CHAPTER 1
AIRPLANE GENERAL

CONTENTS

- Glareshield (Figure 1-9)
- Center pedestal (Figure 1-10)
- First officer's instrument panel (Figure 1-11)
- First officer's side panel (Figure 1-12)
- First officer's side console (Figure 1-13)
- Control wheel switches (Figure 1-14)

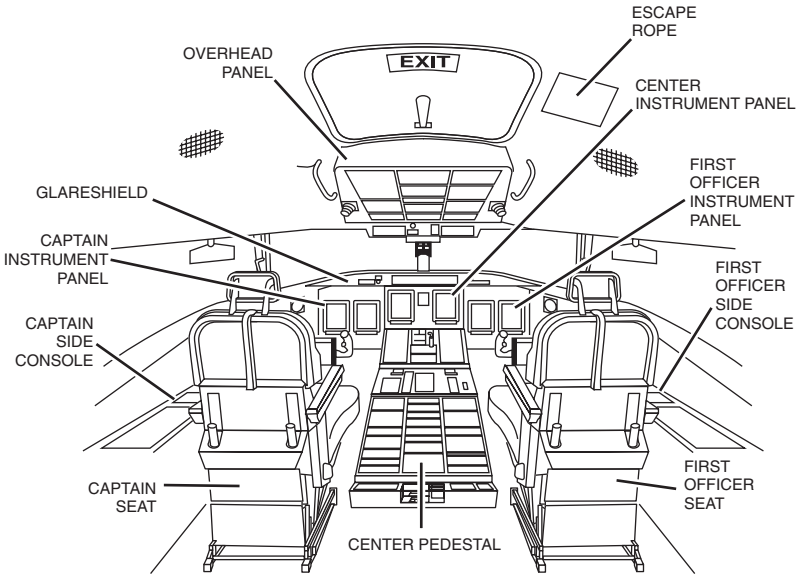


Figure 1-3 Flight Compartment Forward View

Figure 1-11 First Officer's Instrument Panel

Operating Limitations

The flightdeck door must be kept closed and locked at all times during flight except to permit access and egress in accordance with the FOM and this FCOM.

Any time the flightdeck door is opened in flight, a challenge and response closing and locking verification must be used to verify that the door is closed and locked.

Any time one of the required flight crew leaves the flightdeck another crew member must be present in the flightdeck to ensure that the required crew member is not locked out of the flightdeck.

Operating Procedures

Normal—To secure the cockpit door for flight, slide the main latch into position to lock the door. The deadbolt assembly is for ground use only or as directed by the MEL.

Emergency Procedures

Emergency Egress—Unlock and lift lower hinge pin. Unlock and pull down upper hinge pin. Kick out door at hinge side. Rotate door clockwise and stow against the galley.

CAUTION

Due to the weight of the door, this procedure must be started from the lower hinge pin.

Emergency Ingress—In the event that the crew becomes trapped in the cockpit or becomes incapacitated, rescue personnel can enter through the cockpit upper hatch, which is operable from both inside and outside the cockpit.

Decompression Panel—The decompression panel is held on the door by the decompression latch. When the pressure difference between the passenger cabin and the flightdeck is more than a preset limit, the latch will release the panel.

NOTE

1. Maximum load capacity of door is 454 kilograms (1,000 pounds).

2. Maximum number of people permitted on the stairway is four.

Door Operation (Normal)

Normal door operation is accomplished by executing the following procedures. The interior single-lever handle rotates downward to lock and upward to unlock. Total rotation of the handle is approximately 53°.

To open from the interior (Figure 1-27):

- An initial 22° free motion of the handle before unlatching unlocks the latch mechanism and opens the pressurization flap in the exterior door surface. Continued rotation of the handle unlatches the upper two "C" rotary latches and disengages the four latch pins.

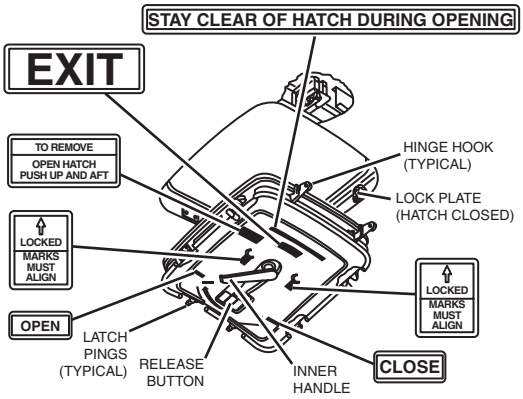
- As the door is pushed outward, it descends in a controlled gradual movement damped by the motor-actuator. The door ground support wheel deploys from the stowed position.

To open from the exterior (Figure 1-28):

- Grasp the outer handle on its lower edge and rotate upward and outward. This action unlocks and opens the mechanism, opening the pressurization flap in the exterior door surface.

- Pulling outward on the handle rotates the door downward. The opening sequence then follows that described for the operation from the interior.

INTERIOR VIEW



EXTERIOR VIEW

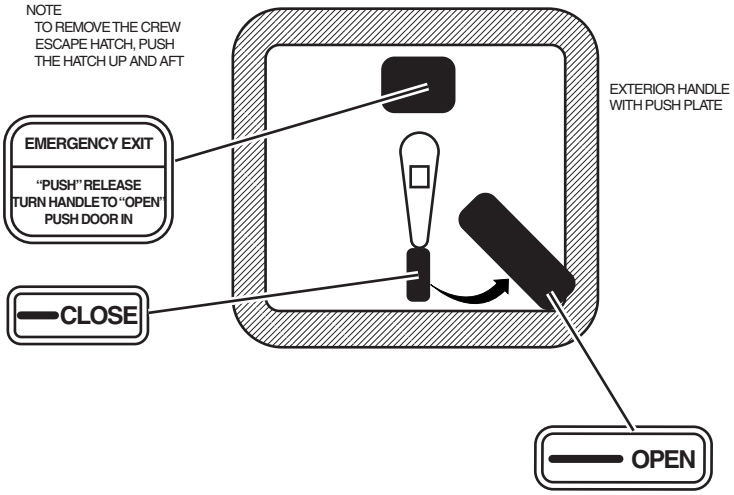


Figure 1-30 Crew Escape Hatch

WINGS

The fully-cantilevered, one-piece, sweptback wing (Figure 1-39) is the primary load-carrying aircraft structure. At the bottom of the fuselage midsection, the wing attaches to the fuselage-keel longerons and fuselage frames. The wing attaches to the fuselage-keel longerons at the center of the front and rear spars. It also attaches to the fuselage frames at three locations on each side of the wing center section and at two locations on the rear spar. Each wing also includes attachments for flight control surfaces as well as integral fuel tanks.

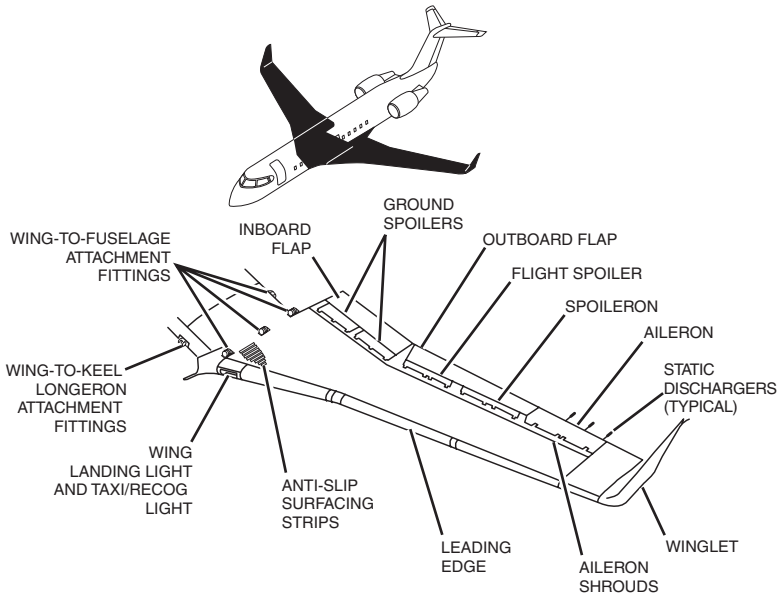


Figure 1-39 Wings

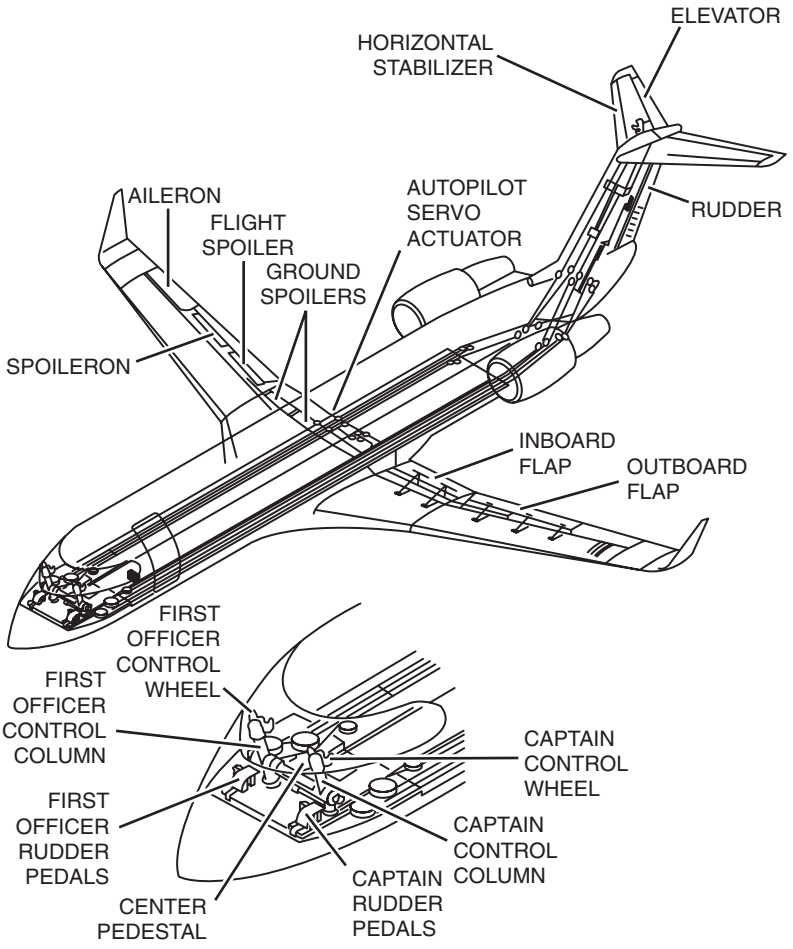


Figure 1-46 Flight Controls

adjust the neutral position of the primary flight control, which reduces the force required to move the control surfaces. For the elevator, the entire horizontal stabilizer is moved.

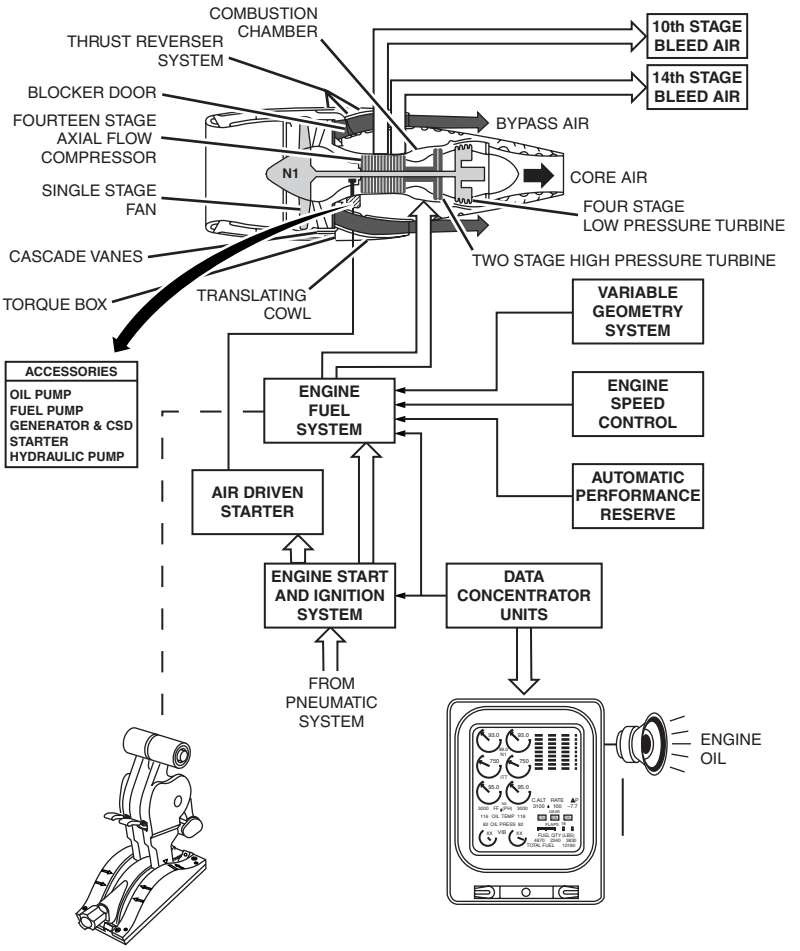


Figure 1-52 Powerplant

INTEGRATED STANDBY INSTRUMENT SYSTEM

For aircraft 8891 and subsequent, Bombarier has replaced the existing standby electronic instrument with a new integrated standby instrument and improved stall protection computers (Figure 1-62).

The new integrated standby instrument (ISI) provides standby attitude, altitude and airspeed information to the flight crew. To retain full operational capability under emergency conditions the ISI is powered by the battery bus. The ISI uses inputs from the alternate pitot probe and static ports. The ISI displays the following information: attitude displays, ILS deviation, altitude display (corrected), V_{MO} display, airspeed display, static source error protection, Mach number, barometric pressure, and slip-skid indication.

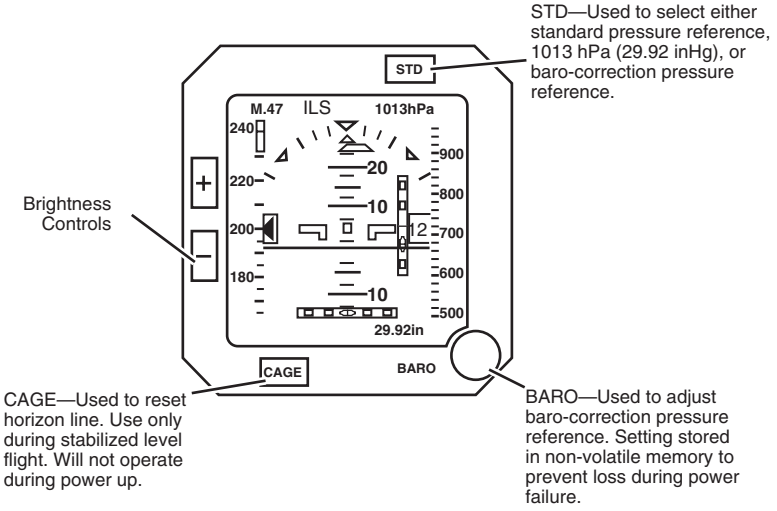


Figure 1-62 Integrated Standby Instrument System

CPLT	Copilot
CRS	Course
CRT	Cathode-ray tube
CRZ	Cruise
CSD	Constant speed drive
CTR	Center
CVR	Cockpit voice recorder
CW	Clockwise
CYL	Cylinder

D

DA	Drift angle
DBU	Data base unit
DC	Direct current
DCP	Display control panel
DCU	Data concentrator unit
DECEL	Decelerate(d)
DECR	Decrease
DEFL	Defuel
DEG	Degree
DEPR	Depressurize
DEPT	Departure
DEST	Destination
DET	Detector
DEV	Deviation
DFDAU	Digital flight data acquisition unit
DFDR	Digital flight data recorder
DG	Directional gyro
DH	Decision height
DIFF	Differential
DIM	Dimming
DIR	Direct
DIS	Distance (to way point), disconnect
DISC	Disconnect
DISCH	Discharge

TE	Trailing edge
V_{FTO}	Final Takeoff Speed
TEMP	Temperature
TGT	Target
TO, T/O	Takeoff
TOL	Tolerance
TRB, TURB	Turbulence
TRK	Track
TRM	Trim
TRU	Transformer rectifier unit
T_2	Engine inlet temperature

U

UNSCHD	Unscheduled
USB	Upper side band
USG	United States gallons
UTIL	utility

V

V	Volt
V_A	Design maneuvering speed
V_B	Design speed for maximum gust intensity
V_C	Design cruising speed
V_D	Design diving speed
V_{DF}/M_{DF}	Demonstrated flight diving speed
V_{EF}	Engine failure speed
V_F	Design flap speed
V_{FC}/M_{FC}	Maximum speed for stability characteristics
V_{FE}	Maximum flap extended speed
V_{LE}	Maximum landing gear extended speed
V_{LO}	Maximum landing gear operating speed
V_{LOF}	Liftoff speed

- Engine and wing ice protection (from the 14th stage engine compressors).

- Air conditioning and avionics cooling (from the 10th stage engine compressors or, the APU while on ground and up to 15,000 feet). A ground cart supplying conditioned air can also be used for cabin heating or cooling. Ground air pressure is displayed at the left and right 10th-stage pressure readouts on the ECS page. There is no pressure readout on the ECS page when the airplane is operating with DC power only.

Pneumatic 10th-stage and 14th-stage bleed air flow is controlled by the respective shutoff valves via the BLEED AIR panel.

A leak detection system monitors the 10th- and 14th-stage duct systems for bleed-air leaks. If a leak is detected, visual warnings appear on the overhead control panel and the EICAS and accompanied by aural warnings. The affected duct is isolated by closing the shutoff valve. The bleed-air leak detection system can be tested via the DUCT MON switch on the BLEED AIR panel.

AIR-CONDITIONING SYSTEM

The air-conditioning system provides ventilation and temperature regulation in the occupied areas. The system consists of two independent air-conditioning packs and a ram-air ventilation system. The air-conditioning packs (air cycle machines with related control valves and monitoring) normally work in parallel to accomplish compartment temperature control.

Each pack (Figure 2-2) is normally supplied bleed air from the onside engine. The APU directly feeds the left pack. Bleed air flow to each pack is controlled by a pressure regulating shutoff valve which is controlled by the respective pack switchlights on the AIR CONDITIONING panel. An isolation valve interconnects the pneumatic bleed air sources so that either engine or the APU can supply both packs. The isolation valve is controlled by the 10th-stage ISOL switchlight on the BLEED AIR panel.

Duct Monitor Switch

The DUCT MON switch checks the bleed-air leak detection system.

TEST—Tests 10th- and 14th-stage loops by grounding the loop to simulate a duct failure. The following indications are given:

- L and R 10TH DUCT warning messages and illumination of the DUCT FAIL light in the switchlights
- L and R 14TH DUCT warning messages and illumination of the DUCT FAIL in the switchlights
- ANTI-ICE DUCT warning message and illumination of the DUCT FAIL portion of the wing anti-ice test switchlight
- "Bleed-air duct" aural warning

NORM—Normal (neutral) switch position. The switch is spring-loaded to this position.

LOOP A—Tests loop A of the 10th stage for continuity to ensure that the loop is not shorted to ground.

LOOP B—Tests loop B of the 10th stage for continuity to ensure that the loop is not shorted to ground.

EICAS Indications

See Figure 2-8 for EICAS indications.

Primary Display—Primary Page

Warning Messages (Red)

L or R 10TH DUCT—Indicates a leak in the respective 10th-stage manifold (Figure 2-8). The message is accompanied by a "Bleed-air duct" aural warning.

Secondary Display—Status Page

Status Messages (White)

OVBD COOL FAIL—Overboard exhaust valve is closed when passenger and service doors are not locked.

INBD COOL FAIL—Inboard exhaust valve is closed when passenger and service doors are locked.

NOTE

The inboard cooling shutoff valve (INBD COOL SOV) is used during flight to flush cool the avionics system equipment. The valve is normally closed on the ground and open during flight.

CKPT COOL FAIL—The avionics cooling air valve is closed on the ground or open in flight.

COOL EXHAUST FAIL—Exhaust fan has failed, or exhaust low cooling flow is sensed.

PFD/MFD Overtemperature Indication

DISPLAY TEMP—Display overtemperature warning message (red) appears on the PFD or MFD to indicate an approaching thermal shutdown (Figure 2-13). The sky and ground raster is removed to delay the shutdown.

CARGO BAY AIR CONDITIONING

CARGO Switch

The CARGO switch on the overhead panel controls cargo bay air conditioning (See Figure 2-10).

COND AIR—Conditioned and recirculated cabin air flows to the cargo bay.

Table 2-1 POWER SUPPLY AND CIRCUIT-BREAKER SUMMARY (Cont)

SYSTEM	SUB-SYSTEM	CB NOMEN-CLATURE	BUS BAR	CB PANEL NO.	CB LOCA-TION
Air Conditioning (Cabin)	Right Pack	R AIR COND UNIT	DC BUS 2	2	J1
	Cabin Temperature Control	CABIN TEMP CONT			J2
		CABIN TEMP CONT MAN			J3
		GALLEY & LAVATORY FAN	AC BUS 2		C5
		CABIN FAN			C8
Galley Heating	Heater 1	GALLEY HTRS	AC BUS 2	2	B11
	Heater 2				
	Fan				

WARNING AURAL MESSAGES

Various aural messages call attention to warnings. The ten warning types are shown in Table 3-1.

Table 3-1 AURAL WARNING TYPES

SOUNDS	INDICATIONS	CHAPTER REFERENCES
Warbler	Stall	Stall protection, Chapter 10, “Flight Controls”
Siren	Wind shear	Wind shear and GPWS, Chapter 17, “Navigation”
“Whoop whoop”	GPWS mode 1 or 2 (excessive descent or closure rate)	GPWS, Chapter 17, “Navigation”
Fire bell	Fire warning	Chapter 9, “Fire Protection”
Voice	Voice aural warning	Chapters 2–18
Clacker	• Excessive stabilizer trim movement • V_{MO}/M_{MO} exceedance • Airspeed too high for current flap setting	Chapter 10, “Flight Controls”
Horn	Gear not down	Chapter 15, “Landing Gear”
Cavalry charge	Autopilot disconnected	Chapter 4, “Automatic Flight Controls”
Warning (triple chime)	Warning tone that precedes an aircraft system voice advisory	Chapters 2—18
C-chord	Altitude alert	Chapter 11, “Flight Instruments”

Table 3-3 EFIS AND EICAS MESSAGES (Cont)

MESSAGE	TYPE	CHAPTER REFERENCE
COOL EXHAUST FAIL	S	2
CPAM FAIL	S	2
COWL A/ICE ON	A	14
CPTL ROLL CMD	A	10
DC BUS 1	C	7
DC BUS 2	C	7
DC EMER BUS	C	7
DC ESS BUS	C	7
DC ESS TIE CLSD	S	7
DC SERV BUS	C	7
DC TIE 1 CLSD	S	7
DC TIE 2 CLSD	S	7
DCU1 APR FAIL	S	18
DCU2 APR FAIL	S	18
DCU1 AURAL INOP	S	3
DCU2 AURAL INOP	S	3
DCU1 INOP	S	18
DCU2 INOP	S	18
DIFF PRESS	W	2
DISPLAY COOL	C	2
DUCT MON LOOP A	S	14
DUCT MON LOOP B	S	14

Table 3-3 EFIS AND EICAS MESSAGES (Cont)

MESSAGE	TYPE	CHAPTER REFERENCE
WING OVHT	W	14
WOW INPUT	C	15
WOW OUTPUT	C	15
WOW OUTPUT FAIL	S	15
XFLOW/APU PUMP	C	12
YAW DAMPER	C	4
YD 1 INOP	S	4
YD 2 INOP	S	4

Inhibits

During the initial takeoff, final takeoff, and landing phases, the data concentrator unit (DCU) will process inhibit logic to minimize spurious or distracting warning or caution messages.

The initial takeoff inhibits are enabled when:

- Left and right engine N_1 is greater than 79%
- Weight on wheels, and
- Airspeed is less than 100 knots

The initial takeoff inhibit is removed when:

- Left and right engine N_1 is less than 67.6%, or
- Airplane is in the final takeoff phase

panel), ED1 displays the EICAS primary page only and responds to caution paging commands entered at the EICAS control panel.

The EICAS primary page shows the following (Figure 3-4):

- Engine indications—Warnings, cautions, and gage color logic. See Chapter 18 for details.
- Fuel flow readouts (green)—See Chapter 12 for details.
- Oil pressure gages—Oil pressure readouts appear during engine start:
  - Green range—26 to 115 psid
  - Amber range—116 to 140 psid
  - Red range—0 to 25 psid

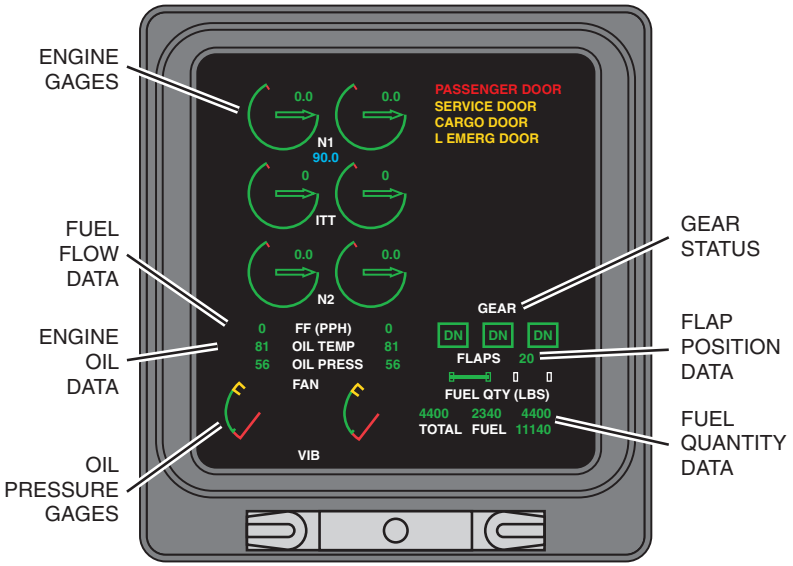


Figure 3-4 EICAS Primary Page

CONTROLS AND INDICATIONS

GLARESHIELD

MASTER CAUTION reset switchlight—The momentary-action switchlights (Figure 3-8) come on amber in conjunction with certain overhead panel lights and EICAS messages. Pushing either switchlight turns both lights out and resets the caution system for subsequent indications.

MASTER WARNING reset switchlight—The momentary-action switchlights come on red in conjunction with red overhead panel lights and EICAS messages. Pushing either switchlight turns both lights out and resets the warning system for subsequent indications.

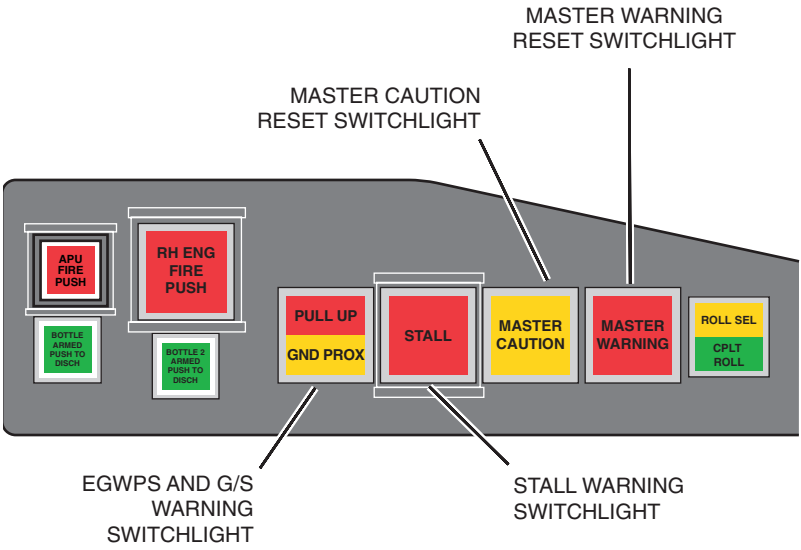


Figure 3-8 Glareshield

CHAPTER 4
AUTOMATIC FLIGHT CONTROLS

CONTENTS

other side does not concurrently capture, it continues to operate on the heading selected until it independently captures.

NOTE

Aircraft limitations prohibit APPR mode VOR approaches (either flight director or autopilot coupled).

Approach mode automatically selects glide-slope mode after localizer capture. An onside localizer capture clears turbulence mode on both sides.

Dead reckoning is provided during VOR station passage. When DME data is available, the dead reckoning region is where DME distance to the station is less than 0.6 nautical mile. Without DME data, dead reckoning is based on a high rate of VOR deviation.

The CRS 1 knob selects the Captain's course; the CRS 2 knob selects the First Officer's course. Both are displayed on the PFDs. Pushing the switch in the center of either course knob selects the course required to fly directly to the station.

Pushing the APPR switch on the FCP selects the approach mode. The approach mode is cleared by pushing the APPR switch again, selecting another lateral mode, or changing the source of the onside navigation signal.

Illumination of the lights on the side of the APPR switch indicate the approach mode engagement. Arming is indicated by two messages on the PFD, a green HDG message in the lateral capture field, and a white navigation source identifier in the lateral arm field. Capture/tracking is annunciated with a green message in the lateral capture field on the PFD identifying the navigation source. The navigation source can be VOR 1 or 2, LOC 1 or 2, or FMS 1 or 2. Dead reckoning operation is indicated by a white DR message on the PFD.

Back Course Mode

The back course mode generates flight director commands to capture and track the selected back course displayed on the PFD. The

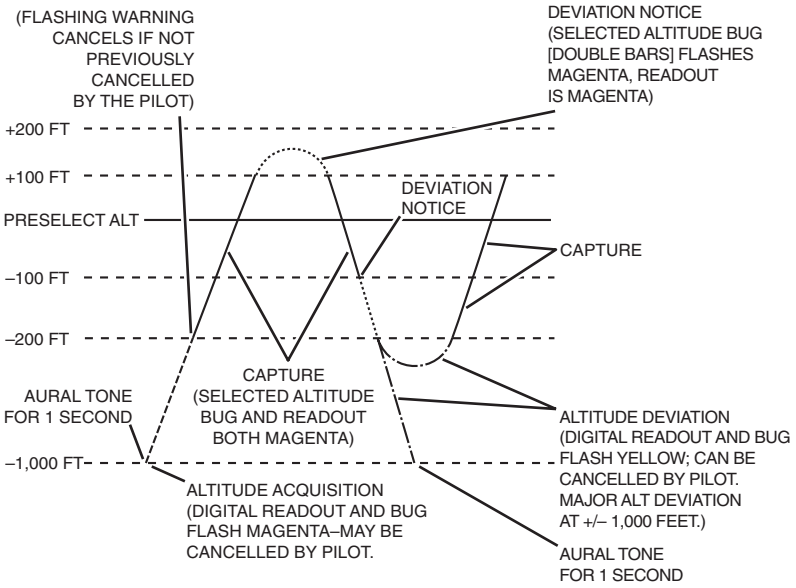


Figure 4-1 Attitude Alert System

Altitude Alert System

The PFDs alert the pilots when the airplane is approaching the preselected altitude or if the airplane is deviating from a previously selected and acquired altitude (Figure 4-1). Altitude advisories display on the altimeter portion of the PFDs at the preselect altitude digital readout, above the barometric tape, at the preselect bugs, and by double bars across fine and coarse tapes.

The altitude alert system processes data from the air data computers and is independent of autopilot or flight director modes. The altitude (ALT) knob on the flight control panel sets the desired altitude.

The preselect digital readout and bugs change state and color as follows:

B/C Pushbutton

The B/C pushbutton selects or deselects the back-course mode. Indicators, adjacent to the pushbutton, illuminate or extinguish respectively. Back course capture clears all lateral modes. Back course mode arming is indicated on the PFD by the green HDG indication in the lateral capture field, and as the white B/C1 in the navigation source indicator field. Back-course mode capture is indicated on the PFD in green as B/C1 in the lateral capture field.

HDG Knob

Rotating the HDG outer knob changes the selected heading (indicated by the heading bugs and readouts on both PFDs). Clockwise rotation increases the selected heading.

PUSH SYNC Pushbutton

The PUSH/SYNC pushbutton synchronizes the heading indications on the PFD to the current aircraft heading (indicated by the lubber line on the PFD). Operation of the pushbutton synchronizes the heading bugs on both PFDs.

1/2 BANK Pushbutton

Used during heading select mode, the 1/2 BANK pushbutton alternately selects or clears the half-bank mode. Indicators, adjacent to the pushbutton, illuminate or extinguish respectively. At power on, the AFCS sets the high-bank limit (31.5°). Pressing the button sets the low-bank limit (15°). When pressed, 1/2 BANK displays on the PFD. Half-bank mode is automatically selected above 31,600 feet. Approach mode capture or any localizer capture clears the half-bank mode.

Table 4-1 PFD INDICATIONS (Cont)

INDICATION	COLOR	DESCRIPTION
IAS or MACH	Green	Speed mode (annunciated in vertical capture field)
	Flashing amber	Overspeed mode (annunciated in vertical capture field)
FMS1 FMS2 LOC1 LOC2 VOR1 VOR2	White	Navigation or approach mode–armed (annunciated, in the lateral arm field, identifying navigation source)
	Green	Navigation or approach mode–capture/ tracking (annunciated, in the lateral capture field, identifying navigation source)
GA	Green	Lateral go-around mode (annunciated in lateral capture field
		Vertical go-around mode (annunciated in vertical capture field)
GA/WS		Go-around display after initial windshear warning
GS	White	Glide slope mode–armed (annunciated in vertical capture field)
VS #.#↑	Green	Vertical speed mode, (current vertical speed reference is – – – – fpm up)
VS #.#↓	Green	Vertical speed mode, (current vertical speed reference is – – – – fpm down)
YD	Amber	Both yaw dampers disengaged
1/2 BNK	White	Half bank mode (illuminates when airplane altitude is ≥31,600 feet or when 1/2 BANK pushbutton selected)
V-bars	Magenta	Integrated lateral and vertical flight guidance commands (not present if either command is invalid)

Autopilot Engagement Display

The autopilot engagement display indicates engagement, disengagement, or side transfer (see Table 4-1). After autopilot disengagement, the takeoff/go-around (TOGA) switches cancel the autopilot caution and audible warnings.

Mistrim Indicators

The mistrim indicators (Figure 4-21) display when the autopilot monitoring system detects failure in the trim systems.

YD—The yellow indication shows the yaw damper is disengaged.

E—The boxed yellow indication shows a mistrimmed elevator.

A—The boxed yellow indication shows a mistrimmed aileron.

R—The boxed yellow indication shows a mistrimmed rudder.

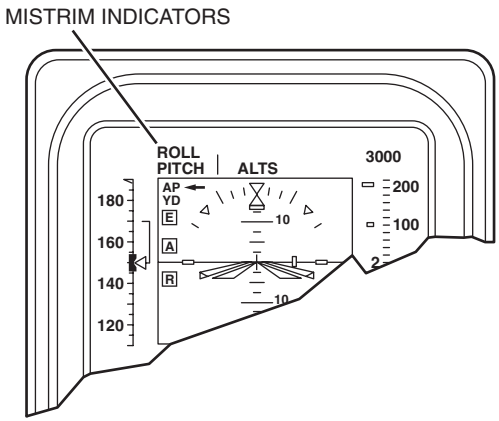


Figure 4-21 PFD—Yaw Damper and Mistrim Indications

Enclosure

An APU enclosure creates a fire zone, isolates the APU from the aft equipment compartment, and prevents damage to the aircraft should a fire occur. The bottom of the enclosure is connected to a drain system to prevent the buildup of fluids in the container.

Air Inlet and Exhaust Port

The APU air inlet is located on the upper left side of the rear fuselage and connected to the APU by an inlet-duct assembly. A variable-position inlet door, controlled by the ECU, is installed in the inlet. The APU electronic unit controls the operation of the air intake door according to an airplane pressure altitude and true airspeed schedule (Figure 5-2).

The potentiometer provides inlet door position information to the ECU. The EICAS secondary display then presents inlet door position messages on the status page based on ECU-supplied information. Ducts vent APU exhaust through a port below the right engine.

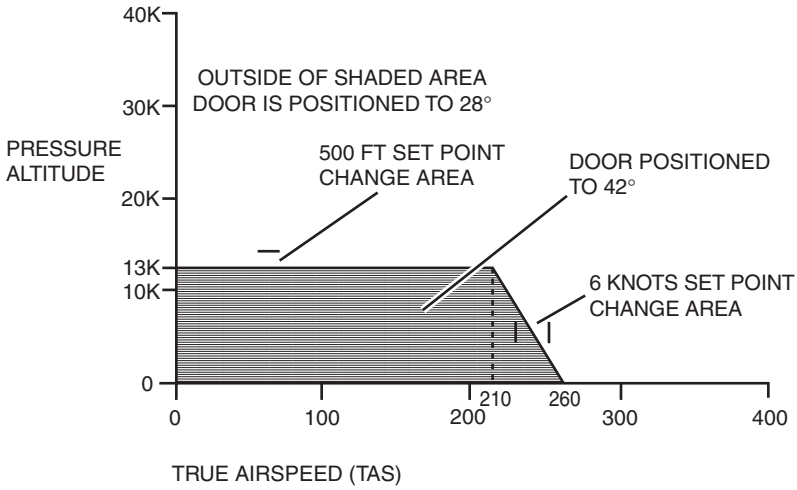


Figure 5-2 Pressure Altitude and True Airspeed Schedule

APU OIL TEMP—Indicates APU has high oil temperature (325˚C)—This message is accompanied by an audible voice message. APU shuts down automatically (on ground only).

APU FAULT—Indicates loss of APU control circuits (microprocessor, thermocouple, or speed signal)—The APU shuts down automatically.

APU SOV FAIL—Indicates the APU fuel feed shutoff valve is not in a confirmed position (either open or closed)

APU SOV OPEN—Indicates the APU fuel feed shutoff valve is open 10 seconds after an APU fire condition

APU LCV FAIL—Indicates the load control valve has failed (either open or closed)

APU BLEED ON—Indicates the load control valve is open and barometric altitude is greater than 15,000 feet

XFLOW/APU PUMP—Indicates the APU's transfer pump has failed (low pressure)—It is accompanied by the illumination of the XFER/APU PUMP switchlight.

EICAS Secondary Display

APU EGT Indicator and Digital Readout

The APU EGT indicator, with digital readout, displays exhaust gas temperature in degrees Centigrade.

APU RPM Indicator and Digital Readout

The APU RPM indicator, with digital readout, displays percent rpm.

NOTE

The gauges will remain in view for approximately 60 seconds, after PWR FUEL switch/light pressed out.

TABLE

Mode Selector Switch

The four-position rotary knob selects the operating modes.

OFF—There is no power to the backup tuning unit.

STBY (standby)—Echoes frequency set at COM 1 and NAV 1

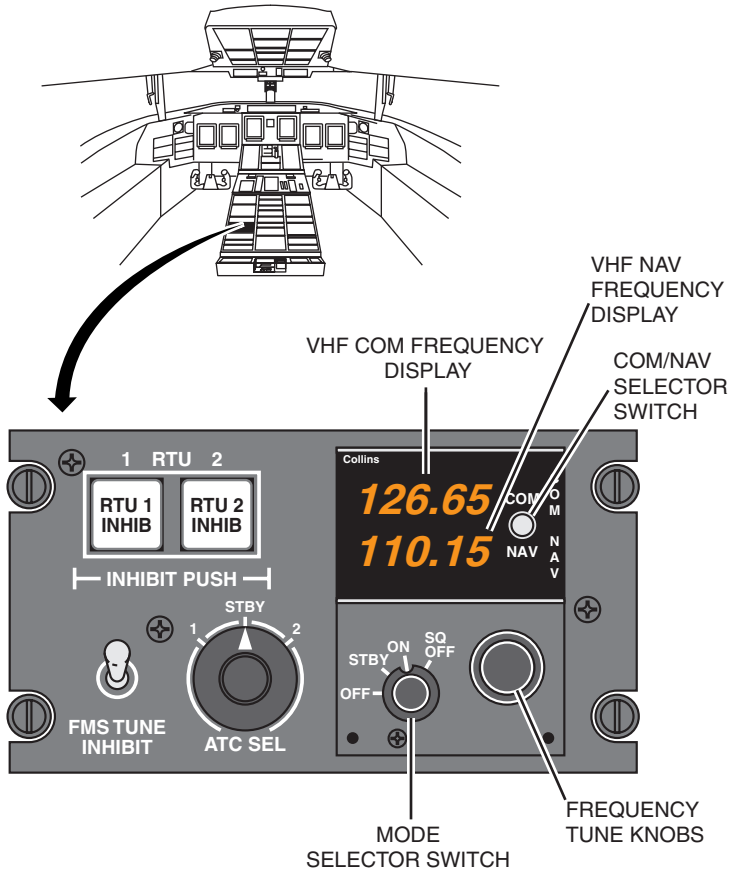


Figure 6-5 Backup Tuning Unit

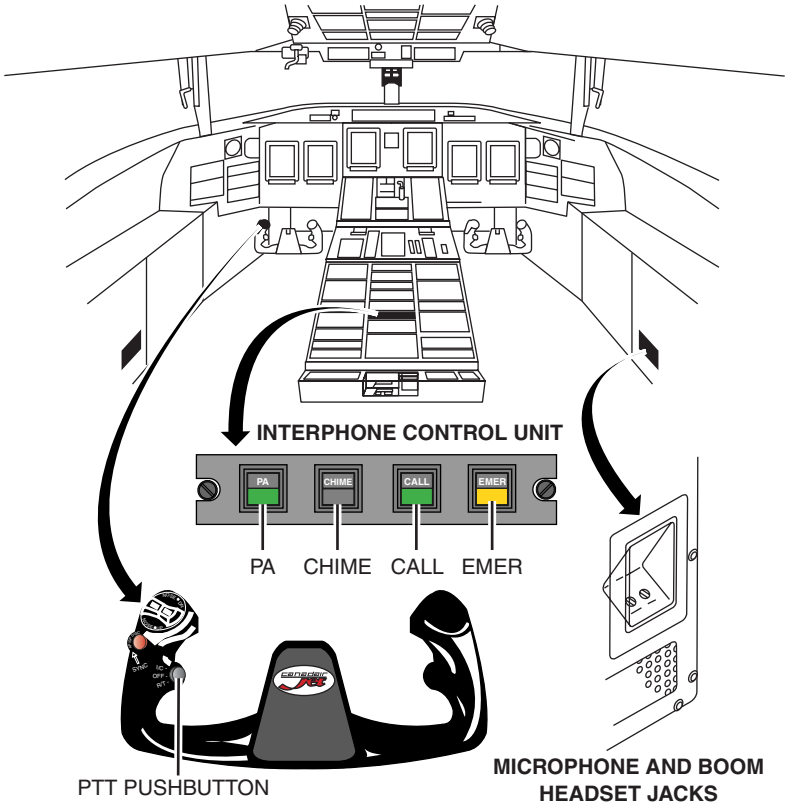


Figure 6-8 Interphone Control Unit

interphone electronic unit. This illuminates the CALL light on the interphone control unit and the CALL LED at the attendant station.

EMER—Pushing the EMER switchlight supplies a HI/LO chime to the cabin speakers (The transmit select switch must be in the PA position before pushing the switchlight). This also flashes the EMER light on the interphone control unit and the EMER LED at the attendant panel flashes.

The PA and CALL switchlights have green indicator lights and the EMER switchlight has an amber light. The CHIME switch does not have a light.

CHAPTER 7
ELECTRICAL

CONTENTS

The AC utility buses is powered from the main AC buses or AC service bus. In flight, the AC utility buses are automatically shed if only one generator is operational. On the ground, both utility buses are shed if external AC power is connected and the flaps are >0°.

There is priority control of AC power distribution. If the APU generator is supplying power to a bus, and an engine-driven generator is applied on the respective bus, the APU generator is automatically taken off the bus. If external power is supplying power to a bus and either the APU or main generator is placed on the bus, the external power is automatically taken off the bus and the other generator takes the load for that bus. Shutting down a generator, for any reason other than a fault on that generator bus, automatically transfers the load from that generator to the operative generator.

The status of the AC essential bus is shown on the EICAS secondary display (AC ELECTRICAL page) as ESS BUS. The ESS BUS indication is shown only when the bus is operational and on-line. The ESS BUS power source is shown by a flow line from the available power source (AC BUS 1 or AC BUS 2).

AC Essential-Bus Transfer

AC essential-bus transfer is automatically controlled by the AC voltage and frequency sensor. If an out-of-tolerance voltage or frequency condition occurs on AC bus 1, which energizes the AC essential bus, the AC essential bus source is automatically transferred to AC bus 2. This occurs when the voltage on any phase of the AC essential bus is less than 90 volts, or during a complete loss of power to the AC essential bus.

AC System Components

Integrated-Drive Generators

The main generators are 30-kVA, 115-VAC, three-phase, 400-hertz, integrated-drive generators (IDGs), mounted on each engines accessory gearbox. Each IDG is driven by a constant speed drive mechanism, which maintains the generator at a constant rpm. An IDG is automatically disconnected from its accessory gearbox if it

- APU fire extinguisher (squib 1 and 2)
- Fuel-shutoff valves (left and right engine and APU)
- Hydraulic shutoff valves (left and right engine)

Battery Charging

The main battery charger and APU battery charger are in a charging configuration at all times when the battery master switch is on and the applicable AC utility bus is powered as follows:

- 115-volt to the No. 1 AC utility bus for the main battery charger
- 115-volt to the No. 2 AC utility bus for the APU battery charger

NOTE

In flight, both chargers are shed during single generator operations. On the ground, both chargers are shed if external power is connected and flaps more than 0°, and the passenger and service doors are locked.

EXTERNAL POWER

External AC power, supplied through the AC receptacle in the forward part of the airplane, provides power to the airplane as shown in Table 7-6.

Table 7-6 EXTERNAL POWER DISTRIBUTION

MAIN BUS CONFIGURATION	GROUND SERVICE CONFIGURATION
No.1 AC bus No.2 AC bus AC service bus No. 1 and No. 2 AC utility bus (with WOW and flaps at 0°)	AC service bus No. 1 and No. 2 AC utility bus

External DC power, through the receptacle at the right engine pylon, supplies the APU battery-direct bus, main battery-direct bus, and left and right battery bus. External DC power can start the APU. The

DC SERV BUS

The amber DC SERV BUS caution message indicates the DC service bus is not powered with either the No.1 or No. 2 AC bus on line.

ESS TRU1/2

These amber caution messages indicate the respective essential TRU voltage is less than 18 VDC, with the AC essential bus not failed.

GEN 1/2 OVLD

The amber GEN 1/2 OVLD caution messages indicate the respective generator-control unit detected an overload.

GEN 1/2 OFF

These amber caution messages indicate the respective generator is off.

IDG 1/2

The amber IDG 1/2 caution messages indicate the respective IDG has low oil pressure or excessive oil temperature.

MAIN BATT OFF

The amber MAIN BATT OFF caution message indicates the main battery is at less than 18 VDC.

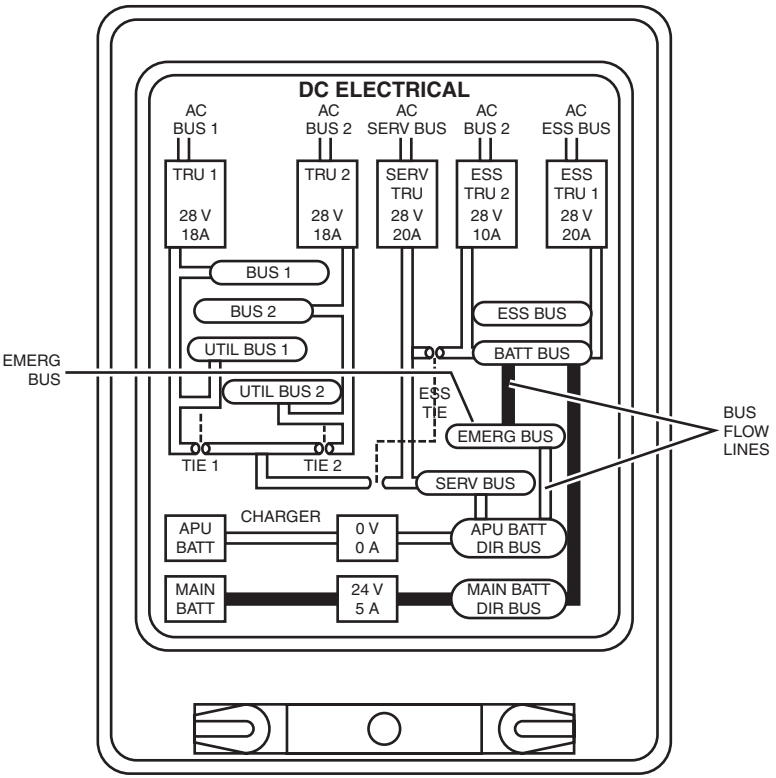


Figure 7-13 EICAS Secondary Display—DC ELECTRICAL Page (1 of 4)

Table 7-11 POWER SUPPLY AND CIRCUIT-BREAKER SUMMARY (Cont)

SYSTEM	SUB-SYSTEM	CB	BUS BAR	CB PANEL	LOCA-TION
DC distri-bution	DC service bus	SERV BUS FEED	APU BAT DIR	5	B3
		BUS FEED	DC SER-VICE	2	T5
		SER-VICE TRU	AC SER-VICE		R5
		PWR SENS/ SERV BUS	DC SER-VICE		T6
		PWR SENS/ SERV TRU	DC SER-VICE		T7
	DC emer-gency bus	APU BATT DIRECT FEED	DC EMER BUS	1	S6

TABLES

Table 8-5 DESCENT (10 MIN.) FROM 41,000 FEET TO LEVEL FLIGHT AT SAFE ALTITUDE (NOTE 3)

CREW		2		3	
Initial Bottle Pressure		1,400 psi	1,850 psi	1,400 psi	1,850 psi
Cabin Pressure Altitude	10,000 Feet	0h 31' 28"	0h 44' 52"	0h 18' 57"	0h 27' 53"
	14,000 Feet	0h 38' 32"	0h 54' 21"	0h 23' 46"	0h 34' 18"
	18,000 Feet	0h 47' 51"	1h 06' 53"	0h 30' 03"	0h 42' 45"
	21,000 Feet	0h 56' 59"	1h 19' 14"	0h 36' 11"	0h 51' 01"
Note 3: 100% mask setting for descent and level flight					

Protective Breathing Equipment

Protective breathing equipment (smoke hoods) (Figure 8-5) is in the flight compartment and cabin for smoke and fire fighting. This equipment is stowed in a vacuum-sealed bag, inside a container, mounted aft of the captain's seat on the CB-panel wall.

The smoke hood consists of an air-regeneration system and a hood with a clear visor. The air-regeneration system is a chemical process that forms oxygen and absorbs carbon dioxide. Before donning the hood, an actuation cord (lanyard) must be pulled. Use of a hand microphone, intercom handset, or megaphone is possible while wearing the hood. Use of a headset is not possible (operation causes significant airflow noise within the hood). The hood must be removed when airflow noise stops and breathing becomes labored.

WARNING

Suffocation may occur if the hood is used without oxygen supply.

OVER WATER EMERGENCY EQUIPMENT

A life vest is provided for each occupant of the flight compartment (Figure 8-12). Each life vest includes a manual and an oral inflation system and a locator light.

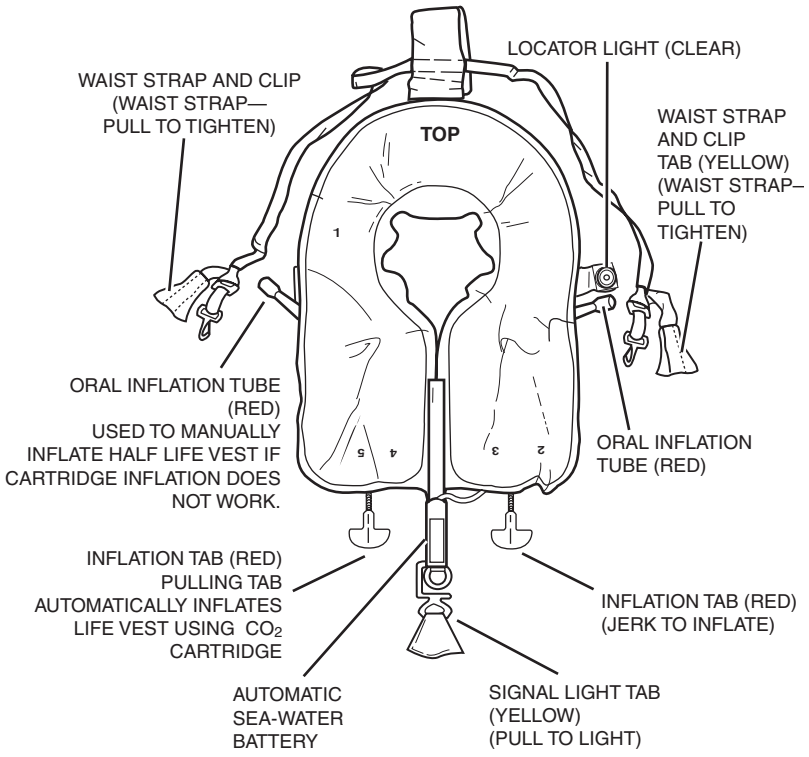


Figure 8-12 Life Vest

Power Distribution and Circuit-Breaker Summary

Table 8-6 shows the power distribution and circuit-breaker summary for the oxygen system.

Table 8-6 OXYGEN SYSTEM CIRCUIT PROTECTION

SYSTEM	SUB-SYSTEM	CB	BUS BAR	PANEL NO.	CB LOCATION
Crew oxygen system	Oxygen indicator	CREW OXYGEN MONITOR	DC BAT	2	P10
Pass. oxygen system	CPAM deploy	PASS OXYGEN/ AUTO DEPLOY			P11
	PASS OXY ON switch deploy	PASS OXYGEN/ MANUAL DEPLOY		1	P11
	Latch relay (RH)	PASS OXYGEN/ RIGHT PASS		2	P12
	Latch relay (LH)	PASS OXYGEN/ LEFT PASS		1	P12

- Squibs are armed.
- Engine fuel feed shutoff valve closes.
- Bleed-air shutoff valve closes.
- Hydraulic shutoff valve closes.
- Engine-driven generator shuts down.

- The onside BOTTLE ARMED PUSH TO DISCH switchlight is pressed:
  - Bottle 1 or 2 squib fires.
  - Firex extinguishing agent discharges.
  - The respective ENG BOT 1 or 2 LO message appears on EICAS.

If a fire or overheat condition in the engine persists:

- LH or RH ENG FIRE PUSH switchlight remains illuminated.
- The remaining BOTTLE ARMED PUSH TO DISCH switchlight is pressed:
  - The respective bottle squib fires.
  - Firex extinguishing agent discharges.
  - The respective ENG BOT LO message appears on EICAS with MASTER CAUTION.

NORM—Selects normal operation. The switches are spring-loaded to this position.

NOTE

If a CARGO BOTTLE test is conducted with the CARGO switch selected to FAN or COND AIR, a CARGO FAN FAIL status message will come on.

APU BOTTLE Switch

TEST—APU Firex bottle pressure and squib circuit continuity are checked. The APU SQUIB 1 and 2 green advisory message is displayed if the test results are successful.

NORM—Selects normal operation. The switches are spring-loaded to this position.

CARGO BOTTLE Switch

TEST 1—Simulates a smoke condition on the No. 1 detector with the following indications:

- "Smoke" aural message activates.
- SMOKE CARGO warning message appears.
- CARGO SQUIB 1 advisory message appears (continuity check of squib 1).
- CARGO FIREX panel switchlight indications:
  - Red NORMAL CARGO SMOKE PUSH
  - Red STANDBY CARGO SMOKE PUSH
  - Green NORMAL BOTTLE ARMED PUSH TO DISCH

TEST 2—Simulates a smoke condition on the No. 2 detector with the following indications:

- "Smoke" aural message activates.
- SMOKE CARGO warning message appears.

CIRCUIT BREAKERS

Table 9-2 lists all circuit breakers protecting the power supply for fire protection system components. The table also includes circuit-breaker location and source of power.

Table 9-2 POWER SUPPLY AND CIRCUIT-BREAKER SUMMARY

SUB-SYSTEM	CB NOMENCLATURE	BUS BAR	CB PANEL	CB LOCATION
Fire detector loops	FIRE DET LOOP A	DC BAT	1	N1
	FIRE DET LOOP B			N2
	FIRE DET TEST			N3
Engine bottles	FIRE EXT 1 R ENG	DC EMER	1	R1
	FIRE EXT 1 L ENG			R2
	FIRE EXT 2 R ENG			R3
	FIRE EXT 2 L ENG			R4
APU bottle	APU FIRE EXT A			R5
	APU FIRE EXT B			R6
Cargo compartment	CARGO FIREX 1	DC BAT	1	P1
	CARGO FIREX 2	DC BUS 1	1	G1
Waste compartment/ lavatory	SMOKE DET	DC BUS 1	1	K1

Ground gust damping (gust locks) are provided on the elevators, ailerons, and rudder. Valves in the PCUs provide gust damping when the hydraulic systems are depressurized.

The secondary flight controls consist of the horizontal stabilizer, inboard and outboard flaps, flight spoilers, ground spoilers, and various trim systems. The horizontal stabilizer assists the elevators in providing pitch control. Inputs from the Mach trim, autopilot trim, or control wheel trim reposition the horizontal stabilizer through an electric screw jack.

High lift for takeoff and landing is provided by the trailing edge flaps (inboard and outboard). The flaps are moved by an electric power drive unit, flexible drive shafts, and screw jacks in response to commands from the FLAPS selector. The EICAS provides flap position indicators and readouts (primary page and flight controls page), and aural and visual warnings for takeoff configuration deviation and abnormal flap conditions.

Flight spoilers provide lift dumping in flight. Flight spoiler deployment follows flight crew input at the center pedestal flight spoiler control lever.

Intermediate flight spoiler deploy positions are available between the positions marked. The EICAS indicates flight spoiler cautions, spoiler position readouts (FLIGHT CONTROLS synoptic page), and takeoff configuration aural and visual warnings. The four spoiler panels on the upper surface of each wing function to dump lift and increase drag to assist other braking systems during landing or in the event of a rejected takeoff.

Aileron, horizontal stabilizer, and rudder trim controls are on the center pedestal and control wheel switches (pitch NOSE UP/NOSE DN). The EICAS indicates trim through position indicators and readouts. The EICAS also provides trim system takeoff configuration aural and visual warnings.

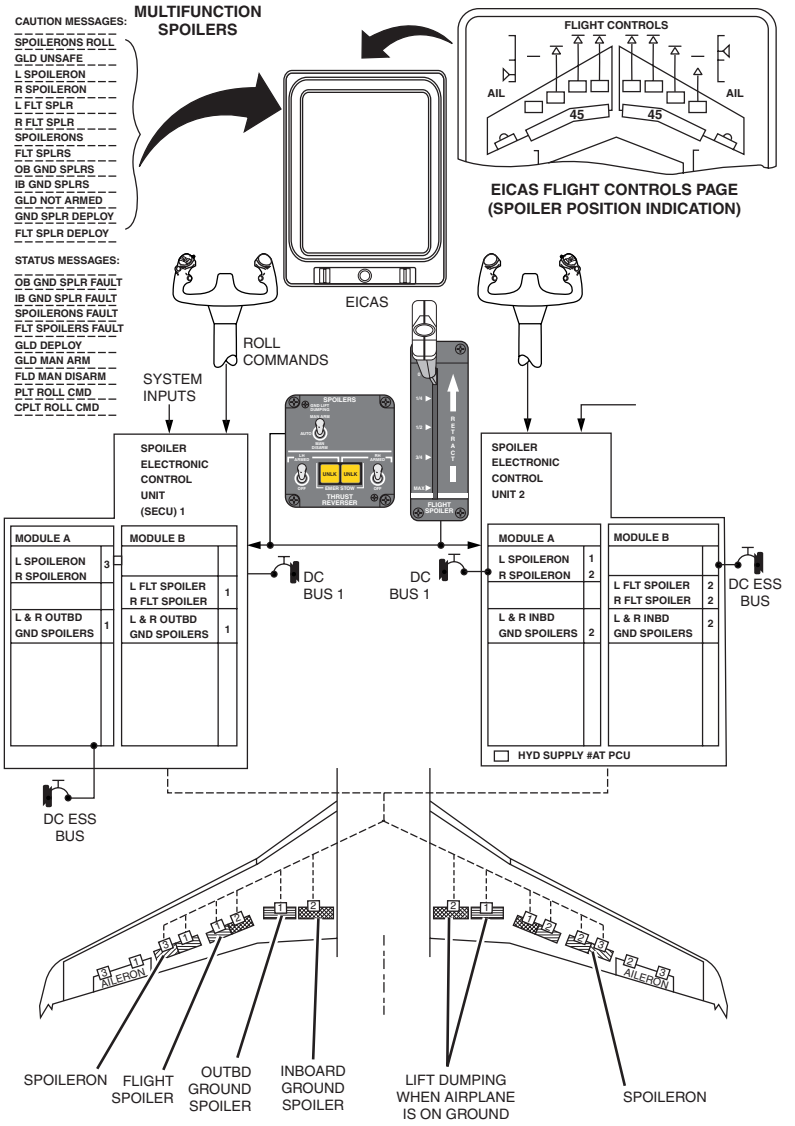
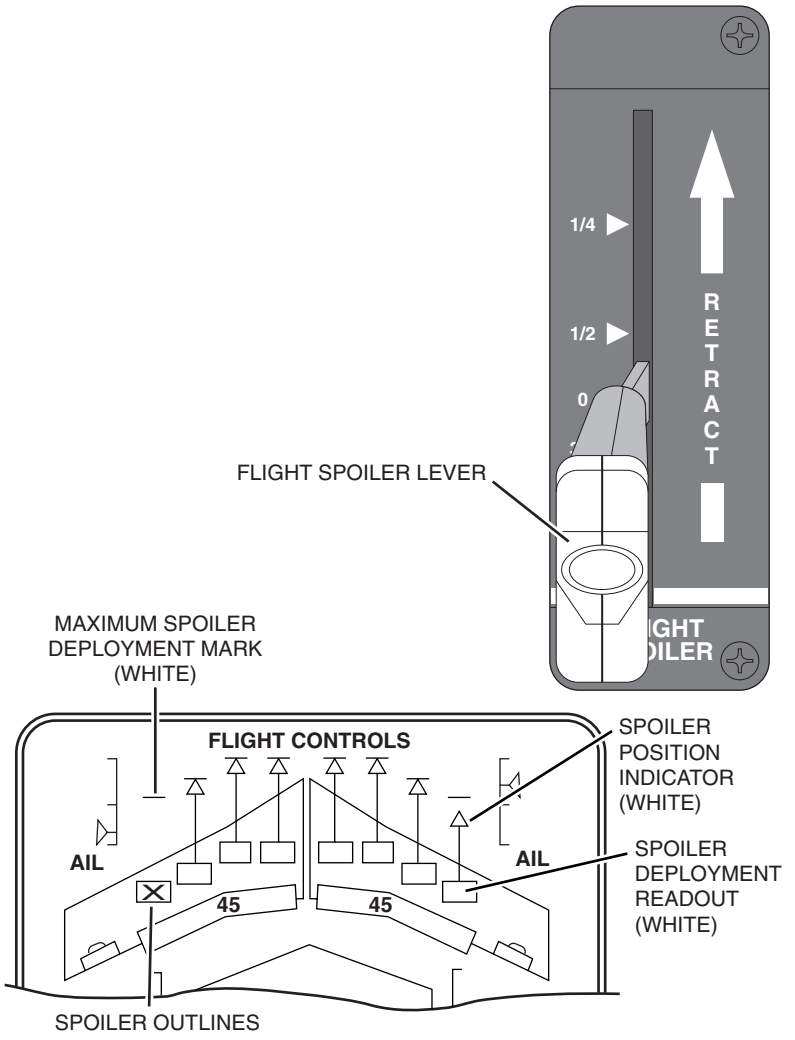
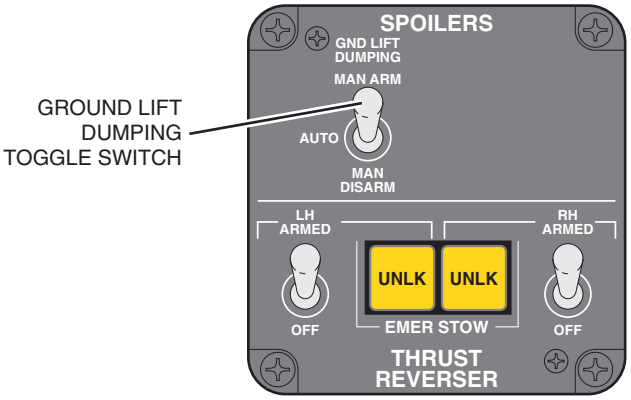


Figure 10-8 Spoiler and Spoileron Control System



NOTE:
AN AMBER X IS DISPLAYED WHEN DATA IS INVALID, AND POSITION INDICATOR (ARROW) IS REMOVED. A SPOILER WITH AN AMBER X INDICATION MAY STILL OPERATE NORMALLY.

Figure 10-13 Flight Spoilers Controls and Indications



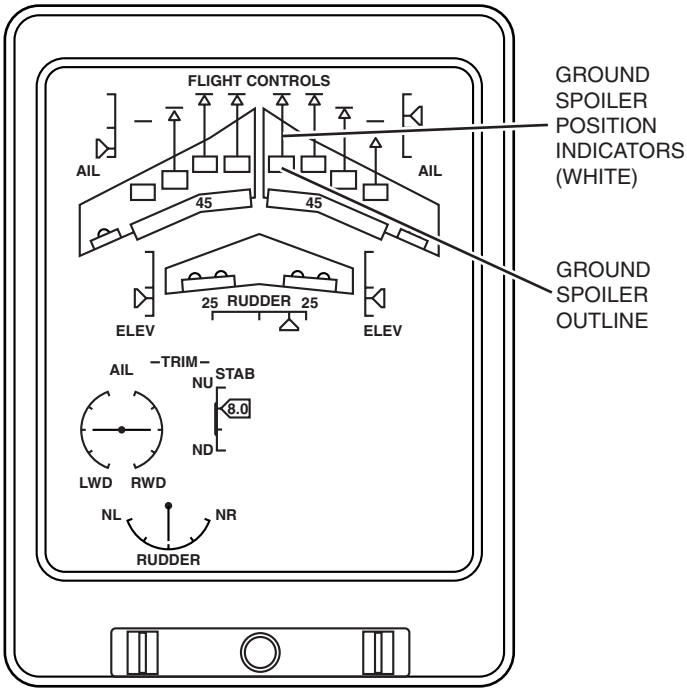


Figure 10-22 Ground Spoiler Controls and Indications

TABLE OF CONTENTS

Label Lines

Label lines show above each data line. They describe the information in a data line or provide additional information related to the data.

Function Lines

Many of the display pages use the two bottom line select keys for additional function selections. To separate functional selection lines from the data lines, the display page shows a dashed line across the display on the label line above the bottom two line select keys. For some functions, in addition to the dashed line, there may also be a label on the line that describes the functional operations of one or both of the bottom line select keys.

Scratchpad

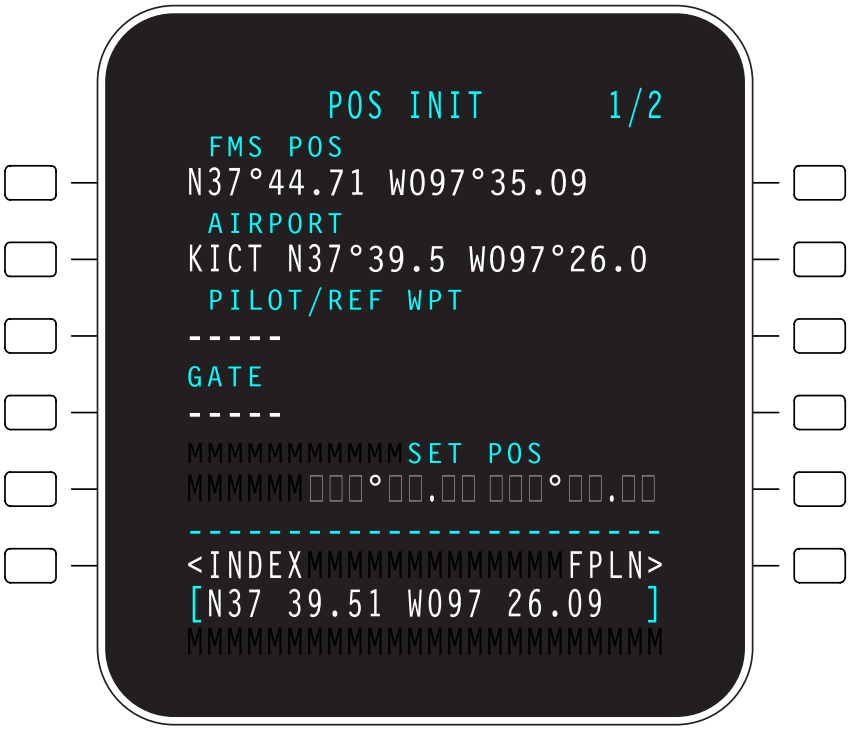
The scratchpad display line shows just below the bottom line select keys with brackets **[ ]** at each end of the line to help identify it. Unless otherwise specified, all data entered, changes made to a flight plan, or other FMS-controlled function, must be done through the scratchpad. When the scratchpad is empty (no text or messages shown between the brackets), enter data into it using the alphanumeric keypad, or copy data directly from the display by pushing the appropriate line select key. Once data is in the scratchpad, transfer it to the desired data line on the appropriate display page by pushing the line select key for that data position. Messages show momentarily on the scratchpad line for data entry errors and other scratchpad operating errors. Scratchpad messages are described in detail in the MESSAGES AND ANNUNCIATIONS section of this pilot's guide.

Message Line

Below the scratchpad on the bottom line of the display is the message line. Various messages show on the message line to alert you to various functional operations. Each message is described in detail in the MESSAGES AND ANNUNCIATIONS section of this pilot's guide.

POS INIT PAGE

"SET POS" PROMPT SHOWING



ROUTE MENU PAGE

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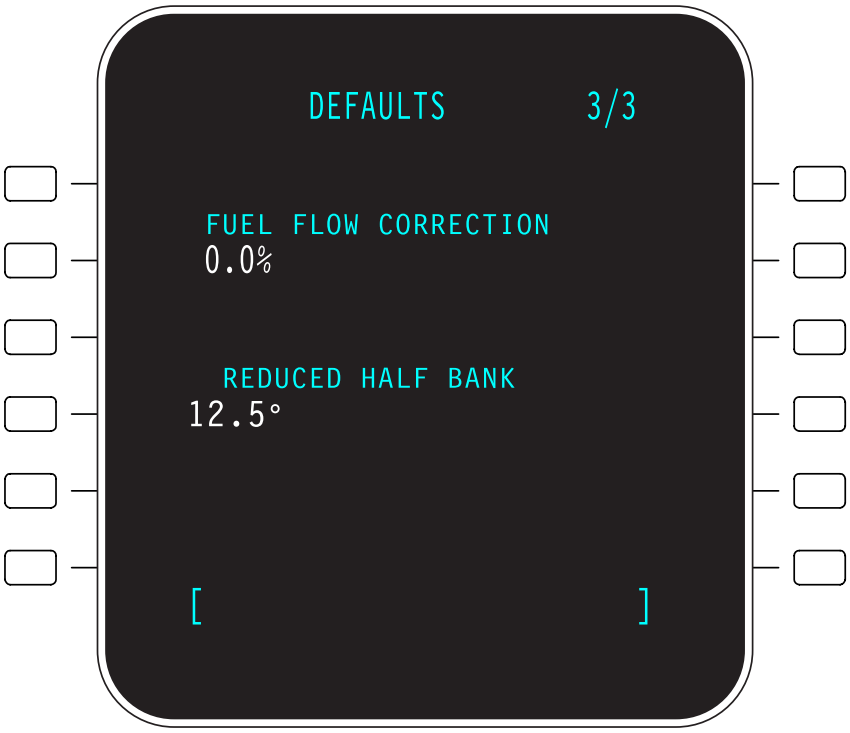
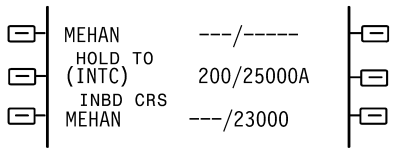
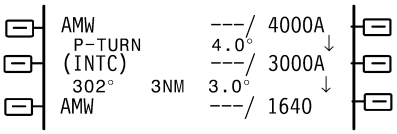
TYPICAL DEFAULTS PAGE 3

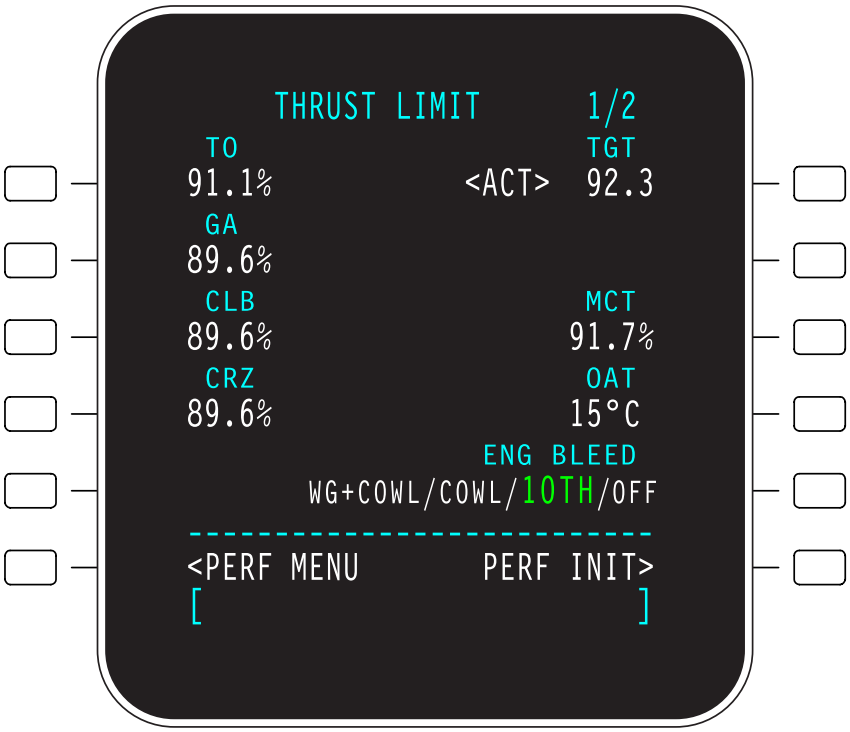


For a "hold to an inbound course" set of legs (i.e., some approach transitions use a course reversal holding pattern to establish the course into the final approach), HOLD TO, the intercept identifier (INTC) and INBD CRS (to identify the inbound waypoint) are shown. A course reversal hold terminates when the holding intercepts the course into the final approach.	
For a procedure turn set of legs, P-TURN and the intercept identifier (INTC) are shown. In the example, the procedure turn originates at AMW and terminates when the path intercepts the course into the final approach (also AMW).	

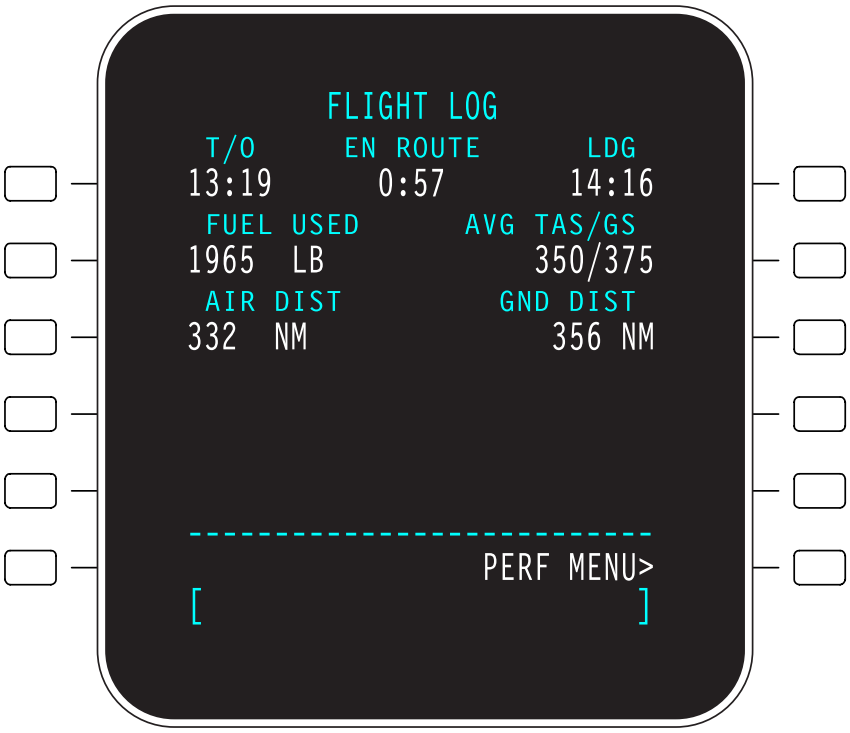
In addition to the leg type and course, a LEGS page also shows:

- The distance from the current position of the airplane to the waypoint
- A SID, STAR, approach, or pilot-entered reference airspeed at a waypoint
- A SID, STAR, approach, or pilot-entered constraint altitude or flight level at a waypoint
- Predicted altitude intercept at a waypoint
- AUTO/INHIBIT SEQUENCE mode selection
- Line key selections for additional LEG DATA and LEG WIND information
- A line key selection for RUNWAY UPDATE to update the FMS (and IRS in some installations) to the runway threshold position before takeoff. [Only available when the airplane is on the ground and an ORIGIN runway has been selected]

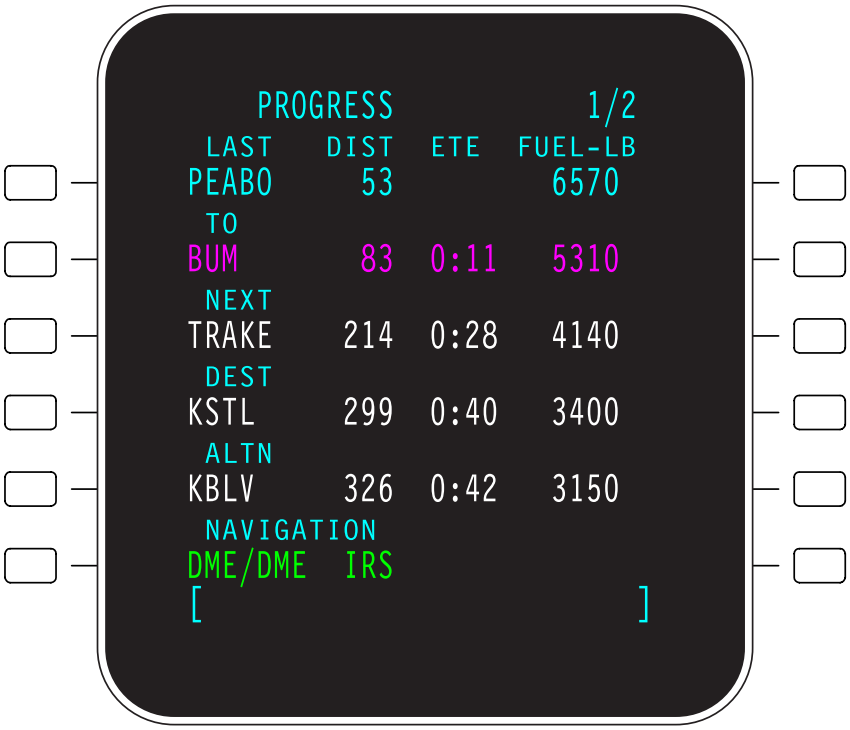
THRUST LIMIT PAGE 1



FLIGHT LOG PAGE



TYPICAL PROGESS PAGE 1



MESSAGES PAGE

WITH TYPICAL MESSAGES

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6RT
WX
USTB
UTC 12:35 TAS 295 GS 319 SAT -6C TAT 0C
RW19R 18NM :CLIMB
PEABO 12NM 0:02 :PEABO
BUM 148NM 0:28 : 4000
KSTL 364NM 1:09 : 0:02/ 12NM
352
N
33
3
>100
SLN
50
PEABO
KICT

ADDENDUM 3
TO
COLLINS FMS-4200 FLIGHT MANAGEMENT SYSTEM
PILOT'S GUIDE

Part Number 523-0778363-002117, 2nd Edition Dated 15 Dec 99

Insert this addendum sheet facing page 2-136

The following NOTE is added after the last paragraph.

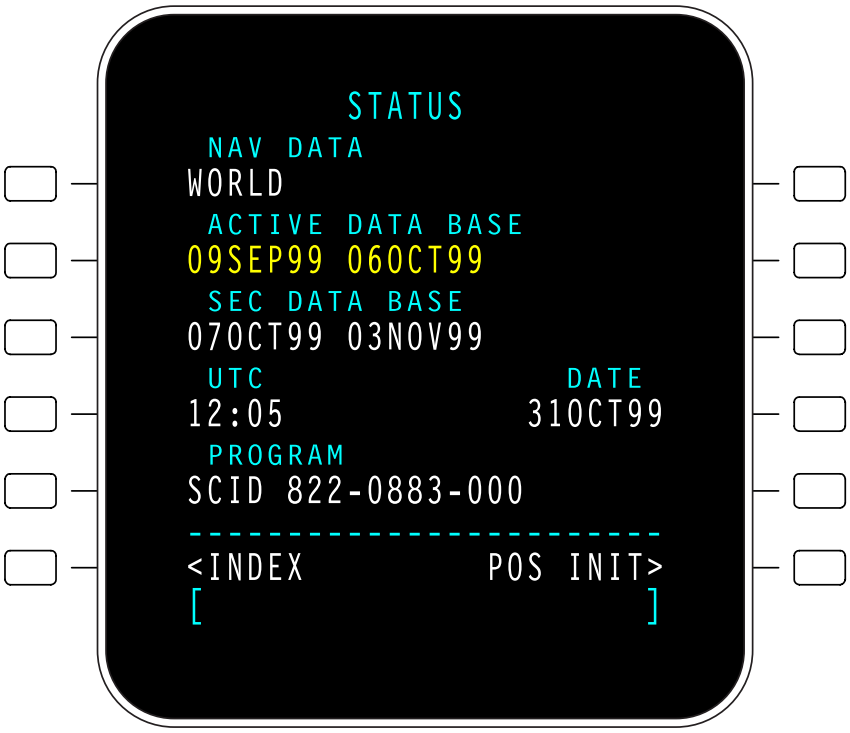
NOTE

The FMS POSITION SUMMARY page includes a list of navigation sensors (or combination of sensors) that may be used by the FMS to determine position. One of the columns on the page is labeled USE. For airplanes equipped with an IRS, the IRS is not part of the FMS navigation solution when any other sensors are being used (GPS/DME/VOR). NO will be displayed in the USE column to indicate IRS is not being used by the FMS. When position fixing sensors are used, the IRS position errors are determined and stored. Once the FMS is not able to use position fixing sensors, it attempts to use the IRS position data if IRS is selected for use by the crew (i.e., ENABLED on the IRS CONTROL page.) The IRS position is then corrected using the stored IRS position errors. YES will be displayed in the USE column when IRS is being used by the FMS for position.


POWER
FAIL
Collins

STATUS PAGE

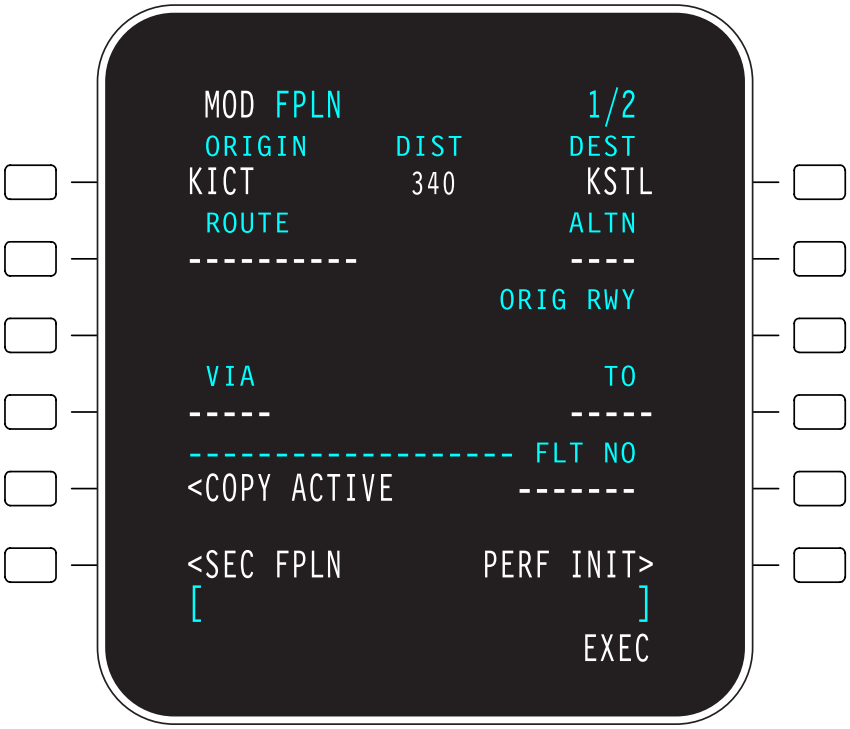
WITH EXPIRED ACTIVE DATA BASE



MFD WITH VNAV WINDOW DISPLAY SELECTED

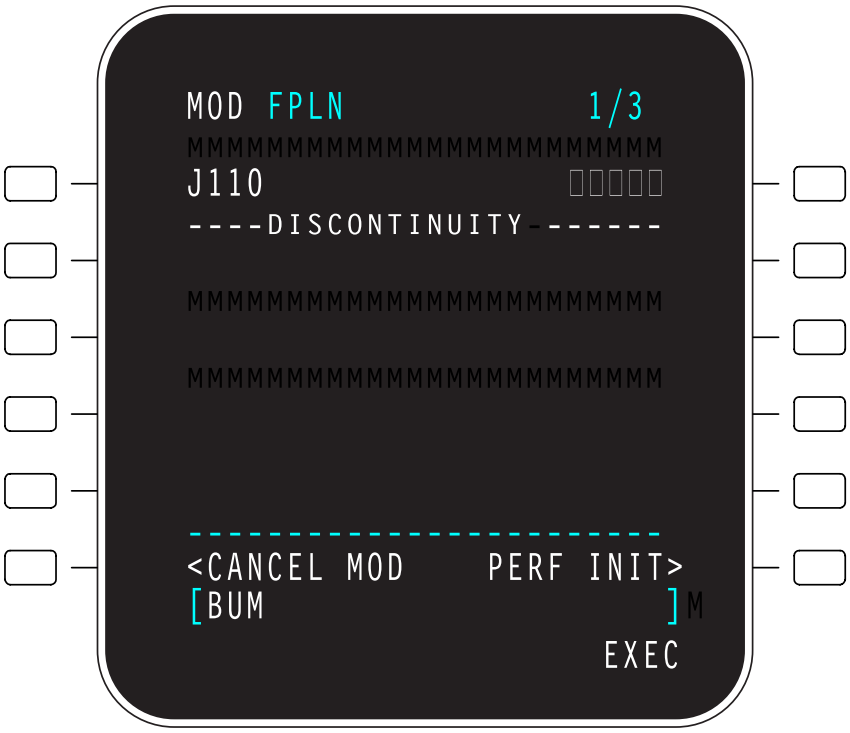
MOD FPLN PAGE WITH

DEST AIRPORT ENTERED



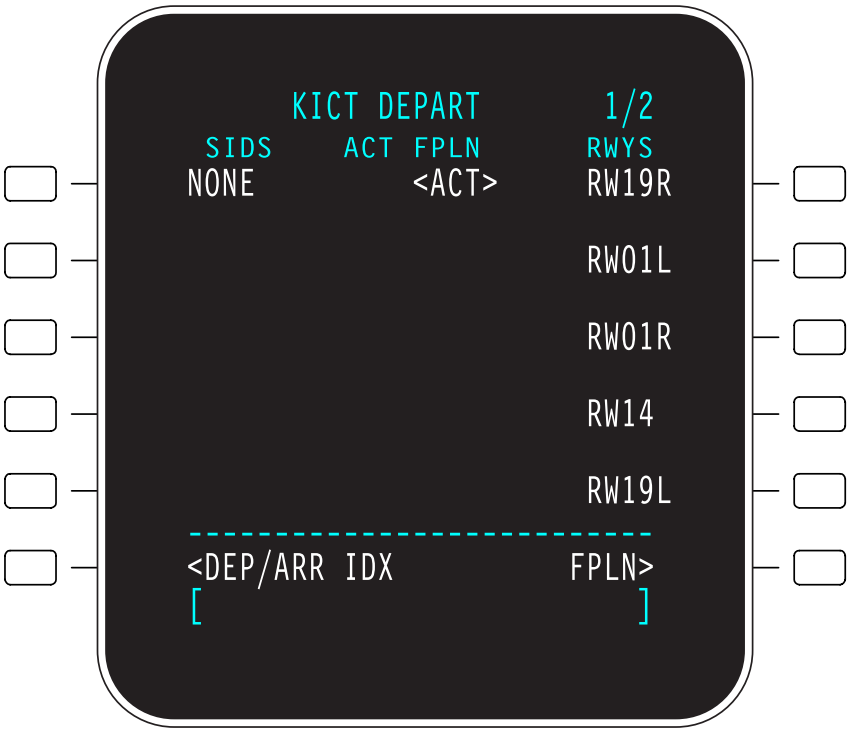
FLIGHT PLAN WITH AIRWAY LEG

(AIRWAY EXIT POINT IN SCRATCHPAD)

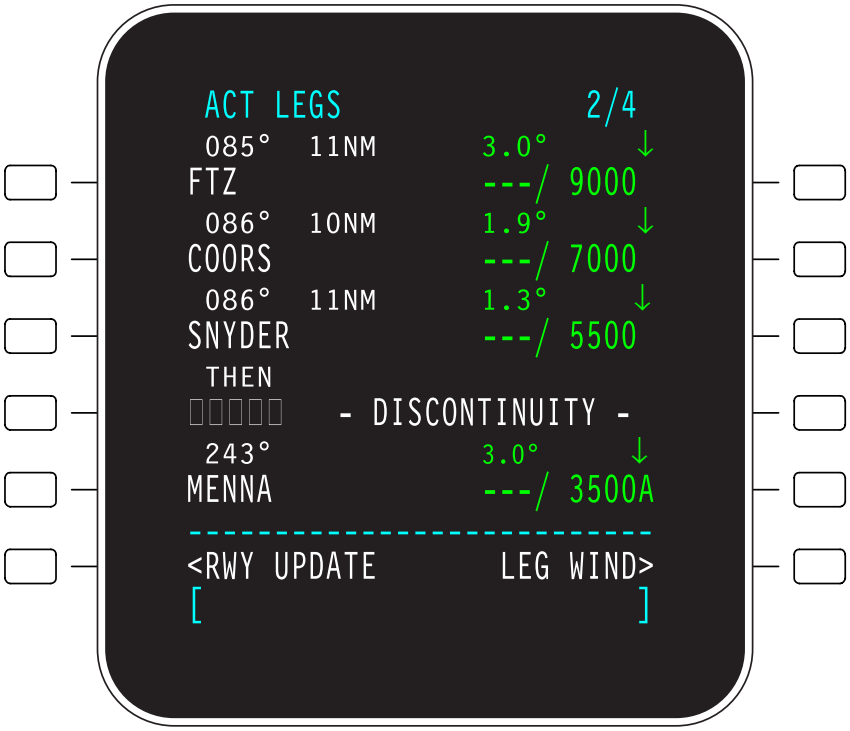


DEPART PAGE SHOWING

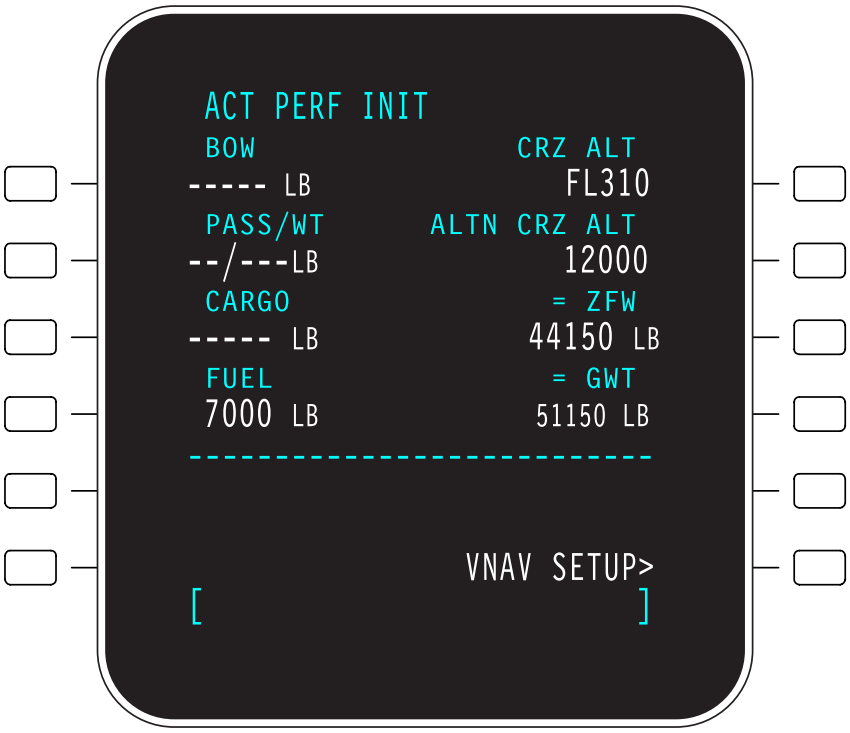
ORIGIN RUNWAY SELECTED



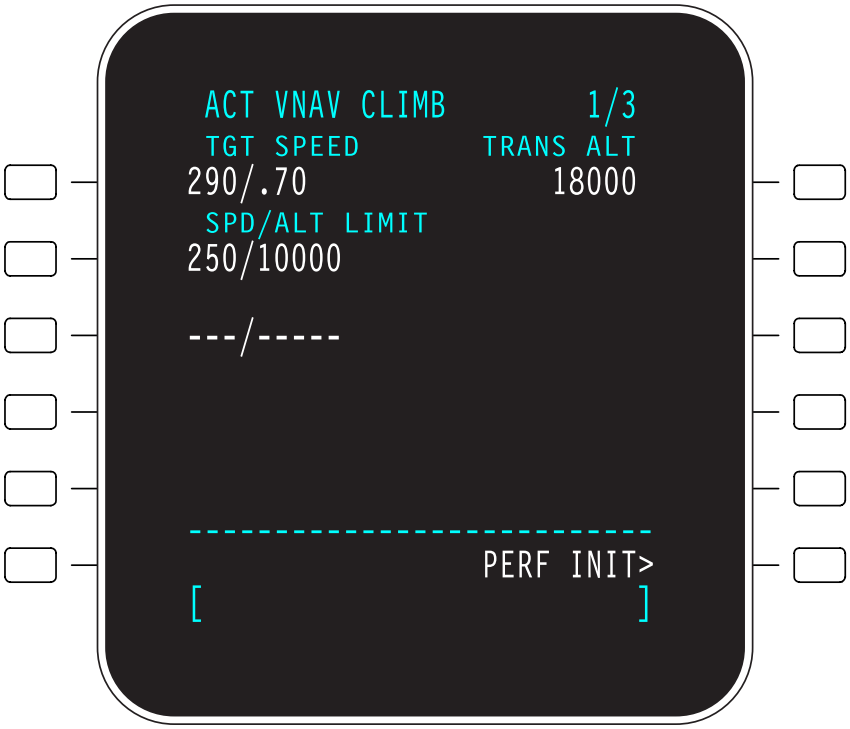
ACT LEGS PAGE WITH
A DISCONTINUITY



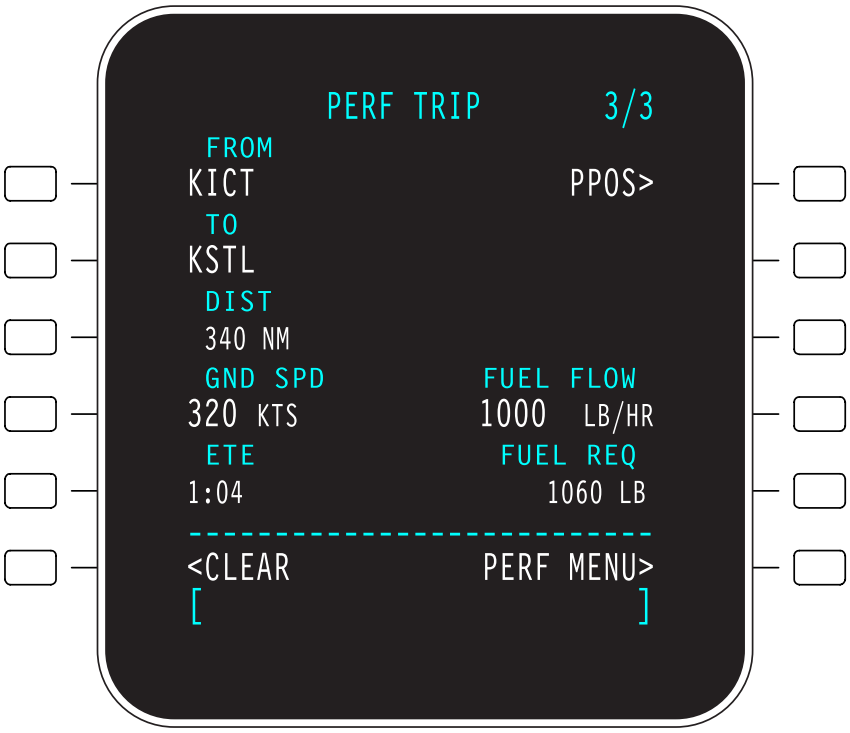
SIMPLE PERF INIT



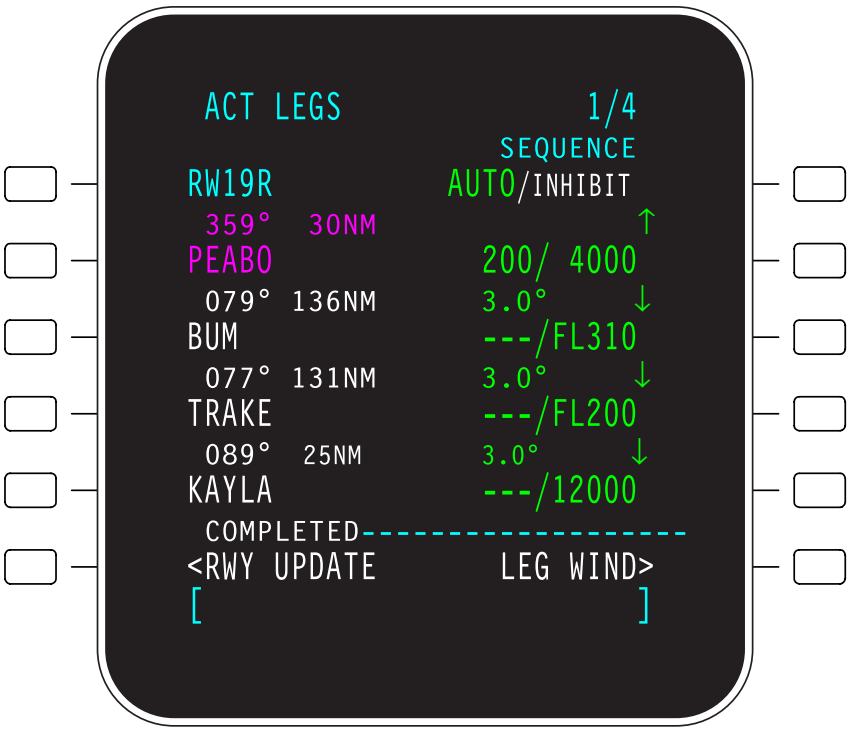
VNAV SETUP PAGE 1 (CLIMB)



TYPICAL PERF TRIP PAGE



RUNWAY UPDATE COMPLETE

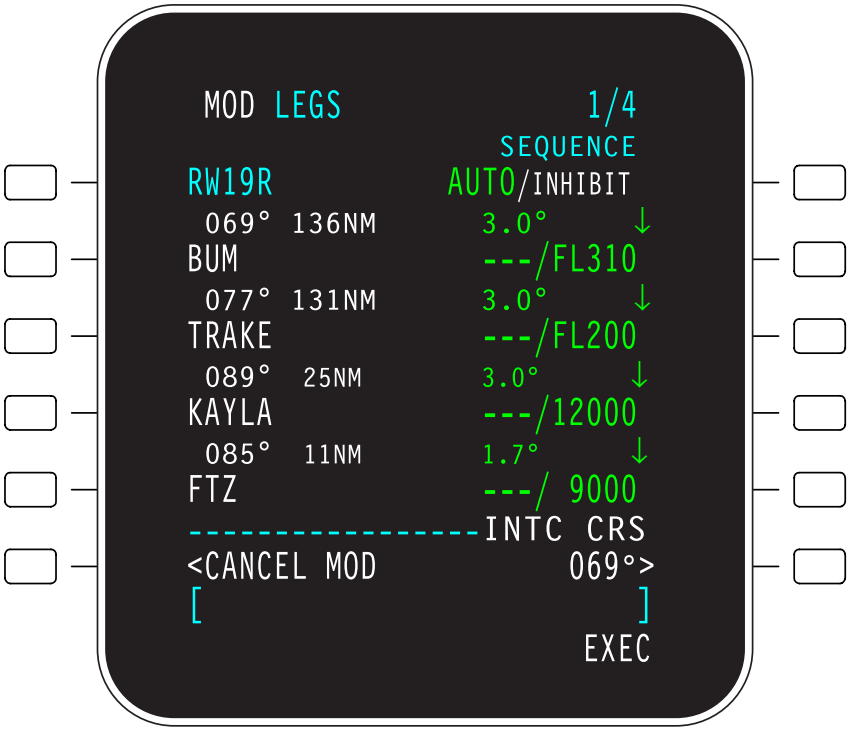


Flight Control System

To use the FMS steering commands provided for the flight control system to laterally guide the airplane along the ACT FPLN route:

1. Verify/Set FMS as the NAV source.
2. Select the NAV mode on the autopilot flight control panel.

DIRECT-TO ON LEGS PAGE



ACT LEGS PAGE WITH HOLD
AT PRESENT POSITION

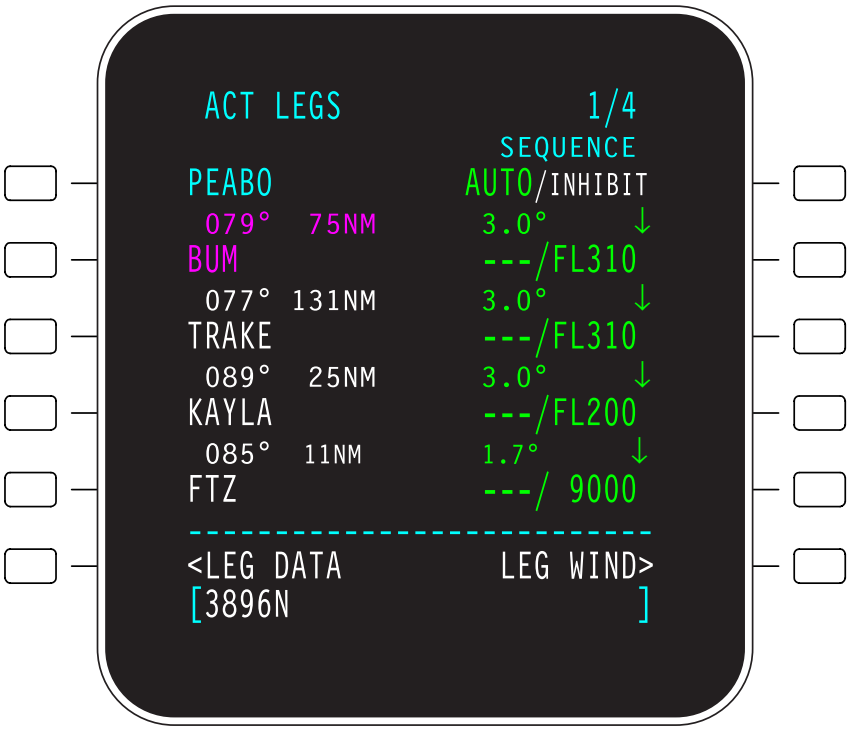
FPLN/LEGS Pages

You can define a waypoint from the FPLN or LEGS page by entering the waypoint data into the scratchpad and transferring it to the appropriate data line. There are five formats for defining a waypoint and a description of each follows the procedure example.

To enter a pilot-defined waypoint into a flight plan from the FPLN or LEGS page:

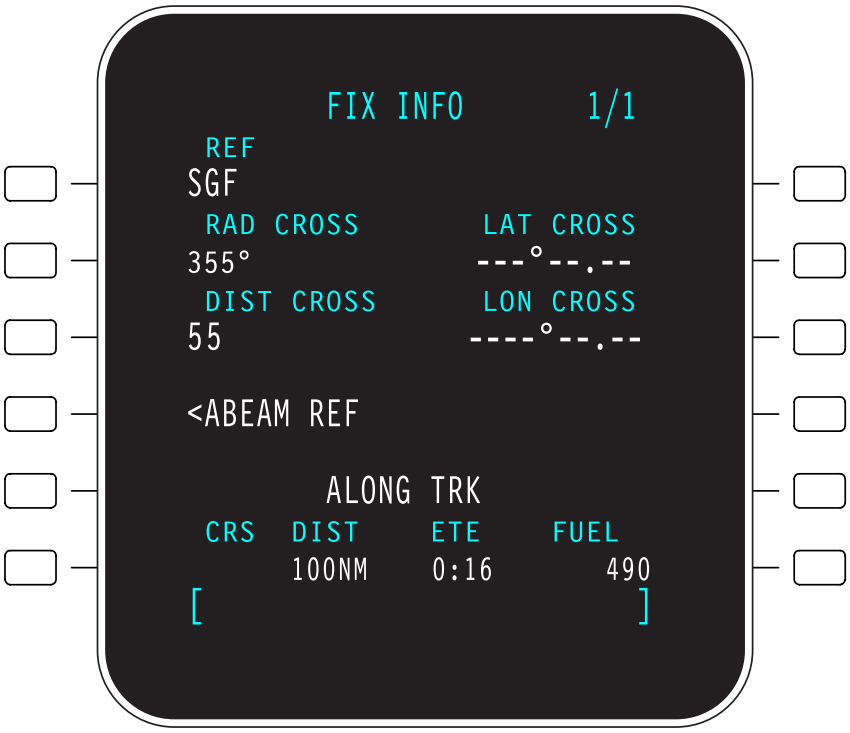
1. Select the desired entry page.
2. Enter the waypoint definition into the scratchpad.
3. Push the line select key at the location in the flight plan where you want to enter the waypoint.
4. Verify the flight plan change on the CDU and MFD, then push the EXEC key to execute the flight plan change.

SHORTHAND LAT/LONG WPT



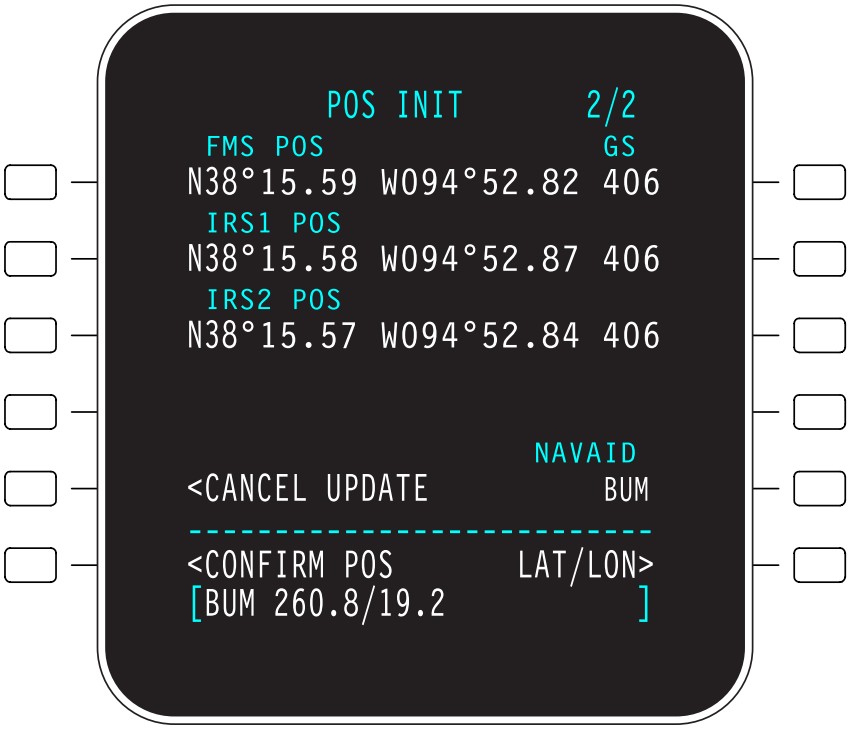
FIX INFO PAGE

WITH DISTANCE CROSS FIX



POS INIT PAGE WITH

UPDATE FROM NAVAID POSITION



APPROACH

Approaches are selected from the APPR or VISUAL columns on the ARRIVAL page. Select the ARRIVAL page with the DEP ARR key or with the appropriate ARR line key on the DEP/ARR INDEX page. Both visual and instrument approaches can be selected from the ARRIVAL page.

VERTICAL NAVIGATION (VNAV)

VNAV information is shown on the LEGS pages. Push the LEGS key to show the LEGS page.

The FMS provides multiple waypoint VNAV for each phase of flight. VNAV aids the pilot in complying with:

- Altitude and speed constraints at waypoints
- Speed limits at altitudes
- The vertical flight profile as specified by the pilot.

During the various phases of flight, advisory VNAV follows the flight plan. It levels the airplane once the preselect altitude is captured and prompts a descent at a planned location. Step climbs can be initiated with the altitude preselector and selection of the desired climb mode. During descent, VNAV computes a geographical path to each waypoint with an altitude constraint, and provides guidance relative to that path. If there are multiple altitude constraints at various waypoints along the flight plan, the FMS automatically adjusts the descent path for a smooth stabilized descent while ensuring that the altitude constraints are honored.

In a flight plan, each waypoint can show, as appropriate:

- An altitude constraint
- Climb or descent applicability (↑ for climb, ↓ for descent)
- A vertical path angle
- A speed constraint.

With some exceptions, each of these can be changed. When any VNAV entries or changes are made, the FMS handles them by creating a MOD FPLN in the same manner as a lateral change. For the changes to be included in the ACT FPLN, you must push the EXEC key to execute the flight plan.

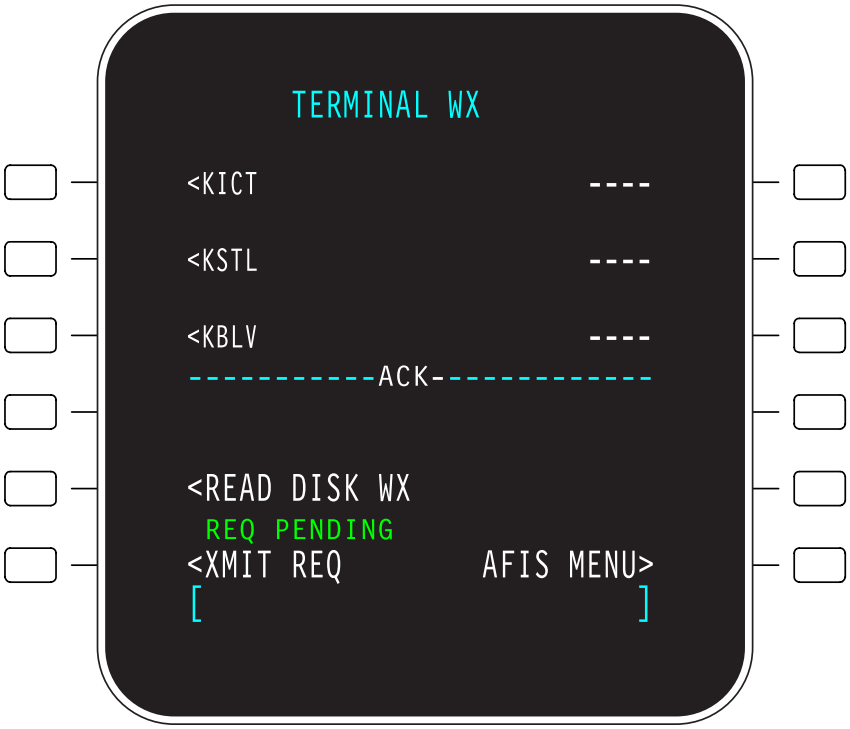
When a flight plan is created, the FMS automatically makes the first half of the waypoints in the flight plan climbs (↑) and the last half descents (↓), as shown by the up and down arrows. SID waypoints are automatically assigned as climbs and STAR and approach waypoints as descents. You can change this using the entry formats described above. The letters C and D do not show on the altitude constraints once they are transferred from the scratchpad into the flight plan.

An altitude constraint that shows in yellow indicates any of the following:

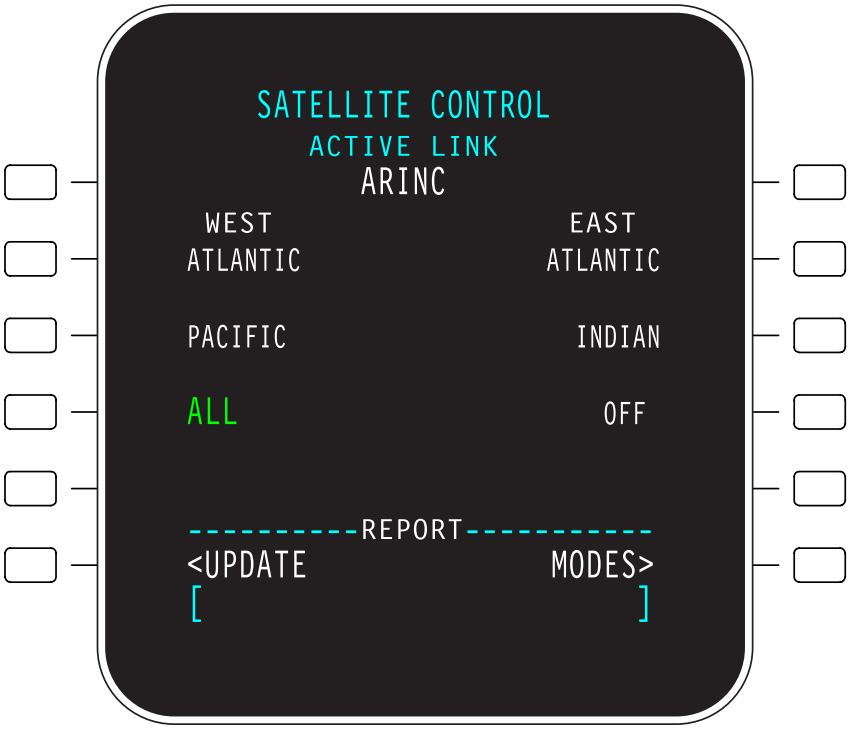
- You currently are not flying, or will not be able to fly, the airplane in a manner required to meet the specified altitude constraint.

AFIS MENU PAGE

TERMINAL WX REQUEST PAGE

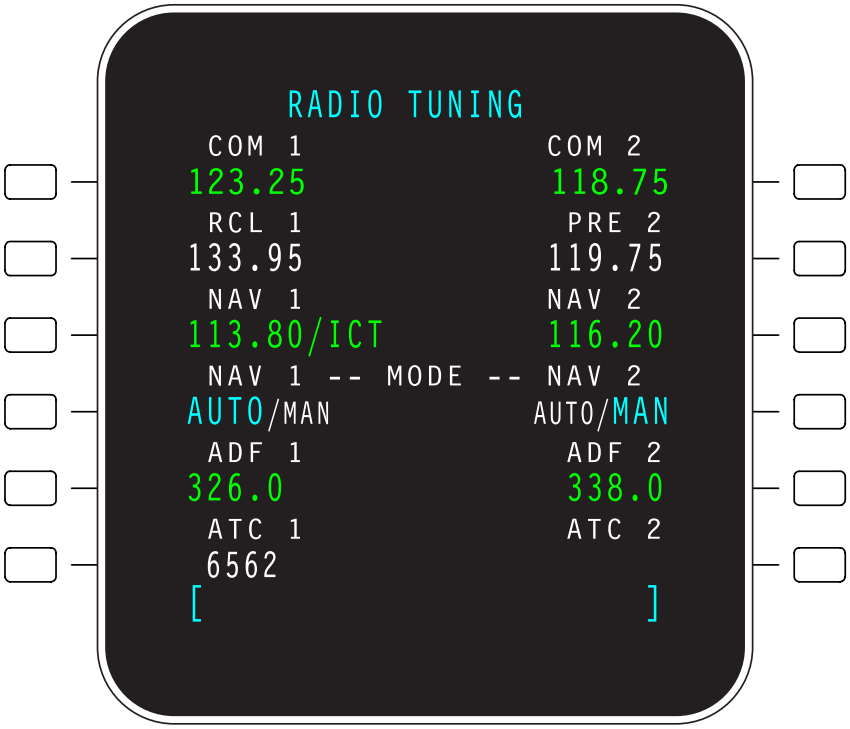


SATELLITE CONTROL PAGE



NAV RADIO #1

TUNED BY IDENT



LOADING DATA BASE

TYPICAL PROGRESS PAGE

Flight Plan

Each FMS-4200 may hold two flight plans. One flight plan is the called the active flight plan and the other is called the second flight plan. Active flight plan data shows on the ACT FPLN, MOD FPLN, LEGS, ACT LEGS, and MOD LEGS display pages. Second flight plan data shows on the SEC FPLN and SEC LEGS display pages. Only the active flight plan is used for navigation and it is used only when FMS is selected as the NAV source.

A flight plan is made up of waypoints created from a combination of elements that include some or all of the following:

- Airports (origin, destination and alternate)
- Departure runway
- SID and transition
- Direct-to routes
- Airways
- Pilot-defined waypoints
- Holds
- STAR and transition
- Approach procedure, or arrival runway extension, and arrival runway
- Missed approach procedure
- Route to the alternate airport.

A waypoint is any point that is used as a reference for a navigation fix. Waypoints may be either predefined or pilot-defined. Predefined waypoints are stored in the FMS navigation database with the identifiers that are shown on aeronautical charts. These waypoints may be airports, navaids, or other charted navigation fixes and uncharted fixes used in SIDs, STARs, and approaches. Pilot-defined waypoints are stored within a flight plan and in the Pilot-defined waypoint list, but not in the FMS navigation database.

In dual FMS installations set to the SYNC operating mode, flight plan data is shared between both systems. In the INDEP operating mode, each FMS has its own flight plans. However, the flight plans can be copied, in whole, from one FMS to the other.

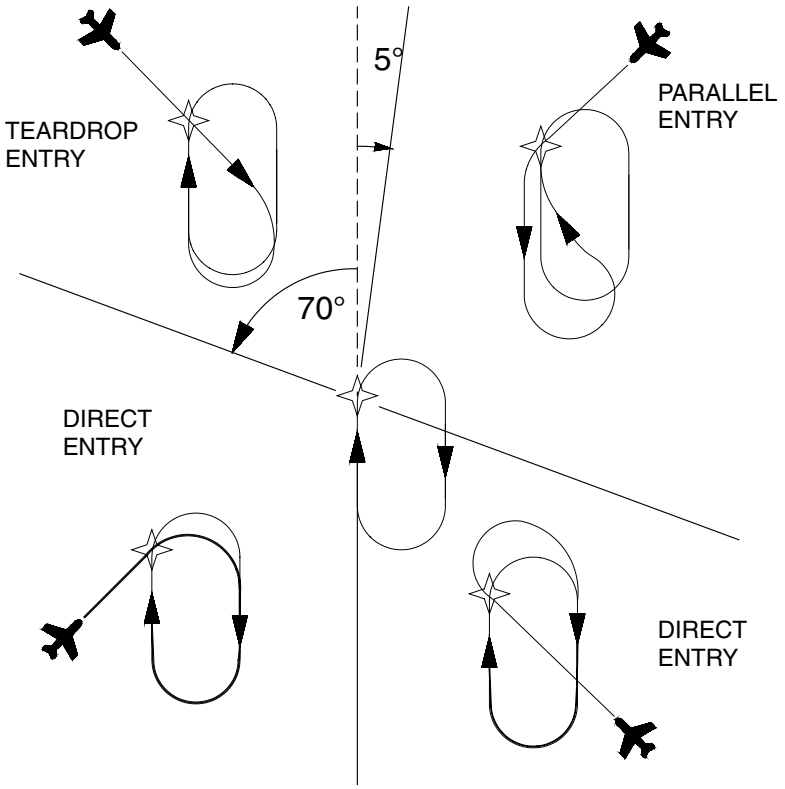
In SYNC mode, as the airplane progresses along the flight plan route, both FMSs are simultaneously sequenced from one waypoint to the next by the FMS that is selected for use by the autopilot. In the INDEP mode, when both FMS1 and FMS2 are selected as NAV sources, each FMS independently sequences through the flight plan as the airplane progresses along the route.

Holding Patterns

Entry

As the airplane approaches a holding fix, the FMS calculates the initial size of the holding pattern based on the current wind conditions, the airplane's true airspeed or the MAX HOLD speed, whichever is lower, and either the leg time or the leg distance of the hold. In addition, it determines the best entry method based on the direction of approach to the holding fix, and the direction and type (standard or nonstandard) of holding pattern. The entry method is selected in accordance with the rules depicted in the following figure.

For parallel entries into a hold, the FMS steers the outbound entry leg to an extended fixed distance. This is done to ensure the protected airspace of the holding pattern is not violated when flown in excessive wind conditions. If your ground speed is slow, the parallel entry leg may extend well beyond the normal inbound leg turn (as shown below). However, even with the extended entry leg, the FMS maintains the airplane well within the protected airspace for a holding pattern.



Instrument

Select an instrument approach and any related elements for that approach on the ARRIVAL page. The ARRIVAL page is selected with the DEP/ARR key or with a line key selection on the DEP/ARR INDEX page.

The FMS provides lateral steering commands to the flight control system and advisory vertical steering commands to fly non-precision approaches. All FMS database instrument approaches are either localizer-based or FMS-based. Localizer-based approaches include:

- ILS
- Localizer Only (LOC)
- Simplified Directional Facility (SDF)
- Localizer Directional Aid (LDA)
- Localizer Back Course (B/C).

All other approaches are FMS-based.

Transitions

Many instrument approaches use transitions to go from the en route or STAR environment to the approach environment. Transitions available for any given approach may include specific charted and named transitions, vectored transitions, or a combination of both. Instrument approach transitions, along with the desired approach, are selected on the ARRIVAL page. When you select an approach, the list of transitions available for that approach shows under the annunciation "TRANS". The default transition for all approaches is VECTORS. If you want a transition other than VECTORS, you must select one from the list of available transitions.

When you select an approach on the ARRIVAL page and execute the flight plan change, a discontinuity is automatically inserted into the flight plan to separate the en route or STAR segment from the approach segment, unless the en route or STAR terminates on the initial approach waypoint. When the FMS sequences to that discontinuity, it automatically changes from the AUTO SEQUENCE mode to the INHIBIT SEQUENCE mode.

An easy method to transition to an approach with a named transition (other than VECTORS) is to close the discontinuity before the FMS sequences it into the TO waypoint position. It should be closed with an appropriate waypoint from the approach segment of the flight plan.

For VECTORS transitions, one of the two following procedures may be used:

When vectors to final are expected, select the VECTORS transition when selecting the approach. This transition consists of a course-to-fix leg in the flight plan leading to the final approach course toward the FAF (or toward the FACF

Satellite numbers may be entered one at a time. All deselected satellites are deleted simultaneously using the DELETE key function, or you can delete individual satellites from the deselected list by reentering the satellite number.

If approach is enabled and any of the following conditions are true, then "NO APPR" is annunciated in yellow on the PFD.

- Approach RAIM is not available at any time while the airplane is between 2 NM inbound to FAF and FAF
- Approach RAIM is available while the airplane is between 2 NM inbound to FAF and FAF, MAP is more than 5 min from FAF, and approach RAIM is predicted to be unavailable within 5 min of predicted arrival time at MAP
- Approach RAIM is not available at 2 NM inbound to FAF and approach RAIM is predicted to be unavailable within 5 min of predicted arrival time at FAF or MAP
- Approach RAIM is not available for 5 minutes during final approach
- "GPS NOT AVAILABLE," "NO APPR GPS RAIM," "NO GPS RAIM," or "FMS DR" message is annunciated after 20 seconds while in final approach.

RNAV

To fly an RNAV, VOR/DME, or VOR approach as an RNAV approach with FMS, but without the GPS sensor, the approach must be selected and inserted into the flight plan. When the approach is enabled, cross track deviation display sensitivity, enforcement of approach navigation accuracy and integrity, and the display of vertical deviation information during the final approach are activated. If flight director vertical steering guidance is desired, the preselector altitude must remain set below airplane altitude past FAF.

When the FMS sequences from the en route segment to the approach segment, the following events occur.

At 30 NM great circle distance from the airport reference point (ARP), the system automatically:

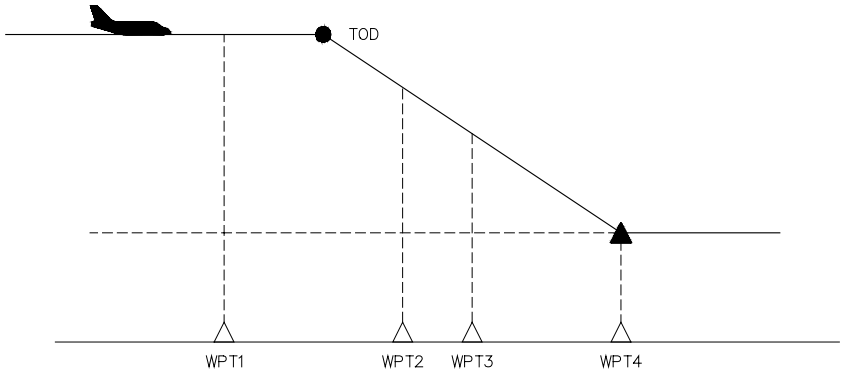
- Transitions to terminal deviation sensitivity (±1.00 NM)
- Begins monitoring for terminal navigation accuracy
- Shows the "TERM" message on the PFD.

Between 2 NM from FAF up to FAF, if the approach is enabled and FAF waypoint sequencing conditions are met, the system automatically:

- Shows the "APPR" message on the PFD
- Maintains deviation sensitivity of ±1.00 NM
- Begins monitoring for approach navigation accuracy.

VPA

The descent path is defined by the vertical path angle (VPA). A default VPA (set on the CDU DEFAULTS page) is initially shown on the VNAV DESCENT page and it is applied to a flight plan when one is created. You can overwrite the default setting on the VNAV DESCENT page to apply it to the entire descent portion of a flight plan, or you can overwrite it on the LEGS pages for specific descent segments of a flight plan.



VPATH DESCENT PATH

Path Smoothing

When there are two or more altitude constraints in a descent path, the FMS calculates and flies a smooth descent path without intermediate altitude hold segments, as long as each of the descent segments has a VPA greater than the airplane's minimum allowable VPA (typically 1 degree). When two altitude constraints are so far apart that a straight-line path connecting the two constraints is shallower than the minimum allowable VPA, or you have specified a VPA for that segment, an altitude hold is inserted before the descent.

VPAs on the second and subsequent descent segments are modified to provide the path continuity. The computed VPA is shown on the LEGS page. A descent path is always computed to the last descent altitude constraint in a flight plan or before a discontinuity, regardless of the altitude type (AT, AT OR ABOVE, AT OR BELOW or BETWEEN). If the last descent altitude is BETWEEN, the path defaults to the upper altitude constraint. The descent path is computed through, versus to, AT OR ABOVE, AT OR BELOW, or BETWEEN descent constraints that are not last in the flight plan or before a discontinuity. This allows the FMS to both maintain the selected VPA and perform path smoothing whenever possible to create a continuous descent path through these constraints. AT OR ABOVE, AT OR BELOW, and BETWEEN constraints are always honored but they do not unduly restrict the path. In the approach phase of flight, VNAV computes a descent path that flies to the first altitude

ADDENDUM 1
To
Collins FMS-4200
Flight Management System Pilot's Guide

Part Number 523-0778363-002117, 2nd Edition
Dated 15 December 1999

Insert this addendum sheet facing page 17-4.

The Messages table will be expanded to include the following items. The added items will appear in alphabetical order at the next revision to the pilot's guide.

CDU MESSAGE	PFD MESSAGE	COLOR	DESCRIPTION
ADC TEMP DISAGREE	MSG	Yellow	SAT temperature values for the air data computers are in disagreement.
CHECK TAKEOFF PERF	None shown	Yellow	Verify that performance database with takeoff N1 thrust tables is loaded.
FMS-EFD N1 DISAGREE	MSG	Yellow	N1 thrust comparator indicates mismatch between FMS and EFD values.
FMS-FMS N1 DISAGREE	MSG	Yellow	N1 thrust comparator indicates mismatch between FMS LRUs.
LOW POS ACCURACY	MSG	Yellow	Position accuracy is below the RNP required value.
PERF OUT OF RANGE	MSG	White	Performance parameter values are exceeded.
UNABLE VHF NAV TUNE	MSG	Yellow	VHF navigation receiver tuning is unavailable.

CDU MESSAGE	PFD MESSAGE	COLOR	DESCRIPTION
NO VPATH CONDITION	MSG	White	When this message shows, VPATH mode automatically reverts to VPITCH mode. This occurs because either the airplane crossed a vertical discontinuity in the descent path, or a flight plan edit occurred that caused the active descent path to move. Changing the autopilot to a mode other than VPITCH or passing the last altitude constraint on the descent path clears this message.
NO VPATH-DISCON	MSG	White	VPATH arm is invalid because there is a discontinuity down track. Clear the discontinuity to clear this message.
NO VPATH-PILOT CMD	MSG	White	You have selected a vertical autopilot mode while flying VPATH. VPATH will automatically recapture only after: (1) Vertical deviation exceeds 1 dot, and (2) The airplane is maneuvered back to the VNAV path. Another way to clear this message is to cycle VNAV off and on.
NO VPATH THIS LEG	MSG	White	This message occurs when the flight plan sequences to a new leg that is a holding pattern. When this occurs, VPATH automatically changes to VPITCH. Changing the autopilot to a mode other than VPITCH, or changing to a leg that is not a holding pattern, clears this message.
NO VPATH-TAE	MSG	White	VPATH mode has automatically reverted to VPITCH mode because the track angle error has exceeded the specified limits. This message will clear when the airplane is turned to fly along the FMS course line or when you select an autopilot mode other than VPITCH.
NO VPATH-VECTORS	MSG	White	VPATH mode has automatically reverted to VPITCH mode because there is a heading leg in the FMS flight plan. This message will clear after passing the heading leg, or when you set the autopilot to a mode other than VPITCH.

DBU and Maintenance Operations

The following messages show on the CDU scratchpad for data entry or selection problems related to use of the DBU and maintenance operations. The messages show in white for approximately one second, then the previous scratchpad entry returns for correction or deletion.

MESSAGE	DESCRIPTION
DBU NOT RESPONDING	The DBU is not responding to commands from the FMS.
DISK CHANGED DURING REQ	The disk was changed before the last command was completed. Cancel the operation or reinsert the previous disk.
DISK DRIVE COLD	The disk drive indicates it is too cold to operate. The drive must be above 0° F for it to operate.
DISK DRIVE NOT READY	No diskette is inserted in the disk drive. Insert the disk and try the procedure again.
DISK ERROR	The disk drive detected an error while reading or writing to the disk. Try the procedure again.
DISK UNFORMATTED	The disk inserted into the DBU is not formatted. Format the disk and try again.
DISK WRITE PROTECTED	You attempted to write data to the disk in the DBU and the write protection tab on the disk is set to the protect position. If you are sure that you want to write to this disk, set the tab on the disk to the unprotected position and try again.
FILE NOT DELETABLE	You attempted to delete a file that cannot be deleted.
FILE NOT FOUND	The disk in the DBU does not contain a file requested by the FMS. Cancel the operation or check to be sure you inserted the correct disk and try again.
FILE TRANSFER ERROR	An error occurred while transferring data between the FMS and the DBU. Cancel the operation or try again.
FMS LOAD ERROR	The FMS has detected an error in storing the disk data. Cancel the operation and try again.
FMS MEMORY FULL	The FMS does not have enough memory to load the requested data from the disk. Cancel the operation.
FMS NOT RESPONDING	The FMS is not responding to the DBU. Cancel the operation and try again.

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