operator's guide

FMS-3000
Flight Management System
For the Cessna Citation Encore+

Rockwell Collins

operator's guide

FMS-3000 Flight Management System for the Cessna Citation Encore+

Notice

INFORMATION SUBJECT TO EXPORT LAWS

The technical data in this document (or file) is controlled for export under the Export Administration Regulations (EAR), 15 CFR Parts 730-774. Violations of these laws may be subject to fines and penalties under the Export Administration Act.

Rockwell Collins

operator's guide

FMS-3000 Flight Management System for the Cessna Citation Encore+

Notice

INFORMATION SUBJECT TO EXPORT LAWS

Rockwell Collins

For product orders or inquiries, please contact:

Rockwell Collins
Customer Response Center
400 Collins Rd NE M/S 133-100
Cedar Rapids, IA 52498-0001

TELEPHONE: 1.888.265.5467
INTERNATIONAL: 1.319.265.5467
FAX NO: 1.319.295.4941
EMAIL: response@rockwellcollins.com

Printed in the USA

SOFTWARE COPYRIGHT NOTICE

TABLE OF CONTENTS

Tab Title Page

Tab Title Page

Tab Title Page

Tab Title Page

Tab Title Page

Tab Title Page

This page intentionally left blank

LIST OF ILLUSTRATIONS

Figure Title Page

TABLE OF CONTENTS

This page intentionally left blank

INTRODUCTION

The FMS-3000 Flight Management System includes the Flight Management Computer (FMC), Control Display Unit (CDU), and Global Positioning System (GPS). The system is used to control the flight displays, FMS, radio tuning, and other aircraft functions. This operator's guide provides operating information for this system. It is not a training manual. It is a guide to understand the operation of the FMS-3000 Flight Management System designed by Rockwell Collins, Inc.

NOTE

It is possible on a Cessna Citation Encore+ to have a dual FMS system with only one Collins FMS installed. This is referred to as a mixed system. This guide describes operation and displays only for the Collins FMS. It does not address operation of any non-Collins FMS installed on the aircraft.

Basic operating procedures for the FMS-3000 are described and arranged approximately in the order of their use in the various phases of flight, from preflight through missed approach. Additional functions of the FMS-3000 such as radio tuning, database loading, and other operating information are also described.

Not all display elements and/or annunciations shown in the figures and described in this operator's guide will show on every system installation. Some of the information shown is determined by other equipment installed in the aircraft, the FMS options installed, the interconnect wiring on the aircraft, and the regime of flight. Also, some display elements and/or annunciations will not show on the displays at the same time as other elements and/or annunciations. In some instances, the data shown on a specific CDU page can, based on variations in installations, show on a different display page. The colors of some display elements can also be different. Refer to the applicable aircraft flight manuals for information related to the installed options and variations.

In some cases, there is more than one way to accomplish a task related to flight planning, changing a flight plan, or other FMS functions. In general, this guide describes only one method for doing a specific task.

To submit comments regarding this manual, please contact:

Rockwell Collins Services
Rockwell Collins, Inc.
400 Collins Rd NE
Cedar Rapids, IA 52498-0001

Attn: Technical Operations M/S 153-250

or send email to: techmanuals@rockwellcollins.com

SAFETY SUMMARY

CAUTION

Some aircraft operators can have special procedures that are different from those given in this operator's guide. Refer to the applicable aircraft flight manual for instructions specified for your aircraft.

CAUTION

Be careful if you wear sunglasses with lenses that cause you not to see some colors. These types of lenses can have an unwanted effect on how some colors show on the electronic flight displays. You cannot see some items on the display when you wear these types of sunglasses. Also, the color of some items can change. For example, some blue lenses can cause a magenta display item to show as red. If the displays are read incorrectly, possible damage to the equipment could occur.

CAUTION

Monitor all instruments to identify if an FMS malfunction occurs. The FMS-3000 and related components operate as a system and usually give the pilot an indication when a malfunction occurs. However, the pilot must also know that it is not possible to monitor the system for all possible malfunctions. Also, incorrect operation could occur without an indication of a malfunction.

NOTICES

NOTE

The FMS-3000 can hold a large database of navigation aids, waypoints, and airport data to help the pilot with navigation. However, the pilot must have and use the applicable charts, terminal procedures, and facility directories necessary for the flight. Applicable federal regulations give instructions about the requirement to have the applicable documents available.

NOTE

Defects that can be seen on the display surface of the AFD-3010 are permitted. However, these defects must not cause a distraction or make the pilot read the display incorrectly. Also, defects that cannot be seen in an operational format from a minimum view distance are permitted.

Defective ON or defective OFF rows or columns can make servicing of the AFD-3010 necessary. Groups (three or more adjacent elements) of defective ON elements are not permitted. Defective OFF elements are permitted if they do not make the pilot read the display incorrectly or cause distraction.

The number of defective ON elements that are permitted include no more than: 6 red, 6 green, 10 blue, or 5 sets of two adjacent defects. The number of defective OFF elements that are permitted include no more than: 5 sets of two adjacent defects, 1 set of three adjacent defects, or 30 defective OFF elements.

LIST OF ACRONYMS AND ABBREVIATIONS

ACT	Active
ADC	Air Data Computer
AFD	Adaptive Flight Display
AFIS	Airborne Flight Information System
AGL	Above Ground Level
AHRS	Attitude Heading Reference System
AIR DIST	Air Distance
ALT	Altitude
ALTN	Alternate
APP	Autopilot Panel
APPR	Approach

APT(S)	Airport(s)
ARP	Airport Reference Point
ARR	Arrival
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
AV PASS WT	Average Passenger Weight
AVAIL	Available
AVG TAS/GS	Average True Airspeed/Ground Speed
BOC	Bottom Of Climb
BOD	Bottom Of Descent
BOW	Basic Operating Weight
BRG	Bearing
BRT	Bright
C	Celsius
CAP	Capture
CDU	Control Display Unit
CHK	Check
CLR DEL	Clear/Delete
CMD	Commanded
COM	Communication
CPAS	Collins Portable Access System
CPN	Collins Part Number
CRS	Course
CRZ ALT	Cruise Altitude
CTL	Control
CTR	Center
DB	Data Base
DBU	Data Base Unit
DCP	Display Control Panel
DEP	Departure
DES	Descent
DEST	Destination
DEV	Deviation
DH	Decision Height
DIR	Direction
DIST	Distance
DME	Distance Measuring Equipment
DR	Dead Reckoning
DTK	Desired Track
EFC	Expect Further Clearance

ELEV	Elevation
ETA	Estimated Time of Arrival
ETE	Estimated Time En Route
EXEC	Execute
F	Fahrenheit
FACF	Final Approach Course Fix
FAF	Final Approach Fix
FCC	Flight Control Computer
FCS	Flight Control System
FIX ETA	ETA at the Fix
FL	Flight Level
FLT	Flight
FMC	Flight Management Computer
FMS	Flight Management System
FPLN	Flight Plan
FSU	File Server Unit
GA	Go Around
GND SPD	Ground Speed
GPS	Global Positioning System
GS	Glideslope
GWT	Gross Weight
HDG	Heading
HI NAVAIDS	High Altitude Navaids
HSI	Horizontal Situation Indicator
IAPS	Integrated Avionics Processor System
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organization
ID	Identifier
IDENT	Identifier
IDX	Index
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INBD CRS	Inbound Course
INDEP	Independent
INHB	Inhibit
INIT	Initialize
INTC	Intercept
INTERS	Intersections
ISA	International Standard Atmosphere
ISA DEV	Deviation from ISA
KIAS	Knots, Indicated Airspeed

KT	Knots
LAT	Latitude
LDG	Landing
LO NAVAIDS	Low Altitude Navaids
LOC	Localizer
LON	Longitude
LRU	Line Replaceable Unit
LSK	Line Select Key
LW	Landing Weight
MAG VAR	Magnetic Variation
MAN	Manual
MAP	Missed Approach Point
MDA	Minimum Descent Altitude
MFD	Multifunction Display
MGMT	Management
MOD	Modify
MSG	Message
MSP	Mode Select Panel
NAV	Navigation
NAVAID	Navigational Aid
NDB	Non-Directional Beacon
NM	Nautical Mile
OAT	Outside Air Temperature
OFST	Offset
OP	Operation
OPS	Operations
ORIG	Origin
ORIG RWY	Origin/Departure Runway
P ALT	Pressure Altitude
PASS/WT	Passenger Weight
PERF	Performance
PFD	Primary Flight Display
POS	Position
POS DIFF	Position Differences
POS INIT	Position Initialization
PPOS	Present Position
PREV	Previous
PROG	Progress
QNH	Barometric Pressure Setting
RAIM	Receiver Autonomous Integrity Monitoring
REF	Reference

REF CRS	Reference Course
REQ	Request
RESV	Reserve
RNG TO RESV	Range to Reserves
RNP	Required Navigation Performance
RTES	Routes
RTU	Radio Tuning Unit
RWY	Runway
SAT	(1) Static Air Temperature (2) Satellite
SEC FPLN	Secondary Flight Plan
SEL	Select
SEQ	Sequence
SID	Standard Instrument Departure
SP RNG	Specific Range
SPD/ALT LIMIT	Speed/Altitude Limit
STAR	Standard Terminal Arrival Route
STBY	Standby
SYNC	Synchronize
TACAN	Tactical Air Navigation
TAE	Track Angle Error
TAS	True Airspeed
TAT	(1) Total Air Temperature (2) True Air Temperature
TCAS	Traffic Collision Avoidance System
TERM	Terminal
TERM WPTS	Terminal Waypoints
TGT	Target
TGT SPEED	Target Speed
TIME TO RESV	Time To Reserves
T/O	Takeoff
TOC	Top Of Climb
TOD	Top Of Descent
TRANS	Transition
TRANS ALT	Transition Altitude
TRANS FL	Transition Flight Level
TRK	Track
TTG	Time To Go
TXT	Text
U/D	Up/Down
UTC	Coordinated Universal Time

VHF	Very High Frequency
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
VPA	Vertical Path Angle
VS	Vertical Speed
VSR	Vertical Speed Required
VTA	Vertical Track Alert
WPT(S)	Waypoint(s)
WT	Weight
WX	Weather
XSIDE	Cross Side
XTALK	Cross Talk
XTD	Cross Track Deviation
XTK	Cross Track
ZFW	Zero Fuel Weight

TABLE OF CONTENTS

This page intentionally left blank

OVERVIEW

INTRODUCTION

The FMS-3000 supplies the capability of en route, terminal, and non-precision approach navigation. The system contains an advanced GPS receiver and processes the transmissions from multiple GPS satellites simultaneously to calculate navigation solutions based on information from all satellites in view. A minimum of four satellites with acceptable geometry, or three satellites plus calibrated barometric altitude, are necessary for the FMS to calculate a navigation solution. With additional satellites, the system can improve the fault tolerance and accuracy of the navigation solution and supply Receiver Autonomous Integrity Monitoring (RAIM) to detect satellite failures. The system also supplies predictive RAIM, which is used to determine whether the satellite geometry at the destination airport will be sufficient to support approach at the planned time of arrival. The computed GPS position, velocity and time are input to the Flight Management function, which integrates this data into the flight plan-based navigation solution. The FMS also receives data from the AHRS, ADC, DME and VOR. The FMS supplies necessary controls for all input sensors, when appropriate.

The FMS can be initialized, waypoints chosen, and destination selected by a variety of pilot-friendly means. SIDs, STARs, and Airways are accommodated. A great circle route is calculated between waypoints for en route lateral navigation, and roll steering is provided to the Flight Control System (FCS). A sophisticated interface with the FCS allows the FMS VNAV function to select various FCS vertical modes of navigation. The FMS supplies vertical steering when appropriate. The FMS interfaces with the electronic flight displays to supply conventional navigation information and state-of-the-art map presentation.

A typical FMS-3000 system as installed on the Cessna Citation Encore+ consists of the components listed below:

- One CDU-3000 Control Display Unit
- One FMC-3000 Flight Management Computer
- One GPS-4000A Global Positioning System Sensor
- One CPAS-3000 Collins Portable Access System Data Loader.

A second FMC and CDU, along with a second GPS, can optionally be installed for a dual system.

NOTE

It is possible on a Cessna Citation Encore+ to have a dual FMS system with only one Collins FMS installed. This is referred to as a mixed system. When this is the configuration, the Collins FMS will operate as a single FMS (no SYNC/INDEP selection). FMS identification on CDU pages will be referenced as FMS1. FMS identification on flight displays (PFD and MFD) will reference the Collins FMS as FMS1 and any non-Collins FMS as FMS2. This guide describes operation and displays only for the Collins FMS. It does not address operation of any non-Collins FMS installed on the aircraft.

SYSTEM DESCRIPTION

The Flight Management System (FMS) is usually installed as a dual system. A Collins Portable Access System (CPAS-3000) Data Loader is used to load navigation, performance databases, as well as store and load pilot-defined routes and pilot-defined waypoints from a disk. Each FMC is a single Line Replaceable Unit (LRU) that receives data from both the left and right avionics systems. A single CDU is necessary for operator control of the FMS.

KEY OPERATING FEATURES

- The CDU is the primary interface with the pilot:
  - Function keys supply quick access to frequently used CDU pages.
  - Full alphanumeric keypad allows pilot input.
  - Line select keys supply additional control of FMS functions.
- Full color electronic flight displays (PFD and MFD) supply additional FMS information and both map and text page capability.
- The CPAS supplies disk reading and database loading capability.

Figure 2-1 FMS System Schematic Diagram (Sheet 1 of 2)

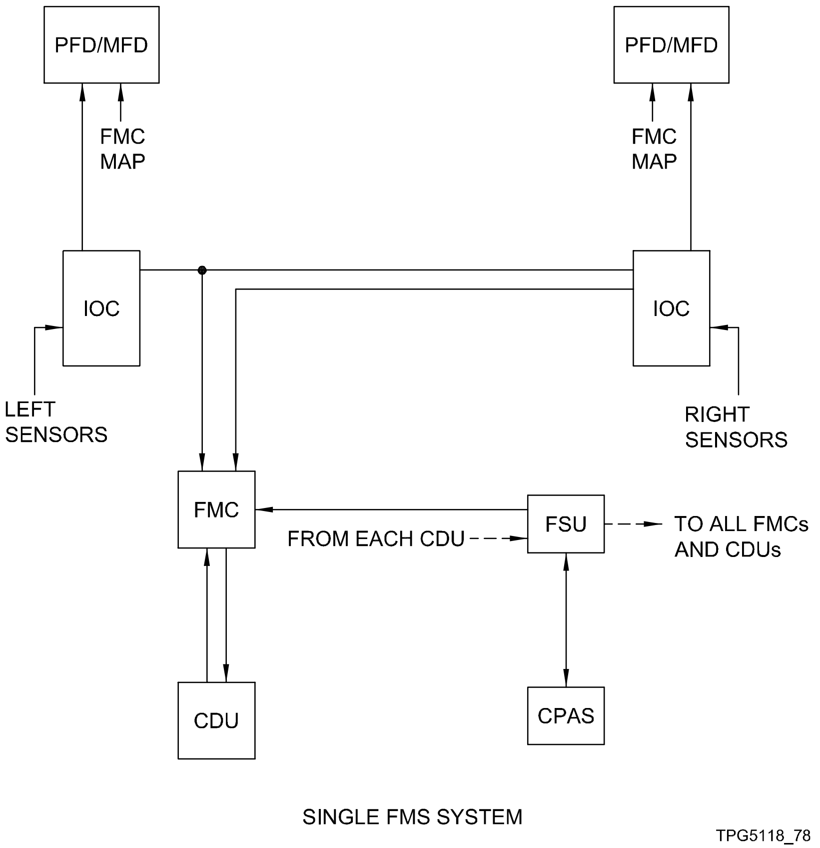
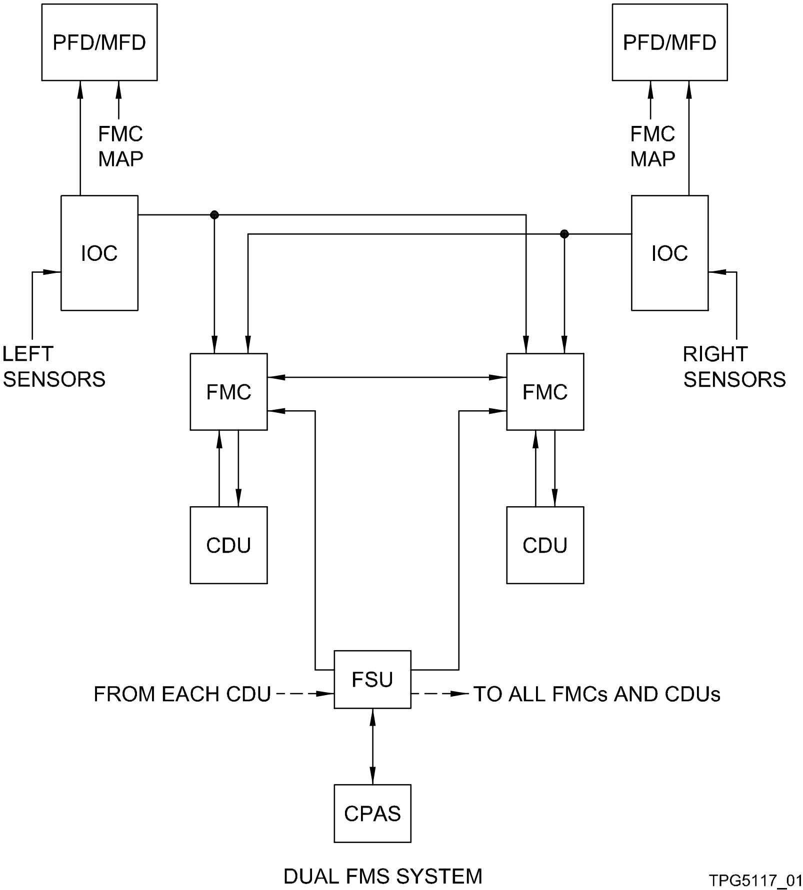
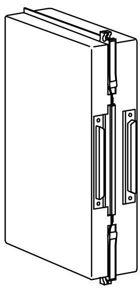


Figure 2-1 FMS System Schematic Diagram (Sheet 2 of 2)



COMPONENTS

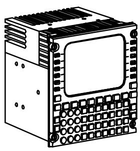
FMC



Flight Management Computer

The FMC accepts data from multiple navigation sensors, including VOR, DME, and GPS, and computes a position estimate. The data from each sensor is weighted according to its error characteristics so that the position estimate is the best possible. The FMC will supply navigation in the en route, terminal, and approach phases of flight. The FMC will determine that it is in the terminal phase of flight when an origin or arrival airport has been entered in the flight plan, and the location of the aircraft is within 30 NM of the origin or arrival airport. The FMC will determine that it is in the approach phase of flight upon passage of 2 NM inbound to the Final Approach Fix and fly a non-precision approach when the approach has been activated.

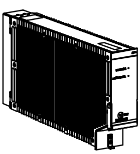
CDU



Control Display Unit

The CDU communicates with the FMC and other subsystems using the ARINC 739 protocol. This supplies the capability for the CDU to act as a Multifunction Control Display Unit (MCDU) and communicate with other compatible subsystems. The available subsystems are selectable from the INDEX (or MCDU MENU) page at all times.

	CPAS	The Collins Portable Access System (CPAS) Data Loader is the data loader for the FMS-3000 and other aircraft systems. The CPAS-3000 Data Loader is a software application that supplies external media upload and download capabilities to Ethernet-based Line Replaceable Units (LRU) like the Collins File Server Unit (FSU). The FSU supplies the capability to allow uploads and downloads to the FMC. A separate, customer-supplied PC or laptop computer is required to run the CPAS-3000 Data Loader program. Refer to the Collins CPAS-3000 Data Loader Operator's Guide (CPN 523-0790386) for information on how to install and operate the CPAS-3000 Data Loader.
GPS	Global Positioning System Sensor	The GPS-4000A Global Positioning System processes the GPS signals received from the antenna to supply various navigation data (three dimensional position and velocity, plus time) to the same-side IAPS data concentrators. The active GPS antenna acquires, actively filters, and amplifies the GPS signals from up to 12 satellites and sends them to the GPS receiver. The GPS satellite signals supply all data necessary to calculate the position, velocity and time.



KEY PERFORMANCE FEATURES

- Navigation is based on using all of the aircraft's available navigation sensors to fly from waypoint to waypoint along a flight plan route. With the navigation and other sensor data available to it, the FMS determines its present position relative to the flight plan route, and computes steering commands for use by the flight control system to fly the aircraft along the route.
- System performance predictions are available for the active flight plan, the modified flight plan, and the second flight plan. Second flight plan performance predictions are only provided for system configurations that support a performance database.
- Selectable independent and synchronized modes of operation are provided. In the synchronized mode, certain initialization operations and selections performed on one FMC are communicated to the other FMC (for dual Collins FMS installations). This includes selection of active database, deselection of navaids, enabling/disabling of VOR/DME from the navigation solution, and performance mode selection and fuel flow and ground speed values entered on the FUEL MGMT page.

KEY TROUBLESHOOTING FEATURES

Messages on the CDU and electronic flight displays supply indications of malfunctions, incorrect operations, or data entry or pilot operation errors.

This page intentionally left blank

TABLE OF CONTENTS

This page intentionally left blank

PREFLIGHT

INTRODUCTION

Typical FMS preflight procedures can include:

- Use the STATUS page to make sure the correct navigation and performance databases are installed in the FMS.
- Make sure the date and time are correct on the STATUS page and set them if necessary.
- Set the initial position on the POS INIT page as necessary.
- Enable or disable VOR/DME USAGE on the VOR CONTROL page, or individually inhibit the use of any VOR/DME navaid that is indicated out of service by NOTAMs.
- Enable GPS sensors on the GPS CONTROL page.
- Set the synchronized (SYNC) or independent (INDEP) operating mode on the FMS CONTROL page for systems with dual FMS installation.
- Set the display mode options for the MAP display on the MFD MAP DISPLAY MENU page.
- Set the NAV1 and NAV2 tuning mode to AUTO on the NAV CONTROL page.

Optional equipment and functions installed in an aircraft and operational variations can delete or add additional preflight functions for the FMS. Refer to the applicable aircraft flight manuals for specific FMS preflight procedures for the aircraft.

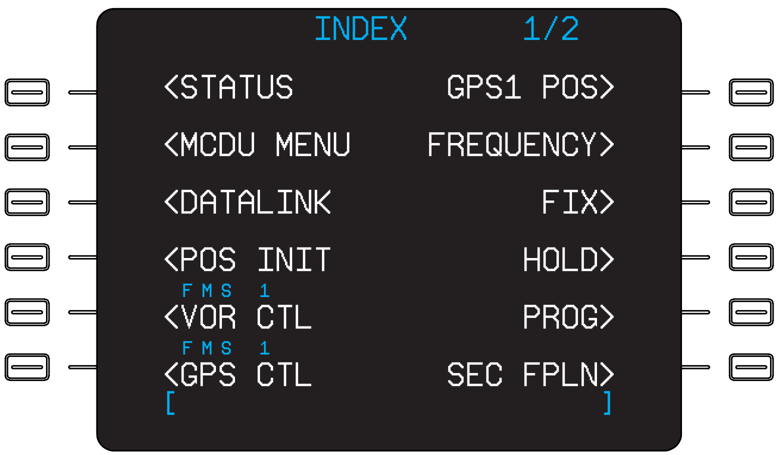
INDEX PAGE OPERATIONS

RATIONALE:

The INDEX pages supply access to FMS functions that do not have direct access through the CDU function keys.

SUMMARY:

The INDEX pages are used to select available functions that are not directly selectable with the function keys. The options available on the INDEX pages include, but are not limited to, access to the system DEFAULTS pages, VOR and GPS CONTROL pages, the HOLD function, the SEC FPLN function, the ROUTE MENU, and others.



TPG5117_06

▼ CHECKLIST:

1	Push the IDX function key to show INDEX 1/2 page.
2	Push the PREV and NEXT function keys to show INDEX 2/2 page if necessary.
3	Push the line select key for the applicable function to show the related page.

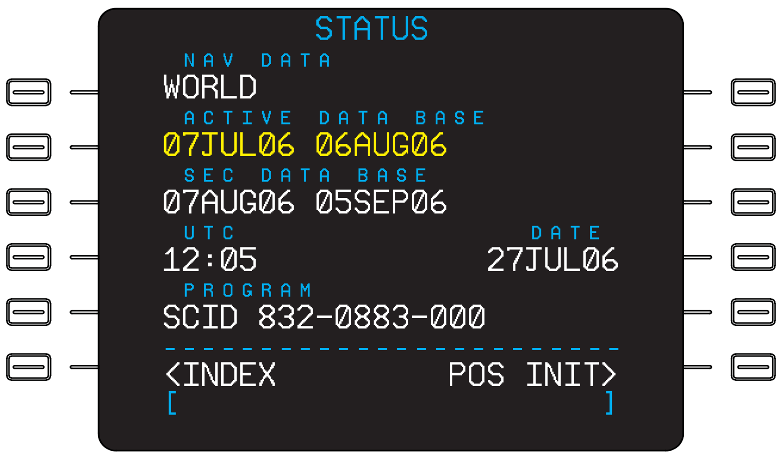
STATUS PAGE OPERATIONS

RATIONALE:

The STATUS page check lets the operator know if the correct databases are installed in the FMC. It is also used to set the date and time if necessary.

SUMMARY:

The STATUS page is used to make sure that the correct navigation and performance databases are installed in the FMS. It is also used to make sure that the date and time are correct and set them if necessary.



TPH6992_02

PRECONDITIONS:

The STATUS page shows on the CDU display at initial power-up, or when it is selected from INDEX 1/2 page.

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the STATUS line select key to show the STATUS page.

SET TIME

SUMMARY:

When there is a valid system clock, the current time as received from the clock shows on the Coordinated Universal Time (UTC) data line. Normally, the left system clock is the time source. If the left system clock is inoperative or the data is invalid, the right clock is used. If neither system clock is available or valid, dashes show on the UTC data line to indicate time can be entered.

RULES:

In installations with GPS sensors enabled for use by the FMS, the FMS time and date are automatically updated with GPS time and date. Manual updates are not permitted. Also, some FMS installations automatically get time and date from the aircraft clock. Again, manual updates are not permitted.

▼ **CHECKLIST:**

1	Enter the desired time into the scratchpad.
2	Push the UTC line select key to move the scratchpad time entry to the UTC data line.

▲

SET DATE

SUMMARY:

When there is a valid system clock, the current date as received from the clock shows on the UTC data line. Normally, the left system clock is the date source. If the left system clock is inoperative or the data is invalid, the right clock is used. If neither system clock is available or valid, dashes show on the DATE data line to indicate a date can be entered.

RULES:

In installations with GPS sensors enabled for use by the FMS, the FMS time and date are automatically updated with GPS time and date. Manual updates are not permitted. Also, some FMS installations automatically get time and date from the aircraft clock. Again, manual updates are not permitted.

▼ **CHECKLIST:**

1	Enter the desired date into the scratchpad.
2	Push the DATE line select key to move the scratchpad date entry to the DATE data line.

DATABASE CHECK/CHANGE

RULES:

The aircraft must be on the ground to change the navigation database.

▼ **CHECKLIST:**

1	Push the SEC DATA BASE line select key to copy the effective dates for the secondary database into the scratchpad.
2	Push the ACTIVE DATA BASE line select key to move the secondary database dates from the scratchpad to the active database line. The previous effective dates of the active database automatically move to the secondary database line.

NOTE

When the navigation database is changed, the ACT and SEC FPLNs will be erased.

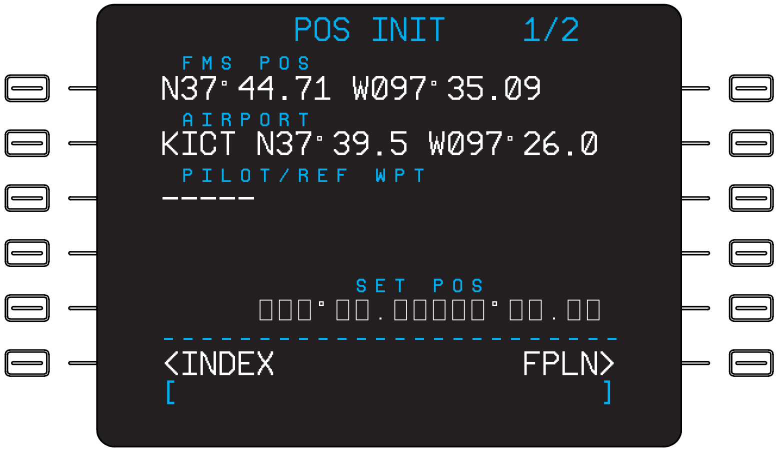
POSITION INITIALIZATION

RATIONALE:

It is necessary to do a Position Initialization (POS INIT) of the FMS for it to be fully operational.

SUMMARY:

The FMS position is initialized on the POS INIT 1/2 page. When the aircraft is on the ground, the AIRPORT or PILOT/REF WPT data line is usually filled with the destination airport from the last flight (if one was defined for that flight). AIRPORT, PILOT/REF WPT, GPS, or FMS latitude and longitude position data can be used to initialize position. Use the most accurate position data available to initialize the position. GPS latitude and longitude position data is available on POS INIT 2/2 page.



TPG5117_08

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the POS INIT line select key to show the POS INIT 1/2 page.

3 Push the line select key adjacent to the desired position (for example, AIRPORT) to copy the latitude and longitude, shown to the right of the position identifier, into the scratchpad.

4 Push the SET POS line select key to move the latitude and longitude from the scratchpad to the SET POS display line.

NOTE

The message RESET INITIAL POS shows on the message line if the initialized position is greater than 40 NM from the last known FMS position. This situation can occur if a maintenance action replaced the FMS since the last flight. If the position is correct, the message is cleared when the SET POS line select key is pushed two more times to enter the position. If the position is not correct, the correct position must be entered into the SET POS field.

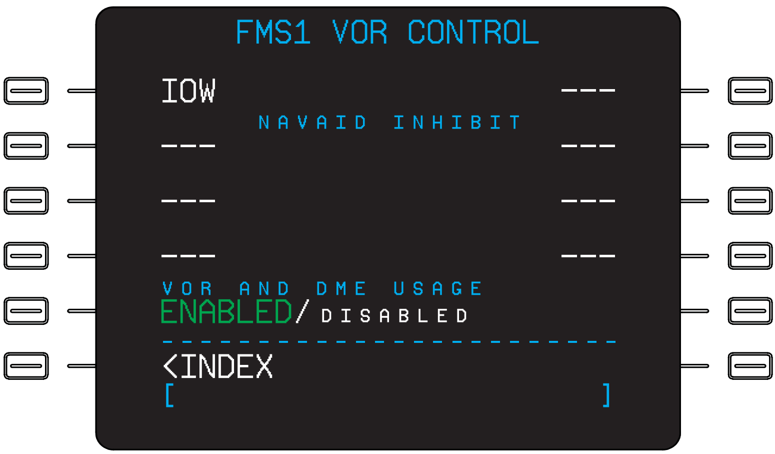
VOR/DME NAVAID INHIBIT

RATIONALE:

When a specified VOR is known to be invalid, it can be inhibited to keep it out of the FMS position solution. Additionally, all VOR/DME sensor data can disabled for use by the FMS when it determines its position.

SUMMARY:

The FMS VOR CONTROL page can be used to inhibit up to eight individual VORs. This page is also used to enable or disable VOR/DME USAGE by the FMS when it calculates the position solution.



TPG5117_09

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the VOR CTL line select key to show the VOR CONTROL page.
3	Enter the VOR identifier into the scratchpad.

4 Push a line select key for the right side or left side of the NAVAID INHIBIT display line. This moves the VOR identifier from the scratchpad to the right or the left NAVAID INHIBIT prompt.

NOTE

A disabled navaid is re-enabled only when it is deleted from the NAVAID INHIBIT data line, or when the active navigation database is changed on the STATUS page. A navaid is removed from the NAVAID INHIBIT data lines in one of two ways: 1) The identifier for a different navaid that is to be inhibited must be entered. 2) The CLR DEL function key is used to enter DELETE into the scratchpad, then the DELETE entry is moved to the applicable NAVAID INHIBIT data line.

5 To enable or disable VOR/DME USAGE by the FMS, push the ENABLED/DISABLED line select key to select between ENABLED and DISABLED VOR/DME USAGE. The selected mode shows in green.

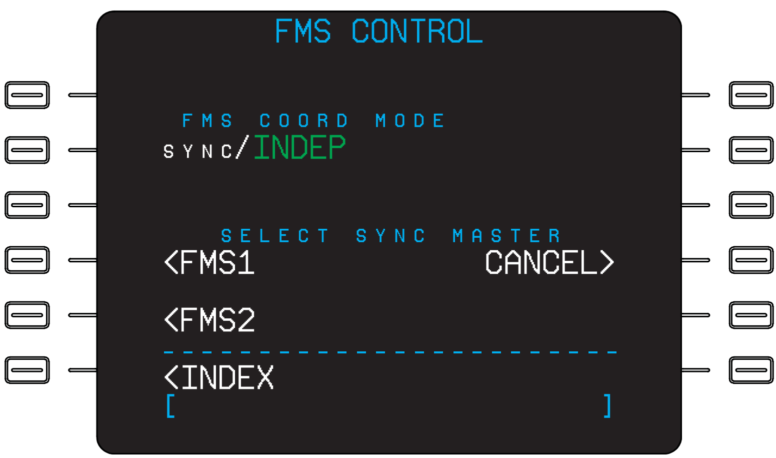
CONTROL MODE SELECTION (DUAL FMS)

RATIONALE:

The FMS CONTROL MODE lets the two FMCs (optional dual FMS installation) operate in a synchronized (SYNC) or independent (INDEP) mode, based on the needs of the operator.

SUMMARY:

In the synchronized mode, flight plan changes and most FMS operations are automatically synchronized between both FMSs. Changes made to an active flight plan on one FMS are synchronized with the other FMS when the EXEC function key on the CDU is pushed to execute the flight plan. Changes made to the second flight plan on one FMS are synchronized immediately with the other FMS. In the independent mode, none of the mode selections or flight planning data from one FMS are shared with the other FMS.



TPG5117_10

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the NEXT function key to show the INDEX 2/2 page.

3	Push the FMS CTL line select key to show the FMS CONTROL page.
4	Push the FMS COORD MODE line select key to change the mode.
5	When the mode is changed from INDEP to SYNC, the prompt SELECT SYNC MASTER shows on the page. Push the FMS1 or FMS2 line select key to select the FMS that is to be the synchronization master.

NOTE

When SYNC mode selection is made, an FMS must be specified as the MASTER. The flight plans in the FMS that is selected as the MASTER are moved to the other FMS and replace any previous flight plans in that FMS. This can have an effect on the decision on which FMS to select as the MASTER. Once SYNC mode is selected, flight plan changes made on either FMS are automatically made to the other FMS regardless of which one was initially selected as the MASTER.

MFD DATA WINDOW SELECTION

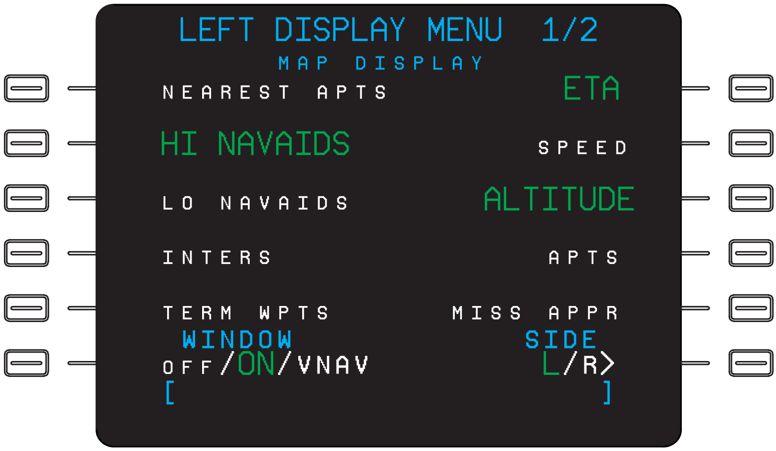
RATIONALE:

A four-line data window on the MFD can be selected for display. The display supplies navigation data only, or a combination of navigation and VNAV data.

SUMMARY:

The MFD Data Window shows at the top of the navigation display on the MFD when the MFD is set to the PPOS MAP or PLAN MAP display mode. The MFD Data Window is a four-line text display of navigation progress data. When the WINDOW selection is ON, the data window shows navigation information only. When the WINDOW selection is VNAV, VNAV information is added to the display. The MAP DISPLAY page is used to control the MFD Data Window selection. The MFD Data Window shows the data that follows:

- LAST waypoint passed, the distance from the last waypoint, and the time of passage.
- TO waypoint, the distance and time-to-go to the waypoint, and the ETA at the waypoint.
- NEXT waypoint after the TO waypoint, the distance and time-to-go to the waypoint, and the ETA at the waypoint.
- DEST (destination) airport, the distance and time-to-go to the destination, and the ETA at the destination.
- FUEL available at the destination airport.
- GW of the aircraft at the destination airport.
- Advisory VNAV data for the TO waypoint, which includes the altitude constraint, and the time and distance to that point.



TPF2726_11

▼ CHECKLIST:

1 Push the MFD MENU function key to show the DISPLAY MENU page.

2 Push the MFD DATA function key if necessary to change the TEXT DISPLAY page to the MAP DISPLAY page.

3 Push the WINDOW line select key to set the navigation data display window OFF or ON, or select VNAV data to show in the MFD display window.

NOTE

Each push of the WINDOW line select key selects the next mode in the sequence (OFF, ON, VNAV).

TUNING MODE SELECTION

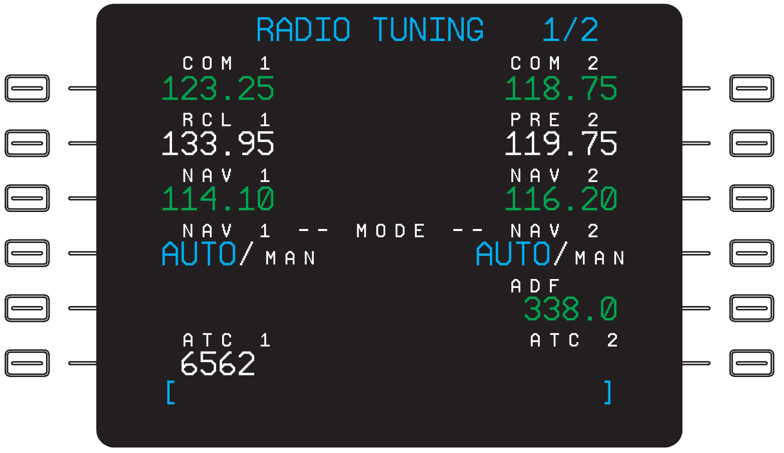
RATIONALE:

The tuning mode selection lets the operator either tune the navigation radios manually or have the FMS tune them automatically.

SUMMARY:

The FMS can automatically tune navigation receivers to use distance and radial data from different navigation stations to calculate its position. However, some conditions can prevent correct operation of automatic tuning and cause the FMS to automatically go back to the manual tuning mode. The FMS automatically goes back to manual mode when one of these items occurs:

- Selection of DME HOLD
- The NAV receiver is manually tuned from the FMS
- The NAV receiver is manually tuned from the RTU
- The selected NAV source is changed to something other than the FMS
- A NAV receiver failure.



TPG5117_68

▼ CHECKLIST:

1 Push the TUN function key to show the RADIO TUNING 1/2 page.

2 Push the AUTO/MAN line select key adjacent to the applicable navigation radio (NAV 1 or NAV 2). Each push of the line select key changes the tuning mode.

NOTE

The normal and recommended mode of operation is AUTO when FMS is used as the navigation source.

This page intentionally left blank

TABLE OF CONTENTS

This page intentionally left blank

FLIGHT PLANNING

INTRODUCTION

The procedures in this chapter are applicable to creating an active flight plan (ACT/MOD FPLN) and a second flight plan (SEC FPLN). The FMS uses the ACT FPLN to generate steering commands that are used by the aircraft flight control system. A SEC FPLN can be saved and recalled from FMS memory, but cannot be used to generate steering commands. Creation of a flight plan on the SEC FPLN pages is identical to the procedure to create an ACT FPLN, except for the selection of SEC FPLN page.

TIP

When a flight plan is created from scratch, push the EXEC function to save MOD FPLN in its current state at any time. Doing a save as each task is entered in a flight plan allows the operator to correct errors without a complete rewrite of the flight plan. The CANCEL MOD line select key will delete all changes made since the EXEC function key was last pushed. Make sure that the flight plan is correct before it is executed with the EXEC function key.

TIP

It is necessary to make sure that a flight plan is correct before it is executed. To make sure that a flight plan is correct, use the MOD LEGS pages on the CDU and the MFD in the PLAN MAP display mode. The PLAN MAP shows a North-up pictorial presentation of the flight plan route. This map can be used to look at each waypoint along the route of flight.

NOTE

The plain English routing name will be shown for each identifier.

CREATE A FLIGHT PLAN

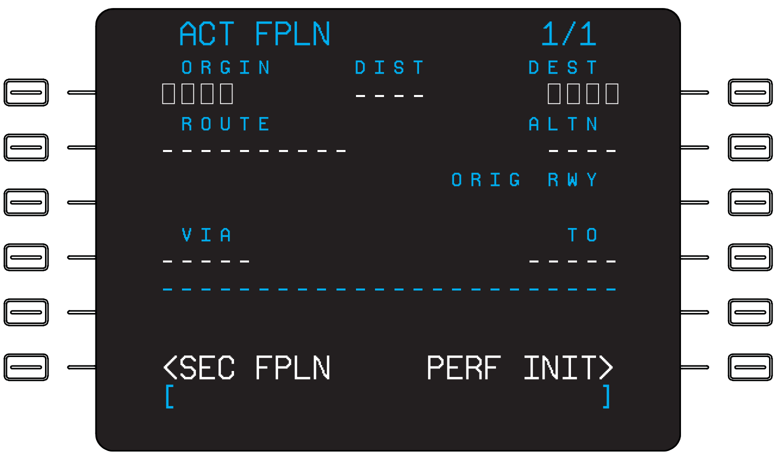
RATIONALE:

The flight plan function lets the pilot create a flight plan that is customized for each particular route of flight. Changes or additions to the flight plan can be made at any point, either during the creation process or as necessary inflight.

SUMMARY:

The basic steps to create a flight plan from scratch include:

1. Enter the origin, destination and alternate airports.
2. Select a departure runway or a Standard Instrument Departure (SID) with a departure runway.
3. Enter a route from the departure to the arrival.
4. Select a Standard Terminal Arrival Route (STAR) with or without a transition and an approach.



TPG5117_13

RULES:

Use the guidelines that follow when creating a flight plan:

- Navigation facilities and procedures that can be entered and selected for a flight plan include, but are not limited to:
  - Airports
  - Airways
  - STARs
  - Navaids (for example VOR/DME, NDB, TACAN)
  - Intersections
  - Holds
  - SIDs
  - Approaches.
- At least one waypoint must be entered into a flight plan, whether or not an ORIGIN or DEST airport is entered, for the FMS to show a route on the MFD maps.
- When airport identifiers are entered, use the ICAO standard identifiers that include the country code for the airport.

▼ CHECKLIST:

1 Push the FPLN function key to show the ACT FPLN page.

2 Enter the ORIGIN airport.

TECH DETAIL

An ORIGIN airport is an optional entry. However, a SID or departure runway cannot be selected without entry of an ORIGIN airport.

NOTE

A change to or deletion of the ORIGIN airport erases an existing ACT/MOD FPLN. In addition, the ORIGIN airport cannot be changed or deleted while the aircraft is airborne (NOT ON GROUND shows on the CDU message line).

2.1 Enter the identifier of the ORIGIN airport into the scratchpad.

2.2 Push the ORIGIN line select key to move the scratchpad entry to the ORIGIN prompt.

3 Enter the Destination (DEST) airport.

TECH DETAIL

A DEST airport is an optional entry. However, a STAR or an approach cannot be selected without entry of a DEST airport.

3.1 Enter the identifier of the destination airport into the scratchpad.

3.2 Push the DEST line select key to move the scratchpad entry to the DEST prompt.

4 Enter the alternate (ALTN) airport.

NOTE

An ALTN airport is an optional entry.

4.1 Enter identifier of the alternate airport into the scratchpad.

4.2 Push the ALTN line select key.

5 Enter the ROUTE name (optional).

NOTE

When the name of a route that is stored in the PILOT ROUTE LIST or DISK LIST is entered, the FMS automatically loads that route directly into the MOD FPLN. When a new route is created for storage in the PILOT ROUTE LIST, a unique name for that route must be entered.

5.1 Enter the name of the route into the scratchpad.

5.2 Push the ROUTE line select key to move the route name from the scratchpad to the ROUTE prompt.

6 Select the Origin Runway (ORIG RWY) for departure.

TECH DETAIL

The ORIG RWY identifies the selected departure runway. When the ORIG RWY is selected, the flight plan starts at the runway threshold instead of the airport reference point (only if the ORIGIN airport is entered). It is an optional entry. However, without an ORIG RWY, the FMS cannot perform a RUNWAY UPDATE at the runway threshold.

6.1 Push the DEP ARR function key to show the DEPART page for the ORIG airport.

NOTE

When the DEP ARR function key is pushed, one of three pages shows: the DEPART, ARRIVAL, or DEP/ARR INDEX page. If the aircraft is on the ground, or airborne but less than either 50 NM from the origin airport or halfway to the destination airport, the DEPART page for the origin airport shows.

If the aircraft is airborne, and more than halfway to the destination airport, or more than 50 NM from the origin airport, the ARRIVAL page for the destination airport shows. If no active flight plan exists, or no origin or destination airport is specified, the DEP/ARR INDEX page shows.

To show a different page, push the line select key for the DEP/ARR INDEX page, or push the DEP ARR function key a second time to show the DEP/ARR INDEX page. The applicable page for the applicable airport is selected from the DEP/ARR INDEX page.

6.2 Push the line select key adjacent to the applicable runway in the RWYS column.

NOTE

For some airports, the runway list fills more than one page. The NEXT and PREV function keys are used as necessary to show the applicable runway.

6.3 Push the FPLN line select key or the FPLN function key to go back to the MOD FPLN page.

7 Select a SID if necessary for the ORIG airport.

TECH DETAIL

Only the approved combinations of transition routes and runways show for each SID. Thus, if the first selection is the departure runway, only transition routes and SID for that runway show in the SIDS and TRANS columns on the DEPART page. In the same manner, if the first selection is the SID, only transition routes and runways for that departure show under the TRANS and RWYS columns.

7.1 Push the DEP ARR function key to show the DEPART page for the ORIG airport.

NOTE

One of three pages shows when the DEP ARR function key is pushed: the DEPART, ARRIVAL, or DEP/ARR INDEX page. If a page other than the DEPART page shows, push the line select key for the DEP/ARR INDEX page, or push the DEP ARR function key a second time to show the DEP/ARR INDEX page. The DEPART page for the applicable airport is selected from the DEP/ARR INDEX page.

7.2 Push the line select key adjacent to the applicable SID in the SIDS column.

7.3 Push the line select key adjacent to the applicable transition (TRANS) route.

7.4 Push the line select key adjacent to the applicable departure runway (RWYS).

7.5 Push the FPLN line select key or the FPLN function key to go back to the MOD FPLN page.

8 Enter the flight plan legs.

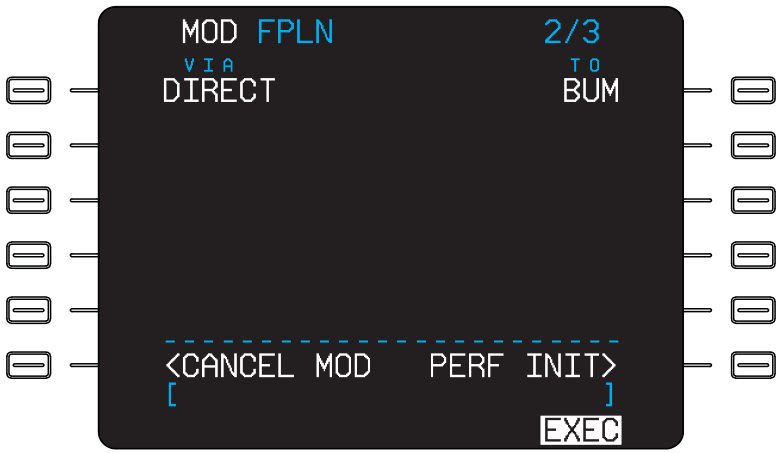
NOTE

Flight plan legs can include direct legs and airway legs in different combinations or order.

DIRECT LEGS

SUMMARY:

Direct legs of a flight plan are defined through waypoints in the TO column on the right side of the applicable flight plan page. When a waypoint is entered, DIRECT shows in the VIA column on the left side of the page.



TPG5117_14

PRECONDITIONS:

This procedure starts from the ACT/MOD FPLN page.

▼ CHECKLIST:

1 Enter the applicable waypoint into the scratchpad.

> **NOTE**
>
> It is possible that the current ACT/MOD FPLN page will not have a prompt that shows in the TO column. The NEXT or PREV function key can be pushed as necessary to show the applicable page.

2 Push the TO column line select key to move the waypoint from the scratchpad to the TO prompt.

NOTE

Occasionally a waypoint identifier (for example, BLH) can be used more than once in the navigation database. In such instances, the SELECT WPT page shows when the TO line select key is pushed in Step 2. On the SELECT WPT page, identically-named waypoints show in order from closest to the waypoint before the insertion point to the farthest from the insertion point. If there is no preceding waypoint in the flight plan, then they are put in order from the waypoint closest to the current FMS position to the waypoint farthest from that position. The waypoint is selected when the line select key adjacent to the applicable waypoint is pushed. Refer to the SELECT WPT section of the MENUS AND DISPLAYS chapter in this guide for additional information on the SELECT WPT page.

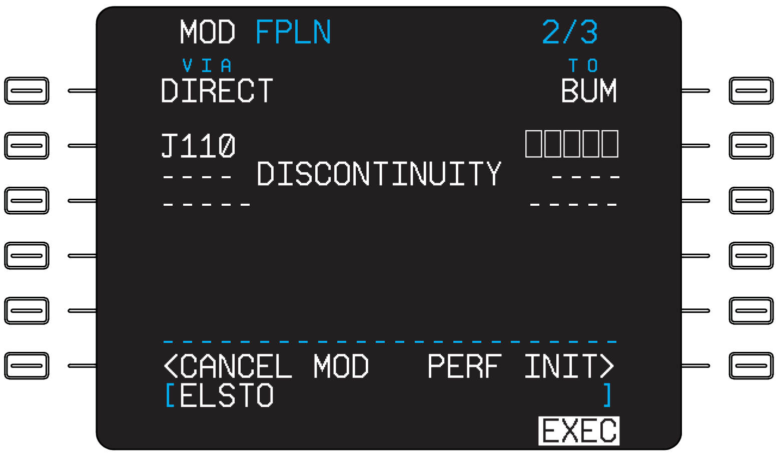
NOTE

If a wrong waypoint was entered, or a change or deletion is necessary after the FPLN was executed with the EXEC function key, refer to the CHANGE/CORRECT A FLIGHT PLAN section in this chapter.

AIRWAY LEGS

SUMMARY:

Enter airway identifiers as shown on the navigation charts (for example, V29, J65) into the VIA column on the left side of the ACT/MOD FPLN pages. Enter entry and exit waypoints into the TO column on the right side of these pages. When an airway is entered in the flight plan, all intermediate waypoints along the airway are automatically entered as well. These waypoints show on the ACT/MOD LEGS pages on the CDU, and in the FMS MAP and PLAN MAP display modes on the MFD. Different combinations of airways and direct legs as necessary for the flight plan can be entered as long as the entry and exit waypoint requirements are followed.



TPG5117_15

PRECONDITIONS:

This procedure starts from the ACT/MOD FPLN page.

RULES:

Use the guidelines that follow to enter an airway leg into the flight plan.

- Both the entry waypoint that precedes the airway in the flight plan, and the exit waypoint of the airway itself must be on that airway.
- If an attempt is made to enter either an entry or an exit waypoint that is not on the airway, it causes the FMS to generate the message NOT ON AIRWAY.

- Two airways that cross without a defined crossing intersection cannot be entered.

▼ CHECKLIST:

1 Enter the entry waypoint of the airway into the scratchpad.

NOTE

If the entry waypoint is already in the flight plan, Steps 1 and 2 can be ignored.

2 Push the TO column line select key to move the waypoint from the scratchpad to the TO prompt.

3 Enter the airway identifier into the scratchpad.

4 Push the VIA column line select key to move the airway identifier from the scratchpad to the VIA prompt.

NOTE

When the VIA line select key is pushed, the FMS generates a DISCONTINUITY in the flight plan. The DISCONTINUITY is cleared when the airway exit waypoint is entered.

5 Enter the airway exit waypoint into the scratchpad.

6 Push the TO column line select key adjacent to the must-enter prompts to move the waypoint from the scratchpad to the flight plan airway exit. This enters the airway exit waypoint in the TO column and clears the DISCONTINUITY.

7 Repeat Steps 3 through 6 to add more airways to the flight plan.

▲

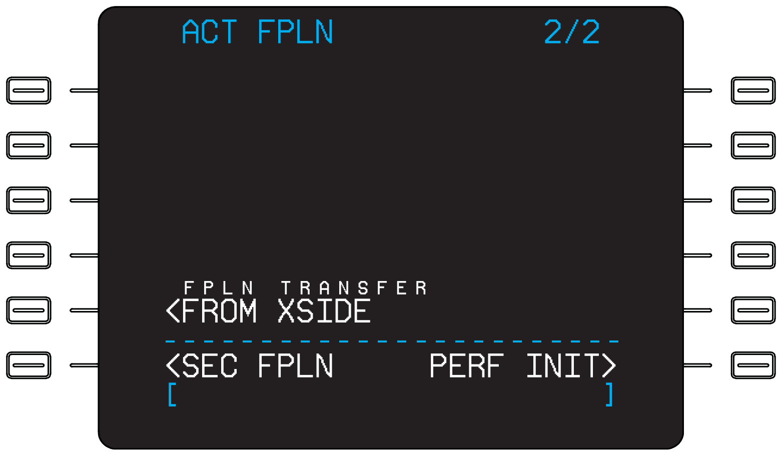
TRANSFER A FLIGHT PLAN

RATIONALE:

The transfer function lets the pilot copy a flight plan from one FMS to the other.

SUMMARY:

When the FMS-3000 operates in the independent mode (INDEP), flight plans entered into one FMS are not automatically copied to the other. The cross-side transfer function lets the pilot copy the ACT FPLN and SEC FPLN from the cross-side FMS to the same-side FMS. The procedure for a SEC FPLN transfer is identical to an ACT FPLN transfer.



TPG5117_16

▼ CHECKLIST:

1	On the same-side FMS, push the FPLN function key to show the ACT FPLN page.
2	Push the NEXT or PREV function key as necessary to show the last ACT FPLN page with the FPLN TRANSFER FROM XSIDE prompt.

3 Push the FPLN TRANSFER FROM XSIDE line select key to copy the cross-side ACT FPLN to the same-side FMS. The CDU shows FPLN TRANSFER IN PROGRESS. When the copy process is complete, the CDU changes back to the MOD FPLN page.

4 Make sure that the correct FPLN is entered, then push EXEC to execute the flight plan.

CAUTION

When dual FMSs are in INDEP mode, the pilot can use the above procedure to transfer flight plans from one FMS to the other. If a MOD FPLN exists on the cross-side FMS, the MOD FPLN will be transferred to the same-side FMS, but the unexecuted edits/changes will not. Thus, it is possible to have two different flight plans in the two FMSs after a flight plan transfer. As a precaution, the changes to the flight plan can be executed any before a FPLN transfer is started.

VERIFY A FLIGHT PLAN

RATIONALE:

It is necessary before takeoff to make sure that the planned route of flight is correct and matches the flight plan that was filed.

SUMMARY:

The pilot must make sure that the flight plan is correct before it is executed. A check for accuracy can be done with the plan map on the MFD when it is set to the PLAN MAP display mode. The pilot can also look at the flight plan route on the applicable LEGS pages on the CDU.

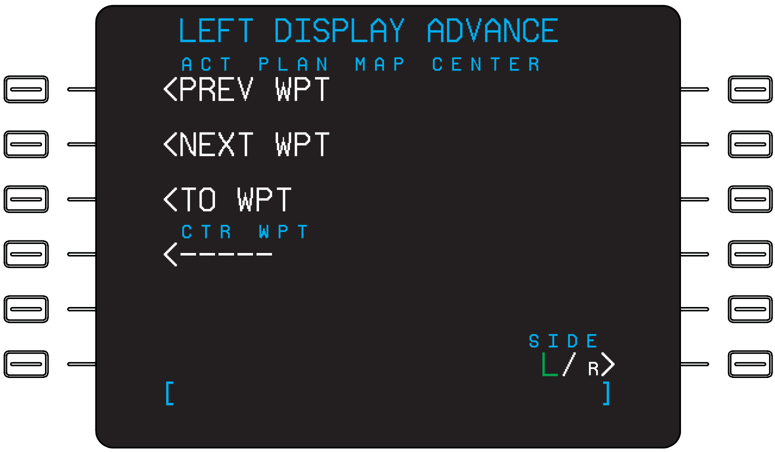
▼ **CHECKLIST:**

1	Make sure that the flight plan has been entered into the FMS.
2	Make sure that the route of flight is correct. Use the MFD plan map scroll function to look at each waypoint or use the FPLN or LEGS pages on the CDU to look at the waypoints on the route of flight.

MFD PLAN MAP SCROLLING

SUMMARY:

Use the MFD ADVANCE page to scroll the MFD plan map from waypoint to waypoint along a flight plan route.



TPG5117_17

▼ CHECKLIST:

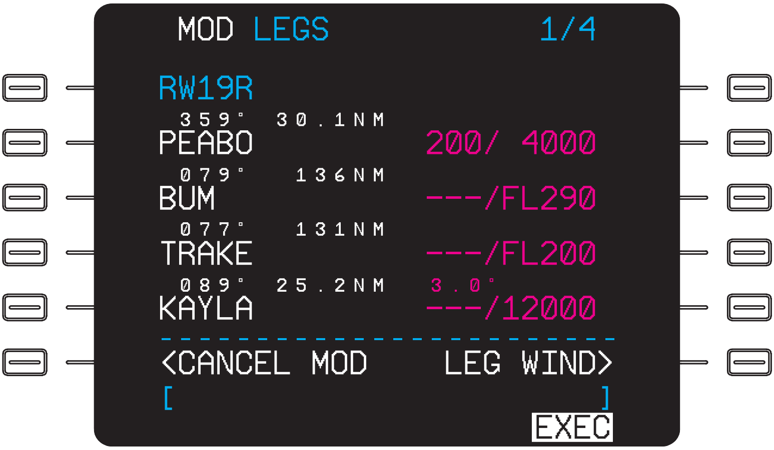
1	Set the MFD to the PLAN MAP display mode and select the applicable display range.
2	Push the MFD ADV function key to show the MFD ADVANCE page.
3	Use one of the methods that follow to scroll the flight plan route on the MFD. • Push the PREV WPT or NEXT WPT line select key to move the display center point to the previous or next waypoint along the flight plan route. • Push the TO WPT line select key to place the current TO waypoint in the center of the display.

- Enter a waypoint identifier in the scratchpad, then push the CTR WPT line select key to center the display on that waypoint.

CDU SCROLLING

SUMMARY:

Use the ACT/MOD FPLN or ACT/MOD LEGS pages to make sure that the route is correct. The FPLN pages show filed flight plan routing, but not each individual waypoint on the route. On the LEGS pages, each waypoint used to define the flight plan route can be viewed, to include those conditional waypoints used in SIDs, STARs, and approaches.



TPG5117_18

▼ CHECKLIST:

1	Push the FPLN function key to show the ACT/MOD FPLN pages or the LEGS function key to show the ACT/MOD LEGS pages.
2	Push the NEXT and PREV function keys as necessary to move from page to page to review the entire flight plan.

CHANGE A FLIGHT PLAN (FPLN PAGES)

RATIONALE:

Changes to the flight plan route or corrections to the flight plan can be made on the ACT/MOD FPLN pages.

SUMMARY:

The procedures in this section are used to change or correct the flight plan on the ACT/MOD FPLN pages. They will also work for the SEC FPLN pages when these pages are selected. Changes to the flight plan will not take effect until the EXEC function key is pushed.

▼ **CHECKLIST:**

1. Push the FPLN function key to show the ACT/MOD FPLN page.
2. Push the NEXT or PREV function key to show the page where the change/correction is necessary.
3. Make the change/correction to the flight plan. Changes/corrections that can be made on the FPLN pages include:
   - Delete an airway
   - Insert/add an airway
   - Delete a direct waypoint
   - Insert a direct waypoint
   - Change the SID and/or departure runway
   - Delete a discontinuity.
4. Push the EXEC function key to execute the changes and update the flight plan.

▲

DELETE AN AIRWAY

PRECONDITIONS:

This procedure starts from the ACT/MOD FPLN page.

▼ CHECKLIST:

1 Push the CLR DEL function key to enter DELETE in the scratchpad.

2 Push the VIA column line select key adjacent to the airway to be deleted.

NOTE

The first line of the FPLN page cannot be deleted while the aircraft is airborne. However, any one of the lines on the LEGS pages can be deleted.

NOTE

When the VIA line select key is pushed in Step 2 above, DIRECT now appears in the VIA column and will be the new routing for the selected flight plan leg.

▲

INSERT/ADD AN AIRWAY

PRECONDITIONS:

This procedure starts from the ACT/MOD FPLN page.

RULES:

The entry waypoint of an airway must come before the airway in the flight plan, and the airway must have an exit waypoint.

▼ CHECKLIST:

1 Make sure that the entry point of the airway is in the flight plan.

2 Enter the airway identifier into the scratchpad.

3 Push the VIA column line select key below the airway entry waypoint to transfer the airway to the flight plan.

NOTE

If the exit point of the airway is already in the flight plan, Steps 4 and 5 can be ignored.

4 Enter the exit waypoint identifier into the scratchpad.

5 Push the TO line select key adjacent to the DISCONTINUITY prompts to move the waypoint to the TO column and remove the discontinuity.

DELETE A DIRECT WAYPOINT

PRECONDITIONS:

This procedure starts from the ACT/MOD FPLN page.

▼ **CHECKLIST:**

1 Push the CLR DEL function key to enter DELETE into the scratchpad.

2 Push the TO column line select key adjacent to the DIRECT waypoint to be deleted.

INSERT/ADD A DIRECT WAYPOINT

PRECONDITIONS:

This procedure starts from the ACT/MOD FPLN page.

▼ CHECKLIST:

1 Enter the waypoint identifier in the scratchpad.

2 Push the TO line select key where the waypoint is to be entered to add it to the flight plan.

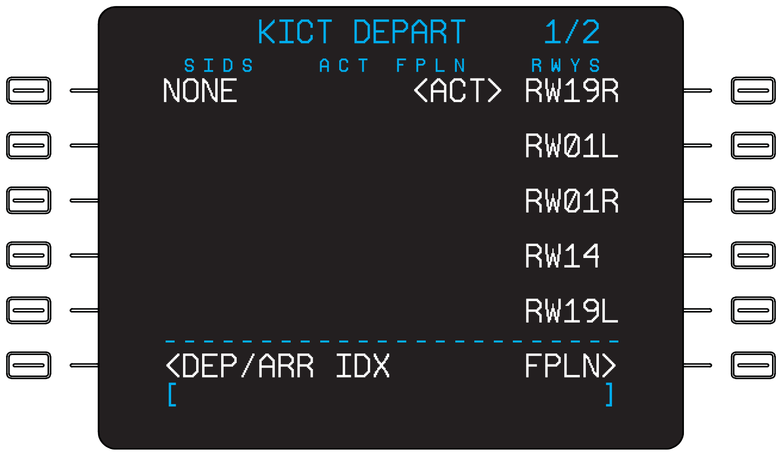
▲

CHANGE SID AND/OR DEPARTURE RUNWAY

SUMMARY:

Changes that can be made to a selected SID include selection of:

- A different SID
- A different transition route for the selected SID
- A different departure runway for the selected SID
- Any available combination of transition routes and runways for the selected SID.



TPG5117_19

▼ CHECKLIST:

1	Push the DEP ARR function key to show the DEPART page.

NOTE

One of three pages shows when the DEP ARR function key is pushed: the DEPART, ARRIVAL, or DEP/ARR INDEX page. If a page other than the DEPART page shows, push the line select key for the DEP/ARR INDEX page, or push the DEP ARR function key a second time to show the DEP/ARR INDEX page. The DEPART page for the applicable airport is selected from the DEP/ARR INDEX page.

2 Push the line select key for the applicable SID or runway (RWYS).

3 Push the line select key for the applicable transition route if one is available.

NOTE

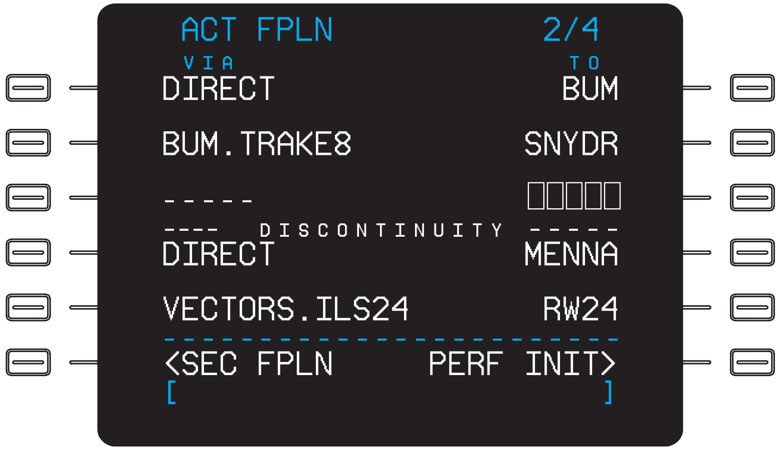
After the selection of a SID and transition, the only way to show the entire TRANS list again is to select the SID again.

4 Push the FPLN line select key or the FPLN function key to go back to the MOD FPLN pages.

DELETE A DISCONTINUITY

SUMMARY:

Discontinuities are used to indicate a break in a flight plan sequence. They are used, for example, to separate the approach segment from the arrival segment. They are also used to segregate a changed portion of a flight plan from an unchanged portion during certain flight plan edits or changes. They can be deleted with a CLR DEL function key entry (DELETE) from the scratchpad, or by entering the next applicable waypoint at the discontinuity prompts. When a discontinuity is deleted, a direct-to course is created to the next waypoint in the flight plan. Also, once a discontinuity is deleted, additional changes to the flight plan can be required or applicable, depending on the resulting construction of the flight plan.



TPG5117_20

PRECONDITIONS:

Some discontinuities cannot be deleted with the CLR DEL function key. In these cases, enter the next applicable waypoint at the discontinuity prompts. Examples of discontinuities that cannot be deleted include:

- A discontinuity before an approach with an initial leg that is radar vectored.
- A discontinuity at the end of an airway where the next waypoint is not on that airway.

- A discontinuity before a leg that does not have a defined starting point, such as a DME-arc leg.

This procedure starts from the ACT/MOD FPLN page.

▼ CHECKLIST:

1 Do either of the two steps listed below to remove the discontinuity.

- Push the CLR DEL function key to enter DELETE into the scratchpad.
- Push the line select key for the next applicable waypoint to enter that waypoint identifier into the scratchpad.

2 Push the line select key adjacent to the prompt boxes above the DISCONTINUITY to enter the scratchpad entry.

▲

CHANGE A FLIGHT PLAN (LEGS PAGES)

RATIONALE:

Changes to the flight plan route or corrections to the flight plan can be made on the ACT/MOD LEGS pages.

SUMMARY:

The procedures in this section are used to change or correct the Flight Plan on ACT/MOD LEGS pages. They will also work for the SEC LEGS pages when these pages are selected. Changes to the flight plan will not take effect until the EXEC function key is pushed.

▼ **CHECKLIST:**

1	Push the LEGS function key to show the ACT/MOD LEGS page.
2	Push the NEXT or PREV function key to show the page where the change/correction is necessary.
3	Make the change/correction to the flight plan. Changes/corrections that can be made on the LEGS pages include: • Delete a waypoint • Insert a waypoint • Create/delete a flyover waypoint • Enter/change VNAV data • Delete a discontinuity • Enter/change ISA Deviation and winds aloft.
4	Push the EXEC function key to execute the changes and update the flight plan.

▲

DELETE A WAYPOINT

PRECONDITIONS:

This procedure starts from the ACT/MOD LEGS page.

▼ CHECKLIST:

1	Push the CLR DEL function key to enter DELETE into the scratchpad.
2	Push the line select key of the waypoint that is to be deleted.

▲

INSERT A WAYPOINT

PRECONDITIONS:

This procedure starts from the ACT/MOD LEGS page.

▼ CHECKLIST:

1	Enter the new waypoint identifier into the scratchpad.
2	Push the line select key at the entry point for the new waypoint to move the entry from the scratchpad.

▲

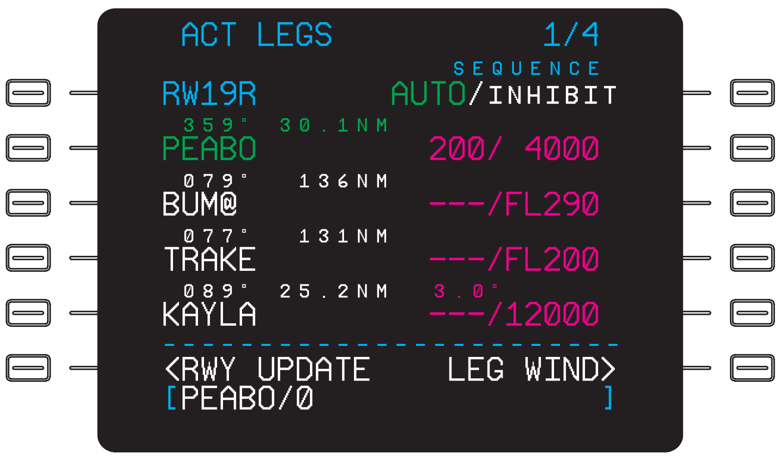
CREATE A FLYOVER WAYPOINT

RATIONALE:

Waypoints can be designated as flyover waypoints, which make it necessary for the aircraft to fly over the waypoint before the aircraft turns.

SUMMARY:

It is possible to change a non-flyover waypoint into a flyover waypoint. On the MFD PLAN MAP, when the flyover attribute is added, the flight plan route is drawn as a line through the flyover waypoint. An arrowhead that points toward the waypoint that follows the flyover waypoint shows an offset from the next course because of the flyover.



TPG5117_21

PRECONDITIONS:

This procedure starts from the ACT/MOD LEGS page.

▼ CHECKLIST:

1	Push the PREV or NEXT function key to find the page with waypoint that is to be made into a flyover waypoint.

2 If the scratchpad is not empty, use the CLR function key to clear the scratchpad.

3 Push the line select key adjacent to the applicable waypoint to copy the waypoint identifier to the scratchpad.

4 With the keypad, add a /0 (slash - zero) suffix to the waypoint identifier to enable the flyover attribute.

5 Push the line select key for the waypoint identifier to move the modified waypoint identifier from the scratchpad.

NOTE

When the changed waypoint has been inserted into the flight plan, the waypoint identifier shows with an @ designation to indicate that it is a flyover waypoint.

DELETE A FLYOVER WAYPOINT

SUMMARY:

Waypoints that have been user-defined as flyover waypoints can have the flyover attribute removed if the flyover requirement no longer exists. When the flyover attribute is removed from the waypoint, the course is drawn on the MFD Plan Map from point to point as usual (with no course offset) for non-flyover waypoints.

PRECONDITIONS:

This procedure starts from the ACT/MOD LEGS page.

▼ CHECKLIST:

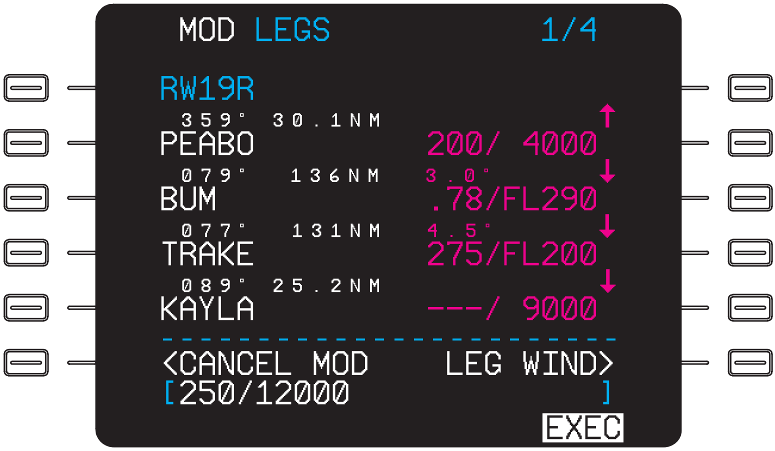
1	Push the PREV or NEXT function key to find the page with the waypoint that is designated a flyover waypoint as shown by the @ suffixed to the waypoint identifier.
2	If the scratchpad is not empty, use the CLR DEL key to clear the scratchpad.
3	Push the line select key adjacent to the flyover waypoint to copy the waypoint identifier to the scratchpad.
4	With the keypad, add a /0 (slash - zero) suffix to the waypoint identifier (this disables the flyover attribute).
5	Push the line select key for the waypoint identifier to move the modified waypoint identifier from the scratchpad.

▲

ENTER/CHANGE VNAV DATA

SUMMARY:

VNAV entries include altitude constraints, speeds (IAS or Mach), and Vertical Path Angles (VPA) for climbs and descents. They can be entered one at a time, or as combined entry speeds and altitude only. For special data about VNAV entries, refer to the VNAV chapter of this operator's guide.



TPG5117_22

PRECONDITIONS:

This procedure starts from the ACT/MOD LEGS page.

RULES:

Use the guidelines that follow to enter or change VNAV data.

- For speeds, enter a three digit number (IAS) from 100 to 499, or a two digit Mach setting from .10 to .99 (with the decimal point prefix).
- For VPA, entry range is from 1.0 to the maximum VPA specified for the aircraft.

- Altitude entry range is from -1300 feet to 65,000 feet, and FL000 to FL650. Flight level entries have an F or FL before the numbers.
  - Altitudes can have the letter A (at or above) or B (at or below) after the numbers.
  - For between altitudes, enter the lower altitude followed by an A, immediately followed by the upper altitude, followed by B (for example, 6000A8000B).
  - Enter C to change a descent to a climb, or D to change a climb to a descent.
- Speeds and altitude entries can be entered at the same time if they are divided by a / (slash) mark (for example, 250/10000, .78/F290).

▼ CHECKLIST:

1 Enter the VNAV data in the scratchpad.

2 Push the line select key for the applicable waypoint to enter the data from the scratchpad.

TIP

When the same information is entered into several waypoints, push the applicable right side line select key (instead of manual data entry) to copy the VNAV information to the scratchpad. The data can then be transferred to another waypoint.

NOTE

In an aircraft that supports the FMS performance function, flight plan altitude constraints that exceed the cruise altitude (CRZ ALT) specified by the crew on the PERF INIT page show in yellow on the ACT/MOD LEGS page.

DELETE A DISCONTINUITY

PRECONDITIONS:

This procedure starts from the ACT/MOD LEGS page.

TPG5117_23

RULES:

Some discontinuities cannot be deleted with the CLR DEL function key. In these cases, enter the next applicable waypoint at the discontinuity prompts. Examples of discontinuities that cannot be deleted include:

- A discontinuity before an approach with an initial leg that is radar vectored.
- A discontinuity at the end of an airway where the next waypoint is not on that airway.
- A discontinuity before a leg that does not have a defined starting point, such as a DME-arc leg.

▼ CHECKLIST:

1	Do either of the two steps listed below to remove the discontinuity. • Push the CLR DEL function key to enter DELETE into the scratchpad.

- Push the line select key for the next applicable waypoint to enter that waypoint identifier into the scratchpad.

2 Push the line select key adjacent to the prompt boxes above the DISCONTINUITY to enter the scratchpad entry.

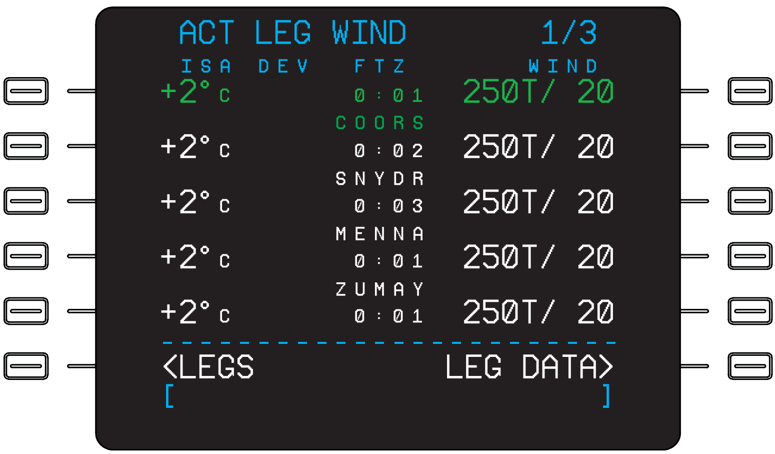
TIP

To remove a leg or legs that follow a discontinuity, select the applicable downtrack waypoint, then enter it into the THEN prompt of the discontinuity. The downtrack waypoint will replace the discontinuity. All intermediate waypoints between the discontinuity and the selected waypoint will be deleted from the flight plan.

ENTER/CHANGE ISA DEVIATION AND WINDS ALOFT

SUMMARY:

ISA Deviation (ISA DEV) and winds aloft for each leg of the flight plan are entered through the LEG WIND page. The LEGS pages give access to the LEG WIND pages. The FMS uses winds and ISA deviation in its performance calculations such as fuel consumption, leg times, and ETAs. Each LEG WIND page is related to a LEGS page. In other words, if the LEG WIND line select key on ACT/MOD LEGS 3/6 page is pushed, the ACT/MOD LEG WIND 3/6 page shows on the display.



TPG5117_24

PRECONDITIONS:

This procedure starts from the ACT/MOD LEGS page.

RULES:

Winds can be entered in any one of the formats that follow:

- Direction and speed (280/25)
- Headwind or tailwind (H32 or T85)
- Plus wind or minus wind (P102 or M50). Plus is a tailwind.

▼ **CHECKLIST:**

1 Push the LEG WIND line select key to show the related ACT/MOD LEG WIND page.

2 On the applicable ACT/MOD LEG WIND page, enter the ISA deviation and/or wind data in the scratchpad for the individual leg.

NOTE

ISA DEV and winds aloft data can be entered independently of each other. ISA DEV, or winds, or both, for each leg can be entered.

3 Push the applicable line select key for the leg where the data is to be entered to transfer it from the scratchpad.

▲

STORE A FLIGHT PLAN

RATIONALE:

Both the ACT FPLN and the SEC FPLN can be stored directly to FMS memory.

SUMMARY:

The ACT STORE and SEC STORE functions let active and secondary flight plans be written to FMS memory to be used again. Once the ACT FPLN or SEC FPLN has been created, the ACT STORE and SEC STORE line key selections on the PILOT ROUTE LIST page let the operator store the flight plan in FMS memory.

TPG5117_25

▼ CHECKLIST:

1	Push the FPLN function key to show the ACT/MOD FPLN page.
2	Push the SEC FPLN line select key on the ACT/MOD FPLN page to show the SEC FPLN page.
3	Push the ROUTE MENU line select key on the SEC FPLN page to show the ROUTE MENU page.

NOTE

The INDEX page also supplies access to the ROUTE MENU page.

4 Push the PILOT ROUTE LIST line select key to show the PILOT ROUTE LIST page.

5 Push the ACT STORE line select key to save the active flight plan with the route name shown.

NOTE

PILOT ROUTE LIST names are defined by the individual user.

NOTE

A SEC FPLN is stored in the same manner. In Step 5, the SEC STORE line select key is pushed to store SEC FPLN as a route.

6 If a route with the same name is already stored in memory, the CDU shows OVERWRITE ROUTE? with YES and NO line key selections.

6.1 To overwrite the existing route with the new route, push the YES line select key.

6.2 To keep the old route, push the NO line select key.

6.3 To store the route with a new name, do the steps that follow:

6.3.1 Enter the new name in the scratchpad.

6.3.2 Push the ACT STORE line select key again to save the ACT FPLN with the new name.

ACTIVATE AND EXECUTE A SEC FPLN

RATIONALE:

A SEC FPLN can be made into an ACT FPLN when necessary.

SUMMARY:

A SEC FPLN is created in the same manner as an ACT FPLN, but is not used by the FMS to generate steering commands. The SEC FPLN must be activated and executed before it is used.

TPG5117_26

PRECONDITIONS:

The pilot must make sure that the flight plan is correct before it is executed. A check for accuracy can be done with the plan map on the MFD when it is set to the PLAN MAP display mode or with the applicable LEGS pages on the CDU. Refer to the procedure VERIFY A FLIGHT PLAN in this section.

▼ CHECKLIST:

1	Push the FPLN function key to show the ACT/MOD FPLN page.
2	Push the SEC FPLN line select key on the ACT/MOD FPLN page to show the SEC FPLN page.

NOTE

The INDEX page also supplies access to the SEC FPLN page.

3 Push the ACTIVATE line select key to activate the flight plan and show the MOD FPLN page.

4 Push the EXEC function key to execute the flight plan and show the ACT FPLN page.

NOTE

When a SEC FPLN is activated and executed, the ACT FPLN and SEC FPLN exchange places. This prevents loss of the previous flight plan, and lets it be recalled if necessary.

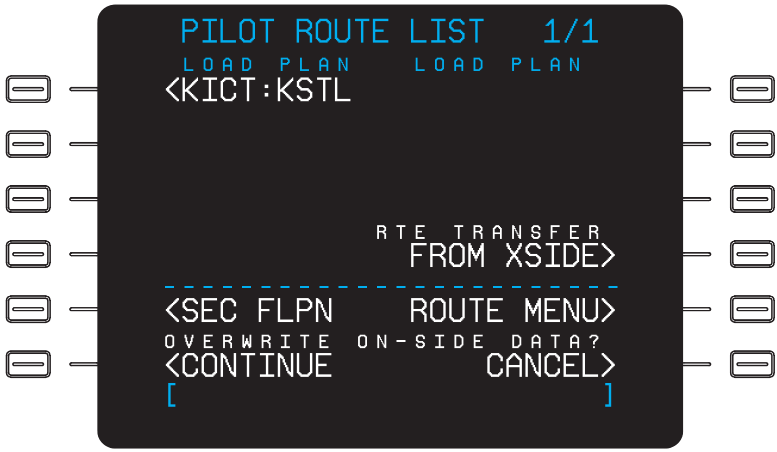
PILOT ROUTE LIST TRANSFER

RATIONALE:

A PILOT ROUTE LIST that is contained in one FMS can be transferred to the cross-side FMS. This is useful if an FMC has been replaced.

SUMMARY:

The PILOT ROUTE LIST transfer lets the pilot copy/transfer routes stored in one FMS to the other FMS.



TPG5117_27

RULES:

Cross-side PILOT ROUTE LIST transfers are permitted only when the aircraft is on the ground.

▼ CHECKLIST:

1	Push the IDX function key to show INDEX 1/2 page.
2	Push the ROUTE MENU line select key to show the ROUTE MENU page.

NOTE

The ROUTE MENU line key selection on the SEC FPLN page also supplies access to the PILOT ROUTE LIST.

3 Push the PILOT ROUTE LIST line select key to show the PILOT ROUTE LIST page.

4 Push the RTE TRANSFER FROM XSIDE line select key on the last page of the PILOT ROUTE LIST pages to copy the cross-side FMS routes to the same-side FMS.

NOTE

Pilot routes are automatically stored in both FMSs if they are in SYNC mode. The PILOT ROUTE LIST can differ on the two FMSs if routes were stored while the FMS was in INDEP mode or one of the FMCs was replaced after routes were stored.

5 When the RTE TRANSFER FROM XSIDE line select key is pushed, if the same-side FMS already contains routes in the PILOT ROUTE LIST, the FMS prompt OVERWRITE ON-SIDE DATA? appears. Do one of the two actions that follow:

- Push the CONTINUE line select key to complete the transfer.
- Push the CANCEL line select key to end the procedure.

LOAD AND EXECUTE A STORED PILOT ROUTE

RATIONALE:

A stored pilot route can be used as an ACT FPLN.

SUMMARY:

A route that is stored in the PILOT ROUTE LIST can be activated and used as an active flight plan. A stored route is entered into the SEC FPLN pages, activated to become a MOD FPLN, then executed to become an ACT FPLN. A pilot route can include different combinations of the elements that make up a flight plan route. It can be used as is, or changed and stored as a new route or as a replacement of the stored route. Refer to the CHANGE/CORRECT A FLIGHT PLAN procedure for instructions on how to change a flight plan route.

TPG5117_28

▼ **CHECKLIST:**

1	Push the IDX function key to show INDEX 1/2 page.
2	Push the ROUTE MENU line select key to show the ROUTE MENU page.

NOTE

The SEC FPLN function also supplies access to the ROUTE MENU page.

3 Push the PILOT ROUTE LIST line select key to show the PILOT ROUTE LIST page.

4 Push the line select key adjacent to the applicable flight plan.

5 Make sure that the flight plan is correct on the CDU and on the MFD PLAN MAP, then push the ACTIVATE line select key to activate the route as a MOD FPLN.

NOTE

With the MOD FPLN function, the flight plan can be changed or corrected before it is executed and used as an ACT FPLN.

6 Push the EXEC function key to execute the MOD FPLN.

NOTE

If the name of a specified route that exists in the PILOT ROUTE LIST is known, enter that name directly in the scratchpad and transfer it to the ROUTE data line on the ACT/MOD FPLN or SEC FPLN pages. The FMS automatically finds the route in the PILOT ROUTE LIST and loads it into the flight plan.

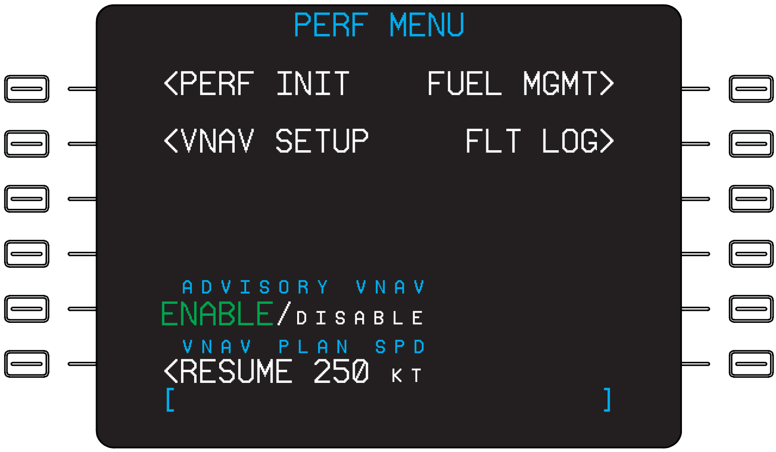
TABLE OF CONTENTS

This page intentionally left blank

PERFORMANCE

INTRODUCTION

A variety of performance functions and information is available to the pilot from the FMS-3000. The basic functions are selected from the PERF MENU page. The selections on the PERF MENU page include:



TPH6992_04

- PERF INIT — One page to set and examine various attributes used to initialize the performance functions.
- VNAV SETUP — Three pages to set/show target speeds, altitude limits, and vertical path angle, as well as other attributes in the climb, cruise, and descent phases of flight.
- FUEL MGMT — Up to three pages to set/show the various elements for fuel management, select the performance operating mode, monitor fuel flow and fuel used, and a trip planning function/calculator.
- FLT LOG — The FLIGHT LOG page keeps track of the take off (T/O), en route (EN ROUTE), and landing (LDG) times, as well as the FUEL USED, average true airspeed/ground speed (AVG TAS/GS), air distance (AIR DIST), and ground distance (GND DIST).
- ADVISORY VNAV — Enables and disables advisory VNAV features, which include the required vertical speed, vertical deviation scale, and constraint altitudes for display on the Primary Flight Display (PFD).

- VNAV PLAN SPD — Shows the speed bug setting the FMS uses or will use when VNAV PLAN SPD is active or resumed.

Some elements of the performance functions have default values that can be changed as necessary on the DEFAULTS page. For more flexibility, some of the defaults can be changed on the performance pages for an individual flight.

The VNAV PLAN SPD display shows the VNAV planned reference speed for the current position in the flight plan. The VNAV value shows dashes when VNAV is invalid.

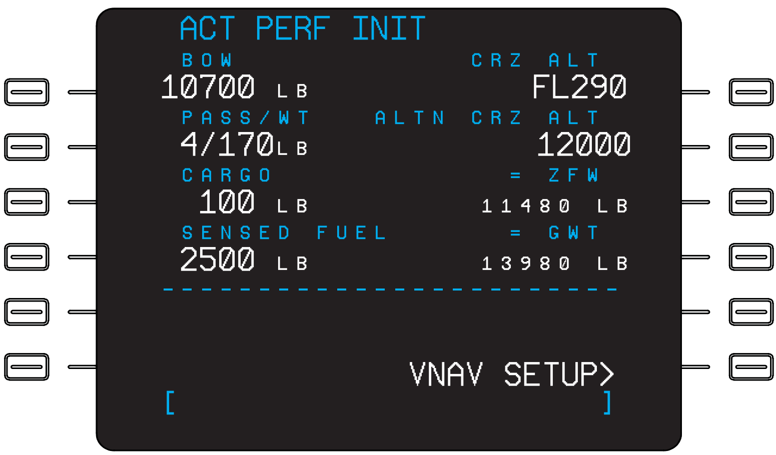
PERF INIT

RATIONALE:

A Performance Initialization (PERF INIT) must be done before each flight for all of the FMS performance features to operate correctly and supply performance-related information to the operator.

SUMMARY:

Access to the ACT/MOD PERF INIT page is supplied by the applicable line select key on the ACT/MOD FPLN, PERF MENU, and VNAV SETUP pages. Prompt boxes (□ □ □ □ □ □) for FUEL and CRZ ALT, on the ACT/MOD PERF INIT page, identify the entries that are necessary to activate the performance functions. An initialization of the performance functions can be simple or detailed, based on the needs of the pilots. The procedures for both a simple and detailed performance initialization follow.



TPH6992_05

▼ CHECKLIST:

1	Push the PERF function key.
2	Push the PERF INIT line select key to show the PERF INIT page.

3 Do either the SIMPLE PERF INIT or DETAILED PERF INIT checklist.

SIMPLE PERF INIT

SUMMARY:

When the simplified performance initialization is used, the Basic Operating Weight (BOW), Passenger Weight (PASS/WT), and Zero Fuel Weight (ZFW) entries are available from the default values. The fields for number of passengers and CARGO weight initially show zeroes. For a simple performance initialization, the only items that are necessary are:

- Total FUEL weight
- Cruise altitude (CRZ ALT).

▼ CHECKLIST:

1 Enter the total FUEL weight into the scratchpad.

2 Push the FUEL line select key to move the entry to the FUEL data line.

NOTE

A manual FUEL entry on the ACT/MOD PERF INIT page updates the fuel weight for the current flight plan. After initialization by the pilot, the FMS subtracts the fuel consumed as measured by the fuel flow sensors from the total fuel to compute the FUEL. Creation of a new flight plan or deletion of the current flight plan does not change the FUEL value on the ACT/MOD PERF INIT page.

NOTE

The FUEL field on ACT/MOD PERF INIT page does not accept the DELETE command, but it does accept manual entries or overwrite values.

3 Enter the planned cruise altitude (CRZ ALT) into the scratchpad.

4 Push the CRZ ALT line select key to move the entry to the CRZ ALT data line.

NOTE

Manual CRZ ALT entries on the ACT/MOD PERF INIT page update the cruise altitude for the current flight plan. However, the entry is applicable ONLY to the current flight plan and the value goes back to the default (prompt boxes) when a new flight plan is created.

5 Make sure that the flight plan changed on the CDU, then push the EXEC function key to execute the change to the flight plan.

NOTE

The CRZ ALT value can be reset to the default value with the deletion of the manual entry. The CLR DEL key is used to enter DELETE into the scratchpad, then the CRZ ALT line select key is pushed to move the DELETE command to the CRZ ALT field.

DETAILED PERF INIT

▼ CHECKLIST:

1 Make sure that the correct Basic Operating Weight (BOW) for the aircraft shows on the ACT/MOD PERF INIT page.

2 Enter the number of passengers (PASS).

3 Enter the CARGO weight.

4	Enter the FUEL (total) weight.
5	Enter the CRZ ALT for the flight.
6	Enter the Zero Fuel Weight (ZFW) if desired.
7	Enter the aircraft Gross Weight (GWT) if desired.
8	Make sure that all entries are correct, then push the EXEC function key to execute the change to the flight plan.

▲

BOW

SUMMARY:

The Basic Operating Weight (BOW) that shows on the ACT/MOD PERF INIT page can only be changed on the DEFAULTS page. Manual BOW entries for BOW on the DEFAULTS 1/3 page automatically update the BOW on the ACT/MOD PERF INIT page, and are applied to the current flight plan. Deletion of a manual entry for BOW on the DEFAULTS 1/3 page takes the BOW back to the default value defined in the database for the aircraft. This value also updates the BOW value that shows on the ACT/MOD PERF INIT page for the current flight plan.

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the NEXT function key to show the INDEX 2/2 page.
3	Push the DEFAULTS line select key to show the DEFAULTS 1/3 page.
4	Enter the BOW value into the scratchpad.

5 Push the BOW line select key to move the entry from the scratchpad.

PASS/WT

SUMMARY:

Manual PASS/WT entries on the ACT/MOD PERF INIT page update the number of passengers and/or average passenger weight for the current flight plan ONLY. This value goes back to the default values (zero passengers, default average passenger weight) when a new flight plan is created. Deletion of the PASS/WT value on the ACT/MOD PERF INIT page takes the PASS/WT back to zero passengers and the default average passenger weight from the DEFAULTS 1/3 page (0/170 LB). The default value (170 LB) for Average Passenger Weight (AV PASS WT) is defined by the performance database or can be entered manually on DEFAULTS 1/3 page.

RULES:

The guidelines that follow are applicable to AV PASS WT manual entries on the DEFAULTS 1/3 page.

- A manual AV PASS WT entry on the DEFAULTS 1/3 page does NOT automatically update the average passenger weight (PASS/WT) on the ACT/MOD PERF INIT page for the current flight plan. However, a manual entry will update the average passenger weight value on the ACT/MOD PERF INIT page when the next flight plan is created. The manual entry becomes the default AV PASS WT value for subsequent flight plans.
- When AV PASS WT has been entered manually on the DEFAULTS 1/3 page, deletion of the manual entry takes the AV PASS WT back to the default value (170 LB) defined by the performance database. The new value does NOT automatically update the average passenger weight on the ACT/MOD PERF INIT page for the current flight plan. The new AV PASS WT value updates the ACT/MOD PERF INIT page the next time a flight plan is created and becomes the default value thereafter.

▼ **CHECKLIST:**

1 On the ACT/MOD PERF INIT page, enter either of the values that follow:

- The number of passengers only
- The number of passengers and a new weight per passenger.

2 Push the PASS/WT line select key to move the entry from the scratchpad.

▲

CARGO

SUMMARY:

Manual CARGO entries on the ACT/MOD PERF INIT page update the cargo weight for the current flight plan. This value is applicable to the current flight plan ONLY and goes back to the default value (zero LBS) when a new flight plan is created. Deletion of a manual CARGO entry on the ACT/MOD PERF INIT page takes the cargo weight back to the default value.

▼ **CHECKLIST:**

1 On the ACT/MOD PERF INIT page, enter the cargo weight into the scratchpad.

2 Push the CARGO line select key to move the scratchpad entry to the CARGO line.

▲

FUEL (TOTAL WEIGHT)

SUMMARY:

Manual fuel entries on the ACT/MOD PERF INIT page update the fuel weight for the current flight plan. After initialization by the pilot, the FMS subtracts the fuel consumed as measured by the fuel flow sensors to compute FUEL. Creation of a new flight plan or deletion of the current flight plan does not change the FUEL value on the ACT/MOD PERF INIT page.

▼ CHECKLIST:

1 On the ACT/MOD PERF INIT page, enter the fuel weight into the scratchpad.

2 Push the FUEL line select key to move the scratchpad entry to the FUEL line.

TECH DETAIL

The FUEL field shows one of three labels: SENSED FUEL, CALC FUEL, and MAN FUEL. SENSED FUEL shows when the fuel quantity can be sensed by the total fuel quantity sensor. CALC FUEL shows when the engines are in operation and the fuel value is based on the FMS-calculated fuel remaining based on the fuel burn rate. MAN FUEL shows for any manual fuel entry.

NOTE

The FUEL field on ACT/MOD PERF INIT page does not accept the DELETE command, but it does accept manual entry or overwrite values.

NOTE

Changes to the FUEL weight can be made without execution of the flight plan.

▲

CRZ ALT

▼ **CHECKLIST:**

1 On the ACT/MOD PERF INIT page, enter the planned cruise altitude into the scratchpad.

2 Push the CRZ ALT line select key to move the scratchpad entry to the CRZ ALT line.

NOTE

A manual CRZ ALT entry on ACT/MOD PERF INIT page updates the cruise altitude for the current flight plan. However, the entry is applicable ONLY to the current flight plan, and the value goes back to the default (prompt boxes) when a new flight plan is created.

▲

ZFW

SUMMARY:

Zero Fuel Weight (ZFW) shows on the ACT/MOD PERF INIT page. The ZFW is computed using basic operating weight, total passenger weight, and cargo weight. However, ZFW can also be entered manually.

▼ **CHECKLIST:**

1 On the ACT/MOD PERF INIT page, enter the Zero Fuel Weight in the scratchpad.

2 Push the ZFW line select key to move the scratchpad entry to the ZFW line.

NOTE

A manual ZFW entry on ACT/MOD PERF INIT page replaces BOW, PASS/WT, and CARGO values with dashes. Also, if a FUEL weight has been entered, the FMS computes Gross Weight (GWT) as the sum of ZFW and the FUEL weight. A change to the FUEL entry must also be executed to update the current flight plan.

NOTE

When a manual ZFW entry on ACT/MOD PERF INIT page is deleted, BOW, PASS/WT, and CARGO values are restored. The FMS computes ZFW as the sum of BOW, PASS/WT, and CARGO weight. If FUEL weight is specified, GWT is computed as the sum of ZFW and FUEL weight. A change to the FUEL entry must be executed to update the flight plan.

GWT

SUMMARY:

The FMS computes Gross Weight (GWT) if data for BOW, PASS/WT, CARGO, FUEL, and ZFW are available on the ACT/MOD PERF INIT page. However, GWT can also be entered manually.

▼ CHECKLIST:

1	On the ACT/MOD PERF INIT page, enter the gross weight of the aircraft into the scratchpad.
2	Push the GWT line select key to move the scratchpad entry to the GWT line.

NOTE

A manual GWT entry on ACT/MOD PERF INIT page replaces BOW, PASS/WT, and CARGO values with dashes. Also, if a FUEL weight has been entered, the FMS computes Zero Fuel Weight (ZFW) as the difference between GWT and the FUEL weight. It must also be executed to update the current flight plan.

VNAV SETUP

RATIONALE:

The VNAV SETUP pages let the operator change a speed/altitude limit, a target speed, and the transition altitude, or add a speed/altitude limit if one is desired.

SUMMARY:

The ACT/MOD VNAV CLIMB, CRUISE, and DESCENT pages show default IAS and Mach TGT SPEED. On each page, the IAS and Mach speeds are independent from each other, which lets the pilot set each individually as necessary. Default speed/altitude limits are also shown on the ACT/MOD VNAV CLIMB and DESCENT pages. The ACT/MOD VNAV DESCENT page has another default for a Vertical Path Angle (VPA). Each of these default values can be changed on the DEFAULTS pages, or for a single flight, on the applicable VNAV SETUP page. In addition, on the CLIMB and DESCENT pages, a speed/altitude limit can be added to the existing defaults.

▼ CHECKLIST:

1 Push the PERF function key to show the PERF MENU page.

2 Push the VNAV SETUP line select key to show the ACT/MOD VNAV CLIMB, CRUISE, or DESCENT page.

NOTE

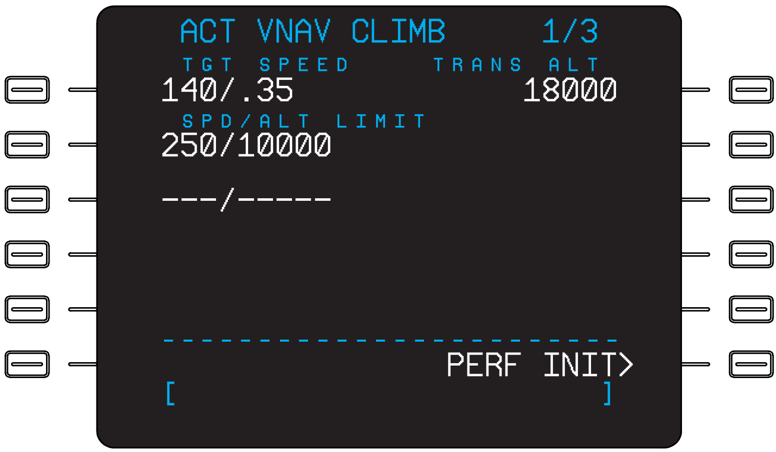
The ACT/MOD PERF INIT pages also have a VNAV SETUP line key selection that supplies access to the ACT/MOD VNAV CLIMB, CRUISE, and DESCENT pages.

VNAV CLIMB

SUMMARY:

The ACT/MOD VNAV CLIMB page shows the default settings for the items listed below. These parameters can be changed as necessary and another SPD/ALT LIMIT added if desired.

- Target Speed in IAS/Mach (TGT SPEED)
- Transition Altitude (TRANS ALT)
- Speed/Altitude Limit (SPD/ALT LIMIT).



TPG5117_31

RULES:

The guidelines that follow are applicable when changes are made on the VNAV CLIMB page.

- The default SPD/ALT LIMIT can be deleted if it is not applicable to the aircraft.
- TRANS ALT on the VNAV CLIMB page and TRANS FL on the VNAV DESCENT page are interconnected. A change to either one results in the same change to the other.

▼ **CHECKLIST:**

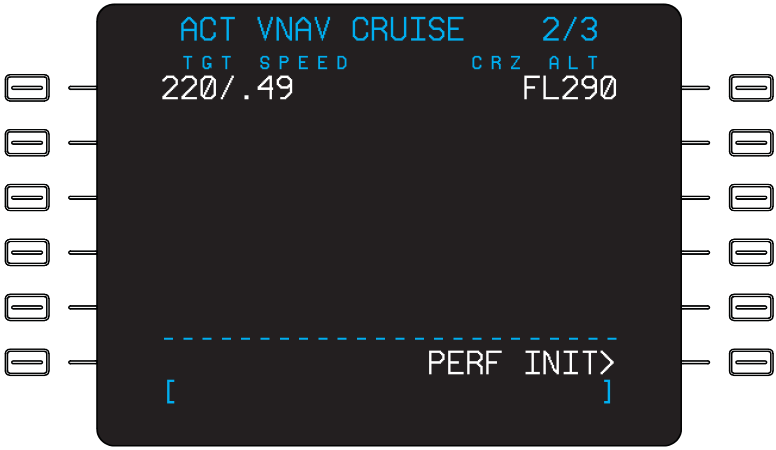
1	Enter the desired change into the scratchpad.

2 Push the line select key for the applicable data line to move the scratchpad entry to that data line.

VNAV CRUISE

SUMMARY:

The ACT/MOD VNAV CRUISE page shows the default setting for TGT SPEED and the selected cruise altitude (CRZ ALT).



TPH6992_24

RULES:

The CRZ ALT is the same altitude that is entered on the PERF INIT page. Changes to the CRZ ALT on the VNAV CRUISE page will also change the CRZ ALT on the PERF INIT page.

▼ **CHECKLIST:**

1. Push the PREV or NEXT function key as necessary to show the ACT/MOD VNAV CRUISE page.
2. Enter the desired change into the scratchpad.
3. Push the line select key for the applicable data line to move the scratchpad entry to that data line.

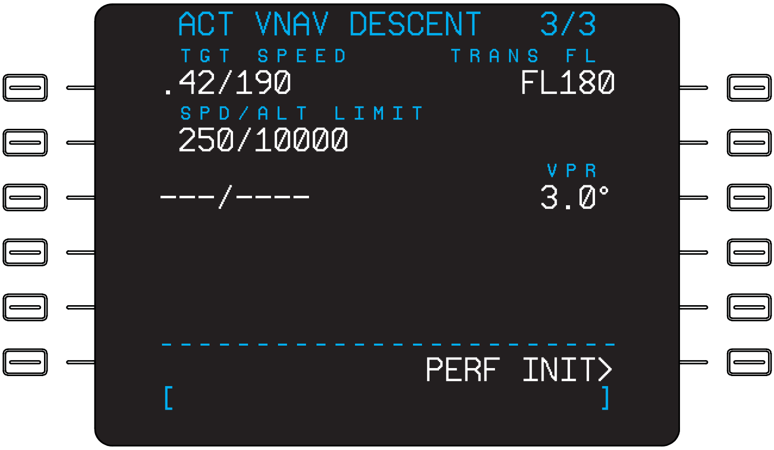
▲

VNAV DESCENT

SUMMARY:

The ACT/MOD VNAV DESCENT page shows the default settings for the items listed below. These parameters can be changed as necessary and another SPD/ALT LIMIT added if desired.

- Target Speed in IAS/Mach (TGT SPEED)
- Transition Flight Level (TRANS FL)
- Speed/Altitude Limit (SPD/ALT LIMIT)
- Vertical Path Angle (VPA).



TPG5117_33

RULES:

The guidelines that follow are applicable when changes are made on the VNAV DESCENT page.

- The default SPD/ALT LIMIT can be deleted if it is not applicable to the aircraft.
- TRANS ALT on the VNAV CLIMB page and TRANS FL on the VNAV DESCENT page are interconnected. A change to either one results in the same change to the other.

▼ CHECKLIST:

1. Push the PREV or NEXT function key as necessary to show the ACT/MOD VNAV DESCENT page.
2. Enter the desired change into the scratchpad.
3. Push the line select key for the applicable data line to move the scratchpad entry to that data line.

▲

VPA

SUMMARY:

A change to the Vertical Path Angle (VPA) on the ACT/MOD VNAV DESCENT page changes the VPA data for all descents in the flight plan that are not smoothed or specified otherwise in the flight plan. However, on the LEGS page, the VPA for any individual descent can be specified, which overrides the settings on the ACT/MOD VNAV DESCENT page.

▼ CHECKLIST:

1. Enter the desired descent path angle into the scratchpad.
2. Push the VPA line select key to move the scratchpad entry to the VPA data line.

▲

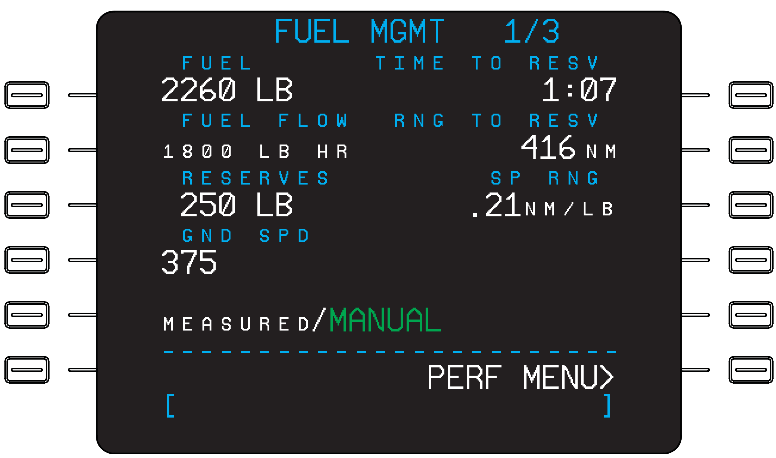
FUEL MANAGEMENT (FUEL MGMT)

RATIONALE:

The Fuel Management (FUEL MGMT) function gives information on fuel consumption, which lets the pilot do precise trip planning and inflight fuel management.

SUMMARY:

The FUEL MGMT function provides information to the pilots on fuel usage, time and range to reserves, and specific range based on True Airspeed (TAS) and Ground Speed (GS). FUEL MGMT also provides a trip calculator that allows the pilot to do “what if” fuel and time calculations to determine fuel requirements. The default values shown for each of the parameters on the FUEL MGMT pages are the current measured values for each parameter. The total quantity of FUEL is the same as the fuel remaining on the PERF INIT page and cannot be changed on the FUEL MGMT page. However, the FUEL FLOW, RESERVES, and/or GND SPD can be changed to see the affect the change has on each of the other values shown on the FUEL MGMT page. To return to the measured values, use the CLR DEL function key to delete all the changes made.



TPH6992_09

RULES:

The FUEL quantity can only be changed on the PERF INIT page. The FUEL quantity on the FUEL MGMT page is for display only.

▼ CHECKLIST:

1 Push the PERF function key to show the PERF MENU page.

2 Push the FUEL MGMT line select key to show the FUEL MGMT 1/3 page.

▲

FUEL MGMT CALCULATIONS

SUMMARY:

FUEL MGMT calculations are made on the FUEL MGMT 1/3 page. TIME TO RESV, RNG TO RESV, and SP RNG are calculated from the fuel, flow, reserves, and ground speed data. Changes cannot be made directly to TIME TO RESV, RNG TO RESV, and SP RNG. To make TIME TO RESV calculations, the FMS requires fuel, fuel flow, and reserves data. To make RNG TO RESV and SP RNG calculations, the FMS requires the addition of ground speed data.

PRECONDITIONS:

The procedure that follows starts on the FUEL MGMT 1/3 page.

▼ CHECKLIST:

1 Enter the desired change into the scratchpad.

2 Push the line select key for the applicable data line to move the scratchpad entry to that line.

NOTE

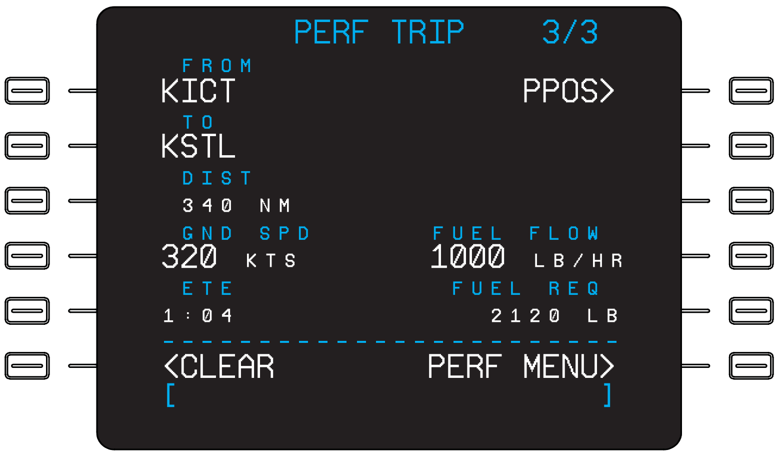
Sensor-measured data (MEASURED mode) shows in small font characters. Pilot entries (MANUAL mode) show in large font characters. To return to MEASURED mode after MANUAL entries are made, the manual entries must be deleted. To delete a manual entry, DELETE must be entered in the scratchpad with the DEL key, then the line select key for the data to be deleted must be pushed. When a manual entry is deleted, it is automatically replaced with a measured or default value.

3 Repeat Steps 1 and 2 as necessary to make changes to the FUEL, FUEL FLOW, RESERVES, and GND SPD.

TRIP CALCULATOR OPERATION

SUMMARY:

The PERF TRIP 3/3 page is a trip performance calculator. This page shows the TOTAL FUEL FLOW, FUEL REQ, ETE, and GND SPD. On this page, fuel calculations can be made from the Present Position (PPOS) of the aircraft to a specified waypoint, a specified distance, or from one specific waypoint to another. Also, fuel flow and ground speed can be changed to determine fuel requirements and/or time to the specified point or distance.



TPH6992_10

PRECONDITIONS:

The procedure that follows starts on the FUEL MGMT 1/3 page.

▼ CHECKLIST:

1	Push the PREV function key to show the PERF TRIP 3/3 page.
2	Use the scratchpad to enter either FROM or TO waypoints, or push the PPOS line select key to enter the aircraft present position as the FROM waypoint (shown as a latitude and longitude position), then enter a TO waypoint or distance.

3 Push the line select keys to move the entries to the applicable data lines in the calculator.

4 Repeat Steps 2 and 3 as necessary to enter more information, such as fuel flow and ground speed, or push the CLEAR line select key to reset the page.

VNAV PLAN SPD

RATIONALE:

VNAV PLAN SPD function let the pilot know about speed restrictions for the various phases of flight.

SUMMARY:

VNAV PLAN SPD can be placed on the PFD reference airspeed bug with the RESUME line select key. On the PERF MENU page, the VNAV PLAN SPD shows the more restrictive of any one of the speeds listed below.

- A climb or descent speed constraint set on the ACT LEGS page
- A SPD/ALT LIMIT set on the VNAV CLIMB or VNAV DESCENT pages
- A TGT SPEED for the current phase of flight as specified on the VNAV CLIMB, VNAV CRUISE, or VNAV DESCENT pages
- A decelerating speed when the aircraft approaches a lower speed limit
- V_{MO}/M_{MO}.

▼ **CHECKLIST:**

1	Push the PERF function key to show the PERF MENU page.
2	Push the VNAV PLAN SPD RESUME line select key to set the speed bug to the value shown on the data line.

NOTE

The RESUME selection is only available when VNAV is selected on the Mode Select Panel (MSP).

POST CONDITIONS:

The PFD reference airspeed bug can go back to the manual setting by a turn of the reference airspeed wheel located on the Autopilot Panel (APP).

Climb speed limits are indicated with up (↑) arrows and descent speed limits are indicated with down (↓) arrows on the ACT LEGS pages.

Climb speed limits on waypoints are applicable before the aircraft passes the waypoint. If the climb speed limit is no longer applicable, it can be deleted on the ACT/MOD LEGS page. Speed limits on holding patterns are applicable only to the holding pattern legs.

Descent speed limits on waypoints on the ACT LEGS pages are applicable after the aircraft passes the waypoints. If the descent speed limit is no longer applicable after the waypoint has been sequenced, the speed limit can be deleted on the ACT/MOD LEGS page.

REVIEW FLIGHT LOG

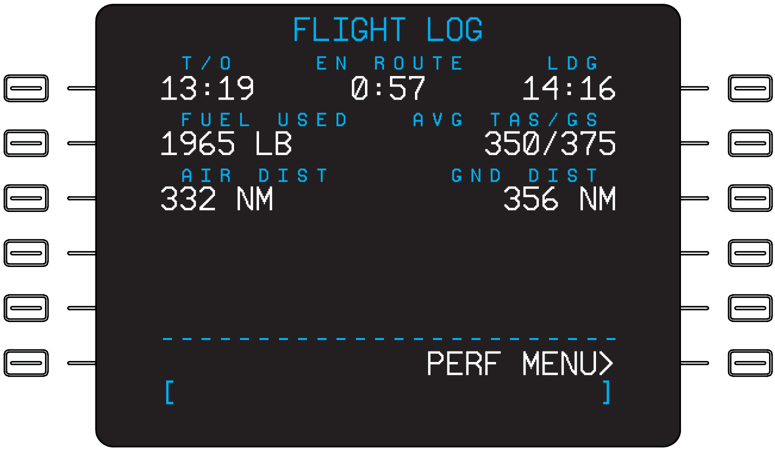
RATIONALE:

The FLIGHT LOG page lets the pilot review en route performance.

SUMMARY:

The FLIGHT LOG page shows the items listed below. Data on the FLIGHT LOG page is for display only.

- Takeoff time (T/O)
- En Route time (EN ROUTE)
- Landing time (LDG)
- Total amount of fuel used (FUEL USED)
- Average true airspeed and ground speed (AVG TAS/GS)
- Total air distance (AIR DIST)
- Total ground distance (GND DIST).



TPG5117_36

▼ CHECKLIST:

1	Push the PERF function key to show the PERF MENU page.

2 Push the FLT LOG line select key to show the FLIGHT LOG page.

This page intentionally left blank

TABLE OF CONTENTS

This page intentionally left blank

DEPARTURE

INTRODUCTION

This chapter includes some of the functions that are likely to be used during the departure phase of flight. With the exception of RWY UPDATE, these functions can also be used in other phases of flight as well.

If the aircraft is set up to use the FMS as the navigation source for a departure, this reduces the workload on the pilot during a critical phase of flight. A position update of the FMS to the runway threshold before departure gives the flight crew the most accurate navigation data during and after takeoff. To use the FMS steering commands that are given to the flight director, the pilot must select FMS as the NAV source (as indicated on the PFD) and select the NAV mode on the Mode Select Panel (MSP).

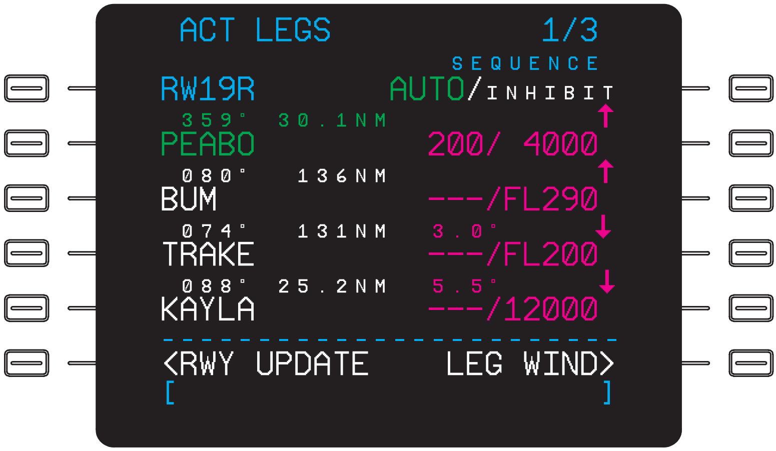
RUNWAY UPDATE

RATIONALE:

A RWY UPDATE updates the FMS position to the runway threshold coordinates, which can increase the navigational accuracy of the FMS.

SUMMARY:

The RWY UPDATE prompt shows on the ACT LEGS page when a departure runway is included in the flight plan and the aircraft is on the ground. Based on the source that was used to initialize the FMS position, the FMS usually provides greater navigation accuracy during takeoff and climbout when the position is updated at the runway threshold just before takeoff.



TPG5117_37

▼ CHECKLIST:

1	Push the LEGS function key to show the ACT LEGS page.
2	Push the RWY UPDATE line select key to update the FMS with the departure runway threshold coordinates.

POST CONDITIONS:

When the position update is complete, the annunciation COMPLETED shows above RWY UPDATE on the CDU that issued the request to do the runway update.

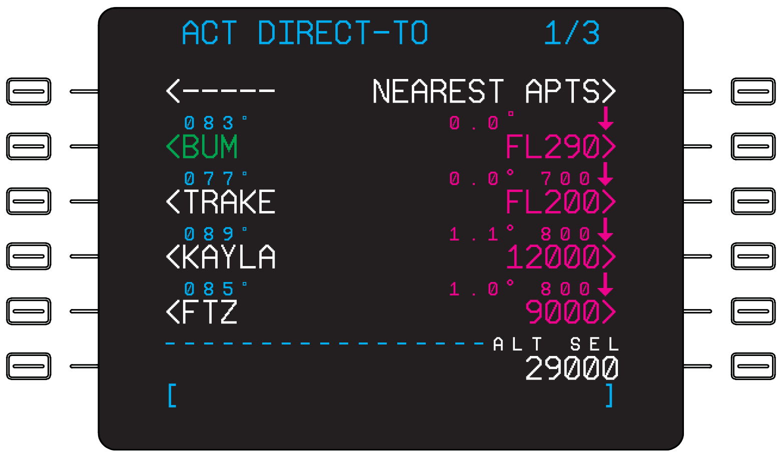
DIRECT-TO WAYPOINT (DIR KEY)

RATIONALE:

The Direct-To waypoint function, when selected, sends FMS steering commands to the flight guidance system to fly directly to the selected waypoint.

SUMMARY:

Pushing the DIR function key shows the ACT DIRECT-TO page. The ACT DIRECT-TO page can consist of several pages. To find a waypoint that is part of the active flight plan, but not shown on the current page, push the NEXT or PREV function key as necessary to show the desired waypoint. The annunciation HISTORY shows at the top of the page just below the title line when a DIRECT-TO HISTORY page shows on the CDU.



TPG5117_38

▼ CHECKLIST:

1	Push the DIR function key to show the ACT DIRECT-TO page.
2	Push the line select key next to the identifier of the waypoint to fly Direct-To.

NOTE

Many SIDs and STARs contain conditional waypoints that have no fixed geographical location, such as a heading to an altitude leg or a vector leg. Although these types of waypoints show on the ACT DIRECT-TO page, they cannot be selected for Direct-To navigation.

TIP

To intercept and fly a specific course to the Direct-To waypoint, enter the course into the scratchpad, then transfer it to the INTC CRS line on the MOD LEGS page before executing the modified flight plan.

3 Make sure that the flight plan changed on the MFD and CDU, then push the EXEC function key to execute the modified flight plan.

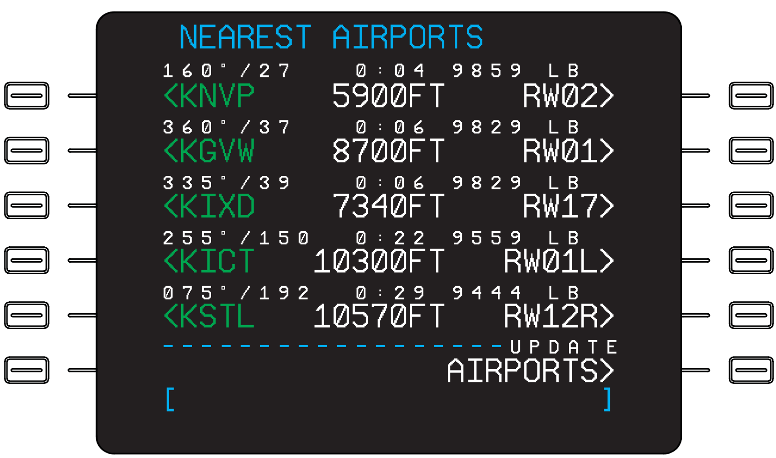
DIRECT-TO NEAREST AIRPORTS

RATIONALE:

The NEAREST AIRPORTS feature shows airports nearest to the aircraft position in the event an emergency landing or diversion is necessary. In the same manner as the Direct-To waypoint function, the FMS calculates a course direct-to the selected airport and sends steering commands to the flight guidance system to fly directly to the selected airport.

SUMMARY:

The NEAREST APTS prompt shows on the ACT DIRECT-TO page. Pushing the line select key next to the NEAREST APTS selection shows the NEAREST AIRPORTS page on the CDU. The NEAREST AIRPORTS page shows a list of five airports that normally includes the origin and destination airports, as well as the three nearest airports. The airports are listed by the ICAO identification code, and are arranged by distance from the present position of the aircraft. The pilot can select a course either direct to the airport reference point, or to the longest runway at the selected airport. The NEAREST AIRPORTS page has a page refresh feature (UPDATE AIRPORTS) that updates the page using the current position of the aircraft.



TPG5117_39

▼ CHECKLIST:

1	Push the DIR function key to show the ACT DIRECT-TO page.
2	Push the NEAREST APTS line select key to show the NEAREST AIRPORTS page.
3	Push a line key for the desired airport. • Push the airport ICAO line select key to cause the FMS to compute a course direct to the airport reference point. • Push the runway line select key to cause the FMS to compute a course direct to the longest runway at the airport for a visual approach.
4	The FMS shows the MOD LEGS page with the course and distance to the selected airport. • If the airport reference point was selected, the MOD LEGS page shows the course and distance to the airport reference point. • If the longest runway was selected, the MOD LEGS page shows the course and distance to the runway extension point. It also shows the VNAV constraint associated with the visual approach point, followed by the selected runway as a visual approach procedure.
5	To intercept and fly a specific course to the airport reference point or runway extension point, enter the course into the scratchpad, then transfer it to the INTC CRS line on the MOD LEGS page.
6	Make sure that the flight plan changed on the MFD and CDU, then push the EXEC key to execute the modified flight plan.

NOTE

If the Direct-To course is to the airport reference point, no STAR or runway associated with the selected airport shows in the new flight plan. There are also no VNAV constraints associated with the selected Direct-To airport in the new flight plan.

NOTE

The NEAREST AIRPORTS function replaces all the waypoints that remain in the active flight plan with only the selected nearest airport or visual approach for the selected nearest airport. After a DIRECT-TO the nearest airport is executed with the EXEC function key, all of the replaced waypoints are permanently deleted from the active flight plan.

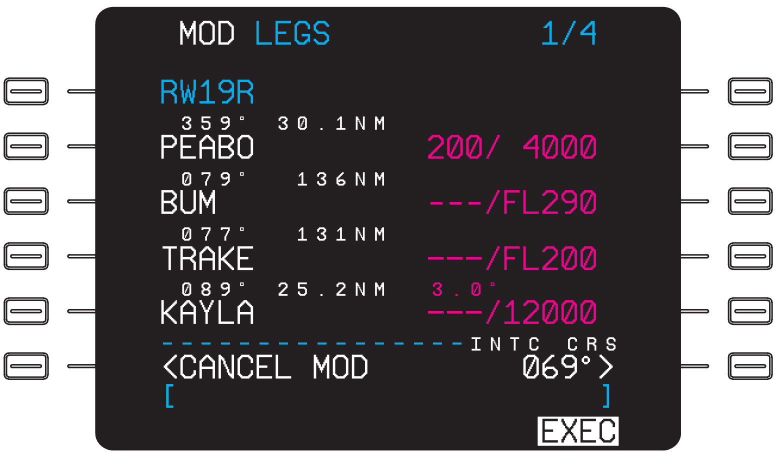
DIRECT-TO WAYPOINT (ACT LEGS PAGE)

RATIONALE:

The ACT LEGS pages also provide a Direct-To function. The Direct-To function, when selected, sends FMS steering commands to the flight guidance system to fly directly to the selected waypoint.

SUMMARY:

To create a Direct-To on the ACT LEGS page, change the current TO waypoint to the specified go-direct waypoint. The Direct-To waypoint can be an existing down-track waypoint in the current flight plan or any other valid waypoint.



TPG5117_40

▼ CHECKLIST:

1	Push the LEGS function key to show the ACT/MOD LEGS page.

NOTE

The ACT LEGS page can consist of several pages. To find a waypoint that is part of the active flight plan, but not shown on the current page, the NEXT or PREV function key can be used as necessary to show the desired waypoint.

2 Enter a waypoint in the scratchpad by one of the two methods that follow:

NOTE

Selection of a down-track waypoint as the Direct-To waypoint deletes any waypoints on the flight plan between the current waypoint. The selected waypoint is deleted when the Direct-To waypoint is transferred from the scratchpad to the TO waypoint line. However, the FMS stores the intermediate waypoints in the DIRECT-TO history and the intermediate waypoints are still available for use if the pilot goes to the DIRECT-TO history pages.

- Push the line select key adjacent to the identifier of the specified direct-to waypoint.
- Manually enter the waypoint identifier with the keypad.

3 Push the line select key next to the current TO waypoint (shown in green on the ACT/MOD LEGS page) to move the waypoint from the scratchpad to the TO waypoint display line.

4 To intercept and fly a specific course to the Direct-To waypoint, enter the course into the scratchpad, then transfer it to the INTC CRS line on the MOD LEGS page.

5 Make sure the flight plan changed on the MFD and CDU, then push the EXEC function key to execute the modified flight plan.

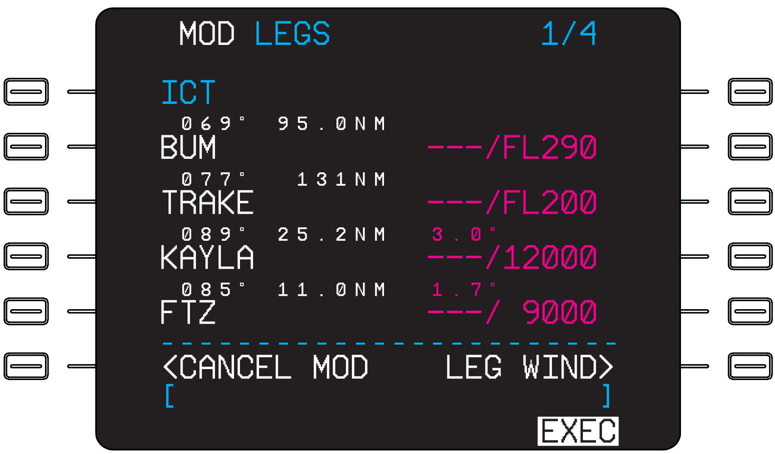
FROM WAYPOINT EDIT

RATIONALE:

The FROM waypoint edit function lets the pilot change the FROM waypoint as necessary.

SUMMARY:

When the FROM waypoint (shown on the LEGS page above the TO waypoint) is changed, the leg from that waypoint to the next waypoint can be established as the active leg. The FMS will then arm to intercept the route and fly the new course to the TO waypoint. A FROM waypoint edit is done on the LEGS page.



TPG5117_41

▼ CHECKLIST:

1	Push the LEGS function key to show the LEGS page.
2	Enter the new FROM waypoint in the scratchpad.

NOTE

The top waypoint in cyan on ACT/MOD LEGS 1/X page is the FROM waypoint.

3 Push the FROM waypoint line select key to transfer the waypoint from the scratchpad to the FROM waypoint data field.

4 Make sure the flight plan changed on the CDU and MFD, then push the EXEC function key to execute the changed flight plan.

NOTE

Selection of a down-track waypoint as the new FROM waypoint deletes any waypoints on the flight plan between the current FROM waypoint and the new FROM waypoint. The selected waypoint will also be deleted when the Direct-From waypoint is entered into the FROM waypoint line.

This page intentionally left blank

TABLE OF CONTENTS

EN ROUTE

INTRODUCTION

This chapter shows how to insert a hold in a flight plan, change a holding pattern, and exit a holding pattern. It also describes how to enter a reference fix, create pilot-defined waypoints, enter an offset course parallel to the flight plan, and update the FMS position while en route.

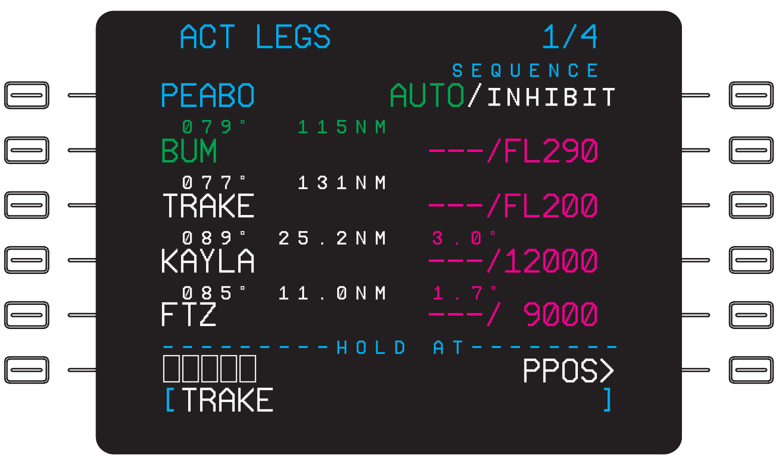
HOLD AT FLIGHT PLAN WAYPOINT

RATIONALE:

The HOLD function causes the FMS to load the hold pattern at the designated hold point into the flight plan, which reduces the workload on the pilot.

SUMMARY:

The INDEX 1/2 page supplies access to the HOLD function. A flight plan can have up to six holds. A hold can be defined with either an inbound course and turn direction, or with a quadrant and a radial, and be referenced either from a navaid or from the point on which the hold is defined.



TPG5117_42

RULES:

When the HOLD line select key on the INDEX 1/2 page is pushed, one of three pages shows, based on the number of holds in the flight plan. If no holds exist, the ACT LEGS page with the HOLD AT prompt appears. If the flight plan contains one hold that is not in the missed approach or alternate flight plan, the ACT FPLN HOLD page for that hold shows. If the flight plan contains more than one hold, or at least one hold in the missed approach or alternate flight plan, the ACT HOLD LIST page shows. This page shows all holds that are in the flight plan. Missed approach and alternate flight plan holds are identified on the ACT HOLD LIST page.

▼ **CHECKLIST:**

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the HOLD line select key.
3	If the ACT FPLN HOLD or the ACT HOLD LIST page shows, push the NEW HOLD line select key to show the ACT LEGS page with the HOLD AT prompt. If not, proceed to Step 4.
4	Push the line select key next to the waypoint for the hold to copy the waypoint identifier to the scratchpad.
5	Push the line select key for the prompt boxes under the HOLD AT field to enter the scratchpad entry. **NOTE** When the waypoint identifier is entered into the HOLD AT prompt boxes, the page changes from the ACT LEGS page to the MOD FPLN HOLD page.
6	Make sure that the flight plan changed on the MFD and on the CDU, then push the EXEC function key to execute the modified flight plan.

7 Push the LEGS function key to go back to the LEGS page and make sure that the hold shows on the LEGS page.

NOTE

The ACT LEGS can consist of several pages. The NEXT or PREV function key can be used as necessary to show the desired waypoint on the CDU.

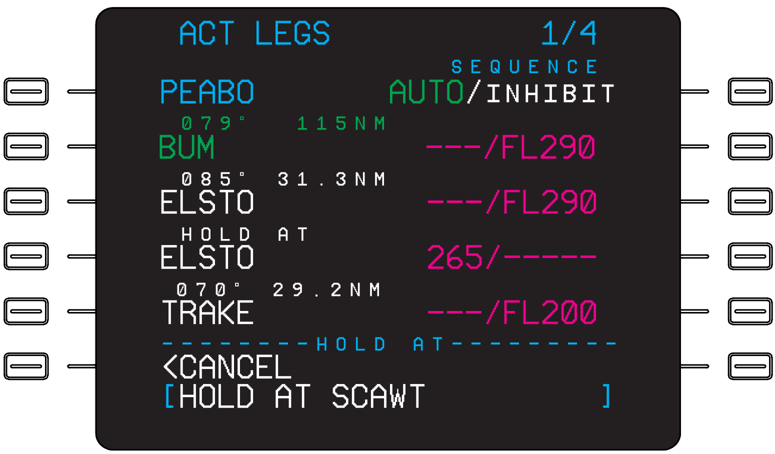
HOLD AT NON-FLIGHT PLAN WAYPOINT

RATIONALE:

A HOLD can be set up at a waypoint that is not in the flight plan. The HOLD function automatically loads the new holding fix, the course and distance to the holding fix, and the hold pattern at the designated hold point into the flight plan, which reduces the workload on the pilot.

SUMMARY:

The INDEX 1/2 page supplies access to the HOLD function. A flight plan can have up to six holds. A hold can be defined with either an inbound course and turn direction, or with a quadrant and a radial, and be referenced either from a navaid or from the point on which the hold is defined.



TPH6992_12

RULES:

When the HOLD line select key on the INDEX 1/2 page is pushed, one of three pages shows, based on the number of holds in the flight plan. If no holds exist, the ACT LEGS page with the HOLD AT prompt shows. If the flight plan contains one hold that is not in the missed approach or alternate flight plan, the ACT FPLN HOLD page for that hold shows. If the flight plan contains more than one hold, or at least one hold in the missed approach or alternate flight plan, the ACT HOLD LIST page shows. This page shows all holds in the flight plan.

Missed approach and alternate flight plan holds are identified on the ACT HOLD LIST page.

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the HOLD line select key.
3	If the ACT FPLN HOLD or the ACT HOLD LIST page shows, push the NEW HOLD line select key to show the ACT LEGS page with the HOLD AT prompt.
4	Enter the identifier of the desired holding fix into the scratchpad.
5	Push the line select key for the prompt boxes under the HOLD AT field to transfer the scratchpad entry. **NOTE** When the new waypoint is entered into the HOLD AT prompt boxes, HOLD AT IDENT shows in the scratchpad.
6	Push the line select key of the waypoint that the HOLD is to come before.
7	Make sure that the flight plan changed on the MFD and on the CDU, then push the EXEC function key to execute the modified flight plan.
8	Push the LEGS function key to go back to the LEGS page and make sure that the hold shows on the LEGS page.

NOTE

The ACT LEGS can consist of several pages. The NEXT or PREV function key can be used as necessary to show the desired waypoint on the CDU.

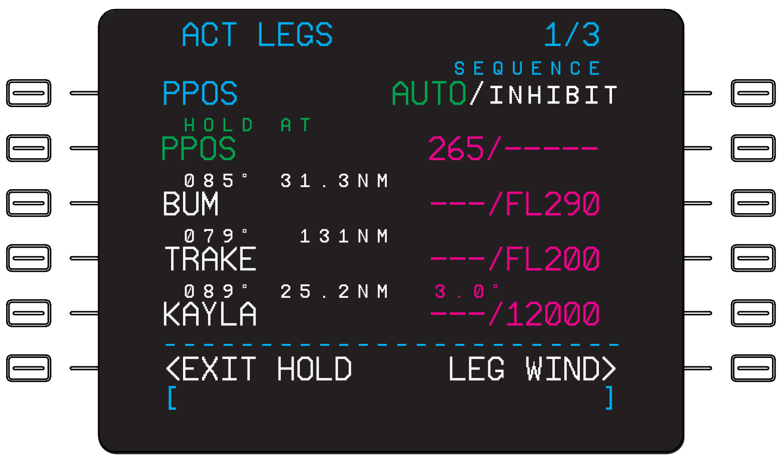
HOLD AT PRESENT POSITION

RATIONALE:

A HOLD can be set up at the Present Position (PPOS) of the aircraft. The HOLD function causes the FMS to automatically load the present position holding pattern into the flight plan, which reduces the workload on the pilot.

SUMMARY:

The INDEX 1/2 page supplies access to the HOLD function. A flight plan can have up to six holds. A hold can be defined with either an inbound course and turn direction, or with a quadrant and a radial, and be referenced either from a navaid or from the point on which the hold is defined.



TPG5117_44

RULES:

When the HOLD line select key on the INDEX 1/2 page is pushed, one of three pages appears, depending on the number of holds in the flight plan. If no holds exist, the ACT LEGS page with the HOLD AT prompt appears. If the flight plan contains one hold that is not in the missed approach or alternate flight plan, the ACT FPLN HOLD page for that hold shows. If the flight plan contains more than one hold, or at least one hold in the missed approach or alternate flight plan, the ACT HOLD LIST page shows. This page shows all holds in the flight plan. Missed approach and alternate flight plan holds are identified on the ACT HOLD LIST page.

▼ CHECKLIST:

1 Push the IDX function key to show the INDEX 1/2 page.

2 Push the HOLD line select key.

3 If the ACT FPLN HOLD or the ACT HOLD LIST page shows, push the NEW HOLD line select key to show the ACT LEGS page with the HOLD AT prompt.

4 Push the PPOS line select key to show the HOLD page with the aircraft present position as the holding fix.

NOTE

Present position holds are inbound on the current course with right hand turns and leg lengths of 1.0 or 1.5 minutes, based on altitude and aircraft specifications. The pilot can make changes to both the leg length and turn direction of a present position hold if necessary.

5 Make sure that the flight plan changed on the MFD and on the CDU, then push the EXEC function key to execute the modified flight plan.

6 Push the LEGS function key to go back to the LEGS page and make sure that the hold shows on the LEGS page.

NOTE

The ACT LEGS can consist of several pages. The NEXT or PREV function key can be used as necessary to show the desired waypoint on the CDU.

▲

CHANGE A HOLDING PATTERN

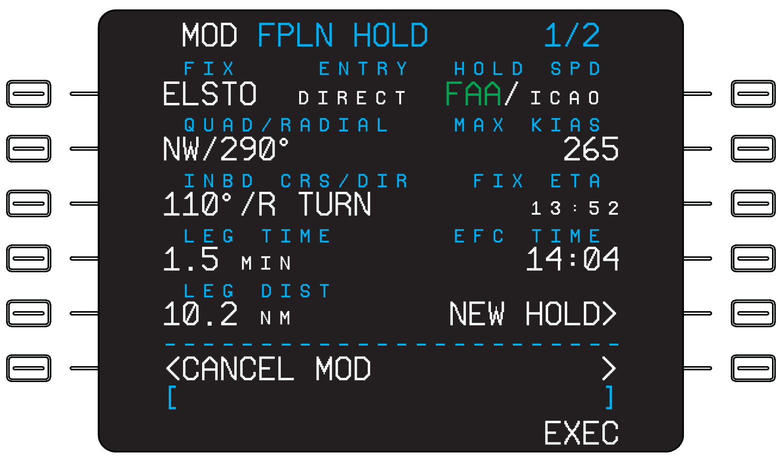
RATIONALE:

A holding pattern can be changed as necessary.

SUMMARY:

If the flight plan contains one hold that is not in the missed approach or alternate flight plan, the ACT FPLN HOLD page for that hold shows when the HOLD line select key is pushed. If the flight plan contains more than one hold or at least one hold in the missed approach or alternate flight plan, the ACT HOLD LIST page shows when the HOLD line select key is pushed. The procedure that follows is used to change the various elements of an existing hold. A hold can be changed as follows:

- Upon creation
- Before it becomes active
- While in progress (except the inbound course).



TPG5117_45

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.

2 Push the HOLD line select key to show the ACT FPLN HOLD or the ACT HOLD LIST page.

NOTE

The ACT HOLD LIST shows all holds in the flight plan. Missed approach procedure holds and holds in the alternate flight plan are identified as such on the ACT HOLD LIST page.

3 If the ACT HOLD LIST page shows, push the line select key for the hold that is to be changed to show the ACT FPLN HOLD page.

4 To change the inbound course and direction of turn of a hold, or quadrant and radial, enter the appropriate information into the scratchpad.

NOTE

The QUAD/RADIAL is used only if cleared to hold in a particular cardinal direction (quadrant) from a specified fix defined off a VOR radial. When QUAD/RADIAL is entered, the FMS automatically computes the inbound course for the hold. Based on the direction of the hold off the fix, the resulting inbound course can be a reciprocal of the radial. The QUAD/RADIAL entry never determines the direction of turn of the hold itself. Standard holding pattern turns are to the right. The controlling authority issues all non-standard holding instructions.

NOTE

The inbound course of a hold in progress cannot be manually changed.

5 Push the applicable line select key to enter the information from the scratchpad.

6 To change a time-based leg to a distance-based leg, enter the distance into the scratchpad.

NOTE

A leg time or leg distance modified from the defaults supplied by the FMS shows in large size text.

7 Push the LEG DIST line select key to move the leg distance from the scratchpad to the LEG DIST data field.

8 To enter or change the Expect Further Clearance (EFC) time, enter the time into the scratchpad.

NOTE

Entry of EFC time is optional. The modified hold can be executed without the EFC time.

9 Push the EFC TIME line select key to move the time from the scratchpad to the EFC TIME entry line.

10 Make sure that the flight plan changed on the MFD and CDU, then push the EXEC function key to execute the modified flight plan.

NOTE

The MAX KIAS or MACH speed setting is the default speed limit for the hold. It also shows on the LEGS page as a speed constraint for the holding waypoint, unless a SID, STAR, or approach procedure specified a speed limit for the hold. A change to the speed can be entered on the LEGS page, but not on the HOLD page. The speed setting lets the FMS generate a CHECK SPEED message 1 minute before the aircraft reaches the holding fix if the airspeed of the aircraft is more than the prescribed limit. The size of the holding pattern is based on bank angle limit, current winds, and the true airspeed of the aircraft or MAX KIAS, whichever is lower, when the aircraft crosses the holding fix.

11 To change or examine the data for another hold from the ACT/MOD FPLN HOLD page, push the PREV or NEXT function key to show the ACT FPLN HOLD page for that hold. This bypasses the ACT HOLD LIST page when modifying or examining more than one hold.

EXIT HOLDING

RATIONALE:

The FMS will automatically exit the holding pattern and continue on the flight plan path when exit conditions are met.

SUMMARY:

A hold exit can be initiated from the ACT LEGS page or the ACT FPLN HOLD page. The FMS-calculated exit path shows on the MFD map. The FMS steers the aircraft to exit the hold in one of three ways:

- If the aircraft is already on the inbound turn or inbound leg of the hold, the FMS steers the aircraft along the existing holding track to exit the hold.
- If the aircraft is on the outbound turn, the FMS continues the turn through the outbound leg heading and back to the holding fix.
- If the aircraft is on the outbound leg of the hold before the inbound turn, the FMS starts an immediate turn to the inbound leg to exit the hold.

▼ **CHECKLIST:**

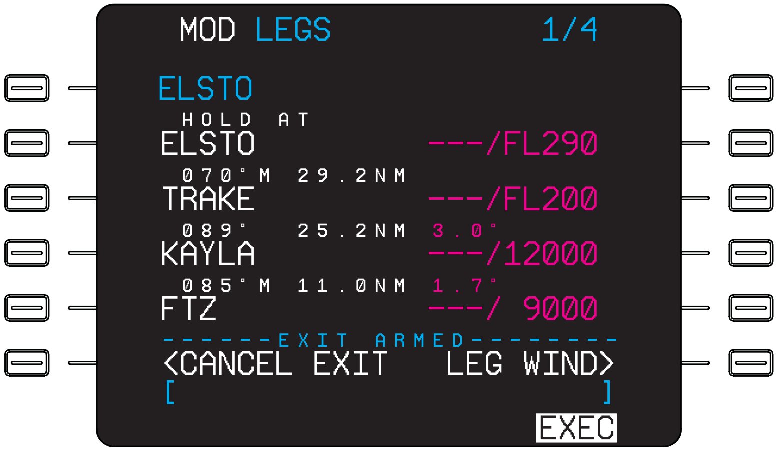
1	Arm the FMS for exit either through the ACT LEGS page or the ACT FPLN HOLD page.
2	Execute the flight plan change.

▲

VIA ACT LEGS PAGE

SUMMARY:

A hold can be exited from the ACT LEGS page. To exit the hold, the FMS is armed for the exit, then the flight plan change is executed.



TPG5117_46

▼ CHECKLIST:

1 Push the LEGS function key to show the ACT LEGS page.

2 Push the EXIT HOLD line select key.

3 Push the EXEC function key to execute the change and exit the holding pattern.

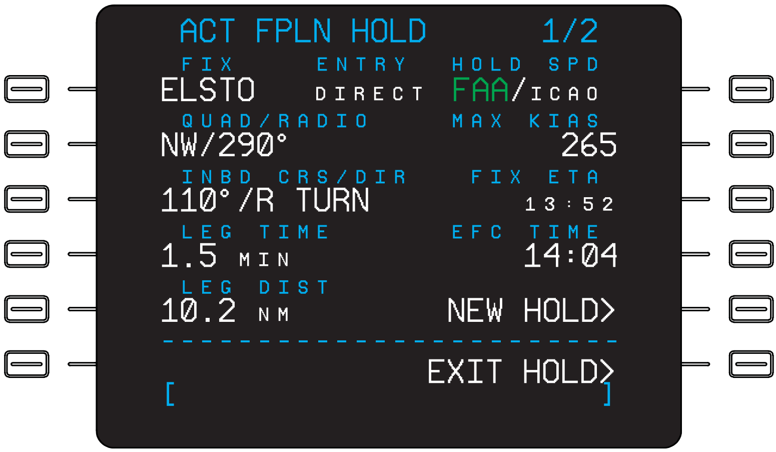
NOTE

Course reversal holds that commonly appear in approach transitions automatically arm for exit once the aircraft has established the hold. However, the pilot can cancel the exit before the aircraft reaches the final course intercept point.

VIA ACT FPLN HOLD PAGE

SUMMARY:

A hold can be exited from the ACT FPLN HOLD page. To exit the hold, the FMS is armed for the exit, then the flight plan change is executed.



TPG5117_47

▼ **CHECKLIST:**

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the HOLD line select key to show the ACT FPLN HOLD page.
3	Push the EXIT HOLD line select key.
4	Push the EXEC function key to execute the change and exit the holding pattern.

NOTE

Course reversal holds that commonly appear in approach transitions automatically arm for exit once the aircraft has established the hold. However, the pilot can cancel the exit before the aircraft reaches the final course intercept point.

CANCEL HOLDING EXIT

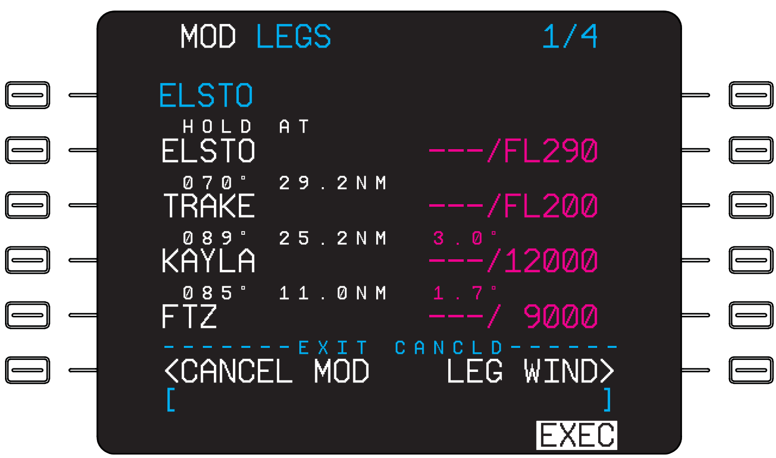
RATIONALE:

A hold exit can be cancelled at any time while the aircraft is still in the holding pattern.

SUMMARY:

The pilot can cancel a hold exit at any time or at any point around the holding pattern before the aircraft crosses the holding fix for the exit. However, the pilot must cancel the exit from course reversal holds, used in instrument approach procedures, before the FMS sequences to the inbound course INTC waypoint. The FMS steers the aircraft to continue the hold in one of three ways:

- If an outbound turn is in progress, the FMS will complete the turn to the outbound leg and continue the hold.
- If an inbound turn is in progress, the FMS will complete the turn to the inbound leg and continue the hold.
- If the aircraft is on the inbound leg, the FMS will continue the hold as if the exit were never selected.



TPG5117_48

▼ CHECKLIST:

1 Push the LEGS function key to show the ACT LEGS page.

2 Push the CANCEL EXIT line select key to cancel the hold exit.

3 Push the EXEC function key to execute the change and remain in the hold.

▲

CREATE PILOT-DEFINED WAYPOINTS

RATIONALE:

The pilot can create unique pilot-defined waypoints that can be used in a flight plan.

SUMMARY:

Pilot-defined waypoints can be created on the ACT FPLN, ACT LEGS, or DEFINE PILOT WPT page. These waypoints can also be stored/saved for recall from the PILOT WPT LIST page. Pilot-defined waypoints can be stored with or without a name given to them. A named pilot-defined waypoint on the ACT/MOD FPLN or LEGS page is stored in the PILOT WPT LIST. If the waypoint name already exists in the PILOT WPT LIST, the prompt WPT ALREADY EXISTS <REPLACE, CANCEL> appears. Selection of the REPLACE option causes the new waypoint definition to replace the old one in the PILOT WPT LIST. Selection of the CANCEL option keeps the original definition in the PILOT WPT LIST and does not update the flight plan. There are five ways to define a waypoint:

- Along-Track Offset — A waypoint that is offset a specified distance and is either before or after a specified waypoint on the flight plan route.
- PLACE BRG/DIST — A waypoint that is defined as a bearing and distance from another waypoint.
- PLACE BRG/PLACE BRG — A waypoint that is defined as the intersection created by bearings from two different waypoints.
- LATITUDE and LONGITUDE — A waypoint that is defined by latitude and longitude.
- Shorthand LATITUDE and LONGITUDE — A waypoint that is defined by shorthand (hemispheric) latitude and longitude.

RULES:

Up to 100 pilot-defined waypoints can be stored in the FMS, but no more than 50 can be stored in one flight plan.

▼ **CHECKLIST:**

1	Select the desired entry page (ACT LEGS or ACT FPLN).

2 Enter the waypoint definition into the scratchpad.

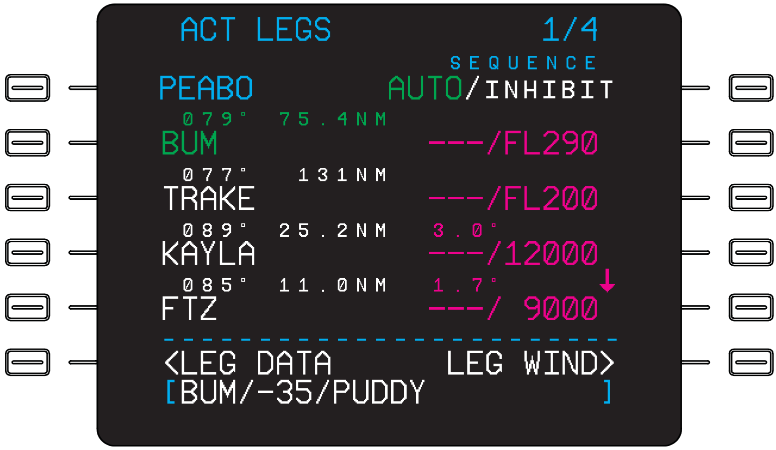
3 Push the line select key at the applicable location in the flight plan to enter the waypoint.

4 Make sure the flight plan changed on the CDU and MFD, then push the EXEC function key to execute the flight plan change.

ALONG-TRACK OFFSET

SUMMARY:

An existing waypoint (base waypoint) in the flight plan defines an along-track offset waypoint. The waypoint must be along the route of flight and not off-track. The entry format is IDENT/DIST. IDENT is the name of the waypoint on which the offset waypoint is based. DIST is the distance from the base waypoint.



TPG5117_49

RULES:

The guidelines that follow are applicable when an along-track offset waypoint is created.

- A positive value for distance inserts the along-track offset waypoint down-track from the base waypoint in the flight plan. A negative distance value inserts it before the base waypoint in the flight plan.
- The entered positive distance value must be less than the length of the leg that immediately follows the base waypoint in the flight plan.
- For the active leg, a negative distance value must be less than the distance from the present position of the aircraft to the TO waypoint.
- A negative offset value is permitted only if the flight plan specifies a track-to-fix leg immediately before the base waypoint. In this case, the negative offset value must be less than the length of the leg that is immediately before the waypoint.

▼ CHECKLIST:

1 Enter the name of the flight plan waypoint (IDENT), followed by a slash (/) and the distance from the waypoint (DIST). A name (NAME) for the waypoint can also be entered. Use the format (IDENT/DIST/NAME).

NOTE

The FMS automatically stores the named waypoint in the PILOT WPT LIST.

2 Push the line select key for the base waypoint to enter the waypoint into the flight plan.

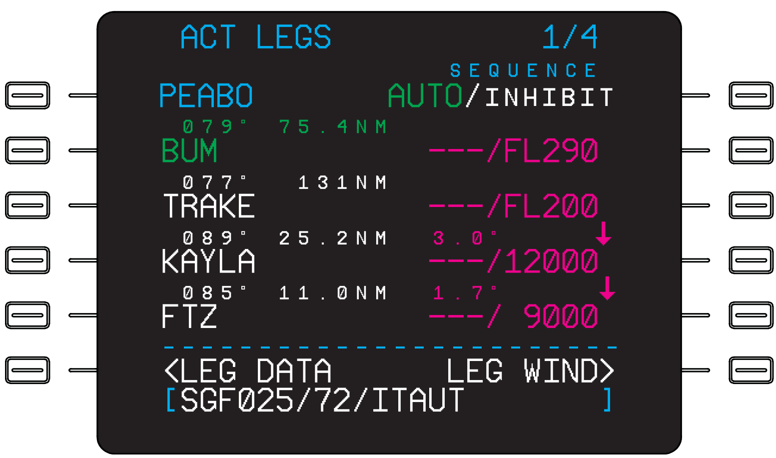
▲

PLACE BRG/DIST

SUMMARY:

A PLACE BRG/DIST waypoint is based on any valid geographically fixed point. The scratchpad entry format is IDENTBRG/DIST with the base waypoint identifier for IDENT, a numeric value for BRG, a slash, and a numeric value for DIST (for example, CME025/7, TCS360/105, TAGGS275.3T/15.5), The items listed below can be used as the IDENT for the base waypoint.

- Navaids
- En route intersections
- Non-directional beacons
- Airports
- Reference points
- Runway threshold of the origin, destination or alternate airport
- Terminal waypoints of the origin, destination or alternate airport
- Other pilot-defined waypoints (except those defined with shorthand latitude/longitude).



TPG5117_50

RULES:

The guidelines that follow describe the specific requirements for a BRG entry.

- The bearing must be a three digit number (or four digits with a decimal point for tenths of a degree).
- All leading zeros must be entered (for example, 005, 040, 007.1, 055.2T).
- 000 or 360 can be entered for North. The FMS always shows North as 360.
- Distance entries must be between 0.1 and 199.9 NM. Use a leading zero for a distance of less than one NM.

▼ CHECKLIST:

1 Enter the base waypoint identifier (IDENT) and bearing (BRG), followed by a slash (/) and the DIST from the base waypoint. A name can be added if desired (NAME). Use the format IDENT BRG/DIST/NAME.

NOTE

The bearing reference can be forced to True north if the letter T is added as a suffix to the BRG.

NOTE

If a name is not specified, the FMS uses the base waypoint identifier with a number added as a suffix to give it a unique name in the flight plan.

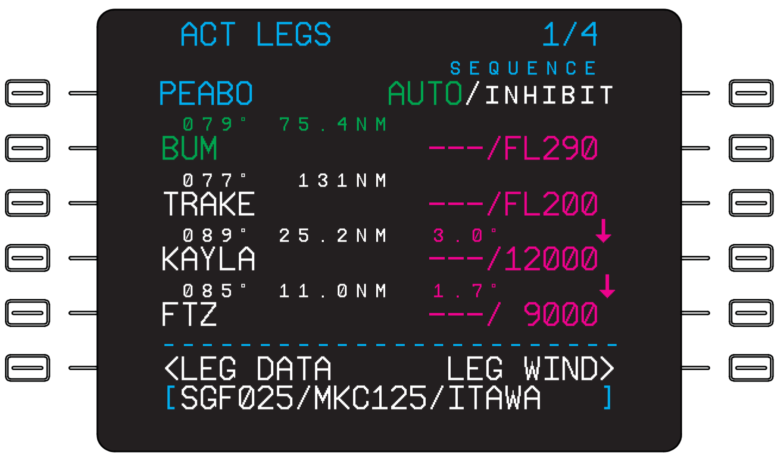
2 Push the line select key where the pilot-defined waypoint is to be added to enter the waypoint into the flight plan.

▲

PLACE BRG/PLACE BRG

SUMMARY:

A PLACE BRG/PLACE BRG waypoint is defined by the same criteria that is used to define other waypoints, with the addition of runway extension for the destination airport. The scratchpad entry format is IDENTBRG/IDENTBRG, with the waypoint identifier as the IDENT and a numeric value for BRG. Bearing entry format and references are the same as those previously described for PLACE BRG/DIST waypoints. For PLACE BRG/PLACE BRG waypoints, the FMS uses the first waypoint and bearing entry as the base waypoint. The second waypoint and bearing determine the intersection point of the specified bearings. The FMS then converts the intersection into a PLACE BRG/DIST waypoint based on the first waypoint. This can be seen by copying the waypoint from the flight plan (once it is entered in the flight plan) back into the scratchpad.



TPG5117_51

▼ **CHECKLIST:**

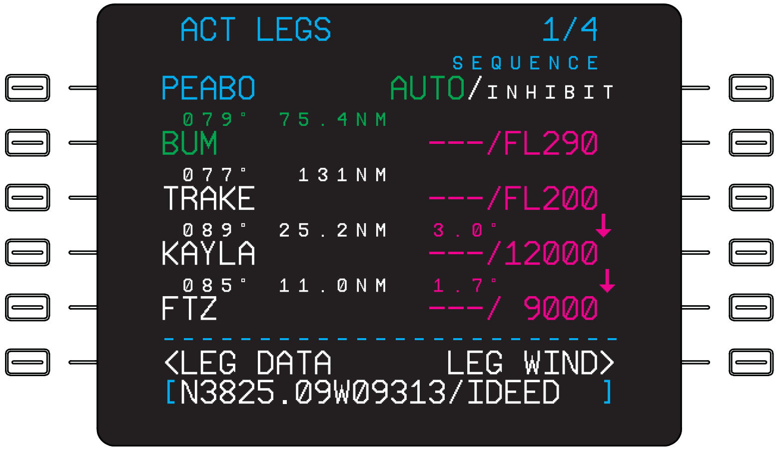
1	Enter the first base waypoint IDENT and BRG, followed by a slash (/), then the second base waypoint IDENT and BRG. A name can be added if desired. Use the format IDENT BRG/IDENT BRG/NAME.

2 Push the line select key where the pilot-defined waypoint is to be added to enter the waypoint into the flight plan.

LATITUDE AND LONGITUDE

SUMMARY:

Latitude and longitude can be used to specify a waypoint. The scratchpad entry format (N or S)DDMM.MM(W or E)DDDMM.MM is used for a latitude/longitude-based waypoint. The hemispheric designation (N/S, E/W) must always come before the coordinates. The coordinates are entered with the standard of four digits for latitude and five digits for longitude.



TPG5117_52

RULES:

The guidelines that follow are applicable for entering latitude and longitude coordinates.

- If waypoint coordinates are in whole degrees of latitude, longitude or both, the minutes do not have to be entered (for example, N40, S09, W030, E042).
- Always enter degrees of longitude in three digits.
- When entering minutes, use two numbers before the decimal point.
- When using a decimal point, enter at least one number after it.
- The minutes entry range is from 00.00 to 59.99.

▼ **CHECKLIST:**

1 Enter the latitude followed by the longitude of the waypoint. A name can be entered if desired. Use the format (N or S)DDMM.MM(W or E)DDDMM.MM/NAME.

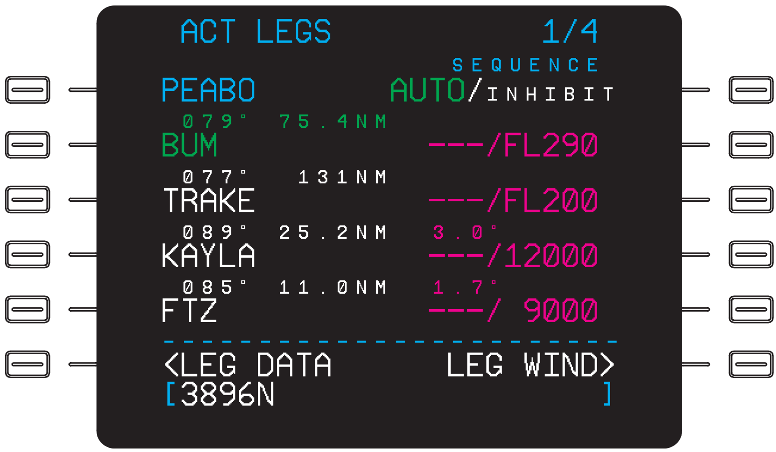
2 Push the line select key where the pilot-defined waypoint is to be added to enter the waypoint into the flight plan.

▲

SHORTHAND LATITUDE/LONGITUDE

SUMMARY:

Shorthand latitude and longitude entries differ from regular latitude/longitude entries in that shorthand entries are resolved to only one degree of both latitude and longitude. Shorthand entries cannot be named, and the entry must have five characters.



TPG5117_53

RULES:

The rules that follow define shorthand latitude and longitude entries.

- The letters N or E identify positions in the Northern Hemisphere. The letter N indicates North latitude and West longitude. The letter E indicates North latitude and East longitude.
- The letters S and W identify positions in the Southern Hemisphere. The letter S indicates South latitude and East longitude. The letter W indicates South latitude and West longitude.
- The two-digit latitude **always** comes before longitude. The placement of the letter indicates the value of the longitude hundreds digit. If longitude is 100 degrees or greater, the letter is in the third character position, which lets it function as the 100 digit in the longitude. If the longitude is less than 100 degrees, the letter is the last of the five characters.

▼ CHECKLIST:

1. Enter the latitude, letter designator, and longitude as described in the rules listed above.
2. Push the line select key where the pilot-defined waypoint is to be added to enter the waypoint into the flight plan.

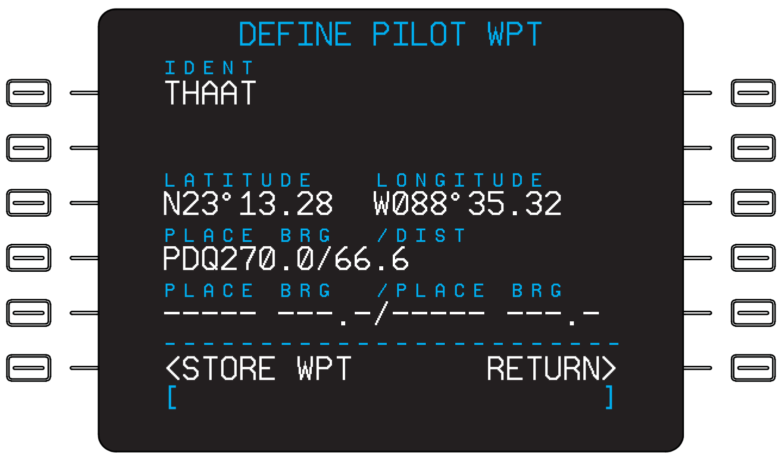
DEFINE AND STORE PILOT WAYPOINTS

RATIONALE:

Pilot-defined waypoints can be defined and stored on the DEFINE PILOT WPT page to be used in the future.

SUMMARY:

Waypoints can be defined and stored on the DEFINE PILOT WPT page. Pilot-defined waypoints that were stored from the DEFINE PILOT WPT page remain in the FMS in the PILOT WPT LIST until they are manually deleted.



TPG5117_91

▼ **CHECKLIST:**

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the NEXT function key to show the INDEX 2/2 page.
3	Push the DATA BASE line select key to show the DATA BASE page.

4 Push the DEFINE WPT line select key to show the DEFINE PILOT WPT page.

5 Enter a name (IDENT) for the waypoint into the scratchpad.

6 Push the IDENT line select key to move the scratchpad entry to the IDENT data field.

7 Enter LATITUDE and LONGITUDE, a PLACE BRG/DIST, or a PLACE BRG/PLACE BRG into the scratchpad.

NOTE

Shorthand latitude/longitude entries cannot be defined on the DEFINE PILOT WPT page. They also cannot be stored in the PILOT WPT LIST.

8 Push the line select key for the type of waypoint to enter.

9 Push the STORE WPT line select key to store the waypoint with the assigned name in the FMS database.

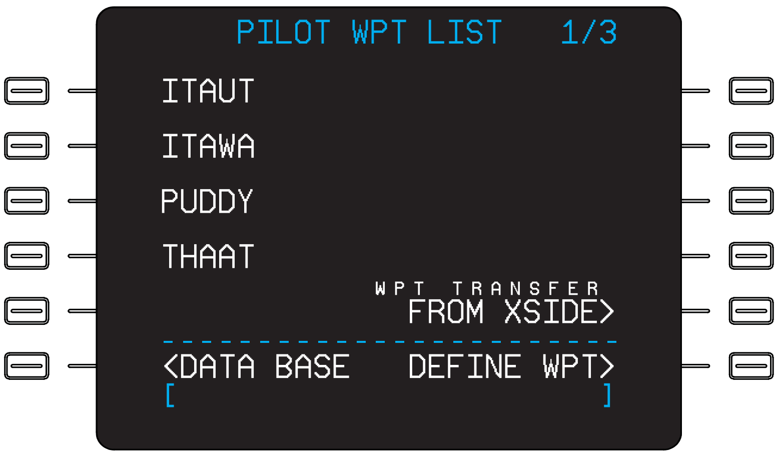
SELECT PILOT-DEFINED WAYPOINTS

RATIONALE:

Pilot-defined waypoints that have been stored in the PILOT WPT LIST can be recalled and used in a flight plan.

SUMMARY:

A stored waypoint is retrieved from the PILOT WPT LIST page to be used in the flight plan. If the name of the waypoint is already known, the waypoint can be entered directly on the ACT/MOD FPLN or ACT/MOD LEGS pages. The FMS will get the waypoint from the PILOT WPT LIST and insert it into the flight plan.



TPG5117_55

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the NEXT function key to show the INDEX 2/2 page.
3	Push the DATA BASE line select key to show the DATA BASE page.

4 Push the PILOT WPT LIST line select key to show the PILOT WPT LIST page.

NOTE

The PILOT WPT LIST can require several pages to show the entire list. The NEXT or PREV function key can be used as necessary to show the desired waypoint on the display.

5 Push the line select key for the desired waypoint to copy it to the scratchpad.

6 Push the LEGS or FPLN function key to show the LEGS or FPLN page.

7 Push the NEXT or PREV function key as necessary to show the desired location to insert the waypoint.

8 Push the desired line select key to enter the waypoint data into the flight plan.

9 Make sure that the flight plan changed on the CDU and MFD, then push the EXEC function key to execute the flight plan.

FIX INFO ENTRIES

RATIONALE:

The FIX INFO function lets the pilot enter a fix that can be used as a reference point.

SUMMARY:

Fix entries are made on the FIX INFO pages. Each FIX INFO page (up to two pages) shows a reference waypoint and the fix data based on that waypoint. Each reference fix shows on an individual FIX INFO page. The FIX INFO page can be used to get a direct-to course, Distance (DIST), Estimated Time En Route (ETE), and FUEL to a reference waypoint. There are four types of fixes that can be entered on the FIX INFO page:

- Abeam
- Radial Crossing
- Distance Crossing
- Latitude or Longitude Crossing.

▼ **CHECKLIST:**

1 Push the IDX function key to show the INDEX 1/2 page.

2 Push the FIX INFO line select key to show the FIX INFO page(s).

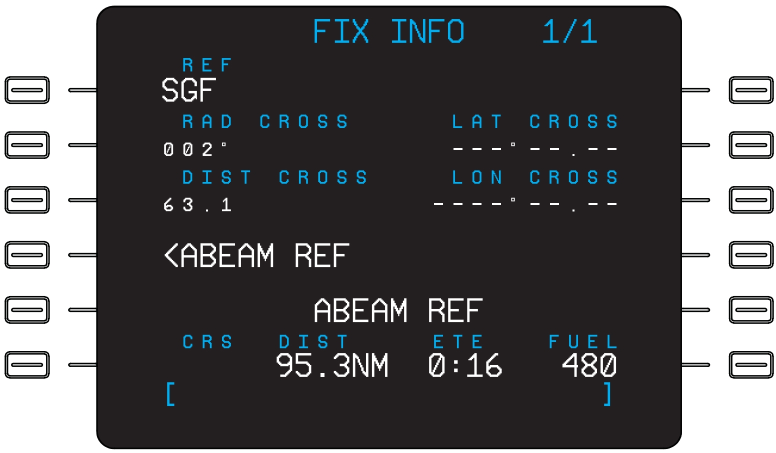
> **NOTE**
>
> The NEXT or PREV function key can be used as necessary to find the next blank FIX INFO page to enter a new fix.

3 Enter the data for the type of fix (abeam, radial crossing, distance crossing, latitude or longitude crossing).

ABEAM FIX

SUMMARY:

An abeam fix is the point on the flight plan where the reference waypoint is perpendicular to the flight plan leg. The abeam fix shows on the MFD as a small green circle around the fix reference. A dashed green line also shows and leads from the green circle to a small white circle on the course line at the fix point.



TPG5117_56

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the FIX INFO line select key to show the FIX INFO page(s).
	NOTE The NEXT or PREV function key can be used as necessary to find the next blank FIX INFO page to enter a new fix.
3	Enter a reference waypoint into the scratchpad.

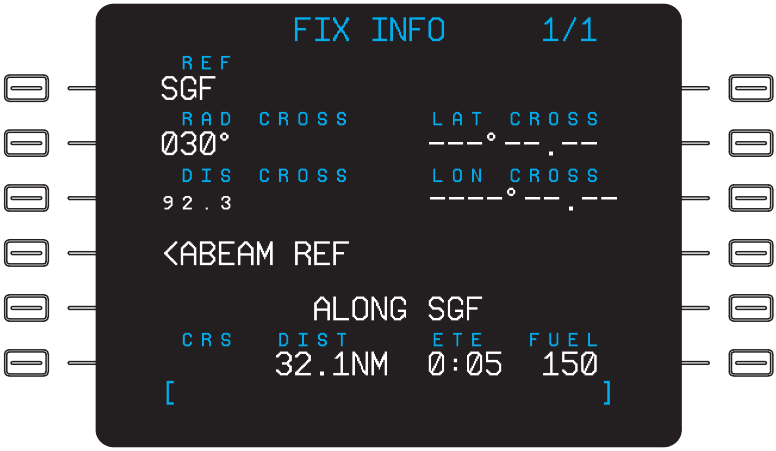
4 Push the REF line select key to transfer the waypoint to the REF data field.

5 Push the ABEAM REF line select key to show the abeam fix.

RADIAL CROSSING FIX

SUMMARY:

A radial crossing fix is the point at which a specific radial from the reference waypoint intersects the flight plan. The radial crossing fix shows on the MFD as a small green circle around the fix reference. A dashed green line also shows and leads from the green circle to a small white circle on the course line at the fix point.



TPG5117_57

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the FIX INFO line select key to show the FIX INFO page(s).

NOTE

The NEXT or PREV function key can be used as necessary to find the next blank FIX INFO page to enter a new fix.

3 Enter a reference waypoint identifier into the scratchpad.

4 Push the REF line select key to move the waypoint from the scratchpad to the REF entry line.

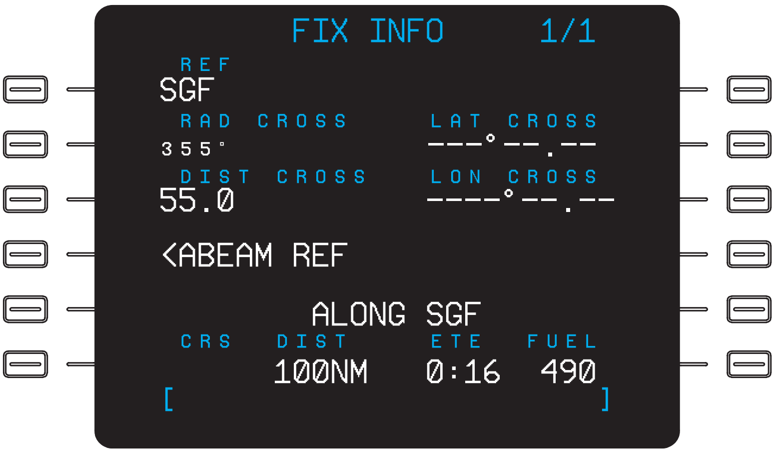
5 Enter the desired radial into the scratchpad.

6 Push the RAD CROSS line select key to move the radial from the scratchpad to the RAD CROSS line.

DISTANCE CROSSING FIX

SUMMARY:

A distance crossing fix is the point at which a specific distance measured from the reference waypoint intersects the flight plan. A distance crossing fix shows as a large green circle (or partial circle) centered over the fix reference. The radius of the circle is equal to the specified distance from the fix reference. A small white circle shows at the point where the large circle intersects the course line.



TPG5117_58

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the FIX INFO line select key to show the FIX INFO page(s).

NOTE

The NEXT or PREV function key can be used as necessary to find the next blank FIX INFO page to enter a new fix.

3	Enter a reference waypoint identifier into the scratchpad.
4	Push the REF line select key to move the waypoint from the scratchpad to the REF entry line.
5	Enter the desired distance into the scratchpad.

NOTE

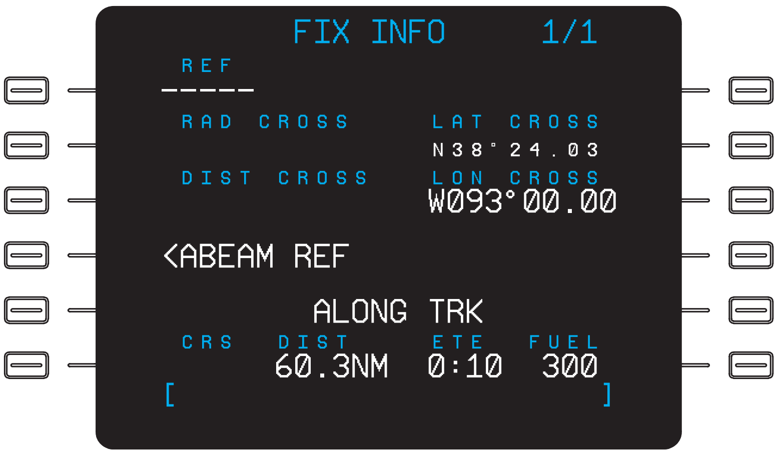
The DIS CROSS field on the FIX INFO page accepts any positive whole number that is less than or equal to 199.9 NM as a valid distance entry. If the DIS CROSS value is greater than 199.9 NM, or the resulting RAD CROSS radial does not intersect the flight plan within 199.9 NM, the message NO INTERSECTION appears.

6	Push the DIST CROSS line select key to move the distance from the scratchpad to the DIST CROSS line.

LATITUDE/LONGITUDE CROSSING FIX

SUMMARY:

A Latitude or Longitude Crossing fix is the point where a specified latitude or longitude intersects the flight plan. A Latitude or Longitude Crossing point fix shows as a white circle at the point on the flight plan where the specified latitude or longitude intersects the flight plan. Latitude or Longitude Crossing point fixes do not use reference waypoints. A reference waypoint cannot be entered. A latitude or longitude can be entered, but not both. The fix coordinates must intersect the flight plan, or the message NO INTERSECTION shows in the scratchpad. When a correct latitude or longitude entry is made, it shows in large font text, and the corresponding latitude or longitude for the intersecting point shows in small font text.



TPG5117_59

▼ **CHECKLIST:**

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the FIX INFO line select key to show the FIX INFO page(s).

NOTE

The NEXT or PREV function key can be used as necessary to find the next blank FIX INFO page to enter a new fix.

3 Enter a latitude or longitude coordinate that the flight plan crosses.

4 Push the LAT CROSS or LON CROSS line select key to transfer the coordinate to the LAT CROSS or LON CROSS line.

NOTE

When the applicable latitude or longitude-crossing coordinate is loaded into the LAT CROSS or LON CROSS line, the FMS automatically loads the corresponding longitude or latitude. Direct entry coordinates appear in large font text. FMS-calculated coordinates appear as small font text.

CHANGE FIX INFO ENTRY TO WAYPOINT

RATIONALE:

A fix on any of the FIX INFO pages can be changed into a waypoint that can be used in the flight plan.

SUMMARY:

Any of the four types of fixes on the FIX INFO pages can be made into a waypoint that can be used in the flight plan.

▼ **CHECKLIST:**

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the FIX INFO line select key to show the FIX INFO page(s).
	NOTE The NEXT or PREV function key can be used as necessary to show the appropriate FIX INFO page that contains the applicable fix information.
3	Push the REF line select key to enter the fix into the scratchpad (shows as a PLACE BRG/DIST fix).
4	Push the LEGS function key to show the ACT LEGS page.
5	Push the applicable line select key to enter the waypoint into the flight plan.
6	Push the EXEC function key to execute the change. The FMS assigns a name to the new waypoint based on either of the two criteria that follow. • If the fix has a reference waypoint (abeam, distance crossing, or radial crossing), the name is based on the reference waypoint.

- If the fix is a LAT CROSS or LONG CROSS, the name assigned is LL##. The numbers (##) are generated by the FMS based on the number of similar-type fixes in the database.

DELETE FIX INFO ENTRIES

RATIONALE:

A FIX INFO entry can be deleted when it is no longer necessary.

SUMMARY:

Deletion of the REF waypoint, RAD CROSS, DIS CROSS, LAT CROSS or LON CROSS on the FIX INFO page will delete the FIX INFO entry.

▼ **CHECKLIST:**

1 Push the IDX function key to show the INDEX 1/2 page.

2 Push the FIX line select key to show the FIX INFO page.

3 Push the CLR DEL function key to enter DELETE into the scratchpad.

NOTE

The NEXT or PREV function key can be used as necessary to show the applicable FIX INFO page from which the fix is to be deleted.

4 Push the line select key to delete the REF waypoint, or RAD CROSS, DIST CROSS, LAT CROSS, or LON CROSS fix.

NOTE

When the REF of a FIX is deleted from the FIX INFO 1/2 page, if there is another fix on the FIX INFO 2/2 page, it moves to the FIX INFO 1/2 page.

▲

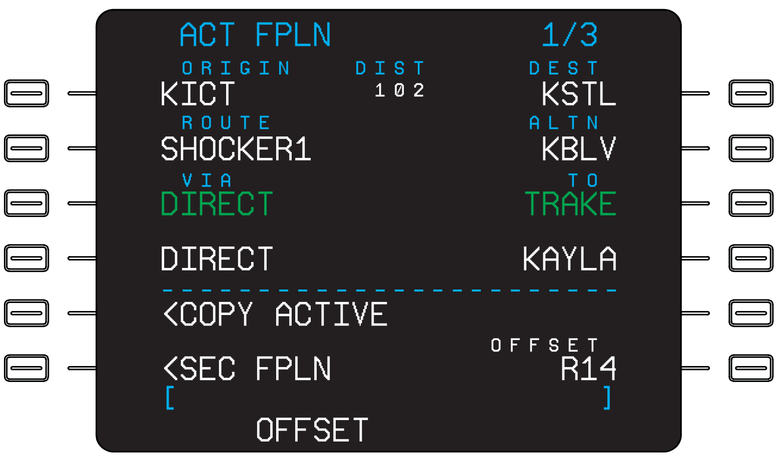
FLY OFFSET PARALLEL COURSE

RATIONALE:

The FMS can be set up to fly a course offset from the planned flight path.

SUMMARY:

Offset parallel courses are entered on the ACT/MOD FPLN page. Parallel offset entries must be in whole numbers from 1 to 99 NM, preceded or followed by L for left of the course, or R for right of the course (for example, L2, 5L, R28, 17R). To change an entered offset parallel course, enter a new course, only numbers, or only letters. Entry of an offset shows the message OFFSET on the message line of the CDU, and the annunciation OFST on the PFD. The MFD shows a dashed magenta line that is parallel to the course line for the active offset track. Enter an offset only when the active leg is a fixed-track leg that terminates at a geographically fixed waypoint.



TPG5117_60

RULES:

Refer to the rules that follow when setting up the FMS for an offset parallel course.

- Offsets end at flight plan discontinuities, DME arc legs, holding patterns, approach legs, and any other leg type that does not end at a geographically fixed waypoint.

- Offsets end at waypoints with course changes greater than 100 degrees.
- OFFSET WILL END shows on the message line approximately two minutes before the aircraft arrives at the termination waypoint. The message OFFSET TERMINATED shows on the message line when the offset ends. Both messages are disabled for offsets that end at the last waypoint in a flight plan.

▼ CHECKLIST:

1	Push the FPLN function key to show the ACT/MOD FPLN page.
2	Enter the necessary offset into the scratchpad.
3	Push the OFFSET line select key to enter the offset into the OFFSET display line.
4	Make sure that the flight plan changed on the CDU and MFD, then push the EXEC function key to execute the flight plan.

▲

CANCEL OFFSET PARALLEL COURSE

RATIONALE:

An offset parallel course can be manually cancelled at any time.

SUMMARY:

To cancel an offset manually, enter either a distance of zero or a DELETE command into the OFFSET data line, or complete a Direct-To edit on the flight plan. When an offset is either manually ended or deleted, no messages show on the message line. When the offset is cancelled, the FMS steers a course direct to the TO waypoint.

▼ **CHECKLIST:**

1 Push the FPLN function key to show the ACT/MOD FPLN page.

2 Do either of the two actions that follow:

- Push the CLR DEL function key to enter a DELETE command into the scratchpad.
- Enter a distance of 0 into the scratchpad.

3 Push the OFFSET line select key to delete the offset.

4 Make sure that the flight plan changed on the CDU and MFD, then push the EXEC function key to execute the flight plan.

▲

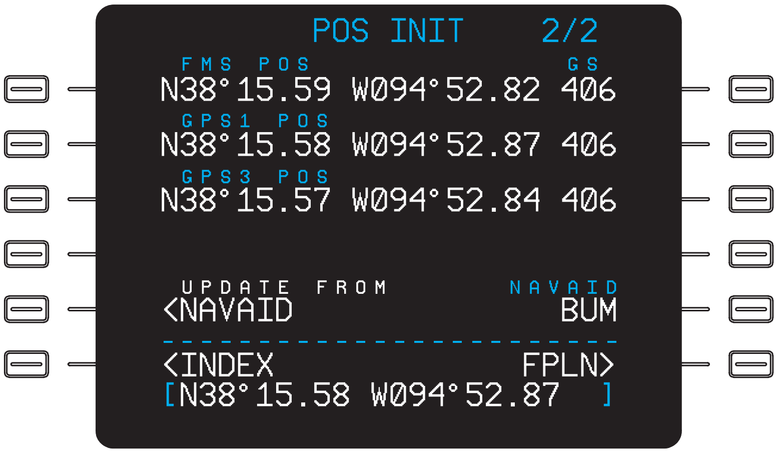
POSITION UPDATE

RATIONALE:

The FMS position can be updated to increase navigation accuracy.

SUMMARY:

The FMS position update function lets the pilot update the FMS to increase navigation accuracy. The FMS position can be updated from a GPS sensor or from a selected navaid en route.



TPG5117_61

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the POS INIT line select key to show the POS INIT 1/2 page.
3	Do the position update with either a GPS sensor or a navaid.

VIA GPS

PRECONDITIONS:

The procedure that follows starts on the POS INIT 1/2 page.

▼ **CHECKLIST:**

1 Push the NEXT function key to show the POS INIT 2/2 page with the position source (GPS sensor) for the update.

2 Push the left side line select key to copy the latitude or longitude data from the desired sensor to the scratchpad.

3 Push the PREV or NEXT function key as necessary to show the POS INIT page with the SET POS prompt.

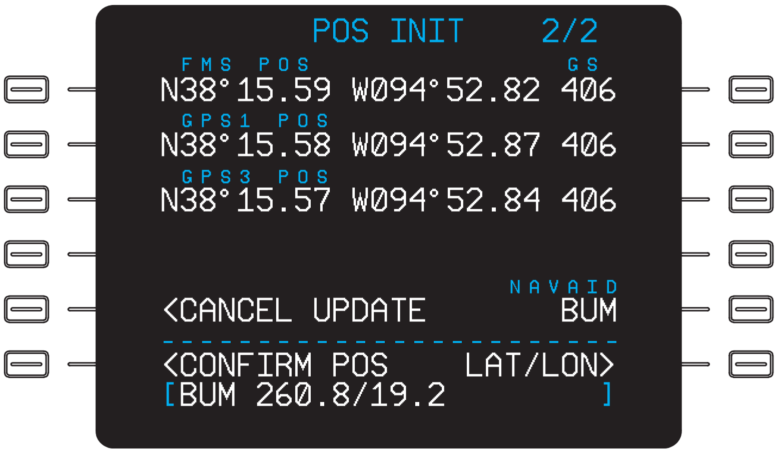
4 Push the SET POS line select key to enter the scratchpad entry into the SET POS line and update the FMS position.

▲

VIA NAVAID

SUMMARY:

The UPDATE FROM NAVAID feature lets the pilot update the FMS position with position data from a navaid. When an update from a navaid is done, the FMS prompts the pilot to confirm the position update. The position shows on the scratchpad entry line as a radial and distance from the selected NAVAID. A LAT/LON line select key lets pilot change the position data to latitude and longitude if desired.



TPG5117_62

PRECONDITIONS:

The procedure that follows starts on the POS INIT 1/2 page.

▼ **CHECKLIST:**

1 Push the NEXT function key to show the POS INIT 2/2 page with the UPDATE FROM NAVAID line select key.

NOTE

A navaid identifier must show in the NAVAID display data field on the lower right side of POS INIT 2/2 page to do a navaid position update.

2 If the NAVAID line shows dashes, or a navaid other than the one desired shows, enter the identifier of an appropriate, receivable navaid into the scratchpad and enter it into the NAVAID line. Continue with the steps that follow.

3 Push the UPDATE FROM NAVAID line select key.

4 Push the CONFIRM POS line select key to update the position.

NOTE

The UPDATE FROM NAVAID function is available only when the aircraft is airborne.

This page intentionally left blank

TABLE OF CONTENTS

This page intentionally left blank

ARRIVAL AND APPROACH

INTRODUCTION

Preparation for arrival and approach to an airport can include selection of an arrival procedure with an associated transition route, and an approach procedure. Not all items have to be selected. Selection options are as follows:

- A Standard Terminal Arrival Route (STAR) and transition
- An approach and transition.

The DEP ARR function key supplies access to the DEP/ARR INDEX page from any display page on the CDU. From the DEP/ARR INDEX page, the applicable ARRIVAL page can be selected.

To show the ARRIVAL page from any other CDU page:

1. Push the DEP ARR function key on the CDU to show the DEP/ARR INDEX page.
2. Push the line select key adjacent to the ARR prompt. The ARRIVAL page for the entered airport identifier shows.

If a departure (ORIGIN), destination (DEST) and alternate (ALTN) airport are entered on the MOD/ACT FPLN page, when the DEP/ARR function key is pushed, the DEPART page for the ORIGIN airport shows.

To show the ARRIVAL page from the MOD/ACT FPLN page:

1. Push the DEP ARR function key on the CDU to show the DEPART page for the origin airport.
2. Push the line select key adjacent to DEP/ARR IDX to show the DEP/ARR INDEX page.
3. Push the line select key adjacent to ARR to show the ARRIVAL page for the selected airport.

NOTE

If the aircraft is on the ground, or airborne but less than 50 NM from the origin airport or less than halfway to the destination airport, the DEPART page for the origin airport shows. If the aircraft is airborne and more than halfway to the destination airport, the ARRIVAL page for the destination airport shows. If no active flight plan exists, or no origin or destination airport was specified, the DEP/ARR INDEX page shows.

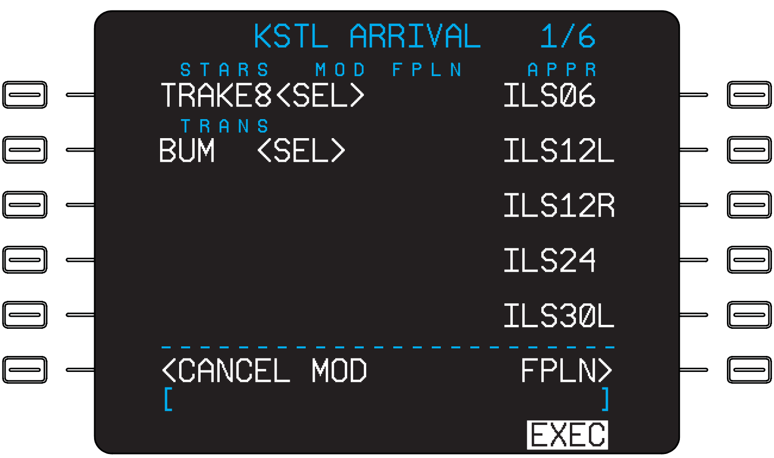
SELECT/CHANGE A STAR

RATIONALE:

Selection of a STAR and any associated transition on the ARRIVAL page loads the published procedure into the flight plan, which decreases the workload on the pilot.

SUMMARY:

When a STAR and an associated transition are selected on the ARRIVAL page, the FMS loads the waypoints and altitudes of the published procedure into the active flight plan. The pilot can look at the change to the flight plan before it is executed.



TPG5117_63

RULES:

The rules that follow are applicable to selection of a STAR and transition.

- When a STAR is selected or changed, if the STAR is not associated with a previously selected approach or runway, the runway or approach selection on the ARRIVAL page is removed.
- If a STAR is reselected, and a leg of that STAR happens to be active, that leg remains in the flight plan as the active leg. The legs of the new STAR, which is preceded by a DISCONTINUITY, follow the active leg.
- Changing the selection of the STAR removes the old STAR from the flight plan. The new STAR is inserted in place of the old STAR, unless a leg of the old STAR is active. In that case, the new STAR is inserted after the active waypoint.
- If a previously selected runway is not associated with the newly selected STAR, the runway is removed from the flight plan.

▼ CHECKLIST:

1 Push the line select key adjacent to the applicable procedure in the STARS list to select it as the active STAR. The selected STAR identifier followed by <SEL> shows, and the transition list for that STAR shows below the TRANS legend.

NOTE

For some airports, the lists shown on the ARRIVAL page are large enough to fill several display pages. The NEXT or PREV key is used as necessary to show the desired STAR or transition route, then the line select key for the desired item is pushed.

2 Push the line select key next to the applicable transition to select it as the active transition. The selected transition is followed by <SEL>.

3 Make sure that the flight plan changed on the CDU and MFD, then push the EXEC function key on the CDU to execute the flight plan.

NOTE

If the destination airport is the last waypoint in the flight plan when an arrival or approach is selected, the destination airport IDENT is replaced with the selected arrival/approach procedure unless the destination airport is the active (TO) waypoint. If the destination airport is the active waypoint when the procedure is selected, the destination airport remains the active waypoint to prevent the current aircraft course from being unexpectedly changed when the MOD FPLN is executed.

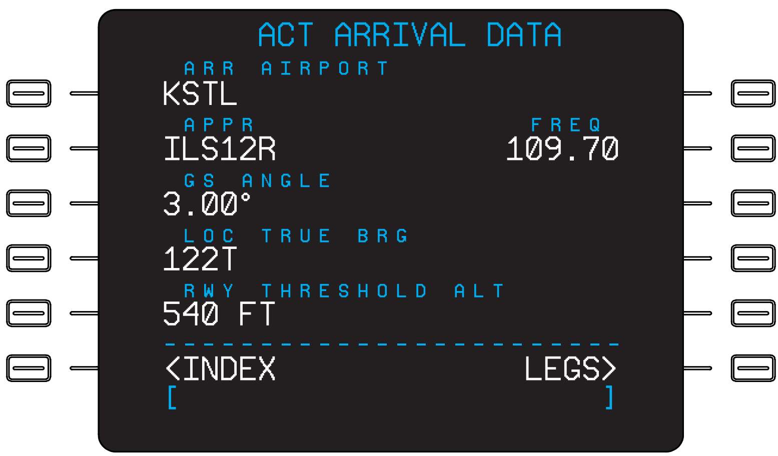
VIEW ARRIVAL DATA

RATIONALE:

The ARRIVAL DATA function lets the pilot look at data on the destination airfield and approach, if specified.

SUMMARY:

Data on the destination airfield and approach, if specified, shows on the ACT ARRIVAL DATA page. The INDEX 2/2 page supplies access to the ACT ARRIVAL DATA page. If no approach is selected, only the airport ICAO identifier shows. If an approach is selected, the approach, runway, and runway threshold altitude show. If an ILS approach is selected, the glideslope angle, localizer true bearing, and localizer frequency show.



TPG5117_64

▼ CHECKLIST:

1	Push the IDX function key on the CDU to show the INDEX 1/2 page.
2	Push the NEXT function key to show INDEX 2/2 page.

3 Push the ARR DATA line select key to show the ACT ARRIVAL DATA page.

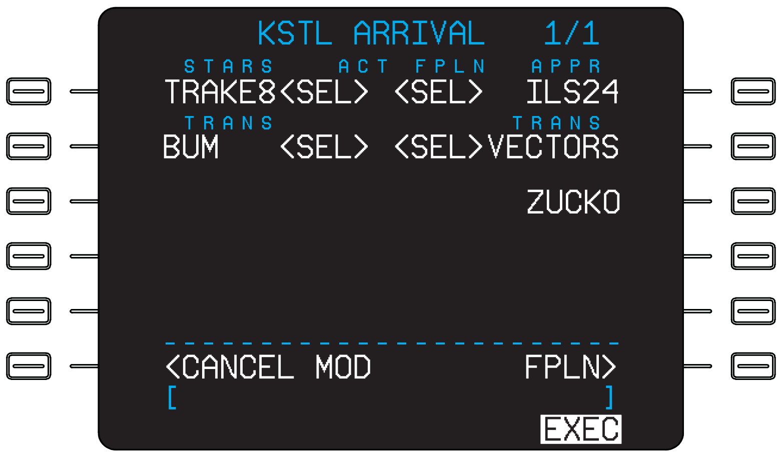
SELECT/CHANGE AN APPROACH

RATIONALE:

Selection of an approach and the associated transition on the ARRIVAL page loads the published procedure into the flight plan, which reduces the workload on the pilot.

SUMMARY:

When an approach and its associated transition are selected on the ARRIVAL page, the FMS loads the waypoints and altitudes of the published procedure into the active flight plan. The pilot must make sure that the change to the flight plan is correct before it is executed. Approaches are selected from the ARRIVAL page. Both visual and instrument approaches can be selected from the ARRIVAL page.



TPG5117_65

PRECONDITIONS:

Either an origin (ORIG) or a destination (DEST) airport must be specified in the flight plan for approach selections to be available on the ARRIVAL page.

▼ **CHECKLIST:**

1	Push the DEP ARR function key on the CDU to show the DEP/ARR INDEX page.

2 Push the line select key adjacent to the approach for the desired airport.

NOTE

When the DEP ARR key is pushed, one of three pages shows: the DEPART, ARRIVAL, or DEP/ARR INDEX page. If the aircraft is on the ground, or airborne but less than 50 NM from the origin airport or less than halfway to the destination airport, the DEPART page for the origin airport shows. If the aircraft is airborne and more than halfway to the destination airport, the ARRIVAL page for the destination airport shows. If no active flight plan exists, or no origin or destination airport was specified, the DEP/ARR INDEX page shows. A different page, if desired, can be selected from the DEP/ARR INDEX page.

3 Push the line select key next to the desired approach under the APPR list. The selected approach shows <SEL> beside the selected runway and TRANS <SEL> VECTORS shows under the selected runway.

NOTE

For some airports, the APPR and VISUAL lists are large enough to fill several display pages. The NEXT or PREV function key can be used as necessary to show the desired approach on the page. The applicable approach can then be selected.

4 Push the line select key for the desired STARS approach. The selected approach shows SEL beside the selected STAR and TRANS shows below the selected STAR.

5 Push the LEGS function key on the CDU to show the ACT/MOD LEGS page.

NOTE

When an approach is added to the flight plan as a result of selections made on the ARRIVAL page, it causes a discontinuity that comes immediately before the approach procedure that is to be added to the flight plan. The pilot must decide whether to keep the discontinuity or remove it.

6 Make sure that the flight plan changed on the CDU and MFD, then push the EXEC function key to execute the flight plan. When the flight plan accepts the change, the SEL changes to ACT.

NOTE

If the destination airport is the last waypoint in the flight plan when an arrival or approach is selected, the destination airport IDENT is replaced with the selected arrival/approach procedure unless the destination airport is the active (T/O) waypoint. If the destination airport is the active waypoint when the procedure is selected, the destination airport will remain the active waypoint to prevent the current aircraft course from being unexpectedly changed when the MOD FPLN is executed.

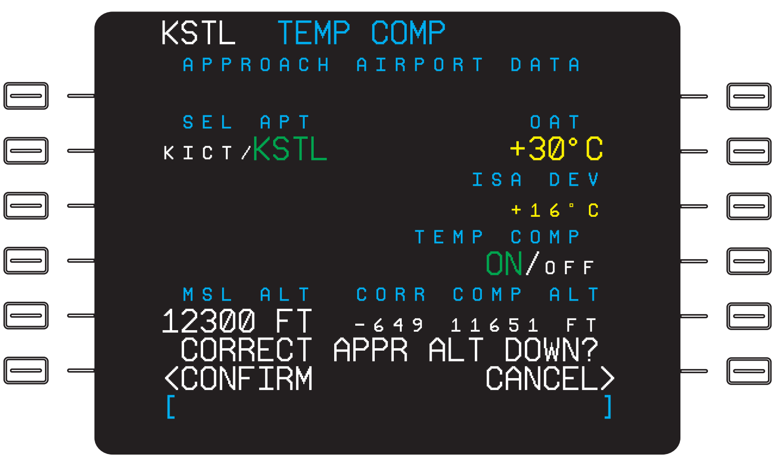
TEMPERATURE COMPENSATION OPERATION

RATIONALE:

The Temperature Compensation (TEMP COMP) feature lets the pilot determine if it is necessary to have the FMS automatically compensate altitudes and path angles for temperature. The FMS will compensate altitude constraints and vertical path angles associated with the approach, the approach transition, and the missed approach when temperatures are above or below normal.

SUMMARY:

The need for temperature compensation comes from the fact that barometric altimeters are calibrated to indicate true altitude only under International Standard Atmosphere (ISA) conditions of temperature and sea level pressure. In cases where the temperature is more than ISA, the true altitude will be higher than the altitude indicated by the altimeter. Conversely, when the temperature is less than ISA, the true altitude will be lower than indicated. The FMS flies VNAV on a non-precision approach using the barometric altimeter for the altitude sensor. Thus, on a day when the temperature is lower than ISA, the true altitude/VPA flown by the aircraft will be below the published altitude/VPA unless the appropriate constraint altitudes and vertical path angles are compensated to account for the below ISA temperature condition.



TPG5347_70

PRECONDITIONS:

Temperature compensation capability is an optional feature that is controlled with a software configuration strap, which is loaded at the factory.

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page.
2	Push the NEXT or PREV function key to show the INDEX 2/2 page.
3	Push the TEMP COMP line select key to show the TEMP COMP page.
4	Make sure that the arrival airport is the highlighted selection in the Select Airport (SEL APT) data field. Push the SEL APT line select key if necessary to make this selection. **NOTE** If both the ORIGIN and destination (DEST) airport are specified in the flight plan, the default selection of the landing airport is the ORIGIN airport while the aircraft is either within 50 NM of the airport or less than halfway along the flight plan route, whichever distance is smaller. When the aircraft present position no longer meets these criteria, the DEST airport is the default selection.

When the temperature compensation feature is ON and the aircraft position is within the terminal area for either the ORIGIN or DEST airport, and an OAT is not entered for the airport, the message CHECK APT OAT shows in yellow on the CDU annunciation line. The CHECK APT OAT message is cleared when the temperature compensation is turned OFF, or when the aircraft leaves the terminal area, or when a valid temperature for the airport is entered.

5 Enter the Outside Air Temperature (OAT) value into the scratchpad.

NOTE

OAT can be entered either in degrees Celsius or Fahrenheit by entering the numerical value preceded by or followed by the letter C or the letter F. The manually-entered value shows in large white font. The appropriate letter (C or F) shows after the OAT value. The default unit of measurement is Celsius. A temperature entry without units is interpreted by the FMS to be in the same units as those currently shown.

6 Push the OAT line select key to transfer the OAT value from the scratchpad.

NOTE

The temperature entry is cleared with a DELETE entry or whenever the flight plan is cleared (for example, the origin airport is changed, the active navigation database is changed, or a new route is loaded). The temperature entry is also cleared after a cold start. When the temperature entry is cleared, it causes the field to be go back to Celsius.

After the initial OAT value is entered, the FMS calculates ISA DEV using the value entered for OAT and the elevation of the associated airport.

When ISA DEV is less than or equal to 0 °C, the OAT value and the ISA DEV show in yellow font. The message CORRECT APPR ALT DOWN? and the prompts CONFIRM and CANCEL also show. Do one of the actions that follow to clear the message.

6.1 Push the CONFIRM line select key to have the FMS accept the OAT value for temperature compensation calculations and show the OAT and ISA DEV.

6.2 Push the CANCEL line select key to cause the OAT and ISA DEV to go back to their previous states.

7 Examine the changes to the flight plan, then push the EXEC function key to accept the MOD FPLN.

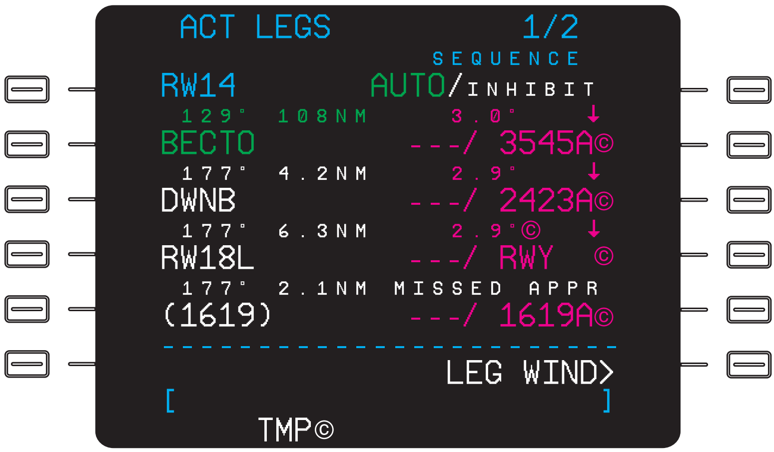
TECH DETAIL

Application of temperature compensation causes changes to the database altitudes and VPA associated with the approach procedure, approach transition, and missed approach procedure in the ACT FPLN. This causes the flight plan to change from an ACT FPLN to a MOD FPLN, and it must be executed before it will become active again.

POST CONDITIONS:

When temperature compensation is turned on and the proper supporting data entered, all vertical path angles and altitude constraints that are retrieved from the navigational database that are associated with the approach procedure, approach transition, and missed approach procedure will be adjusted to compensate for temperature effects on the altimeter. But if the constraint that is retrieved from the database is an altitude that is above the flight level transition altitude, then the altitude constraint will not be temperature compensated. Manually-entered constraints are not automatically temperature compensated.

When the first temperature-compensated leg in the approach becomes active while temperature compensation is active, TMP© shows in white on the CDU annunciation line. The annunciation remains active as long as any approach leg (transition, approach, or missed approach) is active. The annunciation is cleared when an approach leg is no longer active or if the temperature compensation is cancelled. To cancel temperature compensation, either set the feature to off or delete the airport temperature associated with the approach in the flight plan.



TPH6992_13

TEMP COMP CALCULATOR

RATIONALE:

A separate TEMP COMP calculator lets the pilot calculate a temperature-compensated altitude from an uncompensated altitude.

SUMMARY:

The TEMP COMP calculator uses the OAT and airport selected in the SEL APT field to determine the airport OAT and airport elevation that are used in the calculation of temperature compensation. If either the OAT or the SEL APT field is blank, the data fields associated with the TEMP COMP calculator will also be blank.

PRECONDITIONS:

Either the ORIGIN or DEST airport must be selected in the SEL APT field, and an OAT value must be entered.

▼ CHECKLIST:

1 Enter into the scratchpad the mean sea level (MSL) altitude value for which calculation for temperature compensation is wanted.

NOTE

The MSL altitude value can be any numeric entry between –1300 to 65,000 feet.

NOTE

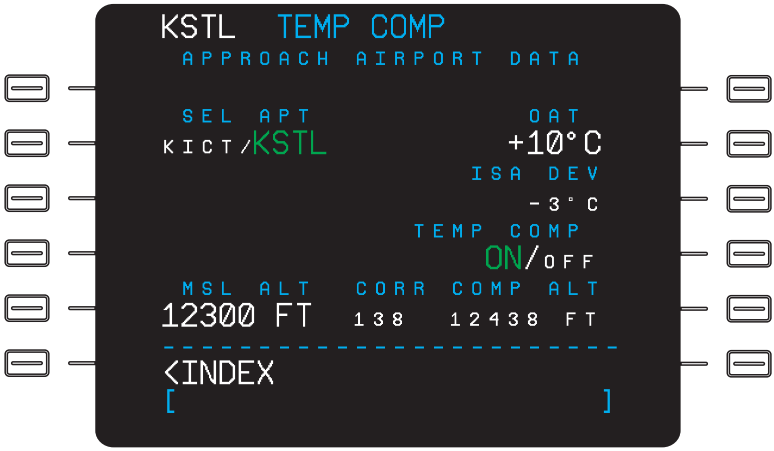
An altitude value can be copied to the scratchpad by a push of the line select key adjacent to the desired value.

2 Push the MSL ALT line select key to enter the altitude entry from the scratchpad.

▲

POST CONDITIONS:

The MSL ALT entry shows in large white font with FT after the altitude value to indicate the units. The Compensated Altitude (COMP ALT) field shows the result of application of TEMP COMP to the MSL ALT entered by the pilot and shows in small white font. Below the Correction (CORR) legend, the FMS shows the difference between compensated value and the original value. This lets the pilot know the amount of compensation or correction that has been applied and shows in small white font.



TPG5347_71

TABLE OF CONTENTS

This page intentionally left blank

MISSED APPROACH

INTRODUCTION

Missed approach procedures are automatically inserted into the flight plan after the missed approach point or runway threshold when an approach is selected. For the FMS to sequence beyond the missed approach point to the missed approach procedure, the approach must be disabled, or the aircraft must fly to the missed approach point (MAP) waypoint with AUTO SEQUENCE selected.

To prevent clutter on the MFD map display, the missed approach legs are generally inhibited from display before the missed approach procedure is active.

The pilot can select a preview display of the missed approach procedure (shown in cyan) on the MFD MAP by selection of the MISSED APPROACH option on the MAP DISPLAY page. The MAP DISPLAY page shows when the MFD MENU function key is pushed while the MFD MAP format is selected.

The missed approach procedure shows on the MFD MAP as part of the normal flight plan route if the flight plan approach is disabled and the missed approach point (MAP) is the active waypoint. The procedure also shows if the FMS has sequenced the flight plan to the missed approach procedure. The missed approach procedure, which includes any procedural holds, shows on the CDU, PFD, and MFD as a normal flight plan. Any legs in the flight plan that follow the missed approach will show in the same format as an alternate flight plan.

An approach can be disabled (which enables the missed approach procedure) in a number of different ways as follows:

1. When the approach procedure is active, push the Go Around button. This lets the FMS sequence the flight plan into the missed approach procedure.
2. Select AUTO sequencing (AUTO SEQUENCE) when at the missed approach point. This changes the sequencing from INHIBIT to AUTO.
3. Push the APPR ENABLED line select key on the ARRIVAL page to select NO.
4. Delete the FAF or MAP waypoint.

5. Edit the flight plan to make a point in the missed approach procedure the active waypoint.

NOTE

The APPR ENABLED line key selection on the ARRIVAL page is available only for non-precision approaches.

MISSED APPROACH — LOCALIZER-BASED

RATIONALE:

Use the FMS to fly the missed approach procedure, which reduces the workload on the pilot.

SUMMARY:

The missed approach procedure shows in the flight plan and on the MFD to assist the pilot while the aircraft flies the missed approach.

RULES:

▼ **CHECKLIST:**

1	Select Go Around (GA).
2	Set power and configuration as needed.
3	Make sure that AUTO sequence is selected (ACT LEGS page).
4	Make sure that the first waypoint of the missed approach is the TO waypoint.
5	Set FMS as NAV SOURCE.
6	Set the applicable lateral and vertical flight director modes (NAV or VNAV).
7	Engage the autopilot (if desired).

▲

MISSED APPROACH — FMS-BASED

RATIONALE:

Use the FMS to fly the missed approach procedure, which reduces the workload on the pilot.

SUMMARY:

The missed approach procedure shows in the flight plan and on the MFD to assist the pilot while the aircraft flies the missed approach.

▼ **CHECKLIST:**

1	Select Go Around (GA).
2	Set power and configuration as needed.
3	Make sure that AUTO sequence is selected (ACT LEGS page).
4	Make sure that the first waypoint of the missed approach is the TO waypoint.
5	Set the applicable lateral and vertical flight director modes (NAV or VNAV).
6	Engage the autopilot (if desired).

▲

TABLE OF CONTENTS

This page intentionally left blank

RADIO OPERATIONS

INTRODUCTION

Control of communication and navigation radio equipment is done through the RADIO TUNING page. The RADIO TUNING page controls and displays the COM, NAV, ADF, and ATC transponder radios. It also has controls for selection of the automatic tuning mode in which the FMS automatically tunes the paired VOR and DME channel 1 frequencies of the NAV receivers. MAN is the default mode, but AUTO is the recommended mode of operation for the NAV receivers.

The radios are tuned in several different ways. The COM, NAV, and ADF radios can be tuned directly with the scratchpad entry method or by selection of a preset frequency. Communication frequencies are differentiated by three digits after the decimal point to accommodate 8.33 kHz tuning. NAV receivers can be tuned through entry of the frequency of the station, either manually or through preset channels, or through entry of the three letter identifier of the station. NAV receivers can also be set to be automatically tuned by the FMS as described above. ADF receivers must be tuned directly with the applicable frequency.

Colors on the RADIO TUNING pages are used as follows:

- The page title line shows in cyan.
- Radio names show in white.
- Active frequencies show in green.
- Active navigation tuning modes AUTO/MAN and the transponder STAND BY annunciation show in cyan.

NOTE

If the aircraft has a dual FMS system installed (two FMCs), Radio Tuning Unit (RTU) capabilities are only available on the left CDU.

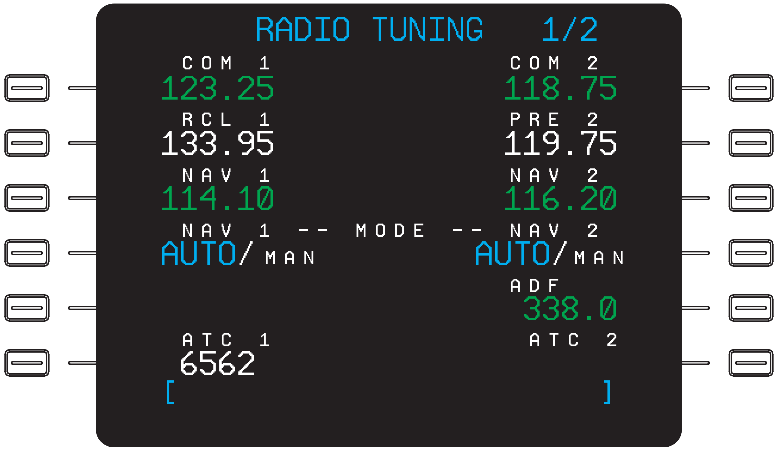
MANUAL TUNING (ALL RADIO TYPES)

RATIONALE:

All radios can be manually tuned as necessary.

SUMMARY:

The FMS supplies manual tuning control of both the same-side and cross-side radios. Data entry is made through the scratchpad and the line select keys. Information is entered on the scratchpad, then transferred to the applicable location with the adjacent line select key. Messages indicate when the information entered is not correct for the data field.



TPG5117_68

RULES:

The FMS supports 8.33 kHz frequency separation in the VHF frequency range of 118.000 to 136.990. Navaid frequencies, ADF frequencies, and transponder codes are not affected by the 8.33 kHz separation. In the 8.33 kHz tuning configuration, the RADIO TUNING page shows six digits for COM channel names (frequencies). The table on page 10-3 shows the naming convention for frequencies. The actual tuning frequency (for example, 118.0083) is not entered in the scratchpad in the 8.33 kHz mode. An attempt to enter an invalid channel name in any of the COM channels causes the message INVALID ENTRY to show in the scratchpad. Entry of trailing zeros and decimal points as part of the channel name is not necessary, but they will show once the channel name has been entered.

FREQUENCY (MHz)	**CHANNEL SPACING (kHz)**	**CHANNEL NAME**
118.0000	25	118.000
118.0000	8.33	118.005
118.0083	8.33	118.010
118.0167	8.33	118.015
118.0250	25	118.025
118.0250	8.33	118.030
118.0333	8.33	118.035
118.0417	8.33	118.040
118.0500	25	118.050
118.0500	8.33	118.055
118.0583	8.33	118.060
118.0667	8.33	118.065
118.0750	25	118.075
118.0750	8.33	118.080
ETC.	ETC.	ETC.

▼ CHECKLIST:

1 Push the TUN function key to show the RADIO TUNING 1/2 page.

2 To tune a radio (COM, NAV, ADF) directly, do one of the steps that follow:

- Enter the frequency into the scratchpad, then push the line select key for the applicable radio.
- **NAV radios only:** Enter the three letter identifier for the NAVAID, then push the line select key for the applicable radio (NAV 1 or NAV 2).

▲

TUNING MODE SELECTION

RATIONALE:

The tuning mode selection lets the operator either tune the navigation radios manually or have the FMS tune them automatically.

SUMMARY:

The FMS can automatically tune navigation receivers to use DME and radial data from different navigation stations to calculate its position. However, some conditions can prevent correct operation of automatic tuning and cause the FMS to go back automatically to the manual tuning mode. The FMS automatically goes back to manual mode when one of these items occurs:

- DME HOLD is selected.
- The NAV receiver is manually tuned from the FMS.
- The NAV receiver is manually tuned from the RTU.
- The selected NAV source is changed to something other than the FMS.
- There is a failure of a NAV receiver.

▼ **CHECKLIST:**

1	Push the TUN function key to show the RADIO TUNING 1/2 page.
2	Push the AUTO/MAN line select key adjacent to the applicable navigation radio (NAV 1 or NAV 2). Each push of the line select key changes the tuning mode.

NOTE

The normal and recommended mode of operation is AUTO when FMS is used as the navigation source.

▲

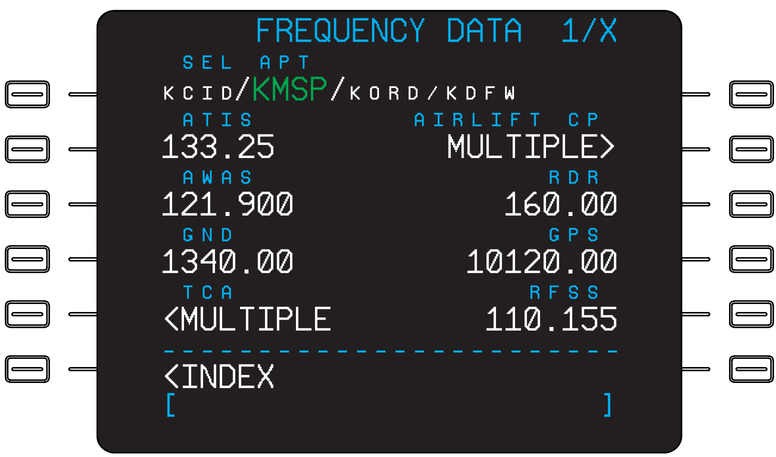
FREQUENCY LOOKUP

RATIONALE:

The FREQUENCY DATA pages show communication frequencies associated with airports, which allows the pilot to quickly find and tune a desired frequency.

SUMMARY:

The FMS supplies the capability to look up communication frequencies associated with airports, select a particular frequency, and tune the radio to that frequency via the FREQUENCY DATA pages. The FREQUENCY DATA page lists the departure, destination, and alternate airports contained in the active flight plan, along with space for a pilot-entered airport. When an airport is selected on the FREQUENCY DATA page, the communication types (for example, ATIS, clearance delivery, and flight service stations) show along with the frequencies available for that frequency type. The pilot can select a frequency and tune the radio to that frequency with the CDU scratchpad.



TPH6992_14

▼ CHECKLIST:

1	Push the IDX function key to show the INDEX 1/2 page with the FREQUENCY selection.

2 Push the FREQUENCY line select key to show the FREQUENCY DATA page.

3 The currently selected airport shows in large green font. To change the airport selection, push the SEL APT line select key until the desired airport identifier is selected.

NOTE

If no pilot-entered airport currently exists, four prompt boxes show in the pilot-entered airport field.

4 To enter an airport that is not in the active flight plan, or to change the pilot-entered airport:

4.1 Enter the four letter ICAO identifier of the airport into the scratchpad.

4.2 Push the SEL APT line select key to transfer the airport identifier to the prompt boxes.

5 To tune the radio to the desired frequency, do the steps that follow.

NOTE

Based on the number of frequencies available for the selected airport, there can be up to nine FREQUENCY DATA pages. The NEXT or PREV function key can be used as necessary to show the page with the desired communication type.

NOTE

Some communication types have multiple frequencies available. The MULTIPLE line select key for that communication type is used to show the list of frequencies. A page with the communication type as the title (for example, TCA) shows with the list of frequencies. Based on the number of frequencies available for that communication type, there can be up to nine additional pages for that communication type. The PREV or NEXT function key can be used as necessary to display any additional pages.

5.1 Push the line select key for the desired frequency to copy the frequency to the scratchpad.

5.2 Push the TUN function key to show the RADIO TUNING 1/2 page.

5.3 Push the line select key for the appropriate radio to enter the frequency from the scratchpad and tune the radio to that frequency.

This page intentionally left blank

TABLE OF CONTENTS

This page intentionally left blank

VNAV OPERATIONS

INTRODUCTION

The FMS supplies multiple Vertical Navigation (VNAV) waypoints for each phase of flight. VNAV helps the pilot to comply with the items that follow:

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

VNAV mode automatically commands the flight director to sequence modes and set target speeds and altitudes. This is to make sure that the flight plan requirements are followed within the constraints of the preselect altitude setting. Because of the integration of VNAV data with the autopilot, pilots have full command of the normal autopilot modes (Pitch, Flight Level Change, Vertical Speed, and Altitude Hold) while the VNAV mode is active. If the aircraft is commanded to violate a VNAV constraint, the VNAV functions give the pilot appropriate warning annunciations.

During the various phases of flight, VNAV follows the flight plan. It captures an altitude to level the aircraft at the flight plan altitude constraints, and begins 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 it makes sure that the altitude constraints are honored.

NOTE

The FMS vertical speed advisory pointer shows on the PFD Vertical Speed Indicator (VSI) to let the flight crew know what climb or descent rate is necessary for the aircraft to reach the next altitude constraint. The vertical speed advisory pointer on the PFD VSI can show even when FMS performance calculations indicate that the climb or descent rate necessary to reach the flight plan altitude constraint exceeds the capability of the aircraft. The vertical speed advisory pointer position on the VSI scale is only a reflection of the FMS calculation of necessary climb/descent rates associated with the flight plan. Display of the vertical speed advisory pointer does not imply that the aircraft can meet the required climb or descent rate.

In a flight plan, each waypoint can show some or all of the VNAV data that follows. With some exceptions, each of these can be changed.

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

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 waypoints descents (↓). SID waypoints are automatically assigned as climbs, and STAR and approach waypoints as descents. Flight plan climb or descent constraints can be changed. Use the entry formats described in the procedure that follows.

An altitude constraint that shows in yellow indicates one of the conditions that follow is true:

- The current rate of climb or descent is not sufficient to meet the specified flight plan altitude constraints.
- Climb altitude constraints do not occur before all descent altitude constraints (except for the missed approach procedure).
- A climb altitude constraint is lower than the climb altitude constraint that comes before it.
- A descent altitude constraint is higher than the descent altitude constraint that comes before it.
- An altitude constraint is higher than the cruise altitude (CRZ ALT) that was defined on the PERF INIT page.

An altitude constraint that shows in yellow is not necessarily an incorrect entry. Examine any altitude constraint that shows in yellow to determine why it shows in yellow.

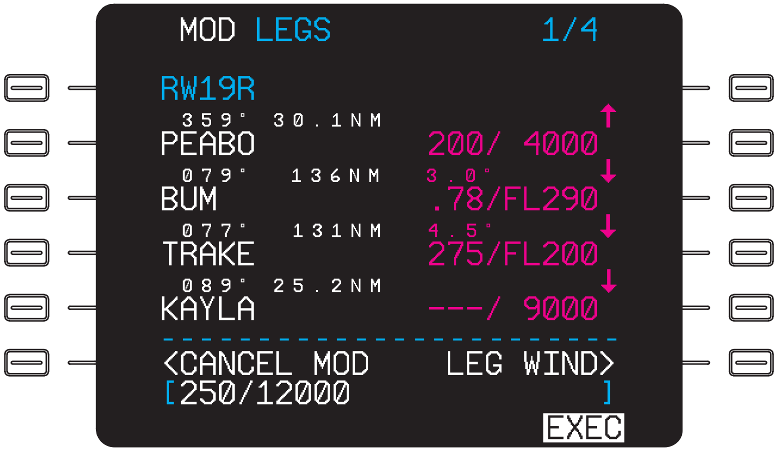
ENTER/CHANGE VNAV DATA

RATIONALE:

When VNAV data is entered or updated for the active plan, it lets the operator take advantage of the VNAV capability.

SUMMARY:

VNAV information shows on the ACT LEGS pages. When any VNAV entry or change is made, the FMS handles the modification by creation of a MOD FPLN similar that done for a lateral flight plan change. For the changes to be included in the ACT FPLN, the EXEC function key on the CDU must be pushed to execute the flight plan.



TPG5117_22

RULES:

Use the guidelines that follow to enter or change VNAV data.

- For speeds, enter a three-digit number (IAS) from 100 to 499, or a two-digit Mach setting from .10 to .99 (with the decimal point prefix).
- For VPA, entry range is from 1.0 to the maximum VPA specified for the aircraft.

- For altitude, entries can be barometric pressure altitudes or flight levels. When a barometric pressure altitude that is less than 500 feet is entered, put a / (slash) before the altitude so that the FMS will not identify the altitude as a speed or VPA.
  - Altitude entry range is from -1300 feet to 65,000 feet, and FL000 to FL650. Flight level entries have a F or FL before the numbers.
  - Altitudes can have the letter A (at or above) or B (at or below) after the numbers.
  - For between altitudes, enter the lower altitude followed by an A, immediately followed by the upper altitude, followed with a B (for example, 6000A8000B).
  - Enter the letter C to change a descent to a climb, or the letter D to change a climb to a descent.
- Speeds and altitude entries can be entered at the same time if they are divided by a / (slash) mark (for example, 250/10000, .78/F290).

▼ CHECKLIST:

1 Push the LEGS function key on the CDU to show the ACT LEGS page.

2 Enter the desired data in the scratchpad.

NOTE

The letters C and D do not show on the altitude constraints once they are moved from the scratchpad to the flight plan. The flight plan indicates an up arrow for climb altitude constraints and a down arrow for descent altitude constraints.

NOTE

When barometric pressure altitudes are entered, if the altitude is less than 500 feet, a / (slash) must be put before the altitude to prevent misidentification by the FMS of the altitude as a speed or VPA.

NOTE

Flight plan altitude constraints that exceed the cruise altitude (CRZ ALT) specified by the crew on the PERF INIT page show in yellow on the ACT/MOD LEGS page.

3 Push the line select key for the appropriate waypoint to transfer the information from the scratchpad.

TIP

When the same information is entered into several waypoints, push the applicable right side line select key (instead of manual data entry) to copy the VNAV information to the scratchpad. The data can then be transferred to another waypoint.

4 Make sure the data is correct, then push the EXEC function key to execute the MOD FPLN.

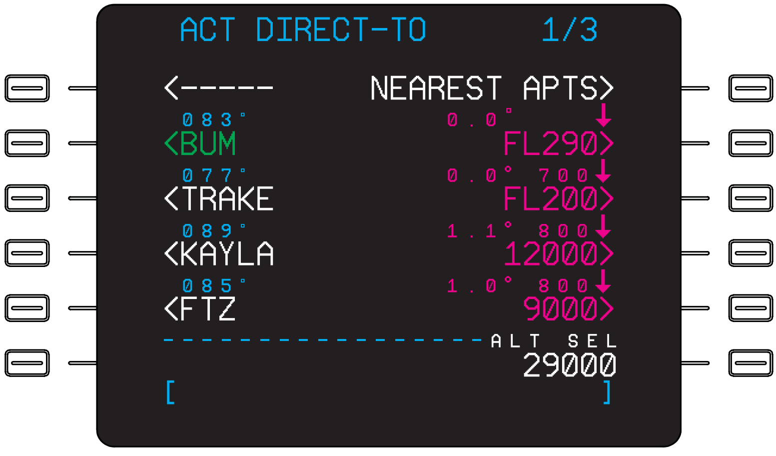
VERTICAL DIRECT-TO

RATIONALE:

The Vertical Direct-To function lets the operator create an FMS descent path to a down-track waypoint.

SUMMARY:

The operator can enter a Direct-To descent to an altitude at a down-track waypoint. In response, the FMS will calculate a Vertical Path Angle (VPA) and provide pitch steering commands to vertically fly Direct-To the selected altitude. The waypoint for the Direct-To altitude does not have to be the active lateral waypoint. It can be any down-track waypoint. When a Vertical Direct-To is created, if there are other altitude constraints between the aircraft present position and the waypoint selected as the Vertical Direct-To, the intermediate constraints are automatically deleted when the Vertical Direct-To is executed.



TPG5117_38

PRECONDITIONS:

Make sure that VNAV is enabled on the Mode Select Panel (MSP) before proceeding with a Vertical Direct-To.

RULES:

- The Direct-To waypoint cannot be a waypoint beyond a discontinuity or a vectors leg.

- A Vertical Direct-To cannot be created when the active waypoint is a holding pattern.
- A Vertical Direct-To is limited to descents only, and cannot exceed the maximum VPA specified for the aircraft.

▼ CHECKLIST:

1 Push the DIR function key to show the ACT DIRECT-TO page.

NOTE

If the desired altitude already shows on the target waypoint, Step 2 can be ignored.

2 Enter the desired altitude in the scratchpad, or push the ALT SEL line select key to enter the preselector altitude in the scratchpad.

3 Push the line select key adjacent to the associated waypoint to enter the altitude value.

NOTE

The waypoint list can be large enough to fill several CDU display pages. The NEXT or PREV function key can be used as necessary to show the desired waypoint on the display.

4 Push the line select key to the left of the desired waypoint to command a vertical Direct-To.

5 Make sure the flight plan changed on the CDU, then push the EXEC function key to execute the flight plan.

▲

This page intentionally left blank

TABLE OF CONTENTS

This page intentionally left blank

CONTROLS AND INDICATORS

INTRODUCTION

Primary control of the Flight Management System (FMS) is through the Control Display Unit (CDU). The CDU acts as the single control point for FMS operations and functions. The electronic flight displays (PFD and MFD) supply additional display capability for FMS information and functions.

The CDU is the pilot's interface with the various functions of the FMS-3000. It has a color display to show the FMS-related information and function modes. The line select keys around the display select modes and copy or enter displayed information. The function keys are used to directly select many of the FMS functions and display modes. The CDU also has a full alphanumeric keypad for data entry.

All operations that include entry of data for FMS operating functions are done through the use of a scratchpad entry system. Data, such as data for a flight plan, performance data, or data for other FMS operations, is entered one of two ways:

- It is entered directly into the scratchpad with the keypad.
- The line select key adjacent to a display line is pushed to copy the applicable data to the scratchpad.

Once data is in the scratchpad, it is moved to the applicable data line by a push of the line select key for the entry position.

FMS operating modes are selected directly with the applicable function key, or by selection of an item from a menu shown on the display. Some functions are alternately switched on and off with sequential pushes of the associated line select key or a function key.

The Primary Flight Display (PFD) shows the information related to FMS operations, which includes the NAV source annunciation, the course/deviation bar, a navigation data readout, Vertical Navigation (VNAV) information, and FMS messages.

The Multifunction Display (MFD) shows both FMS Map and Text displays. Map displays show the various navigation facilities within the selected map range, as well as progress along the flight plan. A text window that shows navigation and VNAV information above the MFD map display can be enabled. Text displays show data about navigation and aircraft performance in text-only formats.

CDU DISPLAYS

TPG5117_73

The top line of the CDU display shows a title/mode, and the current page number and total number of pages as applicable for that display mode. Below the title/mode line, there are up to six data lines and six label lines to show data on a display page. The two bottom lines on the display are used for the scratchpad and message lines. Many of the display pages are configured to show two columns of information. This lets the line select keys on both sides of the display be used to select, copy, or transfer displayed data. Refer to the MENUS AND DISPLAYS chapter of this operator's guide for more information about a specific display page.

▼ CALLOUTS:

Text Lines	The display shows up to 15 lines of 24 characters of text in five colors. Text shows in a large or small font, based on its use. Generally, display page titles, data lines with a mode selection or data entry capability, manual or default override entries, and active mode selections show in the large font. Label lines, FMS-calculated data values, and unselected modes/functions show in the small font.
Title/Mode Line	The top line of the CDU display always shows the display page title or mode, and the current page and total number of pages when applicable.
Data Lines	Data lines align with the line select keys. Data lines show specific information related to the selected display page. On many of the display pages, the line select keys can copy the associated data line information into the scratchpad to use on another data line on the same page, or on another display page.

□ □ □ □ □ □
Prompts

Prompts show on data lines as small square boxes. A prompt indicates input of data is necessary to do the function related to the prompt description on the label line. If no data is entered for a specific prompt, the FMS will not be able to do the related function, or it can have degraded performance. To enter data to replace a prompt, data must be entered into the scratchpad, then transferred to the prompt with the applicable line select key.

– – – – – – –
Dashes

Dashes show on data lines where data can be entered. The dashed data lines are for optional information and do not require input. It can be necessary that specific format be used for the data that is entered on a dashed data line. To enter data into a dashed data line, data must be entered into the scratchpad, then transferred to the data line with the applicable line select key.

Label Lines

Label lines show above each data line. They describe the information in a data line or give more 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 function 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 can also be a label on the line that describes the operation of one or both of the bottom line select keys.

Scratchpad

The bracketed **[ ]** scratchpad display line shows just below the bottom line select keys. Unless specified otherwise, all data entered, changes made to a flight plan, or other FMS-controlled functions, must be done through the scratchpad. When the scratchpad is empty (no text or messages showing between the brackets), enter data into it using the alphanumeric keypad, or copy data directly from the display by pushing the applicable line select key. Once data is in the scratchpad, transfer it to the desired data line on the applicable 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 ANNUNCIATORS chapter of this operator'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 inform or alert the operator of the various functional operations. Each message is described in detail in the MESSAGES AND ANNUNCIATORS chapter of this operator's guide.

Display Colors

Five colors (cyan, yellow, magenta, white, and green) are used to show text on the various CDU display pages.

Cyan is generally used for secondary information. Cyan is specifically used for:

- Display page titles and page numbers
- Label line text (except on the RADIO TUNING page)
- FROM waypoint on the ACT/MOD LEGS page
- Scratchpad brackets.

Green is generally used for active mode selections, and same-side data. Green is specifically used for:

- TO waypoints on the CDU
- Active mode selection (except on the RADIO TUNING page when it is used for frequencies and transponder codes).

White is generally used for:

- Line select key functions
- Scratchpad entries and error messages
- Selected messages on the message line and MESSAGES page
- Data lines except for those with mode selections and the TO waypoint
- Unselected modes
- The word MOD on the modified FPLN and LEGS display page titles
- TO waypoint on the MOD FPLN and MOD LEGS display pages
- ACT LEGS and RADIO TUNING page label lines
- MSG, EXEC, and OFFSET annunciations on the message line.

Yellow is generally used for selected messages on the message line and MESSAGES page, cross-side data, and for an expired active database.

Magenta is used for VNAV data.

CDU CONTROLS

TPG5117_73

▼ CALLOUTS:

Line Select Keys	The line select keys are placed on either side of the display. Push a line select key to copy or transfer its associated display data to or from the scratchpad, or to select an associated operating mode or function shown on a display page.
MSG Message Key	Push the MSG function key on the CDU to show the MESSAGES page. Refer to the figure on page 13-115. Push the MSG key while the MESSAGES page is showing to return to the CDU display mode that was showing before the MESSAGES display mode was selected. Refer to the MESSAGES AND ANNUNCIATIONS chapter for detailed descriptions of the messages that show on the MESSAGES page and message line.
DIR Direct Function Key	Push the DIR function key on the CDU to show the ACT DIRECT-TO pages. The ACT DIRECT-TO pages can consist of several pages and show a list of waypoints in the active flight plan. The pilot can select a DIRECT-TO waypoint from the list, or enter any valid waypoint into the top (dashed) waypoint line as a DIRECT-TO waypoint. The pilot can also enter an altitude for a vertical DIRECT-TO. The ACT DIRECT-TO pages also show a selection for NEAREST AIRPORTS. Refer to the figure on page 13-108.

FPLN
Flight Plan Function Key

Push the FPLN function key on the CDU to show either the ACT FPLN or MOD FPLN page. Each page shows the same information. Refer to the figure on page 13-81.

LEGS
Legs Function Key

Push the LEGS key to show either the ACT LEGS or MOD LEGS page. Each of these pages shows the same information. Refer to the figure on page 13-83.

DEP ARR
Departure/Arrival Function Key

Push the DEP ARR function key on the CDU key to show the DEPART page for the origin airport, the ARRIVAL page for the destination airport, or the DEP/ARR INDEX page. If the DEPART or ARRIVAL page is showing, a second push of the DEP ARR key shows the DEP/ARR INDEX page. Refer to the figure on page 13-101, the figure on page 13-103, and the figure on page 13-105.

PERF
Performance Function Key

Push the PERF function key on the CDU to show the PERF MENU page. The PERF MENU page shows a menu of the available performance functions, allows the pilot to enable the VNAV advisory function, and displays/enables the VNAV PLAN SPD. Refer to the figure on page 13-87.

MFD MENU MFD Menu Function Key	Push the MFD MENU pages on the CDU to show the DISPLAY MENU page. When the MFD MENU function key is pushed, either the MAP DISPLAY page or the TEXT DISPLAY page shows. The MFD DATA function key controls whether the MAP DISPLAY or TEXT DISPLAY menu shows. The DISPLAY MENU page is used to select the display of airports, navigation facilities, and other navigation-related display elements, modes or options for the PPOS MAP, PLAN MAP, and TEXT display modes of the MFDs. Refer to the figure on page 13-116 and the figure on page 13-120.
MFD ADV MFD Advance Function Key	Push the MFD ADV function key on the CDU to show the DISPLAY ADVANCE page. Use this page to move through the MFD text pages, or to move the center waypoint on the MFD PLAN MAP. This page shows either a TEXT DISPLAY menu or a PLAN MAP CENTER menu, depending on whether the MFD is in a Map mode or the Text mode. The MFD DATA function key controls whether the TEXT DISPLAY or the PLAN MAP CENTER menu shows. Refer to the figure on page 13-123 and the figure on page 13-125.

MFD DATA
MFD Data Function Key

Push the MFD DATA function key on the CDU to alternately switch display modes between MAP and TEXT modes for the same-side MFD. When MAP mode is selected, the MFD is in MAP mode. On the CDU, the MAP DISPLAY menu shows when the MFD MENU key is pushed, and the PLAN MAP CENTER page shows when the MFD ADV key is pushed. When TEXT mode is selected, the MFD is in TEXT mode. On the CDU, the TEXT DISPLAY menu shows when the MFD MENU key is pushed, and the TEXT DISPLAY menu shows when the MFD ADV key is pushed.

PREV
Previous Page Function Key

Many CDU display modes, such as ACT LEGS and ACT FPLN, can require several pages to show all their information. Page numbers in the upper right corner show the current page and total number of pages of the display mode. Push the PREV function key to go back to a previous page of a selected display mode. When the first page of display mode is showing, push the PREV function key to go directly to the last page of that display mode.

NEXT
Next Page Function Key

Many CDU display modes, such as ACT LEGS and ACT FPLN, can require several pages to show all their information. Page numbers in the upper right corner show the current page and total number of pages of the display mode. Push the NEXT function key to advance to the next page of the selected display mode. When the last page of a display mode is showing, push the NEXT function key to return to the first page of that display mode.

EXEC
Execute Function Key

Push the EXEC function key to execute a flight plan and change the MOD LEGS to the ACT LEGS or MOD FPLN to the ACT FPLN page. Pushing the EXEC function key allows the FMS to use the flight plan to generate steering commands for the flight control systems if any of the following apply:

- A new flight plan is entered on the FPLN or LEGS pages
- A modification is made to an active flight plan on the ACT FPLN or ACT LEGS pages
- Selected entries or changes are made on the PERF INIT pages.

This method of flight plan activation allows the operator to enter, change, and review a flight plan before it is activated for use as a steering source by the FMS.

IDX
Index Function Key

Push the IDX function key to show the INDEX pages. The INDEX pages shows a menu of additional FMS functions available, that do not have direct access function keys. Refer to the figure on page 13-3 and the figure on page 13-6.

TUN
Radio Tuning Function Key

Push the TUN function key on the CDU to show the RADIO TUNING pages. Refer to the figure on page 13-112.

NOTE

> The equipment installed in the aircraft, the interconnect wiring in the aircraft, and the FMS options installed determine what radio controls are available on the RADIO TUNING pages.

CLR DEL
Clear/Delete Function Key

The CLR DEL key does two functions that depend on whether or not there is data in the scratchpad.

- When there is data in the scratchpad, push and release the CLR DEL key to backspace one character at a time (right to left), or push and hold the key for more than one half second to clear the entire scratchpad at once.
- When there is no data in the scratchpad, push the CLR DEL key to enter the word DELETE into the scratchpad. This can then be transferred to various functions or data fields on the CDU pages to delete the data currently entered/showing for that function or field.

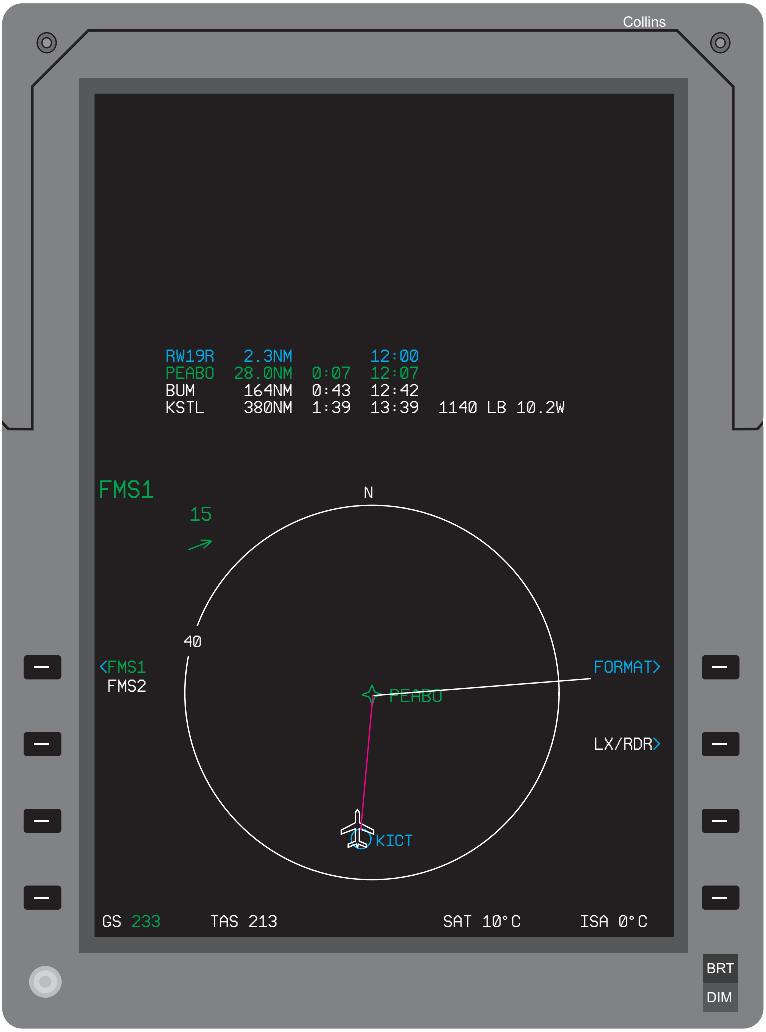
Keypad

The keypad includes the 26 letters of the alphabet, the numbers 0 through 9, a decimal point, a +/– key, a space (SP) key, and a slash (/) key. Push the letter keys to enter letter characters into the scratchpad. Push the number keys to enter numbers into the scratchpad.

BRT DIM
Bright/Dim Button

The BRT DIM button adjusts the brightness of the CDU display. Push the BRT edge of the button to increase brightness. Push the DIM edge of the button to decrease brightness.

MFD



TPG5117_74

The MFD shows both FMS map and text displays. In the map display modes, symbols are used to identify and show the various navigation facilities in relation to the current position of the aircraft or a selected waypoint along the flight plan. The MFD also has a five-line text window that can be enabled to show selected navigation and VNAV information above the MFD map display. Text displays show information related to the flight plan progress, current position of the aircraft, status of navigation sensors (VOR/DME and GPS), fuel management, and other functions. FMS text pages cannot be displayed on the MFD while the PFD is in MAP mode. Controls for the MFD are provided primarily through the Display Control Panel (DCP) and the CDU.

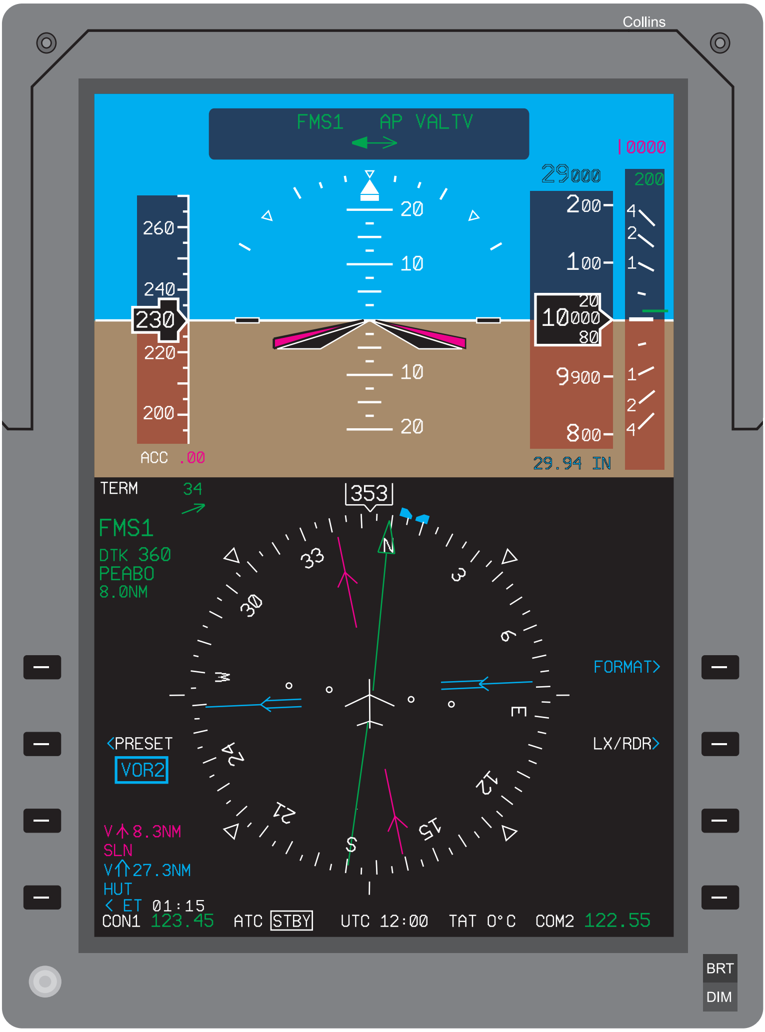
NOTE

Adaptive Flight Display (AFD) panels are used for both PFD and MFD displays. Normally, the center AFD is used for the MFD display. In certain cases, such as failure of the center AFD, by using a display reversion switch, the MFD display information for engines and TCAS can be shown on either PFD, but no FMS information will be displayed.

▼ CALLOUTS:

BRT **DIM** Brightness Control Button	The BRT DIM button adjusts the brightness of the MFD display. Push the BRT edge of the button to increase brightness. Push the DIM edge of the button to decrease brightness.

PFD



TPH6993_01

The PFD shows the information related to FMS operations, which includes the NAV source annunciation, the course/deviation bar, a navigation data readout, Vertical Navigation (VNAV) information, and FMS messages. The Display Control Panel (DCP) and Mode Select

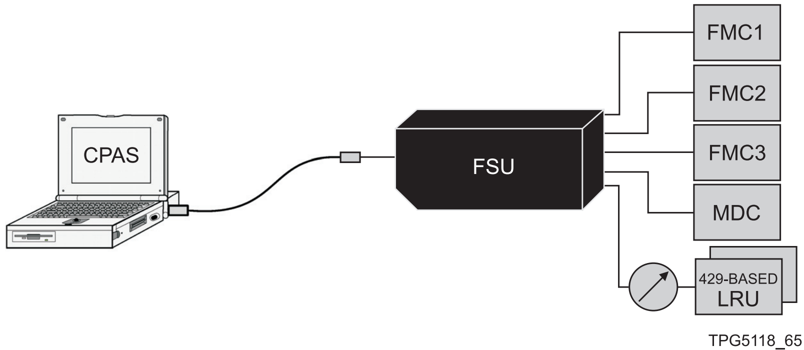
Panel (MSP) supply most of the controls for displaying information on the PFD. Controls for other sensors, such as those for air data and attitude, also control the information shown on the PFD.

▼ **CALLOUTS:**

BRT **DIM** Brightness Control Button	The BRT DIM button adjusts the brightness of the PFD display. Push the BRT edge of the button to increase brightness. Push the DIM edge of the button to decrease brightness.

▲

CPAS



The Collins Portable Access System (CPAS) Data Loader is the data loader for the FMS-3000 and other aircraft systems. The CPAS-3000 Data Loader is a software application that provides external media upload and download capabilities to Ethernet-based Line Replaceable Units (LRU) like the Collins File Server Unit (FSU). The FSU provides the capability to allow uploads and downloads to the FMC. A separate, customer-supplied PC or laptop computer is required to run the CPAS-3000 Data Loader program. Refer to the Collins CPAS-3000 Data Loader Operator's Guide (CPN 523-0790386) for information on how to install and operate the CPAS-3000 Data Loader.

This page intentionally left blank

TABLE OF CONTENTS

Title	Page

This page intentionally left blank

MENUS AND DISPLAYS

INTRODUCTION

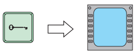
This chapter gives data about the display elements and pages related to FMS-3000 operations. It includes descriptions of the CDU display pages, and the Primary Flight Display (PFD) and the Multifunction Display (MFD) display elements that are related to FMS operations.

CDU DISPLAYS

Figure 13-1   CDU Display Page

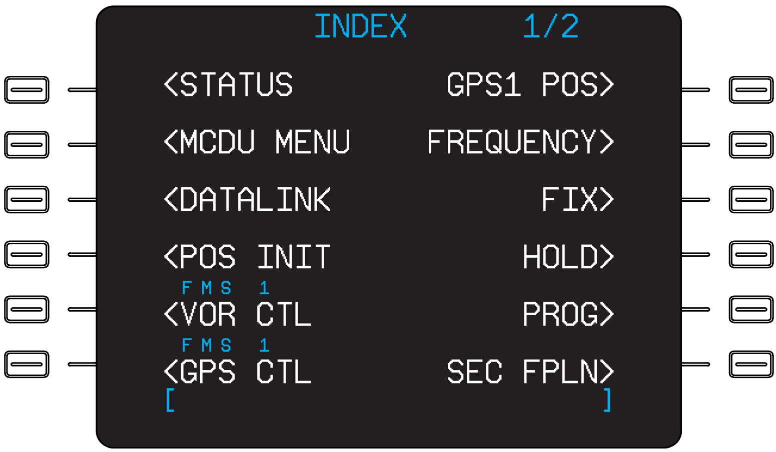
IDX

Path:



IDX
INDEX
1/2 Page

Figure 13-2 INDEX 1/2 Page



TPG5117_06

Push the IDX function key to show the INDEX pages. The INDEX pages show a menu of additional available FMS functions that do not have direct access from function keys. The menu includes identifiers for the associated sensor side and FMS control pages (for example, FMS1 VOR CONTROL, FMS2 GPS CONTROL).

NOTE

The functions available from the INDEX pages and the number of pages can be different based on the equipment installed in the aircraft, the interconnect wiring on the aircraft, and the options installed in the FMS.

▼ SELECTIONS:

MCDU MENU	Selection shows the MCDU MENU page. Refer to the figure on page 13-8.

DATALINK

Selection supplies access to the DATALINK pages. Refer to the Collins Corporate Datalink System CMU-4000/RIU-40X0 Operator's Guide, CPN 523–0790499, for more information about the Datalink function.

NOTE

If the DATALINK function is not selected as an option, the DATALINK selection will not be available.

STATUS

Selection shows the STATUS page. Refer to the figure on page 13-10.

POS INIT

Selection shows the POS INIT 1/2 page. Refer to the figure on page 13-12.

VOR CTL

Selection shows the VOR CONTROL page. Refer to the figure on page 13-16.

GPS CTL

Selection shows the GPS CONTROL page. Refer to the figure on page 13-17.

GPS1 POS

Selection shows the GPS page. Refer to the figure on page 13-19.

FREQUENCY

Selection shows the FREQUENCY DATA page. Refer to the figure on page 13-20.

FIX

Selection shows the FIX INFO page. Refer to the figure on page 13-25.

HOLD

Selection shows the FPLN HOLD page, the HOLD LIST page, or the ACT LEGS page with the HOLD AT prompt. Refer to the figure on page 13-29, the figure on page 13-35, and the figure on page 13-31.

PROG	Selection shows the PROGRESS 1/2 page. Refer to the figure on page 13-36.
SEC FPLN	Selection shows the ACT SEC FPLN page. Refer to the figure on page 13-40.

Path:

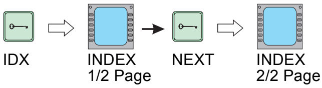
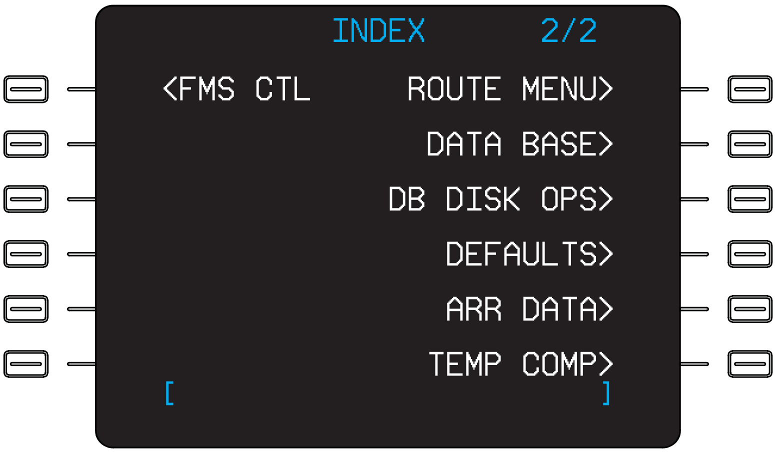


Figure 13-3   INDEX 2/2 Page



TPG5117_76

▼ SELECTIONS:

FMS CTL	Selection shows the FMS CONTROL page. Refer to the figure on page 13-42.
ROUTE MENU	Selection shows the ROUTE MENU page. Refer to the figure on page 13-43.
DATA BASE	Selection shows the DATA BASE page. Refer to the figure on page 13-48.

DB DISK OPS

In the Citation Encore+, the CPAS-3000 is used for database operations instead of a DBU. If the DB DISK OPS line key selection shows on the INDEX 2/2 page, the message KEY NOT ACTIVE shows on the CDU scratchpad line if the line select key is pushed.

DEFAULTS

Selection shows the DEFAULTS 1/3 page. Refer to the figure on page 13-59.

ARR DATA

Selection shows the ARRIVAL DATA page for the destination airport. Refer to the figure on page 13-64.

TEMP COMP

Selection shows the TEMP COMP page. Refer to the figure on page 13-65.

NOTE

Temperature compensation is an optional feature that is controlled with a software configuration strap loaded at the factory. If temperature compensation is not selected, the TEMP COMP selection will not be available.

MCDU MENU

Path:

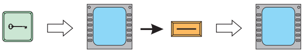
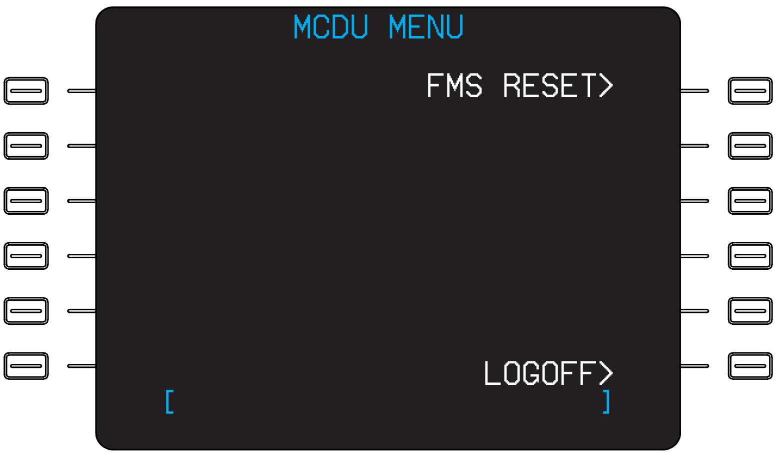


Figure 13-4   MCDU MENU Page



The MCDU MENU page provides access to the FMS reset function. The FMS reset function allows the operator to reset the CDU in the event the FMS has stopped responding or is locked up. If the FMS is locked up, the CDU will show the MCDU MENU page with the FMS RESET> prompt.

▼ SELECTIONS:

FMS RESET	Selection shows the RESET CONTROL page. Refer to the figure on page 13-9.

▲

RESET CONTROL

Path:

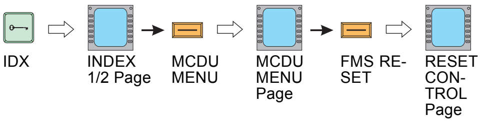


Figure 13-5 RESET CONTROL Page

TPH6992_23

The RESET CONTROL page provides the control to reset the CDU. When FMS RESET is selected on the MCDU MENU page, the RESET CONTROL page shows with a warning of the possible loss of data if the reset function is performed. If the operator still wants to perform the reset function, push the RESET line select key. The CDU sends the reset command to the appropriate (same-side) FMS. Once the FMS has been reset, it can be necessary for the operator to re-enter previously entered data, such as flight plan data and pilot-waypoints.

To exit the RESET CONTROL page without continuing with the reset function, push the CANCEL line select key to return to the MCDU MENU page.

STATUS

Path:

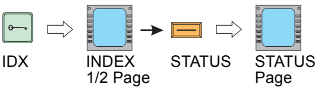
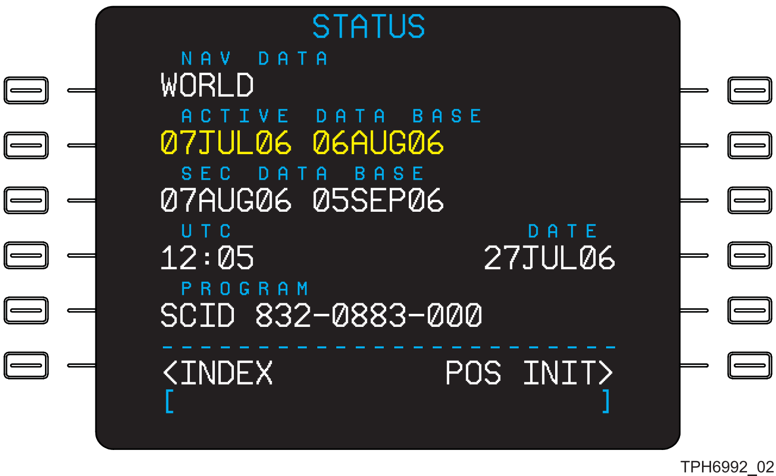


Figure 13-6   STATUS Page



The STATUS page can show on the CDU display at initial power-up, or when selected from the INDEX 1/2 page. When the SYNC mode is selected, STATUS page data is automatically copied to the cross-side FMS. In the INDEP mode, each FMS STATUS page must be modified separately.

NOTE

The FMS STATUS page can show on the CDU display at initial power-up. In SATCOM-equipped aircraft, the SATCOM menu page can show on the CDU display at initial power-up. To access the FMS STATUS page, push the IDX key to show the INDEX 1/2 page, then push the STATUS line select key to show the STATUS page.

The STATUS page shows the items that follow:

- A NAV DATA identifier for the installed navigation databases
- The ACTIVE DATA BASE and SEC DATA BASE effective dates
- UTC time and DATE currently set for the FMS

- A PROGRAM identification code for the operating software installed in the FMS
- Line key selections for returning to the INDEX 1/2 page, or for going on to the POS INIT 1/2 page.

An out-of-date ACTIVE DATA BASE shows in yellow, and a corrupted database (either the ACTIVE or SEC) shows dashed lines in place of the effective dates. If a database is not loaded, the effective dates are blank.

In dual FMS installations set to the SYNC mode, STATUS page data is automatically copied to the cross-side FMS. In the INDEP mode, each FMS STATUS page must be modified separately.

▼ SELECTIONS:

INDEX	Selection shows the INDEX 1/2 page. Refer to the figure on page 13-3.
POS INIT	Selection shows the POS INIT 1/2 page. Refer to the figure on page 13-12.

POS INIT

Path:

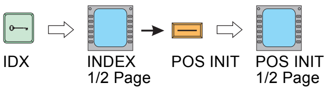
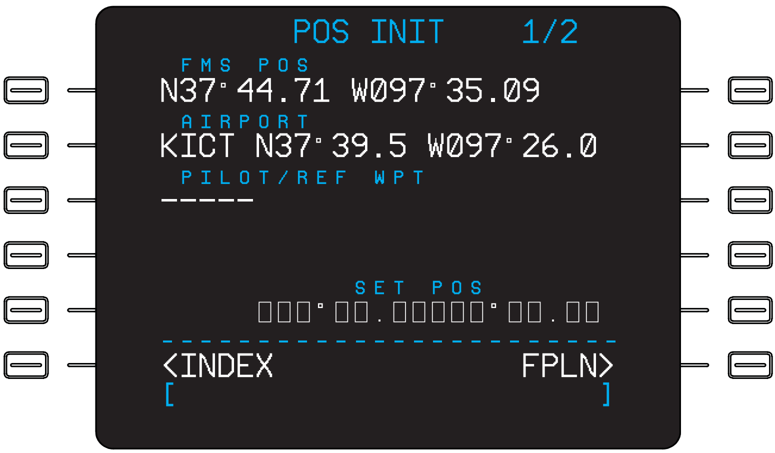


Figure 13-7 POS INIT 1/2 Page



TPG5117_08

The POS INIT line select key on the INDEX 1/2 page supplies access to the POS INIT pages. These pages are used to display and update the position data for the FMS. Based on the equipment installed in the aircraft, there can be several POS INIT pages. The POS INIT 1/2 page always shows:

- The current FMS Position (FMS POS).
- An AIRPORT and its position (when on the ground).
- A PILOT/REF WPT and its position (for entering a specific waypoint to use for a position update or initialization).
- SET POS with a latitude and longitude position, prompt boxes, or dashes. The prompt boxes show when the FMS needs a position update. Otherwise, either a position or dashes shows.

When an appropriate identifier is entered into the AIRPORT or PILOT/REF WPT data line, the associated latitude and longitude position shows adjacent to the identifier. Use any of the latitude and longitude positions shown on the page as a SET POS entry.

When the aircraft is on the ground, the AIRPORT or PILOT/REF WPT data line is normally filled with the destination airport from the last flight (if one was defined for that flight). Regardless of the data that shows, the pilot can enter the ICAO identifier of any airport in the navigation database. When an airport identifier is entered into the AIRPORT data line, the airport reference point latitude/longitude position shows adjacent to the identifier. Use of an AIRPORT entry to set the FMS position is possible only when the aircraft is on the ground. Display of the AIRPORT identifier and its location is cleared at takeoff.

The PILOT/REF WPT line is filled with a waypoint identifier when there is a Pilot Defined Waypoint within 3 NM of the current FMS position. Any Pilot Defined Waypoint, or any waypoint in the navigation database, can be used in the PILOT/REF WPT line. Use the PILOT/REF WPT entry to set the FMS position only when the aircraft is on the ground. The PILOT/REF WPT and its location are removed at takeoff.

The SET POS line shows prompt boxes to indicate that the FMS requires a position initialization or update. Entering a position into the SET POS line from the scratchpad updates the FMS to that position. If the position is more than 40 NM from the last known position, the message RESET INITIAL POS shows on the message line. Push the SET POS line select key two more times to re-enter or reset the position.

The SET POS line shows dashes 2 minutes after an entry is made if the aircraft is airborne, or 2 minutes after the aircraft becomes airborne if the entry is made when the aircraft is on the ground.

Path:

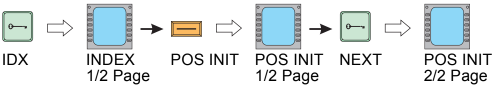
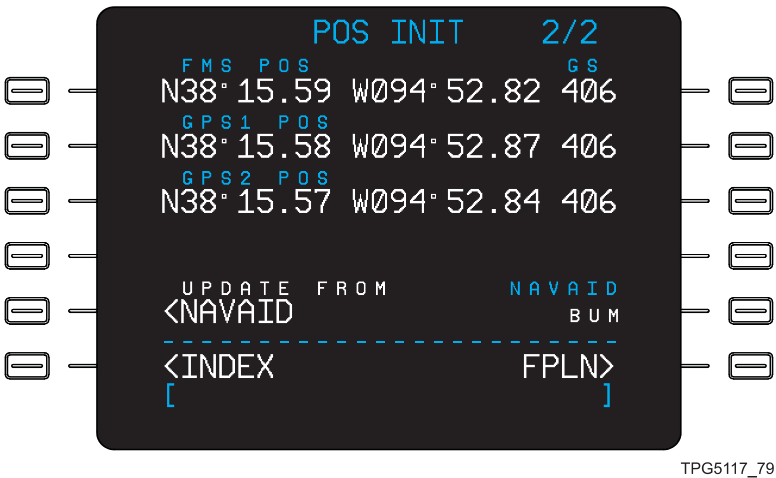


Figure 13-8   POS INIT 2/2 Page



Additional POS INIT pages show position information from other sensors available for use by the FMS, as well as the UPDATE FROM NAVAID function. Use the position information from any of the available sensors to initialize or update the FMS position. The UPDATE FROM NAVAID function is available only when the aircraft is airborne.

The UPDATE FROM NAVAID line is pre-filled with the identifier of a navaid that meets the conditions that follow:

- The navaid is not disabled for use on the VOR CONTROL page.
- The navaid has collocated VOR and DME components (VOR/DME or VORTAC).
- Both same-side VOR and DME frequencies are tuned to the navaid.
- Both same-side VOR and DME data are valid.
- The current position based on the VOR/DME signals is within 30 NM of the FMS position.
- DME distance measures less than 100 NM.
- If a DME identifier is received, it must match the navaid identifier.

If no navaid satisfies the above conditions, the NAVAID field shows dashes.

An identifier can be manually entered to replace the dashes or to select another navaid instead of the one currently showing. A manually entered navaid shows in large font characters and remains on the NAVAID line until another identifier is entered, the NAV radio frequency changes, or the DME identifier differs.

Manual entry of a navaid identifier is accepted by the FMS provided the entry collocates the VOR and DME components. Entering a navaid identifier tunes the same-side VOR radio to the navaid frequency, and sets the tuning mode of that radio to MAN on the RADIO TUNING page. When an identifier is entered, which is not in the database, or is an unacceptable navaid, the appropriate scratchpad message shows on the CDU message line as follows:

- NOT IN DATA BASE
- NOT A COLOCATED NAVAID
- NOT A VOR/DME
- NAVAID INHIBITED.

If the VOR or DME components of a manually selected navaid are not received within five seconds after the selection, the identifier field changes to dashes and the scratchpad shows the message NAVAID NOT RECEIVED.

The navaid position initially shows as a radial and distance from the navaid. Push the LAT/LON line select key to see the position as a latitude/longitude. The position is updated regularly using the signals received from the specified navaid. Push the CONFIRM POS line select key to update the FMS position. If the position update from the navaid causes the message RESET INITIAL POS to show, a second UPDATE FROM NAVAID is required and must be accomplished within 5 NM of the first NAVAID update.

VOR CONTROL

Path:

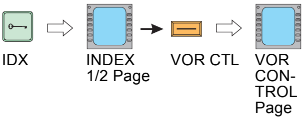
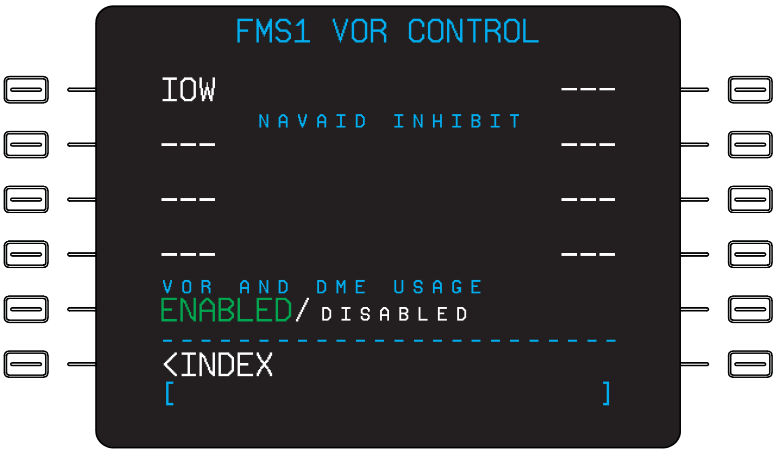


Figure 13-9   VOR CONTROL Page



TPG5117_09

The VOR CONTROL page is used to disable or enable the use of all VOR and DME sensor data by the FMS in the calculations to determine position. It is also used to inhibit up to eight specific navigation aids from use by the FMS.

Push the ENABLED/DISABLED line select key to alternately enable and disable VOR AND DME USAGE. When VOR and DME usage is disabled, the message VOR/DME DISABLED shows on the MESSAGES page.

To disable use of an individual VOR, enter the IDENT into the scratchpad, then transfer it to one of the NAVAID INHIBIT data lines. Up to eight navigation aids can be inhibited from use by the FMS. Individually inhibited navigation aids remain inhibited until they are deleted from the data lines, or until a new navigation database is selected.

GPS CONTROL

Path:

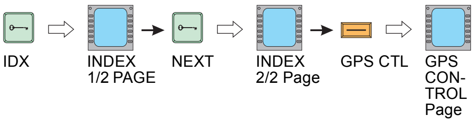
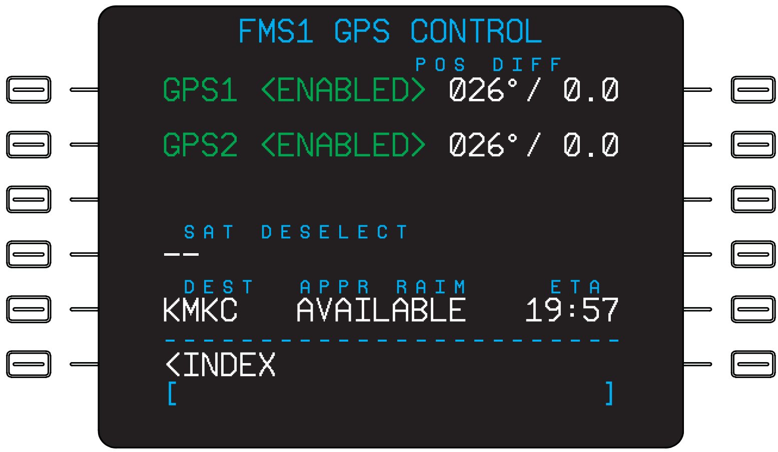


Figure 13-10 GPS CONTROL Page



TPG5117_80

The GPS CONTROL page shows position differences (POS DIFF) between each GPS sensor position and the position calculated by the FMS. Both direction and distance (up to 99.9 NM) show. A position difference greater than 99.9 NM shows as 99.9 NM. Dashes show for the POS DIFF if there is insufficient data to calculate a difference.

The line select key for each installed GPS sensor enables or disables the use of the sensor by the FMS. If a GPS sensor has been DISABLED, it remains disabled until the pilot manually enables it.

SAT DESELECT is used to deselect up to eight satellites that are scheduled to be out of service as identified in NOTAMs. Deselected satellites (SAT DESELECT) are not included in the predicted RAIM computations. Enter the satellite numbers one at a time. Enable all deselected satellites at once with the CLR DEL function key, or enable individual satellites from the list by reentering the satellite number.

The DEST and ETA entries, by default, are those of the active flight plan. Changes can be manually entered to see if RAIM is available for other destinations and/or arrival times. APPR RAIM indicates if approach RAIM will be available at the ETA shown.

GPS POS

Path:

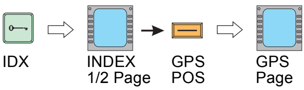
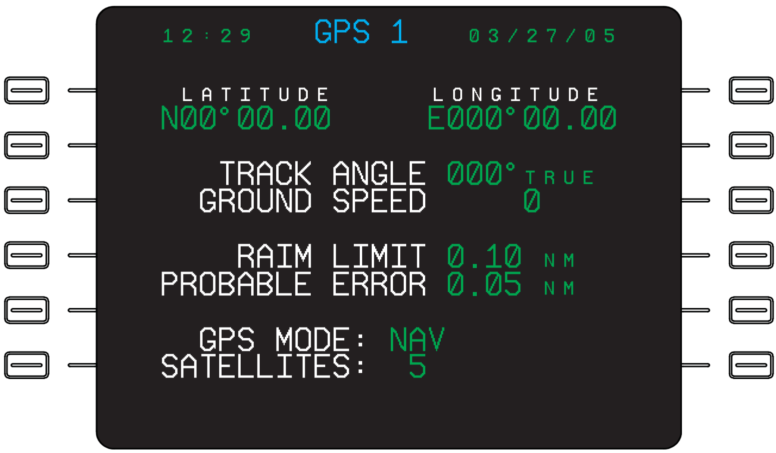


Figure 13-11 GPS Page



TPG5117_81

The GPS page is used to show the current GPS position and related GPS information. The information on the GPS page is for display only and cannot be edited. The GPS page shows:

- The current time and date
- Latitude and longitude coordinates of the GPS position
- Track angle and ground speed
- RAIM LIMIT in nautical miles
- PROBABLE ERROR in nautical miles
- The current GPS MODE
- The number of satellites the GPS is currently tracking.

FREQUENCY

Condition(s):

If there are airport frequencies stored in the navigation database, the FREQUENCY DATA page shows.

Path:

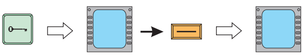
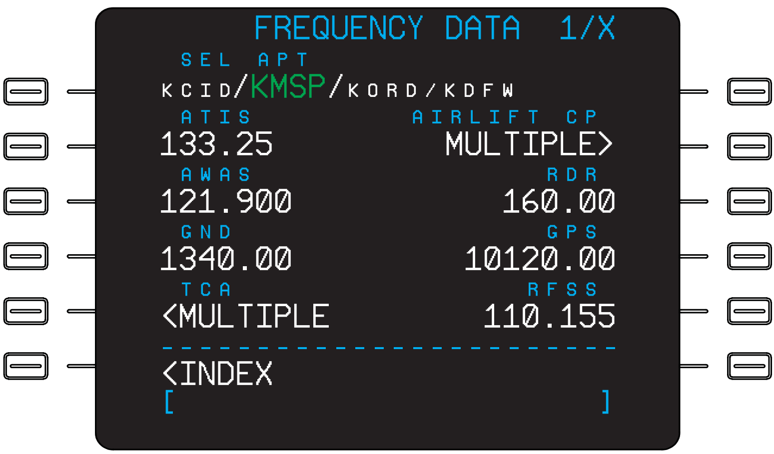


Figure 13-12 FREQUENCY DATA Page



TPH6992_14

The FREQUENCY DATA pages show communication frequencies associated with airports.

The FREQUENCY DATA page lists the origin, destination, and alternate airports along with a space for a pilot-entered airport.

If a pilot-entered airport identifier is associated with more than one airport stored in the navigation database, the SELECT APT page that lists the identifier, ICAO country code, and the latitude and longitude for each airport shows. Refer to the figure on page 13-80.

If there are no frequencies stored in the database, the FREQUENCY DATA page with the message NO DATA AVAILABLE page shows. Refer to the figure on page 13-22.

The FREQUENCY DATA page shows up to eight communication types per page, four on each side of the page. If more than eight frequencies are available for an airport, up to nine pages are available to show the frequencies. Push the PREV and NEXT function keys to show more pages.

▼ SELECTIONS:

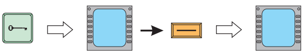
SEL APT	The SEL APT field lists airport identifiers that are in the active flight plan. The order of the list is departure (origin), arrival, alternate, and a pilot-entered airport. If no airport is in the flight plan, four dashes show for the airport. The SEL APT line select key is used to select the airports for which frequency data is desired. Each push of the line select key selects the next airport in the list. Changes made to the origin, destination or alternate airport results in the selection of that airport and a return to the first FREQUENCY DATA page.
Communication Types	For communication types with more than one frequency available for a particular airport, a line select key is labeled with that frequency type and a MULTIPLE selection. Push the MULTIPLE line select key to show the Communication Type page for the selected airport. Refer to the figure on page 13-23.
INDEX	Selection returns the display to the INDEX 1/2 page. Refer to the figure on page 13-3.

▲

Condition(s):

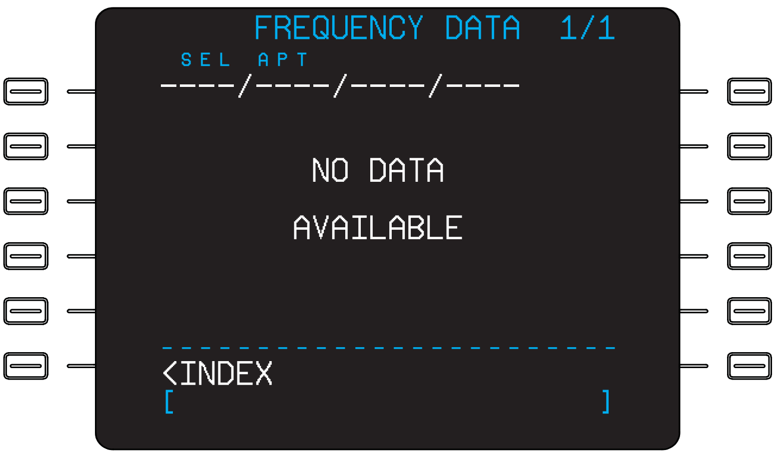
If there are no airport frequencies stored in the navigation database, the FREQUENCY DATA page shows with the message NO DATA AVAILABLE.

Path:



IDX → INDEX 1/2 Page → FRE-QUENCY → FRE-QUENCY DATA Page

Figure 13-13 FREQUENCY DATA Page – No Data Available



TPG5347_13

Selecting the INDEX line select key returns the display to the INDEX 1/2 page. Refer to the figure on page 13-3.

COMMUNICATION TYPE

Path:

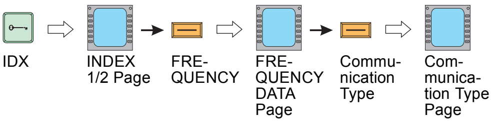
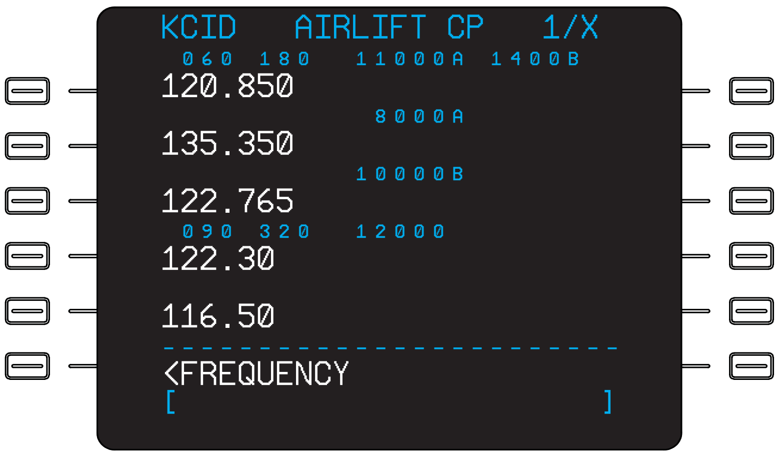


Figure 13-14 Communication Type Page



TPG5347_08

Frequencies listed down the left hand side line select keys are ordered as follows: VHF 8.33, VHF, HF and UHF. The Communication Type page displays up to five frequencies per page for up to nine pages. Push the PREV and NEXT function keys to display any additional pages.

Sector and altitude limitations (as available) are listed above the frequencies. The sector limitation consists of two three-digit fields separated by a blank space. Altitude limitations show in feet. There are four types of altitude limitations:

- At or above altitude limits, which are followed by an A
- At or below altitude limits, which are followed by a B
- Between altitude limits, which show as at or above and at or below altitudes separated by a blank space
- At limits.

If the scratchpad is empty, a push of a line select key next to a frequency copies the frequency to the scratchpad.

▼ SELECTIONS:

FREQUENCY	Selection returns the display to the FREQUENCY DATA page 1/X. Refer to the figure on page 13-20.

▲

FIX

Path:

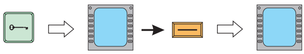
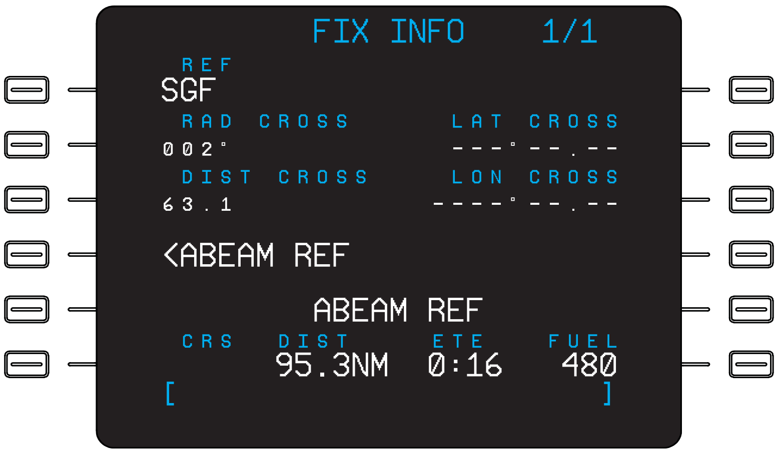


Figure 13-15 FIX INFO Page



TPG5117_56

Each FIX INFO page is used to create pilot-defined waypoints based on a reference waypoint, a latitude crossing, or a longitude crossing. A flight plan can have two fix waypoints. Each reference fix shows on an individual FIX INFO page, with two FIX INFO pages available. There are four types of fixes: abeam, radial, distance, and latitude or longitude crossing point.

NOTE

Fixes can be converted to waypoints for use in a flight plan. Refer to the EN ROUTE chapter of this operator's guide for instructions on how to convert a fix to a waypoint.

An abeam fix is the point on the flight plan where the reference waypoint is perpendicular to a flight plan leg. A radial crossing fix is the point where a specific radial that originates from the reference waypoint intersects the flight plan. A distance crossing fix is the point where a specific distance measured from the reference waypoint intersects the flight plan. A latitude or longitude crossing point fix is the point where the specified latitude or longitude entry intersects the flight plan.

On the MFD, a radial crossing fix or abeam fix shows as a small green circle around the fix reference, with a dashed green line from the circle to a small white circle on the course line at the fix point. A distance crossing fix shows as a large green circle (or partial circle) centered over the fix reference, with a radius equal to the specified distance from the fix reference, and a small white circle at the point where the large circle intersects the course line. The latitude or longitude crossing fix shows as a small white circle at the point on the flight plan where the specified latitude or longitude intersects the flight plan.

▼ SELECTIONS:

REF

Used to enter the identifier of a reference waypoint for a fix. A fix reference can be a waypoint, navaid, or airport. Once a fix reference is entered into the REF prompt from the scratchpad, the FIX INFO page shows the course (CRS), DIST, ETE, and estimated FUEL remaining from the fix reference to the present position of the aircraft under the DATA TITLE.

NOTE

Runway threshold waypoints cannot be used as fix references.

RAD CROSS

Used to enter a specific radial from the reference waypoint that intersects the flight plan. A REF waypoint must be entered for a RAD CROSS fix.

DIS CROSS

Used to enter a specific distance from the reference waypoint that intersects the flight plan. A REF waypoint must be entered for a DIS CROSS fix.

NOTE

The DIS CROSS field on the FIX INFO page accepts any positive whole number that is less than or equal to 199.9 NM as a valid distance entry. If the DIS CROSS value is greater than 199.9 NM, or the resulting RAD CROSS radial does not intersect the flight plan within 199.9 NM, the message NO INTERSECTION appears.

LAT CROSS

Used to enter a specified latitude coordinate that intersects the flight plan. LAT CROSS fixes do not use reference waypoints. If a reference waypoint was entered, LAT CROSS and LON CROSS show dashes. The fix coordinates must intersect the flight plan or the message NO INTERSECTION shows in the scratchpad. When a correct LAT CROSS entry is made, it shows in large font text and the corresponding LON CROSS for the intersecting point shows in small font text.

LON CROSS

Used to enter a specified longitude coordinate that intersects the flight plan. LON CROSS fixes do not use reference waypoints. If a reference waypoint was entered, LAT CROSS and LON CROSS show dashes. The fix coordinates must intersect the flight plan or the message NO INTERSECTION shows in the scratchpad. When a correct LON CROSS entry is made, it shows in large font text and the corresponding LAT CROSS for the intersecting point shows in small font text.

ABEAM REF	Used to select a fix abeam the entered REF waypoint. An abeam fix is the point on the flight plan where the reference waypoint is perpendicular to a flight plan leg.
DATA TITLE	The default data title that shows above the CRS, DIST, ETE, FUEL readout is DIRECT TO. • Once the REF waypoint is entered, the REF identifier is added to DIRECT TO (for example, DIRECT TO ABQ). • If the fix intersects the flight plan, ALONG TRK shows as the data title. • If the fix is an abeam fix, ABEAM shows as the data title with the REF waypoint identifier (for example, ABEAM ABQ).

HOLD

Condition(s):

When the HOLD line select key on the INDEX 1/2 page is pushed and no holds currently exist in the flight plan, the ACT LEGS page with the HOLD AT prompt shows on the CDU.

Path:

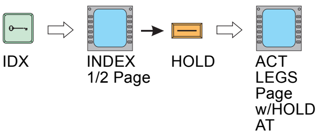
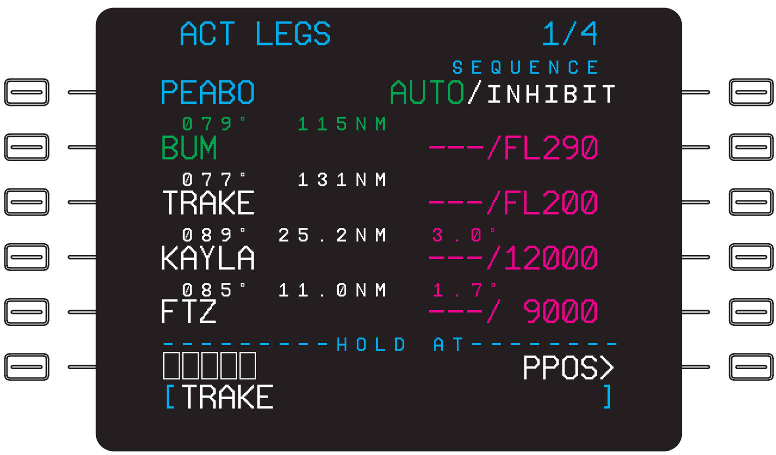


Figure 13-16 ACT LEGS Page With HOLD AT Prompt



TPG5117_42

On the ACT LEGS page, a hold can be entered at a flight plan waypoint, at a waypoint not in the flight plan, or at the present position of the aircraft. A hold is entered by entering the designated hold at point in the scratchpad, then transferring it to the HOLD AT prompt. Refer to the EN ROUTE chapter of this operator’s guide for instructions on entering a hold.

▼ **SELECTIONS:**

HOLD AT □ □ □ □ □	Prompt boxes are used to enter the identifier of the waypoint for the hold. Up to five characters can be entered. When the hold waypoint is entered into the prompts, the page changes to the MOD FPLN HOLD page with the hold point as the FIX.
PPOS	Used to select the present position of the aircraft as the holding point. When PPOS is selected, the page changes to the MOD FPLN HOLD page with PPOS as the holding FIX.

▲

Condition(s):

When the HOLD line select key on the INDEX 1/2 page is pushed and one hold already exists in the flight plan, the ACT FPLN HOLD page shows on the CDU.

Path:

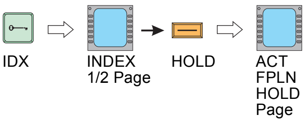


Figure 13-17 ACT FPLN HOLD Page

The ACT FPLN HOLD page shows the holding fix, the type of entry into holding (direct, teardrop, parallel), the holding pattern, and speeds for the existing hold. The pilot can modify the hold or enter a new hold with the NEW HOLD selection. Refer to the EN ROUTE chapter of this operator's guide for instructions on how to modify a hold.

▼ SELECTIONS:

FIX ENTRY	Identifies the holding pattern FIX and the type of ENTRY into the holding pattern (DIRECT, TEARDP, PARALL).

HOLD SPD	Selects the display of FAA or ICAO recommended holding speed (HOLD SPD) values. The default selection is FAA. The selected mode shows in large green text, and the unselected mode shows in small white text.
QUAD/RADIAL	Used to show/enter the quadrant and radial on which the holding pattern is based. The QUAD/RADIAL is used only if cleared to hold in a particular cardinal direction (quadrant) from a specified fix defined off a VOR radial. When QUAD/RADIAL is entered, the FMS automatically computes the inbound course for the hold. Based on the radial, the resulting inbound course can be a reciprocal heading of the radial. The QUAD/RADIAL entry **never** determines the direction of turn of the hold itself. Standard hold pattern turns are to the right. The controlling authority issues non-standard holding instructions (for example, left turns). The following examples show valid QUAD/RADIAL entries: • S/185 • NE/017 • SW/245.
MAX KIAS	Shows the maximum recommended holding speed in knots IAS (KIAS).
INBD CRS/DIR	Shows the inbound course (INBD CRS) and direction of turns (DIR) for the holding pattern. The pilot can modify the inbound course and direction if necessary. The following examples show valid INBD CRS/DIR entries: • 275/R

- 318/L
- 182T/L.

NOTE

A T can be added to the course to create a true north reference.

FIX ETA

Show the Estimated Time Of Arrival (ETA) at the holding fix. The time is based on the distance around the holding pattern. The ETA is computed by the FMS and cannot be manually changed.

LEG TIME

Shows the duration of the pattern leg in minutes. LEG TIME can be manually changed if necessary. If LEG TIME is manually entered, the FMS recomputes the LEG DIST using ground speed and leg time.

EFC TIME

Shows the Expect Further Clearance (EFC). EFC TIME is an optional pilot entry. Entry format for EFC TIME is HHMM or HMM (for example, 1345 or 020). Entering EFC TIME does not create a MOD FPLN, and EFC TIME can be edited at any time during a hold. When the specified EFC TIME arrives, and the aircraft has not exited the hold, the message HOLD EFC EXPIRED shows.

LEG DIST

Show the length of the pattern leg in nautical miles. LEG DIST can be manually changed if necessary. If LEG DIST is manually entered, the FMS recomputes the LEG TIME using ground speed and leg length.

NEW HOLD	Selection shows the ACT LEGS page with the HOLD AT prompt to enter a new holding fix. Refer to the figure on page 13-29.

Condition(s):

When the HOLD line select key on the INDEX 1/2 page is pushed and two or more holds currently exist in the flight plan, the ACT HOLD LIST page shows on the CDU.

Path:

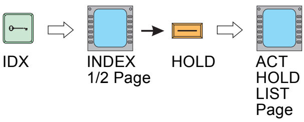


Figure 13-18 ACT HOLD LIST Page

The ACT HOLD LIST page shows all holds currently in the flight plan. Holds that are part of an approach or a missed approach procedure are identified as such on the HOLD LIST page. The NEW HOLD line key selection shows the ACT LEGS page with the HOLD AT prompt to enter a new hold into the flight plan. To show the ACT FPLN HOLD page for an existing hold, push the line select key next to the holding fix.

PROGRESS

Path:

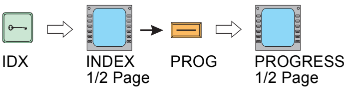
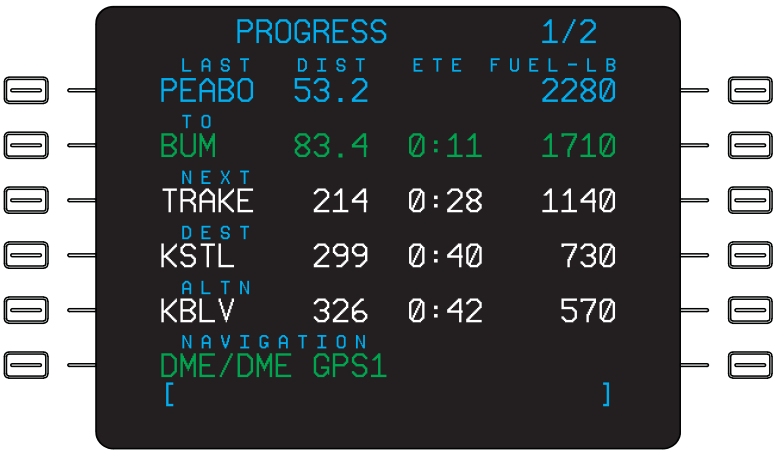


Figure 13-19 PROGRESS 1/2 Page



TPG5117_84

The PROGRESS 1/2 page shows flight plan and performance data. The data is based on the measured fuel flow and ground speed. In the MANUAL performance mode, the data is based on the pilot-entered fuel flow and/or ground speed on the FUEL MGMT page. The page title changes to MANUAL PROGRESS when the MANUAL mode on the FUEL MGMT page is active.

The LAST waypoint is the last waypoint passed in the flight plan. Distance (DIST) shown for the last waypoint is the distance from that waypoint. FUEL-LB is the fuel remaining at that waypoint.

The TO waypoint is the active waypoint. Dashes show for the TO waypoint if there is no active waypoint due to a discontinuity, or after passing the last waypoint at the end of the flight plan. DIST is the distance to the TO waypoint. For a holding fix, the TO waypoint DIST is the distance from the current position of the aircraft around the holding pattern to the fix. ETE is to the TO waypoint. FUEL-LB is the current remaining fuel.

The NEXT waypoint is the waypoint following the TO waypoint in the flight plan, except when the TO waypoint is a holding fix. If the leg following the TO waypoint is a hold, the NEXT waypoint is the waypoint that follows the holding fix. DIST for the NEXT waypoint is the distance from the current position of the aircraft to the NEXT waypoint. ETE is to the NEXT waypoint. FUEL-LB is the projected remaining fuel upon reaching the NEXT waypoint.

The DEST waypoint is the same as the DEST airport on the ACT FPLN page. If no destination airport is entered, dashes show for the DEST waypoint. DIST, ETE, and FUEL-LB are projected for the DEST airport, or runway threshold if an arrival runway has been selected, and are calculated from the current position of the aircraft along the flight plan route.

The ALTN waypoint is the same as the ALTN airport of the ACT FPLN page. If no alternate is entered, then dashes show for the ALTN. DIST, ETE, and FUEL-LB are projected for the ALTN airport and are calculated from the current position of the aircraft to the ALTN airport.

The navigation sensors used by the FMS are annunciated under the NAVIGATION title. The annunciations are based on the equipment installed in the aircraft. The following list shows the available annunciations.

- DME/DME – (indicates two or more DMEs in use)
- VOR/DME1 – (indicates that DME/DME is not in use and that the VOR and DME pair tuned on the NAV1 radio are in use)
- VOR/DME2 – (indicates that DME/DME is in use and that the VOR and DME pair turned on the NAV2 radio are in use)
- GPS1
- GPS2.

NOTE

When both VOR and DME sensor pairs are used to determine position, the pair tuned to the closest navaid is annunciated.

Path:

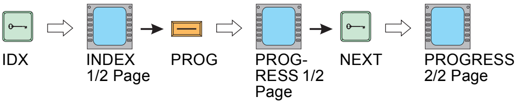
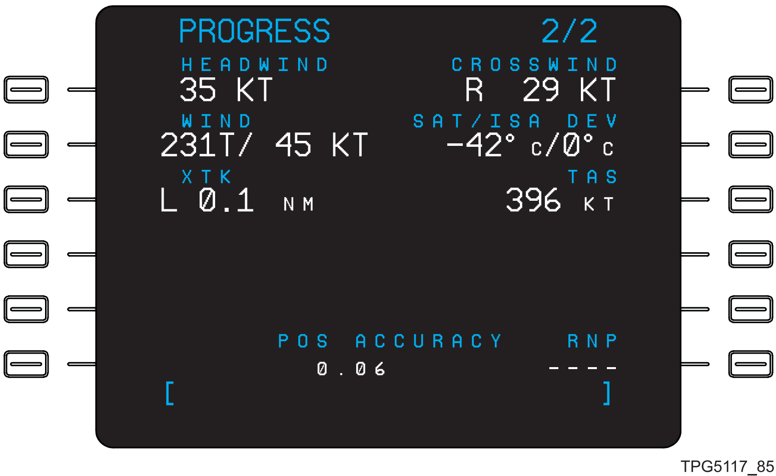


Figure 13-20 PROGRESS 2/2 Page



The PROGRESS 2/2 page shows the wind and temperature effects on the aircraft. The data is based on the measured fuel flow and ground speed. In the MANUAL performance mode, the data is based on the pilot-entered fuel flow and/or ground speed on the FUEL MGMT page. The page title changes to MANUAL PROGRESS when the MANUAL mode on the FUEL MGMT page is active. PROGRESS 2/2 page shows:

- HEADWIND or TAILWIND and CROSSWIND components
- WIND direction and speed
- Static air temperature (SAT) and ISA temperature deviation (DEV)
- Cross track (XTK) direction and distance in nautical miles
- True airspeed (TAS)
- Expected POS ACCURACY in nautical miles
- Required Navigation Performance (RNP) in nautical miles. Refer to the Required Navigation Performance section of the PRINCIPLES OF NAVIGATION chapter for an explanation of RNP and POS ACCURACY.

NOTE

The RNP value is an optional pilot entry. Dashes show for the following: no value has been entered, an on-ground cold start, or entering a new origin airport has cleared the flight plan.

NOTE

Wind direction is always referenced to true north on the PROGRESS page.

SEC FPLN

Path:

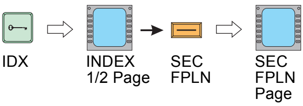


Figure 13-21 SEC FPLN Page

TPG5117_26

The SEC FPLN pages show the same type of information as the ACT FPLN pages. The SEC FPLN page with the last waypoint or route entry also shows a line key selection for SEC TRANSFER FROM XSIDE (only shown when FMSs are in independent mode), which is used to transfer the secondary flight plan from the cross-side FMS. Like the active/modified flight plan, the secondary flight plan is complete when it includes both the lateral and vertical segments, plus the expected flight conditions required for time and fuel calculations. Unlike the ACT/MOD FPLN, the SEC FPLN does not use sensor data to estimate time, fuel, and weight calculations (estimates are based on the performance database of the aircraft). Manual changes affect the secondary flight plan performance calculations.

▼ SELECTIONS:

ROUTE MENU	Selection shows the ROUTE MENU page. Refer to the figure on page 13-43.

ACTIVATE	Activates the SEC FPLN for use as the ACT FPLN. Refer to the FLIGHT PLANNING chapter for information on activating a SEC FPLN.
SEC LEGS	Selection shows the SEC LEGS pages. SEC LEGS pages show the same type of information as the ACT LEGS pages.

FMS CONTROL

Path:

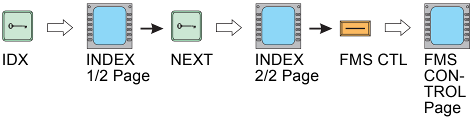
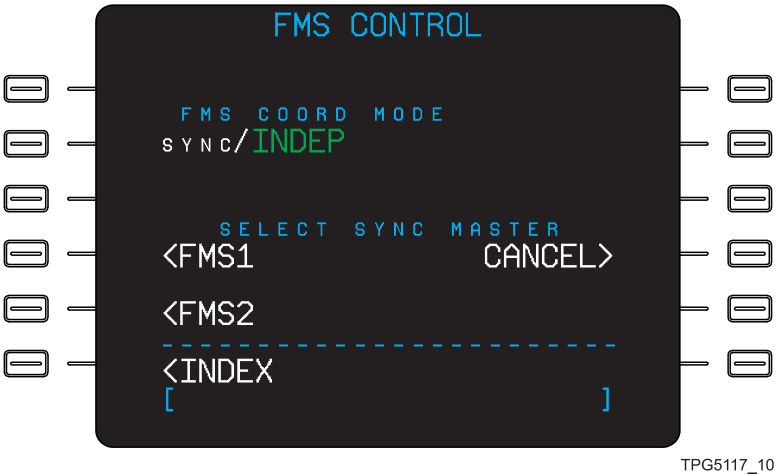


Figure 13-22 FMS CONTROL Page



The FMS CONTROL page is used to select synchronized (SYNC) or independent (INDEP) mode for the FMS COORD MODE.

When changing from INDEP to SYNC, the prompt SELECT SYNC MASTER requires the selection of a sync master. Choose whichever FMS is desired to retain its existing flight plans. When an FMS is selected as master, its flight plans are transferred to the other FMS during the change to the SYNC mode. Any flight plans in the other FMS are lost.

When changing from SYNC to INDEP, a CONFIRM prompt requires confirmation of the change. Push the CONFIRM line select key to confirm the change, or push the CANCEL line select key to cancel the operation.

ROUTE MENU

Path:

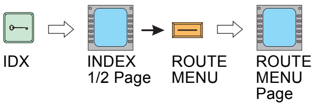
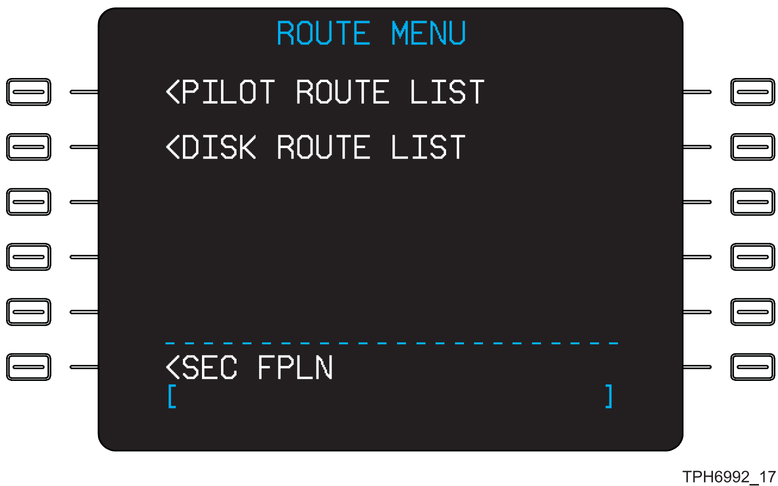


Figure 13-23 ROUTE MENU Page



The ROUTE MENU page shows an index of the route lists available from which to select preplanned flight plan routes. The available route lists include the PILOT ROUTE LIST and the DISK ROUTE LIST. In addition to the routes already loaded into the FMS in the PILOT ROUTE LIST, the DISK ROUTE LIST feature provides the ability to load a flight plan from a disk.

▼ SELECTIONS:

PILOT ROUTE LIST	Selection shows the PILOT ROUTE LIST page. Refer to the figure on page 13-45.
DISK ROUTE LIST	Selection shows the DISK ROUTE LIST page. Refer to the figure on page 13-47.

SEC FPLN

Selection shows the SEC FPLN page.
Refer to the figure on page 13-40.

PILOT ROUTE LIST

Path:

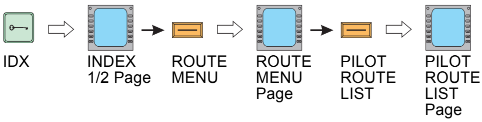


Figure 13-24 PILOT ROUTE LIST Page

TPG5117_28

The PILOT ROUTE LIST page shows a list of the routes stored in the FMS. Select a route from the list by a push of the line select key adjacent to the desired route.

▼ SELECTIONS:

RTE TRANSFER FROM XSIDE	Initiates a transfer of pilot routes contained in the cross-side FMS to the same-side (requesting) FMS.
SEC FPLN	Selection shows the SEC FPLN page.
ROUTE MENU	Selection shows the ROUTE MENU.
ACT STORE	Selection saves the current ACT FPLN and adds it to the PILOT ROUTE LIST.

SEC STORE	Selection saves the SEC FPLN and adds it to the PILOT ROUTE LIST.

DISK ROUTE LIST

Path:

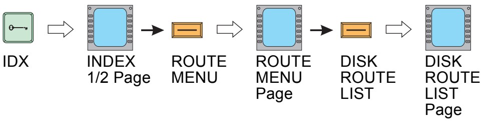
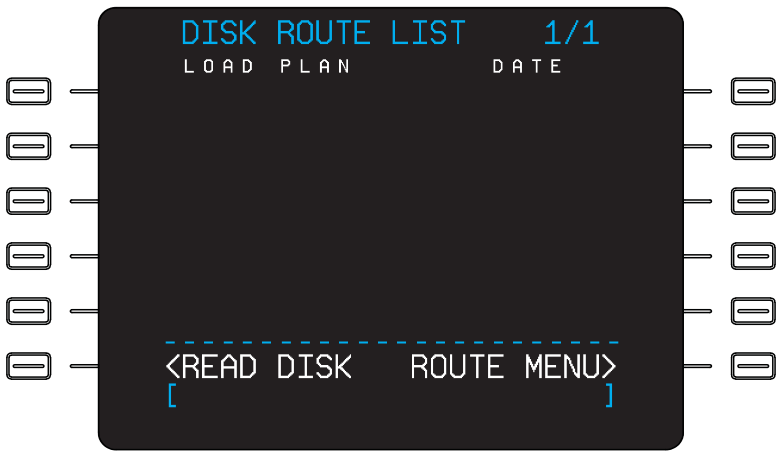


Figure 13-25 DISK ROUTE LIST Page



TPG5117_88

The DISK ROUTE LIST page is used to load a route from a computer disk. Pushing the READ DISK line select key causes the data loader to read an inserted disk that contains the desired routes. The CDU then shows a list of flight plan routes on the disk. Pushing the line select key adjacent to the desired route loads that route into the SEC FPLN, which can then be activated and executed.

DATA BASE

Condition(s):

If the IDENT field is empty when the DATA BASE line select key is pushed, the DATA BASE page shows with the IDENT prompts.

Path:

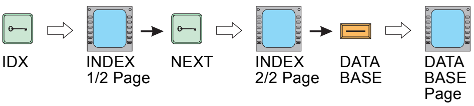
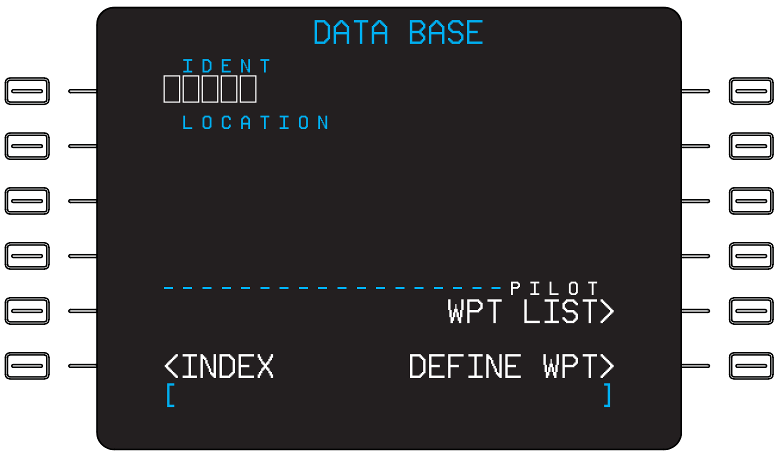


Figure 13-26 DATA BASE Page with IDENT Prompts



TPG5117_89

The DATA BASE page is used to show information about a specific airport, navaid, intersection, or PILOT WPT LIST waypoint. To show the desired information, enter the identifier into the IDENT prompts.

If a waypoint identifier that is associated with more than one waypoint stored in the navigation database is entered, a SELECT WPT page is presented that shows the waypoint type, latitudes, longitudes, and ICAO country codes, which assists in the selection of the desired waypoint. Duplicate waypoint types and their associated pages are listed as follows. Refer to the SELECT WPT section of this chapter for information about each page type.

- Duplicate Airport/Navaid — Refer to the figure on page 13-72.
- Duplicate Airport Runway — Refer to the figure on page 13-74.

- Duplicate Airport Terminal/En Route Intersection — Refer to the figure on page 13-75.
- Duplicate Pilot Defined/En Route Intersection — Refer to the figure on page 13-76.
- Duplicate VOR/DME Navaids — Refer to the figure on page 13-77.
- Duplicate ILS Station — Refer to the figure on page 13-79.

If an airport identifier that is associated with more than one airport stored in the navigation database is entered, the SELECT APT page shows. Refer to the figure on page 13-80.

▼ SELECTIONS:

IDENT □ □ □ □ □	The IDENT prompts are used to enter the identifier of an airport, navaid, waypoint in the FMS database, or waypoint in the PILOT WPT LIST.
PILOT WPT LIST	Selection shows the PILOT WPT LIST page. Refer to the figure on page 13-45.
INDEX	Selection shows the INDEX 1/2 page.
DEFINE WPT	Selection shows the DEFINE PILOT WPT page. Refer to the figure on page 13-55.

▲

Condition(s):

When an airport identifier is entered into the IDENT prompts, the DATA BASE page shows with the airport information.

Path:

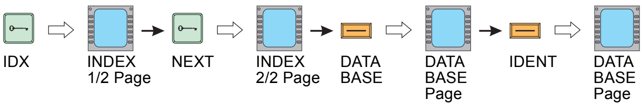
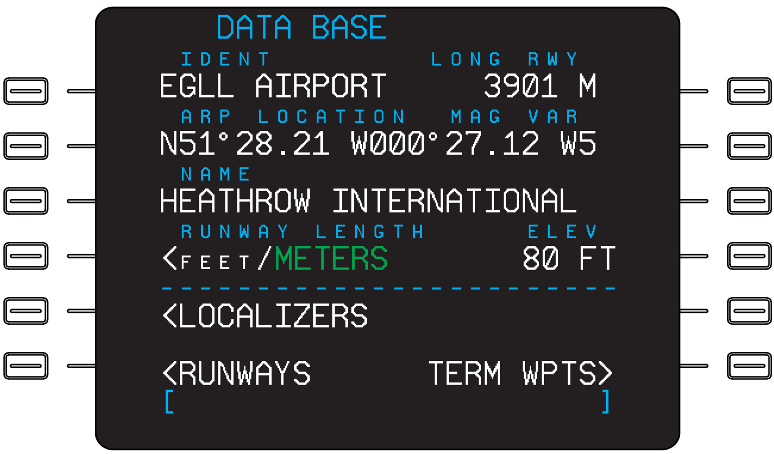


Figure 13-27 DATA BASE Page with Airport Information



TPH6992_18

For airports, the DATA BASE page shows:

- Airport identification code (IDENT)
- Longest operational hard surface runway (LONG RWY)
- RUNWAY LENGTH in FEET or METERS
- Latitude and longitude position of the geographical center of the airport (ARP)
- Magnetic variation (MAG VAR)
- NAME of the airport
- Airport elevation (ELEV) in feet
- LOCALIZERS select function
- RUNWAYS select function
- TERM WPTS select function.

Condition(s):

When a navaid identifier is entered into the IDENT prompts, the DATA BASE page shows with the navaid information.

Path:

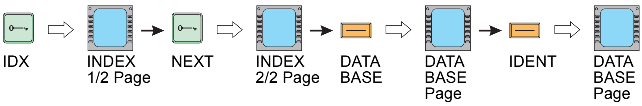
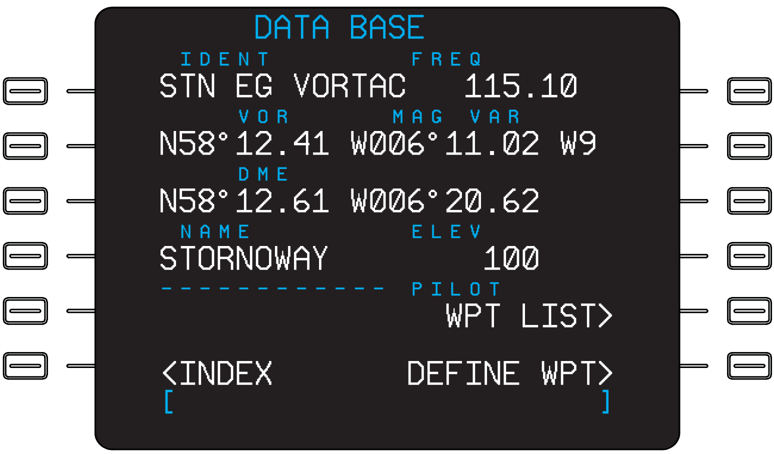


Figure 13-28 DATA BASE Page with Navaid Information



TPG5347_12

For VOR, VOR/DME, DME, VORTAC, and TACAN navaids, the DATA BASE page shows:

- Identifier of navaid and type of equipment (VOR, VOR/DME, VORTAC, or TACAN)
- Transmitter frequency
- Latitude and longitude for VOR and DME facilities, as appropriate
- MAG VAR (for facilities that include VOR equipment)
- NAME of the navaid
- ELEV in feet.

Condition(s):

When a waypoint identifier is entered into the IDENT prompts, the DATA BASE page shows with the waypoint information.

Path:

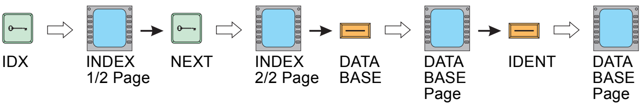
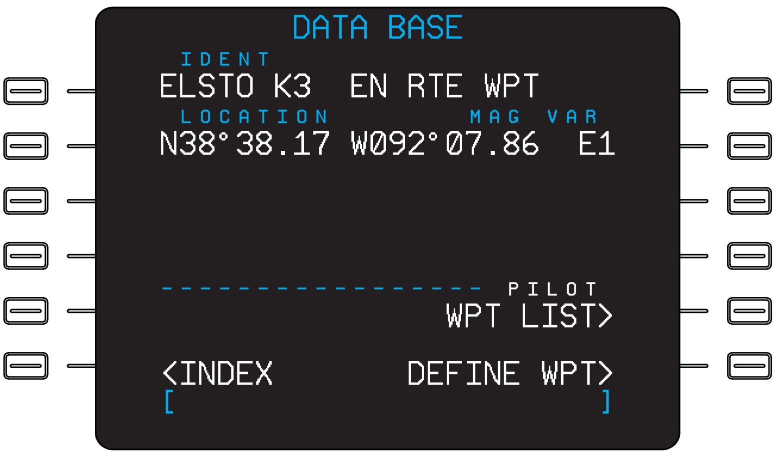


Figure 13-29 DATA BASE Page with Waypoint Information



TPG5347_14

For waypoints in the PILOT WPT LIST, the DATA BASE page shows the latitude, longitude, and MAG VAR, and the basis for the definition of the waypoint.

For waypoints in the FMS database, the DATA BASE page shows the waypoint name, the latitude and longitude, the ICAO country code and location, the type of waypoint, and the MAG VAR.

PILOT WPT LIST

Path:

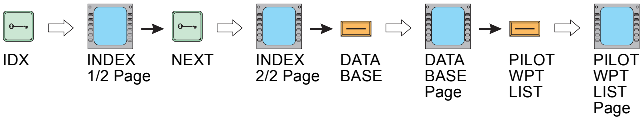
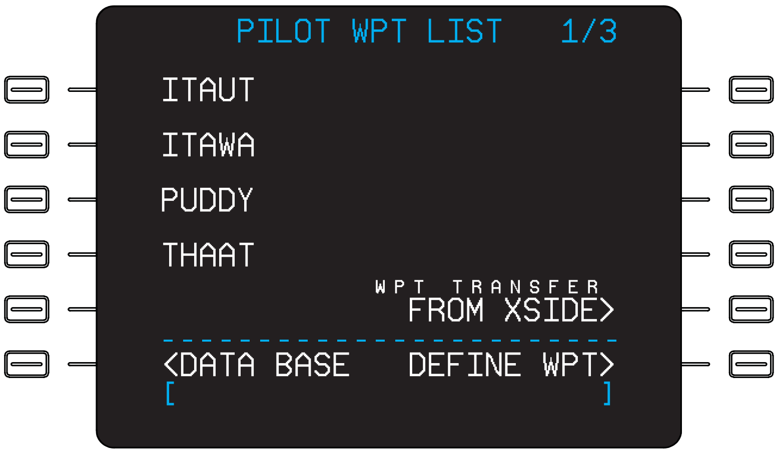


Figure 13-30 PILOT WPT LIST Page



TPG5117_55

The PILOT WPT LIST page shows a list of all pilot-defined waypoints in the FMS database. Up to 100 waypoints can be stored in the database. Each PILOT WPT LIST page shows up to 10 pilot-defined waypoints. Push the NEXT and PREV functions keys to show all PILOT WPT LIST pages.

▼ SELECTIONS:

WPT TRANSFER FROM XSIDE	Selection initiates a transfer of the PILOT WPT LIST in the cross-side FMS to the same-side (requesting) FMS.
DATA BASE	Selection shows the DATA BASE page.

DEFINE WPT	Selection shows the DEFINE PILOT WPT page. Refer to the figure on page 13-55.

DEFINE PILOT WPT

Path:

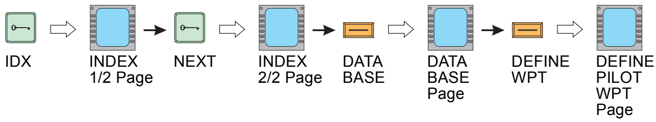
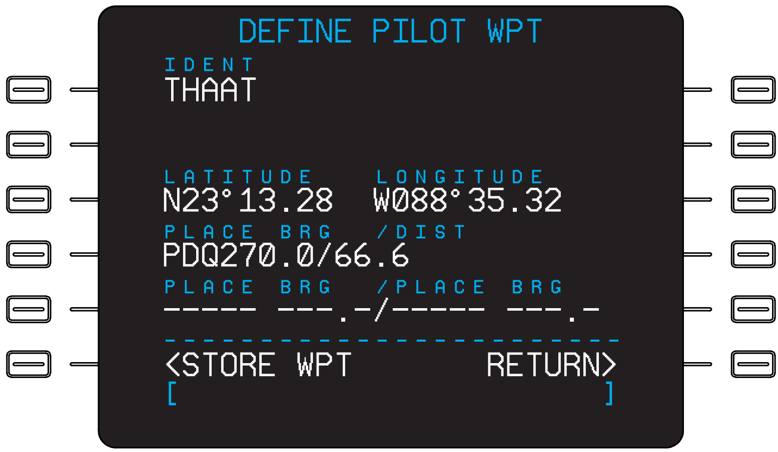


Figure 13-31 DEFINE PILOT WPT Page



TPG5117_91

The DEFINE PILOT WPT page is used to create and name pilot-defined waypoints. The waypoints can then be stored in the PILOT WPT LIST. Up to 100 pilot defined waypoints can be stored in the database.

▼ SELECTIONS:

IDENT	Used to enter a unique name for the pilot-defined waypoint. Up to five characters (letters and numbers) can be entered.

LATITUDE LONGITUDE

Used to define a waypoint by latitude and longitude coordinates. The format for latitude and longitude data entry is (N or S) DDMM.MM (W or E) DDDMM.MM where D represent degrees and M represents minutes. The following guidelines apply to entering coordinates.

- If the coordinates are in whole degrees of latitude or longitude, the minute entries are not required.
- If minutes are entered, use two digits before a decimal point.
- If a decimal point is used, use at least one number after it.
- The acceptable range for entering minutes is 00.00 to 59.99.
- Optional spaces can be placed between the degrees and minutes fields, and between the latitude and longitude fields.

PLACE BRG/DIST

Used to define a waypoint by a bearing and distance from a base waypoint. The format for a PLACE BRG/DIST entry is a base waypoint identifier followed by a bearing in degrees, a slash, and a distance value (for example, CID005.3/23.5). The following rules apply to PLACE BRG/DIST entries:

- Base waypoint identifiers must be valid navigation aids, en route intersections, non-directional beacons, airport reference points, or pilot-defined waypoints.

- Bearings can be specified in tenths of degrees if desired (for example, 034.5). Bearings must be specified with three numbers for the whole degree part, with leading zeros where necessary (for example, 005).
- North bearings can be entered as 000 or as 360. The FMS always shows North as 360.
- Distance entries are limited to 199.9 NM. Zero distance values are not accepted.

TECH DETAIL

Bearing references vary based on the type of a base waypoint. If the base waypoint has a VOR component, then the bearing is referenced to the VOR radial of zero degrees. If the base waypoint is an airport reference point or a runway threshold, bearing is referenced to the North Datum of the airport. For other base waypoints, bearing is referenced to either magnetic north or true north, based upon the latitude of the base waypoint. For base waypoints between the latitudes of 73 degrees north and 60 degrees south, the entered azimuth data is referenced to magnetic north using a computed value for the magnetic variation. Otherwise, the entered azimuth is referenced to true north. Suffixing the bearing with the letter T for true north overrides the logic mentioned above and fixes the reference to true north (for example, CID034T/15).

PLACE BRG/
PLACE BRG

Used to define a waypoint by the intersection of bearings from two different base waypoints.

STORE WPT	Selection stores the new waypoint in the PILOT WPT LIST.
RETURN	Selection returns the display to the previous display page.

DEFAULTS

Path:

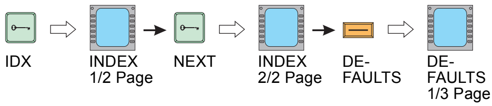
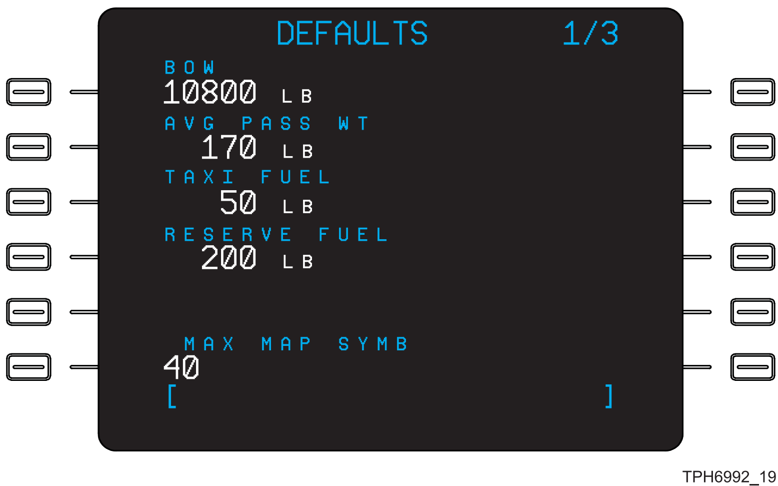


Figure 13-32 DEFAULTS 1/3 Page



The DEFAULTS 1/3 page shows default values for the performance values that show on the PERF INIT page. The DEFAULTS 1/3 page is used to set or change the default values/settings for:

- Basic Operating Weight (BOW)
- Average Passenger Weight (AVG PASS WT)
- TAXI FUEL Weight
- RESERVE FUEL Weight
- MAX MAP SYMBols.

The settings on the DEFAULTS pages remain in effect until they are changed. However, for any individual flight plan, any of the defaults on the appropriate display page of a flight plan can be overridden. Overriding the default setting from within a flight plan does not change the settings on the DEFAULTS pages. Also, when changes are made to the settings on the DEFAULTS pages, they do not affect the ACT/MOD FPLN or SEC FPLN.

Changes made on the DEFAULTS pages are applied only when a new flight plan is created, or one is selected from the PILOT ROUTES LIST. BOW and FUEL FLOW CORRECTION are exceptions to this rule. These values are applied to the ACT/MOD/SEC FPLN as soon as they are entered/changed on the DEFAULTS pages.

MAX MAP SYMB determines the maximum number of all types of map symbols that can show on the MFD MAP. A detailed description of how symbols are prioritized for display can be found in the MFD section of this chapter.

Path:

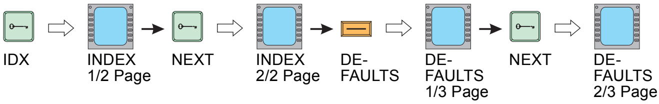
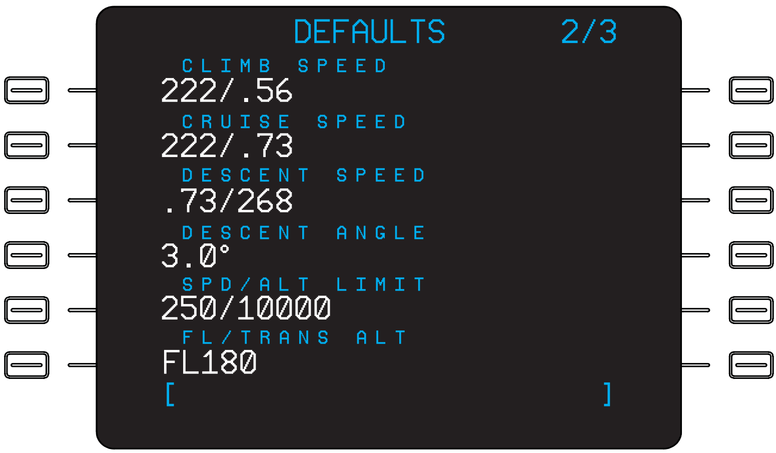


Figure 13-33 DEFAULTS 2/3 Page



TPH6992_26

The DEFAULTS 2/3 page is used to set or change the default values/settings for:

- CLIMB SPEED
- CRUISE SPEED
- DESCENT SPEED
- DESCENT ANGLE
- SPD/ALT LIMIT
- FL/TRANS ALT.

Path:

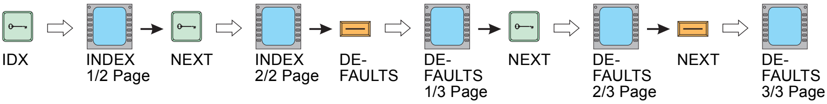
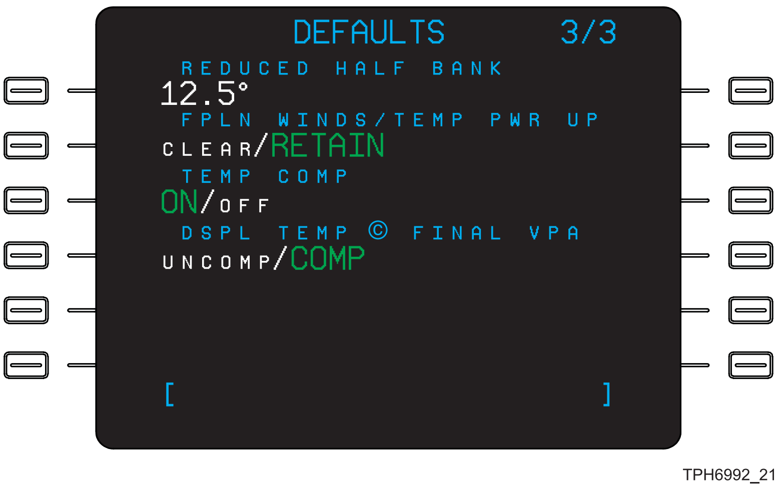


Figure 13-34 DEFAULTS 3/3 Page



The DEFAULTS 3/3 page shows default values and settings for performance-related information. Use DEFAULTS 3/3 page to change the default values/settings for:

- REDUCED HALF BANK — Controls the reduced half bank angle used by the FMS for early turn anticipation. With the half bank mode selected on the autopilot, in shallow turns that require less than the normal full turn anticipation distance, the FMS uses the reduced half bank angle to execute the turn. For sharper turns, the FMS ignores the reduced limit and uses progressively steeper turns, up to the half bank limit of the autopilot, to avoid an overshoot. The reduced bank limits range is from 5° to 12.5°. REDUCED HALF BANK settings other than the system default setting shown at power-up are not saved when power is removed from the FMS. Deleting a setting returns the system to the default setting.
- FPLN WINDS/TEMP PWR UP — Controls the option at system power up to CLEAR or RETAIN wind and temperature data previously entered into a flight plan.

- TEMP COMP — Controls the option at system power up to have the optional temperature compensation function ON or OFF.
- DSPL TMP© FINAL VPA — Controls the option to have the Vertical Path Angle (VPA) for the final approach segment to be shown as either an uncompensated (UNCOMP) or compensated (COMP) value.

NOTE

Temperature compensation is an optional feature that is controlled with a software configuration strap loaded at the factory. If temperature compensation is not selected, the TEMP COMP and DSPL TMP ©FINAL VPA selections will not be available.

ARR DATA

Path:

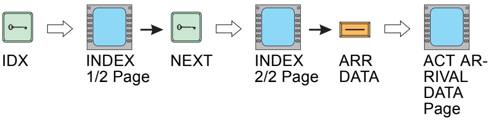
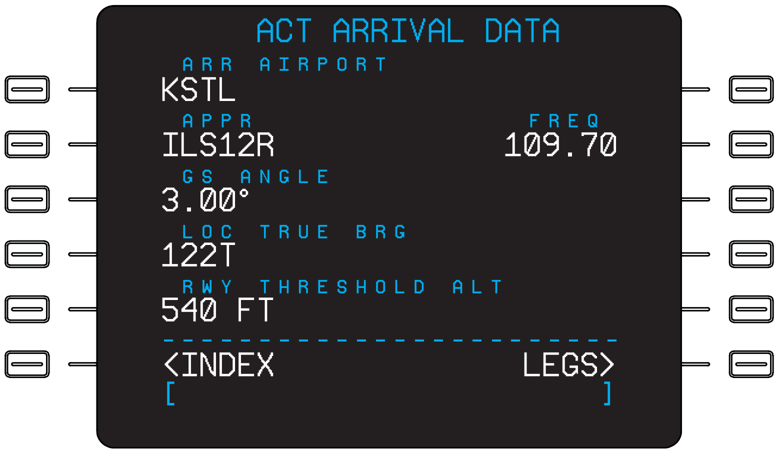


Figure 13-35 ACT ARRIVAL DATA Page



TPG5117_64

The ACT ARRIVAL DATA page shows information on the destination airfield. If no destination airport has been entered, all display fields are blank. If no approach is selected, only the four-letter airport ICAO identifier shows. If a non-precision approach has been selected, the approach designation and runway, and runway threshold altitude also show. If an ILS approach is selected, the glide slope angle, localizer true bearing, and localizer frequency show in addition to the information already described. The information presented on the ARRIVAL DATA page is for display only. To change the display, select a new approach at the destination airport through the ARRIVAL page.

TEMP COMP

Condition(s):

Temperature compensation is an optional feature that is controlled with a software configuration strap loaded at the factory. If temperature compensation is not selected, the TEMP COMP page will not be available.

Path:

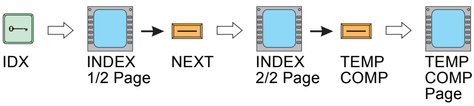
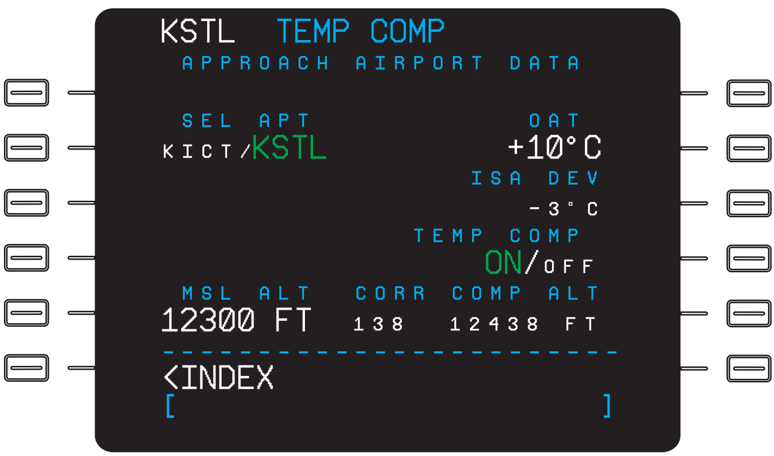


Figure 13-36 TEMP COMP Page



TPG5347_71

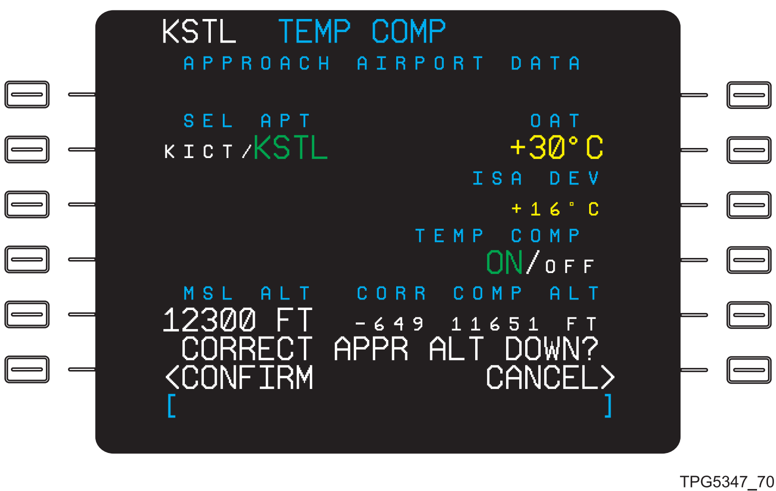
Barometric altimeters are calibrated to indicate true altitude only under International Standard Atmosphere (ISA) conditions of temperature and sea level pressure. In cases where the temperature is higher than ISA, the true altitude will be higher than the altitude indicated by the altimeter. Conversely, when the temperature is lower than ISA, the true altitude will be lower than indicated. The FMS flies VNAV on a non-precision approach using the barometric altimeter for the altitude sensor. On a day when the temperature is lower than ISA, the true altitude/VPA flown by the aircraft will be below the published altitude/VPA unless the appropriate constraint altitudes and vertical path angles are compensated to account for the below ISA temperature condition.

The FMS Temperature Compensation feature supplies the pilot a mechanism to have the FMS automatically compensate the altitude constraints and vertical path angles associate with the approach, the approach transition, and the missed approach.

The Outside Air Temperature (OAT) value must be entered before temperature compensation can be computed. A valid OAT is in the range from –55 °C to 70 °C. The OAT entered and shown is the aerodrome temperature that is associated with the airport that is selected via the SEL APT line select key. Upon initial entry of a new OAT value, the FMS will calculate ISA DEV using the value entered for OAT and the elevation of the associated airport.

When ISA DEV is equal to or less than 0 °C (cold temperature), the OAT value is accepted for temperature compensation and calculations show. The OAT value shows in large white font. The calculated ISA DEV shows in small white font.

Figure 13-37 TEMP COMP with ISA DEV greater than 0 °C



When ISA DEV is greater than 0 °C (hot temperature), the OAT value shows in large yellow font and the calculated ISA DEV shows in small yellow font. The message CORRECT APPR ALT DOWN? shows in large white font, along with the options CONFIRM and CANCEL. Pushing the CONFIRM line select key will cause the FMS to accept the OAT value for temperature compensation calculations and show OAT and ISA DEV in white font. Pushing the CANCEL line select key will cause OAT and ISA DEV to be returned to their previous states.

NOTE

The CORR APPR ALT DOWN? prompt refers to the indicated altitudes and not the true altitudes.

▼ SELECTIONS:

SEL APT	Used to manually select the airport for which temperature compensation is to be applied. Pushing the line select key cycles between the origin airport and the destination airport. The selected airport shows in large green font. The unselected airport shows in small white font. **NOTE** If both the origin and destination airport are specified in the active flight plan, the default selection of the landing airport is the origin airport while the aircraft is either within 50 NM of the airport or less than halfway along the flight plan route, whichever distance is smaller. When the aircraft present position no longer meets these criteria, the destination airport is the default selection.

OAT	Used to enter the outside air temperature for the airport shown in the SEL APT field. The OAT entered and shown is the aerodrome temperature that is associated with the airport that is selected via SEL APT. OAT is a required input parameter to compute temperature compensation data. When TEMP COMP is ON, prompt boxes indicate OAT is a required entry. When TEMP COMP is OFF, dashes indicate OAT is an optional entry. When no airport is available for selection via the SEL APT (SEL APT is blank) function, then OAT is also blank and any attempt to enter a value for OAT causes the message KEY NOT ACTIVE to be shown on the scratchpad. OAT can be either entered in degrees C or degrees F. The numerical value is entered either preceded by or followed by the letter C or the letter F. The manually entered value shows in large font. The appropriate letter (C or F) shows after the OAT value. The default unit of measurement for OAT is Celsius. A temperature entry without units is interpreted to be in the same units as currently shown.
ISA DEV	Used to show the FMS-calculated deviation from ISA temperature based on the entered OAT value and the elevation of the airport selected in the SEL APT field. The ISA DEV shows in small font.

TEMP COMP

Used to select Temperature Compensation ON or OFF. At initial power-up or upon a new flight plan, the selection (ON or OFF) defaults to the setting specified on the DEFAULTS 3/3 page.

NOTE

A change to the TEMP COMP setting always creates a MOD FPLN condition.

MSL ALT

When OAT for either the origin or destination airport has been entered, the MSL ALT field lets an altitude be entered. MSL ALT entries show in large white font.

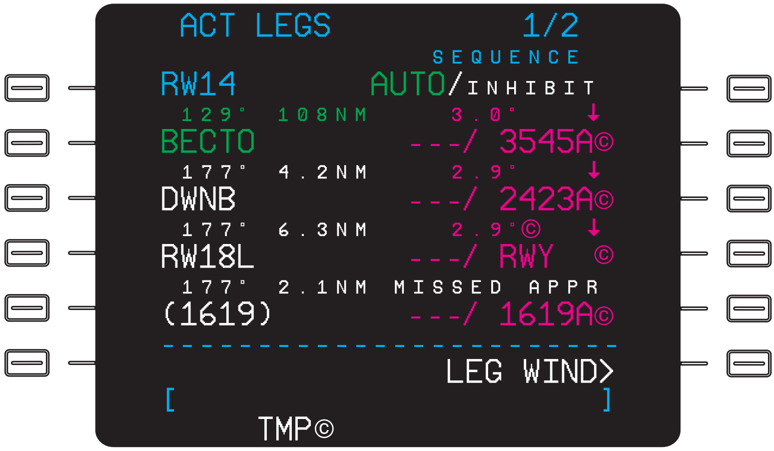
CORR

Shows the difference between the compensated value and the original value. This shows the pilot the amount of correction or compensation that has been applied. The difference between the compensated value and the original value shows in small white font.

COMP ALT

Shows the result of applying temperature compensation to the MSL ALT entered by the pilot. The altitude shows in small white font with FT appended to it to signify the units. A negative correction value is indicated by a minus (–) sign.

Figure 13-38 ACT LEGS Page with TEMP COMP On



TPH6992_13

When TEMP COMP is active, the FMS adds a copyright symbol (©) to indicate when temperature compensation has been applied to a waypoint constraint altitude or VPA. If a compensated altitude constraint shows in other places on the CDU or MFD display, such as the VNAV window, then the copyright symbol will show there as well. TMP© shows in white on the bottom CDU annunciation line while temperature compensation is active and being applied to appropriate altitude constraints.

If TEMP COMP is ON and the FMS has all the information necessary to calculate temperature compensation, a VPA or altitude constraint that is loaded from the navigation database as part of an approach procedure, an approach procedure transition, or missed approach procedure, will be automatically temperature compensated. Exceptions that result in temperature compensation not being applied include altitude constraints that are above the flight level transition altitude, and manually-entered altitude or VPA constraints.

NOTE

Temperature compensation is not applied to altitude above the flight level transition altitude. However, when the FMS is applying temperature compensation to an altitude below the transition altitude, it is possible that the resulting altitude can be above the transition altitude. These situations will result in a flight level altitude with a copyright symbol (©), which indicates a temperature-compensated flight level altitude. Since flight level altitudes are rounded to the nearest hundredths, the indicated altitude is not the corrected true altitude.

NOTE

The temperature-compensated VPA display on the ACT/MOD LEGS pages is the value that results from the temperature-compensated altitude and is not the actual VPA that the aircraft will fly. When temperature compensation is active, the aircraft will always fly the actual VPA contained in the database for that approach.

SELECT WPT

Condition(s):

If an airport identifier that is associated with both a navaid and an airport stored in the navigation database is entered, the SELECT WPT page shows with airport and navaid information.

Path:

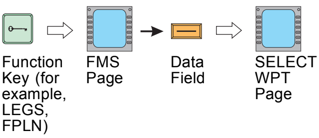
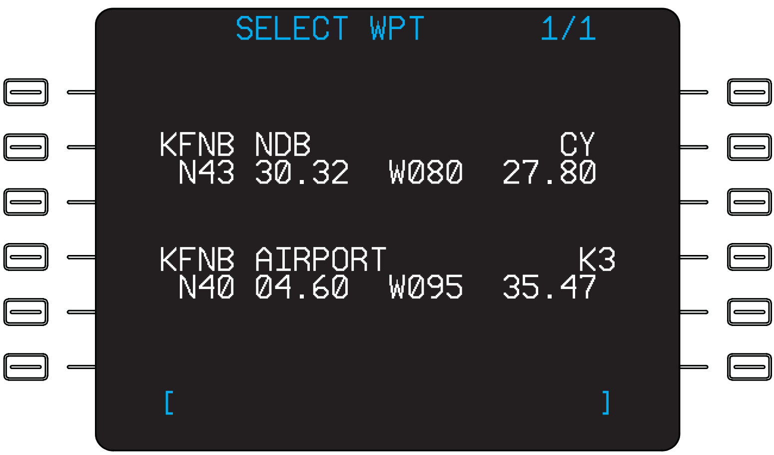


Figure 13-39 SELECT WPT Page – Airport/Navaid



TPG5347_09

Each entry shows the airport or navaid identifier, latitude, longitude, and ICAO country code. The duplicate identifier waypoints are ordered by increasing distance from the FMS position if the entry is on the RADIO TUNING page or POS INIT page, or if the entry involves the active waypoint. If the entry is on the FPLN or LEGS pages, the duplicate identifier waypoints are ordered by distance from the previous waypoint if one exists. Otherwise, for the FPLN and LEGS pages, the duplicate identifier waypoints are ordered by distance from the FMS position.

A push of the left or right line select key next to one of the duplicate identifiers transfers the waypoint identifier into the data line of the page that was shown before the SELECT WPT page and returns the display to the previous page.

If a selection on the SELECT WPT page is not made before leaving the page (through selection of another function key), the requested edit is cancelled and the scratchpad is cleared.

Condition(s):

If an airport runway waypoint identifier that is associated with more than one airport stored in the navigation database is entered, the SELECT WPT page shows with airport runway information.

Path:

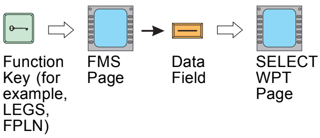
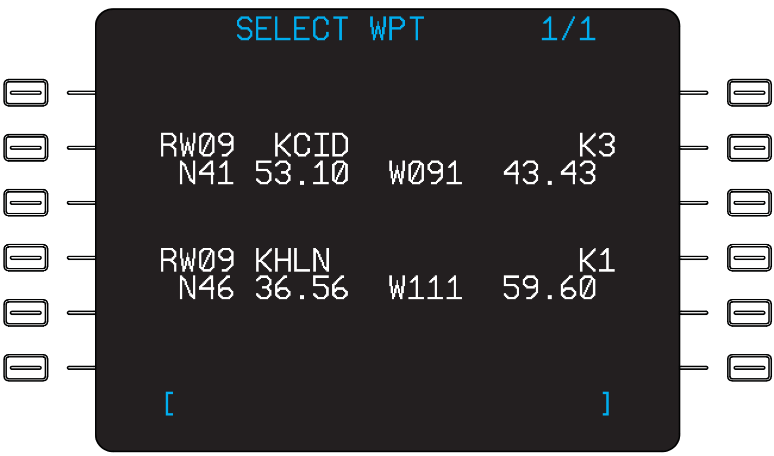


Figure 13-40 SELECT WPT Page – Airport Runway



TPG5347_10

Each entry shows the runway, airport identifier, latitude, longitude, and ICAO country code. The duplicate identifier waypoints are ordered by increasing distance from the FMS position if the entry is on the RADIO TUNING page or POS INIT page, or if the entry involves the active waypoint. If the entry is on the FPLN or LEGS pages, the duplicate identifier waypoints are ordered by distance from the previous waypoint if one exists. Otherwise, for the FPLN and LEGS pages, the duplicate identifier waypoints are ordered by distance from the FMS position.

Condition(s):

If an airport terminal waypoint identifier that is associated with an airport and a en route intersection stored in the navigation database is entered, the SELECT WPT page shows with airport terminal and en route intersection information.

Path:

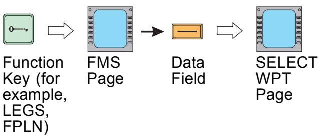
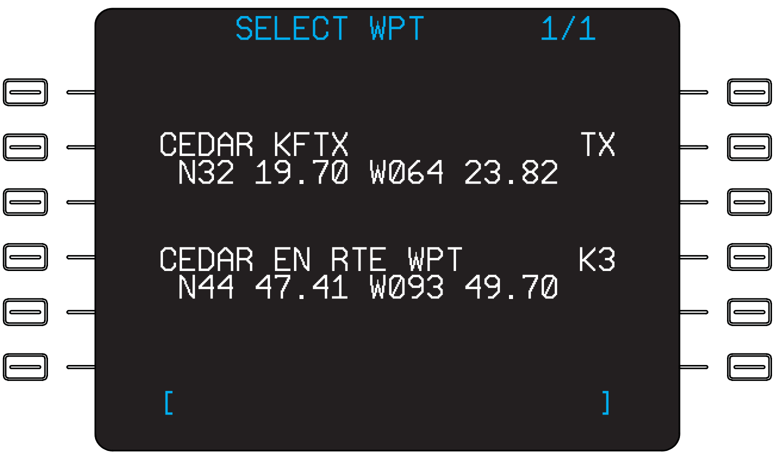


Figure 13-41 SELECT WPT Page – Airport Terminal & En Route Intersection



TPG5347_02

Each entry shows the waypoint identifier, type designation (terminal or en route), latitude, longitude, and ICAO country code. The duplicate identifier waypoints are ordered by increasing distance from the FMS position if the entry is on the RADIO TUNING page or POS INIT page, or if the entry involves the active waypoint. If the entry is on the FPLN or LEGS pages, the duplicate identifier waypoints are ordered by distance from the previous waypoint if one exists. Otherwise, for the FPLN and LEGS pages, the duplicate identifier waypoints are ordered by distance from the FMS position.

Condition(s):

If a pilot-defined waypoint identifier that is associated with an en route intersection stored in the navigation database is entered, the SELECT WPT page shows with pilot-defined waypoint and en route intersection information.

Path:

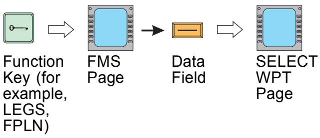
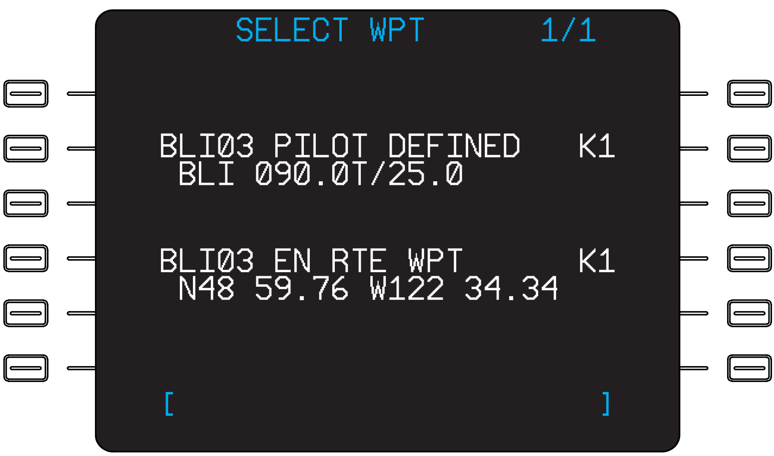


Figure 13-42 SELECT WPT Page – Pilot Defined & En Route Intersection



TPG5347_03

Each entry shows the waypoint identifier, type designation (pilot-defined or en route), latitude, longitude, and ICAO country code. The duplicate identifier waypoints are ordered by increasing distance from the FMS position if the entry is on the RADIO TUNING page or POS INIT page, or if the entry involves the active waypoint. If the entry is on the FPLN or LEGS pages, the duplicate identifier waypoints are ordered by distance from the previous waypoint if one exists. Otherwise, for the FPLN and LEGS pages, the duplicate identifier waypoints are ordered by distance from the FMS position.

Condition(s):

If a waypoint identifier that is associated with duplicate navaids (VOR and DME) stored in the navigation database is entered, the SELECT WPT page shows with VOR and DME information.

Path:

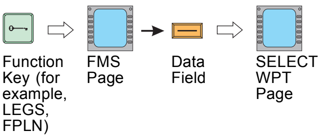
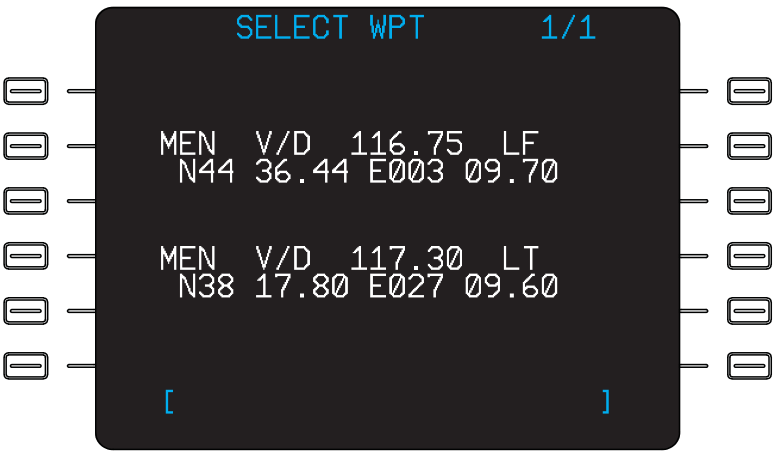
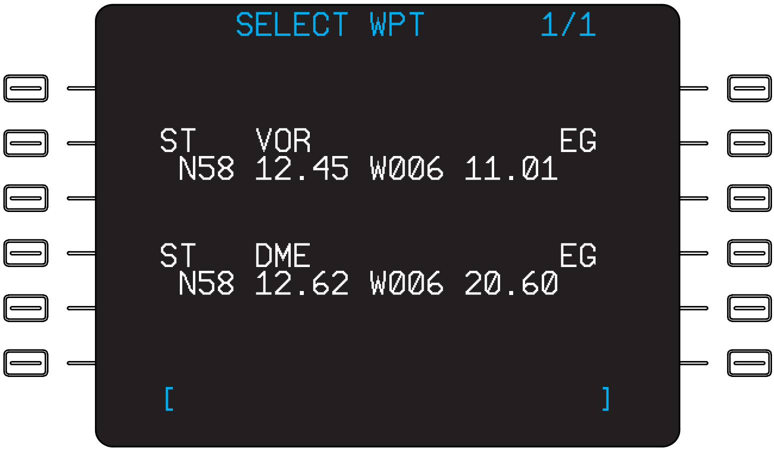


Figure 13-43 SELECT WPT Page – VOR/DME Navaid Pages



TPG5347_04



TPG5347_05

Each entry shows the waypoint identifier, type of navaid, the frequency as applicable, latitude, longitude, and ICAO country code. The duplicate identifier waypoints are ordered by increasing distance from the FMS position if the entry is on the RADIO TUNING page or POS INIT page, or if the entry involves the active waypoint. If the entry is on the FPLN or LEGS pages, the duplicate identifier waypoints are ordered by distance from the previous waypoint if one exists. Otherwise, for the FPLN and LEGS pages, the duplicate identifier waypoints are ordered by distance from the FMS position.

Condition(s):

If a waypoint identifier that is associated with duplicate ILS waypoints stored in the navigation database is entered, the SELECT WPT page shows with ILS information.

Path:

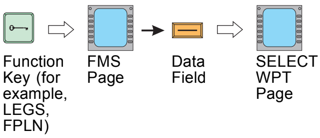
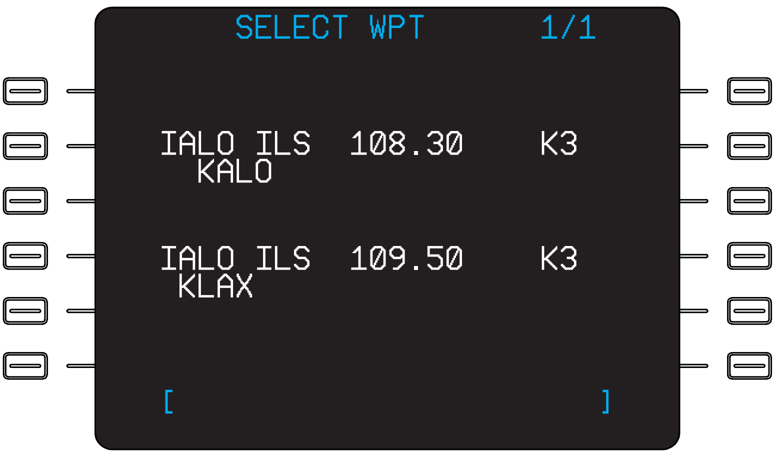


Figure 13-44 SELECT WPT Page – ILS Station



TPG5347_06

Each entry shows the waypoint identifier, type of navaid, frequency, associated airport, and ICAO country code. The duplicate identifier waypoints are ordered by increasing distance from the FMS position if the entry is on the RADIO TUNING page or POS INIT page, or if the entry involves the active waypoint. If the entry is on the FPLN or LEGS pages, the duplicate identifier waypoints are ordered by distance from the previous waypoint if one exists. Otherwise, for the FPLN and LEGS pages, the duplicate identifier waypoints are ordered by distance from the FMS position.

SELECT APT

Path:

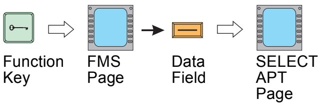
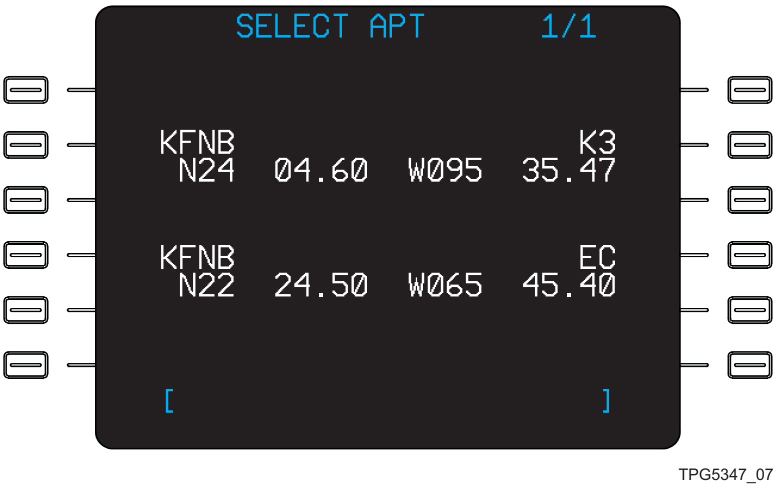


Figure 13-45 SELECT APT Page



If the pilot enters an airport identifier that is associated with more than one airport stored in the navigation database, the SELECT APT page shows.

Each entry shows the airport identifier, latitude, longitude, and ICAO country code. The duplicate airports are ordered by increasing distance from the FMS position.

Pushing the left or right line select key next to one of the duplicate identifiers transfers the airport identifier into the data line of the page that was shown before the SELECT APT page and returns the display to the previous page.

If a selection on the SELECT APT page is not made before leaving the page (through selection of another function key), the requested edit is cancelled and the scratchpad is cleared.

FPLN

Condition(s):

When the FPLN function key on the CDU is pushed, the ACT FPLN or MOD FPLN page shows. Each page shows the same information.

- If no flight plan exists, or an unmodified active flight plan is in use, the ACT FPLN page shows.
- If a flight plan modification is in progress, the MOD FPLN page shows.

Path:

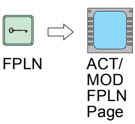
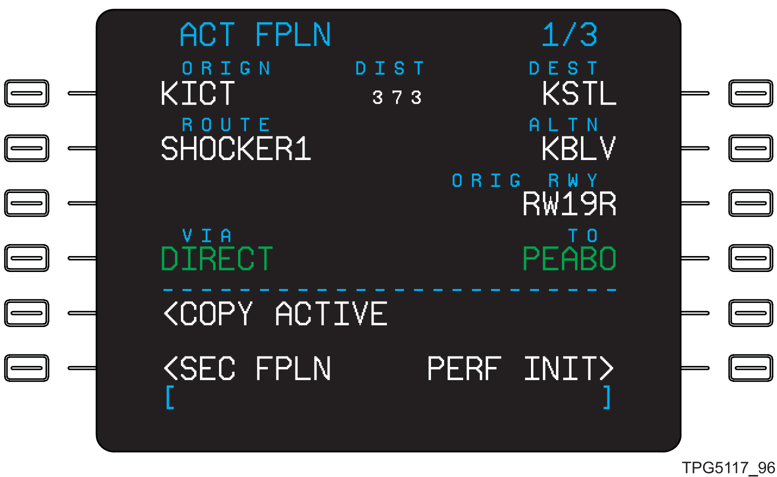


Figure 13-46 ACT FPLN Page



Information shown on the ACT FPLN pages varies with the equipment and options installed in the aircraft. Items that show on the ACT/MOD FPLN pages can include:

- ORIGIN, DEST and ALTN airports
- Distance to the destination airport (DIST)
- ROUTE identifier
- Departure runway (ORIG RWY)

- The beginning of the flight plan route (VIA and TO)
- Offset track distance (OFFSET).

All subsequent ACT or MOD FPLN pages show up to five lines of flight plan routing data, and line key selections for the SEC FPLN and PERF INIT pages. The active route shows in magenta. All other route data shows in white.

▼ SELECTIONS:

COPY ACTIVE	Selection copies the ACT FPLN and loads it into the SEC FPLN.
SEC FPLN	Selection shows the SEC FPLN page. Refer to the figure on page 13-40.
PERF INIT	Selection shows the PERF INIT pages. Refer to the figure on page 13-89.

▲

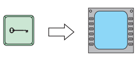
LEGS

Condition(s):

When the LEGS function key on the CDU is pushed, the ACT LEGS or MOD LEGS page shows. Each page shows the same information.

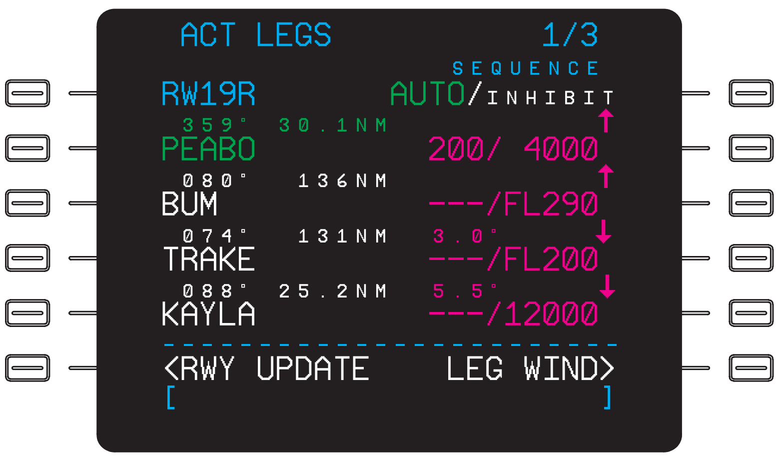
- If an unmodified active flight plan is in used, the ACT LEGS page shows.
- If a flight plan modification is in progress, the MOD LEGS page shows.

Path:



LEGS ACT/ MOD LEGS Page

Figure 13-47 ACT LEGS Page



TPG5117_37

The ACT LEGS and MOD LEGS pages show a list of all of the leg segments that make up a flight plan route. The TO leg shows in green, the last waypoint passed (FROM waypoint) shows in cyan, and all other leg waypoints show in white. Various types of flight plan legs are identified by the information shown in the left column of the display page. The list that follows describes the information shown for each leg type.

- For a magnetic or true course leg that terminates at a database or pilot-defined waypoint, the course direction and waypoint identifier show.
- For a magnetic or true heading leg with an altitude termination point, the heading and terminating altitude show.
- For a DME ARC leg, the distance and direction of the turn show, along with a unique identifier.
- For a distance terminated leg, the course and waypoint with the terminating distance show.
- For a radial terminated leg, the course and waypoint with the terminating radial show.
- For an intercept leg that terminates when it intercepts the next leg, a course and the identifier (INTC) show.
- For a leg that is terminated manually when vectored from it, a course and the identifier (VECT) show.
- For a hold, HOLD AT and the holding fix identifier show.
- For a hold-to-an-inbound-course set of legs (for example, 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) show. 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) show.

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

- The distance from the current position of the aircraft to the waypoint.
- Vertical navigation information for the waypoint to include any of the following.
  - Descent angle to the altitude constraint.
  - 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.

LEG WIND

Path:

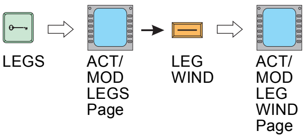
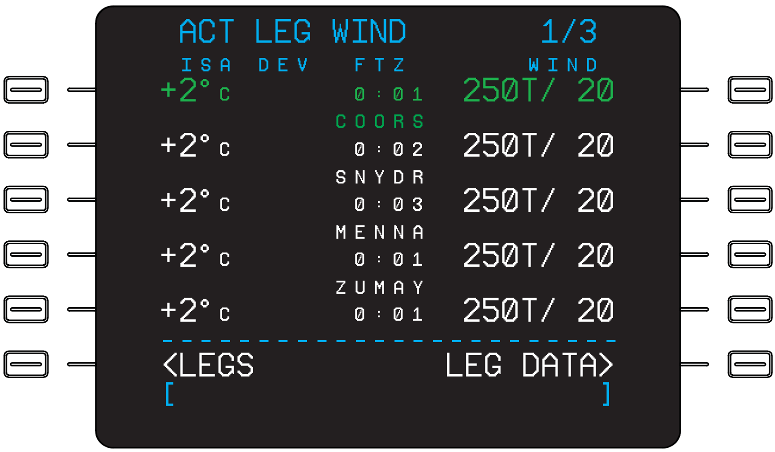


Figure 13-48 LEG WIND Page



TPG5117_24

The same color conventions for TO waypoint, active leg and FROM waypoint that are used on the LEGS page are also used on the LEG WIND page. Refer to the FLIGHT PLANNING chapter for information on entering winds and ISA deviation on the LEG WIND pages.

LEG DATA

Path:

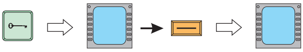
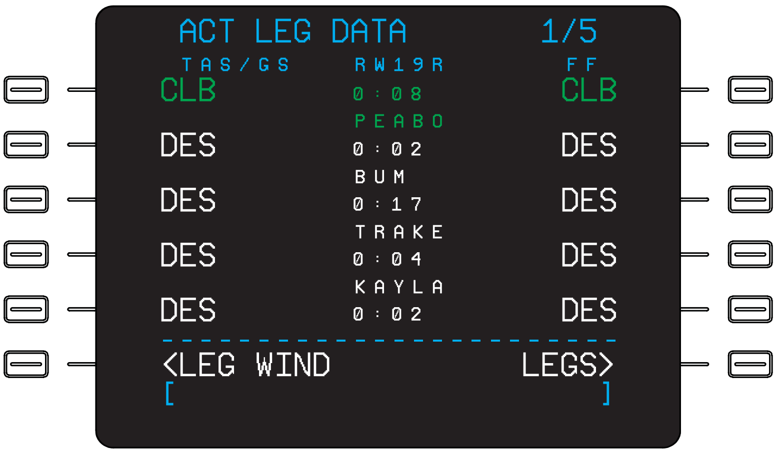


Figure 13-49 LEG DATA Page

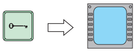


TPG5347_73

When winds and ISA DEV are entered on the LEG WINDS pages, the LEG DATA pages show true air speed, ground speed, leg time and fuel flow predictions for each leg of the flight plan. The same color conventions for TO waypoint, active leg and FROM waypoint that are used on the LEGS page are also used on the LEG DATA page. Information on the LEG DATA page is for display only.

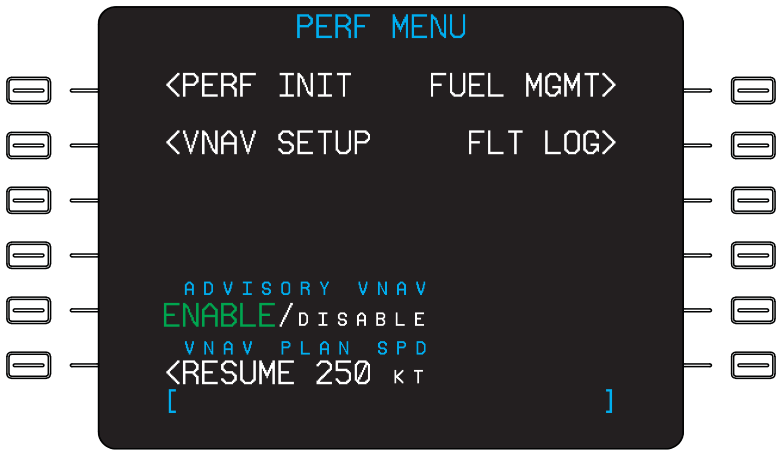
PERF

Path:



PERF → PERF MENU Page

Figure 13-50 PERF MENU Page



TPH6992_04

The PERF MENU page shows a menu of the available performance functions, allows the pilot to enable the VNAV advisory function, and displays/enables the VNAV PLAN SPD.

▼ SELECTIONS:

PERF INIT	Selection shows the PERF INIT pages. Refer to the figure on page 13-89.
VNAV SETUP	Selection shows the VNAV setup pages (VNAV CLIMB, VNAV CRUISE, VNAV DESCENT). Refer to the figure on page 13-90, the figure on page 13-92, and the figure on page 13-94.

FUEL MGMT	Selection shows the FUEL MGMT pages. Refer to the figure on page 13-96.
FLT LOG	Selection shows the FLIGHT LOG page. Refer to the figure on page 13-100.
ADVISORY VNAV	Selection enables and disables advisory VNAV features , which includes the required vertical speed, vertical deviation scale, and constraint altitudes for display on the Primary Flight Display (PFD).
VNAV PLAN SPD	VNAV PLAN SPD, shown at the bottom left of the PERF MENU page, shows the VNAV speed for the current flight phase that is specified on the VNAV SETUP pages, or a flight plan speed restriction, whichever is the most restrictive. The RESUME text shows when VNAV PLAN SPD is not selected. Refer to the PERFORMANCE chapter for a more detailed description of VNAV PLAN SPD.

PERF INIT

Path:

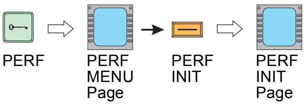
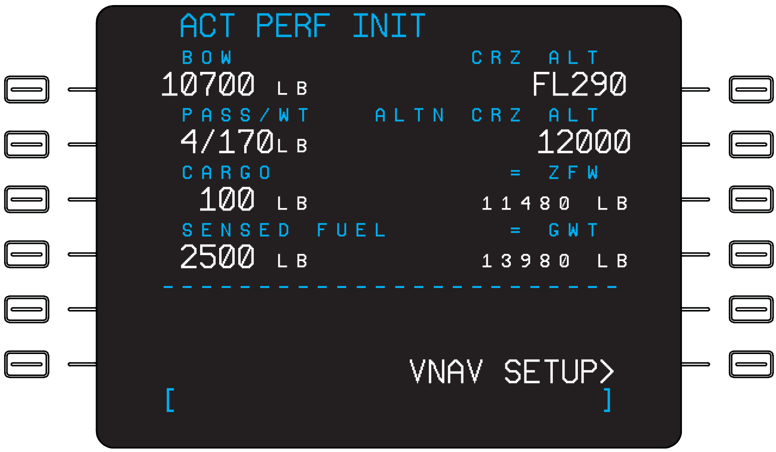


Figure 13-51 PERF INIT Page



TPH6992_05

The PERF INIT page is used for setting or reviewing various attributes used to initialize the performance functions. Prompt boxes (□ □ □ □ □) for FUEL and CRZ ALT, on the ACT PERF INIT page, identify the entries required to activate the performance functions. Initializing the PERF functions can be very simple or very detailed, based on the needs of the pilots. Refer to the PERFORMANCE chapter for a more detailed description of PERF INIT.

TECH DETAIL

The FUEL field shows one of three labels: SENSED FUEL, CALC FUEL, and MAN FUEL. SENSED FUEL shows when the fuel quantity can be sensed by the total fuel quantity sensor. CALC FUEL shows when the engines are running and the fuel value reflects the FMS-calculated fuel remaining based on the fuel burn rate. MAN FUEL shows for any manual fuel entry.

VNAV SETUP

Condition(s):

When the VNAV SETUP line select key is pushed and the aircraft is on the ground or in the climb phase, the ACT VNAV CLIMB page shows.

Path:

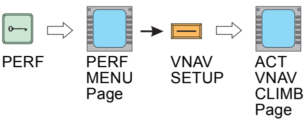
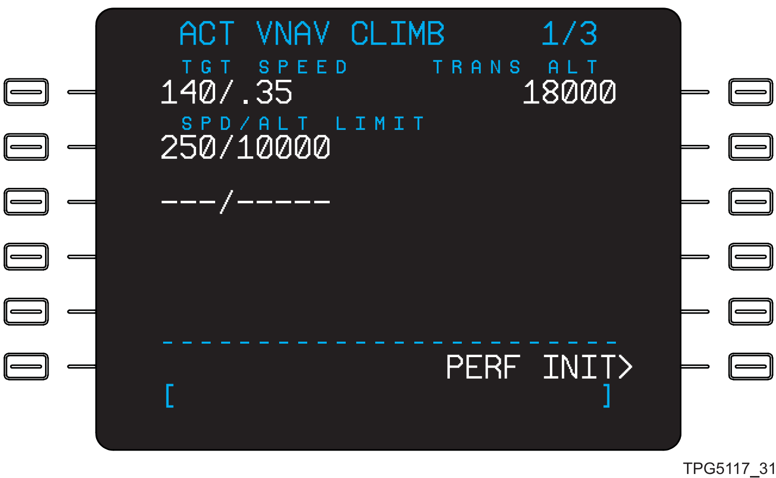


Figure 13-52 VNAV CLIMB Page



The ACT NAV CLIMB page shows the default setting for target speed (TGT SPEED) and speed/altitude limit (SPD/ALT LIMIT) for the climb phase, along with the TRANS ALT. The IAS and Mach speeds that show on each page are independent so that individual speeds for each phase of flight can be set. The speed/altitude limits are also independent on each page. An additional SPD/ALT LIMIT entries can be added to the default setting.

▼ SELECTIONS:

TGT SPEED	Shows the default target speed for the climb in IAS and Mach. TGT SPEED can be changed as necessary.
TRANS ALT	Shows the transition altitude. The value is retrieved from the FL/TRANS ALT setting on DEFAULTS 2/3 page every time a new flight plan is created. This value can be changed without affecting the value on DEFAULTS 2/3 page. **NOTE** TRANS ALT on the CLIMB page and TRANS FL on the DESCENT page are interconnected. Changing either one results in a concurrent change in the other.
SPD ALT/LIMIT	Shows the default speed/altitude limit. The speed/altitude limit can be changed as necessary or another SPD/ALT LIMIT can be added.
PERF INIT	Selection shows the PERF INIT page. Refer to the figure on page 13-89.

Condition(s):

When the VNAV SETUP line select key is pushed and the aircraft is in the cruise phase, the ACT VNAV CRUISE page shows.

Path:

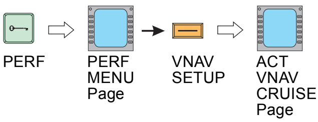
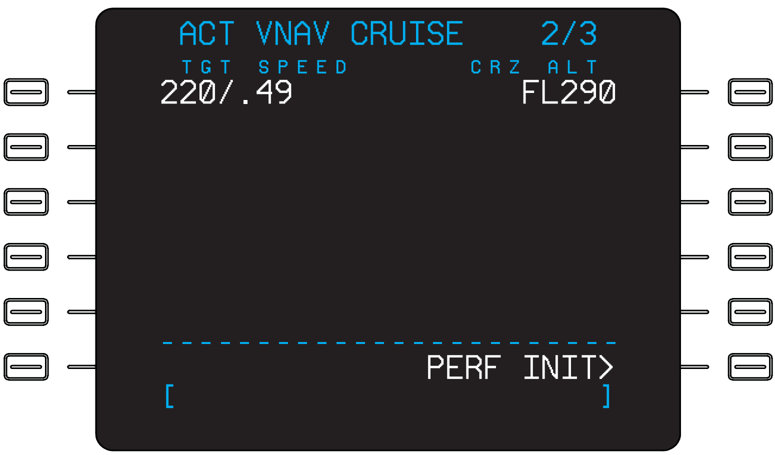


Figure 13-53 VNAV CRUISE Page



TPH6992_24

The ACT/MOD VNAV CRUISE page shows the default setting for TGT SPEED and the selected CRZ ALT. The IAS and Mach speeds that show on each page are independent so that individual speeds for each phase of flight can be set. The speed/altitude limits are also independent on each page. All of the default values on each page can be changed on the DEFAULTS 2/3 page, or for a single flight, on the VNAV SETUP pages. However, changes made on the DEFAULTS 2/3 page do not take effect for the current flight plan.

▼ SELECTIONS:

TGT SPEED	Shows the default target speed for the cruise in IAS and Mach. TGT SPEED can be changed as necessary.

CRZ ALT

Shows the planned cruise altitude for the flight.

NOTE

The CRZ ALT is the same altitude that is entered on the PERF INIT page. Changing the CRZ ALT on the VNAV CRUISE page also changes it on the PERF INIT pages.

Condition(s):

When the VNAV SETUP line select key is pushed and the aircraft is in the descent phase, the ACT VNAV DESCENT page shows.

Path:

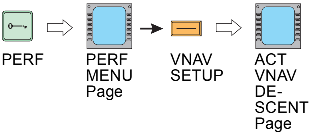
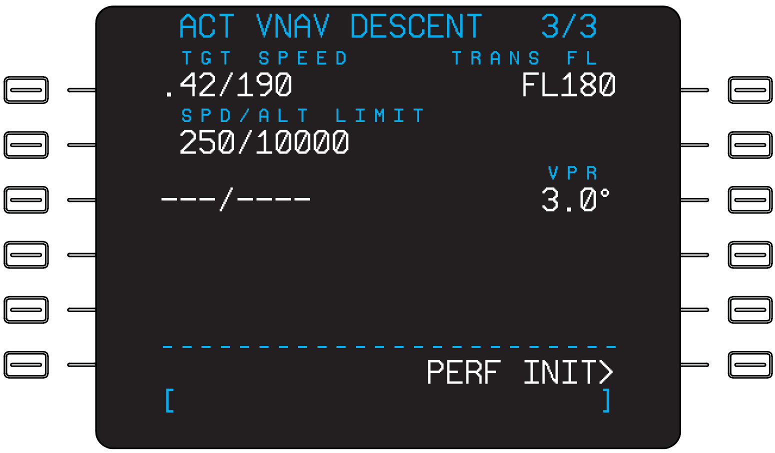


Figure 13-54 VNAV DESCENT Page



TPG5117_33

The ACT VNAV DESCENT page shows the default setting for TGT SPEED and SPD/ALT LIMIT for the descent phase, along with the TRANS FL. The ACT VNAV DESCENT page also shows a default setting for Vertical Path Angle (VPA) for the descent. The IAS and Mach speeds that show on each page are independent so that individual speeds for each phase of flight can be set. The speed/altitude limits are also independent on each page. All of the default values on each page can be changed on the DEFAULTS 2/3 page, or for a single flight, on the VNAV SETUP pages. However, changes made on the DEFAULTS 2/3 page do not take affect for the current flight plan.

▼ **SELECTIONS:**

TGT SPEED

Shows the default target speed for the cruise in IAS and Mach. TGT SPEED can be changed as necessary.

TRANS FL

Shows the transition flight level. The value is retrieved from the FL/TRANS ALT setting on the DEFAULTS 2/3 page every time a new flight plan is created. This value can be changed without affecting the value on the DEFAULTS 2/3 page.

NOTE

TRANS ALT on the CLIMB page and TRANS FL on the DESCENT page are interconnected. Changing either one results in a concurrent change in the other.

SPD ALT/LIMIT

Shows the default speed/altitude limit. The SPD/ALT LIMIT can be changed as necessary or another SPD/ALT LIMIT can be added.

VPA

Shows the default setting for vertical path angle. The default value can be changed as necessary. Changing the default VPA on the ACT VNAV DESCENT page changes the VPA for all descents in the flight plan. However, on the LEGS page, the VPA can be changed for an individual descent. Refer to the VNAV OPERATIONS chapter for information on how to set the VPA for an individual descent.

FUEL MGMT

Path:

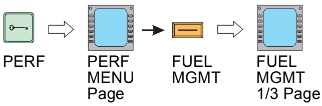
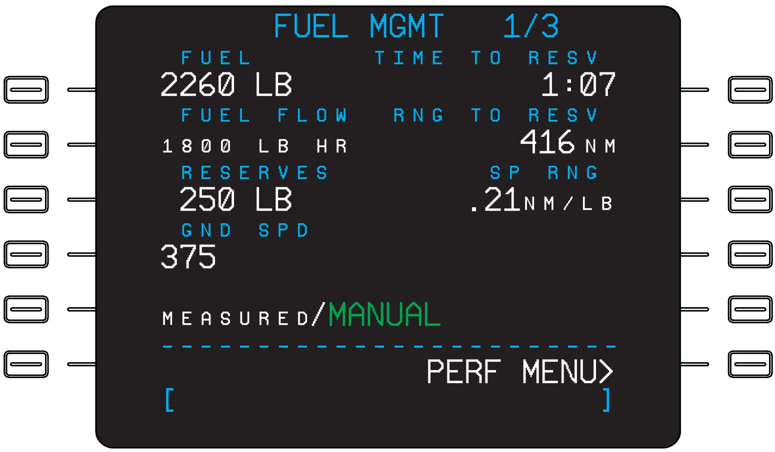


Figure 13-55 FUEL MGMT 1/3 Page



TPH6992_09

The FUEL MGMT 1/3 page shows:

- Total quantity of FUEL
- Total FUEL FLOW
- Total RESERVES
- Ground speed (GND SPD)
- Time to reserves (TIME TO RESV)
- Range to reserves (RNG TO RESV)
- Current fuel burn for a Specific Range (SP RNG).

NOTE

The FUEL quantity can only be changed on the PERF INIT page. FUEL quantity on the FUEL MGMT is for display only.

The FMS can calculate performance data in MEASURED or MANUAL mode.

On the CDU, the performance mode affects ETE and FUEL-LB/KG shown on the PROGRESS pages.

On the MFD, the mode selected affects the ETA and FUEL shown on the ACT FPLN PROGRESS pages. The data shown is based on the current sensor-measured data for FUEL FLOW and GND SPD (MEASURED mode), or pilot-entered FUEL FLOW and GND SPD (MANUAL mode). In MEASURED mode, wide variations in the performance data can be seen during climb and descent phases of flight.

NOTE

To help differentiate sensor-measured FUEL FLOW and GND SPD from pilot entries, sensor-measured data shows in small font characters and pilot entries show in large font characters. To return the FMS to MEASURED mode after making manual entries, which automatically selects the MANUAL mode, all of the manual entries must be deleted. Use the CLR DEL function key to enter DELETE into the scratchpad and transfer it to the entry to be deleted. When a manual entry is deleted, the current sensor measured value shows.

Path:

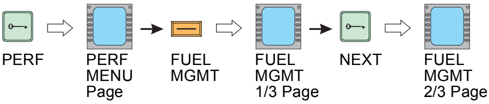
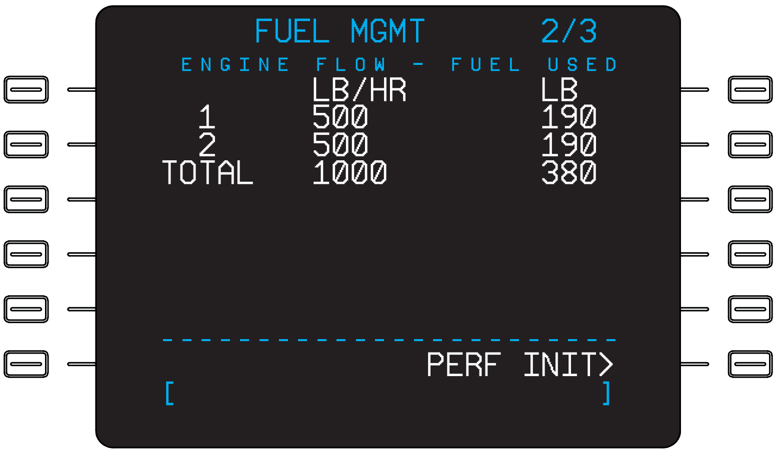


Figure 13-56 FUEL MGMT 2/3 Page



TPG5117_97

FUEL MGMT 2/3 page shows the ENGINE FUEL-FLOW-USED, which is the fuel flow rate and fuel used for each engine individually and the TOTAL for both. Values shown are for display only.

Path:

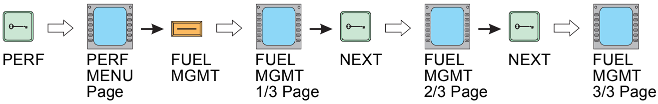
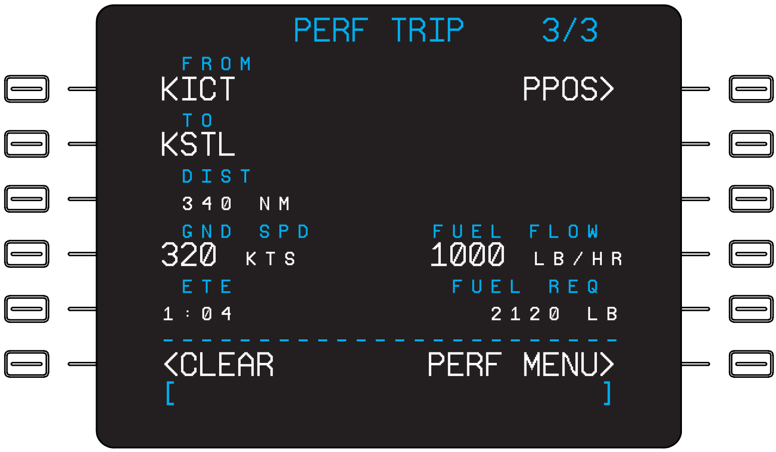


Figure 13-57 PERF TRIP 3/3 Page



TPH6992_10

The PERF TRIP 3/3 page is a trip calculator. This page shows the following:

- FROM
- TO
- DIST
- GND SPD
- ETE
- PPOS
- FUEL FLOW (LB/HR)
- FUEL REQ (LB).

The PERF TRIP 3/3 page is used to calculate ETE and the fuel required (FUEL REQ) based on DIST, GND SPD, and FUEL FLOW. Distance can be specified either FROM a specific waypoint, or from the present position (PPOS) to a specific waypoint (TO) or a specified distance (DIST). Ground speed (GND SPD) and FUEL FLOW can also be entered manually to replace the defaults.

FLIGHT LOG

Path:

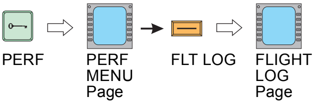
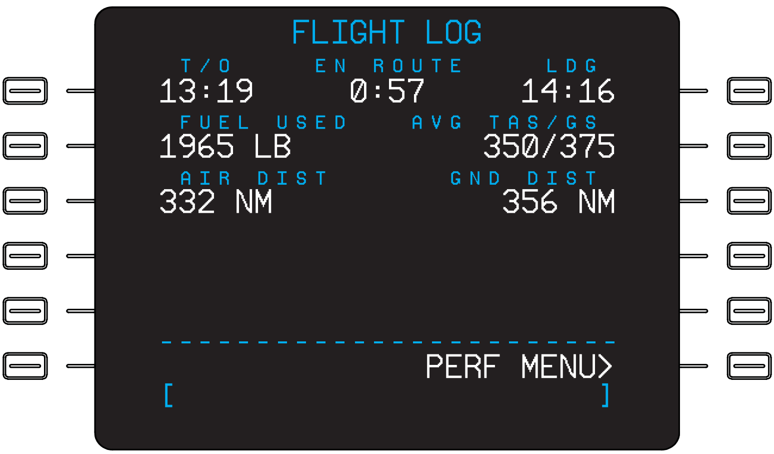


Figure 13-58 FLIGHT LOG Page



TPG5117_36

The FLIGHT LOG page shows:

- Takeoff time (T/O)
- EN ROUTE time
- Landing time (LDG)
- FUEL USED
- Average true airspeed and ground speed (AVG TAS/GS)
- AIR DIST
- GND DIST
- A line key selection to return to the PERF MENU page.

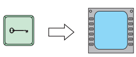
DEP ARR

Condition(s):

The DEP/ARR INDEX page shows if one of the conditions that follow is true when the DEP ARR function key is pushed:

- Neither an active or modified flight plan exists.
- The SEC FPLN page or SEC LEGS page shows.
- The origin or destination airport is not specified.

Path:



DEP ARR

DEP/ ARR INDEX Page

Figure 13-59 DEP/ARR INDEX Page

TPG5117_98

The DEP/ARR INDEX page shows the identifiers for the origin and destination airports for the ACT FPLN and the SEC FPLN if the airports have been entered on the respective flight plan pages. Also shown is an entry line labeled OTHER for showing departures and arrivals for an airport that is not associated with either flight plan.

When an airport identifier is entered into the scratchpad, and the DEP line select key adjacent to the OTHER legend is pushed, the CDU page changes to a DEPART page that shows SIDS and RWYS for the selected airport. These departures cannot be directly incorporated into a flight plan as they are for display only.

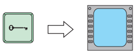
When an airport identifier is entered into the scratchpad and the ARR line select key adjacent to the OTHER legend is pushed, the CDU page changes to an ARRIVAL page that shows STARS and APPR, which includes any visual approaches, for the selected airport. These arrivals cannot be directly incorporated into a flight plan as they are for display only.

Condition(s):

The DEPART page for the origin airport shows if all of the conditions that follow are true when the DEP ARR function key is pushed:

- An active or modified flight plan exists.
- Neither the SEC FPLN page nor the SEC LEGS page is showing.
- The aircraft is on the ground.

Path:



DEP ARR → DEPART Page

Figure 13-60 DEPART Page

TPG5117_99

The DEPART page shows a list of runways and a list of SIDS, arranged in alphabetical and numerical order. From these lists, a runway and a Standard Instrument Departure (SID) can be selected. Pushing a line select key to select a runway on the DEPART page clears all other runways from the display, and the list of SIDS is restricted to those applicable to the selected runway. If, on the other hand, a SID is selected, all other SIDS are cleared from the list and only applicable runways show on the runway list.

Until the EXEC function key on the CDU is pushed, the CANCEL MOD line select key can be used to clear the pending changes. With selection of a runway or a SID, the EXEC annunciation shows to indicate the EXEC function key executes the pending flight plan changes.

After selecting either a runway or a SID, make a selection from the items remaining in the other list. After a SID has been selected, a list of en route transitions (if available) shows below the selected SID. Use the NEXT and PREV function keys on the CDU as necessary to show all the DEPART pages.

If the DEPART page is selected to show when either runway or SID has been previously selected, the DEPART page shows the selected items along with the unselected items. Selected items show at the top of the lists and the remaining items are arranged in alphabetical and numerical order.

If a selected item is incompatible with a previous selection, the previous selection is removed. For example, if a new SID is selected, but it is not associated with the previously selected runway, the runway selection is removed. If a SID is reselected, and a leg of that SID happens to be active, that leg remains in the flight plan as the active leg, with the new SID, which is preceded by a discontinuity, following the active leg.

After the departure selections are made, a push of the line select key adjacent to FPLN shows the ACT/MOD FPLN page with the selections of runway, SID, and en route transition, as appropriate. If the flight plan contains waypoints when the SID is selected and the first waypoint is not the SID exit point, a discontinuity is inserted after the SID procedure. After passing the first waypoint, the departure runway display on the first ACT/MOD FPLN page is removed and another VIA data line is added.

Condition(s):

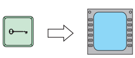
The ARRIVAL page for the ORIGIN airport shows if all of the following are true when the DEP ARR function key is pushed:

- An active or modified flight plan exists.
- Neither the SEC FPLN page nor the SEC LEGS page is showing.
- The aircraft is airborne and less than 50 NM from the origin airport or less than halfway to the destination airport.

The ARRIVAL page for the DEST airport shows if all of the following are true when the DEP ARR function key is pushed:

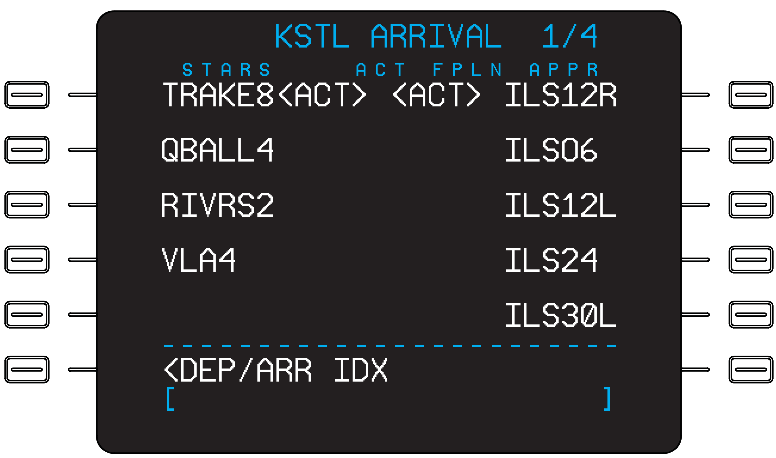
- An active or modified flight plan exists.
- Neither the SEC FPLN page nor the SEC LEGS page is showing.
- The aircraft is airborne and more than 50 NM from the origin airport or more than halfway to the destination airport.

Path:



DEP ARR ARRIVAL Page

Figure 13-61 ARRIVAL Page



TPG5118_01

The ARRIVAL page shows a list of approaches and runways, along with a list of Standard Terminal Arrival Routes (STAR). From these lists select an approach, runway, and/or a STAR. Use the NEXT or

PREV function key on the CDU as necessary to sequence through the ARRIVAL pages.

Pushing a line select key to select an approach or runway on the ARRIVAL page clears all other approaches and runways from the display, and the list of STARs shows only the STARs associated with the selected approach or runway. If a STAR is selected, it clears all other STARs from the list and only applicable runways and approaches show on the approach and runway list. After a STAR is selected, the available transitions for the chosen STAR show.

Until the EXEC function key on the CDU is pushed, use the CANCEL MOD line select key to clear the pending changes. Once the runway or SID is selected, the EXEC annunciation shows to indicate that a push of the EXEC function key executes the pending flight plan changes.

If the ARRIVAL page is selected to show when an approach, runway, or STARS has been previously selected, the ARRIVAL page shows the selected items along with the unselected items. Selected items show at the top of the lists and the remaining items show in normal order.

Select the approach, runway, and/or the STAR. If a newly selected item is incompatible with a previous selection, the previous selection is removed. For example, when a new STAR is selected, but is not associated with the previously selected approach or runway, the approach or runway selection is removed. If a STAR is reselected, and a leg of that STAR happens to be active, that leg remains in the flight plan as the active leg, with the new STAR, which is preceded by a discontinuity, following the active leg.

Changing the selection of the STAR removes the previous STAR from the flight plan. The new STAR is inserted in place of the old STAR, unless a leg of the previous STAR happens to be active. In that case, the new STAR is inserted after the active waypoint. Additionally, if the selected runway is not associated with the newly selected STAR, the runway is removed from the flight plan.

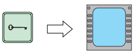
After the arrival selections are made, the associated FPLN page shows the selections of STAR, en route transition, approach procedure, runway, and runway extension, as appropriate.

The table that follows cross-references TERMINAL PROCEDURE DESIGNATION names to those shown on the CDU. For simplicity, the table lists only the root designations without the various suffix designations that define specific runways or procedure types. The CDU does show the appropriate suffix with the designations listed in the table (for example, VORA, ILS21R). Also, some circling approaches have unique names that do not follow the conventions described in the table, but they show correctly on the CDU.

TERMINAL PROCEDURE DESIGNATION	**CDU DESIGNATION**
ILS	ILS
LOC	LOC
B/C	B/C
LDA	LDA
SDF	SDF
GPS	GPS
LORAN	LRN
VOR or GPS	GVOR
VOR DME or GPS	GVOR
VOR	VOR
VOR DME	VOR
NDB or GPS	GNDB
NDB DME OR GPS	GNDB
NDB	NDB
NDB DME	NDB
IGS	IGS
TACAN	TCN
RNAV or GPS	GRNV
RNAV	RNV
VISUAL Approaches To A Runway	RW

DIR

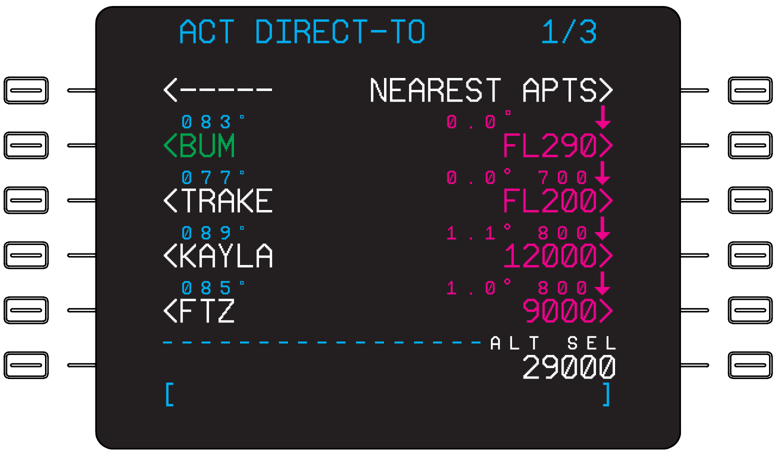
Path:



DIR

DI-
RECT-TO
Page

Figure 13-62 ACT DIRECT-TO Page



TPG5117_38

The ACT DIRECT-TO pages can consist of several pages and show a list of waypoints in the active flight plan The pilot can select a DIRECT-TO waypoint from the list, or enter any valid waypoint into the top (dashed) waypoint line as a DIRECT-TO waypoint.

NOTE

Many SIDS and STARS contain conditional waypoints that have no fixed geographical location, such as a heading to an altitude leg or a vectors leg. Although these types of waypoints show on the ACT DIRECT-TO pages, they cannot be selected for DIRECT-TO navigation.

On the right side of the DIRECT-TO pages, the pilot can enter an altitude for the waypoints shown in the list. The current preselector altitude shows in white in the lower right corner of the display.

On the ACT DIRECT-TO page, the pilot can page forward through the list of waypoints from the current TO waypoint to the last waypoint in the active flight plan, or page backward through a HISTORY list of the waypoints already passed in the flight plan. Use the NEXT function key on the CDU to page forward and the PREV function key to show the HISTORY pages.

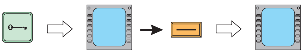
When selecting a DIRECT-TO waypoint, the FMS changes to the MOD FPLN page with the selected waypoint in the TO waypoint position. Also shown is a line key selection for an INTC CRS to the TO waypoint. If desired, change the intercept course before executing the modified flight plan.

▼ SELECTIONS:

NEAREST APTS	Selection show the NEAREST AIRPORTS page. Refer to the figure on page 13-110.

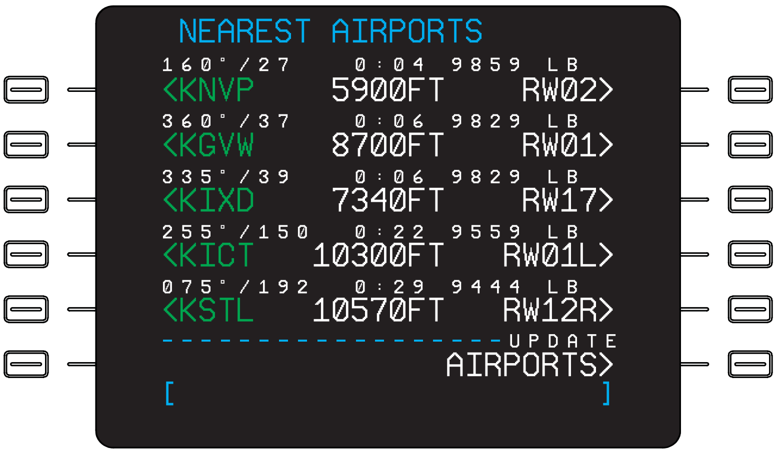
NEAREST AIRPORTS

Path:



DIR | DI-RECT-TO Page | NEAR-EST APTS | NEAR-EST AIR-PORTS Page

Figure 13-63 NEAREST AIRPORTS Page



TPG5117_39

The NEAREST AIRPORTS page shows a list of five airports that includes the departure (ORIGIN) and arrival (DEST) airports, as well as three other airports that are closest to the present position of the aircraft. If the origin and destination airports are the same, the list shows the four closest airports along with the ORIG/DEST airport. If no ORIG or DEST airport is defined in the active flight plan, the list shows the five closest airports.

The closest airports are listed by the ICAO airport identification code, and are arranged in order of increasing distance from the present position of the aircraft. If two or more airports are equidistant from the aircraft, the airports are listed in order of increasing course change required to proceed to the airport (for example, the airport that requires the lesser course change is listed first).

For each airport, the NEAREST AIRPORTS page shows the bearing and distance from the present position of the aircraft to the airport reference point, the ETE, the fuel remaining at the destination, the designation of the longest runway (for example, RWY23, RWY03L), and the length of the longest runway. If more than one runway is the longest at the airport (same length), the runway is chosen by alphabetical order.

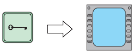
The pilot can select between setting a direct course to the Airport Reference Point (ARP) or the runway extension point of the longest runway for a visual approach. If the pilot chooses the ARP, the FMS calculates the course and distance to the ARP for the modified flight plan. The FMS does not include any STARs or runways associated with the airport, nor does it include any VNAV constraints associated with the airport.

If the pilot selects the longest runway for the direct-to course, the FMS calculates the course and distance to the runway extension point for a visual approach, and includes the VNAV constraint associated with the visual approach in the modified flight plan. The FMS also inserts the selected runway for a RWY type approach.

The NEAREST AIRPORTS page shows the airports closest to the present position of the aircraft when the page is first shown. The FMS does not automatically update the page based on the current position of the aircraft while the NEAREST AIRPORTS page shows. To have the FMS recalculate the closest airports for the new position, push the line select key next to the UPDATE AIRPORTS prompt on the NEAREST AIRPORTS page.

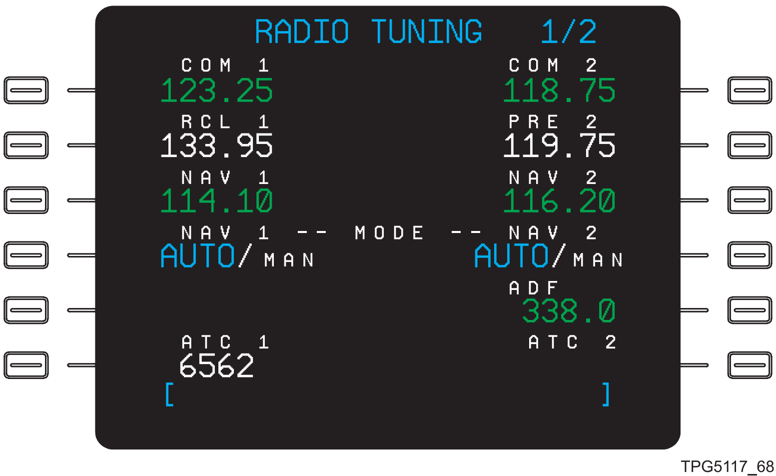
TUN

Path:



TUN → RADIO TUNING 1/2 Page

Figure 13-64 RADIO TUNING 1/2 Page



The RADIO TUNING 1/2 page shows:

- Currently selected frequencies for the COM, NAV, and ADF radios
- NAV radio tuning mode (AUTO/MAN)
- STANDBY annunciation for the active transponder when it is set to the STANDBY mode.

NOTE

If the aircraft has a dual FMS system installed (two FMCs), Radio Tuning Unit (RTU) capabilities are only available on the left CDU.

▼ SELECTIONS:

COMx	The COMx (COM1, COM2) line select key is used to enter a frequency for the appropriate COM radio.

NAVx	The NAVx (NAV1, NAV2) line select key is used to enter a frequency for the appropriate NAV radio.
NAVx MODE	The NAVx (NAV1, NAV2) MODE line select key selects the AUTO or MAN tuning mode for the NAV radios. The selected mode shows in large cyan text. The unselected mode shows in small white text.
ATCx	The ATCx (ATC1, ATC2) line select key is used to enter the ATC beacon code.

Path:

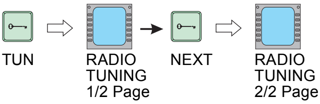


Figure 13-65 RADIO TUNING 2/2 Page

TPH6992_25

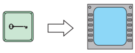
The RADIO TUNING 2/2 page shows the FLIGHT ID code and currently tuned ADF frequencies.

▼ SELECTIONS:

FLIGHT ID	The FLIGHT ID line select key is used to enter the Flight Identification code. Up to 8 characters can be entered for the FLIGHT ID code.
ADFx	The ADFx (ADF1, ADF2) line select key is used to enter a frequency for the appropriate ADF radio.

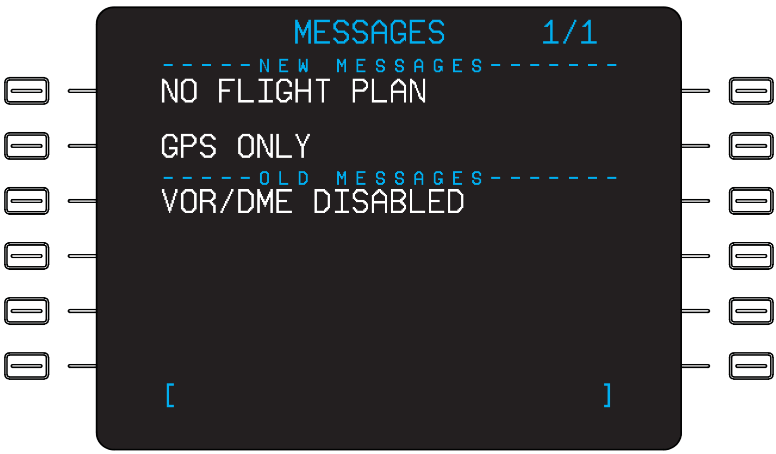
MSG

Path:



MSG → MES-SAGES Page

Figure 13-66 MESSAGES Page



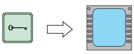
The MESSAGES page shows new and old FMS messages. Push the MSG key while the MESSAGES page is showing to return to the CDU display mode that was showing before the MESSAGES display mode was selected. Refer to the MESSAGES AND ANNUNCIATORS chapter for detailed descriptions of the messages that show on the MESSAGES page and message line.

MFD MENU

Condition(s):

When the MFD MENU function key is pushed and the MFD is in map display mode (as set by the MFD DATA function key), the MAP DISPLAY version of the DISPLAY MENU page shows.

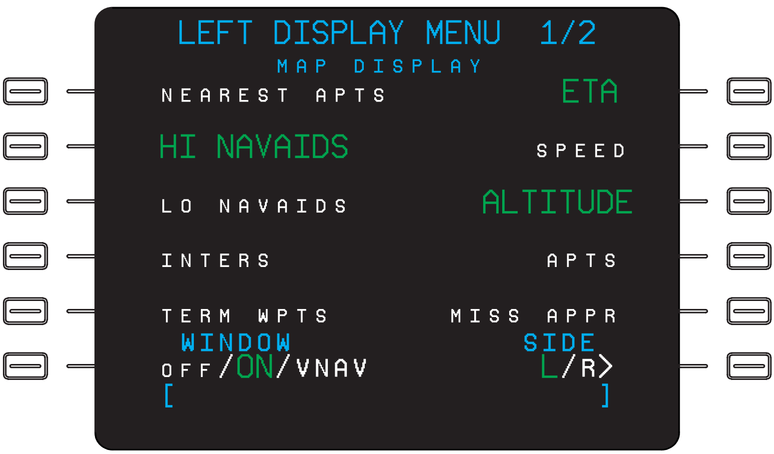
Path:



MFD MENU

DISPLAY MENU 1/2 Page

Figure 13-67 MAP DISPLAY 1/2 Page



The MAP DISPLAY menu pages are used to control the display of airports, navigation facilities, and other navigation-related display elements on the MFD. Any number or combination of items in the menu can show on the MFD (up to the limit specified for MAX MAP SYMBOLS on the DEFAULTS page). Selected items show in large green font, unselected items show in small white font.

▼ SELECTIONS:

NEAREST APTS	Shows the origin and destination airports, and the three airports closest to the present position of the aircraft. The data is continuously updated. However, if the CDU is showing the NEAREST AIRPORTS page, the five airports shown on the MFD match the five airports listed on the CDU page.
HI NAVAIDS	Shows the high altitude navaids.
LO NAVAIDS	Shows the low altitude navaids.
INTERS	Shows intersections.
TERM WPTS	Shows terminal waypoints.
WINDOW	When ON or VNAV is selected, a four-line text display of navigation progress data shows at the top of the MFD when the MFD is set to the PPOS MAP or PLAN MAP display modes. Selecting OFF returns the display to a windowless format. Each push of the line select key selects the next option (OFF, ON, VNAV) in order.
ETA	Selection shows the ETA adjacent to waypoints, intersections, or navaids.
SPEED	Selection shows the current speed adjacent to waypoints, intersections, or navaids.
ALTITUDE	Selection shows reference altitude data adjacent to waypoints, intersections, or navaids.

APTS	Selection shows airports.
MISS APPR	Selection shows the plan path for the published missed approach procedure (based upon the approach selected on the ARRIVAL page).
SIDE	Selection determines which MFD (left side or right side) the CDU is controlling

Path:

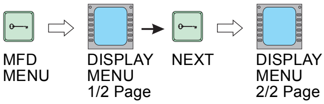


Figure 13-68 MAP DISPLAY 2/2 Page

TPG5118_12

▼ SELECTIONS:

NDBS	Selection shows non-directional beacons.
RNG: ALT SEL	Selection shows the arc symbols for range to altitude along the flight path to indicate where the aircraft will reach the altitude preselector altitude.
LRN POS	Selection shows the LRN sensor position symbol.
ALTN FPLN	Selection shows the alternate flight plan route on the MFD PLAN MAP.

▲

Condition(s):

When MFD MENU function key is pushed and the MFD is in text display mode (as set by the MFD DATA function key), the TEXT DISPLAY version of the DISPLAY MENU page shows.

Path:

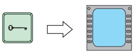
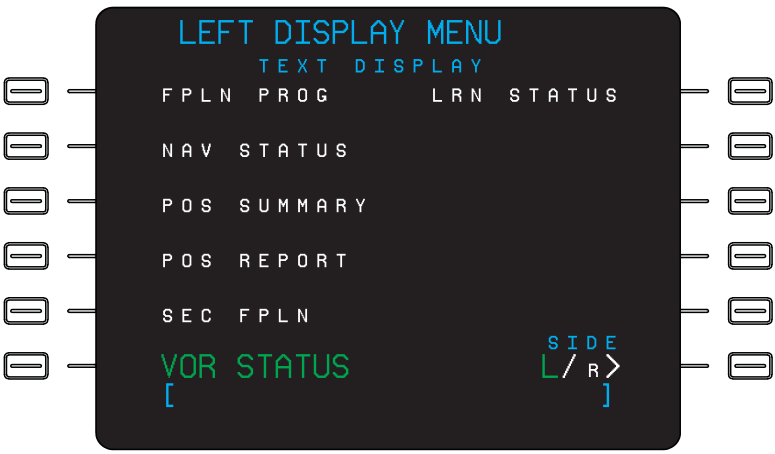


Figure 13-69 TEXT DISPLAY Page



TPH6992_22

The TEXT DISPLAY menu shows a list of text page display modes for the MFD. Text pages show on the MFD when the text mode is selected with the MFD DATA function key. Each MFD can show only one text page at a time, therefore, only one menu item can be selected at any time for each MFD. Selected menu items show in large green font, unselected menu items show in small white font.

NOTE

FMS text pages cannot be shown on the MFD while the PFD is in MAP mode.

▼ SELECTIONS:

FPLN PROG	Selects the ACT FPLN PROGRESS page for display. The ACT FPLN PROGRESS page shows DIST, ETA, and FUEL information for the waypoints in the flight plan. Refer to the figure on page 13-142.
NAV STATUS	Selects the NAV STATUS page for display. The NAV STATUS page shows navigation information for the TO waypoint. Refer to the figure on page 13-146.
POS SUMMARY	Selects the POSITION SUMMARY page for display. The POSITION SUMMARY page shows the navigation sensors in use and their position differences relative to the FMS current position. Refer to the figure on page 13-148.
POS REPORT	Selects the POSITION REPORT page for display. The POSITION REPORT page shows all information needed for making position reports, which includes waypoints, times, fuel and weather information. Refer to the figure on page 13-150.
SEC FPLN	Selects the SEC FPLN page for display. The SEC FPLN page shows DIST, ETA, and FUEL for the second flight plan. Refer to the figure on page 13-152.
VOR STATUS	Selects the VOR STATUS page for display. The VOR STATUS page shows VOR/DME navigation information to include the identifier, frequency, and bearing and distance data. Refer to the figure on page 13-154.

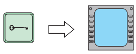
LRN STATUS	Selects the LRN STATUS page for display. The LRN STATUS page shows status information for the long-range navigation sensors. Refer to the figure on page 13-156.
SIDE	Selection determines which MFD (left side or right side) the CDU is controlling.

MFD ADV

Condition(s):

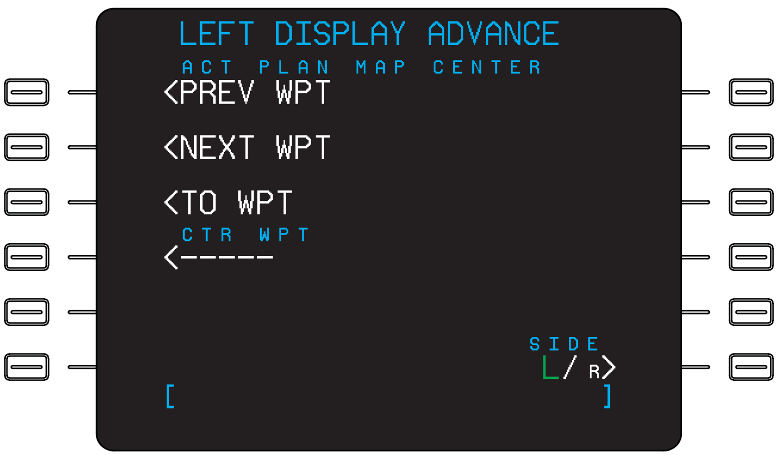
When MFD ADV function key is pushed and the MFD is in map display mode (as set by the MFD DATA function key), the PLAN MAP CENTER version of the DISPLAY ADVANCE page shows.

Path:



MFD ADV → DISPLAY ADVANCE Page

Figure 13-70 DISPLAY ADVANCE Page — PLAN MAP CENTER



TPG5117_17

The PLAN MAP CENTER version of the DISPLAY ADVANCE page is used to move the center waypoint on the MFD PLAN MAP.

▼ SELECTIONS:

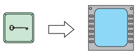
PREV WPT	Selects the previous waypoint (PREV WPT) in the flight plan as the center point of the MFD PLAN MAP.
NEXT WPT	Selects the next waypoint (NEXT WPT) in the flight plan as the center point of the MFD PLAN MAP.

TO WPT	Select the current TO waypoint in the flight plan as the center point of the MFD PLAN MAP.
CTR WPT	Used to enter any valid waypoint as the center of the MFD PLAN MAP. The waypoint does not have to be a waypoint in the flight plan.

Condition(s):

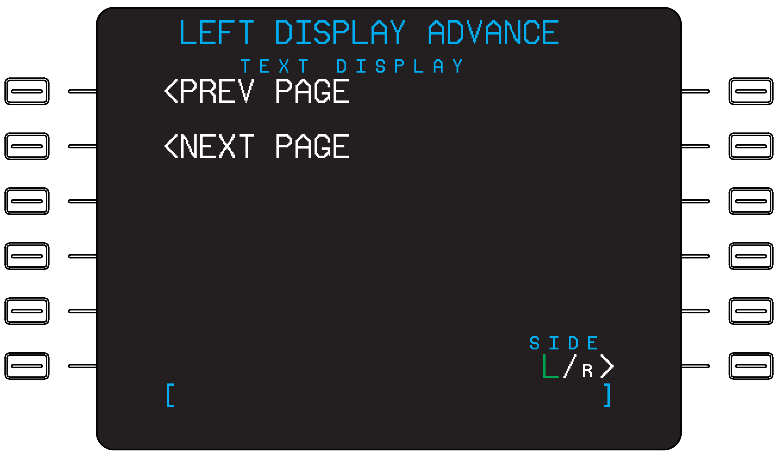
When MFD ADV function key is pushed and the MFD is in text display mode (as set by the MFD DATA function key), the TEXT DISPLAY version of the DISPLAY ADVANCE page shows.

Path:



MFD ADV → DISPLAY ADVANCE Page

Figure 13-71 DISPLAY ADVANCE Page — TEXT DISPLAY



TPG5118_14

The TEXT DISPLAY version of the DISPLAY ADVANCE page is used to change the text page shown on the MFD. The TEXT DISPLAY selections can only change the pages within the selected text page. If another type of text page is desired, push the MFD MENU key to show the MFD MENU page, then select the desired text display. The MFD DISPLAY ADVANCE menus affect the text pages of the left MFD or right MFD according to the selection of the SIDE L/R selection.

▼ SELECTIONS:

PREV PAGE	Selects the previous page (PREV PAGE) of the selected text display.

NEXT PAGE	Selects the next page of the selected text display.

MFD DATA

Figure 13-72 MFD DATA Mode — TEXT DISPLAY Page

TPG5118_14

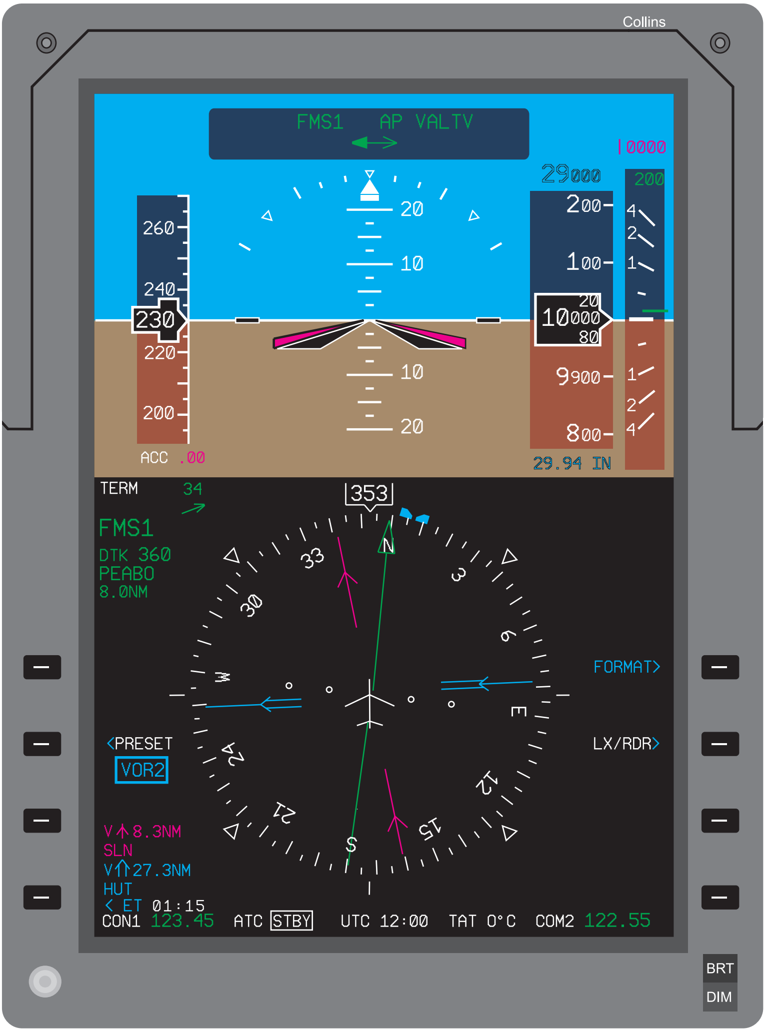
In a dual FMC system with a single MFD, an MFD DATA key push on either CDU causes the FMC to direct a toggle between a map display or a text display, provided the MFD is capable at that time of displaying remote text. The text page to be shown is chosen from the DISPLAY MENU page (refer to the figure on page 13-120), which is accessed via the MFD MENU function key. A second push of the MFD DATA key causes the MFD to return to the format that was active before the MFD DATA key was pushed.

NOTE

FMS Text pages cannot be shown on the MFD while the PFD is in MAP mode.

PFD DISPLAYS

Figure 13-73 Typical PFD Display



TPH6993_01

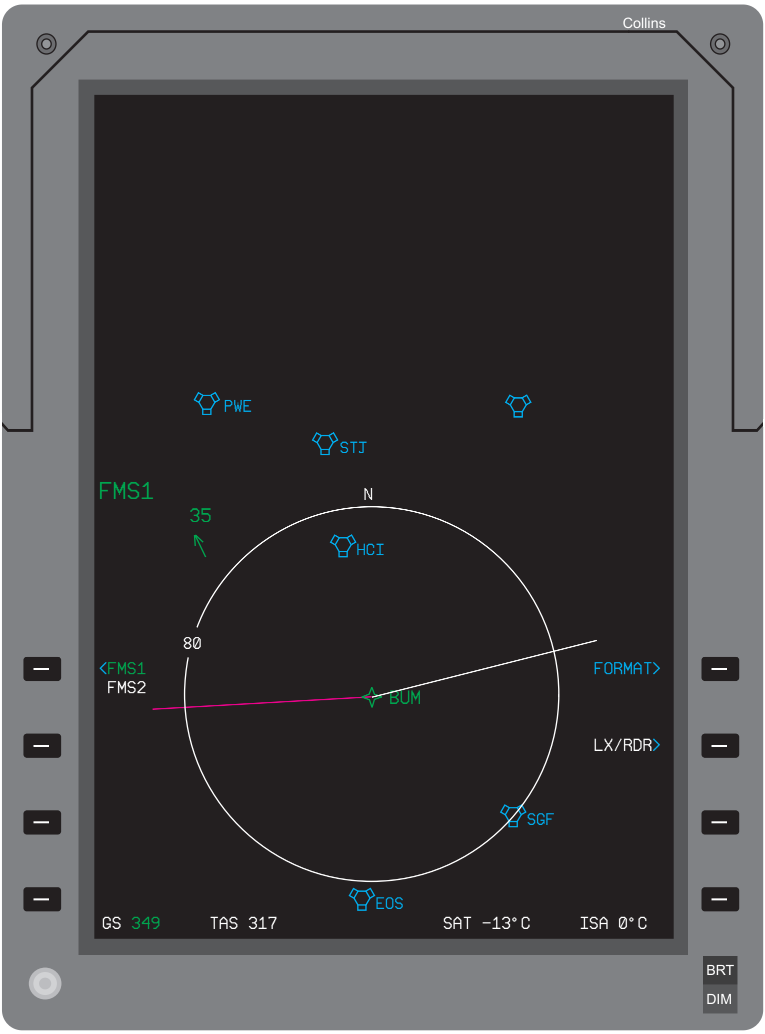
This section describes only the generic elements of the PFD that are related to or used by the FMS.

A PFD display shows the following information related to FMS operations:

- NAV source annunciation.
- TO waypoint identifier annunciation.
- Course/deviation bar.
- Distance to the TO waypoint in nautical miles.
- Course to the TO waypoint.
- NAV to NAV Capture Preview function.
- VNAV altitude mode and constraint annunciations, along with vertical deviation and vertical speed advisories. Refer to the Principles of VNAV chapter for further information on VNAV functions.
- Two message lines for FMS annunciations and messages.

MFD DISPLAYS

Figure 13-74 Typical MFD Display



TPG5118_16

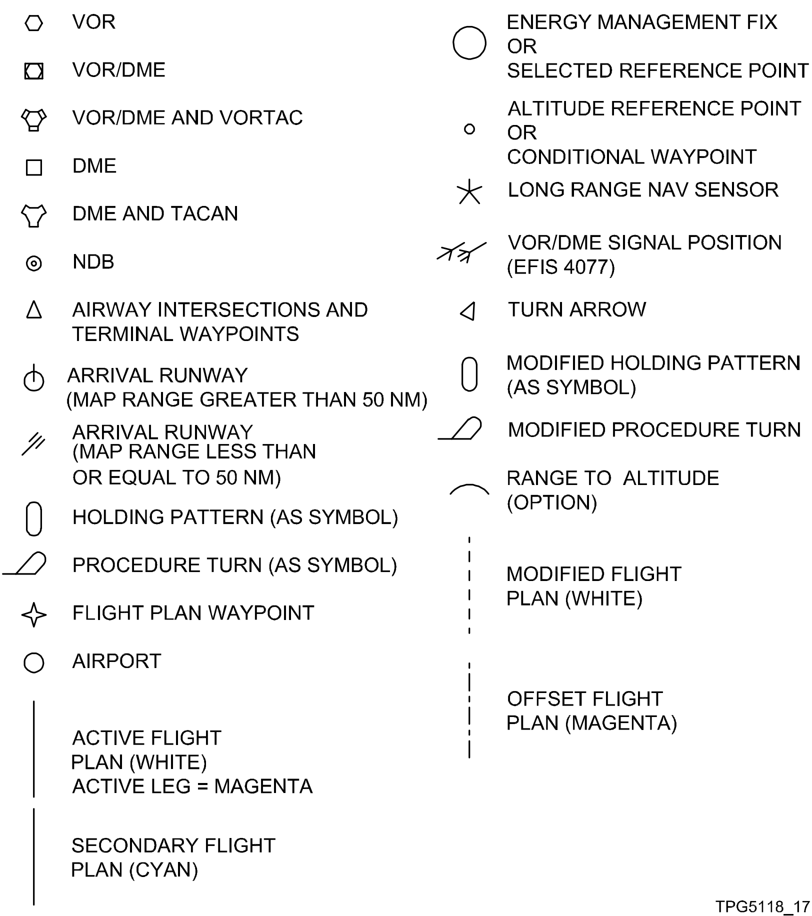
This section describes only the display elements of MFD displays that show information related to or used by the FMS. Adaptive Flight Display (AFD) panels are used for both PFD and MFD displays. Normally, the center AFD is used for the MFD display. In certain cases, such as failure of the center AFD, by using a display reversion switch, the MFD display information for engines and TCAS can show on the pilot's PFD, but no FMS information shows.

MFD MAP DISPLAYS

Condition(s):

The MFD DATA function key is used to alternately switch display modes between the MAP DISPLAY and TEXT DISPLAY on the MFD and CDU when the MFD MENU page is selected.

Figure 13-75 MFD Map Symbols



The MFD DATA key is used to alternately switch display modes between the MAP DISPLAY and TEXT DISPLAY on the MFD and CDU when the MFD MENU page is selected on the CDU. In dual FMS installations, the MFD DATA key toggles between the map and text pages of the same-side MFD. For FMS functions, the MFD shows the PPOS MAP, PLAN MAP, and TEXT display modes. In the PPOS MAP and PLAN MAP display modes, symbols are used to identify and show the various navigation facilities in relation to the current position of the aircraft (PPOS MAP) or a selected waypoint along the flight plan (PLAN MAP). Also shown in these display modes are:

- Track for the active flight plan (shown as a solid white line)
- Track for a modified flight plan (shown as a dashed white line)
- Track for the second flight plan (shown as a solid cyan line)
- Track for the missed approach preview (shown in cyan)
- Any parallel offset track (shown as a dashed magenta line)
- The TO waypoint (shown in magenta)
- Runways (shown by two different symbols which depends on the selected display range)
- Holding patterns (shown as racetracks that change size relative to the speed of the aircraft and the distance or time base for the hold)
- Special turns from a SID or STAR
- A cyan circle around a selected fix reference point
- A conditional waypoint, which shows in white, created from a reference fix
- Speed, altitude and ETA waypoint data (shows next to each flight plan waypoint)
- A VOR/DME signal position indicator for a currently tuned navaid (only shows in the PPOS MAP display mode)
- Five-pointed star symbols to show the position determination of each LRN sensor relative to the FMS position, which is the aircraft symbol, and each other (only shows in the PPOS MAP display mode).

The symbols that show on the MFD in the PPOS MAP and PLAN MAP modes are selected from the MFD DISPLAY MENU on the CDU. In both the PPOS MAP and PLAN MAP display modes, the number of symbols shown on the MFD is limited to 40 of all types. The number of map symbols selected for display is set on the DEFAULTS 1/3 page. The figure on page 13-132 shows the map symbols that show on the PPOS MAP and PLAN MAP display modes. Map symbols are selected for display based on the following priorities:

- High altitude navaids (HI NAVAIDS)

- Low altitude navaids (LO NAVAIDS)
- Intersections (INTERS)
- NDBs (NDBS)
- Airports (APTS)
- Terminal waypoints (TERM WPTS).

Map symbols selected on the DISPLAY MENU show approximately in order of distance from the reference point of the map. The prioritization of symbols causes the selected highest priority items that are closest to the map reference point to be shown first, for example, HI NAVAIDS take priority over INTERS if both are selected for display. The selection continues at expanding ranges until either the total count has been reached, or all highest priority selected items within the map range have been included. If the total number of display symbols has not yet been reached, the FMS continues to display items based on priorities until the maximum count is attained, or all available data has been included for the map. The FMS fills the map display using the MAX MAP SYMBOLS setting on the DEFAULTS page, the display hierarchy described previously, and the range selected for the map display.

Even when selected for display, not all symbols show for all display ranges. The following is a list of the symbols and the ranges at which they show on the MFD.

- HI NAVAIDS — Show at all display ranges
- LO NAVAIDS — Show at all display ranges
- INTERS — Show at ranges of 50 NM or less
- NDBS — Show at ranges of 50 NM or less
- APTS — Show at all display ranges
- TERM WPTS — Show at map ranges of 25 NM or less.

MFD PRESENT POSITION (PPOS) MAP

Condition(s):

The PPOS MAP display mode is selected with the FORMAT line select key on the MFD.

Figure 13-76 MFD PPOS MAP Display

TPG5118_18

The PPOS MAP display mode is a heading up display page with the airplane symbol located just below the middle of the display and two range rings centered on the airplane symbol.

The PPOS MAP display mode shows in one of three ways: without a navigation progress data window, with a navigation progress data window, or with VNAV or Advisory VNAV data included in the progress window. The WINDOW line select key on the MFD MENU page on the CDU selects what shows on the PPOS MAP.

The navigation data progress window at the top of the MFD in the PPOS MAP display mode shows, when activated:

- LAST waypoint passed, the distance from the last waypoint, and the time of passage
- TO waypoint, the distance and time-to-go to the waypoint, and the ETA at the waypoint
- NEXT waypoint after the TO waypoint, the distance and time-to-go to the waypoint, and the ETA at the waypoint
- DEST (destination) airport, the distance and time-to-go to the destination, and the ETA at the destination
- FUEL available at the destination airport
- GW of the aircraft at the destination airport
- If the FMS is set to MANUAL fuel flow and ground speed for the performance calculations, the annunciation MANUAL shows.

Figure 13-77 MFD PPOS Map With NAV Window

TPG5118_19

When the VNAV display option is selected, VNAV window data shows above the present position and plan maps. Selecting VNAV clears destination airport fuel and gross weight information, and the ETA column from the display. Vertical data relating to the next VNAV climb or descent in the flight plan replaces fuel, GW, and ETA data, and is separated from the progress data by a vertical dotted line.

When VNAV display option is selected, the next altitude constraint in the flight plan shows. If the next constraint is a climb, the VNAV window displays CLIMB, the constraint altitude, the waypoint name, and time and distance to the constraint waypoint. If there are no down track climb constraints and the aircraft is not close to a Top Of Descent (TOD), the VNAV window is blank.

The TOD line shows when the distance to TOD is less than 50 NM or 20% of the total flight plan distance, whichever is less, but not less than 20 NM. The next descent altitude constraint and time and distance to that point also show along with the TOD line. If the aircraft begins an early descent before the TOD would normally be shown, the next altitude constraint information shows, but the TOD line does not because it is no longer relevant.

For descents, the VNAV window gives vertical Direct-To information when the required minimum descent rate exceeds 100 FPM. The descent window shows the vertical speed required and VPA to fly directly to the next altitude constraint while following the flight plan, as well as the waypoint information previously described.

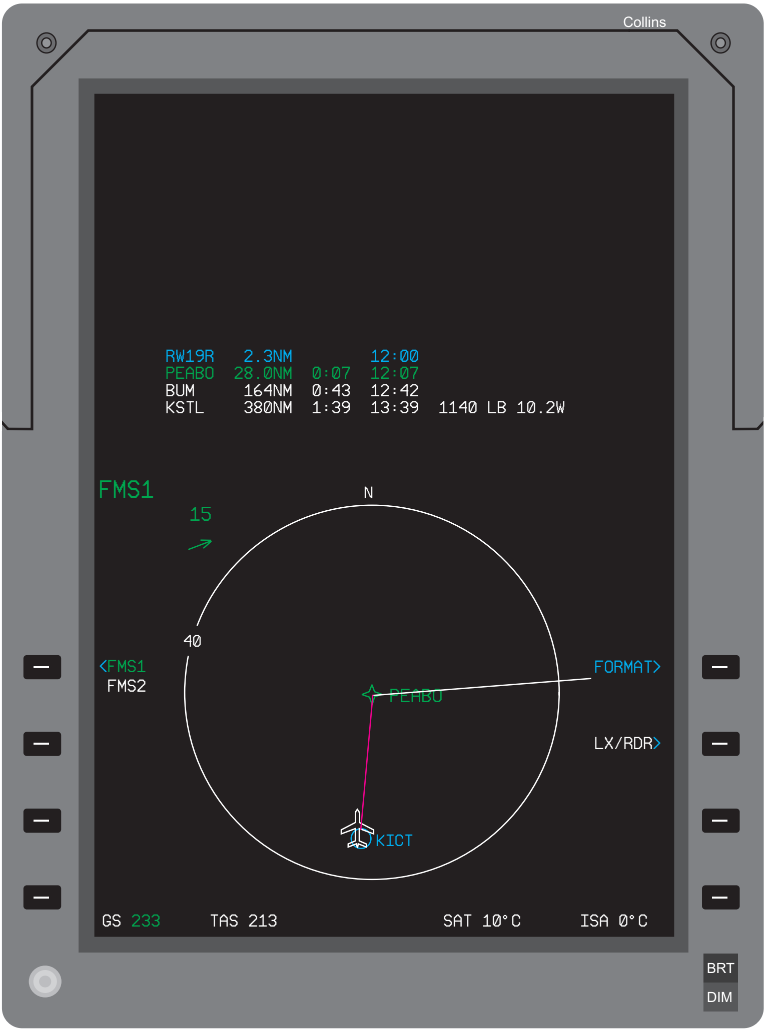
If there are no further altitude constraints, the VNAV data window is blank. However, if the aircraft has not begun descent to the destination airport, DES ADVISORY with a time and distance to a recommended descent point appears in the window. This point is based on following a descent profile that has the aircraft arriving at 1500 FT AGL not later than 10 NM from the destination airport.

MFD PLAN MAP

Condition(s):

The PLAN MAP display mode is selected with the FORMAT line select key on the MFD.

Figure 13-78 MFD PLAN MAP Display



TPG5117_74

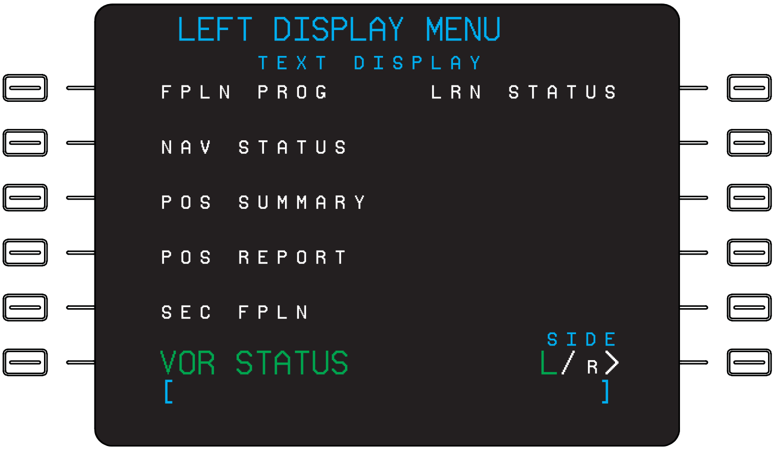
The PLAN MAP display shows a north up map centered on a selected waypoint. If there is no active flight plan, the map center is aircraft present position. If the flight plan shown on the CDU is the active or second flight plan, the first waypoint of the respective flight plan is the center waypoint, unless otherwise selected on the CDU. Use the CDU DISPLAY ADVANCE page to move the center waypoint on the MFD.

MFD TEXT DISPLAYS

Condition(s):

The MFD DATA function key is used to select either the MAP DISPLAY or TEXT DISPLAY mode on the MFD, and on the CDU when the MFD MENU page is selected.

Figure 13-79 TEXT DISPLAY Page



TPH6992_22

The TEXT DISPLAY mode shows various pages of text related to FMS functions. The TEXT DISPLAY selections and the corresponding MFD display page include:

- FPLN PROG — FMS ACT FPLN PROGRESS
- NAV STATUS — FMS NAV STATUS
- POS SUMMARY — FMS POSITION SUMMARY
- POS REPORT — FMS ACT POS REPORT
- SEC FPLN — FMS SEC FPLN
- VOR STATUS — VOR/DME STATUS
- LRN STATUS — LRN STATUS.

NOTE

FMS text pages cannot be shown on the MFD while the PFD is in MAP mode.

FMS ACT FPLN PROGRESS

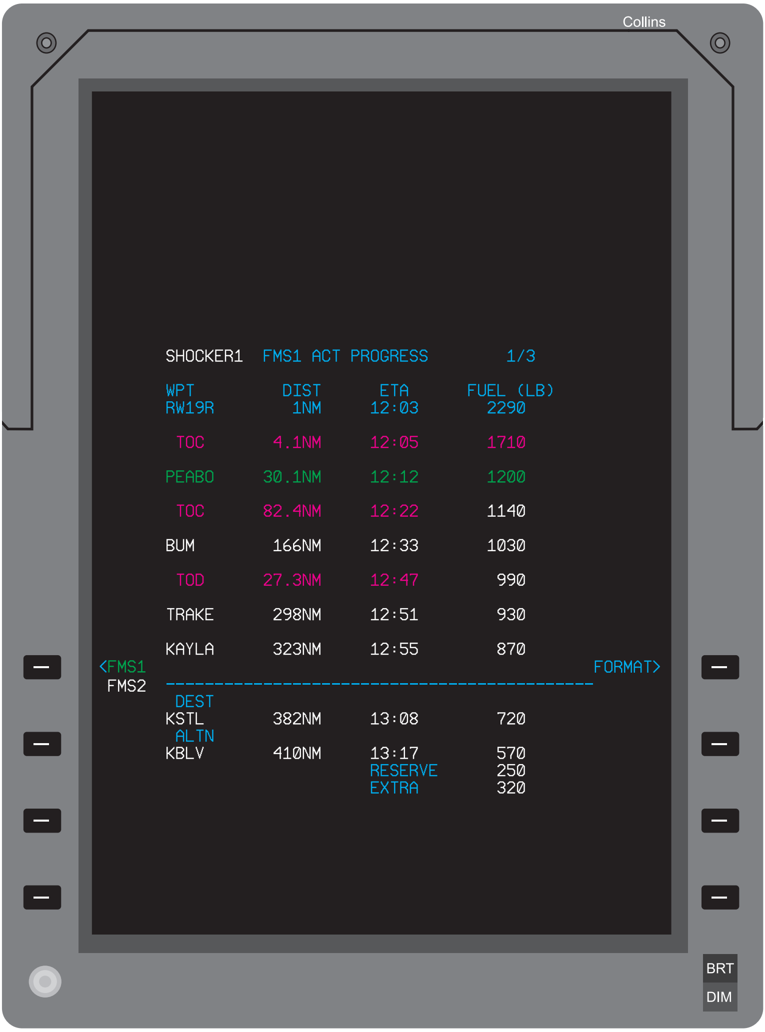


Figure 13-80 FMS ACT FPLN PROGRESS Page

TPG5118_22

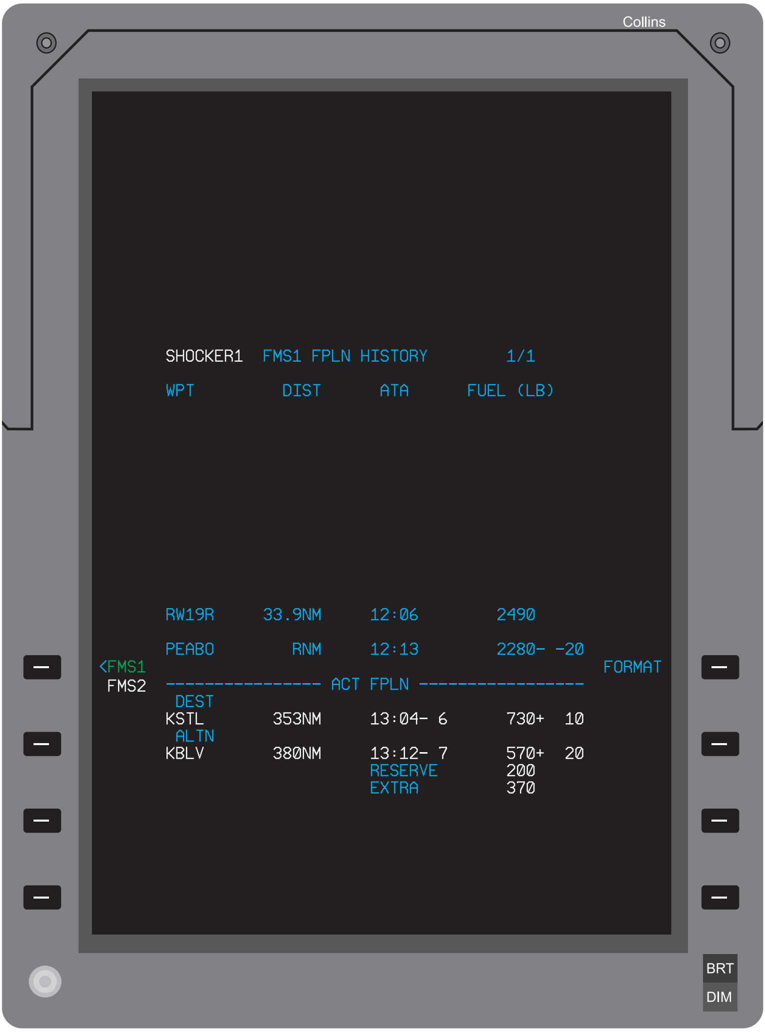
The FMS ACT FPLN PROGRESS text page on the MFD shows:

- Last waypoint passed
- Active TO waypoint

- A sequence of waypoints following the TO waypoint
- Destination (DEST) airport
- Alternate (ALTN) airport
- RESERVE FUEL
- EXTRA FUEL.

FMS FPLN HISTORY

Figure 13-81 FMS ACT FPLN HISTORY Page



TPG5118_23

The FPLN HISTORY page shows the waypoints that have been passed as well as:

- Distance (DIST) in nautical miles from the waypoint

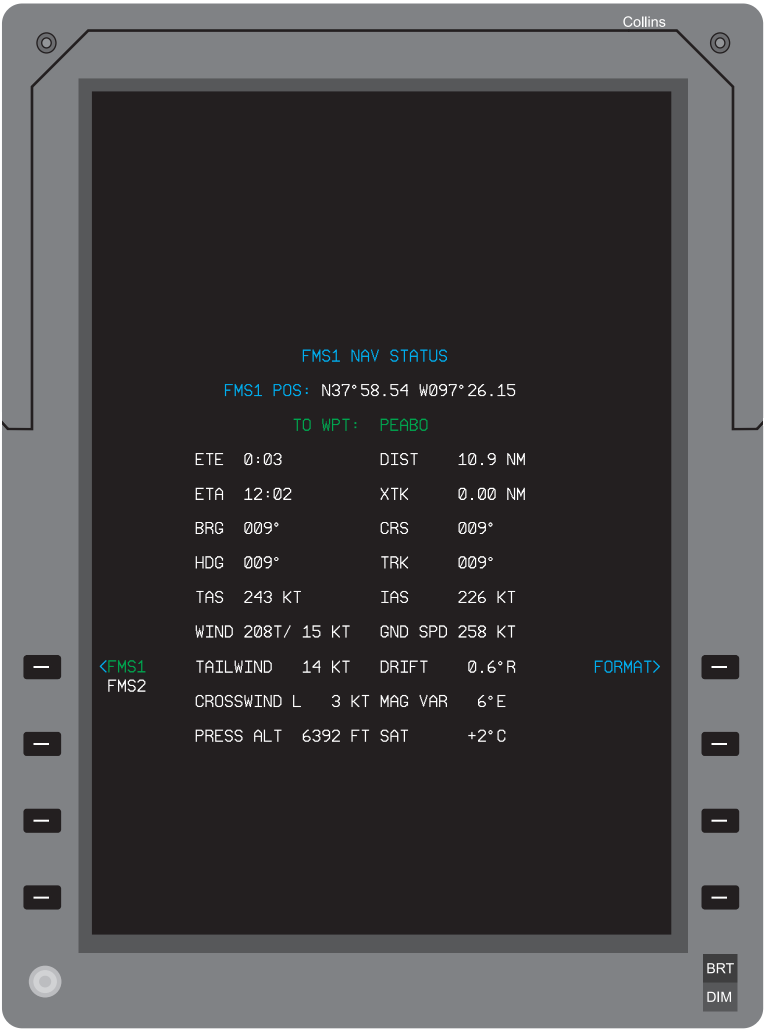
- Actual Time of Arrival (ATA) for the waypoints
- Predicted remaining FUEL at the waypoints.

The FPLN HISTORY page also shows DEST, ALTN, RESERVE FUEL, and EXTRA FUEL.

The FPLN HISTORY page is accessed from the FMS ACT FPLN PROGRESS page. With the FMS ACT FPLN PROGRESS text page showing on the MFD, push the MFD ADV function key to show the TEXT DISPLAY version of the DISPLAY ADVANCE page (refer to the figure on page 13-125). Push either the PREV PAGE or NEXT PAGE line select key as many times as necessary to show the FPLN HISTORY page.

FMS NAV STATUS

Figure 13-82 FMS NAV STATUS Page



TPG5118_24

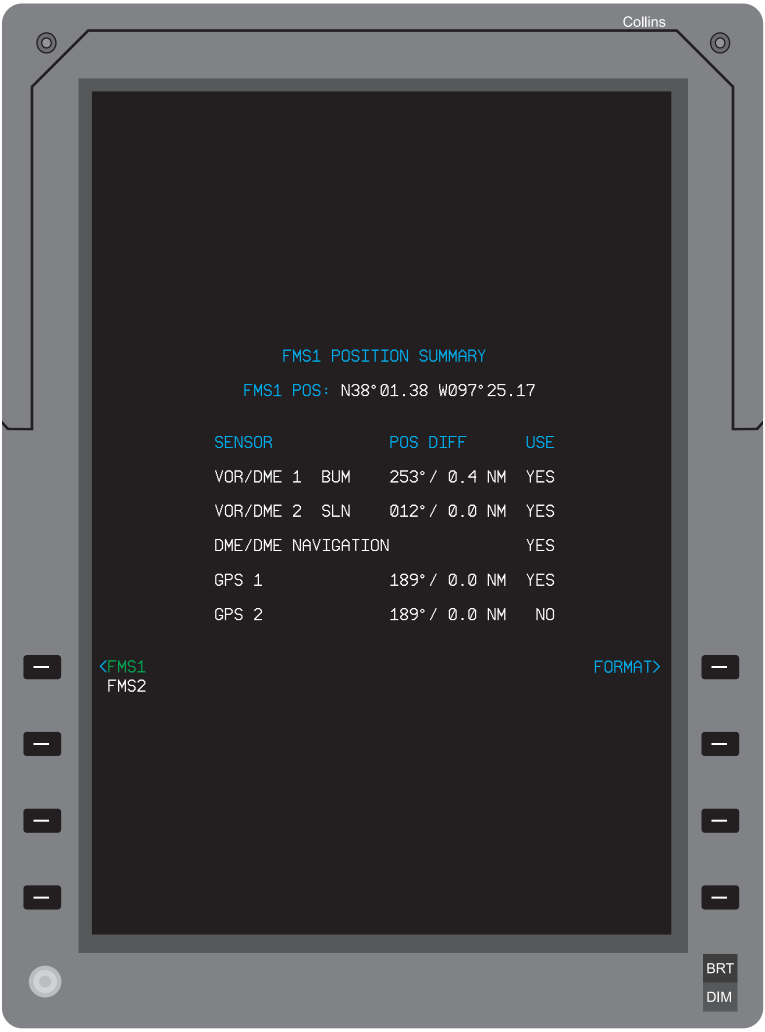
The FMS NAV STATUS text page on the MFD shows:

- FMS current latitude/longitude position
- TO waypoint

- ETE
- DIST (distance to go)
- ETA
- XTK (Cross Track position (L or R) and distance)
- BRG (bearing)
- CRS (course)
- HDG (heading)
- TRK (track)
- TAS
- IAS
- WIND direction and speed
- GND SPD
- HEADWIND/TAILWIND speed
- DRIFT in degrees and direction (L or R)
- CROSSWIND direction (L or R) and speed
- MAG VAR (magnetic variation)
- PRESS ALT (pressure altitude)
- SAT (static air temperature).

FMS POSITION SUMMARY

Figure 13-83 FMS POSITION SUMMARY Page



TPG5118_25

The FMS POSITION SUMMARY text page on the MFD shows:

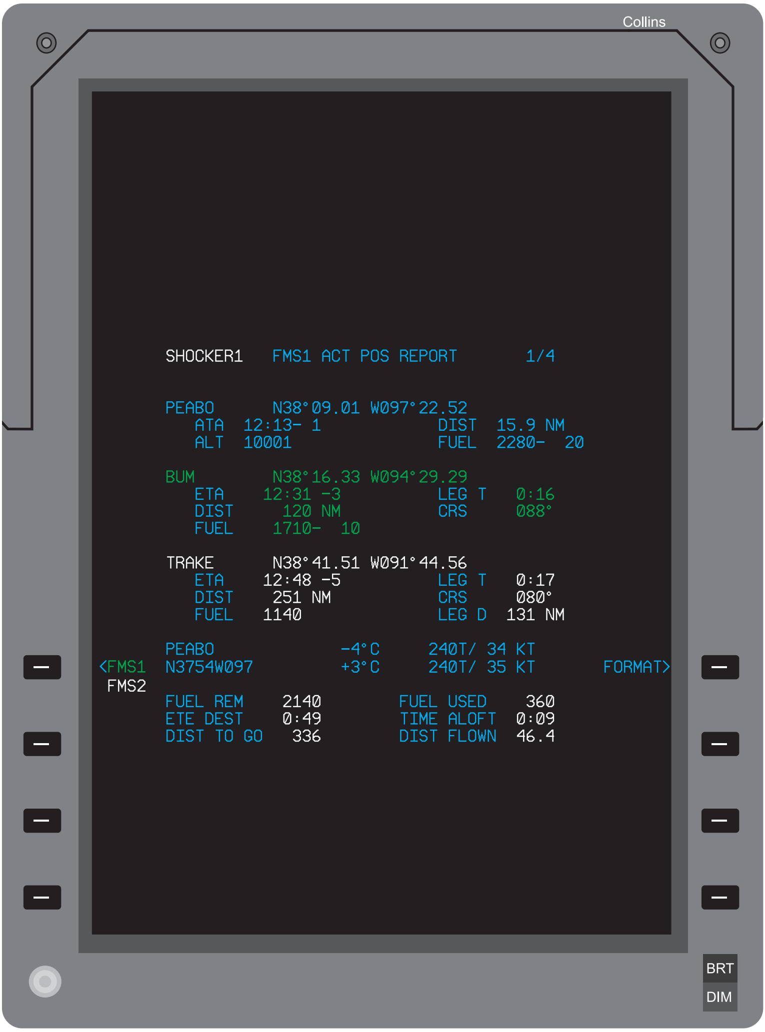
- FMS latitude and longitude position (POS)
- Each of the navigation sensors installed in the aircraft (SENSOR)

- Position difference (POS DIFF) as bearing and distance for each sensor as appropriate
- USE of each sensor in the navigation solution — YES, NO, or DIS (disabled).

The POS DIFF is in radial and distance format, and is measured from the FMS position to the sensor position. The USE annunciation indicates the current status of the sensors in use by the FMS to determine position. YES indicates a sensor is in use, NO indicates it is not in use, and DIS indicates the sensor is disabled for use by the FMS.

FMS ACT POS REPORT

Figure 13-84 FMS ACT POS REPORT Page



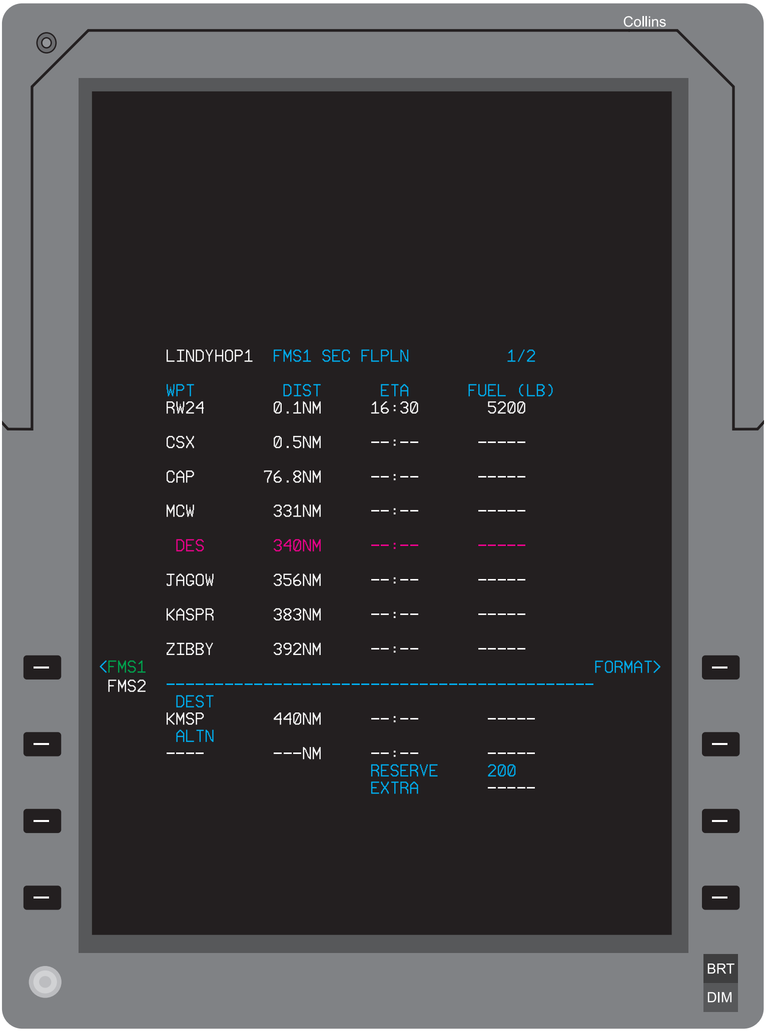
TPG5118_26

The FMS POSITION REPORT page shows the information, which includes waypoints, times, fuel, and weather information, needed to make position reports:

- FROM waypoint, latitude and longitude coordinates, Actual Time of Arrival (ATA), altitude at crossing (ALT), distance from that point (DIST), and fuel at the point (FUEL)
- TO waypoint, coordinates, Estimated Time of Arrival (ETA), distance to the point (DIST), estimated fuel (FUEL), leg time in minutes (LEG T), and course (CRS)
- NEXT waypoint with coordinates, ETA, distance (DIST), fuel (FUEL), leg time (LEG T), course (CRS), and leg distance (LEG D)
- Meteorological report information with temperature and winds aloft information for the FROM waypoint just passed, and the temperature and winds aloft for the midpoint between the previous waypoint and the FROM waypoint
- Fuel remaining (FUEL REM)
- Estimated Time En Route to the destination (ETE DEST)
- Distance to go (DIST TO GO)
- FUEL USED
- TIME ALOFT
- DIST FLOWN.

FMS SEC FPLN

Figure 13-85 FMS SEC FPLN Page

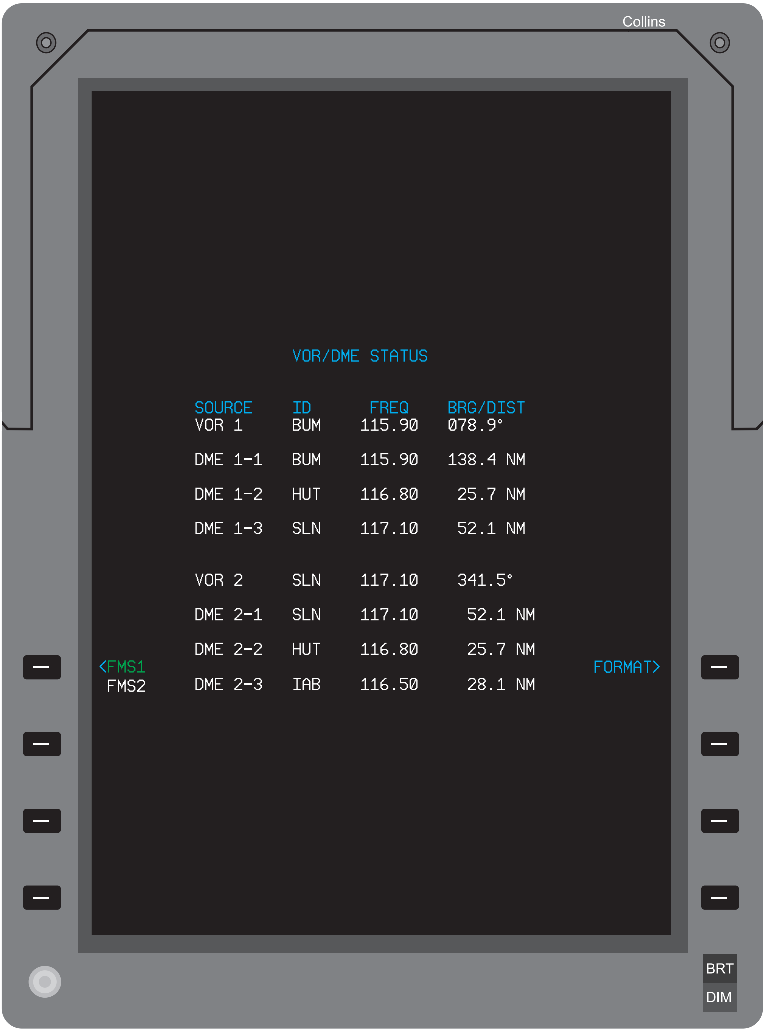


TPH6993_02

The FMS SEC FPLN page shows WPT, DIST (distance to the next waypoint), ETE, and FUEL at each waypoint for the SEC FPLN. ETE and fuel remaining remain blank until the SEC FPLN is activated. Distance to the destination airport for the SEC FPLN and any specified alternate shows at the bottom of the page, with ETE and fuel information remaining blank until the SEC FPLN is activated.

VOR/DME STATUS

Figure 13-86 VOR/DME STATUS Page



TPG5118_28

The VOR/DME STATUS text page on the MFD shows:

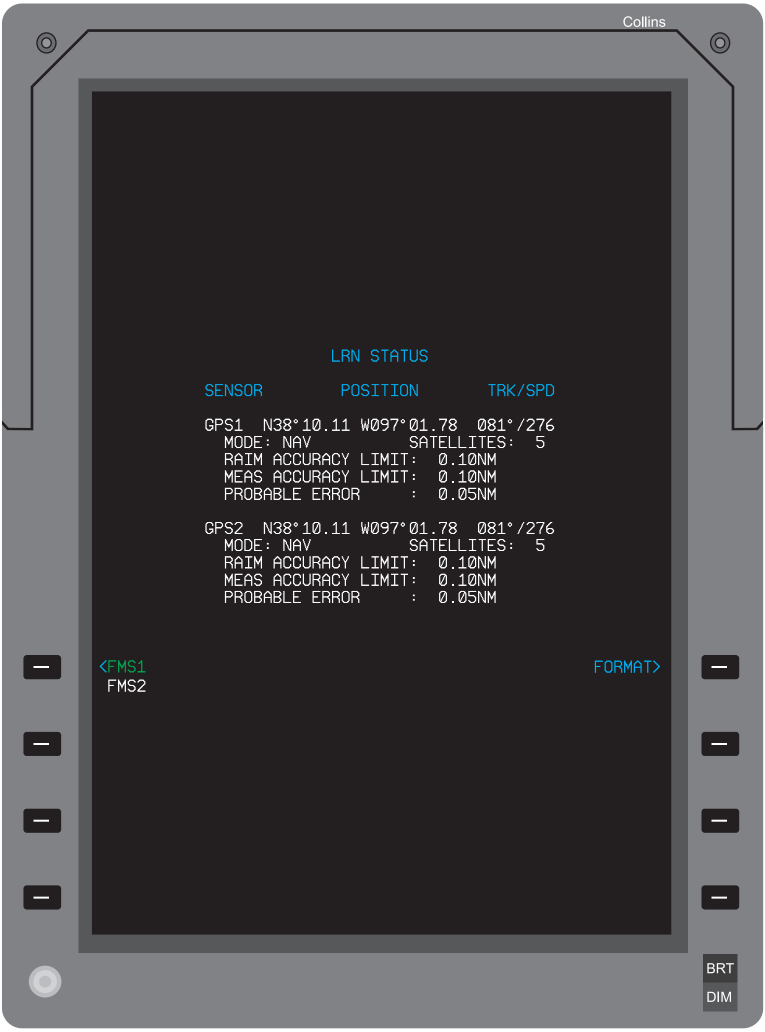
- A list of the installed VOR/DME NAV sensors (SOURCE).

- Identification (ID) of the source from which the sensor is receiving a valid signal.
- Frequency (FREQ) of the current NAV facility.
- Bearing/distance (BRG/DIST) to the NAV facility.

An H identifies a DME sensor that is set to DME HOLD. Dashes indicate the sensor data is invalid or unavailable.

LRN STATUS

Figure 13-87 LRN STATUS Page



TPG5118_29

The LRN STATUS page shows:

- Each installed GPS (SENSOR)

- The current latitude and longitude position (POSITION) of each sensor
- The current tracking direction and speed (TRK/SPD) of each sensor
- The current operating MODE of each sensor
- The number of SATELLITES in use by each sensor
- The RAIM ACCURACY LIMIT of each sensor
- The MEAS ACCURACY LIMIT of each sensor
- The PROBABLE ERROR of each sensor.

This page intentionally left blank

TABLE OF CONTENTS

This page intentionally left blank

MESSAGES AND ANNUNCIATORS

INTRODUCTION

The FMS-3000 Flight Management System shows various messages and annunciations on the CDU, PFD, and MFD displays. This chapter gives a brief description of each message and annunciation, and the action that can be taken, if applicable, when it shows on the display.

There are two display lines on the CDU that show messages. The bottom display line is called the message line. The other display line is the scratchpad line.

Messages that show on the CDU scratchpad line are generally related to maintenance operations. These messages show in white on the display for approximately 1 second, then the previous scratchpad entry shows for correction or deletion. The PFD and MFD do not show annunciations for scratchpad messages. Also, scratchpad messages do not show on the MESSAGES page.

Messages that show on the message line are generally related to the system operation. Most of these messages also show on the CDU MESSAGES page. For many of these messages, the FMS shows an annunciation on the PFD and/or MFD at the same time. Some conditions can cause two annunciations to show on the PFD.

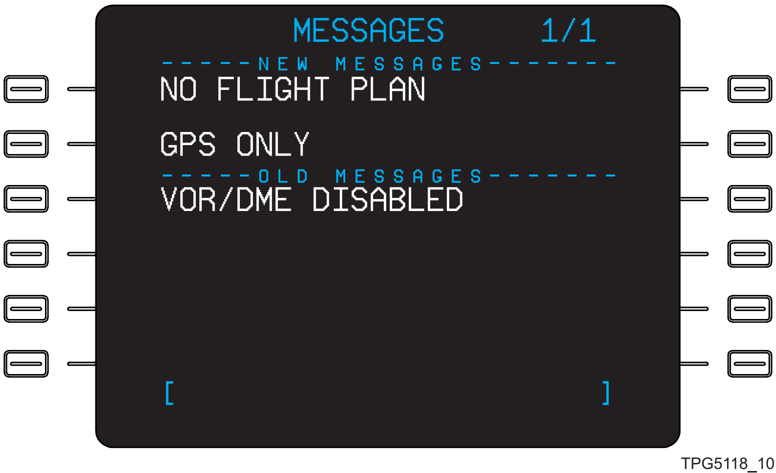
On the message line, a new message overwrites any existing message except for the execute message. When multiple messages occur, they are prioritized and the most important or most recent message is the one that shows. The MESSAGES page stores all the current active messages that were generated for the message line.

To review all messages stored on the MESSAGES page:

NOTE

The MESSAGES page can require more than one page to show all messages. Push the NEXT or PREV key as necessary to review all messages.

Figure 14-1 CDU MESSAGES Page



1. Push the MSG function key on the CDU to show the MESSAGES page.
2. Push the MSG function key a second time to return to the display page shown before selection of the MESSAGES page, or push any other function key to show that function display page.

FMS annunciations on the PFD and MFD alert the operator to some specific operating conditions. These messages stay on while the condition causing them exists, or for a minimum of 5 seconds. The PFD annunciation lines are below the NAV sensor annunciations. The PFD message line is in the middle of the HSI display. The MFD message line is at the bottom of the MFD display.

VISUAL ANNUNCIATIONS

CREW AWARENESS MESSAGES

▼ **CDU Message Line/MESSAGES Page:**

AFIS FPLN LOADED PFD MSG(White)	⇒ Review the new flight plans. Shows to indicate loading of AFIS flight plans is complete.

▼ **CDU Message Line/MESSAGES Page:**

AFIS FPLN UPDATED PFD MSG(White)	⇒ Review the new flight plans. Shows to indicate the requested flight plan update is complete.

▼ **CDU Message Line/MESSAGES Page:**

APPR FOR REF ONLY (White) PFD MSG(White)	Shows when the aircraft is within 30 NM of the FAF for the selected approach, and the approach is not qualified for use by the FMS as primary approach guidance.

▼ **CDU Message Line/MESSAGES Page:**

CHECK ALT SEL (White) PFD MSG(White)	VNAV is active and either of the conditions that follow is true: • (Climb) The preselected altitude is not higher than the current barometric altitude of the aircraft, and the aircraft is within 45 seconds of a bottom of climb.

- (Descent) The preselect altitude is not lower than the current barometric altitude of the aircraft, and the aircraft is within 45 seconds of a top of descent and approach condition is not active.

▼ CDU Message Line/MESSAGES Page:

CHECK APT OAT (Yellow) PFD MSG(Yellow)	⇒ Enter a valid temperature for the airport associated with the approach. ⇒ Select TEMP COMP to OFF if temperature compensation is not necessary for the approach. Shows when all of the conditions that follow are true: • The temperature compensation option is turned on. • TEMP COMP is selected ON. • An approach is in the flight plan and the aircraft position is within the terminal area for the approach. • An OAT has not been entered for the airport associated with the approach. The message is automatically cleared when the aircraft leaves the terminal area for the approach.

▼ CDU Message Line/MESSAGES Page:

CHECK FPLN ALT (White) PFD MSG(White)	Shows when there is an error in an altitude constraint because it results in a reversal of a climb or descent altitude, or the aircraft has exceeded a down-track altitude constraint.

▲

▼ CDU Message Line/MESSAGES Page:

CHECK FUEL AT DEST (Yellow) PFD MSG(Yellow)	Informs the pilot that the computed fuel for the active flight plan destination airport is less than the specified reserve fuel.

▲

▼ CDU Message Line/MESSAGES Page:

CHECK FUEL AT ALTN (Yellow) PFD MSG(Yellow)	Informs the pilot that the computed fuel for the active flight plan alternate airport is less than the specified reserve fuel. If the condition for CHECK FUEL AT DEST exists, this message will be suppressed.

▲

▼ CDU Message Line/MESSAGES Page:

CHECK LOC TUNING (White) PFD MSG(White)	⇒ Manually tune the correct localizer frequency if necessary before making the approach. Shows when the aircraft is at or within 30 NM of the destination airport, a localizer-based approach is selected, and the navigation frequency does not match the tuned value of the FMS.

▲

▼ CDU Message Line/MESSAGES Page:

CHECK NAV SOURCE (White) PFD MSG(White)	⇒ Set the navigation source to FMS or LOC. Shows when VNAV is selected and the navigation source is not FMS or LOC after the FMS initiated ILS capture.

▲

▼ CDU Message Line/MESSAGES Page:

CHECK NAV TUNING (White) PFD MSG(White)	⇒ Select the correct VOR/DME for the approach. ⇒ Select the AUTO tuning mode when able. Shows when the aircraft is at or within 30 NM of the destination airport, approach mode is selected, an RNAV approach is selected, and the FMS could not tune the referenced navaid. If the correct VOR/DME is not available, the approach is not authorized.

▲

▼ CDU Message Line/MESSAGES Page:

CHECK SPEED (Yellow) PFD MSG(Yellow) PFD SPD(Yellow)	⇒ Reduce aircraft speed. Shows when either condition that follows is true. • The current airspeed is 20 knots or 0.03 Mach greater than a VNAV speed restriction and VNAV is selected.

- The aircraft is within 2 minutes of a hold and the current indicated airspeed is 20 knots or 0.03 Mach greater than the maximum recommended holding airspeed.

▼ CDU Message Line/MESSAGES Page:

CHECK VPA ENTRY (White) PFD MSG(White)	⇒ Check the entered descent angle and enter new VPA if necessary. A descent angle entered by the user is greater than the VPA limit but less than or equal to the maximum VPA allowed for the aircraft.

▼ CDU Message Line/MESSAGES Page:

CHK DATABASE DATES (White) PFD MSG(White)	⇒ Go to the STATUS page and select the appropriate database on each CDU. To operate dual FMS installations in the coordinated mode, the active databases on both systems must have the same effective dates. Shows when they are not the same.

▼ CDU Message Line/MESSAGES Page:

CHK POS (Yellow) PFD CHK POS(Yellow) PFD MSG(Yellow)	⇒ Do a position update of the FMS. ⇒ If a failed sensor caused the problem, disable the failed sensor. Shows when the FMS has determined that a navigation sensor is not meeting the accuracy requirements for the current phase of flight. This message is usually followed by another message showing the affected sensor (for example, FMS-FMS DISAGREE, GPS-FMS DISAGREE, VOR/DME DIST>75NM).

▼ CDU Message Line/MESSAGES Page:

CRS REVERSAL IN FPLN (Yellow) PFD MSG(Yellow)	⇒ Edit the flight plan to eliminate the course reversal. ⇒ Ignore the message if the flight plan course reversal is intentional. Shows when the flight plan route contains a course reversal of more than 160 degrees at the TO waypoint. Its purpose is to identify a possible error in a flight plan.

▼ CDU Message Line/MESSAGES Page:

DB MEMORY FAULT (White) PFD MSG(White)	Shows when there is a fault in the Data Base Memory.

▼ CDU Message Line/MESSAGES Page:

DECELERATE (White) PFD MSG(White)	⇒ Reduce aircraft speed. Shows when the current airspeed is faster than planned decelerating reference speed computed by VNAV when VNAV is selected.

▲

▼ CDU Message Line/MESSAGES Page:

DL FPLN LOADED (White)	⇒ Go to the SEC FPLN pages to view the flight plan and clear the message. Shows when the Datalink flight plan that was requested by the pilot has been loaded and not yet viewed.

▲

▼ CDU Message Line/MESSAGES Page:

DL FPLN REJECTED (White)	⇒ Review the flight plan for errors. Resubmit the flight plan if necessary. Shows when the Datalink flight plan that was requested by the pilot has been rejected. The rejection can be caused by one or more of the conditions that follow: • A flight plan recall uplink is received from the Information Provider with the last FMS generated flight plan recall request number and a rejected message is present. • The FMS failed to send a valid flight plan update request. • The FMS failed to load a valid flight plan update. • The CRC check did not pass.

- An uplinked airport identifier is not recognized by the FMS.

▼ **CDU Message Line/MESSAGES Page:**

DL WINDS UPDATED (White)	⇒ Go to the LEG WIND page to view the winds. ⇒ Cancel the MOD FPLN if desired/necessary. The Datalink flight plan wind update that the pilot requested has been loaded into the active flight plan, creating a MOD FPLN that has not yet been viewed.

▼ **CDU Message Line/MESSAGES Page:**

DL WINDS RE-JECTED (White)	⇒ Send a new FPLN WIND UPDATE request if desired/necessary. Shows when a flight plan winds update uplink is received from the Information Provider with the last FMS-generated flight plan winds update request number and a rejected message is received. The rejection can be caused by one or more of the conditions that follow: • The flight plan wind update that was requested has been rejected by the information provider. • The FMS failed to send a valid wind update request. • The FMS failed to load a valid wind update.

▼ **CDU Message Line/MESSAGES Page:**

DME-FMS DIS-AGREE (Yellow) PFD MSG(Yellow)	⇒ Determine if one of the NAV sensors is in error. Disable that sensor if necessary. ⇒ Determine if a DME station is in error. Disable that DME station if necessary. ⇒ Do a position update of the FMS (only if necessary). Shows when one or more DMEs are inconsistent with the current FMS position estimate. This message is annunciated when the difference is 2.0 NM in the en route environment, 1.0 NM in the terminal environment, and 0.5 NM in the approach environment.

▲

▼ **CDU Message Line/MESSAGES Page:**

DR EXCEEDS 5 MIN (Yellow) PFD MSG(Yellow) PFD FMS DR(Yellow) MFD DR EXCEEDS 5 MIN(White)	⇒ Make sure navigation sensors are enabled. Enable them if they are not. ⇒ Do a position update of the FMS with data from a known good sensor. Shows when the FMS has been in DR mode for more than 5 minutes while airborne. Another reason for this message can be that the FMS position was not properly initialized.

▲

▼ CDU Message Line/MESSAGES Page:

EXEC FPLN MOD
(Yellow)

PFD
MSG(White)

⇒ Do any of the following actions to remove the message:

- Continue the modification.
- Verify the current change and push the EXEC function key on the CDU to execute the flight plan.
- Push the CANCEL MOD line key to cancel the modification in progress.

Shows when a modified flight plan exists and no CDU keyboard activity has been observed for 15 seconds.

▲

▼ CDU Message Line/MESSAGES Page:

FMS DR
(White)

PFD
MSG(White)

PFD
FMS DR(White)

MFD
FMS DR(White)

⇒ Make sure VOR/DME and GPS sensors are enabled. Enable them if they are not.

⇒ Determine if AUTO tuning mode is selected on the TUNE page. Select AUTO if it is not.

⇒ Determine if any VOR/DME stations are being received. If airborne, climb higher to receive more stations.

⇒ Do a position update of the FMS with data from a known good sensor.

Shows when the aircraft is on the ground or has been airborne for less than 2 minutes and the FMS has been in dead reckoning mode for between 10 to 30 seconds. Another reason for this message could be that the FMS position was not properly initialized.

▲

▼ CDU Message Line/MESSAGES Page:

FMS DR (Yellow) PFD MSG(Yellow) PFD FMS DR(Yellow) MFD FMS DR(White)	⇒ Make sure navigation sensors are enabled. Enable them if they are not. ⇒ Do a position update of the FMS with data from a known good sensor. Shows when the FMS has been in DR mode for at least 2 minutes. Another reason for this message could be that the FMS position was not properly initialized.

▲

▼ CDU Message Line/MESSAGES Page:

FMS-FMS DIS-AGREE (Yellow) PFD MSG(Yellow)	⇒ Review the sensor position summary page on both sides to determine the best FMS position, then do one of the actions that follow: • Do a position update for the suspected incorrect side. • Change to INDEP operation and use the known good FMS. Shows when the cross-side FMS position data is significantly different from that of the same-side FMS.

▲

▼ CDU Message Line/MESSAGES Page:

FMS INDEPENDENT OP (White) PFD MSG(White)	⇒ If the communications failure was due to a power fluctuation, select SYNC mode again on the FMS CONTROL page. ⇒ If CHK DATABASE DATES also shows, correct the dates to allow SYNC operation.

Shows when in a dual FMS installation, a communications failure between the FMSs has occurred, the selected databases are different, or the software programs in the FMS are different and the FMS cannot operate in the SYNC mode.

▼ **CDU Message Line/MESSAGES Page:**

FMS NAV INVALID (Yellow) PFD MSG(Yellow) MFD FMS NAV INVALID(White)	⇒ Check the NAV sensors to be sure they are enabled. ⇒ Check for a heading sensor failure. Shows when the FMS does not have a valid source for sensor and heading data while the aircraft is airborne for more than 2 minutes.

▼ **CDU Message Line/MESSAGES Page:**

FMS NAV INVALID (White) PFD MSG(White) MFD FMS NAV INVALID(White)	⇒ Check the NAV sensors to be sure they are enabled. ⇒ Check for a heading sensor failure. Shows when the FMS does not have a valid source for sensor and heading data while the aircraft is on the ground.

▼ CDU Message Line/MESSAGES Page:

FPLN DISCONTINU-ITY (Yellow) PFD MSG(Yellow) PFD DISCONTINUITY(White)	⇒ Modify the flight plan as necessary. Shows when the flight plan has sequenced past, or is within 2 minutes of sequencing past, the last waypoint before a flight plan discontinuity.

▼ CDU Message Line/MESSAGES Page:

FUEL FLOW NOT AVAIL (White) PFD MSG(White)	Shows when fuel flow data has been invalid for at least 2 minutes.

▼ CDU Message Line/MESSAGES Page:

GPS DISABLED (White)	⇒ If the GPS sensors are valid, enable the GPS sensors on the GPS CONTROL page. Shows when the GPS sensors are disabled for use by the FMS on the GPS CONTROL page. This can degrade FMS navigation performance.

▼ CDU Message Line/MESSAGES Page:

GPS-FMS DIS-AGREE (Yellow) PFD MSG(Yellow)	⇒ Do a position update of the FMS with data from a known good sensor. ⇒ Determine if a GPS sensor is failed or invalid. Disable the sensor if necessary. The GPS position estimate is different from that of the FMS. Shows when the difference is: • 2.0 NM or greater in the oceanic, remote, or en route environment • 1.0 NM or greater in the terminal environment • 0.3 NM or greater in the approach environment.

▼ CDU Message Line/MESSAGES Page:

GPS NOT AVAIL-ABLE (Yellow) PFD MSG(Yellow)	Shows when the FMS is not using GPS position data as part of its calculations to determine position. Shows if the GPS has been unavailable for at least 2 minutes in the terminal environment of the destination airport, or at least 30 seconds in the approach environment of the destination airport, and the GPS sensors are enabled.

▼ CDU Message Line/MESSAGES Page:

GPS NOT AVAILABLE (White) PFD MSG(White)	Shows when the FMS is not using GPS position data as part of its calculations to determine position. Shows when the GPS has been unavailable for at least 5 minutes in the oceanic, remote or en route environment.

▼ CDU Message Line/MESSAGES Page:

GPS ONLY (White) PFD GPS ONLY(White) PFD MSG(White)	⇒ Determine if other navigation sensors are valid. Enable the navigation sensors if disabled. Shows when the FMS is using position data from the GPS sensor only. Shows only if all of the other sensors are disabled, invalid, or failed. This message can be inhibited in some aircraft installations.

▼ CDU Message Line/MESSAGES Page:

GPS REVERTED (White) PFD MSG(White)	Shows when the FMS is using the cross-side GPS sensor, instead of the same-side sensor, while the same-side sensor is enabled. This could be the result of invalid data from the same-side GPS sensor or a failed same-side sensor.

▼ CDU Message Line/MESSAGES Page:

HALF-BANK SELECTED (Yellow) PFD MSG(Yellow)	⇒ Deselect HALF-BANK mode. Shows when the same-side FMS is selected as a navigation display source, any FMS is the active NAV source, HALF-BANK mode is selected on the flight control panel and one of the conditions that follow is true: • The active waypoint is a hold fix, but the holding pattern is not yet active, and the time to the active waypoint is less than 1 minute OR any holding pattern is active. • The active waypoint is a procedure turn fix and the time to the procedure turn is less than 1 minute OR any procedure turn is active. • The active leg is an approach leg. An overshoot of the desired path can occur when HALF-BANK mode is selected.

▼ CDU Message Line/MESSAGES Page:

HOLD EFC EXPIRED (White) PFD MSG(White)	⇒ Enter new EFC time on HOLD page or obtain clearance to exit the hold. Shows when the Expect Further Clearance (EFC) time has expired and the aircraft has not exited the hold.

▼ **CDU Message Line/MESSAGES Page:**

INITIALIZE POSITION (Yellow) PFD MSG(Yellow)	⇒ Initialize the FMS from the POS INIT page on the CDU. Shows when the FMS has not been initialized.

▲

▼ **CDU Message Line/MESSAGES Page:**

LAST WAYPOINT (Yellow) PFD MSG(Yellow)	⇒ Insert the next waypoint into the flight plan if the aircraft has not reached the destination. ⇒ Select an arrival and/or approach on the DEP/ARR page for the destination airport if not already accomplished. Shows when the aircraft has passed, or is within 2 minutes of passing, the last waypoint in the flight plan.

▲

▼ **CDU Message Line/MESSAGES Page:**

LOC WILL BE TUNED (White) PFD MSG(White)	⇒ Select AUTO tuning mode if necessary. Shows when the FMS is within 30 seconds of automatically tuning the localizer and the radio tuning mode is set to MANUAL.

▲

▼ CDU Message Line/MESSAGES Page:

LOW POS ACCURACY (Yellow) PFD MSG(Yellow)	Shows when the estimated position accuracy value is greater than the Required Navigation Performance (RNP) value that shows on the PROGRESS page.

▼ CDU Message Line/MESSAGES Page:

MAX VPA EXCEEDED (White) PFD MSG(White)	⇒ Select another approach or obtain amended approach clearance. Shows a descent angle specified in the selected approach exceeds the maximum VPA for the aircraft.

▼ CDU Message Line/MESSAGES Page:

NO APPR GPS RAIM (White) PFD MSG(White)	⇒ Select a non-GPS approach if possible. Shows when a GPS or GPS-only approach is specified in the flight plan, and RAIM is predicted to be unavailable to the GPS sensor for the approach.

▼ CDU Message Line/MESSAGES Page:

NO APPR REVERSION (White) PFD NO APPR(White)	Shows when either DCP is in reversion mode while the aircraft is within 30 NM of the airport, a localizer-based approach is in the active flight plan, and FMS-to-localizer NAV-to-NAV capture is enabled. NAV-to-NAV capture does not occur with the DCP in reversion.

▼ CDU Message Line/MESSAGES Page:

NO FLIGHT PLAN (White) PFD NO FLIGHT PLAN(White)	⇒ Create and execute a new flight plan, or activate and execute an existing flight plan. Shows when the FMS does not have an active flight plan.

▼ CDU Message Line/MESSAGES Page:

NO GPS RAIM (White) PFD MSG(White)	Shows when the FMS is using GPS in its calculations to determine position in the en route, terminal, or approach phase of flight, and RAIM is not available at the required accuracy to the GPS sensor.

▼ CDU Message Line/MESSAGES Page:

NO NAV DATA BASE (White) PFD MSG(White)	⇒ Load a database into the FMS system. Shows when the FMS has no navigation database.

▼ CDU Message Line/MESSAGES Page:

NO TXT WHEN PFD MAP (White)	⇒ This message clears itself. Shows when the aircraft configuration supports an FMS map display on the PFD, the PFD is currently showing a present position map, and the MFD DATA key was pushed.

▼ **CDU Message Line/MESSAGES Page:**

NO VPATH CONDI-TION (White) PFD MSG(White)	⇒ Changing the autopilot to a mode other than VPITCH or passing the last altitude constraint on the descent path clears this message. Shows when VPATH mode automatically reverts to VPITCH mode. This occurs because either the aircraft crossed a vertical discontinuity in the descent path, or a flight plan edit occurred that caused the active descent path to move.

▲

▼ **CDU Message Line/MESSAGES Page:**

NO VPATH-PILOT CMD (White) PFD MSG(White)	⇒ Turn VNAV off then back on. Shows when selection of a vertical autopilot mode while flying VPATH. VPATH automatically recaptures only after vertical deviation exceeds one dot, and the aircraft is maneuvered back to the VNAV path.

▲

▼ **CDU Message Line/MESSAGES Page:**

NO VPATH THIS LEG (White) PFD MSG(White)	⇒ Change the autopilot to a mode other than VPITCH. ⇒ Change to a leg that is not a holding pattern. Shows when the flight plan sequences to a new leg that is a holding pattern. When this occurs, VPATH automatically changes to VPITCH.

▲

▼ **CDU Message Line/MESSAGES Page:**

NO VPATH-TAE (White) PFD MSG(White)	⇒ Turn the aircraft to fly along the FMS course line. ⇒ Change the autopilot to a mode other than VPITCH. Shows when VPATH mode has automatically reverted to VPITCH mode because the track-angle error has exceeded the specified limits.

▲

▼ **CDU Message Line/MESSAGES Page:**

NO VPATH-VECTORS (White) PFD MSG(White)	⇒ Change the autopilot to a mode other than VPITCH. Shows when VPATH mode has automatically reverted to VPITCH mode because there is a heading leg in the FMS flight plan. Message also clears after the aircraft passes the heading leg.

▲

▼ **CDU Message Line/MESSAGES Page:**

NO VPATH-XTD (White) PFD MSG(White)	⇒ Reduce the cross-track distance to within the specified limit. ⇒ Change the autopilot to a mode other than VPITCH. Shows when VPATH mode has automatically reverted to VPITCH mode because the cross-track deviation has exceeded the specified limits.

▲

▼ **CDU Message Line/MESSAGES Page:**

NOT ON INTERCEPT TRACK (Yellow) PFD MSG(Yellow)	⇒ Turn the aircraft to intercept the FMS track. ⇒ If the FMS is steering the aircraft, this condition is corrected automatically. Assess any potential airspace violations during the maneuver. Shows when the FMS is steering the aircraft back to the active leg, or it is armed for capture, but the current flight path does not intercept the active flight plan leg.

▲

▼ **CDU Message Line/MESSAGES Page:**

OFFSET TERMI-NATED (White) PFD MSG(White)	Shows when the aircraft has reached the end of a parallel offset leg of the flight plan.

▲

▼ **CDU Message Line/MESSAGES Page:**

OFFSET WILL END (White) PFD MSG(White)	Shows when the aircraft is within 2 minutes of the end of an offset track.

▲

▼ **CDU Message Line/MESSAGES Page:**

PATH BELOW A/C (White) PFD MSG(White)	Shows when the current descent path is below the aircraft, the aircraft is in a holding pattern, and will not intercept the descent path unless the aircraft descends.

▲

▼ **CDU Message Line/MESSAGES Page:**

PROGRAM DIFFER (White) PFD MSG(White)	⇒ Contact a maintenance technician to correct this problem. Shows when the two FMS software programs are incompatible. Also shows when an incorrect FMC or CDU is installed in the aircraft.

▲

▼ **CDU Message Line/MESSAGES Page:**

RESET INITIAL POS (Yellow) PFD MSG(Yellow)	⇒ Reinitialize the FMS position on the POS INIT page on the CDU. Shows when the position entered during position initialization is greater than 40 NM from the last known FMS position. Because of this, the FMS is requesting that the initial position be reentered for verification.

▲

▼ CDU Message Line/MESSAGES Page:

UNABLE CRZ ALT (White) PFD MSG(White)	⇒ Correct the vertical profile to clear the message. Shows when the FMS performance predictions indicate the aircraft cannot reach the cruise altitude because of climb or cruise ceiling limitations, or the climb and descent profiles overlap.

▲

▼ CDU Message Line/MESSAGES Page:

UNABLE FPLN ALT (Yellow) PFD MSG(Yellow)	⇒ Correct the vertical profile of the climb or descent to clear this message. Shows when the FMS performance predictions indicate an altitude constraint cannot be met at the specified waypoint.

▲

▼ CDU Message Line/MESSAGES Page:

UNABLE NEXT ALT (Yellow) PFD MSG(Yellow)	⇒ Correct the flight plan altitude constraint. ⇒ Change the climb or descent profile to comply with the current constraint.

Shows when the next altitude constraint cannot be cleared in the flight plan at the present rate of climb or descent. This message shows when the climb or descent is insufficient for at least 1 minute or more. Also shows that an automatic vertical direct-to has been attempted, and it cannot be performed because the required descent path exceeds the maximum VPA for the aircraft. This message does not show when the FMS is in an altitude hold mode.

▼ CDU Message Line/MESSAGES Page:

UNABLE TO SEQ FPLN (White) PFD MSG(White)	⇒ Change the flight plan to eliminate the conditions listed below. Shows when any of the conditions that follow occur: • A SID, STAR, or approach specifies that the active leg be terminated at a specified distance from a DME station, and the current flight path of the aircraft does not intercept the specified DME station. • A SID, STAR, or approach specifies that the active leg is a heading leg, which terminates either at a specified VOR radial or when it intercepts the next leg, and the termination point is more than 50 NM from the present position of the aircraft. • An altitude-terminated procedure leg is active and barometric altitude is invalid, or vertical speed has been negative for at least 1 minute.

▼ CDU Message Line/MESSAGES Page:

VNAV SENSOR FAIL (White) PFD MSG(White)	⇒ Determine which is the invalid or failed sensor, and select a reversion mode to provide valid data to the FMS. Shows when the sensor data for VNAV functions is not available or is invalid.

▼ CDU Message Line/MESSAGES Page:

VNAV WARN-TAE (White) PFD MSG(White)	Shows when the aircraft track angle error is greater than: • 80% of the TAE threshold for oceanic/remote, en route, or terminal • 50% of the TAE threshold for approach • VNAV is deactivated at threshold crossing. This message only shows if the aircraft is configured to drop VNAV in this situation.

▼ CDU Message Line/MESSAGES Page:

VNAV WARN-XTD (White) PFD MSG(White)	Shows when the aircraft cross-track distance is greater than: • 80% of the XTD threshold for oceanic/remote, en route, or terminal • 50% of the XTD threshold for approach • VNAV is deactivated at threshold crossing. This message only shows if the aircraft is configured to drop VNAV in this situation.

▼ **CDU Message Line/MESSAGES Page:**

VOR/DME DISABLED (White)	⇒ Enable the VOR/DME sensors on the VOR CONTROL page. Shows when the VOR/DME navigation sensors are deselected for use by the FMS on the VOR CONTROL page. This can degrade FMS navigation capability.

▼ **CDU Message Line/MESSAGES Page:**

VOR/DME DISTANCE>75 NM (Yellow) PFD MSG(Yellow)	Shows when the FMS is navigating within a terminal area using a single collocated VOR/DME for determining position and the navaid is greater than 75 NM from the present position.

▼ **CDU Message Line/MESSAGES Page:**

VOR/FMS DISAGREE (Yellow) PFD MSG(Yellow)	⇒ Do a position update of the FMS with data from a known good sensor. ⇒ Disable individual VOR/DME navaids. ⇒ Disable the use of all VOR/DME navaids. Shows when the VOR/DME position estimate is different from that of the FMS. This messages shows when the difference is greater than 10 NM in the en route environment, and greater than 5 NM in the terminal and approach environment. The pilot should determine whether the FMS position of the VOR signal is incorrect and determine the appropriate action, if any.

CDU Message Line/MESSAGES Page:

XTALK FAIL (White) PFD MSG(White)	Shows in a dual FMS installation when the two systems have had a communications failure and cannot operate in the SYNC mode.

CDU ANNUNCIATIONS

▼ **CDU Annunciation Line:**

AFIS (White)	Shows to indicate new AFIS information is available. (Does not show on the MESSAGES page.)

▲

▼ **CDU Annunciation Line:**

EXEC (White)	⇒ Verify the flight plan change, then push the EXEC function key on the CDU to execute the flight plan. Shows at the right side of the message line anytime an active flight plan is modified, or when a new flight plan is activated. (Does not show on the MESSAGES page.)

▲

▼ **CDU Annunciation Line:**

MSG (White or Yellow) PFD MSG(White or Yellow)	⇒ Push the MSG function key to acknowledge the message and remove the MSG annunciation from the PFD. Shows when the CDU message page contains a new or old message. Also shows on the PFD for each new message. The MSG annunciation shows on the CDU as long as there is a message on the MESSAGES page. (Does not show on the MESSAGES page.)

▲

▼ CDU Annunciation Line:

OFFSET (White)	Shows when a parallel offset is in use. The message clears when the offset is terminated. (Does not show on the MESSAGES page.)

▼ CDU Annunciation Line:

TMP© (White)	Indicates that Temperature Compensation is being applied to appropriate legs of the approach, approach transition, and missed approach procedure, and the aircraft is flying a leg that could have been affected. (Does not show on the MESSAGES page.)

PILOT OPERATIONS MESSAGES

▼ **CDU Scratchpad:**

ALONG TRACK WPT N/A (White)	⇒ Check for a possible scratchpad entry error. ⇒ Make sure that the entry complies with the entry rules for pilot-entered waypoints. Shows when an attempt to enter a place/along-track offset or place/along-track offset/name waypoint in the flight plan failed.

▲

▼ **CDU Scratchpad:**

CHK SELECTED DATA BASE (White)	⇒ Go to the STATUS page on each CDU and verify that the navigation database name and effective dates are the same. A new database will have to be loaded in one or both FMSs. Shows when the effective date and active database is not the same on each FMS in a dual installation.

▲

▼ **CDU Scratchpad:**

DATE ENTRY N/A (White)	⇒ Refer to the appropriate aircraft flight manuals to set the DATE.

Shows when an attempt to enter a date value in the DATE location on the STATUS page failed because current conditions do not allow the clock to be reset. In many aircraft, the date and time shown on the FMS STATUS page are set by the aircraft clocks and cannot be set from the FMS.

▼ **CDU Scratchpad:**

DEFAULT ENTRY ONLY (White)	⇒ Go to the DEFAULTS page to modify the parameter. Shows when the crew has attempted to modify a default parameter that can only be modified on the DEFAULTS page.

▼ **CDU Scratchpad:**

DISTANCE TOO LARGE (White)	⇒ Make sure that the correct reference waypoint and the correct distance were used. Shows when an attempt is made to enter an along-track waypoint offset that is too large for the flight plan leg.

▼ **CDU Scratchpad:**

DME IN HOLD (White)	⇒ Clear the HOLD mode, and then set the navigation radio to the AUTO mode.

Shows when an attempt to set the navigation radio-tuning mode to AUTO failed because the affected radio has a DME in the HOLD mode.

▼ CDU Scratchpad:

ENTER CRZ ALT (White)	⇒ Enter the cruise altitude and resubmit the AFIS request. Shows when an AFIS request to update the flight plan has been made and cruise altitude has not been entered on the active flight plan.

▼ CDU Scratchpad:

FMS FAULT (White)	⇒ Report this problem to the maintenance personnel. Shows when the FMS has detected an internal fault that prevents it from storing the database.

▼ CDU Scratchpad:

FPLN EDIT IN PROGRESS (White)	⇒ Execute the modified flight plan on the cross-side FMS, then try again. Shows when an attempt is made to select the SYNC mode while one FMS has a flight plan edit in progress (MOD FPLN).

▼ **CDU Scratchpad:**

FPLN FULL (White)	⇒ Delete extra waypoints/legs, or wait until there are fewer than 100 legs in the flight plan. Shows when an attempt is made to add waypoints to a flight plan failed because the flight plan already has the maximum number (100) of legs allowed. The flight plan leg count includes legs in the DIRECT-TO HISTORY and the alternate flight plan.

▲

▼ **CDU Scratchpad:**

FUEL FLOW NOT AVAIL (White)	Shows when the fuel flow data has been invalid for at least 2 minutes.

▲

▼ **CDU Scratchpad:**

INBD CRS ENTRY N/A (White)	Shows when an attempt is made to edit the inbound course of an active hold.

▲

▼ **CDU Scratchpad:**

INTERSECTION>400 NM (White)	⇒ Correct the waypoint entry and try again. Shows when a waypoint specified by the intersection of radials from two navaids is more than 400 NM from either of the navaids.

▲

▼ CDU Scratchpad:

INVALID DELETE (White)	⇒ This message clears itself. Shows when an attempt is made to delete data that cannot be deleted with the DELETE function.

▼ CDU Scratchpad:

INVALID DIRECT-TO (White)	⇒ Modify the flight plan as necessary to correct the problem. Shows when a Direct-To request cannot be complied with because any of the conditions below are true. • The selected Direct-To waypoint is not a geographical waypoint. • The vertical Direct-To was requested to an altitude that is above the barometric altitude of the aircraft or requires a descent path that exceeds the maximum VPA. • There is a VECTORS leg or discontinuity between the current aircraft position and the target waypoint.

▼ CDU Scratchpad:

INVALID ENTRY (White)	⇒ Correct the entry and try again. Shows when the data entry is invalid (invalid format, value out of range, etc.) for the attempted data entry field.

▼ CDU Scratchpad:

INVALID ROUTE
(White)

⇒ Enter waypoints into a route before attempting to store the route.

Shows when an attempt is made to store a route that does not have any waypoints.

▲

▼ CDU Scratchpad:

KEY NOT ACTIVE
(White)

⇒ The message clears itself.

Shows when an inactive line key or function key is pushed.

▲

▼ CDU Scratchpad:

LIST FULL
(White)

⇒ Enable a GPS satellite before attempting to disable another one.

Shows when eight GPS satellites are disabled on the GPS CONTROL page and an attempt was made to disable another one. Only eight satellites can be disabled at one time.

▲

▼ CDU Scratchpad:

N/A IN POLAR REGION
(White)

⇒ The message clears itself.

Shows when an attempt is made to perform a disallowed edit in the polar regions of the flight plan. None of the following items that are located in a polar region can be entered:

- A hold either at a fix or at PPOS

- A reference fix (FIX INFO page)
- A reference fix for a place bearing/distance
- A place bearing/place bearing fix
- An along-track fix
- A course edit to fix
- A FROM waypoint.

▼ CDU Scratchpad:

NAVAID INHIBITED (White)	⇒ Select a different navaid for the position update or enable the inhibited navaid on the VOR CONTROL page. Shows when an attempt to specify a navaid for position update on the POS INIT page failed because the navaid is inhibited on the VOR CONTROL page.

▼ CDU Scratchpad:

NAVAID NOT RECEIVED (White)	⇒ Select a different navaid for the position update. Shows when an attempt to update position from a navaid on the POS INIT page failed because the navaid signal is invalid.

▼ **CDU Scratchpad:**

NO ENTRY ALLOWED (White)	⇒ Select a valid entry field for the data in the scratchpad. Shows when a line select key adjacent to a data field, is pushed, that does not allow entry of data.

▼ **CDU Scratchpad:**

NO INTERSECTION (White)	⇒ Correct the radial entries and try again. ⇒ If the message is for an airway entry, modify the flight plan if necessary and try again. Shows when the waypoint specified by the intersection of radials from two navaids does not exist because the radials do not intersect, or the radial or distance does not intercept a flight plan leg. This message also shows when trying to enter an airway for which there is neither an entry or exit waypoint already in the flight plan.

▼ **CDU Scratchpad:**

NO XSIDE DATA (White)	Shows when an attempt is made to transfer a cross-side waypoint list and there is no data in the cross-side FMS.

▼ CDU Scratchpad:

NO XSIDE FPLN (White)	Shows when an attempt is made to transfer an empty flight plan from the cross-side FMS.

▲

▼ CDU Scratchpad:

NOT A COLOCATED NAVAID (White)	⇒ Select another VOR/DME or another sensor type to initialize or update the position. Shows when an attempt is made to use a non-collocated VOR/DME to initialize position or update from a navaid.

▲

▼ CDU Scratchpad:

NOT A VOR/DME (White)	⇒ Select another VOR/DME or another sensor type to initialize or update the position. Shows when the station identifier entered corresponds to a navaid that is not a paired VOR/DME, which is unacceptable for initializing or updating the position.

▲

▼ CDU Scratchpad:

NOT IN DATA BASE (White)	⇒ The message clears itself. Shows when the identifier entered in the scratchpad is not in the navigation database.

▲

▼ **CDU Scratchpad:**

NOT ON AIRWAY (White)	⇒ Select a waypoint that is located on the airway and try again. Shows when an attempt to enter an exit waypoint for an airway failed because the waypoint is not part of the airway.

▲

▼ **CDU Scratchpad:**

NOT ON GROUND (White)	Shows when the FMS has determined that the aircraft is not on the ground and the pilot has attempted to perform one of the following actions: • Select an active database • Load a database from disk • Transfer a pilot route • Specify an origin airport in the active flight plan. The above actions are not permitted while the aircraft is airborne.

▲

▼ **CDU Scratchpad:**

PILOT WPT LIST FULL (White)	⇒ To enter another pilot-defined waypoint, first delete one from the current flight plan or the pilot waypoint database.

Shows when an attempt is made to enter a pilot-defined waypoint into the flight plan and there are already 50 pilot-defined waypoints in the flight plan. This message also shows when trying to store a waypoint in the pilot waypoint database, and the total number of waypoints in the database is at the limit of 100 waypoints.

▼ **CDU Scratchpad:**

QUAD/RADIAL ENTRY N/A (White)	The QUAD/RADIAL of an active hold cannot be edited.

▼ **CDU Scratchpad:**

RADIO IS NAV SOURCE (White)	⇒ Set the navigation source to FMS and try again. Shows when an attempt is made to set the navigation radio tuning mode to AUTO when the affected radio is the navigation source.

▼ **CDU Scratchpad:**

ROUTE LIST FULL (White)	⇒ Delete a route to make room for the new route and try again to store it. Shows when 100 routes have been stored in the FMS route database, or there is not enough memory to store this route.

▼ **CDU Scratchpad:**

SYNC N/A
(White)

⇒ On the STATUS page, make sure the PROGRAM names in both FMSs are the same. If they are not the same, then the appropriate programs must be installed in the FMSs. If they are the same, there is a cross-talk communications failure between the FMSs.

Shows when an attempt to select the SYNC mode failed, because the two software programs in the FMSs are different, or cross-talk communication between the two FMSs is unavailable.

▲

▼ **CDU Scratchpad:**

SYSTEM NOT AVAILABLE
(White)

Shows when an attempt is made to select an MCDU function and the associated system is not available to the FMS.

▲

▼ **CDU Scratchpad:**

TIME ENTRY N/A
(White)

⇒ Refer to the appropriate aircraft flight manuals to set the TIME for the aircraft clock.

Shows when an attempt to change the UTC time on the STATUS page failed because an external clock source is in use. In many aircraft, the date and time shown on the FMS STATUS page are set by the aircraft clocks and cannot be set from the FMS.

▲

▼ CDU Scratchpad:

TOO MANY HOLDS
(White)

⇒ Delete a previous hold from the flight plan to make room to add a new one.

Shows when an attempt to enter a hold into a flight plan failed because the flight plan already has the maximum number of holds allowed. Only six holds are allowed in a flight plan, which includes the Direct-To history.

▲

▼ CDU Scratchpad:

TUNING NOT AVAIL
(White)

⇒ Set the reversion modes so that this FMS is not in stand-alone mode and try again.

Shows in a triple FMS installation when the FMS being used is in stand-alone operating mode (reverted out), and an attempt is made to tune a radio from the RADIO TUNING page.

▲

▼ CDU Scratchpad:

WPT NOT MATCHED
(White)

⇒ Correct the scratchpad entry and try again.

Shows when an attempt to enter a place/along-track offset waypoint at a location in the flight plan failed because the waypoint identifiers in the flight plan and scratchpad did not match.

▲

CDU Scratchpad:

XSIDE EDIT IN PROGRESS (White)	⇒ Cancel or execute the modification on the other CDU to allow edits from this CDU. Shows when an attempt to edit an active flight plan failed, because the other CDU is already in the MOD mode. Only one CDU at a time is allowed to edit the active flight plan when either FMS is set to the SYNC mode.

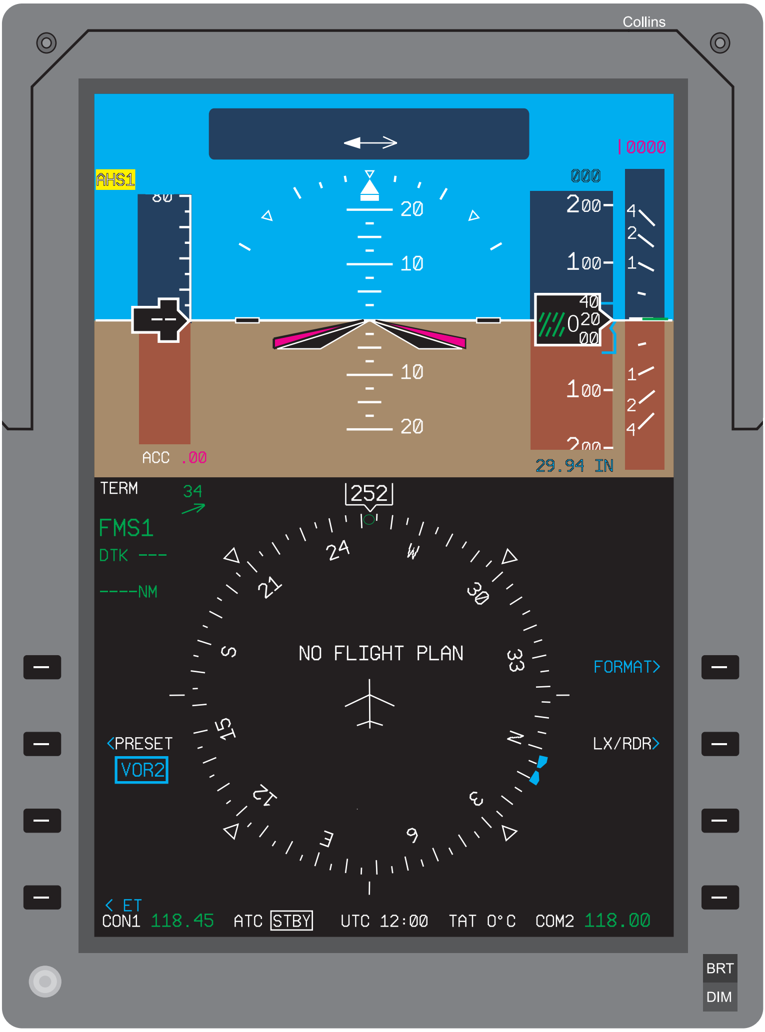
CDU Scratchpad:

XSIDE STORE FAIL (White)	Shows when an attempt is made to store a waypoint on the same-side FMS while in the SYNC mode, and the cross-side FMS could not store the data. This can occur if the database on the cross-side FMS is full, but the same-side FMS database is not, or when the cross-side database contains an identically named item that is not in the same-side database.

CDU Scratchpad:

XTALK BUS FAILURE (White)	Shows when the cross-talk bus is invalid and an attempt is made to change the cross-side navigation radio tuning mode from manual to automatic.

PFD MESSAGES



TPH6993_03

▼ **PFD Top Annunciation Line:**

APPR (Green)	Shows when the lateral and vertical deviation shown on the PFD is set to the approach sensitivity level and RNAV approach is active.

▼ **PFD Top Annunciation Line:**

CHK POS (Yellow)	Shows the calculated FMS position does not meet the accuracy requirements for the current phase of flight.

▼ **PFD Top Annunciation Line:**

FMS DR (White)	Shows when the FMS is in dead reckoning mode with the aircraft on the ground or airborne for less than 2 minutes.

▼ **PFD Top Annunciation Line:**

FMS DR (Yellow)	Shows when the FMS is in dead reckoning mode with the aircraft airborne for more than 2 minutes.

▼ **PFD Top Annunciation Line:**

GPS APPR (Green)	Shows when the lateral and vertical deviation is set to the approach sensitivity level and a GPS approach is active.

▼ PFD Top Annunciation Line:

GPS ONLY (White)	Shows when the FMS position is determined from GPS sensor data only.

▼ PFD Top Annunciation Line:

NO APPR (White)	Shows when the FMS guidance for the approach is not approved or the approach had been disabled. When this annunciation shows on the display, the lateral deviation scaling reverts to the terminal environment sensitivity level.

▼ PFD Top Annunciation Line:

NO APPR (Yellow)	Shows during final approach, when the navigation accuracy required to complete the approach is lost.

▼ PFD Top Annunciation Line:

SEQ INHB (White)	Shows when the SEQUENCE mode is set to INHIBIT on the LEGS page and the aircraft is on the FROM side of the active waypoint. Setting SEQUENCE to AUTO on the LEGS page removes this annunciation.

▼ PFD Top Annunciation Line:

TERM (White)	Shows when the lateral and vertical deviations are set to the terminal sensitivity levels.

▼ PFD Bottom Annunciation Line:

ALT (Yellow)	Shows when the rate of climb or descent is less than what is required to make the next altitude constraint specified in the flight plan.

▼ PFD Bottom Annunciation Line:

BOC (White)	Shows when the aircraft is within 1 minute of a Bottom Of Climb (BOC) altitude change. When the aircraft is within 5 seconds of the change, the annunciation begins to flash. The annunciation turns off after the aircraft passes the BOC point.

▼ PFD Bottom Annunciation Line:

HOLD (White)	Shows when a holding pattern is active.

▼ PFD Bottom Annunciation Line:

MSG (White)	Shows when there is a white message on the CDU MESSAGES page.

▼ PFD Bottom Annunciation Line:

MSG (Yellow)	Shows when there is a yellow message on the CDU MESSAGES page.

▼ PFD Bottom Annunciation Line:

OFST (White)	Shows when a flight plan parallel offset is in effect.

▼ PFD Bottom Annunciation Line:

SPD (Yellow)	Shows when the current aircraft speed is 20 knots or greater than the target speed and VNAV is selected. It also shows when the aircraft is within 2 minutes of reaching a hold and the aircraft speed is 10 knots or greater than the recommended maximum holding speed and VNAV is not selected or not available.

▼ PFD Bottom Annunciation Line:

TOD (White)	Shows when the aircraft is within 1 minute of a Top Of Descent (TOD) altitude change. When the aircraft is within 5 seconds of the change, the annunciation begins to flash. The annunciation turns off after the aircraft passes the TOD point.

▼ PFD Message Line:

DISCONTINUITY (White)	⇒ Delete the discontinuity. ⇒ Sequence past the discontinuity if it cannot be deleted.

Shows in the middle of the HSI displays when the active leg of the flight plan is a discontinuity.

▼ PFD Message Line:

NO FLIGHT PLAN (White)	⇒ Enter and execute a flight plan. ⇒ Select a navigation source other than FMS. Shows in the middle of the HSI display when FMS is selected as the navigation source and there is no flight plan entered into the FMS.

MFD MESSAGES

TPG5118_32

▼ MFD Message Line:

CHK POS (Yellow)	⇒ Verify all sensors are enabled for use by the FMS.

⇒ Perform a position update if an accurate position can be determined by one of the navigation sensors.

Shows when the FMS position estimate does not meet the accuracy required for the current phase of flight.

▼ MFD Message Line:

FMS NAV INVALID (Yellow)	⇒ Check the NAV sensors to be sure they are enabled. ⇒ Check for an attitude sensor failure. Shows when the aircraft is airborne and the FMS does not have a valid airspeed or heading.

▼ MFD Message Line:

FMS NAV INVALID (White)	⇒ Check the NAV sensors to be sure they are enabled. ⇒ Check for an attitude sensor failure. Shows when the aircraft is on the ground and the FMS does not have a valid source for heading.

▼ MFD Message Line:

FMS DR (White)	⇒ Make sure VOR/DME and GPS sensors are enabled. ⇒ Make sure AUTO tuning mode is selected on the TUNING page.

	⇒ Do a position update of the FMS with data from a known good sensor. Shows when the FMS is in dead reckoning mode with the aircraft on the ground or airborne for less than 2 minutes.

▼ MFD Message Line:

FMS DR (Yellow)	⇒ Make sure navigation sensors are enabled. ⇒ Do a position update of the FMS with data from a known good sensor. Shows when the FMS is in dead reckoning mode and the aircraft has been airborne for longer than 2 minutes.

▼ MFD Message Line:

DR EXCEEDS 5 MIN (Yellow)	Shows when the FMS has been in DR mode for 5 minutes or longer.

This page intentionally left blank

TABLE OF CONTENTS

Title	Page

ADDENDUM 1
TO
FMS-3000 Flight Management System for the Cessna Citation Encore+
PILOT'S GUIDE

Part Number 523-0808270-001117, 1st Edition Dated 31 Jul 06

NOTICE

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

The technical data in this document (or file) is controlled for export under the Export Administration Regulations (EAR), 15 CFR Parts 730-774. Violations of these laws may be subject to fines and penalties under the Export Administration Act.

Insert this addendum sheet prior to page 15-1

The following information is provided for aircrew awareness and should be accessible to pilots on the flight deck. A choice between two Navigational Databases Vendors is available for Rockwell Collins Flight Management Systems requiring a *Type 4* or *Type 6* navigation database. Two choices exist for Navigation database for the RCI FMS and they are named: **Standard** (Lufthansa Systems Inc.) and **Optional** (Jeppesen Sanderson Inc.).

The status of the FAA AC 20 -153 Type-1 Navigation Database Vendor Letter of Acceptance (LOA) and Rockwell Collins FAA AC 20 -153 Type-2 LOA that ensure compliance of the aeronautical data to the State data sources can be found at the following link. http://www.rockwellcollins.com/fms/navalerts.asp

The CDU Status Page delineates which vendor's navigational data is loaded into the FMC by the respective prefix letter "**L**" (LSY) or "**J**" (Jeppesen) preceding the identified Nav Data.

Regulatory guidance for preflight planning requires crew members to verify their Flight Plan (route verification check) and accomplish a legs verification check for the complete flight plan route and note or resolve any discrepancies, these observations are offered for consideration by customers electing to change database vendors. These observations are neither totally inclusive nor exclusive and are subject to change with each AIRAC cycle (28 day update cycle). The following LSY observations are general in nature, were noted during one AIRAC cycle and therefore will not be updated

1. When lifting off the runway on takeoff or on a missed approach, an initial altitude constraint not defined by the procedure can be referenced in the navigational database.
    - LSY usually references 500' AGL

2. *"Expected Altitude"* constraints published in Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs) are often included in the LSY database.
3. Waypoint fixes exist that are not defined as part of a procedural design.
   - o The name and location of aeronautical data representing an undefined fix is at the discretion of the vendor. An example would be the waypoints used to define a turn to final from an arcing approach.
4. STAR/SID Name and Transition:
   - o Waypoints listed as referenced to the PROCEDURAL named fix may not be dependent on runway selection in the LSY database. The BYP5 STAR into Dallas/Ft Worth is an example.
      a. The LSY database lists the waypoints past BYP prior to runway selection (i.e. all the way to STONZ).
   - o The LSY database lists only the RNAV procedure if more than published procedure exists.
      a. STAR example at Cairo (HECA): The BALTIM 1A *RNAV* arrival into Cairo for RWY 05R is listed as BLT1A, not RBLT1A.
5. Approach Transition Name: A database vendor has discretion in approach transition naming. Washington Reagan (KDCA) can be referenced to illustrate.
   - o The GRNV04 approach with the Transition of *GTN* in the LSY database represents the Georgetown Transition.
6. The LSY database provides Airport Communication Frequency coverage at most Large Volume Airports.
7. The LSY Navigational Database always uses an Airport Identifier consisting of four characters (i.e. KWOO, not WOO).

If you have any questions regarding this FMS Pilot's/Operator's Guide Addendum, please contact your local Rockwell Collins Customer Support Engineer or call FMS & Database Support at 319.295.5000.

PRINCIPLES OF FMS NAVIGATION

INTRODUCTION

FMS-3000 navigation is based on using all of the available navigation sensors on the aircraft to fly from waypoint to waypoint along a flight plan route. The waypoints are based on the information contained in the FMS-3000 Navigation Database, as well as pilot-defined waypoints. A flight plan route is selected from a route list, or created from the database waypoint information and/or pilot-defined waypoints. With the navigation and other sensor data available to it, the FMS determines the present position relative to the flight plan route and computes steering commands for use by the flight control system. These commands are used to fly the aircraft along the route.

FMS DATABASE

The FMS-3000 typically contains two databases: the active database, and the secondary database. Only the active database is used for flight planning and navigation purposes. The secondary database allows a new database to be loaded before the effective date so the new database is ready for use when it becomes valid.

A database can include, but is not limited to, data about these facilities:

- Airports and Runways
- Navaids to include VOR, DME, and TACAN
- GPS
- NDB
- Airways
- Intersections
- Pilot-defined waypoints
- SIDs and STARs
- Approach procedures and Missed Approach procedures.

A new, updated database must be installed every 28 days to make sure that it contains the latest available information for the facilities described previously. Updates are accomplished by loading new data into the Flight Management Computer (FMC) on the aircraft.

Navigation database information is used for many purposes. Pilots use the information to create and modify flight plans. The FMS uses the information to do any of the actions that follow:

- Select the VOR/DME navaids to use in determining the position.
- Show information about the various navigation facilities on the CDU, MFD data pages and MAP displays.
- Automatically insert into a flight plan the waypoints that make up a selected airway, SID, STAR, or approach.

DUAL FMS COORDINATION

Dual FMS installations can operate in a synchronized (SYNC) or independent (INDEP) mode. The mode is selected by the pilot on the FMS CONTROL page.

SYNC

In the synchronized mode, the items that follow are automatically synchronized between both FMSs:

- FMS position initialization
- Database selection
- Disabled VOR/DME navaids
- Disabled navigation sensors (except for GPS)
- All mode selections
- FIX INFO entries
- Flight entries or changes (for active flight plans, only after the flight plan is executed)
- Second flight plan entries or changes.

In the synchronized mode, changes made to an active flight plan on one FMS are synchronized with the other FMS when the EXEC function key on the CDU is pushed to execute the flight plan. Changes made to the second flight plan on one FMS are synchronized immediately with the other FMS.

Only one FMS can change an active flight plan at any time. If one FMS already has a MOD FPLN in progress, any attempt to edit or change the active flight plan from the other FMS shows the message XSIDE

EDIT IN PROGRESS on the CDU scratchpad line. The same is true if an attempt is made to activate a flight plan from the other FMS.

When both FMSs are selected as navigation sources, sequencing of the flight plan legs is controlled by the FMS that is selected as the active NAV steering source. When only one FMS is selected as the navigation source, it controls the sequencing of flight plan legs.

INDEP

In the independent mode, none of the mode selections (except for the MAG/TRUE display reference selection) or flight planning data from one FMS are shared with the other FMS. Flight plans can still be copied in whole from one FMS to the other through the FPLN TRANSFER function on the last page of the ACT FPLN and SEC FPLN pages. If a flight plan transfer is attempted when a flight plan is being edited (MOD FPLN page showing), the flight plan will be transferred without the new information. If a transfer is attempted when no flight plan exists on the other FMS, the message NO XSIDE FPLN shows on the scratchpad. If the database is not the same on both FMSs when a flight plan transfer is attempted, the message CHK SELECTED DATA BASE shows on the scratchpad line. The database must be the same on both FMSs to copy a flight plan from one to the other.

NOTE

Due to variations in each FMS as it determines the position, it is possible that sequencing from one leg of a flight plan to the next will not occur simultaneously on both systems while they are in the independent mode of operation.

POSITION INITIALIZATION

PREFLIGHT

After power is applied to the FMS, a position initialization process is necessary for the FMS to accurately determine the present position. This is done by entry of a known position, such as the airport, runway threshold, gate, or navaid, into the FMS through the POS INIT pages on the CDU. This lets the FMS use the available sensors to accurately determine and track the present position, direction, and speed. The most accurate way to initialize the FMS position is to enter on the POS INIT page the coordinates, if known, for the location where the aircraft is currently parked.

RUNWAY UPDATES

To further increase the accuracy of the initial position before takeoff, the ACT LEGS page provides the capability to update the position to the runway threshold. As the aircraft moves into position on the runway, the FMS can be updated to that initial position. It is important that the aircraft be at the threshold before this update is completed. In aircraft with GPS sensors available for use by the FMS, it is not necessary to do position updates at the runway threshold.

POSITION UPDATES

Updates to the FMS position are completed inflight using position data from a GPS sensor, a navaid, or the FMS itself (based on the equipment installed in the aircraft). However, GPS sensors cannot be position updated from the FMS while the aircraft is airborne.

FLIGHT PLAN

Each FMS-3000 can hold two flight plans: the active flight plan and the second flight plan. Active flight plan data shows on the ACT FPLN, MOD FPLN, 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 navigation source.

A flight plan is made up of waypoints, which are created from a combination of elements that include some or all of the items that follow:

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

A waypoint is a point that is used as a reference for a navigation fix. Waypoints can be either predefined or pilot-defined. Predefined waypoints are stored in the FMS navigation database with the identifiers that show on aeronautical charts. These waypoints can 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 synchronized operating mode, flight plan data is shared between both systems. In the independent operating mode, flight plan data is not shared between the systems. However, the flight plans can be copied, in whole, from one FMS to the other.

In synchronized mode, as the aircraft progresses along the flight plan route, both FMSs are simultaneously sequenced from one waypoint to the next. In the independent mode, when both FMS1 and FMS2 are selected as navigation sources, each FMS independently sequences through the flight plan as the aircraft progresses along the route.

NAVIGATION SENSORS

To navigate, the FMS-3000 uses sensor data from GPS, VOR/DME navaids, and air data systems, along with the active flight plan and internal database information. The sensor data is used by the FMS to determine the present position, direction, and speed.

To determine the present position, the FMS uses all of the installed and enabled navigation sensors available. The FMS uses data from each sensor to determine position, as long as the data is valid or the sensor has not been specifically disabled. By default, all navigation sensors are enabled for use by the FMS at startup. Disabling sensors can degrade the accuracy of the position. Since the FMS weighs the accuracy and validity of each sensor as part of determining the position, all sensors should be enabled at all times. Disabling a known invalid or failed sensor, or up to eight specific navaids that are out of service, would be the only exception to this. By leaving all sensors enabled, the FMS can properly select the most accurate sensors for use in calculating the position.

VOR AND DME

For VOR and DME navigation, the FMS scans approximately every 3 minutes for the best combination of DME stations, according to the database and present position. It takes into account the service volume of the navaids, the altitude and distance of the aircraft from them, and the geometric relationship required for accurate positioning data. To make sure that the DME stations received have valid signals and are the stations it expected to receive, the FMS verifies the actual station identifiers it receives with the database information for the expected station and rejects any DME stations with invalid identifiers.

The default FMS operating mode for use of VOR/DME navaids is DME/DME navigation. In this mode, the FMS automatically tunes DME channels 2 and 3, using the distance data as part of the calculations to determine position. It does this with both NAV receivers, unless they are specifically disabled for use by the FMS on the VOR CONTROL page. When the NAV receiver tuning mode for the FMS is set to AUTO on the RADIO TUNING page, the FMS automatically tunes the paired VOR and DME channel 1 frequencies in addition to DME channels 2 and 3. This gives the FMS up to six DME stations to use in determining the position with a high degree of accuracy.

The FMS uses the database to select and tune DME stations, first looking for stations with a geometry that will give the most accurate position information. If one or more of those stations cannot be received or the signal is invalid, it scans for another station. It continues to do this until it finds valid stations within the required geometric limits for determining the position. As the search expands and the geometric positioning of the stations degrades, the accuracy of the DME positions data decreases. However, the FMS takes this into account as it calculates the present position. After the DME scan is complete, any DME channels that did not receive a valid signal are tuned to the navaids closest to the present position of the aircraft. They remain tuned to those navaids until the next scan.

NOTE

When the aircraft is on the ground, the FMS tunes the navigation receivers to the closest navaids so they will be available as soon as possible after takeoff.

When at least two properly positioned DME stations are received and valid, the present position of the aircraft can be calculated using the distance data from each of those stations. If more valid stations are received, and they are within the required geometric limits, they are also used as part of determining the position and will improve the accuracy. For this reason, the FMS NAV tuning mode should always be set to AUTO to make the additional VOR/DME channels available to the FMS for DME/DME navigation. If the geometry of the received and valid DME stations will not result in an acceptably accurate position determination, the FMS removes the DME/DME navigation data from the calculations to determine position.

When less than two correctly positioned and valid DME stations are available, the FMS can still use VOR radial and DME distance from a collocated VOR/DME pair as part of the calculations to determine position. As with DME/DME, the FMS supplements VOR/DME data with data from the other navigation sensors available to it, as previously described, to increase the accuracy of the position solution.

When the aircraft is within the cone of confusion of a VOR/DME navaid that is currently in use for VOR/DME navigation, the FMS removes that VOR/DME navigation data from the position calculations. The FMS considers the aircraft to be within the cone of confusion when the elevation angle from the navaid to the aircraft is greater than 45 degrees.

GPS

The FMS uses, by default, the same-side GPS sensor data as it is provided by the sensor.

GPS can be used for primary means of navigation in oceanic and remote areas, provided a qualified GPS sensor is installed in the aircraft. Qualified GPS sensors include a ground-based prediction program that verifies GPS navigation availability over the planned route. Pre-departure verification of GPS availability is required for GPS as primary means of navigation before each flight.

The Collins-supplied GPS is approved for primary means of navigation and as a qualified GPS sensor if used with the Collins ground-based prediction program.

Status and integrity of the GPS position solution shows on the MFD LRN STATUS page. GPS Receiver Autonomous Integrity Monitoring (RAIM) is used to assure that the GPS solution meets the required accuracy criteria that follow:

- 4 NM oceanic/remote
- 2 NM en route
- 1 NM terminal
- 0.3 NM final approach with 99.9% confidence.

The current Receiver Autonomous Integrity Monitoring (RAIM) accuracy limit is displayed on the LRN STATUS page. The oceanic/remote threshold is used in the North Atlantic region. Other remote areas use the en route threshold.

The measured accuracy limit on LRN STATUS page indicates the maximum estimated error based on measurement inconsistency. Unless an error is detected by RAIM, this value is always less than the RAIM accuracy limit.

When an error is detected, it is annunciated on the LRN STATUS page. If the detected error cannot be predicted to be less than the required integrity threshold, GPS is removed from the navigation solution. If no other navigation sensors are available, the FMS navigates by dead reckoning. If no error is detected by RAIM, the probable GPS error shows. This is a statistical number based on normal satellite error characteristics.

DEAD RECKONING (DR)

When no navigation sensor data is available for the FMS to use, it begins navigating in the DR mode. In this mode, it estimates the position based only on the last known position, heading, and airspeed. To identify this mode, FMS DR shows on the MFD and PFD if the navigation source is FMS. The annunciation also shows on the CDU message line and MESSAGES page.

REVERSION MODE

Normally, the FMS uses same-side data from the installed GPS and air data sensors. However, if a same-side sensor fails or the data is invalid, the FMS automatically changes to the cross-side sensor as long as the data from that sensor is valid and it has not been manually disabled on the control page for that sensor. Only one of each sensor type is used by the FMS in the calculations to determine position.

If the FMS is using a cross-side sensor while the aircraft is on the ground, it will automatically change back to the same-side sensor if data from that sensor becomes valid before the aircraft is airborne. When the aircraft is airborne, if the FMS changes to, or is already using, a cross-side sensor, it will not change back to the same-side sensor even if the sensor returns to a valid state. However, if the cross-side sensor becomes invalid while the same-side sensor is valid, it will change back to the same-side sensor. In addition, at any time, a sensor that has been manually disabled can be manually enabled on the CDU control page for that sensor.

SENSOR MONITORING

The FMS continuously monitors the navigation sensors to make sure they provide valid position data to the FMS. If position data from a specific sensor varies significantly from the FMS position, the CHK POS message is annunciated on the PFD and MFD. It also shows on the CDU message line and MESSAGES page, where it is followed by a message that identifies the suspect sensor (GPS-FMS DISAGREE, FMS-FMS DISAGREE, or DME-FMS DISAGREE). The monitors for each sensor type have different thresholds, based on the phase of flight (en route or terminal), for annunciating a sensor disagreement.

REQUIRED NAVIGATION PERFORMANCE (RNP)

Required Navigation Performance (RNP) is a statement of the navigation accuracy necessary for operation within a defined airspace. The RNP value can be specified by the pilot and entered on the PROGRESS 2/2 page through the CDU. The FMS also computes the expected position accuracy based upon the navigation sensors it is using. The expected position accuracy also shows on the PROGRESS 2/2 page.

When flying in RNP airspace, the error in the location of the aircraft is required to be less than the RNP value 95% of the time. FMS position error should be less than the expected position accuracy 95% of the time. Therefore, when the expected position accuracy value is greater than the RNP value, the message LOW POSITION ACCURACY shows on the CDU message line.

If, for example, the aircraft were operating in an area that requires position accuracy to within 2 NM, the pilot would manually enter 2.0 in the RNP field. If the FMS position accuracy exceeds 2.0, which is the RNP setting, the LOW POSITION ACCURACY message will appear. The pilot should then determine if the FMS is using all available sensors for determining position, and take corrective action, such as enabling sensors or amending clearance if necessary.

FLIGHT PLAN TRACKING

The FMS accomplishes flight plan tracking by determining the present position, direction, and speed, and then computing steering commands for use by the flight control system to steer the aircraft along a flight plan route. Flight plan routes are typically made up of great circle legs from waypoint to waypoint.

WAYPOINTS

In addition to identifying a specific navigation facility, a waypoint can have one or more other unique properties. Some of these properties are as follows: TO waypoints, flyover waypoints, and conditional waypoints.

A TO waypoint is the waypoint to which the FMS is currently tracking on the active leg of the flight plan. The CDU and MFD show the TO waypoint information in green, and the TO waypoint identifier is annunciated in green on the PFD under the NAV source annunciation.

A flyover waypoint is a waypoint that must be flown over or abeam before the FMS sequences to the next waypoint of the flight plan. Leg terminating waypoints, such as a waypoint before a discontinuity, a holding fix waypoint, some waypoints in SIDs and STARs, the Missed Approach (MAP) waypoint, and the last waypoint at the end of a flight plan, are flyover waypoints.

It is possible to transform a non-flyover waypoint into a flyover waypoint, and subsequently remove the flyover attribute from a user-defined flyover waypoint. By adding or removing a /0 (slash zero) to or from a waypoint identifier, the FMS flight plan editor allows the user to add, or remove, the flyover attribute. Refer to the FLIGHT PLANNING chapter of this operator's guide for the procedure for adding or removing the flyover attribute.

Conditional waypoints are waypoints that are part of a SID, STAR, or approach and are not located at a geographically fixed position. They show enclosed in parenthesis. A turn point located at a specified altitude, and the point where a heading leg intersects with a leg defined by a VOR radial are two examples of conditional waypoints. A conditional waypoint cannot be manually entered into a flight plan. They are entered as part of a SID or STAR.

LEG SEQUENCING

Flight plan legs are typically defined by the waypoint at each end of the leg. As the aircraft approaches the TO waypoint, the FMS gives a waypoint alert by flashing the waypoint identifier on the PFD, and the waypoint identifier and symbol on the MFD maps. Approximately 5 seconds after the waypoint alert the FMS sequences to the next leg of the flight plan and generates steering commands to steer the aircraft toward the new TO waypoint.

When the FMS sequences to a discontinuity in the flight plan, or when the last waypoint in the flight plan is passed, it begins computing steering commands to fly wings level.

MAGNETIC VARIATION EFFECTS ON DISPLAYED DESIRED COURSE

On an HSI, the numeric course and the position of the course pointer arrow for a waypoint or navaid facility often differ slightly from the course value shown by the FMS. The difference is compounded as the distance from that fix increases. The difference exists for the following reasons:

1. As the aircraft travels along the flight path, the FMS constantly calculates the current value of the desired true track, which reflects the changing direction of the curved geodesic route abeam the present position of the aircraft.
2. The FMS corrects the current desired true track to a magnetic reference using the calculated value for magnetic variation at the present position of the aircraft. This value can be somewhat different from the value used to define an arrival or departure course as described above because of the following:
   - The actual magnetic variation varies from place to place as the aircraft travels.
   - The magnetic model used by the FMS to calculate local variation will not exactly match the declination or magnetic variation published in the navigation database for the navaids and airports.

Another effect caused by the differences in MAG VAR as described above appears when editing a flight plan: the course value shown on the CDU can change when the pilot executes the flight plan. Before executing a flight plan, the course shown to a waypoint is based on the source magnetic variance. After executing the flight plan, the course is based on the MAG VAR at the present position of the aircraft. The resulting course over the ground is exactly as specified by the pilot using the declination or magnetic variation contained in the database.

DISCONTINUITIES

Discontinuities are inserted automatically during certain edits of a flight plan. Their purpose is to segregate portions of the flight plan that are not naturally connected, such as an approach procedure not connected by an Initial Approach Fix (IAF) to the last en route or arrival waypoint.

A waypoint before a discontinuity is treated as a flyover waypoint. As such, the FMS sequences a flight plan to a discontinuity only as the aircraft passes abeam the waypoint. At that point, the FMS steers the aircraft to wings-level mode. The aircraft will continue to fly wings-level until FMS is deselected as the navigation source or the discontinuity is removed.

Two minutes before reaching a waypoint that is followed by a discontinuity, the message FPLN DISCONTINUITY shows on the CDU message line. The waypoint alert feature flashes the waypoint and the identifier on the CDU and MFD for 5 seconds. The waypoint alert will flash the waypoint and the identifier again 5 seconds before sequencing to the discontinuity.

While the FMS is steering to wings-level flight, no data shows on the displays for the following:

- Time-to-go
- Distance-to-go
- Bearing to waypoint
- Course
- Cross track deviation
- Course arrow
- Course digital readout.

In addition, the LNAV mode annunciation shows in yellow on the PFD.

A discontinuity can be deleted from a flight plan at any time by replacing it with the next waypoint in the flight plan. Some discontinuities can also be deleted directly by entering DELETE in the scratchpad with the CLR DEL function key on the CDU and transferring it to the discontinuity. Either method results in the FMS connecting the last waypoint before the discontinuity with the next waypoint following the discontinuity.

Deleting a discontinuity when it is the active leg (the TO waypoint) results in a direct-to course to the next waypoint unless a specific course is entered and activates in the INTC CRS data line.

Another way to sequence beyond a discontinuity is to select AUTO sequencing with the AUTO/INHIBIT line select key. When the FMS sequences to a discontinuity, the sequencing mode is automatically changed to INHIBIT. Push the AUTO/INHIBIT line key to select AUTO, and the FMS will sequence to the next waypoint in the flight plan.

TURNS

The FMS computes a turn using a constant bank angle. For small turns, the amount of bank angle is small. The larger the turn, the greater the bank angle. It also computes when to start a turn based on the type of waypoint, the number of degrees of turn, the true airspeed of the aircraft, the current heading relative to the new heading, and the wind conditions. During a turn, the FMS continuously computes the bank angle to compensate for changes in wind conditions, true airspeed, and the heading of the aircraft relative to the new course.

BANK ANGLE AND ROLL RATE

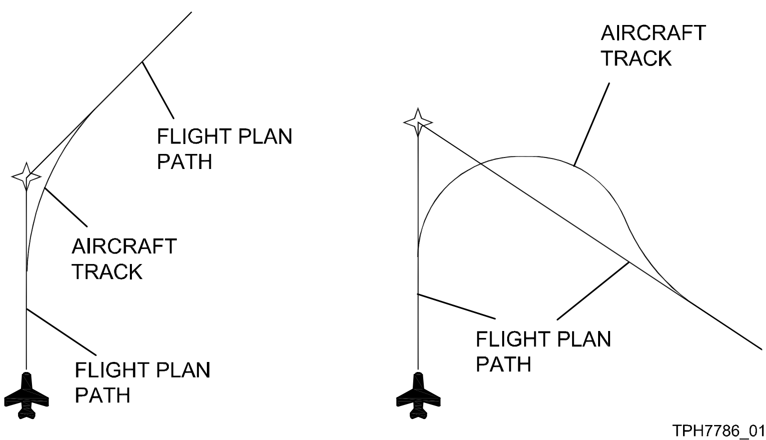
The bank angle and roll rate during a turn is continuously computed by the FMS with consideration for the bank angle limits of the flight control systems. With the flight control system set to the normal operation mode (no bank limit selected), the bank angle is limited to approximately 25 degrees. With the flight control system set to the HALF-BANK mode, the bank angle is limited to approximately 12.5 degrees. Roll rate is set at 3 degrees per second for all turns.

ANTICIPATION

As the aircraft approaches a turn at a waypoint, in addition to computing the bank angle for the turn, the FMS computes the point that the turn is to start. This is called turn anticipation. Its purpose is to prevent the aircraft overshooting the new course during the turn. Essentially, the FMS cuts the corner of the turn to make a smooth transition to the new course.

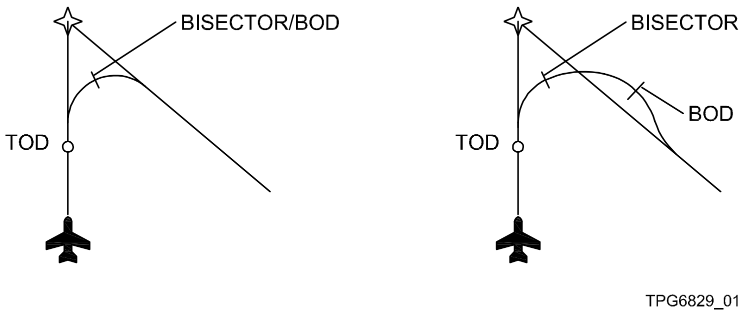
For flight plan leg turns at true airspeeds of less than 350 knots, the turn initiation point is not further than 7 NM from the waypoint. At true airspeeds of 350 knots or greater, the turn initiation limit is no further than 12 NM from the waypoint. A waypoint alert flashes the active waypoint identifier on the PFD display, and the active waypoint symbol and identifier on the MFD map appear approximately 5 seconds before the FMS initiates the turn to the new course. While turn anticipation prevents most overshoots, very large course changes can still result in some overshoot.

Figure 15-1 Typical Flight Path for Turns



Overshoots can have an effect on how a VNAV descent path is flown. Without an overshoot, the aircraft will begin descent at the TOD, and, in most cases, will bottom out at the turn bisector if a level off segment begins at the subject bisector. Overshoots caused by sharp turns (for example 120 degrees) and/or higher ground speeds can cause the bottoming out (VNAV Bottom of Descent) to occur beyond the bisector. Under these conditions, the pilot must monitor VNAV to make sure that the altitude constraints are met.

Figure 15-2   Effects of Overshoots on Descents

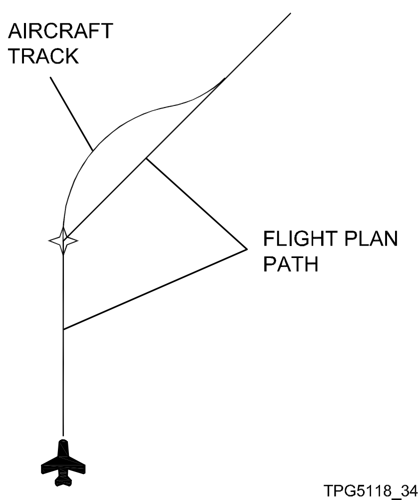


FLYOVER WAYPOINTS

Waypoints designated as flyover waypoints require the aircraft to fly over the waypoint before a turn is started. Examples include leg terminating waypoints such as a waypoint before a discontinuity, holding fix waypoints, and the last waypoint at the end of a flight plan.

It is possible to transform a non-flyover waypoint into a flyover waypoint, and subsequently remove the flyover attribute from a user-defined flyover waypoint. By adding or removing a /0 (slash zero) to or from a waypoint identifier, the FMS flight plan editor allows the user to add, or remove, the flyover attribute. Refer to the FLIGHT PLANNING chapter of this guide for the procedure to add or remove the user-defined flyover attribute.

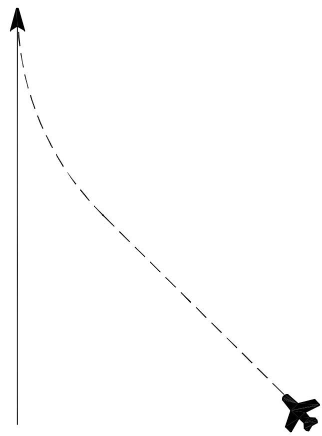
Figure 15-3   Typical Course Change at a Flyover Waypoint



INTERCEPTING A TRACK

The FMS can intercept an active course track at any angle of convergence. Whenever possible, the intercept is such that the aircraft turns onto the active course without overshoot. However, if the intercept angle is great and the distance to the course is short, an overshoot will occur. If the intercept path is such that the intercept will not occur before the active waypoint, the message NOT ON INTERCEPT TRK shows on the CDU message page.

Figure 15-4 Typical Course Intercept



TPG5118_35

PARALLEL OFFSET COURSE TRACKING

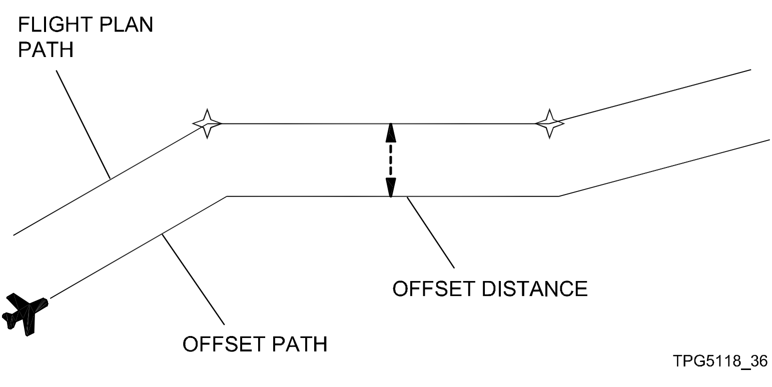
The FMS can track a parallel offset path to a flight plan route. While tracking an offset path, course heading and deviation are referenced to the offset path. Also, distance and time-to-go data for the active leg are referenced to the offset path intersections, effectively treating these intersections as actual waypoints. Turn anticipation and waypoint alerts are also referenced from the offset intersections.

Adding, changing, or deleting an offset to a flight plan path causes the FMS to immediately steer to the new offset, or the original flight plan path if the offset is deleted. For large changes in the offset path, the FMS can steer an intercept of up to 45 degrees to the new path.

Cancel offset tracking manually by entering a zero offset, or deleting it with the CLR DEL function key on the CDU. Offset flight plan tracking is canceled automatically when:

- A Direct-To or other type course change is made to the flight plan.
- The flight plan sequences to a leg that does not support an offset path (holding leg or vectors leg).
- The flight plan sequences to a discontinuity.
- The flight plan sequences to a leg that requires a course change of greater than 100 degrees.

Figure 15-5   Typical Parallel Offset Course Tracking



HOLDING PATTERNS

ENTRY

Just before crossing the holding fix, the FMS calculates the size of the holding pattern. The calculation is based on the wind conditions, the true airspeed of the aircraft or the MAX HOLD speed, whichever is lower, and either the leg time or the leg distance of the hold. The size of the holding pattern is set (unless edited on the CDU HOLD page) until the fix is passed again. Just before each subsequent pass of the fix, the FMS recalculates the holding pattern. Thus, each circuit of the holding pattern is the proper size for the existing wind conditions and true airspeed.

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 make sure the protected airspace of the holding pattern is not violated when flown in excessive wind conditions. If the ground speed is slow, the parallel entry leg can extend well beyond the normal inbound leg turn (as shown below). However, even with the extended entry leg, the FMS maintains the aircraft well within the protected airspace for a holding pattern.

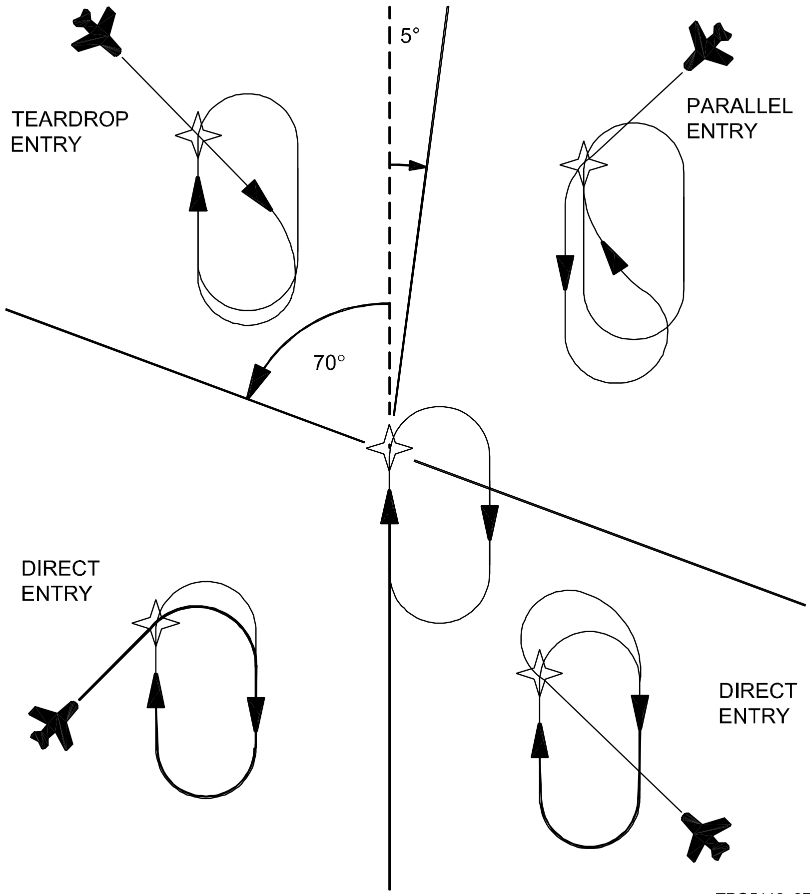
FLYING A HOLD

The FMS provides holding pattern steering data to the flight control system. The FMS is calculated to steer the aircraft in the smallest symmetrical racetrack pattern within the aircraft selected bank angle limit. The normal bank angle limit is 25 degrees and the HALF-BANK limit is 12.5 degrees. Holding patterns should be flown in normal bank mode unless weight and/or altitude prohibit and ATC approves the use of HALF-BANK.

NOTE

The message HALF-BANK SELECTED shows on the CDU message line when the aircraft is within 1 minute of arriving at the holding pattern fix and HALF-BANK is selected on the flight control system.

Figure 15-6 Typical Holding Entry Options

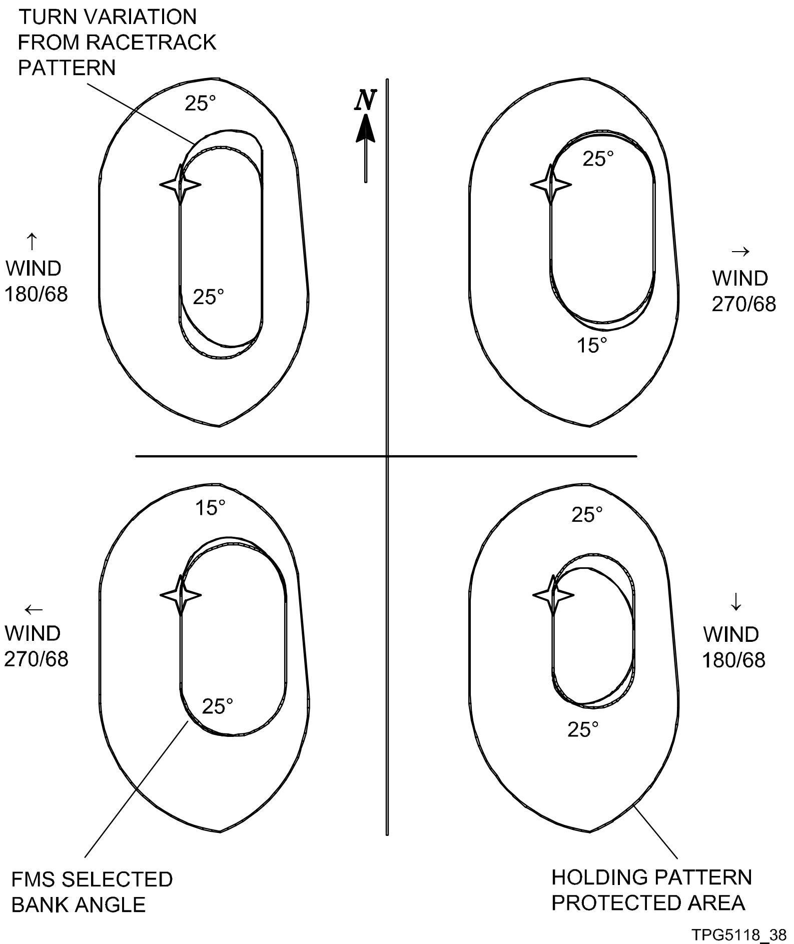


WARNING

Based on the size of the holding pattern and the airspeed of the aircraft, it can be impossible for the FMS to maintain the aircraft within the protected airspace of a holding pattern in strong wind conditions when the flight control system is set to the half bank mode.

The FMS steers the aircraft around the holding pattern using a constant bank angle in the turns. It is possible that the track of the aircraft in the turns of a holding pattern in strong wind conditions will not be a true semicircular path, as shown in the figure on page 15-22. In addition, the radius of the turns for the holding pattern is size-limited to the MAX KIAS speed for the hold. If the speed is greater than the MAX KIAS for the hold, it is possible that the FMS will not be able to maintain the aircraft within the boundaries of the protected airspace of the holding pattern.

Figure 15-7 Holding Paths in Various Wind Conditions



When flying a hold, approximately 5 seconds before reaching the holding fix on each circuit around the holding pattern, the waypoint alert feature flashes the holding fix waypoint to alert the pilot of crossing the fix.

SPEEDS

Both FAA and ICAO recommended maximum holding speeds are programmed into the FMS. They show on the HOLD page on the CDU, and also on the LEGS page as the default speed for a hold. The FMS uses the LEGS page speed limits to show a CHECK SPEED message, on the message line of the CDU. The CHECK SPEED message shows when the aircraft speed exceeds the calculated deceleration profile for the upcoming speed limit by more than 20 knots. When VNAV is not active, the message is inhibited while the aircraft is more than 1 minute away from the initial arrival at the holding fix.

DISTANCE AND TIME

To help the pilot visualize the current position relative to the fix, distance and time to the holding fix show on the PFD, and are based on the direct distance from the present position of the aircraft to the holding fix. The distance and time to the holding fix that show on the MFD and on the CDU are based on the distance around the holding pattern to the fix, giving an exact ETA to the holding fix.

CHANGES

Changing the hold direction, leg time, leg length, or inbound course on the CDU HOLD page, causes the FMS to immediately recalculate the holding pattern. If a change to a holding pattern results in the aircraft being off the holding track, the FMS steers the aircraft onto the new holding pattern track using the smallest course change required.

NOTE

> The direction and inbound course of a hold cannot be changed once the hold is the active leg of the flight plan.

EXIT

Holds can be exited in one of two ways based on whether or not the hold is part of a course reversal for an approach procedure.

COURSE REVERSALS

When making a direct or teardrop entry into a course reversal hold of an approach, EXIT HOLD is automatically selected as soon as the aircraft enters the hold. When making a parallel entry into a course reversal hold, EXIT HOLD is selected after completing the entry. The pilot can manually select or cancel EXIT HOLD at any time. The aircraft automatically exits a course reversal hold when established on the inbound course at the INTC waypoint as shown on the MFD and the LEGS page of the CDU, rather than at the FIX waypoint.

OTHER HOLDS

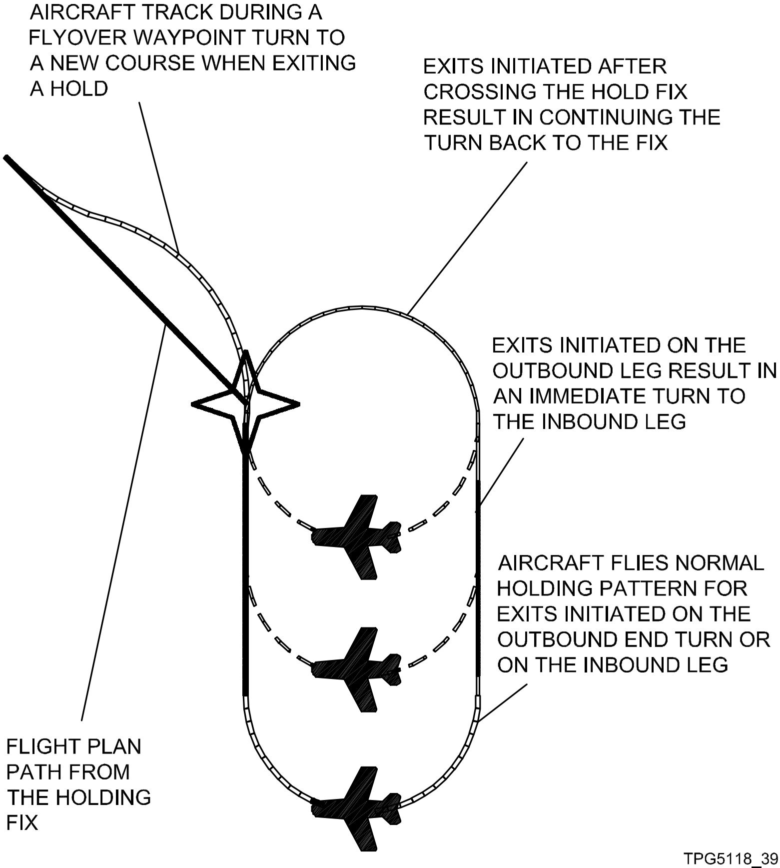
When EXIT HOLD is selected and executed, the EXIT ARMED message shows on the CDU LEGS page, and the FMS steers the aircraft to exit the holding pattern onto the next leg of the flight plan. If the aircraft is on the outbound turn or leg of the holding pattern when EXIT HOLD is selected and executed, the FMS immediately begins to steer the aircraft back to the inbound leg to the fix. If the aircraft is on the inbound turn or leg when EXIT HOLD is selected, the aircraft continues around the holding pattern to the fix in the normal manner. In both cases, the FMS steers the aircraft to fly over the holding fix waypoint and capture the course for the next leg of the flight plan.

CANCEL EXIT

An EXIT HOLD can be canceled at any time. However, if CANCEL EXIT is selected and executed after the FMS has initiated a turn to the inbound leg to exit the hold, it will continue the turn to the inbound leg and return to the fix. After crossing the fix, the FMS follows the complete holding pattern in the normal way.

If the aircraft is on the inbound turn or leg before crossing the fix when CANCEL EXIT is selected and executed, the FMS steers the aircraft around the holding pattern as if EXIT HOLD had not been selected and executed.

Figure 15-8 FMS Steering for Non Course-Reversal Hold Exit



FLIGHT PLAN TERMINATION

Two minutes before reaching the last waypoint of a flight plan, the CDU shows the message LAST WAYPOINT and the waypoint alert flashes the waypoint for 5 seconds. When the aircraft is within 5 seconds of passing abeam the last waypoint, the waypoint alert again flashes the waypoint. As the aircraft passes abeam the last waypoint, the FMS begins steering to maintain wings-level flight. The FMS continues to steer wings-level until it is deselected as the navigation source, or until a new waypoint is entered into the flight plan. The LEGS page shows the last waypoint until a new one is entered.

While the FMS is steering to wings-level flight, no data shows on the displays for time-to-go, distance-to-go, bearing to waypoint, course, cross track deviation, course arrow, and course digital readout. Also, the LNAV mode annunciation shows in yellow.

HEADING LEGS

For departure and arrival procedures that include legs that must be flown to a specified heading rather than a course, the FMS steers the aircraft to maintain the FMS flight plan heading.

OPERATION IN THE POLAR REGION

DEFINITION

The FMS computes the polar region as the area north of 89 degrees north latitude, inclusive, and the area south of 89 degrees south latitude, inclusive. The FMS navigation and steering is designed to operate normally in the polar region. The flight director and cross-track deviation displayed on the HSI work the same way and are completely unaffected when flying in the polar regions. The main differences observed when operating in or around the polar region have to do with flight plan entry limitations and the affects on cockpit displays.

FLIGHT PLAN ENTRY LIMITATIONS

Waypoints defined by place bearing/distance, place bearing/place bearing, and place along track, can be located in the polar regions. However, a reference fix used for any of these types cannot be located in the polar regions. If a waypoint definition is attempted with a reference fix located in the polar region, the message N/A IN POLAR REGION shows in the scratchpad. This restriction also includes both FMC-named and pilot named waypoints.

A FROM waypoint edit cannot be located within the polar regions. If an attempt is made to enter a FROM waypoint located in the polar regions, the message N/A IN POLAR REGION shows in the scratchpad.

Holding fixes cannot be located in the polar regions. This includes present position holding fixes. An attempt to define a holding pattern with a fix located in the polar regions causes the message N/A IN POLAR REGION to show in the scratchpad.

Course edits to a fix located in the polar regions are not allowed. An attempt to perform a course edit to a fix located in the polar regions causes the message N/A IN POLAR REGION to show in the scratchpad.

The FIX INFO page is not supported in the polar regions. If an attempt is made to use a reference fix located in the polar regions, the message N/A IN POLAR REGION shows in the scratchpad.

No search patterns are allowed north of 80 degrees north latitude, inclusive, or south of 80 degrees south latitude, inclusive. If any sector of a search pattern lies at or north of 80 degrees north latitude, or at or south of 80 degrees south latitude, then the message N/A IN POLAR REGION shows in the scratchpad.

EFFECTS ON COCKPIT DISPLAYS

Under certain conditions near the pole, the compass card on one flight display can rotate in the opposite direction or at a different rate when compared to the cross-side compass card.

The FMS uses a variety of navigational sensors to compute the most accurate position solution possible. Of all the sensor data available, GPS data is the most heavily weighted in the FMS navigation solution. Navigational radio sensor data also has some influence on the FMS position solution but, while operating in the polar regions, navaid availability is so sparse that this usually is not a factor. When the FMS is coupled to the autopilot as the lateral navigation steering source, the FMS will fly a path that is referenced to the navigation position solution.

When the FMS is coupled to the autopilot as the lateral navigation steering source, the FMS flies a path that is referenced to the navigation position solution.

The compass card on each Primary Flight Display (PFD) is referenced to aircraft heading. Each PFD uses either the same-side IRS or AHRS for heading source under normal conditions. Each IRS position calculation can drift from actual position by as much as 3 NM per hour. This implies that the IRS being used as the heading reference for the displays on one side could be referenced to a position several miles away from the IRS being used as a heading source for the displays on the other side.

As the aircraft FMS flies over the pole using the primarily GPS-based navigation solution, the aircraft heading displayed will be referenced to an IRS. The IRS appears to fly a course parallel to the aircraft track except that it travels either to the left, right, ahead, or behind the aircraft.

Since the heading-up display of the compass card on the PFD will follow the heading output of the same-side IRS heading, it is possible that the compass card on one side will not match the compass card on the other side. Therefore, when comparing the sensors on the displays on one side to the other, the compass card on one side could swing earlier or later than the other. Also, depending on how each of the IRS sensors have drifted in relation to the FMS position, the compass card on one side could swing clockwise while the other side swings counterclockwise. Again, depending on how each of the IRS sensors have drifted in relation to the FMS position, another possibility would have the compass cards on both displays turn in the same direction but at different rates.

In any case, whenever the heading shown on one side disagrees with the other side by more than six degrees, the yellow-boxed HDG flag and the yellow EFIS COMP MON message shows on the PFDs.

Another display effect is a possible 5-second period where the aircraft symbol appears to fly backwards on the map. This happens due to a difference in the update rates for the data being sent to the display to show the map. The FMS updates the display data sent to show a map once every 5 seconds. Between map data updates, the display updates the position of the aircraft symbol at a much faster rate. When the aircraft passes directly over a pole, this can cause some interesting effects as the map compass card whips around giving a possible 5 second illusion of the aircraft symbol flying backwards.

Not all of the effects discussed above have an effect on the guidance of the aircraft given by the roll commands from the FMS, the autopilot flight directors, or the cross track deviation as displayed on the HSI.

APPROACHES

The FMS-3000 is designed and authorized to automatically execute non-precision GPS, GPS overlay, multi-sensor RNAV, TACAN (as a GPS overlay), and VOR approaches. The lateral and vertical approach guidance is provided, whether using the course deviation, flight director guidance, or coupled autopilot. The database includes missed approach procedures for all approaches, and the procedures are designed to accommodate ATC radar vectors issued before or during an approach. The FMS can track all leg types stored in the approach database.

The FMS is used when flying ILS, localizer, localizer back course, Localizer Directional Aid (LDA) and Simplified Directional Facility (SDF) approaches. The FMS uses approach data to preset the PFD displays, autopilot, and the localizer receiver before beginning an approach with automatic NAV-to-NAV capture. Automatic transition to localizer guidance occurs when the aircraft is in a position to capture the localizer beam. Missed approach procedures for these approaches are also included.

Instrument Guidance System (IGS), non-GPS TACAN, non-GPS NDB, and LORAN approaches are included in the database. These are used to generate an FMS MAP for orientation on the MFD, although the approaches are executed using the authorized non-FMS guidance.

Visual approaches are also supported. The FMS MAP mode on the MFD shows runway threshold and runway extension waypoints.

The FAA has identified certain approaches as Phase Three GPS Approaches. These approaches are identified on the approach charts with “or GPS” in the name of the approach (for example, VOR or GPS Rwy 28). A Phase 3 approach is identified on the CDU approach selection list by prefixing the base name with a G (for example, GVOR28), unless the Phase 3 approach is not a GPS-only approach (identified as GPS28). ATC gives clearance for a Phase Three GPS approach using the GPS name (GPS 28) while also giving clearance for the same approach without GPS using the base name (VOR 28). An example clearance would read: "Cleared GPS approach, VOR 28, report runway in sight."

VISUAL APPROACHES

WARNING

A visual approach must not be used in Instrument Meteorological Conditions (IMC) as a substitute for an Instrument Flight Rules (IFR) approach.

As discussed here, a visual approach for the FMS is not the same as an IFR visual approach clearance issued by ATC. The FMS is not used for a visual approach in IMC. Visual approaches should only be used in Visual Flight Rules (VFR) conditions.

For a visual approach, the FMS generates lateral and vertical flight paths for an ILS-like approach to a runway. It also gives both lateral and vertical steering commands to the flight control system to capture and follow the generated flight paths of the approach.

Lateral and vertical guidance are indicated on the PFD by the lateral deviation bar and scale on the HSI, and the vertical deviation scale and pointer. Lateral deviation sensitivity is ±1 NM for terminal operation. When the aircraft is within 30 NM of the runway threshold, the message TERM shows on the PFD.

To set up the FMS for a visual approach, simply select an arrival runway for the destination airport on the ARRIVAL page. On selection of the arrival runway, the FMS automatically adds a five-mile runway extension waypoint. The runway default extension can be changed or deleted.

The FMS also creates a discontinuity from the last en route or STAR waypoint to the runway extension waypoint for the visual approach. The discontinuity can be deleted or initiate a Direct-To the runway extension at the appropriate time. If no other altitude constraints exist at prior waypoints, the VNAV function computes the Top Of Descent (TOD) and en route descent profile to the selected altitude at the runway extension waypoint of the visual approach. The altitude constraints and/or VPA are set on the LEGS page.

Enter a runway extension of 25.0 NM or less into the RWY EXT on the ARRIVAL page. The default is 5 NM. When a RWY EXT is entered, an unnamed pilot-defined waypoint is created. The waypoint is placed at a specified distance from the threshold and along the extension of the runway centerline. The fix is entered into the flight plan with a name consisting of the runway identifier prefixed with RX (example: RX27R).

Changing the selected runway removes the previously selected runway, and associated runway extension fix, from the flight plan. The new selected runway replaces the old selected runway, unless the old selected runway is the active waypoint. In that case, the new selected runway is inserted after the active waypoint. Additionally, if a STAR had been chosen that is not associated with the newly selected runway, the STAR is removed from the flight plan.

Changing a runway extension fix removes any previously selected runway extension fix from the flight plan, unless the old runway extension fix is the active waypoint. In that case, the new runway extension fix is inserted after the active waypoint.

INSTRUMENT APPROACHES

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

The FMS provides vertical and lateral steering commands to the flight control system to fly non-precision approaches, and it provides automatic NAV source transitions from FMS to a ILS sensor (NAV-to-NAV transfer) for localizer-based 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 can 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. Selection of an approach shows the list of transitions available for that approach under the annunciation TRANS. The default transition for all approaches is VECTORS. If a transition other than VECTORS is desired, it must be selected from the list of available transitions. Select transitions other than VECTORS from the list of available transitions.

Selection of an approach on the ARRIVAL page and then executing the flight plan change inserts a discontinuity automatically in the flight plan. This separates 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 to 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 procedures that follow can be used:

Select the VECTORS transition when vectors to final approach are expected. This transition consists of a course-to-fix leg in the flight plan leading to the final approach course toward the Final Approach Fix (FAF) or toward the Final Approach Course Fix (FACF) fix if present. With this course-to-fix leg established, follow radar vectors manually with the autopilot, or with the flight director. When the aircraft is properly positioned and cleared for the approach, intercept the course-to-fix leg leading to final approach, either manually or using the flight control system.

A second method for flying a VECTORS approach is to set the flight control system to the heading mode to follow ATC vectors, then change the flight plan in the FMS to set up for the approach. To do this, on the LEGS page, select an appropriate waypoint from the approach segment of the flight plan and make it the TO waypoint. Before executing the flight plan change, push the INTC CRS line key to set the appropriate course to intercept for the approach.

NOTE

When manually sequencing to an approach, inserting an approach segment waypoint in the TO waypoint position causes the FMS to automatically enter an inbound course to that waypoint on the INTC CRS data line. In addition, the FMS automatically inserts the appropriate INTC CRS into the flight plan when AUTO sequence to an approach waypoint from a discontinuity is selected.

To prevent the FAF from sequencing prematurely, regardless of the aircraft position, special waypoint passage criteria applies to the FAF. At 2.0 NM radial distance from the FAF, the criteria that follow must be true:

- The aircraft must have less than 1.6 NM cross track deviation.
- The magnitude of intercept (track angle minus outbound course from the FAF) must be less than 90 degrees.
- The aircraft altitude must be less than 3000 feet above the FAF altitude constraint.
- The FAF must be the TO waypoint or next waypoint after the TO waypoint.

LOCALIZER-BASED APPROACHES

The FMS-3000 supports a class of localizer-based approaches that include LOC, B/C, LDA, SDF, and full ILS. Although the FMS does not execute the final approach phase of these approaches, it does support initial approach phases leading to lateral navaid capture. Vector transitions to the approach are also supported. Missed approach procedures are included and are flown by reselecting FMS as the NAV source following a missed approach.

Localizer-based approaches have, as a minimum, the items that follow: an approach entry point called a Final Approach Course Fix, a Final Approach Fix, a runway threshold, and a missed approach procedure. One characteristic of the FACF is that localizer signal reception is assured on the leg from the FACF to the FAF.

The FACF fix can be named and printed on the published approach chart, but not always. However, the FACF is always named in the FMS database. If the database default name applies to an FACF, the first letter C designates the FACF waypoint type. The second letter refers to the approach type, for example, I for ILS, L for localizer, B for back course localizer, X for LDA, and Z for SDF. For circling approaches, the standard second-letter identifier is F.

The FAF and the portions of the approach that follow the localizer interception are included in the approach flight plan. They show on the MFD FMS MAP only as a visual reference aid depicting the overall navigation situation.

Localizer-based approaches and transitions are selected on the ARRIVAL page. The ARRIVAL page is selected with the DEP ARR function key or with the ARR line select key on the DEP/ARR INDEX page.

For airports with STARS, an available approach can be selected with or without an accompanying STAR.

When the aircraft flies to within 30 NM of the destination airport, the displays, autopilot, and localizer receiver are automatically preset and tuned by the FMS using the NAV-to-NAV transfer function, on selection of a localizer-based approach. It tunes the new LOC frequency, selects it as the preset navigation source, and sets the inbound preset second course.

If the NAV radio is set to manual tuning mode, 30 seconds before the FMS attempts to tune the radio, the CDU shows the message LOC WILL BE TUNED to alert the pilot that the FMS will retune the radio. After the 30 second notice if the FMS was unable to tune the radio, the message CHECK NAV TUNING shows to indicate that it was unable to tune the localizer frequency. The pilot must verity the navigation radio is tuned to the proper localizer frequency.

NAV-to-NAV transfer functions only when the same-side FMS is using the same-side navigation sensors and only when the same-side FMS is selected as the active same-side navigation source.

Because of navigation errors, the actual localizer path can differ from the FMS path from the FACF to the runway. If the localizer capture is at a very small angle, it is possible that the flight path will not converge properly with the localizer, and capture could be uncertain.

The FMS uses the localizer deviation signal to turn the aircraft away from the FMS course toward the localizer course. This assures capture of the beam despite FMS position errors. This steering occurs only if the FACF to the FAF, or the FAF to runway, leg is active and the localizer signal is valid.

Selecting approach mode on the flight control system arms the flight director for localizer or ILS capture, regardless of the current active flight plan leg. Use discretion in choosing the proper time to arm for the approach, since radar vectors or published approach routes can prematurely approach or cross the localizer.

When the aircraft is in a position to capture the localizer, and cleared for the approach, select the approach mode on the flight control system. The flight control computer automatically changes the NAV source from FMS to the localizer when the aircraft is in a position to receive and capture the localizer signal. Vertical navigation guidance is provided up to the point of glideslope capture for an ILS approach or to the final approach fix for a localizer-only or localizer back course approach.

If the FMS is operating in synchronized mode, all CDU flight-planning actions are cross-linked. Automatic setup of the flight displays and radio tuning as described above occurs on both sides of the cockpit, provided the same-side FMS is selected as the active navigation source for the flight displays. After the approach is selected on the flight control panel, localizer capture takes place independently on each side. If the cross-side FMS is selected as the active navigation source for the flight displays, the pilot must manually tune the localizer and sequence the PFD source selection to VOR/LOC to capture localizer on that side.

W

WARNING

For all types of localizer-based approaches manually set the DH or MDA alerters. It is the responsibility of the pilot to recognize when the aircraft reaches the DH or MDA, and to make a decision on whether or not to continue the approach.

To activate the missed approach, refer to the recommended missed approach checklist in the MISSED APPROACH chapter of this guide.

FMS-BASED APPROACHES

FMS-based approaches and transitions are selected on the ARRIVAL page. The ARRIVAL page is selected with the DEP ARR function key or with the ARR line select key on the DEP/ARR INDEX page.

All FMS-based approaches are non-precision approaches. This includes VISUAL, GPS, RNAV, VOR/DME, VOR, TACAN (as a GPS overlay), and NDB.

The FMS is certified to do both stand-alone GPS and multi-sensor non-precision approaches. GPS sensor data is used predominantly for all FMS-based approaches. However, other available navigation sensors are used as part of the process used by the FMS to determine the position.

The FMS also monitors the Receiver Autonomous Integrity Monitoring (RAIM) to make sure the required GPS accuracy is maintained for an approach. Visual, RNAV, VOR/DME, TACAN, and VOR approaches can also be executed by the FMS without GPS.

Lateral and vertical guidance is available throughout all FMS-based approaches. On the PFD, the lateral deviation bar and scale on the HSI give the lateral guidance, and the vertical deviation pointer and scale give the vertical guidance. The intent is to fly non-precision FMS-based approaches in a manner similar to that of an ILS. The FMS provides steering commands to fly the aircraft along the flight plan route to a position where it captures an FMS-generated lateral and vertical flight path for the approach. As with all approaches, the pilots must maintain vigilance and verify the aircraft is maintaining the correct lateral course and vertical profile.

FMS approach logic is automatically enabled at 30 NM from the Airport Reference Point (ARP) of the destination airport and remains active until after the Missed Approach Point (MAP). The approach logic can be disabled at any time. The approach must be disabled in order to transition to a missed approach procedure.

To disable the approach, do any of the actions that follow:

- Push the GA button.
- Make a lateral change to the flight plan between the FAF and MAP.
- Manually sequence through the flight plan past the MAP waypoint.
- Delete the FAF or MAP waypoint.
- Push the APPR ENABLED line key on the ARRIVAL page to select NO.
- If the TO waypoint is the MAP, select AUTO SEQUENCE.

WARNING

For all types of FMS-based and/or non-precision approaches, the pilot must manually set the MDA alerters.

There are two different types of non-precision FMS-based approaches: RWY and V-MDA. In addition to the RWY and V-MDA types of non-precision approaches, specific procedures must be followed to fly DME ARC approaches and special considerations must be observed when holding at the FAF.

RWY APPROACHES

WARNING

It is the responsibility of the pilot to recognize when the aircraft reaches the MDA, and to make a decision on how to continue the approach. In aircraft with coupled VNAV capability, the FMS will not level the aircraft at the MDA for RWY type approaches.

WARNING

With coupled VNAV capability, even though the VPA for a RWY type approach provides compliance with step-down fix altitude restrictions down to the MDA, it is the responsibility of the pilot to monitor for that compliance, and intervene if necessary to prevent a descent through a step-down fix.

Runway approaches are those that terminate at a missed approach point generally located at the runway threshold. The annunciation RWY shows on the ACT LEGS page to identify this type of non-precision approach.

The VPA used by the FMS for a runway approach terminates at approximately 50 feet above the runway threshold at the missed approach point. The VPA is specific for a given approach and provides obstacle clearance down to the Minimum Descent Altitude (MDA). The runway waypoint VPA, shown on the LEGS page, cannot be changed or deleted. For this type of approach, the FMS steers the aircraft along a lateral and vertical flight path very similar to that of an ILS. Vertical flight-path tracking is based on the corrected barometric altitude of the aircraft.

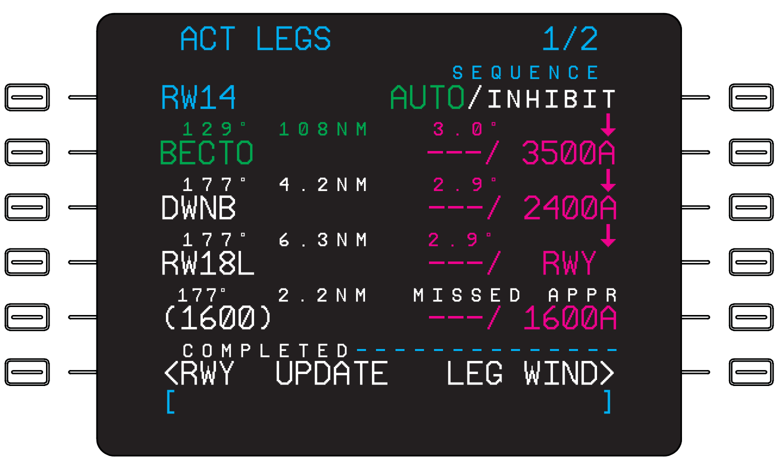
There are two different ways the pilot can choose to fly the runway approach. For some approaches, only authorized operators can use

VNAV DA(H) in lieu of MDA(H). If authorized, the pilot would select the approach mode (APPR) of the autopilot when flying the approach. The approach mode of the autopilot will display VGP to indicate when the aircraft is being steered vertically to a pseudo-glide path very similar to that of an ILS glideslope. When the autopilot is in VGP mode, the aircraft will continue descent through the preselect altitude just like for an ILS approach operation. If the operator is not authorized to use VNAV DA(H) in lieu of MDA(H), the pilot would leave the autopilot in NAV mode when flying the approach. The preselect altitude would be set to the MDA for the approach in accordance with the approach category of the aircraft for the approach being flown. When NAV mode remains selected, the VNAV mode will remain VPATH instead of transitioning to VGP during the approach. When in VPATH mode during the entire approach, the aircraft will honor the preselect altitude and capture the MDA altitude (with the preselector set at the MDA altitude).

TIP

The pilot can view the actual altitude the VNAV will fly to for a RWY approach by pushing the line select key next to the RWY annunciation on the ACT LEGS page. This copies the RWY altitude to the scratchpad.

Figure 15-9   ACT LEGS Page with RWY Approach



TPG5118_40

V-MDA APPROACHES

WARNING

Refer to the AFM for the limitation for V-MDA approaches. The use of VNAV vertical guidance for a V-MDA type approach between the final approach fix and the missed approach fix is prohibited.

WARNING

Pilots must review the appropriate terminal procedures for an approach and adjust the MDA when appropriate in accordance with the approach category requirements of the aircraft. It is the responsibility of the pilot to recognize when the aircraft reaches the MDA, and to make a decision on how to continue the approach. In installations with coupled VNAV capability, the FMS will capture and track the MDA for V-MDA type approaches.

WARNING

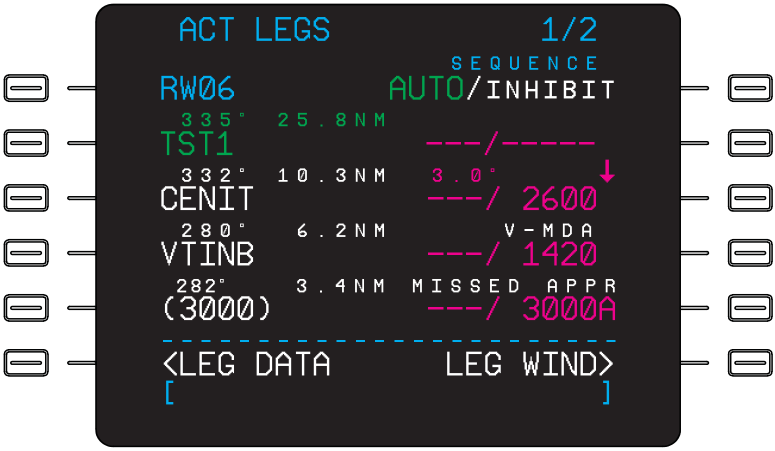
The FMS does not recognize step-down fixes between the FAF and the MAP, and will not try to comply with them. It is possible, on some V-MDA approaches, for a selected VPA to result in a vertical flight path that would go below a step-down fix altitude restriction. If a given approach has any step-down fixes between the FAF and arrival at MDA, VNAV should not be used for this portion of the approach.

V-MDA approaches are those that terminate at a missed approach point generally located somewhere other than the runway threshold. The annunciation V-MDA shows on the ACT LEGS page to identify this type of non-precision approach. Examples of V-MDA type approaches are circling approaches or approaches where the missed approach point is a navaid located on the field.

For V-MDA type approaches, the pilot must make sure to set the MDA of the missed approach point in accordance with the approach category of the aircraft for the approach being flown.

The FMS does not provide VNAV guidance between the FAF and the missed approach point on a V-MDA approach because protection from step-down fix altitude constraints cannot be provided. However, VNAV will protect and capture the V-MDA altitude on the missed approach point waypoint. In other words, between the FAF and the missed approach point of the V-MDA approach, the FMS will not be able to guide the aircraft vertically using the VGP or VPATH modes of the autopilot. Instead, if the autopilot mode was either VGP or VPATH before the FAF, the autopilot mode will drop to VPTCH between the FAF and the missed approach altitude. In either case, the NO VPATH CONDITION message will appear on the CDU to indicate that FMS VNAV guidance is no longer being provided.

Figure 15-10 ACT LEGS Page with V-MDA Approach



TPG5118_41

NOTE

Based on the approach, if the altitude of a missed approach point waypoint is changed, it also can require changing the altitude of the FAF, any intermediate waypoints. It also can require changing the altitude of the initial waypoint of the missed approach procedure. The proper temperature compensation will have to be calculated as part of determining these altitudes when operating in extremely cold temperatures.

DME ARC APPROACHES

To intercept a DME arc at a published entry point, no special procedures are required. The FMS will fly to the entry point, turn to intercept the published arc, and fly the approach. Radar-vectored DME arc approaches, however, require the pilot to maintain situational awareness to intercept the arc somewhere between the published entry and exit points of the arc.

GPS APPROACHES

To fly a GPS approach, or an RNAV, VOR/DME, VOR, TACAN, or NDB approach as a GPS-overlay approach using the FMS, 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 aircraft altitude past the leg into the FAF.

NOTE

> GPS and NDB approaches cannot be flown with the FMS if the GPS navigation sensor is not available.

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, the system automatically:

- Transitions to terminal deviation sensitivity (±1.0 NM)
- Begins monitoring for terminal navigation accuracy (RAIM)
- Shows the TERM message on the PFD.

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

- Smoothly transitions to approach deviation sensitivity (±0.3 NM)
- Begins monitoring for approach navigation accuracy (RAIM)
- Shows the GPS APPR message on the PFD.

Between the FAF and the MAP, the system automatically:

- Maintains the deviation sensitivity at ±0.3 NM
- Continues monitoring of approach navigation accuracy (RAIM)
- Shows the GPS APPR message on the PFD.

The integrity of the GPS position solution is monitored by using more than the minimum number of satellite measurements to determine the position, and by making sure that the redundant measurements do not produce inconsistent position solutions. This is known as Receiver Autonomous Integrity Monitoring (RAIM).

If the number of satellites cannot support RAIM for the phase of flight (4 NM oceanic/remote, 1 NM en route, 1 NM terminal and 0.3 NM approach), RAIM is not available. The message NO GPS RAIM shows on the CDU. This does not mean that the GPS position is inaccurate. It means that the accuracy of the GPS position cannot be guaranteed. The pilot is responsible for proper monitoring of backup navigation means in the cockpit in accordance with any provisional airworthiness conditions imposed upon GPS approaches.

RAIM status can be examined on the MFD LRN STATUS page. RAIM is available if the RAIM ACCURACY LIMIT value is less than that required for the current phase of flight. The LRN STATUS page also shows a MEASUREMENT ACCURACY LIMIT based on the current GPS measurements plus the most probable GPS error. If the satellite signals disagree and the source of the disagreement cannot be isolated to one satellite, the RAIM DETECTED ERROR message will be shown on the MFD LRN STATUS page.

The FMS does not use the GPS data to determine aircraft position if the RAIM DETECTED ERROR message and the MEASUREMENT ACCURACY LIMIT is greater than what the current phase of flight requires, or the PROBABLE ERROR is too large.

There can be short periods when the required approach accuracy is unavailable. By predicting future satellite positions, the GPS is capable of estimating the availability of approach accuracy. This feature is called predictive RAIM.

The GPS CONTROL page on the CDU gives access to the GPS predictive RAIM capability any time the FMS and GPS systems are operational. Normally, the active flight plan contains the required data (destination and ETA) and the estimates are made automatically.

When approach RAIM is unavailable, the message NO APPR GPS RAIM shows on the CDU. This message can show only when the aircraft is within the arrival terminal area and a GPS approach is selected. However, the current RAIM status can be viewed at any time on the GPS CONTROL page as described below.

Flight plan destination and estimated time of arrival are automatically inserted on the GPS CONTROL page. However, before departure the pilot can change them to check alternate destinations and arrival times. Pilot entries show in large font characters and automatic entries from a flight plan show in small font characters.

GPS RAIM status annunciations for the specified DEST and ETA that show on the GPS CONTROL page are:

- AVAILABLE — GPS approach RAIM is available.
- UNAVAILABLE — GPS approach RAIM is not available.
- REQ PENDING — RAIM status is being evaluated.
- INIT GPS — RAIM cannot be evaluated, GPS is not initialized.

Predicted approach RAIM availability at a destination is based on the ETA predicted by the aircraft performance function. If performance predictions are not available because the required data was not entered, ETA for predicted approach RAIM is measured ground speed when the aircraft is in the destination terminal area.

The GPS CONTROL page also gives the pilot the ability to manually deselect up to eight satellites identified as out of service in NOTAMs. Deselected satellites are not included in the predicted RAIM computations. Satellite numbers can be entered one at a time. All deselected satellites are deleted simultaneously using the CLR DEL function key on the CDU, or 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 shows in yellow on the PFD.

- Approach RAIM is not available at any time while the aircraft is between 2 NM inbound to the FAF and the FAF.
- Approach RAIM is available while the aircraft is between 2 NM inbound to the FAF and the FAF. The missed approach point is more than 5 minutes from the FAF, and approach RAIM is predicted to be unavailable within 5 minutes of predicted arrival time at missed approach point.
- Approach RAIM is not available at 2 NM inbound to the FAF and approach RAIM is predicted to be unavailable within 5 minutes of predicted arrival time at the FAF or missed approach point.
- 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 APPROACHES

To fly an RNAV, VOR/DME, TACAN, or VOR approach as an RNAV approach with FMS, but without the GPS sensor, the approach must be selected and put in 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.

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

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

Between the FAF and the MAP, the system automatically:

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

Selection of an RNAV approach is the same as the selection of any other approach on the ARRIVAL page. RNAV approaches include a Final Approach Fix (for example, FF31), a missed approach point, and a missed approach procedure. RNAV approaches also include transitions that constitute entry routes for the approach.

For RNAV approaches, the FMS automatically tunes the recommended navaid when the aircraft is 30 NM from the arrival airport. If the radio is not properly tuned because it is in manual tune mode or the radio was re-tuned, the message CHECK LOC TUNING shows on the CDU. If the recommended navaid is not tuned when the aircraft is within 2 NM inbound to the FAF, NO APPR shows in yellow on the PFD.

Although pilot-entered waypoints that define an approach can be included in the flight plan, the FMS does not support important aspects of approach operation for these waypoints. Some of the aspects not supported for pilot-entered approach waypoints include approach deviation scaling, approach accuracy checking, certain leg types commonly used in approaches, and approach mode VNAV operation. Because of these limitations, using pilot-entered approaches with the FMS is approved for pilot reference only. An independent primary source of navigation must be used to conduct the approach.

AUTOMATIC REVERSION

The FMS executes a non-precision approach using the procedures described in the GPS Approaches section if GPS is installed on the aircraft and enabled. Otherwise, the FMS uses the procedures described in the RNAV Approaches section. As a reminder, GPS-only and NDB approaches are not qualified to be flown under the RNAV rules.

The FMS will automatically revert to RNAV approach rules under either of the conditions that follow:

- The pilot elects to fly a non-precision approach under the GPS approach rules and the GPS signal is not available.
- The GPS RAIM does not meet the 0.3 NM requirement.

The automatic reversion will not occur for an GPS-only or NDB approach, or if the aircraft has passed the FAF waypoint. If GPS RAIM meets the 0.3 NM requirement within 2 NM before reaching the FAF waypoint, the approach will be allowed to continue for up to 5 minutes with RAIM larger than 0.3 NM. A GPS receiver failure will cause reversion to the cross-side GPS receiver. If that receiver fails, reversion will be to the RNAV approach, unless the failure occurred inside of the FAF.

COURSE REVERSAL HOLDS IN APPROACH TRANSITIONS

When an approach includes a course reversal hold and the FMS sequences to the waypoint of that hold, the hold is automatically armed for exit. The aircraft will fly the holding pattern, then complete the approach procedure unless a parallel entry is required. On a parallel entry, the hold will be automatically armed for exit after the entry has been completed. However, the exit can be selected at any time.

If ATC clearance requires a further hold, push the CANCEL EXIT line select key on the LEGS page to cancel the hold exit and continue flying the hold. When cleared to exit the hold, push the EXIT HOLD line select key on the LEGS page to arm the FMS to exit the hold and continue the approach.

Course reversal holds in an approach transition have a waypoint labeled INTC at the point where the holding pattern intercepts the final approach course. Altitude constraints that apply until the aircraft is established on the final approach course are applied to the intercept waypoint.

Not all approaches have a hold in the approach transition. However, many do have a hold in the missed approach procedure. In an approach with these conditions, to enter a hold at the FAF as part of a non-published approach procedure, a new hold at the FAF must be added. When selected, the HOLD page first shows the ACT HOLD LIST with the missed approach hold clearly labeled on the list. Push the NEW HOLD line select key and add a new hold at the FAF waypoint. This will result in what appears to be two holds at the same waypoint. One of the holds is at the FAF and the other is part of the missed approach procedure.

MISSED APPROACH

Missed approach procedures are included in the flight plan as part of an approach. The missed approach point waypoint shows on the LEGS page as the waypoint just before the MISSED APPR label. It also shows on the ACT/MOD FPLN page as MISSED APPROACH. The first waypoint after the MISSED APPR annunciation is usually the initial altitude-constraint waypoint for the missed approach. It shows in parentheses and cannot be copied to the scratchpad, but it can be deleted. It also shows on the MFD, in parentheses, as the first waypoint of the missed approach.

NOTE

> Missed approach procedures do not show on the MFD display until the missed approach is active, or the MISS APPR map display option is selected on the MFD MENU page.

For the FMS to sequence beyond the missed approach point to the missed approach procedure, disable approach, or fly to the missed approach point waypoint with AUTO SEQUENCE selected.

Disable an approach as follows:

- Push the GA button.
- Make a lateral change to the flight plan between the FAF and missed approach point.
- Manually sequence through the flight plan past the missed approach point waypoint.
- Delete the FAF or missed approach point waypoint.
- Push the APPR ENABLED line key on the ARRIVAL page to select NO.
- Select AUTO sequencing when the missed approach point is reached.

NOTE

The APPR ENABLED line key selection, on the ARRIVAL page, is available only for non-precision approaches.

While on the missed approach, the pilot can edit the flight plan to select a new approach (refer to the ARRIVAL AND APPROACH chapter of this guide), or sequence the FMS to a waypoint on the route to the alternate airport.

Some missed approach procedures can require flying a segment of a SID as part of the procedure. To do this, select the DEP option for the destination airport on the DEP/ARR INDEX page. Once the desired SID is selected, the FMS will insert it in the flight plan preceded by a discontinuity.

NOTE

To prevent an inadvertent loss of airspeed, VNAV does NOT automatically initiate a climb when the FMS sequences to the missed approach procedure. Pilots must initiate any climbs required for the missed approach procedure. After initiating the climb, with FMS as the navigation source and the VNAV mode selected on the flight control system, the FMS will capture and track the altitude constraint.

The following two simplified checklists, one for each type of approach (localizer-based and FMS-based), should aid in the transition to a missed approach.

To transition to a missed approach procedure from a localizer-based approach:

1. Select Go Around (GA).
2. Set power and configuration as required.
3. Make sure AUTO sequence is selected (LEGS page).
4. Make sure the TO waypoint is the first waypoint of the missed approach.
5. Set FMS as NAV SOURCE.
6. Set the appropriate lateral and vertical flight director modes.
7. Engage autopilot (if desired).

To transition to a missed approach procedure from an FMS-based approach:

1. Select Go Around (GA).
2. Set power and configuration as required.
3. Make sure AUTO sequence is selected (LEGS page).
4. Make sure the TO waypoint is the first waypoint of the missed approach.
5. Set the desired lateral and vertical flight director modes.
6. Engage autopilot (if desired).

TABLE OF CONTENTS

This page intentionally left blank

PRINCIPLES OF VNAV

INTRODUCTION

The FMS-3000 provides multiple waypoint Vertical Navigation (VNAV) for each phase of flight (climb, cruise and descent). The VNAV function helps the pilot to comply with altitude and speed constraints at waypoints, and speed limits at altitudes. It also helps in following the vertical flight profile entered in the active flight plan.

Selecting VNAV mode on the flight control system allows the autopilot to sequence modes and set target speeds and altitudes to maintain the flight plan requirements within the constraints of the preselector altitude setting. The preselector will override any VNAV commands, except glidepath, generated by the FMS. With VNAV integrated with the autopilot, the pilot has command of all autopilot modes (pitch, flight level change, vertical speed, and altitude hold) while VNAV mode is active. Target speeds are set with the airspeed reference knob. The FMS gives the appropriate VNAV warning annunciations to alert the pilot of any violation to flight plan constraints.

During the various phases of flight, VNAV follows the flight plan. It levels the aircraft on capture of the preselect altitude and begins a descent at a planned location. Step climbs may be initiated by the preselect altitude and selection of the desired climb mode.

During the descent mode, VNAV computes a geographical path to each waypoint and gives guidance relative to that path, ensuring the descent altitude constraints are honored. As the approach and its corresponding procedure environments are entered, VNAV is fully automated, providing smooth transitions and easing pilot workload. In addition to following a planned vertical profile that is entered in the FMS flight plan, the vertical Direct-To feature allows the pilot to execute a Direct-To vertical path to an altitude at a waypoint.

Vertical navigation information shows on the PFD when VNAV is selected or advisory VNAV is enabled. The information that shows includes:

- The next altitude constraint
- Vertical deviation from the planned descent path
- Vertical speed required to fly to a Direct-To the next altitude constraint.

VNAV PLAN SPD shows on the PERF MENU page. Advisory VNAV is enabled and disabled on the PERF MENU page as well.

SETUP

A vertical guidance profile is defined by the active flight plan and the settings on the VNAV SETUP pages. The flight plan defines the altitude and speed constraints on the LEGS page. VNAV SETUP pages define the cruise altitude, speed targets, altitude-dependent speed limits, and Vertical Path Angle (VPA) for descents. Vertical navigation data is also used in the performance calculations.

There are default values for all VNAV parameters except cruise altitude. When the pilot selects SID, STAR, and approach procedures, the appropriate speed and altitude constraints at waypoints are automatically loaded into the flight plan. The pilot can set up the VNAV default parameters so each flight is automatically initialized in accordance with the way the aircraft is flown. When nonstandard flight conditions arise, the VNAV parameters can be modified for that flight without changing the default values for subsequent flights. No data entry is required on the VNAV setup pages to activate VNAV, unless modification to the defaults or addition to a speed or altitude constraint is necessary.

To select the VNAV setup pages, push the PERF function key on the CDU to show the PERF MENU page, then push the VNAV SETUP line select key to show the VNAV SETUP pages. If VNAV is in use, the page associated with the current flight phase (climb, cruise, or descent) shows when the VNAV SETUP line select key is pushed. Push the NEXT or PREV function key as necessary to show the other pages.

COUPLED VNAV SELECT AND DESELECT

Push the VNAV key on the flight control panel to select and deselect coupled VNAV. Coupled VNAV is active when it is both valid and selected.

VNAV is valid when the following three conditions are met:

- An ACT FPLN with a TO waypoint exists in the FMS.

- The PFD NAV source is either a valid FMS or localizer . For a localizer, the bearing must be entered into the flight plan and the FMS must have executed a localizer-based capture.
- Preselector altitude, barometric altitude, and airspeed or Mach speed are all valid.

PFD ANNUNCIATIONS AND DISPLAYS

MODES

Captured VNAV modes are annunciated at the top of the PFD where the autopilot vertical modes are annunciated. A captured VNAV mode annunciation shows the letter V in front of the autopilot annunciations. Descent path (VPATH or VGP) and VNAV altitude capture and hold (VALTV CAP and VALTV) are additional unique VNAV modes that are also annunciated on the PFD.

INVALID VNAV

A yellow VNAV annunciation shows in the autopilot mode field, when VNAV is selected on the flight control system and VNAV is not valid. If VNAV becomes invalid after it has been an active mode, the V is removed from view, and the yellow VNAV annunciation shows. If VPATH or VGP show when VNAV becomes invalid, the mode annunciation reverts to autopilot pitch. A CDU message identifies the reason that VNAV is invalid after VNAV is selected. One of the two CDU messages that follow show to identify the reason why the VNAV is invalid when VNAV is selected:

- CHECK NAV SOURCE
- VNAV SENSOR FAIL.

FLIGHT PLAN TARGET ALTITUDE

The VNAV data has a Flight Plan Target Altitude (FPTA) derived from the altitude constraints in the active flight plan. The FPTA shows on the PFD near the preselector altitude when VNAV is active or advisory VNAV is selected. Generally, it is the next altitude constraint in the flight plan consistent with the current phase of flight. Therefore, a distant descent altitude constraint is not shown when the aircraft is climbing to cruise altitude. When the flight plan contains a VNAV altitude constraint in a down-track waypoint, and the constraint is below the current altitude of the aircraft, the VNAV target altitude for the descent will not show on the PFD. The altitude preselector must be set below the present barometric altitude for the descent VNAV target altitude to show on the PFD.

The target altitude is the next altitude constraint that will be captured by VNAV. Whether the altitude is captured depends on the type of altitude constraint, the geometry of adjacent altitude constraints may not be captured. If VNAV captures the altitude, ALTV shows on the PFD. For step descents, where the aircraft levels at an intermediate constraint altitude, the intermediate altitude remains in view after passing the constraint waypoint so that the autopilot can continue to hold that altitude. The VNAV target altitude is always updated to the next altitude constraint when the 1-minute Top of Descent (TOD) or Bottom of Climb (BOC) annunciation shows on the PFD, unless the autopilot is capturing the VNAV target altitude.

A flight plan target altitude sequences to the next target 60 seconds before arriving at the switch point, if the current target altitude has been captured.

The altitude being captured or tracked (preselector, VNAV target, or pressure) is identified on the PFD by the suffix character in the active mode display field. The final V (instead of an S) indicates the VNAV target altitude (instead of the preselector altitude) is captured. Refer to the table that follows:

MODE ANNUNCIATION	ALTITUDE TRACKED
VALTS	Preselector
VALTV	VNAV Target
VALT	Pressure

MODE ANNUNCIATION	ALTITUDE ARMED
ALTS	Preselector
ALTV	VNAV Target

DEVIATION SCALE AND POINTERS

A unique FMS deviation pointer shows the vertical deviation from the descent path on the same scale as the glideslope deviation (when in

VPATH or VGP mode, or when close to the planned descent path). When VNAV is active, the vertical deviation scale and pointer show on the display 60 seconds before the aircraft arrives at the top of descent. If advisory VNAV is selected, the vertical deviation scale and pointer show when the vertical deviation is within 1000 feet of the descent path.

VERTICAL SPEED

An FMS vertical-speed advisory pointer shows on the vertical speed display to indicate either of the following conditions:

- The minimum average vertical speed to climb from present position to the next climb constraint if the rate is at least 100 fpm. Vertical speed required to AT OR BELOW constraints is not shown because there is no minimum value.
- The initial vertical speed if a descent were initiated at the present position to the next descent altitude constraint. This is an advisory pointer to assist in determining when it is appropriate to initiate a descent. The vertical speed pointer shows only if the required descent rate is at least 100 fpm, and top of descent at current altitude is within 50 NM or vertical deviation is displayed. The pointer shows in all VNAV modes. The vertical speed required for descent shows in the VNAV MFD window as a number. Vertical speed required to AT OR ABOVE constraints is not shown because there is no minimum value.

The vertical speed advisory pointer shows whenever VNAV is active or advisory VNAV is selected and the above display conditions are met.

NOTE

> The FMS vertical speed advisory pointer shows on the Vertical Speed Indicator (VSI) on the PFD to let the flight crew know what climb or descent rate is necessary for the aircraft to reach the next altitude constraint. The vertical speed advisory pointer on the PFD VSI can show even when FMS performance calculations indicate that the climb or descent rate required to reach the flight plan altitude constraint exceeds the capability of the aircraft. The vertical speed advisory pointer position on the VSI scale is only a reflection of the FMS calculation of required climb/descent rates associated with the flight plan. Display of the vertical speed advisory pointer does not imply that the aircraft is capable of meeting the required climb or descent rate.

VNAV ARMED MODES

When coupled VNAV is active, the vertical armed fields on the PFD show the armed mode, if any. There are three armed fields. One field shows the armed holding mode: ALTS for the preselector or ALTV for the VNAV target altitude. A second field shows the armed VNAV vertical mode: Flight Level Change (FLC), VS, or PATH. The third field shows the armed glidepath mode: GS for an ILS glideslope or GP for a VNAV glidepath. VNAV does not control the ALTS or GS armed modes. VNAV can arm the following modes:

- ALTV (climb or descent)
- FLC (climb only)
- VS, PATH, GP (descent only).

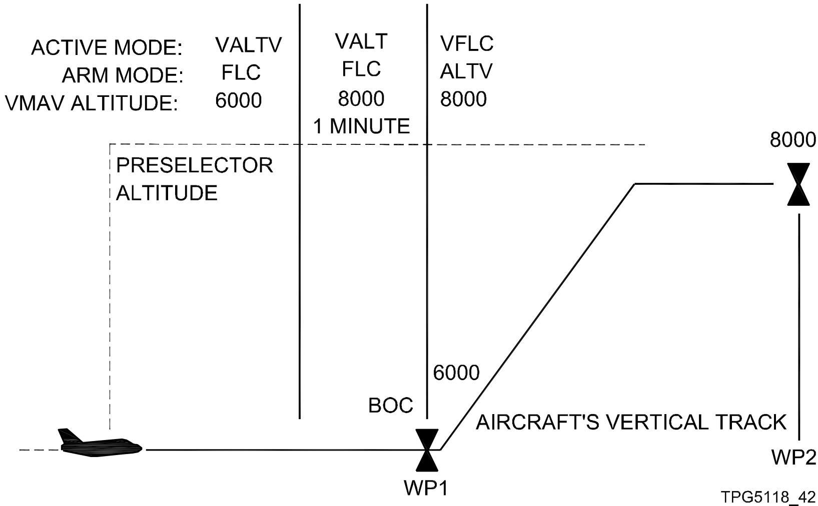
The general principles for arming the modes are as follows:

- In the climb phase, VNAV arms for FLC if the aircraft is holding at a VNAV target altitude, the preselector is above the current aircraft altitude, and there is a down-track climb altitude constraint.
- In the cruise or descent phase, VNAV arms for PATH if there is a down-track descent altitude constraint, the preselector is below the current aircraft altitude, and all other conditions are normal. GP is a special case of PATH. VNAV arms for GP when APPR is selected on the Mode Select Panel, the final descent path will be captured, and the preselector is set low enough to not intercept the path before the FACF.

The two figures that follow depict various VNAV armed scenarios when the aircraft is following both the lateral and vertical flight plans. Any given mode remains armed until that mode captures or the conditions are changed. Captured modes show above the armed mode.

The figure on page 16-7 shows a climb from 6000 to 8000 feet where FLC is armed when approaching BOC, and automatically sequences to VFLC when abeam the waypoint at BOC. The VNAV altitude displayed on the PFD is updated from 6000 to 8000 feet when the aircraft is 1 minute from BOC.

Figure 16-1 FLC Armed Scenario

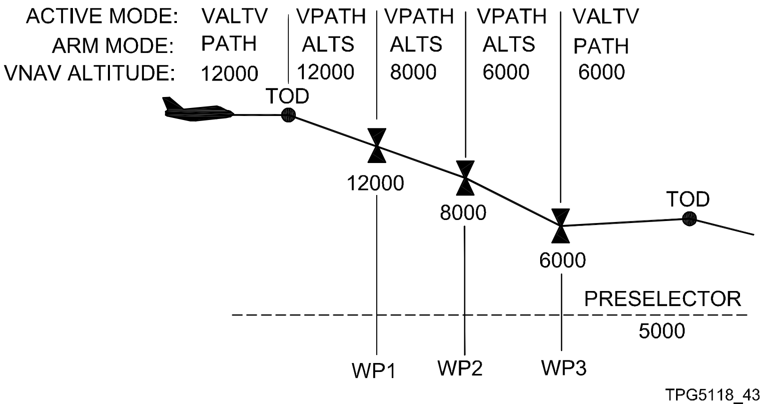


When the flight plan descent altitude constraints are aligned so a smoothed path can be flown through the constraints, VNAV will not level at the intermediate altitudes. However, the PFD does show the next altitude constraint. The arm field shows that VNAV will do one of the following three things:

- Level at the displayed altitude (ALTV arm)
- Continue to descend when crossing the constraint altitude (ALTV arm not shown)
- Capture the preselector altitude when it is reached (ALTS arm).

ALTV indicates the VNAV altitude shown on the PFD is to be captured. The preselector altitude is always armed, except when in VGP mode. Therefore, ALTS arm shows if ALTV arm is not appropriate. An example of the arm mode transitions shows in the figure on page 16-8.

Figure 16-2   Arm Mode Annunciations



Abnormal conditions that cause the PATH or GP arm to be invalid and the associated CDU message are as follows:

- Cross track deviation exceeds the limits for the current environment (en route, terminal, or approach) (NO VPATH – XTD)
- Track angle error exceeds the limits for the current environment (en route, terminal, or approach) (NO VPATH – TAE)
- Another autopilot mode is selected (NO VPATH – PILOT CMD)
- A down track heading leg (VECT) interrupts the vertical path (NO VPATH – VECTORS)
- A holding pattern is active (NO VPATH THIS LEG)
- The aircraft is on the FROM side of a waypoint for which sequencing is inhibited
- Other conditions as described in the VNAV DESCENTS section exist (NO VPATH CONDITION).

OPERATION

CLIMB

For the climb phase, VNAV provides speed and altitude targets consistent with the climb constraints and speed limits. It also provides automatic mode sequencing using the flight level change mode that shows as VFLC on the PFD. A VNAV climb can be done in any of the normal autopilot modes. When an altitude constraint or preselect altitude is encountered during a climb, the altitude is captured and held using an altitude hold mode. The flight level change mode controls pitch to maintain the commanded IAS or Mach speed. The altitude hold mode controls pitch to maintain the commanded altitude.

The climb phase is entered whenever preselect altitude is set above the altitude of the aircraft, and the autopilot is in an altitude change mode (flight level change, vertical speed, or pitch).

ALTITUDE CONSTRAINTS

When one or more climb altitude constraints are specified in the flight plan, VNAV allows the aircraft to climb to each constraint altitude and hold that altitude until the constraint is cleared. If the altitude constraint requires the aircraft to cross the waypoint AT the specified altitude, or requires the aircraft to cross the waypoint AT OR BELOW the specified altitude the specified altitude is held until the waypoint is reached. If the altitude constraint requires the aircraft to cross the waypoint BETWEEN two altitudes, the higher altitude is held. If the altitude constraint requires the aircraft to cross the waypoint AT OR ABOVE the specified altitude, then there is no requirement to hold an altitude. While in the climb phase, VNAV honors only climb constraints.

When approaching an altitude constraint, the FMS continually updates the predicted Top Of Climb (TOC) location and predicted altitude intercept at the constraint waypoint. If the predicted altitude intercept at the constraint waypoint violates the altitude constraint, the message UNABLE NEXT ALT shows in yellow on the CDU, ALT shows in yellow and MSG shows flashing in yellow on the PFD.

If the aircraft is at a constraint altitude and the preselected altitude is raised, and an altitude change mode (flight level change, vertical speed, pitch) is selected, VNAV allows the aircraft to leave the constraint altitude. However, if the constraint is an AT, AT OR BELOW or

BETWEEN, the message CHECK FPLN ALT shows on the CDU. This message also annunciates when the VNAV selection is made while the aircraft is above the next climb constraint altitude.

The vertical speed that is required for the next altitude constraint also shows on the PFD. It shows as an advisory to aid the pilot in judging the climb requirements. During climb for the active flight plan, the average vertical speed shown for the next altitude constraint waypoint is computed from present position to the altitude constraint waypoint. All other vertical speed advisories for altitude constraints farther down-track are computed between the corresponding altitude constraint waypoint and the previous altitude constraint waypoint.

When the aircraft is within capture distance of the constraint altitude, the VNAV mode automatically sequences to VALTS or VALTV and remains in VALTS, VALTV, or VALT until a climb is resumed. The PFD shows an altitude capture after the mode switch. If the capture altitude is not the same as the preselect altitude, an aural alert is issued when the aircraft is within 1000 feet of the capture.

One minute before the aircraft reaches the altitude constraint waypoint in an altitude hold mode, the annunciation BOC shows on the PFD, and the flight plan target altitude changes to the next altitude constraint. If the preselect altitude is not raised at least 45 seconds before the aircraft reaches the altitude constraint waypoint, the message CHECK PRESELECTOR shows on the CDU message line and on the CDU message page. MSG shows on the PFD to indicate that a new message is on the CDU. At 5 seconds before the bottom of the climb, BOC flashes on the PFD, and the VNAV aural alert sounds.

If the preselect altitude is raised before the aircraft reaches the altitude constraint waypoint, the VNAV mode automatically sequences to VFLC, and resumes the climb after crossing the constraint waypoint.

PRESELECT ALTITUDE CAPTURE

If the preselect altitude is not raised to the flight plan target altitude or above, the preselected altitude will be captured, causing the mode to be sequenced to VALTS. When preselect altitude is eventually raised, VNAV will not sequence to climb VFLC until a climb mode selection is made (flight level change, vertical speed, or pitch).

CRUISE ALTITUDE TRACKING

Cruise altitude on the PERF INIT page is not a required entry. All VNAV features are available without a cruise altitude entry with two exceptions: TOD from the cruise altitude is not shown and performance predictions are not available.

If a cruise altitude is entered, and the aircraft is flying at a higher altitude after capturing the planned cruise altitude, VNAV automatically adjusts the cruise altitude to match the actual flight altitude. This happens when the aircraft initially reaches the cruise altitude that was entered. If the aircraft is climbing from the planned cruise altitude to the preselector setting, then the planned cruise altitude is set to the preselector setting until the aircraft reaches the planned descent path.

If the aircraft never reaches the planned cruise altitude, the climb phase of VNAV operation does not readjust the planned cruise altitude downward. However, when the aircraft is close to the next descent path, the planned top of descent point is readjusted to correspond to the actual aircraft altitude.

SCENARIOS

The series of figures that follows shows various scenarios for climbs. In the figures, the track of the aircraft shows as a solid line, the preselector setting shows as a dashed line, and the FMS flight planned path shows as a thick, solid line. Also, autopilot mode selections show in a box with the associated arm and capture mode annunciations below them. VTA in the figures indicates the Vertical Track Alert that occurs 60 seconds before mode sequencing at the BOC.

Figure 16-3 VNAV Selection during a Climb

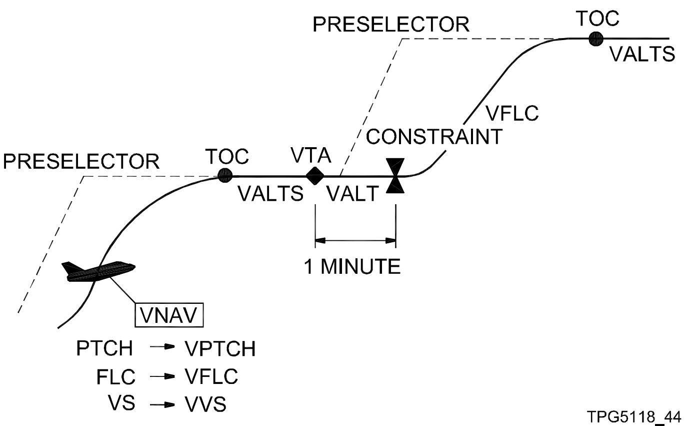
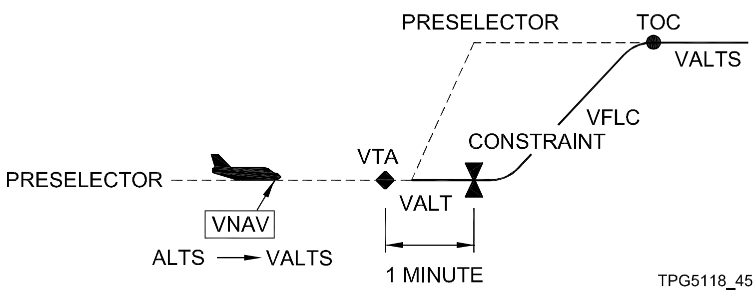


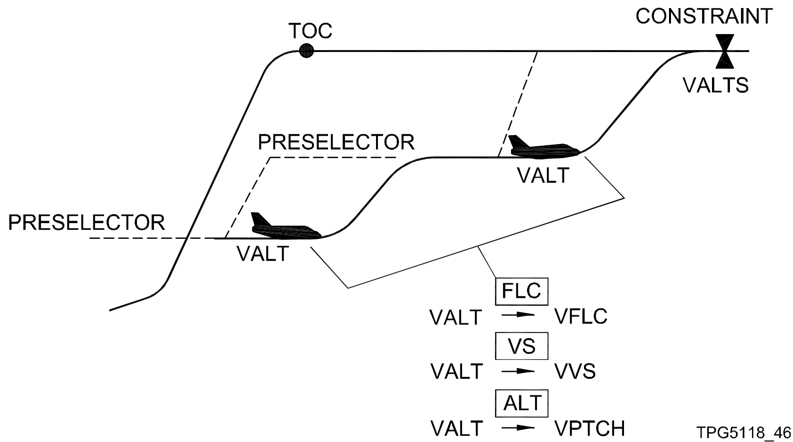
Figure 16-4 VNAV Selection with Autopilot Set to ALT Mode



NOTE

Figure 16-4 shows a normal FMS transition to climb.

Figure 16-5   Climb Using the Preselector



NOTE

Figure 16-5 shows using the preselector as an intermediate altitude constraint.

Figure 16-6   Aircraft Crosses BOC before Preselector is Set

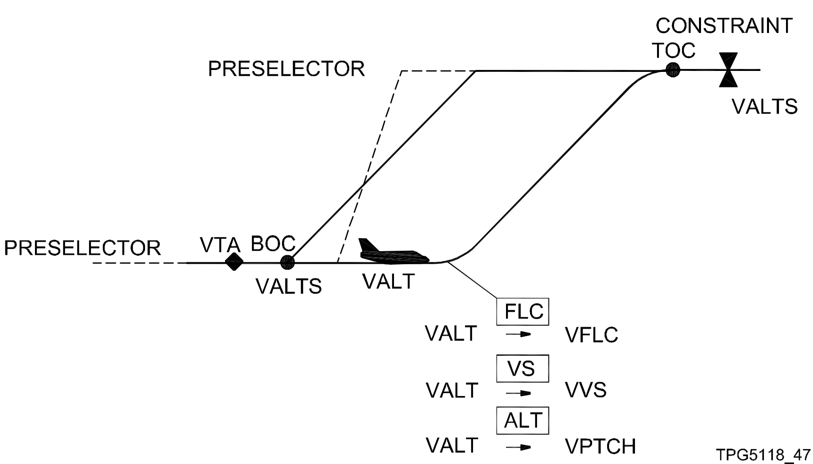


Figure 16-7   UNABLE NEXT ALT Condition

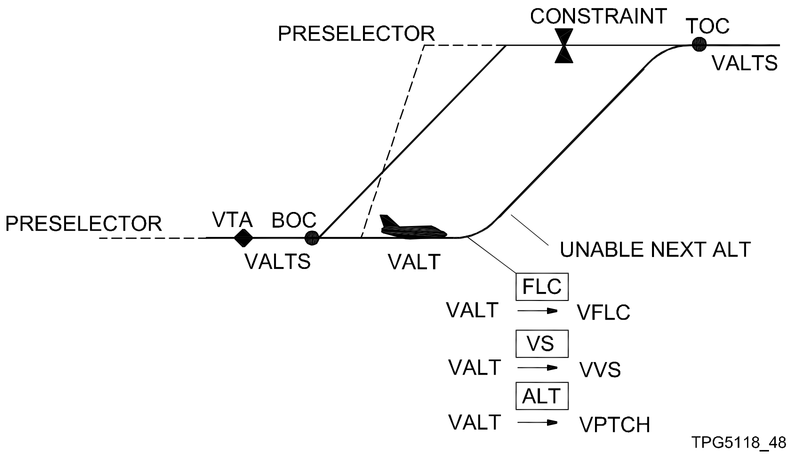
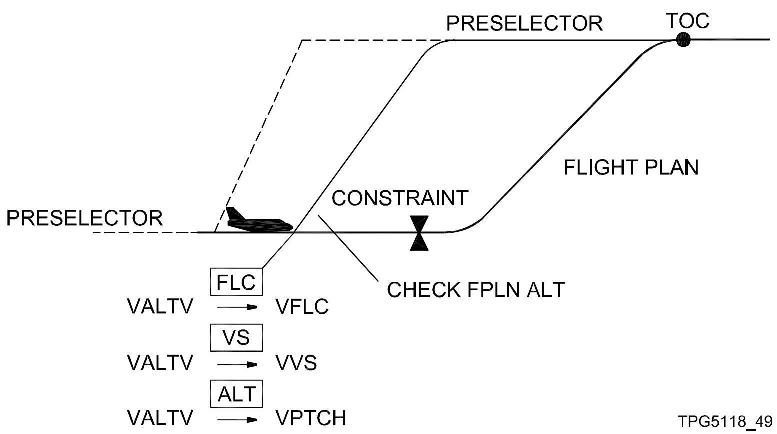


Figure 16-8   CHECK FPLN ALT Condition



NOTE

Figure 16-8 shows that a climb initiated before reaching an altitude constraint waypoint results in a CHECK FPLN ALT condition.

CRUISE

The cruise phase begins when the cruise altitude is captured. Cruise speed command is the Mach or IAS speed target that shows on the cruise VNAV SETUP page. If the cruise altitude is so low that a climb-altitude-dependent speed limit is applicable, then the cruise speed command is limited to that altitude-dependent speed limit.

To execute a step climb, raise the preselect altitude to the desired step climb altitude and select a climb mode. The FMS automatically raises the cruise altitude shown on the VNAV page to the preselect altitude and the step climb will begin. Climb speed targets are used for planned reference speed during a step climb.

DESCENT

Vertical navigation provides path guidance (VPATH or VGP), speed-referenced descent guidance (VFLC), and any other normal descent mode to arrive at a waypoint at a desired altitude. In general, planned and Direct-To VNAV descents are path-based descents, where pitch steering follows a straight-line descent path and speed is controlled by manual thrust management.

The pilot can select any descent mode that does not provide path guidance to an altitude at a waypoint. However, the altitude constraints are annunciated and enforced in all descents. Descent advisory to a destination that has no terminal altitude constraint is not automatically initiated. However, the recommended entry point for the descent advisory shows on the MFD map and on the VNAV display as DES.

The descent phase is entered when the preselected altitude is set below the current altitude of the aircraft and an altitude change mode (flight level change, vertical speed or pitch) is selected on the flight control panel. The descent phase can also include altitude hold segments.

PATH

The descent path is defined by an altitude at a waypoint and a VPA. The VPA is the angle that defines a straight-line path through the target altitude at the target waypoint. The target altitude and target waypoint comprise the next descent altitude constraint in the flight plan ahead of the present position of the aircraft. The VPA will be one of the following:

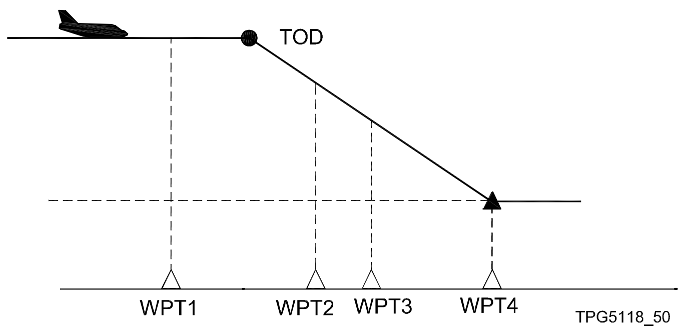
- The angle that appears on the ACT PERF INIT page
- The angle entered by the pilot on the ACT LEGS page
- The angle computed by the FMS to satisfy either descent path smoothing requirements or descend direct requirements of the waypoint
- The angle required for executing a vertical Direct-To.

The LEGS page shows the VPA for the descent path directly above the target altitude for each descent segment. The planned descent path is captured when crossed if the preselect altitude is set low enough to allow capture.

VPA

The descent path is defined by the VPA. The default VPA is initially shown on the VNAV DESCENT page and it is applied to a flight plan when one is created. The default setting can be overwritten on the VNAV DESCENT page and applied to the entire descent portion of a flight plan, or overwritten on the LEGS pages for specific descent segments of a flight plan.

Figure 16-9   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 minimum allowable VPA for the aircraft of 1 degree. An altitude hold is inserted before the descent 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 there is a specified VPA for that segment.

VPAs on the second and subsequent descent segments are modified to provide the path continuity. The computed VPA shows 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. If the last descent altitude is BETWEEN, the path defaults to the upper altitude constraint. The descent path is computed through 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 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 restrict the path. In the approach phase of flight, VNAV computes a descent path that flies to the first altitude constraint in the approach transition even if it is specified as AT OR ABOVE in the flight plan.

For a smooth descent path, the FMS cannot select a VPA greater than the maximum allowable VPA for the aircraft. If adjacent altitude constraints require a steeper path than the limit of the aircraft, the lower altitude constraint shows in yellow on the LEGS page. The message UNABLE FPLN ALT shows on the message line to alert the pilot to the need to resolve the vertical path ambiguity.

VERTICAL DIRECT-TO

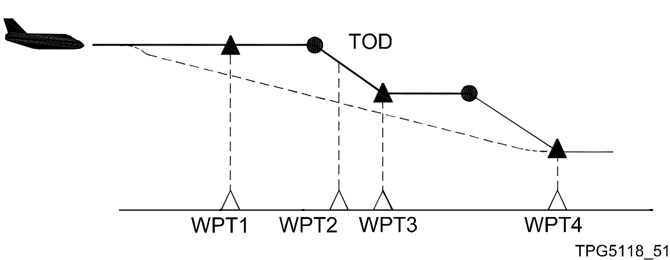
The pilot can specify a descent path from the current aircraft position Direct-To a selected altitude at a waypoint, which includes:

- The next altitude constraint waypoint in the flight plan
- Any down-track altitude constraint waypoint in the flight plan
- Any other waypoint in the flight plan, provided a new altitude constraint is specified for the waypoint.

All altitude constraints between the current aircraft altitude and the specified Direct-To target altitude are cleared when a vertical Direct-To is initiated.

The vertical Direct-To path is computed as long as the required VPA is less than the maximum allowable VPA for the aircraft. A descent path can be very shallow, but it cannot be a climb.

Figure 16-10 Vertical Direct-To



FLIGHT LEVEL CHANGE, VERTICAL SPEED, OR PITCH

In flight level change mode, pitch steering holds the descent speed, and thrust controls the vertical speed. In flight level change, vertical speed, or pitch modes, the aircraft descends to the preselector altitude or the next flight plan constraint, whichever occurs first. The vertical situation displays continue to reflect the active flight plan profile. The descent path modes are automatically captured if the aircraft intercepts the VNAV descent path profile again during the descent.

VNAV flight level change, vertical speed or pitch descents are initiated by the following:

- Directly selecting any vertical mode on the flight control panel while VNAV is active. VPATH is not recaptured unless the aircraft deviates at least one dot on the vertical deviation scale from the planned descent path, then subsequently satisfies the path capture conditions.
- Automatic VVS selection when the active VPA is modified during a VPATH descent. When the active VPA is edited, the descent path will move and can result in creating a very large vertical deviation, which prevents the path from being recaptured. However, VPATH will be recaptured if the aircraft gets within capture distance of the path.
- Automatic VVS selection during VPATH descent if:
  - The flight plan contains an intermediate discontinuity, heading leg, altitude-terminated leg, or manually terminated leg, except a manually terminated holding pattern between the aircraft and the next altitude constraint.
  - The aircraft track angle error is more than 75 degrees during en route or terminal operations, or 30 degrees during final approach.
  - The cross track deviation is greater than 10 NM during en route operations, or full scale lateral deviation exists during final approach and linear variation is from 10 NM to 1 NM during terminal operations.
- Automatic VVS selection during VPATH descent if the active leg is a holding pattern without an altitude constraint (assuming that any future manually terminated holding patterns in the descent path are canceled before they become active).

To recapture a VPATH or VGP descent after manually selecting a flight level change, vertical speed, or pitch descent mode, the vertical deviation must exceed one dot on the PFD vertical deviation scale. The

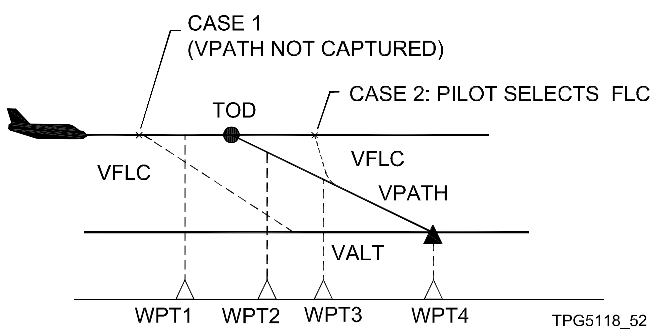
VPATH or VGP mode must be inactive for at least 20 seconds before attempting to capture the path again. One dot on the vertical deviation scale equals 250 feet in the en route and terminal environments, and 125 feet in the approach environment.

These capture limitations prevent VNAV from immediately recapturing the path after selection of a flight level, vertical speed, or pitch mode change. If the pilot wants to immediately recapture VPATH or VGP after selection of flight level change, vertical speed, or pitch, the VNAV button on the FCP must be pushed to turn the VNAV mode off, then back on. This procedure defeats the capture limitations.

When the VNAV mode is automatically sequenced from VPATH to VVS, the CDU shows the message NO VPATH THIS LEG if the VPATH or VGP mode is dropped because the active leg is a holding pattern. The CDU shows NO VPATH CONDITION if the active leg is not a holding pattern.

As Figure 16-11 shows, in CASE 1, the altitude preselector is set lower and FLC is selected before VPATH capture at TOD. In CASE 2, the altitude preselector is set lower and FLC selected after passing the TOD.

Figure 16-11 FLC Selection



ALTITUDE CONSTRAINTS

When one or more descent altitude constraints are specified in the flight plan, the FMS plans the VNAV path so the aircraft descends to each constraint altitude. It holds that altitude until the aircraft reaches the planned top of descent to the next altitude constraint. This is true unless the descent path allows the path-smoothing feature to create one continuous descent. When smoothing is used to create the descent path (VPATH or VGP), the path is designed to keep the aircraft as high as possible for as long as possible without violating any altitude constraints.

VNAV captures and holds the preselector altitude when making a flight level change, vertical speed, or pitch descent that does not intersect the planned descent path.

When a flight level change, vertical speed, or pitch descent takes the aircraft down to the altitude constraint of a future waypoint before the waypoint is reached, VNAV holds the specified altitude until arrival at the waypoint. This happens when constraint requires the aircraft to cross the waypoint AT the specified altitude, or AT OR ABOVE the specified altitude.

If the altitude constraint requires the aircraft to cross the waypoint BETWEEN two altitudes, the lower altitude is held. If the altitude constraint requires the aircraft to cross the waypoint AT OR BELOW the specified altitude, no altitude will be held since there is no requirement to hold altitude before the aircraft reaches the waypoint. In the descent phase, VNAV honors only descent constraints.

As the aircraft approaches an altitude constraint, the FMS updates the predicted altitude intercept at the constraint waypoint. If the predicted altitude intercept at the waypoint violates the altitude constraint, the message UNABLE NEXT ALT shows on the CDU. In addition, the PFD shows ALT in yellow and a flashing yellow MSG annunciation. The UNABLE NEXT ALT message also shows when the vertical speed of the aircraft is less than the vertical speed required reach the constraint.

If the aircraft is approaching an altitude constraint waypoint at the specified altitude and the preselector altitude is lowered, and an altitude change mode is selected, VNAV allows the aircraft to leave the constraint altitude. However, if the constraint is an AT, AT OR ABOVE or BETWEEN altitude, the message CHECK FPLN ALT shows on the CDU. This message also shows the selected VNAV when the aircraft is already below the next descent constraint altitude.

When the aircraft is within the capture distance of a constraint altitude, the VNAV mode automatically sequences to altitude hold and remains in altitude hold until the descent is resumed. The PFD shows an altitude capture annunciation after the mode switch. If the capture altitude is not the same as the preselect altitude, an aural alert is issued when the aircraft is within 1000 feet of the capture altitude.

PRESELECT ALTITUDE CAPTURE

During a descent, VNAV captures the preselected altitude, instead of the planned flight plan target altitude, when the preselected altitude is not set below the flight plan target altitude. When it captures a preselected altitude, it changes the VNAV mode to the VALTS mode.

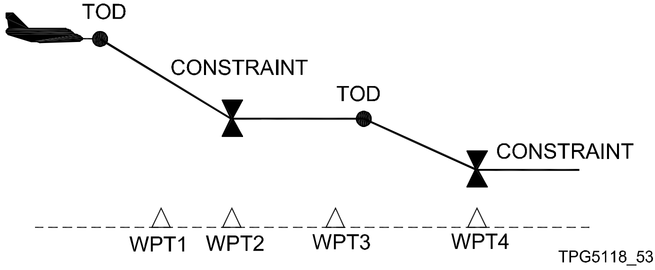
TOP OF DESCENT

The predicted Top Of Descent (TOD) location shows on both the PPOS and PLAN maps on the MFD to help the pilot anticipate an upcoming descent. TOD also shows on the MFD ACT FPLN PROGRESS data page to show the relationship of the TOD location relative to other flight plan waypoints.

The FMS continuously calculates the TOD location. When the aircraft reaches the capture point, the descent path becomes fixed and VNAV begins to track the path. The initial location of the TOD is at the intersection of the planned cruise altitude and the planned descent path. If there is a subsequent planned altitude hold segment that follows an altitude constraint waypoint, TOD also shows at the top of the second descent segment as shown in Figure 16-12.

If the aircraft is close to and approaching the descent path, and is not at a planned altitude that intercepts the path, the FMS recalculates the TOD location based on the intersection of the current altitude and the descent path. The aircraft is considered to be close to the descent path when it is 50 NM or 20% of the origin to destination distance, whichever is smaller, but not less than 6 NM.

Figure 16-12 Flight Plan with Two Descent Segments



One minute before the aircraft intercepts the planned descent path, TOD shows on the PFD message line. If the flight plan target altitude is different from the current preselect altitude, the new target altitude shows on the PFD. The new flight plan target altitude is the next altitude constraint.

Forty-five seconds before the aircraft reaches the TOD, if the preselect altitude has not been lowered, the message CHECK PRESELECTOR shows on the CDU, and MSG shows on the PFD to remind the pilot to lower the preselector altitude.

Five seconds before the aircraft reaches the TOD, the annunciation TOD flashes on the PFD and an aural alert is sounded. If the preselector altitude is set lower than the current altitude of the aircraft before the aircraft reaches the TOD, the VNAV mode automatically sequences to VPATH, and the descent starts when the aircraft reaches the TOD. If the preselector altitude is not set lower than the current altitude of the aircraft before the aircraft reaches the TOD, VNAV continues in the VALT mode.

If the aircraft is about to intersect the planned descent path, VNAV captures the path, even if the altitude at the capture point is not a planned target altitude and the point at which the descent is initiated is not a planned TOD. The altitude alerts and messages described before are provided as appropriate, and the VNAV mode automatically sequences to VPATH mode if the preselector altitude is lowered before the aircraft reaches the descent path intersection.

NOTE

For these cases, the TOD annunciations that show on the PFD can occur before the aircraft reaches the TOD location that is depicted on the PPOS or PLAN MAP.

GUIDANCE

The FMS VNAV function provides the pilot all the necessary guidance information required to fly the desired path and maintain situational awareness. Whether defined by angle or vertical Direct-To, the FMS displays the same information for all path descents.

VERTICAL DEVIATION

A vertical deviation scale and pointer show on the PFD next to the altitude display when the aircraft is within 1000 feet of the planned vertical path.

DESCENT ANGLE AND VERTICAL SPEED

The VNAV data window on the MFD map shows the descent angle to the next flight plan altitude. It also shows the descent angle and VS from the current position of the aircraft Direct-To the next flight plan altitude constraint waypoint.

FLIGHT DIRECTOR PITCH STEERING

Steering cues show on the PFD to guide the aircraft to capture and track the flight plan VNAV profile. When the vertical path is captured, it is annunciated and pitch steering begins a pitch-over to capture and track the descent path.

SCENARIOS

The series of figures that follows shows various scenarios for descents. The track of the aircraft shows as a solid line, pre-selector settings show as a dashed line, and the FMS flight-planned path shows as a thick solid line. Also, autopilot mode selections show in a box with the associated arm and capture mode annunciations below them. VTA in the figures indicates the vertical track alert that occurs 60 seconds before mode sequencing at the TOD.

Figure 16-13 Normal FMS Transition to a Descent

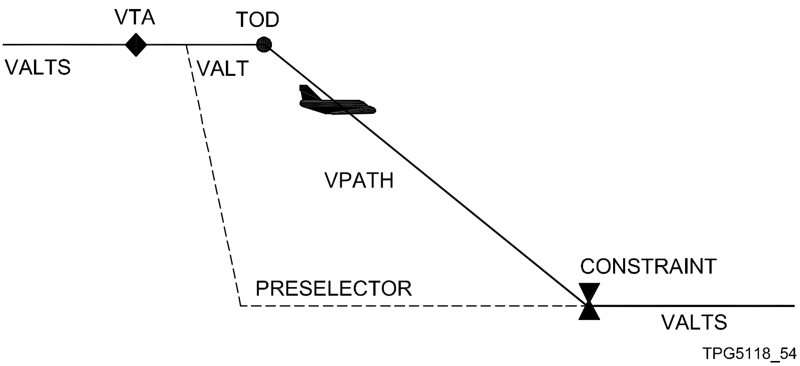
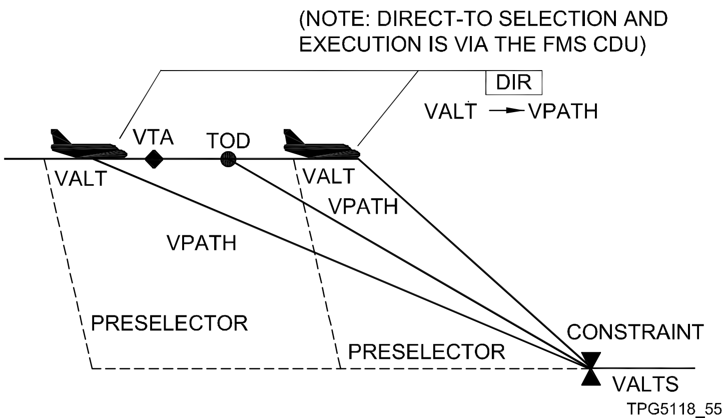


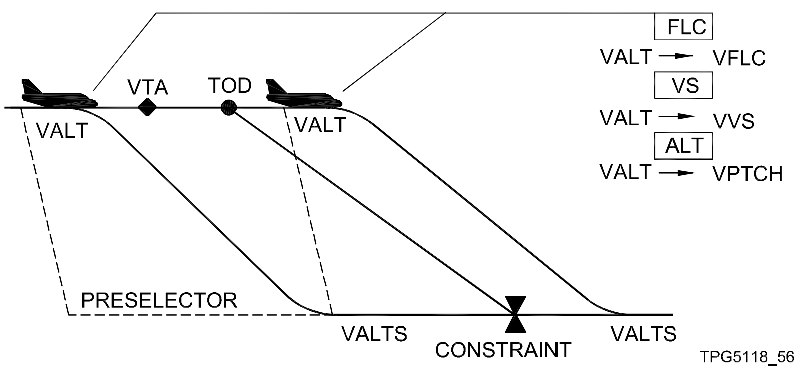
Figure 16-14 Vertical Direct-To Selection



NOTE

Figure 16-14 shows vertical Direct-To selection before and after crossing the TOD.

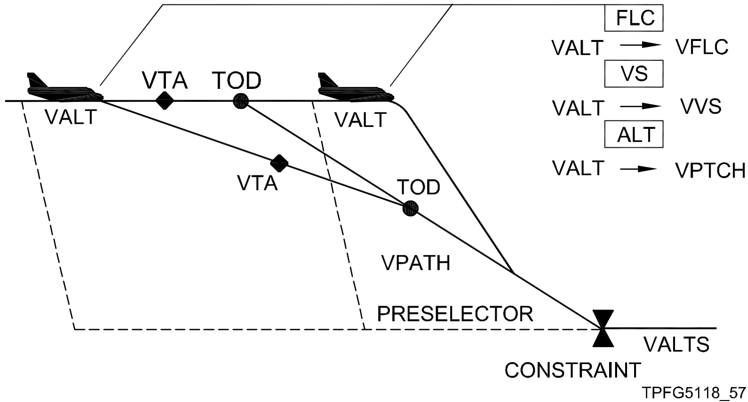
Figure 16-15 Early or Late Descent Selection: Scenario 1



NOTE

Figure 16-15 shows early or late descent selection with **NO** flight plan intercept.

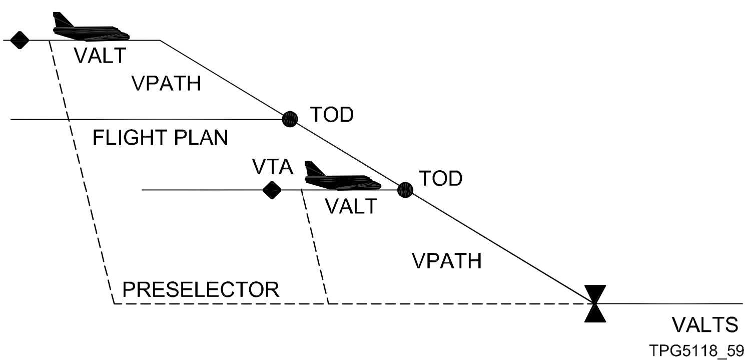
Figure 16-16 Early or Late Descent Selection: Scenario 2



NOTE

Figure 16-16 shows early or late descent selection with a flight plan path intercept.

Figure 16-17 Early or Late Descent Selection: Scenario 3



NOTE

Figure 16-17 shows early or late descent selection with an above or below flight plan altitude.

Figure 16-18 Multiple VPATH Mode Descents

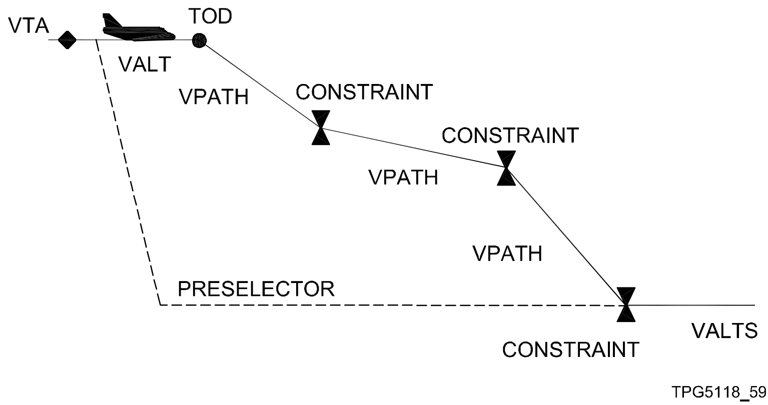
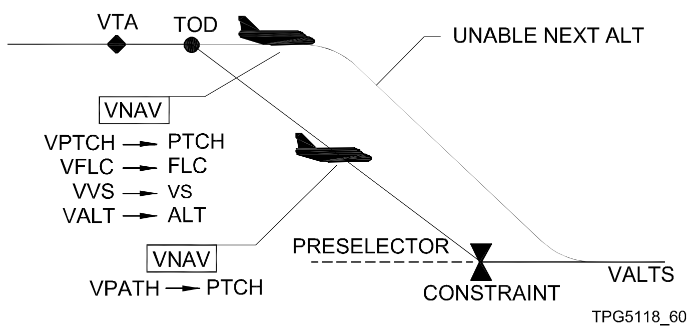


Figure 16-19 VNAV Deselection



OFF FLIGHT PLAN

Basic VNAV operation assumes the flight plan is being followed. However, during the course of a flight, it is possible that the aircraft will be required to fly through a flight plan discontinuity, fly ATC vectors, or capture a localizer. In these cases and others, it is likely that the route will be different both laterally and vertically from the flight plan entered into the FMS. This section gives some specifics about VNAV operations when the aircraft is not following the flight plan.

PATH MODES

VPATH automatically reverts to VVS descent when the straight-line geographic descent path to an altitude constraint waypoint becomes ambiguous. This occurs when:

- There is a flight plan discontinuity or a manually terminated leg between the TOD and the altitude constraint waypoint.
- Track angle error exceeds an acceptable threshold.
- Cross track deviation exceeds an acceptable threshold.

The pilot can still use flight level change, vertical speed, pitch climb/descent, and altitude hold modes.

Acceptable track angle error and cross track deviation thresholds depend on the airspace environment. In en route and oceanic/remote areas, track angle error must be less than 75 degrees and cross track deviation less than 10 NM.

In the terminal area, track angle error must be less than 75 degrees. The cross track deviation decreases from 10 NM at the terminal area boundary, or 30 NM from the Airport Reference Point, to 1.1 NM at 5 NM from the Airport Reference Point.

In the approach area, track angle error must be less than 30 degrees and cross track deviation must be less than 110 percent of the full scale cross track deviation. In approach, the cross track deviation scale varies from 1 NM when the aircraft is 2 NM out and inbound to FAF, to 0.3 NM at FAF and beyond.

HEADING MODE

When using heading mode to follow ATC vectors, and the active flight plan leg is not a vectors leg, the FMS continues to sequence the flight plan as the aircraft passes abeam the waypoints. VNAV also continues to fly to the next altitude constraint at the TO waypoint or beyond, and the altitude constraints continue to sequence as the flight plan sequences. Path descents remain active, provided the aircraft is within the course and cross track deviation limits specified above and the active leg has a defined track.

Use flight level change, vertical speed, or pitch descents when a flight plan vectors leg is before the next altitude constraint, as there is no specified track for a vectors leg. However, a DES advisory shows on the MFD if a top of descent based on great circle distances occurs before the vectors leg.

DISCONTINUITIES

VNAV remains active when the FMS sequences the ACT/MOD FPLN to a discontinuity. The flight can be continued using the heading mode, or the discontinuity can be removed, which then returns the aircraft to tracking the ACT FPLN.

VNAV honors altitude constraints across a discontinuity and captures that altitude if intercepted. However, it cannot fly a path descent across a discontinuity.

APPROACHES

ILS CAPTURE

When the autopilot captures the localizer of a localizer-based approach to the destination airport selected in the flight plan, VNAV remains active until one of the following is true:

- Glideslope is captured
- There is no glideslope
- Initiation of a descent to the runway.

An altitude constraint is always specified for the final approach course fix (FACF) waypoint and is usually specified for the final approach fix (FAF) waypoint.

A localizer is normally captured just before arrival at the FACF. Therefore, normal VNAV operation brings the aircraft to the FACF and FAF waypoints at the required altitudes. At the FAF, if there is no glideslope, or the glideslope was not captured, and a manual descent has not been initiated, the VNAV will maintain altitude hold beyond the FAF. This happens because there are no further descent altitude constraints in the flight plan.

For normal operation, the FMS sequences the flight plan to the runway threshold after passing the FAF. For missed approach procedures, VNAV gives climb guidance to the altitude constraints in the missed approach procedure if VNAV is reselected after the aircraft enters the procedure.

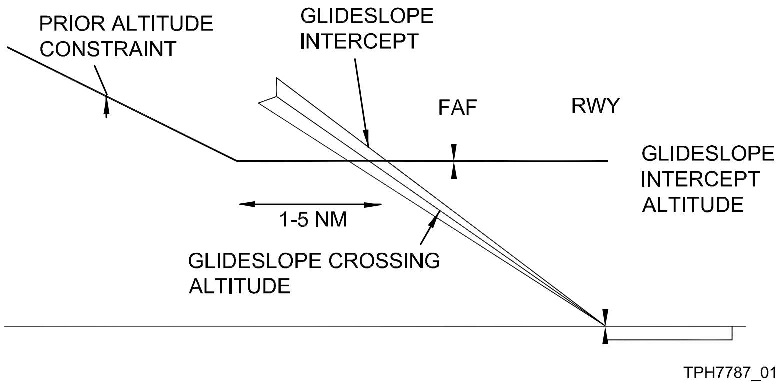
ILS AND LOCALIZER-BASED APPROACHES

The VNAV descent profile on all localizer-based approaches does not descend below the FAF altitude. In the case of an ILS approach, the VNAV can remain active until glideslope capture. The pilot is responsible for descent below the FAF altitude on localizer-only approaches. VNAV remains active after localizer capture.

The FAF waypoint on an ILS approach specifies the glideslope intercept altitude on the LEGS page. As glideslope is intercepted before crossing the FAF, the aircraft crosses the FAF waypoint at the glideslope crossing altitude, which is usually lower than the glideslope intercept altitude.

The VNAV descent for an ILS approach is designed to reach the glideslope intercept altitude 1 to 5 NM before the aircraft intercepts the glideslope. This allows the aircraft to establish stabilized level flight to intercept glideslope, as shown in Figure 16-20. The descent path will reach glideslope intercept altitude at least 5 NM before the glideslope intercept, unless the approach geometry is very tight.

Figure 16-20 VNAV Glideslope Intercept



RNAV AND GPS APPROACHES

As long as VNAV remains selected, the FMS flies to the altitude constraints of RNAV and GPS procedures, up to and including the FAF and missed approach point or runway threshold. VPATH or VGP descents are made as long as the aircraft does not exceed a 30-degree track angle error or full-scale deviation. Full-scale deviation equals 1 NM at 2 NM from FAF, to 0.3 NM at FAF and beyond.

Vertical deviation guidance to the descent altitude constraint at the missed approach point is also available if approach is enabled in the FMS and the required navigation accuracy is available. Vertical steering guidance to the missed approach point or runway threshold is available in VGP mode. VNAV does not recognize or control the aircraft with respect to the MDA.

To enable the VGP mode, the pilot must select APPR on the FCP. The VGP mode allows the preselector to be set at the missed approach altitude and continue descent to the runway.

If VNAV is still selected when the FMS sequences to the missed approach point, VNAV will give climb guidance to the altitude constraints in the missed approach procedure. VNAV does not initiate a climb in the missed approach procedure, but it does give guidance with respect to the altitude constraints of the procedure.

The figures that follow show different approach path modes. In Figure 16-21, APPR is selected on the FCP and the VGP mode is engaged. In Figure 16-22, although the descent path is followed, VGP mode is never engaged. In Figure 16-23, VNAV is not armed and the FMS will not direct an automatic descent.

Figure 16-21 GP-Armed To VGP Captured Scenario

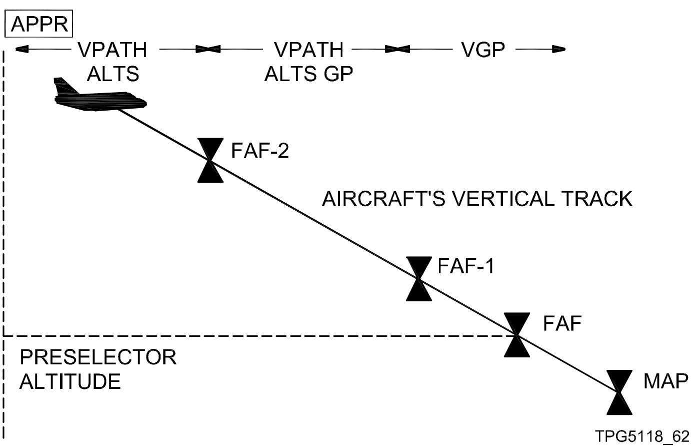
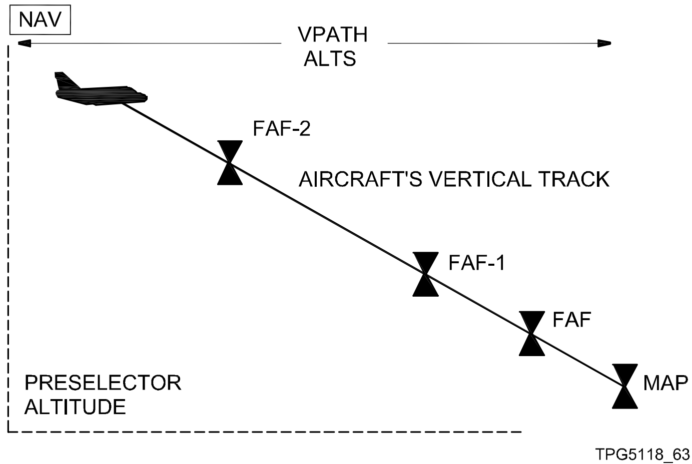


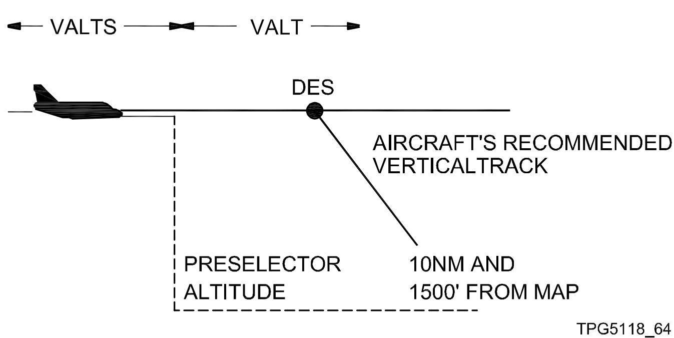
Figure 16-22 VPATH (Not VGP) Approach Scenario



NOTE

Figure 16-22 shows that because APPR is not selected on the Flight Control Panel, GP is never armed and VGP is never captured.

Figure 16-23 No VNAV Armed Mode Scenario



VISUAL AND OTHER APPROACHES NOT QUALIFIED FOR FMS

Vertical navigation guidance is available for visual approaches to a runway, and for any other approach that is not executed as an FMS approach (for example, IGS, TCN, or NDB approaches). Vertical deviation and vertical steering guidance to the runway threshold or missed approach point are available in VPATH mode if both of the following conditions are met:

- The required approach navigation accuracy is available.
- The preselect altitude remains below aircraft altitude.

INDEX

Subject Page

A

B

C

Subject Page

G

Subject Page

Subject Page

Subject Page

R

Subject Page

Subject Page

W

Z

This page intentionally left blank

523-0808270-011117

Rockwell Collins