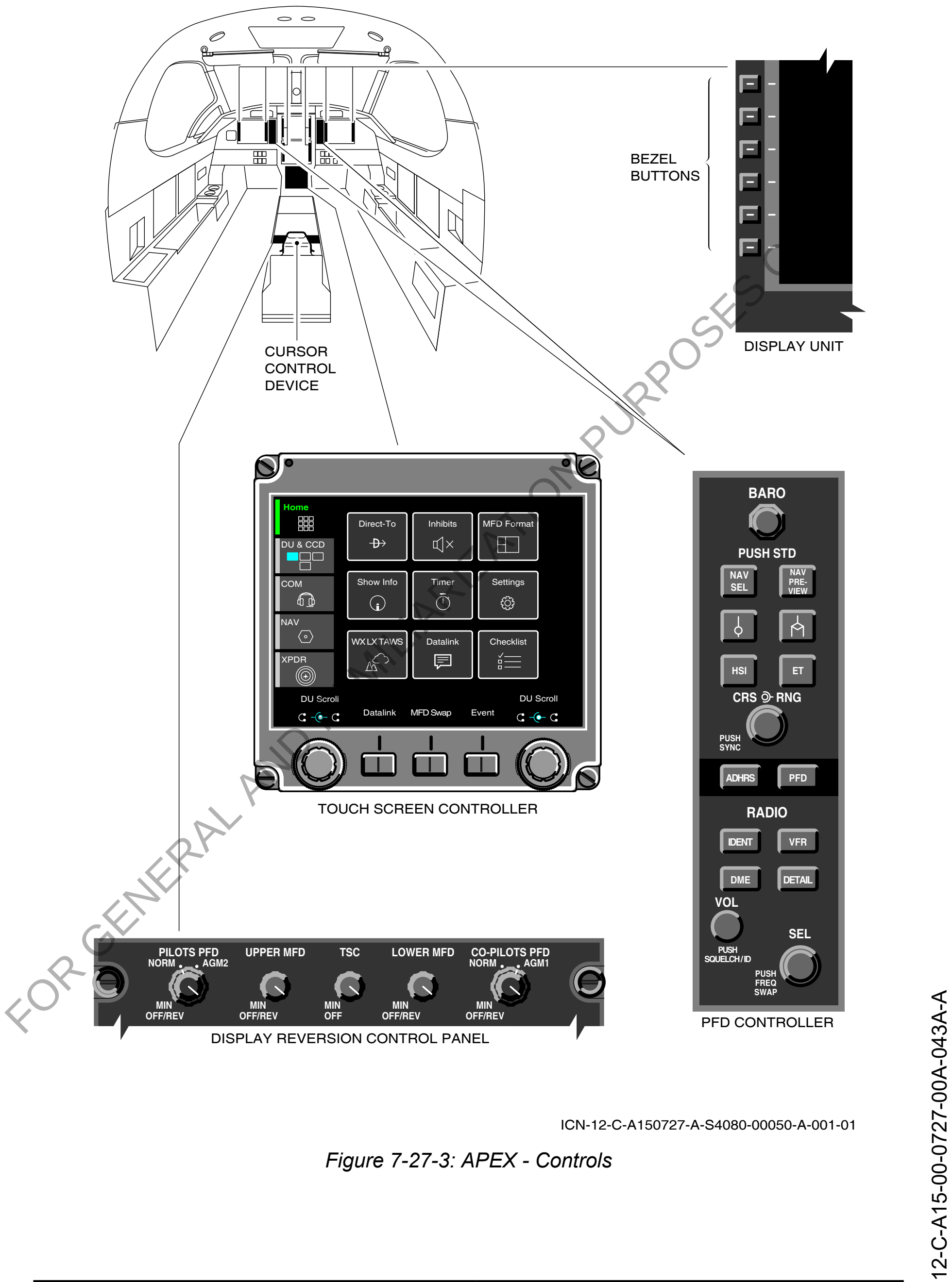

Figure 7-27-3: APEX - Controls

7-27-6 Primary Flight Display

Refer to Fig. 7-27-4, Typical APEX ADI HSI Display - HSI Rose.

The Primary Flight Display (PFD) provides all the essential flight data to the pilot. The PFD displays attitude, heading, airspeed and altitude in the left 2/3rd window. The right upper 1/6th window displays the engine indicators and the right lower 1/6th window displays the radio controls, refer to the Engine and Primus APEX - Communication and Navigation sections for a description of these windows. A second optional PFD can be installed for the copilot, the window layout on this PFD is shown in a mirror image.

In normal operation the PFD receives air data, heading inputs for flight guidance, radio navigation or FMS data and engine instrument data. The PFD is divided into the following display areas:

- Flight Mode Annunciators (FMA)
- Attitude Director Indicator (ADI)
- Airspeed
- Altitude
- Vertical Speed
- Horizontal Situation Indicator (HSI) Displays and Annunciators
- Radio Management
- Engine Instruments.

Attitude information is displayed on an electronic ADI and heading and course information on an electronic HSI.

The T/O and LDG V-speeds are entered from the FMW. All V-speed entries are limited from 30 to 200 knots with the exception of VT that is limited from 30 to V_{MO} knots. Only entered V-speeds will be displayed. The ADI T/O V-speeds are displayed in the lower portion of the airspeed tape, if the aircraft is “on ground” and below 45 knots. The ADI T/O V-speed bugs are displayed on the airspeed tape while the Indicated Airspeed is less than the highest V-speed (VX, VR and VY) plus 10 knots. The ADI Landing/Approach bugs are displayed while airborne and the indicated Airspeed transitions to less than the highest V-speed (VT, VREF and VGA) plus 40 knots. 5 seconds after landing the T/O V-speeds are displayed on the airspeed tape or in the preview window if speed is below 45 knots. After an electrical power cycle the V-speeds have to be reprogrammed for the next flight.

The Dynamic Speed Bug (DSB) is shown as a green chevron on the right side of the airspeed tape when the calibrated airspeed is 45 knots or more and the aircraft status is in-air. The DSB is removed when the aircraft is on the ground and below 45 knots for more than 5 seconds. Based on angle of attack information, the DSB indicates 1.3 V_S referenced to the airspeed tape.

The Avionics window on the systems MFD provides the pilot with the capability to configure some display options on the ADI and HSI, and to utilize the FMS custom database feature.

The displayed data is compared by the comparison monitors and if data is determined to be invalid or miscompare, warning, caution and miscompare annunciations are shown on the PFD. The warning annunciators are shown in white on a red box or a red cross over the symbol or tape. Some miscompare annunciators are shown in white on a red box and some are shown in black on an amber box. The NO TAKEOFF and ATT FAIL annunciators are shown in the same location on the ADI. For annunciator detail refer to:

- Fig. 7-27-4, Typical APEX ADI HSI Display - HSI Rose
- Fig. 7-27-5, Typical APEX ADI HSI Display - HSI Arc
- Fig. 7-27-6, Typical APEX ADI HSI Display - Failed Indications
- Fig. 7-27-7, Typical APEX ADI HSI Display - All Failures
- Fig. 7-27-8, Typical APEX ADI HSI Display - Miscompare Annunciations.

The following displays can be overlaid on the HSI in the partial compass (ARC) mode:

- Traffic
- Weather Radar
- Lightning (optional)
- Terrain from EGPWS (optional).

The PFD controller contains the controls for ADI/HSI:

BARO	Rotary click knob for the setting of the current barometric pressure value for display on the PFD altitude window for the selected ADAHRS channel. Clockwise rotation increments and counter clockwise decrements the barometric correction value
PUSH STD	Push button to set the current barometric pressure value to standard pressure
NAV SEL	Push button to cycle through the navigation sources shown on the HSI display
NAV PRE-VIEW	Push button to activate and cycle through available navigation sensors when FMS is the active sensor
O (circle)	Push button to cycle through the No. 1 sources of navigation bearing to be displayed on HSI as a circle pointer (single pointer)
◊ (diamond)	Push button to cycle through the No. 2 sources of navigation bearing to be displayed on HSI as a diamond pointer (double pointer)
HSI	Push button to alternate HSI display between compass and arc formats
ET	Push button to activate and control an elapsed timer displayed on PFD
CRS/RNG	Dual rotary click knob, inner for control of the desired VOR/LOC course to be flown and the selected navigation sensor shown on the HSI. Outer for control of the range display on the HSI
PUSH SYNC	Push button to cause a synchronization of the selected course to the current VOR bearing, if a VOR is the selected navigation sensor

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Refer to the Pilot’s Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for complete information on the description and operation of the PFD.

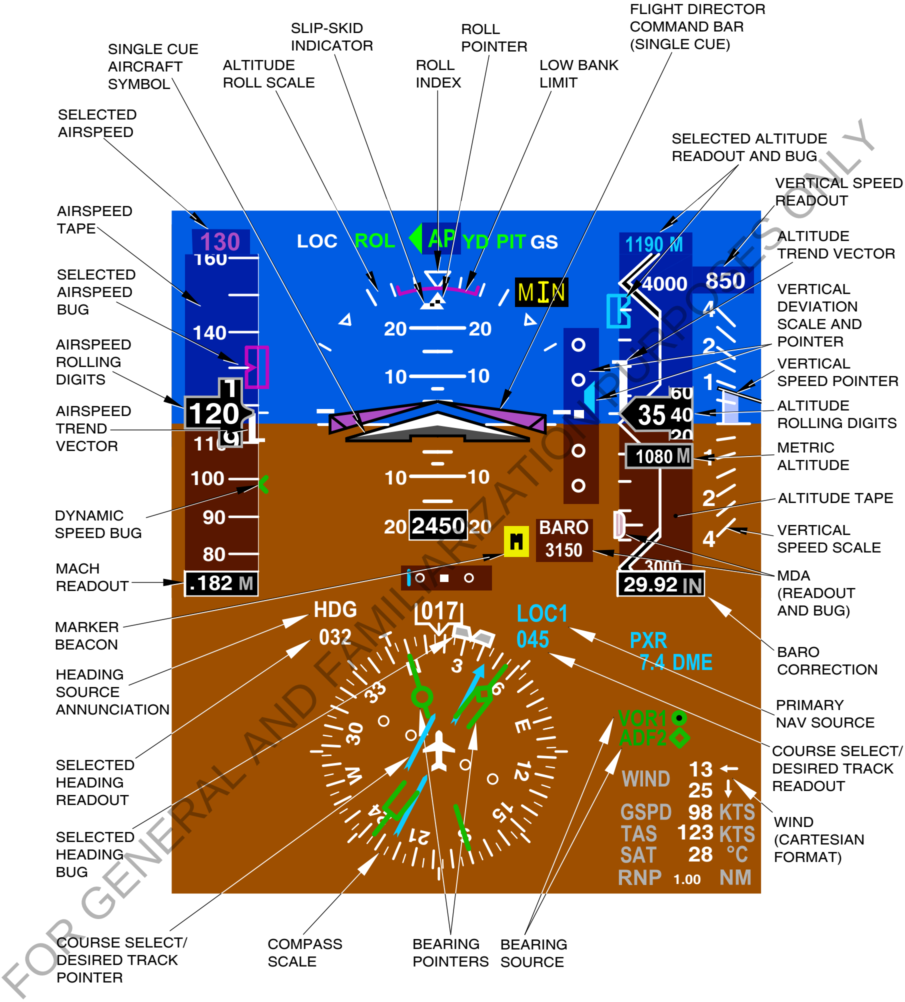

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Figure 7-27-4: Typical APEX ADI HSI Display - HSI Rose

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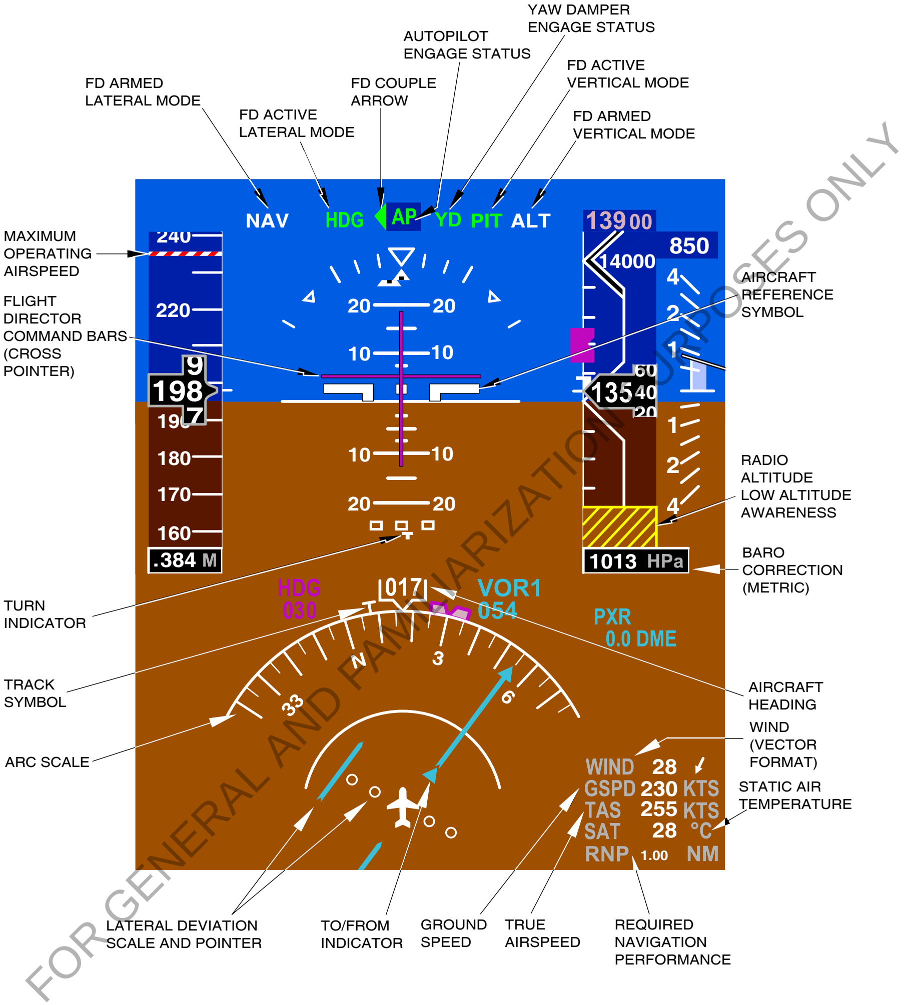

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Figure 7-27-5: Typical APEX ADI HSI Display - HSI Arc

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Figure 7-27-6: Typical APEX ADI HSI Display - Failed Indications

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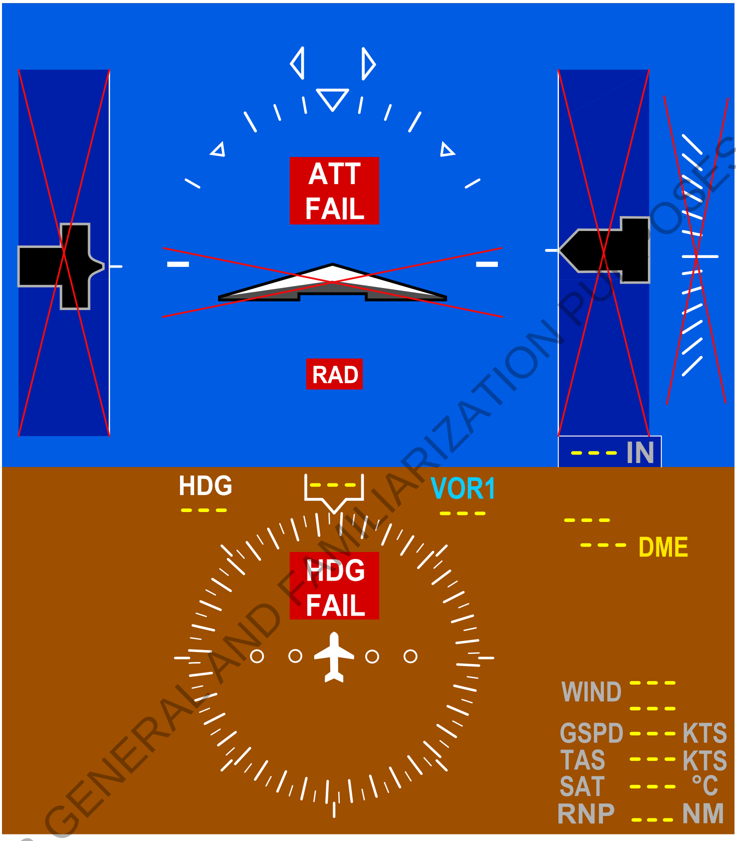

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Figure 7-27-7: Typical APEX ADI HSI Display - All Failures

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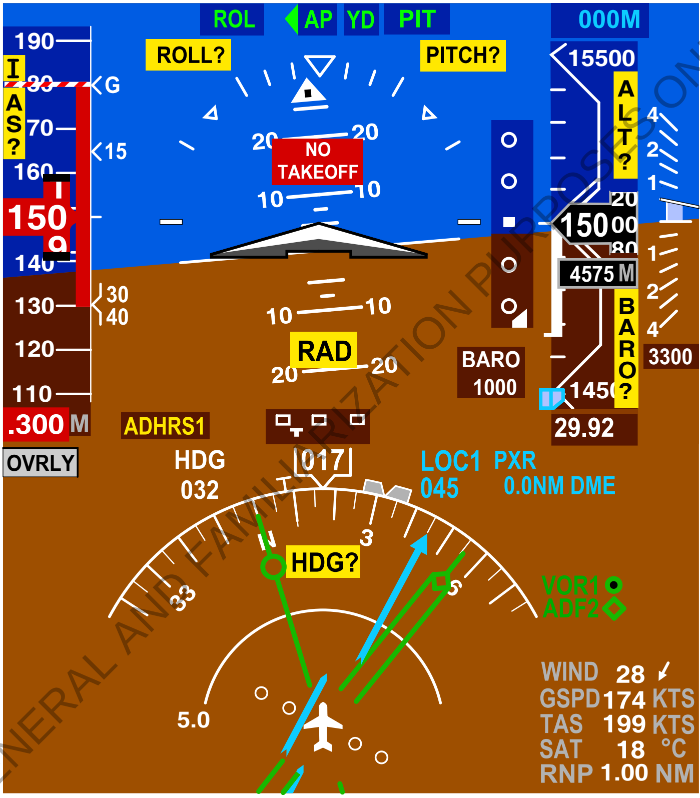

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Figure 7-27-8: Typical APEX ADI HSI Display - Miscompare Annunciations

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7-27-7 Situation Awareness Multifunction Display

The upper MFD default display is used for situation awareness formats with various other system displays in dedicated windows. The bezel buttons on the sides of the MFD are used to select formats and control various systems. Refer to the Flight Management System section and the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for complete information on the description and operation of the MFD.

7-27-8 Systems Multifunction Display

Refer to Fig. 7-27-9, Systems Multi Function Display.

The lower MFD default display is used for the aircraft systems displays and control and for the display of CAS messages. The MFD display is divided into six windows with the two center windows further sub divided. Refer to the relevant aircraft system section for further information on the content of systems MFD windows, apart from the lower left window which displays the following menus:

CKLST	If no valid database is installed, the window will display (optional) Checklist Unavailable. If installed, displays an electronic Normal Procedures Checklist as a menu line item
SENSORS	Sensor Type selections provide a hierarchical view of the navigation status to the pilot. The highest levels contain summary information and the lower levels contain more sensor specific details. The pull down menu contains selection of the Performance, FMS and GPS pages
WX/LX/TAWS	The Weather, Lightning and Terrain set up pages can be accessed from their individual tabs
AVIONICS	The avionics window gives the capability to configure the following display options on the ADI and HSI from the PFD tab: – Barometric correction imperial or metric – Metric altitude enable or disenable – Wind format X-Y or vector – Heading display magnetic or true – Baro synchronization enable or disable.
DATALINK	The datalink window gives the flight crew access to text based communications using a datalink network: – Datalink ● Airline Operational Control (AOC) ● Air Traffic Services (ATS) – Protected Mode Controller Pilot Datalink Communications (PM-CPDLC) (optional).

The following display option is controlled from the FCS tab:

Flight Director command cue s-cue or cross pointer

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The Custom DB tab is used for managing the FMS custom database:

SCMS/DL	Only available on the ground. The Configuration Management Systems page displays configuration information for all installed software/databases and is used for return to service type operations.

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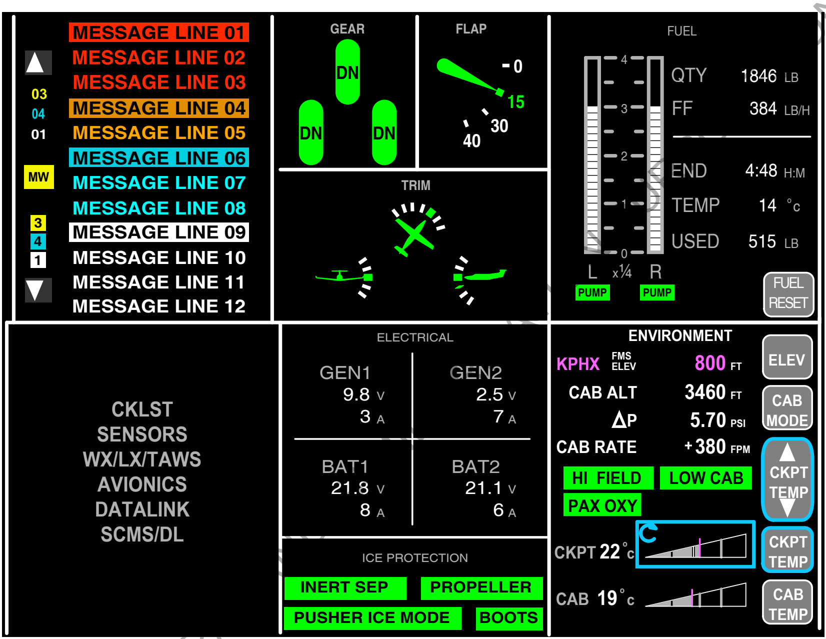

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Figure 7-27-9: Systems Multi Function Display

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7-27-9 Indication / Warning

The Crew Alerting System (CAS) window on the systems MFD will show the following Caution and Advisory messages for the APEX core system status (refer to Table 7-27-3):

Table 7-27-3: Primus APEX - CAS Messages

CAS Message	Description
MAU A Fail MAU B Fail	Indicates Channel A or B of Modular Avionics Unit is failed
Check DU 1 Check DU 2 Check DU 3 Check DU 4 Check DU 1+2 Check DU 1+3 Check DU 1+4 Check DU 2+3 Check DU 2+4 Check DU 3+4 Check DU 1+2+3 Check DU 1+2+4 Check DU 1+3+4 Check DU 2+3+4 Check DU 1+2+3+4	Indicates that there is a problem with either a Display Unit, the fiber channel between the AGM and Display Unit or a Display Unit connector
DU 1 Overheat DU 2 Overheat DU 3 Overheat DU 4 Overheat DU 1+2 Overheat DU 1+3 Overheat DU 1+4 Overheat DU 2+3 Overheat DU 2+4 Overheat DU 3+4 Overheat DU 1+2+3 Overheat DU 1+2+4 Overheat DU 1+3+4 Overheat DU 2+3+4 Overheat DU 1+2+3+4 Overheat	Indicates one or two or three or four (if installed) Display Units have overheated
Check Pilot PFD Check Copilot PFD Check Engine Display	Indicates pilots PFD wrap monitor failed Indicates copilots PFD wrap monitor failed Indicates pilot and copilot engine displays wrap monitor failed
LH PFD CTLR Fail RH PFD CTLR Fail LH+RH PFD CTLR Fail	Indicates Pilot's PFD Controller has failed (on ground only) Indicates Copilot's PFD Controller has failed (on ground only) Indicates Pilot's and Copilot's PFD Controllers have failed (on ground only)
ASCB Fail	Indicates Avionics Standard Data Bus has failed
APM 1 Fail APM 2 Fail APM 1+2 Fail	Indicates No.1, No. 2 or both Aircraft Personality Modules have failed (on ground only)

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Table 7-27-3: Primus APEX - CAS Messages (continued from previous page)

CAS Message	Description
CMS 1+2 Fail	Indicates No.1 and No. 2 Configuration Management System has failed (on ground only)
System Config Fail	Indicates System Configuration Monitor detects a HW or SW configuration error (on ground only)
Validate Config	Indicates System Configuration Monitor detects a system part number change (on ground only)
APM Miscompare	Indicates Aircraft Personality Modules disagree over installed systems configuration (on ground only)
AIOP A Module Fail AIOP B Module Fail	Indicates Actuator I/O Module Ch A or B has failed in the Modular Avionics Unit
CSIO A Fail CSIO B Fail CSIO A+B Fail	Indicates Custom I/O Module Ch A or B has failed in the Modular Avionics Unit
MAU A Overheat MAU B Overheat MAU A+B Overheat	Indicates Modular Avionics Unit Channel A or B or both channels have overheated
MAU Fan Fail	Indicates a Modular Avionics Unit cooling fan has failed
GIO A Fail GIO B Fail GIO A+B Fail	Indicates Generic I/O Module Ch A or B or both have failed in the Modular Avionics Unit
AGM 1 fail AGM 2 fail	Indicates Advanced Graphics Module Ch A or B has failed in the Modular Avionics Unit
TSC Fail	Indicates Touch Screen Controller has failed
TSC Fan Fail	Indicates Touch Screen Controller fan has failed
LH PFD CTLR Fail RH PFD CTLR Fail LH+RH PFD CTLR Fail	Indicates Pilot's PFD Controller has failed Indicates Copilot's PFD Controller has failed Indicates Pilot's and Copilot's PFD Controllers have failed
CMS 1 Fail CMS 2 Fail	Indicates Configuration Management System 1 or 2 has failed Indicates Configuration Management System 2 has failed

7-28 Primus APEX - Attitude and Heading

7-28-1 General

Refer to Fig. 7-28-2, Attitude and Heading - Polar Regions.

The Attitude and Heading system comprises:

- Air Data and Attitude Heading Reference System (ADAHRS)
- Electronic Standby Instrument system (ESIS).

7-28-2 Air Data and Attitude Heading Reference System (ADAHRS)

7-28-2.1 General

The aircraft is equipped with one dual channel ADAHRS. Each channel has a separate power supply, Channel A from the Essential Bus and Channel B from the Main Bus. The system provides primary attitude, heading and air data parameters from each channel to the Modular Avionics Unit (MAU). This ensures that a single component failure will not affect both channels.

7-28-2.2 Description

Each channel of the ADAHRS contains a solid-state Microelectromechanical Systems (MEMS) technology sensor block, which contains three rate sensors and three accelerometers in an orthogonal triad configuration. The triad in Channel B is skewed relative to Channel A. Each channel has an interface for an Outside Air Temperature (OAT) probe, a magnetometer and two isolated absolute pressure sensors (one for pitot and one for static pressure). Channel A receives inputs from the No. 1 pitot/static, magnetometer and temperature probe. Channel B receives inputs from the No. 2 pitot/static, magnetometer and temperature probe. Each channel also has a Central Processing Unit (CPU). The ADAHRS is installed under the cabin floor between frames 25 and 26.

During normal operation the pilots Primary Flight Display (PFD) receives ADAHRS source data from the No. 1 pitot/static system (left side sensors) and ADAHRS Channel A. The copilot PFD (when installed) receives ADAHRS source data from the No. 2 pitot/static system (right side sensors) and ADAHRS Channel B. The controllers for the pilot and copilot PFD have an ADHRS button, which can be used to change the PFD ADAHRS source channel. ADAHRS source annunciations will be shown in amber in the lower left region of PFD Attitude Director Indicator (ADI) window when the same source has been selected on both pilot and copilot PFDs.

The ADAHRS also receives data from the Global Positioning Systems (GPS) sensor, in the single GPS installation the data signal is connected to both ADAHRS channels. In an optional dual GPS installation, the GPS 1 data signal is connected to the ADAHRS channel A and the GPS 2 data signal is connected to the ADAHRS channel B.

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7-28-2.3 Operation

Each ADAHRS channel CPU receives air data, temperature and heading information from that channel's sensor block and passes it to the other channel. Both CPU's compare the data to verify sensor integrity. Verified AHRS and air data information is sent to each channel of the MAU for the APEX system.

If the data from a sensor does not pass the verification check the data is discarded and not used. A fault signal will be sent to the MAU and a caution will be shown on the Crew Alerting system (CAS). In this case the ADHRS button on the PFD Controller for the failed side can be pressed to change the ADAHRS source channel to the opposite side.

7-28-2.4 High And Low Latitude Operations

The ADAHRS automatically provides calculated magnetic track, when the measured horizontal magnetic field strength is less than 60 mGauss but still within the coverage of the Magnetic Variation look up table of the Flight Management System (FMS), and true track when operating outside this coverage. When true track is displayed, the airplane symbol on the INAV and Charts display is removed. When flying from true track zone into magnetic track zone, magnetic mode needs to be manually selected on the Avionics window. The Weather Radar, Stormscope and TCAS data is always shown relative to the aircraft's nose and is therefore not corrected for Drift Angle in Track Mode.

The coverage of the Magnetic Variation look up table can be seen in the Fig. 7-28-2, Attitude and Heading - Polar Regions. If desired, the crew can also manually select a true North reference before the automatic switch from mag to track occurs. As soon as the measured horizontal magnetic field strength is more than 75 mGauss, the system automatically switches back to the MAG HDG. This hysteresis can be seen in Fig. 7-28-1, Hysteresis Figure of the Magnetic Variation below.

Note
Magnetic Heading is not reliable in regions where the magnetic inclination (dip angle) exceeds 80° due to environmental variations.

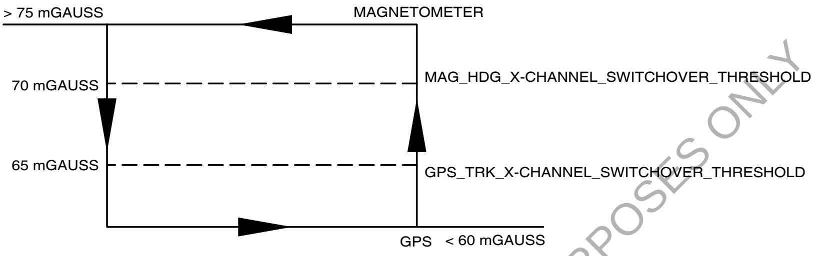

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Figure 7-28-1: Hysteresis Figure of the Magnetic Variation

7-28-2.5 Horizontal Magnetic Field Strength

On the ground in geographical latitudes where the measured horizontal magnetic field strength is less than 60 mGauss and the aircraft ground speed is less than 9 kts neither heading from the ADAHRS, nor track from the GPS is provided. Therefore heading flags (HDG FAIL) are shown on the Horizontal Situation Indicator (HSI) and (HDG) on the Interactive Navigation (INAV). During the initial takeoff roll track output is provided and the heading flags are removed.

With the optional HDG/TRK Override switch installed (Refer to Fig. 7-19-1), the pilot can manually force the system into a magnetic HDG or GPS-TRK mode, independent from the implemented automatic switching.

7-28-2.6 Optional HDG/TRK Override Switch

An optional HDG/TRK Override switch can be installed on the right side of the pilot's lower left panel. It is a three position rocker type switch with the positions GPS TRK / AUTO / MAG HDG. The switch gives the pilot the ability to select either GPS Track or Magnetic Heading as directional indication on the HSI, independent of the implemented automatic switching.

With the switch in AUTO (normal position) the measured magnetic HDG is shown on the HSI as long as the measured horizontal magnetic field strength is at least 60 mGauss. If the measured horizontal magnetic field strength becomes less than 60 mGauss the system automatically switches to track reversion mode and GPS-TRK will be indicated on the HSI. In this case the pilot should manually switch to TRK on the Automatic Flight Control System (AFCS) panel. The system automatically switches back to the MAG HDG as soon as the measured horizontal magnetic field strength is more than 75 mGauss (hysteresis).

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If the HDG/TRK Override switch is in the GPS TRK position, the system is forced to indicate GPS-Track on the HSI. In this case two different readings are possible on the HSI either magnetic track or true track. If the magnetic variation look up table of the FMS is valid the HSI reading will be magnetic track (MAG TRK) and a CAS **HSI is MAG TRK** message will be shown. If the magnetic variation look up table is not valid the HSI reading will be true track (TRU TRK) and a CAS **HSI is TRU TRK** message will be shown.

If the HDG/TRK Override switch is in the MAG HDG position, the system is forced to indicate magnetic heading on the HSI. With a measured horizontal magnetic field strength of less than 60 mGauss this may lead to HDG comparator flags and the magnetic heading on the HSI may show inaccurate or unstable readings.

Refer to Pilatus Pilot Guide Document No. 02336 for more information on the operation of the HDG/TRK override switch. The guide can be found at: www.pilatus-aircraft.com -> Menu -> Customer Support -> MyPilatus Customer Portal.

7-28-2.7 Indication/Warning

The CAS window of the systems Multi Function Display (MFD) displays the following Cautions and Advisory messages for the ADAHRS status (refer to Table 7-28-1):

Table 7-28-1: ADAHRS - CAS Messages

CAS Message	Description
ADC A fail **ADC B Fail** **ADC A+B Fail**	Loss of altitude and airspeed data from ADAHRS Channel A Loss of altitude and airspeed data from ADAHRS Channel B Loss of altitude and airspeed data from ADAHRS Channel A and B
AHRS A Fail **AHRS B Fail** **AHRS A+B Fail**	Loss of attitude and heading data from ADAHRS Channel A Loss of attitude and heading data from ADAHRS Channel B Loss of attitude and heading data from ADAHRS Channel A and B
HSI 1 is MAG TRK **HSI 1 is TRU TRK** **HSI 2 is MAG TRK** **HSI 2 is TRU TRK** **HSI 1 + 2 is MAG TRK** **HSI 1 + 2 is TRU TRK**	HSI 1 is referenced to a magnetic track HSI 1 is referenced to a true track HSI 2 is referenced to a magnetic track HSI 2 is referenced to a true track HSI 1 and 2 is referenced to a magnetic track HSI 1 and 2 is referenced to a true track
LH OAT Fail	Loss of total and static air temperature from ADAHRS Channel A
RH OAT Fail	Loss of total and static air temperature from ADAHRS Channel B
LH+RH OAT Fail	Loss of total and static air temperature from ADAHRS Channel A and B

Refer to the Pitot Static Systems, Section 7-20, Pitot Static Systems, for the pitot and static systems cautions.

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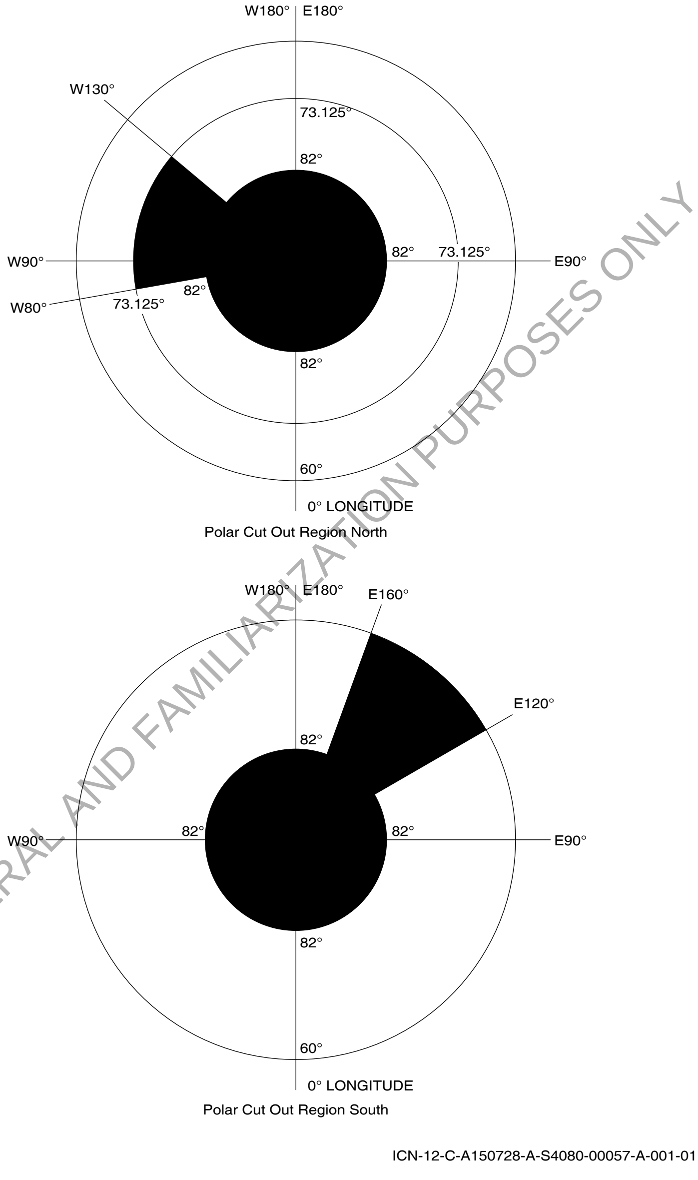

Figure 7-28-2: Attitude and Heading - Polar Regions

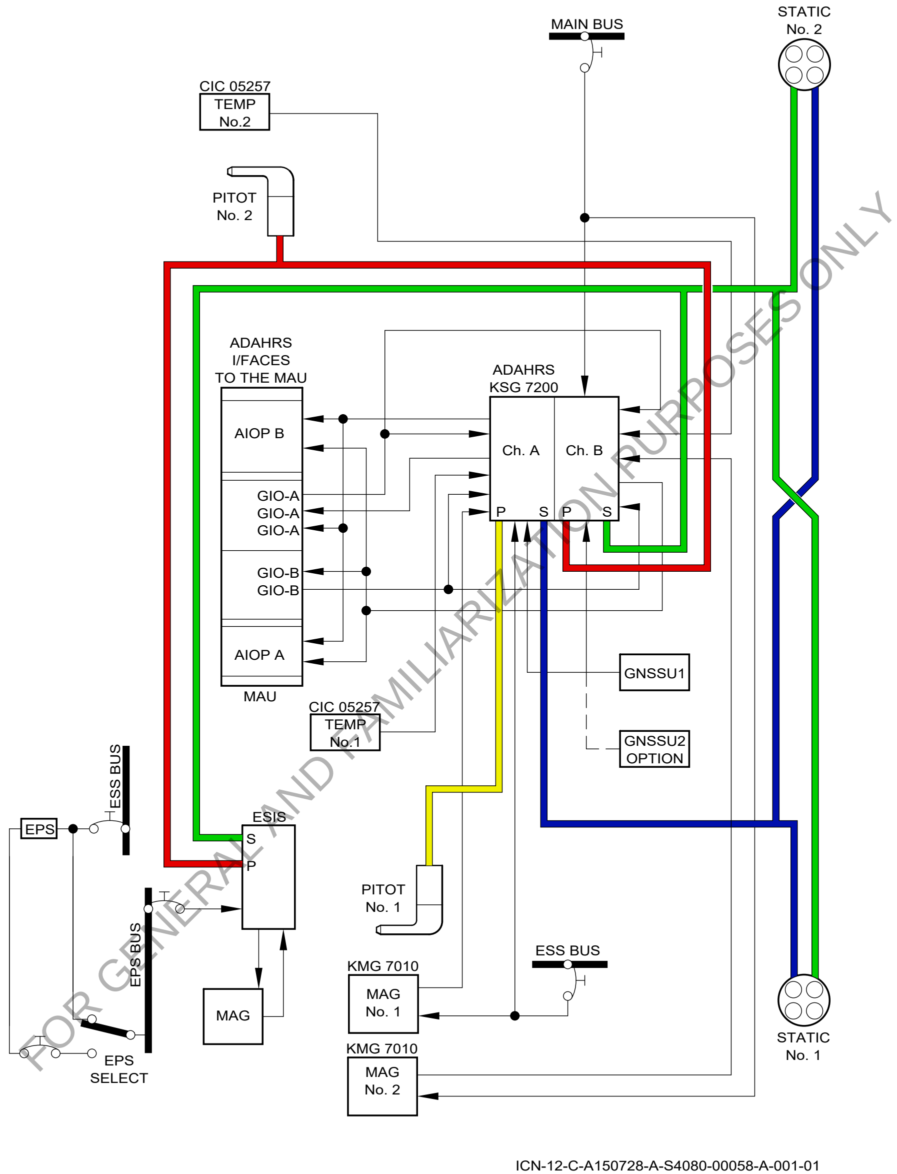

Figure 7-28-3: Attitude and Heading – Schematic

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7-28-3 Electronic Standby Instrument System (ESIS)

Refer to Fig. 7-28-3, Attitude and Heading, for system schematic

Refer to Fig. 7-28-4, ESIS - Typical Operational Display

Fig. 7-28-5, ESIS - Typical Splash Screen Display

Fig. 7-28-6, ESIS - Typical ATT Aligning Display

Fig. 7-28-7, ESIS - Typical Failure Flags

7-28-3.1 General

The ESIS provides displays for attitude, altitude and airspeed in case of primary display failure. It is also a Standby Magnetic Direction Indicator that gives an alternate source for magnetic heading. The ESIS is independent of the Primus APEX system and is installed on the left instrument panel.

The ESIS contains electronic inertial and pressure sensors and electronic processors which calculate and display attitude, skid/slip, altitude, airspeed, and VMO.

Electrical power is supplied from the Emergency Power Supply (EPS) busbar. Static and pitot pressure inputs to the ESIS come from the right hand No. 2 pitot/static system. The heading display is from a separate magnetometer installed in the right wing.

7-28-3.2 Description

The ESIS internal inertial sensors compute and display the attitude (pitch and roll), skid/slip and altitude on an active LCD matrix color display screen.

Internal pressure sensors measure the total and static pressure to compute and display altitude, indicated airspeed corrected for Static Source Error Correction (SSEC) and VMO. The ESIS also displays magnetic heading from a separate magnetometer.

If a failure is detected by the ESIS in its system, the display of the corresponding data is removed from the screen and it is replaced by either a failure message (“Attitude Fail”) or by a red cross.

The ESIS has a rotating push-button knob and a single bezel key marked MENU which is used to access the in-flight menu. When the in-flight menu is active, the menu items are selected and adjusted by rotating and pressing the knob.

An ambient light sensor is provided on the ESIS bezel. The ambient light sensor is used by the ESIS to automatically control the display brightness based on the intensity of the ambient light and the brightness offset value selected by the pilot within the in-flight menu.

The ESIS in-flight menu has the following selectable items:

- Set BRT Trim
- BARO Units
- Metric Altitude
- Attitude Alignment
- System Status.

Display brightness

The display brightness is controlled by selecting the Set BRT Trim item within the in-flight menu. Use the rotating knob to increase or decrease the brightness offset value.

Barometric pressure units

The units for barometric pressure can be changed using the BARO Units item within the in-flight menu. Barometric pressure can be displayed in Millibars, Hectopascals or Inches of Mercury based on the unit selected.

When the in-flight menu is not active, the rotating knob is used to increase or decrease the barometric pressure. Pressing the rotating knob sets the barometric pressure to STD.

Metric altitude

The metric altitude display can be set to ON or OFF by selecting the Metric Altitude item within the in-flight menu.

Attitude alignment

Attitude alignment can be manually activated by selecting the Attitude Alignment item within the in-flight menu and then pressing the rotating knob to confirm.

Note
Manual attitude alignment is performed when an attitude discrepancy (more than 4°) between the ESIS and PFD is detected by the pilot. The attitude alignment function can only be used in straight and level flight.

The alignment of attitude may take up to 3 minutes to complete depending on the motion of the aircraft. The attitude message and progress bar remain showing on the screen until the unit is properly aligned. During alignment, the magnetic heading indication is removed from the screen.

System status

The system status item within the in-flight menu displays the aircraft effectivity applicable to the currently installed aircraft configuration file.

Ground/flight switching

The ESIS uses airspeed data to switch between ground/flight conditions automatically.

Magnetic heading

Magnetic heading information must not be used in the following regions due to unsuitable magnetic fields (a red HDG failure flag will be displayed):

- North of 70° N latitude
- South of 70° S latitude
- North of 65° N latitude between 75° W and 115° W longitude (northern Canada)
- North of 62° N latitude between 87.5° W and 100° W longitude (northern Canada)
- North of 65° N latitude between 75° E and 120° E longitude (northern Russia)
- South of 55° S latitude between 120° and 165° E longitude (south of Australia and New Zealand).

The magnetic heading will fail (a red HDG failure flag will be displayed) if the calculated magnetic dip angle exceeds 82° and may fail in regions where the magnetic dip angle exceeds 80° due to environmental variations.

7-28-3.3 Operation

Power off

The ESIS is not operational and the display is blank.

Power on

The ESIS checks for software, hardware and DCM-750 compatibility during start-up. If no errors are detected, the unit starts initialization and obtains the aircraft configuration and installation settings from the configuration module. Errors detected at this time are shown as an error message on the splash screen (refer to Fig. 7-28-5).

After the self-check and initialization are completed, the ESIS splash screen is displayed and shows the system identification information for approximately 5 seconds including: company name, system name and software and firmware version. After the spash screen is removed, the ESIS enters normal mode and begins automatic alignment.

During alignment an ATT ALIGNING message is displayed above the aircraft reference symbol. A progress bar is located below the aircraft reference symbol until the unit is properly aligned. During alignment the magnetic heading is invalid (refer to Fig. 7-28-6). The alignment of attitude may require up to 3 minutes to complete depending on motion of the aircraft. When under extreme cold temperatures, the alignment procedure may take longer, up to 8 minutes. The alignment procedure must be performed when the aircraft is either stationary on ground, or while maintaining a straight and level flight. To maintain control of the aircraft during alignment, the ESIS provides basic attitude performance similar to attitude degraded mode until alignment is complete

When alignment is complete, the ESIS display shows pitch, roll, heading and slip-skid information. If alignment is not satisfactory, the display will show a red ATT FAIL flag.

7-28-3.4 Indication / Warning

The ESIS monitors the system status and will display a red failure flag if an invalidity is identified. The failure flags that can be displayed are (refer to Fig. 7-28-7):

- ALT
- ATT FAIL
- IAS
- HDG
- ADEC.

When displayed, a failure flag will first flash on/off for 5 seconds and then remain on. The failure flag is removed when the invalidity condition is resolved.

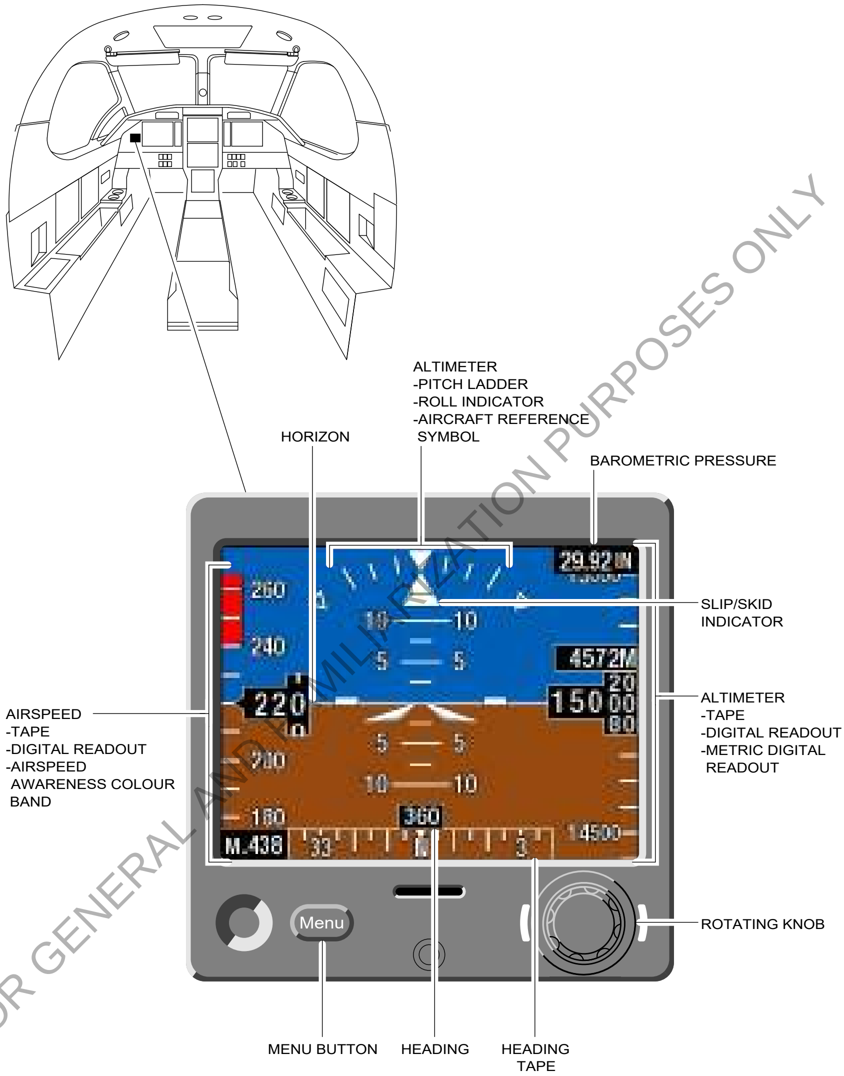

Figure 7-28-4: ESIS - Typical Operational Display

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Figure 7-28-5: ESIS - Typical Splash Screen Display

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Figure 7-28-6: ESIS - Typical ATT Aligning Display

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Figure 7-28-7: ESIS - Typical Failure Flags

7-28-4 Standby Magnetic Compass (If Installed)

A standby magnetic compass (E2B) is installed on the center post between the windshields. The compass is a self-contained unit that shows aircraft magnetic heading.

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7-29 Primus APEX - Communication and Navigation

7-29-1 General

Refer to Fig. 7-29-1, APEX Communication and Navigation - Schematic.

The communication and navigation part of the Primus APEX comprises:

- Two Honeywell KTR 2280A Multi Mode Digital Radio (MMDR) integrated transceivers
- KMA 29 or KMA 29A Audio Control Panel
- KN-63 Distance Measuring Equipment
- KXP 2290 Transponder
- Global Positioning System.

7-29-2 Multimode Digital Radio Transceiver (MMDR)

Multi Mode Digital Radio (MMDR) integrated transceivers are installed behind the pilots Primary Flight Display (PFD) and upper Multi Function Display (MFD). Power supplies to the MMDR's are from the Avionic 1 bus for MMDR No. 1 and from the Main bus for MMDR No. 2. The No. 2 MMDR also has a power supply from the Standby bus to permit radio communication without the avionic systems being powered up. The COM 2 system utilizes the upper antenna primarily for ground communications and the COM 1 system utilizes the lower antenna for airborne communications.

The MMDR is a combined VHF communications and navigation transceiver and forms part of the APEX system. The MMDR receives inputs in ARINC 429 format and outputs in ARINC 429 and analogue formats. The navigation section of the MMDR contains VOR, LOC and GS functions. The VHF communications section contains four receivers available for COM and ADF functions and one transmitter. Primary controls for the MMDR are on the Touch Screen Controller (TSC) and the PFD Control Panel, with display of the selected information on the PFD. An EMERG COM 1 transfer to 121.5 MHz switch is installed on the cockpit rear left switch panel. A transfer switch is installed on the PCL and is used to interchange the active and standby frequencies that are set on the COM 1 display.

The optional ADF function will tune frequencies from 200 to 1799 kHz and 2180 to 2189 kHz. If no ADF equipment is installed it is still possible to select the ADF bearing pointers. The ADF pointer label will be displayed but no bearing pointers will be shown.

The KTR 2280A MMDR provides a morse code decoding capability which automatically decodes the morse code identifier of a (VOR, LOC) station. If available, the morse code identifier is shown to the left of the morse code annunciatior (ID).

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7-29-3 Radio Tuning Windows

The radio tuning window is on the bottom right of the pilots PFD and bottom left of the copilots PFD (when installed). Each radio tuning window is divided into subwindows which show the installed receivers in the following format COM1, COM2, NAV1, NAV2, optional ADF and XPDR. To make selections the radio sub-window must be activated by pressing the adjacent bezel button. If the DETAIL button on the PFD Controller is pressed a detail window will be shown and the different equipment modes can be selected by pressing the associated soft key for more than one second.

STUCK MIC is displayed in amber between the squelch inhibit and Transmit/Receive annunciator if a transmit button is pushed for 32 seconds or more. When the STUCK MIC annunciator shows, the selected radio stops transmitting immediately.

When it is necessary to make a radio transmission for more than 32 seconds, momentarily release the transmit button. This resets the stuck microphone protection timer, after which another 32 seconds of transmission are available.

7-29-4 Controls And Displays

Refer to Fig. 7-29-1, APEX Communication and Navigation - Schematic

Table 7-29-1: Primus APEX - Communication and Navigation - Controls

Button / Switch	Description
PFD bezel:	
PFD bezel buttons	See Section 7-27, Primus APEX
Control Panel PFD, Radio Segment:	
IDENT pushbutton	Activates XPDR identification response mode, independent of cursor position
VFR pushbutton	Alternates between active transponder code and configured VFR code, independent of cursor position
DETAIL pushbutton	Activates a secondary radio window/page to allow option or mode selections for the related radio system. Push the button again to revert to the selected radio tuning page
VOL rotary control	Adjusts the radio volume level (COM, NAV, ADF if installed)
SEL rotary control	Dual rotary controls to tune radio frequency and transponder codes
PUSH FREQ SWAP	Toggles the active frequency to the standby (preset) frequency and vice versa
PUSH SQUELCH / ID	Squelch inhibit when the cursor is focused on a COM radio, Morse code filter when the cursor is focused on a NAV radio
Touch Screen Controller, radio controls:	
COM QA button	Shows the COM quick access dialog on the TSC screen which is used to tune the COM radio frequencies. The selected radio and frequency are shown on the top line. COM1 is selected by default.
NAV QA button	Shows the NAV quick access dialog on the TSC screen which is used to tune the NAV and ADF radio frequencies. The selected navigation source and frequency are shown on the top line. NAV1 is selected by default.

Table 7-29-1: Primus APEX - Communication and Navigation - Controls (continued from previous page)

Button / Switch	Description
XPDR QA button	Shows the XPDR quick access dialog on the TSC screen which is used to set the transponder code. The current transponder code is shown on the top line.
SWAP/CLOSE (COM and NAV dialog)	Swaps the active and standby (preset) VHF NAV or VHF COM frequencies for the radio
Additional radio controls:	
COM 1 NORM/EMERG Switch	A COM 1 NORM/EMERG switch on the left hand side panel allows the pilot to set COM1 to either: NORM: Normal radio tuning controls are enabled EMERG: VHF COM 1 active frequency is set to 121.50 MHz. The previous active frequency is moved to the standby frequency window
Frequency Transfer Switch (FTS)	A Frequency Transfer switch on the Power Control Lever allows the pilot to transfer COM 1 between the active frequency and the standby frequency

7-29-4.1 VHF Communication Control and Display

Refer to Fig. 7-29-3, VHF Com Display and Detail Page

Table 7-29-2: Primus APEX - VHF Communication - Control and Display

Field	Description
Active Frequency	Shows the frequency currently in use
Standby Frequency	Shows the frequency currently on standby
Transmit Receive annunciator	Shows transmit or receive mode
Squelch Inhibit annunciator	Shows that squelch has been deselected
Volume Control Scale	Shows the range of available volume adjustment
Volume Control Indication	Shows the current volume setting against the volume scale

7-29-4.2 VHF Navigation Control and Display

Refer to Fig. 7-29-4, VHF Nav Display and Detail Page

Table 7-29-3: Primus APEX - VHF Navigation - Control and Display

Field	Description
Active Frequency	Shows the frequency currently in use
Preset Frequency	Shows the frequency currently on standby
VOR Bearing	Shows the bearing of the selected beacon
Morse ID Annunciator	Shows the navigation identification filter is OFF
DME association	Shows DME Hold is selected
Volume Control scale	Shows the range of available volume adjustment

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7-29-4.3 ADF Control and Display (if installed)

Refer to Fig. 7-29-5, ADF (if installed) Display and Detail Page

Table 7-29-4: Primus APEX - ADF Control and Display

Field	Description
ADF Frequency	Shows the frequency of the selected station (shows amber dashes when the frequency is missing)
ADF Mode	Shows the selected mode (will not be shown if the mode data is missing or invalid)

7-29-4.4 Transponder (XPDR) Control and Display

Refer to Fig. 7-29-2, Transponder Display and Detail Page

Table 7-29-5: Primus APEX - XPDR Control and Display

Field	Description
ATC Code	Shows the transponder code that is set (shows amber dashes if the code is missing or invalid)
Aircraft flight level	Shows the aircraft flight level rounded to the nearest 100 feet (replaced by amber dashes when the ATC code is missing)
Air/Ground Mode	Shows GND when the aircraft status is on the ground
ATC selectable mode	Shows the selected XPDR mode (STBY, ON or ALT)
ATC active mode	Shows the XPDR mode that is in use (not displayed when the ATC code data is missing or invalid)
Ident annunciator	Shows IDT when identification is activated
Reply annunciator	Shows a reply from the XPDR to interrogation

7-29-5 Audio Control Panel

The KMA 29 or KMA 29A (optional) audio control panel provides audio system control for the crew and passengers. The panel also provides an interface to the Passenger Address (PA) system and aural warning system as well as a marker beacon receiver. The optional KMA 29A also includes a Bluetooth® transceiver.

The audio control panel is used to make audio selections for all audio communications to and from the crew. The audio control panel receives inputs from all audio communication channels and aural warnings. Audio outputs from the panel are to the flight compartment speaker and crew headsets. The audio outputs to the crew headsets are in stereo. There is a PTT switch on each control wheel left yoke and on the hand microphones.

The audio control panel is installed above the pilots PFD and an optional second audio control panel can be installed above the copilots PFD. Momentary pushbuttons are used to select one of the COM transceivers for the pilot and copilot position, which allows radio transmission. Pressing a button turns on the associated receiver and the green LED. The pilot can identify which receivers are selected by noting which LEDs are on. In the Split Mode, the pilot has the ability to transmit on one COM, while the copilot can transmit on another COM. In the Split Mode, the pilot has the ability to transmit on one COM, while the copilot can transmit on another COM. A fail-safe mode connects the pilot headphone and microphone to COM 1 if there is a power failure or the power switch is set to the EMG/OFF position (for the correct operation of headsets capable of stereo operation, the headset must be set to stereo mode). For the intercom system there is a push button mode switch and a small volume control knob for crew intercom volume and a large knob for the passenger intercom volume. The AUX button selects the entertainment audio.

Marker beacon receiver

A marker beacon receiver provides the necessary marker beacon signals to the PFD and audio indications for an Instrument Landing System (ILS). The MKR push button, when selected, allows the pilot to cycle the marker beacon audio between ON (high sensitivity), ON (low sensitivity), OFF, ON (high sensitivity), and so on. The marker beacon audio can be muted by pressing the MKR MUTE/TEST button. The pilots audio panel is connected to the marker beacon receiver and the copilots audio panel (if installed) receives marker beacon information via the pilots audio panel. The marker beacon can be tested by pressing and holding the MKR MUTE/TEST button. For the KMA 29, press and hold on either panel for 1 second. For the KMA 29A, press and hold on the pilots panel for five seconds.

Radio playback (KMA 29A)

The audio control panel automatically records and stores the last incoming audio from the radio that is selected for transmission (max 8 recordings). The PLY button when selected plays the latest recorded radio audio. The BCK button when selected allows the pilot to cycle through the recorded radio audio in reverse order (latest recording first).

Bluetooth® transceiver (KMA 29A)

A Bluetooth® transceiver provides the necessary Bluetooth® connectivity. Each audio control panel is capable of pairing one other Bluetooth® capable device (for example: cellphone or tablet). The Bluetooth® transceiver is capable of providing cellular phone operation and music streaming. When the Bluetooth® function is activated (press and hold the BT/Mute button for 5 seconds), the audio control panels are always discoverable, except for when a device is already paired to it. Once Bluetooth® is activated, the audio control panels will appear as “Pilot KMA29A” and “Copilot KMA29A” on the user’s personal device. Pairing requires an access code at the first attempt to pair the personal device to the ACP. Subsequent pairings are accomplished without the use of an access code.

Note

A security code option is available and can be installed with the Maintenance Mode if required.

The TEL button when selected activates the telephone mode and allows the user to answer a phone call received on the paired cellphone.

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The BT/MUTE button when selected allows the user to cycle through various audio source muting options. The BT/MUTE button cycles through four mute modes (Bluetooth® suppressed, No Mute, Radio and Mute All):

− Bluetooth® suppressed

  In Bluetooth® suppressed mode all audio received via the Bluetooth® connection is set to OFF.

− NO MUTE

  In No Mute mode all audio received via the Bluetooth® connection will be played and will intermix audibly with other audio sources (for example: COM radio and Intercom audio).

− RADIO MUTE

  In Radio Mute mode the audio received via the Bluetooth® connection will be muted/ suppressed when any COM audio is received. Bluetooth® audio will be resumed after the COM audio stops.

− MUTE ALL

  In Mute All mode the Bluetooth® audio is muted/suppressed if any other kind of audio is received (for example COM, NAV, MKR, etc). Bluetooth® audio will be resumed after the other audio source stops.

At power up, the default is MUTE ALL.

SPLIT mode (KMA 29)

To enter SPLIT mode on a single KMA 29 installation, the SPLIT button is used. Press the left side of the SPLIT button followed by pressing the required COM audio button to select the pilot's COM source. Press the right side of the SPLIT button followed by pressing the required COM audio button to select the copilot's COM source.

SPLIT mode (KMA 29A)

To enter SPLIT mode on a single KMA 29A installation, both required COM audio buttons (MIC) must be pushed simultaneously.

Head Related Transfer Function (HRTF) (KMA 29A)

The audio control panel provides the ability to place each of the available COM audio sources in one of eight spatial positions: 9 o'clock near and far, 10, 11, 1 and 2 o'clock and 3 o'clock near and far. The HRTF button, when selected, turns the HRTF function ON or OFF.

7-29-6 Dual Audio Panel Operation

KMA 29

When two KMA 29 audio panels are installed, both have access to the communications transceivers. When both panels have selected the same transmitter, the KMA 29 designated as the pilot position has priority.

Indication arrows above the microphone selectors indicate which side has selected the radio for transmit. Offside radio indication is user selectable. When the offside indication is off, only the mic select arrow for the KMA 29 position is active. When on, the pilot can see which radio the copilot has selected for transmit, and vice versa, by noting which of the arrows is illuminated.

To toggle the offside transmit selection indication, press the right side of the SPLIT button three times within one and a half seconds. When the mode is activated, the NAV 1 indicator blinks once. When the mode is toggled off, the NAV 1 indicator blinks twice. This mode remains in effect until changed by the user, including power cycles.

KMA 29A

When two KMA 29A audio panels are installed, both have access to the communications transceivers. When both panels have selected the same transmitter, the KMA 29A designated as the pilot position has priority.

7-29-7 Audio Panel Controls

Refer to Fig. 7-29-2, APEX Communication and Navigation - Controls and Displays.

Table 7-29-6: Primus APEX - Audio panel controls

Control	Description
SPKR/PA	Speaker /Passenger Address rocker switch. Toggles between the following selections: – ON LED illuminated: All selected audio will come over cockpit speaker (headset audio is always on) – OFF LED illuminated: No audio over cockpit speaker – PA LED illuminated: Pilot can transmit through microphone to cabin speaker
COM MIC	Microphone input selector buttons
TEL (KMA 29A)	Telephone call accept button
BCK / PLY (KMA 29A)	Radio playback button. PLY plays back the latest recorded incoming audio. BCK cycles through the recorded audio (8 max) in reverse order, (latest recording first)
CREW/PAX ICS VOL	Crew/Passenger Intercom system volume knob. Inner knob for crew intercom
PUSH EMG/OFF	Power on and emergency/off switch. Pilot and copilot microphones connected to COM 1
ICS	Intercom System toggle switch. Toggles between ISO (isolated), ALL and CREW
COM AUDIO	Com Audio selector buttons
HRTF (KMA 29A)	Head Related Transfer Function (HRTF) button. When pressed turns the HRTF function ON or OFF
NAV, ADF (if installed), DME	Navigation Radio Audio selector buttons
AUX	Entertainment audio select button
BT/MUTE (KMA 29A)	The BT/MUTE button cycles through four mute modes: Bluetooth® suppressed, No Mute, Radio Mute and Mute All

Table 7-29-6: Primus APEX - Audio panel controls (continued from previous page)

Control	Description
MKR	KMA 29: Marker button. When pressed (LED illuminated) audio indicator enabled KMA 29A: Marker Beacon. When pressed (LED illuminated) audio indicator enabled. Sensitivity is set to HI. Subsequent pressing of the button alternates between OFF, HI and LOW
MKR SENS (KMA 29)	Marker Beacon sensitivity button. Alternates between HI and LOW
MKR MUTE/TEST	Marker Beacon Mute/Test button. When pressed and released, marker beacon audio is muted for that beacon. When pressed for one second (KMA 29) or five seconds (KMA 29A) marker beacon discretes go high for one second in order to test the marker beacon. The marker annunciations are shown on the PFD. **Note** The TEST function on the optional second copilot audio control panel is inoperative on the KMA 29A.

7-29-8 Distance Measuring Equipment (DME)

A KN-63 DME transceiver is installed under the cabin floor. Power supply to the DME is from the Avionic 1 bus. The transceiver transmits a signal to a ground station and calculates the time between the transmitted signal and the reply signal from the ground station. It uses the data to give the distance from a ground station, the groundspeed and the time-to-station. The maximum range of the DME transceiver is 389 nautical miles. The transceiver has 200 different channels. The transmitter processes signals between 1025 MHz and 1150 MHz and the receiver processes signals between 962 MHz and 1213 MHz.

The DME detail window can be shown in the radio tuning window by pressing the DME button on the PFD Controller. An alternative means of accessing the DME window is through the Go To DME Detail soft key in the NAV detail window. The DME detail window contains soft keys DME PAIR to select the association of the DME to NAV 1 or NAV 2 and DME HOLD to select DME hold ON or OFF. When the DME hold is selected to ON, an H adjacent to the DME distance is displayed on the PFD HSI display.

7-29-9 Transponder (XPDR)

The Transponder KXP 2290A is installed behind the pilot PFD and is controlled by the PFD controller. The KXP 2290A transponder supports ADS-B Out functionality. The KXP 2290A transponder can be installed in diversity and non-diversity versions. With the diversity version, an upper and a lower ATC antenna are installed. An optional second transponder can be installed. The KXP 2290A transponder transmits elementary, enhanced and extended squitter data. Each system receives data on ARINC 429 databuses.

The transponder ADS-B Out status annunciator is located below the transponder code (see Fig. 7-29-6, XPDR Function and Display Location). ADS-B Out status is displayed in white when the transponder indicates ADS-B Out is ON and the Aircraft Personality Module (APM) indicates that ADS-B Out is enabled.

CAUTION

The ADS-B out annunciator must be displayed in white to meet the requirements specified in Section 2, Systems and Equipment Limits, otherwise Flight in ADS-B equipped airspace is not allowed. the ADS-B system must be enabled (set to ON) during all flight phases including airport surface movement operations.

The ADS-B Out status is displayed in amber when the transponder indicates ADS-B Out is failed and the APM indicates that ADS-B Out is enabled. The ADS-B Out annunciator is removed if the APM indicates that ADS-B Out is not enabled, or the transponder indicates ADS-B Out is off, or a failure has occurred.

ADS-B Out capability can be set ON/OFF on the transponder detail window (see Fig. 7-29-6, Transponder Display and Detail Page). ADS-B Out is set to ON by default at power on and independent of the STBY, ON or ALT (or TA or TA/RA if TCAS I or TCAS II is installed) mode.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for further information about the ADS-B Out control and function.

7-29-10 Global Navigation Satellite Sensor Unit (GNSSU)

7-29-10.1 General

Either one or two GNSSUs (2nd GNSSU is a Factory Option) can be installed in the aircraft, behind the systems MFD. Power supply to GNSSU 1 is from the Standby Bus, to GNSSU 2 from the Avionic 2 Bus. Both GNSSUs process satellite data to determine aircraft position, velocity and time. Both GNSSUs are certified of tracking the U.S. Global Position System (GPS). Tracking of any other Global Navigation Satellite Systems (GNSS), e.g. Galileo, is not certified yet. Both GNSSUs calculate and output navigation data, satellite measure data, Receiver Autonomous Integrity Monitoring (RAIM) and Predictive RAIM (PRAIM). Both GNSSUs also manage Sign Status Matrix (SSM), satellite status and perform BITE. The processed output data of both GNSSUs is sent to the CSIO module within the MAU for further use by the rest of the avionics system. An Apex maintenance function interfaces with both GNSSUs.

The GPS data page can be accessed from the SENSOR page. The SENSOR page can be accessed with the systems MFD lower left window in focus and selecting the SENSORS page menu.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for complete information on the description and operation of the communication and navigation equipment.

7-29-10.2 Satellite Based Augmentation System (SBAS)

The aircraft is equipped with a KSG200 SBAS capable GNSSU.

The SBAS capable GNSSU provides GNSS position corrected by the SBAS providing improved accuracy and integrity. The SBAS capable GNSSUs are certified for interoperability with the signals-in-space provided by the U.S. Wide Area Augmentation System (WAAS) and other SBAS providers, e.g. operate both within SBAS and outside SBAS coverage area. Within the SBAS coverage area, the SBAS capable GNSSUs are able to determine the vertical and horizontal guidance information sufficient for Localizer Performance with Vertical Guidance (LPV) approaches.

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7-29-10.3 SBAS/LPV

The basic concept of the LPV functionality is Area Navigation (RNAV) using ILS control laws. In order to enable the SBAS/LPV an SBAS capable GNSSU must be installed. Operational information of LPV is given in Section 4.28, LPV/LP Detailed Operating Procedures.

7-29-10.4 Indication / Warning

The Crew Alerting system (CAS) window of the systems MFD displays the following Cautions and Advisory messages for the communication and navigation equipment status:

Table 7-29-7: Primus APEX - Communication and Navigation - CAS Messages

CAS Message	Description
MMDR 1 Fail MMDR 2 Fail MMDR 1+2 Fail	Multi Mode Digital Radio No. 1 has failed Multi Mode Digital Radio No. 2 has failed Multi Mode Digital Radios No. 1 and 2 have failed
MMDR 1 Overheat MMDR 2 Overheat MMDR 1+2 Overheat	Multi Mode Digital Radio No. 1 has overheated Multi Mode Digital Radio No. 2 has overheated Multi Mode Digital Radios No. 1 and 2 have overheated
DME 1 Fail	Distance Measuring Equipment No. 1 has failed
XPDR 1 Fail XPDR 2 Fail XPDR 1+2 Fail	Transponder No. 1 failed Transponder No. 2 failed (only if optional second XPDR installed) Transponder No. 1 and 2 failed (only if two XPDR's installed)
GPS 1 Fail GPS 2 Fail GPS 1+2 Fail No Alt Reporting	Global Positioning system No. 1 failed GPS No. 2 failed (only if optional second GPS installed) GPS 1 and 2 failed (only if two GPS's installed) In flight and XPDR is not selected to ALT, TA or TA/RA mode

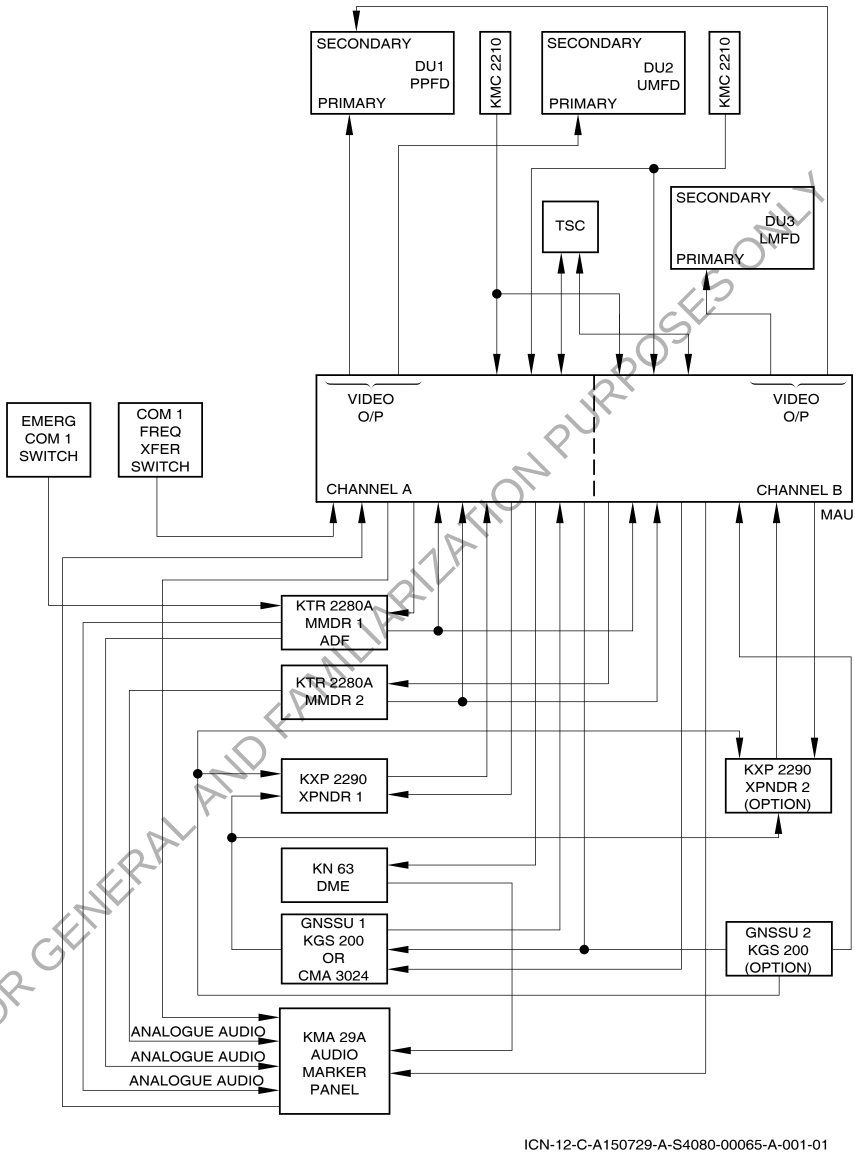

Figure 7-29-1: APEX Communication and Navigation - Schematic

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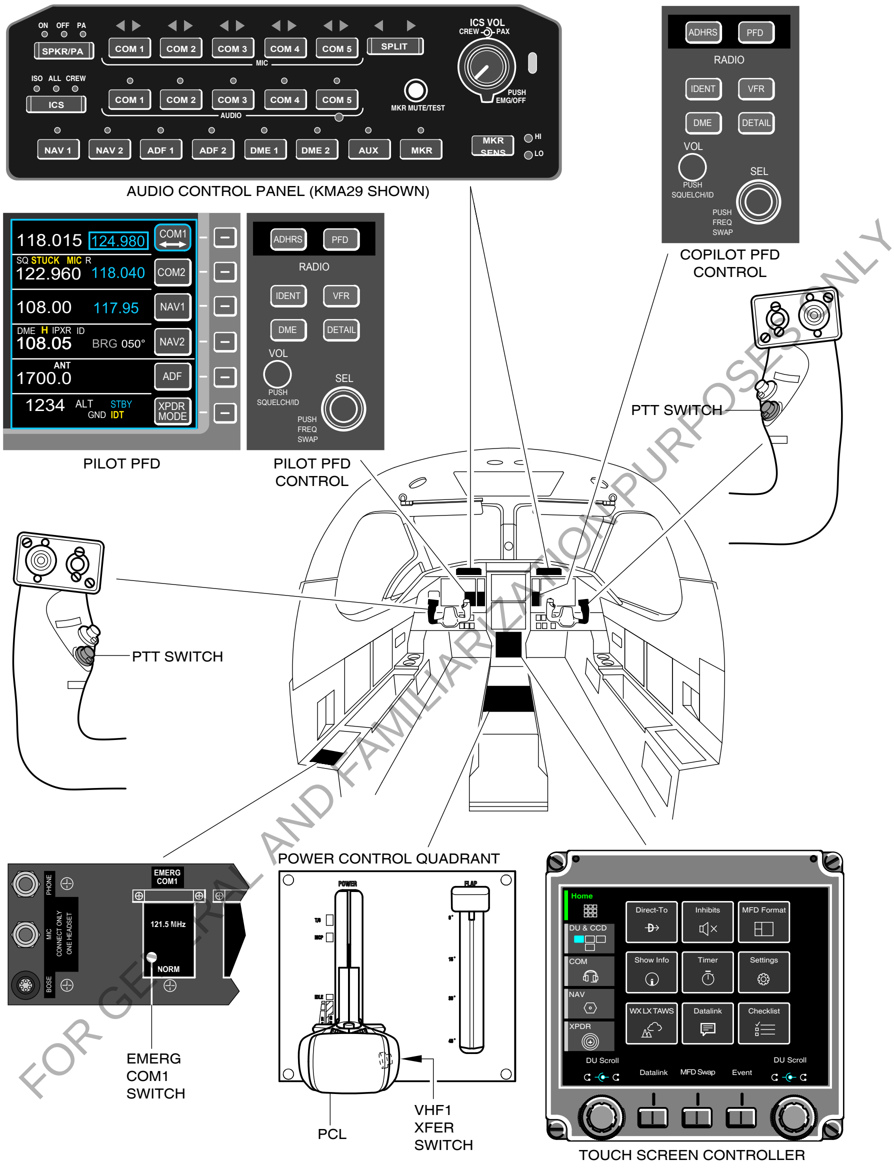

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Figure 7-29-2: APEX Communication and Navigation - Controls and Displays

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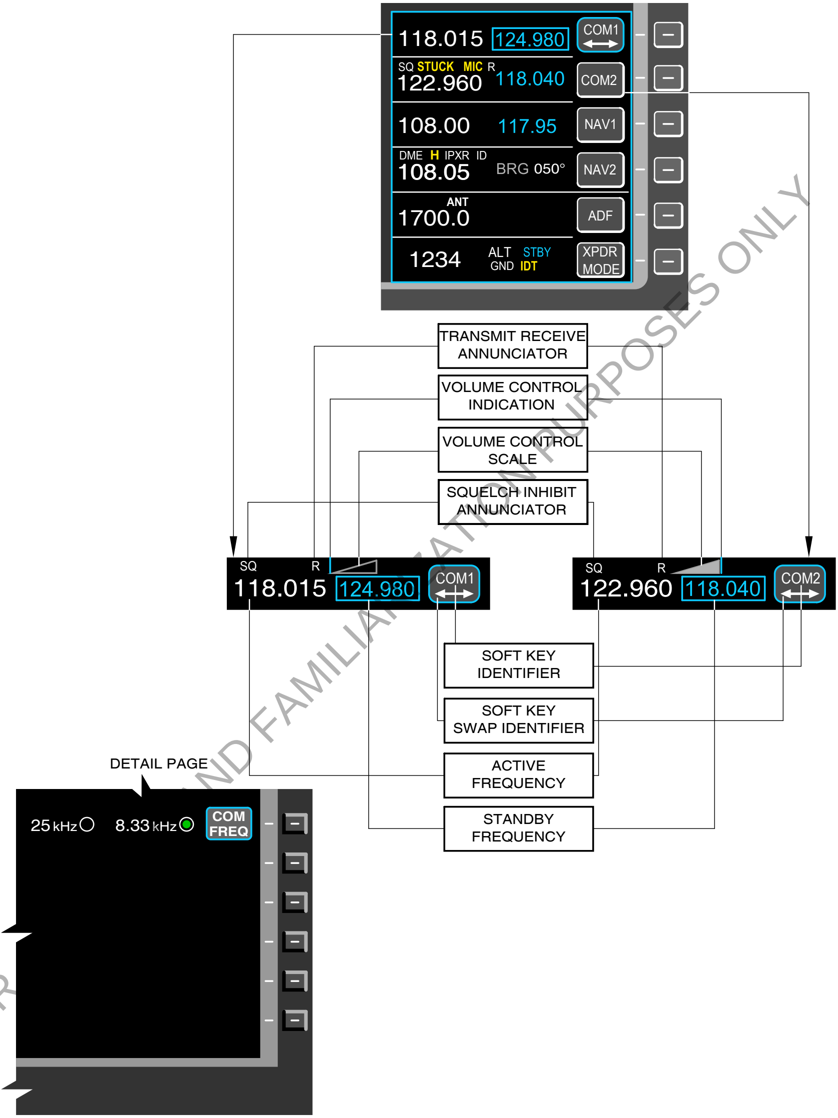

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Figure 7-29-3: VHF Com Display and Detail Page

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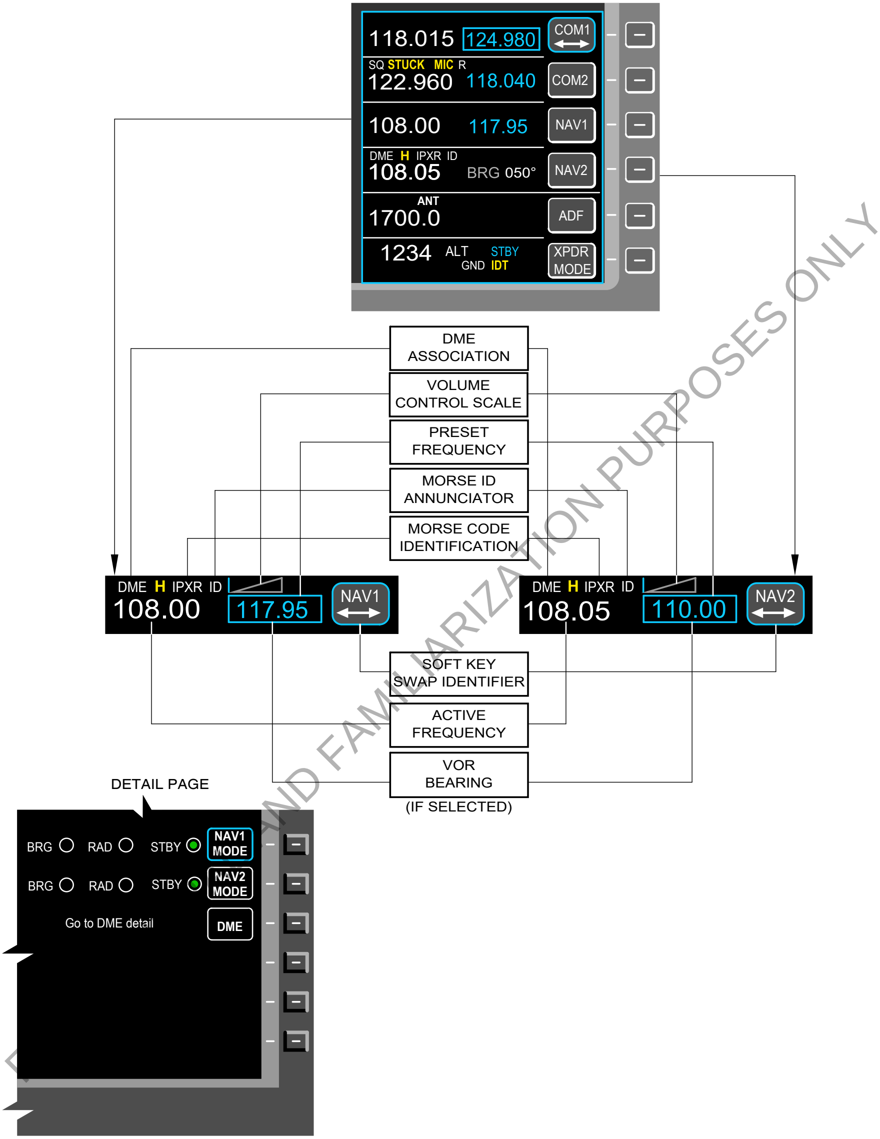

ICN-12-C-A150729-A-S4080-00068-A-001-01

Figure 7-29-4: VHF Nav Display and Detail Page

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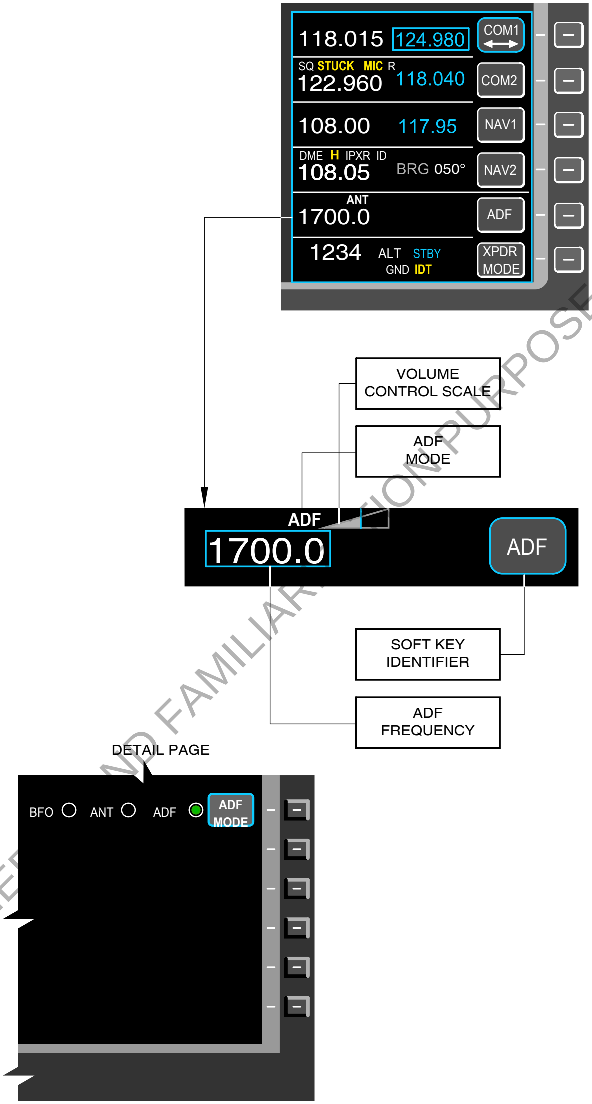

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Figure 7-29-5: ADF (if installed) Display and Detail Page

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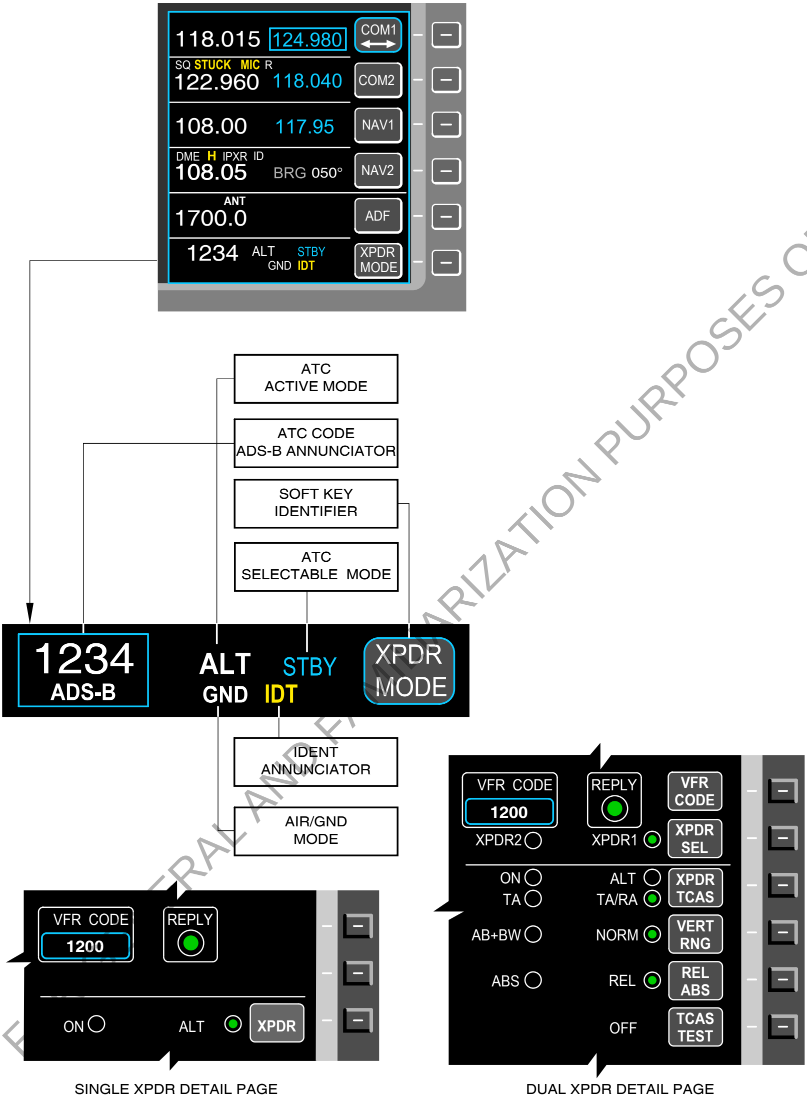

Figure 7-29-6: Transponder Display and Detail Page

7-29-11 HF Communications System

7-29-11.1 General

The KHF 1050 High Frequency (HF) communication system gives long range voice communication in remote areas. Additionally the system enables the operator to communicate using the Maritime Radiotelephone Network to contact marine operators.

The HF system operates in the High Frequency Short Wave Band from 2.000 Mhz up to 29.999 Mhz in tuning steps of 1.0 Mhz.

The HF system comprises:

- a PS440 Control Unit
- a KRX1053 Receiver/Exciter
- a KPA1052 Power Amplifier
- a KAC1052 Antenna Coupler
- an RF antenna.

The power supply to the HF system is 28 VDC through the HF TX and HF RX circuit breakers on the AVIONIC 2 BUS circuit breaker panel.

7-29-11.2 Description

The Control Unit is installed on the pilots lower left panel. It provides the controls for operation of the HF system. For a description of the controls on the Control Unit, refer to the KHF 1050 Pilot’s Guide. Voice and audio signals are interfaced to the pilot’s Audio Control Panel COM 3 push buttons.

The Receiver/Exciter is installed under the cabin floor between frames 33 and 34. The Receiver/Exciter provides the circuitry for RF receive and transmit functions. It generates a low power RF signal to excite the Power Amplifier when in transmit mode and demodulates the received RF signal to generate the required audio output in the receive mode. It also controls the audio interface and control switching for the Power Amplifier and Antenna Coupler.

The Power Amplifier is installed under the cabin floor between frames 31 and 32. Its main functions are to excite the low power RF signal from the Receiver/Exciter to a high energy signal which is then fed to Antenna Coupler and in the receive mode it passes the RF signal from the Antenna Coupler to the Receiver/Exciter. Excessive RF signal amplification protection is provided.

The Antenna Coupler is installed in the upper rear fuselage between frames 37 and 38. It contains the main matching circuitry to match the 50 Ohm exciter signal to the various impedances of the antenna. The Antenna Coupler contains a Non Volatile Memory (NVM) to store the best impedance value for each previously tuned frequency to reduce tuning time. The Antenna Coupler is pressurized with nitrogen to reduce the possibility of arcing. Low pressure warnings are given on the Control Unit and if the Nitrogen pressure becomes too low the Antenna Coupler output power will be limited.

The RF Antenna is installed on the top of the rear fuselage. It is routed in a V shape from the Antenna Coupler up to an attachment point on the horizontal stabilizer and back down to an earth point on the top of the rear fuselage.

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7-29-11.3 Operation

Under normal operation conditions, the KHF1050 HF system is connected to the Pilots Audio Control Panel on COM 3 input selection.

The operator is able to either directly set a frequency on the Control Unit, or in channel mode, select the appropriate frequency channel for the intended use.

Once a frequency or a channel has been selected and output power level set, pressing the PTT button will initiate tuning of the chosen frequency which should be completed after approx. 8 seconds. Unsuccessful tuning will result in an error message displayed on the Control Unit.

If the HF control unit indicates “PRS W”, the couple is losing Nitrogen pressure and may be approaching a pressure fault condition. The HF radio will continue to function normally but the indication should be reported to maintenance.

If the HF control unit indicates “PRS F”, the coupler has lost Nitrogen pressure and will therefore operate in the pressure fault condition. In this condition, the HF radio will reduce transmit power to 50W regardless of the transmit power selected by the crew. Report to maintenance.

The operator may choose to use and pre-program up to 99 channels with often used frequencies for direct access in operation. In addition, the system provides preprogrammed channels of the Maritime Radiotelephony Network (ITU) for aircraft/ship communication using HF equipment.

Under operational emergency conditions in areas with bad VHF coverage, the KHF1050 provides six pre-programmed emergency channels (EMR1 - EMR6) for international distress and calling.

EMR 1 is factory programmed to 2.182 MHz international calling frequency.

EMR 2 to EMR 6 is factory programmed but can be overwritten by the operator if he wishes to use different emergency frequencies.

Refer to the KHF 1050 Pilot’s Guide for complete information on the operation of the HF system.

CAUTION
Do not operate the HF communications system when ground power is connected

7-29-12 Aerowave 100 Satcom System

7-29-12.1 General

The Aerowave 100 satellite communication (SATCOM) system, if installed, gives long range voice and data communication via the Inmarsat satellite constellation.

The Aerowave 100 system comprises:

- A High-speed Data Unit (HDU)
- An External Satcom Configuration Module (ESCM)
- A bias-T
- An active Low Gain Antenna (LGA)
- A Wi-Fi router
- An ON-OFF switch in the cockpit

The power supply to the Aerowave 100 system is 28 VDC through the AEROWAVE circuit breaker on the NON ESS BUS circuit breaker panel.

The Aerowave 100 system is stand-alone and has no connection to on-board aircraft systems.

7-29-12.2 Description

The HDU is installed under the cabin floor on the aft side of frame 31. It provides the power, control and distribution of telephony and high-speed data services to the components in the system.

The ESCM is installed under the cabin floor on the forward side of frame 32. The ESCM is connected to the HDU and contains the Subscriber Identity Module (SIM). The SIM identifies the sitcom terminal of the HDU to the Inmarsat Services Provider.

The bias-T is installed under the cabin floor on the aft side of frame 32. It provides the power necessary for the active LGA to function. The bias-T also has an active GPS receiver element that works with the LGA to supply navigation data to the HDU. The navigation data is used to calculate the aircraft to satellite elevation (look angle) and Doppler effect while the aircraft moves.

The active LGA is installed on the top of the fuselage between frames 22 and 23. The active LGA lets the HDU communicate with the Inmarsat Swift Broadband Class 15 Services (SBB-200). These services supply voice and high-speed data to a maximum of 200 kbps when the look angle is above 20 degrees.

The Wi-Fi router is installed in the aft baggage compartment on the right side of the fuselage between frames 34 and 35. It is an IEEE 802.11 g and n wireless router that operates in the 2.4 GHz bandwidth spectrum and gives connection to any consumer data device with Wi-Fi connectivity. The Wi-Fi router supports WEP, WPA or WPA2 wireless security and has a single cast antenna.

The ON-OFF switch is installed in the cockpit on the RH side wall panel. The switch is used to turn the Aerowave 100 system ON or OFF as required.

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7-29-12.3 Operation

The Aerowave 100 SATCOM system is in operation as soon as the non-essential bus is powered. When in operation, the system automatically connects to the Inmarsat satellite network with the subscriber information contained in the ESCM.

The ON-OFF switch in the cockpit can be used to disable the system when it is not needed.

Wi-Fi enabled devices that are connected to the Wi-Fi router can be used to access the internet.

An alternative Wi-Fi router gives the added function of Voice over Internet Protocol (VOIP). Customers can use VOIP to make voice calls with a Personal Electronic Device (PED). A maximum of three PEDs can be connected at the same time. Only one user (PED) can make a voice call at a time.

7-30 Primus APEX - Situation Awareness

7-30-1 General

Refer to Fig. 7-30-1, APEX Situation Awareness - Schematic

The situation awareness part of the Primus APEX comprises:

- RDR 2000 or RDR 2060 (optional) Weather Radar - refer to the Weather Radar (WX) paragraph
- KRA 405B Radar Altimeter - refer to the Radar Altimeter paragraph
- Navigation Map - refer to Section 7-33, Primus APEX - Flight Management System
- Optional Equipment (TCAS, EGPWS, TCAS, LSS, XM and SmartView) - refer to the Optional Equipment paragraph.

7-30-2 Weather Radar (WX)

Refer to Fig. 7-30-2, APEX Weather Radar - Overlay Menu and Display

The weather radar system gives the pilot a selectable horizontal or vertical display of thunderstorms or high density precipitation in front of the aircraft. The weather radar system can be used with an optional Lightning Sensor System, which shows areas of lightning activity 360 degrees around the aircraft.

The RDR 2000 or RDR 2060 (optional) Weather Radar installation consists of a radar receiver and radar transmitter in a radome installed in the right wing tip. The power supply to the weather radar is 28 VDC through the WX RDR circuit breaker on the AVIONIC 1 BUS circuit breaker panel.

7-30-2.1 Description

The RDR 2000 sensor unit receives pitch and roll signals from the ADAHRS to stabilize the radar antenna.

The RDR 2060 sensor unit receives pitch, roll and altitude signals from the ADAHRS to stabilize the radar antenna. The altitude signal is used to support additional functionality (e.g. Auto Tilt).

The sensor unit transmits a beam of pulsed microwave energy. When a pulse intercepts a bank of cloud, the energy is reflected back to the antenna. The return signals are processed by the sensor unit and sent to the Modular Avionics Unit (MAU) for display. The sensor unit is connected to a configuration module and receives an air/ground status from the MAU.

Weather radar can be displayed as overlays on the PFD's and INAV Map. The PFD weather radar overlay can be assessed by pressing the soft key on the side of the Horizontal Situation Indicator (HSI) display. The soft key identifier OVRLY appears in white. Pressing the OVRLY soft key displays the overlay selection menu. Selecting WX RDR will enable the weather radar overlay to be displayed on the HSI. There is also an OFF selection to remove the overlay. The WX overlay can be displayed on the Situation Awareness MFD INAV Map. First select the WX overlay on the pilot's HSI and then select the WX button on the Active Layers Control Bar.

The WX overlay can be independently selected for either the PFD or Situational Awareness MFD within the same Advanced Graphics Module (AGM). It should however be noted that the Situational Awareness MFD WX overlay is limited to the maximum resolution of the PFD HSI range and will be inhibited when the TAWS overlay is selected on the HSI.

When the Tilt/Gain knob button on the TSC is activated on the WX page on the TSC, the current weather radar mode is shown above the right hand rotary knob of the TSC and the Tilt/Gain control remains active, even when the WX page is not displayed on the TSC.

The RDR 2060 weather radar can be optionally installed. When the RDR 2060 is installed, additional features and functionalities are available. The main features and functionalites are described below:

- Magnetron power increased by 50% to 6 kW

  This extends the theoretical weather detection capability from 240 NM to 320 NM and allows the pilot to have a greater awareness of the airspace ahead

- Auto Range Limiting (ARL)

  When the Auto Range Limit checkbox is selected, a blue area is displayed behind the weather systems where weather detection is no longer possible because of attenuation. This allows the pilot to have increased awareness about sensor performance

- Auto Step Scan

  When the automatic step scan radio button is selected, the antenna does a complete scan, followed by sequential tilts (up or down) in 4 degree increments. This allows the pilot to vertically profile the entire azimuth scan angle by monitoring successive antenna scans

- Auto Tilt

  When the automatic radio button is selected, the antenna position is automatically adjusted to maintain a common beam intercept point with the earth. For example, when the tilt is such that the last 10 percent of the display show ground returns, the system will automatically adjust the tilt based on barometric altitude during ascent or descent to maintain ground returns on 10 percent of the display.

- Lateral Scan

  When set to full, the weather radar performs a full 100° scan as normal. When set to sector, the weather radar performs a 60° scan which leads to a quicker update of the weather radar picture. However, when set to sector, the weather radar returns are no longer synchronized between the pilot's PFD and the copilot's PFD: The left to right scan is shown on the pilot's PFD and the right to left scan on the copilot's PFD. The sector can be adjusted 20° to the left or to the right with the azimuth selection.

- Vertical weather

  When the vertical profile checkbox is selected, the weather radar performs a vertical scan after each lateral scan. The vertical profile is shown on the vertical weather page on the MFD. When the vertical profile is selected, the lateral scan can be set to off and the weather radar will only perform vertical scans and there will be no weather overlay on the PFDs. The azimuth selection determines where the vertical scan is performed. There is no roll stabilization when the vertical profile is active.

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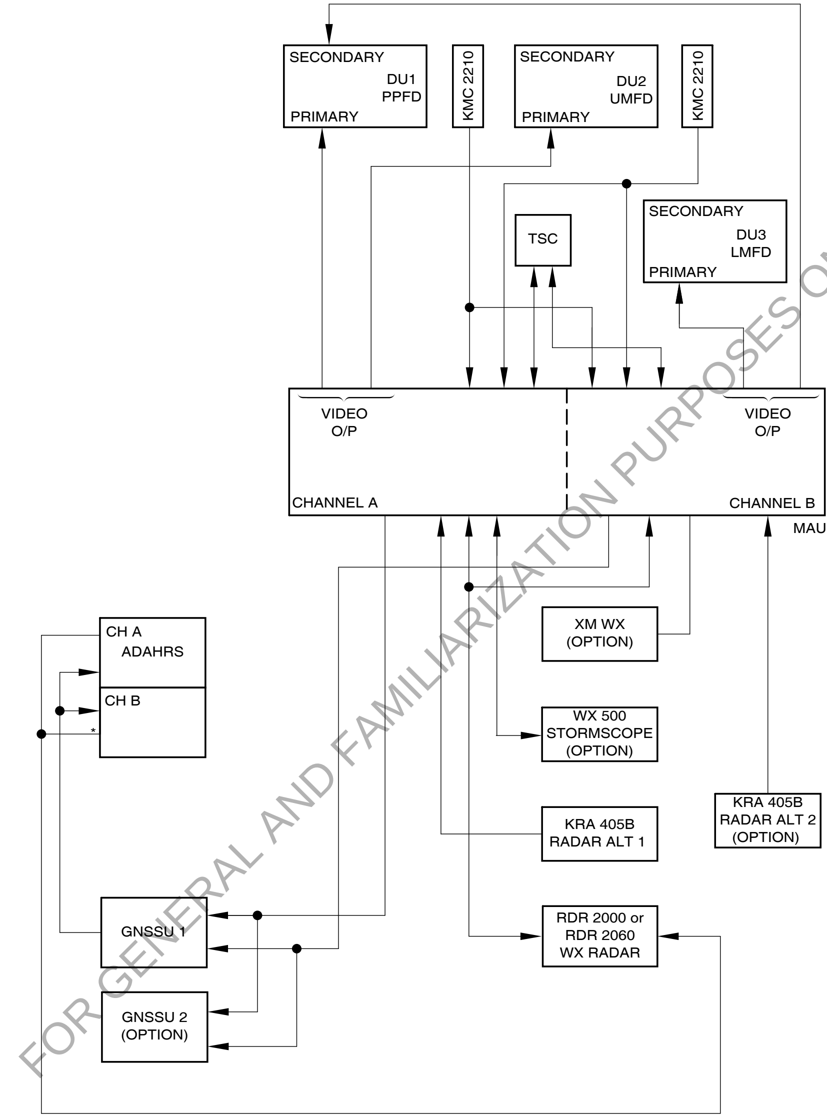
7-30-2.2 Operation

The controls for the weather radar are on the Touch Screen Controller (TSC). The WX LX TAWS button on the home page gives access to the weather radar controls. The WX Radar mode button allows to select the modes OFF/STBY/TEST/WX ON/GND MAP. The current active mode is shown in green or white within the button. Soft buttons and the TSC rotary knobs allow to modify the tilt or gain setting. Additional buttons are shown to control further WX settings. The Tilt/Gain knob button allows to permanently allocate the right hand rotary knobs to modify the Tilt/Gain setting independent of the shown TSC format. Weather radar annunciations for ALERT, MODE and TILT are located on the left side of the HSI. The ALERT annunciations are TX ON GND in amber when WX and transmit on ground are selected on the TSC and the aircraft is on the ground. TGT ALRT is given in amber when there are potentially hazardous targets directly in front of the aircraft that are outside of the selected range. Longer ranges should be selected to view the questionable target. The MODE annunciation is that set by the TSC. The TILT annunciation value is a three digit number preceded by an arrow, up for positive value and down for negative value. Faults are annunciated WX FAULT in white on the right lower part of the weather radar overlay and failures are annunciated WX FAIL in amber.

For further information on operational techniques and weather interpretation consult the RDR 2000 or RDR 2060 Pilot Guide.

The Avionics window of the systems MFD also contains WX/LX/TAWS setup pages. The WX setup tab is selected via the page menu of the multifunctional window and has similar controls as the TSC WX format page.

Refer to the Pilot’s Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for complete information on the description and operation of the weather radar.



*RDR 2060 INSTALLATION ONLY

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Figure 7-30-1: APEX Situation Awareness – Schematic

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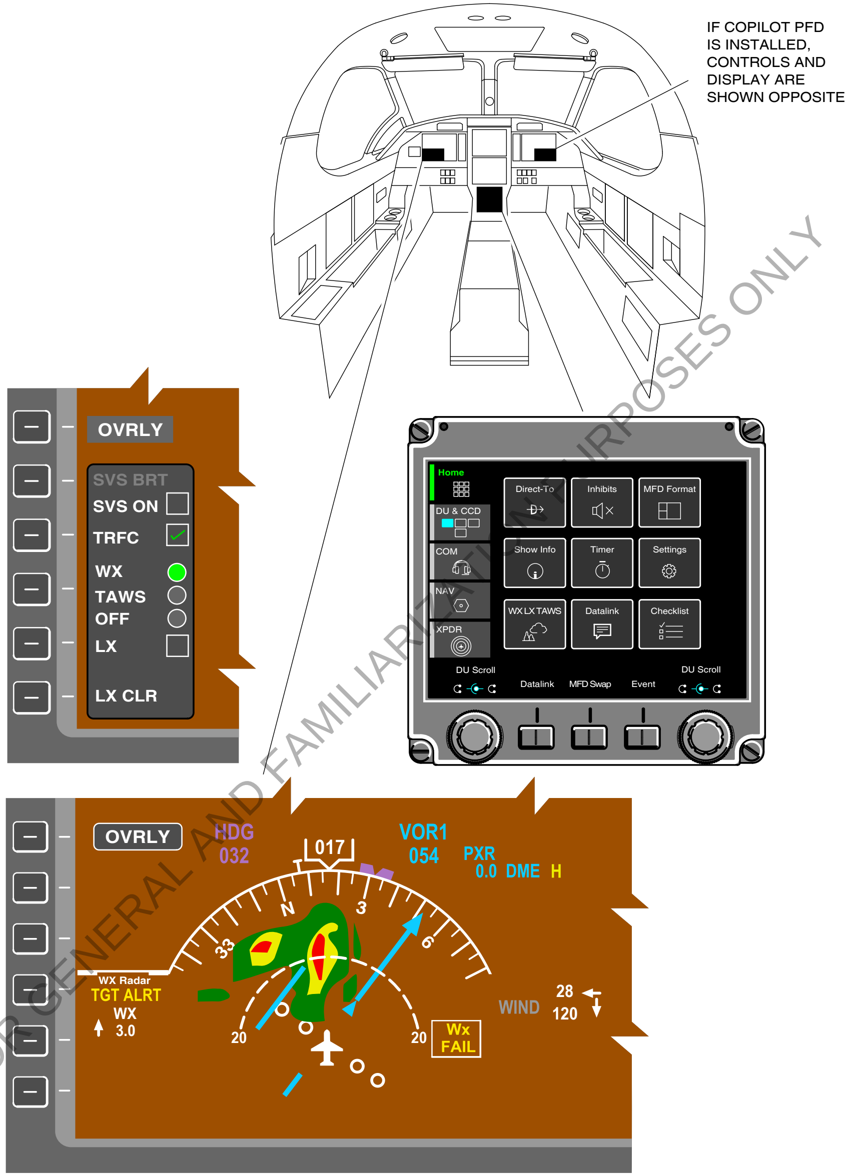

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Figure 7-30-2: APEX Weather Radar – Overlay Menu and Display

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7-30-3 Radar Altimeter

7-30-3.1 Description

The KRA 405B transceiver is installed under the cabin floor between frames 26 and 27. The power supply to the transceiver is 28 VDC through the RAD ALT 1 circuit breaker on the AVIONIC 1 BUS circuit breaker panel. An optional second radar altimeter can be installed.

The transceiver sends a signal to the transmit antenna and gets the return signal from the receive antenna. The transceiver measures the time between the transmitted signal and the reply signal then processes the data to give height from the ground. The maximum operating height AGL used by the system is 2500 ft.

The radar altimeter system measures the aircraft height Above Ground Level (AGL) electronically and sends the height AGL data to the MAU for display in the ADI window of the pilot PFD and copilot PFD (when installed). The digital readout for radio altitude is displayed in green text to the lower right of the aircraft symbol on the PFD. The radar altitude display is removed at altitudes greater than 2500 ft. When altitude is less than 550 feet, the lower portion of the PFD altitude tape will show a yellow cross hatched box to indicate the ground proximity.

If the radar altitude data becomes invalid the digital readout will be replaced with RAD in white. The radar altimeter data is also used by the optional situation awareness systems.

7-30-3.2 Indication / Warning

The Crew Alerting system (CAS) window of the systems Multi Function Display (MFD) displays the following CAS messages for the radar altimeter status (refer to Table 7-30-1):

Table 7-30-1: Primus APEX - Weather Radar - CAS Messages

CAS Message	Description
RA 1 Fail	Indicates RA failed in both CSIO module channels

7-30-4 Optional Equipment

7-30-4.1 Enhanced Ground Proximity Warning System (EGPWS)

7-30-4.1.1 General

The Enhanced Ground Proximity Warning System (EGPWS) consists of an Enhanced Ground Proximity Warning Function (EGPWF) hosted on a processor card housed in the Modular Avionics Unit (MAU).

The EGPWS provides an enhanced capability of reducing accidents caused by controlled flight into terrain. The system achieves this by receiving a variety of aircraft parameters as inputs, then applying alerting algorithms to provide the flight crew with aural messages and visual annunciation and display. The EGPWS provides the flight crew with enhanced Class A terrain awareness while following an ATC flight plan clearance. The EGPWS can optionally be set to TAWS Class A or Class B.

The EGPWS uses GPS position data for accurate position determination in conjunction with a global database. The database also contains the locations of all runways longer than 2000 feet that have a published instrument approach. The TAWS terrain overlay when selected is displayed on the PFD HSI.

Optionally, these features can be included in the EGPWS: SmartLanding® and SmartRunway®.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E, for information regarding the specific operating details of the system. For further information, refer to the latest edition of the Honeywell EGPWS Pilot's Guide.

7-30-4.1.2 Description

The EGPWS uses the database and inputs from the GPS, FMS, ADAHRS, APEX and radio altimeter to perform its proximity computations.

Terrain is displayed as a variable density dot pattern in green, yellow or red. The pattern density and color being a function of how close the terrain or obstacle is, relative to the altitude of the aircraft. Solid red for a warning terrain threat area and solid yellow for a caution terrain threat area.

The terrain alerting algorithms continuously compute the terrain clearance envelopes ahead of the aircraft. If the boundaries of these envelopes conflict with terrain elevation data in the terrain database, then alerts are issued. Two envelopes are computed, one corresponding to a terrain caution alert and the other to a terrain warning alert.

When the required conditions have been met to generate a terrain or obstacle caution alert, the terrain image on the PFD TAWS Overlay is enhanced to highlight the threatening terrain as solid yellow for caution threats and the appropriate aural alert is given. When the required conditions have been met to generate a terrain or obstacle warning alert, the display image on the PFD TAWS Overlay is enhanced to highlight the terrain as solid red and the appropriate aural alert is given.

7-30-4.1.3 Operation

Refer to Fig. 7-30-3, APEX Terrain - Overlay Menu and Display

The (EGPWS) terrain overlay on the PFD HSI can be selected by pressing the bezel button adjacent to the OVERLAY annunciator, which then displays the overlay selection menu. Select TAWS with the bezel button and repress the OVERLAY bezel button. Terrain map data from the EGPWS is displayed on the lateral map display on the HSI.

EGPWS mode white annunciators for STEEP APR, TERR INHIB and TERR are displayed in the lower left portion of the HSI. When the optional TAWS Class A is installed, G/S INHIB and FLAP OVRD will be displayed as well. The steep approach (STEEP APR) mode which allows the pilot to fly a steeper approach angle without terrain callouts being generated, can be selected from the TAWS set up page. The TERR annunciation indicates normal operation of the TAWS. The terrain inhibit (TERR INHIB), glideslope inhibit (G/S INHIB) and flap override (FLAP OVRD) options are available on the TSC.

Mode 5 Glideslope alerts can be manually cancelled when below 2000 feet Radio Altitude by pressing the G/S INHIBIT button. This button is typically pressed when an unreliable glideslope is expected or when maneuvering is required during an Instrument Landing System (ILS) final approach. The G/S INHIBIT function is automatically reset below 30 feet radar altitude or if the aircraft climbs above 2000 feet or by selecting a non-ILS frequency as the primary navigation source. Unsafe Terrain Clearance alerts can be manually inhibited by pressing the FLAP OVRD button.

All six modes can be manually inhibited by pressing the TERR INHIB button at the Inhibits view (under the Home QA button) on the TSC. All the terrain and aural alerts are deactivated. This feature is generally used when the position accuracy is inadequate or when operating at airports not in the terrain database.

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Three amber annunciators for TEST, RANGE and TERR N/A can be displayed on the HSI. A test of the EGPWS can be performed from the TAWS set up page using the TAWS SELF TEST soft key on the MFD or by selecting the TAWS tab on the TSC home page and selecting the TAWS Self Test button. The range update failure shows that the actual range of the TAWS does not match the currently displayed HSI range. The terrain unavailable status shows that the TAWS is not available.

The EGPWS sends aural alert messages, when necessary, to the audio control panel and to the headphones and cockpit speaker. At the same time annunciations are displayed on the PFD ADI in an amber box for GND PROX or red box for PULL UP. The annunciations flash in reverse video for 5 seconds and then remain on until the condition is no longer detected. If the TAWS terrain overlay is not displayed and a EGPWS alert is set, the terrain overlay will be displayed (automatic pop-up) on the HSI in the partial compass mode.

The EGPWS voice messages are annunciated as per the priorities set within the Primus APEX - Monitor Warning System (MWS).

The enhanced feature of the EGPWS is the ability to alert the crew to and provide a display of potential conflict with terrain. Terrain conflict alerts will initiate a specific aural message and annunciator illumination. The EGPWS keeps a synthetic image of local terrain in front of the aircraft for display on the PFD Terrain Overlay.

Other enhanced features of the EGPWS are:

- Terrain Alerting and Display (TAD)
- Peaks
- Obstacles
- Envelope Modulation
- Terrain Clearance Floor (TCF)
- Runway Field Clearance Floor (RFCF)
- Geometric Altitude.

The EGPWS issues voice messages and tones for the following types of warning:

- Sink rate pull up warning (Mode 1)
- Terrain closure pull up warning (with preface - Mode 2)
- Terrain awareness pull up warning (with preface - TAD)
- Terrain (Mode 2B/Mode 2A Altitude Gain)
- Minimums type (Mode 6)
- Terrain awareness caution (TAD)
- Too low terrain (Mode 4)
- Too low terrain (TCF)
- Altitude callouts (Mode 6)
- Too low gear (Mode 4)
- Too low flaps (Mode 4)
- Sink rate (Mode 1)
- Don’t sink (Mode 3)
- Glideslope (Mode 5)
- Approaching minimums type (Mode 6)
- Bank angle (mode 6)
- SR/SL Cautions
- SR/SL Advisories

7-30-4.1.4 Indication / Warning

The CAS window on the Systems MFD will show the following advisory messages for the Terrain Avoidance system status (refer to Table 7-30-2):

Table 7-30-2: Primus APEX - EGPWS - CAS Messages

CAS Message	Description
FLAP OVRD Active	Flap Override selected for EGPWF
G/S INHB Active	Glide slope inhibited for EGPWF while flying backcourse approach
RAAS Fail	Internal hardware / software or input failures leading to loss of Runway Awareness and Advisory System (RAAS) function
RAAS Inhibit	RAAS inhibit selected by pilot
RAAS Not Available	Missing RAAS Parameter (e.g. Airport not in Database) leading to loss of RAAS function
TAWS Fail	Indicates terrain avoidance system data has become invalid
Terrain Fail	Terrain Awareness inoperative leading to loss of display
Terr Inhib Active	Indicates terrain visual and aural alerting is inhibited

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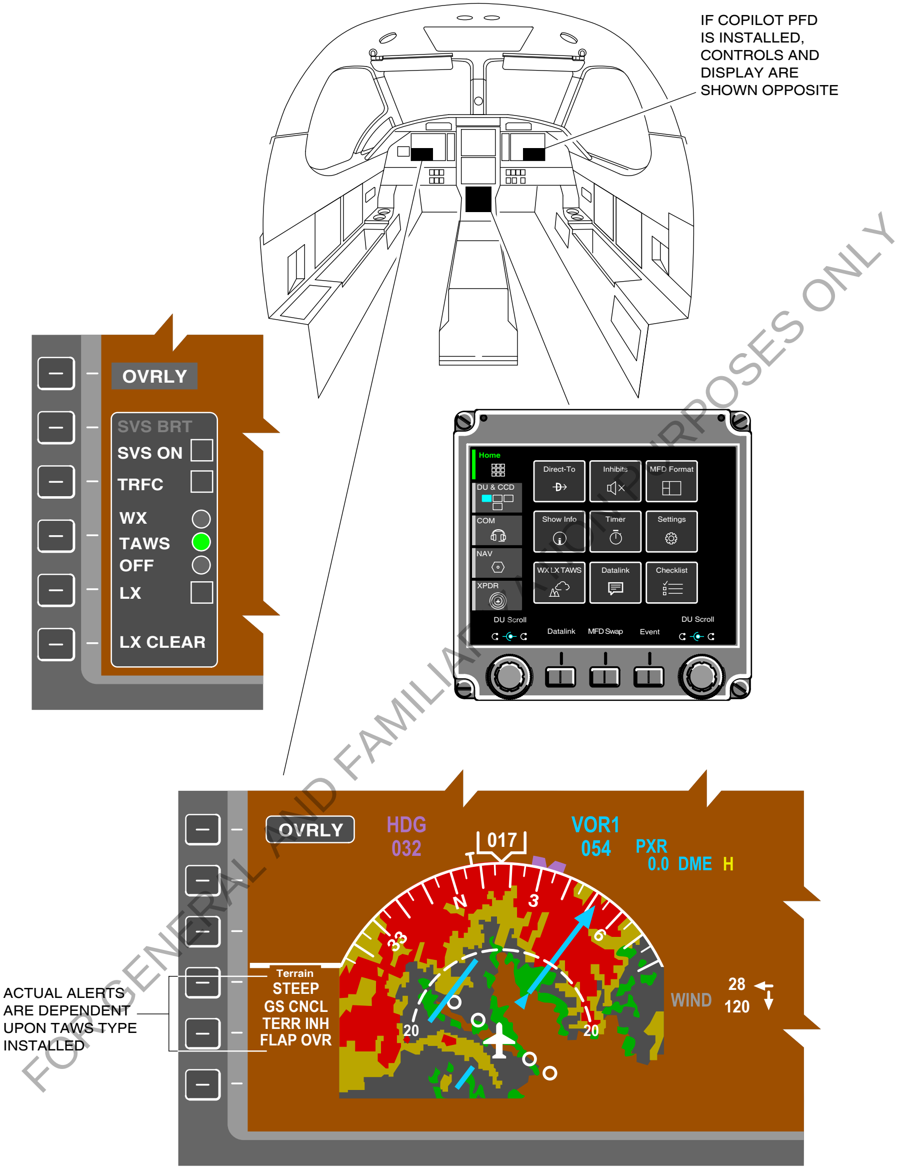

Figure 7-30-3: APEX Terrain - Overlay Menu and Display

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7-30-4.2 Traffic Collision And Avoidance System (TCAS)

7-30-4.2.1 General

The TPA-100C Traffic Collision and Avoidance System (TCAS I or II) comprises a processor, one Upper antenna (directional), one Lower antenna (omnidirectional) and a configuration module. Power supply to the processor is 28 VDC through the TCAS circuit breaker on the Avionic 1 BUS circuit breaker panel. Aural alerts are available through the headphones and cockpit speaker.

TCAS is intended as an aid to the see and avoid concept. Once an Intruder is visually acquired, it is the pilot's responsibility to maneuver as necessary to maintain safe separation.

TCAS I does not incorporate the sophisticated sensors, bearing accuracy or track rate computations incorporated in TCAS II that are necessary for evasive maneuvering (rapid change in pitch, roll, normal acceleration, thrust or speed). In general, TCAS I does not provide adequate information for pilots to determine reliably which horizontal or, in some cases, vertical direction to move to increase separation, and there is some likelihood that such maneuvers will actually result in reduced separation.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for information regarding the specific operating details of the system. For further information refer to the TPA-100C Pilots Guide.

7-30-4.2.2 Description

The TCAS detects and tracks other (Intruder) aircraft by interrogating their transponders. From the transponder replies, TCAS determines range, bearing and (if the Intruder is equipped with a Mode C or S transponder) relative altitude. Intruders equipped with a Mode A transponder do not provide altitude information. With this data, the TCAS uses standard algorithms to determine the threat of collision. When a possible collision hazard exists, the TCAS issues a visual and aural Traffic Advisory (TA) (TCAS I and II) or Resolution Advisory (RA) (TCAS II) to the flight crew. The TCAS will not detect aircraft which have no operating transponder.

The TCAS traffic overlay when selected is displayed on the PFD or the Map window of the INAV. It displays the horizontal picture of the traffic around the aircraft. The horizontal picture represents aircraft (intruders) within the surveillance volume, including the range, azimuth, altitude and vertical direction arrows, when the information is available from the TCAS processor operation.

7-30-4.2.3 Operation

Refer to Fig. 7-30-4, APEX Traffic - Overlay Menu and Display

The TCAS traffic overlay on the PFD HSI can be selected by pressing the bezel button adjacent to the OVERLAY annunciator, which then displays the overlay selection menu. Select TRFC with the bezel button and repress the OVERLAY bezel button.

The TCAS overlay can be displayed on the Situation Awareness MFD INAV Map by selecting the TCAS button on the Active Layers Control Bar.

For TCAS I, the aircraft intruder symbology consists of three different shapes:

- Traffic Advisory (TA) displayed as a solid amber circle
- Proximate Traffic (PA) displayed as solid cyan diamond
- Other Traffic, no threat, displayed as hollow cyan diamond.

For TCAS II, the aircraft intruder symbology consists of eight different shapes:

- Non-directional RA displayed as a solid red square
- Directional RA displayed as a solid red square with arrowhead inside
- Non-directional TA displayed as a solid amber circle
- Directional TA displayed as a solid amber circle with arrowhead inside
- Non-directional Proximate Traffic (PA) displayed as solid cyan diamond
- Directional Proximate Traffic (PA) displayed as solid cyan diamond with arrowhead inside
- Non-directional other traffic, no threat, displayed as hollow cyan diamond
- Directional other traffic, no threat, displayed as hollow cyan arrowhead.

A data tag representing intruder altitude is displayed above or below and a vertical speed arrow pointing up or down to the right of the intruder symbol. TCAS can track up to 60 aircraft and display up to 30 intruders.

TA (TCAS I and II) or RA (TCAS II) intruders that are outside the set display range on the selected PFD or MFD are shown in such a way that half of the non-direction symbol is visible at the approximate azimuth. Increasing the HSI range can make the intruder visible on the PFD or MFD.

If an Intruder gets to within 20 to 48 seconds of a projected closest point of approach and/or meets other range and closure criteria, it is then considered a potential threat and a visual TA is issued with a voice message.

The TCAS system will issue an aural “Traffic, Traffic” alert message at the same time a TA is detected and displayed on the Traffic overlay. This assists the pilot in achieving visual acquisition of the threat traffic. If the TCAS traffic overlay is not displayed and a TCAS alert is set, an amber TRFC soft key is displayed. Pressing the bezel button adjacent to the TRFC soft key will enable the traffic overlay to be displayed on the HSI in the partial compass mode.

The TCAS aural alert is sent directly to the audio control panel and is available through the headphones and cockpit speaker. TCAS aural alerts cannot be muted by the pilot. TCAS aural alerts are part of the third priority group of aural warnings. Only the stall warning aural alert and the EGPWF aural alerts have greater priority than TCAS aural alerts.

TCAS II: If an Intruder gets to within 15 to 35 seconds of a projected closest point of approach (10 to 15 seconds after the TA was issued), it is then considered a collision threat and a visual RA is issued. When an RA occurs, the pilot flying shall respond immediately to RA displays and aural alerts, manoeuvring as indicated, unless doing so would jeopardize the safe operation of the aircraft.

Note
Visually acquired traffic may not be the same traffic causing an RA. The visual perception of an encounter may be misleading, particularly at night.

TCAS is intended as an aid to the see and avoid concept. Once an intruder is visually acquired, it is the pilots responsibility to maneuver as necessary to maintain safe separation.

7-30-4.2.4 Indication / Warning

The CAS window on the systems MFD will show the following advisory message for the Terrain and Traffic Alerting systems status (refer to Table 7-30-3):

Table 7-30-3: Primus APEX - TCAS - CAS Messages

CAS Message	Description
TCAS Fail	TCAS hardware/software fault leading to loss of Traffic Collision Avoidance System (TCAS) and Cockpit Display of Traffic Information (CDTI)

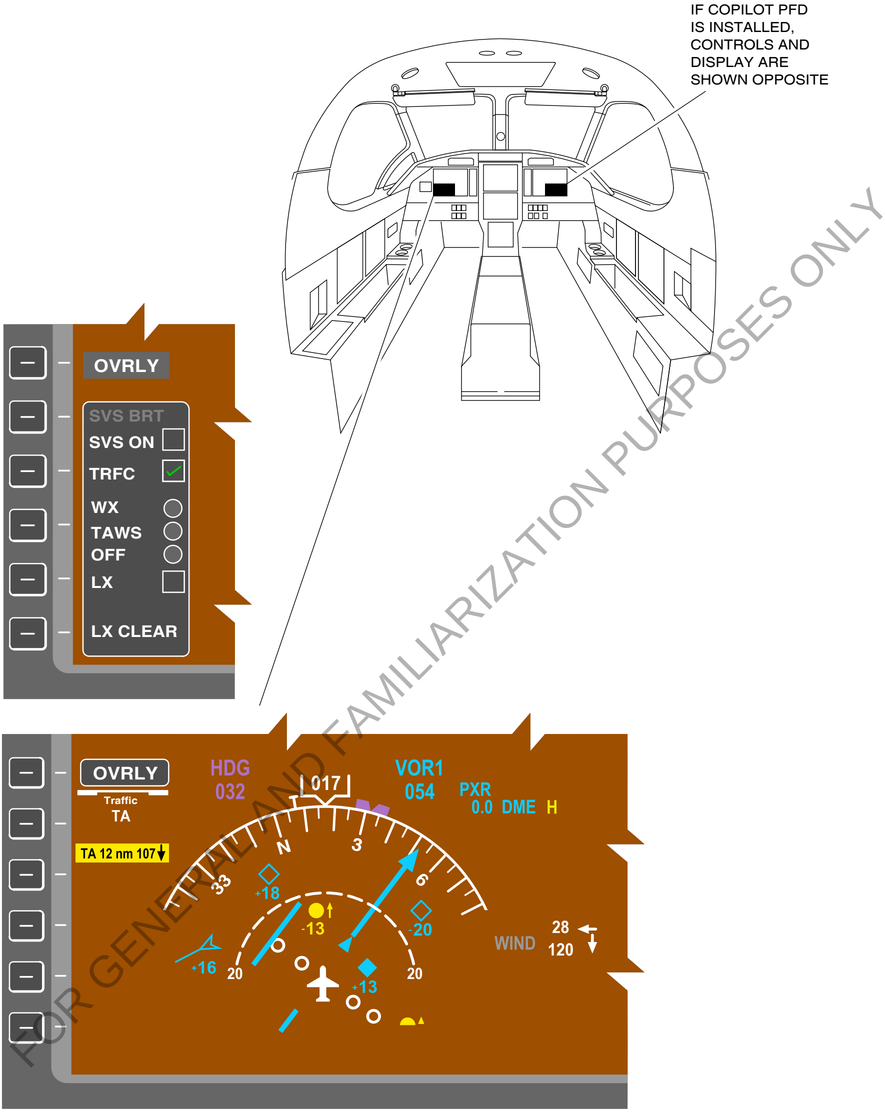

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Figure 7-30-4: APEX Traffic - Overlay Menu and Display

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7-30-4.3 Automatic Dependent Surveillance - Broadcast (ADS-B) In

7-30-4.3.1 General

ADS-B In is a feature of the transponder that can provide the following additional features:

- Basic Airborne situational awareness (AIRB)
- Visual Separation on Approach (VSA)
- SURFace situational awareness (SURF)
- Oceanic In-Trail Procedure (ITP)
- Enhance Visual Acquisition (EVAcq)

The ADS-B In receiver gets broadcast data from other transponder equipped aircraft.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for information regarding the specific operating details of ADS-B In.

7-30-4.3.2 Indication / Warning

The CAS window on the systems MFD will show the following advisory message for the ADS-B In systems status (refer to Table 7-30-4):

Table 7-30-4: Primus APEX - TCAS - CAS Messages

CAS Message	Description
ADS-B In Fail	TCAS hardware/software fault leading to loss of Cockpit Display of Traffic Information (CDTI)

7-30-4.4 Lightning Sensor System

7-30-4.4.1 General

The Lightning Sensor System (LSS) Stormscope WX 500 processor is installed under the cabin floor between frames 34 and 35. The power supply to the system is 28 VDC through the STORMSCOPE circuit breaker on the AVIONIC 2 BUS circuit breaker panel.

7-30-4.4.2 Description

The LSS detects lightning activity 360 degrees around the aircraft up to a distance of 200 nautical miles. The antenna is installed on the bottom of the fuselage, it detects intra-cloud, inter-cloud or cloud-to-ground electrical discharges and sends the resulting discharge signals to the processor. The processor converts the signals into range and bearing data then stores the data in memory. The processor then communicates the data to the MAU as strikes and cells with updates every two seconds.

To maintain correct storm orientation the system receives heading source data from the ADAHRS. If the heading source data becomes invalid the LSS may fail and remain failed until a complete power cycle is performed.

The LSS is inhibited automatically when the pilot or copilot presses his PTT switch. This prevents false lightning activity detections which could be caused by the communications transmission signals.

For further information on the use of the system, operational techniques and weather display interpretation consult the Stormscope Model WX-500 User's Guide.

7-30-4.4.3 Operation

Refer to Fig. 7-30-5, APEX Lightning - Overlay Menu and Display

The LSS is a passive system and is commanded into the normal working mode by the MAU at power up. The system has three levels of self test; at power on, continuous and pilot initiated. The pilot initiated LX self test which takes approximately 30 seconds can be done from the LX set up page accessed from the WX/LX/TAWS menu on the TSC or the MFD lower 1/6th window tab. The LX MODE can be toggled between Cell and Strike on the LX set up page. The power default state of LX MODE is Strike.

During the system operation the partial compass of the HSI display and the Situation Awareness MFD Map display can be overlaid with lightning information. There are two components of the lightning display, mode/fault annunciations; strike rate and lightning cell/strike data. Mode/fault and strike rate annunciations are placed outside the display area and the lightning cell/strike is placed inside the display using a lightning symbol as described in the cell and strike modes given below.

The Lightning (LX) overlay on the PFD HSI can be selected by pressing the bezel button adjacent to the OVERLAY annunciator, which then shows the overlay selection menu. Select LX with the bezel button and then press the OVERLAY bezel button again.

The Situation Awareness MFD INAV Map Lightning Sensor System overlay can be displayed by selecting the WX button on the Active Layers Control Bar and then selecting the LSS check box.

When the LSS overlay is selected the normal mode annunciations for CELL or STRIKE and the RATE are shown in white on the bottom left of the overlay. In either the cell or strike mode, if a lightning strike is detected within 25 nm of the aircraft position within the last three minutes the mode annunciator will change to amber.

Indicated distance of lightning activity may differ slightly from distance provided by the XM SAT Weather. This is due to the measuring technique used by the WX-500 Stormscope.

Annunciations in white are also given: CLEAR, TEST and FAULT. If the lightning sensor fails an amber LX FAIL annunciation will be shown and the RATE and overlay display data will be removed.

7-30-4.4.3 .1 Strike Display Mode (default mode)

In the strike display mode a discharge symbol is shown on the lightning detection overlay when the LSS detects a discharge within the selected range and view. The strike display mode shows the discharge points on the overlay in relation to where the discharges are actually detected instead of close to an associated group as is done in the cell display mode. The strike display mode is most useful during periods of light electrical discharge activity because it may show discharges associated with a building thunderstorm.

7-30-4.4.3 .2 Cell Display Mode

In the cell display mode a discharge symbol is shown on the lightning detection overlay when the LSS detects discharges within the selected range and view. The system will show another discharge symbol close to the first for each additional discharge determined to be associated with the group. Discharges not associated with a group are not shown unless its detected within 25 nm radius of the aircraft. The effect of this clustering algorithm is to display the location of storm cells instead of individual discharges. The cell display mode is most useful during periods of heavy electrical discharge activity.

Clearing the discharge points periodically while monitoring thunderstorms is a good way to determine if the storm is building or dissipating. Discharge points in a building storm will reappear faster and in larger numbers. Discharge points in a dissipating storm will appear slower and in smaller numbers. The LX CLR soft key is accessed from the OVRLY window and when the adjacent bezel button is pressed an LX CLR “ON” indicator will show for three seconds and all the lightning cells or strikes will be removed from the PFD and any other displays.

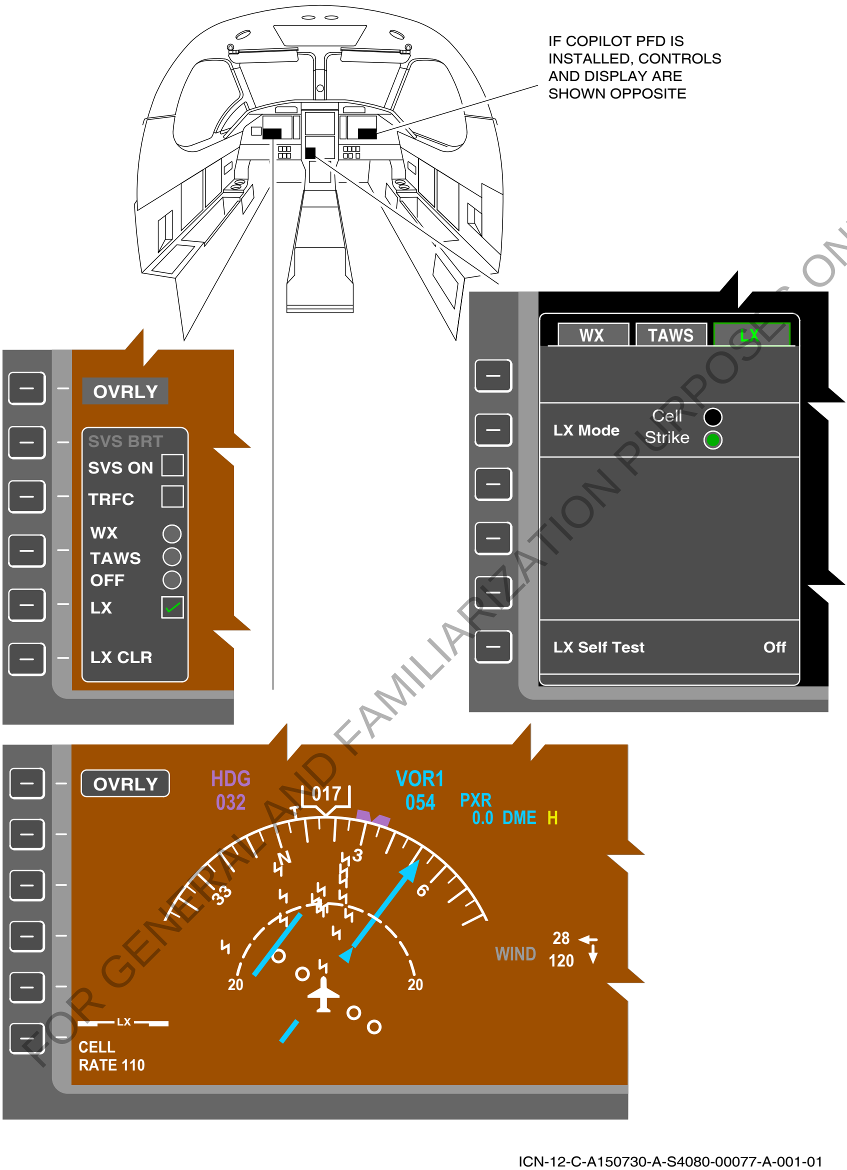

Figure 7-30-5: APEX Lightning – Overlay Menu and Display

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7-30-4.5 XM Sat Weather

7-30-4.5.1 Description

The XM Sat Weather is a streaming weather data source which provides data to the Primus Apex system for display on the Situation Awareness MFD Map display. The XM Sat Weather processor is installed under the cabin floor between frames 27 and 28. The power supply to the XM Sat Weather system is 28 VDC through the XM SAT WX circuit breaker on the STANDBY BUS. An XM antenna is installed on the forward top of the fuselage.

The XM Weather Receiver sends validated data to the MAU.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E for more information regarding the specific operating details of the XM Sat Weather system.

7-30-4.5.2 Operation

The XM Sat Weather INAV overlays are selected from the WX button menu on the Situation Awareness MFD.

The following Table 7-30-5 gives the XM Sat Weather system declutter ranges (nm).

Table 7-30-5: XM Sat Weather system declutter ranges (nm)

Layer	Min. Range (North Up)	Min. Range (Heading Up)	Max. Range (North Up)	Max. Range (Heading Up)
NEXRAD	10	5	500	250
Composite Radar	10	5	500	250
Sat	50	25	500	250
Winds	50	25	500	250
Tops	10	5	500	250
Lghtng	10	5	200	100
Turb	50	25	500	250
E-Tops	10	5	500	250
Freezing	50	25	500	250
TFR	5	2.5	500	250
AIRMET	50	25	500	250
SIGMET	5	2.5	500	250
PIREP	50	25	500	250
AIREP	50	25	500	250
Icing	10	5	750	375
NXRDcv	Min INAV range	Min INAV range	Max INAV range	Max INAV range
METAR	Min INAV range	Min INAV range	* 75	* 37.5
TAF	Min INAV range	Min INAV range	* 75	* 37.5

* Airport symbols are decluttered at this range.

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7-30-4.6 SmartView

7-30-4.6.1 General

The purpose of SmartView (SV) is to enhance the pilot's awareness of the aircraft position in relation to terrain, obstacles and airports within the limits of the navigation source capabilities of the system.

SV does not provide the accuracy or reliability upon which the flight crew can solely base decisions and/or plan maneuvers to avoid terrain or obstacles.

Note

To avoid intentional misuse of SmartView (SV) refer to Section 2 (Limitations), Systems and Equipment Limits.

The integrity of SV depends on the validity of the installed Obstacle and Terrain database. If using SV, it is the Pilot's responsibility to verify that a valid database is installed.

Along with the SV option, the PFD also provides PFD symbology to reduce pilot's workload, which is available whether SV is turned ON or OFF.

7-30-4.6.2 Primary Flight Display and SmartView Elements

7-30-4.6.2.1 SmartView Display

Refer to Fig. 7-30-6, SmartView Display Elements and Fig. 7-30-7, Parked Heading Reference Symbol.

Advanced PFD symbology consists of:

1 Flight Path Symbol

The Flight Path Symbol (FPS) is a representation of the current aircraft flight path over ground, i.e. Flight Path Angle (FPA) and track.

2 Flight Path Director

The Flight Path Director (FPD) provides guidance cues with respect to the FPS.

3 Acceleration Chevron

The relative position of the Acceleration Chevron with respect to the FPS indicates the instantaneous acceleration/deceleration of the aircraft with respect to the current Indicated Air Speed (IAS).

4 Zero Pitch/Path Reference Line

The PFD includes a white horizon line that represents the true horizon. If the Aircraft Reference Symbol (ARS) is in line with that white horizon line it indicates a zero pitch. If the FPS is in line with that white horizon line it indicates zero FPA. Therefore the white horizon line is called Zero Pitch/Path Reference Line (ZPRL).

5 Track Reference Symbol

The Track Reference Symbol (TRS) on the ZPRL represents the aircraft track.

6 Heading Reference Symbol

The Heading Reference Symbol (HRS) on the ZPRL indicates the current aircraft heading.

Note
The angle between the TRS and HRS represents the current Drift Angle (DA). If the DA is greater than 9 degrees the HRS will be parked on either side of the display (on the right side if the wind comes from the right and on the left side if the wind comes from the left) and will be ghosted (dashed). In this scenario, the HRS is nonconformal to the synthetic scenery and the angle between the HRS and the TRS does not represent the DA anymore.

SmartView consists of:

1 Synthetic Scenery

The synthetic scenery provides the display of sky, water and terrain relative to the current aircraft position and track, and is depicted from the perspective of the flight crew. The synthetic scenery is created based on the terrain database.

Note
The terrain database has an area of coverage from latitude 80 degrees North to latitude 80 degrees South in all longitudes.

2 Grid Lines

Grid lines are regularly spaced black lines on terrain that help to provide an optical flow for general sense of motion and altitude above ground and aid depth perception and terrain closure rate to the flight crew.

3 Range Rings

The terrain tracing range rings indicate points on the terrain that are the same indicated ground distance from the aircraft. The white range rings mark distances of 3 nm, 5 nm, 10 nm and 20 nm.

4 Obstacles

All obstacles in the database that are 200 ft AGL or higher are shown on the synthetic scenery by a purple rectangle that represents the true height of the obstacle, but not the true width. Obstacles are always assumed to be 80 ft wide. Obstacles appear when the obstacle position is 13 nm (ground range) from the aircraft. The obstacles are created based on the obstacle database.

Note
Terrain and obstacles shown above the ZPRL are above the current aircraft altitude. Similarly, terrain and obstacles shown below the ZPRL are below the current aircraft altitude. SV is intended to assist as an awareness tool only. It may not provide either the accuracy or fidelity (or both) on which to solely base decisions and plan maneuvers to avoid terrain or obstacles.

5 Runways and Runway Markings

All runways from the database are displayed on the synthetic scenery. Runways appear on the display at a range of 33 nm (ground distance). Runways are shown with a realistic looking surface texture, runway identification number and center line.

Note
All runways are shown without clear ways.

6 Destination Runway Outline

A cyan box is placed around the FMS selected runway to help the pilot to easily identify the destination runway.

7 Destination Runway Extended Centre Line

The destination runway extended centre line is a line originating from the FMS selected destination runway end along the runway direction. The length of the extended centre line is 10 nm.

Note
The extended destination runway center line does not represent a localizer.

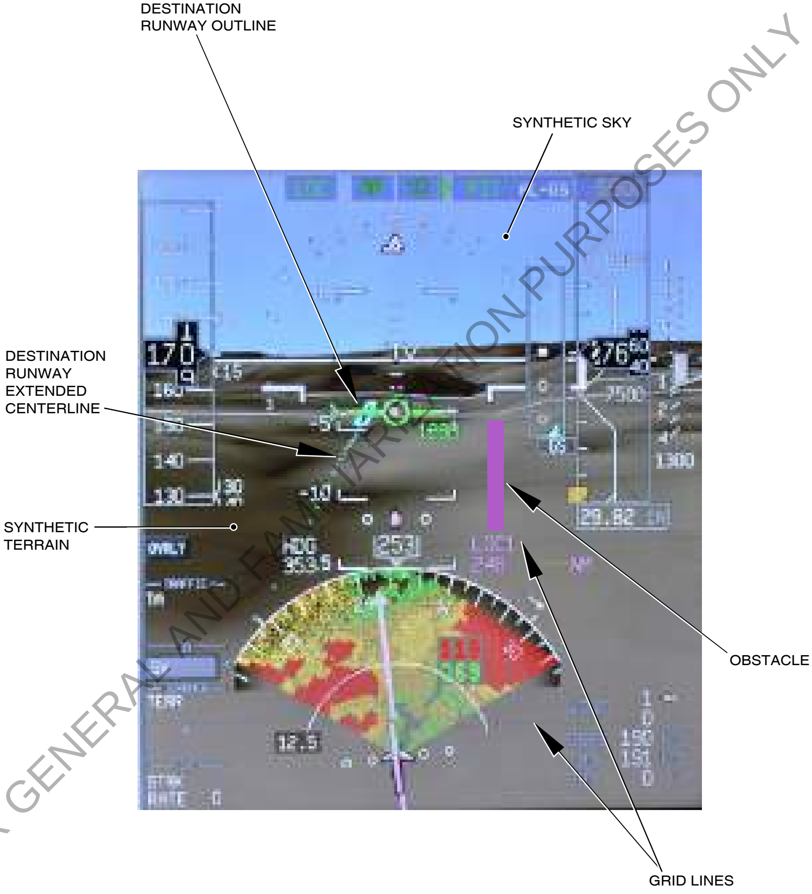

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Figure 7-30-6: SmartView Display Elements (Sheet 1 of 3)

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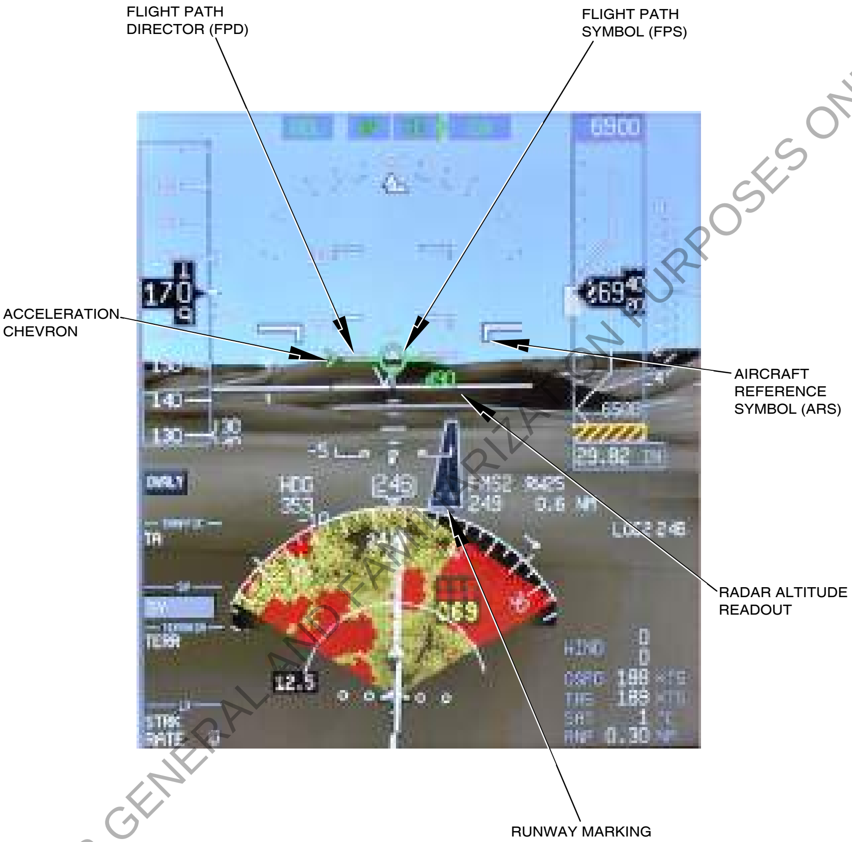

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Figure 7-30-6: SmartView Display Elements (Sheet 2 of 3)

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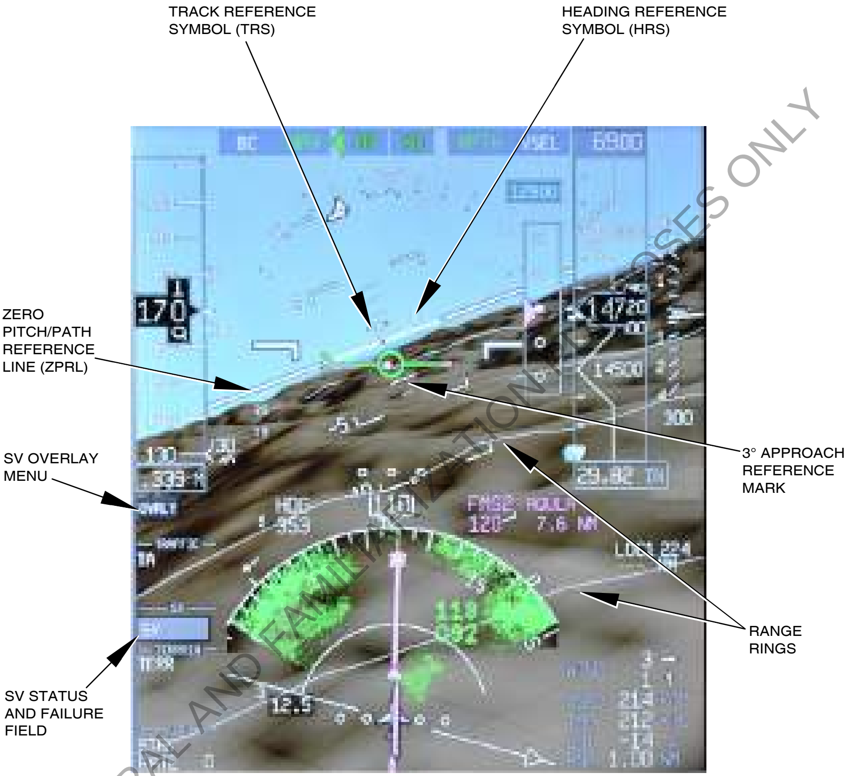

Figure 7-30-6: SmartView Display Elements (Sheet 3 of 3)

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Figure 7-30-7: Parked Heading Reference Symbol

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7-30-4.6.2 .2 SV Vertical Centering Mode

The vertical centering mode is pitch-based. This means the synthetic terrain is vertically centered with the ARS, which does not move vertically. The vertical scale is positioned so that the ARS represents the correct aircraft pitch attitude.

Note
The synthetic scenery is vertically centered to where the aircraft is pointing at (pitch angle) and not where it is going to (Flight Path Angle).

Note
The FPS can move vertically to indicate the current aircraft FPA in respect to the vertical scale.

7-30-4.6.2 .3 SV Lateral Centering Mode

The SV lateral centering mode is track-based. This means the synthetic terrain is laterally centered with the FPS, which does not move laterally.

Note
The FPS is always conformal to the synthetic scenery, obstacles and runways. The synthetic scenery is laterally centered to where the aircraft is going to (tracking) and not where it is pointing at (heading).

Note
The ARS does not move laterally. Therefore it does not indicate the aircraft heading. For indication of the aircraft heading the pilot must use the (Horizontal Situation Indicator) HSI. The HRS on the ZPRL also gives a reference for the aircraft heading with respect to the background synthetic scenery.

7-30-4.6.2 .4 SV Field of Regard Lines

Refer to Fig. 7-30-8, iNAV lateral Field of Regard line.

The lateral Field of Regard (FOR) lines are displayed on the 2D map (iNAV). The FOR lines represent the lateral limits of the displayed synthetic scenery.

Note
As a consequence of the track-based lateral centering mode the FOR lines are also centered according to the aircraft track. Therefore during high DA the FOR lines will not symmetrically line up with the aircraft longitudinal axis (heading).

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Figure 7-30-8: iNAV lateral Field of Regard line

7-30-4.6.2 Flight Director Selection
.5

Refer to Fig. 7-30-9, FCS Tab and Fig. 7-30-10, Flight Director Modes.

Three Flight Director (FD) modes are available. They can be selected from the FCS tab in the Avionics window:

- Single-Cue (S-Cue) Flight Director with a flying wedge as primary reference symbol
- Cross-Pointer (X-Ptr) Flight Director with gull wings as primary reference symbol
- Flight Path (Flt-Path) Flight Director with a FPS as primary reference symbol.

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Figure 7-30-9: FCS Tab

If Flt-Path is selected as Flight Director mode the FPS is the primary reference symbol and gull wings are shown as a secondary reference symbol (Aircraft Reference Symbol). In this case the FPS cannot be selected OFF (FPS selection is greyed out).

If S-Cue or X-Ptr is selected as Flight Director mode the flying wedge or gull wings are shown as the primary reference symbol. The FPS in this case is a secondary symbol and can be selected ON or OFF in the FPS selection line in the FCS tab in the Avionics window.

The FD selection menu can be controlled via DU bezel buttons or via CCD or TSC on the FCS tab in the Avionics window. The FD selection will cycle with each press between S-Cue, X-Ptr and Flt-Path.

At power-up the default is the last pilot selection. In the case that the FPS is invalid initially at power-up, the system defaults to X-Ptr.

	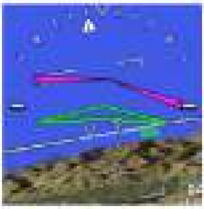	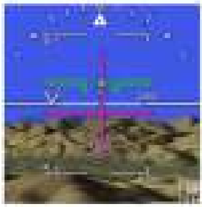	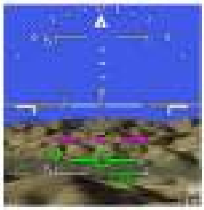
PITCH-BASED MODE			PATH-BASED MODE
GUIDANCE CUE	SINGLE CUE (S-CUE) FLIGHT DIRECTOR	CROSS POINTER (X-PTR) FLIGHT DIRECTOR	FLIGHT PATH (FLT-PATH) DIRECTOR
PRIMARY CONTROL REFERENCE	FLYING WEDGE AIRCRAFT REFERENCE SYMBOL	GULL WINGS AIRCRAFT REFERENCE SYMBOL	FLIGHT PATH SYMBOL
SECONDARY REFERENCE	DE-EMPHASIZED FLIGHT PATH SYMBOL	DE-EMPHASIZED FLIGHT PATH SYMBOL	DE-EMPHASIZED GULL WINGS AIRCRAFT REFERENCE SYMBOL

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Figure 7-30-10: Flight Director Modes

1 Pitch-Based Mode

In pitch-based mode (S-Cue or X-Ptr Flight Director) the primary control reference is the ARS displayed as a green flying wedge or gull wings. The FPS, if selected, is deemphasized (smaller and grey in colour) as it is a secondary reference. In this mode the magenta Flight Director (S-Cue or X-Ptr) provides guidance cues with respect to the green ARS.

2 Path-Based Mode

In path-based mode (Flt-Path Flight Director) the primary control reference is the FPS, displayed as a green circle with wings. The ARS is shown as gull wings. As the ARS in this case is a secondary reference, it is shown deemphasized (thinner, expanded and white/grey in colour). In this mode the magenta FPD provides guidance cues with respect to the green FPS.

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7-30-4.6.2.6 Unusual Attitudes

Refer to Fig. 7-30-11, Unusual Attitude Overlays and Fig. 7-30-12, Synthetic Blue Display.

1 Semi-Transparent Blue over Brown in unusual attitudes.

In unusual attitudes, there may not be enough sky or terrain shown to provide an adequate interpretation of the aircraft attitude. To aid this information a semitransparent blue or brown is overlaid in certain attitudes. The sky/terrain colour is semi-transparent so the pilot can continue to see the terrain behind the sky/terrain colour for terrain awareness. In this case the ZPRL is non-conformal, i.e. the angle between the ZPRL and the ARS does not represent the current aircraft pitch angle anymore and the angle between the FPS and the ZPRL does not represent the current FPA. However, the ARS and the FPS are still presented correct with respect to the background vertical scale of the display.

Note
In normal operation, with enough blue (sky) on the top of the display, the semi-transparent synthetic blue will not be visible. When terrain is displayed on the upper part of the display (e.g. when tracking to a mountain), the semitransparent synthetic blue becomes visible.

2 Reversion to PFD due to excessive bank angle:

Refer to Fig. 7-30-13, Excessive Bank Angle.

At excessive angles of bank the PFD symbology is decluttered. SV is removed if the bank angle increases at 65 degrees left or right. The FPS will be removed at 70 degrees left or right bank.

3 Reversion to PFD due to excessive pitch angle:

Refer to Fig. 7-30-14, Excessive Pitch Angle.

The PFD will declutter at 30 degrees pitch up or 20 degrees pitch down. The FPS will be removed at 40 degrees pitch up or 30 degrees pitch down.

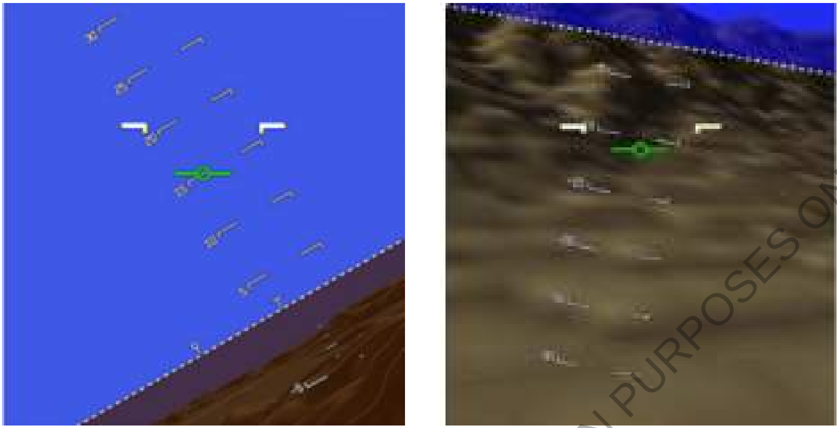

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Figure 7-30-11: Unusual Attitude Overlays

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Figure 7-30-12: Synthetic Blue Display

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Figure 7-30-13: Excessive Bank Angle

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Figure 7-30-14: Excessive Pitch Angle

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7-31 Primus APEX - Monitor Warning System (MWS)

7-31-1 General

The MWS performs the following functions:

- Monitor Warning Function (MWF)
  - System monitors
  - Aural Warning.
- Crew Alerting System (CAS)
- Flight Alerting System (FAS).

7-31-2 Monitor Warning Function (MWF)

The MWF continuously monitors the interfaced aircraft systems and initiates the appropriate warning, caution and aural alerts to the crew when necessary.

The MWF runs in both channels of the Modular Avionics Unit (MAU), each MWF is comparison monitored with its opposing channel for integrity of the resultant alert.

Each MWF instance will produce a priority status parameter, and dependent on its origin will be sent to the FAS (Refer to Section 3, FAS Messages and Actions for these messages), CAS or to the Aural Warning system.

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7-31-3 System Monitors

The MWF provides two levels of system monitoring, Level A and C. The level A monitor consists of the following:

- On ground
  - WOW air-ground monitor
  - Radio altitude air-ground monitor
  - Calibrated airspeed air-ground monitor
  - Aircraft on ground monitor.
- PBIT on ground
- Engine running
- Inhibit monitors
  - Takeoff global inhibit monitor
  - Approach global inhibit monitor
  - Standby Bus On global inhibit monitor
  - Electrical power on functional inhibit monitor
  - Engine start functional inhibit monitor
  - Taxi functional inhibit monitor.
- Cruise functional inhibit monitor
- Takeoff configuration
- Check DU graphics generation and display monitor
- Gear warning monitor
- Stall warning monitor
- Cabin pressurized warning monitor
- Overspeed warning monitor
- CPCS doors monitor
- CPCS takeoff roll monitor
- Landing gear status.

The level C monitor consists of the following:

- Sensor miscompare
  - Selected ADAHRS data determination
  - Pitch miscompare monitor
  - Roll miscompare monitor
  - Heading miscompare monitor
  - Barometric corrected altitude miscompare monitor
  - Barometric correction miscompare monitor
  - Calibrated airspeed miscompare monitor.
- Altitude alert
- Autopilot engage
- Minimums alert
- Gear enable energized
- De-ice boots
- Hydraulic pressure
- Engine automatic start
- Oil debris
- ACS control
- ASCB Bus.

7-31-4 Aural Warning

The MWF consists of two monitor warning functions that provide requests for the aural warning drivers to output tones and/or voice callouts to the audio system.

Table 7-31-1 lists the aural alerts generated from the MWF in priority order.

Table 7-31-1: Aural Alerts

CONDITION	AURAL MESSAGE / TONE	TYPE	MUTABLE
Stall	"Stall"	Continuous	No
Terrain alerts	Numerous	N/A	Note 1
Traffic alerts	Numerous	External	Note 2
Gear	"Gear"	Continuous	No
Overspeed	"Speed"	Continuous	No
Takeoff Configuration	"No Takeoff"	Continuous	No
Cabin Pressurized	"Cabin"	Continuous	No
Warning Chime	Triple Chime	Continuous	Yes
Pitch Trim Runaway	"Trim Runaway"	Continuous	Yes
Yaw Trim Runaway	"Trim Runaway"	Continuous	Yes
Engine Fire	"Fire"	Continuous	Yes
Cabin Altitude	"Cabin Altitude"	Continuous	Yes
Battery Hot Warning	"Battery Hot"	Continuous	Yes *
Propeller Low Pitch Warning	"Propeller Low Pitch"	Continuous	Yes
RAAS Cautions	Numerous	N/A	Note 1
Smart Runway / Smart Landing Cautions (optional)	Numerous	N/A	Note 1
Caution Chime	Single Chime	Continuous	Yes
AP Uncommanded Disconnect	Cavalry Charge	Continuous	Yes
Minimums	"Minimums"	Single	No
AP Commanded Disconnect	Cavalry Charge	Single	No
Altitude	C Chord	Single	No
Vertical Track Alert	C Chord (0.2 sec on, 0.15 sec off, 0.2 sec on)	Single	No
AT (optional) Uncommanded Disconnect	"Autothrottle"	Continuous	Yes
AT (optional) Commanded Disconnect	"Autothrottle"	Single	No
RAAS Advisories	Numerous	N/A	Note 1
ATC Uplink Aural	Ding-Dong	Single	Yes
ATC center notified failed	Ding-Dong	Single	Yes
ATC MSG buffer full	Ding-Dong	Single	Yes
ATS uplink aural	Ding-Dong	Single	Yes
Smart Runway / Smart Landing Advisories (optional)	Numerous	N/A	Note 1

Note	
1	EGPWF tones are commanded by the EGPW function on the MAU and played based on MWS priorities.
2	TCAS alerts are part of the third priority group of aural warnings. Only the stall and EGPWF aural alerts have a higher priority than TCAS aural alerts.
3	* Only when NiCad batteries are installed.

If the MWF detects a fault in the aural warning system a CAS caution message will be shown to annunciate the Aural Warning Failure. If one channel of the aural warning system becomes inhibited or defective a CAS advisory message will be shown to indicate an aural warning fault. If one channel of the MWF becomes defective a CAS advisory message will be shown to indicate an MWF A or B channel failure. The aural warning system can be disabled by operation of the AURAL WARN INHIBIT switch on the cockpit rear left switch panel, in the event of a failed repetitive aural.

For normal operation the AURAL WARN INHIBIT switch should not be selected to INHIBIT. To reduce nuisance alerting in the cockpit, both channels of the aural warning are disabled while the aircraft is on the ground and not fully powered.

7-31-5 Crew Alerting System (CAS)

Refer to Fig. 7-31-1, Crew Alerting System (CAS).

When the MWF detects an out of limits condition it will illuminate either the master WARNING or master CAUTION attention lights and generate the appropriate message and aural alert. The CAS messages are displayed in the CAS window of the systems Multi Function Display (MFD). When no messages are active the window is blank except for the window title CAS and the scroll arrows. The window can display 12 lines of messages of 20 characters each.

The CAS messages have four levels:

- **Warning (red)**

  Indicates a condition that requires an immediate corrective action by the pilot. A red warning CAS message will be displayed in reverse (red background) until acknowledged by pressing the WARNING attention light. After which the CAS warning message text will be shown in the red warning color

- **Caution (amber)**

  Indicates a condition that requires a pilots attention but not an immediate reaction. An amber caution CAS message will be displayed in reverse (amber background) until acknowledged by pressing the CAUTION attention light. After which the CAS caution message text will be shown in the amber caution color. Unacknowledged reversed caution messages cannot be scrolled off the CAS window

- **Advisory (cyan)**

  Indicates a system condition, which requires pilot awareness and may require crew action. A cyan advisory CAS message will be displayed in reverse (cyan background) for 5 seconds. After 5 seconds they will be shown in the cyan advisory color

- **Status (white)**

  Are only displayed on the ground in white text and indicate a maintenance action is required. The **Event** message will be displayed in flight to indicate that the crew initiated event recording is captured.

The CAS messages have been given a hierarchical priority status. Red warning has priority over an amber caution, which has priority over cyan advisory. The purpose of the priority status is that new incoming messages will be held in a queuing system based on priorities. Whenever a new CAS message becomes active it will appear in the appropriate color in reverse video.

Red master WARNING and amber master CAUTION attention lights are positioned on the instrument panel directly in front of the pilot and copilot. They alert the crew to changes in the CAS monitoring status. Any condition that causes a red or amber CAS message also causes the applicable master WARNING or CAUTION attention light to come on. Some warnings are accompanied with a voice callout which will sound through the overhead speaker and/or headset(s). Pushing the applicable master WARNING or CAUTION attention light acknowledges the message and extinguishes the light. This action also changes the warning or caution message from reverse video to normal text in the CAS window. All advisory and status messages will be automatically acknowledged and revert to normal text after being in view for 5 seconds.

The master WARNING and CAUTION attention lights are checked before flight by pressing the LAMP switch on the overhead panel which will make the pilot and copilot attention lights illuminate.

In the event that more than 12 messages are active simultaneously, scrolling is provided for the pilot to view all active messages. Warning messages cannot be scrolled off the display. Caution messages can only be scrolled off the display when they have been acknowledged. Scrolling is not active until the message window is full. On the left side of the CAS window a digital display will show the number of CAS messages scrolled off the CAS window for each color. Acknowledged messages scrolled off the CAS window will appear in normal text and unacknowledged messages will be shown in reverse video.

To initiate CAS scrolling, press the bezel button adjacent to the up or down arrow softkey. Scrolling of the CAS messages can also be done with the Cursor Control Device (CCD) by bringing the CAS window into focus, and then use the scrollwheel function to scroll up or down.

In the event of a MWF miscompare condition, an amber MW annunciator is displayed on the left of the CAS window (Ref. Fig. 7-31-1, Crew Alerting System (CAS)). When this MW annunciator is displayed, the pilot can toggle between the MWF Sources by pressing the bezel button adjacent to the MW softkey. The pilot decides which MWF Source to select in a miscompare condition.

All the warnings (including their respective audio), cautions, advisory and status messages that can be displayed on the CAS are listed in Table 7-31-2 (warnings), Table 7-31-3 (cautions), Table 7-31-4 (advisories) and Table 7-31-5 (status). An X in the flight phase columns indicates a message is inhibited during that flight phase.

Refer to the relevant aircraft System Indication/Warning section for a description of the conditions when a CAS message will be generated. Refer to Section 3, General for the relevant emergency procedures given for the CAS Warning and Caution messages.

7-31-6 CAS Warning Messages (RED)

Table 7-31-2: CAS Warning Messages (Red)

Message Text	Voice	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
Engine Fire	Fire	X						
Engine ITT		X						
Engine Torque		X						
Engine NG		X						
Engine NP		X						
Engine Oil Press		X						
Engine Oil Temp		X						
Essential Bus		X		X				
Generators		X	X	X				
Cabin Pressure		X		X				
Starter Engaged		X		X				
Battery 1 Hot	Battery Hot	X		X		X		X
Battery 2 Hot		X		X		X		X
Battery 1 + 2 Hot		X		X		X		X
Pitch Trim Runaway	Trim Runaway	X		X				
Engine Oil Level (only valid with engine oil pressure below 50 psig)		X		X				
Cabin Altitude	Cabin Altitude	X		X				
Passenger Door		X		X				X
Cargo Door		X		X				X
Pax + Cargo Door		X		X				X

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Table 7-31-2: CAS Warning Messages (Red) (continued from previous page)

Message Text	Voice	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
Propeller Low Pitch	Propeller Low Pitch	X		X				
EPECS Fail		X						
Yaw Trim Runaway	Trim Runaway	X		X				

7-31-7 CAS Caution Messages (AMBER)

Table 7-31-3: CAS Caution Messages (Amber)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
MAU A Fail			X				
MAU B Fail			X				
Engine ITT	X						
Engine Torque	X						
Engine NG	X						
Engine NP	X						
Engine Oil Press	X						
Engine Oil Temp	X						
EPECS Degraded	X				X		X
Probes Off	X		X		X		X
Fuel Quantity Fault	X		X		X		X
Fuel Balance Fault	X		X		X		X
LH Fuel Low	X		X				
RH Fuel Low	X		X				
LH & RH Fuel Low	X		X				
Fuel Pressure Low	X						
Fuel PRESS SENS Fail	X				X		X
Fuel IMP Bypass	X		X		X		X
Fuel Filter Blocked	X						
Fuel TEMP	X				X		X
LH Fuel Pump	X				X		X
RH Fuel Pump	X				X		X
LH & RH Fuel Pump	X				X		X
Gear Actuator Cntl	X		X				
Invalid Gear Config			X		X	X	X
External Power	X		X		X	X	X
ACS Low Inflow	X		X		X		X
ECS Fault	X		X		X		X
CPCS Fault	X		X		X		X

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Table 7-31-3: CAS Caution Messages (Amber) (continued from previous page)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
Generator 1 Off	X		X		X		X
Generator 2 Off	X		X		X		X
Fuel Imbalance	X		X		X		X
Bus Tie	X				X		X
Pusher	X		X				
Avionics 1 Bus	X		X		X		X
Avionics 2 Bus	X		X		X		X
Avionics 1 + 2 Bus	X		X		X		X
Fire Detector	X		X		X		X
Generator 1 Volts	X		X		X		X
Generator 2 Volts	X		X		X		X
Generator 1 + 2 Volts	X		X		X		X
Battery 1	X		X		X		X
Battery 2	X		X		X		X
Battery 1 + 2	X		X		X		X
Battery 1 Off	X		X		X		X
Battery 2 Off	X		X		X		X
Battery 1 + 2 Off	X		X		X		X
Flaps	X		X				
Engine Chip	X		X		X		X
Main Bus	X		X		X		X
Generator 1 Bus	X		X		X		X
Generator 2 Bus	X		X		X		X
Generator 1 + Bus	X		X		X		X
AOA De Ice	X		X				X
Pitot 1 Heat	X		X		X		X
Pitot 2 Heat	X		X		X		X
Pitot 1 + 2 Heat	X		X		X		X
Static Heat	X		X				X
Inertial Separator	X		X				X
De Ice Boots	X		X				X
LH Windshield Heat	X		X		X		X
RH Windshield Heat	X		X		X		X
LH + RH Windshield Heat	X		X		X		X
Propeller De Ice	X		X				X
Check DU 1			X				
Check DU 2			X				
Check DU 1+2			X				
Check DU 3			X				
Check DU 1+3			X				
Check DU 2+3			X				
Check DU 1+2+3			X				

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Table 7-31-3: CAS Caution Messages (Amber) (continued from previous page)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
Check DU 4			X				
Check DU 1+4			X				
Check DU 2+4			X				
Check DU 1+2+4			X				
Check DU 3+4			X				
Check DU 1+3+4			X				
Check DU 2+3+4			X				
Check DU 1+2+3+4							
Non Essential Bus	X		X		X		X
Standby Bus			X		X		X
RA 1 Fail	X		X		X		
RA 2 Fail	X		X		X		
RA 1+2 Fail	X		X		X		
MMDR 1 Fail			X		X		X
MMDR 2 Fail			X		X		X
MMDR 1+2 Fail			X		X		X
XPDR 1 Fail	X		X		X		X
XPDR 2 Fail	X		X		X		X
XPDR 1+2 fail	X		X		X		X
AHRS A Fail	X		X		X		X
AHRS B Fail	X		X		X		X
AHRS A+B Fail	X		X		X		X
ADC A Fail	X		X		X		X
ADC B Fail	X		X		X		X
ADC A+B Fail	X		X		X		X
Air/Ground Fail	X		X		X		X
Aural Warning Fail	X	X	X		X		X
DME 1 Fail	X		X		X		X
DME 2 Fail	X		X		X		X
DME 1+2 Fail	X		X		X		X
MMDR 1 Overheat			X		X		X
MMDR 2 Overheat			X		X		X
MMDR 1+2 Overheat			X		X		X
HSI1 is MAG TRK	X	X	X				
HSI1 is TRU TRK	X	X	X				
HSI2 is MAG TRK	X	X	X				
HSI2 is TRU TRK	X	X	X				
HSI1+2 is MAG TRK	X	X	X				
HSI1+2 is TRU TRK	X	X	X				
AP Hold LH Wing Dn		X	X	X	X		
AP Hold RH Wing Dn		X	X	X	X		
AP Hold Nose Up		X	X	X	X		
AP Hold Nose Dn		X	X	X	X		

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Table 7-31-3: CAS Caution Messages (Amber) (continued from previous page)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
YD Hold Nose Left		X	X	X	X		
YD Hold Nose Right		X	X	X	X		
LH PFD CTLR Fail			X		X	X	X
RH PFD CTLR Fail			X		X	X	X
LH+RH PFD CTLR Fail			X		X	X	X
FLT CTLR Ch A Fail	X		X		X	X	X
FLT CTLR Ch B Fail	X		X		X	X	X
FLT CTLR Ch A+B	X		X		X	X	X
DU 1 Overheat	X		X		X		X
DU 2 Overheat	X		X		X		X
DU 1+2 Overheat	X		X		X		X
DU 3 Overheat	X		X		X		X
DU 1+3 Overheat	X		X		X		X
DU 1+2+3 Overheat	X		X		X		X
DU 1+4 Overheat	X		X		X		X
DU 4 Overheat	X		X		X		X
DU 1+4 Overheat	X		X		X		X
DU 1+2+4 Overheat	X		X		X		X
DU 2+4 Overheat	X		X		X		X
DU 3+4 Overheat	X		X		X		X
DU 1+3+4 Overheat	X		X		X		X
DU 2+3+4 Overheat	X		X		X		X
DU 1+2+3+4 Overheat	X		X		X		X
APM 1 Fail			X		X	X	X
APM 2 Fail			X		X	X	X
APM 1+2 Fail			X		X	X	X
CMS 1+2 Fail	X		X		X	X	X
System Config Fail			X		X	X	X
Validate Config	X		X		X	X	X
APM Miscompare	X		X		X	X	X
Cabin Pressure	X		X				
FMS1-GPS1 Pos Misc			X		X		X
FMS1-GPS2 Pos Misc			X		X		X
FMS1-GPS1+2 Pos Misc			X		X		X
FMS2-GPS1 Pos Misc			X		X		X
FMS2-GPS2 Pos Misc			X		X		X
FMS2-GPS1+2 Pos Misc			X		X		X
Unable FMS-GPS Mon	X	X	X		X		
Check Pilot PFD	X		X				
Check Copilot PFD	X	X	X				
Check Engine Display	X		X				
ASCB Fail	X		X		X		X
Boots TEMP Limit							

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Table 7-31-3: CAS Caution Messages (Amber) (continued from previous page)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
Flaps EXT Limit							
Emergency Descent							
Gear Power Fail	X						
ATC Datalink Fail			X		X		X
YD Fail	X		X		X		X
YD Off							

7-31-8 CAS Advisory Messages (CYAN)

Table 7-31-4: CAS Advisory Messages (Cyan)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
Terr Inhib Active							
MWF A Fail			X		X		X
MWF B Fail			X		X		X
Aural Warning Fault	X	X	X		X	X	X
No Alt Reporting							
YD Fail	X		X		X		X
AP Fail	X		X		X		X
AIOP A Module Fail			X		X		X
AIOP B Module Fail			X		X		X
CSIO A Fail			X		X		X
CSIO B Fail			X		X		X
CSIO A + B Fail			X		X		X
MAU A Overheat			X		X		X
MAU B Overheat			X		X		X
MAU A + B Overheat			X		X		X
FMS1 Fail			X		X		X
FMS2 Fail			X		X		X
FMS1+2 Fail			X		X		X
Maintenance Fail	X		X	X	X	X	X
MAU Fan Fail			X		X		X
MF CTLR Fail			X		X		X
FMS Synch Error	X		X		X		X
LH OAT Fail	X		X		X		X
RH OAT Fail	X		X		X		X
LH+RH OAT Fail	X		X		X		X
LH PFD CTLR Fail			X		X		X
RH PFD CTLR Fail			X		X		X
LH+RH PFD CTLR Fail			X		X		X
FD Fail	X		X		X		X

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Table 7-31-4: CAS Advisory Messages (Cyan) (continued from previous page)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
CMS 1 Fail			X		X		X
CMS 2 Fail			X		X		X
GIO A Fail			X		X		X
GIO B Fail			X		X		X
GIO A+B Fail			X		X		X
AGM 1 Fail			X		X		X
AGM 2 Fail			X		X		X
Takeoff Config	X		X		X	X	X
ACMF Logs Full	X		X		X	X	X
ACMF Logs >80% Full	X		X		X	X	X
Engine Log Full	X		X		X	X	X
Engine Log >80% Full	X		X		X	X	X
Pusher Safe Mode	X		X				
FLT CTLR Ch A Fail	X		X		X		X
FLT CTLR Ch B Fail	X		X		X		X
FLT CTLR Ch A+B Fail	X		X		X		X
TCAS Fail	X	X	X		X		X
TAWS Fail	X				X		X
GPS 1 Fail			X		X		X
GPS 2 Fail			X		X		X
GPS 1+2 Fail			X		X		X
AFCS Fault	X	X	X		X		X
CVR Fail	X		X		X		X
FDR Fail	X		X		X		X
Gear Control Fault	X		X		X	X	X
Flameout	X						
AUTO Relight	X						
EPECS Fault	X				X		X
Prop Reverse Fail	X						
TF Fail	X	X	X		X		X
AT Fail		X	X		X		X
CIO 1 Fail							
PROC 1 Fail							
Aural Warning Fault	X	X	X		X	X	X
ADS-B In Fail	X	X	X		X		X
VSA Unvailable	X	X	X		X		
SURF Traffic UNAVAIL	X	X	X		X		X
Windshear Fail					X		X
G/S Inhib Active							
FLAP OVRD Active							
STEEP APR Active							
Terrain Fail	X						

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Table 7-31-4: CAS Advisory Messages (Cyan) (continued from previous page)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
RAAS Fail	X		X		X	X	
RAAS Inhibit							
RAAS Not Available	X		X		X	X	
AOC Uplink			X		X		X
ATS Uplink			X		X		X
ATC Uplink			X		X		X
TSC Fail					X		
TSC Fan Fail					X		

7-31-9 CAS Status Messages (WHITE)

Table 7-31-5: CAS Status Messages (White)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
FCMU Fault	X		X		X	X	X
Low Lvl Sense Fault	X		X		X	X	X
Maint Memory Full	X		X		X	X	X
No Eng Trend Store	X		X		X	X	X
EPECS TLD	X				X	X	X
EPECS MAINT Mode	X				X		X
Wet Motoring	X				X		X
Dry Motoring	X				X		X
Maintenance Feather	X				X		X
Fuel Filter Replace	X				X		X
Engine Exceedence	X		X		X	X	X
Aircraft Exceedence	X		X		X	X	X
Event	X						
LH WOW Fault	X		X		X	X	X
RH WOW Fault	X		X		X	X	X
LH+RH WOW Fault	X		X		X	X	X
LH Fan Fault	X		X		X	X	X
RH Fan Fault	X		X		X	X	X
LH+RH Fan Fault	X		X		X	X	X
Crew Event Store	X		X		X	X	X
AGM1/FMS1 GFP Inop	X		X		X	X	X
AGM1/FMS2 GFP Inop	X		X		X	X	X
AGM1/FMS1+2 GFP Inop	X		X		X	X	X
AGM2/FMS1 GFP Inop	X		X		X	X	X
AGM2/FMS2 GFP Inop	X		X		X	X	X
AGM2/FMS1+2 GFP Inop	X		X		X	X	X
AGM 1 DB Error	X		X		X	X	X

Table 7-31-5: CAS Status Messages (White) (continued from previous page)

Message Text	Stby Bus	Elec Pwr on	Eng Start	Taxi	Takeoff	Cruise	Approach
AGM 2 DB Error	X		X		X	X	X
AGM 1+2 DB Error	X		X		X	X	X
AGM 1 DB Old	X		X		X	X	X
AGM 2 DB Old	X		X		X	X	X
AGM 1+2 DB Old	X		X		X	X	X
Function Unavailable							
Prop Feather Inhibit					X		X

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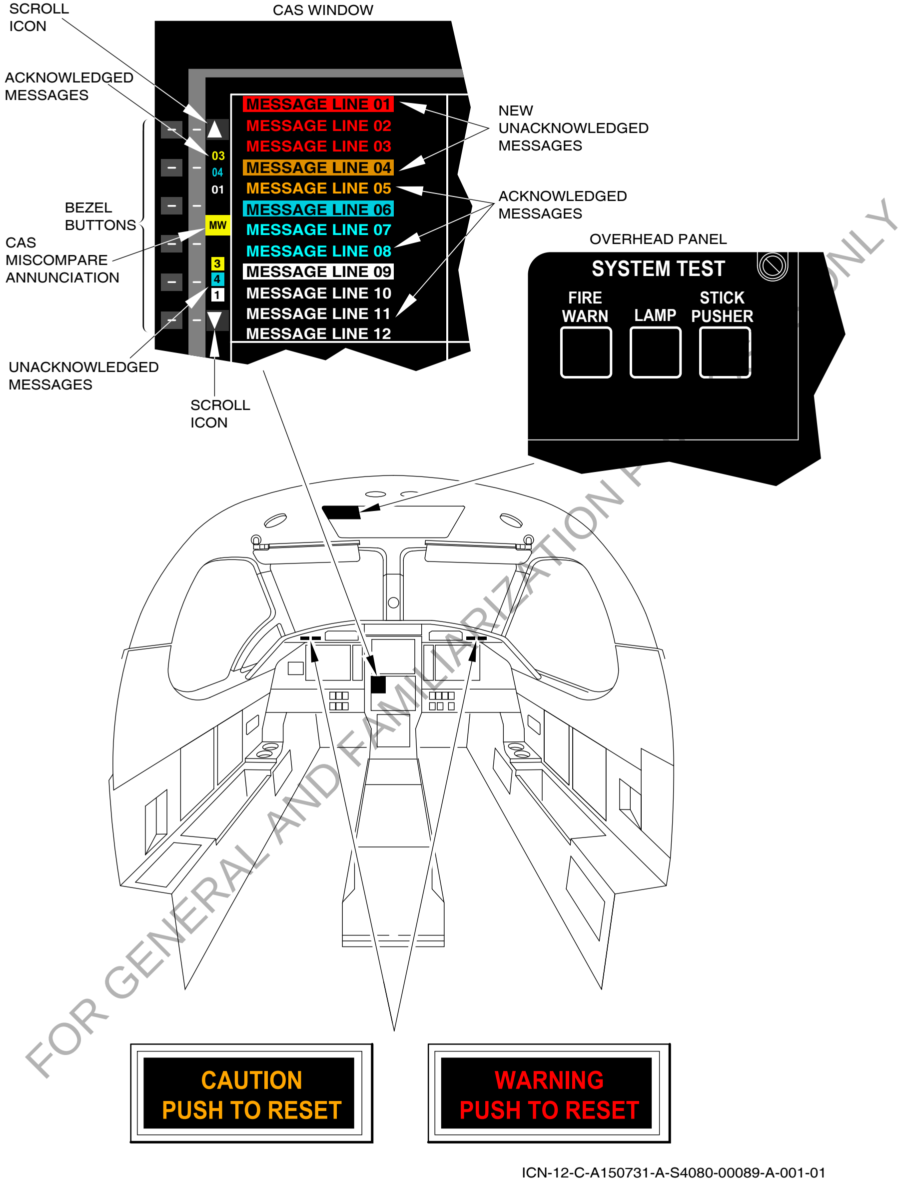

Figure 7-31-1: Crew Alerting System (CAS)

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7-32 Primus APEX - Automatic Flight Control System

7-32-1 General

Refer to Fig. 7-32-1, AFCS Schematic.

The Automatic Flight Control System (AFCS) provides the following functions:

- Autopilot (including automatic pitch trim)
- Yaw Damper (including automatic yaw trim)
- Flight Director (FD) guidance
- Thrust Management System (optional)
- Emergency Descent Mode
- Tactile Feedback.

The AFCS function is hosted in the Modular Avionics Unit (MAU). The autopilot software runs in channels A and B of the MAU and both channels are required to be functional for normal autopilot operation. Pilot control is via a control panel installed above the upper Multi Function Display (MFD).

Auto flight control is accomplished with aileron, elevator and rudder servo actuator motors.

The AFCS consists of the following components:

- AFCS processing within the MAU
- Flight Controller (FC)
- Pitch and yaw trim adaptor and actuators
- Aileron, elevator and rudder servos.

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7-32-2 Description

The aileron, elevator and rudder servo motors communicate with the MAU via dual Controller Area Network (CAN) data buses. The AFCS function in the MAU generates servo commands that are identically output onto both of the CAN data buses. Commands received by the servo from each of the CAN data buses are dual processed within the servo and the resultant processed data must agree to effect a servo action. Additionally both servo channels must agree in their monitoring of motor current, clutch solenoid engagement and motor position.

The servo motors have an electrical clutch that is used to engage and disengage the output shaft from the drive train. The servo motors are mounted on capstans which are connected by autopilot cables to the flight control cables. The capstans incorporate a mechanical clutch, which can be physically overridden by the pilot if the electrical clutch will not disengage. Power to actuate the electrical clutch is supplied from the Avionic 1 bus A/P SERVO ENABLE circuit breaker through the MAU. When the autopilot is engaged the electrical clutches engage and connect the servo motors to the capstans in order to move the flight control surfaces. Electrical power to move the servos is supplied from the Avionic 1 bus through the A/P SERVO circuit breaker. The pilot can disconnect the electrical clutches (autopilot) by pressing the AP DISC push-button switch mounted on each control wheel yoke. This is the primary means of disconnecting the autopilot but operation of any of the following controls will also disconnect the autopilot:

- Trim engage switch on the pilot or copilot control wheel
- Rudder trim switch on the PCL
- Alternate Stab Trim switch on the center console
- Trim Interrupt switch on the center console
- AP switch on the FC panel.

When the autopilot is engaged the horizontal stabilizer trim actuator alternate motor and the rudder trim actuator motor are interfaced through the trim adapter to the AFCS autotrim function in the MAU. This autotrim function is to minimize the steadystate torque on the elevator and rudder servos. Manual trim commands are monitored by the MAU and disconnect the autopilot whenever sensed.

The pilot can momentarily disconnect the aileron and elevator electrical clutches by pressing the Touch Control Steering (TCS) push-button switch mounted on each control wheel. Release of the TCS push button will re-engage the aileron and elevator electrical clutches.

The Takeoff / Go Around (TO/GA) switch on the left side of the Power Control Lever (PCL) is used to initiate a go around mode in the flight director.

Flap position and flap fail indications are provided to the AFCS function in the MAU as part of the auto pitch trim control laws. The AFCS monitors the positions of the control wheel AP DISC and TCS switches, the TO/GA switch on the PCL, the manual pitch/roll trim switches on the control wheel, the rudder trim switch on the PCL and the TRIM INTERRUPT and ALTERNATE STAB TRIM switches on the center console.

The FC panel provides the means for selection of all AFCS functions except Go Around mode, TCS and AP/AT quick disconnect. Electrical power is supplied to the FC for Ch A from the Avionic 1 bus through the FLT CONT CH A circuit breaker. The FC Ch B is supplied from the Avionic 2 bus through the FLT CONT CH B circuit breaker.

Refer to Fig. 7-32-2, AFCS - Controls and Indications.

AFCS mode selection provides the following functions (refer to Table 7-32-1):

Table 7-32-1: AFCS - Controls

AFCS Control	Description
L/R	Selects which PFD pilot or copilot (if installed) is used for coupling with the FD. At power up, the default setting for the control is L (left for pilot side)
HDG/T	Momentary push-button to engage or disengage the HDG or TRK mode. When pressed the green annunciator bar above the button comes on
HDG TRK	The control is a dual concentric knob that allows selection between HDG and TRK mode and is used in conjunction with the HDG TRK switch. The outer control is a two-position rotary switch with a pointer. Selects either heading or track on the HSI compass card. The inner knob provides a continuous selection for the Heading or Track Select Bug on the HSI compass and digital readout. Clockwise increments and counter-clockwise decrements the heading or track value by 1 degree per detent. The dual concentric knob is also a momentary push-button PUSH SYNC for synchronization of the selected Heading or Track to the current aircraft heading or track
AP, FD, YD	Momentary push-buttons to engage or disengage the autopilot, flight director and yaw damper. When pressed the green annunciator bar above the button comes on. The AP and YD annunciators and FD command bars will be illuminated on the PFD displays, when the respective button is pressed and engagement occurs
ALT	Controls the altitude preselect and alerting bug on the altitude tape of the PFD displays. The control is a dual concentric knob. Clockwise rotation of the outer control increments and counterclockwise decrements the altitude preselect value by 1000 feet per detent. Clockwise rotation of the inner knob increments and counter-clockwise decrements the altitude preselect value by 100 feet per detent
PITCHWHEEL	Rotating pitchwheel to adjust the vertical mode target values (pitch attitude or vertical speed). The pitchwheel control is only active if the FD is engaged
BNK	Momentary push-button to engage or disengage the high and low bank limits. A magenta arc is displayed on PFD ADI roll scale when low bank selected. The BNK mode is only available in HDG or TRK mode. BNK is automatically activated in HDG mode above FL 250
NAV	Momentary push-button to engage NAV mode. When pressed the green annunciator bar above the button comes on. NAV mode provides tracking of the primary navigation source

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Table 7-32-1: AFCS - Controls (continued from previous page)

AFCS Control	Description
APR	Momentary push-button to engage APR mode. When pressed the green annunciator bar above the button comes on. APR mode gives capture and tracking of approaches
VS	Momentary push-button to engage VS mode. When pressed the green annunciator bar above the button comes on. VS mode is used to climb or descend at the target vertical speed.
VNAV	Momentary push-button to engage VNAV mode (if installed). When pressed the green annunciator bar above the button comes on. Pressing VNAV arms the VNAV modes of the flight director.
FLC	Momentary push-button to engage Flight Level Change (FLC) mode. FLC mode can only be engaged if the altitude preselect is set and is not at current aircraft altitude. The PCL needs to be used in the correct sense to allow proper operation of FLC mode. **Note** The PCL needs to be operated by the pilot if the optional autothrottle is not installed. When pressed the green annunciator bar above the button comes on. The speed target defaults to the current aircraft speed, and the FMS provides guidance for the flight director to climb or descend at the speed target while complying with the altitude preselector. This mode is mainly used for climb and descent. During climb, if insufficient thrust is available to maintain the speed reference, the system will attempt to climb at the maximum speed achievable below the speed reference. During descent, if there is excessive thrust available to maintain the speed reference, the system will attempt to descent at the minimum speed achievable above the speed reference.
ALT	Momentary push-button to engage ALT mode. When pressed the green annunciator bar above the button comes on. Alt mode is used to hold an altitude. The aircraft levels off at the present altitude when the ALT button is pressed
MINIMUMS	Octagonal rotary knob to adjust the minimum height/altitude, referenced to either a target Radar Altitude or Barometric altitude respectively. Clockwise or counter-clockwise rotation when RA is active increases or decreases the minimums value over a range of 0 to 2500 feet. Clockwise or counter-clockwise rotation when BARO is active increases or decreases the minimums value over a range of 20 to 16,000 feet. The knob adjusts the minimums value 10 feet per detent. The rotary knob is also a momentary push-button PUSH RA/BARO to switch between a minimums referenced to radar altitude or to barometric altitude

Table 7-32-1: AFCS - Controls (continued from previous page)

AFCS Control	Description
AT	Momentary push-button to engage the optional autothrottle function
FMS MAN	The control is a dual concentric knob with a push select (see IAS/MACH) that allows selection between FMS computed speed target or Manually selected speed target for display on the ADI speed tape. The outer control is a two-position rotary switch with a pointer and selects either FMS or Manually selected speed target. The inner knob provides a continuous selection for the Manual speed bug on the ADI speed tape
IAS/MACH	Momentary push select button on the FMS MAN knob to toggle the speed bug reference between IAS and MACH airspeed

7-32-3 Operation

Note
The AP should be engaged when flying in a steady state condition.

Pressing the AP push-button on the FC panel will engage the Autopilot (AP), Yaw Damper (YD) and FD. The associated annunciation bars will illuminate on the FC panel and the AP and YD green annunciators and FD bars will be shown on the PFD. Whenever the autopilot is engaged, the pressing of the YD button will disengage the yaw damper and autopilot, the pressing of the AP button will not disengage the yaw damper.

Autopilot disengagement is defined as either normal or abnormal. A normal disengagement is initiated manually by pressing the AP DISC push-button on the control wheel or by the AP push button on the FC or by activating the manual trim system. A normal disconnect will cause the AP indication on the PFD to flash red/white and the aural “Cavalry Charge” warning tone to be activated. After 2.5 seconds the AP indicator and audio are removed. Any disengagement due to a monitor trip or failure is considered abnormal. An abnormal disconnect will cause the AP indication on the PFD to flash red/white and the aural warning tone to be activated until acknowledged via the AP DISC push-button. For some failures an autopilot disengagement will be accompanied by a CAS advisory indicating the reason for the disengagement.

The AFCS also controls the pitch and yaw manual trim actuators through the trim interface unit. Whenever the AP is engaged the pitch auto trim function is active, whenever the YD is engaged the yaw auto trim function is active. Pitch and roll commands are limited to +/- 20° and +/- 35° respectively. If the autopilot is engaged or the TCS is used to position the aircraft outside of these limits the autopilot will initially reduce the angles to the above limits.

When the autopilot is engaged the horizontal stabilizer trim actuator will be driven in order to minimize steady-state torque on the elevator servo motor. Operation of the trim switches on the control wheels or the ALTERNATE STAB TRIM switch on the center console will automatically disengage the autopilot and yaw damper. Similarly when the Yaw Damper is engaged the rudder trim actuator will be driven in order to minimize steady-state torque on the rudder servo motor. Operation of the Rudder Trim switch on the Power Control Lever will automatically disengage the autopilot and yaw damper.

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The use of the yaw damper is highly recommended when flying above FL155 (15,500 ft) and its use is mandatory when flying above FL155 with airspeeds below 140 KIAS. When flying at high altitude with the yaw damper off, high power selected and at low speed, large right rudder pedal deflection may cause large aircraft yaw angles and require the pilot to apply positive left rudder pedal force to re-establish balanced flight. **YD Off** is displayed on the CAS when flying above FL155 with the yaw damper off.

During autopilot operation, the voltages on each side of the horizontal stabilizer and rudder trim actuators are monitored by the MAU for trim runaway and trim inactive conditions. If either condition is detected, the trim engage relay is released and a CAS **Pitch Trim Runaway** or **Yaw Trim Runaway** and an aural “Trim Runaway” warning is given. A yaw damper failure will be shown as a CAS **YD Fail** advisory when flying below FL155 or a CAS **YD Fail** caution when flying at FL155 or above.

The autopilot can be engaged with or without the FD guidance modes active. When no flight director mode is active, engagement of the autopilot will automatically bring up the FD in the pitch hold vertical mode and the roll hold lateral mode with FD guidance on the PFD’s. When FD guidance modes have been selected, the autopilot will couple itself to the pitch and roll commands generated by the FD guidance function.

HDG mode is not available if the heading flag is displayed on both HSI. All other modes may be operational.

FLC mode climb should only be performed with the speed target at or above the Dynamic Speed Bug (DSB) and V_{REF}.

The flight director source indicator arrow has a left side default at power up. If the pilot selects DU1 and DU 2 off the AGM 1 display capability is disabled and then flight director switches automatically to the right side PFD format (AGM 2). Selecting DU 1 and or DU 2 on again does not automatically revert the indicator arrow back to the left side. This can be done by pressing the L/R button on the FC panel.

When encountering turbulence with autopilot and the optional autothrottle engaged while in a steady cruise condition, consider turning off the autothrottle to avoid frequent autothrottle induced longitudinal accelerations. This will increase comfort and engine longevity.

When disengaging the autopilot, yaw damper or the optional autothrottle, always use the appropriate button on the FGP. Only use the quick-disconnect button on the yoke before landing.

7-32-4 Indication / Warning

Depending on mode selection, the PFD displays the following AFCS related information:

- AP engage status
- YD engage status
- YD fail indication
- TF engage status
- EDM engage status
- AT engage status (optional)
- TCS status
- FD commands and status
- FD data source (PFD couple)
- Vertical speed bug
- Overspeed mode management
- Heading bug
- IAS bug
- Armed lateral mode
- Active lateral mode
- Armed vertical mode
- Active vertical mode
- Altitude preselect.

The Crew Alerting System (CAS) window of the systems MFD, displays the following Warning, Caution and Advisory messages for the AFCS status (refer to Table 7-32-2):

Table 7-32-2: AFCS - CAS Massages

CAS Message	Description
Pitch Trim Runaway	Manual or auto pitch trim runaway or trim failure, monitor detects failure of trim to properly respond, accompanied with voice callout “Trim Runaway”
Yaw Trim Runaway	Manual or auto yaw trim runaway or trim failure, monitor detects failure of trim to properly respond, accompanied with voice callout “Trim Runaway”
AP Hold LH Wing DN AP Hold RH Wing DN	Roll mistrim, monitor detects excessive forces over an excessive time period
AP Hold Nose UP AP Hold Nose DN	Pitch mistrim, monitor detects excessive forces over an excessive time period
YD Hold Nose Left YD Hold Nose Right	Yaw mistrim, monitor detects excessive forces over an excessive time period
YD Fail	Yaw damper not available (at or above FL155)
YD Off	Yaw damper off (at or above FL155)

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Table 7-32-2: AFCS - CAS Massages (continued from previous page)

CAS Message	Description
Emergency Descent	Emergency Descent Mode engaged
YD Fail	Yaw damper not available (below FL155)
AP Fail	Autopilot not available
FD Fail	Flight director not available
AFCS Fault	Fault detected in the AFCS system
TF Fail	Tactile Feedback not available
AT Fail	Optional Autothrottle not available

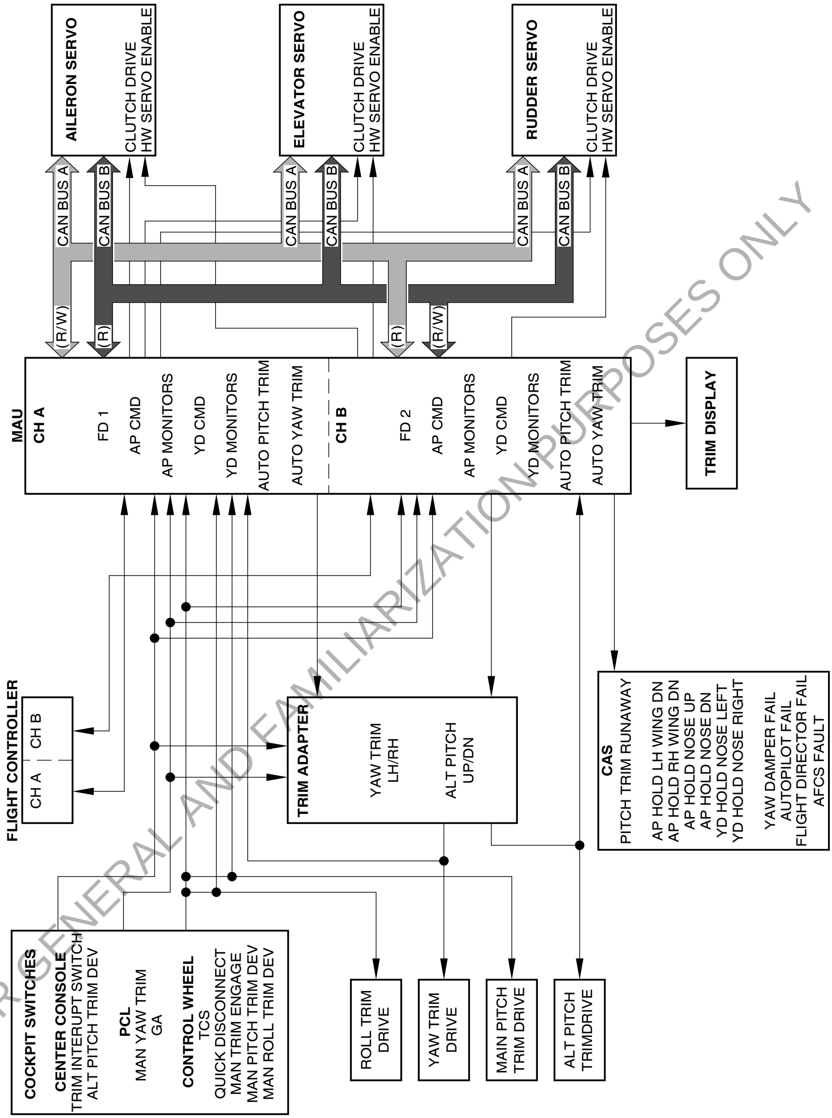

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Figure 7-32-1: AFCS - Schematic

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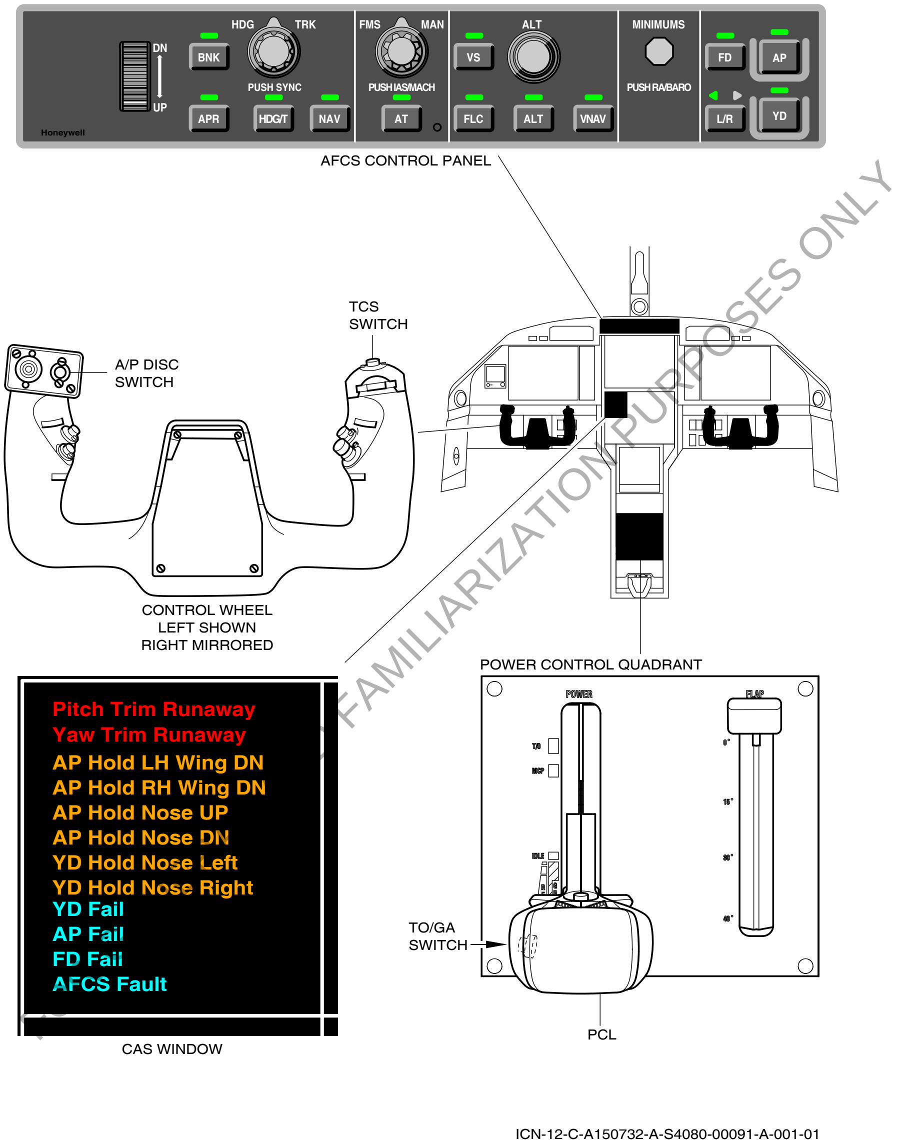

Figure 7-32-2: AFCS - Controls and Indications

7-32-5 Thrust Management System (optional)

The TMS provides the following functions:

- Thrust Director
- Thrust/Speed Control System (Autothrottle) (optional)

7-32-5.1 Thrust Director

The Thrust Director function provides a Flight Director type capability for manual control of the Power Control Lever (PCL). PCL guidance commands are presented on the PFD for use by the pilot to manually control the position of the PCL.

The Thrust Director is turned on/off with the Flight Director via the FD push button on the FC panel. The Thrust Director function can be independently turned on/off via a soft key on the FCS page on the MFD. Once on, the Thrust Director will drive a PCL guidance cue on the PFD.

7-32-5.2 Autothrottle

The optional autothrottle function provides an automatic, full flight regime energy management with a minimum of pilot inputs. Flight economy is improved by accurate speed control and thrust management. Safety is enhanced by maintaining aircraft speed and engine torque within the minimum/maximum operating limits which helps to reduce pilot workload.

The autothrottle function software is installed on the MAU (AIOP a and AIOP b modules) and interfaces with:

- The Throttle Quadrant Assembly (TQA) (autothrottle servo and quick disconnect switch on the PCL)
- The Engine Electronic Control unit (EEC)
- The FC panel (AT button and speed target bezel button/rotary knob).

The autothrottle is programmed to protect speed and thrust limits during the various phases of flight (takeoff, climb, cruise, descent and approach). The autothrottle (and thrust director) control laws are designed to maximize passenger comfort and minimze unnecessary response to temporary environmental variations (e.g. a gust of wind) with gradual throttle response to smoothly capture a new selected airspeed.

The autothrottle reduces the pilot workload by managing PCL control from takeoff through the entire flight until final approach. Autothrottle modes are automatically tied to autopilot/flight director modes and speed control is fully coordinated with the AFCS, thus requiring minimum pilot interaction.

WARNING

DO NOT ATTEMPT TO LAND WITH THE AUTOTHROTTLE ENGAGED. THE AUTOTHROTTLE MUST BE DISENGAGED PRIOR TO LANDING (REFER TO SECTION 2, SYSTEMS AND EQUIPMENT LIMITS, PRIMUS APEX - AUTOMATIC FLIGHT CONTROL SYSTEM).

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When engaged, the autothrottle can be disengaged by:

- Pressing the AT button on the FGP
- Pressing the AT Quick-Disconnect (QD) button on the PCL
- Pressing the AP QD button on the yoke
- Manual override of the PCL.

The autothrottle features a pilot override monitor which, when autothrottle is engaged, monitors for a significant override input of the PCL by the pilot. When the pilot moves the PCL, thus overriding the autothrottle, the override monitor function will disengage the autothrottle resulting in an abnormal disconnect.

Autothrottle can be armed on ground by selecting the Go-Around (GA) mode followed by pressing the AT button on the FGP. A cyan AT THR annunciation will be displayed on the PFD.

When active, the autothrottle determines a requested thrust and corresponding PCL setting based on current airspeed, speed target and the selected speed or thrust mode. The autothrottle will then command a PCL rate to the TQA to achieve the required PCL position (as provided by the EEC). The autothrottle output is limited to the engine torque based on EEC provided bug ratings for takeoff, climb, cruise and idle. Once a speed/thrust limit is reached, the autothrottle mode changes to indicate “LIM” informing the pilot that a limit is reached.

CAUTION
The autothrottle observes the high airspeed limits (V_{MO}, M_{MO}) and low airspeed limits only while in the speed hold mode.

The autothrottle modes are:

- Thrust

  Thrust mode is active when:

  - Takeoff and Go around (PCL set to takeoff thrust)
  - FLC Climb (PCL set to Climb thrust and below)
  - FLC Descent (PCL set to Idle thrust or above)
  - EDM
- Speed Hold

  Speed hold mode is active when:

  - All other modes including VS, ALT, ASEL, GS, etc
  - PCL set to maintain manual or FMS speed reference
- Takeoff Hold

  Takeoff Hold is active during takeoff when speed is more than 60 knot until the aircraft is more than 400 feet above the runway. Takeoff Hold mode makes sure that no undesirable PCL movement occurs during this critical phase of flight.

For more information on the autothrottle refer to the Pilot’s Guide for the Advanced Cockpit Environment (ACE^{TM}) (powered by Honeywell) for the Pilatus PC-12/47E.

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7-32-6 Emergency Descent Mode

The Emergency Descent Mode is a function that will automatically descend the aircraft to a safe altitude in the event of detecting a cabin decompression.

The EDM is armed whenever the aircraft is above 20,000 ft and the autopilot is engaged and will become active five seconds after a CABIN ALTITUDE CAS message and associated callout is triggered. Once active, the EDM performs a 90 degree left turn, will make the thrust director display an idle PCL command on the PFD and descends at V_{MO}/M_{MO} to 15,000 feet. At 15,000 feet the aircraft performs an altitude capture followed by the autopilot transitioning to heading mode and 160 knots speed hold mode (if autothrottle installed). The PFD will show EDM on both lateral and vertical FD mode annunciators, Emergency Descent will be displayed on the CAS window and the autothrottle mode is displayed as AT EDM informing the pilot that EDM is active.

If autothrottle is installed, the EDM will perform the above steps and also engage the autothrottle (if not engaged already) and command the thrust to idle.

EDM can be cancelled by the pilot by disengaging the autopilot through the quick disconnect, activation of manual trim or the AP push button on the FC panel. All other push buttons on the FC panel will be ignored and have no effect when EDM is active. Pushing the TCS button temporarily deactivates EDM and release of the TCS button will reactivate EDM as long as the aircraft altitude is still above 20,000 feet, the autopilot is on and the CABIN ALTITUDE CAS message is still on.

Note
When using the quick disconnect button on the PCL to disengage the EDM, the autothrottle will stay engaged. The autothrottle can be disengaged by pressing the AT button on the FGP.

7-32-7 Tactile Feedback

The TF system uses the autopilot's aileron servo to provide a force on the ailerons to bring the aircraft back to within a safe bank angle when detecting that the aircraft is approaching or banking beyond 51 degrees left or right. The TF system will activate at 51 degrees for lower roll rates or at 49 degrees at higher roll rates (approaching 51 degrees). TF activation at 51 degrees bank angle makes sure that the TF system does not generate nuisance activations in normal operation. The TF system will automatically deactivate once the aircraft returns to within 31 degrees bank angle.

The TF system is only available when the autopilot is not engaged.

Note
The TCS function is available when TF is engaged.

When activated at a bank rate of less than 10 degrees per second, the TF system will steadily increase the force from a minimum of 10 lb at the yoke at 51 degrees bank angle, up to a maximum force of 25 lb at the yoke at 60 degrees bank angle. If the pilot has hands on the yoke, the TF System provides an opposing force when aircraft roll attitude exceeds 51 degrees Angle of Bank, returning the aircraft within 31 degrees angle of bank and deactivates.

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When TF is active, **TF** is displayed on the PFDs Flight Mode Annunciator. The pilot can manually override/deactivate the TF by using the TCS or by pressing the quick disconnect switch on the yoke. When manually deactivated, the TF system remains deactivated until the TF system detects the standard deactivation threshold (31 degrees bank angle or less) after which the TF system is available again.

The PFD Statuses tab on the Avionics Window can be used to check if the TF system is installed on the aircraft. If the TF system is installed, the PFD Statuses tab will show “Tactile Feedback Enabled”.

Loss of TF is indicated by a **TF Fail** message on the CAS.

7-33 Primus APEX - Flight Management System

7-33-1 Description

(Refer to Fig. 7-33-1)

The flight planning function of the Flight Management System (FMS) enables the pilot to build, review and modify flight plans on the Situation Awareness Multi Function Display (MFD) via the Cursor Control Device (CCD) or the Touch Screen Controller (TSC). Flight plans are stored for retrieval and activation at a later time. They are a series of legs and are bounded by waypoints. Waypoints are named and precisely located by latitude and longitude. Database waypoints include airports, Navaids, runways, published named fixes, unnamed fixes and intersections. The FMS provides the pilot with the facility to create pilot defined waypoints as Lat/Long, Place/Bearing/Distance or Place/Bearing/Place/Bearing in an active or secondary flight plan. If the pilot does not name a pilot defined waypoint, the FMS creates a temporary waypoint.

The pilot has the option to load an off-aircraft created flight plan instead of creating a new flight plan on the aircraft. The flight plan is installed on the flash memory of FMS 1 in the same way as when updateing the FMS database (refer to Database Loading). With a dual FMS installation, saving the flight plan after uploading will synchronize the flight plan between the FMS 1 and FMS 2 custom databases.

The active flight plan is the flight plan that the FMS is actively flying. An active flight plan contains a From waypoint, a To waypoint and a destination (optional). Waypoints are either database, pilot defined or temporary waypoints. Changes made to an active flight plan are inserted into a pending flight plan, which can be reviewed before the changes are incorporated into the active flight plan.

The FMS provides the ability to add altitude and speed constraints to waypoints of the active flight plan. It will also calculate a Top-Of-Climb (TOC) waypoint that laterally indicates where the cruise altitude level off will occur and will similarly create a Top-Of-Descent (TOD) waypoint that laterally indicates where the descent from cruise altitude should occur. These waypoints are displayed on the Situation Awareness Multi Function Display (MFD) map. A waypoint altitude constraint can be entered on any waypoint of the flight plan. The FMS will indicate a predicted or pilot entered descent angle for each waypoint.

When an “At” Altitude Constraint is defined for a waypoint in the descent portion of the flight plan, the FMS calculates the vertical profile with a default 3° descent angle. The pilot can enter up to 8°, perform a vertical direct-to limited to 8° or load a procedure.

Before reaching the TOD, the FMS generates a Vertical Track Alert (VTA) and a Vertical Navigation Deviation Scale, similar to a Glideslope, is displayed on the Primary Flight Display (PFD).

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The VNAV information is for advisory only and can be coupled to the AP/FD. VNAV is based on the Barometric Altitude, therefore a correct Baro Correction Selection is essential for safe operation.

Note

- VNAV must not be used when the CAS message **ADC A Fail**, **ADC B Fail** or **ADC A+B Fail** are shown
- A secondary flight plan can be created and stored at any time and is not related to the active flight plan. Only one stored flight plan can be activated into the secondary state at a time to review
- Each stored and active flight plan can contain a maximum of 100 waypoints. The FMS can store up to 255 flight plans and 300 custom waypoints
- When saving a flight plan into the stored database there is an unannunciated time delay of up to 45 seconds
- Stored flight plans do not contain procedures associated with the Origin or Destination and the Weather Alternate destinations not stored. The FMS provides only one active flight plan. Stored flight plans can be deleted
- After the Performance Compute button is pressed there will be unannunciated time delay before the Computing Data … status is displayed
- After an electrical power cycle, the active flight plan is lost and must be reentered
- When a circling approach is chosen, the FMS will create a Discontinuity after the last waypoint of the overlay approach. Vertical guidance after this point cannot be relied on. The autopilot will revert to basic modes (Pitch and Roll)
- Visual Reporting Points (VRP) can be selected for display on INAV. A pilot defined waypoint can be created on top of the VRP to be used as part of the flight plan. Alternative, autopilot track line shown on INAV can be used to maneuver the aircraft over the VRP.

The FMS also has the ability to compute:

- Waypoints for specific legs, which includes Direct-To, holding patterns, procedure turns, leg intercepts, TOCs and TODs
- Distance and Course computations
- ETE and ETA calculations
- Curved path distance calculations
- Altitude constraint type determination.

The active leg defined as the From To waypoint in an active flight plan, can be modified:

- Direct-To, any waypoint
- Present position hold, create a fix at the current latitude/longitude aircraft position from which the aircraft may hold (not always available-see Pilot's Guide for the Advanced Cockpit Environment (ACE™) (powered by Honeywell) for the Pilatus PC-12/47E)
- Pilot confirmation of an active leg modification change initiated by the pilot
- Automatic active leg sequencing, when satisfied the FMS makes the To waypoint the From waypoint and the next waypoint the To waypoint
- Procedure turns, creation and deletion of a procedure turn on the active flight plan that is part of a database procedure.

A discontinuity leg may exist in the active flight plan when there is insufficient lateral flight plan definition. The FMS will allow the programming of a discontinuity leg when it is part of a database procedure.

FMS controls are provided via the CCD and on the Home page of the TSC (refer to Table 7-33-1):

Table 7-33-1: FMS - Controls

FMS Control	Description
D→(Direct-To)	The Direct to Dialog box opens in the Waypoint List Window
Show Info	The INFO Dialog Box opens on the INAV
Auto pop-up keypad/keyboard	Inputs data at the cursor position

7-33-2 Operation

7-33-2.1 Graphical Flight Planning

The Graphical Flight Planning (GFP) mode allows the pilot to make and change flight plans. GFP can be performed on the Waypoint List and on the Interactive Navigation map display. GFP mode starts automatically and shows the options for the selected data or active flight planning task when the pilot moves the cursor over the object he wants to modify. This generates commands to the FMS. The FMS receives and validates the commands, actions them and displays the changed flight plan. Two menus are available when GFP mode is started - Select Object menu and Select Task menu.

- Select Object menu

  At large ranges on the lateral map, many objects may be shown very close to each other. The Select Object menu allows the pilot to tell the system which particular object he wants to change. Also, a waypoint may be listed more than once in the active flight plan, approach, missed approach or alternate flight plan. The pilot must tell the FMS which waypoint listing to change.

- Select Task menu

  See Table 7-33-2 for the functions that can be selected using the Select Task menu.

Table 7-33-2: FMS - Graphical Flight Planning - Select Task menu functions

Task	Action
Center Map	Lateral map centers at the selected location
Direct To	Direct To route modification performed
Intercept …	Starts a dialogue box to define a heading select intercept leg inbound to an object
Change Dest	Assigns the selected airport as the new destination
Show Info …	Starts a dialogue box showing all the information about the selected object
Departure/Arrival	Starts a dialogue box to insert, delete, modify and review the selected departure/arrival procedure
Amend Route	Performs modification of the selected flight plan route
Delete Wpt	Removes the selected waypoint from the flight plan
Cross …	Starts a dialogue box to define lateral and vertical constraints on a waypoint
Hold …	Starts a dialogue box to define, modify and/or delete holding patterns for waypoints
Procedure Turn …	Starts a dialogue box to define, modify and/or delete a procedure turn
Direct To Recovery	Adds to the pending flight plan waypoints that were removed when a direct-to was previously performed
PPOS Hold …	Starts a dialogue box to define, modify and/or delete a holding pattern for PPOS
Offset …	Starts a dialogue box to define, modify and/or delete offset
Airway …	Starts a join airway dialogue box to add an airway to the flight plan
XXXX Departure	Starts the procedure dialogue box for the origin
YYYY Arrival	Starts the procedure dialogue box for the destination
Orbit ... (optional)	Starts a dialogue box to define, modify and/or delete a circular leg around a designated waypoint
SAR ... (optional)	Starts a dialogue box to define, modify and/or delete a search pattern for SAR operations
Visual App ... (optional)	Starts a dialogue box to define, modify and/or delete a Visual Approach to a user-defined approach to a runway or pilot-defined waypoint

7-33-2.2 Actual Flight Planning

The Flight Management Window (FMW) is used to access or create a fight plan. The FMW is displayed in a 1/6th window format on the Situation Awareness MFD. A Flight Plan (FPLN) pull down menu allows selection of either the Active or Secondary flight plan for display and interaction. The Phase of Flight (POF) selections for a flight plan are Init, Preflight, Departure and Arrival. Available POFs are indicated by white outlined icons with gray button borders. Upon selection the button border and icon changes to green and the available tabs are displayed.

The INIT (initialization) POF, when selected, displays a Time/Date tab, a Data Bases tab and an S/W (software) tab.

Position is automatically initialized at power up.

The Preflight POF, when selected, displays a FPLN (Flight Plan), an Alt/Spd tab and a Fuel/ Weight tab. When all the mandatory data has been entered on the Preflight tabs the Compute button becomes highlighted. Pressing the Compute button initiates the computation of performance parameters by the FMS. The Computing Data message will be removed when the computed performance data is available for display.

The Departure POF when selected, displays a SID (Standard Instrument Departure)/Takeoff page that includes the Takeoff V Speeds and the Transition Altitude.

The Arrival POF, when selected, displays a STAR (Standard Terminal Arrival Route)/Landing page that includes the Landing V Speeds and the Transition level.

The pilot can also define a Secondary flight plan which is totally independent of the primary active flight plan. The Secondary flight plan may be created, stored and activated at any time, but only one stored flight plan may be activated into the secondary state for review.

Once airborne the aircraft can be flown either indirectly through the Flight Director or automatically through the autopilot. The FMS active flight plan is used to steer the aircraft and the FMS constantly calculates and updates the aircraft position and performance data output data to the displays.

7-33-2.3 Displays

Flight plans are shown pictorially on the Situation Awareness MFD with vector lines between successive connected waypoints, transition onto waypoints, holding patterns and procedure turns.

See Table 7-33-3 for the ARINC 424 leg types that are supported by the FMS.

Table 7-33-3: FMS - ARINC 424 Leg Types

Leg Type	Description
IF	Initial Fix
TF	Track to a Fix
CF	Course to a Fix
DF	Direct to a Fix
FA	Fix to an Altitude
RF	Constant Radius Arc
AF	Arc to a Fix
VA	Heading to an Altitude
VI	Heading to an Intercept
VM	Heading to a Manual Termination
PI	Procedure Turn
HA	Holding with Altitude Termination
HF	Holding with Single Circuit Termination at the Fix
HM	Holding with a Manual termination

Flight planning information is shown in the upper left 1/6th window. This window can be made larger (upper left and lower left windows combined 1/3rd window) to show more information when Waypoint (WPT) information is active. The information displayed is controlled by on-screen pull-down menus which are selected by the CCD or TSC.

Navigation and steering information is displayed on the PFD ADI/HSI and the upper MFD right window. A bezel button on the PFD HSI will be used to select an Overlay menu which will show flight planning and situational awareness information on the HSI.

7-33-3 Database Loading

7-33-3.1 Database Loading with RT

The Navigation Database updates can be loaded with the Remote Terminal software to the FMS Navigation Database. Refer to the PC-12/47E Data Loading Guide (Document Number 02313). The guide can be found at www.pilatus-aircraft.com -> Menu -> Customer Support -> Technical Publications -> PC-12 -> Flight Manuals -> Data Loading Guide.

Note
If a Connected Flight Deck (CFD) is installed, it must be disabled by opening the CB "WLAN Data Load" before energizing the aircraft electrical system.

7-33-3.2 Database Loading with Connected Flight Deck (CFD)

If the optional CFD is installed, an Apple iPad can be used to load Navigation and Electronic Chart Databases to PRIMUS APEX. To do this, the INDS Data Manager application is used on an iPad with an INDS subscription. Firstly, the iPad must be connected to an internet network to download the databases. Thereafter, the iPad can be connected to the wireless network of the aircraft to upload the databases to PRIMUS APEX. Refer to the PC-12/47E Wireless Data Loading (Connected Flight Deck) guide (Document Number 02373). The guide can be found at www.pilatus-aircraft.com -> Menu -> Customer Support -> Technical Publications -> PC-12 -> Flight Manuals -> Data Loading Guide.

The loading of the Navigation and Electronic Chart Databases can be done with the aircraft only powered by the STBY bus, after pressing the MAU DATA LOAD switch on the copilot side panel. A red cross will be shown on all powered MFDs and PFDs during the data loading process. This is normal and due to the Advanced Graphics Module (AGM) being set to download data mode. The data loading process shall not be interrupted nor shall the aircraft be de-energized.

When the data loading has been completed, the lower MFD (and, if powered, the copilot PFD) will return to their default configuration. The pilot PFD and upper MFD will continue to display red crosses.

A full power cycle of the aircraft is required to return the aircraft to normal operation.

Stuck database upload

When attempting to upload INDS databases (Charts, Navigational, Terrain) using the INDS Data Manager iPad application, in rare cases the status bar in the application remains at 64% for 5 minutes or more, and does not complete the upload. The APEX pilot PFD and upper MFD show red crosses, while the co-pilot PFD and MFD return to normal screens. The following procedure shall be performed to resolve the issue:

CAUTION
Do NOT remove electrical power from the aircraft.

1.	On the iPad: Force close the INDS Datamanager app..............	Push the home button (double click) on the iPad and swipe up to close the app
2.	WLAN DATA LOAD circuit breaker (Standby Bus $_L$X4).........	Pull

CAUTION

You must wait the full 1 minute for the Connected Flight Deck to completely power down.

3.	WLAN DATA LOAD circuit breaker (Standby Bus $_L$X4).........	Reset

Wait 2-3 minutes for the Connected Flight Deck to fully reboot. The iPad should reconnect automatically.

When the iPad has reconnected to the Connected Flight Deck:

4.	Re-start the INDS Data Manager application on the iPad................	
5.	Push the upload button of the database that remained stuck at 64%..	Verify that the progress bar goes up to 100% and the database upload completes successfully
6.	Do a full power cycle of the aircraft..	

Following database uploads should complete successfully without issues. If not, repeat the above procedure.

----------- END -----------

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7-33-4 Indication / Warning

The Crew Alerting System (CAS) window on the systems MFD will show the following caution, advisory and status messages for the FMS (refer to Table 7-33-4):

Table 7-33-4: FMS - CAS Messages

CAS Message	Description
FMS-GPS1 Pos Misc FMS-GPS2 Pos Misc FMS-GPS1+2 Pos Misc	Indicates FMS to GPS 1 position miscompare Indicates FMS to GPS 2 position miscompare (only if GPS 2 installed) Indicates FMS to GPS 1+2 position miscompare (only if GPS 2 installed)
Unable FMS-GPS Mon	Indicates FMS to GPS position monitor has failed (Typical RAIM not available)
FMS Fail	Indicates FMS has failed
AGM2/FMS 1GFP Inop	Indicates graphical flight planning function failed in AGM 2
AGM 1 DB Error AGM 2 DB Error AGM 1+2 DB Error	Indicates database in AGM 1 has an error Indicates database in AGM 2 has an error Indicates database in AGM 1+2 have an error
AGM 1 DB Old AGM 2 DB Old AGM 1+2 DB Old	Indicates database in AGM 1 is out of date Indicates database in AGM 2 is out of date Indicates database in AGM 1+2 are out of date

The following FMS annunciations can be shown on the PFD (refer to Table 7-33-5):

Table 7-33-5: FMS - Annunciations on PFD

FMS Annunciation on PFD	Description
APP Approach advisory	Indicates FMS is in approach mode
XTK Offset advisory	Displayed when lateral offset has been entered
MSG Message advisory	Displayed when message is shown on INAV map
DR Dead Reckoning alert	Displayed when operating in DR mode for more than 2 minutes
DGRD Degraded alert	Displayed when FMS accuracy cannot guarantee accuracy for present phase of flight due to sensor availability

The following FMS messages (refer to Table 7-33-6) can be shown on the INAV Map or on other INAV windows and dialogue boxes, refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE™) (powered by Honeywell) for the Pilatus PC-12/47E for the explanations:

Table 7-33-6: FMS - Messages shown on INAV Map, Windows and/or Dialogue Boxes

ACDB Config Mismatch	High PCDR Turn GRD SPD
ACDB Database Mismatch	Intersection Not Found
Active Mode is Mag/True Hdg	Invalid Aircraft DB
Active Mode is Mag/True Trk	Invalid Custom DB
Alt Constraint Deleted	Invalid Direct To Entry
Brg/Crs must be in True	Invalid Entry
Check *PD Placement	Invalid FPLN Operation
Check Alt Constraint	Invalid NAV DB
Check Baro Set	NDB Over Max Size
Check data Load (xx)	No Position Sensors
Check Dest Fuel	No Present Position
Check GPS 1 Position	Offset Cancel
Check GPS 2 Position	Offset Cancel Next WPT
Check Loaded Wind/Temp	Check Orbit Radius / GSPD
Check Spd/Altitude Limit	PERF-VNAV Unavailable
Check Speed Constraint	Predict LPV Unavailable
Compare Fuel Quantity	Radials Do Not Intersect
Data Base out of Date	RAIM Will Exceed Limit
DB Transfer Aborted	Reset ALT SEL?
DB Transfer Complete	SBAS APPR Load Fail
DB Transfer in Progress	Single Operation
Entering Polar Region	Stored FPL PERF Unavailable
Exceeds Cert Ceiling	Unable *PD Placement
Exceeds Max Gross Weight	Unable Approach Mod
Exceeds Max Landing Weight	Unable CDB XLOAD In Prog
Exceeds Max Landing WT	Unable Hold Change
Exiting Polar Region	Unable Next ALT
Flight Plan Full	Unable Offset
FLT Path Angle Too Steep	Unable PCDR Turn Change
FMS Exiting Hold	Unable RNP
FMS-LPV Miscompare	Unable RNP Next WPT
FPL Storage Full	Used by Active FPL
GPS RAIM Above Limit	Vert Dir Over Max Ang
GPS Config Miscompare	Vert Dir Under Min Ang
GPS RAIM Unavailable	Waypoint Not Found
High Holding GRD SPD	WPT Storage Full.

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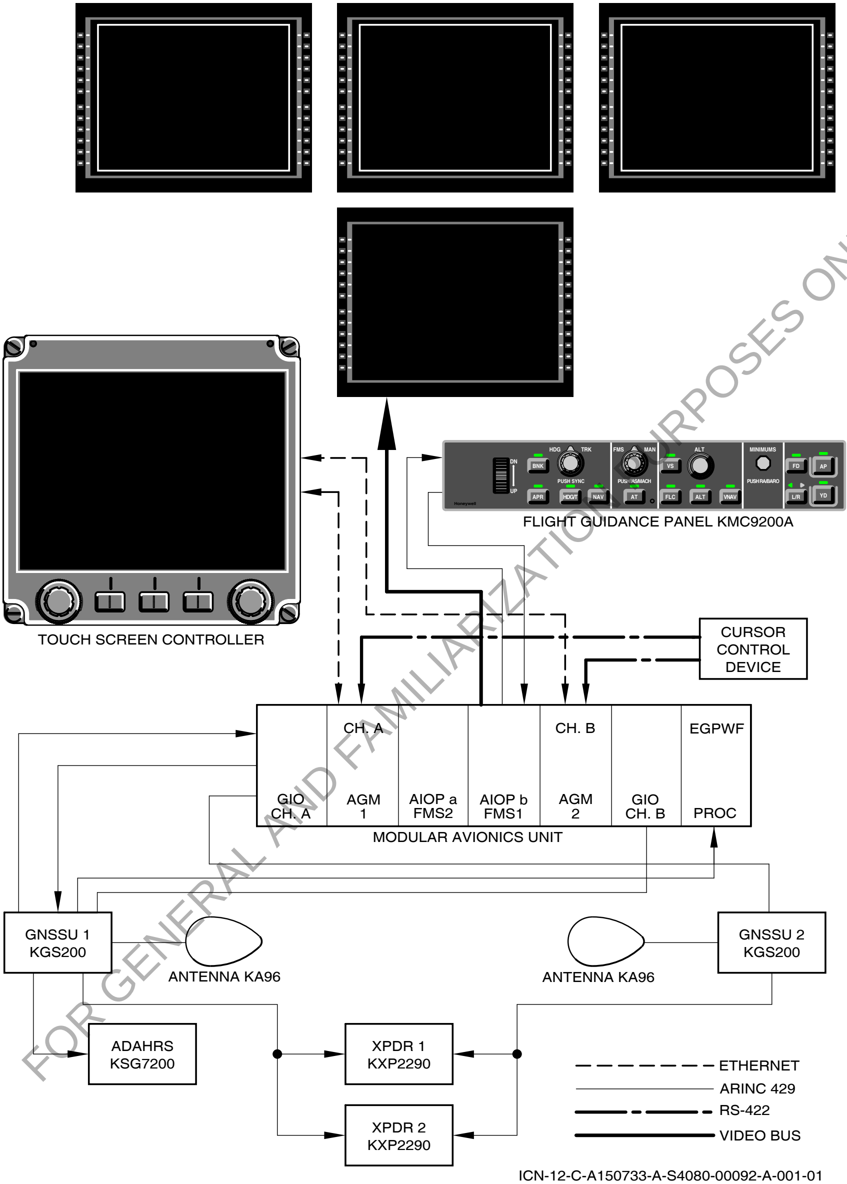

Figure 7-33-1: FMS - Schematic

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7-33-5 Dual FMS (Optional)

7-33-5.1 General

FMS 1 is located on AIOP b card and FMS 2 is located on AIOP a card. Both FMS share the existing APEX resources and interfaces (INAV, TSC, and CCD). The dual FMS system can operate in either Synch mode or Single mode.

Dual FMS provide a “One FMS” view to the crew. In normal operation both FMS are in Synch mode (Primary/Secondary). In this configuration both FMS have the same flight plan and all synchronization between the multiple FMS instances is automatic. Although the FMS operates in a Synch mode, some data is computed independently to enhance safety. For example, the desired track and cross track error on each HSI are driven and computed independently. The positions of each FMS are crosscompared, and a message is shown if the positions disagree.

In Single mode, data is not synchronized between the two FMS and all navigation guidance is calculated independently. The guidance information from FMS 1 or 2 can be selected for display on each HSI by using the NAV SEL button on PFD controller. In FMS Single mode, the crew can only apply changes to the FMS which is selected for display on the INAV. INAV always represents the information from the FMS on the FD coupled side HSI.

Refer to the Pilot’s Guide for the Advanced Cockpit Environment (ACE™) (powered by Honeywell) for the Pilatus PC-12/47E for additional information.

7-33-5.2 FMS Synchronization

Active and Selected FMS mode fields (Single or Synch) are shown on the FMS Sensor Page (refer to Fig. 7-33-2). The selected mode can be manually changed on this page. If the Active Mode does not match the selected mode for any of the FMS, the FMS Synch Error is shown on the CAS window and the Problems button becomes selectable for access to the FMS Problems dialog box. Once on Battery power, to solve synchronization problems, select the Avionics window tab Custom DB (refer to Fig. 7-33-3) and select the Xload tab. This action synchronizes FMS 1 and FMS 2 Custom databases.

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Figure 7-33-2: FMS - Mode Selection Page (Dual FMS)

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Figure 7-33-3: FMS - Avionics Window Custom DB Tab (Dual FMS)

In Synch mode the following items are synchronized between the two FMS:

- Position Initialization Data, when both FMS are running
- Active Flight Plan Data
- Secondary Flight Plan Data
- Custom Database, when both FMS are running.

Note

Both FMS need to be up and running (Batteries ON) for automatic synchronization of “Custom Database” and “Position Initialization Data”. In PDC mode only FMS 1 is powered, therefore changing the Custom Database in PDC mode (saving flight plan or pilot defined waypoints), causes database miscompare and forces both FMS into Single mode when FMS 2 is powered. Cross-loading of the “Custom Database” on the “Cust DB” tab in the avionics window is required to re-synchronize both FMS.

Note

In PDC mode only FMS 1 is powered. If FMS position initialization is done in PDC mode then FMS 2 position will not be initialized. Consequently, after power up, FMS 2 will not provide guidance information until position initialization is repeated. FMS1 and FMS2 position will be auto-initialized at power up.

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7-33-5.3 Indication / Warning

The CAS window on the systems MFD will show the following caution, advisory and status messages for the Dual FMS (refer to Table 7-33-7):

Table 7-33-7: FMS - CAS Messages (Dual FMS)

CAS Message	Description
FMS1-GPS1 Pos Misc FMS1-GPS2 Pos Misc FMS1-GPS1+2 Pos Misc FMS2-GPS1 Pos Misc FMS2-GPS2 Pos Misc FMS2-GPS1+2 Pos Misc	Indicates FMS1 to GPS 1 position miscompare Indicates FMS1 to GPS 2 position miscompare Indicates FMS1 to GPS 1+2 position miscompare Indicates FMS2 to GPS 1 position miscompare Indicates FMS2 to GPS 2 position miscompare Indicates FMS2 to GPS 1+2 position miscompare
FMS1 Fail FMS2 Fail FMS1+2 Fail FMS Synch Error	Indicates FMS1 has failed Indicates FMS2 has failed Indicates FMS1 and FMS2 have failed Indicates the active mode does not match the selected FMS mode
AGM1/FMS1 GFP Inop AGM1/FMS1+2 GFP Inop AGM1/FMS2 GFP Inop AGM2/FMS 1GFP Inop AGM2/FMS1+2 GFP Inop AGM2/FMS2 GFP Inop	Indicates FMS1 graphical flight planning function failed in AGM 1 Indicates FMS1 and 2 graphical flight planning function failed in AGM 1 Indicates FMS2 graphical flight planning function failed in AGM 1 Indicates FMS1 graphical flight planning function failed in AGM 2 Indicates FMS1 and 2 graphical flight planning function failed in AGM 2 Indicates FMS2 graphical flight planning function failed in AGM 2
AGM 1 DB Error AGM 2 DB Error AGM 1+2 DB Error	Indicates database in AGM 1 has an error Indicates database in AGM 2 has an error Indicates database in AGM 1+2 have an error
AGM 1 DB Old AGM 2 DB Old AGM 1+2 DB Old	Indicates database in AGM 1 is out of date Indicates database in AGM 2 is out of date Indicates database in AGM 1+2 are out of date

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7-34 Primus APEX - Aircraft Condition Monitoring System (ACMS)

7-34-1 General

7-34-1.1 Engine Trend Recording

The engine trend recording function of the Aircraft Condition Monitoring System (ACMS) records selected engine trend data into a Stable Cruise log file stored in Non Volatile Memory (NVM). The Stable Cruise file record is created once per flight when the aircraft is in a stable cruise condition. Stable cruise is determined from pre set conditions achieved in two minute window and then records pressure altitude, static air temperature, computed airspeed, torque, Np, Ng, ITT and fuel flow. The Stable Cruise file is capable of storing up to 5000 records, which should be enough for between engine overhauls. If the Stable Cruise file does reach maximum capacity, the oldest record is removed and the newest added to the log file. Crew Alerting System (CAS) advisories are generated when the log file has less than 20% storage capacity remaining and another when the file is full.

7-34-1.2 Trend Data Download

The Primus Apex system supports two methods for transferring the ACMS log data on the ground. One is via the optional Connected Flight Deck (CFD) and the other is via the LAN connector on the aircraft maintenance panel to a laptop computer. Only the CFD method is described here.

Trend Data Download With Connected Flight Deck

If the optional CFD is installed, the Honeywell MyCMC Apple iPad application can be used to download the ACMS files. The MyCMC application can also be used to reset the “ACMF Logs Full” CAS message from APEX. The iPad must be connected to the CFD wireless network of the aircraft to download the files from the PRIMUS APEX. Refer to the PC-12/47E Wireless Data Loading System (Connected Flight Deck) guide (Document Number 02373). The guide can be found at www.pilatus-aircraft.com -> Menu -> Customer Support -> Technical Publications -> PC-12 -> Flight Manuals -> Data Loading Guide.

The download of these files can be done with the aircraft only powered by the STBY bus, after pressing the MAU DATA LOAD switch on the copilot side panel. A red cross will be shown on all powered MFDs and PFDs during the data loading process. This is normal and due to the AGM being set to download data mode. The data loading process shall not be interrupted nor shall the aircraft be de-energized. When the data loading has been completed, the lower MFD (and, if powered, the copilot PFD) will return to their default configuration. The pilot PFD and upper MFD will continue to display red crosses.

A full power cycle of the aircraft is required to return the aircraft to normal operation.

CAUTION

The SYS CONFIG and Data Loading pages should not be active before takeoff. Normally the Data Loading page is grayed out (un-selectable) when the aircraft is in flight. However if the SYS CONFIG and Data Loading window is selected before takeoff it will remain active and Data Loading could be initiated in flight, with the subsequent blanking of displays.

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7-34-1.3 Indication

The CAS window on the systems MFD will show the following advisory and status messages for the ACMS (refer to Table 7-34-1):

Table 7-34-1: ACMS - CAS Messages

CAS Message	Description
ACMF Logs Full	Indicates that one or more Aircraft Data, Navigation & Air data, or Engine Data log files are full. Data will be lost if not transferred
ACMF Logs >80% Full	Indicates that one or more Aircraft Data, Navigation & Air data, or Engine Data log files are more than 80% full. Data may be lost if not transferred
Engine Log Full	Indicates that Engine Stable Cruise data log files are full. Data will be lost if not transferred
Engine Log >80% Full	Indicates that Engine Stable Cruise data log file is more than 80% full. Data may be lost if not transferred
No Engine Trend Store	Indicates that a Stable Cruise flight data store was not successful. During the last flight. Will remain on until next power cycle
Engine Exceedance	Reminds on the ground that during flight a WARNING was displayed for an exceedance of one or more of the following engine parameters: – Oil Pressure, Oil Temperature, ITT, TORQUE, NG, NP or Fuel Temperature High. If no exceedances were noted by the pilot, continue flight and report to maintenance personnel. If an exceedance was noted, maintenance action may be required before continued flight, depending on the extent of the exceeded parameter – The CAS message will be displayed on the ground as a reminder, until the next power cycle
Aircraft Exceedance	Reminds on the ground that during flight an AIRSPEED WARNING was displayed or an acceleration (g limit) was exceeded If no exceedances were noted by the pilot, continue flight and report to maintenance personnel. If an exceedance was noted, maintenance action may be required before continued flight, depending on the extent of the exceeded parameter The CAS message will be displayed on the ground as a reminder, until the next power cycle
Event	5 sec airborne indication, to show that a crew initiated event has been recorded
Crew Event Store	Indicates after landing, that a crew initiated event has been recorded and is available for download

7-34-1.4 Event Button

The use of the Event button on the TSC may aid maintenance crew with troubleshooting. When pressed, the sampling rate of selected aircraft, navigation, air and engine parameters increases from once per minute to once per second. Maintenance should be informed about the use of the Event button.

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7-35 Primus APEX - Aircraft Diagnostic and Maintenance System (ADMS)

7-35-1 General

The Aircraft Diagnostic and Maintenance System (ADMS) consists of a Central Maintenance Computer (CMC) function and member systems. The CMC function is a software application hosted on the Modular Avionics Unit (MAU) Advanced Graphics Module. It runs under the Digital Engine Operating System (DEOS). The CMC acquires the Fault Reports from the various Member Systems and the Flight Deck Effects from the Monitor Warning Function (MWF) system. Member systems are the aircraft system equipment that comply with the requirements of the CMC Specifications for Member Systems. A list of the member system equipment can be found in the Aircraft Maintenance Manual. A data file called Loadable Diagnostic Information (LDI) contains the Member System information that is used to drive the CMC. The CMC collects information and stores failures in a Fault History Database (FHDB) which can be accessed by a maintenance technician, using the Remote Terminal, to assess the past and present operating condition of the aircraft.

7-35-2 Description

The CMC's function is to provide the means to identify and isolate faulted hardware, Line Replaceable Unit(s) (LRUs), modules and wiring. The Member Systems implement their own Built-in Test (BIT) capability either by initiated BIT, continuous BIT or power up BIT. The BIT capability identifies faults and provides information to the CMC which is processed against Member system specific data from the LDI data file to produce maintenance messages, which are then stored in the Fault History Database.

The MWF continuously provides the CMC a list of all MWF messages and indication of the status of each message. The CMC correlates MWF messages with maintenance messages and stores this information in the FHDB along with the correlation with MWF messages, indications of which fault report caused the massage and the Date/Time, Flight Leg and Phase. A Flight Leg is a sequential number incremented at each transition of the aircraft from ground to air. Each midnight UTC the CMC software resets the Flight Log to 1. The Flight Phase definitions are contained in the LDI. The FHDB has a capacity to store up to 10 MB of data. Once full capacity is reached the CMC will overwrite the oldest records with the newest records. The CMC is functional but not accessible in flight, full maintenance functionality is only available on the ground. On the ground, the CMC will generate a Crew Alerting System (CAS) advisory message if there is a fault in the system and a status message when the ADMS memory is full.

A PC loaded with Remote Terminal Software allows access to the CMC through the LAN BUS connector on the Aircraft Maintenance Panel. The Remote Terminal Software provides all the user interface capability that is needed to perform diagnostics on the systems. In order to use this software the Advanced Graphics Module (AGM) in the MAU must be operating.

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7-35-3 Maintenance Data Download

The Fault History Database (FHDB) can be downloaded with a laptop and the Honeywell Remote Terminal 8RT) software, or via the optionally installed Connected Flight Deck.

7-35-3.1 Maintenance Data Download with RT

Note
If a Connected Flight Deck is installed, it must be disabled by opening the CB “WLAN Data Load”, prior to powering up the aircraft.

For more information on how to download the maintenance data with RT, refer to the PC-12/47E Data Loading guide (Document Number 02313). The guide can be found at www.pilatus-aircraft.com -> Menu -> Customer Support -> Technical Publications -> PC-12 -> Flight Manuals -> Data Loading Guide.

7-35-3.2 Maintenance Data Download with Connected Flight Deck (CFD)

If the optional Connected Flight Deck (CFD) is installed, the Honeywell MyCMC Apple iPad application can be used to download the Fault History Database. The iPad must be connected to the CFD wireless network of the aircraft to download the files from PRIMUS APEX. Refer to the PC-12/47E Wireless Data Loading (Connected Flight Deck) guide (Document Number 02373). The guide can be found at www.pilatus-aircraft.com -> Menu -> Customer Support -> Technical Publications -> PC-12 -> Flight Manuals -> Data Loading Guide.

The download of the FHDB files can be done with the aircraft only powered by the STBY bus, after pressing the MAU DATA LOAD switch on the copilot side panel. A red cross will be shown on all powered MFDs and PFDs during the data loading process. This is normal and due to the AGM being set to download data mode. The data loading process shall not be interrupted nor shall the aircraft be de-energized.

When the data loading has been completed, the lower Multi Function Display (MFD) (and, if powered, the copilot Primary Flight Display (PFD)) will return to their default configuration. The pilot PFD and upper MFD will continue to display red crosses.

A full power cycle of the aircraft is required to return the aircraft to normal operation.

7-35-4 Indication

The CAS window on the systems MFD will show the following advisory and status messages for the ADMS (refer to Table 7-35-1):

Table 7-35-1: ADMS - CAS Messages

CAS Message	Description
Maintenance Fail	On ground, indicates ADMS failure
Maint Memory Full	On ground, indicates ADMS memory is full

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7-36 Primus APEX - Optional Electronic Charts

7-36-1 General

The Primus APEX system provides the functionality to display optional Jeppesen Sanderson terminal charts. The charts functionality is hosted on the Advanced Graphic Module (AGM 1 and AGM 2) within the MAU and displays information primarily from the charts database. Refer to Section 7-27, Primus APEX, for the APEX system architecture. Updated charts are released every two weeks and are loaded when the aircraft is on the ground with the Remote Terminal software. Refer to the Database Downloading paragraph for the procedure to download data. The charts are stored as vector images that can be scaled, rotated and split. The pilot has the ability to select and manipulate the charts for viewing by using the Cursor Control Device (CCD) or Touch Screen Controller (TSC).

Refer to the limitations given in Section 2, Systems and Equipment Limits, Primus Apex - Electrionic Charts, for the use of electronic charts.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE™) (powered by Honeywell) for the Pilatus PC-12/47E for complete information on the description and usage of Jeppesen charts.

7-36-2 Functionality

Refer to Fig. 7-36-1, Charts Graphical User Interface.

The charts functionality can be activated by pressing the Charts softkey on the Situation Awareness MFD or using the TSC MFD Format page or CCD page selection. The Charts softkey activates the charts on the Situation Awareness Multi Function Display (MFD). The charts then replace the INAV map and the remaining one third window is used to display the Waypoint List and the Flight Management Window. The TSC MFD Format page allows to select the synoptic, chart (option) and video (option) window on the Systems MFD. The Charts functionality can be activated on both MFDs.

The Airport Pull-Down Menu is located at the top left and is activated by placing the cursor over the Airport Selection Box and then selecting ENTER with the CCD or TSC. This provides the ability to display a maximum of four airports (three automatic selections and one search selection). The automatic selections consist of origin, destination and alternate airports derived from an active flight plan. In addition, the pilot can display charts from any airport by using the Search Aprt menu item. In the case when a flight plan is not complete (with origin, destination and alternate), the automatic selections for the charts may not be able to provide the full functionality.

Chart effectivity and coverage information can be viewed using the Revision Info menu item. When the chart data is current the volume label is displayed in white. If the chart is used beyond its intended cycle time, the volume label and a notification “May contain outdated information” are displayed in amber to indicate that the database needs to be updated. In addition, a Crew Alerting System (CAS) message **AGM 1 DB Old** , **AGM 2 DB Old** or **AGM 1+2 DB Old** is displayed.

The seven chart type tabs for each airport are segregated into the following categories (refer to Table 7-36-1):

Table 7-36-1: Electronic Charts - Chart Types

Chart Type	Description
Aprt	Airport Diagrams
SID	Standard Instrument Departure
STAR	Standard Terminal Arrival Route
App	Approach procedures
Noise	Noise abatement procedures
NOTAM	Airport notice to airmen
Airsp	Terminal airspace

The CCD scroll function or the TSC knob controls the magnification of the chart window, which allows the smallest chart characters to be sized to a readable level.

The scroll frame is enabled whenever the cursor is placed along the chart display edge in any direction. Once the cursor is located within the frame leg of the desired scroll direction, the ENT button on the CCD, or pushing and holding on the DU&CCD touchpad on the TSC, can be used for scrolling. For each press, the chart will scroll in increments in the direction of the arrows.

The aircraft symbol will only be shown on Geo referenced charts. Geo referenced charts are indicated by a small aircraft symbol on the right of the chart title bar.

The airport chart for destination airport will be automatically displayed after landing if the charts window is shown on the MFD.

Night mode is optional and once selected will show all charts in a color palette that is optimized for viewing in dark cockpit environments (refer to Fig. 7-36-2). Night mode will automatically be selected at aircraft power-up if it is nighttime at the aircraft location.

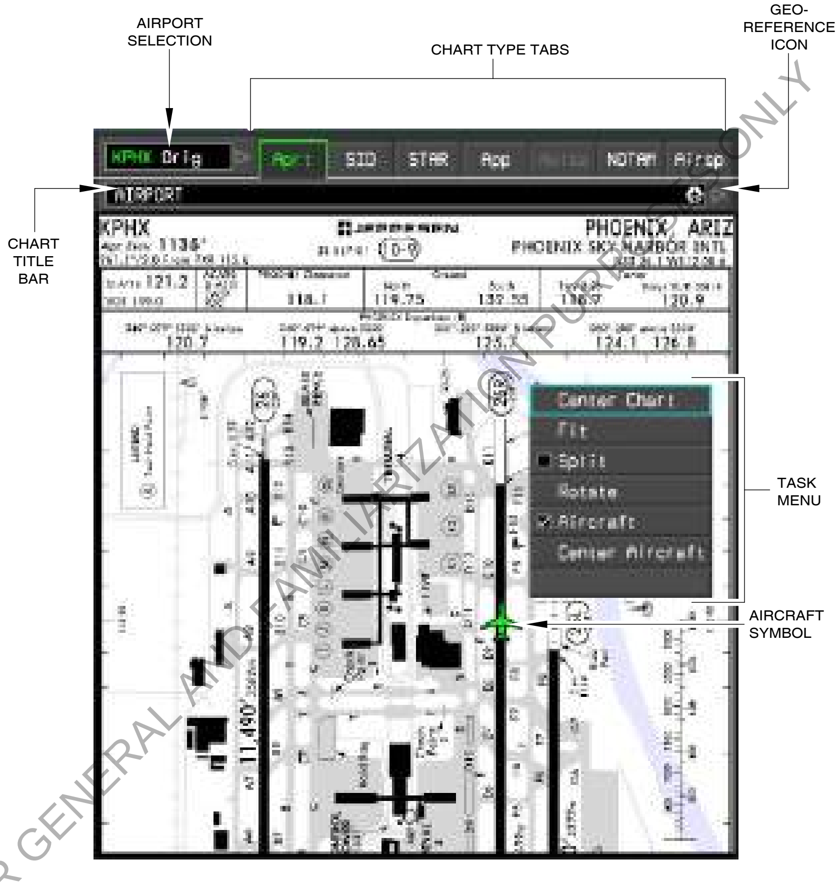

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Figure 7-36-1: Charts - Graphical User Interface

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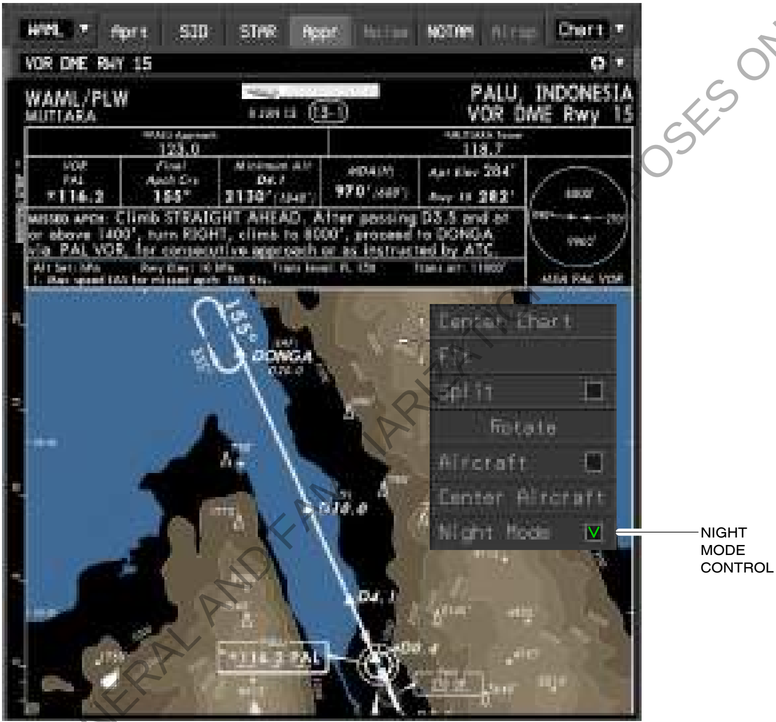

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Figure 7-36-2: Charts - Night Mode (optional)

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7-36-3 Electronic Chart Database Loading

7-36-3.1 Electronic Chart Database Loading with RT

The Charts Database updates can be downloaded with the Remote Terminal software to the FMS Navigation Database. Refer to the PC-12/47E data Loading Guide (Document Number 02313) available on the Pilatus web site.

Note
If a Connected Flight Deck (CFD) is installed, it must be disabled by opening the CB "WLAN Data Load" before energizing the aircraft electrical system.

7-36-3.2 Electronic Chart Database Loading with Connected Flight Deck (CFD)

If the optional CFD is installed, an Apple iPad can be used to load Navigation and Electronic Chart Databases to PRIMUS APEX. To do this, the INDS Data Manager application is used on an iPad with an INDS subscription. Firstly, the iPad must be connected to an internet network to download the databases. Thereafter, the iPad can be connected to the wireless network of the aircraft to upload the databases to PRIMUS APEX. Refer to the PC-12/47E Wireless Data Loading (Connected Flight Deck) guide (Document Number 02373). The guide can be found at www.pilatus-aircraft.com - > Menu -> Customer Support -> Technical Publications -> PC-12 -> Flight Manuals -> Data Loading Guide.

7-36-4 Optional Apex Video Input

7-36-4.1 General

The Primus APEX system provides the functionality to display video on the Systems MFD. An optional video input module converts analogue video input signals to digital format that can be used by the Modular Avionics Unit (MAU) to display the video.

Note
It is the responsibility of the operator to apply for operational approval at the local authority for displaying video on the Systems MFD by using the optional video input module.

7-36-4.2 Functionality

The video functionality can be activated by opening the page selection drop down menu using the CCD or from the TSC MFD Format page.

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7-37 Primus APEX - Optional Electronic Checklist

7-37-1 General

The Primus APEX system provides the functionality to host an optional Electronic Checklist (ECL) database that will be supplied and certified independently. Refer to the limitations given in this POH Section 2, Systems and Equipment Limits, Primus Apex - Electrionic Checklist for the use of the ECL.

The default location of the ECL is on the lower Multi Function Display (MFD) in the bottom left window. If desired, the ECL can also be displayed on the TSC by pushing the Checklist button on the TSC home page. The ECL can thus be shown on either the MFD or the TSC. Or, the ECL can be shown on both the MFD and the TSC at the same time. When the ECL is shown on both the MFD and TSC, both electronic checklist mirror each other when changes are made.

The ECL is designed with a CAS linking functionality that automatically activates the associated checklist for specific CAS messages.

Control of the ECL is via the Touch Screen Controller (TSC), soft keys on the ECL display and flight control wheel yoke buttons.

7-37-2 Description

The ECL layout consists of two types of line items: Menu line items and Checklist line items. The Menu line items are the Normal Procedures Checklist and the Checklist line items are divided into two types. These are Open Loop and Inactive. The Open Loop items are those items that will require pilot feed-back to check-off. An inactive item can be used as a Note to the pilot or to allow blank lines. Inactive items do not require any pilot action.

7-37-3 Operation

When selected on the MFD or TSC, the ECL will be called up to the GENERAL MENU page. The Normal Procedures Checklist can then be selected. If there are no procedures installed for a Checklist or a failure occurs, a “Checklist Unavailable” message will be displayed in the checklist window. The MFD bezel buttons perform the same function as the soft keys shown on the TSC.

The selected checklist menu will appear in the checklist window. Inside the checklist the cursor will be positioned on the first unchecked item in the checklist. To check off items in a checklist push on either the ENT bezel key on the MFD or the TSC soft key or press the CHKLST button on the yoke to complete the checklist action. The item checkbox will then be filled with a checkmark and the cursor will then move to the next item. Once all the checklist items are checked off, the message “Checklist Complete” will be displayed at the end of the checklist.

When using the CKLST button on the pilot or copilot control wheel yoke an item can only be checked or unchecked. The MFD bezel keys or TSC soft keys must be used to move the cursor in all other circumstances.

Refer to the Pilot’s Guide for the Advanced Cockpit Environment (ACE™) (powered by Honeywell) for the Pilatus PC-12/47E for more information on the ECL.

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7-38 Primus APEX - Coupled VNAV Approach

7-38-1 General

The Primus APEX avionics suite provides a coupled VNAV approach functionality.

7-38-2 Description

The FMS is capable of generating a vertical flight profile by using altitude and angle constraints from the flight plan waypoints. The waypoint constraints used by the FMS for both climb and descent, may come from the Navigation Database via terminal procedures or may be entered by the crew. The VNAV function will ensure compliance with the PSA or the FMS altitude constraints whichever target is closer to the actual altitude.

The FMS calculates the path deviation by using barometric altitude signal from the ADAHRS.

The vertical profile calculated by the FMS can be displayed on the Vertical Situational Display (VSD). After changes to the vertical flight profile it can take up to 10 seconds to re-compute the VSD.

Refer to Honeywell APEX Pilots Guide for more information on coupled VNAV.

7-38-3 VNAV Modes

The FMS supports four vertical modes:

- VNAV Flight Level Change (VFLC)

  The FMS provides target altitude guidance for the flight director to climb or descend. This mode is mainly used for climb and descent. VFLC will also engage when VNAV Altitude (VALT) hold is engaged, the target altitude is more than approximately 150 feet from the current altitude of the aircraft, and the FMS initiates a climb or descent.

- VNAV Altitude Select Capture (VSEL)

  VSEL is active whenever the aircraft is capturing FMS or PSA altitude and VNAV is active

- VNAV Altitude Hold (VALT)

  VALT is used for holding an altitude as computed by the FMS or by the preselected altitude (PSA). The autopilot automatically transitions from VALT to VFLC or VPTH mode when an altitude constraint is passed, next altitude constraint is at different altitude and PSA allows a flight level change

- VNAV Path (VPTH)

  VPTH mode is a descent mode used by the FMS to guide the aircraft along a geo-referenced path.

7-38-4 Pilot’s Display

7-38-4.1 General

With coupled VNAV active, the following information is displayed on the Primary Flight Display (PFD). Refer to Fig. 7-38-1, VNAV - Example Indications:

- Vertical Deviation Pointer

  Represents the FMS VNAV descent profile deviation

- FMS Altitude and Target Bug and digital Readout

  Provides information for the next altitude constraint defined in the flight plan and is displayed as long as the FMS is selected as the primary navigation source

- VNAV Modes

  VNAV autopilot armed and active modes (VFLC, VSEL, VALT and VPTH)

- Vertical Tracks Alert

  Warns the pilot of an impending vertical-mode or vertical-track change by VNAV (e.g. before crossing a climb / descent constraint that does not equal the altitude preselector).

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Figure 7-38-1: VNAV - Example Indications

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7-38-4.2 VNAV Pre-Approach Path Guidance

Refer to Fig. 7-38-2, FMS VNAV Pre-Approach Pointer.

VNAV pre-approach path deviation will be indicated on the left side of the vertical deviation scale as a solid pointer as shown below. The so called VNAV preapproach pointer is not labelled as it always represents the barometric VNAV pointer driven by FMS and it is always on the left of the vertical scale. If an Instrument Flight Rules (IFR) approach procedure is available and loaded into the FMS the pre approach pointer will be removed when the system is transitioning to GS, LPV or VNAV for final approach guidance. The FMS is able to guide the aircraft on the pre-approach vertical path by using the VPTH mode on a continuous descent profile from TOD down to a runway threshold for a visual approach supplementary guidance.

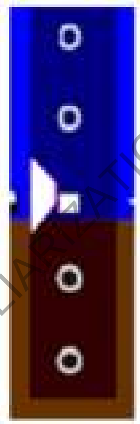

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Figure 7-38-2: FMS VNAV Pre-Approach Pointer

7-38-4.3 Approach Pointer Display

Refer to Fig. 7-38-3, VNAV, LPV and GS Pointers.

Refer to Fig. 7-38-4, VNAV, LPV and GS Ghost Preview Pointers.

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The vertical approach path deviation is displayed on the right side of the vertical deviation scale as a solid pointer and is displayed as soon as the approach capture criteria are met. The approach pointer will be labelled in a white font off to the right and below the vertical scale to identify the pointer as follows:

- VNAV, if the pointer is driven by the FMS using barometric altitude from the ADAHRS. The VNAV pointer is displayed during LNAV or LNAV/VNAV approaches
- LPV, if the pointer is driven by the FMS using the GNSSU proportional path deviation prior transition to the LPV approach or if the pointer is driven directly by the GNSSU during LPV approach
- GS, if the pointer is driven by the Multi Mode Digital Radio during ILS approach.

The approach pointers for the VNAV, LPV and ILS approaches are mutually exclusive and are shown below.

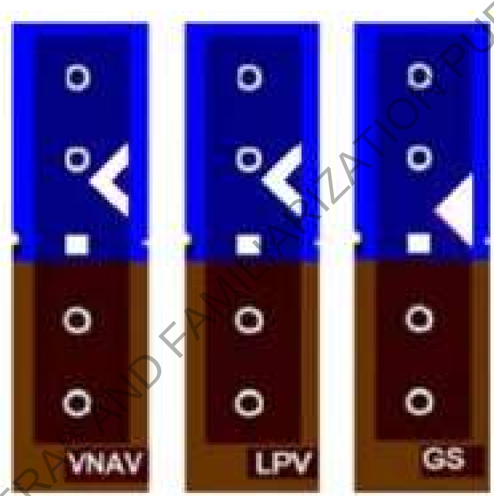

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Figure 7-38-3: VNAV, LPV and GS Pointers

If the selected approach path deviation becomes valid at any time within the terminal area, then it will be displayed as a ghost preview pointer until the approach capture criteria are met. The display of a ghost preview pointer allows the crew to arm the approach mode before the approach becomes captured. The ghost preview pointer will be displayed as a hollow pointer as shown below. The labelling for the ghost preview pointer follows the same philosophy as for the approach pointer.

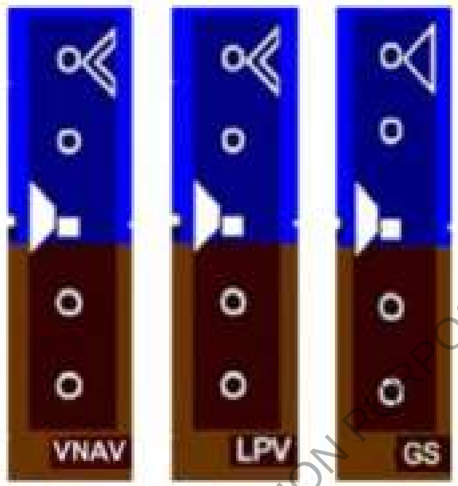

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Figure 7-38-4: VNAV, LPV and GS Ghost Preview Pointers

Note
NAV Preview is not available while executing a VNAV or LPV approach.

7-38-4.4 Vertical Deviation Display

Refer to Fig. 7-38-5, Vertical Deviation Pointer During Standard VNAV Approach.

The vertical deviation pointers displayed during a standard VNAV approach are shown below. The left picture shows the ghost preview pointer displayed along with any vertical AFCS mode except VGP. The next picture shows the armed ghost preview pointer displayed when the next leg is not the FAF and the corresponding AFCS mode is VGP armed mode. The next picture shows the armed approach pointer displayed when the active leg is to the FAF and the corresponding AFCS mode is VGP armed mode. The right picture shows the approach pointer displayed when the approach capture criteria are met and the corresponding AFCS mode is VGP active mode.

The vertical deviation information is displayed on the right side of the Attitude Director Indicator (ADI) sphere next to the altitude tape. The vertical deviation display provides the pre-approach and approach path guidance.

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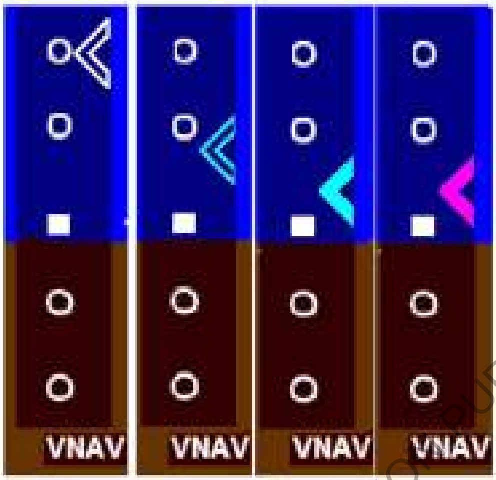

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Figure 7-38-5: Vertical Deviation Pointer During Standard VNAV Approach

7-38-4.5 Altitude Preselector

The altitude preselector is displayed as PSA altitude bug and a PSA digital readout. The pilot selects ATC assigned altitudes using the PSA knob to ensure that the aircraft will not fly through a clearance limit. VNAV uses the altitude preselector to compute altitude targets as well as a variety of other calculations.

In all VNAV modes (except VGP or if engine out condition exists) the FMS will not command the aircraft to move away from the preselected altitude. This gives the pilot a means to control the aircraft movement and to confirm the climb/descent commands of the VNAV functionality Vertical Track Alert.

The FMS will output a Vertical Track Alert (VTA) message to warn the pilot of an impending vertical mode or vertical track change. The VTA annunciation will be displayed in white with a semi-transparent background above the vertical deviation display. Conditions causing a display of VTA include the following:

- Before crossing a climb/descent constraint that does not equal the altitude preselector
- Before TOD while in VALT
- Before resumption of climb after a constraint
- Prior to resuming descent after level off at the speed/altitude limit or descent intermediate level segment
- One minute prior to a TOD in VALT when in a holding pattern and Exit Hold has been selected
- In climb and holding one minute prior to a constrained Hold Fix and Exit Hold has been selected.

7-38-4.6 ILS Approach

Refer to Fig. 7-38-6, Vertical Deviation Pointers During Standard ILS Approach.

Refer to Fig. 7-38-7, Excessive Vertical Deviation during ILS Approach.

The vertical deviation pointers displayed during standard Instrument Landing system (ILS) approach are shown below. The left picture shows the ghost preview pointer displayed along with any vertical AFCS mode except GS. The next picture shows the ILS approach pointer displayed when the ILS localizer is captured and the corresponding AFCS mode is GS armed mode. The right picture shows the approach pointer displayed when the ILS glideslope is captured and the corresponding Flight Director (FD) mode is GS active mode.

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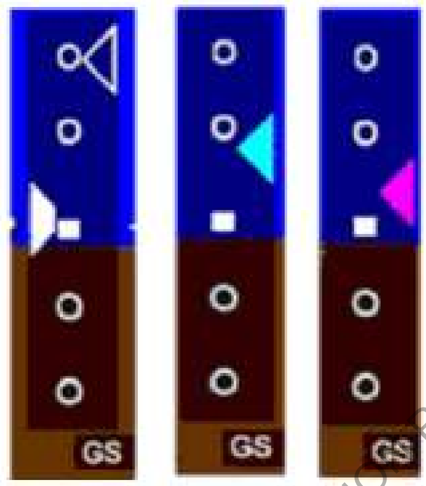

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Figure 7-38-6: Vertical Deviation Pointers During Standard ILS Approach

An excessive vertical deviation indication for ILS approaches triggers when the ILS approach is captured, radar altimeter is less than 500 ft and the vertical deviation exceeds one dot. When these conditions are valid, the deviation scale flashes amber for five seconds and then shows in steady amber for as long as the conditions are true.

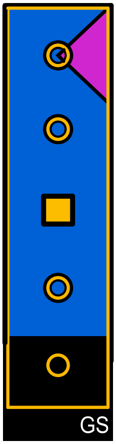

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Figure 7-38-7: Excessive Vertical Deviation during ILS Approach

7-38-4.7 Vertical Situation Display

Refer to Fig. 7-38-8, Vertical Situation Display.

The Vertical Situation Display (VSD) provides a vertical flight view that supplements the lateral map. The VSD can be used to improve the pilot situational awareness during coupled VNAV operation. The VSD is selectable through the VSD softkey on the 2/3rd INAV Window on the MFD. The VSD overlays the bottom of the INAV window. The following are displayed on the VSD:

- Aircraft Symbol
- FMS Vertical Flight Plan
- Actual Flight Path
- FMS Computed Points (Top of Climb, Top of Descent)
- Runway (Origin, Destination, Alternate)
- Altitude preselector Bug and Readout
- Terrain
- ILS Beam
- Flight Plan or Track mode annunciation
- Cursor position on VSD with distance and coordinates indication.

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Figure 7-38-8: Vertical Situation Display

Note
The Vertical Situation Display provides situational awareness and must not be used for navigation purposes.

Items that exist in both INAV and VSD will be displayed using the INAV color code.

The vertical profile is calculated by the FMS and is displayed on the VSD. After changes to the vertical flight profile it can take up to 10 seconds to re-compute the VSD.

Vertical profile is calculated based on the baro-setting from PFD. Therefore when flying with STD baro-setting, the profile for an approach can be shown with an offset.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE^{TM}) (powered by Honeywell) for the Pilatus PC-12/47E for details of the Vertical Situation Display.

7-38-5 VNAV Operation Description

Refer to Fig. 7-38-9, Flight Plan on Vertical Situation Display.

Defining a lateral FMS flight plan entering origin and destination also automatically generates a vertical flight plan, when performance is initialized. Top of climb is calculated according the generic aircraft performance model based on set cruise altitude or PSA whichever is higher. After takeoff when VNAV mode on the FGP is pressed, VFLC mode is automatically engaged which sets the speed bug at the current climb speed. The altitude target can be manually adjusted by the pilot using the altitude selector on the FGP.

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Altitude constraints can be found in terminal procedures or can be defined by the pilot in the waypoints list cross dialogue box. During the VNAV climb in VFLC mode the system will comply with all restricting altitude constraints or the PSA, whichever target is closer to the current altitude. If an FMS altitude constraint waypoint in climb is passed, the system will automatically switch back to VFLC mode to continue the climb, but the pilot has to change the speed target or power setting to initiate the climb.

Keeping the VALT mode engaged in cruise will allow the aircraft to descend in VPTH mode once the Top-Of-Descent (TOD) is reached and the PSA is set to a lower altitude. Typical descents are flown in VPTH mode. However, intercepting a VPTH descent from above or below can also be made in VFLC mode. When VNAV is active, VFLC mode can be initiated for climb or descent by pressing the FLC button.

The default descent profile in VPTH mode is 3°, but can be modified by the pilot to a maximum of 8°. Coupled VPTH continuous descents can be flown from TOD until 400ft AGL on a visual approach. However from maximum 30 NM to the destination airport the approach path guidance is typically transitioned to VGP, or GS using the FGP approach button. The vertical direct to function can be used to define a direct vertical path from the present aircraft altitude to the FAF altitude constraint for a coupled continuous descent approach passing through several waypoints.

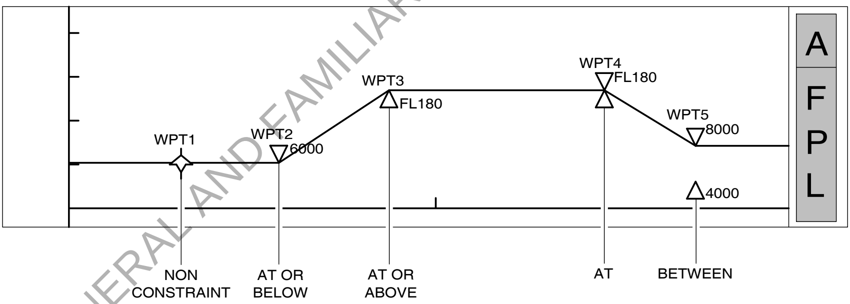

Figure 7-38-9: Flight Plan on Vertical Situation Display

7-38-6 Visual Approach (optional)

7-38-6.1 General

The Primus APEX avionics suite provides an optional Visual Approach function.

7-38-6.2 Description

The visual approach functionality provides a method to setup a user defined standard VNAV approach to a runway or a pilot defined waypoint.

The visual approach function is activated via the INAV Graphical Flight Planning task menu pattern. The visual approach function can be a left hand or right hand downwind approach or a straight-in approach pattern.

The visual approach function uses VGP mode for vertical guidance during the descent, regardless of the altitude pre-selector setting. The VGP glideslope is drawn to the destination waypoint.

The visual approach function does not automatically take local procedures or terrain into account. It is the pilot's responsibility to make sure sufficient terrain clearance is maintained at all times.

Refer to the Pilot's Guide for the Advanced Cockpit Environment (ACE™) (powered by Honeywell) for the Pilatus PC-12/47E for more information on the Visual Approach function.

7-38-6.3 Pilot's Display

7-38-6.3.1 General

The pilot's display during visual approach is the same as a standard VNAV approach.

7-38-6.3.2 Vertical Deviation Display

The vertical deviation pointers displayed during a visual approach are identical to a standard VNAV approach.

7-39 Primus APEX - Optional LPV/LP Approach

7-39-1 General

This section provides the information necessary to operate the PC-12/47E aircraft with Localizer Performance with Vertical (LPV) Guidance or Localizer Performance (LP) Functionality as factory options installed.

The installed SBAS GNSSU and Honeywell PRIMUS APEX avionics suite complies with FAA AC 20-138A (LPV Approach), FAA AC 20-138D (LP Approach), FAA AC 90-107 (aircraft and systems requirements) and EASA AMC 20-28 for navigation using Global Position System (GPS) with Wide Area Augmentation System (WAAS) or EGNOS (within the coverage of a Satellite-Based Augmentation System complying with ICAO Annex 10) for en route, terminal area, non-precision approach operations (including “GPS”, “or GPS”, and “RNAV” approaches), approach procedures with vertical guidance (including “LNAV/VNAV” and “LPV”). The Primus APEX Suite complies with AC20-129 for Baro VNAV.

For all aircraft the relevant Primus Apex option SBAS function has to be activated in the Aircraft Personality Module (APM) options file.

A detailed description of the system operation can be found in the Pilot’s Guide for the Advanced Cockpit Environment (ACE^{TM}) (powered by Honeywell) for the Pilatus PC-12/47E.

For aircraft with TAWS Class A (EGPWS) installed with -30 software or higher, mode 5 alert “below glideslope” is provided for LPV approaches.

7-39-2 Description

The SBAS GNSSU provides GPS position corrected by the SBAS providing improved accuracy and integrity. Refer to the Primus Apex Comms and Nav - GPS section for a description of the SBAS GNSSU.

The RNAV approach to LPV/LP minimum may be selected on the Flight Management Window (FMW) STAR/Landing page. If the Final Approach Segment data block is available for any selected RNAV approach then the LPV/LP minimum selection will be displayed by default. The pilot can change the RNAV minimum if required. The selection of LNAV(/VNAV) is only meant to deselect the LPV/LP approach, since landing minima is set manually using the MINIMUMS knob on the Flight Guidance Panel (FGP).

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7-39-3 Pilot’s Display

Refer to Fig. 7-39-1, LPV and LP Approach Status Display Armed

The SBAS GNSSU information is displayed on the Primary Flight Display (PFD) and Multi Functional Display (MFD).

The LPV/LP status indicator provides the following information to the pilot.

White (arm)

The LPV/LP approach status is indicated on the LPV/LP status field. The LPV/LP status field is located below the flight director vertical mode display as shown below.

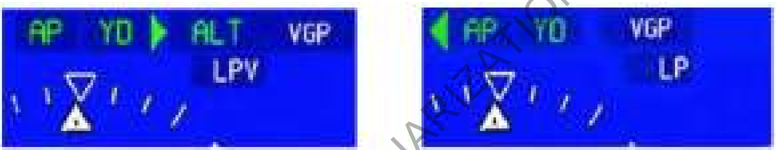

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Figure 7-39-1: LPV and LP Approach Status Display Armed

Green (active)

Refer to Fig. 7-39-2, LPV and LP Approach Status Display Active

LPV or LP is displayed in green on the PFD when LPV/LP status is active and the aircraft is within the approach area.

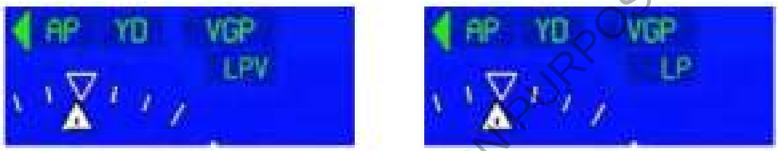

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Figure 7-39-2: LPV and LP Approach Status Display Active

Amber ("LPV UNVL" or "LP UNVL")

Refer to Fig. 7-39-3, LPV and LP Approach Status Display Unavailable

LPV UNVL or LP UNVL is displayed in amber when the pilot loads an RNAV approach to LPV/LP minimums, but an error has been detected or the pilot selected a NAV preview outside the approach area or Vertical Glidepath (VGP) was not armed nor captured.

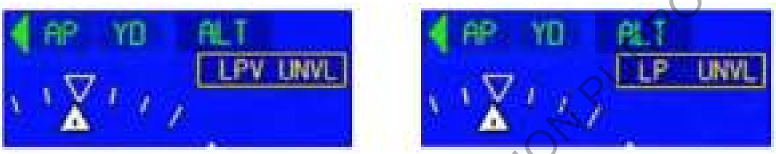

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Figure 7-39-3: LPV and LP Approach Status Display Unavailable

7-39-3.1 Vertical Deviation Display

Vertical deviation information is displayed on the right side of the Attitude Direction Indicator (ADI) sphere next to the altitude tape. The Vertical deviation display provides the pre-approach and approach path deviation.

For LPV the approach path deviation is provided by the SBAS GNSSU.

For LP approach Baro-VNAV is used to provide vertical deviation indication. The LP vertical guidance is advisory only and pilots must use the barometric altimeter as the primary altitude reference. This is to ensure compliance with any and all altitude restrictions during instrument approach operations.

7-39-3.2 LPV Approach

Refer to Fig. 7-39-4, Vertical Deviation Pointers During Standard LPV Approach

The vertical deviation pointers displayed during a standard LPV approach are shown below. The left picture shows the ghost preview pointer displayed along with any vertical Automatic Flight Control System (AFCS) mode except VGP. The next picture shows the armed ghost preview pointer displayed when the next leg is not the Final Approach Fix (FAF) and the corresponding AFCS mode is VGP armed mode. The next picture shows the armed approach pointer displayed when the active leg is to the FAF and the corresponding FD mode is VGP armed mode. The right picture shows the approach pointer displayed when the approach capture criteria are met and the corresponding Flight Director (FD) mode is VGP active mode.

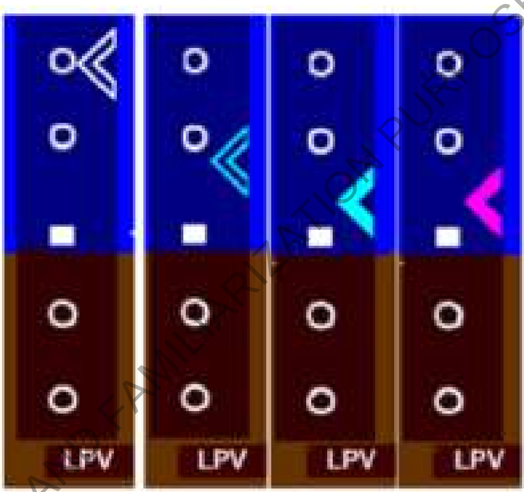

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Figure 7-39-4: Vertical Deviation Pointers During Standard LPV Approach

7-39-3.3 LP Approach

The vertical deviation pointers displayed during a LP approach are identical to a Baro-VNAV approach.

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7-40 Lightweight Data Recorder (If Installed)

7-40-1 Description

Refer to Fig. 7-40-1, Lightweight Data Recorder Schematic.

The Lightweight Data Recorder (LDR) is an airborne crash-survivable recording system which records both cockpit voice and aircraft flight data.

The LDR simultaneously records:

- One channel of audio from the pilot's audio panel. The latest 120 minutes of recorded audio data is retained
- One channel of audio from the Cockpit Area Microphone (CAM). The latest 120 minutes of recorded audio data is retained
- One channel for flight data information received from the Modular Avionics Unit (MAU) by ARINC 717 databus. The latest 25 hours of ARINC data at a rate of 256 words per second is retained
- One channel for datalink data information received from the Modular Avionics Unit (MAU) by ARINC 429 databus. The latest 25 hours of ARINC data at a rate of 256 words per second is retained.

The LDR correlates the voice and flight data to within ± 1 second.

The LDR system has:

- A LDR installed in the rear fuselage between Frames 36 and 37
- A CAM installed on the right lower sidewall panel in the flight compartment
- A CV ERASE/CVFDR TEST switch and a CVFDR TEST LED installed on the copilot's auxiliary panel.

The power supply to the LDR system is 28 VDC from the Battery and External Power Junction Box (BEPJB) through the CVFDR POWER circuit breaker installed in the rear fuselage. The LDR is powered when the STBY BUS switch is ON and the HOT BATT BUS has a minimum of 18 VDC.

CVFDR TEST LED indicator and a CV ERASE/CVFDR TEST switch is installed on the copilot's auxiliary panel.

The green CVFDR TEST LED indicator is ON to show the LDR has no faults when the CV ERASE/CVFDR TEST switch has been set to CVFDR TEST. The CV ERASE switch gives the option to delete the recorded voice data. The spring loaded switch must be set to ERASE for at least three seconds to erase the voice data. It does not erase the flight data.

7-40-2 Operation

Power off:

The LDR system is not operating, no data is recorded.

Power on:

The LDR system operates and records audio and flight data.

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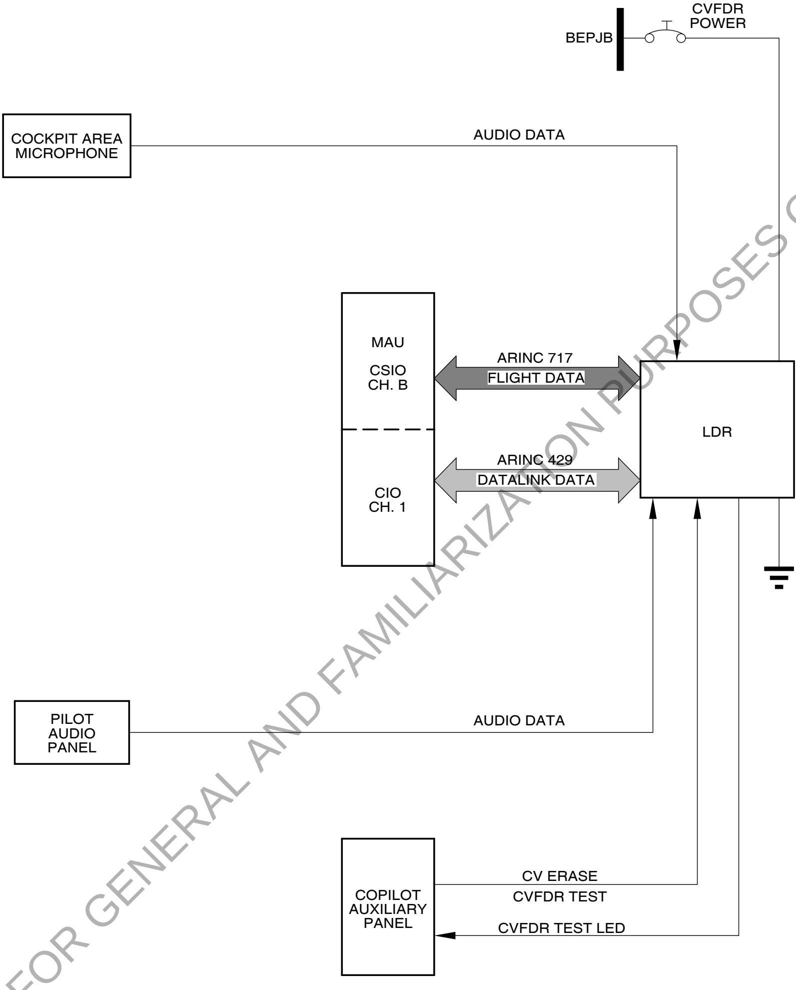

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Figure 7-40-1: Lightweight Data Recorder - Schematic

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SECTION 8

Handling, Servicing and Maintenance

Table of Contents

8-1 General

8-1-1 General

This section contains factory-recommended procedures for proper ground handling and routine care and servicing of the PC-12 airplane. It also identifies certain inspection and maintenance requirements that must be followed if the airplane is to retain its performance and dependability. It is recommended that a planned schedule be followed for lubrication and preventive maintenance based on climatic and flying conditions which may be encountered.

All correspondence regarding the airplane must contain a reference to the manufacturer's serial number (MSN) and be addressed to:

PILATUS AIRCRAFT LTD. CUSTOMER SUPPORT GENERAL AVIATION, CH-6371 STANS, SWITZERLAND

Customer Support	
Website:	http://www.pilatus-aircraft.com → Contact Us
Tel:	+41 848 247 365 (24/7/365 customer support)

Pilatus Aircraft Ltd. cannot accept responsibility for continued airworthiness of any airplane not maintained in accordance with the information contained within this section and the Airplane Maintenance Manual (AMM).

8-1-2 Identification Plate

An identification plate is located on the lower left side of the fuselage aft of the cargo door. This plate displays the manufacturer's name, model designation, serial number (MSN), date of manufacture and the FOCA and FAA type certificate numbers.

Certain regulations may require an identification plate that displays the airplane registration number. This identification plate is located in the empennage.

8-1-3 Airplane Inspections

8-1-3.1 Airplane Inspection Periods

As required by regulations, all civil airplanes must undergo a complete inspection annually (each twelve calendar months). In addition to the required annual inspection, the manufacturer also requires inspections based on flying hours and Time Limited Inspections.

Other inspections may be required by the issuance of airworthiness directives or service bulletins applicable to the airplane, engine, propeller and components. It is the responsibility of the operator to ensure compliance with all applicable airworthiness directives and, when the inspections are repetitive, to take appropriate steps to prevent inadvertent non-compliance.

8-1-3.2 Airplane Scheduled Inspections

As required by national regulations, the airplane must be the subjected to a complete Annual Inspection. In addition, national regulations may require periodic, hourly inspections. The PC-12 AMM Chapter 5 gives the manufacturers recommended time limits for inspections, maintenance checks and the scheduled and unscheduled inspections.

The inspection intervals are based on normal usage of the airplane under average environmental conditions. Airplane operated in extremely humid tropics, or in exceptionally cold, damp climates, salt-laden conditions may need more frequent inspections for wear, corrosion and lubrication. Under these adverse conditions, the hourly inspection should be done at a more frequent interval. The owner or operator can then set his own inspection interval based on field experience.

The hourly inspection interval should never be exceeded by more than 10% but not more than 500 FH (refer to the AMM Chapter 5 for more information on permissible tolerances), which can be used only if additional time is required to reach a maintenance center. The permissible tolerances are not cumulative. For example, the 600 FH inspection can be accomplished at any time between 540 FH and 660 FH (±10% or ±60 FH).

The owner or operator is responsible for complying with any local regulations. The owner or operator is primarily responsible for maintaining the airplane in an airworthy condition, including compliance with Airworthiness Directives. It is further the responsibility of the owner or operator to make sure that the airplane is inspected in conformity with the inspection sheets.

Detailed information of systems and sub-systems on the airplane can be found in the relevant chapters of the AMM. Reference is made to the topics in this manual and Pilatus issued Service Bulletins for inspection, repair, removal and installation procedures. It is the responsibility of the owner or operator to make sure that mechanics inspecting the airplane have access to these documents.

The master maintenance plan and the different inspection packages list the maintenance and structural significant items for inspection and state the level of inspection required.

8-1-3.2.1 Component Life Policy

The AMM Section 4 contains the Airworthiness Limitations which specify Life Limit and Inspection Intervals for major components of the airplane.

The AMM Section 5 contains the time limits for overhaul and replacement of components based on average usage and environmental conditions. The stated time limits do not constitute a guarantee that the component will remain in service until this time as the environmental conditions that the component is operated in cannot be controlled by the manufacturer.

8-1-4 Preventive Maintenance

Pilots operating the airplane should refer to the regulations of the country of registry for information on preventive maintenance that may be performed by pilots.

The holder of a Pilot Certificate may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an airplane which the pilot owns or operates and which is not used to carry persons or property for hire, except as provided in the applicable FAR's. Although such maintenance is allowed by law, each individual should make an analysis as to whether he/she has the ability to perform the work.

Pilatus Aircraft Ltd should be contacted for further information, or for the required maintenance which must be accomplished by appropriately licensed personnel. All other maintenance required on the airplane should be accomplished by the appropriately licensed personnel.

The aircraft has Computer Aided Testing (CAT) connectors which are installed in the maintenance test panel on the right side of the flight compartment. They are the central access point for ground maintenance to do aircraft system tests using either a portable computer or a maintenance box. Serious flight safety implications could result if equipment is connected to the CAT connectors during flight. The protective CAT connector caps must be installed during flight and all test equipment must be removed from the aircraft.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

- The date the work was accomplished
- Description of the work
- Number of hours on the airplane
- The certificate number of pilot performing the work
- Signature of the individual doing the work.

8-1-5 Modifications or Repairs

It is essential that the Airworthiness Authorities of the country of registry be contacted prior to any modifications to the airplane to ensure that the airworthiness of the airplane is not violated. Modifications or repairs to the airplane must be accomplished by licensed personnel.

8-1-6 Service Bulletins and Service Letters

Pilatus Aircraft will issue Service Bulletins and Service Letters from time to time which will be sent to owners, service centers and distributors. Service Bulletins should be complied with promptly and depending on their nature material and labor allowances may apply, this aspect will be addressed in the Planning Information section of the bulletin. Service Letters give information on product improvements, or discussion on field problems. Service Bulletin and Service Letter Indexes are issued periodically to provide a complete listing of all issued bulletins and letters.

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8-2 Ground Handling

8-2-1 Towing

Refer to Fig. 8-2-1, Aircraft Towing

The use of a towing arm which attaches to lugs on the nose leg is the recommended method of towing the airplane over prepared, hard, even ground. The towing arm should incorporate shock absorbers to prevent damage to the airplane. The steering arm provided for this airplane is a steering bar extension to the tail stand. When not in use the components of the towing arm are stowed inside the rear fuselage cone accessible through the battery door.

When towing the airplane, a qualified person should sit in the cockpit ready for immediate braking action, in the event that the towing arm becomes uncoupled. The movement of the towing vehicle should always be started and stopped slowly to avoid unnecessary shock loads. When towing in a congested area, two helpers should watch the wing tip and tail clearances.

In any towing operation, especially when towing with a vehicle, do not exceed the nose gear maximum tow limit angle either side of center or damage to the nose gear will result. The maximum tow limit angle is indicated by a placard on the nose strut. If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose gear does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose tire will also increase the tail height.

When towing an aircraft it is recommended to install the propeller towing restraint to avoid damage to the propeller. The towing restraint, which is part of the parking equipment, is attached to the propeller restraint and the tow bar. During this operation, the propeller restraint has to be attached to the spinner dome with the hooks, provided in the parking equipment.

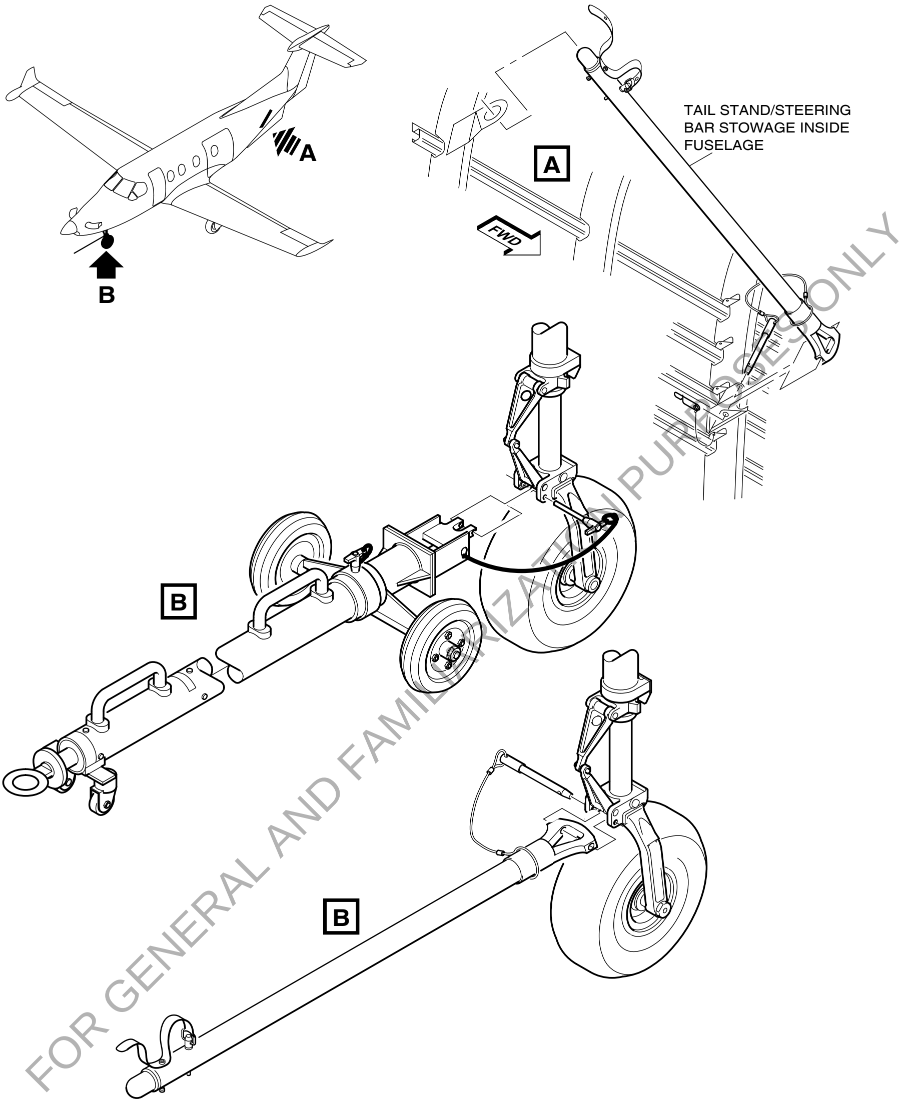

Figure 8-2-1: Aircraft Towing

CAUTION

To avoid any damage, the propeller restraint must not be attached to the exhaust covers or the engine cowling.

In the event that towing lines are necessary, ropes should be attached to the main gear struts as high as possible without contacting brake lines or wire harness. The lines should be long enough to clear the nose and/or tail by not less than 20 feet. A qualified person should occupy the pilot's seat to maintain control of the airplane by the use of the nose wheel steering and brakes.

It is acceptable to tow the aircraft by grasping the nose wheel and lifting it just enough to clear the ground.

8-2-2 Parking

In normal weather conditions, the airplane can be parked on any firm surface, headed into wind (if possible) and the parking brake applied, or wheel chocks in place, or both. Make sure that the rudder/nose wheel is centered.

The tail stand should be installed any time the aircraft is parked outside and wet snow fall is expected.

Parking for long periods should be done with wheel chocks in place and the parking brake released. Install cockpit control locks. Blanks and covers should be fitted at any time the airplane is parked for an extended time or overnight (refer to Fig. 8-2-2). Before the blanks and covers are installed they must be checked for condition and completeness (i.e. in serviceable condition with all warning flags attached). When the aircraft is parked in direct sunlight and Outside Air Temperature (OAT) is above 30°C it is recommended to install the Cockpit Sun Screen.

The airplane should be moored if it is to be parked in the open for long periods and weather conditions are unfavorable. In extreme conditions, the airplane should be parked in a hangar, as structural damage can occur in high winds, even when moored correctly.

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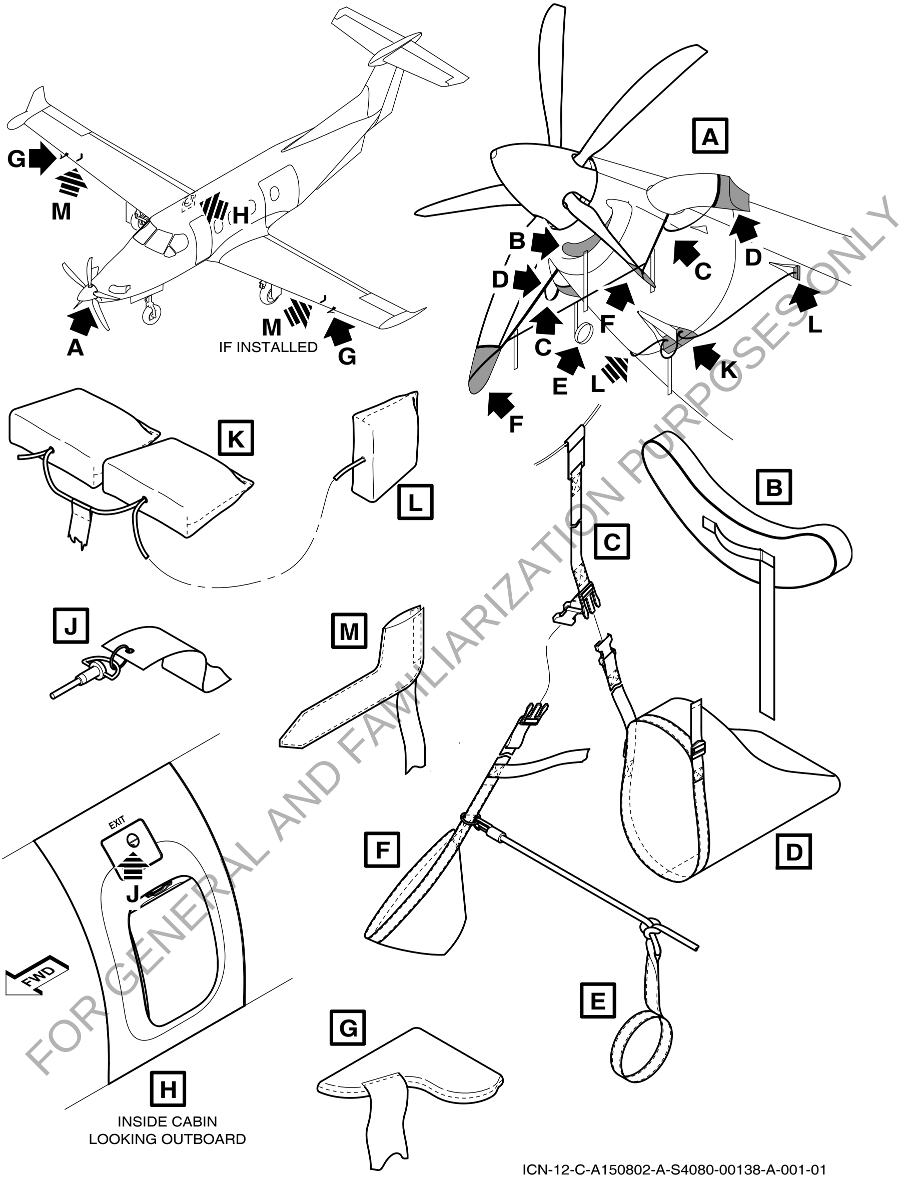

Figure 8-2-2: Blanks and Covers

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8-3 Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane (refer to Fig. 8-2-2 and Fig. 8-3-1):

- Head the airplane into wind, where possible
- Retract the flaps
- Close the inertial separator
- Install cockpit control locks
- Chock the wheels
- Install the blanks and covers
- Install the propeller anchor
- Secure tiedown ropes to the wings at approximately 45° and tail tiedown points at a maximum of 25° angle to the ground
- Fit the propeller boots, and attach to the cowling under the engine exhausts, to prevent engine wind milling
- If the aircraft is in direct sunlight and Outside Air Temperature (OAT) is above 30°C it is recommended to install the Cockpit Sun Screen.

CAUTION

Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.

CAUTION

Make sure propeller anchor is properly installed to prevent possible engine damage due to wind milling with zero oil pressure.

Note

When using rope of a non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract. Hemp ropes contract significantly in high moisture conditions.
Additional preparations for high winds include using tiedown ropes from the nose landing gear.

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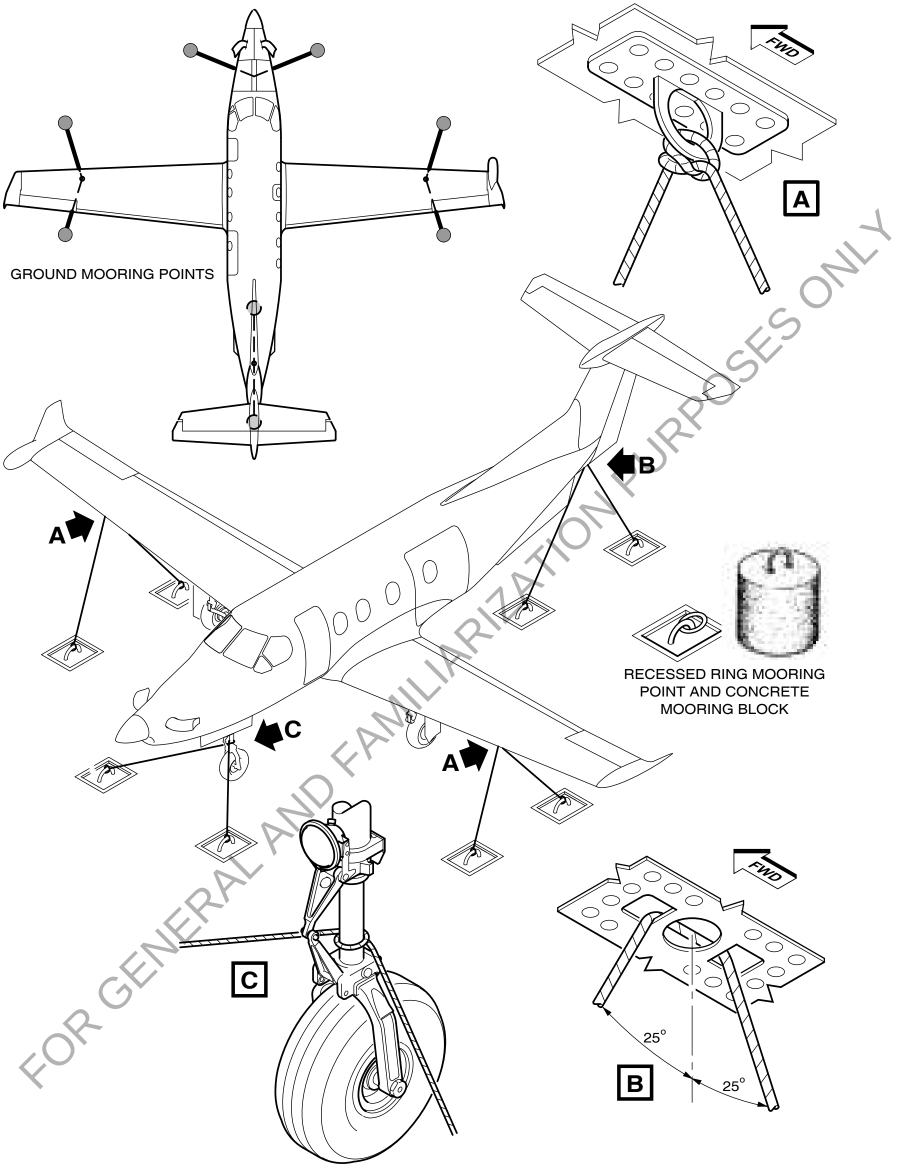

Figure 8-3-1: Airplane Mooring

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8-4 Jacking

8-4-1 Single Wheel Jacking

To assist in wheel and brake maintenance, both the two main wheels and the nose wheel can be jacked, independently, using a bottle jack and an adapter (refer to Fig. 8-4-1). The adapters are shaped to accept the piston of a bottle jack. It is advisable that when jacking the nose wheel up, the tail support should be fitted in the rear main jacking pad as a precautionary measure.

Chock the other two tires before single wheel jacking to prevent airplane movement.

8-4-2 Airplane Jacking

The airplane is equipped with two main jacking points and a combined tail jacking pad/mooring point (refer to Fig. 8-4-2). The two main jacking points are located on the wing bottom surface just outboard of the fuselage and the tail jacking pad is located on the fuselage bottom surface just forward of the empennage.

Hydraulic jacks are used at the main jacking points to raise and lower the airplane. The tail jacking point is used to maintain the airplane in a level attitude during lifting. When the airplane is raised or lowered, the airplane tail is also progressively raised or lowered accordingly.

CAUTION
Attach ballast to the Tail Jacking Point to prevent any possible rear fuselage upwards movement, while the airplane is on jacks.

Refer to the Aircraft Maintenance Manual Chapter 7 for procedures on lifting and lowering the complete airplane and information concerning the amount of ballast to be attached to the tail jacking point.

Note
When jacking the airplane outdoors, use the tiedown for provisions for the wing and tail as described in Section 8-3, Mooring.

8-4-3 Levelling

Longitudinal and lateral leveling of the airplane is achieved by positioning a spirit level along or across one of the seat rails in the aft fuselage area. This task is normally done in conjunction with raising the airplane on the three main jacks for weighing, setting of landing lights and fuel system calibration.

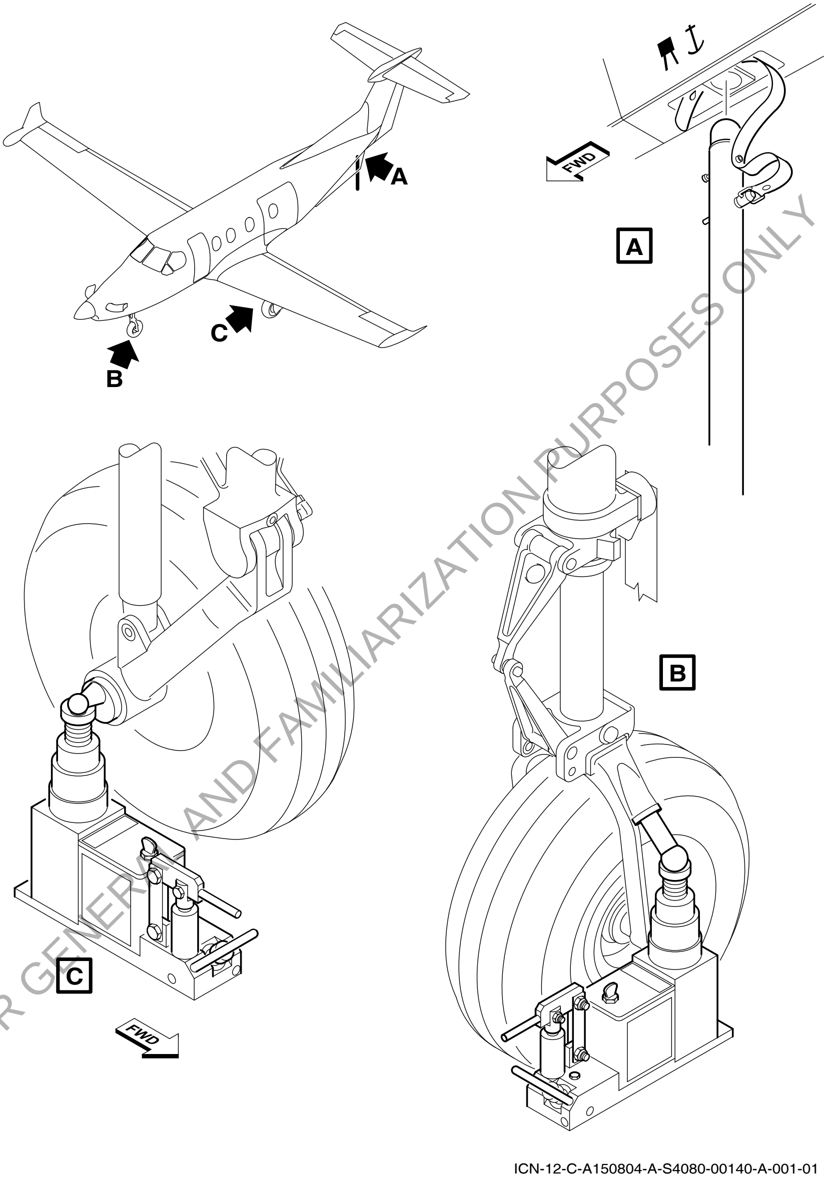

Figure 8-4-1: Single Wheel Jacking

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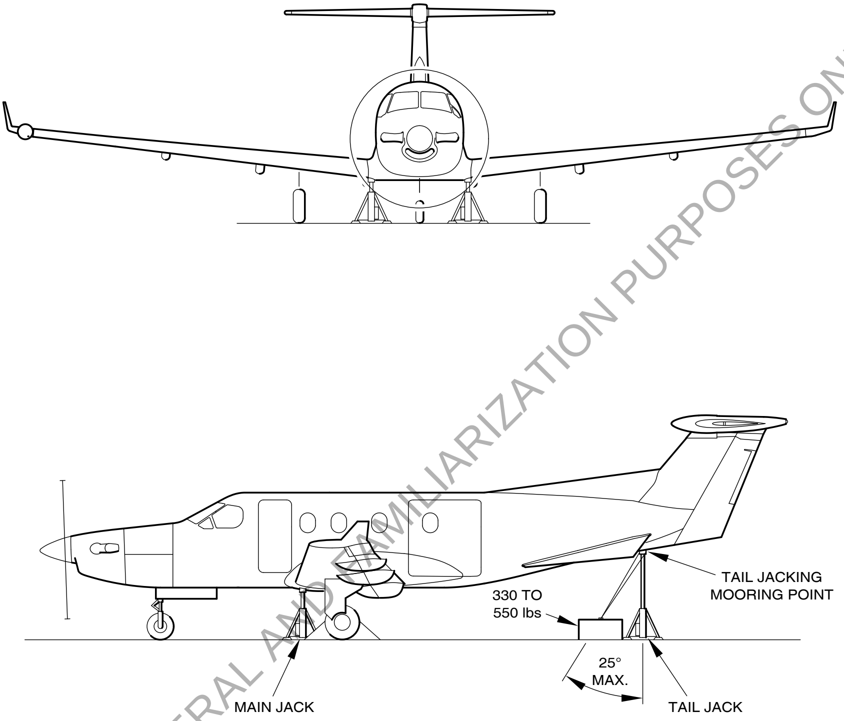

Figure 8-4-2: Main Jacking Points

8-5 Passenger Seat Removal and Installation

Pilots may remove and install passenger seats in accordance with the information given in Section 6-8, Interior Configurations.

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8-6 Servicing

8-6-1 General

In addition to the inspection periods (detailed in Airplane Inspection) and the pre-flight inspections provided in Section 4, Preflight Inspection, of this Handbook, complete servicing instructions are detailed in the AMM Chapter 12-00-00. The following sub-paragraphs give an overview.

8-6-2 Battery

Access to the batteries is gained by opening the hinged panel (31AB) located on the rear fuselage bottom surface. The batteries must be regularly maintained in accordance with the AMM. The operator must also make sure that the battery vents pipes which extrude from the fuselage, just aft of the hinged panel, are free of dirt and any sign of corrosion. In the event that corrosion or a blockage is found, a maintenance shop visit is required, as this situation - if left unchecked - could lead to explosive pressure being reached within the battery which could jeopardize airplane safety.

An external power control unit is installed which will allow the batteries to be charged on the ground. With an external power unit connected and operating set the EXT PWR and BAT 1 or BAT 2 switches to ON to ground charge a battery. The battery must be vented during ground charging operations, refer to the AMM Chap 24 for instructions.

8-6-3 Engine Oil

Oils specified for use in the PT6E-67XP engine oil system are listed in Section 2, Power Plant Limitations, Oil.

If operating conditions are such that the engine will be subjected to frequent cold soaking at an ambient temperature of -18 °C or lower, the use of PWA521, Type II oil (5cs) (viscosity) oil (Type II) is recommended.

The engine oil dipstick is marked HOT, COLD and ADD 1,2,3,4,5:

- ADD 1,2,3,4,5 gives the quantity of oil in US quarts that must be added to the oil tank to fill it when it is hot
- HOT refers to the engine condition in the first ten minutes after shutdown
- COLD refers to the engine condition when the engine has been shutdown for 12 hours or more. To prevent too much oil in the engine, do not use this identification to fill the engine oil system.

A visual sight gauge is provided to allow the oil level to be checked without removing the dipstick. If the oil level is below the green band on the sight gauge the oil level has to be checked with the dipstick.

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CAUTION

The green marks on the filler sleeve and the dipstick must be aligned when the dipstick is installed.

Note

The usual oil level is when the dipstick shows one US quarts below maximum. Oil above this level can be vented overboard.

CAUTION

Never replenish the oil in a cold engine, as this can result in overfilling of the system. Start the engine and run at ground idle for 5 minutes, recheck the oil level before adding oil to the system.

Make sure that the oil is of the correct type. Refer to Section 2, Power Plant Limitations, Oil.

To prevent oil dripping from the dipstick and contaminating equipment, hold a piece of absorbent lint-free material under the dipstick during removal.

8-6-3.1 Oil Replenishment Procedure

1 Open the left engine access panel and secure open with the struts.

2 Use a ladder for better access to the filler cap/dipstick.

3 Release the locking mechanism and remove the filler cap/dipstick assembly from the filler neck on the filler neck on the accessory gearbox.

4 Find the oil level shown on the dipstick.

> **Note**
>
> If there is no indication of oil on the dipstick, large oil pressure changes have been noted or the rate of use of oil is high, find the cause.

5 Replenish the oil according to HOT/COLD condition of the engine.

6 Make a note of the quantity of oil used.

7 Reinstall the filler cap/dipstick assembly and engage the locking mechanism.

8 Check green markings on the filler sleeve and dipstick are aligned.

> **Note**
>
> To check if the filler cap is properly installed, open the right hand engine access door. The green line cannot be seen from the LH engine access door without a mirror being used.

9 Close the access panel.

8-6-3.2 Complete Oil System Replenishment

Refer to the AMM for the Complete Oil System Replenishment procedure.

WARNING

MAKE SURE THE FILLER CAP/DIPSTICK IS PROPERLY ENGAGED AND LOCKED AFTER REPLENISHMENT.

8-6-4 Fuel System

The left and right wing fuel tanks are gravity filled through openings on the upper surface. The tanks should always be kept full between flights to reduce explosive vapor space and condensation. Allowance should be made for expansion to minimize venting of fuel if ambient temperature is expected to rise markedly. Approved fuels are to be used. Refer to Section 2, Powerplant Limitations, Fuel.

WARNING

CHECK FUEL SUPPLY VEHICLE FOR CORRECT FUEL GRADE AND TYPE. USE AN APPROVED WATER DETECTION KIT TO CHECK FOR WATER CONTAMINATION.

CAUTION

Anti-icing additives are not required for aircraft operation within the certified outside air temperature limits (refer to Section 2, Outside Air Temperature Limits).

Nevertheless, it is important to drain free water from the wing tanks before the first flight of the day. There are two fuel tank drain valves on the lower surface of each wing.

Note

There are two fuel tank drain valves on the lower surface of each wing and one on the front left of the fuselage, aft of the nose wheel well.

8-6-4.1 Refueling Precautions

During refueling/defueling operations, the following arrangements must be complied with:

- Refuel and defuel only in a well-ventilated area
- Do not allow open flame or smoking in the vicinity of the airplane while refueling
- Do not replenish the oxygen system during refueling or defueling
- Do not operate airplane electrical or radio equipment while refueling
- High frequency pulse transmissions in the vicinity of the airplane represent a fire hazard
- During all refueling/defueling operations, fire-fighting equipment must be available.

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8-6-4.2 Fueling Procedure

1. Make sure the fuel supplied is checked for type, grade and freedom from contamination.
2. Make sure that the refueling vehicle is grounded.
3. Ground the vehicle to the airplane (attach the vehicle grounding lead to the nose landing gear).
4. Remove external power, if connected.
5. Make sure all electrical power is OFF.
6. Connect the grounding cable from the nozzle to grounding point next to the fuel cap.

CAUTION

Directing the nozzle outboard may cause damage to the fuel quantity probe.

7. Open the wing fuel cap and insert the nozzle, directing it inboard, after first making sure that the filler nozzle is clean.
8. Add fuel. Allow the fuel to settle when topping-off the fuel tank. Remove the fuel nozzle and disconnect the grounding cable. Secure the filler cap.
9. Repeat the procedure for the other wing tank.
10. Remove the vehicle grounding cable from the airplane.
11. Clean up any fuel spillage (Use a water hose if excessive).
12. On the overhead panel set the STBY BUS switch to ON
    Check all system switches are OFF.
13. Set both Battery switches to ON and check the fuel quantity gauges for correct indication.
14. Set both Battery switches to OFF.
15. Set the STBY BUS switch to the OFF position.

8-6-4.3 Fuel Contamination

Fuel contamination is usually the result of foreign material present in the fuel system. This foreign material can take many forms, i.e. water, sand, dirt, microbes or bacterial growth. In addition, additives that are not compatible with the fuel used can cause the fuel to become contaminated.

Jet fuel contains some dissolved, suspended water and is a fuel contamination concern. The quantity of water that can remain in solution will depend upon the temperature of the fuel. Dissolved water cannot be removed by a filter during a fuel service but will be released from suspension as the fuel temperature decreases, as during flight. These supercooled water droplets only need to contact solid contaminates or receive an impact shock to change into ice crystals. In addition, free water may result from condensation, mainly when descending into warm, humid air with cold fuel tanks. The PC-12 fuel system is designed to operate without requiring fuel anti-icing additives, but requires careful maintenance. Excessive ice forming at the bottom of the tanks could block pump inlets and excessive ice forming in the motive flow lines could block ejector nozzles.

For cold weather operations it is recommended to refuel, with warm fuel, before the flight. This improves water drainage and reduces the time to warm up fuel before takeoff. Do not artificially heat the fuel, natural heating within the aircraft environmental envelope is acceptable.

Before the first flight of the day and after each refueling, use a clean container and drain at least one sample of fuel from each tank drain valve to determine if contaminants are present (and that the airplane has been fueled with the proper fuel). If contamination is detected, drain all fuel drains points until all contamination has been removed. If after repeated sampling, evidence of contamination still exists, the fuel tanks should be completely drained and the fuel system flushed. Do not fly the airplane with contaminated or unapproved fuel.

In addition, operators who are not acquainted with a particular airfield should be assured that the fuel supply has been checked for contamination and is properly filtered before allowing the airplane to be serviced. Also, fuel tanks should be kept full between flights, provided weight and balance considerations will permit, to reduce the possibility of water condensing on the walls of partially filled tanks.

8-6-4.4 Fuel Anti-Ice Additive

Anti-icing additive is not required for PC-12 operation within the certified outside air temperature limits (refer to Section 2, Outside Air Temperature Limits), but may still be used if desired.

Refer to Section 2, Power Plant Limitations, Anti-Icing Additive, for additive types and concentration levels.

WARNING

THE FUEL SYSTEM ANTI-ICING ADDITIVES CONTAIN ETHYLENE GLYCOL MONOETHYL ETHER WHICH IS HIGHLY TOXIC. THESE PRODUCTS MUST BE HANDLED WITH EXTREME CARE. AVOID ALL DIRECT CONTACT WITH SKIN AND CLOTHING. ANY CLOTHING ACCIDENTLY CONTAMINATED BY SPLASHING SHOULD BE PROMPTLY REMOVED AND THE SKIN WASHED WITH SOAP AND WATER. PREVENT CONTACT WITH EYES AND AVOID INHALATION OF VAPORS. IF CONTACT IS MADE WITH THE EYES THEY SHOULD BE FLUSHED WITH WATER FOR 15 MINUTES. CONSULT A PHYSICIAN AS RAPIDLY AS POSSIBLE AFTER ALL CONTACT CASES.

Blend the additive in accordance with the additive supplier's recommendations.

Do a water drain check before the first flight of the day.

8-6-5 Landing Gear - Tires

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

Nose Wheel Tire:

- Wheel type: BFG PN3-1501
- Tire size: 17.5 x 6.25-6, 8PR, TL (160 mph)
- Tire Pressure: 60 +3 -0 psi (4.1 +0.2 -0 bar)
- Max. castor rotation: +/- 60° free (+/- 12° Nose Wheel Steering).

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Main Wheel Tires:

- Wheel type: BFG PN3-1543-1
- Tire size: 8.50-10, 10PR, TL (160 mph)
- Tire pressure: 60 + 3 - 0 psi (4.1 + 0.2 - 0 bar).

Refer to the AMM for the alternative types of tires that can be installed.

8-6-6 Landing Gear - Brakes

The fluid level should be checked periodically or at a scheduled maintenance event and replenished as necessary. Each brake assembly incorporates a brake lining wear indicator. As the brake pads wear, the pin will be pulled into the piston housing. When the system is pressurized and the pin is flush with the piston housing, the brake linings must be overhauled.

Refer to the AMM for complete information on the type of hydraulic fluid, servicing the fluid level and brake inspection and replacement.

8-6-7 Lubrication Points

Proper lubrication is essential for trouble-free operation of mechanical components. Lubricants and dispensing equipment must be kept clean. Use only one lubricant in a grease gun or oil can. After lubrication, clean off all excessive grease or oil to prevent dust and dirt build-up.

The frequency of application may be increased for a particular type of operation or if excessive wear is experienced. For lubricating instructions, locations and lubricants refer to the AMM, Chapter 12.

8-6-8 Vapor Cycle Cooling System (VCCS) (If Installed)

CAUTION
Operation of the system at low ambient temperatures for more than 15 minutes can result in major damage to the compressor.

Note
A temperature switch is installed to keep the system from operating and causing possible damage if operated for extended periods of time if ambient temperature is below -12 °C (10 °F). In this case, it is recommended that the aircraft be heated above this threshold to enable the system to operate.

During cold winter months, the system should be operated for 10-15 minutes every two weeks to maintain a thin oil film on the compressor output shaft dynamic seal to prevent shaft leakage.

Prior to selecting on the air conditioning system (energizing the compressor drive), run the blowers on high speed for a minimum of 5 minutes. This will aid in warming the refrigerant and bringing it up to an acceptable temperature enabling operation of the system.

8-6-9 Oxygen System

The standard oxygen system replenishment is carried out at a hinged service panel (11BR) on the right side of the fuselage, forward of the wing leading edge. The service panel is fitted with an oxygen replenishment valve and a system pressure gage. The gage is marked from 0 to 2000 psi, with a red zone from 1850 to 2000 psi. A charge pressure/temperature chart is installed on the inside of the service panel.

The larger capacity oxygen system replenishment is carried out at a hinged service door (31AB) on the bottom of the fuselage, rear of the wing trailing edge. An oxygen service panel is installed inside of the rear fuselage on the forward frame. The service panel is fitted with an oxygen replenishment valve and a system pressure gage. The gage is marked from 0 to 2000 psi, with a red zone from 1850 to 2000 psi. A charge pressure/temperature chart is also installed on the service panel.

8-6-9.1 Replenishment Procedure

WARNING

MAKE SURE THAT THE AIRPLANE IS FITTED WITH A GROUNDING CABLE AND IS PROPERLY GROUNDED. THE OXYGEN CART MUST BE ELECTRICALLY BONDED TO THE AIRPLANE.

DO NOT OPERATE THE AIRPLANE ELECTRICAL SWITCHES OR CONNECT/ DISCONNECT GROUND POWER DURING OXYGEN SYSTEM REPLENISHMENT.

DO NOT OPERATE THE OXYGEN SYSTEM DURING REFUELING/DEFUELING OR ANY OTHER SERVICING PROCEDURE THAT COULD CAUSE IGNITION.

INTRODUCTION OF PETROLEUM BASED SUBSTANCES SUCH AS GREASE OR OIL TO OXYGEN CREATES A SERIOUS FIRE HAZARD. USE NO OIL OR GREASE WITH THE OXYGEN REPLENISHMENT EQUIPMENT.

ALWAYS OPEN SHUTOFF VALVE SLOWLY TO AVOID GENERATING HEAT AND REPLENISH THE SYSTEM SLOWLY (MINIMUM TIME 6 MINUTES).

CAUTION

Replenishment of the oxygen system should only be carried out by qualified personnel.

Obtain the Outside Air Temperature. (OAT). A fully charged cylinder has a pressure of 1841 psi at a temperature of 20 °C. Filling pressures will vary depending upon the ambient temperature in the service bay and the temperature rise due to the compression of the oxygen. If the airplane is or has been parked outside in the sun, the temperature inside the fuselage will be appreciably higher than ambient. Table 8-6-1 lists the required charging pressures for a range of temperatures.

1 Open

- The oxygen service panel 11BR on aircraft with the standard oxygen system
- The service door 31AB on aircraft with the larger capacity oxygen system.

2 Hold the thermometer close to the oxygen cylinder.

3 Make sure the thermometer indication is constant. Make a note of the indication.

4 Refer to the temperature/pressure graph for the correct oxygen cylinder pressure.

5 If the pressure on the service panel gage is low, fill the oxygen cylinder.

6 Make sure the area around the service panel charging valve is clean. Remove the cap from the charging valve.

7 Make sure the oxygen supply hose is clean and connect it to the charging valve.

8 Slowly pressurize the oxygen cylinder to the correct pressure.

9 Close the oxygen supply and let the cylinder temperature become stable.

10 Monitor the oxygen pressure on the gage and fill to the correct pressure if necessary.

11 Release the pressure in the oxygen supply hose and disconnect from the charging valve.

12 Install the cap on the charging valve. Make sure the work area is clear of tools and other items.

13 Close the service panel 11BR or the service door 31AB.

Table 8-6-1: Oxygen Charging Pressures

Temp (°C)	Press (psig)
85	2419
80	2375
75	2331
70	2287
65	2242
60	2198
55	2153
50	2108
45	2063
40	2018
35	1974
30	1930
25	1885
21	1850
20	1841
15	1798
10	1755
5	1712
0	1669
-5	1628
-10	1586
-15	1545
-20	1505
-25	1466
-30	1426
-35	1388
-40	1351
-45	1313
-50	1275
-55	1239

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8-7 Cleaning and Care

8-7-1 Windshield / Side Windows

CAUTION

Remove wrist-watches, rings and other jewelry from hands and wrists before cleaning the side windows.

Windshields and windows are easily damaged by improper handling and cleaning techniques.

Do not use solvents, fuels, detergents, alcohol, acetone or thinners to clean the side windows.

Transparent plastics lack the surface hardness of glass. Exercise caution when cleaning all the side windows to avoid scratching or scoring transparencies.

The following procedures provide information regarding cleaning and servicing of windshields and windows. Improper cleaning, or use of unapproved cleaning agents, can cause damage to these surfaces. As a preventive measure, do not park the airplane where it might be subjected to direct contact with or vapor from: methanol, denatured alcohol, gasoline, benzene, xylene, MEK, acetone, carbon tetrachloride, lacquer thinners, commercial or household window cleaning sprays, paint strippers or other types of solvents. Do not park airplane near a paint-spray shop.

8-7-1.1 Windshield (Glass)

1 Place the airplane inside a hanger or in a shaded area and allow to cool from the heat of the sun's rays.

2 Using clean (preferably running) water, flood the surface. Use bare clean hands, with no jewelry, to feel and dislodge any dirt or abrasive materials.

3 Using a mild soap or detergent (such as dish washing liquid) in water, wash the surface. Again, use only the bare hand to provide rubbing force. (A clean lintfree cloth may be used to transfer the soap solution to the surface, but extreme care must be excised to prevent scratching the surface.)

4 Rinse the surface thoroughly with clean fresh water and dry with a clean cloth or damp chamois leather.

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8-7-1.2 Side Windows (Acrylic)

1 Flush with clean water to remove loose dust etc.

2 Wash the side windows using a soft sponge, warm water and soft soap solution.

3 Rinse with clean water and dry with a damp chamois leather.

4 Use an appropriate transparency cleaner to remove any grease, smears, etc., still adhering to the side windows.

Note

Rubbing transparencies with a dry cloth will cause scratches and the build-up of an electrostatic charge which attracts dust. Where an electrostatic charge is present, gently pat the area with a damp chamois leather to remove the charge and any accumulated dust.

8-7-2 Exterior Paint Surfaces

The airplane should be washed with a mild soap and water solution. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or cause corrosion of metal. Cover areas where cleaning solutions could cause damage.

Exterior Recommended Cleaning Agents:

- Mild soap or approved detergent
- Jet MULSO 2 (TURCO product) or equivalent.

To wash the airplane, use the following procedure:

Note

To prevent water from entering the pitot/static systems, the pitot tube openings and the static ports should be blanked off. Exposed flight control bearings should be protected prior to washing. Install wheel covers to minimize water ingress.

1 Flush away loose dirt with water.

2 Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush. Do not allow the solution to dry before washing off. To remove exhaust stains, allow the solution to remain on the surface longer.

3 To remove stubborn oil and grease, use a cloth dampened with naphtha.

4 Rinse all surfaces thoroughly.

5 Polish and seal the surfaces with a wax polish.

Note

Any good automotive wax may be used to preserve the painted surfaces. Soft lint-free cleaning cloths should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas, but see also paragraph De-icing Boot Care.

8-7-3 De-icing Boot Care

The wings, T-tail, and propeller de-icing boots have a special electrical-conductive coating to bleed off static charges which cause radio interference and may perforate the boots. Fuelling and other servicing practices should be done carefully to avoid damaging the conductive coating or tearing of the boots.

To prolong the life of the de-icing boots, they should be washed, with a mild soap and water solution, rinsed with clean water, and serviced on a regular basis in accordance with the instructions in the AMM. Keep the boots clean and free from oil, grease and other solvents which cause neoprene to swell and deteriorate.

8-7-4 Brake Care

If the brakes are used exclusively for low speeds (below 25 knots), it is recommended to condition (glaze) the brake linings by performing a firm brake after landing (at about 80 knots) every 30 landings to ensure optimum service life is achieved.

8-7-5 Propeller Care

Propeller care consists of checking the propeller area for leaks and damage; this also includes any damage to the propeller hub and de-icing boots. Inspect the visible hub parts daily for surface damage. Look for evidence of grease and or oil leaks. Inspect the propeller blades, daily, for scratches and gouges in the leading or trailing edge, or on the blade face and camber surfaces.

WARNING

ABNORMAL GREASE LEAKAGE CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT, WHICH MAY EVENTUALLY RESULT IN AN IN-FLIGHT BLADE SEPARATION.

Check blades for radial play or movement of blade tip (in and out, back and forth). Refer to loose blades in the Inspection Procedures section of the Propeller Owner's Manual.

Inspect de-ice boots for damage. Refer to the de-ice systems chapter of the Propeller Owner's Manual for the inspection information.

Visually inspect the entire blade and the erosion shield (lead, trail, face and camber sides) for nicks, gouges, looseness of material, erosion, cracks and debonds. Visually inspect the blades for lightning strike. Defects or damage discovered during preflight inspection must be evaluated in accordance with the allowable damage given in the Propeller Owner's Manual to determine if repairs are required before further flight.

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8-7-6 Landing Gear Care

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

1. Place a catch-pan under the gear to catch the waste.
2. Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush the areas sprayed, in order to clean them.
3. Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry. If necessary help the drying process with a gentle blast of compressed air.
4. Remove the plastic cover and the catch-pan from the wheel.

8-7-7 Engine Care

The engine exterior and compartment may be cleaned, using a suitable solvent. Most efficient cleaning is done using a spray-type cleaner. Before spray cleaning, make sure the protection is afforded for components which might be adversely affected by the solvent.

8-7-8 Interior Care

The cockpit area should be frequently vacuum-cleaned. Instrument and side panels may be cleaned with a chamois leather made moist with clean water.

CAUTION

Do not clean fabric surfaces with a soap solution or water. This can inhibit the properties of the fireblock treatment applied to the fabric.

Seat harnesses that have been soiled may be cleaned by gently scrubbing with a soft brush, water and an approved soap. Alternatively, an officially approved detergent emulsion may be used when diluted in the proper proportions. Seats may be cleaned as per manufacturers-recommended instructions.

Dust and loose dirt should be picked up regularly with a vacuum-cleaner. Stained carpets should be cleaned with a non-flammable dry cleaning carpet shampoo which should be kept as dry as possible and again vacuumed.

Blot up any spilled liquid on the seats promptly with cleansing tissue or rags. Do not 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 any sticky materials with a dull knife, then spot-clean the area, following the manufacturer's instructions.

Headliners, side panels and paint work should be cleaned with a lint-free cloth dampened with a mild soap and water mixture. Oil and grease can be removed with a sponge and common household detergent and then wiped dry with a clean rag.

Oxygen masks assemblies should be cleaned with a suitable oil-free disinfectant and then wipe dirt or foreign particles from the unit with a clean dry lint-free cloth.

Care kits are available for the care of leather upholstery and high gloss cabin furniture, refer to the Illustrated Parts Catalog for the kit Part No’s.

8-7-9 Primus Apex Display Care

CAUTION

Remove wrist-watches, rings and other jewelry from hands and wrists before cleaning the Primus Apex display screens.

Do not use a cleaner that has acetone, thinner, benzene, ethyl alcohol, toluene, ethyl acid, ammonia, methyl chloride or alkaline based solvents. These chemicals can damage the display screen anti-glare coating.

Do not attach self-adhesive labels or notes on the display screen surfaces. This can damage the anti-glare coating.

The Primus Apex display screens (Primary Flight Display, Multi Function Display and Touch Screen Controller) must only be cleaned with the manufacturer’s recommended cleaning material (Isopropyl alcohol) and a clean microfiber cloth. Fold a clean microfiber cloth around a small piece of rigid (credit card sized) plastic, and ensure that the cloth covers the entire plastic. Use the Isopropyl alcohol to moisten the cloth, then wipe the screen carefully to remove dust and marks.

Clean the display bezel with a damp cloth and a minimum quantity of soap solution.

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8-8 Extended Storage

Prolonged out-of-service care applies to all airplanes which will not be flown for less than 60 days but which are to be kept ready-to-fly, with the least possible preparation. If the airplane is to be stored temporarily, or indefinitely, reference must be made to the AMM for the proper storage procedures, which are all time related and classified as follows:

Part 1	Up to 7 days.
Part 2	More than 7 days and up to 28 days.
Part 3	More than 28 days and up to 90 days.
Part 4	More than 90 days.

Parts 1 and 2 are considered as flyable storage status.

- Part 1 storage

  Part 1 storage requires that the airplane is moored and properly grounded, all covers and blanks are fitted, and that the fuel tanks are full. The engine must be preserved. Where possible, cover the windshield with a light cotton dust cover.

- Part 2 storage

  Part 2 storage begins after Part 1 (7 days) has elapsed, and includes placing desiccant bags and humidity indicators in the engine exhaust stubs and behind the exhaust stub covers. A suitable means must be provided to view the humidity indicators with the stub covers installed.

  Open and install a safety clip on these circuit breakers: E-NAV/ELT (Essental Bus) and DCTU/CLOCK (Battery and External Power Junction Box).

  At 7 day intervals:

  Check the tire pressures.

  Drain any water from the fuel system.

  Check the humidity indicator, in the engine exhaust stubs, and replace the desiccant bags, if the humidity is in excess of 40%.

  Move the airplane to prevent flat areas on the tires. Mark the tires with tape to ensure the tires are placed approximately 90 degrees from their previous position.

- Part 3 storage

  Part 3 storage should be a planned situation, when the time difference can be foreseen but following on from the Part 2, the batteries must be removed and their state of charge regularly checked.

  At 7 day intervals:

  Check the tire pressures.

  Drain any water from the fuel system.

  Check the humidity indicator, in the engine exhaust stubs, and replace the desiccant bags, if the humidity is in excess of 40%.

  Move the airplane to prevent flat areas on the tires. Mark the tires with tape to ensure the tires are placed approximately 90 degrees from their previous position.

- Stage 4 storage

  Stage 4 is a definite planned exercise, when deterioration of the airplane must be considered. An engine inactive for over 90 days in the airframe, or removed for long term storage, must in addition to the Stage 3 procedure, have the engine oil drained and filled with preserving oil in accordance with the P&WC EMM.

To return the airplane to service, refer to the AMM for specific instructions.

8-9 Corrosion Inspection

8-9-1 General

If a flight to a Service Center imposes an operational burden, the following bi-weekly corrosion inspection may be carried out by the operator. Pilots must be trained by qualified maintenance personnel to identify corrosion and to understand the critical inspection areas. The training must be given to the corrosion inspection procedures as detailed in the AMM.

The inspection must be recorded in the aircraft flight log book.

If corrosion is evident or suspected, you must contact a Pilatus service center for further instructions.

8-9-2 Severe Climatic Areas

Aircraft based/operated in severe climatic areas, (refer to Section 8, Geographical Location and Environment), must be inspected every 14 days as follows:

- Wash the exterior surface of the aircraft
- Examine the aircraft skin, especially around the seams and fasteners
- Make sure all drain holes are clear
- Examine the landing gear compartments, especially the landing gear, wheels, tubing clamps, folding strut, overcenter spring and actuators
- Examine the flight control surfaces, especially the bearings
- Examine all doors, especially the locks, handles and hinges.

Based on inspection results, the inspection interval can be increased to every 30 days. At this interval it is recommended that the aircraft is washed on a weekly basis.

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8-10 Geographical Location and Environment

The geographical location and environmental conditions can cause damage to the aircraft exposed to the conditions that follow:

- Marine atmospheres
- Moisture
- Acid rain
- Tropical temperatures
- Industrial chemicals
- Soil and dust in the atmosphere.

Moisture is in the air as a gas, water vapor or as finely divided droplets of liquid. These forms of moisture contain chemicals such as chlorides, sulfates and nitrates. When the moisture evaporates the chemicals remain on the surfaces. The moisture and the chemicals can be trapped in joints. A capillary action can put moisture in to bond lines and cause corrosion.

Salt particles, when dissolved in water, form strong electrolytes. Sea winds carry the dissolved salt, on to the land and can make the coastal environments very corrosive.

The industrial chemicals that follow can cause corrosion:

- Carbon
- Nitrates
- Ozone
- Sulfur dioxide
- Sulfates.

These industrial chemicals cause damage to non-metallic materials and can cause severe corrosion of many metals.

Warm, moist air, usually in tropical climates can make the formation of corrosion a very quick process. Cold dry air, usually in cold climates makes the formation of corrosion a slower process.

Islands and areas near the sea are in severe corrosion zones.

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SECTION 9

Supplements

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9-1 General

This section provides information in the form of supplements for the operation of the airplane when equipped with optional equipment or systems which are not installed on the standard airplane. All of the supplements are EASA Approved and those that are applicable are part of this Handbook.
The information contained in each supplement applies only when the specific equipment or system is installed in the airplane.

Mark X if installed	Subject	Report No.
	IAC AR Certified Airplanes	02407
	Operations in Cold Conditions	02408
	Aircraft Registered in Canada	02409
	Aircraft Registered in the Republic of Argentina	02410
	Aircraft Registered in the People’s Republic of China (PRC)	02411
	Steep Approach Landings	02412
	Aircraft Registered in Ukraine	02413
	Aircraft Registered in Chile	02414
	Passenger Oxygen Drop-Down Mask System	02415
	Propeller Low Speed Operation	02439
	FATA Certified PC-12/47E Airplanes	02464
	German Placards	02474
	Aircraft Registered in Brazil	02486

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PILOT'S OPERATING HANDBOOK
AND
EASA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

REPORT NO. 02408

FOR

OPERATION IN COLD CONDITIONS

This supplement must be attached to the Pilot's Operating Handbook and EASA Approved Airplane Flight Manual for the EASA certified PC-12/47E airplanes. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual.

This Airplane Flight Manual Supplement is approved under Authority of DOA No. EASA.21J.357.

Date of Approval: 15 October 2019

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Front Matter

Table of Contents

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List of Effective Data Modules

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module

N = New data module

	Data module code (DMC)	Document title	N/C	Issue date
	A15-00-2408-00A-002A-A	List of Effective Data Modules	C	18.12.2020
	A15-00-2408-00A-003A-A	Change Highlights	N	18.12.2020
	A15-00-2408-00A-003B-A	Log of Revisions	C	18.12.2020
	A15-00-2408-00A-002B-A	Log of Temporary Revisions		15.10.2019
	A15-00-2408-01A-010A-A	General	C	18.12.2020
*	A15-10-2408-02A-043A-A	Limitations		15.10.2019
*	A15-30-2408-04A-131A-A	Normal Procedures		15.10.2019
	A15-00-2408-07A-043A-A	Airplane and Systems Description		15.10.2019
	A15-20-2408-08A-043A-A	Handling, Servicing and Maintenance		15.10.2019

* Authority Approved

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Log of Revisions

1 Issue 001 Revision 00 - Dated: 15 October 2019

Initial Issue of the PC-12/47E AFMS 02408.

The Issue 001 Revision 00 of the AFMS ref. 02408 is approved under the authority of DOA ref. EASA.21J.357

Approval date: 15.10.2019

Table 1: List of changes

Section	PTS Number	Description of Change
All	19595	New AFMS for MSN 1720, 2001 and up.

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Log of Revisions

1 Issue 001 Revision 00 - Dated: 15 October 2019

Initial Issue of the PC-12/47E AFMS 02408.

The Issue 001 Revision 00 of the AFMS ref. 02408 is approved under the authority of DOA ref. EASA.21J.357

Approval date: 15.10.2019

Table 1-1-1: List of changes

Section	PTS Number	Description of Change
All	19595	New AFMS for MSN 1720, 2001 and up.

2 Issue 001 Revision 01 - Dated: 18 December 2020

The Issue 001 Revision 01 of the AFMS ref. 02408 is approved under the authority of DOA ref. EASA.21J.357

Approval date: 18.12.2020

Table 1-1-2: Issue 001 - Revision 01 - List of changes

Section	PTS Number	Description of Change
Front Matter		
List of Applicable Data Modules	21999	Updated for Issue 001 - Revision 01.
Change Highlights	21999	New DM.
Log of Revisions	21999	Updated for Issue 001 - Revision 01.
Section 1		
1	21316	Effectivity of AFMS added.

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Log of Temporary Revisions

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2408-00A-002B-A

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2408-00A-002B-A

SECTION 1

General

Table of Contents

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1 General

This supplement provides the information necessary to operate the PC-12/47E aircraft, in cold temperatures with the cold weather preheater system factory option installed.

This supplement must be attached to the Pilot's Operating Handbook (POH) Report No.:

- 02406 (for MSN 1720, 2001 and up).

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SECTION 2

Limitations (EASA Approved)

Table of Contents

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2 Limitations

2-21 Other Limitations

2-21.1 Operations in Cold Conditions

Ambient ground temperature	0 to -15 °C	Battery heater required
Ambient ground temperature	-15 °C and below	Battery, engine and supplementary cabin heater required. External engine blanket recommended

A cabin underfloor temperature of -15 °C or warmer is required prior to takeoff.

The aircraft must be clear of deposits of snow, ice and frost from the lifting and control surfaces immediately prior to takeoff.

2-23 Placards

Near the Engine Heating electrical power connector:

115 VOLTS AC 60HZ ENGINE HEATER	OR	**230 VOLTS AC ENGINE HEATER**

Near the Battery Heater electrical power connector:

115 VOLTS AC 60HZ BATTERY HEATER AND CABIN POWER OUTLET	OR	**230 VOLTS AC BATTERY HEATER AND CABIN POWER OUTLET**

12-C-A15-10-2408-02A-043A-A

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SECTION 4

Normal Procedures (EASA Approved)

Table of Contents

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4 Normal Procedures

General 4-1

If the aircraft is to be parked outside for an extended period of time and the ambient ground temperature is expected to be:

0 to -15 °C	Connect a 115 or 230 VAC (as placarded) ground power supply to the battery heater connector.
-15 °C and below	Connect a 115 or 230 VAC (as placarded) ground power supply to the battery and engine heater connectors. Put a blanket cover over the engine. Put a supplementary heater in the center of the cabin.

The heater connector access doors must be opened and adapter cables installed. The adapter cables are contained in the aircraft flight bag.

---------- END -----------

Pre Flight Inspection 4-2

Switch off and disconnect the ground power supply to battery and engine heaters. Remove the adapter cables and stow them in the aircraft flight bag and close the heater connector access doors. Remove blanket cover from engine nacelle and supplementary heater from the cabin.

---------- END -----------

Engine Starting 4-3

It is recommended to use external power for engine starting, using a ground power unit capable of supplying 1000 ampere DC current.

After engine start at cold temperatures of below -15 °C, maximum cabin heating should be selected and the temperature of the underfloor avionic bay monitored on the environmental window of the systems MFD, to observe a minimum temperature of above -15 °C prior to commencement of flight.

---------- END -----------

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SECTION 7

Airplane and Systems Description

Table of Contents

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7 Airplane and Systems Description

7-1 General

The factory option is available for 115 VAC and 230 VAC. The correct operation voltage is placarded adjacent to the connectors.

7-2 Battery Heater System

7-2.1 Description

A belt type heating element is wrapped around the outside of the batteries. A temperature sensor is attached to the aircraft skin and a wiring harness connects the temperature sensor to the batteries heating element and the external power connector. The wiring harness has an additional connector installed for the connection of a supplementary cabin heater. The connector and a power on indicator light are installed in a mounting box under an access door on the lower rear fuselage. The connector has a protective cap installed.

7-2.2 Operation

When AC power is supplied to the external connector the indicator light will come on and power is supplied to the temperature sensor and supplementary heater connector. The temperature sensor will supply power to the battery heating elements when the skin temperature of the aircraft goes below 0° C.

7-3 Engine Heater System

7-3.1 Description

Three wrap around type heating elements are installed on the engine at the following locations:

- on the LH side of the reduction gearbox
- on the RH side of the reduction gearbox
- on the LH side of the accessory gearbox

A wiring harness routed down the left side of the engine connects the heating elements to an external power connector. The connector and a power on indicator light are installed in a mounting box under an access door on the left lower front fuselage. The connector has a protective cap installed.

7-3.2 Operation

When AC power is supplied to the external connector the indicator light will come on and power is supplied to the three engine heating elements. An insulated engine cover is placed over the engine nacelle to assist in heat retention in the engine bay.

12-C-A15-00-2408-07A-043A-A

7-4 Supplementary Heater

Supplementary ceramic element safety heater with a maximum rating of 1500 Watts is placed in the center of the aircraft cabin to provide heating. The cabin heater is connected to the connector on the battery heating element wiring harness.

CAUTION

For a 115 VAC system, the cabin heater connector is limited to a maximum of 1500W.

For a 230 VAC system, the cabin heater connector is limited to a maximum of 1850W.

Do not overload, as this may result in damage to the connector and wiring.

Do not use a supplementary heater of a different voltage rating to that placarded on the aircraft.

A temperature sensor is installed under the cabin floor between frames 17 and 18. When configured for cold weather operations, the under floor temperature is displayed as part of the environment window of the systems Multi Function Display (MFD).

SECTION 8

Handling, Servicing and Maintenance

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8 Handling, Servicing and Maintenance

8-1 General

On the first use of the adapter cables the free end will need to be equipped with electrical connectors appropriate for the country of operation power supply.

8-6 Servicing

At each aircraft inspection examine the battery and engine heating elements for damage and the wiring harnesses for security of attachment.

8-6.1 Battery Servicing

Depending on the type of battery installed, a more frequent check of the fluid level maybe recommended, when using the battery heating system for long periods of time. Check the battery manufacturer's information for any additional servicing requirements.

When removing and installing the battery from the battery box take care not to damage the heating element on the edges of the box. Small tears in the element can be repaired with RTV silicone. If any of the element wire is exposed the element should be replaced.

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PILOT'S OPERATING HANDBOOK
AND
EASA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

REPORT NO. 02409

FOR

PC-12/47E REGISTERED IN CANADA

This supplement must be attached to the Pilot's Operating Handbook and EASA Approved Airplane Flight Manual when operating the PC-12/47E in Canada. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual.

Approved by:

European Aviation Safety Agency (EASA)

Date of Approval: 23 July 2020

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Front Matter

Table of Contents

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List of Effective Data Modules

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module

N = New data module

	Data module code (DMC)	Document title	N/C	Issue date
	A15-00-2409-00A-002A-A	List of Effective Data Modules	N	24.07.2020
	A15-00-2409-00A-003B-A	Log of Revisions	N	24.07.2020
	A15-00-2409-00A-002B-A	Log of Temporary Revisions	N	24.07.2020
	A15-00-2409-01A-010A-A	General	N	24.07.2020
*	A15-10-2409-02A-043A-A	Limitations	N	24.07.2020
*	A15-30-2409-04A-131A-A	Normal Procedures	N	24.07.2020
*	A15-30-2409-06A-010A-A	Weight and Balance	N	24.07.2020

* Authority Approved

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Log of Revisions

1 Issue 001 Revision 00 - Dated: 24 July 2020

Initial Issue of the PC-12 AFMS 02409.

The Issue 001 Revision 00 of the AFMS ref. 02409 is approved by Transport Canada Civil Aviation (TCCA) letter 5010-A598 (16710691).

Approval date: 23.07.2020

Table 1-1-1: List of changes

Data Module Code	Change Type	Description of Change
All	New Issue	**Change:** PC-12 AFMS Aircraft Registered in Canada - Initial Issue.

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Log of Temporary Revisions

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2409-00A-002B-A

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2409-00A-002B-A

SECTION 1

General

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1 General

This supplement provides the information necessary to operate the PC-12/47E aircraft under Canadian registration with the Canadian Certification Factory Option Kit Part No. 500.21.12.040 or 500.21.12.039 installed, or Post Service Bulletin 04-010 which lists the aircraft tasks that must be done prior to registration of the aircraft in Canada.

This supplement must be attached to the Pilot’s Operating Handbook (POH) Report No.:

- 02406 (for MSN 1720, 2001 and up).

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SECTION 2

Limitations

Table of Contents

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2 Limitations

2-8 PC-12/47E Center of Gravity Limits

Table 2-1: PC-12/47E Center of Gravity Limits

Weight Pounds (kilograms)	Forward Limit A.O.D.: In. / M	Aft Limit A.O.D.: In. / M
10450 (4740)	232.20 / 5.898	240.43 / 6.107
9921 (4500)	232.20 / 5.898	240.94 / 6.120
9039 (4100)	227.49 / 5.778	241.63 / 6.143
7938 (3600)	227.49 / 5.778	243.06 / 6.172
6615 (3000)	227.49 / 5.778	243.06 / 6.172
5732 (2600)	227.49 / 5.778	-

12-C-A15-10-2409-02A-043A-A

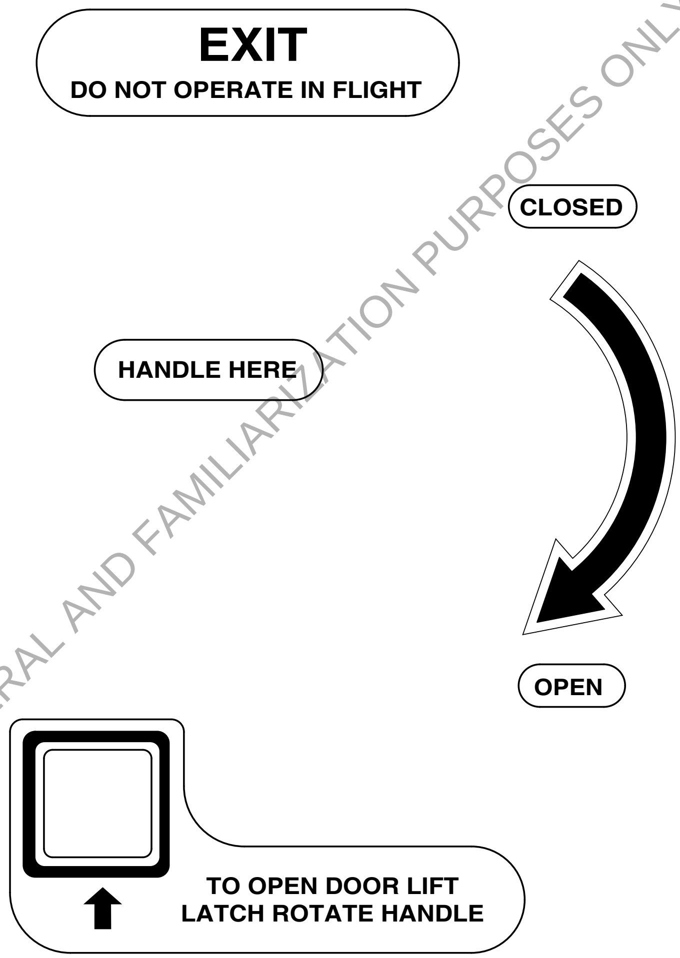
2-21-16 Primus Apex - ADAHRS

To operate the PC-12/47E within the Northern Domestic Airspace (NDA) of Canada with respect to the operational approvals for Global Positioning Systems (GPS), the current requirements are for a non GPS alternate. This will require a directional gyro. This directional gyro shall be able to operate in a free gyro mode (not slaved to magnetometer or GPS) when needed to meet the navigation requirements without the use of the GPS within NDA.

2-23 Placards

PLACARDS

Luminescent placards on Interior of Cabin Door:



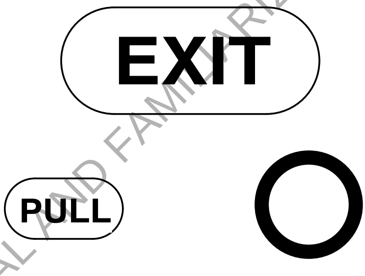
ICN-12-C-A150902-A-S4080-00164-A-001-01

Figure 2-23-1: Placards (Sheet 1 of 3)

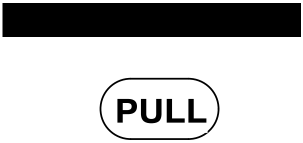
Luminescent placard on Interior of upper LH sidewall near Cabin Door:

Luminescent placard on Interior of upper RH sidewall near Emergency Exit:

Luminescent placards on Interior of Emergency Exit:



Luminescent placards underneath cover on Emergency Exit:

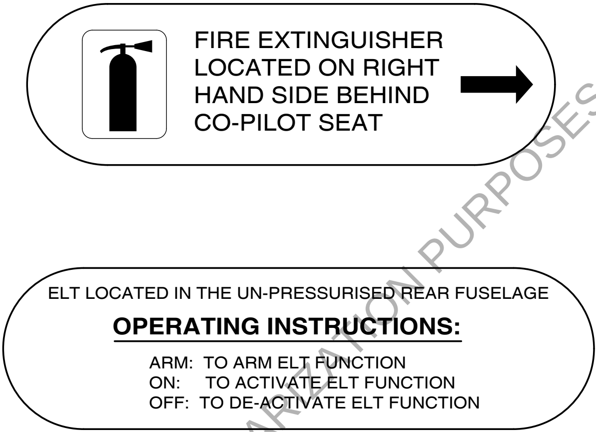


ICN-12-C-A150902-A-S4080-00165-A-001-01

Figure 2-23-1: Placards (Sheet 2 of 3)

12-C-A15-10-2409-02A-043A-A

Luminescent placards on rear of LH forward bulkhead:



ICN-12-C-A150902-A-S4080-00166-A-001-01

Figure 2-23-1: Placards (Sheet 3 of 3)

12-C-A15-10-2409-02A-043A-A

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SECTION 4

Normal Procedures

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4 Normal Procedures

Before Starting Engine 4-4-01

Additional item:

Before first flight of the day:

19a.	Trim interrupt switch....................	ON
	Pitch trim switch..........................	OPERATE. Check trim interrupted
	Trim interrupt switch....................	OFF

---------- END -----------

12-C-A15-30-2409-04A-131A-A

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SECTION 6

Weight and Balance

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6 Weight and Balance

6-8 Interior Configurations

Refer to POH Section 6, Interior Configurations and then to the applicable Interior Code No. for seat locations, permitted seat Part Nos. that can be installed, seat weight and moment charts, and seat occupant moment charts.

The following Interior Configurations are approved for PC-12/47E use in Canada:

- Corporate Commuter Interior Code STD-9S (9 single seats)
- Executive Interior Code EX-6S-2 (6 single seats)
- Executive Interior Code EX-4S-STD-4S (4 single executive seats and 4 single standard seats)
- No Cabin Interior Configuration.

12-C-A15-30-2409-06A-010A-A

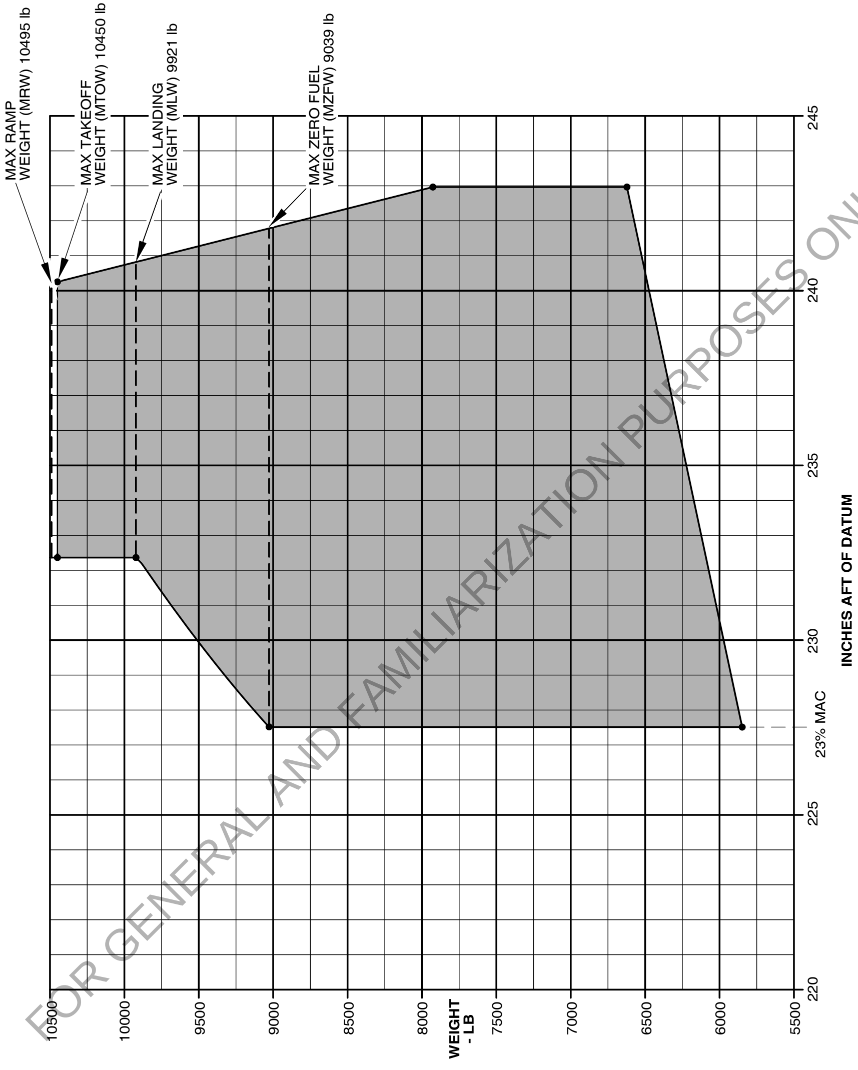
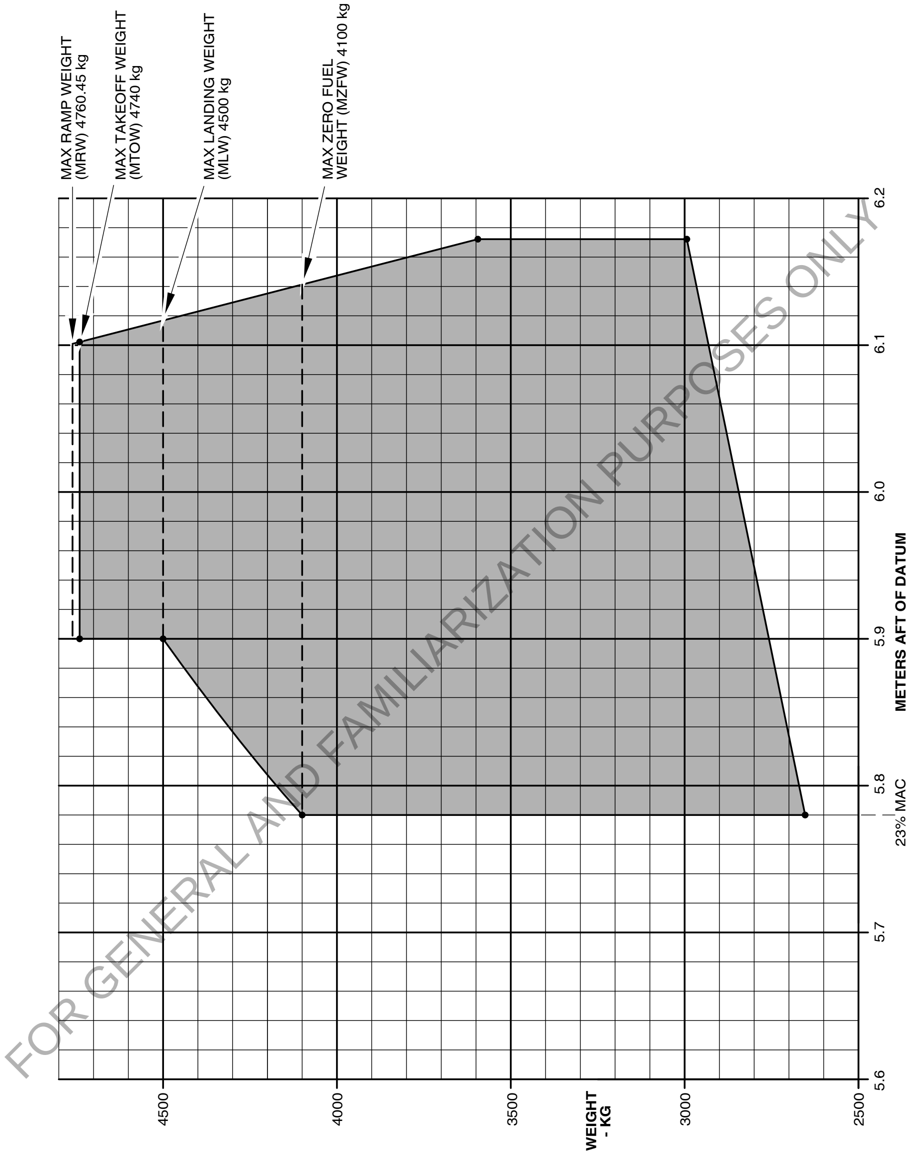


Figure 6-1-1: C. G. Envelope (lb)



ICN-12-C-A150906-A-S4080-00194-A-001-01

Figure 6-1-2: C. G. Envelope (kg)

12-C-A15-30-2409-06A-010A-A

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PILOT'S OPERATING HANDBOOK
AND
EASA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

REPORT NO. 02412

FOR

STEEP APPROACH LANDINGS

This supplement must be attached to the Pilot's Operating Handbook and EASA Approved Airplane Flight Manual for the EASA certified PC-12/47E airplanes. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual.

This Airplane Flight Manual Supplement is approved under the authority of DOA No. EASA.21J.357.

Date of Approval: 15 October 2019

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Front Matter

Table of Contents

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List of Effective Data Modules

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module

N = New data module

	Data module code (DMC)	Document title	N/C	Issue date
	A15-00-2412-00A-002A-A	List of Effective Data Modules	C	18.12.2020
	A15-00-2412-00A-003A-A	Change Highlights	N	18.12.2020
	A15-00-2412-00A-003B-A	Log of Revisions	C	18.12.2020
	A15-00-2412-00A-002B-A	Log of Temporary Revisions		15.10.2019
	A15-00-2412-01A-010A-A	General	C	18.12.2020
*	A15-10-2412-02A-043A-A	Limitations		15.10.2019
*	A15-30-2412-04A-131A-A	Normal Procedures		15.10.2019
	A15-00-2412-07A-043A-A	Airplane and Systems Description		15.10.2019

* Authority Approved

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Change Highlights

This change highlights section shows all changes to PC-12 Pilot's Operating Handbook (POH) Supplement 02412, Issue 001 Revision 01, Dated 18 December 2020.

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module. Replace the data module in the relevant section of the POH.

N = New data module. Insert this data module in the relevant section of the POH.

Data module code Document title	Type	Reason for Update (RFU)
A15-00-2412-00A-002A-A List of Effective Data Modules	C	21999 - Updated for Issue 001 - Revision 01.
A15-00-2412-00A-003A-A Change Highlights	N	Incorporation of new data module
A15-00-2412-00A-003B-A Log of Revisions	C	21999 - Updated for Issue 001 - Revision 01.
A15-00-2412-01A-010A-A General	C	21316 - Added aircraft and POH effectivity.

* Authority Approved

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Log of Revisions

1 Issue 001 Revision 00 - Dated: 15 October 2019

Initial Issue of the PC-12 AFMS 02412.

The Issue 001 Revision 00 of the AFMS ref. 02412 is approved under the authority of DOA ref. EASA.21J.357

Approval date: 15.10.2019

Table 1: Issue 001 - Revision 00 - List of changes

Section	PTS Number	Description of Change
All	19595	New AFMS for MSN 1720, 2001 and up.

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Log of Revisions

1 Issue 001 Revision 00 - Dated: 15 October 2019

Initial Issue of the PC-12 AFMS 02412.

The Issue 001 Revision 00 of the AFMS ref. 02412 is approved under the authority of DOA ref. EASA.21J.357

Approval date: 15.10.2019

Table 1-1-1: Issue 001 - Revision 00 - List of changes

Section	PTS Number	Description of Change
All	19595	New AFMS for MSN 1720, 2001 and up.

2 Issue 001 Revision 01 - Dated: 18 December 2020

The Issue 001 Revision 01 of the AFMS ref. 02412 is approved under the authority of DOA ref. EASA.21J.357

Approval date: 18.12.2020

Table 1-1-2: Issue 001 - Revision 01 - List of changes

Section	PTS Number	Description of Change
Front Matter		
List of Applicable Data Modules	21999	Updated for Issue 001 - Revision 01.
Change Highlights	21999	New DM.
Log of Revisions	21999	Updated for Issue 001 - Revision 01.
Section 1		
1	21316	Added aircraft and POH effectivity.

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Log of Temporary Revisions

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2412-00A-002B-A

No.	Temporary Revision Title	Date of Issue	Cancelled by

SECTION 1

General

Table of Contents

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1 General

This supplement supplies the information necessary for the operation of the PC-12/47E airplane when performing steep instrument approaches using an approved flight path reference system:

- Steep approaches flown manually using raw data vertical guidance provided by Instrument Landing System (ILS), Localizer Performance with Vertical Guidance (LPV) or Flight Management System (FMS)
- Optional steep approaches coupled to autopilot/flight director if following ILS glide slope or FMS Vertical Guidance (VNAV).

This supplement must be attached to the Pilot's Operating Handbook (POH) Report No.:

- 02277 (for MSN 545, 1001 - 1719 and 1721 - 1942)
- 02406 (for MSN 1720, 2001 and up).

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SECTION 2

Limitations (EASA Approved)

Table of Contents

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2 Limitations

2-1 Systems and Equipment Limits

Steep Approach

Note
This Supplement does not guarantee operational approval to conduct steep approaches. It is the responsibility of the operator to apply for operational approval with the local authorities.

Steep approaches greater than 8° are not approved.

The optional Steep Approach ENABLE softkey on the avionics window FCS tab must be enabled for Instrument Landing System (ILS) approaches greater than 4°.

For steep approaches with autopilot coupled to Flight Management System (FMS) vertical guidance (VNAV) the autopilot must be disengaged below 400 ft Above Ground Level (AGL).

For optional steep approaches with autopilot coupled to ILS glideslope the autopilot must be disengaged below 200 ft AGL.

Steep approaches with tail winds greater than 5 kts are not permitted.

Steep approaches in icing conditions or with any visible ice accretion on the airframe are not permitted.

Steep approach landings are not permitted when the Prop Low Speed function is active.

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SECTION 4

Normal Procedures (EASA Approved)

Table of Contents

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4 Normal Procedures

Descent	4-01

For a steep approach extend the landing gear and set the flaps to 40° prior to intercepting the glide slope. Maintain the flaps at 40° until landing.
For optional steep ILS approaches activate the Steep Approach ENABLE softkey on the avionics window FCS tab before capturing the ILS glideslope.

Weather Minima

When intending to carry out a steep approach and landing based on visual references, it is recommended that the visual element of the approach be commenced not below the approved circling minima for the runway and approach in use at the time, or 500ft AGL, whichever is greater. When flying with reference to flight deck instruments (IMC/IFR), the appropriate minima for the instrument approach procedure being flown should of course be used in accordance with IFR regulations.

---------- END -----------

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SECTION 7

Airplane and Systems Description

Table of Contents

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7 Airplane and Systems Description

7-1 Steep Approach

Refer to Fig. 7-1, Avionics FCS Tab

Refer to Fig. 7-2, Steep Annunciation

An additional set of GS gains are provided which are optimized for ILS approaches with angle steeper than 4°. The Steep Approach gains can be selected on the Avionics FCS tab.

ICN-12-C-A150907-A-S4080-00195-A-001-01

Figure 7-1: Avionics FCS Tab

If Enhanced Ground Proximity Warning Function (EGPWF) is installed (Class A or Class B), selecting/deselecting Steep Approach gains on the avionics FCS tab automatically selects/deselects “Steep Appr” option on the TAWS tab, and vice versa.

When the steep approach mode is active, “STEEP APPROACH” is displayed on the left side of the HSI and **STEEP APR Active** is displayed on the MFD.

When the steep approach is selected and AFCS GS mode is armed then a “STEEP” annunciation is shown in white in the upper right corner of the ADI on the Primary Flight Display (PFD), as shown in Fig. 7-2.

When the steep approach is selected and AFCS GS mode is active then the “STEEP” annunciation is shown in green in the upper right corner of the ADI on the PFD.

For more information on the Steep Approach function, refer to the Pilot’s Guide for the Advanced Cockpit Environment (ACE) (powered by Honeywell) for the Pilatus PC-12/47E.

12-C-A15-00-2412-07A-043A-A

ICN-12-C-A150907-A-S4080-00196-A-001-01

Figure 7-2: Steep Annunciation

PILOT'S OPERATING HANDBOOK
AND
EASA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

REPORT NO. 02415

FOR

PASSENGER OXYGEN DROP-DOWN MASK SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and EASA Approved Airplane Flight Manual for the EASA certified PC-12/47E airplanes. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual.

This Airplane Flight Manual Supplement is approved under the authority of DOA No. EASA.21J.357.

Date of Approval: 16 October 2019

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Front Matter

Table of Contents

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List of Effective Data Models

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module

N = New data module

	Data module code (DMC)	Document title	N/C	Issue date
	A15-00-2415-00A-002A-A	List of Effective Data Models	N	16.10.2019
	A15-00-2415-00A-003B-A	Log of Revisions	N	16.10.2019
	A15-00-2415-00A-002B-A	Log of Temporary Revisions	N	16.10.2019
	A15-00-2415-01A-010A-A	General	N	16.10.2019
*	A15-10-2415-02A-043A-A	Limitations	N	16.10.2019
*	A15-30-2415-04A-131A-A	Normal Procedures	N	16.10.2019
	A15-00-2415-07A-043A-A	Airplane and Systems Description	N	16.10.2019
	A15-20-2415-10A-043A-A	Safety and Operational Tips	N	16.10.2019

* Authority Approved

12-C-A15-00-2415-00A-002A-A

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Log of Revisions

1 Issue 001 Revision 00 - Dated: 16 October 2019

Initial Issue of the PC-12 AFMS 02415.

The Issue 001 Revision 00 of the AFMS ref. 02415 is approved the authority of DOA No. EASA.21J.357

Approval date: 16.10.2019

Table 1: List of changes

Section	PTS	Description of Change
All	New Issue	New AFMS for MSN 1720, 2001 and up.

12-C-A15-00-2415-00A-003B-A

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Log of Temporary Revisions

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2415-00A-002B-A

No.	Temporary Revision Title	Date of Issue	Cancelled by

SECTION 1

General

Table of Contents

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1 General

This supplement provides the information necessary to operate the PC-12/47E aircraft with the passenger oxygen drop-down mask system installed.

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SECTION 2

Limitations (EASA Approved)

Table of Contents

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2 Limitations

2-21-7 Oxygen System

A minimum oxygen supply of 10 minutes duration for each occupant is required for dispatch for pressurized flight above FL250.

Note
Some National Operating Requirements may require that a larger quantity of oxygen be carried on the aircraft.

The oxygen system shutoff valve handle in the cockpit must be selected to ON prior to engine start and throughout the duration of flight.

The oxygen masks for the crew must be connected for all flights.

2-22-1 Other Limitations - Child Restraint System

The CARES Restraint System for children (p/n 959.30.01.591) is approved only for children older than 36 months and only for the seat positions 3 and 4.

2-23 Placards - Cockpit

On Cockpit LH Side Panels near oxygen system controls:

Additional placard:

ICN-12-C-A150902-A-S4080-00233-A-001-01

Figure 2-1: Placards - Passenger Oxygen Drop-Down Mask System - Cockpit

12-C-A15-10-2415-02A-043A-A

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SECTION 4

Normal Procedures (EASA Approved)

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4 Normal Procedures

Before Starting Engine 4-4-01

CAUTION

Do NOT set the passenger oxygen selector to ON. If the passenger oxygen selector is set to ON, the passenger oxygen masks will deploy.

---------- END -----------

Shutdown 4-18-01

1. Main OXYGEN lever.................. OFF
2. PASSENGER OXYGEN selector CHECK selector is set to AUTO

---------- END -----------

Oxygen System 4-20-01

1. Oxygen Pressure Gauge........... NOTE READING
2. Outside Air Temperature............ NOTE READING
3. Percentage of Full Bottle............ DETERMINE from the "Oxygen Available with Partially Full Bottle" graph (refer to Fig. 4-1)
4. Calculate.................................... Oxygen duration in minutes:

- Determine the Oxygen Duration in minutes for a full bottle for the number of passengers and pilots from the "Oxygen Duration with Full Bottle" table (refer to Table 4-1 for standard oxygen systems, refer to Table 4-2 for large capacity oxygen systems)
- Multiply the Full Bottle Duration by the percent of Usable Capacity to obtain the available oxygen duration in minutes.

---------- END -----------

12-C-A15-30-2415-04A-131A-A

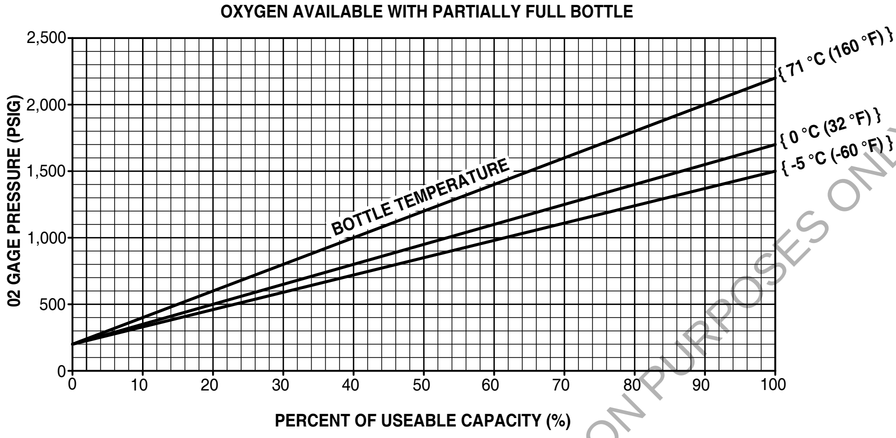

Figure 4-1: Oxygen Available with Partially Full Bottle

Table 4-1: Oxygen Duration with Full Bottle (Standard Oxygen System)

No. of Passengers	Oxygen Duration Pax plus 1 Crew Mask on		Oxygen Duration Pax plus 2 Crew Mask on	
	Diluter/Demand (min)	100% (min)	Diluter/Demand (min)	100% (min)
0	141	59	71	29
1	41	29	32	20
2	31	24	26	17
3	25	20	22	15
4	21	17	19	13
5	18	15	16	12
6	16	14	14	11
7	14	12	13	10
8	13	11	12	10

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Table 4-2: Oxygen Duration with Full Bottle (Large Oxygen System)

No. of Passengers	Oxygen Duration Pax plus 1 Crew Mask on		Oxygen Duration Pax plus 2 Crew Mask on	
	Diluter/Demand (min)	100% (min)	Diluter/Demand (min)	100% (min)
0	477	200	240	98
1	141	100	110	67
2	107	82	88	58
3	86	69	73	52
4	72	60	63	46
5	62	53	55	42
6	54	47	49	38
7	48	42	44	35
8	44	39	40	33

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SECTION 7

Airplane and Systems Description

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7 Airplane and Systems Description

7-18 Oxygen System

7-18.1 General

A constant flow mask is provided at each passenger seat location in the cabin and the toilet. The masks are stored in the cabin headliner trim panel and are permanently connected for all flights. The masks drop-down automatically from the headliner trim panel. Passenger mask deployment can also be selected manually by the flight crew. The oxygen flow to individual passenger masks is initiated when a passenger pulls the mask towards his/her face.

7-18.2 Description

The PASSENGER OXYGEN selector, located in the left cockpit sidewall, has three positions to control the operation of the passenger distribution system. The OFF position stops the flow to the passenger masks. The ON position permits flow to the passenger masks and deploys the passenger drop-down masks. The AUTO position will permit automatic pressurization of the passenger oxygen system and will deploy the passenger drop-down masks automatically when the Cabin Pressure Control System (CPCS) senses a cabin altitude above 13,500 feet +/- 500 feet or when in HI FIELD mode the cabin altitude is sensed above takeoff/landing field elevation +2000 ft or 14,500 +/- 500 ft.

The passenger constant flow oxygen masks are stored in the cabin headliner trim panel for use at each seat position and in the toilet compartment.

7-18.3 Operation

Normal system operation is with the three-position PASSENGER OXYGEN selector in the AUTO position, to provide oxygen immediately in the event of a depressurization. The crew will don their masks. The passengers will pull the drop-down masks towards them and put their masks on.

The ON position will be selected by the pilot, in the event of smoke or fumes being present in the cabin.

The OFF position will be selected if the aircraft is being flown without passengers or is taken out of service for an extended time in order to conserve oxygen.

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SECTION 10

Safety and Operational Tips

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10 Safety and Operational Tips

10-7 Passenger Briefings

10-7.1 GENERAL

In Sections 3 and 4 there are procedural actions that call for the pilot to brief the passengers. They fall into two categories those forming part of an emergency procedure and the more regular type ones for taxiing prior to takeoff and before landing. Tips for passenger briefings during an emergency cannot be specified as each situation will place a different demand on the pilot. However, much of the content in the Taxiing briefing tips can be used to brief the passengers, if time permits. Tips for the recommended subjects that should be covered for the regular passenger briefings are given in the following list:

10-7.2 Taxiing

(Section 4, Normal Procedures, Taxiing)

For aircraft with an executive cabin interior:

- Stow hand baggage in the seat or cabinet drawers
- Move the seat to the required position for takeoff (as per the placard adjacent to each seat)
- Position the seat headrest to support the head
- Stow the tables, cabinet drawers, seat drawers and leg rests
- Switch off electronic equipment
- Fasten seat lap and shoulder belts, tighten lap strap
- Mention the position of the passenger oxygen masks and that if seats are reclined or rotated, passengers may need to locate their mask before putting the mask on
- Mention the location and usage of the spare oxygen mask located in the lavatory if an individual passenger oxygen mask fails to operate
- Mention how to put on the passenger oxygen masks and start the flow of oxygen to the masks
- Mention the location and usage of the emergency exits
- Mention to remain buckled up during cruise in case of unexpected turbulence, but that the shoulder strap may be released once the fasten seat belt sign has been switched off
- Mention the safety on board cards for more detailed information about the safety features (if available).

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PILOT'S OPERATING HANDBOOK
AND
EASA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

REPORT NO. 02439

FOR

PROPELLER LOW SPEED OPERATION

This supplement must be attached to the Pilot's Operating Handbook and EASA Approved Airplane Flight Manual for the EASA certified PC-12/47E airplanes. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual.

This Airplane Flight Manual Supplement is EASA approved.

Ref - 10072536

Date of Approval: 14 February 2020

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Front Matter

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List of Effective Data Modules

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module

N = New data module

	Data module code (DMC)	Document title	N/C	Issue date
	A15-00-2439-00A-002A-A	List of Effective Data Modules	C	18.12.2020
	A15-00-2439-00A-003A-A	Change Highlights	C	18.12.2020
	A15-00-2439-00A-003B-A	Log of Revisions	C	18.12.2020
	A15-00-2439-00A-002B-A	Log of Temporary Revisions		14.02.2020
	A15-00-2439-01A-010A-A	General	C	18.12.2020
*	A15-10-2439-02A-043A-A	Limitations		14.02.2020
*	A15-40-2439-03A-141A-A	Emergency Procedures		14.02.2020
*	A15-48-2439-03A-141A-A	Abnormal Procedures		14.02.2020
*	A15-30-2439-04A-131A-A	Normal Procedures		14.02.2020
*	A15-60-2439-05A-030A-A	Performance		14.02.2020
	A15-00-2439-07A-043A-A	Airplane and Systems Description		14.02.2020

* Authority Approved

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Change Highlights

This change highlights section shows all changes to PC-12 Pilot's Operating Handbook (POH) Supplement 02439, Issue 002 Revision 01, Dated 18 December 2020.

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module. Replace the data module in the relevant section of the POH.

N = New data module. Insert this data module in the relevant section of the POH.

Data module code Document title	Type	Reason for Update (RFU)
A15-00-2439-00A-002A-A List of Effective Data Modules	C	21999 - Updated for Issue 002 - Revision 01.
A15-00-2439-00A-003A-A Change Highlights	N	Incorporation of new data module
A15-00-2439-00A-003B-A Log of Revisions	C	21999 - Updated for Issue 002 - Revision 01.
A15-00-2439-01A-010A-A General	C	21316 - Added aircraft and POH effectivity.

* Authority Approved

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Log of Revisions

1 Issue 001 - Revision 00 - Dated: 14 October 2019

Initial Issue of the PC-12/47E AFM Supplement 02439.

The Issue 001 Revision 00 of the AFM Supplement ref. 02439 is approved under EASA approval number 10071186.

Approval date: 11.10.2019

Table -3-1: Issue 001 - Revision 00 - List of changes

Section	PTS Number	Description of Change
All	18738	AFM Supplement ref. 02439 - Propeller Low Speed option Initial Issue.

2 Issue 002 - Revision 00 - Dated: 14 February 2020

Up- Issue of the PC-12/47E AFM Supplement 02439.

The Issue 002 Revision 00 of the AFM Supplement ref. 02439 is approved under EASA approval number 10072536.

Approval date: 14.02.2020

Table -3-2: Issue 002 - Revision 00 - List of changes

Section	PTS Number	Description of Change
All	20776	AFM Supplement ref. 02439 - Propeller Low Speed option Issue 002 - Revision 00 - Removed emergency procedure "Air Start - With starter"

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Log of Revisions

1 Issue 001 - Revision 00 - Dated: 14 October 2019

Initial Issue of the PC-12/47E AFM Supplement 02439.

The Issue 001 Revision 00 of the AFM Supplement ref. 02439 is approved under EASA approval number 10071186.

Approval date: 11.10.2019

Table 1-1-1: Issue 001 - Revision 00 - List of changes

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All	18738	AFM Supplement ref. 02439 - Propeller Low Speed option Initial Issue.

2 Issue 002 - Revision 00 - Dated: 14 February 2020

Up- Issue of the PC-12/47E AFM Supplement 02439.

The Issue 002 Revision 00 of the AFM Supplement ref. 02439 is approved under EASA approval number 10072536.

Approval date: 14.02.2020

Table 1-1-2: Issue 002 - Revision 00 - List of changes

Section	PTS Number	Description of Change
All	20776	AFM Supplement ref. 02439 - Propeller Low Speed option Issue 002 - Revision 00 - Removed emergency procedure "Air Start - With starter"

3 Issue 002 - Revision 01 - Dated: 18 December 2020

The Issue 002 Revision 01 of the AFMS ref. 02439 is approved under the authority of DOA ref. EASA.21J.357

Approval date: 18.12.2020

Table 1-1-3: Issue 002 - Revision 01 - List of changes

Section	PTS Number	Description of Change
Front Matter		
List of Applicable Data Modules	21999	Updated for Issue 002 - Revision 01.
Change Highlights	21999	New DM.
Log of Revisions	21999	Updated for Issue 002 - Revision 01.
Section 1		
1	21316	Added aircraft and POH effectivity.

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Log of Temporary Revisions

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2439-00A-002B-A

No.	Temporary Revision Title	Date of Issue	Cancelled by

SECTION 1

General

Table of Contents

Subject **Page**

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1 General

This Supplement provides the information necessary to operate the PC-12/47E aircraft with the propeller low speed option installed.

The propeller low speed function provides an optimal means to reduce the aircraft environmental and cabin noise level in flight.

This supplement must be attached to the Pilot's Operating Handbook (POH) Report No.:

- 02406 (for MSN 1720, 2001 and up).

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SECTION 2

Limitations (EASA Approved)

Table of Contents

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2 Limitations

2-4 Power Plant Limitations

Engine operating limits

Note 12:

During steady state operation, operation from 1520 rpm up to 1580 rpm is permitted to allow for governing accuracy.

Propeller

Maximum Normal operation with the Prop Low Speed function active: 1550 rpm ±30 rpm

2-14 Icing Limitations

Flight in icing conditions is prohibited when the Prop Low Speed function is active.

2-21-11 Primus Apex - Automatic Flight Control System

Take-off with autothrottle engaged is prohibited when the Prop Low Speed function is active.

2-21-18 Yaw Damper

Operation with the Prop Low Speed function with flaps retracted configuration is only permitted with the yaw damper operational.

2-21-A1 Steep Approach

Steep approach landings are not permitted when the Prop Low Speed function is active.

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SECTION 3

Emergency Procedures (EASA Approved)

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3 Emergency Procedures

Propeller De Ice 3-18-01

1. PROP LOW SPEED switch........ Confirm OFF

---------- END -----------

Automatic Flight Control System Failures 3-22-50

Yaw damper has failed above 15,500 ft:

YD Fail shows on the CAS window.

Note

The two step procedure that follows should be among the basic aircraft emergency procedures that are committed to memory. It is important that the pilot be proficient in accomplishing the two steps without reference to the POH or the QRH.

1. Airplane control wheel and rudder pedals............................. Grasp and position feet to gain aircraft control
2. Aircraft...................................... Minimize side slip, do not make abrupt or large rudder or aileron control deflections. Keep the slip-skid indicator centered to ±1 trapezoid.

CAUTION

Above 15,500 ft: Fly smoothly and as soon as practical increase speed above 140 KIAS and make only gentle control deflections and small power changes.

3. PROP LOW SPEED switch........ PUSH (set to OFF)

Reset the AFCS as follows:

4. A/P SERVO circuit breaker (Avionic 1 Bus $_L$Z2) and A/P SERVO ENABLE circuit breaker (Avionic 1 Bus $_L$Y2).................... Open, wait 2 seconds, and close (max. 1 attempt per flight only)
5. CAS window............................... Check for AFCS faults

If no AFCS related CAS messages:

6. Aircraft.. Attempt to re-engage Yaw Damper and Autopilot (max. 1 attempt)

Continued on next page

12-C-A15-40-2439-03A-141A-A

Automatic Flight Control System Failures — 3-22-50

continued

If failure persists:

7.	Aircraft..	At pilot's discretion continue flight without the yaw damper or land as soon as practical

---------- END -----------

3A Abnormal Procedures

3A-2 CAS Advisories

CAS Advisory Message	Meaning, Effects and Possible Actions
Prop Low Speed	Indicates that prop low speed mode (nominal Np = 1550 rpm) is active.
YD Fail	Yaw Damper has failed below 15,500 ft. Minimize side slip by using rudder pedals and manual rudder trim. PROP LOW SPEED switch: Set to OFF. Above 15,500 ft, refer to the Automatic Flight Control System Failures - 3-02 procedure. Reset the AFCS as follows: Open the A/P SERVO (Avionic 1 Bus $_L$Z2) and A/P SERVO ENABLE (Avionic 1 Bus $_L$Y2) circuit breakers for 2 secs, then close. Check CAS. Only one reset attempt per flight.

12-C-A15-48-2439-03A-141A-A

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SECTION 4

Normal Procedures (EASA Approved)

Table of Contents

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4 Normal Procedures

Note
The Prop Low Speed mode can be selected ON and OFF at the pilot's discretion (except before engine start and in icing conditions). Use of the Prop Low Speed mode is not recommended for short field landing.

Before Starting Engine 4-4-01

1. LAMP test switch........................ PUSH. (Master Warning and Caution, Trim Interrupt and Prop Low Speed lights)

---------- END -----------

Takeoff 4-9-01

1. PROP LOW SPEED switch........ PUSH (set to ON), if desired

Note
The Prop Low Speed function is not available when autothrottle is engaged during takeoff. Autothrottle always uses 1700 rpm for takeoff.

2. POWER CONTROL LEVER........ SET to MCP (EPECS sets power to ambient conditions.)

CAUTION
Monitor for exceedances. EPECS will not protect against all possibilities of exceedance.

---------- END -----------

12-C-A15-30-2439-04A-131A-A

Flight Into Known Icing Conditions 4-10-01

WARNING

FLIGHT IN ICING CONDITIONS IS NOT PERMITTED WITH THE PROP LOW SPEED FUNCTION SET TO ON. SET THE PROP LOW SPEED FUNCTION TO OFF BEFORE YOU ENTER ICING CONDITIONS.

Before entering icing conditions turn off the prop low speed mode:

1. PROP LOW SPEED switch........ PUSH (set to OFF)
2. CAS window............................... CHECK Prop Low Speed message goes off
3. Np... Confirm correct

---------- END -----------

SECTION 5

Performance (EASA Approved)

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5 Performance

5-3-2 Takeoff Performance

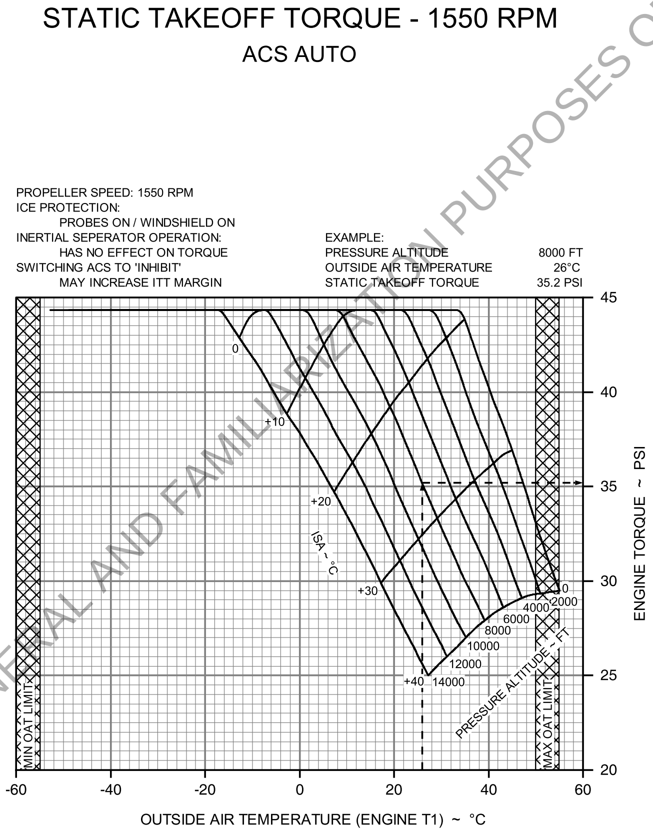

Figure 5-1-1: Propeller Low Speed - Performance - Static Takeoff Torque

12-C-A15-60-2439-05A-030A-A

STATIC TAKEOFF TORQUE - 1550 RPM

ACS INHIBIT

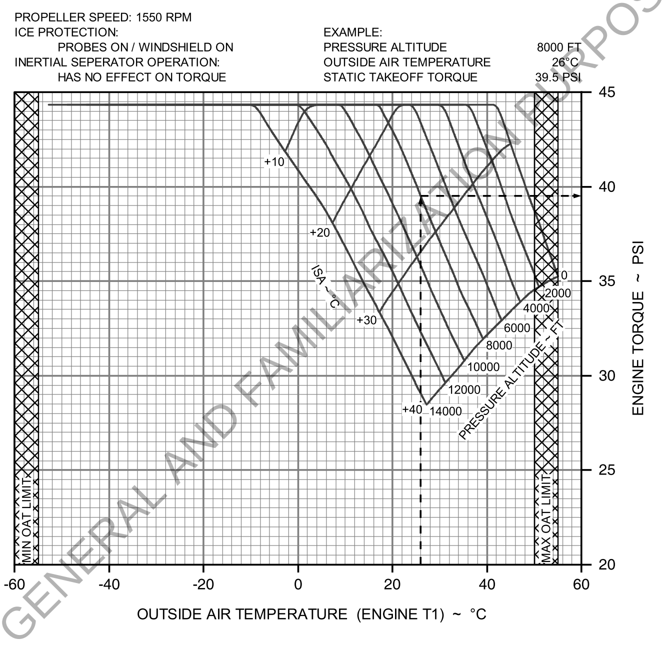

Figure 5-1-2: Propeller Low Speed - Performance - Static Takeoff Torque - ACS OFF

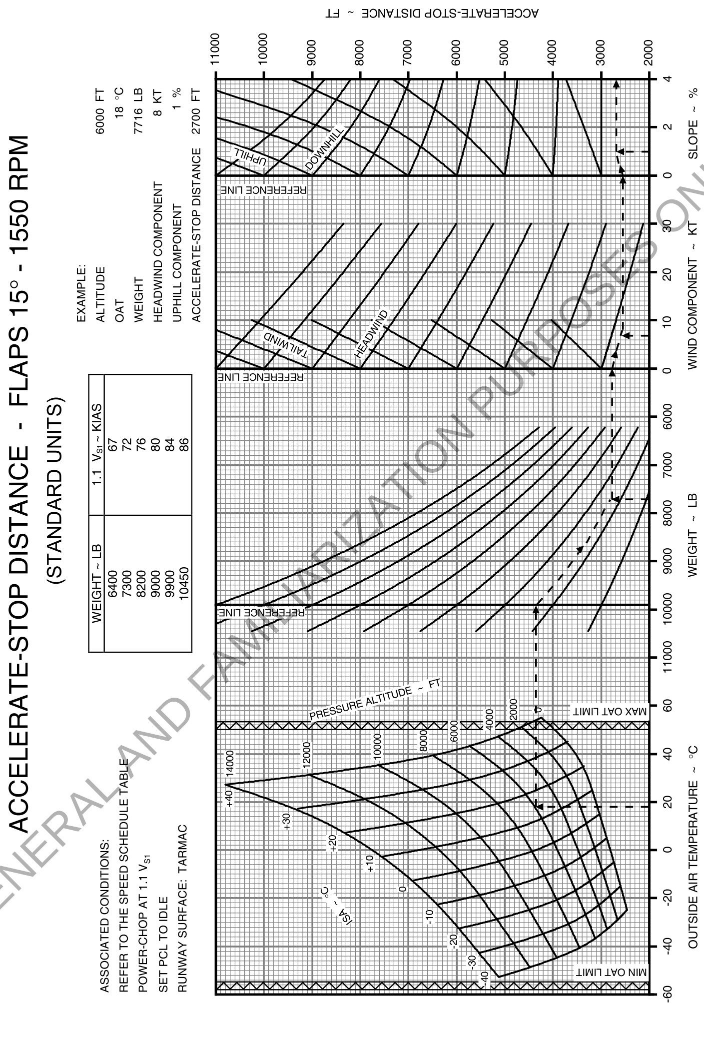

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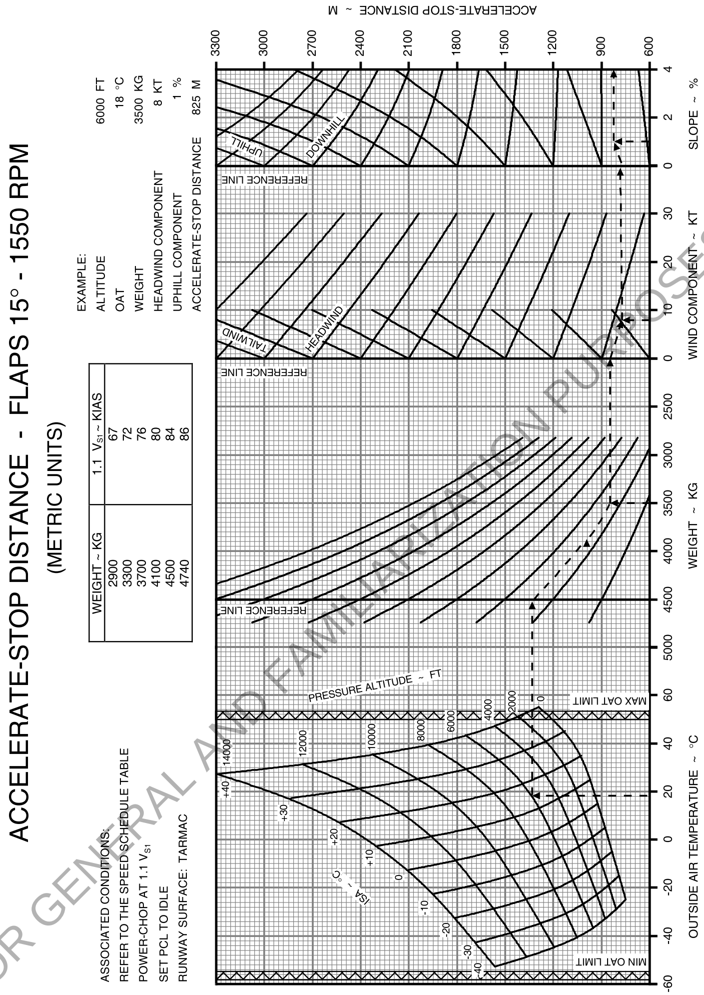
Figure 5-1-3: Propeller Low Speed - Performance - Accelerate-Stop Distance - Flaps 15° (standard units)

12-C-A15-60-2439-05A-030A-A

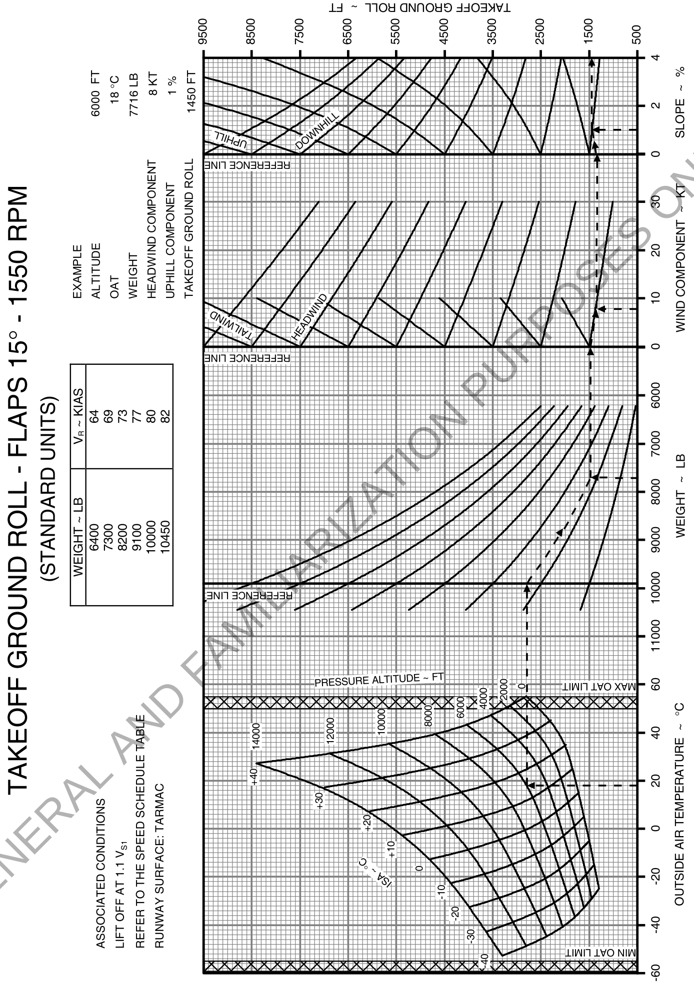


WEIGHT ~ KG	1.1 V_{S1} ~ KIAS
2900	67
3300	72
3700	76
4100	80
4500	84
4740	86

ICN-12-C-A150905-A-S4080-00337-A-001-01

Figure 5-1-4: Propeller Low Speed - Performance - Accelerate-Stop Distance - Flaps 15° (metric units)

12-C-A15-60-2439-05A-030A-A

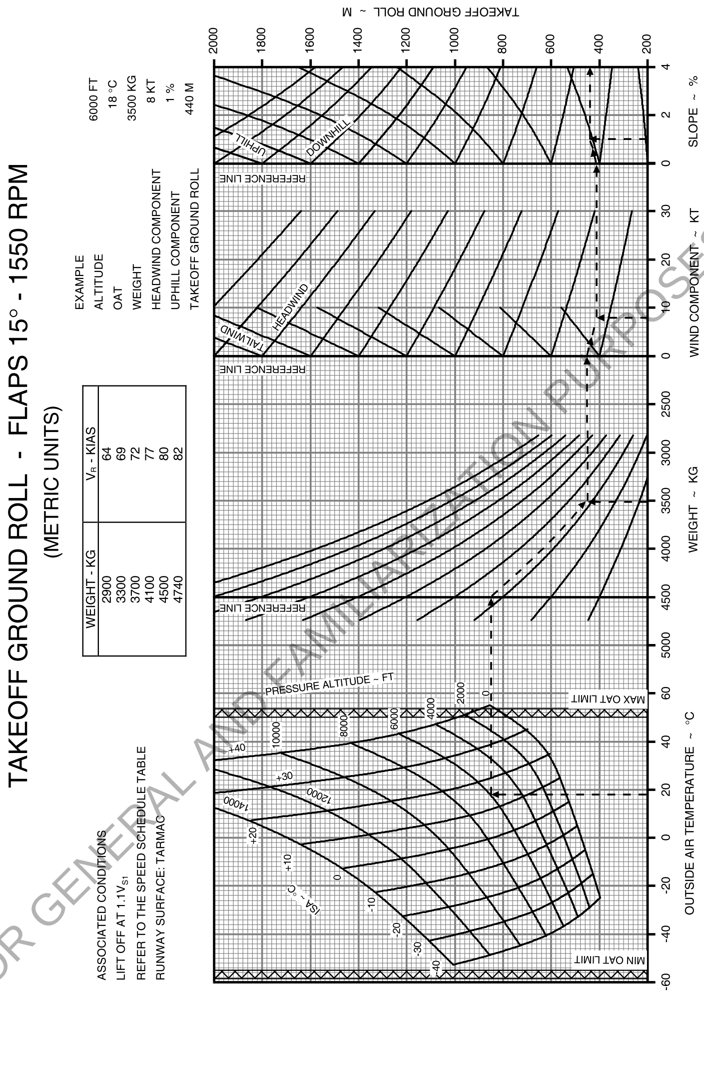


WEIGHT ~ LB	V_R ~ KIAS
6400	64
7300	69
8200	73
9100	77
10000	80
10450	82

ICN-12-C-A150905-A-S4080-00340-A-001-01

Figure 5-1-5: Propeller Low Speed - Performance - Takeoff Ground Roll - Flaps 15° (standard units)

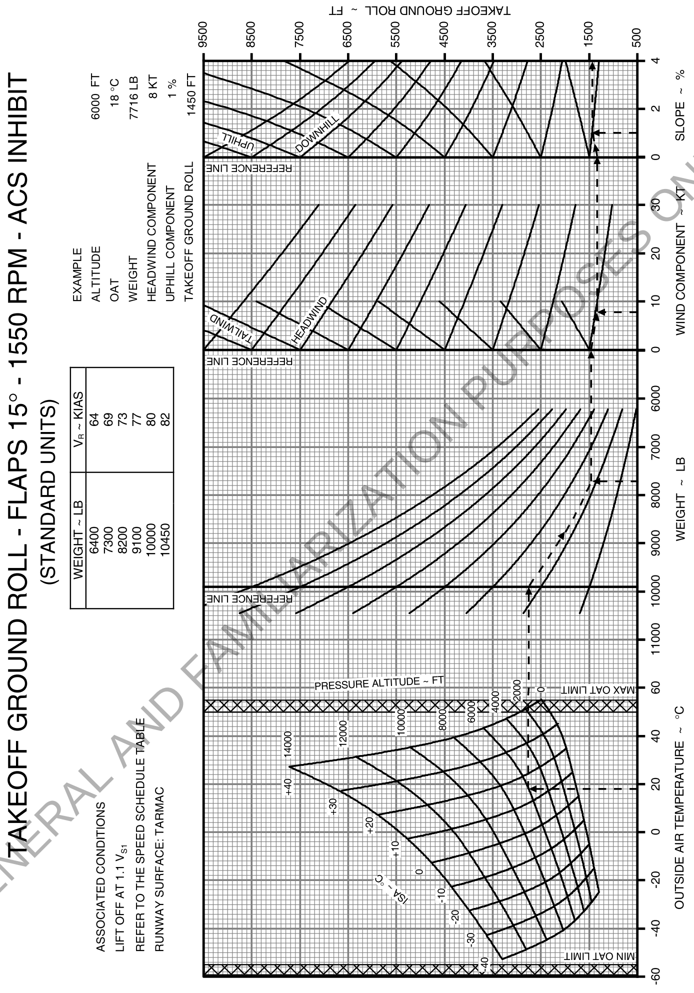
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00341-A-001-01

Figure 5-1-6: Propeller Low Speed - Performance - Takeoff Ground Roll - Flaps 15° (metric units)

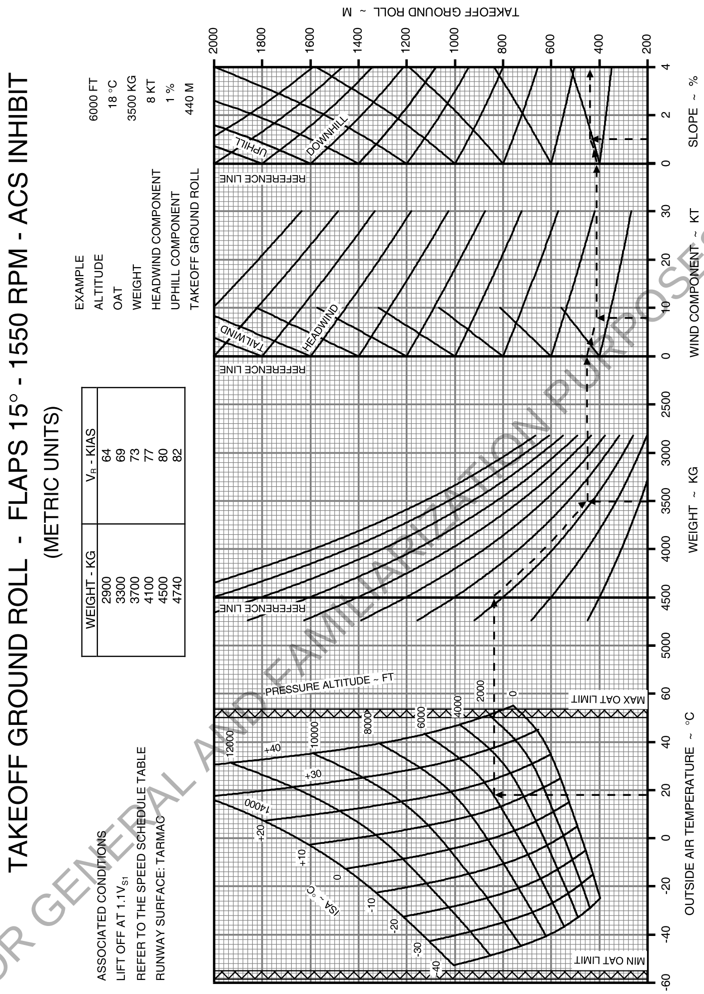
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00342-A-001-01

Figure 5-1-7: Propeller Low Speed - Performance - Takeoff Ground Roll - Flaps 15° - ACS OFF (standard units)

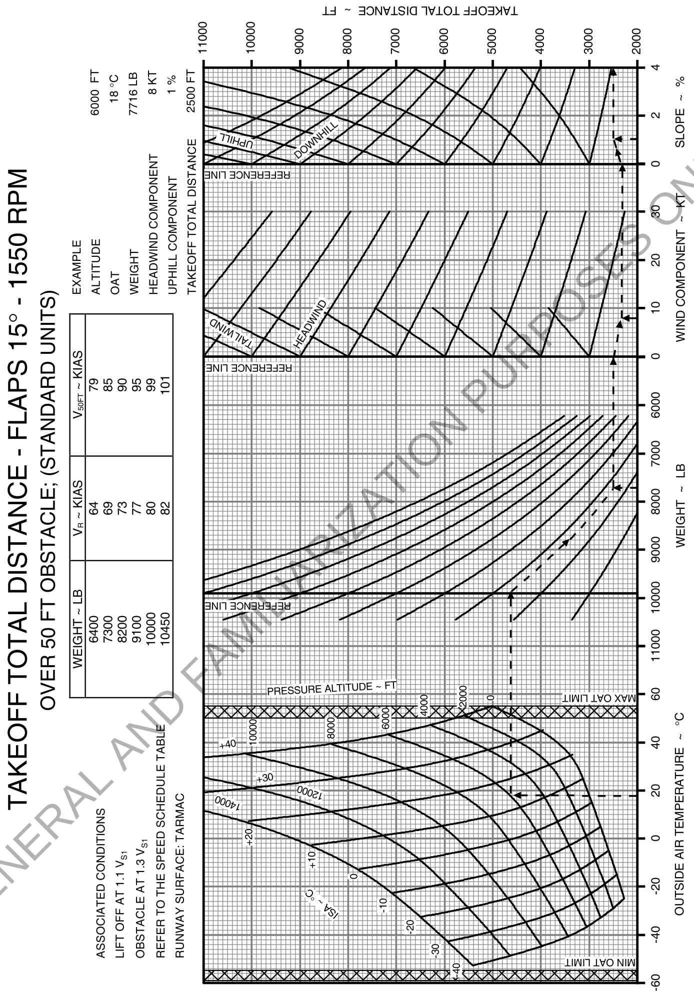
12-C-A15-60-2439-05A-030A-A



12-C-A15-60-2439-05A-030A-A

ICN-12-C-A150905-A-S4080-00343-A-001-01

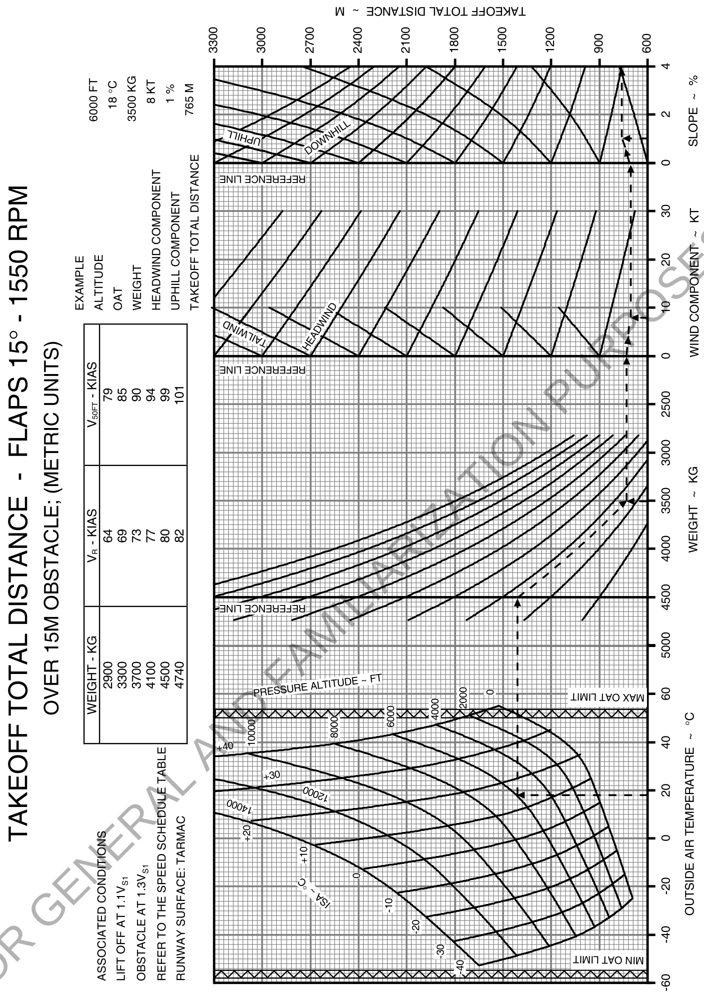
Figure 5-1-8: Propeller Low Speed - Performance - Takeoff Ground Roll - Flaps 15° - ACS OFF (metric units)



ICN-12-C-A150905-A-S4080-00344-A-001-01

Figure 5-1-9: Propeller Low Speed - Performance - Takeoff Total Distance - Flaps 15° (standard units)

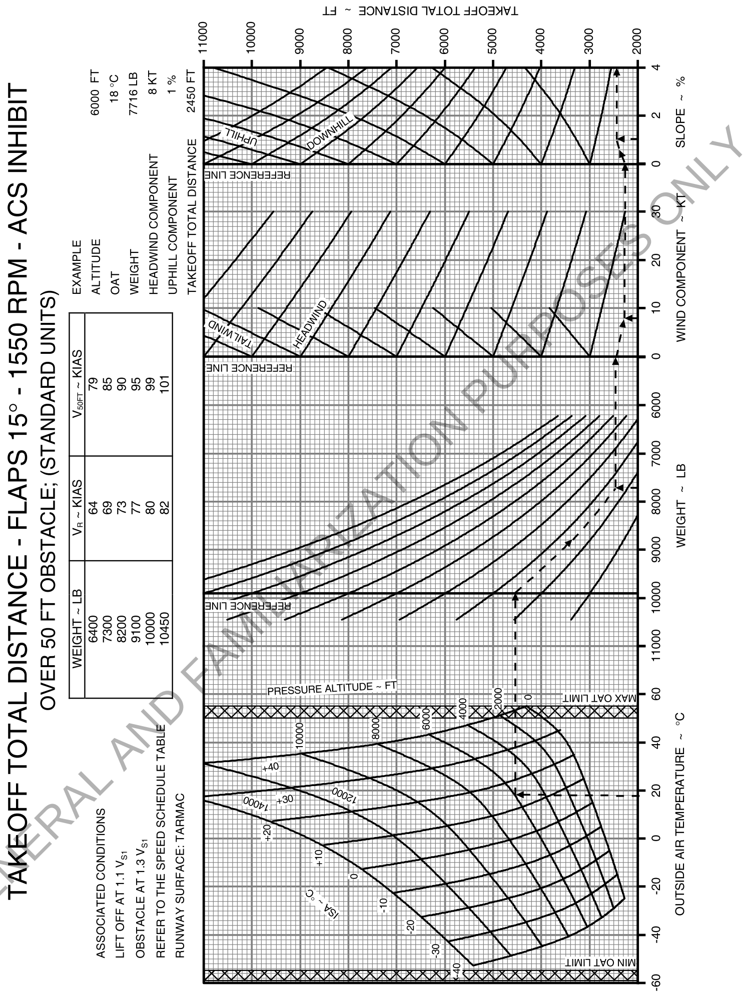
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00345-A-001-01

Figure 5-1-10: Propeller Low Speed - Performance - Takeoff Total Distance - Flaps 15° (metric units)

12-C-A15-60-2439-05A-030A-A

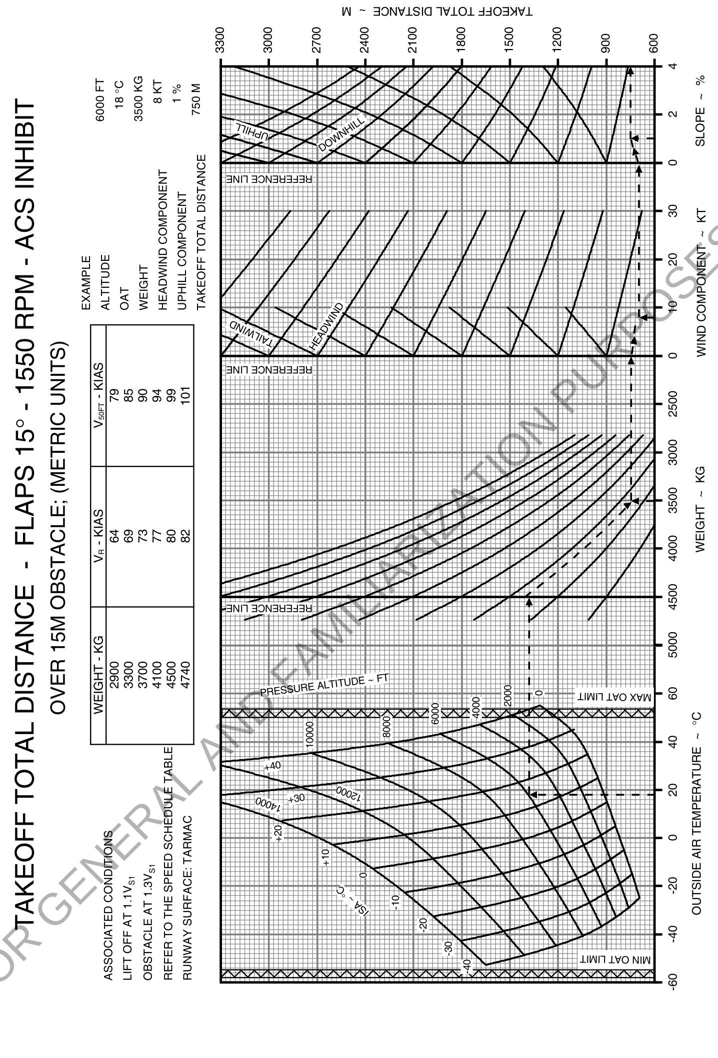


WEIGHT ~ LB	V_R ~ KIAS	V_{50FT} ~ KIAS
6400	64	79
7300	69	85
8200	73	90
9100	77	95
10000	80	99
10450	82	101

ICN-12-C-A150905-A-S4080-00346-A-001-01

Figure 5-1-11: Propeller Low Speed - Performance - Takeoff Total Distance - Flaps 15° - ACS OFF (standard units)

12-C-A15-60-2439-05A-030A-A



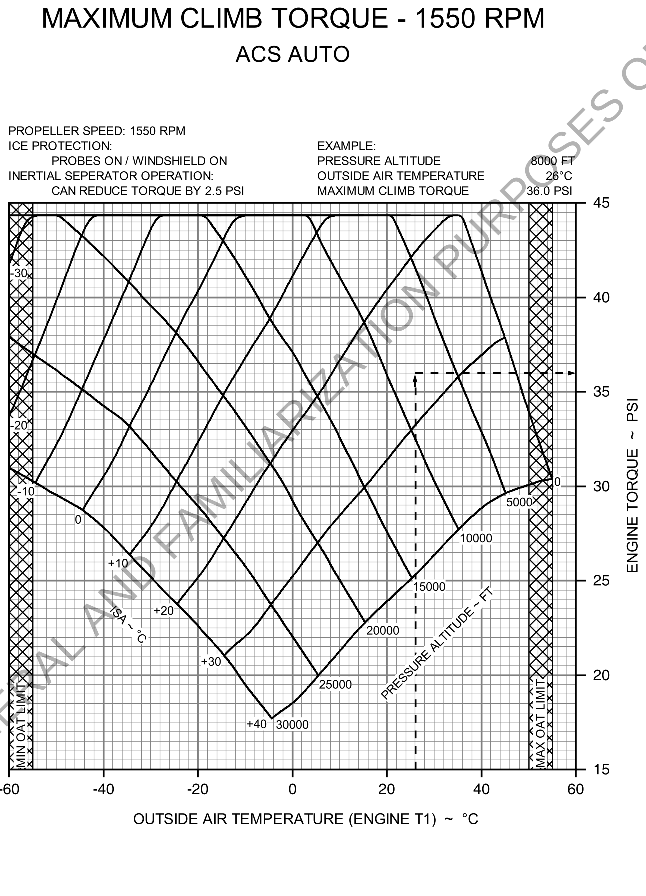
WEIGHT - KG	V_R - KIAS	V_{50FT} - KIAS
2900	64	79
3300	69	85
3700	73	90
4100	77	94
4500	80	99
4740	82	101

ICN-12-C-A150905-A-S4080-00347-A-001-01

Figure 5-1-12: Propeller Low Speed - Performance - Takeoff Total Distance - Flaps 15° - ACS OFF (metric units)

12-C-A15-60-2439-05A-030A-A

5-3-3 Climb Performance



ICN-12-C-A150905-A-S4080-00348-A-001-01

Figure 5-1-13: Propeller Low Speed - Performance - Maximum Climb Torque

12-C-A15-60-2439-05A-030A-A

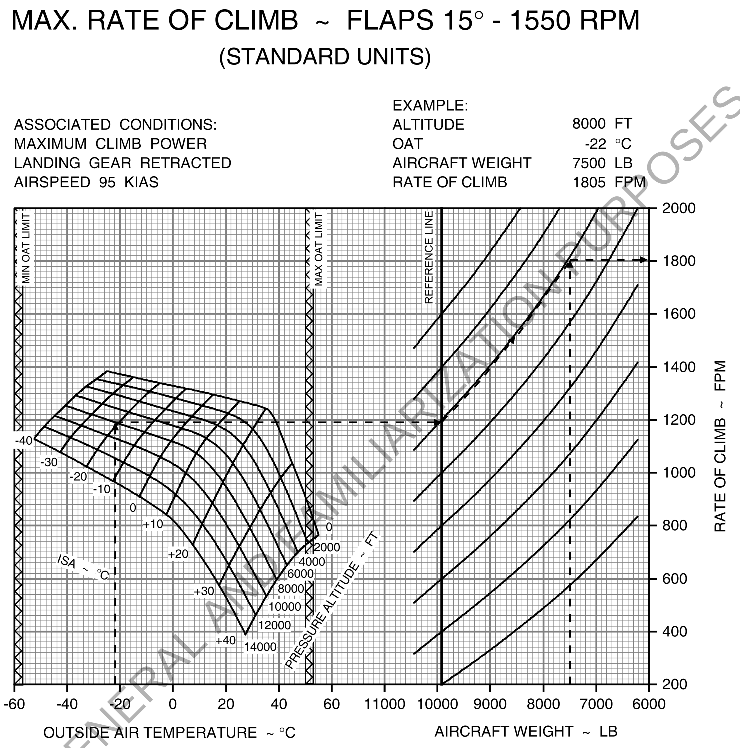
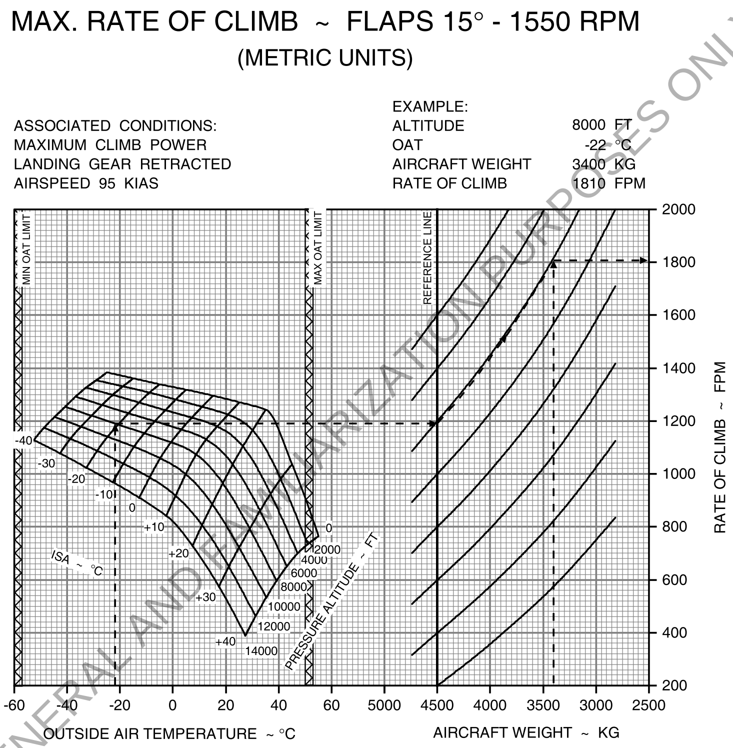


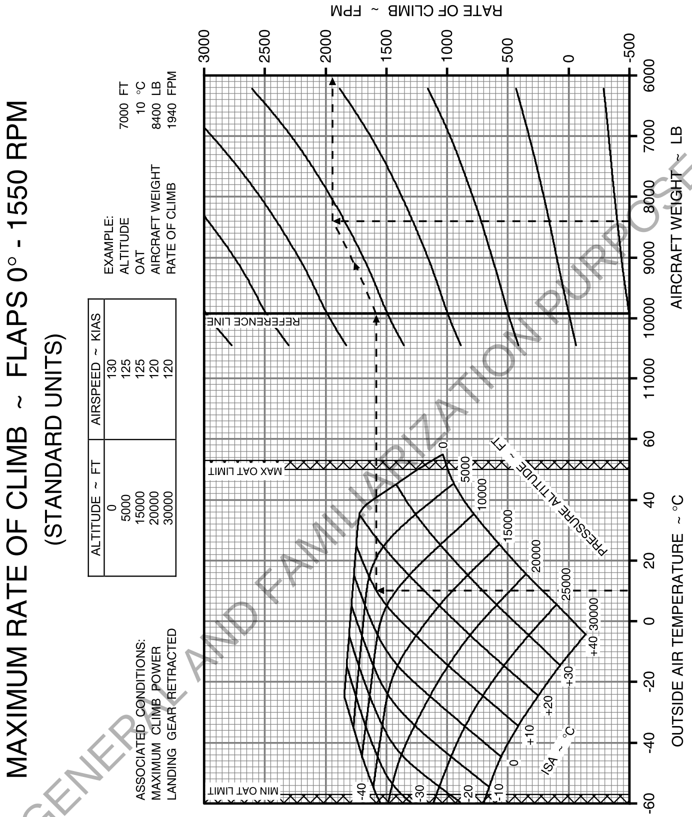
Figure 5-1-14: Propeller Low Speed - Performance - Maximum Rate Of Climb - Flaps 15° (standard units)



ICN-12-C-A150905-A-S4080-00350-A-001-01

Figure 5-1-15: Propeller Low Speed - Performance - Maximum Rate Of Climb - Flaps 15° (metric units)

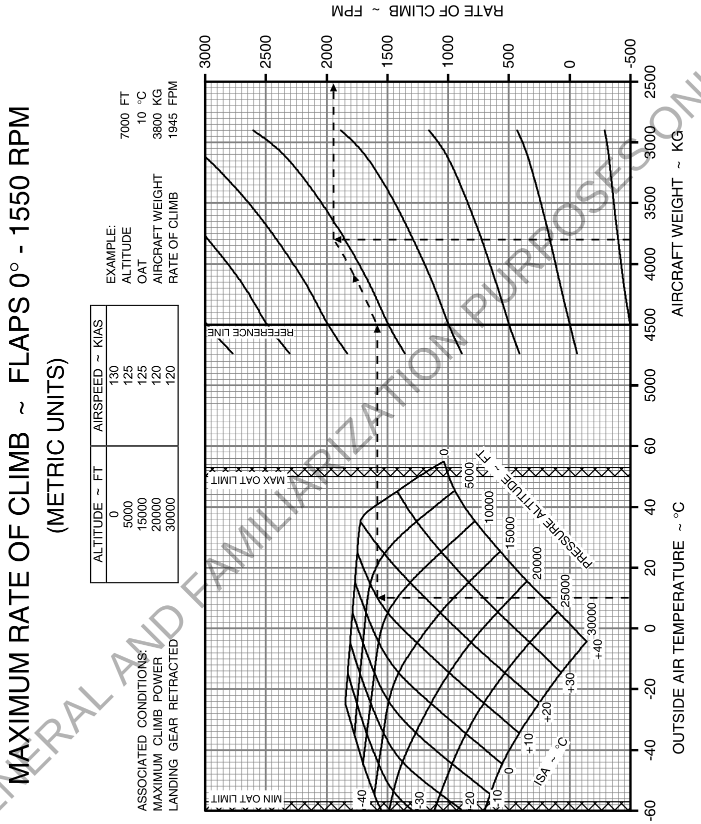
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00351-A-001-01

Figure 5-1-16: Propeller Low Speed - Performance - Maximum Rate Of Climb - Flaps 0° (standard units)

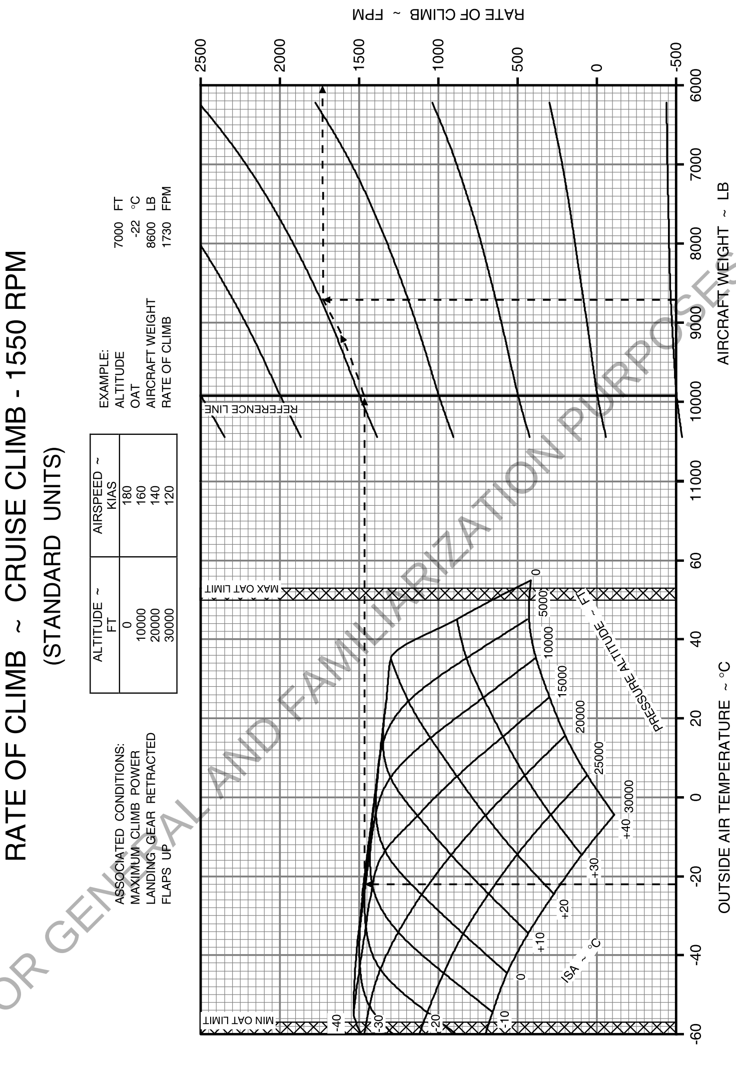
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00352-A-001-01

Figure 5-1-17: Propeller Low Speed - Performance - Maximum Rate Of Climb - Flaps 0° (metric units)

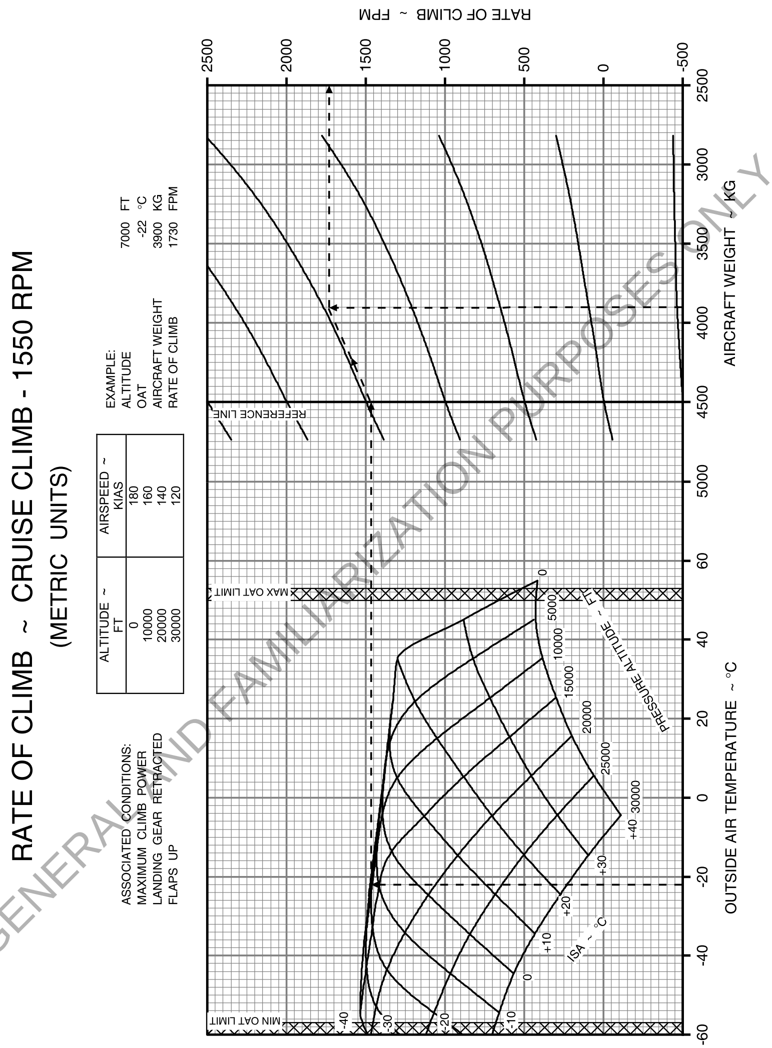
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00353-A-001-01

Figure 5-1-18: Propeller Low Speed - Performance - Rate Of Climb - Cruise Climb (standard units)

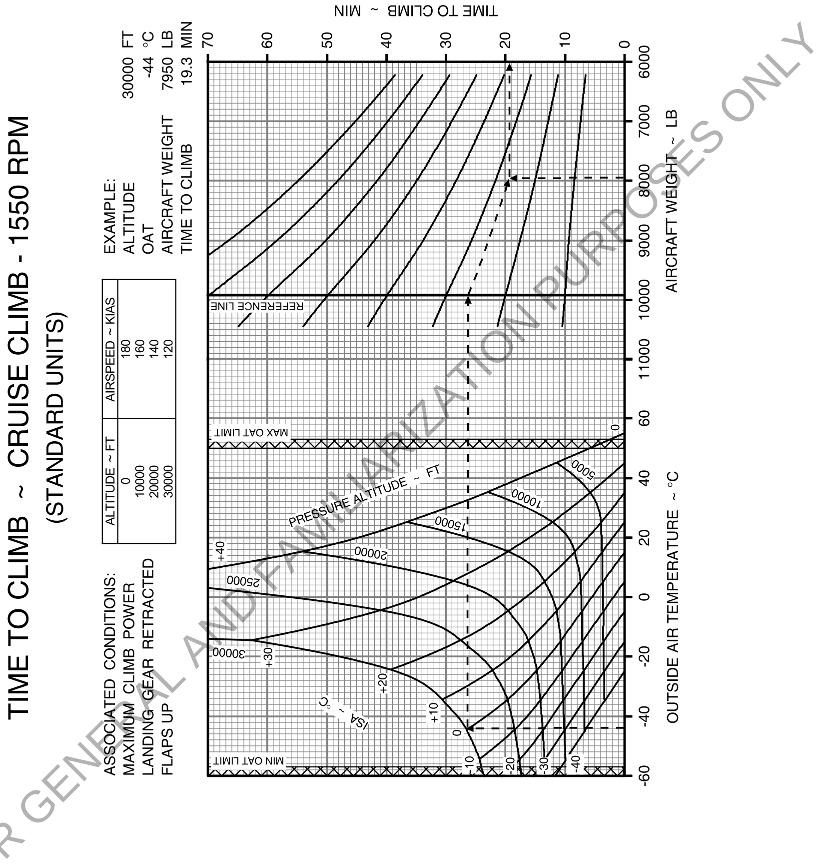
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00354-A-001-01

Figure 5-1-19: Propeller Low Speed - Performance - Rate Of Climb - Cruise Climb (metric units)

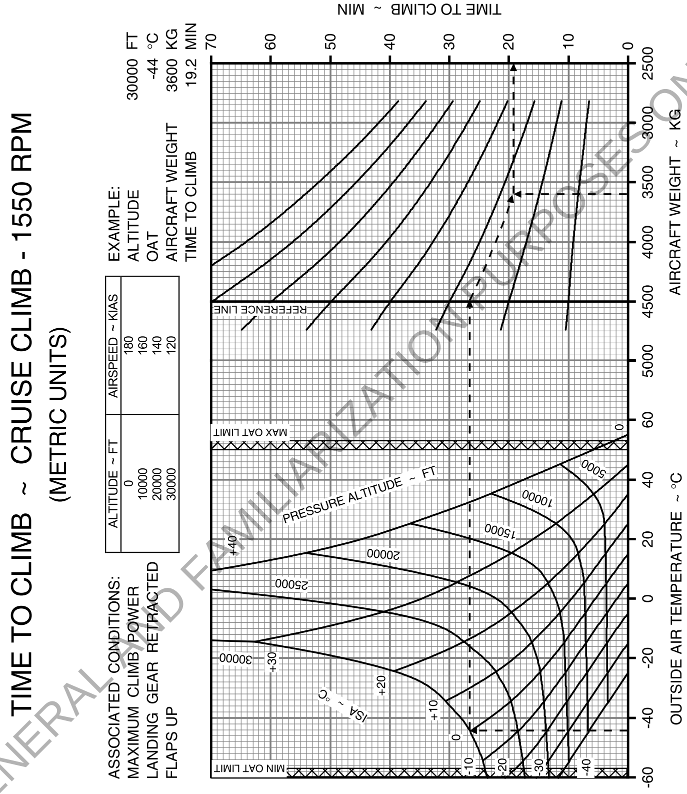
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00355-A-001-01

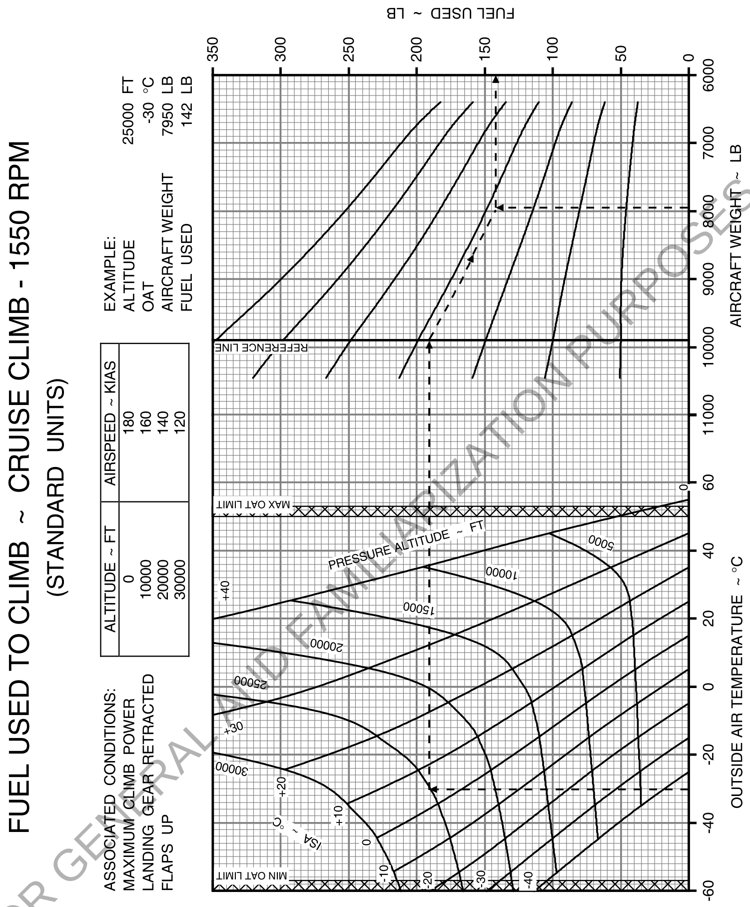
Figure 5-1-20: Propeller Low Speed - Performance - Time To Climb - Cruise Climb (standard units)

12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00356-A-001-01

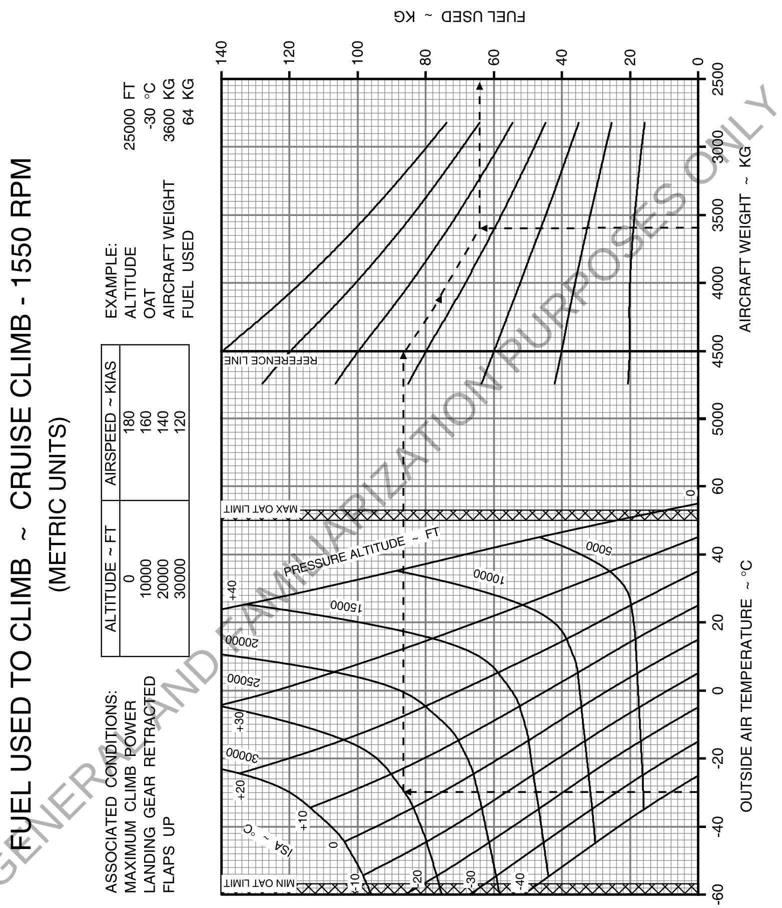
Figure 5-1-21: Propeller Low Speed - Performance - Time To Climb - Cruise Climb (metric units)



ICN-12-C-A150905-A-S4080-00357-A-001-01

Figure 5-1-22: Propeller Low Speed - Performance - Fuel Used To Climb - Cruise Climb (standard units)

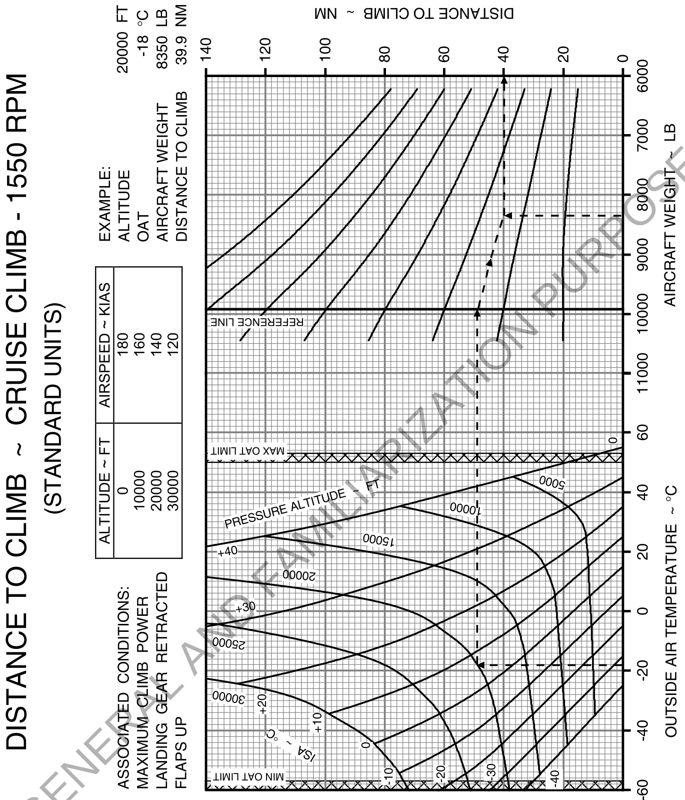
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00358-A-001-01

Figure 5-1-23: Propeller Low Speed - Performance - Fuel Used To Climb - Cruise Climb (metric units)

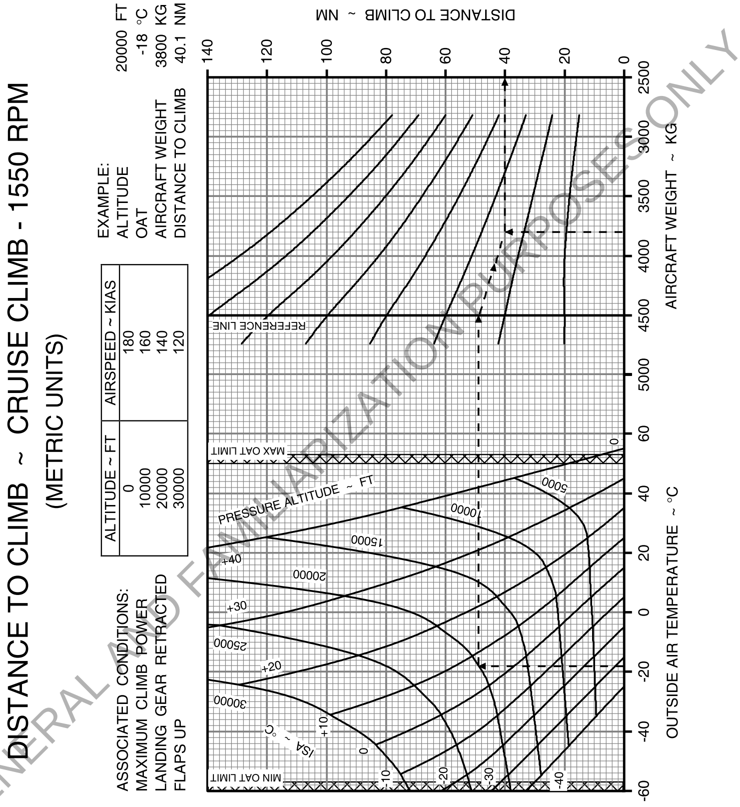
12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00359-A-001-01

Figure 5-1-24: Propeller Low Speed - Performance - Distance To Climb - Cruise Climb (standard units)

12-C-A15-60-2439-05A-030A-A



ICN-12-C-A150905-A-S4080-00360-A-001-01

Figure 5-1-25: Propeller Low Speed - Performance - Distance To Climb - Cruise Climb (metric units)

12-C-A15-60-2439-05A-030A-A

5-3-4 Cruise Performance

MAXIMUM CRUISE POWER - 1550 RPM

NOTE: TORQUE AND FUEL FLOW BASED ON 8000 lb (3629 kg)

						@ 7000 lb (3175 kg)		@ 8000 lb (3629 kg)		@ 9000 lb (4082 kg)		@ 10000 lb (4536 kg)		@ 10400 lb (4717 kg)	
ISA (ºC)	Altitude (ft)	SAT (ºC)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)
-40	0	-25	40.5	603	274	241	223	240	222	239	222	238	221	238	220
	2000	-29	40.6	587	266	239	227	238	226	237	225	236	224	235	224
	4000	-33	40.6	569	258	236	231	235	230	235	229	233	228	233	228
	6000	-37	40.6	554	251	234	235	233	234	232	234	231	232	230	232
	8000	-41	40.6	539	245	232	240	231	239	230	238	228	236	228	236
	10000	-45	40.6	526	239	229	244	228	243	228	242	226	241	225	240
	12000	-49	40.6	519	235	227	249	226	248	225	247	224	245	223	245
	14000	-53	40.6	511	232	225	254	224	253	223	252	222	250	221	249
	16000	-57	40.6	504	229	223	259	222	258	221	257	219	255	219	254
	18000	-61	40.6	496	225	221	265	220	264	219	262	217	260	217	259
	20000	-65	40.6	490	222	219	270	218	269	217	267	215	265	214	264
	22000	-69	39.4	472	214	215	273	215	273	214	273	213	271	212	270
	24000	-73	36.1	433	196	206	270	206	270	206	270	206	270	206	270
	26000	-77	33.3	400	181	197	268	197	268	197	268	197	268	197	268
	28000	-81	30.8	370	168	189	265	189	265	189	265	189	265	189	265
	30000	-84	28.4	344	156	181	262	181	262	181	262	181	262	181	262
-30	0	-15	38.0	611	277	239	225	238	224	237	224	236	223	235	222
	2000	-19	39.0	593	269	236	229	235	228	235	228	233	227	233	226
	4000	-23	40.1	576	261	234	233	233	233	232	232	231	230	230	230
	6000	-27	40.6	560	254	232	238	231	237	230	236	229	235	228	234
	8000	-31	40.6	545	247	230	243	229	242	228	241	227	239	226	239
	10000	-35	40.6	532	241	228	248	227	247	226	246	224	244	224	243
	12000	-39	40.6	524	238	226	253	225	252	224	250	222	249	222	248
	14000	-43	40.6	517	235	224	258	223	257	221	255	220	254	219	253
	16000	-47	40.6	510	231	222	263	221	262	219	260	218	259	217	258
	18000	-51	40.6	501	227	219	269	218	268	217	266	215	264	215	263
	20000	-55	40.4	495	225	217	274	216	273	215	271	213	269	212	268
	22000	-59	37.1	487	221	215	280	214	279	212	277	211	275	210	274
	24000	-63	34.1	448	203	206	277	206	277	206	277	206	277	206	277
	26000	-67	31.6	414	188	197	275	197	275	197	275	197	275	197	275
	28000	-71	29.2	382	173	189	272	189	272	189	272	189	272	189	272
	30000	-74	27.0	355	161	181	269	181	269	181	269	181	269	181	269

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Figure 5-1-26: Propeller Low Speed - Performance - Maximum Cruise Power (Sheet 1 of 4)

12-C-A15-60-2439-05A-030A-A

MAXIMUM CRUISE POWER - 1550 RPM

NOTE: TORQUE AND FUEL FLOW BASED ON 8000 lb (3629 kg)

						@ 7000 lb (3175 kg)		@ 8000 lb (3629 kg)		@ 9000 lb (4082 kg)		@ 10000 lb (4536 kg)		@ 10400 lb (4717 kg)	
ISA (ºC)	Altitude (ft)	SAT (ºC)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)
-20	0	-5	38.9	618	280	236	227	236	227	235	226	234	225	233	224
	2000	-9	40.0	600	272	234	232	233	231	233	230	231	229	231	228
	4000	-13	40.6	582	264	232	236	231	236	231	235	229	233	229	233
	6000	-17	40.6	565	256	230	241	229	240	228	239	227	238	226	237
	8000	-21	40.6	551	250	228	246	227	245	226	244	225	242	224	242
	10000	-25	40.6	537	244	226	251	225	250	224	249	223	247	222	246
	12000	-29	40.6	529	240	224	256	223	255	222	254	220	252	220	251
	14000	-33	40.6	523	237	222	261	221	260	220	259	218	257	218	256
	16000	-37	40.6	515	233	220	267	219	266	217	264	216	262	215	261
	18000	-41	40.6	507	230	218	273	217	271	215	269	213	267	213	267
	20000	-45	40.6	500	227	215	278	214	277	212	275	211	272	210	272
	22000	-49	37.9	495	224	213	284	212	282	210	280	208	278	207	277
	24000	-53	34.9	464	211	206	284	206	284	206	284	205	283	205	282
	26000	-57	32.3	430	195	197	281	197	281	197	281	197	281	197	281
	28000	-61	29.8	396	180	189	278	189	278	189	278	189	278	189	278
	30000	-64	27.6	368	167	181	276	181	276	181	276	181	276	181	276
-10	0	5	39.7	625	283	235	230	234	229	233	229	232	227	231	227
	2000	1	40.6	606	275	233	235	232	234	231	233	230	232	229	231
	4000	-3	40.6	589	267	231	239	230	238	229	238	228	236	227	236
	6000	-7	40.6	572	259	229	244	228	243	227	242	225	241	225	240
	8000	-11	40.6	557	253	227	249	226	248	225	247	223	245	223	245
	10000	-15	40.6	543	246	225	254	224	253	222	252	221	250	220	250
	12000	-19	40.6	535	243	222	260	222	259	220	257	219	255	218	255
	14000	-23	40.6	528	240	220	265	220	264	218	262	216	260	216	260
	16000	-27	40.6	520	236	218	270	217	269	215	267	214	265	213	264
	18000	-31	40.6	512	232	216	276	214	274	213	272	211	270	210	269
	20000	-35	40.6	505	229	213	282	212	280	210	278	209	275	208	275
	22000	-39	38.7	500	227	211	287	209	285	208	283	206	281	205	280
	24000	-43	35.6	481	218	206	290	206	290	204	287	202	285	201	284
	26000	-47	33.0	446	202	197	287	197	287	196	286	194	283	193	281
	28000	-51	30.5	412	187	189	285	189	285	188	284	185	280	184	278
	30000	-54	28.3	382	173	181	282	181	282	179	280	176	276	175	274

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Figure 5-1-26: Propeller Low Speed - Performance - Maximum Cruise Power (Sheet 2 of 4)

12-C-A15-60-2439-05A-030A-A

MAXIMUM CRUISE POWER - 1550 RPM

NOTE: TORQUE AND FUEL FLOW BASED ON 8000 lb (3629 kg)

						@ 7000 lb (3175 kg)		@ 8000 lb (3629 kg)		@ 9000 lb (4082 kg)		@ 10000 lb (4536 kg)		@ 10400 lb (4717 kg)	
ISA (ºC)	Altitude (ft)	SAT (ºC)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)
0	0	15	40.3	631	286	233	233	233	232	232	231	231	230	230	229
	2000	11	40.6	612	278	231	237	231	237	230	236	228	234	228	234
	4000	7	40.6	594	270	229	242	228	241	228	240	226	239	226	238
	6000	3	40.6	578	262	227	247	226	246	225	245	224	243	223	243
	8000	-1	40.6	562	255	225	252	224	251	223	250	222	248	221	248
	10000	-5	40.6	548	249	223	257	222	256	221	255	219	253	219	252
	12000	-9	40.6	540	245	221	263	220	262	218	260	217	258	216	257
	14000	-13	40.6	533	242	218	268	218	267	216	265	214	263	214	262
	16000	-17	40.6	525	238	216	273	215	272	213	270	212	268	211	267
	18000	-21	40.4	517	234	214	279	212	277	211	275	209	273	208	272
	20000	-25	38.6	510	231	211	285	210	283	208	281	206	278	206	278
	22000	-29	36.3	495	224	207	288	205	286	204	284	202	281	201	280
	24000	-33	34.3	465	211	200	288	198	286	196	283	194	280	193	278
	26000	-37	32.2	436	198	193	287	191	285	189	282	186	278	185	276
	28000	-41	30.2	409	186	185	286	183	283	181	279	178	275	176	273
	30000	-44	28.2	382	173	178	285	176	281	172	276	169	271	167	268
10	0	25	40.6	638	290	232	236	231	235	231	234	229	233	229	232
	2000	21	40.6	619	281	230	240	229	239	228	238	227	237	226	236
	4000	17	40.6	601	272	228	245	227	244	226	243	225	242	224	241
	6000	13	40.6	584	265	226	250	225	249	224	248	222	246	222	246
	8000	9	40.6	568	258	224	255	223	254	221	253	220	251	219	250
	10000	5	40.6	554	251	221	260	220	259	219	257	217	256	217	255
	12000	1	40.6	545	247	219	265	218	264	216	262	215	260	214	260
	14000	-3	39.3	539	244	217	271	216	269	214	267	212	265	212	265
	16000	-7	37.9	530	240	214	276	213	275	211	273	210	271	209	270
	18000	-11	36.4	514	233	211	280	209	278	207	276	205	274	205	273
	20000	-15	34.9	489	222	205	282	203	279	201	277	199	275	198	273
	22000	-19	33.1	461	209	198	282	196	279	194	277	192	274	191	272
	24000	-23	31.3	434	197	191	282	189	279	187	276	184	271	183	270
	26000	-27	29.3	406	184	184	280	182	277	179	273	176	268	174	266
	28000	-31	27.4	380	172	176	279	174	275	171	270	167	265	166	262
	30000	-34	25.6	355	161	169	277	166	272	162	267	158	260	157	258

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Figure 5-1-26: Propeller Low Speed - Performance - Maximum Cruise Power (Sheet 3 of 4)

12-C-A15-60-2439-05A-030A-A

MAXIMUM CRUISE POWER - 1550 RPM

NOTE: TORQUE AND FUEL FLOW BASED ON 8000 lb (3629 kg)

						@ 7000 lb (3175 kg)		@ 8000 lb (3629 kg)		@ 9000 lb (4082 kg)		@ 10000 lb (4536 kg)		@ 10400 lb (4717 kg)	
ISA (ºC)	Altitude (ft)	SAT (ºC)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)	IAS (kt)	TAS (kt)
20	0	35	40.6	646	293	231	238	230	237	229	236	228	235	227	234
	2000	31	40.6	625	284	229	243	228	242	227	241	226	239	225	239
	4000	27	40.6	607	275	227	248	226	247	225	246	223	244	223	243
	6000	23	40.1	590	268	224	253	223	252	222	250	221	248	220	248
	8000	19	38.8	574	260	222	257	221	256	220	255	218	253	217	252
	10000	15	37.5	560	254	219	263	219	262	217	260	215	258	215	257
	12000	11	36.2	547	248	216	267	215	265	213	263	212	261	211	260
	14000	7	35.0	524	238	211	269	210	267	208	265	206	263	205	262
	16000	3	33.4	498	226	205	270	203	267	202	265	200	263	199	262
	18000	-1	32.1	474	215	200	271	198	269	196	266	194	263	193	262
	20000	-5	30.7	448	203	194	272	192	269	190	267	187	263	186	261
	22000	-9	29.3	423	192	187	272	185	270	183	266	180	262	179	260
	24000	-13	27.7	398	180	181	272	179	269	176	264	172	259	171	257
	26000	-17	26.1	374	169	174	271	171	267	168	262	164	257	163	254
	28000	-21	24.4	349	158	167	270	164	264	160	259	156	253	154	250
	30000	-24	22.9	327	148	159	267	156	262	152	255	147	248	145	244
30	0	45	35.6	642	291	227	238	226	237	225	236	223	234	223	233
	2000	41	35.4	620	281	225	242	224	241	222	240	221	238	220	237
	4000	37	34.8	596	270	221	246	220	245	219	243	217	241	216	240
	6000	33	33.9	569	258	217	248	216	247	214	245	212	243	211	242
	8000	29	32.8	542	246	212	250	211	249	209	247	207	245	206	244
	10000	25	31.8	517	234	207	253	206	251	204	249	202	246	201	245
	12000	21	30.7	495	225	203	255	201	252	199	250	197	248	196	246
	14000	17	29.6	474	215	197	256	195	254	194	251	191	248	190	247
	16000	13	28.5	452	205	192	257	190	255	188	252	185	249	184	247
	18000	9	27.4	429	195	187	258	185	256	182	253	179	248	178	247
	20000	5	26.3	406	184	181	259	179	256	176	252	173	248	171	246
	22000	1	25.1	384	174	175	259	172	256	169	251	166	246	164	244
	24000	-3	23.7	360	163	168	259	165	254	162	249	158	243	157	241
	26000	-7	22.4	338	153	162	258	158	253	155	247	151	241	148	237
	28000	-11	21.1	317	144	155	256	151	250	147	244	142	236	140	232
	30000	-14	19.8	297	135	148	254	144	248	139	240	133	229	129	222

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Figure 5-1-26: Propeller Low Speed - Performance - Maximum Cruise Power (Sheet 4 of 4)

12-C-A15-60-2439-05A-030A-A

LONG RANGE CRUISE - 1550 RPM

			@ 7000 lb (3175 kg)					@ 8000 lb (3629 kg)					@ 9000 lb (4082 kg)					@ 10000 lb (4536 kg)					@ 10400 lb (4717 kg)				
ISA (ºC)	Altitude (ft)	SAT (ºC)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)
-40	0	-25	20.0	420	191	184	170	20.0	420	191	182	169	20.0	420	191	182	167	20.0	420	191	177	164	20.0	421	201	176	163
	2000	-29	19.7	401	182	181	172	19.7	402	182	179	171	19.8	403	183	179	169	20.0	405	184	176	167	20.0	405	193	175	166
	4000	-33	19.3	383	174	178	175	19.5	384	174	177	174	19.6	386	175	177	172	20.0	389	177	174	171	20.0	389	185	173	169
	6000	-37	19.0	365	166	176	177	19.2	367	166	174	176	19.4	369	167	174	174	20.0	374	170	172	174	20.0	374	178	171	173
	8000	-41	18.7	348	158	173	179	18.9	350	159	172	178	19.2	353	160	172	176	20.0	360	163	170	177	20.0	360	171	169	176
	10000	-45	18.3	332	151	170	181	18.7	335	152	169	180	19.0	338	153	169	179	20.0	347	157	168	180	20.0	347	164	167	179
	12000	-49	18.0	319	145	167	184	18.4	323	146	166	182	18.8	327	148	166	181	20.0	337	153	166	183	20.0	337	160	165	182
	14000	-53	17.7	307	139	164	186	18.1	311	141	163	185	18.6	315	143	163	183	20.0	328	149	164	186	20.0	328	155	163	185
	16000	-57	17.3	294	133	161	188	17.9	298	135	160	187	18.4	303	138	160	186	20.0	317	144	162	189	20.0	317	150	161	188
	18000	-61	17.0	280	127	157	190	17.6	285	129	157	189	18.2	290	132	157	188	20.0	306	139	160	193	20.0	306	145	158	191
	20000	-65	16.7	266	121	154	192	17.3	272	123	153	191	18.0	278	126	153	190	20.0	296	134	157	196	20.0	296	140	156	194
	22000	-69	16.3	254	115	150	194	17.1	261	118	150	193	17.8	268	121	150	193	20.0	287	130	155	199	20.0	287	136	154	197
	24000	-73	16.0	243	110	147	195	16.8	250	113	147	195	17.6	257	117	147	195	20.0	278	126	153	203	20.0	278	132	151	200
	26000	-77	15.7	232	105	144	197	16.5	240	109	144	197	17.4	248	112	144	197	20.0	271	123	150	206	20.0	271	128	148	203
	28000	-81	15.3	222	101	140	199	16.3	231	105	140	199	17.2	239	109	140	199	20.0	265	120	147	209	20.0	265	124	145	206
	30000	-84	15.0	213	97	136	200	16.0	222	101	137	201	17.0	232	105	137	200	20.0	260	118	144	212	20.0	260	122	142	209
-30	0	-15	20.0	425	193	183	173	20.0	425	193	181	171	20.0	425	193	181	169	20.0	425	193	176	166	20.0	425	203	175	165
	2000	-19	19.7	406	184	180	175	19.7	407	184	178	173	19.8	407	185	178	171	20.0	410	186	174	170	20.0	410	195	173	168
	4000	-23	19.3	387	176	177	177	19.5	389	176	176	176	19.6	390	177	176	174	20.0	394	179	173	173	20.0	394	187	171	171
	6000	-27	19.0	369	168	174	179	19.2	371	168	173	178	19.4	373	169	173	176	20.0	379	172	171	176	20.0	379	180	169	174
	8000	-31	18.7	352	160	171	182	18.9	355	161	170	180	19.2	357	162	170	178	20.0	365	165	169	179	20.0	365	173	167	177
	10000	-35	18.3	336	152	168	184	18.7	339	154	167	182	19.0	342	155	167	181	20.0	351	159	167	182	20.0	351	166	165	180
	12000	-39	18.0	323	147	165	186	18.4	327	148	164	185	18.8	331	150	164	183	20.0	341	155	164	185	20.0	341	161	163	183
	14000	-43	17.7	311	141	162	188	18.1	315	143	161	187	18.6	319	145	161	185	20.0	331	150	162	188	20.0	332	157	161	187
	16000	-47	17.3	297	135	159	190	17.9	302	137	158	189	18.4	307	139	158	188	20.0	321	146	160	191	20.0	321	152	159	190
	18000	-51	17.0	283	128	155	192	17.6	289	131	155	191	18.2	294	133	155	190	20.0	310	141	158	195	20.0	310	147	156	193
	20000	-55	16.7	270	122	152	194	17.3	276	125	152	193	18.0	282	128	152	192	20.0	299	136	155	198	20.0	300	142	154	196
	22000	-59	16.3	257	117	149	196	17.1	264	120	148	195	17.8	271	123	148	195	20.0	290	132	153	201	20.0	290	137	151	199
	24000	-63	16.0	246	111	145	198	16.8	253	115	145	197	17.6	260	118	145	197	20.0	282	128	150	205	20.0	282	133	148	202
	26000	-67	15.7	235	106	141	199	16.5	242	110	141	199	17.4	251	114	141	198	20.0	274	124	147	207	20.0	274	129	145	205
	28000	-71	15.3	225	102	138	201	16.3	233	106	138	201	17.2	242	110	138	200	20.0	268	122	144	210	20.0	268	126	142	207
	30000	-74	15.0	216	98	134	202	16.0	225	102	134	203	17.0	234	106	134	201	20.0	263	119	141	213	20.0	263	123	139	210

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Figure 5-1-27: Propeller Low Speed - Performance - Long Range Cruise (Sheet 1 of 4)

LONG RANGE CRUISE - 1550 RPM

			@ 7000 lb (3175 kg)					@ 8000 lb (3629 kg)					@ 9000 lb (4082 kg)					@ 10000 lb (4536 kg)					@ 10400 lb (4717 kg)				
ISA (ºC)	Altitude (ft)	SAT (ºC)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)
-20	0	-5	20.0	430	195	182	175	20.0	430	195	180	173	20.0	430	195	180	171	20.0	430	195	175	168	20.0	430	205	174	167
	2000	-9	19.7	410	186	179	177	19.7	411	186	177	176	19.8	412	187	177	173	20.0	414	188	173	171	20.0	414	197	172	170
	4000	-13	19.3	392	178	176	179	19.5	393	178	174	178	19.6	395	179	174	176	20.0	399	181	171	174	20.0	399	189	170	173
	6000	-17	19.0	374	170	173	181	19.2	376	170	171	180	19.4	378	171	171	178	20.0	384	174	169	178	20.0	384	182	168	176
	8000	-21	18.7	356	162	170	184	18.9	359	163	168	182	19.2	362	164	168	180	20.0	369	167	167	181	20.0	369	175	166	179
	10000	-25	18.3	340	154	167	186	18.7	343	156	166	184	19.0	346	157	166	183	20.0	355	161	165	184	20.0	355	168	163	182
	12000	-29	18.0	327	148	164	188	18.4	331	150	162	187	18.8	335	152	162	185	20.0	345	157	163	187	20.0	345	163	161	185
	14000	-33	17.7	315	143	161	190	18.1	319	145	159	189	18.6	323	147	159	187	20.0	336	152	160	190	20.0	336	159	159	189
	16000	-37	17.3	301	137	157	192	17.9	306	139	156	191	18.4	311	141	156	190	20.0	325	147	158	193	20.0	325	154	157	192
	18000	-41	17.0	287	130	154	194	17.6	292	132	153	193	18.2	298	135	153	192	20.0	314	142	156	197	20.0	314	148	154	195
	20000	-45	16.7	273	124	150	196	17.3	279	127	150	195	18.0	285	129	150	194	20.0	303	137	153	200	20.0	303	143	152	198
	22000	-49	16.3	260	118	147	198	17.1	267	121	146	197	17.8	274	124	146	196	20.0	293	133	151	203	20.0	293	139	149	200
	24000	-53	16.0	248	113	143	200	16.8	256	116	143	199	17.6	263	119	143	198	20.0	285	129	148	206	20.0	285	134	146	203
	26000	-57	15.7	238	108	139	201	16.5	245	111	139	201	17.4	254	115	139	200	20.0	277	126	145	209	20.0	278	130	143	206
	28000	-61	15.3	228	103	136	203	16.3	236	107	136	203	17.2	245	111	136	201	20.0	271	123	142	212	20.0	271	127	140	208
	30000	-64	15.0	218	99	132	204	16.0	227	103	132	204	17.0	237	107	132	203	20.0	266	121	139	215	20.0	266	124	136	211
-10	0	5	20.0	434	197	180	177	20.0	435	197	179	175	20.0	435	197	179	173	20.0	435	197	173	170	20.0	435	207	172	169
	2000	1	19.7	415	188	177	179	19.7	416	189	176	177	19.8	417	189	176	175	20.0	419	190	171	173	20.0	419	199	170	172
	4000	-3	19.3	396	180	174	181	19.5	398	180	173	180	19.6	399	181	173	177	20.0	403	183	169	176	20.0	403	192	168	175
	6000	-7	19.0	378	172	172	184	19.2	380	172	170	182	19.4	382	173	170	180	20.0	388	176	167	179	20.0	388	184	166	178
	8000	-11	18.7	361	164	169	186	18.9	363	165	167	184	19.2	366	166	167	182	20.0	373	169	165	182	20.0	374	177	164	181
	10000	-15	18.3	344	156	165	188	18.7	347	158	164	186	19.0	350	159	164	185	20.0	360	163	163	185	20.0	360	170	162	184
	12000	-19	18.0	331	150	162	190	18.4	335	152	161	189	18.8	338	153	161	187	20.0	349	158	161	189	20.0	349	165	160	187
	14000	-23	17.7	319	145	159	192	18.1	323	146	158	191	18.6	327	148	158	189	20.0	340	154	159	192	20.0	340	160	157	190
	16000	-27	17.3	305	138	156	194	17.9	310	140	155	193	18.4	315	143	155	191	20.0	329	149	156	195	20.0	329	155	155	193
	18000	-31	17.0	290	132	152	196	17.6	296	134	151	195	18.2	301	137	151	194	20.0	318	144	154	198	20.0	318	150	152	196
	20000	-35	16.7	276	125	148	198	17.3	283	128	148	197	18.0	289	131	148	196	20.0	307	139	151	201	20.0	307	145	149	199
	22000	-39	16.3	263	119	145	200	17.1	270	123	144	199	17.8	277	126	144	198	20.0	297	135	148	204	20.0	297	140	146	202
	24000	-43	16.0	251	114	141	202	16.8	259	117	141	201	17.6	266	121	141	200	20.0	288	131	145	207	20.0	288	136	143	204
	26000	-47	15.7	240	109	138	203	16.5	248	113	137	203	17.4	256	116	137	201	20.0	280	127	142	210	20.0	281	132	140	207
	28000	-51	15.3	230	104	134	205	16.3	239	108	134	204	17.2	248	112	134	203	20.0	274	124	139	213	20.0	274	128	137	209
	30000	-54	15.0	221	100	130	206	16.0	230	104	130	206	17.0	240	109	130	204	20.0	269	122	136	216	20.0	269	126	133	211

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Figure 5-1-27: Propeller Low Speed - Performance - Long Range Cruise (Sheet 2 of 4)

LONG RANGE CRUISE - 1550 RPM

			@ 7000 lb (3175 kg)					@ 8000 lb (3629 kg)					@ 9000 lb (4082 kg)					@ 10000 lb (4536 kg)					@ 10400 lb (4717 kg)				
ISA (°C)	Altitude (ft)	SAT (°C)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)
0	0	15	20.0	438	199	179	179	20.0	438	199	177	177	20.0	438	199	177	174	20.0	439	199	172	172	20.0	439	209	171	171
	2000	11	19.7	419	190	176	181	19.7	420	190	174	179	19.8	421	191	174	177	20.0	423	192	170	175	20.0	423	201	169	174
	4000	7	19.3	400	181	173	183	19.5	401	182	172	182	19.6	403	183	172	179	20.0	407	185	168	178	20.0	407	193	167	177
	6000	3	19.0	382	173	170	186	19.2	384	174	169	184	19.4	386	175	169	182	20.0	392	178	166	181	20.0	392	186	165	180
	8000	-1	18.7	365	165	167	188	18.9	367	167	166	186	19.2	370	168	166	184	20.0	377	171	164	184	20.0	377	178	162	183
	10000	-5	18.3	347	158	164	190	18.7	351	159	163	188	19.0	354	160	163	186	20.0	363	165	162	187	20.0	363	171	160	186
	12000	-9	18.0	335	152	161	192	18.4	338	153	159	191	18.8	342	155	159	189	20.0	353	160	159	190	20.0	353	166	158	189
	14000	-13	17.7	322	146	157	194	18.1	326	148	156	193	18.6	331	150	156	191	20.0	343	156	157	193	20.0	343	162	155	192
	16000	-17	17.3	308	140	154	196	17.9	313	142	153	195	18.4	318	144	153	193	20.0	333	151	154	197	20.0	333	157	153	195
	18000	-21	17.0	294	133	150	198	17.6	299	136	149	197	18.2	305	138	149	195	20.0	321	146	152	200	20.0	321	151	150	197
	20000	-25	16.7	279	127	147	200	17.3	285	129	146	199	18.0	292	132	146	197	20.0	310	141	149	203	20.0	310	146	147	200
	22000	-29	16.3	266	121	143	202	17.1	273	124	142	201	17.8	280	127	142	199	20.0	300	136	146	205	20.0	300	141	144	203
	24000	-33	16.0	254	115	139	203	16.8	262	119	139	203	17.6	269	122	139	201	20.0	291	132	143	208	20.0	291	137	141	206
	26000	-37	15.7	243	110	136	205	16.5	251	114	135	204	17.4	259	118	135	202	20.0	283	129	140	211	20.0	284	133	138	208
	28000	-41	15.3	233	105	132	207	16.3	241	109	132	206	17.2	250	113	132	204	20.0	277	126	137	214	20.0	277	129	134	210
	30000	-44	15.0	223	101	128	208	16.0	232	105	128	207	17.0	242	110	128	205	20.0	271	123	134	216	20.0	271	126	131	212
10	0	25	20.0	443	201	178	181	20.0	443	201	176	179	20.0	443	201	176	176	20.0	443	201	171	173	20.0	443	211	169	172
	2000	21	19.7	423	192	175	183	19.7	424	192	173	181	19.8	425	193	173	179	20.0	427	194	169	176	20.0	427	203	167	175
	4000	17	19.3	404	183	172	185	19.5	406	184	170	183	19.6	407	185	170	181	20.0	411	187	167	179	20.0	411	195	165	178
	6000	13	19.0	386	175	169	188	19.2	388	176	167	186	19.4	390	177	167	183	20.0	396	180	164	183	20.0	396	188	163	181
	8000	9	18.7	369	167	166	190	18.9	371	168	164	188	19.2	374	170	164	186	20.0	382	173	162	186	20.0	382	180	161	184
	10000	5	18.3	352	160	163	192	18.7	355	161	161	190	19.0	358	162	161	188	20.0	367	167	160	189	20.0	368	173	158	187
	12000	1	18.0	338	153	159	194	18.4	342	155	158	192	18.8	346	157	158	190	20.0	357	162	157	192	20.0	357	168	156	190
	14000	-3	17.7	326	148	156	196	18.1	330	150	154	194	18.6	335	152	154	192	20.0	347	158	155	195	20.0	347	163	153	193
	16000	-7	17.3	312	141	152	198	17.9	317	144	151	196	18.4	322	146	151	194	20.0	337	153	152	198	20.0	337	158	151	196
	18000	-11	17.0	297	135	149	200	17.6	303	137	148	198	18.2	308	140	148	197	20.0	325	147	150	201	20.0	325	153	148	198
	20000	-15	16.7	283	128	145	202	17.3	289	131	144	200	18.0	295	134	144	199	20.0	314	142	147	204	20.0	314	148	145	201
	22000	-19	16.3	269	122	141	203	17.1	276	125	141	202	17.8	283	128	141	201	20.0	304	138	144	207	20.0	304	143	142	204
	24000	-23	16.0	257	117	138	205	16.8	265	120	137	204	17.6	272	124	137	202	20.0	295	134	141	210	20.0	295	138	139	206
	26000	-27	15.7	246	111	134	207	16.5	254	115	133	206	17.4	262	119	133	204	20.0	287	130	138	212	20.0	287	134	135	209
	28000	-31	15.3	235	107	130	208	16.3	244	111	130	207	17.2	253	115	130	205	20.0	280	127	135	215	20.0	280	131	132	211
	30000	-34	15.0	225	102	127	210	16.0	235	106	126	208	17.0	245	111	126	205	20.0	274	124	131	217	20.0	275	128	128	212

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Figure 5-1-27: Propeller Low Speed - Performance - Long Range Cruise (Sheet 3 of 4)

LONG RANGE CRUISE - 1550 RPM

			@ 7000 lb (3175 kg)					@ 8000 lb (3629 kg)					@ 9000 lb (4082 kg)					@ 10000 lb (4536 kg)					@ 10400 lb (4717 kg)				
ISA (ºC)	Altitude (ft)	SAT (ºC)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	IAS (kt)	TAS (kt)
20	0	35	20.0	448	203	177	182	20.0	448	203	175	181	20.0	448	203	175	178	20.0	448	203	169	175	20.0	448	214	168	174
	2000	31	19.7	428	194	174	185	19.7	428	194	172	183	19.8	429	195	172	180	20.0	432	196	167	178	20.0	432	205	166	177
	4000	27	19.3	409	185	171	187	19.5	410	186	169	185	19.6	412	187	169	183	20.0	416	189	165	181	20.0	416	197	164	180
	6000	23	19.0	391	177	168	189	19.2	393	178	166	187	19.4	395	179	166	185	20.0	401	182	163	184	20.0	401	190	162	183
	8000	19	18.7	373	169	165	192	18.9	376	170	163	189	19.2	378	172	163	187	20.0	386	175	161	187	20.0	386	182	159	186
	10000	15	18.3	356	161	161	194	18.7	359	163	159	192	19.0	362	164	159	189	20.0	372	169	158	190	20.0	372	176	157	189
	12000	11	18.0	342	155	158	196	18.4	346	157	156	194	18.8	350	159	156	192	20.0	361	164	156	193	20.0	361	170	154	191
	14000	7	17.7	330	150	154	198	18.1	334	152	153	196	18.6	339	154	153	194	20.0	352	159	153	196	20.0	352	165	151	194
	16000	3	17.3	316	143	151	199	17.9	321	146	149	198	18.4	326	148	149	196	20.0	341	155	151	199	20.0	341	160	149	197
	18000	-1	17.0	301	136	147	201	17.6	307	139	146	200	18.2	312	142	146	198	20.0	329	149	148	202	20.0	329	154	146	200
	20000	-5	16.7	286	130	143	203	17.3	293	133	142	202	18.0	299	136	142	200	20.0	318	144	145	205	20.0	318	149	143	202
	22000	-9	16.3	273	124	140	205	17.1	280	127	139	204	17.8	287	130	139	202	20.0	307	139	142	208	20.0	308	144	140	205
	24000	-13	16.0	260	118	136	207	16.8	268	122	135	206	17.6	276	125	135	203	20.0	298	135	139	211	20.0	298	140	136	207
	26000	-17	15.7	249	113	133	208	16.5	257	117	132	207	17.4	266	120	132	205	20.0	290	132	136	213	20.0	290	136	133	209
	28000	-21	15.3	238	108	129	210	16.3	247	112	128	208	17.2	256	116	128	205	20.0	283	129	132	216	20.0	284	132	129	211
	30000	-24	15.0	228	104	125	211	16.0	238	108	123	209	17.0	248	112	123	205	20.0	278	126	129	218	20.0	278	129	124	210
30	0	45	20.0	453	205	176	184	20.0	453	205	174	182	20.0	453	205	174	179	20.0	453	205	168	176	20.0	453	216	167	175
	2000	41	19.7	432	196	173	187	19.7	433	196	171	184	19.8	434	197	171	182	20.0	436	198	166	179	20.0	436	208	165	178
	4000	37	19.3	413	187	170	189	19.5	415	188	168	187	19.6	416	189	168	184	20.0	420	191	164	182	20.0	421	200	162	181
	6000	33	19.0	395	179	166	191	19.2	397	180	164	189	19.4	399	181	164	186	20.0	405	184	161	185	20.0	405	193	160	184
	8000	29	18.7	377	171	163	193	18.9	380	172	161	191	19.2	383	174	161	189	20.0	391	177	159	188	20.0	391	186	158	187
	10000	25	18.3	360	163	160	195	18.7	363	165	158	193	19.0	367	166	158	191	20.0	376	171	156	191	20.0	376	178	155	190
	12000	21	18.0	347	157	156	197	18.4	350	159	155	195	18.8	354	161	155	193	20.0	365	166	154	195	20.0	365	173	152	193
	14000	17	17.7	334	151	153	199	18.1	338	153	151	197	18.6	343	155	151	195	20.0	356	161	151	198	20.0	356	168	150	195
	16000	13	17.3	320	145	149	201	17.9	325	147	148	199	18.4	330	150	148	197	20.0	345	156	149	201	20.0	345	162	147	198
	18000	9	17.0	305	138	146	203	17.6	310	141	144	201	18.2	316	143	144	200	20.0	333	151	146	203	20.0	333	156	144	201
	20000	5	16.7	290	132	142	205	17.3	296	134	141	203	18.0	303	137	141	201	20.0	321	146	143	206	20.0	322	151	141	203
	22000	1	16.3	276	125	138	207	17.1	283	128	137	205	17.8	290	132	137	203	20.0	311	141	140	209	20.0	311	146	138	206
	24000	-3	16.0	263	119	135	208	16.8	271	123	134	207	17.6	279	127	134	204	20.0	302	137	137	212	20.0	302	141	134	208
	26000	-7	15.7	252	114	131	210	16.5	260	118	130	208	17.4	269	122	130	205	20.0	294	133	133	214	20.0	294	137	131	210
	28000	-11	15.3	241	109	127	211	16.3	250	113	126	209	17.2	260	118	126	205	20.0	287	130	130	216	20.0	288	134	126	209
	30000	-14	15.0	231	105	122	211	16.0	241	109	121	209	17.0	251	114	121	204	20.0	281	128	125	216	20.0	282	130	121	208

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Figure 5-1-27: Propeller Low Speed - Performance - Long Range Cruise (Sheet 4 of 4)

MAXIMUM ENDURANCE CRUISE - 1550 RPM

NOTE: INDICATED AIRSPEED IS 115 KTS CONSTANT

				@ 7000 lb (3175 kg)			@ 8000 lb (3629 kg)			@ 9000 lb (4082 kg)			@ 10000 lb (4536 kg)			@ 10400 lb (4717 kg)		
ISA (°C)	Altitude (ft)	SAT (°C)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)
-40	0	-25	107	9.1	301	136	9.7	307	139	10.3	315	143	11.0	322	146	11.2	325	148
	2000	-29	110	9.1	287	130	9.7	293	133	10.3	301	136	10.9	308	140	11.2	311	141
	4000	-33	113	9.1	274	124	9.6	280	127	10.3	287	130	10.9	295	134	11.2	298	135
	6000	-37	117	9.0	261	119	9.6	268	121	10.3	275	125	11.0	283	128	11.3	287	130
	8000	-41	120	9.0	250	113	9.6	256	116	10.3	264	120	11.1	273	124	11.5	276	125
	10000	-45	124	9.0	240	109	9.7	247	112	10.5	255	116	11.3	264	120	11.7	267	121
	12000	-49	127	9.1	232	105	9.8	240	109	10.7	248	113	11.5	257	117	11.9	261	118
	14000	-53	131	9.2	226	103	10.0	233	106	10.8	242	110	11.8	251	114	12.1	255	116
	16000	-57	135	9.4	219	99	10.1	226	103	11.1	235	107	12.0	245	111	12.4	248	113
	18000	-61	140	9.5	212	96	10.3	219	99	11.3	228	104	12.3	238	108	12.7	241	109
	20000	-65	144	9.7	205	93	10.5	212	96	11.6	222	101	12.7	232	105	13.1	236	107
	22000	-69	149	9.9	198	90	10.8	206	93	11.9	216	98	13.0	226	103	13.5	230	104
	24000	-73	154	10.2	192	87	11.1	201	91	12.2	211	96	13.4	221	100	13.9	226	102
	26000	-77	159	10.4	187	85	11.4	196	89	12.6	207	94	13.8	218	99	14.3	222	101
	28000	-81	164	10.7	183	83	11.8	192	87	13.0	203	92	14.3	215	97	14.8	219	99
	30000	-84	170	11.0	179	81	12.1	189	86	13.5	201	91	14.8	213	97	15.3	218	99
-30	0	-15	109	9.1	304	138	9.7	311	141	10.3	319	144	11.0	326	148	11.2	329	149
	2000	-19	112	9.1	290	132	9.7	297	134	10.3	304	138	11.0	312	141	11.2	315	143
	4000	-23	116	9.1	277	126	9.6	283	128	10.3	291	132	11.0	299	136	11.3	302	137
	6000	-27	119	9.0	264	120	9.6	271	123	10.3	279	127	11.1	288	131	11.5	291	132
	8000	-31	123	9.1	253	115	9.7	260	118	10.5	269	122	11.3	278	126	11.6	281	128
	10000	-35	126	9.1	243	110	9.8	251	114	10.6	260	118	11.5	269	122	11.8	272	123
	12000	-39	130	9.2	236	107	10.0	244	111	10.8	253	115	11.7	262	119	12.1	266	121
	14000	-43	134	9.4	230	104	10.1	237	108	11.0	247	112	12.0	256	116	12.4	260	118
	16000	-47	138	9.5	223	101	10.3	231	105	11.3	240	109	12.3	250	113	12.7	254	115
	18000	-51	143	9.7	216	98	10.5	224	101	11.6	233	106	12.6	243	110	13.0	247	112
	20000	-55	147	9.9	209	95	10.8	217	98	11.9	227	103	13.0	237	108	13.4	241	109
	22000	-59	152	10.1	203	92	11.1	211	96	12.2	222	100	13.4	232	105	13.8	236	107
	24000	-63	157	10.4	197	89	11.4	206	93	12.6	217	98	13.8	227	103	14.3	232	105
	26000	-67	163	10.7	192	87	11.7	201	91	13.0	213	96	14.2	224	102	14.7	228	104
	28000	-71	168	11.0	188	85	12.1	198	90	13.4	210	95	14.7	221	100	15.3	226	103
	30000	-74	174	11.4	185	84	12.5	195	88	13.9	207	94	15.3	220	100	15.8	225	102

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Figure 5-1-28: Propeller Low Speed - Performance - Maximum Endurance Cruise (Sheet 1 of 4)

MAXIMUM ENDURANCE CRUISE - 1550 RPM

NOTE: INDICATED AIRSPEED IS 115 KTS CONSTANT

				@ 7000 lb (3175 kg)			@ 8000 lb (3629 kg)			@ 9000 lb (4082 kg)			@ 10000 lb (4536 kg)			@ 10400 lb (4717 kg)		
ISA (ºC)	Altitude (ft)	SAT (ºC)	TAS (kt)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)
-20	0	-5	111	9.2	308	140	9.7	314	143	10.4	322	146	11.0	330	150	11.2	332	151
	2000	-9	114	9.1	293	133	9.7	300	136	10.3	308	140	11.0	316	143	11.3	319	145
	4000	-13	118	9.1	280	127	9.7	287	130	10.4	295	134	11.1	304	138	11.4	307	139
	6000	-17	121	9.1	268	121	9.7	275	125	10.5	283	129	11.3	293	133	11.6	296	134
	8000	-21	125	9.1	257	116	9.8	264	120	10.6	273	124	11.5	283	128	11.8	286	130
	10000	-25	129	9.2	247	112	9.9	255	116	10.8	264	120	11.7	274	124	12.0	278	126
	12000	-29	133	9.4	240	109	10.1	248	112	11.0	257	117	11.9	268	121	12.3	272	123
	14000	-33	137	9.5	234	106	10.3	242	110	11.2	252	114	12.2	262	119	12.6	266	121
	16000	-37	141	9.7	227	103	10.5	235	107	11.5	245	111	12.5	256	116	13.0	260	118
	18000	-41	146	9.9	220	100	10.7	228	104	11.8	238	108	12.9	249	113	13.3	253	115
	20000	-45	151	10.1	213	97	11.0	222	101	12.1	232	105	13.3	243	110	13.7	247	112
	22000	-49	156	10.4	207	94	11.3	216	98	12.5	227	103	13.7	238	108	14.2	242	110
	24000	-53	161	10.6	202	91	11.7	211	96	12.9	222	101	14.1	233	106	14.6	238	108
	26000	-57	167	11.0	197	89	12.0	207	94	13.3	218	99	14.6	230	104	15.2	235	107
	28000	-61	172	11.3	193	88	12.4	203	92	13.8	216	98	15.2	228	103	15.7	233	106
	30000	-64	178	11.7	190	86	12.9	200	91	14.3	213	97	15.7	226	103	16.3	232	105
-10	0	5	113	9.2	311	141	9.7	318	144	10.4	326	148	11.0	334	151	11.3	337	153
	2000	1	117	9.1	297	134	9.7	303	138	10.4	311	141	11.1	320	145	11.4	324	147
	4000	-3	120	9.1	283	129	9.7	290	132	10.5	299	136	11.2	308	140	11.6	312	142
	6000	-7	124	9.1	271	123	9.8	279	126	10.6	288	131	11.4	298	135	11.8	301	137
	8000	-11	127	9.2	261	118	9.9	268	122	10.8	278	126	11.6	288	130	12.0	292	132
	10000	-15	131	9.3	251	114	10.1	259	117	10.9	269	122	11.9	279	126	12.2	283	128
	12000	-19	136	9.5	244	111	10.2	252	114	11.2	262	119	12.2	273	124	12.5	277	126
	14000	-23	140	9.6	238	108	10.4	246	112	11.4	257	116	12.5	267	121	12.9	272	123
	16000	-27	144	9.8	231	105	10.7	240	109	11.7	250	114	12.8	261	118	13.2	266	120
	18000	-31	149	10.0	224	102	11.0	233	106	12.0	244	110	13.2	255	115	13.6	259	117
	20000	-35	154	10.3	218	99	11.2	227	103	12.4	238	108	13.6	249	113	14.1	253	115
	22000	-39	159	10.6	212	96	11.6	221	100	12.8	232	105	14.0	244	111	14.5	248	113
	24000	-43	165	10.9	207	94	11.9	216	98	13.2	228	103	14.5	240	109	15.0	245	111
	26000	-47	170	11.2	202	92	12.3	212	96	13.7	224	102	15.0	236	107	15.6	241	109
	28000	-51	176	11.6	198	90	12.8	209	95	14.2	222	101	15.6	234	106	16.2	240	109
	30000	-54	183	12.0	195	88	13.2	206	93	14.7	219	100	16.2	233	106	16.8	239	108

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Figure 5-1-28: Propeller Low Speed - Performance - Maximum Endurance Cruise (Sheet 2 of 4)

MAXIMUM ENDURANCE CRUISE - 1550 RPM

NOTE: INDICATED AIRSPEED IS 115 KTS CONSTANT

ISA (ºC)	Altitude (ft)	SAT (ºC)	TAS (kt)	@ 7000 lb (3175 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 8000 lb (3629 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 9000 lb (4082 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 10000 lb (4536 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 10400 lb (4717 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)
0	0	15	115	9.2	314	142	9.8	321	145	10.4	329	149	11.1	337	153	11.4	341	154
	2000	11	119	9.2	300	136	9.8	307	139	10.5	315	143	11.2	324	147	11.5	328	149
	4000	7	122	9.2	286	130	9.8	294	133	10.6	303	137	11.4	312	142	11.7	316	143
	6000	3	126	9.2	275	125	9.9	282	128	10.7	292	132	11.6	302	137	11.9	306	139
	8000	-1	130	9.3	264	120	10.0	272	123	10.9	282	128	11.8	292	133	12.2	297	134
	10000	-5	134	9.4	254	115	10.2	262	119	11.1	272	124	12.1	283	128	12.5	287	130
	12000	-9	138	9.6	248	112	10.4	256	116	11.4	267	121	12.4	278	126	12.8	282	128
	14000	-13	143	9.8	241	109	10.6	250	113	11.6	261	118	12.7	272	124	13.1	277	126
	16000	-17	147	10.0	235	107	10.9	244	111	11.9	255	116	13.1	266	121	13.5	271	123
	18000	-21	152	10.2	228	103	11.2	237	108	12.3	249	113	13.5	260	118	13.9	265	120
	20000	-25	157	10.5	221	100	11.5	231	105	12.7	242	110	13.9	254	115	14.4	258	117
	22000	-29	163	10.8	216	98	11.8	226	102	13.1	238	108	14.4	250	113	14.9	254	115
	24000	-33	168	11.1	211	96	12.2	221	100	13.6	233	106	14.9	245	111	15.4	250	113
	26000	-37	174	11.5	206	94	12.6	217	98	14.0	229	104	15.4	242	110	16.0	247	112
	28000	-41	180	11.9	203	92	13.1	214	97	14.6	227	103	16.0	240	109	16.6	246	112
	30000	-44	187	12.3	200	90	13.6	211	96	15.1	225	102	16.7	239	109	17.3	245	111
10	0	25	117	9.2	317	144	9.8	324	147	10.5	333	151	11.2	342	155	11.5	345	157
	2000	21	121	9.2	303	137	9.8	310	141	10.6	319	145	11.3	328	149	11.7	332	151
	4000	17	124	9.2	290	131	9.9	298	135	10.7	307	139	11.5	317	144	11.8	321	146
	6000	13	128	9.3	278	126	10.0	286	130	10.8	296	134	11.7	307	139	12.1	311	141
	8000	9	132	9.4	268	121	10.1	276	125	11.0	286	130	12.0	297	135	12.4	302	137
	10000	5	136	9.6	258	117	10.3	267	121	11.3	278	126	12.3	289	131	12.7	293	133
	12000	1	141	9.7	252	114	10.5	261	118	11.6	272	123	12.6	283	128	13.0	288	130
	14000	-3	145	9.9	246	111	10.8	255	116	11.9	266	121	12.9	278	126	13.4	283	128
	16000	-7	150	10.2	239	108	11.1	249	113	12.2	260	118	13.3	272	123	13.8	277	126
	18000	-11	155	10.4	232	105	11.4	242	110	12.5	254	115	13.8	266	121	14.2	271	123
	20000	-15	160	10.7	226	102	11.7	236	107	13.0	248	112	14.2	260	118	14.7	265	120
	22000	-19	166	11.0	220	100	12.1	231	105	13.4	243	110	14.7	255	116	15.2	260	118
	24000	-23	172	11.4	215	98	12.5	226	102	13.9	239	108	15.3	251	114	15.8	257	116
	26000	-27	178	11.8	211	96	13.0	222	101	14.4	235	107	15.9	249	113	16.4	254	115
	28000	-31	184	12.3	208	94	13.5	219	99	15.0	233	106	16.5	247	112	17.1	253	115
	30000	-34	191	12.7	206	93	14.0	217	99	15.6	232	105	17.2	247	112	17.8	254	115

ICN-12-C-A150905-A-S4080-00371-A-001-01

Figure 5-1-28: Propeller Low Speed - Performance - Maximum Endurance Cruise (Sheet 3 of 4)

MAXIMUM ENDURANCE CRUISE - 1550 RPM

NOTE: INDICATED AIRSPEED IS 115 KTS CONSTANT

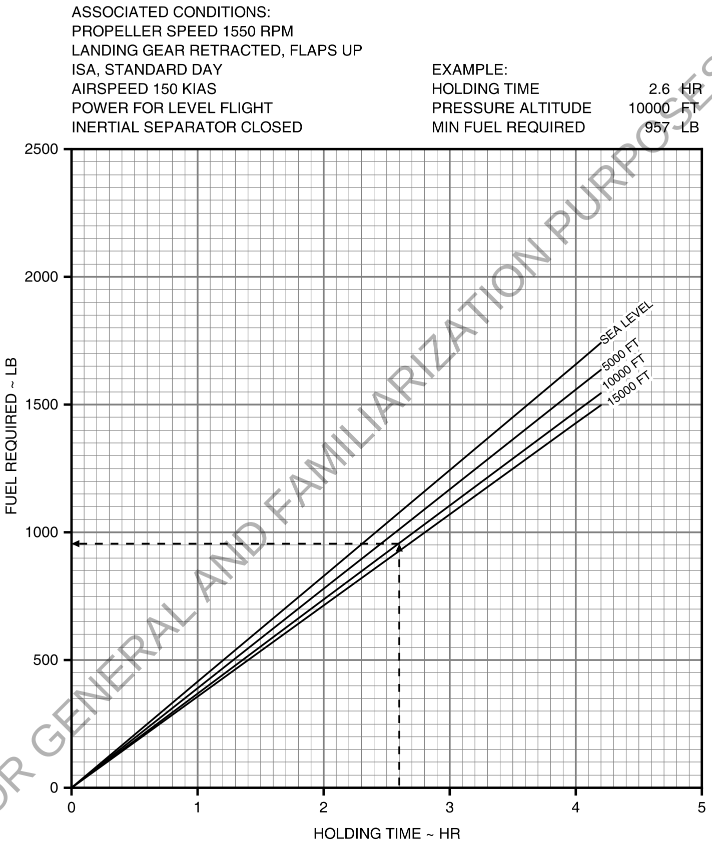
ISA (ºC)	Altitude (ft)	SAT (ºC)	TAS (kt)	@ 7000 lb (3175 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 8000 lb (3629 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 9000 lb (4082 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 10000 lb (4536 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)	@ 10400 lb (4717 kg) Torque (psi)	Fuel flow (lb/h)	Fuel flow (kg/h)
20	0	35	119	9.3	321	146	9.8	329	149	10.6	337	153	11.3	347	157	11.6	350	159
	2000	31	123	9.3	306	139	9.9	314	142	10.6	323	147	11.5	333	151	11.8	337	153
	4000	27	127	9.3	294	133	10.0	302	137	10.8	312	141	11.7	322	146	12.0	326	148
	6000	23	130	9.4	282	128	10.1	291	132	11.0	301	137	11.9	312	142	12.3	316	144
	8000	19	135	9.5	272	123	10.3	280	127	11.2	291	132	12.2	303	137	12.5	307	139
	10000	15	139	9.7	262	119	10.5	271	123	11.5	283	128	12.5	294	133	12.9	299	136
	12000	11	143	9.9	256	116	10.7	265	120	11.7	277	126	12.8	289	131	13.2	293	133
	14000	7	148	10.1	250	113	11.0	260	118	12.1	272	123	13.2	284	129	13.6	289	131
	16000	3	153	10.3	244	111	11.3	254	115	12.4	266	120	13.6	278	126	14.1	283	128
	18000	-1	158	10.6	237	107	11.6	247	112	12.8	259	118	14.0	272	123	14.5	277	126
	20000	-5	163	10.9	231	105	12.0	241	109	13.2	253	115	14.5	266	121	15.0	271	123
	22000	-9	169	11.3	226	102	12.4	236	107	13.7	249	113	15.1	262	119	15.6	267	121
	24000	-13	175	11.7	221	100	12.8	232	105	14.3	245	111	15.7	258	117	16.2	264	120
	26000	-17	181	12.1	217	98	13.3	228	104	14.8	242	110	16.3	256	116	16.9	262	119
	28000	-21	188	12.6	214	97	13.9	226	102	15.4	240	109	17.0	255	116	17.6	261	118
	30000	-24	195	13.1	212	96	14.4	224	102	16.1	239	108	17.7	256	116	18.4	263	119
30	0	45	121	9.3	326	148	9.9	333	151	10.6	342	155	11.4	351	159	11.7	355	161
	2000	41	125	9.3	310	141	10.0	318	144	10.7	328	149	11.6	338	153	11.9	342	155
	4000	37	129	9.4	297	135	10.0	306	139	10.9	316	143	11.8	327	148	12.2	332	150
	6000	33	133	9.5	286	130	10.2	295	134	11.1	306	139	12.1	317	144	12.4	322	146
	8000	29	137	9.6	276	125	10.4	285	129	11.3	296	134	12.4	308	140	12.7	313	142
	10000	25	141	9.8	267	121	10.6	276	125	11.6	288	130	12.7	300	136	13.1	305	138
	12000	21	146	10.0	260	118	10.9	270	122	11.9	282	128	13.0	294	134	13.5	299	136
	14000	17	151	10.2	254	115	11.2	265	120	12.3	277	126	13.4	290	131	13.9	295	134
	16000	13	156	10.5	248	113	11.5	259	117	12.6	271	123	13.9	284	129	14.3	289	131
	18000	9	161	10.8	242	110	11.8	252	114	13.1	265	120	14.4	278	126	14.9	284	129
	20000	5	166	11.2	236	107	12.3	247	112	13.6	260	118	14.9	273	124	15.4	278	126
	22000	1	172	11.6	231	105	12.7	242	110	14.1	255	116	15.5	269	122	16.0	274	124
	24000	-3	178	12.0	226	103	13.2	238	108	14.6	252	114	16.1	266	120	16.7	271	123
	26000	-7	185	12.5	223	101	13.7	234	106	15.2	249	113	16.8	264	120	17.4	269	122
	28000	-11	192	13.0	220	100	14.3	232	105	15.9	247	112	17.5	263	119	18.1	270	122
	30000	-14	199	13.5	218	99	14.9	231	105	16.6	247	112	18.2	265	120	18.9	272	123

ICN-12-C-A150905-A-S4080-00372-A-001-01

Figure 5-1-28: Propeller Low Speed - Performance - Maximum Endurance Cruise (Sheet 4 of 4)

5-3-6 Holding Time and Fuel

HOLDING TIME AND FUEL - 1550 RPM



ICN-12-C-A150905-A-S4080-00373-A-001-01

Figure 5-1-29: Propeller Low Speed - Performance - Holding Time and Fuel

12-C-A15-60-2439-05A-030A-A

5-3-7 Descend Performance

No change.

5-3-8 Power-off Glide Performance

No change.

5-3-9 Balked Landing Performance

No change.

5-3-10 Landing Performance

Landing performance with Prop Low Speed set to ON is unaffected. However, when using reverse thrust and Prop Low Speed set to ON, a 10% margin must be included in the ground roll distance.

12-C-A15-60-2439-05A-030A-A

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SECTION 7

Airplane and Systems Description

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7 Airplane and Systems Description

7-11 Propeller

Prop Low Speed

The propeller control system is capable of governing the propeller at a lower speed of 1550 RPM when the following condition is met:

- The pilot has pushed the PROP LOW SPEED button and the PCL is not in the takeoff range or below idle (reverse range).

The EPECS will override the PROP LOW SPEED request and set the Np to 1700 rpm when:

- PROP LOW SPEED is active and the PCL is moved to the takeoff range, or
- A PROP LOW SPEED selection is made by the pilot while the PCL is in the takeoff range
- A PROP LOW SPEED selection is made by the pilot while the PCL is below idle (reverse range).

Nominal propeller rpm during all phases of operation is 1550 rpm, except at low power settings at low speeds where there is insufficient energy available to rotate the propeller at 1550 rpm.

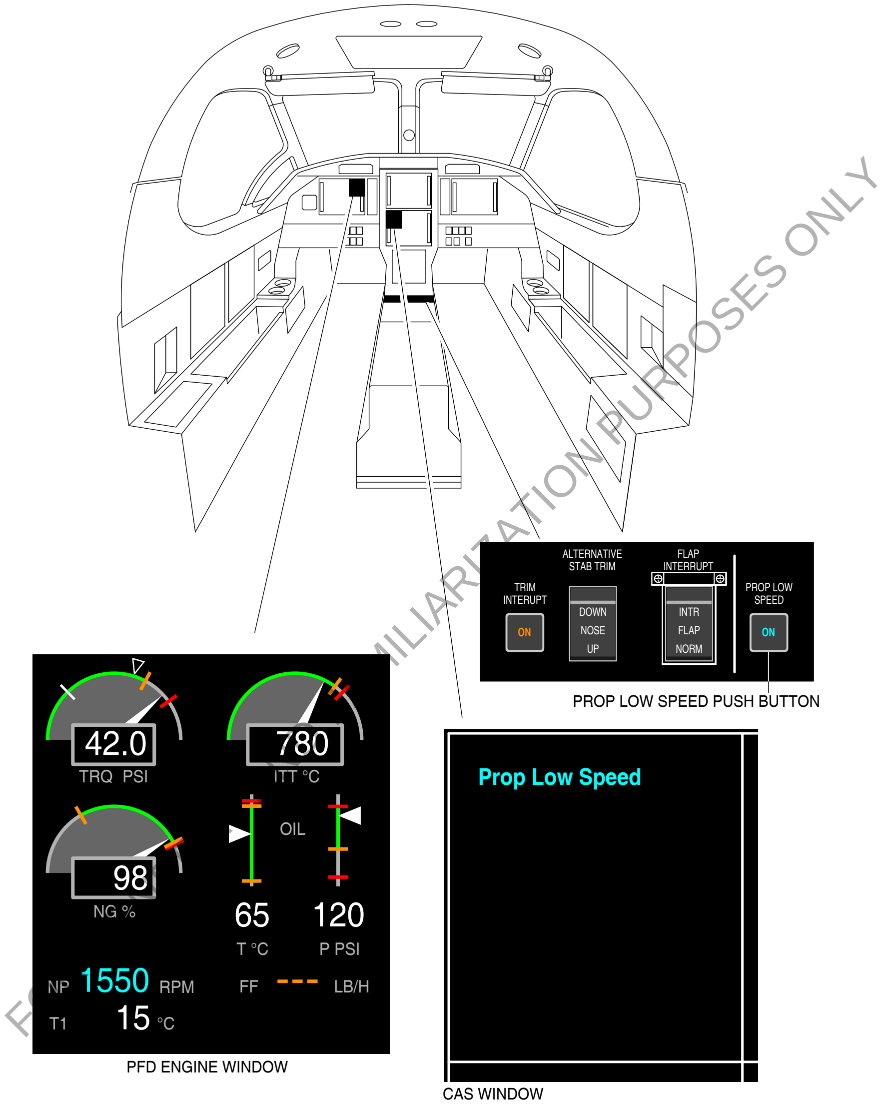
The default setting for the PROP LOW SPEED mode at power-up is OFF (1700 rpm).

Indication / Warning

When the PROP LOW SPEED mode is active (refer to Fig. 7-1-1):

- The Np speed indication on the engine window is shown in cyan and the pilot will be able to monitor the change in Np until it stabilizes at 1550 rpm ±30 rpm
- **Prop Low Speed** is displayed in the CAS window
- The PROP LOW SPEED push button is illuminated and the push button shows the "ON" status.

PROPELLER DEICE will show when both PROP LOW SPEED and the PROP DEICE are selected to ON.



ICN-12-C-A150710-A-S4080-00244-A-001-01

Figure 7-1-1: Prop Low Speed Controls and Indications

12-C-A15-00-2439-07A-043A-A

Noise Level

The noise levels given in the table below should be considered as practical guidance material for the aircraft's noise levels with the Prop Low Speed mode active.

The noise level information in this paragraph has not been submitted by Pilatus to any Civil Airworthiness Authority for approval.

Measurment Method	Prop Low Speed mode active
ICAO Annex 16, Chapter 10	76.2 dB(A)
Swiss VEL	76.2 dB(A)
FAR PART 36, Appendix G	76.2 dB(A)

A further noise reduction of 0.6 dB(A) is possible if take-off is conducted with flaps 30°.

7-19 Cockpit Arrangement

Description

The Prop Low Speed switch is located on the center console (refer to Fig. 7-1-1).

7-31 PRIMUS APEX - MONITOR WARNING SYSTEM (MWS)

CAS Advisory Messages (Cyan)

Message Text	Stby Bus	Elec Pwr On	Eng Start	Taxi	Takeoff	Cruise	Approach
Prop Low Speed	X						

12-C-A15-00-2439-07A-043A-A

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PILOT'S OPERATING HANDBOOK
AND
EASA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

REPORT NO. 02474

FOR

GERMAN PLACARDS

This supplement must be attached to the Pilot's Operating Handbook and EASA Approved Airplane Flight Manual for the EASA certified PC-12 airplanes. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual.

This Airplane Flight Manual Supplement is approved under the authority of DOA No. EASA.21J.357.

Date of Approval: 21 November 2019

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List of Effective Data Modules

All DMC are preceded with PC-12-C but for clarity this has been left out

C = Changed data module

N = New data module

	Data module code (DMC)	Document title	N/C	Issue date
	A15-00-2474-00A-002A-A	List of Effective Data Modules	N	21.11.2019
	A15-00-2474-00A-003B-A	Log of Revisions	N	21.11.2019
	A15-00-2474-00A-002B-A	Log of Temporary Revisions	N	21.11.2019
	A15-00-2474-01A-010A-A	General	N	21.11.2019
*	A15-10-2474-02A-043A-A	Limitations	N	21.11.2019

* Authority Approved

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Log of Revisions

1 Issue 001 - Revision 00 - Dated: 21 November 2019

Initial Issue of the PC-12 AFM Supplement 02474.

The Issue 001 Revision 00 of the AFM Supplement ref. 02474 is approved under the authority of DOA No. EASA.21J.357.

Approval date: 21.11.2019

Table 1: Issue 001 - Revision 00 - List of changes

Section	PTS Number	Description of Change
All	20084	AFM Supplement ref. 02474 - Aircraft with German Placards installed.

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Log of Temporary Revisions

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2474-00A-002B-A

No.	Temporary Revision Title	Date of Issue	Cancelled by

SECTION 1

General

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General

1 General

This supplement provides the information necessary to operate the PC-12 aircraft with placards in the German language installed.

This Supplement must be attached to Pilot’s Operating Handbook Report No.:

- 01973-001
- 02211
- 02277
- 02406

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SECTION 2

Limitations (EASA Approved)

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Limitations

CABIN PLACARDS

The following placards are installed in all aircraft.

On interior of cabin door:

Figure 2-1: Placards - Cabin - German

12-C-A15-10-2474-02A-043A-A

9 SEAT CORPORATE COMMUTER INTERIOR (Interior Code STD-9S)

The cabin placards plus the following are those required for the interior.

Near each passenger oxygen outlet:

SAUERSTOFF or **SAUERSTOFF OXYGEN**

On the rear of the left cockpit bulkhead:

RAUCHEN VERBOTEN or **RAUCHEN VERBOTEN NO SMOKING**

SAUERSTOFFMASKE BEFINDET SICH UNTER DEM SITZ or SAUERSTOFFMASKE BEFINDET SICH UNTER DEM SITZ OXYGEN MASK LOCATED UNDER YOUR SEAT

WAEHREND START UND LANDUNG BEACHTEN
-SITZLEHNE MUSS AUFRECHT SEIN
-KOPFSTUETZE AN KOPF ANPASSEN
-BECKEN - UND SCHULTERGURT MUESSEN ANGELEGT UND GESCHLOSSEN SEIN

or

WAEHREND START UND LANDUNG BEACHTEN
- SITZLEHNE MUSS AUFRECHT SEIN
- KOPFSTUETZE AN KOPF ANPASSEN
- BECKEN- UND SCHULTERGURT MUESSEN ANGELEGT UND GESCHLOSSEN SEIN

FOR TAKEOFF AND LANDING
- SEAT MUST BE FULLY UPRIGHT
- ADJUST HEADREST TO SUPPORT HEAD
- FASTEN SEAT LAP AND SHOULDER BELT

On the rear of the right cockpit bulkhead:

SAUERSTOFFMASKE BEFINDET SICH UNTER DEM SITZ or SAUERSTOFFMASKE BEFINDET SICH UNTER DEM SITZ OXYGEN MASK LOCATED UNDER YOUR SEAT

On the back of the standard passenger seat (except seat 5):

WAEHREND START UND LANDUNG BEACHTEN
-SITZLEHNE MUSS AUFRECHT SEIN
-KOPFSTUETZE AN KOPF ANPASSEN
-BECKEN - UND SCHULTERGURT MUESSEN ANGELEGT UND GESCHLOSSEN SEIN

or

WAEHREND START UND LANDUNG BEACHTEN
- SITZLEHNE MUSS AUFRECHT SEIN
- KOPFSTUETZE AN KOPF ANPASSEN
- BECKEN- UND SCHULTERGURT MUESSEN ANGELEGT UND GESCHLOSSEN SEIN

FOR TAKEOFF AND LANDING
- SEAT MUST BE FULLY UPRIGHT
- ADJUST HEADREST TO SUPPORT HEAD
- FASTEN SEAT LAP AND SHOULDER BELT

SAUERSTOFFMASKE BEFINDET SICH UNTER DEM SITZ or SAUERSTOFFMASKE BEFINDET SICH UNTER DEM SITZ OXYGEN MASK LOCATED UNDER YOUR SEAT

On the back of seat 5:

WAEHREND START UND LANDUNG BEACHTEN
-SITZLEHNE MUSS AUFRECHT SEIN
-KOPFSTUETZE AN KOPF ANPASSEN
-BECKEN - UND SCHULTERGURT MUESSEN ANGELEGT UND GESCHLOSSEN SEIN

or

WAEHREND START UND LANDUNG BEACHTEN
- SITZLEHNE MUSS AUFRECHT SEIN
- KOPFSTUETZE AN KOPF ANPASSEN
- BECKEN- UND SCHULTERGURT MUESSEN ANGELEGT UND GESCHLOSSEN SEIN

FOR TAKEOFF AND LANDING
- SEAT MUST BE FULLY UPRIGHT
- ADJUST HEADREST TO SUPPORT HEAD
- FASTEN SEAT LAP AND SHOULDER BELT

SAUERSTOFFMASKE BEFINDET SICH UNTER DEM VORDEREN SITZ or SAUERSTOFFMASKE BEFINDET SICH UNTER DEM VORDEREN SITZ OXYGEN MASK LOCATED UNDER SEAT IN FRONT

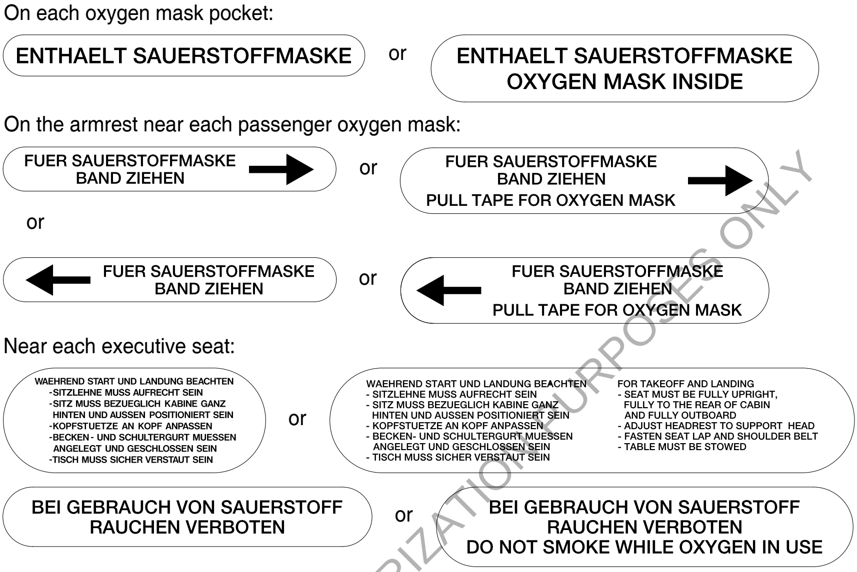
12-C-A150223-A-S4080-00403-A-001-01

Figure 2-2: Placards - Cabin - 9 Seat corporate commuter (Interior code STD-9S) - German

12-C-A15-10-2474-02A-043A-A

6 SEAT EXECUTIVE INTERIOR (Interior Code EX-6S-2)

The cabin placards plus the following are those required for the interior.



12-C-A150223-A-S4080-00404-A-001-01

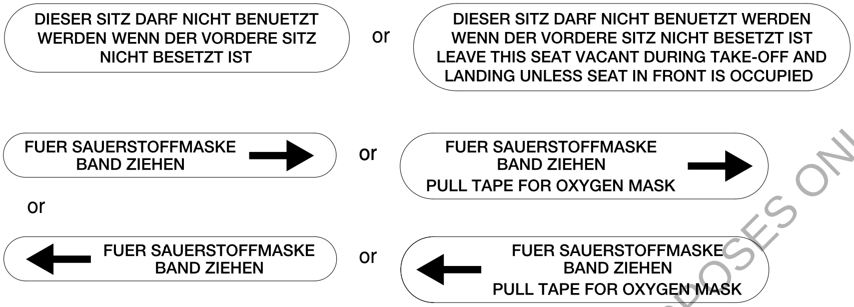
Figure 2-3: Placards - Cabin - 6 Seat executive (Interior code EX-6S-2) - German

12-C-A15-10-2474-02A-043A-A

8 SEAT EXECUTIVE INTERIOR (Interior Code EX-8S)

The cabin placards, the 6 seat executive and the following replacement/additional placards are required for this interior.

Rear of executive passenger seat No. 5, 6, 7 and 8:



12-C-A150223-A-S4080-00405-A-001-01

Figure 2-4: Placards - Cabin - 8 Seat executive (Interior code EX-8S) - German

12-C-A15-10-2474-02A-043A-A

TOILET PLACARDS

The toilet placards are installed in all executive interiors.

On the toilet door #1:

ZUM SCHLIESSEN ZIEHEN

or

ZUM SCHLIESSEN ZIEHEN
TO CLOSE PULL HERE

TOILETTENABTEIL WAEHREND START, LANDUNG UND TURBULENZ NICHT BELEGEN

or

TOILETTENABTEIL WAEHREND START, LANDUNG UND TURBULENZ NICHT BELEGEN
TOILET COMPARTMENT NOT TO BE OCCUPIED DURING TAKEOFF / LANDING AND TURBULENCE

AUF DER TOILETTE RAUCHEN VERBOTEN

or

AUF DER TOILETTE RAUCHEN VERBOTEN
NO SMOKING IN LAVATORY

On the toilet door #3:

ZUM SCHLIESSEN ZIEHEN

or

ZUM SCHLIESSEN ZIEHEN
TO CLOSE PULL HERE

Near the toilet seat:

FUER TOILETTENSPUELUNG HIER DRUECKEN

or

FUER TOILETTENSPUELUNG HIER DRUECKEN
PUSH TO FLUSH

TOILETTENBELEUCHTUNG

or

TOILETTENBELEUCHTUNG
LAVATORY LIGHT

On the oxygen mask box:

ENTHAELT SAUERSTOFFMASKE

or

ENTHAELT SAUERSTOFFMASKE
OXYGEN MASK INSIDE

Below the oxygen mask box:

FUER SAUERSTOFFMASKE BAND ZIEHEN →

or

FUER SAUERSTOFFMASKE BAND ZIEHEN
PULL TAPE FOR OXYGEN MASK →

12-C-A150223-A-S4080-00406-A-001-01

Figure 2-5: Placards - Cabin - Toilet - German

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PILOT'S OPERATING HANDBOOK
AND
EASA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

REPORT NO. 02486

FOR

AIRCRAFT REGISTERED IN BRAZIL

This supplement must be attached to the Pilot's Operating Handbook and EASA Approved Airplane Flight Manual for the EASA certified PC-12 airplanes. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and EASA Approved Airplane Flight Manual.

This Airplane Flight Manual Supplement is approved by the EASA on behalf of the National Agency of Civil Aviation for Brazilian registered aircraft, in accordance with the “Regulamentos Brasileiros de Homologação Aeronáutica” (RBHA) 21, Section 21.29.

Date of Approval: 12 May 2020

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List of Effective Data Modules

All DMC are preceded with 12-C but for clarity this has been left out

C = Changed data module

N = New data module

	Data module code (DMC)	Document title	N/C	Issue date
	A15-00-2486-00A-002A-A	List of Effective Data Modules	N	14.05.2020
	A15-00-2486-00A-003B-A	Log of Revisions	N	14.05.2020
	A15-00-2486-00A-002B-A	Log of Temporary Revisions	N	14.05.2020
	A15-00-2486-01A-010A-A	General	N	14.05.2020
*	A15-10-2486-02A-043A-A	Limitations (EASA Approved)	N	14.05.2020

* Authority Approved

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Log of Revisions

1 Issue 001 - Revision 00 - Dated: 14 May 2020

Initial Issue of the PC-12 AFM Supplement 02486.

The Issue 001 Revision 00 of the AFM Supplement ref. 02486 is EASA approved on behalf of the National Agency of Civil Aviation for Brazilian registered aircraft, in accordance with the "Regulamentos Basileiros de Homologação Aeronáutica" (RBHA) 21, Section 21.29.

Approval date: 12.05.2020

Table 1-1-1: Issue 001 - Revision 00 - List of changes

Section	PTS Number	Description of Change
All	20958	AFM Supplement ref. 02486 - Aircraft registered in Brazil.

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Log of Temporary Revisions

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2486-00A-002B-A

No.	Temporary Revision Title	Date of Issue	Cancelled by

12-C-A15-00-2486-00A-002B-A

SECTION 1
General
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1 General

This supplement provides the information necessary to operate the PC-12/47E aircraft under Brazilian registration.

This supplement must be attached to the Pilot's Operating Handbook (POH) Report No.:

- 02406 (for MSN 1720, 2001 and up).

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SECTION 2

Limitations (EASA Approved)

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2 Limitations (EASA Approved)

2-22 Other Limitations

2-22-A1 Additonal Limitations

A flashlight must be carried on the aircraft at all times.

12-C-A15-10-2486-02A-043A-A

2-23 Placards

Exterior

On exterior Passenger Door:

SAÍDA DE EMERGÊNCIA

APERTE AQUI PARA ABRIR
PUXE A MAÇANETA E
ABRA A PORTA
NÃO ABRA A PORTA COM O MOTOR EM FUNCIONAMENTO, EXCETO EM EMERGÊNCIA

ICN-12-C-A150223-A-S4080-02016-A-001-01

Figure 2-1: Placards - Exterior - Brazil Certification (Sheet 1 of 3)

12-C-A15-10-2486-02A-043A-A

On exterior Cargo Door:

PUXE PARA ABRIR

**APERTE AQUI PARA ABRIR
PUXE A MAÇANETA E
ABRA A PORTA**

**NÃO ABRA A PORTA COM O MOTOR EM
FUNCIONAMENTO, EXCETO EM
EMERGÊNCIA**

On exterior Emergency Exit:

SAÍDA DE EMERGÊNCIA

EMPURRE PARA DESTRAVAR

EMPURRE A PORTA

ICN-12-C-A150223-A-S4080-02017-A-001-01

Figure 2-1: Placards - Exterior - Brazil Certification (Sheet 2 of 3)

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At the rear of the Cargo Door:

**APERTE O BOTÃO PARA
ABAIXAR A PORTA DE
CARGA**

On Rudder (each side):

NÃO EMPURRE

On each side of Engine Lower Front Cowling:

**ÁREA MUITO QUENTE
NÃO TOQUE**

On top surface of each Aileron and three places on top surface of each Flap:

NÃO EMPURRE

Near Fuel Filler:

**COMBUSTÍVEL:
CAPACIDADE TOTAL:
770L. (203 US.GAL.)**

**VEJA O MANUAL DE VOO PARA COMBUSTÍVEIS
E QUANTIDADES APPROVADAS.**

**PONTO DE ATERRAMENTO
PARA ABASTECIMENTO**

ICN-12-C-A150223-A-S4080-02019-A-001-01

Figure 2-1: Placards - Exterior - Brazil Certification (Sheet 3 of 3)

12-C-A15-10-2486-02A-043A-A

Interior

On the LH and RH Instrument Panel:

V_{LO} 180 KIAS
V_{LE} 240 KIAS

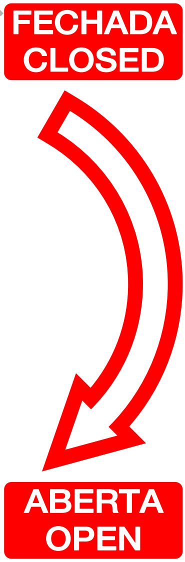
On Interior Passenger Door:

SAÍDA / EXIT
NÃO ABRA EM VÔO
DO NOT OPERATE IN FLIGHT

NÃO ABRA A PORTA COM O MOTOR EM FUNCIONAMENTO EXCETO EM EMERGÊNCIA
DO NOT OPEN DOOR WHEN ENGINE IS RUNNING UNLESS IN EMERGENCY

SOMENTE UMA PESSOA DE CADA VEZ NA ESCADA
ONLY ONE PERSON ON THE STAIRS AT ANY TIME

APERTE O BOTÃO PARA ILUMINAÇÃO NA CABINE DE COMANDO
PUSH BUTTON FOR COCKPIT DOME LIGHT



PARA ABRIR LEVANTE A TRAVA E GIRE A ALAVANCA
TO OPEN LIFT LATCH ROTATE HANDLE

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Figure 2-2: Placards - Interior - Brazil Certification (Sheet 1 of 3)

12-C-A15-10-2486-02A-043A-A

On Interior Emergency Exit:

SAÍDA / EXIT

On Interior Emergency Exit Handle:

PUXE / PULL

On Interior Cargo Door Handle Cover:

PUXE / PULL

On Interior Cargo Door Handle:

LEVANTE A TRAVA E PUXE A ALAVANCA
EMPURRE A PORTA PARA FORA

On Interior Cargo Door:

**NÃO ABRA A PORTA COM O
MOTOR EM FUNCIONAMENTO
EXCETO EM EMERGÊNCIA
DO NOT OPEN DOOR WHEN ENGINE
IS RUNNING UNLESS IN EMERGENCY**

On Cabin to Baggage Area Step:

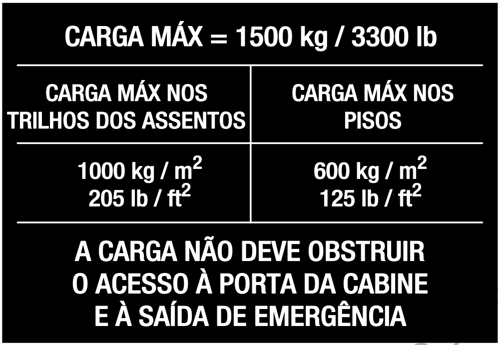
**MANTENHA A GRADE DESOBSTRUÍDA
KEEP GRILL CLEAR**

ICN-12-C-A150223-A-S4080-02022-A-001-01

Figure 2-2: Placards - Interior - Brazil Certification (Sheet 2 of 3)

12-C-A15-10-2486-02A-043A-A

On rear Cargo Door Frame:



On lower Cargo Door Frame:

Above Baggage Area:

On the front side of the right Cockpit Bulkhead:

ICN-12-C-A150223-A-S4080-02023-A-001-01

Figure 2-2: Placards - Interior - Brazil Certification (Sheet 3 of 3)

12-C-A15-10-2486-02A-043A-A

9 Seat Corporate Commuter (STD-9S)

The cabin placards plus the following additional placards are those required for this interior.

Near each Seat:

PARA POUSO E DECOLAGEM
- ENCOSTOS DAS POLTRONAS NA POSIÇÃO VERTICAL
- AJUSTE E UTILIZE O ENCOSTO DA CABEÇA
- APERTE O CINTO DE SEGURANÇA

FOR TAKEOFF AND LANDING
- SEAT MUST BE FULLY UPRIGHT
- ADJUST HEADREST TO SUPPORT HEAD
- FASTEN SEAT LAP AND SHOULDER BELT

Near each Seat, except Seat No. 5:

MÁSCARA DE OXIGÊNIO LOCALIZADA SOB O ASSENTO
OXYGEN MASK LOCATED UNDER YOUR SEAT

Near Seat No. 5:

MÁSCARA DE OXIGÊNIO LOCALIZADA SOB ESTE ASSENTO
OXYGEN MASK LOCATED UNDER SEAT IN FRONT

On the rear of the left Cockpit Bulkhead:

EXTINTOR DE INCÊNDIO LOCALIZADO
NO LADO DIREITO DA CABINE
ATRAS DO ASSENTO DO CO-PILOTO
FIRE EXTINGUISHER LOCATED
ON COCKPIT SIDE RH BULK-
HEAD BEHIND CO-PILOT SEAT

NÃO FUME
NO SMOKING

FIRST AID KIT LOCATED ON COCKPIT SIDE
L.H. BULKHEAD BEHIND PILOT SEAT

Near each Passenger Oxygen Outlet and Cover:

OXIGÊNIO
OXYGEN

On the rear of the right Cockpit Bulkhead:

EXTINTOR DE INCÊNDIO
FIRE EXTINGUISHER

ICN-12-C-A150223-A-S4080-02024-A-001-01

Figure 2-3: Placards - 9 Seat Corporate Commuter (STD-9S) - Brazil Certification

6 Seat Executive (EX-6S-2)

The cabin placards plus the following additional placards are those required for this interior.

Figure 2-4: Placards - 6 Seat Executive (EX-6S-2) - Brazil Certification

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8 Seat Executive (EX-8S), 6 Seat Executive and 2 Seat Corporate Commuter (EX-6S-STD-2S) and 4 Seat Executive and 4 Seat Corporate Commuter (EX-4S-STD-4S)

The cabin placards, the 6 seat executive placards and the following replacement/additional placards are required for this interior.

Near Seats 5, 6, 7 and 8

MANTENHA ESTE ASSENTO DESOCUPADO PARA POUSO E DECOLAGEM,
A MENOS QUE O ASSENTO Á FRENTE ESTEJA OCUPADO
LEAVE THIS SEAT VACANT DURING TAKE-OFF AND LANDING UNLESS
SEAT IN FRONT IS OCCUPIED

On the armrest near Passenger Oxygen Mask for Seats 7 and 8:

PUXE Á FITA PARA ACESSO
Á MÁSCARA DE OXIGÊNIO
PULL TAPE FOR OXYGEN MASK

or

PUXE Á FITA PARA ACESSO
Á MÁSCARA DE OXIGÊNIO
PULL TAPE FOR OXYGEN MASK

ICN-12-C-A150223-A-S4080-02026-A-001-01

Figure 2-5: Placards - 8 Seat Executive (EX-8S), 6 Seat Executive and 2 Seat Corporate Commuter (EX-6S-STD-2S) and 4 Seat Executive and 4 Seat Corporate Commuter (EX-4S-STD-4S) - Brazil Certification

SECTION 10

Safety and Operational Tips

Table of Contents

10-1 General

This section provides information for the operation of the airplane.

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10-2 Safety Tips

Pilots who fly above 10,000 feet should be aware of the need for physiological training. It is recommended that this training be taken before flying above 10,000 feet and receive refresher training every two or three years.

Information on the location of flammable materials, pressure vessels and equipment locations for crash-fire-rescue purposes is given in Section 10, Flammable Materials, Pressure Vessels and Equipment Locations.

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10-3 Operational Tips

10-3-1 Anti-Collision Lights

Anti-collision strobe lights should not be operating when flying through cloud, fog, or haze. Reflected light can produce spatial disorientation.

10-3-2 Crosswind Operation

10-3-2.1 Takeoff

It is possible, if required, to hold the aircraft stationary with the brakes while the engine is at max takeoff power. When the brakes are released, rapid and aggressive use of the rudder and possibly some small application of brake is necessary to establish and maintain the centerline but, once rolling, directional control is easy with rudder only. Holding the elevator neutral will keep the nosewheel on the ground and assist in maintaining directional control.

In strong crosswinds the aircraft establishes a drift angle of up to 10° while accelerating to rotation speed.

In gusty conditions it is recommended to rotate at V_R +10 Kts. On rotation the aircraft yaws considerably further into wind and automatically establishes the heading necessary to track the runway centerline.

10-3-2.2 Landing

It is recommended to use the wing down technique. At approximately 100 to 200 ft on approach to the runway, apply rudder to align the longitudinal axis of the aircraft to the runway and put on bank in the opposite direction to maintain the runway centerline. The aircraft is then flown in a sideslip to touch down initially on one wheel. As soon as one wheel touches, lower the other two to the runway and immediately select the Power Control Lever (PCL) to beta or reverse. Once the aircraft is established on the runway it can be stopped as normal with brakes or reverse power without difficulty. Do not attempt heavy braking in a strong crosswind as the into wind wheel will tend to lock more easily.

In conditions of strong turbulence it is recommended, if runway length permits, to fly the approach with reduced flap deflection to increase Indicated Air Speed (IAS) and aileron efficiency. It is also recommended to increase the approach speed for the chosen flap setting by 50% of the difference between the wind mean speed and max gust speed, to give a greater speed margin over the stall.

10-3-3 Behavior After High Mass/High Speed Braking

In the case of heavy braking, soft brake pedals and/or fusible plug release may occur during following taxi. Limitation in Section 2, Systems and Equipment Limits, applies.

If any signs of soft brake pedals are observed it is highly recommended to stop immediately, shut down the engine and ask for ground assistance. If a decision is taken to continue taxiing, use caution and taxi slowly. Use Beta and/or reverse thrust to control taxi speed only. Pedal fall through (brake failure) and/or fusible plug release can occur anytime when soft pedals are observed.

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10-4 Flammable Materials, Pressure Vessels and Equipment Locations

Refer to Fig. 10-4-1, Flammable Materials, Pressure Vessels and Equipment Locations.

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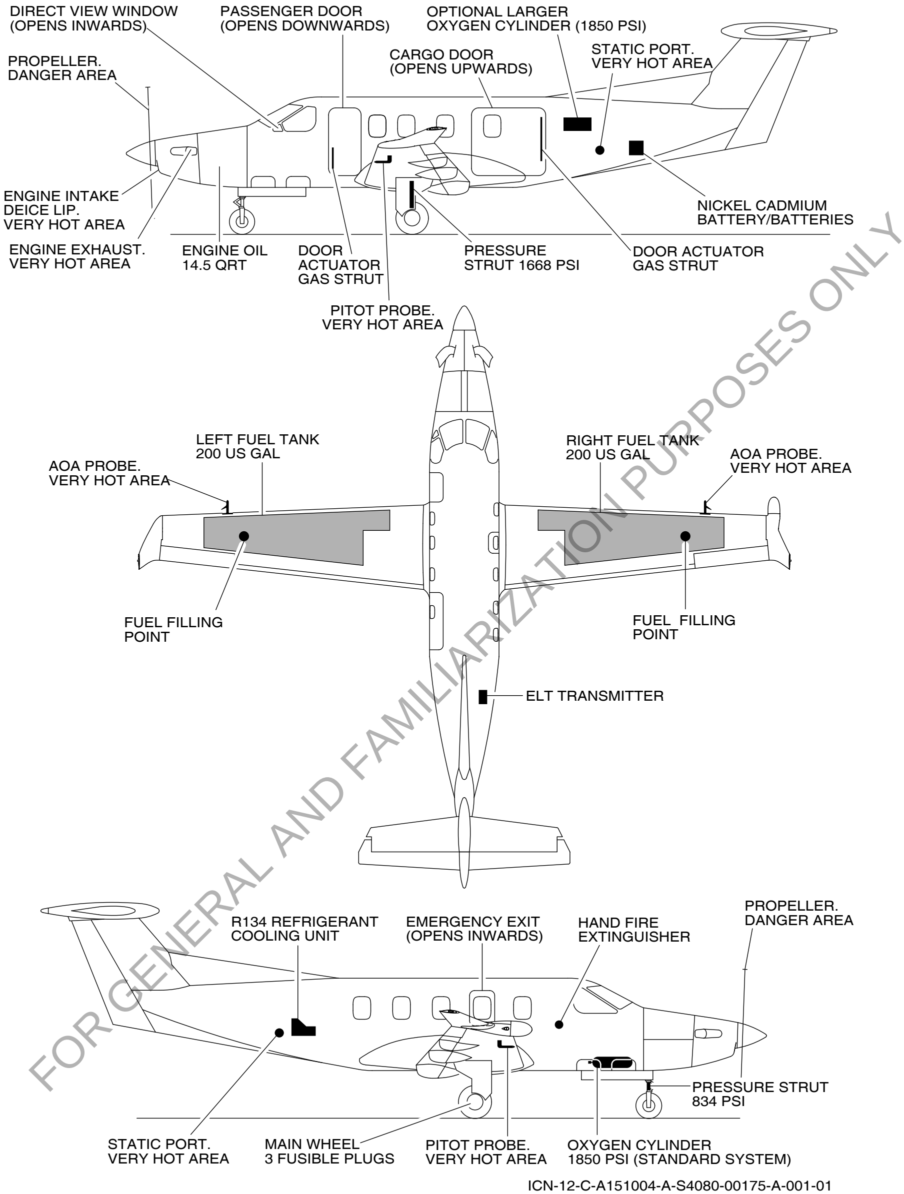

Figure 10-4-1: Flammable Materials, Pressure Vessels and Equipment Locations

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10-5 Removal of Snow, Ice and Frost from the Aircraft

10-5-1 General

Flight crews are responsible for ensuring the aircraft is free of ice, snow or any contaminants. Ground icing may occur whenever there is high humidity with temperatures of +10 °C (+50 °F) or colder.

Approved de-icing/anti-icing fluids must be used during the de-icing/anti-icing procedure.

The aircraft must be clear of all deposits of snow, ice and frost adhering to the lifting and control surfaces immediately prior to takeoff. The clean aircraft concept is essential for safe flight operations. The pilot in command of the aircraft has the ultimate responsibility to determine if the aircraft is clean and in a condition for safe flight.

Manual methods of de-icing provide a capability in clear weather to clean the aircraft to allow a safe takeoff and flight. De-icing/anti-icing fluids can be used to quickly remove frost and to assist in melting and removal of snow. In inclement cold weather conditions, the only alternative may be limited to placing the aircraft in a hangar to perform the cleaning process. Manual methods are described in more detail in the De-icing Only Procedure.

It is recommended that flight crews familiarize themselves seasonally with the following publications for expanded de-ice and anti-ice procedures:

- FAA Advisory Circular AC135-17 (small aircraft)
- AEA Recommendations for De-icing/Anti-icing Aeroplanes on the Ground
- FAA and Transport Canada Holdover Timetables.

Pilatus recommends that ground de-icing/anti-icing is done with the engine shutdown to minimize fluid ingestion into the engine and bleed air ducting.

The ACS BLEED AIR switch must remain set to INHIBIT for approximately five minutes after the de-icing/anti-icing procedure has been completed.

The de-icing/anti-icing crew must be instructed not to direct fluid at the propeller or engine.

De-icing with the engine running may result in a strong and unpleasant smell inside the aircraft, as the engine bleed system carries the odors to the passengers and crew.

Propwash from operating the propeller can cause rapid flow-off of de-icing/anti-icing fluid from the wing and other surfaces within the slip stream.

During the de-icing/anti-icing procedure, the ground crew may have to request the pilot to power down the engine in order to reduce propwash, or to stop the aircraft from sliding forward on a slippery surface.

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10-5-2 De-icing/Anti-icing Fluids

Various de-icing fluids are commercially available.

Clariant fluids were rigorously tested on PC-12 aircraft with no detrimental effect identified. Clariant fluids are therefore recommended by Pilatus for use on PC-12 aircraft.

Note

For de-icing the temperature of all heated fluids should be at least 60 °C (140 °F) at the nozzle. The aircraft skin maximum temperature limit is 70 °C (158 °F).
As part of a two-step procedure, cold Type IV fluids shall only be used within 3 minutes after the surface has been de-iced with heated water or heated Type I fluid as cold Type IV fluids significantly reduce the aircraft lift and increase control forces.

The following de-icing/anti-icing fluids are recommended for use on the PC-12 (refer to Table 10-5-1):

Table 10-5-1: Recommended de-icing/anti-icing fluids for use on the PC-12

International Standard	International Standard	Primary Use	Description
SAE Type I	AMS 1424	De-Icing	Type I fluids are water/glycol mixtures with a glycol content of at least 80%, which contain a corrosion inhibitor package. These fluids have been used for many years to remove ice, snow and frost (de-icing). They offer only limited protection against further icing due to freezing precipitation.
ISO Type I	ISO 11075		
SAE Type II	AMS 1428	Anti- Icing	Type II fluids contain at least 50% of glycol and a corrosion inhibition package. Furthermore, they contain a pseudoplastic thickener system which additionally protects against re-freezing (anti-icing) due to its filmforming properties.
SAE Type III	AMS 1428	Anti- Icing	Type III fluids are used for de-icing/anti-icing and offer longer “holdover” performance than Type I fluids.
SAE Type IV	AMS 1428	Anti- Icing	Type IV fluids contain at least 50% of glycol and a corrosion inhibition package. Furthermore, they contain a pseudoplastic thickener system which additionally protects against re-freezing (anti-icing) due to its filmforming properties.

10-5-3 Health Effects

Pilots must be aware of the potential health problems of de-icing/anti-icing fluids to ensure the correct precautions are taken when a de-icing/anti-icing procedure is done, and to better ensure the wellbeing of the passengers and crew.

10-5-4 Pre-flight Checks for Ice, Slush, Snow or Frost that Adheres to the Aircraft

To establish the need for aircraft de-icing, a pre-flight check is required to identify any contamination that adheres to the aircraft surface and to direct any required deicing/ anti-icing operations.

Note
This check should normally be done by the flight crew when they do a walk around pre-flight check.

Ice can build up on aircraft surfaces during flight through dense clouds or precipitation. When ground Outside Air Temperature (OAT) at the destination is low, it is possible for flaps and other moveable surfaces to be treated but accumulations of ice may remain undetected between stationary and moveable surfaces. It is important that these areas are checked before departure and any frozen deposits removed.

10-5-5 Selecting the De-icing Only or De-icing/Anti-icing Method

Ice, slush and snow must be removed from all aircraft surfaces before dispatch or before anti-icing.

Any contamination found on components of the aircraft that are critical to safe flight must be removed by de-icing.

When freezing precipitation exists, and the precipitation is adhering to the surfaces at the time of dispatch, the aircraft surfaces must be de-iced/anti-iced.

If both de-icing and anti-icing are required, the procedure may be performed in one or two steps.

The selection of one or two-step processes depends on the weather conditions, available equipment, available fluids and the holdover time to be achieved.

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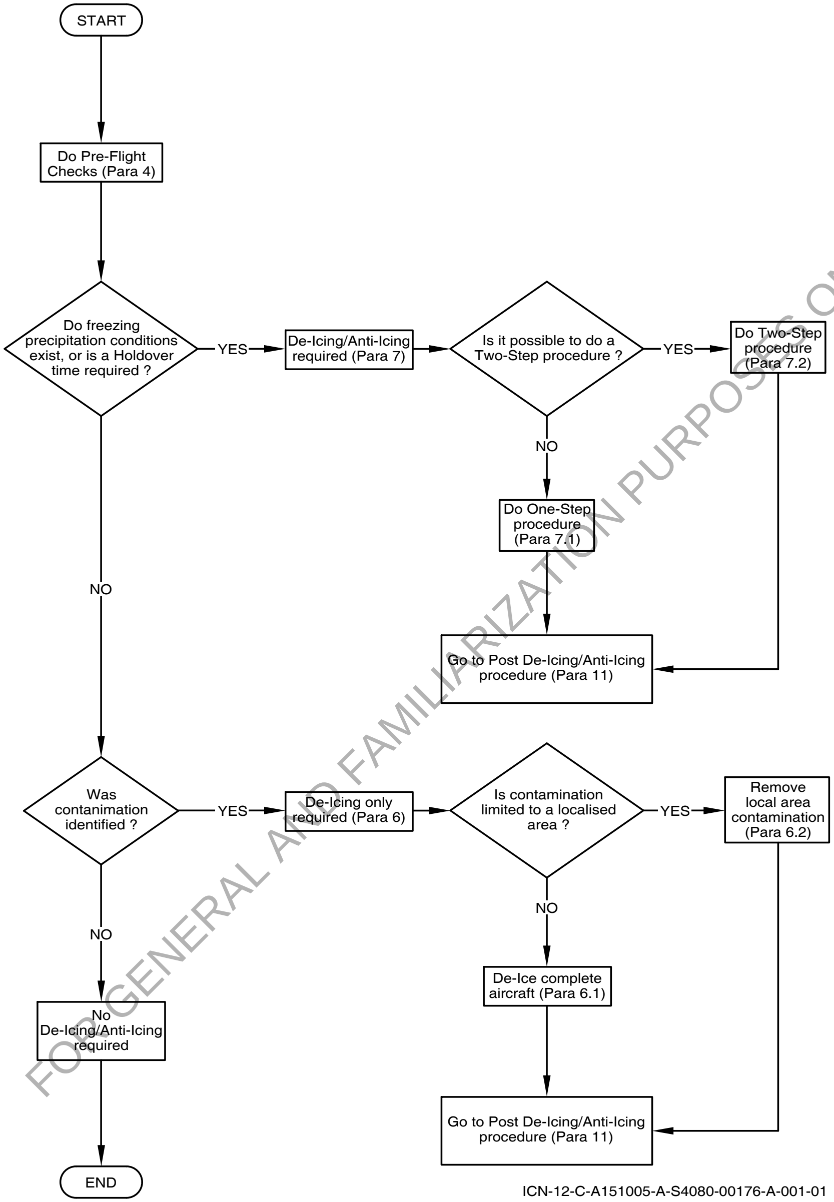

Figure 10-5-1: Selection of de-icing only or de-icing/anti-icing method flowchart

10-5-6 De-icing Only Procedure

To reduce the quantity of de-icing fluid required, a manual method can be used as a pre-step process, before the de-icing process, in order to remove large amounts of frozen contamination, for example, snow, slush or ice.

Ice, slush, snow or frost may be removed from aircraft surfaces by manual methods or fluids.

Manual methods of de-icing such as brooms, brushes, ropes, squeegees etc. can be used to remove dry snow accumulations and to remove the bulk of wet snow deposits. These manual methods require that caution be exercised to prevent damage to the aircraft skin or components.

10-5-6.1 De-icing of the Complete Aircraft

Ground support equipment is required and must have the capability to heat the water and/or de-icing fluids to 60 ºC (140 ºF) or more at the nozzle. However, the temperature of the de-icing/anti-icing fluids in contact with the aircraft surfaces must be limited to less than 70 ºC (158 ºF).

10-5-6.2 Removal of Local Area Ice Contamination

CAUTION

The aircraft must be treated symmetrically, that is, left hand and right hand sides shall receive the same and complete treatment. Aerodynamic problems could result if this requirement is not met.

When the presence of frost and/or ice is limited to localized areas on the surfaces of the aircraft and no precipitation is falling or expected, it is not necessary to apply de-icing/anti-icing fluids to the complete aircraft.

If no holdover time or only de-icing is required, only the contaminated areas will require treatment, then a “local area” de-icing may be done. The affected area(s) must be sprayed with de-icing fluid.

10-5-7 De-icing/Anti-icing

CAUTION

The application of type II, III or IV fluids, may cause residues to collect in aerodynamically quiet areas, cavities and gaps.

Dried residues may rehydrate and freeze following a period of high humidity and/or rain.

This may impede flight controls. These residues must be removed by hot water washing before the next flight.

Whenever possible, use heated water and/or type I fluid to de-ice the aircraft.

10-5-7.1 One Step De-icing/Anti-icing

Heated SAE Type I, II or III Fluid may be used to remove ice, slush and snow from the aircraft prior to departure, and to provide minimal anti-icing protection as given in the applicable Fluid holdover timetable.

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10-5-7.2 Two Step De-icing/Anti-icing

CAUTION

Where re-freezing occurs following the initial treatment, both first and second steps must be repeated.

Steps:

1. De-icing with heated water and/or heated SAE Type I de-icing fluids.
2. Anti-icing: A separate over-spray of cold SAE Type II, III or IV anti-icing fluids may be applied within three minutes (if necessary, area by area) to completely cover the first step fluid in a sufficient amount of second step fluid. The fluid used and it's concentration must be chosen with respect to the desired holdover time, which is dictated by the OAT wing temperature and the weather conditions.

10-5-8 Application of De-icing/Anti-icing Fluid

10-5-8.1 General

Flight crew should supervise the de-icing and anti-icing of the aircraft to ensure proper application of the fluid.

When ice, snow or slush is removed from aircraft surfaces, care must be taken to prevent entry and accumulation of the ice, snow or slush in intakes or control surface hinge areas.

All doors and windows shall be closed.

De-icing and anti-icing fluids must not be directed towards the static ports, pitot heads, Angle-of-Attack (AOA) transmitters, cockpit windows, air intakes, brakes, wheels, engine inlet or exhaust ports.

Note

De-icing or anti-icing fluid that may splash onto heated surfaces (exhaust ducts, AOA transmitters, etc.) will produce significant smoke/vapor.

Fluid must always be sprayed from the front of the aircraft. Fluid sprayed from the rear can force fluid into aerodynamically quiet areas where it may not be able to drain. Refer to Fig. 10-5-2, Essential Aircraft de-icing areas

Any forward area from which fluid may blow back onto the windscreen during taxi or subsequent takeoff shall be free of fluid residues prior to departure.

Note

- If fluid is sprayed or runs onto the windscreen during application, it must be removed prior to taxi and takeoff
- De-icing and anti-icing fluid can be removed by rinsing with approved cleaner and a soft cloth
- The first area to be de-iced/anti-iced should be easily visible from the cockpit and must be used to provide a conservative estimate for unseen areas of the aircraft before a takeoff roll is initiated
- Anti-icing of the lower side of the wings and/or horizontal stabilizer and elevator is not normally expected. However, if these surfaces must be de-iced, the freezing point of the de-icing fluid must be low enough to prevent refreezing.

10-5-8.2 De-icing/Anti-icing the Wings, Tail and Fuselage

The wings are the main lifting surfaces of the aircraft and must be free of snow and ice to operate efficiently. De-icing/anti-icing of the wings should begin at the leading edge wing tip with the flaps retracted, sweeping in the aft and inboard direction.

Tail surfaces should be de-iced/anti-iced in a similar manner to the wing. Move the horizontal stabilizer to nose down for a better visual check. The area adjacent to the elevator balance horns and the horizontal stabilizer must be thoroughly inspected.

Passenger and cargo doors must be de-iced to ensure correct operation. All door hinges, locks and seals must be inspected to make sure that they are free from contamination.

10-5-8.3 Propeller and Engine Area De-icing

WARNING

ICE DEPOSITS SHED FROM THE PROPELLER MAY CAUSE SERIOUS INJURY TO PERSONNEL

CAUTION

De-icing/anti-icing spray directed into the engine can cause a flameout or other problems, depending on the amount of de-icing/anti-icing fluid ingested.

The propeller must be thoroughly de-iced while static. DO NOT start the engine until it has been ascertained that all ice deposits have been removed from the propeller.

If the engine is required to run while de-icing/anti-icing:

- Set the ACS BLEED AIR switch to INHIBIT
- Set the INERT SEP switch to OPEN
- Apply the brakes

If needed, minimal amounts of de-icing/anti-icing fluid can be used to de-ice the engine external cowling area. The engine inlet area must be avoided. Fluid residue on the engine compressor blades can reduce engine performance or cause a stall or surge. This will also minimize the ingestion of fluid vapors into the engine air bleed system.

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Engine intake areas must be inspected for the presence of ice immediately after shutdown. Any accumulation must be removed while the engine is still warm and before the installation of the intake covers.

10-5-8.4 Landing Gear and Wheel Bays De-icing

The application of de-icing fluid in this area must be kept to a minimum. De-icing fluid must not be directed onto the brakes and wheels.

Landing gear and wheel bays must be kept free from a buildup of slush, ice or accumulation of blown snow. Deposits can be removed by brush etc. Where deposits have bonded to surfaces, these can be removed by spraying with deicing fluids.

10-5-8.5 Clear Ice Precautions

Clear ice can form on aircraft surfaces below a layer of snow or slush. It is important that surfaces are closely examined after each de-icing operation to make sure that all deposits have been removed.

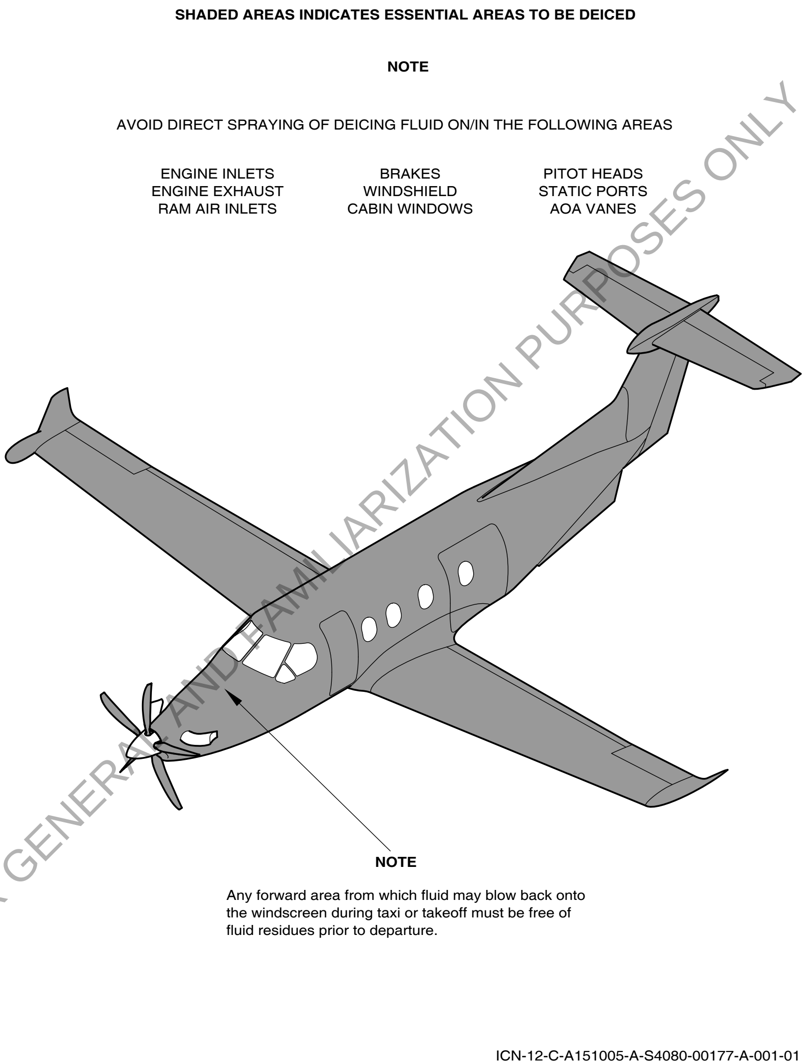

Figure 10-5-2: Essential Aircraft de-icing areas

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SHADED AREAS INDICATES ESSENTIAL AREAS TO BE ANTI-ICED

NOTE

AVOID DIRECT SPRAYING OF ANTI-ICING FLUID ON/IN THE FOLLOWING AREAS

ENGINE INLETS	BRAKES	PITOT HEADS
ENGINE EXHAUST	WINDSHIELD	STATIC PORTS
RAM AIR INLETS	CABIN WINDOWS	AOA VANES

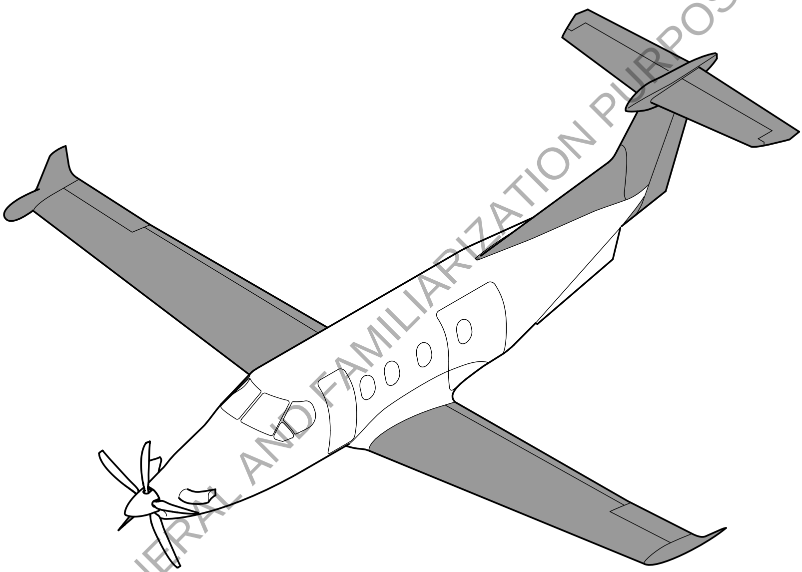

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Figure 10-5-3: Essential Aircraft anti-icing areas

10-5-9 Spraying Technique

10-5-9.1 One Step De-icing/Anti-icing

Heated water and/or heated fluid must be sprayed on the aircraft in a manner which minimizes heat loss on the aircraft. If spraying is carried out with the engine running, the engine must be at Idle with all engine bleed air turned off.

For de-icing, the temperature of all heated fluids must be at least 60 °C (140 °F) at the nozzle. The aircraft skin maximum temperature limit is 70 °C (158 °F).

If possible, fluid should be sprayed in a solid cone pattern of large, coarse droplets.

The fluid must be sprayed as close as possible to the aircraft surface, but not closer than 3 m (10 feet) if a high pressure nozzle is used.

10-5-9.2 Two Step De-icing/Anti-icing

The application technique for SAE Type II, III and IV fluids are the same as for SAE Type I fluid, except that as the aircraft surface is already de-iced, the application lasts only long enough to coat the aircraft surfaces.

10-5-10 Holdover Timetables

Holdover Timetables are only estimates and vary depending on many factors such as temperature, precipitation type, precipitation rate, wind, and airplane skin temperature. Holdover times are based on the mixture ratio of fluid/water.

For a one step De-icing/Anti-icing procedure, the holdover time begins at the start of the treatment.

For a two step De-icing/Anti-icing procedure, the holdover time begins at the start of the second step (anti-icing).

10-5-11 Post De-icing/Anti-icing Procedure

CAUTION

Aircraft operators are solely responsible for ensuring holdover timetables contain current data.

Tables are for use in departure planning only and must be used in conjunction with pre takeoff contamination procedures.

10-5-11.1 Post De-icing/Anti-icing Check

The areas that follow must be checked for any contamination that may still remain after the de-icing/anti-icing procedure has been done:

- Wing leading edges, upper and lower surfaces and aileron including the wing seals
- Horizontal stabilizer leading edges, upper and lower surfaces and the elevator surfaces, particularly the balance horns
- Vertical stabilizer and rudder surfaces
- Flaps
- Propeller
- Engine oil cooler and Environmental Control System (ECS) air intakes
- Inertial separator and screen
- Fuselage
- Static ports, pitot heads, AOA vanes and temperature probes
- Fuel tank vents
- Landing gear.

A thorough pre-flight inspection is more important in extreme temperatures, as this may affect the aircraft and/or its performance.

10-5-11.2 Pre-Takeoff Contamination Check

CAUTION

Under no circumstances shall an aircraft that has been anti-iced receive a further coating of anti-icing fluid directly on top of the contaminated film.

If an additional treatment is required before flight, a complete de-icing/anti-icing procedure must be performed.

Make sure that all residues from any previous treatments are flushed off.

Anti-icing only is not permitted.

A pre-takeoff check must be done by the flight crew before takeoff and within the holdover time. This check is normally done from within the cockpit. It may be accomplished by the continuous assessment of the conditions that affect holdover times, and should include the assessment and adjustment of holdover times.

When freezing precipitation exists, aerodynamic surfaces must be checked just before the aircraft taxis onto the active runway or initiates the takeoff roll, to make sure that they are free of ice, slush and snow or frost (refer to Fig. 10-5-2 and Fig. 10-5-3). This is most important when severe conditions are experienced. When adhering deposits are in evidence, de-icing of the aircraft must be repeated.

10-5-11.3 Flight Control Check

After the de-icing/anti-icing procedure has been done, and before the takeoff roll has started, the flaps must be fully extended and then retracted to the 15 degree position. During control checks, the controls may feel heavier than normal.

10-5-12 Takeoff Performance - SAE Type II, Type III and Type IV Fluids

CAUTION

Anticipate a heavier than normal elevator force at rotation. Even with the increased pull force, the aircraft may rotate slower then normal. The elevator forces will return to normal shortly after takeoff.

The takeoff correction factor is approximate. Actual conditions may require distances greater than those determined.

For takeoff after a de-icing/anti-icing procedure has been done, PUSHER ICE MODE must be used, with the flaps set to 15 degrees, and the rotational speed increased by 10 KIAS (as specified in Section 5, Performance). As a result, the takeoff ground roll distance can be increased by up to 30% and the total distance by up to 31%.

10-5-13 Periodic Inspection - Type II, III and IV Fluids

Operators who use SAE Type II, III or IV anti-icing fluids are recommended to carry out periodic inspections for anti-icing fluid residues. The visual inspection must include:

- Along the wing rear spar area with flaps extended
- Around the perimeter of the aileron surface
- The gaps around the elevator and elevator trim tab
- The gaps around the rudder and rudder trim tab
- Inside the drain hole located at the base of the rudder.

Any identified residues must be removed by cleaning with warm water or an approved fluid.

If the aircraft is washed, or if SAE Type I fluid is used for de-icing, the frequency of inspection may be reduced.

Initially, the inspections must be carried out after a maximum of three applications of SAE Type II, III or IV anti-icing fluids.

The operator must determine the frequency of inspections based on the results of residue inspections, the frequency of de-icing/anti-icing operations as well as the frequency of aircraft washing.

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10-6 Operations from Prepared Unpaved Surfaces

10-6-1 General

The aircraft is constructed for operations from prepared unpaved surfaces.

Prepared unpaved surfaces are taxi-ways and runways that are prepared and approved for aircraft operations with a surface other than tarmac or concrete.

CAUTION

Prepared unpaved surfaces suitable for aircraft operations vary greatly and some may not be suitable for operations.

It is the responsibility of the pilot in command to make sure that each taxi-way and runway surface is fit for use at the intended aircraft weight before commencing operations on it.

The following factors should be considered when deciding if a surface is fit for operation or when operating from prepared unpaved surfaces:

- Surface hardness
- Surface roughness
- Surface type
- Inertial separator
- Aircraft inspection
- Before starting engine
- Taxiing
- Takeoff
- Landing.

10-6-2 Surface Hardness

A prepared unpaved surface may be hard after a period of dry weather but after rain can become soft. The wheels of a heavy aircraft can sink into soft surfaces causing a large increase in drag. This can make taxiing difficult or impossible and increase the takeoff ground roll distance considerably, sometimes to the point where VR cannot be achieved. How deep the wheels sink in, varies with aircraft weight and surface condition. It may be possible to operate a light weight aircraft when it is not possible to operate it at maximum takeoff weight.

10-6-3 Surface Roughness

The taxi-way and runway surface should be smooth. Undulations, depression or bumps can cause longitudinal pitching of the aircraft which may cause a significant reduction in propeller ground clearance. Particular care should be exercised in long grass which can conceal hard objects and depressions and also at the borders between grass and concrete surfaces.

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10-6-4 Surface Type

Loose stones or gravel can cause propeller or airframe damage. The propeller creates turbulence which lifts stones into the air which then are struck by following blades or are accelerated rearwards to hit the airframe. The risk of damage is reduced if the aircraft is allowed to accelerate forwards before high power is selected and if reverse thrust is not used below 30 kts forward speed.

Wet or fresh grass on a hard surface is slippery and has a lower coefficient of friction than short dry grass. Takeoff and stopping distances may increase. On a soft surface landing ground roll may decrease but takeoff ground roll may increase. On sandy or dusty surfaces, or where loose grass is present, reverse thrust can cause a loss of forward visibility and particles ingested into the air intake can cause increased engine wear.

10-6-5 Inertial Separator

When operating from any surface where there is a risk of dust, sand or other material entering the engine intake, it is recommended to open the inertial separator.

On takeoff from hot and high airfields with the inertial separator open it may not be possible to obtain maximum takeoff power (44 psi) and the takeoff performance will consequently deteriorate.

10-6-6 Aircraft Inspection

When operating from prepared unpaved surfaces where there are loose stones, gravel, grit, sand, dust or cut grass etc. there is always a risk of propeller or airframe damage or blockage of air inlets. After operations from prepared unpaved surfaces, where a risk of damage or contamination exists, the aircraft should be thoroughly inspected.

10-6-7 Before Starting Engine

Make sure the area under and adjacent to the propeller is clear of loose stones or other objects which could damage the propeller or enter the engine or oil cooler air inlets.

10-6-8 Taxiing

1. Use minimum power to prevent stone damage particularly when moving away from rest and when turning.
2. Be alert for surface unevenness or obstructions which could cause propeller damage.
3. To turn the aircraft on soft or slippery surfaces using nosewheel steering assisted by brake will help to keep the power low. (Reducing the risk of damage to the propeller or runway surface). If possible avoid making small radius turns.

10-6-9 Takeoff

When aligned for takeoff set a low power before brake release. After brake release, as the aircraft begins to accelerate, move the power lever steadily forwards to achieve takeoff power. This procedure will reduce the risk of damaging the propeller by loose stones on the ground.

10-6-10 Landing

CAUTION
Before landing on a prepared unpaved runway check that the surface is fit for operation at the intended weight.

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10-7 Passenger Briefings

10-7-1 General

In Sections 3 and 4 there are procedural actions that call for the pilot to brief the passengers. They fall into two categories, those forming part of an emergency procedure and the more regular type ones for taxiing prior to takeoff and before landing. Tips for passenger briefings during an emergency cannot be specified as each situation will place a different demand on the pilot. However, much of the content in the Taxiing briefing tips can be used to brief the passengers, if time permits. Tips for the recommended subjects that should be covered for the regular passenger briefings are given in the following lists:

10-7-2 Taxiing

(Section 4, Normal Procedures, Taxiing)

For aircraft with a standard cabin interior:

- Stow hand baggage under the seats
- Put the seat back in the upright position
- Position the seat headrest to support the head
- Switch off electronic equipment
- Fasten seat lap and shoulder belts, and tighten lap strap
- Mention how to locate and put on the passenger oxygen masks
- Mention the location and usage of the emergency exits
- Mention to remain buckled up during cruise in case of unexpected turbulence, but that the shoulder strap may be released (if releasable type) when airborne and permission has been given
- Mention the safety on board cards for more detailed information about the safety features (if available).

For aircraft with an executive cabin interior:

- Stow hand baggage in the seat or cabinet drawers
- Move the seat to the required position for takeoff (as per the placard adjacent to each seat)
- Position the seat headrest to support the head
- Stow the tables, cabinet drawers, seat drawers and legrests
- Switch off electronic equipment
- Fasten seat lap and shoulder belts, tighten lap strap
- Mention how to locate and put on the passenger oxygen masks
- Mention the location and usage of the emergency exits
- Mention to remain buckled up during cruise in case of unexpected turbulence, but that the shoulder strap may be released once the fasten seat belt sign has been switched off
- Mention the safety on board cards for more detailed information about the safety features (if available).

10-7-3 Before Landing

(Section 4, Normal Procedures, Before Landing)

For aircraft with a standard cabin interior:

- Stow hand baggage under the seats
- Put the seat back in the upright position
- Position the seat headrest to support the head
- Switch off electronic equipment
- Fasten seat lap and shoulder belts, tighten lap strap
- Remain seated and buckled until the aircraft has come to a standstill and the engine is turned off.

For aircraft with an executive cabin interior:

- Stow hand baggage in the seat or cabinet drawers
- Move the seat to the required position for landing (as per the placard adjacent to each seat)
- Position the seat headrest to support the head
- Stow the tables, cabinet drawers, seat drawers and legrests
- Switch off electronic equipment
- Fasten seat lap and shoulder belts, tighten lap strap
- Remain seated and buckled until the aircraft has come to a standstill and the engine is turned off.