

FMZ Series Flight Management System

Pilot's Operating Manual



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TO: HOLDERS OF THE FLIGHT MANAGEMENT SYSTEM
(FMS) FOR THE SOFTWARE VERSION 5.3 PILOT'S
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HIGHLIGHTS

This manual has been revised to reflect the addition of Vertical Glide Path (VGP) Mode and Datalink as well as other minor updates. For convenience, the entire manual has been reprinted to avoid inserting changed pages. The List of Effective Pages (LEP) identifies the current revision to each page in this manual.

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FMZ Series Flight Management System (FMS)

Software Version
5.3

Pilot's Operating Manual

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1. Introduction

This pilot's operating manual describes the components, typical operational example, normal, and abnormal operating procedures for the Honeywell Aerospace Electronic Systems Flight Management System (FMS).

This manual covers all FMS operations and options. Depending on equipment installed, specific aircraft may not have all the features described.

CDU pages within this manual are displayed in black and white. Text which would appear in inverse video is designated by a box surrounding the affected text. In addition, the FMS can be configured for pounds or kilograms. Example CDU pages within this manual display pounds as the unit for weight.

The information displayed on each CDU page is for information only. The pages are not intended to reflect current navigational data, aircraft limitations or specific aircraft data base information.

Sections 1 through 3 describe the FMS capabilities and components. Section 4 describes a normal operational example for the FMS. Sections 5 through 9 detail the features and specialized capabilities of the FMS.

Since many topics are covered in this manual, use the index to find specific topics. There are also many cross references within the manual.

This revision of this pilot manual is based on NZ5.3 or later software.

Refer to page 13-3 for information on ordering additional copies of this manual or other Honeywell FMS publications.

2. System Description

The Honeywell Flight Management System (FMS) provides a complete range of FMS functions. This section describes the major functions that are part of the FMS. Section 3, System Components, describes each of the components of the system. Figure 2-1 is a block diagram of the FMS system.

The primary purpose of an FMS is to manage navigation sensors to produce a composite position. Using the composite position, along with flight planning capabilities, the FMS can control navigation, performance, and guidance work throughout the flight. The FMS consists of the following components:

- Control Display Unit (CDU)
- Navigation Computer (NZ)
- Data Loader (DL).

The FMS has the following major functions:

NAVIGATION

- The navigation function computes the aircraft position and velocity for all phases of flight (oceanic, enroute, terminal, and approach), including polar navigation.
- The navigation function automatically blends or selects position sensors to compute an optimum position.
- The pilot can deselect individual sensors when required.

FLIGHT PLANNING

- The flight planning function computes the active flight plan with both lateral and vertical definition.
- Flight plans can be loaded from a flight planning service or by using a personal computer (PC) and a 3.5 inch diskette.

DATA BASE

- The data base contains worldwide coverage of nav aids, airways, Standard Instrument Departure/Standard Terminal Arrival Route (SID/STAR) procedures, approach procedures, airports, and runways.
- The data base can store pilot-defined flight plans and waypoints.

LATERAL NAVIGATION (LNAV)

- LNAV guides the aircraft along a predetermined flightpath at a pilot-selected bank angle for increased passenger comfort.
- LNAV maintains the aircraft within an airway or protected airspace.
- LNAV automatically flies pilot-defined or data base holding patterns, including entry and exit procedures.

VERTICAL NAVIGATION (VNAV)

- VNAV gives a complete vertical profile for the entire flight.
- VNAV is integrated with the lateral flight plan.
- Some ARINC 429 based aircraft are advisory VNAV only (e.g., NASA GII, EMBRAER 145) and do not allow FMS vertical coupling to the flight director and autopilot.

PERFORMANCE

- Performance contains fuel management and time estimates for the flight.
- Performance estimates optimum altitude, cruise modes, step climbs, WHAT-IF situations, and stored flight plan planning.
- Performance has automatic speed targets for each phase of flight.

AUTOTHROTTLE

- This function provides full flight regime autothrottle.
- Autothrottle modes are integrated with the flight director.

AIRBORNE FLIGHT INFORMATION SYSTEM (AFIS™)

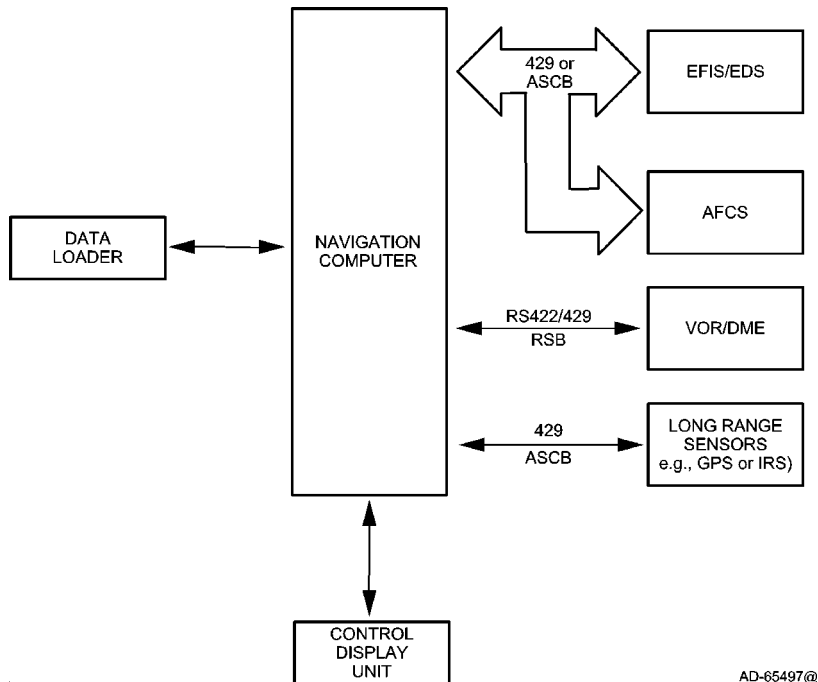
- The FMS interfaces to the Allied-Signal Global AFIS™.

AIRBORNE DATALINK

- The FMS interfaces to ARINC 724B ACARS Management Unit (MU).

NAVIGATION DISPLAYS

- Navigation displays are shown on the Electronic Flight Instrument System (EFIS).
- Electronic maps integrate route map data with auxiliary navigation data to display the aircraft's situation at any time.
- Electronic displays integrate map data with weather radar displays.



AD-65497@

**FMS System Block Diagram
Figure 2-1**

- NOTES:**
1. IN P2000/IC-615 INSTALLATIONS, THE NAVIGATION COMPUTER, EFIS, AND AFCS ARE INTEGRATED INTO ONE UNIT.
 2. SOME INSTALLATIONS DO NOT USE THE ASCB INTERCONNECT TO EFIS/EDS.

3. System Components

This section describes each system component and its function.

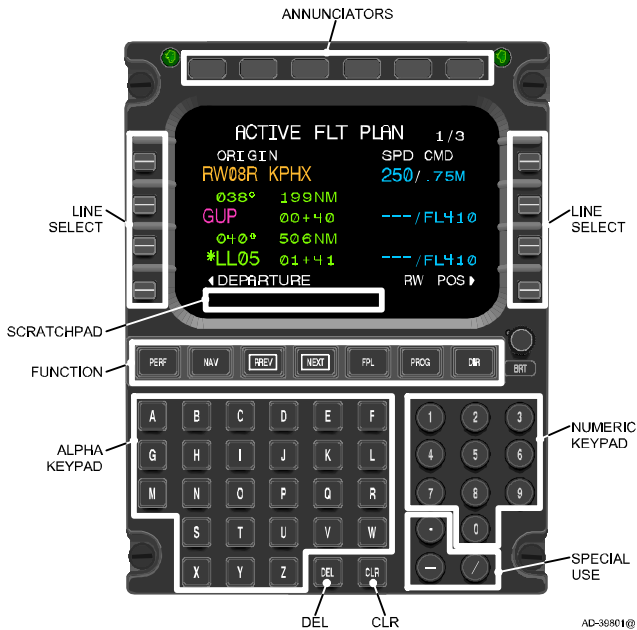
FMS components are listed in Table 3-1.

Model	Unit	Part No.
CD-800	Control Display Unit (Mono CRT)	7004403-VAR
CD-810	Control Display Unit (Color CRT)	7007549-VAR
CD-815	Control Display Unit (AMLCD)	7022360-VAR
DL-800	Data Loader	7004607-VAR
DL-900	Data Loader	7016600-VAR
IC-615	Integrated Computer	7017000-VAR
IC-800	Integrated Avionics Computer	7017300-VAR
NZ-2000	Navigation Computer	7018879-VAR

FMS Components
Table 3-1

CONTROL DISPLAY UNIT (CDU)

The Control Display Unit (CDU), shown in Figure 3-1, is the pilot interface to the system. The function of the CDU is described in this section. It is necessary to know the general rules and operating characteristics of the CDU in order to understand the specific operations of the FMS.



CD-810 With Flight Plan
Figure 3-1

CDU operation is designed to be simple and to minimize crew workload in all phases of flight. The CDU serves as the pilot interface with the navigation computer. Pilots enter data using the alphanumeric keyboard and the line select keys.

Architecture

The CD-800 has a monochrome display while the CD-810 has a full-color display. Both consist of a keyboard, a Cathode Ray Tube (CRT) display, and the electronics required to communicate with the navigation computer. The keyboard consists of line select keys (both sides of the CRT display), alphanumeric keys, function keys, annunciators, and a bright/dim control.

The CD-815 is similar to both the CD-800 and the CD-810, except it uses a Active Matrix Liquid Crystal Display (AMLCD). The CD-815 is able to display video from external sources. External switching on the flight deck is used to switch between video and CDU pages.

CDU Display

The CDU has a full-color display and contains nine lines. Each line contains twenty-four characters. The first line is a title line and the ninth line is the scratchpad.

- **Color Assignments** – Color on the CDU display page is designed to highlight important information. Color assignments are coordinated as much as possible with other displays. Refer to Table 3-2 for a definition of color assignments.

Parameter	Assigned Color
Vertical	Cyan (Blue)
Atmospheric Data	Cyan (Blue)
Lateral	Green
FROM Waypoint	Yellow
TO Waypoint	Magenta
Prompts and Titles	White
Flight Plan Names	Orange
Index Selections	Green

CDU Color Coding Scheme

Table 3-2

- **Viewing Angle** – All symbols for the CD-800, CD-810 and CD-815 are visible at a viewing angle of 45° from the sides, 15° from the top, and 30° from the bottom. The CD-815 can be adjusted for parallax. Refer to page 12-7 for details on parallax adjustment.

Alphanumeric Keys

The CDU alphanumeric keyboard is used by the pilot for input to the FMS. The alphanumeric keys make entries to the scratchpad only. The letters of the alphabet, the numbers 0–9, the decimal, the dash, and the slash are each represented with a CDU key. This is shown in Figure 3-1.

Scratchpad

The bottom line on the CDU display is the scratchpad. The scratchpad is a working area where the pilot can enter data and/or verify data before line selecting the data into its proper position. Alphanumeric entries are made to the scratchpad using the keyboard. As each key is pressed, the character is displayed in the scratchpad. Information in the scratchpad does not affect the FMS until it is moved to another line on the display. Data is retained in the scratchpad throughout all mode and page changes.

The scratchpad has an editing mode. While the editing mode is available all the time, it is most useful when entering messages for functions such as AFIS™. Procedure 3-1 contains the procedure for using the scratchpad editing mode.

Step	Procedure 3-1 Scratchpad Editing Mode
1	The editing mode is entered by ending the scratchpad entry to be edited with a dash (-) and pressing the PREV key.
2	In the editing mode, the PREV and NEXT keys move an inverse video cursor in the scratchpad.
3	The character in the inverse video field can be removed with the CLR key or a new character can be inserted before it.
4	Pressing the DEL key deletes the entire scratchpad entry.
5	The editing mode is exited when the scratchpad entry is moved to a line by pressing a line select button.

The scratchpad also displays advisory and alerting messages. The scratchpad has the following display priority:

- Alerting messages
- Advisory messages
- Delete function
- Entry and line selection.

Line Select Keys

There are four line select keys on each side of the CDU display. Data is selected to a line from the scratchpad or vice-versa using the line select keys. These keys are identified from top to bottom as 1L through 4L on the left side and 1R through 4R on the right side. The line select keys are the most often used keys on the CDU.

- **Direct Access Prompts/Function Selects** – In the case of an index display, the line select keys are used to select functions from the index. In displays other than index, the bottom line select keys (4L, 4R) are primarily used for direct access to other functions in the FMS. The functions most likely to be accessed from the present page and phase of flight are displayed as prompts. An example is the ARRIVAL prompt which is displayed on the active flight plan pages when within 200 NM of the destination. These types of

prompts reduce the number of key strokes in order to minimize pilot workload. The pilot can also access functions through the main navigation and performance indices.

- **Transfer Line Data to Scratchpad** – If the scratchpad is empty, pressing a line select key transfers the respective line data to the scratchpad.
- **Transfer Scratchpad Data to Line Fields** – Once data has been entered into the scratchpad either through line selection or manual keyboard entry, it can be transferred to any of the allowable line select fields on a page. To transfer the data, press the key adjacent to the line where the scratchpad data is intended.

Clear (CLR) Key

This key performs the following functions:

- When a message is displayed in the scratchpad, pressing the CLR key deletes the message.
- When a scratchpad entry begins with an asterisk (*) or pound sign (#), pressing the CLR key removes the entire entry.
- When an alphanumeric entry is made in the scratchpad, one character is cleared from the scratchpad (from right to left) each time the CLR key is pressed. If the CLR key is held down after the first character is cleared, other characters are cleared, one at a time, until the key is released. Refer to Scratchpad (page 3-3) for use of the CLR key editing feature.

Delete (DEL) Key

- The DEL key is used to delete items from the FMS. When the DEL key is pressed, *DELETE* is displayed in the scratchpad. The DEL key can be line selected to delete waypoints or other items displayed in the CDU data fields. When there is a message displayed, the delete operation is inhibited. Delete is also used to return default values after entries have been made. Finally, as noted under Scratchpad (page 3-3), the DEL key can also be used in the scratchpad edit mode. While in the editing mode with a dash (-) at the end of the scratchpad entry, pressing the DEL key will delete the entire scratchpad entry.

Function Keys

The seven function keys located directly below the screen access primary functions, indices (menus), and paging.

FUNCTION KEY PAGING is an option that, when activated, allows for advancement of function pages using additional presses of the function key instead of the NEXT key. For example, when initially selecting a function key, the CDU will display page 1 for that function key. Pressing the same function key again will result in the CDU displaying page 2 for that function. Refer to Step 12, in Procedure 6-31, on page 6-168, for additional details on activating the FUNCTION KEY PAGING option.

- **Performance (PERF) Key** - Pressing the PERF function key displays page 1 of the performance index. The pilot can select any of the index functions by pressing the respective line select key. These are shown in Figures 3-2 and 3-3. Refer to Performance Index, page 5-2, for additional details.

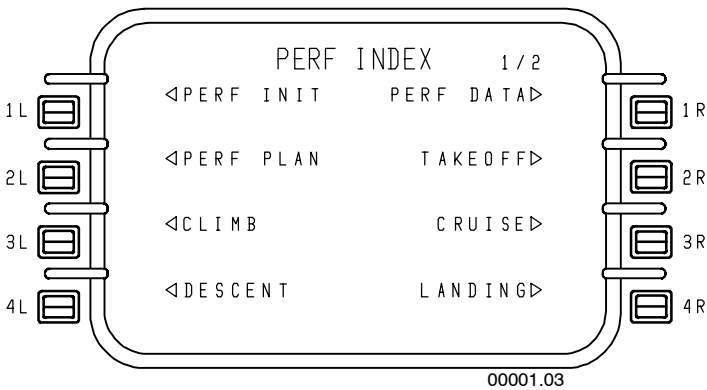


Figure 3-2

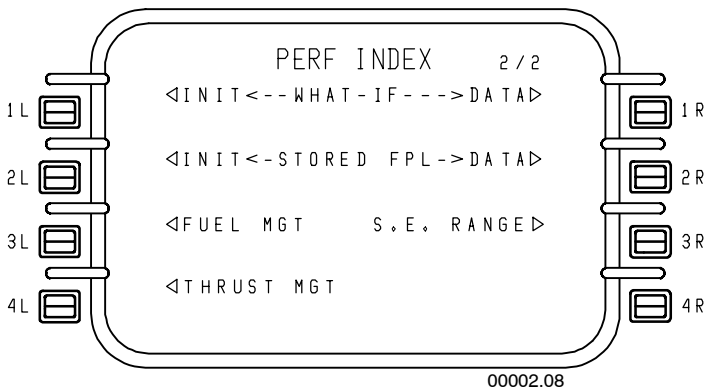


Figure 3-3

- Navigation (NAV) Key** – Pressing the NAV function key displays page 1 of the navigation index. This is shown in Figures 3–4 and 3–5. The pilot can select any of the index functions by pressing the respective line select key. Refer to Navigation Index (NAV) (page 6-1) for additional details.

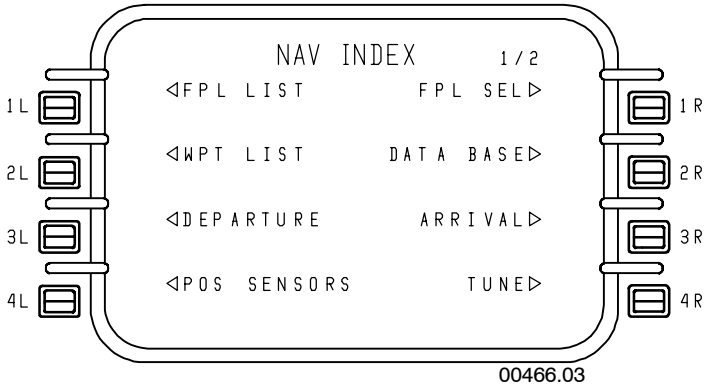


Figure 3-4

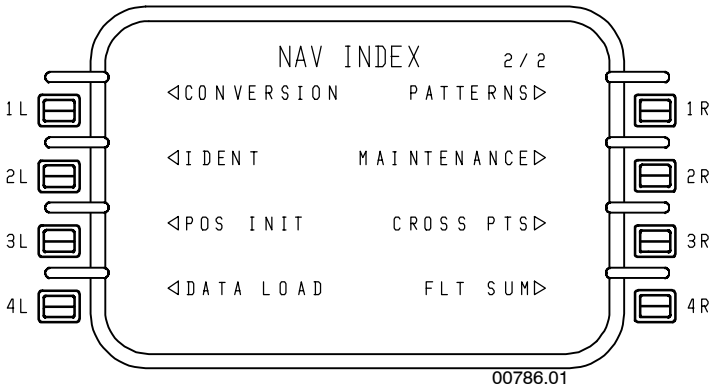


Figure 3-5

- Paging (PREV)/(NEXT) Keys** – The specific page and number of pages in a particular function or menu display are shown in the upper right corner of the display. The page number format is AA/BB where AA is the current page and BB is the total number of pages available. Page changes are made by pressing the PREV (previous) and NEXT keys. The keys can be held down for repeated page changing. Refer to Scratchpad (page 3-3) for use of the PREV and NEXT keys for editing.

- **Flight Plan (FPL) Key** – Pressing the FPL key displays the first page of the active flight plan. An example page is shown in Figure 3-6. If no flight plan is entered, the pilot can perform the following:
 - Manually create a flight plan
 - Select a stored flight plan
 - Load a flight plan from a disk
 - Create a stored flight plan.

Refer to Flight Plan (page 7-1) for additional details.

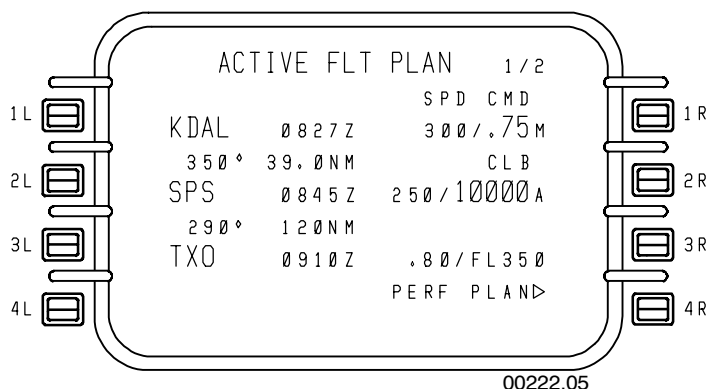


Figure 3-6

- **Progress (PROG) Key** – Pressing the PROG key displays the first progress page. This mode shows the current status of the flight. The first progress page displays the Estimated Time Enroute (ETE), distance to, and fuel projection for the TO waypoint and destination. It also displays the current NAV mode, the number of long range NAVs used, and the navaids that are presently tuned. A typical progress page is shown in Figure 3-7. Refer to Progress (page 8-1) for additional details.

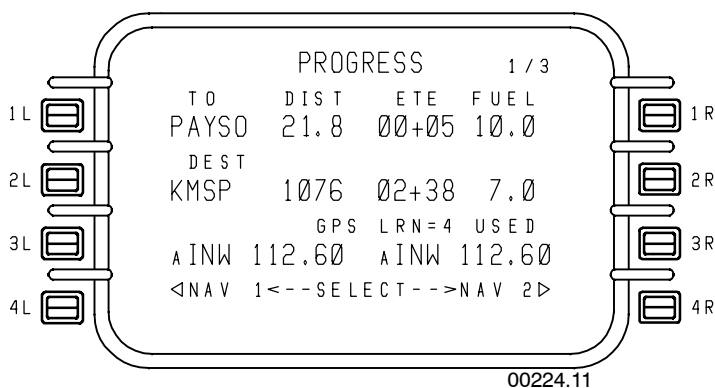


Figure 3-7

- Direct-To/Pattern/Intercept (DIR) Key** - Pressing the DIR function key displays the active flight plan page with the DIRECT, PATTERN, and INTERCEPT prompts. This is shown in Figure 3-8. If other than an active flight plan page is displayed when pressing the button, the first page of the flight plan is displayed. If the active flight plan is already displayed when pressing the button, the display remains on the same page with prompts displayed. DIRECT is the primary function. PATTERN and INTERCEPT must be selected at 4L or 4R, respectively. Refer to Direct/Pattern/Intercept (page 9-1) for additional details.



Figure 3-8
Active Flight Plan in DIR Mode

ACCESSING ANY FMS FUNCTION

The FMS prompts the pilot at 4L and 4R for the most likely functions to be selected. Using these prompts, the FMS steps the pilot through procedures such as initialization. At any time, it is possible to operate out of sequence or to access other areas of the FMS. Follow Procedure 3-2 to access any function of the FMS.

Step	Procedure 3-2 Accessing Any FMS Function
1	Determine the required function. All functions are available at all times from the PERF, NAV, FPL, PROG, or DIR keys.
2	Select the appropriate PERF, NAV, FPL, PROG, or DIR key.
3	If PERF or NAV is selected, read the menu list for the required function or feature.
4	Select the correct function or feature.
5	The FMS displays the function or feature selected.
6	Continue working using the prompts at 4L and 4R if part of a sequence, such as initialization, is being completed.

Annunciators

There are six annunciators located at the top of the CDU keyboard panel. These annunciators can also be repeated on the Electronic Flight Instrument System (EFIS) or other remote annunciators. White and amber annunciators are used on the CDU. White indicates an advisory annunciation and amber indicates an alerting annunciation.

- Display (DSPLY)** – DSPLY is an advisory (white) annunciation. This annunciator is lit when the CDU displays flight plan type pages other than the first page of the active flight plan. The purpose is to provide a distinction with flight plan data controlling the aircraft. When airborne, the DSPLY annunciator is lit in the following cases:
 - When displaying a flight plan page other than page 1
 - When displaying a stored flight plan page
 - When displaying any of the review pages for SIDs and STARs approaches
 - When displaying a CHANGE ACTIVE LEG message
 - When defining an INTERCEPT waypoint on the active leg.
- Dead Reckoning (DR)** – DR is an alerting (amber) annunciation. This annunciator is lit when operating in the DR mode for longer than 2 minutes. The DR mode is defined as the loss of radio updating and all other position sensors (IRS and GPS).
- Degraded (DGRAD)** – DGRAD is an alerting (amber) annunciation. This annunciator is lit when the FMS cannot guarantee the position accuracy for the present phase of flight due to sensor availability. The approved sensors for the flight phases are listed in Table 3-3.

Flight Phase	Approved Sensors (Navigation Mode)			
	GPS	DME/DME	VOR/DME	IRS
Departure or Terminal	X	X	X	(see note)
Enroute	X	X	X	X
Oceanic	X	X	X	X
VOR/DME or VOR Approach	X	X	X	
GPS Approach	X			
NDB Approach	X	X		
NOTE: The FMS uses the IRS as the navigation mode for a limited time in these phases of flight. The time is determined in the FMS by estimating when the drift rate error of the IRS exceeds 1.7 NM for departure and terminal operations.				

Approved Sensors for Flight Phase

Table 3-3

The DGRAD annunciator is lit if both of the following conditions are valid:

- The sensors being used for navigation are not approved for the current phase of flight.
- The FMS is the selected aircraft navigation source on EFIS.

If the DR annunciator lights when the DGRAD annunciator is lit, the DGRAD annunciator is turned off.

- **Message (MSG)** – MSG is an advisory (white) annunciation. This annunciator is lit when a message is displayed in the scratchpad. The annunciator goes out after the message(s) has been cleared from the scratchpad.

Messages are displayed in the CDU scratchpad at various times. They inform or alert the pilot as to system status. Messages are divided into the following two major groups:

- **ADVISORY MESSAGES** – Advisory messages contain information that is helpful to the pilot. Advisory messages are usually the result of a pilot action on the CDU (e.g., making an entry with the incorrect format).

- **ALERTING MESSAGES** – Alerting messages alert the pilot to the FMS status, assuming the pilot is not looking at the CDU (e.g., a message annunciating a sensor failure). Alerting messages also light an external annunciator located in the pilot's primary field of view. Alerting messages are a higher priority than advisory messages.

Messages are stacked for display in priority order on a first in, last out basis. In cases where there are multiple messages stacked, the message annunciator stays lit until all messages are cleared. Only one message can be cleared per CLR key press.

- **Offset (OFFSET)** – OFFSET is an advisory (white) annunciation. The annunciator is lit when a lateral offset has been entered on the PROGRESS 3 page. The annunciator goes out when the offset is removed.
- **Approach (APRCH)** – APRCH is an advisory (white) annunciation. The annunciator indicates the FMS is in the approach mode of operation. In this mode, the EFIS deviation sensitivity and FMS tracking gains are increased. The approach annunciator is lit if ALL of the following conditions are valid:
 - The FMS is the selected aircraft navigation source on EFIS.
 - A non-precision instrument approach must have been activated from the navigation data base. If no approach, or an ILS, LOC, LOC-BC, Landing Directional Aid (LDA), Simplified Directional Facility (SDF), or MLS approach is selected, the APRCH annunciator does not light.
 - The aircraft position is between 2 NM outside the Final Approach Fix (FAF) and the Missed Approach Point (MAP).
 - The DGRAD annunciator must be off.
 - The FMS must be using approved sensors for the selected approach procedure. Approved sensors for non-precision approach procedures are shown in Table 3-4.

Approach Procedure	Approved Sensors (Navigation Mode)		
	GPS	DME/DME	VOR/DME
GPS	X		
VORDME	X	X	X
VOR	X	X	X (see note)
NDB	X	X	
NOTE: VOR approaches with a procedure specified navaid that does NOT have DME capability can be flown by the FMS only if GPS or DME/DME is available.			

Approved Sensors for Approach
Table 3-4

Brightness Control

Both manual and automatic (photo sensor) brightness controls are used to increase or decrease the CDU display brightness. Following manual adjustment, the photo sensors monitor the ambient light and maintain the brightness level of the CDU display over various lighting conditions. As a word of caution, the brightness may be adjusted during evening hours such that, during daylight hours, the display cannot be seen.

NAVIGATION COMPUTER

The FMS has different hardware configurations. The NZ-2000 Navigation Computer, IC-800 Integrated Avionics Computer (IAC), and IC-615 are examples. For purposes of this manual, the computer function of the FMS, regardless of hardware configuration, is referred to as the NZ.

The NZ has two primary functions and multiple secondary functions. The primary functions are position computation and flight planning. These functions work with the associated guidance in both the lateral and vertical axes. The Navigation Data Base (NDB) contained in the NZ is essential to these functions. The data base is used to store waypoints, nav aids, airways, procedures, airports, and other navigation data.

The NZ connects to a variety of short range and long range navigation sensors. The primary short range sensors are VOR/DME and DME/DME. Long range sensors include Inertial Reference System (IRS) and Global Positioning System (GPS). Using the available sensors, the NZ develops an FMS position based on a blend or mix of sensor inputs. Based on the position and the flight plan, the FMS generates information for display on the CDU and EFIS.

The lateral navigation function of the FMS can calculate navigation information relative to selected geographical points. The pilot can define flight plan routes worldwide. The system outputs advisory information and steering signals that show the pilot or Flight Guidance System (FGS) how to guide the aircraft along the desired route. Routes are defined from the aircraft's present position to a destination waypoint along a great circle route or through a series of great circle legs defined by intermediate waypoints.

DATA LOADER

The data loaders, shown in Figures 3-9 and 3-10, are used to transfer data to and from the NZ through an RS422 interface. The data loader can be permanently mounted in the aircraft or used as a portable unit. The data loader uses 3-1/2 inch disks for the transfer of data. The DL-800 Data Loader uses 720 KB disks and the DL-900 Data Loader uses either 720 KB or 1.44 MB disks. The data loader can be used to transfer any of the following:

- Navigation data base information
- Custom data base information
- Aircraft data base information
- Flight plans
- AFIS™ information
- Maintenance data.



DL-800 Data Loader
Figure 3-9



DL-900 Data Loader
Figure 3-10

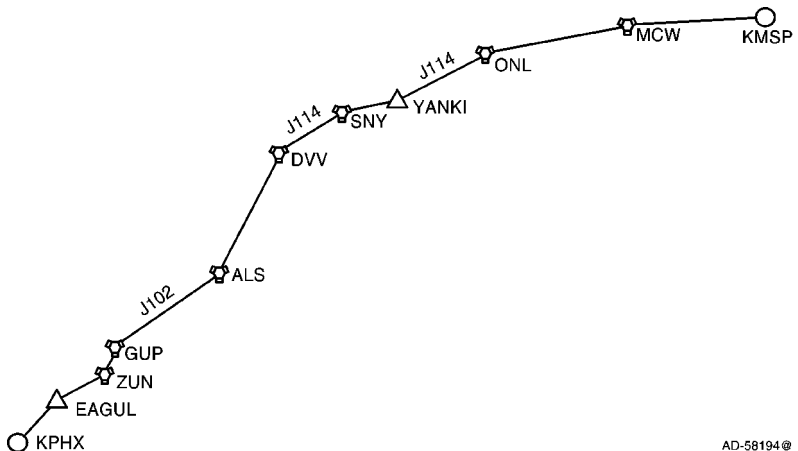
4. Operational Example

This section describes the normal operational procedures of the FMS for a flight from Phoenix, Arizona (KPHX) to Minneapolis/St. Paul, Minnesota (KMSP). KMSP is forecast to be Instrument Meteorological Conditions (IMC) at arrival time; therefore, Duluth, Minnesota (KDLH) is used as the alternate.

The flight route, shown in Figure 4-1, begins in Phoenix and proceeds from Zuni (ZUN) via J102 to the Alamosa (ALS) VOR, direct to the Denver (DVV) VOR, J114 to the O'NEIL (ONL) VOR, then direct to the Mason City (MCW) VOR. The flight departs Phoenix from runway 08R using the EAGUL3 departure with the Zuni (ZUN) transition (KPHX RW08R EAGUL3.ZUN) shown in Figure 4-2. The arrival is via the Mason City transition to the KASPR2 arrival, shown in Figure 4-3, followed by the Press transition to the ILS approach for runway 30L at KMSP (MCW.KASPR2 PRESS.ILS RW30L KMSP). The ILS 30L approach is shown in Figure 4-4.

The Standard Instrument Departure (SID), Standard Terminal Arrival Route (STAR), approach, waypoints, and airways used in this example do not reflect current navigation data. When performing this operational example on the actual FMS, flight plan waypoints, distances, and times will differ from those shown in this manual.

This example often references Sections 5 through 9 for more detailed information. Section 10 provides details about entry format.

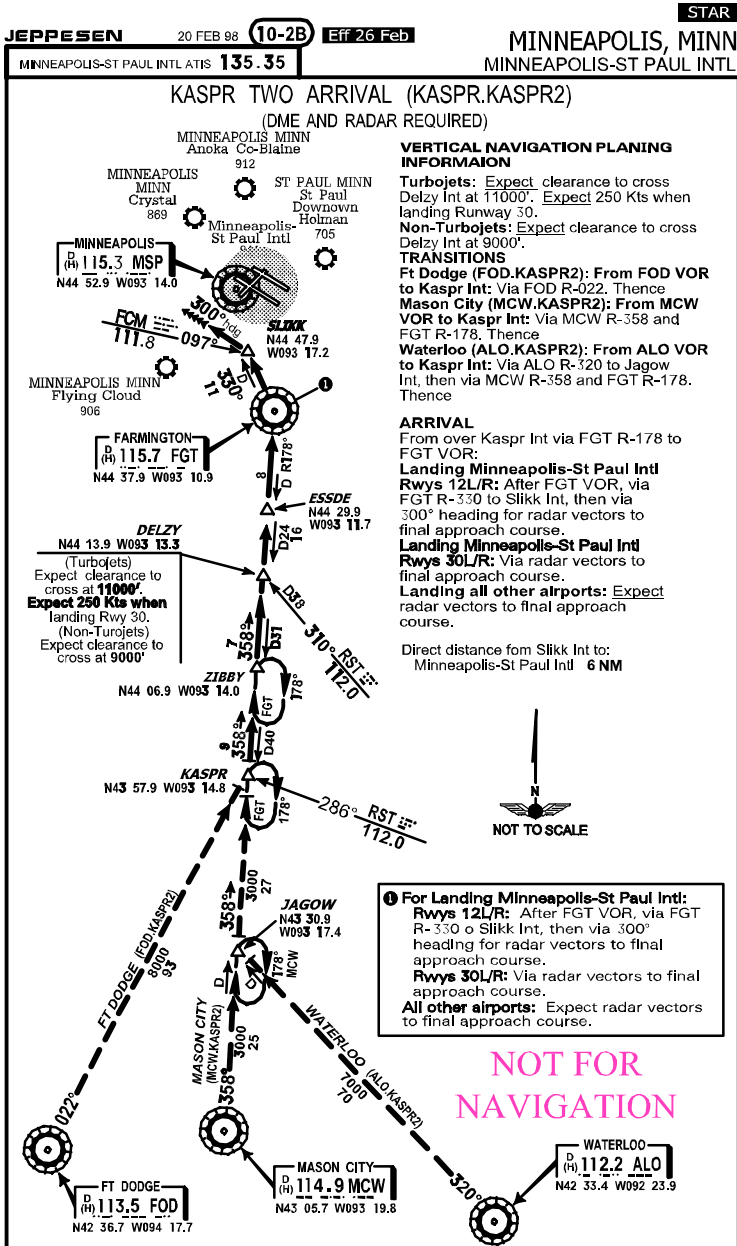


AD-58194@

KPHX to KMSP Flight Route
Figure 4-1



**Phoenix, AZ EAGUL3 Departure
Figure 4-2**



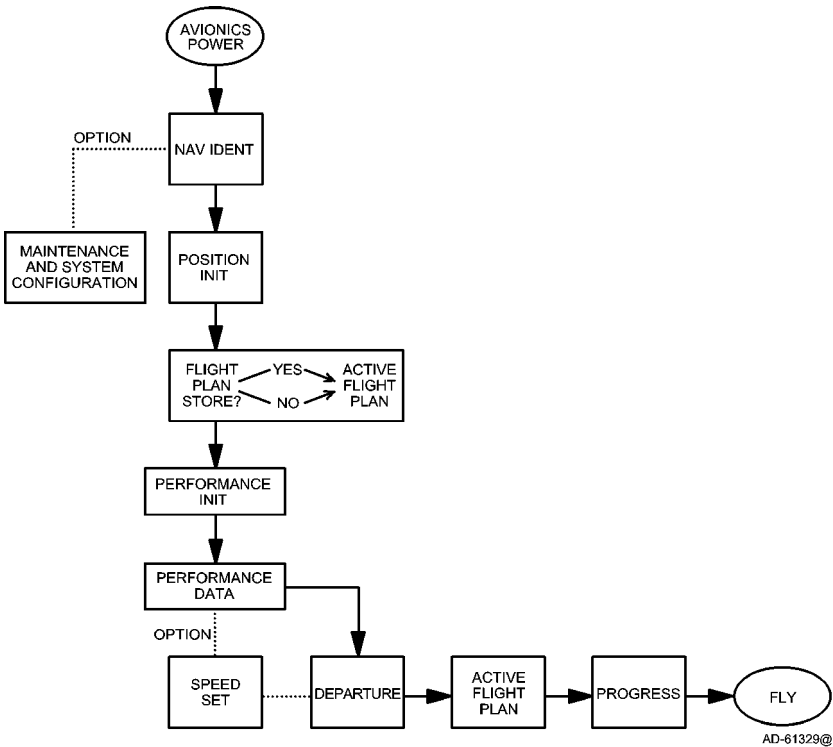
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AD-58009@

Minneapolis, MN KASPR2 Arrival
Figure 4-3

PREDEPARTURE

The FMS guides the pilot through the ground initialization process using the lower right line select key (4R). After completing the page (or pages) for each step, select the lower right key (4R) to move to the next step. Figure 4-5 is a flow chart that shows the preflight procedure for a normal flight.



FMS Preflight Procedure Flow Chart
Figure 4-5

Powerup

- **NAV IDENT 1/1** - Figure 4-6 is displayed when power is first applied.

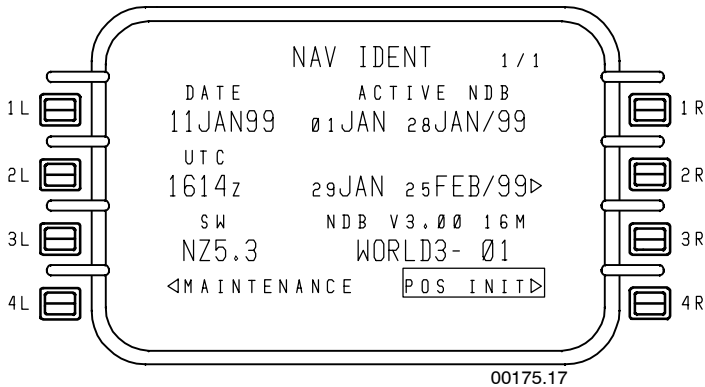


Figure 4-6

The date and time displayed on this page is synchronized with the GPS date and time. The date and time can be changed if the GPS is failed or does not have a valid date/time. A battery maintains the date and time when power is removed from the FMS. Refer to page 6-148 for additional details on changing date and time.

The software identifier is displayed at 3L for verification. The software identifier must be referenced when maintenance action is requested.

The maintenance prompt (4L) can be used to verify the FMS system operating configuration. Refer to page 6-149 for additional details on MAINTENANCE.

Navigation data base (NDB) information is displayed on the right side of the NAV IDENT page. The active data base dates are shown at 1R. The dates for the alternate period are shown at 2R. On power up, the FMS automatically chooses the active NDB that corresponds to the current date. Refer to page 6-148 for additional details on changing active NDB.

The WORLD3-01, shown in Figure 4-6, indicates worldwide coverage and cycle of the NDB. Refer to page 6-184 for the NDB updating procedures. The next initialization step (POS INIT in inverse video) is displayed and selected at 4R.

POSITION INITIALIZATION

- **POSITION INIT 1/1** - Figure 4-7 displays the LAST POS coordinates at 1L. At 2L, the closest RAMPX within 3 NM of the last position (1L) is displayed (refer to RAMPX, page 6-175). If no

RAMPX waypoint is available, the closest Airport Reference Point (ARP) within 3 NM of the last position (1L) is displayed. If no ARP is available, the pilot is prompted to enter a waypoint or coordinates. In this example, the KPHX ARP is shown. At 3L, the coordinates of the highest priority valid GPS is displayed.

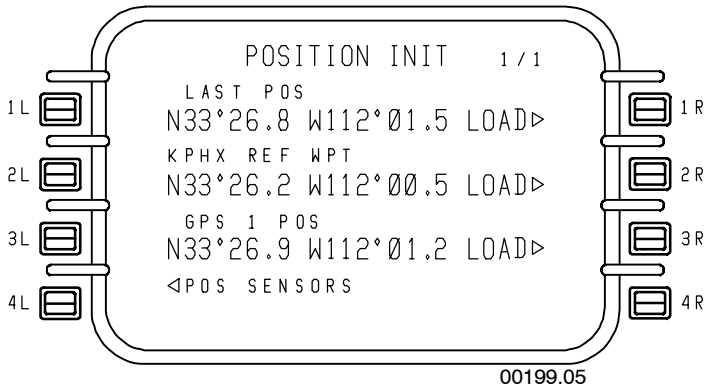


Figure 4-7

To initialize FMS position, select the appropriate LOAD prompt (1R, 2R or 3R). The selected position becomes the FMS position. This is shown in Figure 4-8. This will initialize connected sensors that receive inputs from the FMS. Refer to page 6-175 for additional details on position initialization.

Each FMS position must be initialized. Initialization positions are never transferred between FMSs. After initialization, the FLT PLAN prompt is displayed in the bottom right corner (4R) indicating the next step to be performed. Select this prompt to continue the preflight process.

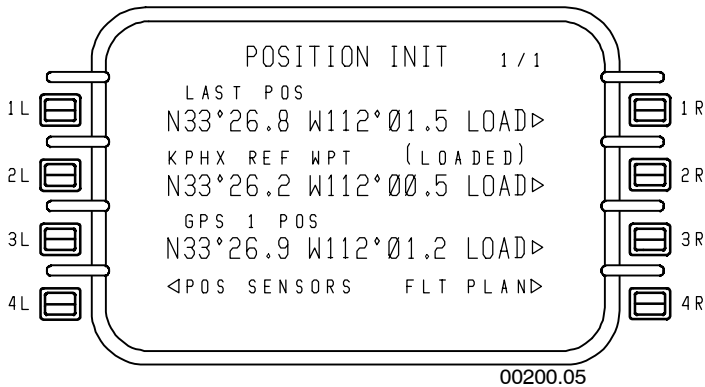


Figure 4-8

ACTIVE FLIGHT PLAN

If the initialization coordinates are within three miles of an airport in the data base, the airport (KPHX in this example) is already loaded in the ORIGIN line. This is shown in Figure 4-9. An optional entry of Estimated Time of Departure (ETD) can be entered in order to provide the Estimated Time of Arrivals (ETAs) prior to takeoff. This supports predictive Receiver Autonomous Integrity Monitor (RAIM) calculations (see page 6-98).

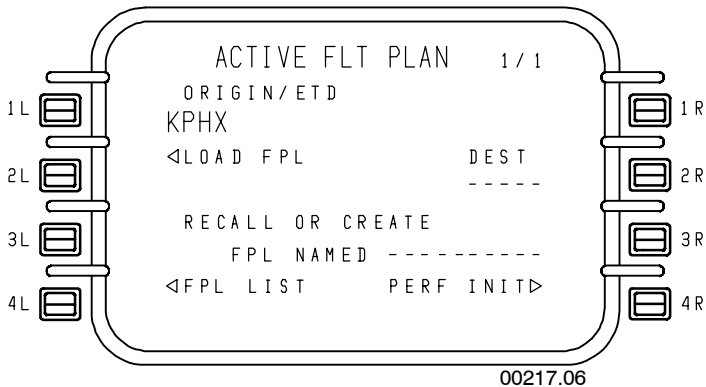


Figure 4-9

The destination (KMSP) is entered in the scratchpad and line selected to the DEST prompt at 2R. This is shown in Figure 4-10.

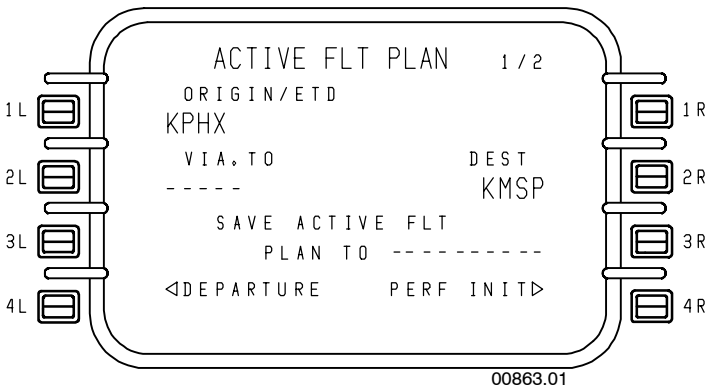


Figure 4-10

If there is a stored flight plan with the same origin and destination, the FLT PLAN LIST page is displayed (refer to page 7-10). If this is the case, select the RETURN prompt (1R) to continue this example. Refer to page 7-8 for additional details on creating/changing flight plans.

Waypoint Entry

Enter the enroute waypoints in the line labeled VIA.TO. Begin with the Zuni (ZUN) VOR shown in Figure 4-11. The entry is made by typing the identifier in the scratchpad and using the line select key adjacent to the VIA.TO prompt. Refer to page 7-2 and 7-13 for waypoint entry options.

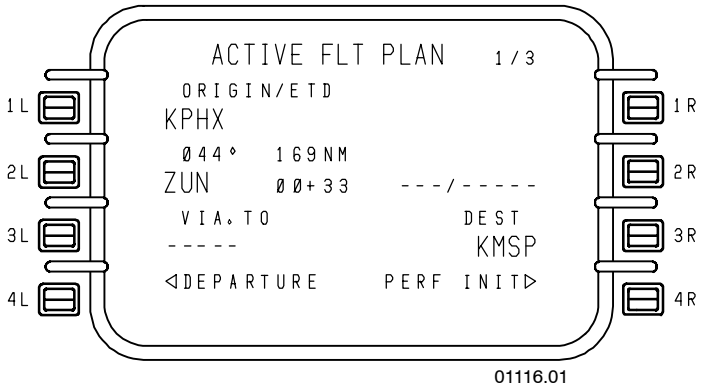


Figure 4-11

Airway Entry

The next entry in this example is a high altitude airway (e.g., J102) to the Alamosa (ALS) VOR. Enter the airway identifier followed by the last desired waypoint of the airway. Both are separated by a period (J102.ALS). This is shown in Figure 4-12. Insert this entry on the line adjacent to the VIA.TO prompt. Refer to page 10-2, airway CDU entry format, for additional details on entering airways.

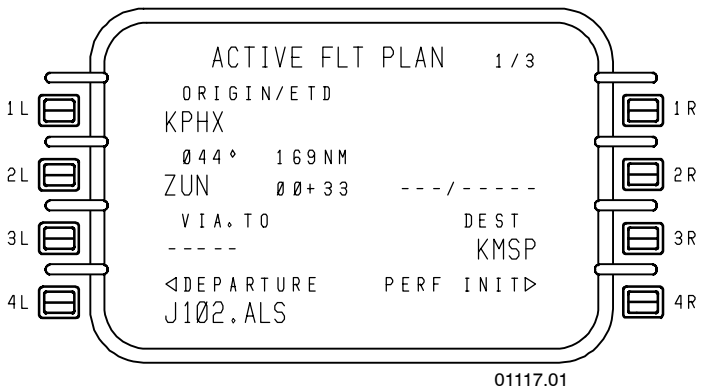


Figure 4-12

The FMS retrieves all waypoints that define J102 between ZUN and ALS. This is shown in Figures 4-13 through 4-15. Refer to page 7-13 for additional details about airway entry.

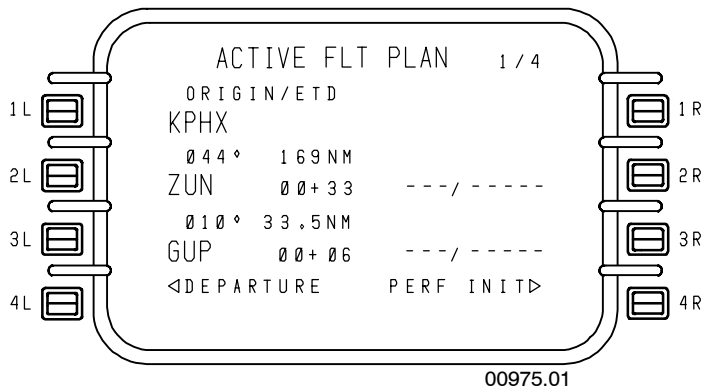


Figure 4-13

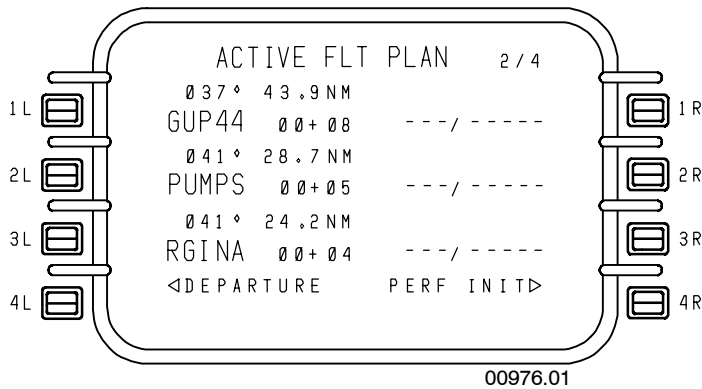


Figure 4-14

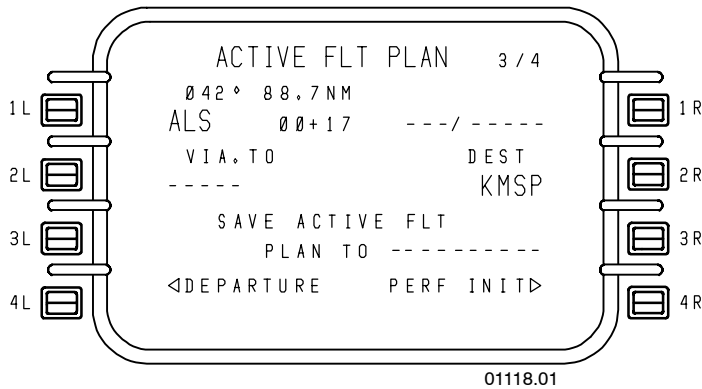


Figure 4-15

The upper right corner of the ACTIVE FLT PLAN page indicates that there are 4 pages for the active flight plan. Pressing the NEXT key advances to the next page of the active flight plan. Pressing the PREV key displays the previous active flight plan page. Refer to page 6-165 for AUTO PAGE information.

In this example, GUP44 is a significant intersection on J102 located 44 miles from the Gallup (GUP) VOR. This same convention is used for other unnamed intersections. For distances greater than 100 NM, the hundreds digit is dropped and the number is prefixed to the navaid ident.

The remainder of the flight plan to Mason City (DVV, J114.ONL, MCW) is entered in the same manner as previously described. Figures 4-16 through 4-19 show the remainder of the ACTIVE FLT PLAN pages.

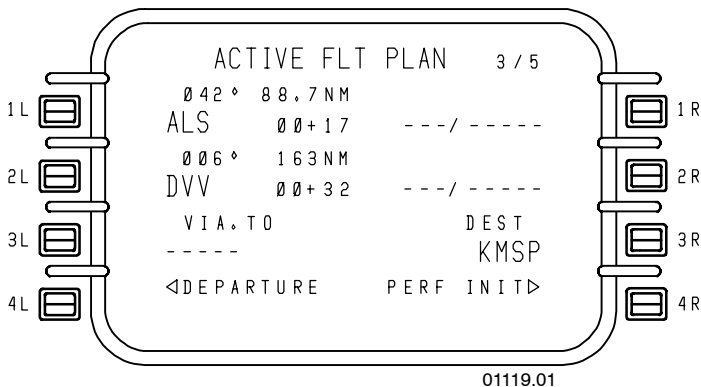


Figure 4-16

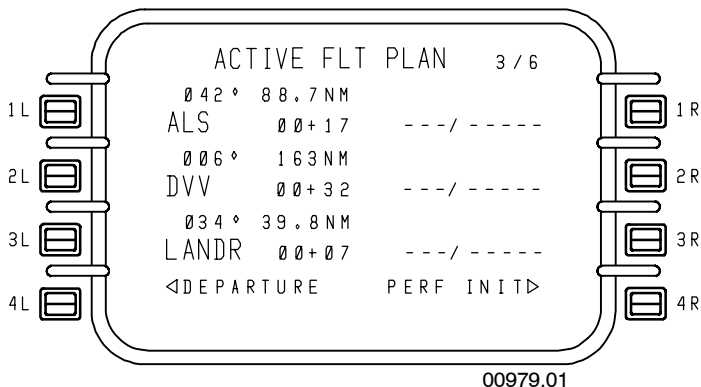


Figure 4-17

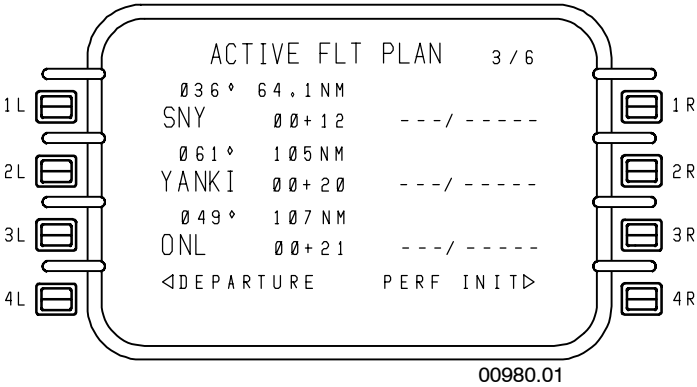


Figure 4-18

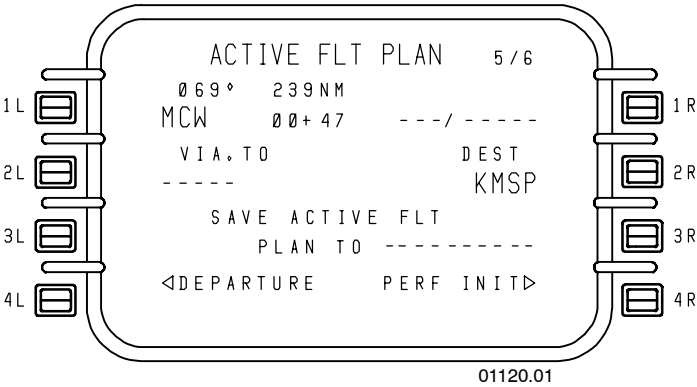


Figure 4-19

The flight plan is closed by moving KMSP to the VIA.TO line by pressing the line select key (2R) adjacent to KMSP. This action moves KMSP to the scratchpad. This is shown in Figure 4-20.

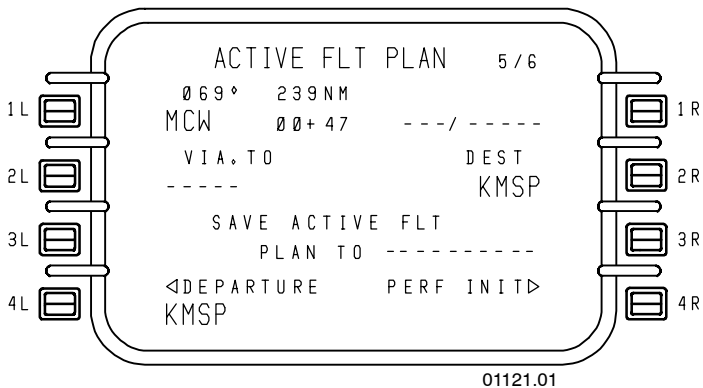


Figure 4-20

As shown in Figure 4-21, press the line select key adjacent to the VIA.TO prompt (2L). The destination must be included as the last flight plan waypoint for ETE to the destination on the PROGRESS page. The destination is also required to calculate performance data.

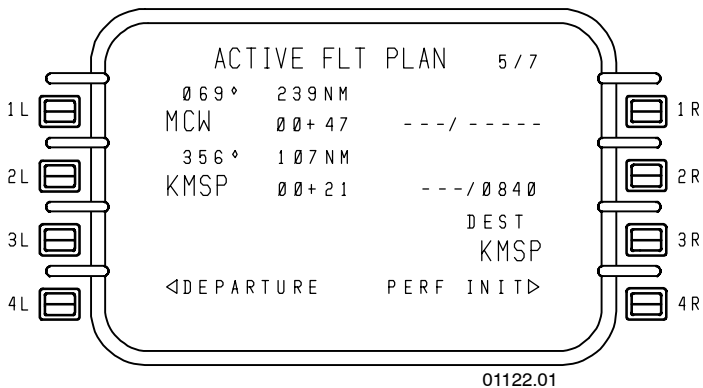


Figure 4-21

The alternate flight plan example is entered by selecting to the alternate page, shown in Figure 4-22. This is accomplished by pressing the NEXT key.

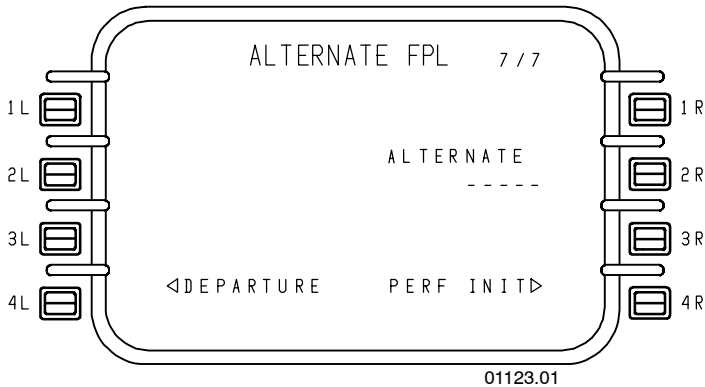


Figure 4-22

Enter the identifier for the alternate destination (2R). Duluth (KDLH) is used for this example, shown in Figure 4-23.

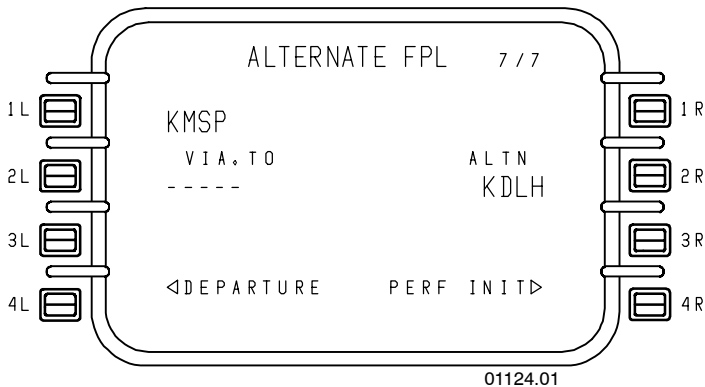
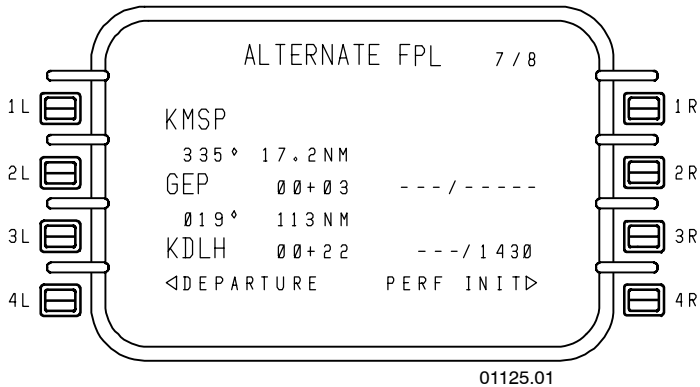


Figure 4-23

The route to KDLH is via the GOPHER (GEP) VOR. The alternate flight plan is entered the same way as for the enroute flight plan. The alternate flight plan is closed by moving KDLH to the VIA.TO line as was done with KMSP in the active flight plan. Figure 4-24 shows the alternate flight plan.

**Figure 4-24**

This completes the flight plan definition. Press the lower right line select key (4R) to begin performance initialization (PERF INIT). The PERF INIT selection will not be displayed if performance has been initialized prior to running this example. Refer to page 7-1 for additional flight planning details.

PERFORMANCE INITIALIZATION

Performance initialization is required for the operation of vertical navigation (VNAV) and performance calculations. There are five PERFORMANCE INIT pages when FULL PERF is selected. This example illustrates the FULL PERF initialization. See page 5-5 for other performance initialization options. The following values are used in the planning of this example flight plan. Actual numbers used depends on the aircraft type.

BOW:	43,000 lb
FUEL:	14,000 lb
CARGO:	200 lb
PASSENGER:	5 @ 170 lb
CRUISE ALTITUDE:	41,000 ft
WINDS ALOFT:	250° @ 125 kts @ FL 410
SPEED SET:	Active

The default values for most performance initialization data are the values from the previous flight. Assuming the aircraft is flown the same way each flight, performance initialization consists of verifying the default values, making changes where required, and entering items such as wind and weight.

Depending on the initialization configuration of the FMS, weights will be displayed in either pounds or kilograms.

Data verified and entered under performance initialization effects several performance functions important to the completion of the flight. For example, understating wind may indicate sufficient fuel to complete the flight. In reality, more fuel may be required. A careful review of initialization data is required to ensure accurate predicted aircraft performance.

If VSPEED pages have not been activated through the FMS SETUP page or through the aircraft data base, some of the page prompts in this example will be different. Refer to VSPEED LABELS, on page 6-170, for additional details. The default setting of VSPEED pages on the FMS SETUP is aircraft dependent.

All data must be entered on the PERF INIT pages in order for the FMS to display VNAV predictions.

Refer to pages 5-5 through 5-26 for a detailed explanation of PERF INIT entries. Many values on the PERF INIT and PERF DATA pages are aircraft-dependent. Actual values may vary from those shown in these examples.

- **PERFORMANCE INIT 1/5** – Figure 4-25 displays the following:
 - Aircraft Type (1L)
 - Tail Number (1R)
 - Data Source (2L)
 - Access to Aircraft Data Base Loading (4L).

The tail number (1R) must be entered on this page if the FULL PERF has been selected as the data source (refer to aircraft tail number on page 5-10).

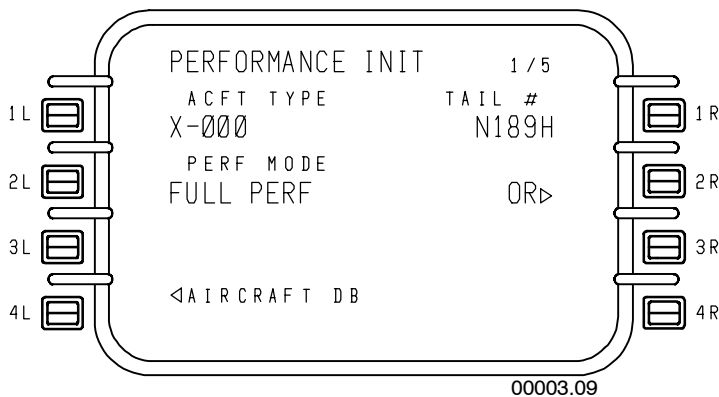


Figure 4-25

- **PERFORMANCE INIT 2/5** – Figure 4–26 displays the current speed schedules. To change any mode, select the OR prompt for the respective mode or enter the calibrated airspeed (CAS)/MACH data directly. Default values can be restored by using the *DELETE* function on the appropriate line.

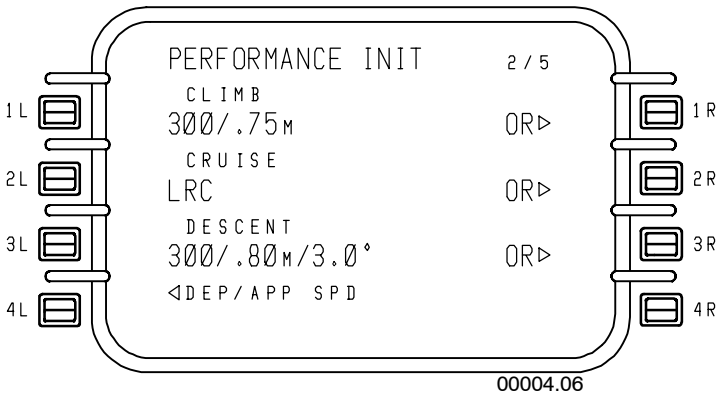


Figure 4–26

The descent angle entered on this page is used as the default value for each path. It is also used for computing Top of Descent (TOD) points.

The FMS uses the climb, cruise, and descent speed schedules to supply a speed command to flight director/autothrottle systems.

As an example, when the OR prompt for cruise is selected, the cruise mode page, shown in Figure 4–27, is displayed. The cruise mode desired can be selected from the available list. This action makes the selected cruise mode active and returns the display to PERFORMANCE INIT 2/5. In this example, Long Range Cruise (LRC) is the active mode.

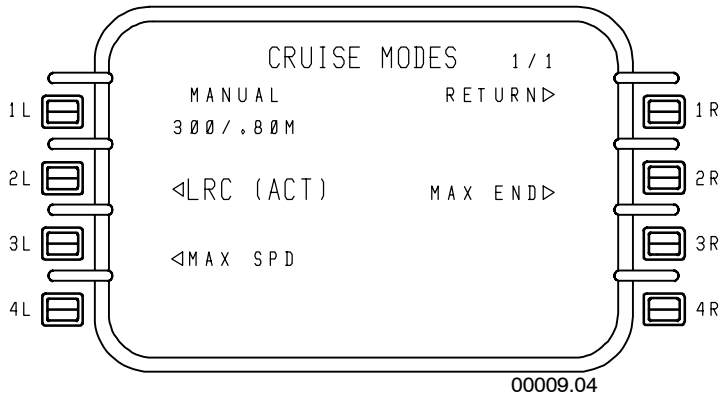


Figure 4-27

The departure/arrival speed prompt (Figure 4-26, line select 4L) is used to access departure, approach, and go-around speed schedules. Refer to page 5-16 for additional details on these pages.

- **PERFORMANCE INIT 3/5** – Figure 4-28 contains the step climb increment that is used for performance planning, fuel reserve, and fuel allowance for takeoff and landing. TO/LDG FUEL powers up with the default values from the aircraft data base file. Entering *DELETE* restores any of these lines to the default values. The FUEL RESERVE line has an OR option. Refer to page 5-19 for additional details on this page.

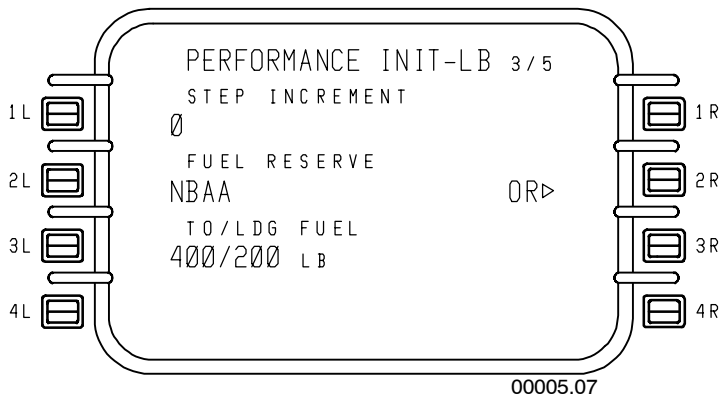


Figure 4-28

- **PERFORMANCE INIT 4/5** – Figure 4–29 contains the following:
 - Transition Altitude (1L)
 - Speed/Altitude Limit (1R)
 - Initial Cruise Altitude (2L)
 - ISA Deviation (2R)
 - Cruise Winds (3L and 3R).

The diagram illustrates the PERFORMANCE INIT 4/5 page layout. It features a central display area with the following text:

```

PERFORMANCE INIT      4 / 5
TRANS ALT  SPD/ALT LIM
18000      250/10000
INIT CRZ ALT  ISA DEV
FL410      +0°C
CRZ WINDS  AT ALTITUDE
250T/125      FL410
<PERF PLAN
  
```

On the left side, there are four control buttons labeled 1L, 2L, 3L, and 4L. On the right side, there are four control buttons labeled 1R, 2R, 3R, and 4R. At the bottom right of the display area, the identifier 00006.07 is shown.

Figure 4–29

Above the transition altitude, ACTIVE FLT PLAN and the PERF PLAN page altitudes are displayed as flight levels. Constraints from SIDs, STARs, and approaches are displayed in feet or flight levels as defined in the navigation data base.

The SPD/ALT LIM is used to limit the speed target to the speed limit for altitudes below the restriction altitude. When in descent and the descent speed is higher than the speed limit, the speed target is reduced before the restriction altitude is reached. The limit can either be changed or eliminated by entering *DELETE*.

Initial cruise altitude can be entered. If **OPTIMUM** is displayed, the optimum cruise altitude is computed. It is displayed in small characters when PERFORMANCE INIT is completed. The optimum cruise altitude is rounded to the nearest 1000 feet.

Average cruise wind and ISA Dev can be entered on this page. This is an optional entry. The FMS assumes zero wind and ISA Dev if no entry is made. Wind information at each waypoint can also be entered on the PERF PLAN pages. Refer to Performance Plan on page 5-31 for additional details.

- **PERFORMANCE INIT 5/5** – Passenger and cargo weights are entered to calculate gross weight. This is shown in Figure 4–30.

When performance initialization is complete, the CONFIRM INIT prompt is displayed in the lower right corner of this page. The CONFIRM INIT line select key (4R) must be pressed to initiate the calculation of performance data. Refer to PERFORMANCE INIT 5/5 (page 5-25) for additional details.

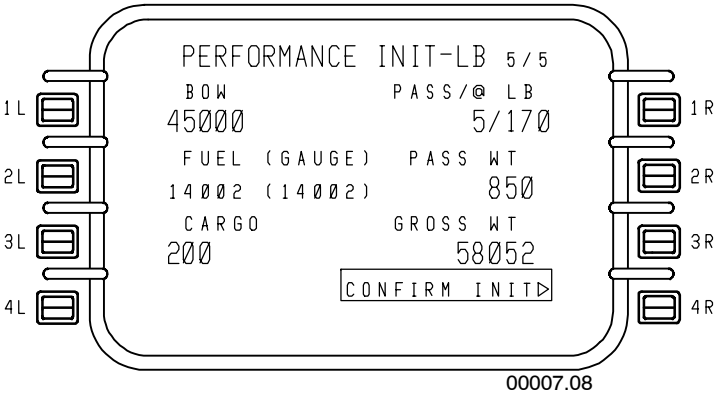


Figure 4-30

PERFORMANCE DATA

There are four pages of PERF DATA. The data is based on the PERFORMANCE INIT pages as well as the active flight plan. Performance data is displayed for the destination and the alternate destination if one has been entered. These pages are continuously updated during the flight.

- **PERF DATA 1/4** – Figure 4-31 displays the following:
 - Cruise/Ceiling Altitude (1L)
 - Step Increment (1R)
 - ETE (2L and 2R)
 - Fuel Required (3L and 3R)
 - Fuel Figure of Merit (FOM) (3L and 3R).

Fuel required is the total fuel which includes the following:

- Takeoff Allowance
- Enroute (Climb / Cruise / Descent)
- Landing Allowance
- Reserves.

Refer to Performance Data, on page 5-27, for additional details.

Pilot entries are permitted on the cruise altitude and step increment lines only. The cruise altitude value increases automatically if the altitude selector is dialed above the current cruise altitude.

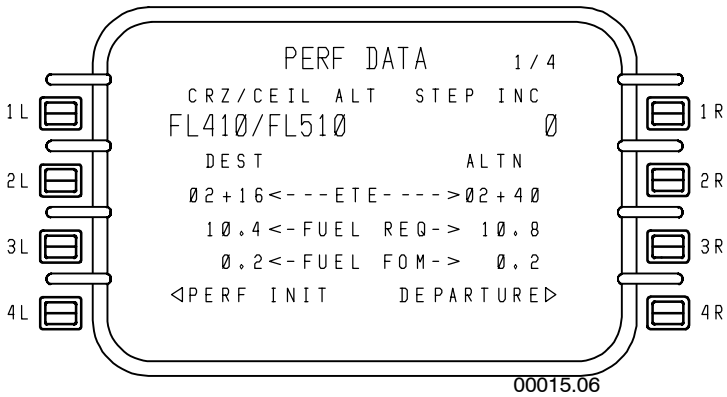


Figure 4-31

- **PERF DATA 2/4** - Figure 4-32 displays the following:
 - Distance to Go (1L and 1R)
 - ETA (2L and 2R) (only displayed when airborne or following an entry of ETD on the active flight plan)
 - Estimated Fuel Remaining (2L and 2R)
 - Estimated Gross Weight (3L and 3R).

No entries are permitted on this page. Refer to PERF DATA 2/4, on page 5-29, for additional details.

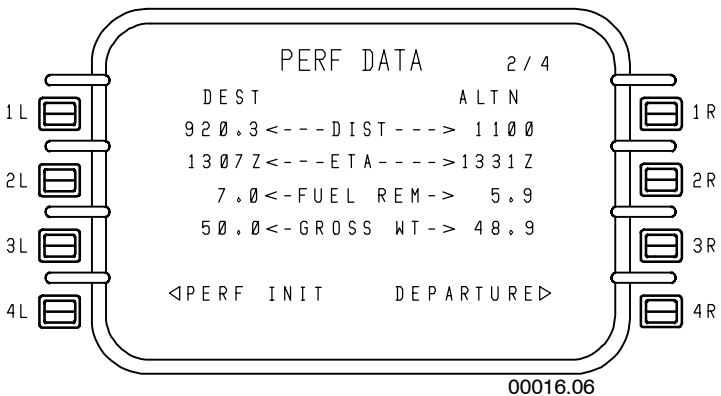


Figure 4-32

- **PERF DATA 3/4** – Figure 4–33 displays the following:
 - Average Cruise Wind (1L)
 - Average Cruise Headwind or Tailwind (1R)
 - Preflight Plan Destination Fuel Remaining (2R)
 - Updated Plan Destination Fuel Remaining (3R) (only displayed when airborne)
 - Difference between Preflight and Updated Plan (3R) (only displayed when airborne).

No entries are permitted on this page. Refer to PERF DATA 3/4, on page 5-30, for additional details.

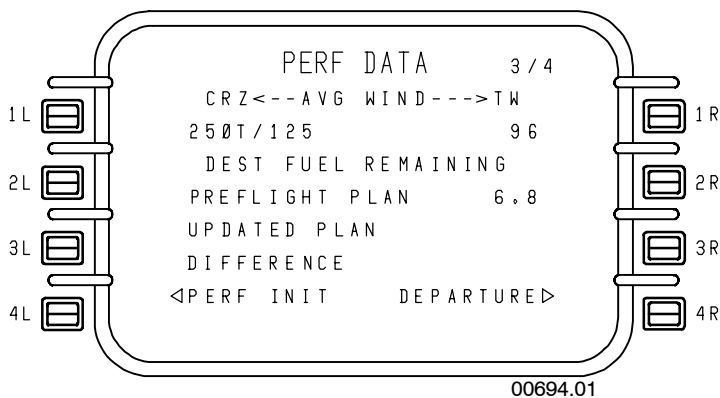


Figure 4-33

- **PERF DATA 4/4** – Figure 4–34 displays the following:
 - Method of Reserve Calculation (1L)
 - Required Reserve (2R)
 - Preflight Plan Fuel Remaining (2R)
 - Updated Plan Fuel Remaining (3R) (only displayed when airborne)
 - Difference between Preflight and Updated Plan (3R) (only displayed when airborne).

The DEPARTURE prompt is displayed on the lower right corner of all the PERF DATA pages indicating the next step. If a runway has already been selected, the prompt is TAKEOFF instead of DEPARTURE. Refer to page 5-31 for additional PERF DATA 4/4 details.

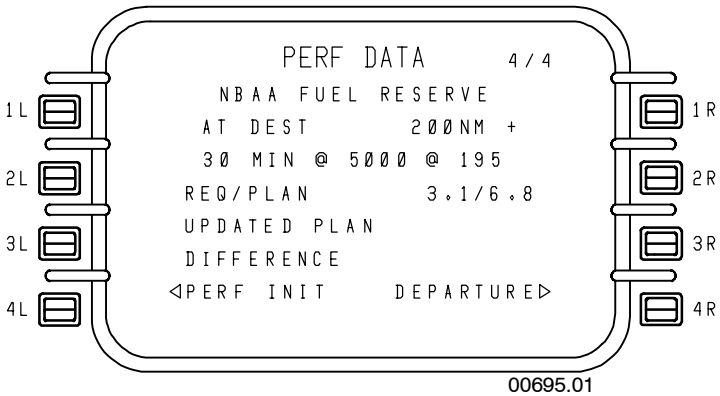


Figure 4-34

DEPARTURE SELECTION

Selecting the DEPARTURE prompt displays the DEPARTURE RUNWAYS page. This is shown in Figure 4-35. The available runways for the origin airport are displayed. In this example, runway 08R is selected with line select 3L.

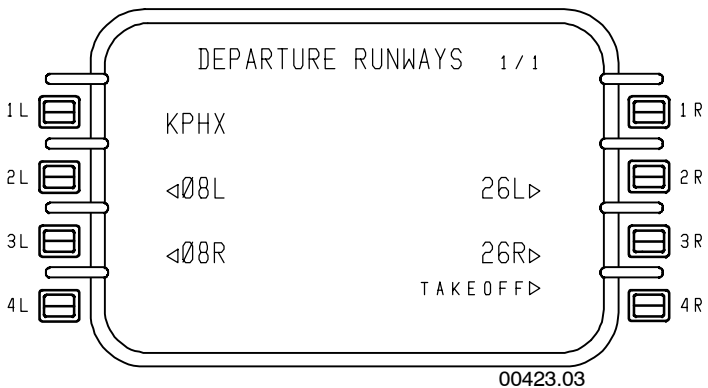


Figure 4-35

After the runway is selected, the SIDs page is displayed with the possible departure procedures. This is shown in Figure 4-36. Select the appropriate procedure from the list. For this example, EAGUL3 at 2R is selected. If no SID is to be used, the ACTIVATE prompt (4R) selects the runway and displays the ACTIVE FLT PLAN page. Refer to page 6-64 for additional details.

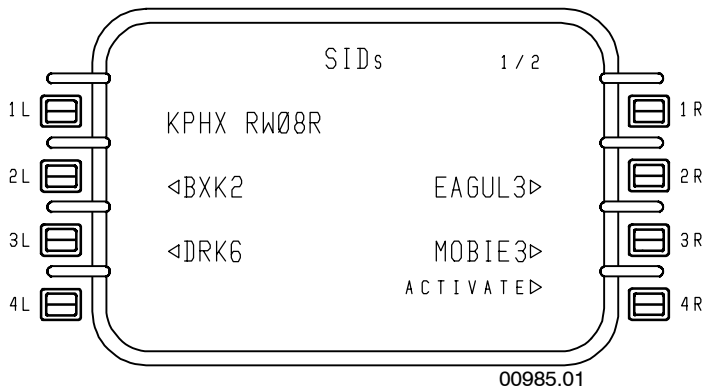


Figure 4-36

The next page, shown in Figure 4-37, lists the enroute transitions for the selected departure. For this flight, the Zuni (ZUN) transition (2L) is selected.

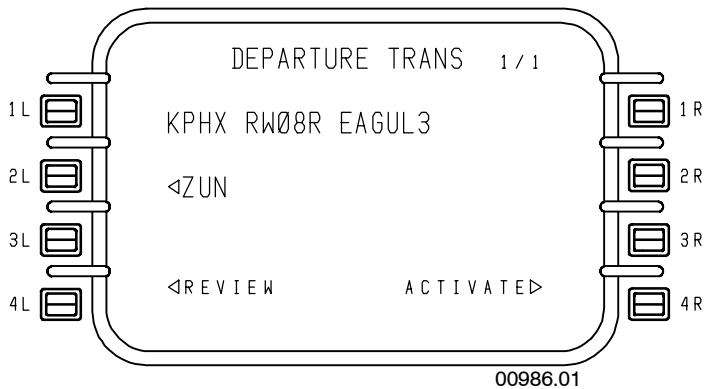


Figure 4-37

At this point, the departure selection is complete and the flight crew may either REVIEW or ACTIVATE the SID, as shown in Figure 4-38. ACTIVATE (4R) inserts the runway and procedure into the active flight plan. The SID contains both the lateral waypoints and any vertical constraints for the procedure contained in the data base. Refer to page 6-64 for additional details on DEPARTURE.

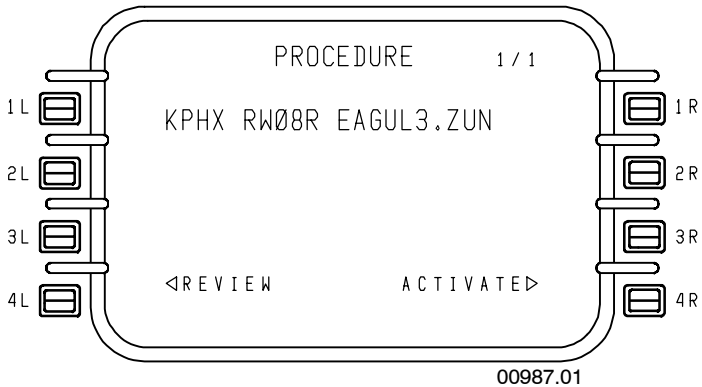


Figure 4-38

Flight Plan Discontinuities

If a discontinuity occurs in a flight plan when adding a SID or STAR, it is caused by the lack of a common point between the flight plan and the inserted SID or STAR. The discontinuity can be removed by one of the two following methods:

- Press the DEL key and the adjacent line select key to delete the discontinuity.
- Move any waypoint into the line where the discontinuity is located.

TAKEOFF DATA

Activating the departure returns the display to the ACTIVE FLT PLAN page. This is shown in Figure 4-39. If the T.O. VSPEED LABELS page is configured (refer to page 6-170), the TAKEOFF prompt is displayed in the lower right corner (4R) indicating the next step. If the page is not configured, the RW POS prompt is displayed (refer to page 4-28). Takeoff is completed using three pages.

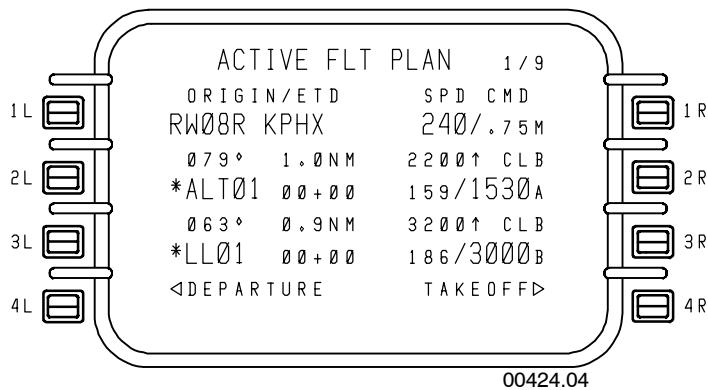


Figure 4-39

• **Takeoff 1/3** – Figure 4-40 displays the following:

- Runway (1L)
- Runway Heading (1L)
- Runway Length (1R)
- Temperature (2L)
- Surface Wind (2R)
- Pressure Altitude (3L)
- BARO (Barometric) Setting (3L)
- Runway Elevation (3R).

Runway information is retrieved from the data base. Temperature is sensed or entered. Barometric Setting (BARO set) is computed by the FMS or can be entered manually. Surface wind is a required entry and is normally the only entry made on this page. Refer to Takeoff, on page 5-35, for additional details.

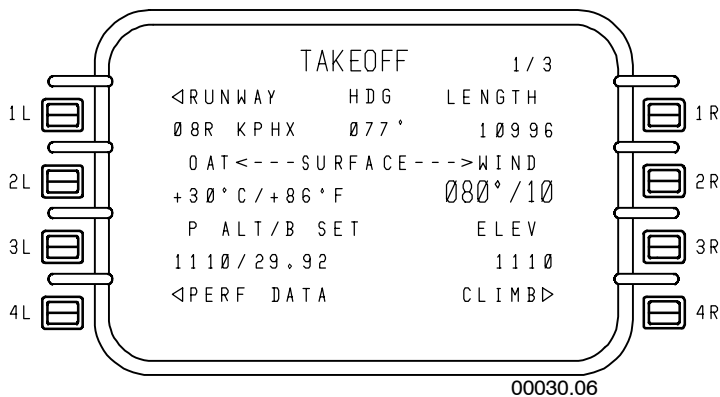


Figure 4-40

● **Takeoff 2/3** – Figure 4-41 displays the following:

- Runway Slope (1L)
- Runway Width (1L)
- Runway Threshold (1R)
- Runway Stopway (2L)
- Headwind/Tailwind and Crosswind (2R)
- Density Altitude (3L).

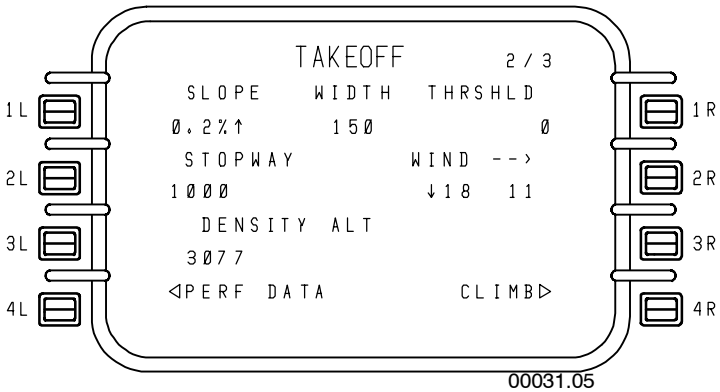


Figure 4-41

● **Takeoff 3/3** – Takeoff speeds can be entered on the page shown in Figure 4-42. This page can be configured with up to six speeds with various labels.

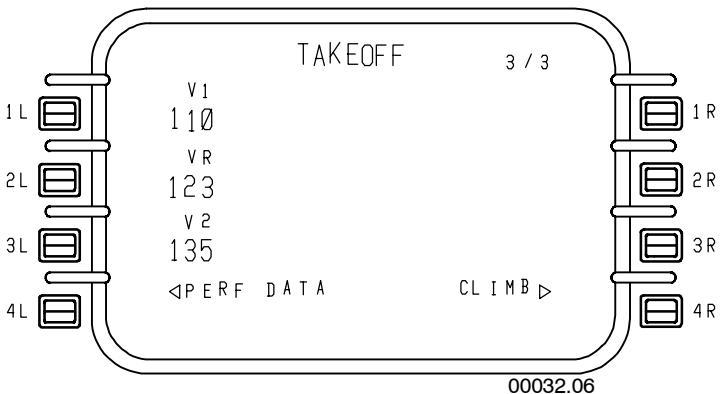


Figure 4-42

RUNWAY POSITION

If a departure runway has been selected, the prompt at 4R of the ACTIVE FLT PLAN displays RW POS when all other actions are completed. Once the aircraft is at the runway threshold, the FMS and long range sensors can be updated to the runway threshold position. **This is an optional action.**

It is recommended that the IRSs not be updated at the end of the runway. This is because a Downmode Align will require the aircraft to be stationary for a minimum of 30 seconds during the procedure. More importantly, if excessive motion is detected, a full IRS realignment will be required. Normal passenger and cargo loading is not considered excessive motion. However, if the IRSs have been in NAV mode for an extended period of time (i.e., greater than 1 hour) and/or excessive groundspeed error has accumulated (i.e., greater than 2 knots), it is recommended that a Downmode Align be performed prior to taxi-out to the runway.

The IRS Downmode Align zeros accumulated velocity errors and updates heading. An optional position update during the procedure zeros any accumulated position error.

Updates are made by pressing the line select key (4R) adjacent to the RW POS prompt on the ACTIVE FLT PLAN page. This is shown in Figure 4-43. This will display the POSITION INIT page.

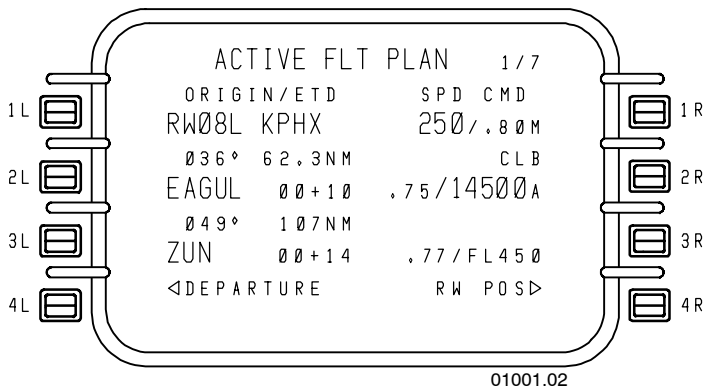


Figure 4-43

- **Position INIT 1/1** – Figure 4-44 displays the coordinates for the selected runway and makes them available for loading. Refer to page 6-175 for additional details on position initialization.

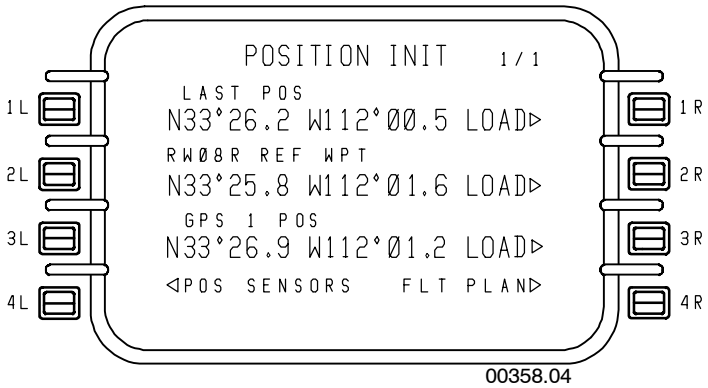


Figure 4-44

- **Threshold Position Update** – Pressing the line select key (2R) adjacent to the runway coordinates will load the runway threshold position into the FMS. This is shown in Figure 4-45. The position is also loaded into sensors set to receive an update.

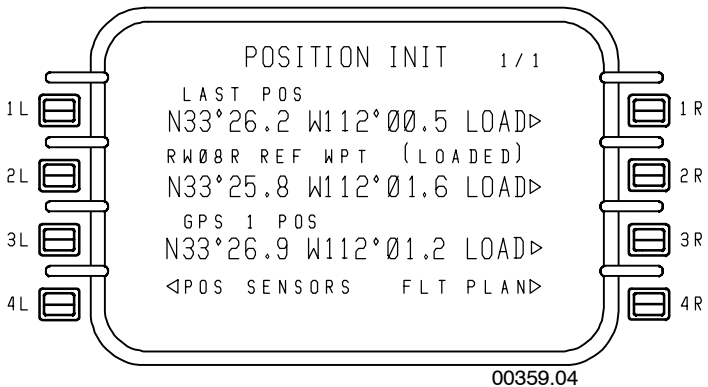


Figure 4-45

TAKEOFF

The FMS considers the aircraft airborne when it exceeds 50 kts groundspeed (GSPD) or 80 kts IAS or weight-off-wheels. When airborne, the ACTIVE FLT PLAN page displays the ETA for each waypoint in place of Estimated Time Enroute (ETE). This is shown in Figure 4-46. If an ETD was entered prior to takeoff, ETAs are already displayed. Once airborne, the ETA for the FROM waypoint is replaced with the actual crossing time. ETEs for any waypoint in the flight plan are available on PERF PLAN pages (refer to page 5-31) or PROGRESS page 1 (refer to page 8-1).

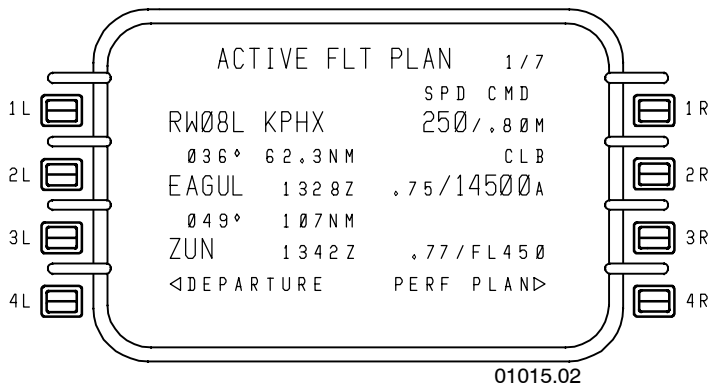


Figure 4-46

The FMS can be selected and coupled to the flight director shortly after take-off. Initially, the FMS is armed on the flight director. When within the capture zone, the FMS captures and begins lateral guidance. Refer to page 7-20 for LNAV details.

If VNAV coupling is required, the flight director VNAV mode can be engaged. The FMS begins generating vertical guidance if the altitude selector has been set to the appropriate altitude. The FMS does not command a climb above, or descent below, the altitude selector. Refer to page 7-21 for VNAV details.

The DEPARTURE prompt is displayed on the active flight plan pages until the aircraft is more than 50 nautical miles (NM) from the origin airport. The DEPARTURE prompt is displayed only when the origin is an airport.

- **Waypoint Sequencing** - On takeoff, the runway becomes the FROM waypoint and remains on the top line of the ACTIVE FLT PLAN page. The TO waypoint appears on the second line. As the aircraft passes the TO waypoint, all waypoints scroll up one line. This is shown in Figure 4-47. This process is called waypoint sequencing.

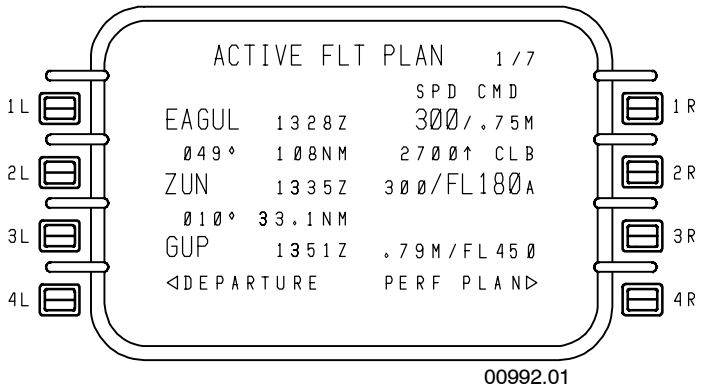


Figure 4-47

- PROGRESS 1/3** – Information available on PROGRESS page 1/3 can be displayed by pressing the PROG function key. This is shown in Figure 4-48. This page includes the navigation mode (GPS) and the number of Long Range Navigation (LRN) sensors being used (LRN=3).

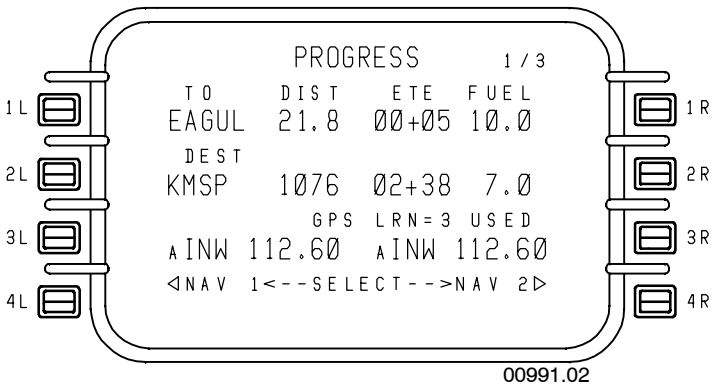


Figure 4-48

ACTIVE FLT PLAN page 1 and PROGRESS page 1 are considered the primary pages of the FMS during flight. Refer to page 8-1 for additional information on the progress pages.

- **PROGRESS 2/3** – Figure 4–49 displays the following:
 - Speed Command (1L)
 - Altitude Command (1L)
 - Distance and Time to Top of Climb (TOC) (2L)
 - Current Fuel Quantity (2R)
 - Distance and Time to Top of Descent (TOD) (3L)
 - Current Gross Weight (3R).

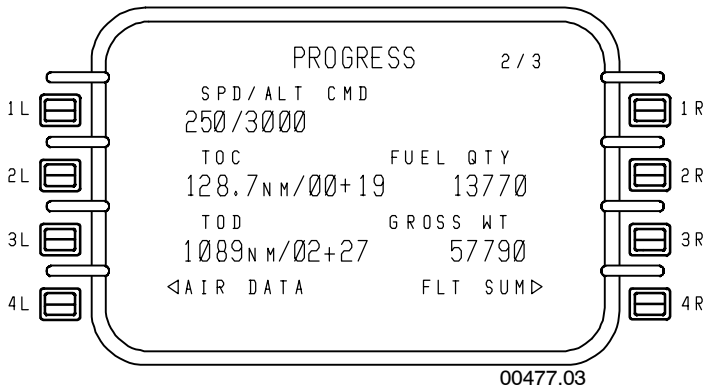


Figure 4–49

The TOC and TOD points are not displayed as waypoints as part of the ACTIVE FLT PLAN. However, they are displayed on the map and vertical profile (if available). The positions of these waypoints are dynamically updated. Their position relative to other waypoints in the flight plan can change. Changes to the flight plan also affect the TOC and TOD positions.

CLIMB

As the climb continues, intermediate altitude clearances can be entered using the altitude selector. The FMS commands the autopilot to climb to the selected altitude or the next altitude constraint, whichever is lowest. If altitude restrictions are associated with a waypoint, they can be entered on the CDU adjacent to the appropriate waypoint. The 18,000 feet at or above constraint on ZUN was entered in this fashion and is shown in Figure 4–50.

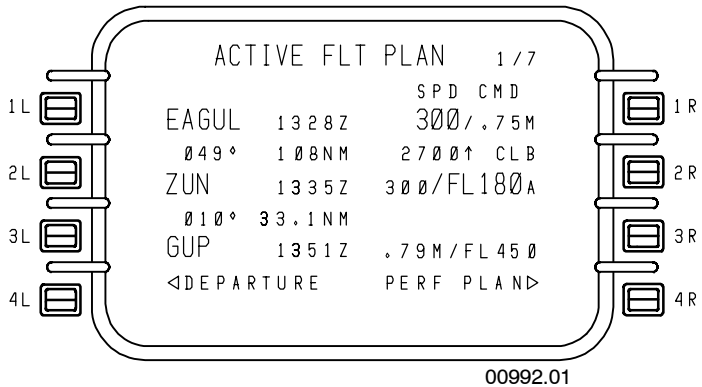


Figure 4-50

ENROUTE

Once at cruise altitude, the information on PROGRESS 2/3 reflects the commanded speed and altitude information for the cruise segment. This is shown in Figure 4-51. In this example, long range cruise was selected as the active cruise mode and .79M represents the long range cruise speed for current conditions.

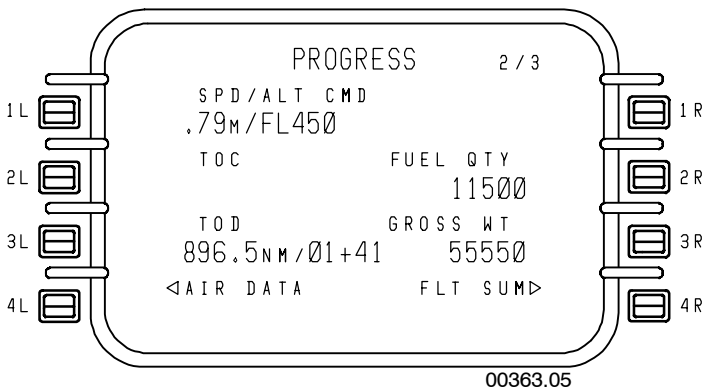


Figure 4-51

As the flight progresses, clearance revisions are completed using one of the two following methods:

1. If the revision is after the TO waypoint, the flight plan is modified by adding or deleting waypoints.
2. If the revision effects the TO waypoint (such as clearance direct from present position to another point), this is done by pressing the DIR key.

Operation of the DIR key displays ACTIVE FLT PLAN page 1, regardless of what page is currently being displayed.

If the direct-to waypoint is already in the flight plan, pressing the line select key to the left of the waypoint makes it the TO waypoint.

If the direct-to waypoint is not in the flight plan, enter the IDENT for the direct-to waypoint in the upper left corner of the page where the dashes are located. It will then become the TO waypoint.

Either of these actions causes the FMS to immediately alter course. For additional information on DIRECT-TO operation, refer to DIRECT-TO on page 9-1.

DESCENT

The FMS calculates a Top of Descent (TOD) point based on the destination elevation and any entered altitude constraints. If VNAV is engaged and the altitude selector is set to a lower altitude, the aircraft descends at the TOD. If VNAV is not engaged or the altitude selector is not set lower, the aircraft remains at altitude through the TOD. In the latter case, the descent can be initiated by setting a lower altitude and selecting an appropriate flight director mode or manually flying the descent. Once in descent, the FMS sets the target altitude to the altitude selector or the next constraint, whichever is higher.

ARRIVAL

When within 200 flight plan miles of the destination airport, the ARRIVAL prompt is displayed at 4R. This is shown in Figure 4-52. Pressing this key will select an arrival procedure or runway. The ARRIVAL page can always be accessed from the NAV INDEX.

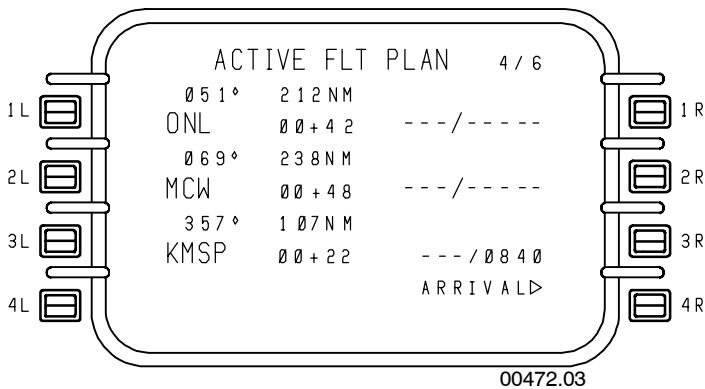


Figure 4-52

Selecting the ARRIVAL prompt displays the ARRIVAL page. This is shown in Figure 4-53. The destination airport is displayed at 1R with access to select the runway, approach, and/or STAR. While the selection can be made in any order, this example selects 2L to choose an approach. Selecting an approach automatically selects a runway.

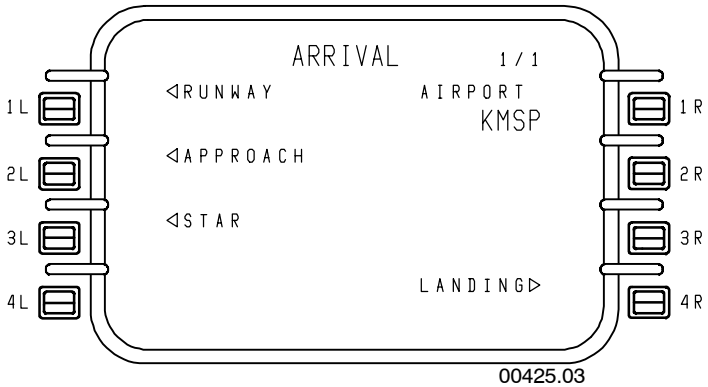


Figure 4-53

Figure 4-54 displays the APPROACH page with the available approach procedures. Select the assigned or required approach. Selecting an approach also includes the missed approach procedure. From this list, the ILS 30L approach (2R) is selected.

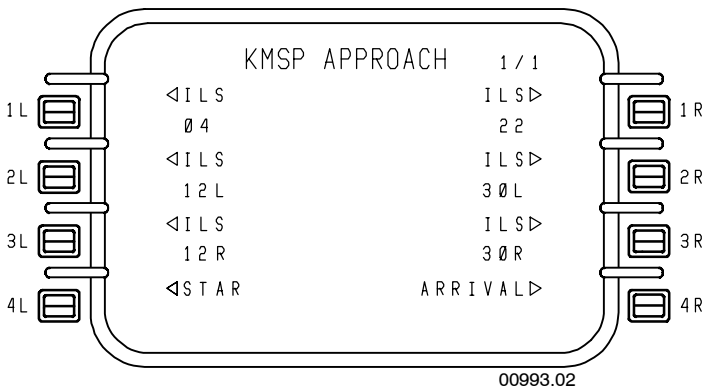


Figure 4-54

Following the approach selection, the APPROACH TRANS page, shown in Figure 4-55, is displayed. Select the appropriate transition. For this example, the PRESS approach transition (1L) is selected.

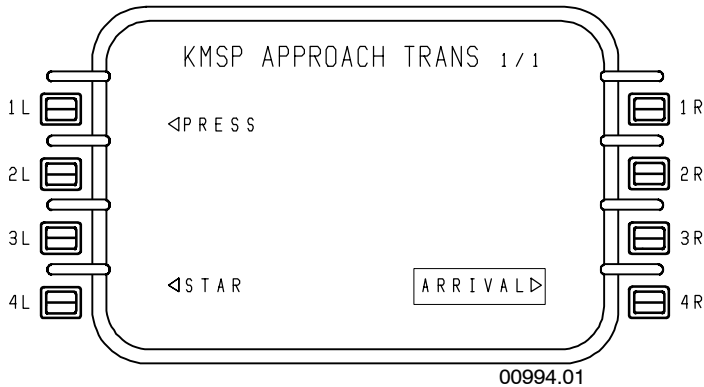


Figure 4-55

After the approach is selected, the STAR page is displayed with the available arrival procedures. This is shown in Figure 4-56. If an arrival procedure has been assigned, select it from the list. From this list, the KASPR2 arrival is selected (3L).

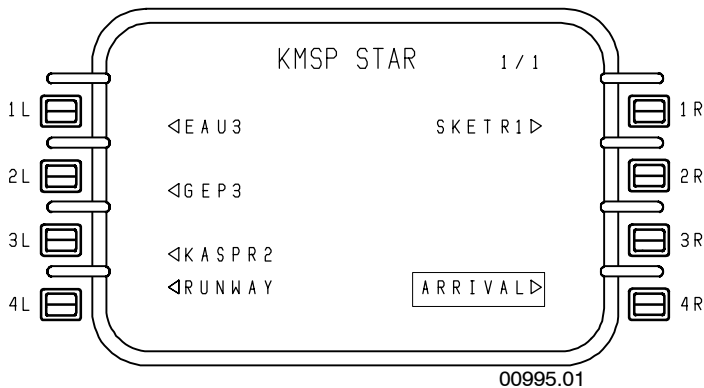


Figure 4-56

If a STAR has transition fixes, the STAR TRANS page is automatically displayed. This is shown in Figure 4-57. If assigned, select the STAR transition. For this flight, the Mason City (MCW) transition (3L) is selected. After the transition is selected, the ARRIVAL page is displayed with a summary of the selections. This is shown in Figure 4-58. If no STAR and/or STAR TRANS is to be used, the ARRIVAL prompt (4R) returns the system to the ARRIVAL summary page that has the ACTIVATE prompt. This is shown in Figure 4-58. The ACTIVATE prompt at 4R inserts the selected procedures in the active flight plan. Refer to page 6-70 for additional ARRIVAL details.

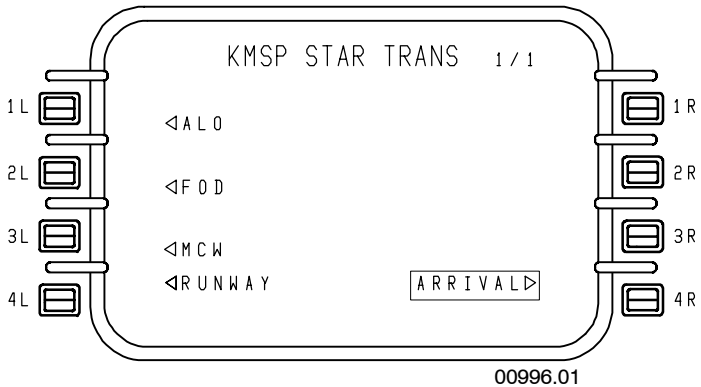


Figure 4-57



Figure 4-58

APPROACH

Once the arrival selection is activated, the FMS guides the aircraft along the STAR and approach procedure. If a localizer based approach is selected as in this example, final approach is flown using the flight director. If a non-precision approach is selected, the FMS can be used for guidance on final approach. Refer to approach on page 6-78 for additional details.

LANDING

Activating the arrival returns the display to the ACTIVE FLT PLAN page. If the LDG VSPEED LABELS page has been configured (refer to page 6-170), the LANDING prompt is displayed in the lower right corner (4R) indicating the next step. If the page has not been configured, the LANDING prompt is not displayed. Landing is completed using three pages.

- **LANDING 1/3** – Figure 4–59 displays the following:
 - Runway Number (1L)
 - Runway Heading (1L)
 - Runway Length (1R)
 - Temperature (2L)
 - Surface Wind (2R)
 - Pressure Altitude/Barometric (BARO) Setting (3L)
 - Runway Elevation (3R).

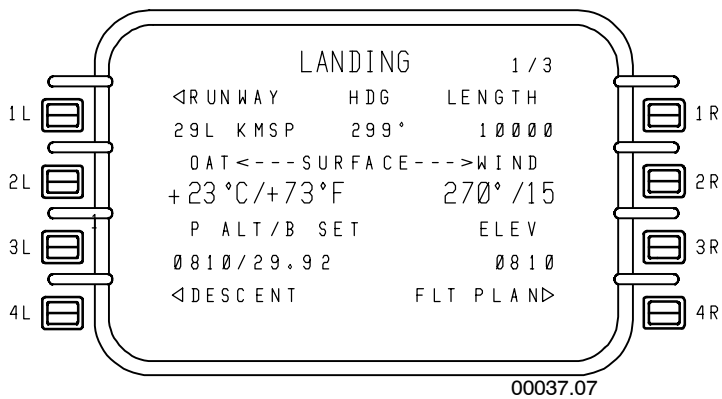


Figure 4–59

Runway information is retrieved from the data base. For landing, both surface temperature and wind are required entries. Barometric setting is computed by the FMS and used to calculate the pressure altitude for the runway elevation.

- **LANDING 2/3** – Figure 4–60 displays the following values:
 - Runway Slope (1L)
 - Runway Width (1L)
 - Runway Threshold (1R)
 - Headwind/Tailwind and Crosswind (2R)
 - Density Altitude (3L).

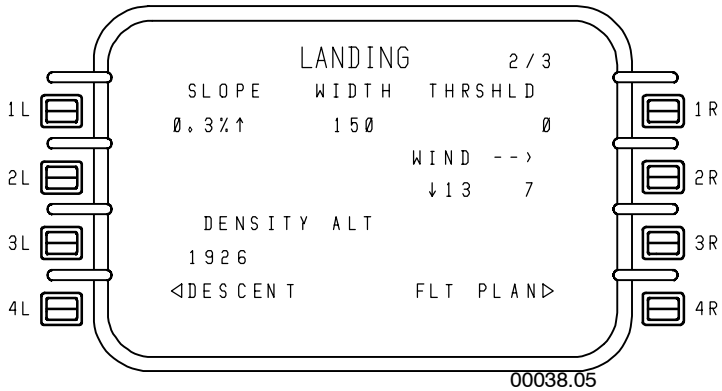


Figure 4-60

- **LANDING 3/3** – Figure 4-61 is used to enter landing speeds. This page can be configured with up to six speeds with various labels. Refer to VSPEED LABELS on page 6-170 for additional details.

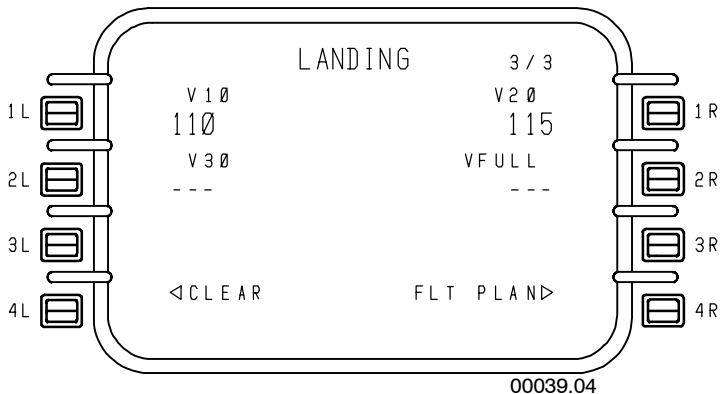


Figure 4-61

MISSED APPROACH

The MISSED APPROACH pages contain waypoints for the missed approach segment. These pages follow the ACTIVE FLT PLAN pages if an approach from the navigation data base has been activated. This is shown in Figure 4-62. The first waypoint on the MISSED APPROACH page 1 is the Missed Approach Point (MAP). The MAP is also in the active flight plan. When activated, the missed approach is inserted into the active flight plan after the MAP.

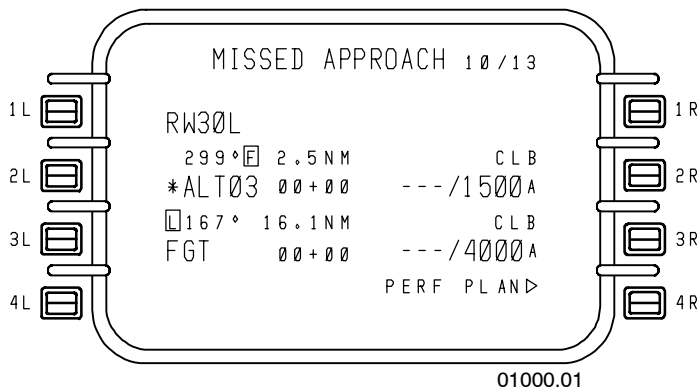


Figure 4-62

Two nautical miles before sequencing the Final Approach Fix (FAF) or five nautical miles from the runway end, the MISSED APPR prompt is displayed at 4L on the ACTIVE FLT PLAN page. The missed approach can be activated by selecting the MISSED APPR prompt (4L) or toggling the TakeOff/Go-Around (TOGA) switch. The missed approach is then inserted into the active flight plan.

The MISSED APPR prompt should not be selected until the decision to miss the approach has been made. When MISSED APPR is selected, any portion of the flight plan that is past the MAP is replaced with the missed approach procedure. Refer to Missed Approach, on page 6-84, for additional details.

ALTERNATE FLIGHT PLAN

The alternate flight plan pages are shown in Figure 4-63. If an alternate is entered, it follows the active flight plan and missed approach (if entered) pages. If a flight plan to an alternate has been entered, the ALTERNATE prompt is displayed on the ACTIVE FLT PLAN page when the aircraft is within 25 NM of the destination. If the flight plan contains an approach, the ALTERNATE prompt is displayed only after the missed approach has been activated. If an ALTERNATE is selected before the destination is reached, the FMS guides the aircraft to the original destination and then to the alternate. ALTERNATE should not be armed until a decision is made to divert to the alternate. To proceed to the alternate without going to the original destination, use the direct (DIR) key.

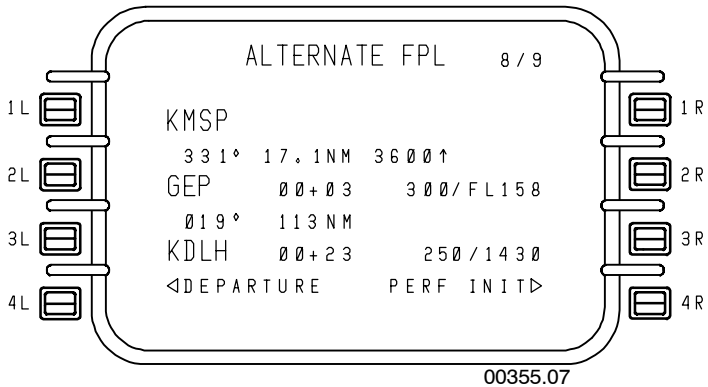


Figure 4-63

CLEARING OF FLIGHT PLANS

The active flight plan is cleared 60 seconds after removing power when the aircraft is in flight or on the ground. The pilot can configure the FMS to retain the active flight plan regardless of the power loss duration. Refer to Standby Power Down, on page 6-174, for additional information.

Activating a stored flight plan clears the previous active flight plan. Activating a stored flight plan while in flight is permitted, but the pilot is required to confirm that the present active flight plan is to be replaced. Whether on the ground or in flight, a stored flight plan or portion of a flight plan can be inserted into the active flight plan as a string of waypoints starting at the point of insertion. Flight plans can also be cleared one waypoint at a time using the DEL key.

While on the ground, entering a new origin after some or all of the flight plan has been defined, is permitted. If the new origin is already a waypoint in the flight plan, the waypoints before the first appearance of the new origin are deleted. If the new origin is not already a waypoint in the flight plan, the whole flight plan is deleted. Deleting the origin clears the entire flight plan. This applies to both active and stored flight plans.

Within approximately 15 seconds after landing, a CLEAR FPL prompt is displayed at the bottom right corner of the screen. Selecting this prompt clears the entire active flight plan.

Another action that can be performed on the ground that results in clearing the active flight plan is to activate the previously inactive data base on the NAV IDENT page of the CDU.

5. Performance

The FMS performance computations are based upon initialization data, flight plan, and input from aircraft systems. With this information, the FMS can control a variety of mission planning and speed control functions for the aircraft.

The CDU pages that control performance are similar to the navigation pages. As a general rule, when the system supplies the information, items are displayed in **small characters**. They are displayed in **large characters** when the pilot makes an entry.

There are several areas of initialization within the performance functions of the FMS. In order for the FMS to calculate performance data, the initialization pages must be reviewed and the CONFIRM INIT prompt at 4R on the last page of initialization must be pressed.

Performance information in the FMS is based on data entered by the pilot and calculated by the FMS. Mission planning data has not been evaluated by the FAA for accuracy and is not approved by the FAA.

FMS fuel quantities are displayed two different ways. When displaying current fuel on board, the quantity is in pounds or kilograms (e.g., 16250). When displaying planned fuel remaining at waypoints and fuel required, the quantity is displayed in thousands of pounds or kilograms (e.g., 12.3, meaning 12,300). Fuel quantities that reflect the gauge value are displayed in pounds or kilograms. Fuel quantities associated with the flight plan are displayed in thousands of pounds or kilograms. **The FMS fuel management data is advisory information only. It must not be used in lieu of the aircraft's primary fuel flow indicator display.**

PERFORMANCE INDEX

The performance index (PERF INDEX) pages are accessed by pressing the PERF function key. This is shown in Figure 5-1.



PERF Index Access
Figure 5-1

When the PERF button is pressed, PERF INDEX page 1/2 is displayed. This is shown in Figure 5-2. Page 2/2 is displayed by using either the PREV or NEXT paging keys, as shown in Figure 5-3. These pages display performance functions that can be selected at any time. Press the line select key adjacent to the respective function to select the function. Page numbers to the outside of each button correspond with pages in this manual that describe the button function. These pages are examples of the index when FULL PERF is selected.

The prompt at 3R on page 2/2, shown in Figure 5-3, is one of the following: S.E. RANGE or E.O. RANGE, which is shown in Figure 5-4.

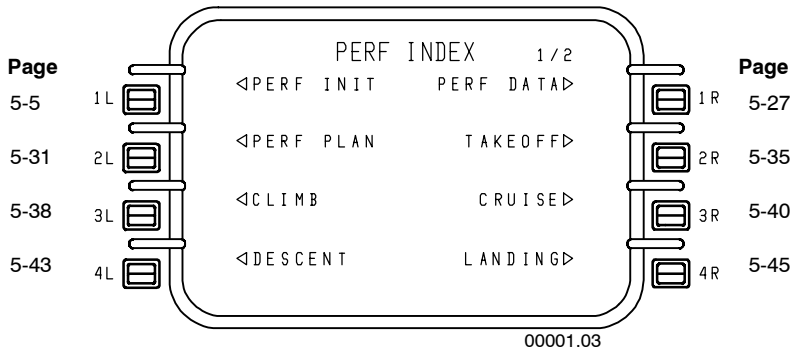


Figure 5-2

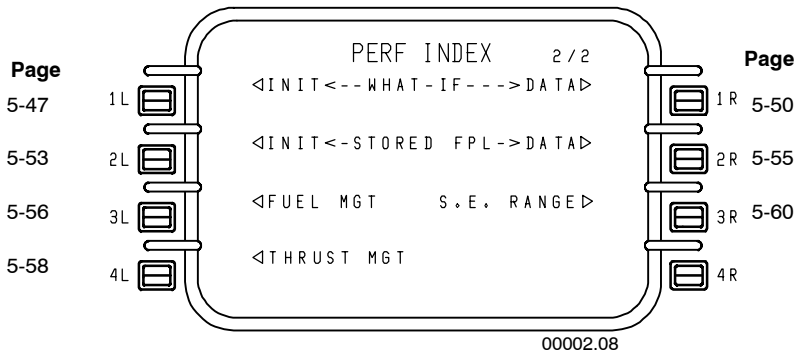


Figure 5-3

Optional Performance Index Selections

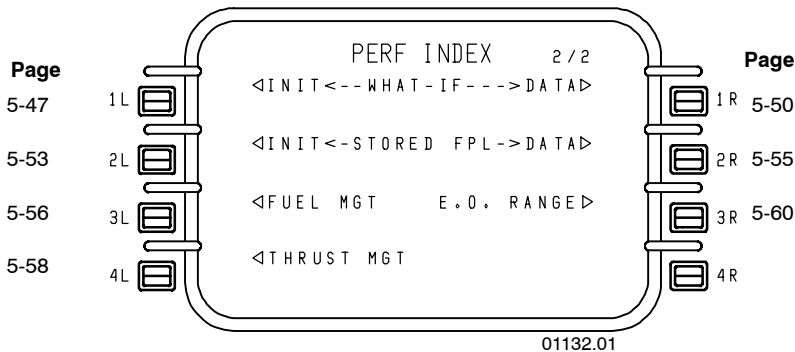
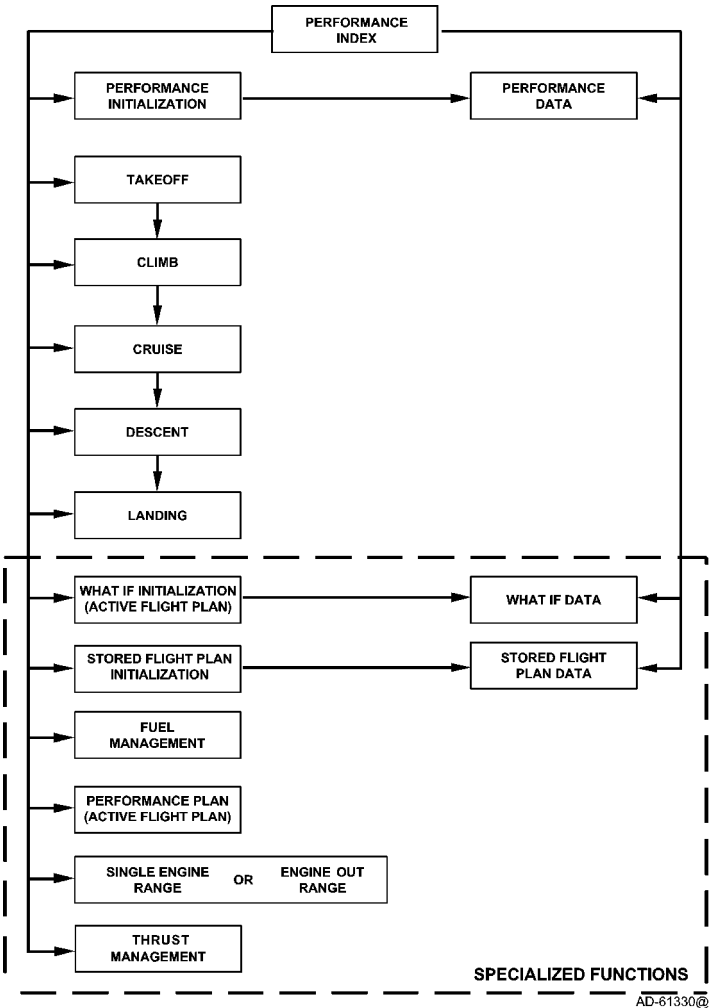


Figure 5-4

Performance Index Organization

Several FMS performance functions require initialization. For these functions, when the related initialization selection is complete, the CONFIRM INIT prompt must be selected to compute the performance data. The computed data is used for FMS and autothrottle control functions. See Figure 5-5 for a block diagram of performance index organization. This block diagram assumes that the active flight plan has been closed and an active departure has been identified.



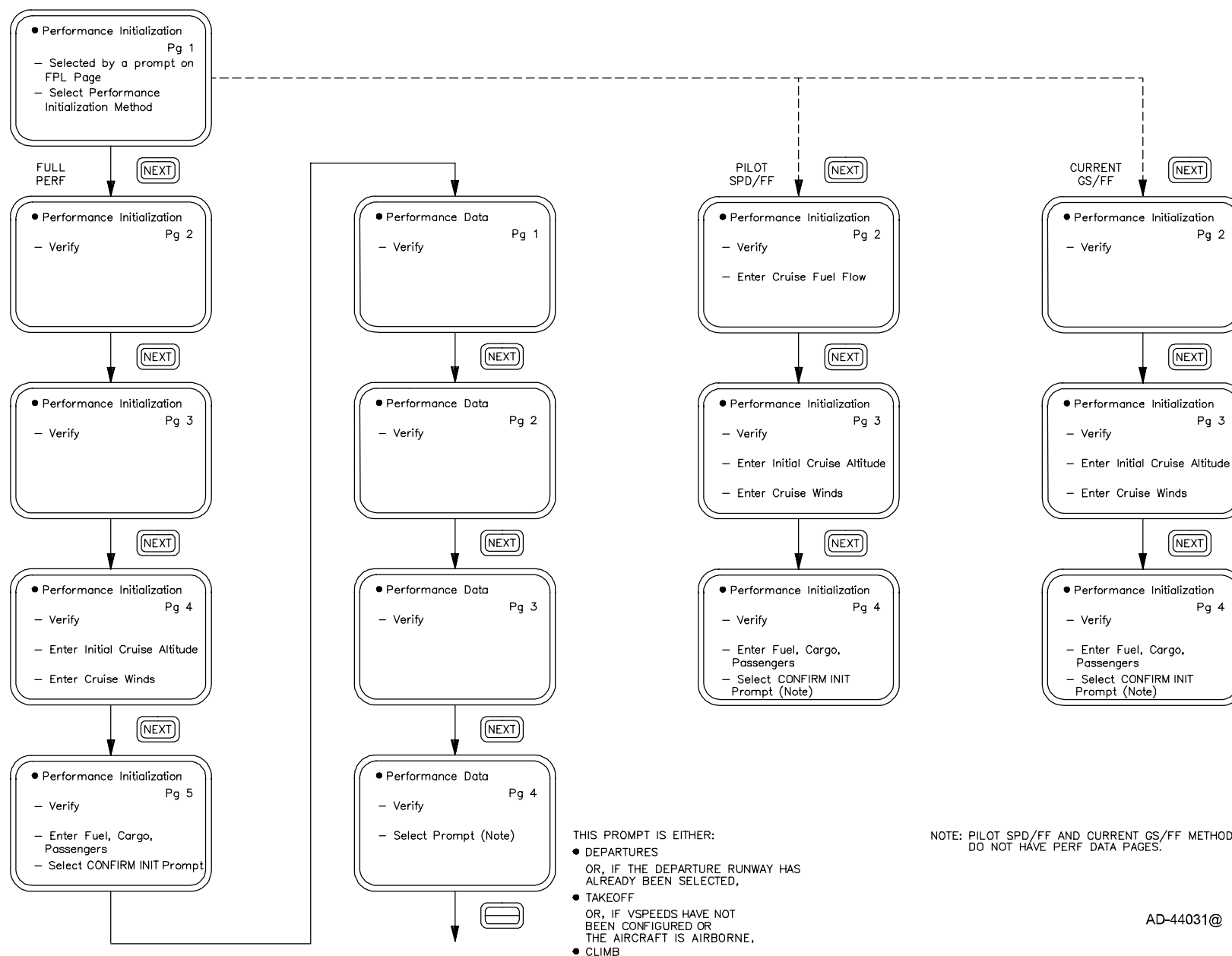
Performance Index Organization
Figure 5-5

PERFORMANCE INITIALIZATION

The pilot can select one of the three methods listed below to complete performance initialization.

- **Full Performance** – The FMS uses an uploaded and learned aircraft data base file to perform time and fuel calculations. The time calculations are also based on pilot-entered speed schedules and winds. Computed cruise speed schedules such as Long Range Cruise (LRC) and maximum speed can be selected.
- **Pilot Speed/Fuel Flow** – The FMS uses pilot-entered speed schedules and winds to perform time calculations. The fuel calculations are based on pilot-entered cruise fuel flow. Adjustments are made for the higher fuel flow in climb.
- **Current Ground Speed/Fuel Flow** – The fuel calculations are based on the current fuel flow displayed on the FUEL MGT page. If a fuel flow entry is made on that page, it takes the place of the sensed fuel flow. The time calculations are based on the current groundspeed when airborne. While on the ground, the FMS uses the default groundspeed.

Figure 5-6 shows the sequence of initialization and data pages for each of the three methods of performance calculations. **The pilot should verify and review all the entered and computed data.**



Performance Initialization Block Diagram
Figure 5-6

Full Performance Method

There are five pages of performance initialization. Many items are recalled from the previous flight to reduce the number of required inputs. These items can be changed. The only items that are required entries for each flight are fuel quantity (unless gauge value is available), cargo weight, and the number of passengers. An average cruise wind should be entered if available. The cruise altitude may be left at optimum or it can be entered.

- **PERFORMANCE INIT 1/5** – Figure 5-7 contains information about the following:
 - **1L** – Aircraft Type (ACFT TYPE) is displayed on this line. No entry is permitted here. The aircraft type is loaded from the aircraft data base. Refer to Data Load (page 6-184) for details on loading an aircraft data base.

If no aircraft data base has been loaded, this line is blank. An aircraft data base must be loaded in order to select the FULL PERF option.

Normally, an aircraft data base needs to be loaded only when the FMS is installed. The aircraft data base is retained from flight to flight and updated by the learning process.

The pilot should verify that the ACFT TYPE data field has the correct aircraft type. The system generates incorrect performance predictions if the FMS contains the wrong AIRCRAFT DB.

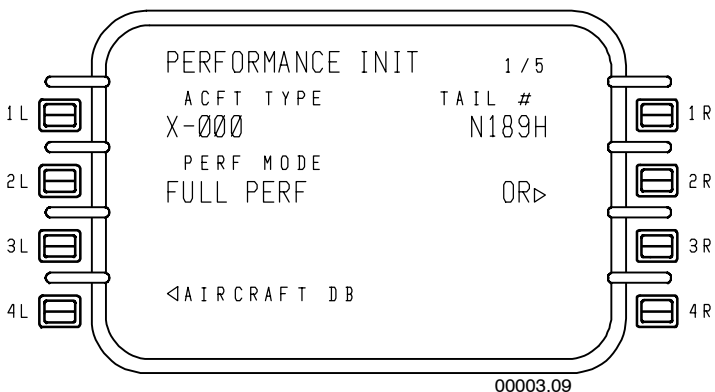


Figure 5-7

- **1R** – Aircraft tail number (TAIL #) is displayed on this line. The tail number must be entered in this field before going to the next page. Once entered, it is saved. No action is required on future flights.

The tail number is used for the following two purposes:

1. Naming of the aircraft data base file – When the aircraft data base file is saved to disk, it will be named using the tail number. This allows the saving of multiple aircraft files on a single diskette.
2. PCDL – The tail number is used by PCDL for the loading of the navigation data base. It is also used for the uploading and download of the custom and aircraft data base files.

- **2L** – The FMS has three perf modes or methods of performance calculations. Use the OR prompt at 2R to change the modes (see Figure 5-8).
- **4L** – This prompt accesses the AIRCRAFT DB down/uploading. The prompt is available only if there is a data loader connected to the FMS and the aircraft is on the ground.

- **PERF MODE 1/1** – Selecting the OR prompt at 2R, shown in Figure 5-7, displays the PERF MODE page, shown in Figure 5-8. The PERF MODE page is used to select the mode for performance calculation.

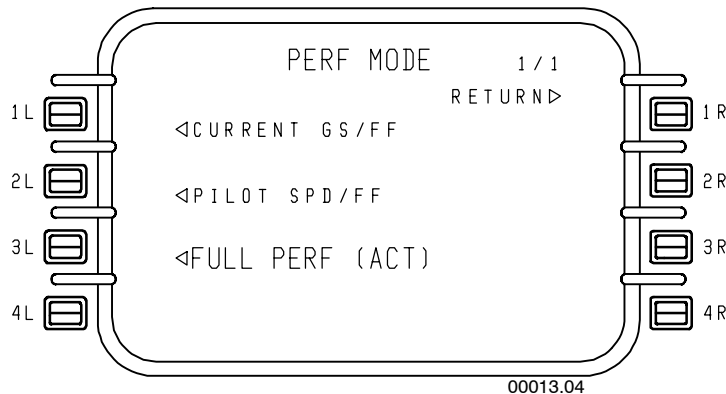


Figure 5-8

- **1L** - When CURRENT GS/FF is selected, performance calculations are based on current groundspeed and current fuel flow. However, while on the ground, the FMS default groundspeed is used. This groundspeed is displayed at 1R on the first page of any stored flight plan. Once airborne, the current groundspeed is used. The current fuel flow is displayed at 1R of the FUEL MGT 1/2 page. However, the value can be overridden by a pilot entry. The overridden value is then used.
- **2L** - Selecting PILOT SPD/FF bases performance calculations on pilot-entered speed schedules and cruise fuel flow. When using this option, the cruise fuel flow must be entered at 2R on the PERFORMANCE INIT 2/4 page. Automatic adjustments are made for the higher fuel flow in climb. Entered winds and sensed winds (once airborne) are included in the groundspeed predictions used for time enroute estimates.
- **3L** - Selecting FULL PERF bases performance on pilot selections and the learned aircraft performance. An aircraft data base must be loaded before this option is available.

It is possible that with an aircraft data base loaded, additional flights are required for the FMS to learn the aircraft performance. Under this condition, the message INSUFFICIENT LEARNED DATA is displayed at 3R and FULL PERF mode is not selectable.

When either CURRENT GS/FF (1L) or PILOT SPD/FF (2L) are selected, the following inputs and features are **not** available:

- PERFORMANCE INIT 3/5 page (this reduces the total number of PERFORMANCE INIT pages to 4)
- The WHAT-IF and Stored Flight Plan Functions
- The PERF DATA pages
- The CLIMB page
- The CRUISE pages
- The DESCENT page
- The S.E. RANGE (or E.O. RANGE) page
- Optimum and Maximum Altitude Computations
- Cruise Speed Schedules:
 - Long Range Cruise (LRC)
 - Maximum Speed (MAX SPD)
 - Maximum Endurance (MAX END)

- Point of No Return (PNR) page
- Equal Time Point (ETP) page.
- **PERFORMANCE INIT 2/5** – Figure 5-9 is used to set the speed schedules for climb, cruise, descent, departure, and arrival. It is also used to set the default descent angle. In FULL PERF and PILOT SPD/FF, these speed schedules are used for making groundspeed predictions. In the CURRENT GS/FF mode, the groundspeed predictions are unaffected by the speed schedules. The active FMS speed command, used by the flight director and autothrottle, uses the appropriate speed schedule based on the phase of flight.

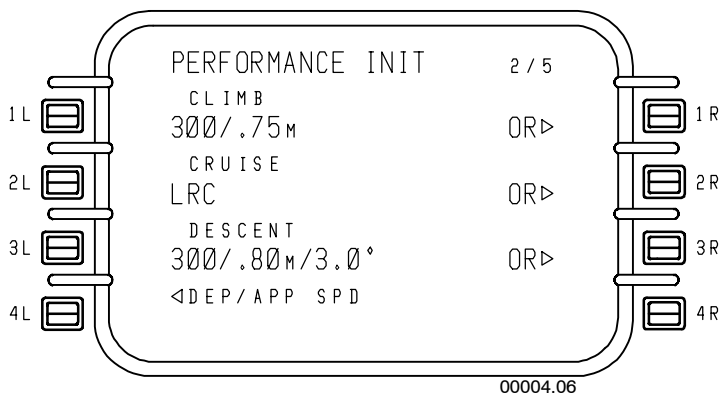


Figure 5-9

- **1L and 3L** – The climb and descent speed schedules are always displayed as both a calibrated airspeed (CAS) and a MACH. Changes can be made by entering a CAS, a MACH, or both separated by a slash (/). The leading slash (/) is optional when entering a MACH only. Entering *DELETE* returns the default climb or descent speed schedule.

The active speed command is the CAS at lower altitudes and MACH at higher altitudes. The crossover altitude is where both the CAS and the MACH translate to the same true airspeed (TAS). The FMS always uses the CAS or MACH entry that provides the lowest TAS at the current altitude.

- **2L** – The cruise speed schedule can be a CAS/MACH pair, only CAS, only MACH, or a system-generated cruise speed schedule. Entries of a CAS, a MACH, or both are accepted. Entering *DELETE* returns the default cruise speed schedule which is LRC in FULL PERF and 300/.80 in CURRENT GS/FF or PILOT SPD/FF. The two other system-generated schedules, MAX SPD and MAX END, can be selected on the CRUISE MODES page only.

If both a CAS and MACH are entered, the active speed command is the CAS or MACH that provides the lowest TAS at the current altitude.

If the LRC or MAX SPD schedules are active, the speed command is issued as a MACH at higher altitudes and a CAS at lower altitudes. This is determined by the V_{mo}/M_{mo} crossover altitude. If the cruise speed schedule is MAX END, the speed command is always CAS.

If only a MACH cruise speed is entered but the cruise altitude is low, the TAS may become excessive. Enter both a CAS and a MACH or use LRC to avoid this situation.

- **3L** – In addition to the speed entries, a default descent angle can be entered in this field. If the angle is being entered independent of the speed entries, the angle can either be entered directly or with two leading slashes (/). Refer to Descent (page 5-43) for additional information.
- **4L** – Selection of this line provides access to the DEPARTURE, APPROACH, and GO-AROUND speed pages. The DEP/APP SPD prompt is not available on all aircraft types. See Figures 5-13 thru 5-16 starting on page 5-16.
- **1R, 2R, and 3R** – Selecting one of the OR prompts will display the CLIMB, CRUISE, or DESCENT MODES page, respectively, as shown in Figures 5-10 through 5-12.

- **CLIMB MODES** – Figure 5-10 is available only when using FULL PERF. The page shows both the manual and default speed schedule as well as which schedule is active.

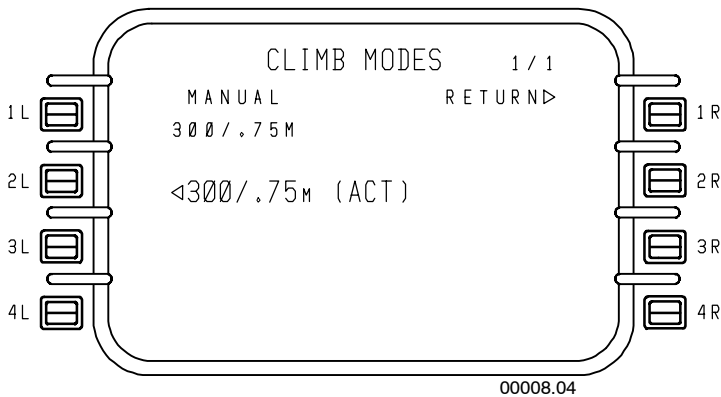


Figure 5-10

- **1L** – This field is used to enter CAS, MACH, or both separated by a slash (/). After an entry is made, the display returns to the PERFORMANCE INIT 2/5 page.
 - **2L** – Selecting this prompt activates the default climb schedule and returns to the PERFORMANCE INIT 2/5 page.
 - **1R** – The RETURN prompt can be used to return to the PERFORMANCE INIT 2/5 page without making any selections.
- **CRUISE MODES** – Figure 5-11 is available only when using FULL PERF. The available modes for cruise are listed on this page with the active mode annotated.

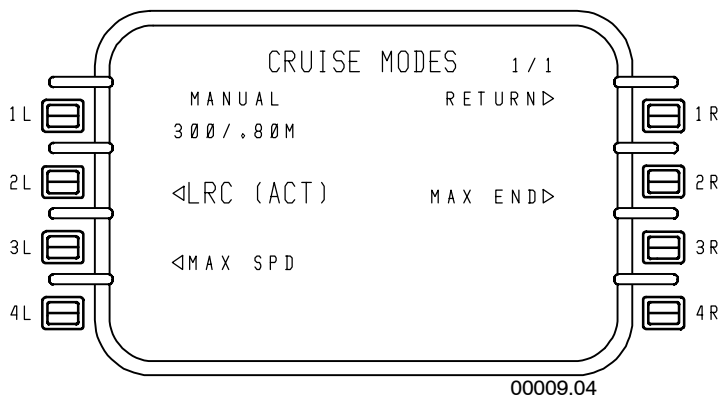


Figure 5-11

- **1L** - A MANUAL cruise speed can be entered and activated at 1L. If an entry is made directly on the PERFORMANCE INIT 2/5 page, it is recorded under the manual entry on this page.
- **2L, 3L, and 2R** - Pressing the line select key for a mode makes it the active cruise mode. The display returns to the PERFORMANCE INIT 2/5 page.
- **1R** - The RETURN prompt returns to the PERFORMANCE INIT 2/5 page with no action performed.
- **DESCENT MODES** - Figure 5-12 is available only when using FULL PERF. The page shows the available descent modes as well as which one is active.

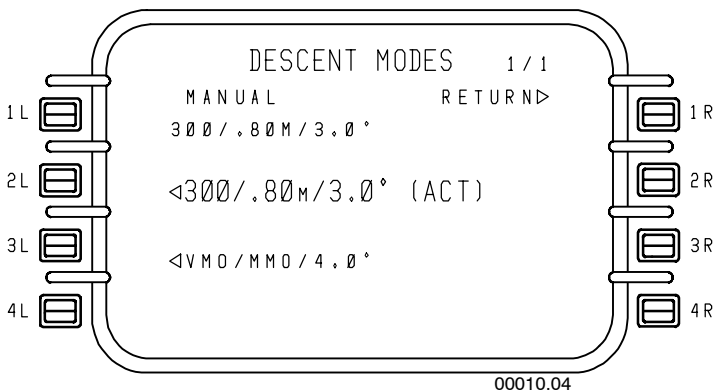


Figure 5-12

- **1L** - This field is used to enter CAS, MACH, or both. The descent angle can also be entered separately or following a CAS/MACH speed entry (e.g., 280/.73/3.5). After an entry is made, the display returns to the PERFORMANCE INIT 2/5 page.
- **2L** - Selecting this prompt activates the default descent speed/angle schedule and returns to the PERFORMANCE INIT 2/5 page.

- **3L** - Selecting this prompt activates the VMO/MMO descent speed/angle and returns to the PERFORMANCE INIT 2/5 page. Changes to the descent angle can be entered directly. This mode should be used only when flying vertical flight level change (VFLCH) or flight level change (FLCH). If VNAV is controlling a path (VPATH), the high speed reversion function changes the VNAV mode to VFLCH if the speed becomes $V_{mo} + 10$ knots. Refer to page 7-43 for additional details.
- **1R** - The RETURN prompt can be used to return to the PERFORMANCE INIT 2/5 page without making any selections.
- **DEPARTURE SPEED** - Figure 5-13 is used to enter departure speed and restriction limits. This data is used to compute FMS speed commands during departure. The aircraft must be operating in the upper and horizontal limits in order for the departure speed limit to be used by the FMS. This page is not available for all FMZ installations.

Figure 5-13

- **1L** - This field is used to enter the departure speed limit. The default value is 200 knots.
- **2L** - This field is used to enter the upper limit of the departure area. The default value is 2500 feet.
- **2R** - This field is used to enter the horizontal limit of the departure area. The default is 4.0 NM.
- **1R** - The RETURN prompt can be used to return to the PERFORMANCE INIT 2/5 page without making any selections.

- **APPROACH SPEED** – Figure 5-14 is used to enter approach speed and restriction limits. This data is used to compute FMS speed targets during approach. This page is not available for all FMZ installations.

APPROACH SPEED 2 / 4

CLEAN 200 RETURN>

DIST TO DESTINATION 15.0NM

FIRST APP WPT YES OR NO>

1L 2L 3L 4L 1R 2R 3R 4R

00482.03

Figure 5-14

- **1L** – This field is used to enter the approach speed limit. The default value is 200 knots.
- **2L** – This field is used to enter the distance out from the destination where the approach speed schedule begins. The default is 15.0 NM.
- **3L and 3R** – Selecting YES for this option starts the approach speed schedule at the first approach waypoint when it is further out than the distance entered at 2L. The default is YES. 3R is used to change the selection.
- **1R** – The RETURN prompt can be used to return to the PERFORMANCE INIT 2/5 page without making any selections.

The second page for approach speed schedules, shown in Figure 5-15, is used to enter approach speed limits for different flap settings. This page is not available for all FMZ installations. If an installation does not support this feature, the page is not available for display.

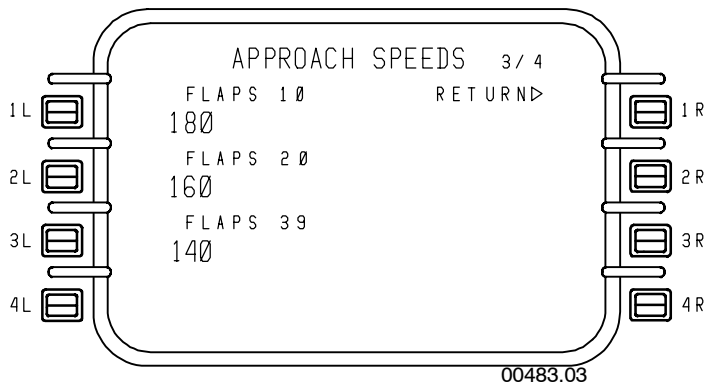


Figure 5-15

- **1L, 2L and 3L** – These fields are used to enter the approach speed limit for different flap settings. Entries of 5 to 74 results in airspeeds referenced from VREF (e.g., entry of 5 results in the display of VREF + 5). Default values are provided from the aircraft data base.
- **1R** – The RETURN prompt can be used to return to the PERFORMANCE INIT 2/5 page without making any selections.
- **GO-AROUND SPEEDS** – Figure 5-16 is used to enter the go-around speed schedules for various configurations.

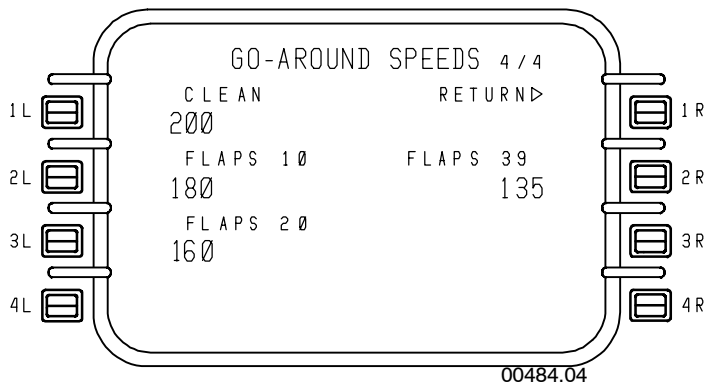


Figure 5-16

- **1L** – This line displays the go-around speed for the clean configuration. The default value of 200 KTS is from the aircraft data base file. Pilot entry is permitted. Entering *DELETE* returns to the default of 200 KTS.

- **2L, 2R and 3L** – These fields are used to enter the go-around speed limit for different flap settings. Entries of 5 to 74 result in the airspeeds referenced from VREF (e.g., entry of 5 results in the display of VREF + 5). Default values are provided from the aircraft data base. These line selects are not available for all FMS installations. If an installation does not support these features, the lines are blank.
- **1R** – The RETURN prompt can be used to return to the PERFORMANCE INIT 2/5 page without making any selections.
- **PERFORMANCE INIT 3/5** – Figure 5-17 is used to review and/or select a step increment for predicted step climbs. It is also the method used for fuel reserve calculations as well as takeoff and landing fuel allowances. The page is available only in the FULL PERF mode.

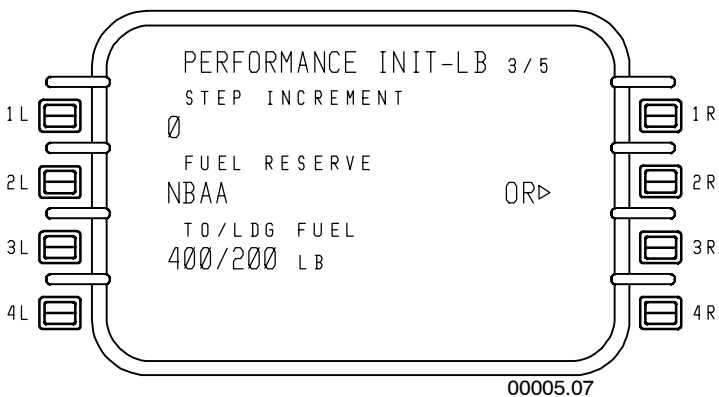


Figure 5-17

- **1L** – Entries for step increment must be in thousands of feet. The three trailing zeros may be omitted. For example, a 4000-foot step climb increment can be selected by entering 4 or 4000. Entering *DELETE* returns the selection to no step or 0 feet.

Step climbs are used for long range flights to optimize the aircraft performance. As the aircraft burns fuel, the optimum altitude goes up. If a step increment is selected, the FMS computes the Bottom of Step Climb (BOSC) point. The BOSC is where the aircraft is light enough to climb by the amount of the step increment to a new cruise altitude. There may be more than one step climb calculated for a flight.

When a step increment is selected, time and fuel predictions assume that the step climbs will be made. Therefore, a step increment should only be selected when the intent is to make the step climbs. If clearance is not given or the step climb is not going to be made, step increment should be set to 0 in order to maintain accurate time and fuel predictions.

- **2L** – The method of calculating fuel reserve is displayed on this line. Entering *DELETE* returns to the default reserve mode which is National Business Aircraft Association (NBAA) rules. If one of the other two modes (pounds remaining or time remaining) has been selected on the FUEL RESERVE page, an entry can be made directly on this page as shown in Figure 5-18. For example, if 1000 LB is displayed, an entry of 2000 changes the reserve quantity to 2000 LB.
- **2R** – This line accesses the FUEL RESERVE page, which is shown in Figure 5-18.
- **3L** – The default values of Takeoff/Landing Fuel (TO/LDG FUEL) are supplied from the aircraft data base. However, manual entries can be made. Manual entries are saved for the next flight. Entering *DELETE* returns the default values.

The takeoff fuel allowance includes fuel burn for taxi and takeoff. Takeoff fuel allowance is decremented by fuel flow. However, it is not decremented past zero. Following takeoff or when the takeoff allowance has been decremented to zero, fuel remaining values are adjusted to account for actual fuel burned.

The takeoff fuel allowance is added to the fuel required calculation. The fuel required calculation is the predicted fuel from takeoff to landing plus reserves.

The landing fuel allowance is a buffer amount of fuel that the FMS incorporates into the total fuel required computation. The landing fuel is intended to cover the ground operation after landing. The value can be changed at any time.

- **FUEL RESERVE 1/1** - Figure 5-18 is where the fuel reserve mode is changed or modified. The fuel reserve page contains three modes.

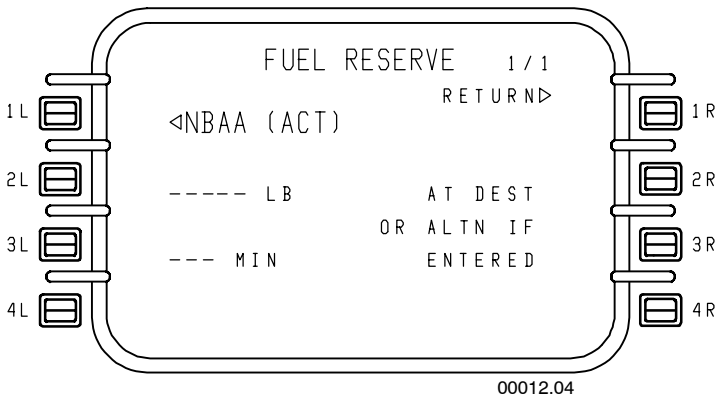


Figure 5-18

- **1L** - Selecting this prompt activates the NBAA reserve mode. The NBAA fuel reserve requirement is the sum of the two following items:

 Fuel required to fly the alternate flight plan (from the destination to the alternate destination). If the alternate flight plan is less than 200 NM or if there is no alternate flight plan, the NBAA standard 200 NM alternate flight plan is assumed.

 Fuel required to hold for 30 minutes at 5000 feet at the reserve holding speed at the alternate.
- **2L** - A fuel reserve in pounds can be entered. The specified fuel reserve applies at the destination, or at the alternate destination if one has been entered.
- **3L** - A fuel reserve in minutes can be entered. The time entered is converted to pounds of fuel assuming flight at 5000 feet at the reserve holding speed. The fuel reserve applies to the destination or the alternate destination if one has been entered.

- **PERFORMANCE INIT 4/5** – Figure 5-19 does not require that an entry be made. However, a flight-specific item such as the cruise wind is a recommended entry. In addition, initial cruise altitude is usually entered.

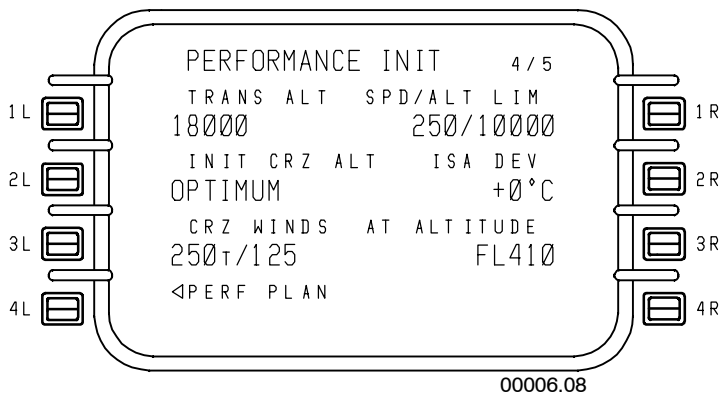


Figure 5-19

- **1L** – The transition altitude can be entered here. The FMS uses the input to determine how to display altitudes. Altitudes above the transition altitude are displayed as Flight Levels (FL) and below in feet. Entering *DELETE* returns the default value of 18,000 feet.
- **1R** – Speed limits associated with altitudes, not waypoints, can be entered. For U.S. operation, 250 knots below 10,000 feet is entered. The FMS speed command is limited to this speed below the restriction altitude. Entering *DELETE* removes the speed/altitude limit and displays dashes. This is the only field that can be left with dashes and still allow performance data to be computed.
- **2L** – INIT CRZ ALT – The initial cruise altitude is entered at this location. The FMS uses the initial cruise altitude to determine the altitude where the cruise phase of flight commences. The FMS changes the speed command and EPR rating from climb to cruise when the aircraft levels at the initial cruise altitude or higher.

The default for INIT CRZ ALT is OPTIMUM if the performance mode is FULL PERF. The FMS will calculate the optimum cruise altitude based upon the performance initialization data. After performance initialization is completed, the calculated optimum altitude is displayed in small characters on this page. The method used to compute the initial cruise altitude is displayed following the altitude.

- (OPTIMUM) indicates that the initial cruise altitude is the optimum altitude.
- (ALT SEL) indicates that the initial cruise altitude was set by using the altitude preselector.
- (FP LIM) indicates that the initial cruise altitude was limited by the active flight plan.

An entry of cruise altitude in FL or feet is permitted. Entering *DELETE* at any time returns to the default of OPTIMUM. If performance is already initialized, the optimum altitude is recomputed.

For PILOT SPD/FF and CURRENT GS/FF, entry prompts are displayed. Entering *DELETE* returns the entry prompts and the performance function is de-initialized.

If an altitude is entered that is lower than the altitude selector, the entry is rejected and the CDU message RESET ALT SEL? is displayed. The cruise altitude must be equal to or greater than the altitude selector.

The INIT CRZ ALT will not automatically change should the aircraft climb to an altitude above the initial cruise altitude shown on PERFORMANCE INIT 4/5. This action does change the cruise altitude as displayed on the PERF DATA pages (refer to page 5-27). Performance data is recalculated to reflect the higher cruise altitude.

- NOTES:**
1. Once in flight, if the actual cruise altitude is lower than the entered or calculated initial cruise altitude, the initial cruise altitude entry should be adjusted to the lower value. This places the FMS in the cruise mode and adjusts the performance predictions to account for the lower cruise altitude.
 2. The speed command for a level-off below the entered or calculated initial cruise altitude is the climb speed target.

Additional Definition of Optimum Altitude

The optimum altitude has different definitions based on the cruise speed mode. For the LRC and manual cruise speeds, the optimum altitude is where the specific range is optimized. This altitude is typically close to the ceiling altitude. The MAX SPD optimum altitude is where true airspeed is maximized. This altitude tends to be close to the V_{MO}/M_{MO} crossover altitude. For MAX END speed, the optimum altitude is where the fuel flow is minimized.

The OPTIMUM altitude is short-trip limited. This means the computed altitude is adjusted downward if the flight is not long enough for a climb to the optimum altitude. Regardless of short-trip limiting, the cruise altitude is always set at least as high as the altitude selector.

- **2R** – The forecast temperature deviation at the **cruise altitude** can be entered in this field. The deviation is relative to the International Standard Atmosphere (ISA). If no entry is made, the displayed default of zero is used. Do not input the temperature deviation at the field elevation. Temperature impacts most performance predictions: the climb gradient, the ceiling altitude, the fuel consumption, the groundspeed predictions, and more. For additional information, refer to the explanation of the Wind and Temperature Model on page 5-32.
- **3L and 3R** – An average cruise wind and corresponding altitude can be entered at 3L and 3R. No entry is required, but it is recommended. If no entry is made, the FMS assumes zero wind. When the cruise wind is entered at 3L, prompts are displayed at 3R. The altitude must also be entered before the cruise wind is accepted. Entering *DELETE* returns the default value of zero.
- **4L** – This prompt is used to access the PERF PLAN pages where individual waypoint wind and temperature entries can be made. Waypoint wind and temperature can be entered at this time in the initialization process or after completing initialization.

- **PERFORMANCE INIT 5/5** – Figure 5-20 is used to calculate the aircraft gross weight.

PERFORMANCE INIT-LB 5/5

BOW 48000 PASS/@ LB 5/170

FUEL (GAUGE) 14002 (14002) PASS WT 850

CARGO 200 GROSS WT 63052

CONFIRM INIT▶

00007.09

Figure 5-20

- **1L** – Basic Operating Weight (BOW) is retained in memory but it should be verified on each flight. A new entry can be made at any time. Entering *DELETE* returns the entry prompts.
- **2L** – The fuel weight, when sensed by the fuel quantity system, is displayed in small characters. The pilot can manually enter a fuel weight which will be displayed in large characters. See FUEL MGT page 1/2 on page 5-56 for additional information regarding FMS fuel quantity computation and fuel leak detection.
- **3L and 1R** – Cargo weight and passenger count must be entered in order to compute performance data. The average weight per passenger can also be adjusted by entering a slash (/) followed by the weight (e.g., /200).
- **4R** – When performance initialization is complete, the **CONFIRM INIT** prompt is displayed in the lower right corner of this page. The **CONFIRM INIT** prompt must be selected for the performance function to calculate performance data and for the VNAV function to be available.

Selecting the CONFIRM INIT prompt displays the PERF DATA page. After confirming initialization, the prompt at 4R of the PERFORMANCE INIT page becomes PERF DATA on all PERF INIT pages.

Pilot Speed/Fuel Flow (SPD/FF) Method

The PILOT SPD/FF method of performance initialization has a total of four pages. The PERFORMANCE INIT 3/5 page for FULL PERF is not used. The performance initialization is similar to the FULL PERF initialization with the following exceptions:

- The PERFORMANCE INIT 2/4 page (page 2/5 for FULL PERF) displays entry prompts at 2R for entry of cruise fuel flow (CRZ FF). There are no OR prompts at 1R and 3R. Note, if the PILOT SPD/FF performance mode is first selected while the aircraft is airborne, the current fuel flow is displayed in this field. This is done to prevent dropping performance initialization and VNAV.
- The PERFORMANCE INIT 3/4 page (page 4/5 for FULL PERF) displays entry prompts for the cruise altitude at 2L. The optimum altitude selection is not available.
- The PERFORMANCE INIT 4/4 page (page 5/5 for FULL PERF) does not show the PERF DATA prompt. There are no PERF DATA pages for this mode. Consequently, there is no requirement to select this prompt.

Current Groundspeed/Fuel Flow (GS/FF) Method

The CURRENT GS/FF method of performance initialization is similar to the PILOT SPD/FF initialization with the following exceptions:

- There is no need to enter cruise fuel flow on the PERFORMANCE 2/5 page. The 2R location is blank.
- The climb, cruise, and descent speed schedules on the PERFORMANCE INIT 2/5 page are used to set FMS speed commands to the flight director. They are not used for performance calculations.
- The cruise wind and temperature entries on the PERFORMANCE INIT 3/4 page are not needed. The time and fuel calculations are based on current conditions only.

Switching Performance Methods

The performance method can be switched manually. In some cases, there is automatic reversion. The following applies:

- Switching between FULL PERF and PILOT SPD/FF causes the current fuel flow to be used as the PILOT SPD/FF cruise fuel flow baseline. A subsequent entry of cruise fuel flow can still be made.

- If the FULL PERF or PILOT SPD/FF methods are being used and become invalid, the FMS automatically reverts to the CURRENT GS/FF method.
- If the FMS reverts to the CURRENT GS/FF method, the PROGRESS page displays fuel and time at destination based on current GS and FF.

PERFORMANCE DATA

The four PERF DATA pages are available if the performance mode is FULL PERF. The performance data is displayed when there is an active flight plan and performance initialization has been completed. Anytime changes are made to the flight plan, performance data computations are updated. In flight, factors such as unexpected winds or routing changes alter the predictions.

When performance data is being recalculated, the displayed data is blanked during the few seconds of calculation. This operation is the general rule for all pages displaying performance data.

- **PERF DATA 1/4** - Figure 5-21 displays the overall fuel and time calculations along with the cruise altitude. If an alternate flight plan has been entered, data for both the destination and the alternate destination is presented.

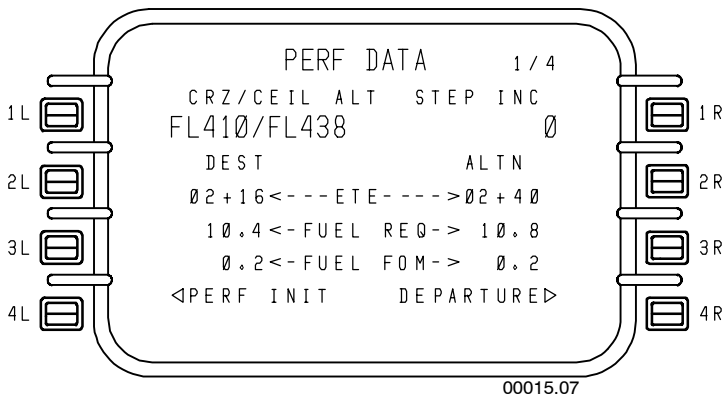


Figure 5-21

- **1L** - The computed cruise and ceiling altitudes are displayed. Cruise altitude can be entered in FL or feet. Entering *DELETE* is interpreted as a request to recompute the optimum altitude. The ceiling altitude is computed by the FMS and cannot be entered.

Additional Details About Cruise Altitude

If optimum altitude is selected for the initial cruise altitude on PERFORMANCE INIT page 4/5, then the computed optimum altitude will be displayed as the cruise altitude on PERF DATA page 1/4. If an initial cruise altitude is entered (e.g., 45000 ft), this altitude will be displayed as the cruise altitude on PERF DATA page 1/4.

If the altitude preselector is dialed to a higher altitude than the cruise altitude on PERF DATA page 1/4, then this field will be updated automatically. The initial cruise altitude on PERFORMANCE INIT page 4/5 remains unaffected by the automatic adjustments. If the cruise segment is actually flown at a lower altitude than the cruise altitude on PERF DATA page 1/4, then a new cruise altitude should be entered by the pilot in this field. If the new cruise altitude is not entered, a climb will be predicted since the FMS will be expecting a climb to the cruise altitude displayed on PERF DATA page 1/4.

Additional Details About Ceiling Altitude

The ceiling altitude is the highest attainable altitude of the aircraft for the given cruise conditions. The ceiling altitude is limited to the certified ceiling altitude. The ceiling altitude depends on the cruise speed mode as well as gross weight and air temperature. Prior to reaching cruise, predicted gross weight and air temperature values at Top of Climb (TOC) are used to compute ceiling altitude. Once in cruise, the current weight and outside air temperature are used.

For the MAX SPEED and the MAX END cruise modes, the highest altitude that can be attained is computed and displayed as the ceiling altitude. For the LRC cruise mode, the ceiling altitude is computed for the LRC schedule. For the manual cruise mode, the ceiling altitude is computed for the entered CAS or MACH.

- **1R** – The step increment can be entered using the same rules as during performance initialization. Refer to page 5-19 for additional details.
- **2L and 2R** – This line displays ETE to the destination and the alternate destination. No entry is permitted.
- **3L and 3R** – This line displays total fuel requirement and the fuel Figure of Merit (FOM). The fuel required includes the fuel to fly the mission, the takeoff and landing allowances, plus reserves.

The fuel FOM is an estimate of the accuracy of the fuel required calculation expressed in thousands of pounds. In Figure 5-21, the FUEL FOM is 0.2 meaning fuel required numbers have an estimated accuracy within ± 200 pounds.

If the alternate mission is less than 200 NM and the NBAA reserve mode is used, the fuel required to the destination is higher than to the alternate destination. This is because the reserve at the destination includes the 200 NM minimum alternate plus 30 minutes of loiter, whereas, at the alternate, only 30 minute of loiter is included.

- **4L and 4R** - The prompt at 4L on all PERF DATA pages is PERF INIT. The prompt at 4R on all PERF DATA pages is either DEPARTURE, if a departure runway has not been selected, or TAKEOFF, if a departure runway has been selected.
- **PERF DATA 2/4** - Figure 5-22 is a display-only page. No entries are permitted. It displays the calculated data listed below.

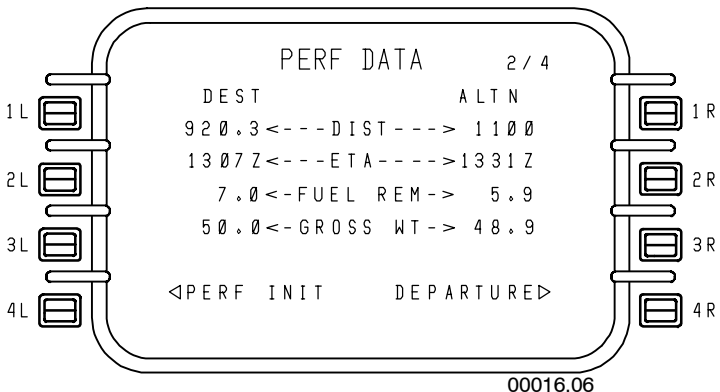


Figure 5-22

- **1L and 1R** - Flight plan distance to go to the destination and the alternate destination are displayed.
- **2L and 2R** - Once airborne, the ETA at the destination and the alternate destination are displayed unless an ETA has been entered on the active flight plan. These fields are blank while on the ground. Also shown is the predicted fuel quantity remaining at the destination and the alternate destination.
- **3L and 3R** - The predicted gross weight at the destination and the alternate destination are displayed.

- **PERF DATA 3/4** – Figure 5-23 shows wind information and tracks fuel prediction changes since takeoff. No entries are permitted.

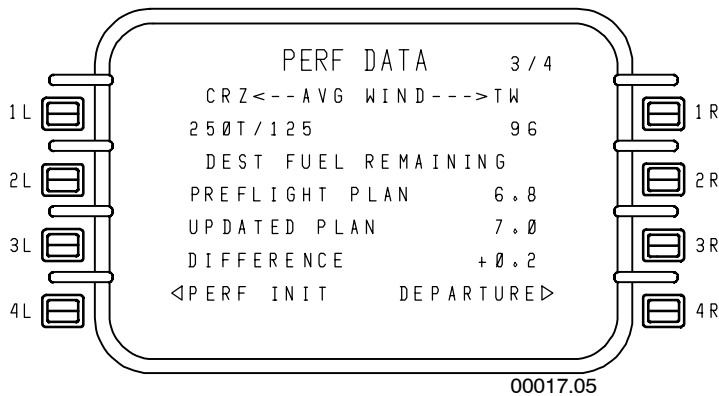


Figure 5-23

- **1L** – The average cruise wind for the remainder of the flight plan, as estimated by the performance mission predictions, is displayed. This wind is computed based on sensed wind and entered wind. Refer to page 5-32 for additional information on wind and temperature entries.
- **1R** – The same wind as in 1L, but resolved into average headwind or tailwind component, is displayed.
- **2L and 2R** – The preflight fuel remaining at the destination is displayed. At takeoff, this value is frozen for the remainder of the flight.
- **3L and 3R** – After takeoff, the latest estimate of fuel remaining at the destination, and the difference to the preflight plan, are displayed. On the ground, these displays are blank. This allows the pilot to compare how well the flight is tracking to the preflight plan.

- **PERF DATA 4/4** – Figure 5-24 displays information about fuel reserve requirements. No entries are permitted.

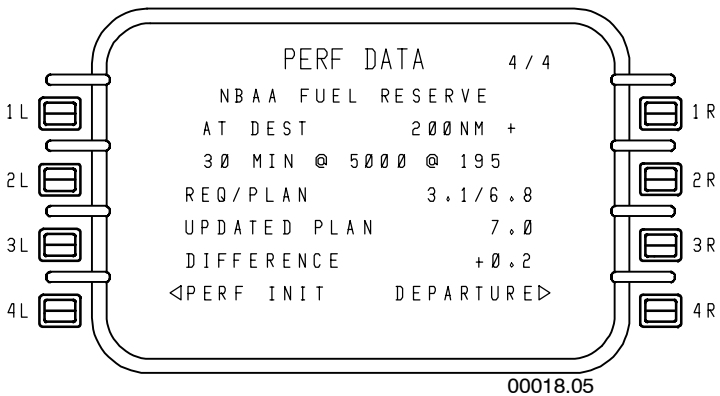


Figure 5-24

- **1L and 1R** – The method of fuel reserve calculation, as chosen on PERFORMANCE INIT page 3/5, is displayed here. The example in Figure 5-24 shows the default mode of NBAA reserves. If the fuel reserve mode is pounds or minutes, the fuel reserve at the destination is displayed when there is no alternate defined. With an alternate flight plan, these two fuel reserve modes show the fuel reserve at the alternate destination.
- **2L and 2R** – The required (REQ) fuel reserve and the predicted fuel remaining (PLAN) are displayed. If the required fuel reserves (REQ) is less than the predicted fuel remaining (PLAN), there is sufficient fuel reserve on board. The PLAN fuel remaining is frozen at takeoff. The REQ fuel changes if the reserve mode is changed.
- **3L and 3R** – The UPDATED PLAN is displayed only while airborne. It represents the most recent estimate of the fuel remaining. While in flight, this quantity should be compared to the REQ fuel. This comparison serves to verify that there is sufficient fuel reserve on board. In addition, the difference between preflight and updated plan is displayed.

PERFORMANCE PLAN

The PERF PLAN pages display the estimated fuel remaining and Estimated Time Enroute (ETE) for each leg of the flight. This is shown in Figure 5-25. No flight plan changes can be made from this page. The PREV and NEXT keys are used to review the entire flight plan. In addition to this information, this page shows a Wind/Temperature (W/T) prompt (right line-selects) for each waypoint.

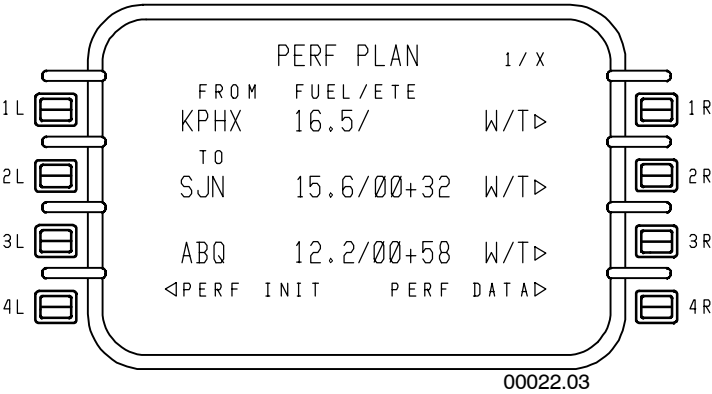


Figure 5-25

Selecting the W/T prompt for a specific waypoint displays the WIND/TEMP page. This page is used for display and entry of wind and temperature information.

Wind and Temperature Pages

- **WIND/TEMP 1/X** – When the WIND/TEMP page is first selected, it displays the predicted altitude as well as the predicted wind and temperature at that altitude for the waypoint. This is shown in Figure 5-26.

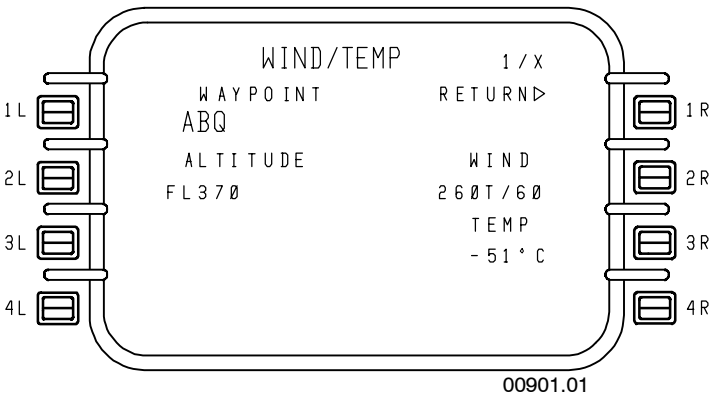


Figure 5-26

- **1L** – The waypoint is displayed. No entry is permitted. However, the PREV and NEXT keys can be used to cycle through the waypoints in the flight plan.
- **1R** – Pressing this line select returns the display to the PERF PLAN page.
- **2L** – The predicted altitude from the performance computations is displayed here. Altitude entries are permitted. They are used to assign an altitude to an entered wind and/or temperature.
- **2R** – The wind displayed is the wind being used for performance computation. This wind is a blend of sensed wind (when airborne) and entered winds. Wind entries in degrees (true and magnitude) can be entered.
- **3R** – The predicted static air temperature is a blend of sensed and entered values. Temperature is entered in degrees Celsius ($^{\circ}\text{C}$).
- **4L** – Upon entry of any data on the WIND/TEMP page, the FMS displays the CLEAR prompt at 4L. This is shown in Figure 5-27. Selection of this prompt clears all entries on the page and returns the default values displayed when the page was first accessed.
- **4R** – Upon entry of a valid wind/temperature, the FMS displays the ENTER prompt at 4R. This is also shown in Figure 5-27. A valid wind/temperature entry requires entry of an altitude, and entry of wind and/or temperature. When an entry is valid, the data is displayed in inverse video and the ENTER prompt appears.

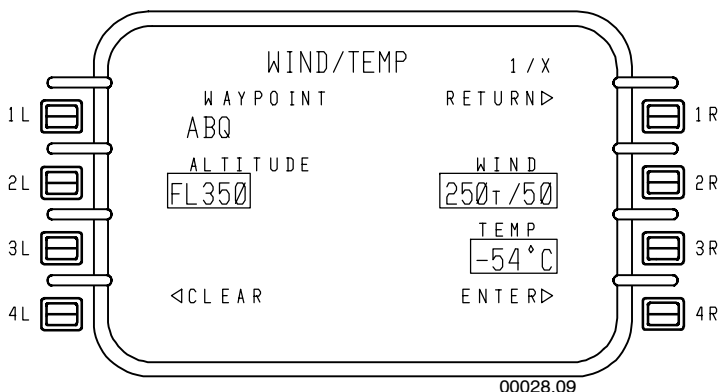


Figure 5-27

WIND AND TEMPERATURE MODEL BLENDING

The FMS wind and temperature model blends wind and temperature entries with the current position sensed wind and temperature. The sensed wind and temperature are blended in proportion to the distance away from the aircraft. For example, at present position, sensed wind and temperature are blended at 100%. At 200 NM, sensed is blended 50% and entered at 50%. At 400 NM, the blend is 20% sensed and 80% entered.

WIND AND TEMPERATURE MODEL ENTRIES

When viewing the WIND/TEMP page, the blended wind and temperature are displayed. Because of this blending, the page does not necessarily reflect the exact pilot entry. The following describes the effect of each type of entry on wind and temperature used by the FMS:

- **No Entry** – If wind or temperature are not entered on any page, a wind of zero and International Standard Atmosphere (ISA) temperature is assumed for each waypoint at every altitude. Performance planning is based on zero wind and ISA temperature plus the blended sensed wind and temperature as previously described.
- **Average Entry Only** – If an average wind and/or temperature (ISA DEV) is entered on the PERF INIT 4/5 page, it applies to every waypoint in the flight plan. The wind is ramped down from the entered altitude to produce a lower wind at lower altitudes. At altitudes above the tropopause, the wind is assumed to be constant.
- **Entry at Waypoint** – Wind and temperature can also be entered at each waypoint on the WIND/TEMP page. When an entry is made at an individual waypoint, it erases any previous entry. The entry is applied to each waypoint forward in the flight plan until a waypoint with another entry is encountered. This permits long flight plans to be subdivided into segments for the purpose of making wind/temperature entries. After an entry has been made, the 4L prompt CLEAR is displayed. This prompt serves as a reminder of where entries have been made. It also clears those entries.

RECOMMENDED ENTRIES

If the wind and temperature are forecast to be fairly constant over the route of flight, an average wind and temperature (ISA DEV) entered on the PERFORMANCE INIT 4/5 page is sufficient. If the flight is short, this is typically a good approximation. The ISA DEV entry should be left at zero if no forecast is available. The temperature variation at high altitudes are usually small and do not impact planning as much as wind variations.

If the wind and temperature are predicted to be significantly different at various flight plan waypoints, waypoint entries should be made. This can be done after an average entry is made or in place of average entries. Waypoint entries are applied forward, so a few representative entries can be made for segments of any length.

For long flight plans, it is recommended to enter the best estimate of the average cruise wind. For shorter flight plans, entered wind matters for preflight. Once in cruise, the sensed wind takes precedence (refer to Wind and Temperature Model Blending on page 5-34).

WIND AND TEMPERATURE AND PERFORMANCE PLANNING

Temperature and especially wind can play a significant role in performance planning. The wind can account for as much as one-third of the groundspeed. If flying a fixed Mach number, the true airspeed is roughly 5% higher if the temperature is increased by 20°C. The increased temperature also affects the fuel flow, the MAX attainable altitude, etc. Therefore, the closer the entered winds and temperatures are to the actual encountered conditions, the better the FMS performance predictions.

TAKEOFF

The FMS computes head/tail and crosswind components as well as density altitude for takeoff.

- **TAKEOFF 1/3** – Figure 5-28 displays data base information about the departure runway (if one has been selected).

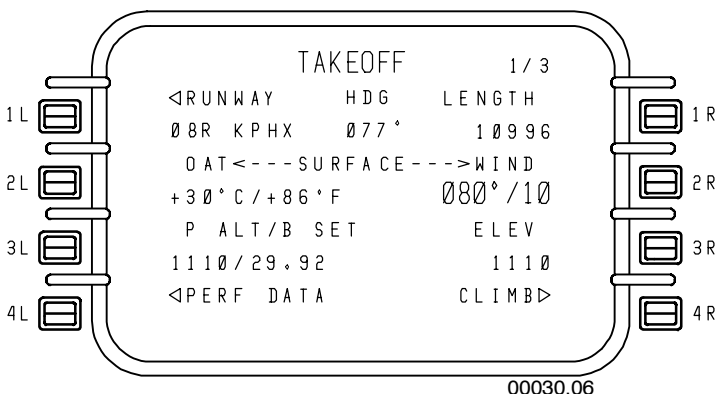


Figure 5-28

- **1L** – The selected runway identifier is displayed. If no runway has been selected on the DEPARTURE pages, the field displays dashes. Entries are permitted and can be made using the two-digit identification (e.g., 29 meaning 290°). Entries in degrees require a three digit input. Selection of 1L, with no entry in the scratchpad, results in display of the DEPARTURE page. See page 6-64 for additional details.
- **1R** – The available runway length and it's magnetic heading is displayed. If no runway has been selected, entry prompts are displayed. An entry of runway length can be made to override the data base information or supply the length when the runway is not in the data base. Note that the actual takeoff and landing length of a runway may differ from the FMS data base due to displaced threshold, stopway, or temporary relocated threshold.
- **2L** – The sensed static air temperature is displayed in this field. An entry can be made in degrees Celsius. Entries in degrees Fahrenheit require a leading slash (/). The temperature is used to compute density altitude.
- **2R** – The surface wind can be entered here. The wind entry is used to compute the head/tail and crosswind components.
- **3L and 3R** – The FMS computed barometric setting and pressure altitude are displayed on this line. The pressure altitude is used for the density altitude computation. The runway elevation from the navigation data base is displayed if a runway has been selected. When a runway has been selected, the FMS computes the pressure altitude based on the field elevation and the sensed barometric altitude.

Entry of barometric setting is permitted and can be made in inches or millibars. Use *DELETE* to return default values and units. Entries for elevation and pressure altitude are permitted.

- **TAKEOFF 2/3** – Figure 5–29 displays the calculated data from the information on the TAKEOFF 1/1 page.

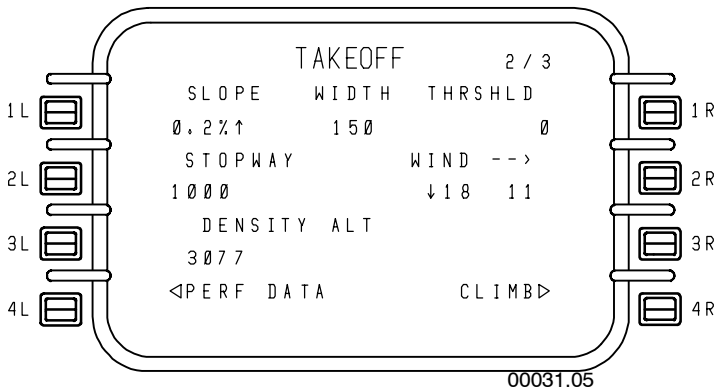


Figure 5-29

- **1L** – The FMS computed slope of the runway is displayed. The FMS computes the slope by taking the elevation of the far end of the runway minus the elevation of the near end of the runway and dividing by the runway length. Positive slopes are shown with an up arrow (↑). Negative slopes are shown with a down arrow (↓). If no runway has been selected, entry prompts are displayed. An entry of slope can be made to override the data base information or supply the slope when the runway is not in the data base.
- **1R** – The width and displaced threshold of the runway, if available from the data base, are displayed. An entry for displaced threshold can be made on this line. The default is 0 feet.
- **2L** – The stopway distance from the navigation data base is displayed. If no runway has been selected, entry prompts are displayed.
- **2R** – Head/tailwind and crosswind resolved by the runway heading and the surface wind entry are displayed.
- **3L** – Density altitude computed from the pressure altitude and the surface temperature is displayed.

- **TAKEOFF 3/3** – Figure 5-30 is used to manually enter takeoff speeds.

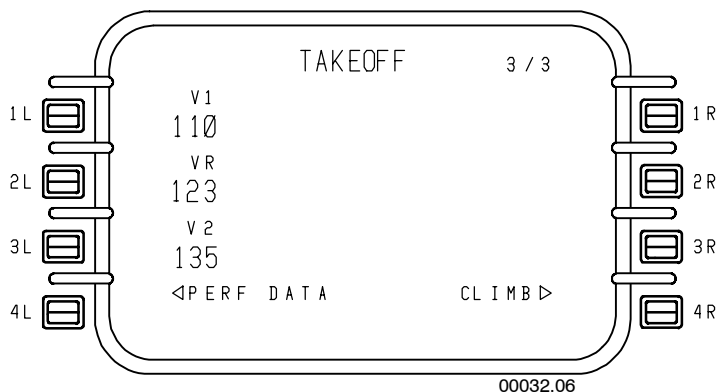


Figure 5-30

This page is displayed if takeoff V_{SPEEDS} have been configured. Takeoff V_{SPEED} labels can be configured manually on the T.O. V_{SPEED} LABELS page. It can be configured automatically by loading an aircraft data base that has the aircraft specific takeoff V_{SPEED} label defined in it. Access to the T.O. V_{SPEED} LABELS page is from the VSPD LABELS prompt on the FMS SETUP page (refer to V_{SPEED} LABELS on page 6-170). Labels for up to 6 V_{SPEEDS} can be configured.

NOTE: The T.O. V_{SPEED} LABELS page is automatically configured to the aircraft type defaults when the aircraft data base is loaded.

These speeds are displayed on the Electronic Flight Instrument System (EFIS) for some, but not all, aircraft types.

- **1L through 3R** – Enter each V_{SPEED} on the appropriate line. The entered speeds are canceled when the aircraft is 1500 feet AGL and more than 10 knots above the highest V_{SPEED} .

CLIMB

The climb page is available only if the FULL PERF mode is used. Performance initialization must be completed before data is displayed on this page. Some items are for display only, but a climb speed schedule and TOC altitude can be entered.

- **CLIMB 1/1** – Figure 5-31 displays the following data:

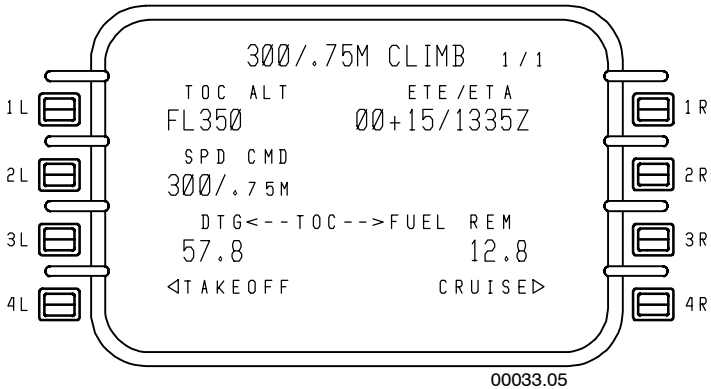


Figure 5-31

- **1L** – Top of Climb Altitude (TOC ALT) is displayed here. It is the same altitude as the cruise altitude on the PERF DATA 1/4 page. An entry is allowed in FL or in feet. An entry changes the cruise altitude displayed on all perf pages. Entering *DELETE* initiates a re-computation of the optimum altitude.
- **1R** – The Estimated Time Enroute (ETE) to TOC (on the ground) and the Estimated Time of Arrival (ETA) at TOC (airborne or if ETD entered) are displayed. No entries are permitted.
- **2L** – The speed command displayed in this field is the current climb speed command in CAS/MACH. The controlling speed (CAS or MACH) is displayed in large characters and the other in small characters. The speed command can be less than the selected speed schedule (shown in the title). This is because of the speed/altitude limit or climb speed constraints.

A speed schedule can be entered on this page. Either CAS or MACH or both can be entered. If a speed is entered on this line, it changes and selects the manual speed schedule on the OR page of the PERFORMANCE INIT 2/5 page. If only CAS or only MACH are entered, the manual speed retains the previous value for the unentered item. For example, if a CAS value is entered, the manual speed schedule is changed to the new CAS value and the previous MACH value. Both CAS and the corresponding MACH value are selected as the active climb speed schedule. Entering *DELETE* returns to the default speed schedule.

- **3L and 3R** – The Distance To Go (DTG) to TOC and the fuel remaining (FUEL REM) at TOC are displayed on this line. No entries are permitted.

CRUISE

The two CRUISE pages are available only if the FULL PERF mode is used. Performance initialization must be completed before data is displayed. Some items are for display only, but entries of speed schedule and cruise altitude are permitted.

The two CRUISE pages can be accessed through the PERF INDEX or from prompts on the CLIMB or DESCENT pages.

- **CRUISE 1/2** - Figure 5-32 has a title that reflects the CRUISE speed mode selected during PERF INIT. In this example, the speed mode is long range cruise.

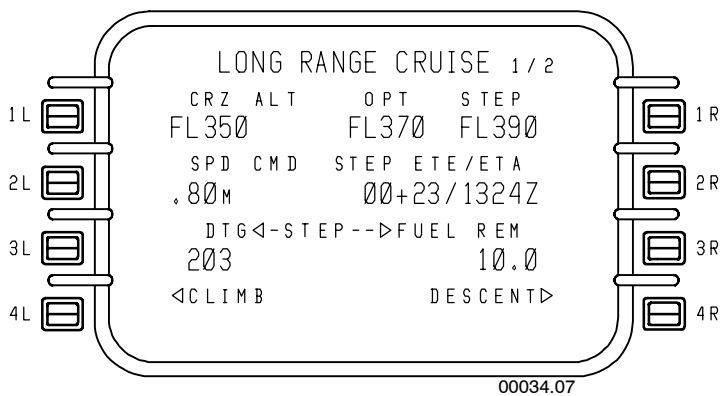


Figure 5-32

- **1L** - The cruise altitude is displayed here. It is the same altitude as the cruise altitude on the PERF DATA 1/4 page. Entries are made in FL or in feet. Entering *DELETE* initiates a re-computation of the optimum altitude.
- **1R** - The optimum altitude and step climb altitude are displayed here. No entries are permitted. The optimum altitude is the current optimum altitude depending on the current gross weight, temperature, and scheduled cruise speed. The current airspeed does not matter. This is because the optimum altitude definition changes with the speed mode. The step altitude reflects the sum of the cruise altitude and the step increment.
- **2L** - The speed shown in this field is the current cruise speed command, either a CAS or a MACH. Only the controlling speed is shown even if the cruise speed mode is a CAS/MACH pair. CAS, MACH or both (separated by a slash (/)) can be entered.

Entering *DELETE* returns to the default speed schedule LRC. Changing the speed schedule on this page also changes the PERFORMANCE INIT 2/5 page. The MAX SPD and the MAX END cruise speed modes can be selected only from the PERFORMANCE INIT 2/5 page. If the speed command is being limited, it is displayed in inverse video.

- **2R** – The ETE and ETA to the Bottom Of Step Climb (BOSC) point are displayed. No entries are permitted. Data is displayed only if the performance function is planning a step climb.
- **3L and 3R** – The Distance To Go (DTG) and the fuel remaining (FUEL REM) at the BOSC point are displayed. No entries are permitted. Data is displayed only when a step climb is planned.

Additional Detail about Step Climb

The data is displayed only if a step increment has been selected and the mission prediction is planning a step. For example, if the flight plan is short enough, no step climb may be computed even though a step increment has been entered. For long flight plans, multiple step climbs may be planned. Data for the next step is displayed on the CRUISE 1/2 page.

If the cruise altitude is not at or close to the optimum altitude, the distance to the step reflects the distance to TOC. This is because a step can be taken as soon as the TOC is reached.

When the cruise speed mode is MAX SPEED, the optimum altitude and the step information pertains to maximizing the true airspeed and not the range.

Recommended Use of Step Climbs

Step climbs are most useful when the pilot wants to optimize the range of the aircraft. Cruise speed modes of LRC or a manual speed schedule are most applicable for optimizing range. Cruise speed modes of MAX SPD or MAX END are used to maximize speed or time. The step climb calculation always calculates the optimum altitude for the chosen cruise speed mode.

It is not uncommon for the first step climb to be immediately available when initial cruise altitude is reached. If this is the case, the distance to bottom of step climb is the same as the distance to TOC. It is displayed as PAST if a level off is made at the initial cruise altitude.

VNAV and Step Climbs

When the aircraft approaches the BOSC point, the FMS issues the vertical track alert. The alert reminds the pilot to set the altitude selector to a higher altitude (if cleared by ATC). This allows VNAV to automatically initiate the climb. If the aircraft is past the BOSC, the pilot must initiate the climb by dialing up the altitude selector and pressing the flight level change button.

- **CRUISE 2/2** - Figure 5-33 shows range and TOD information. No entries are permitted.

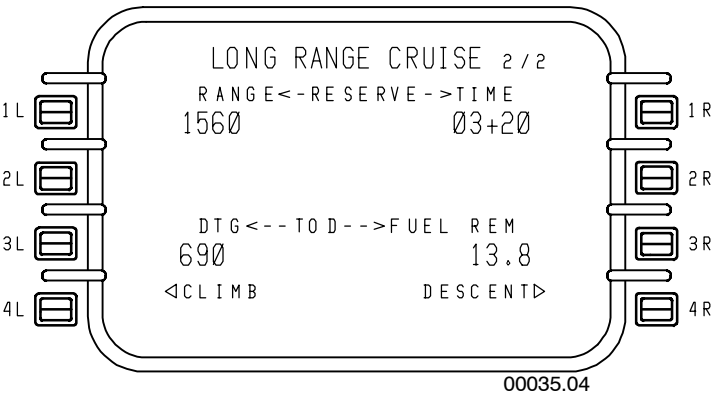


Figure 5-33

- **1L and 1R** - This line shows the range in nautical miles where the fuel remaining equals the reserve fuel. The corresponding time to reserve fuel is also given. The predictions are based on flying the active flight plan to the destination at the given cruise speed schedule. Assuming the range to reserve goes beyond the destination, the predictions after the destination are made at the cruise altitude but with zero winds. No entry is permitted.
- **3L and 3R** - These two lines display the distance to TOD and predicted fuel remaining at TOD. No entry is permitted.

DESCENT

The descent page is available only if the FULL PERF mode is used. Performance initialization must be completed before data is displayed. Some items are for display only, but speed schedule and descent angle can be entered.

- **DESCENT 1/1** – Figure 5-34 has a title line that reflects the selected descent speed schedule.

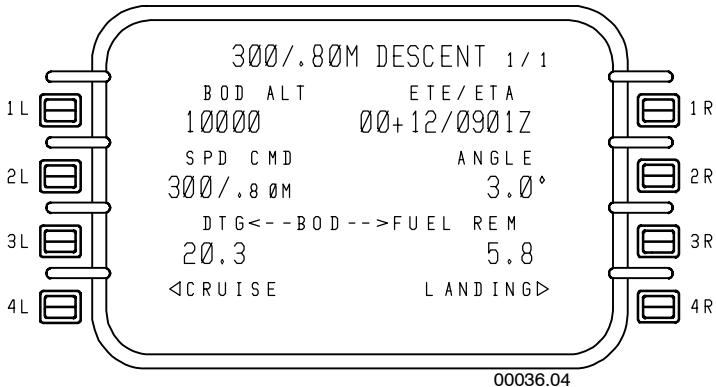


Figure 5-34

- **1L** – Bottom of Descent Altitude (BOD ALT) is displayed. The BOD altitude is the destination elevation if there are no altitude constraints in the descent. If there are one or more descent altitude constraints, the active BOD constraint is always displayed.
- **1R** – The Estimated Time Enroute (ETE) to BOD (on the ground) and the Estimated Time of Arrival (ETA) at BOD (when airborne or if ETD is entered) are displayed. No entries are permitted.
- **2L** – The speed command displayed in this field is the current descent speed command in CAS/MACH. The controlling speed (CAS or MACH) is displayed in large characters and the other in small characters. The speed command may be less than the selected speed schedule (shown in the title). This is because of the speed/altitude limit or descent speed constraints.

A speed schedule can be entered on this page. Either CAS or MACH or both can be entered. If a speed is entered on this page, it changes and selects the manual speed schedule on the OR page of the PERFORMANCE INIT 2/5 page. If only CAS or

MACH are entered, the manual speed retains the previous value for the unentered item. For example, if a CAS value is entered, the manual speed schedule is changed to the new CAS value and the previous MACH value. Both CAS and the corresponding MACH value are selected as the active descent speed schedule. Entering *DELETE* returns the default speed schedule.

- **2R** – The default descent angle is displayed here. Entries change the PERFORMANCE INIT 2/5 page. In VFLCH, the TOD location is computed using this angle. However, the angle (rate) of descent is controlled by the thrust setting. In VPATH, this is the glidepath angle used for descent.
- **3L and 3R** – The Distance To Go (DTG) to BOD and the fuel remaining at BOD are displayed on this line. No entries are permitted. If no altitude constraint has been entered for the descent, the BOD coincides with the destination.
- **4R** – Within 200 NM of the destination, the ARRIVAL prompt is shown on the DESCENT (and FLIGHT PLAN) page. Once an arrival runway is selected, the LANDING prompt is displayed.

Additional Details about Default Descent Angle

The default descent angle is used to place the TOD. If there are no altitude constraints in the descent, the destination elevation is the reference point. The descent angles can also be entered individually at any altitude constraints or they are supplied as part of an arrival or an approach. In that case, the TOD is based on the active BOD and the entered angle. The descent angle displayed on the DESCENT page is always the default descent angle from performance initialization. It could, therefore, differ from the angle flown on any individual path.

LANDING

The FMS computes head/tail and crosswind components as well as density altitude for landing.

- **LANDING 1/3** – Figure 5-35 displays data base information about the arrival runway if one has been selected.

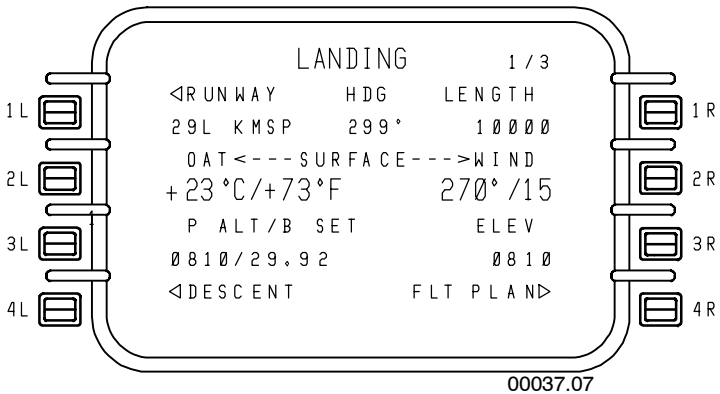


Figure 5-35

- **1L** – The selected runway identifier is displayed. If no runway has been selected on the ARRIVAL pages, the field displays dashes. Selection of this line provides access to the ARRIVAL pages for selection of a runway. Entries are permitted and can be made using the two-digit identification (e.g., 29 meaning 290°). Entries in degrees require a three-digit input. The runway heading is used to resolve the wind into head/tail and crosswind components.
- **1R** – The available runway length and its magnetic heading is displayed. If no runway has been selected, entry prompts are displayed. Entry of a runway length can be made at any time.
- **2L** – Entry prompts are displayed in this field. An entry can be made in degrees Celsius. Entries in degrees Fahrenheit require a leading slash (/). The temperature is used to compute density altitude.
- **2R** – The surface wind can be entered. The wind entry is used to compute the head/tailwind and crosswind components.
- **3L and 3R** – The FMS computed barometric setting and pressure altitude are displayed on this line. The pressure altitude is used for the density altitude computation. The runway elevation from

the navigation data base is displayed if a runway has been selected. When a runway has been selected, the FMS computes the pressure altitude based on the field elevation and the sensed barometric altitude.

Entry of barometric setting is permitted and can be made in inches or millibars. Use *DELETE* to return default values and units. Entries for elevation and pressure altitude are permitted.

- **LANDING 2/3** – Figure 5-36 displays the calculated data from the information on the LANDING 1/3 page.

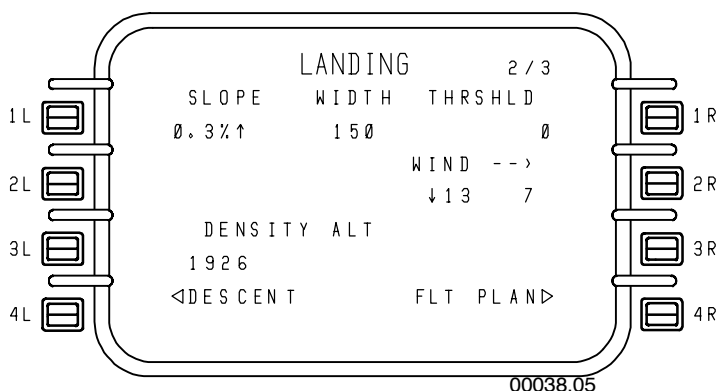


Figure 5-36

- **1L** – The slope of the runway is displayed. If no runway has been selected, entry prompts are displayed. The width of the runway is displayed if a runway has been selected. No entry is permitted.
- **1R** – The threshold of the runway is displayed. If no runway has been selected, entry prompts are displayed.
- **2R** – Head/tailwind and crosswind resolved by the runway heading and the surface wind entry are displayed.
- **3L** – Density altitude computed from the pressure altitude and the surface temperature is displayed.

- **LANDING 3/3** – Figure 5-37 is used to enter landing speeds.

This page is displayed if landing V_{SPEEDS} have been configured. Landing V_{SPEED} labels can be configured manually on the LDG VSPEED LABELS page. It can be automatically configured by loading an aircraft data base that has the aircraft specific landing V_{SPEED} labels defined in it. The LDG VSPEED LABELS page is accessed from the VSPD LABELS prompt on the FMS SETUP page (refer to VSPEED LABELS on page 6-170). The labels for all the V_{SPEEDS} can be customized and up to 6 speeds selected. Landing speeds can be entered any time and are canceled upon landing. These speeds are displayed on the EFIS for some aircraft types.

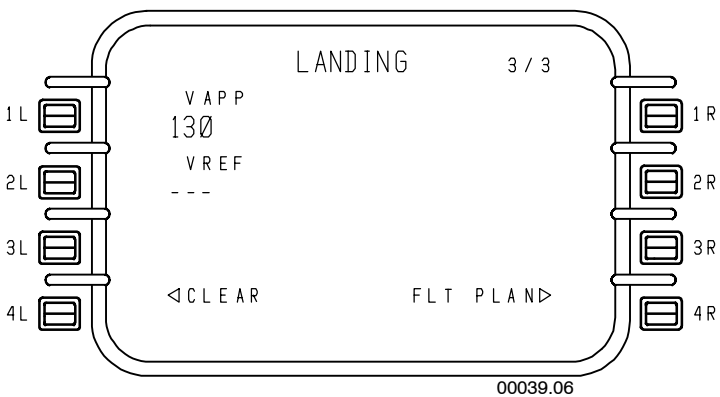


Figure 5-37

- **1L through 3R** – Enter each V_{SPEED} on the appropriate line.

WHAT-IF INITIALIZATION

This function allows for the review and evaluation of performance changes to the active flight plan prior to making the changes. For example, an altitude change can be checked before requesting Air Traffic Control (ATC) approval. If, after evaluation, the pilot wants to make the change, the WHAT-IF performance initialization can be activated into the active flight plan.

The WHAT-IF function is available only in the FULL PERF mode.

The four WHAT-IF INIT pages are initialized the same way as the PERFORMANCE INIT pages 2 through 5. However, some specific rules apply. The WHAT-IF INIT 1/4 page is shown in Figure 5-38.

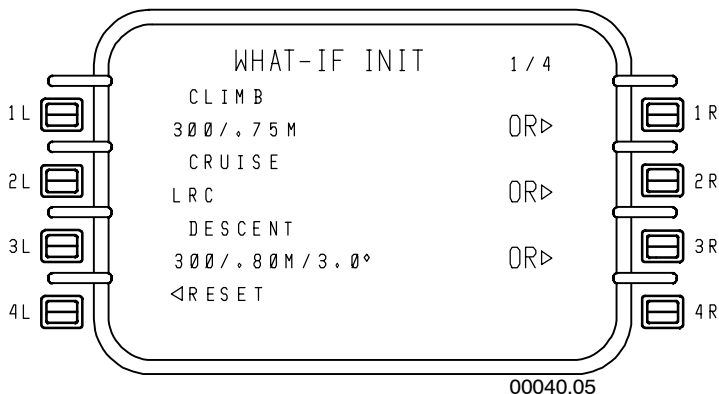


Figure 5-38

Rules for the WHAT-IF Initialization

- All entry parameters default to the selections made on the PERFORMANCE INIT page and are displayed in small characters.
- If an entry is made, it is displayed in large characters. This differentiates between WHAT-IF INIT and the active PERFORMANCE INIT values.
- Entering *DELETE* returns an entry back to the active PERFORMANCE INIT value.
- Optimum cruise altitude can be selected only by typing in OPT or OPTIMUM. Entering *DELETE* to the cruise altitude returns the active PERFORMANCE INIT cruise altitude.
- LRC and NBAA reserve cannot be selected by entering *DELETE* as on the active PERFORMANCE INIT pages. These modes must be line-selected on the WHAT-IF INIT pages.
- **When all required changes to WHAT-IF INIT have been made, the CONFIRM INIT prompt on page 4 must be selected to start calculations. This is shown in Figure 5-39.**
- Once the WHAT-IF data has been computed, all initialization parameters are displayed in large characters. At that point the WHAT-IF initialization no longer tracks changes made to the active initialization.

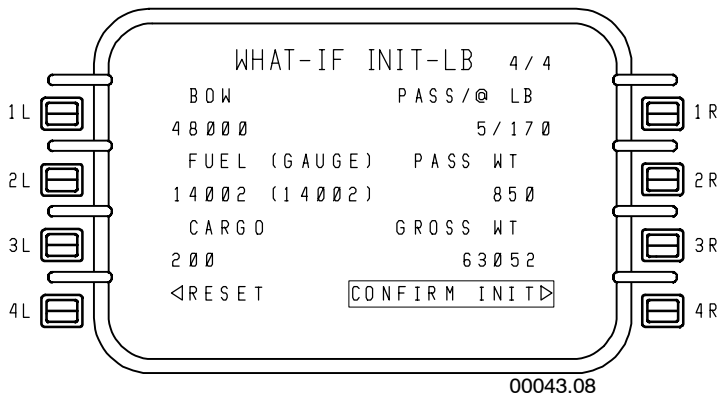


Figure 5-39

Resetting the WHAT-IF Initialization

The RESET prompt at 4L on all WHAT-IF INIT pages displays a page for reset of the WHAT-IF INIT pages. This is shown in Figure 5-40. If YES is selected, any changes made in WHAT-IF INIT are canceled. All of the WHAT-IF INIT values are reset to match PERFORMANCE INIT values. If NO is selected, the display reverts back to WHAT-IF INIT with no change.

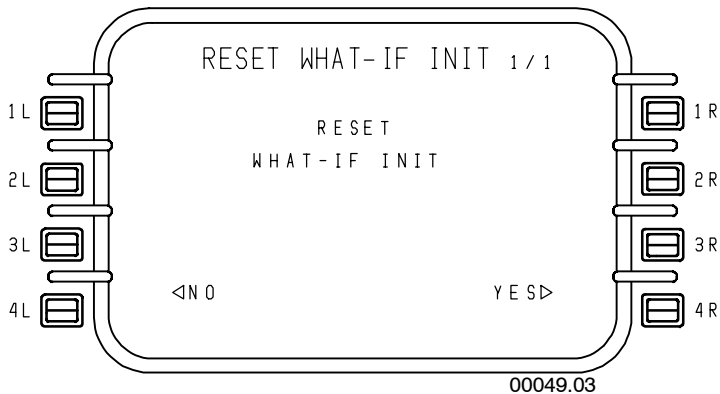


Figure 5-40

WHAT-IF DATA

There are three WHAT-IF DATA pages. The first page is similar to the PERF DATA 1/4 page. The other two pages are similar to the two CRUISE pages. On all three pages, the WHAT-IF SEL prompt at 4R displays a page that is used to select the WHAT-IF conditions to the active PERFORMANCE INIT. This is shown in Figure 5-44. The 4L prompt accesses back to the WHAT-IF INIT page.

- **WHAT-IF DATA 1/3** - Figure 5-41 displays the cruise and ceiling altitude and step increment for the WHAT-IF conditions. The next three lines are a comparison between the active and the WHAT-IF performance predictions.

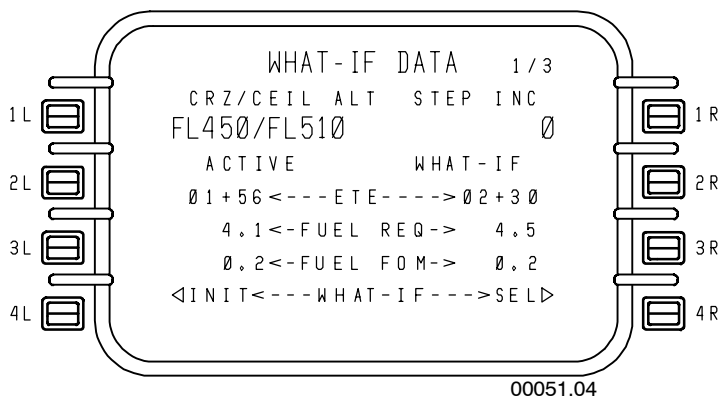


Figure 5-41

- **1L and 1R** - A change to the WHAT-IF cruise altitude and step increment can be entered on this page. Entering *DELETE* resets the cruise altitude or the step increment back to the active PERFORMANCE INIT. Optimum can be selected only on the WHAT-IF INIT 3/4 page. If optimum is selected, the calculated cruise altitude is affected by the distance to the active flight plan TOD. If far away from the TOD, the calculated cruise altitude tends to be at or close to the ceiling altitude. If close to the TOD, the calculated cruise altitude tends to be at or close to the current aircraft altitude.
- **2L, 2R, 3L and 3R** - Time and fuel required, the fuel Figure of Merit (FOM) to the destination for the current performance initialization settings, and the WHAT-IF settings are displayed for comparison. No entries are permitted. Refer to Performance Date, on page 5-27, for additional details on fuel required and FOM.

- **WHAT-IF DATA 2/3** - Figure 5-42 displays the same data as the CRUISE 1/2 page. However, the data applies to the WHAT-IF initialization only. Refer to Cruise, on page 5-40, for additional details.

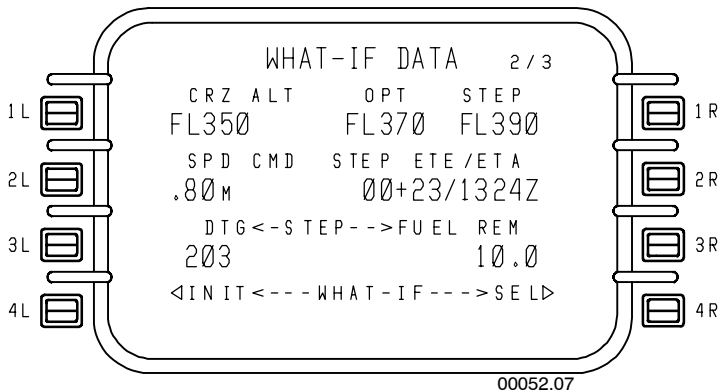


Figure 5-42

- **1L** - The WHAT-IF cruise altitude is displayed and can be entered. Entering *DELETE* returns to the active PERFORMANCE INIT cruise altitude. Optimum can be selected only on WHAT-IF INIT 3/4.
- **1R** - This line displays the current optimum altitude for the WHAT-IF cruise speed mode. The step altitude is also displayed if a WHAT-IF step increment has been selected. A step climb is not planned when the aircraft can complete the step climb before reaching the TOD.
- **2L** - The WHAT-IF cruise speed is displayed and can be entered. Entering *DELETE* returns to the active PERFORMANCE INIT cruise speed. LRC can only be selected on the WHAT-IF INIT pages.
- **2R, 3L and 3R** - These fields display the step climb data if a WHAT-IF step increment has been selected.

- **WHAT-IF DATA 3/3** - Figure 5-43 displays the same data as the CRUISE 2/2 page. However, the data applies to the WHAT-IF initialization only. No entries are permitted on this page.

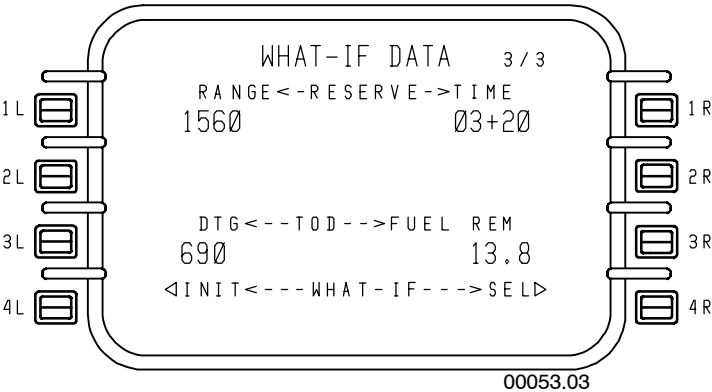


Figure 5-43

- **WHAT-IF SELECT 1/1** - Figure 5-44 has the option to activate the WHAT-IF initialization. If YES is selected, the PERFORMANCE INIT is set equal to the WHAT-IF INIT. Subsequently, the PERF DATA is recomputed. If NO is selected, the display returns to the WHAT-IF DATA with no changes made.

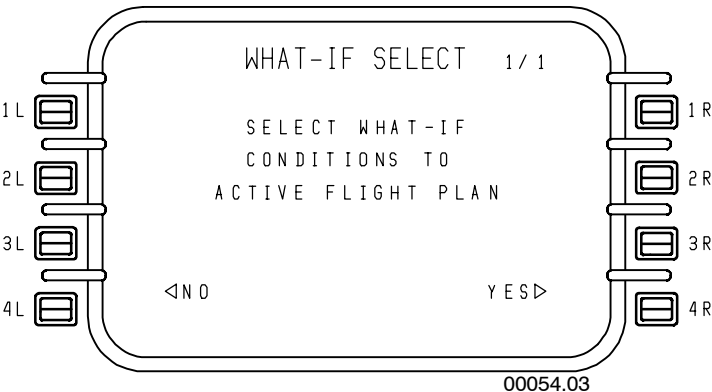


Figure 5-44

STORED FLIGHT PLAN INITIALIZATION

This function is used to calculate performance data for a stored flight plan. This allows review of performance data for a future flight. An example for use of this feature is to order the proper amount of fuel to load and/or estimate the flying time for the next leg of a trip. The information entered in the STORED FPL INIT is deleted from the FMS when power is removed.

The stored flight plan function is available only in the FULL PERF mode.

- STORED FPL INIT 1/5** – Figure 5–45 gives access to either the FPL LIST page (4L) or the FPL SELECT (4R) page. Follow Procedure 5–1 to retrieve a stored flight plan.

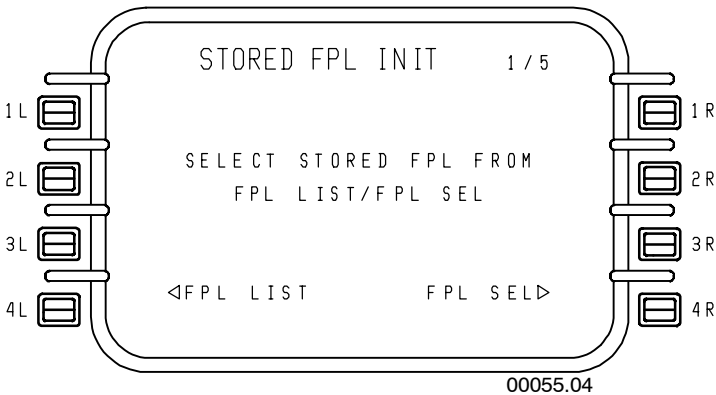
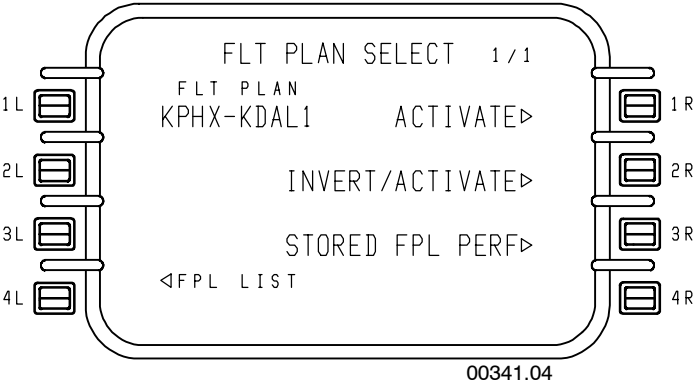


Figure 5–45

Step	Procedure 5-1 Retrieve a Stored Flight Plan for Performance Calculations
1	Select FPL LIST at 4L. This is shown in Figure 5–45.
2	Line-select the desired flight plan from the FLIGHT PLAN LIST x/x pages. This moves the flight plan name down to the scratchpad. In this example, the KPHX-KDAL1 flight plan is selected.
3	Select the FPL SEL prompt at 4R of the FLIGHT PLAN LIST x/x page. The FLT PLAN SELECT page is displayed.
4	Line-select 1L (FLT PLAN) on the FLT PLAN SELECT page. This step enters the flight plan name from the scratchpad.

Step	Procedure 5-1 Retrieve a Stored Flight Plan for Performance Calculations
5	Select the STORED FPL PERF prompt (3R). This is shown in Figure 5-46.  00341.04 Figure 5-46
6	STORED FPL INIT 2/5 is displayed where initialization can begin. By selecting the PREV key, it can be confirmed that the stored flight plan was selected.

- **STORED FPL INIT 2/5 through 5/5** – The initialization is similar to the main performance initialization on PERFORMANCE INIT pages 2/5 through 5/5. The same rules that apply to the WHAT-IF initialization also apply here. The main rule is that the defaults are the active initialization parameters, which are displayed in small characters. Some exceptions apply, however, and are listed as follows.

Rules for the Stored Flight Plan Initialization

The initialization rules are the same as for the WHAT-IF initialization with the following exceptions:

- The cruise altitude defaults to OPTIMUM, regardless of the active performance initialization. This is because the active cruise altitude may not be the best for a stored flight plan. For example, the stored flight plan may be a short leg that requires a low cruise altitude while the current flight may be flown at a high altitude and vice versa.
- The takeoff fuel allowance is set to the general default. While in flight, the active and the WHAT-IF initialization both have zero fuel for the takeoff allowance.

- The fuel must always be entered. This is required for computing a gross weight. Since fuel is not known at this time, a rough estimate is sufficient. When the fuel required is computed, that fuel weight can be reentered to refine the estimate, if significantly different from the entered fuel.

When all required entries are made, the CONFIRM INIT prompt is displayed at 4R. The CONFIRM INIT prompt must be pressed to start the calculation.

STORED FLIGHT PLAN (FPL) DATA

- **FPL DATA 1/1** - Figure 5-47 shows the stored flight data available. The title contains the name of the flight plan being calculated. The page is similar to the PERF DATA 1/4 page.

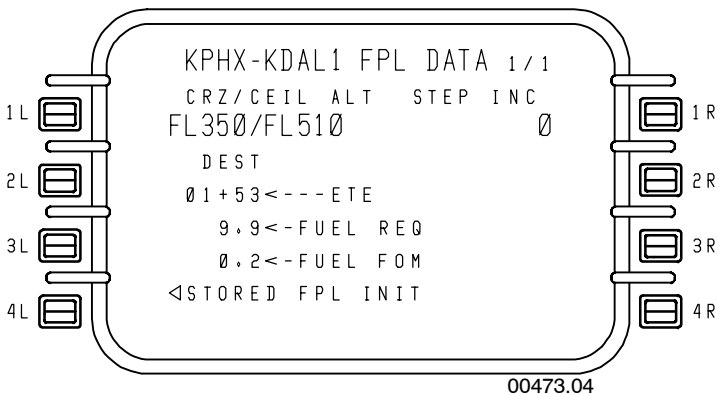


Figure 5-47

- **1L** - The cruise altitude chosen on the initialization pages or the computed optimum cruise altitude is displayed. The cruise altitude can be entered directly on this page. Entering *DELETE* reselects and recomputes the optimum cruise altitude.
- **1R** - The step increment chosen is displayed. A new entry can be made.
- **2L and 3L** - The ETE, the total fuel requirement, and the fuel FOM are displayed for the stored flight plan. The fuel required includes the takeoff allowance, the enroute fuel, the fuel reserve, and the landing allowance.

FUEL MANAGEMENT

- **FUEL MGT 1/2** - Figure 5-48 shows the current fuel quantity, fuel flow, ground speed, true airspeed, ground specific range and air specific range.

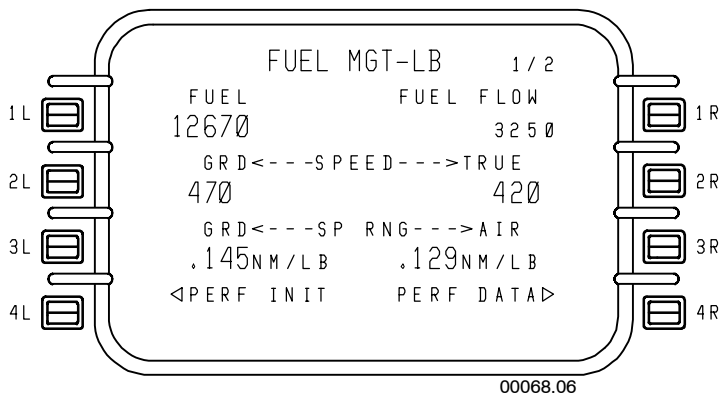


Figure 5-48

- **1L** - The current fuel weight calculated by the FMS is displayed in large characters. It is the same value as the fuel weight on the PERFORMANCE INIT 5/5 (or 4/4) page. If the performance initialization has not been completed, dashes are displayed. An entry can be made to change the PERFORMANCE INIT 5/5 page. Entering *DELETE* displays dashes. This deinitializes the performance function, and, if engaged, causes VNAV to drop.
- **1R** - The sensed fuel flow is displayed in small characters when received by the FMS. Pilot entries are permitted and displayed in large characters. Entering *DELETE* returns the display to the sensed fuel flow if one is available.

Additional Explanation of Fuel Quantity and Fuel Flow

The FMS fuel weight is equal to the gauge value when the aircraft is on the ground. This is the case when either no engines or one engine is running. Upon completion of engine start for both engines, the FMS fuel weight is set equal to the gauge value. This value is then decremented by the sensed fuel flow.

This method allows for fuel leak detection. The FMS will compute fuel weight based upon the sensed fuel flow to the engines. The gauges will provide the sensed fuel weight based

upon engine usage and leakage (if a leak exists). The FMS will display the scratchpad message COMPARE FUEL QUANTITY when the FMS fuel weight differs from the gauge value by more than 2% of the BOW. This message is inhibited if the fuel quantity has been manually entered on the PERFORMANCE INIT 5/5 page.

Entering a manual fuel flow can cause significant differences between the FMS fuel quantity and the actual fuel quantity. For this reason, it is recommended that no entry of fuel be made unless the sensed fuel flow is not available.

NOTE: Entry of a fuel flow here is not the same as entry on PERF INIT 2/5 for pilot entered GS/FF mode.

- **2L and 2R** - The current groundspeed and airspeed are displayed on this line. No entries are permitted.
- **3L and 3R** - The ground and air specific ranges are displayed on this line. The specific ranges are based on the groundspeed, airspeed, and fuel flow shown on the page. No entries are permitted.
- **FUEL MGT 2/2** - Figure 5-49 shows the individual and total engine fuel flow as well as fuel used. APU fuel flow is not available on all aircraft.

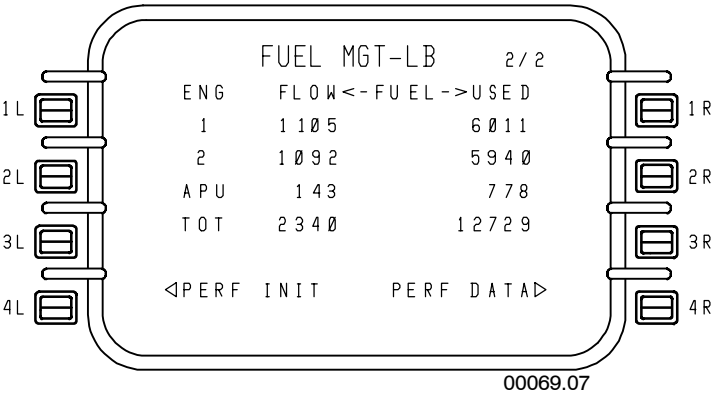


Figure 5-49

The individual engine breakdown of the total fuel flow on the FUEL MGT 1/2 page is shown on this page. The fuel used display is normally cumulative from the last powerup on the ground. The total fuel used is the same as what is displayed at 2L on the FLIGHT SUMMARY page, which can be reset (see page 6-190). Resetting fuel used on the FLIGHT SUMMARY page also resets individual engine fuel used on this page.

THRUST MANAGEMENT

The THRUST MANAGEMENT function is only available on aircraft that control thrust management via the CDU.

- **THRUST MANAGEMENT 1/1** - Figure 5-50 shows the current thrust rating mode and sync mode.

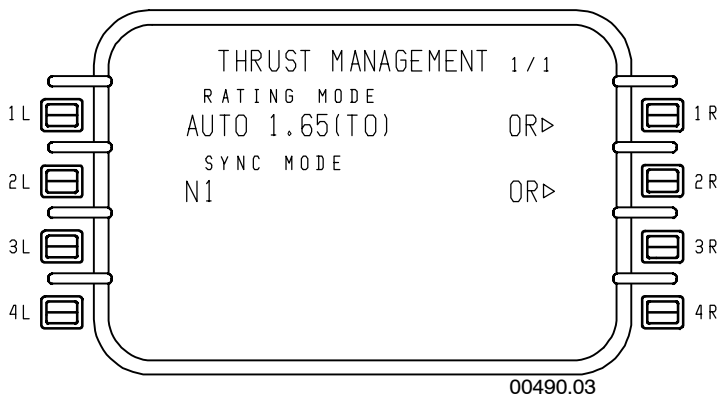


Figure 5-50

- **1L and 1R** - This line displays the current rating mode. No entry is permitted. Press 1R to access the rating mode page.
- **2L and 2R** - This line displays the active sync mode. No entry is permitted. Press 2R to access the sync mode page.
- **RATING MODE 1/1** - Figure 5-51 is used to set the rating mode. The active mode is displayed in large font.

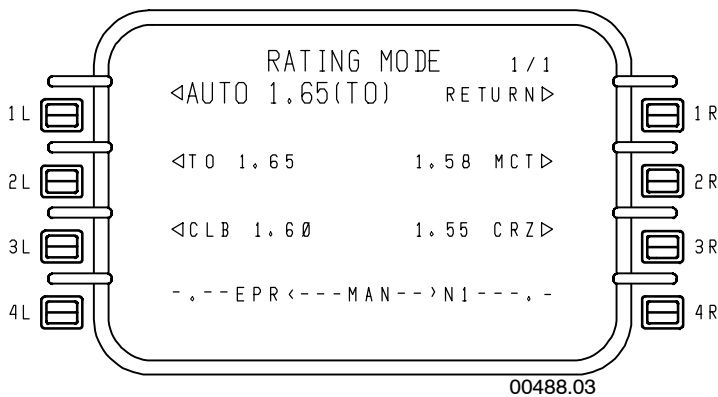


Figure 5-51

- **1L** – This line is used to select the AUTO rating mode. The active mode is displayed adjacent to the word AUTO. Selection of this line results in the FMS displaying the THRUST MANAGEMENT page with AUTO as the rating mode.
- **2L, 3L, 2R and 3R** – These lines are used to select a specific rating mode. Selection of a line results in the FMS displaying the THRUST MANAGEMENT page with the selected mode as the active mode.
- **4L** – This field is used to manually enter EPR.
- **4R** – This field is used to manually enter N1.
- **1R** – The RETURN prompt can be used to return to the THRUST MANAGEMENT 1/1 page without making any selections.
- **SYNC MODE 1/1** – Figure 5-52 is used to select the engine sync mode.

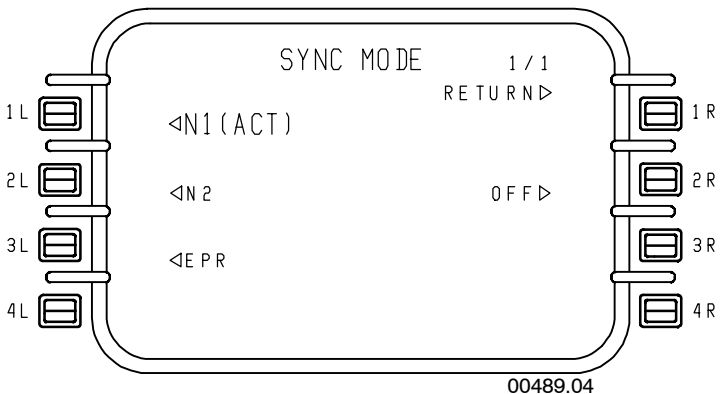


Figure 5-52

- **1L, 2L and 3L** – Selection of a prompt makes the displayed parameter the engine sync mode. Upon selection, the THRUST MANAGEMENT 1/1 page is displayed.
- **2R** – Select this prompt to turn off engine sync. Upon selection, the THRUST MANAGEMENT 1/1 page is displayed.
- **1R** – The RETURN prompt can be used to return to the THRUST MANAGEMENT 1/1 page without making any selections.

SINGLE ENGINE AND ENGINE OUT

The FMS provides performance data for engine out operations. The FMS displays single engine data using the abbreviation S.E. for twin engine aircraft. For aircraft with more than two engines and one engine is not operating, the abbreviation E.O. is used for engine out data.

Following performance initialization, performance information is displayed. Figure 5-53 shows the page for twin engine aircraft (i.e., single engine operations). Figure 5-54 shows the page for aircraft with more than two engines.

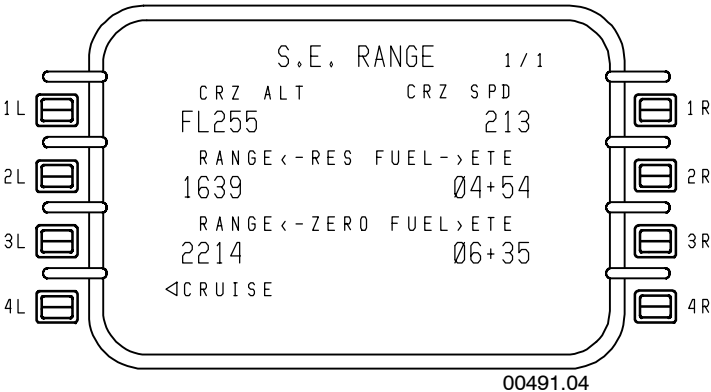


Figure 5-53

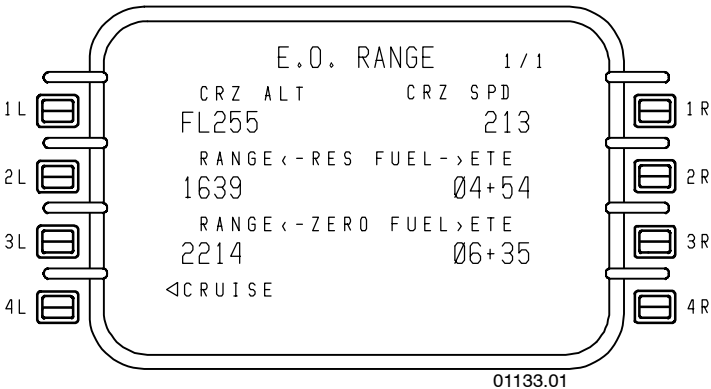


Figure 5-54

- **1L** - The optimum LRC altitude is displayed on this line. No pilot entry is permitted.
- **1R** - The LRC airspeed is displayed on this line. No pilot entry is permitted.

- **2L and 2R** – This line displays the range (in nautical miles) where the fuel remaining equals the reserve fuel. The corresponding time to reserve fuel is also displayed.
- **3L and 3R** – This line displays the range (in nautical miles) where zero fuel remains. The corresponding time to zero fuel is also displayed.
- **4L** – This prompt is used to access the CRUISE pages.

In the event of actual single engine operation, the FMS calculates all performance information based on single engine or engine-out. The titles of pages displaying performance data are changed to indicate single engine operations, as listed below.

- PERF DATA becomes S.E. PERF DATA or E.O. PERF DATA
- CRUISE becomes S.E. CRUISE or E.O. CRUISE
- CLIMB becomes S.E. CLIMB or E.O. CLIMB
- DESCENT becomes S.E. DESCENT or E.O. DESCENT
- PERF PLAN becomes S.E. PERF PLAN or E.O. PERF PLAN
- WHAT-IF becomes S.E. WHAT-IF or E.O. WHAT-IF
- PT OF NO RETURN becomes S.E. PT OF NO RETURN or E.O. PT OF NO RETURN
- EQUAL TIME POINT becomes S.E. EQUAL TIME POINT or E.O. EQUAL TIME POINT

AIRCRAFT DATA BASE

The aircraft data base includes information specific to an aircraft type and learned information specific to the tail number. The aircraft data base is furnished by Honeywell. They are available on the last disk of the navigation data base disks received each month. The aircraft data base must be loaded in order to have the FULL PERF option available.

The aircraft data base can be downloaded from the aircraft using the data loader. This downloaded file is identified by tail number and it contains the learned information. It is recommended that the aircraft data base be downloaded periodically. The downloaded file can be used to upload data when needed (i.e., when replacing the FMS). Uploading this saved file preserves the learned information so the system will not have to start over again.

Refer to page 6-185 for steps to uploading and downloading aircraft data bases. Aircraft data bases cannot be cross loaded from one FMS to another.

6. Navigation

NAVIGATION (NAV) INDEX

The NAV INDEX pages are accessed through the NAV function key on the Control Display Unit (CDU). This is shown in Figure 6-1.



NAV Index Access
Figure 6-1

When the NAV button is pressed, NAV INDEX page 1/2, shown in Figure 6-2, is displayed. Page 2/2, shown in Figure 6-3, is displayed by using either the PREV or NEXT paging keys. These pages show navigation functions that can be selected at any time. Press the line select key adjacent to the respective function to select the function. Page numbers adjacent to each button correspond with page numbers in this manual that describe the button function.

The prompt at 2R on page 1/2, shown in Figure 6-2, is one of the following: DATA BASE, AFIS INDEX (as shown in Figure 6-4), or DATALINK (as shown in Figure 6-5).

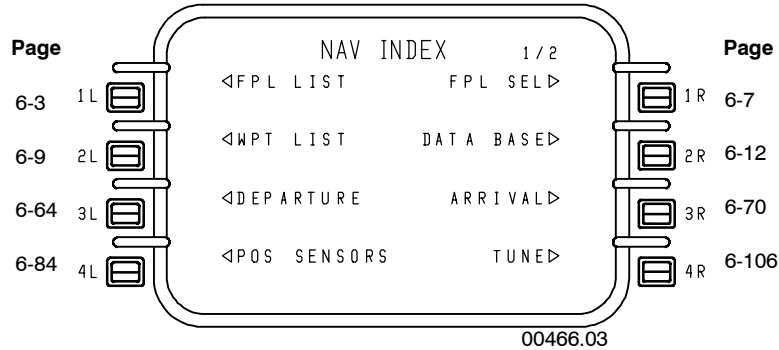


Figure 6-2

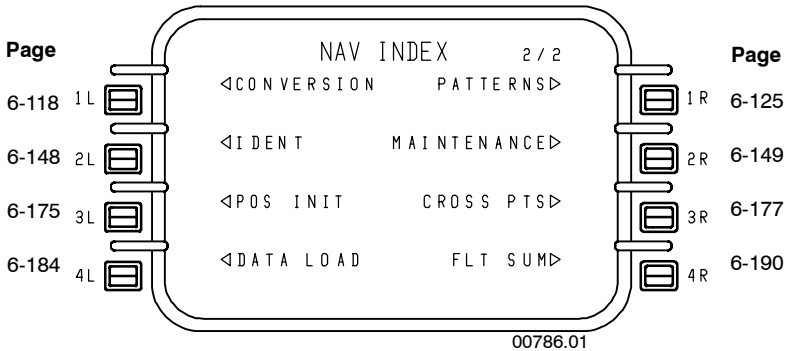


Figure 6-3

Optional Navigation Index Selections

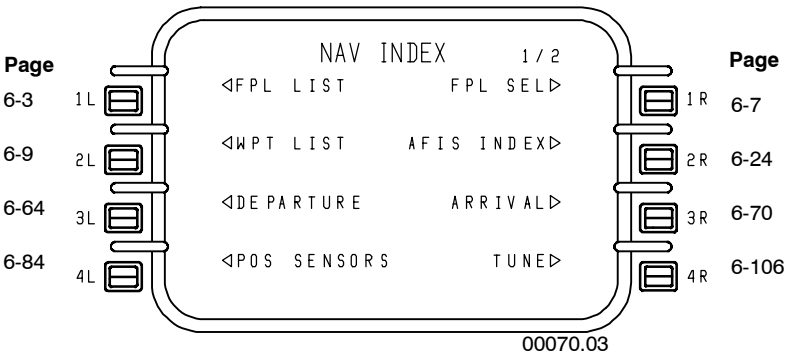


Figure 6-4

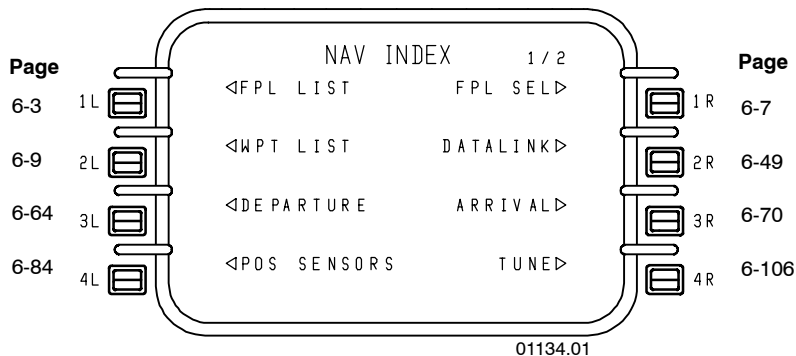


Figure 6-5

On aircraft with a Collins system, there is a third NAV INDEX page used to select options for EFIS displays. This is shown in Figure 6-6.

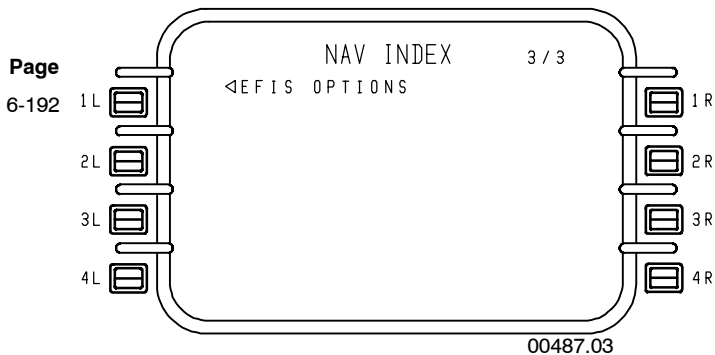


Figure 6-6

FLIGHT PLAN LIST

The FLIGHT PLAN LIST page displays a list of the pilot defined flight plans that have been stored in the FMS memory. From this page, the pilot can define a flight plan, delete flight plans, or select a flight plan to activate.

When no flight plans are stored in the FMS, the FLIGHT PLAN LIST page is blank. This is shown in Figure 6-7.

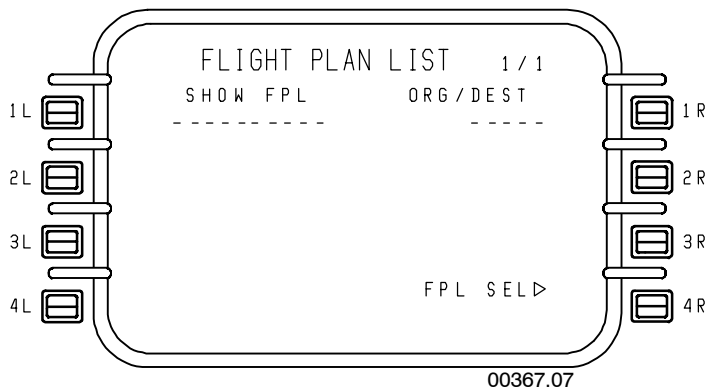


Figure 6-7

If flight plans have been defined, the page lists the flight plans by name. This is shown in Figure 6-8.

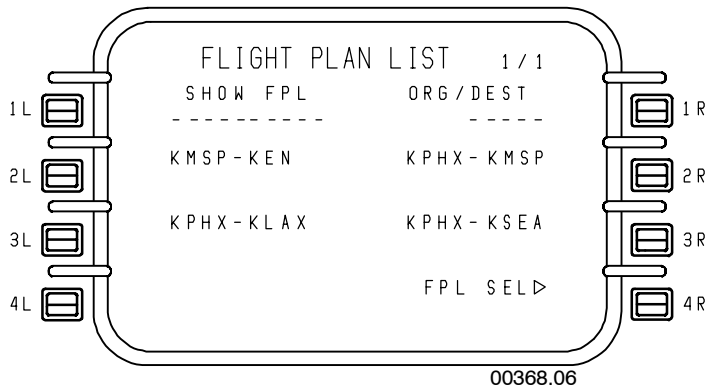
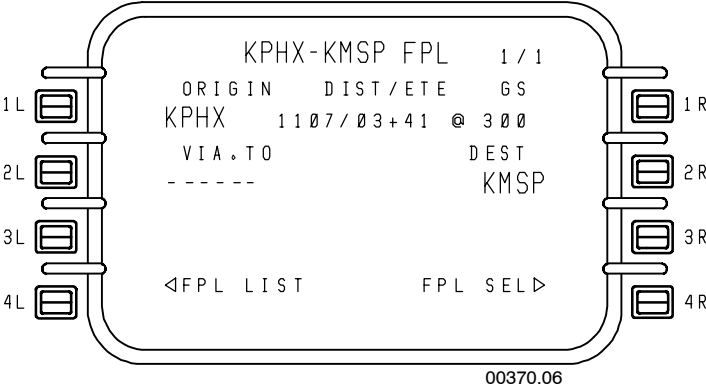


Figure 6-8

Defining Stored Flight Plans

Stored flight plans, like active flight plans, can be defined between any two non-temporary waypoints (navaids, intersections, airports, etc.). A flight plan from Phoenix to Minneapolis is used to illustrate how to define a flight plan in Procedure 6-1.

Step	Procedure 6-1 Defining a Stored Flight Plan
1	Select FPL LIST from the NAV INDEX.
2	Enter the flight plan name into the scratchpad. In this example, KPHX-KMSP is entered (refer to page 10-5 for flight plan name format).

Step	Procedure 6-1 Defining a Stored Flight Plan
3	Select SHOW FPL (1L) as shown in Figure 6-9.  Figure 6-9
4	The FMS places KPHX as the origin and KMSP as the destination. This is shown in Figure 6-10.  Figure 6-10 DETAILS – If the flight plan name is specified as the origin and destination 4-letter ICAO airport identifier separated by a dash (-), the FMS automatically fills in the origin and destination. A single alphanumeric character can be added following the destination identifier to distinguish multiple flight plans between the same origin and destination. If other formats for the flight plan name are used, the pilot can fill in the origin and destination.

Step	Procedure 6-1 Defining a Stored Flight Plan
5	Enter groundspeed at 1R if a speed other than the one shown is required. The FMS displays the distance and Estimated Time Enroute (ETE) for a direct flight from Phoenix to Minneapolis. ETE is calculated based on the groundspeed (GS) at 1R. Distance and time are updated as waypoints are added to the flight plan. The defaulted groundspeed is 300 knots.
6	Enter the route for the flight plan at the VIA.TO prompt. The following cannot be used in stored flight plans: • Temporary waypoints • SIDs, STARs, or approach procedures • Alternate flight plan and destination • Speed or angle constraints • Another stored flight plan.
7	Stored flight plans can contain patterns. If SPECIAL MISSION, under FLIGHT CONFIG, is set to ON, a larger selection of patterns can be stored (refer to Flight Configuration on page 6-164).
8	Close the flight plan by entering the destination waypoint as the last waypoint in the flight plan. This can be done by line selecting the destination from the right side of the page and inserting it on the left side of the page.

Deleting Stored Flight Plans

The DEL key is used to remove stored flight plans from the FMS memory. Procedure 6-2 describes two methods for deleting a flight plan.

Step	Procedure 6-2 Deleting a Stored Flight Plan
1	Select FPL LIST from the NAV INDEX.
2	Press the DEL key (*DELETE* is displayed in the scratchpad). Press the line select key adjacent to the flight plan name to erase it from the FMS memory. OR use step 3.
3	Press the line select key adjacent to the desired flight plan name. Select SHOW FPL (1L). Delete the origin on the stored flight plan display page.

FLIGHT PLAN SELECT

- FLT PLAN SELECT 1/1** – Figure 6–11 is used to select a stored flight plan to be the active flight plan. It can also calculate performance data of the stored flight plan. This page can be accessed from the FLIGHT PLAN LIST page (prompt at 4R) or from the NAV INDEX page.

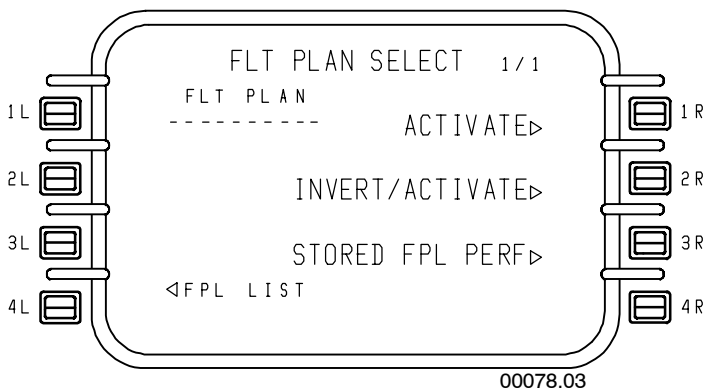
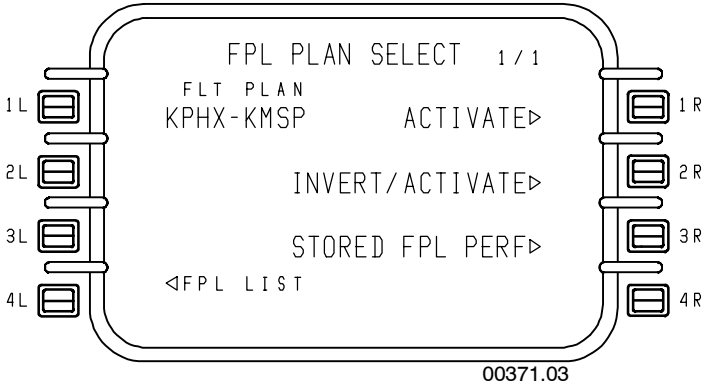
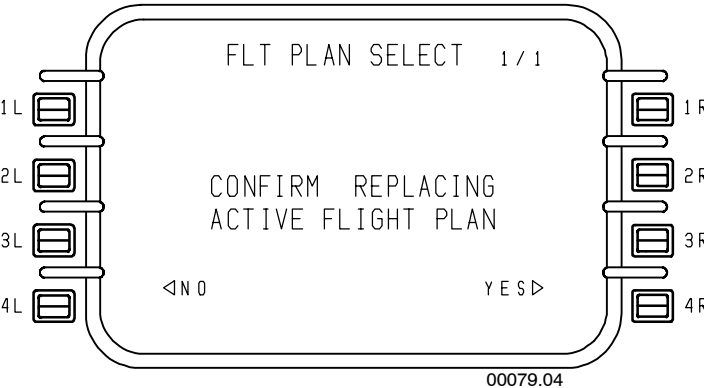


Figure 6-11

To select and activate a stored flight plan, follow Procedure 6–3.

Step	Procedure 6-3 Select and Activate a Stored Flight Plan
1	Select FPL LIST from the NAV INDEX.
2	Select desired flight plan from the list by pressing the adjacent line select key. The name is displayed in the scratchpad.
3	Select FPL SEL at 4R.
4	Press the line select key adjacent to the FLT PLAN prompt (1L) to insert the flight plan name. As an alternative, the flight plan name can be entered directly from the key pad instead of being selected from the list. If a flight plan name is entered that has not been previously defined, the FMS displays pages that are used to enter an undefined flight plan.

Step	Procedure 6-3 Select and Activate a Stored Flight Plan
5	Select ACTIVATE by pressing 1R, INVERT/ACTIVATE by pressing 2R, and STORED FPL PERF by pressing 3R. This is shown in Figure 6-12.  Figure 6-12
6	If an active flight plan exists when one of the activate prompts is selected, the FMS requires a confirmation step. This is shown in Figure 6-13.  Figure 6-13

PILOT WAYPOINT LIST

- PILOT WPT LIST 1/1** – Figure 6-14 contains a list of pilot defined waypoints that are stored in memory and any temporary waypoints (refer to temporary waypoints, page 7-2). Procedure 6-4 is used to store pilot defined waypoints. Pilot defined waypoints can be defined using latitude/longitude (LAT/LON), Place/Bearing/Distance (P/B/D), or Place/Bearing/Place/Bearing (P/B/P/B) as described in the procedure.

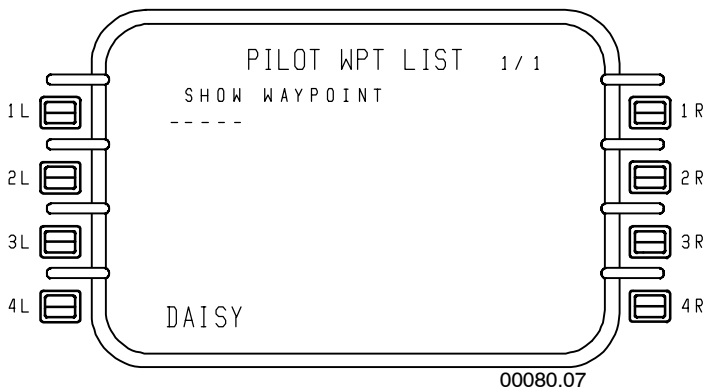
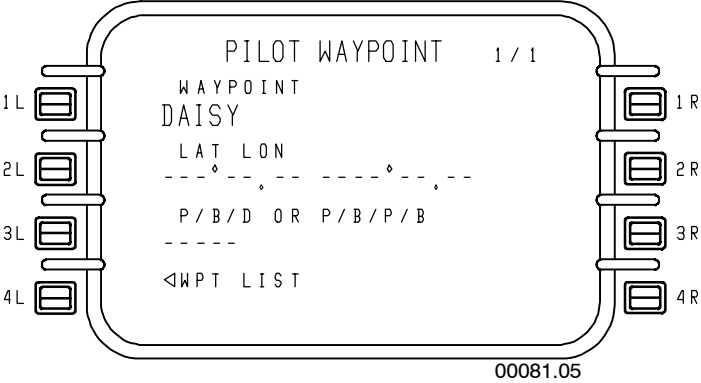
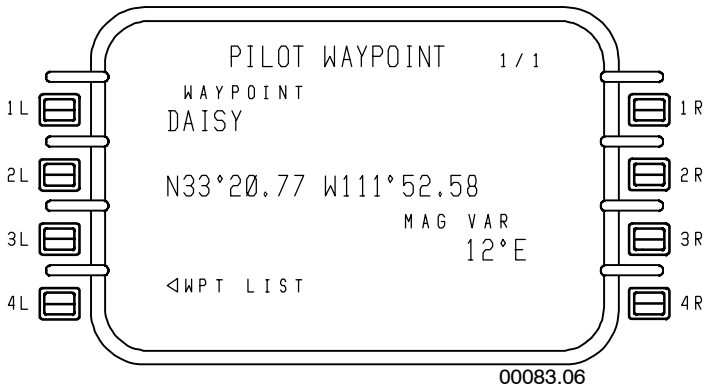
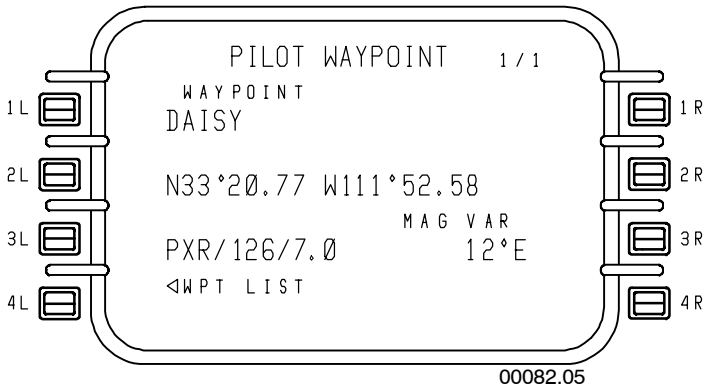
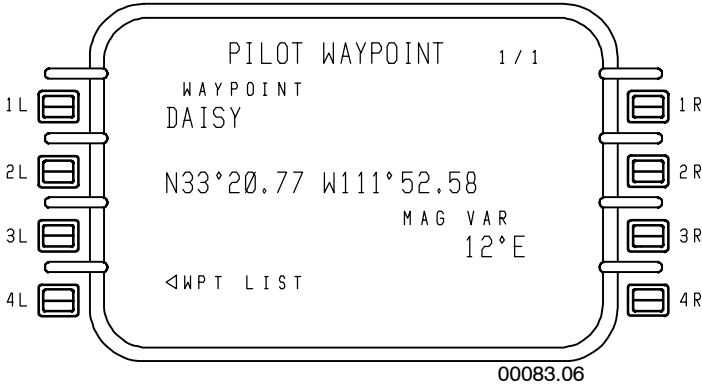


Figure 6-14

Step	Procedure 6-4 Defining and Storing Waypoints
1	Select WPT LIST from the NAV INDEX.
2	Enter an identifier of one to five characters and line select to the SHOW WAYPOINT line (1L). DAISY is used for this example.

Step	Procedure 6-4 Defining and Storing Waypoints
3	The display changes to the definition display as shown in Figure 6-15. Define DAISY by one the following three ways: step 4 (LAT LON), 6 (P/B/D), or 8 (P/B/P/B).  Figure 6-15 If a previously used identifier is entered, the definition for the waypoint is displayed. This prevents the duplication of waypoint names. A page similar to Figure 6-15 is displayed if an undefined waypoint is entered on any page that accepts waypoint entries (except the POS INIT page). For these cases, the RETURN prompt is displayed at 1R. The RETURN prompt can be used before or after a waypoint is defined. The RETURN prompt is used to return to the page where the undefined waypoint was entered. If the waypoint is not defined, the waypoint entry remains in the scratchpad. If the waypoint is defined, the waypoint entry is completed.
4	Enter Latitude/Longitude and select to 2L. N3320.77W1152.58 is used in this example.

Step	Procedure 6-4 Defining and Storing Waypoints
5	The defined waypoint is displayed and shown in Figure 6-16.  Figure 6-16
6	-OR- Enter Place/Bearing/Distance and select to 3L. Use the example, PXR/126/7, where PXR defines place, 126 defines bearing in degrees, and 7 defines distance in nautical miles. Bearing inputs are assumed to be magnetic. True bearings are designated by placing the letter T after the bearing.
7	The defined waypoint is displayed and shown in Figure 6-17.  Figure 6-17

Step	Procedure 6-4 Defining and Storing Waypoints
8	-OR- Enter Place/Bearing/Place/Bearing and select to 3L. Use the example, PXR/130/TFD/358, where PXR defines a place, 130 is the radial from PXR in degrees, TFD defines a second place, and 358 defines the radial from TFD in degrees. Bearing inputs are assumed to be magnetic. True bearings are designated by placing the letter T after the bearing.
9	The defined waypoint is displayed and shown in Figure 6-18. When a waypoint is defined by P/B/P/B, only the coordinates are stored and displayed.  Figure 6-18

DATA BASE

The pilot can interrogate the navigation data base stored in the FMS by selecting DATA BASE from the NAV INDEX and using the DATA BASE function. This is shown in Figure 6-19. **If AFIS is installed, or DATALINK is configured, the DATA BASE prompt is not displayed on the NAV INDEX. The data base functions described in this section may be executed from the pilot waypoint list (WPT LIST) page.**

For additional information regarding the FMS data base, see page 6-21.

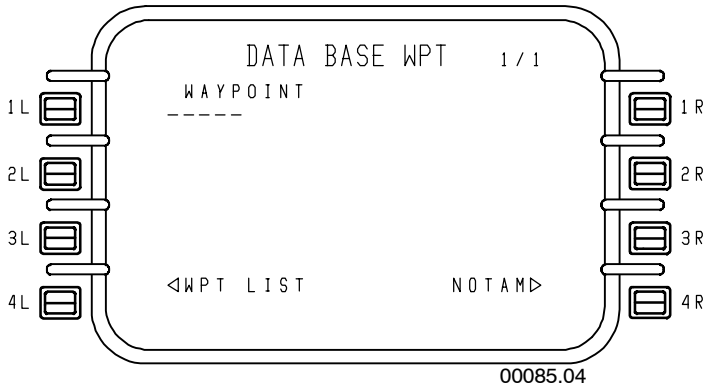


Figure 6-19

A waypoint identifier of the data base can be entered in the upper left line by entering the identifier into the scratchpad and line selecting to 1L. The following items can be displayed from the navigation data base:

- Airports
- Runways
- Nav aids
- ILSs
- Intersections.

The waypoint list (WPT LIST) (4L) and NOTAM (4R) pages can be accessed using the prompts at the bottom of the DATA BASE WPT page.

Airports

Figures 6–20 through 6-22 display the following airport data:

- **Page 1/3**

- Identifier (1L)
- Waypoint Type (1R)
- Airport Name (2L)
- Country (3L).

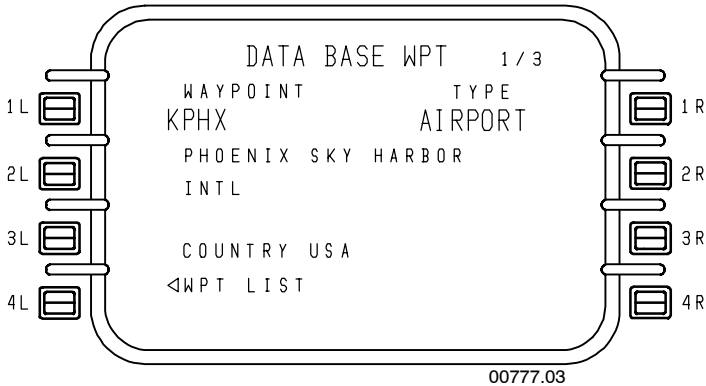


Figure 6-20

- **Page 2/3**

- Identifier (1L)
- Coordinate Position (2L)
- Field Elevation (3L)
- Magnetic Variation (3R).

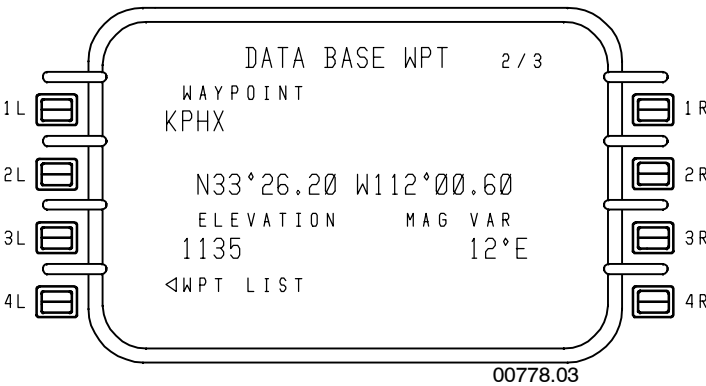


Figure 6-21

• Page 3/3

- Identifier (1L)
- Access to Airport Runways (2L).

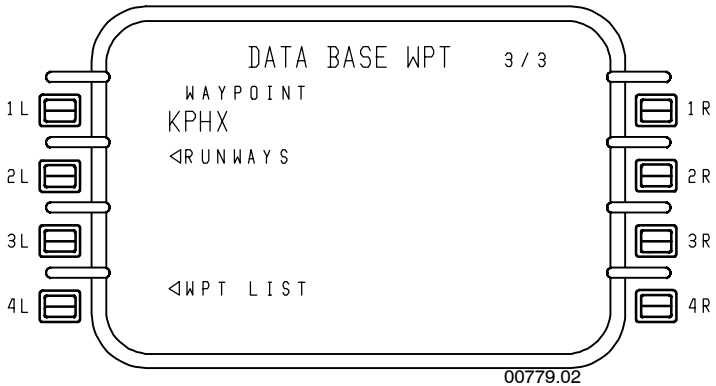


Figure 6-22

Selection of prompt 2L displays the airport runway page, as shown in Figure 6-23.

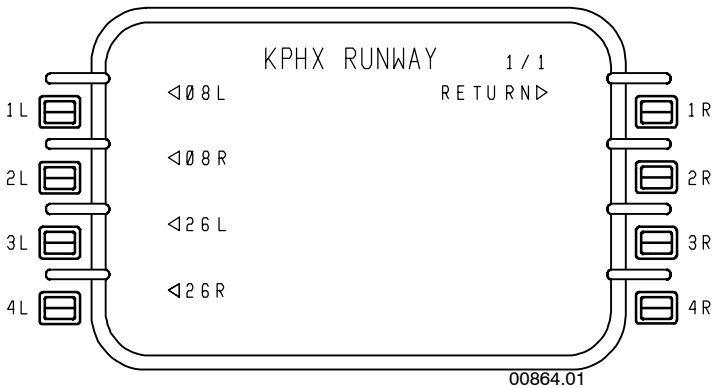


Figure 6-23

If one of the runways is selected, the runway data is displayed. This is shown in Figure 6-24. Selection of the RETURN prompt at 4R results in the display of the airport runway page, shown in Figure 6-23.

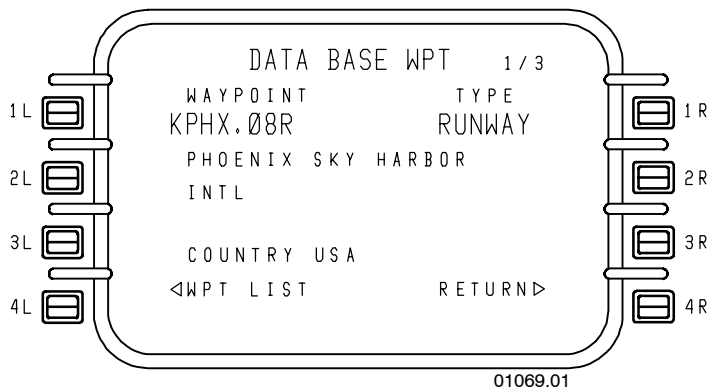


Figure 6-24

Runways

Figures 6-25 through 6-27 display the following information for runways:

- **Page 1/3**
 - Runways Identifier (1L)
 - Waypoint Type (1R)
 - Airport Name (2L) and Country (3L).

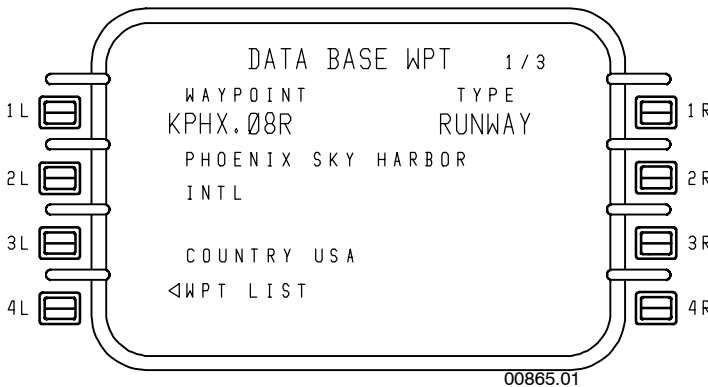


Figure 6-25

• **Page 2/3**

- Identifier (1L)
- Runway Heading and front or back course if the runway has an associated ILS (1R)
- Coordinate Position (2L)
- Elevation (3L)
- Magnetic Variation (3R).

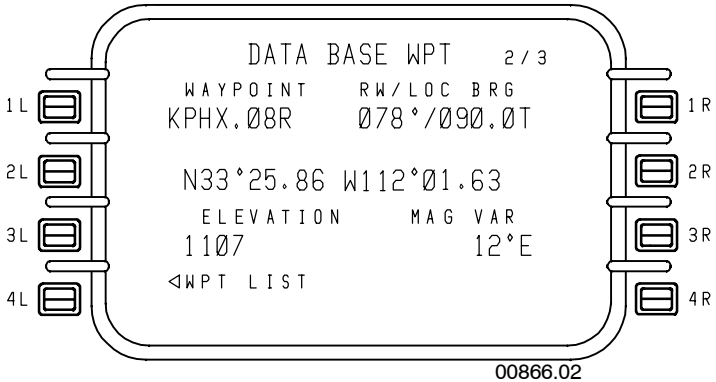


Figure 6-26

• **Page 3/3**

- Identifier (1L)
- Stopway (1R)
- Width (2L) - This field is blank if runway width is not available in the navigation data base.
- Length (2R)
- ILS Glideslope if applicable (3L)
- Displaced Threshold (3R).

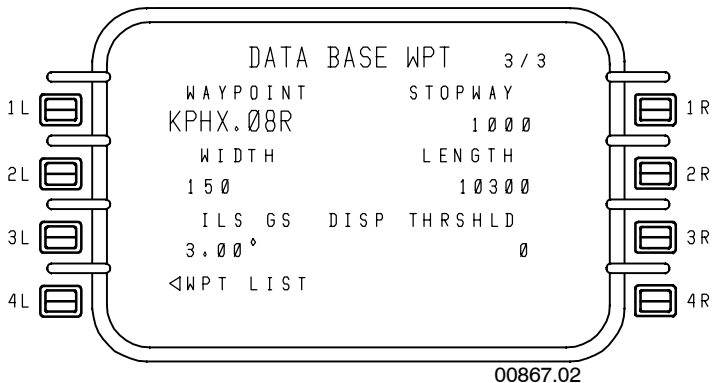


Figure 6-27

Nav aids

Figure 6-28 displays the following information about Nav aids:

- Waypoint Identifier (1L)
- Country (1L)
- Frequency (1R)
- Type (2L)
 - DME (distance measuring equipment)
 - N DME (non co-located)
 - TACAN
 - N TACAN (non co-located)
 - VORTAC
 - VORDME
 - VOR
 - N VOR (non co-located)
- Class (2R)
 - HA (high altitude)
 - LA (low altitude)
 - T (terminal)
 - UR (unrestricted)
- Coordinate Position (2L)
- Elevation (3L)
- Magnetic Declination (3R).

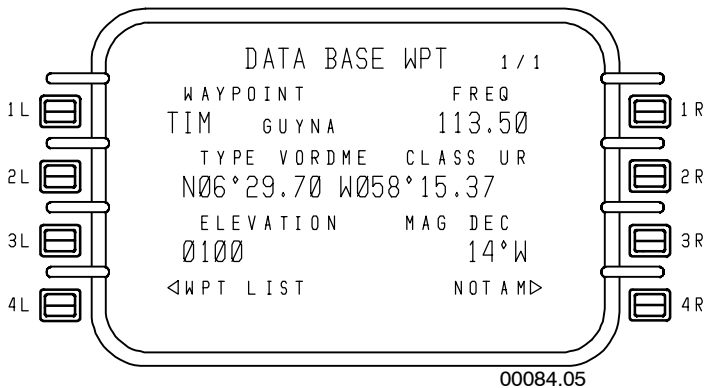


Figure 6-28

Magnetic declination is defined as the difference between the zero degree radial of the station and true north. For many nav aids, this is not equal to the local magnetic variation due to the constantly changing earth magnetic field. If magnetic declination is not available, magnetic variation is displayed.

Figure 6-29 displays the DATA BASE WPT page for a nondirectional beacon. The letters **NB** are entered after the identifier.

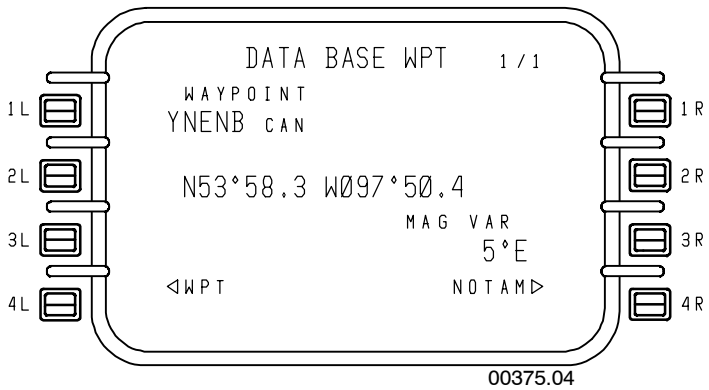


Figure 6-29

Instrument Landing Systems

- **DATA BASE WPT 1/1** – Figure 6-30 displays the following data for instrument landing systems:
 - ILS Identifier (1L)
 - Country (1L)
 - Front Course (1R)
 - Frequency (1R)
 - Type (2L):
 - ILS
 - LOC (localizer)
 - LOC DME (localizer with DME)
 - ILS DME (ILS with DME)
 - MLS
 - Category (2R)
 - I
 - II
 - III
 - Localizer Antenna Coordinates (2L)
 - Magnetic Declination (3R).

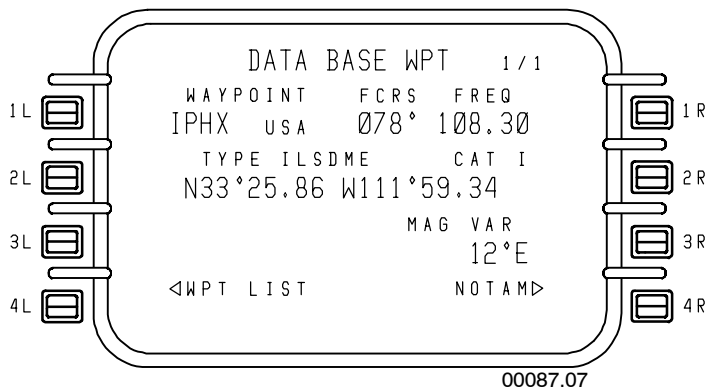


Figure 6-30

Intersections

- **DATA BASE WPT 1/1**– Figure 6-31 displays the following data for intersections.
 - Intersection Identifier (1L)
 - Country (1L)
 - Intersection Coordinates (2L)
 - Magnetic Variation (3R).

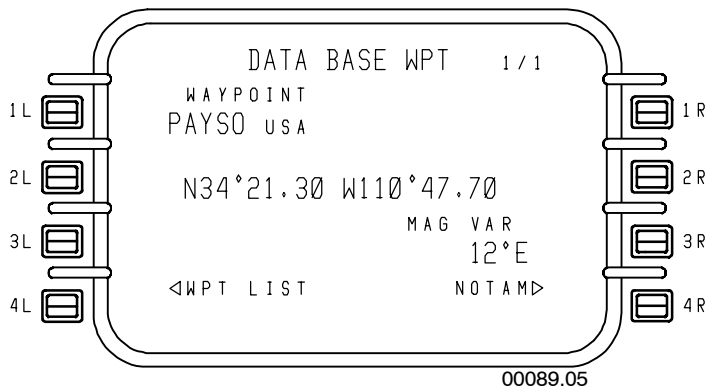


Figure 6-31

Multiple Waypoints

If a waypoint identifier is entered on any page and the FMS finds more than one definition for the identifier, the WAYPOINT SELECT page is displayed. The pilot must choose which definition to use. When inserting waypoints into a stored or active flight plan, the location

closest to the previous waypoint is shown at the top of the page. For all other cases, the location closest to the aircraft position is shown at the top of the page.

For example, if Thermal California (TRM) is entered on the DATA BASE WPT page, the FMS displays all the TRM waypoints found on the WAYPOINT SELECT page. This is shown in Figure 6-32.

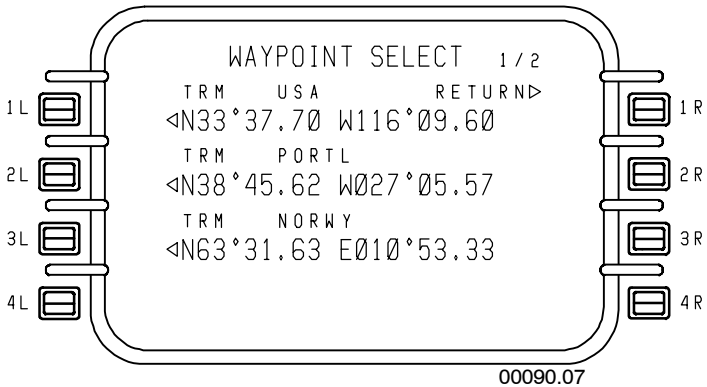


Figure 6-32

Press the line select key adjacent to the desired waypoint. If RETURN (1R) is pressed, no waypoint is selected.

Pilot Defined Waypoints

If a pilot defined waypoint is entered on the DATA BASE WPT page, the FMS switches to the PILOT WAYPOINT page and displays the waypoint as well as the data about the waypoint.

Undefined Waypoints

If an identifier is entered on the DATA BASE WPT page and the FMS cannot find a waypoint in the navigation data base with that identifier, the FMS goes to the PILOT WAYPOINT page for waypoint definition.

FMS DATA BASE

The FMS data base consists of two parts: a navigation data base and a custom (or pilot defined) data base. The navigation data base is loaded into the FMS and can not be changed by the pilot. Using the custom data base, the pilot can customize the FMS by defining waypoints and storing flight plans.

Navigation Data Base

The FMS retrieves information from the navigation data base about waypoints and procedures used in flight planning and to tune navaids for position determination. The data base, supplied by Honeywell, is updated every 28 days (refer to Navigation Data Base Updating on page 6-184).

The navigation data base is designated with a version number, region name, and cycle number (e.g., Version 3.01, WORLD3-310). The FMS uses a Version 3.01 navigation data base or other approved version number. The region name (e.g., WORLD 3, NZ3EAST, NZ3WEST) will vary depending upon the content of the navigation data base. The last 2 digits indicate the cycle number (e.g., -310). There are 13 cycles (28 day periods) during the year. Therefore, the last two digits will range from 01 to 13. If a cycle has to be modified off cycle, a letter is appended starting with A. For example, WORLD3-310A indicates a modified 10th cycle of the navigation data base.

The navigation data base contains the following:

- Navaids
- Airports
- Runways
- Airways (high & low)
- SIDs and STARs
- Approaches
- Named Intersections
- Outer Markers.

Nav aids include Very High Frequency (VHF) nav aids, Instrument Landing System/Microwave Landing System (ILS/MLS), and Navigation Data Bases (NDBs). VHF nav aids stored in the data base consist of the following types:

- VORTAC
- VOR/DME
- TACAN (tactical air navigation)
- VOR
- DME
- VOR/DME (non co-located)
- TACAN (non co-located).

Airport waypoints are the geographic reference point for the airport.

Airways contained in the data base include all waypoints (some are unnamed) and only waypoints that define the airway. Some of these defining waypoints do not appear on paper charts. Some waypoints on the charts appear to be on an airway but are not defining waypoints for the airway.

Custom Data Base

The custom data base consists of pilot defined waypoints and stored flight plans. Up to 200 pilot defined waypoints can be stored.

The pilot can store commonly flown routes using the pilot defined flight plan procedure. The pilot can activate a flight plan from the FMS custom data base rather than repeat the flight plan entry procedure. The FMS custom data base can retain up to 255 flight plans with a total of 2434 waypoints (whichever comes first). Each flight plan can contain a maximum of 100 waypoints.

Temporary Waypoints

Pilot defined waypoints are given a name and permanently stored in the custom data base. The pilot can define temporary waypoints. Temporary waypoints are not given a permanent name and are not permanently stored in the custom data base. Refer to Temporary Waypoints on page 7-2 for additional details.

AIRBORNE FLIGHT INFORMATION SYSTEM (AFIS™) (OPTIONAL)

The Honeywell FMS can be configured to interface with the Allied Signal AFIS. In this configuration, the Honeywell FMS displays the AFIS function while the DL-800/900 Data Loader is the disk interface for the AFIS functions.

The AFIS function is accessed through the NAV INDEX. The AFIS INDEX prompt replaces the DATA BASE prompt (2R) on page 1 of the NAV INDEX when configured.

The FMS is capable of interfacing to printers located on the flight deck via an RS-232 interface. For these installations, AFIS data can be printed. Data can be printed on-demand by the pilot or the FMS can be configured to automatically print incoming messages from AFIS.

This section contains information on the operation of AFIS through the FMS. For a detailed description of the various functions, refer to the appropriate Allied Signal publication.

AFIS Index

Figures 6-33 and 6-34 display the AFIS index with page references for each function. This index is used to select all AFIS functions.

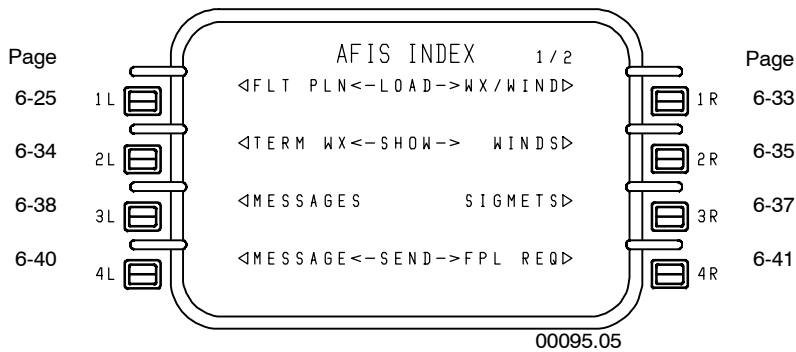


Figure 6-33

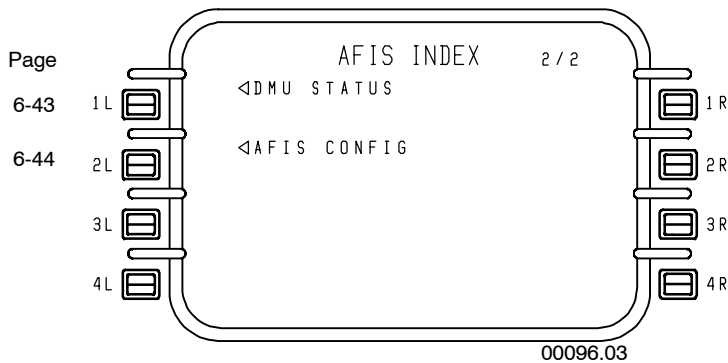


Figure 6-34

Load AFIS Flight Plans

AFIS flight plans may be loaded from either disk or uplinked from the Global Data Center (GDC). The FMS displays only the last uplinked flight plan. Previous flight plans are not retained by the FMS.

- **LOAD AFIS FPL 1/1** - Upon selection of LOAD FLT PLN (1L) on the AFIS INDEX 1/2 page, the LOAD AFIS FPL page is displayed. This is shown in Figure 6-35.

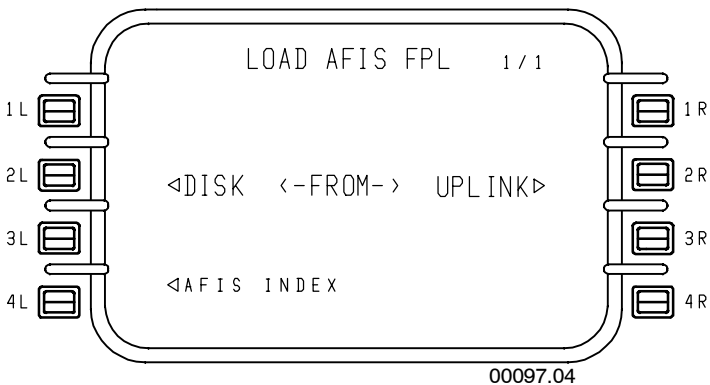


Figure 6-35

The AFIS flight plan can be loaded either from the DL-800/900 Data Loader or uplinked from the GDC. Refer to Procedure 6-5 for loading a flight plan from the data loader. Refer to Procedure 6-6 for uplinking a flight plan from the GDC.

If modifications to the AFIS flight plan are necessary, the plan must first be activated. If there is a weather briefing for the displayed flight plan, INCLUDES WEATHER BRIEF appears at the end of the flight plan. If the flight plan is loaded, the CDU can be used to load the terminal weather with the flight plan.

When a flight plan is selected, verify that all the required flight plan page entries have been completed. It is important to note that the destination must be displayed in the DEST window and it must be the last waypoint in the flight plan.

Refer to the appropriate AFIS operating manual for instructions on formatting flight plans on a disk.

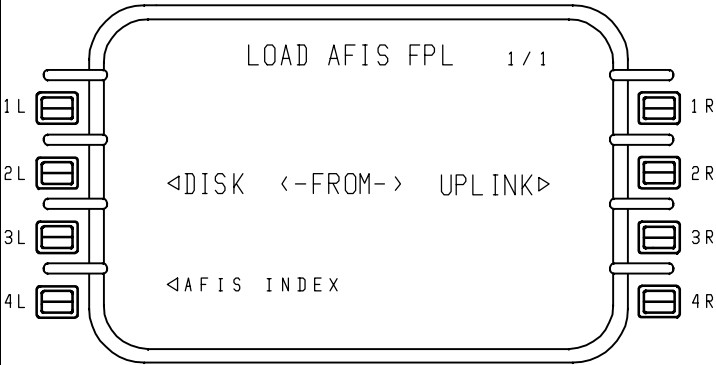
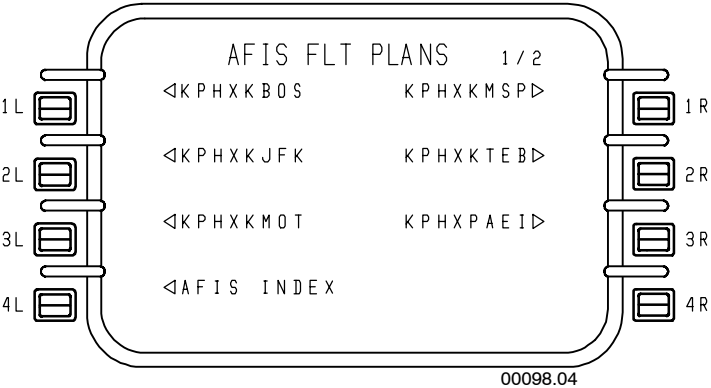
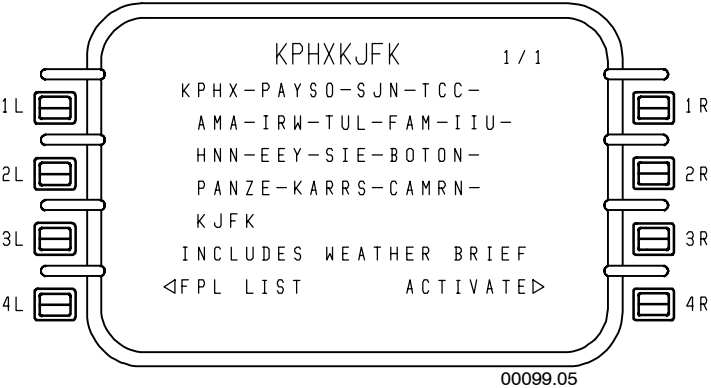
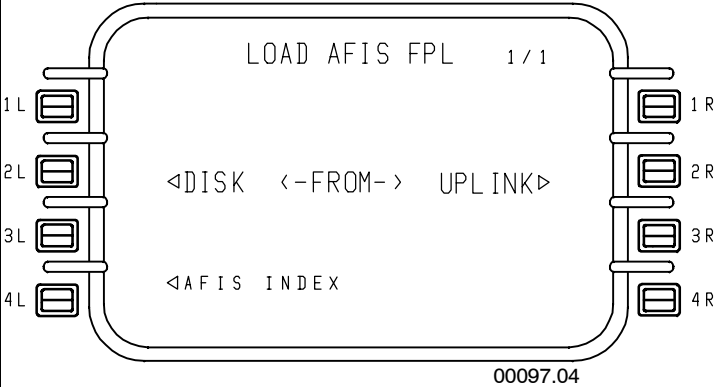
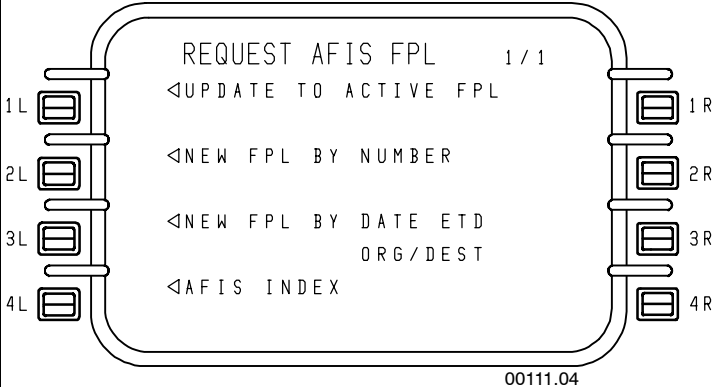
Step	Procedure 6-5 Loading an AFIS Flight Plan from a Disk
1	Select LOAD FLT PLAN from the AFIS INDEX page 1/2.
2	If the DL-800/900 Data Loader is not installed in the aircraft, connect the data loader umbilical cable to the aircraft connector. Apply power to the data loader using the appropriate aircraft circuit breaker and press the data loader power switch. The power LED lights, and after the powerup BITE sequence has been completed, the data LED lights. Select LEFT, RIGHT or AUX (third FMS) to load the respective FMS. Insert the disk containing the AFIS flight plan.
3	Select DISK from the LOAD AFIS FPL page. This is shown in Figure 6-36.  00097.04

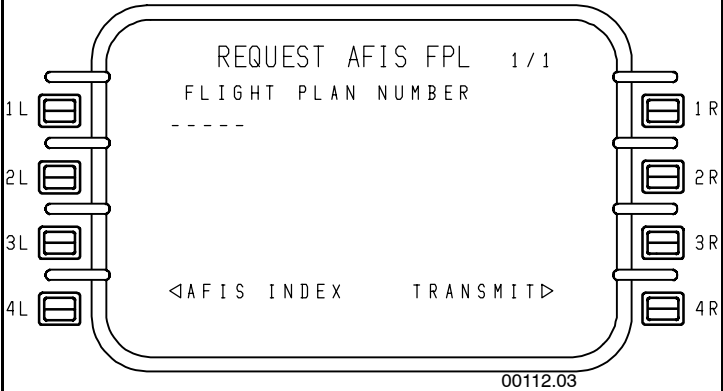
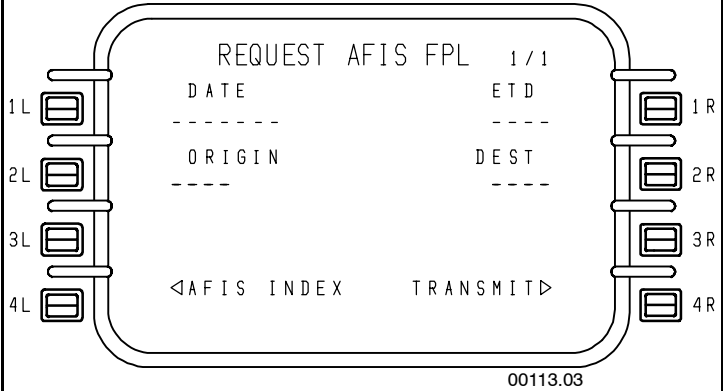
Figure 6-36

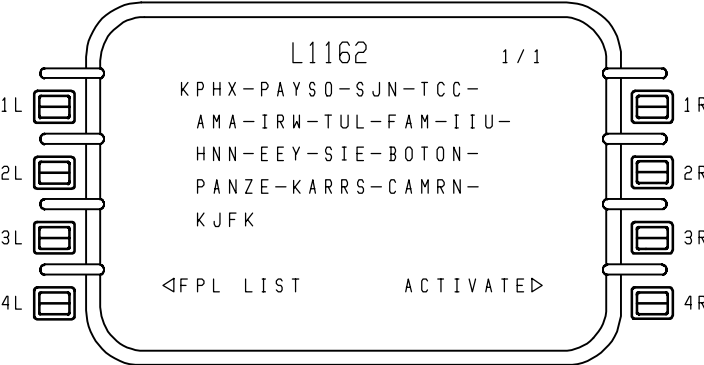
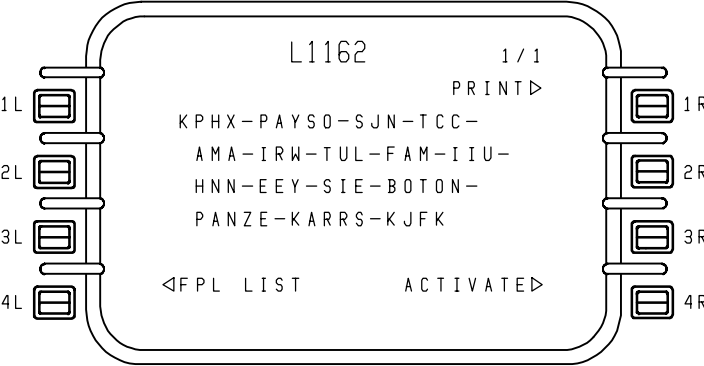
Step	Procedure 6-5 Loading an AFIS Flight Plan from a Disk
4	The FMS displays the flight plans available from the disk. This is shown in Figure 6-37.  Figure 6-37 Select the desired flight plan to be loaded. For this example, KPHXKJFK is selected (2L).
5	The FMS displays the flight plan. This is shown in Figure 6-38.  Figure 6-38 If the FMS is configured for AFIS printing, the flight plan is displayed as shown in Figure 6-39. Select the PRINT prompt (1R) if printing of the flight plan is desired.

Step	Procedure 6-5 Loading an AFIS Flight Plan from a Disk
	 Figure 6-39 Select the ACTIVATE prompt (4R) to begin the loading process.
6	The FMS will request if waypoint predicted wind/temperature data is to be loaded from the flight plan. This is shown in Figure 6-40. If YES is selected, the FMS will load the wind/temperature data supplied with each waypoint into the PERF PLAN pages. This will result in the FMS using the data for performance predictions.  Figure 6-40

Step	Procedure 6-5 Loading an AFIS Flight Plan from a Disk
7	If the flight plan contains terminal weather, the FMS will request if terminal weather is to be loaded from the disk. This is shown in Figure 6-41. If YES is selected, terminal weather will be available for review on the CDU.  00100.04
8	Upon completion of loading the data, the FMS displays the ACTIVE FLT PLAN 1/1 page.

Step		Procedure 6-6 Uplinking an AFIS Flight Plan
1		Select LOAD FLT PLAN from the AFIS INDEX page 1/2.
2		Select UPLINK from the LOAD AFIS FPL page. This is shown in Figure 6-42. Selection of this prompt results in the FMS displaying the last flight plan that was uplinked to the DMU.  Figure 6-42 If the DMU does not have a flight plan that was previously uplinked, the FMS displays the scratchpad message NO UPLINK FPL AVAIL and displays the REQUEST AFIS FPL page. This page is used to request a flight plan from the GDC. This is shown in Figure 6-43.  Figure 6-43

Step	Procedure 6-6 Uplinking an AFIS Flight Plan
3	Select the desired method to request the flight plan from the GDC. The flight plan may be requested using the flight plan number (2L). This is shown in Figure 6-44. The flight plan may also be requested by specifying the date, Estimated Time of Departure (ETD), origin, and destination (3L). This is shown in Figure 6-45.  Figure 6-44 shows a terminal screen for requesting an AFIS Flight Plan (FPL) by flight plan number. The screen has a title bar 'REQUEST AFIS FPL 1 / 1'. Below it, the text 'FLIGHT PLAN NUMBER' is followed by four dashes '----'. At the bottom, there are two options: '<AFIS INDEX' and 'TRANSMIT>'. The screen is flanked by four rows of buttons on the left (labeled 1L, 2L, 3L, 4L) and four rows on the right (labeled 1R, 2R, 3R, 4R). The identifier '00112.03' is at the bottom right. Figure 6-44  Figure 6-45 shows a terminal screen for requesting an AFIS Flight Plan (FPL) by date, ETD, origin, and destination. The screen has a title bar 'REQUEST AFIS FPL 1 / 1'. Below it, the text is organized into two columns: 'DATE' followed by four dashes '----', and 'ETD' followed by four dashes '----'. The next row shows 'ORIGIN' followed by four dashes '----', and 'DEST' followed by four dashes '----'. At the bottom, there are two options: '<AFIS INDEX' and 'TRANSMIT>'. The screen is flanked by four rows of buttons on the left (labeled 1L, 2L, 3L, 4L) and four rows on the right (labeled 1R, 2R, 3R, 4R). The identifier '00113.03' is at the bottom right. Figure 6-45

Step	Procedure 6-6 Uplinking an AFIS Flight Plan
4	For this example, the flight plan will be requested using the flight plan number. Insert the flight plan number and select TRANSMIT (4R). The FMS sends the flight plan request to the DMU for transmission. Upon receiving the flight plan from the DMU, the FMS posts the scratchpad message FLT PLAN RECEIVED. Upon display of the scratchpad message, select LOAD FLT PLAN from the AFIS INDEX page 1/2. Select UPLINK from the LOAD AFIS FPL page, Figure 6-42. Selection of this prompt results in the FMS displaying the last flight plan that was uplinked to the DMU. This is shown in Figure 6-46. If the FMS is configured for AFIS printing, the flight plan is displayed as shown in Figure 6-47. Select the PRINT prompt (1R) if printing of the flight plan is desired. Select the ACTIVATE prompt (4R) to begin the loading process.  01070.02 Figure 6-46  01071.02 Figure 6-47

Step	Procedure 6-6 Uplinking an AFIS Flight Plan
5	The FMS will request if waypoint predicted wind/temperature data is to be loaded from the flight plan. This is shown in Figure 6-48. If YES is selected, the FMS will load the wind/temperature data supplied with each waypoint into the PERF PLAN pages. This will result in the FMS using the data for performance predictions. Figure 6-48
6	Upon completion of loading the flight plan, the FMS displays the ACTIVE FLT PLAN page 1.

Load Weather and Winds

- **LOAD WX/WINDS 1/1** - Figure 6-49 is used to load weather and wind information from an AFIS disk. The page lists the types of information available from the disk.

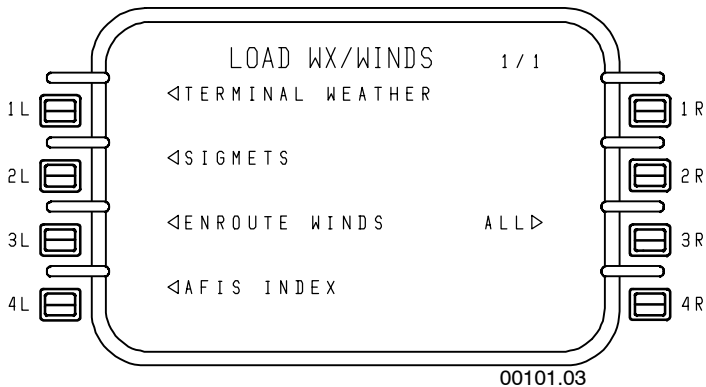


Figure 6-49

The options available are described below.

Show Terminal Weather

- **AVAIL WX REPORTS 1/1** – Figure 6-50 is available from the AFIS INDEX or from the LOAD WX/WINDS page. It is available only when the disk contains weather data or when a report has been received.

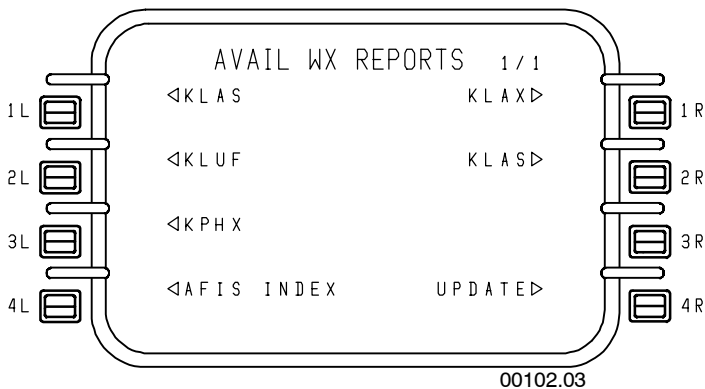


Figure 6-50

Terminal weather reports can be loaded from the airports listed on the display (maximum of 5). If terminal weather for another airport has been previously loaded, the new weather will overwrite the current weather data in the FMS. Weather for any location can be deleted using the DEL key.

If weather for another location is required, enter the identifier in place of one of the five listed on this page. If the new identifier is displayed in inverse video, it indicates that the requested weather is not on the disk or has not been uplinked. Use the UPDATE prompt to request new weather for all airports on the AVAIL WX REPORTS page. When selecting UPDATE, the FMS removes the prompt from the CDU and transmits a request for the listed airports. The message NEW WX REPORTS AVAIL is displayed when the update is received.

If terminal weather information is being displayed when a new report is received, a NEW REPORT prompt (4L) tells the pilot the new report can be selected. If terminal weather is not being displayed when a new report arrives, the information is automatically updated. Figure 6-51 shows a typical TERMINAL WEATHER page.

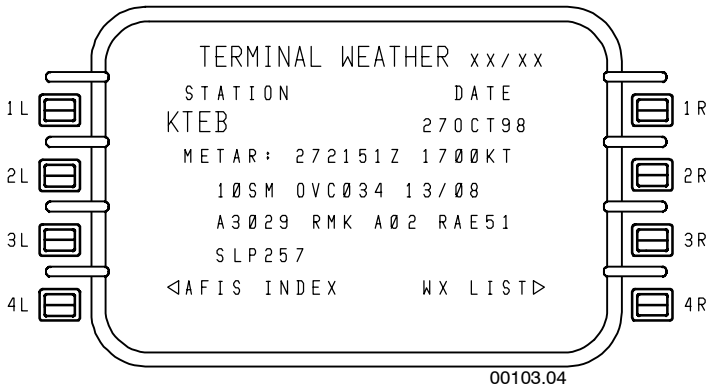


Figure 6-51

Figure 6-52 shows the page with print capability enabled.

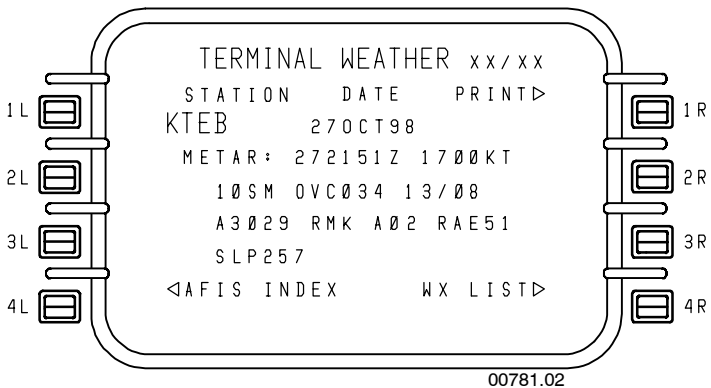


Figure 6-52

Show Winds

- **AVAIL WIND REPTS 1/1** – Figure 6-53 is accessed through the AFIS INDEX or through the LOAD WX/WINDS page. It lists the stations for which the WINDS ALOFT reports have been loaded from disk or updated from a report. Stations can be changed, deleted, or added by the pilot. Up to five stations can be listed on this page. If the pilot enters a station for which the wind data is not available from the disk or the memory, it is displayed in inverse video until an UPDATE is performed.

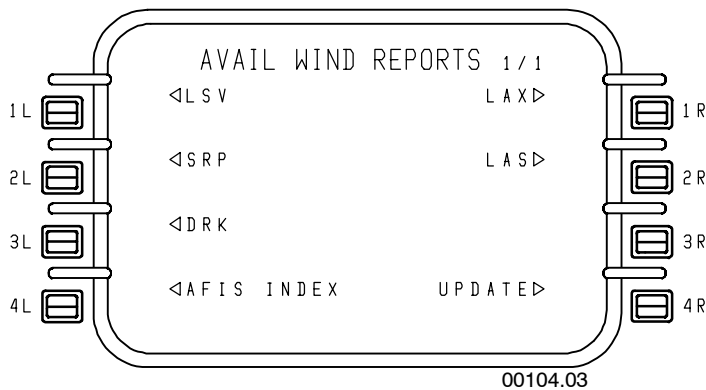


Figure 6-53

If one of the line select keys is pressed when the scratchpad is empty, the display switches to the WINDS ALOFT page. This is shown in Figure 6-54.

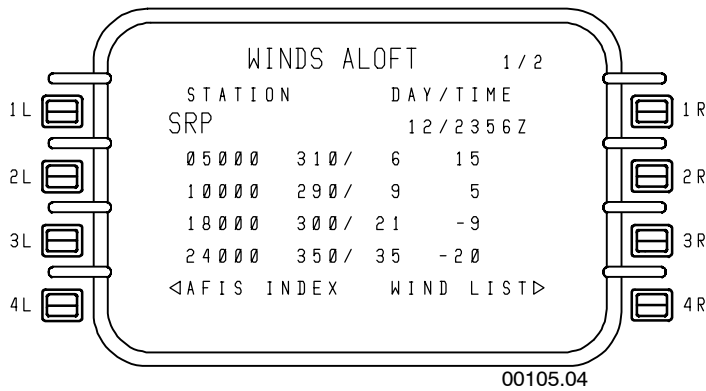


Figure 6-54

Figure 6-55 shows the page with print capability enabled.

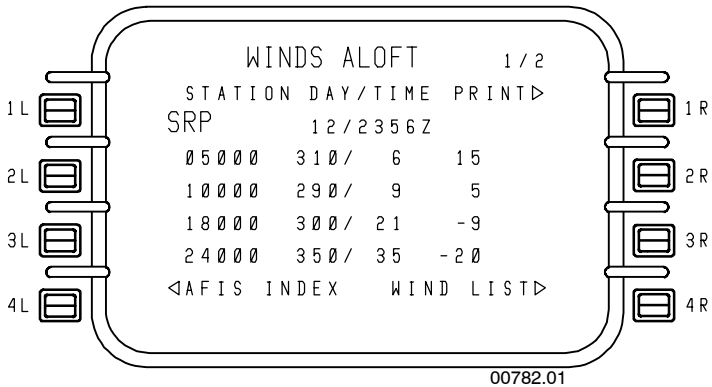


Figure 6-55

The station identification can be changed using the scratchpad and the upper left line select key (1L) to enter a new identification. If the station is not in the list of available reports, NO REPORT is displayed in place of the wind/temperature information.

Sigmets

- **SIGMETS X/X** - Figure 6-56 is selected through the LOAD WX/WINDS page or through AFIS INDEX (3R). This is a **view only** page with the exception of the UPDATE option key. This key functions like the UPDATE function on the AVAIL WX REPORTS page.

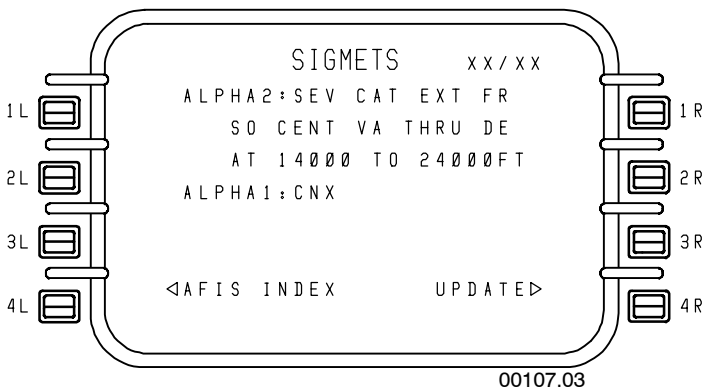


Figure 6-56

Figure 6-57 shows the page with print capability enabled.

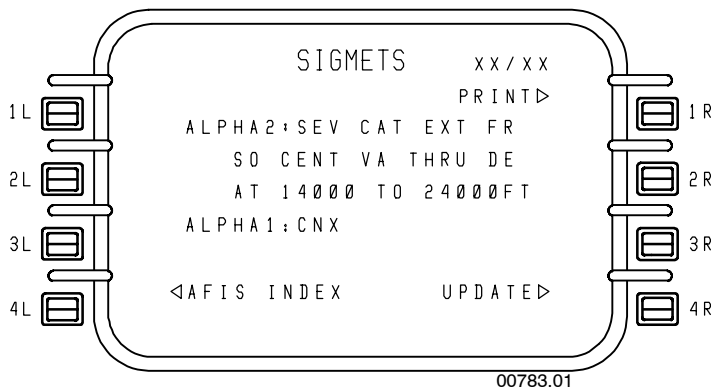


Figure 6-57

- **SIGMETS UPDATE 1/1** – Figure 6-58 prompts the pilot for the end points of the route for which a SIGMET update is required. On this page, the origin and destination of the route can be entered. The defaults are the current origin and destination from the flight plan. Selecting the TRANSMIT prompt activates a request for a SIGMET update.

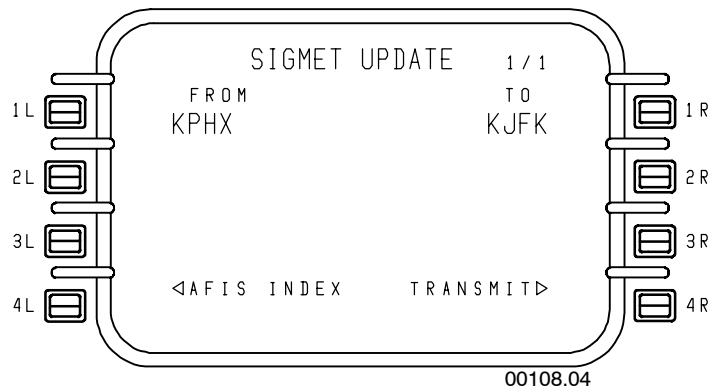


Figure 6-58

Received Messages

- **RECEIVED MESSAGES X/X** – Figure 6-59 is accessed through the AFIS INDEX page. Only one message is displayed per page. However a message can be more than one page in length. A maximum of 99 messages or 2200 total message characters can be held for display. **The numbers in the upper right corner, which are normally page numbers, are, in the case of AFIS MESSAGES, message numbers.** These numbers indicate the

message number currently being viewed and the total number of messages available. If a new message is received when either of the limits apply, the first (oldest) message is deleted to make room for the new message. The CLEAR MSG prompt is used to delete individual messages. When a message is deleted, the display switches to the first page of the next message (if any).



Figure 6-59

Figure 6-60 shows the page with print capability enabled.



Figure 6-60

When power is removed from the FMS and AFIS, messages are not retained. However, if the Data Management Unit (DMU) remains powered, recalled or updated flight plans can be recalled using a prompt on the AFIS FLT PLANS page.

Send Message

- **SEND MESSAGE 1/XX** – Figure 6-61 is accessed through the AFIS INDEX. Each message must contain data in the FROM, TO, and ADDRESS lines. The FROM and TO lines are limited to 16 characters. The address line is limited to 17 characters. Exceeding the character limit will result in an INVALID ENTRY message.

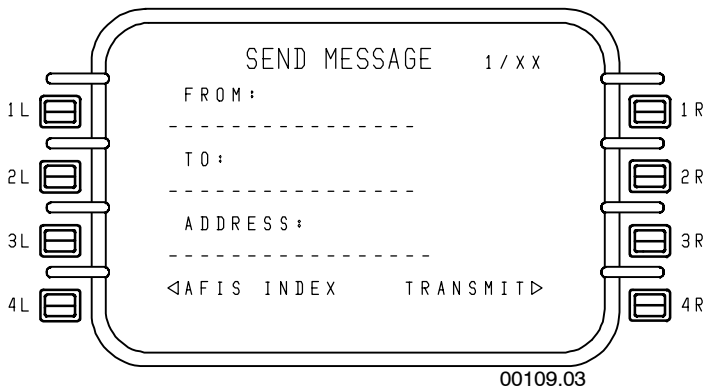


Figure 6-61

Figure 6-62 shows the page with print capability enabled.

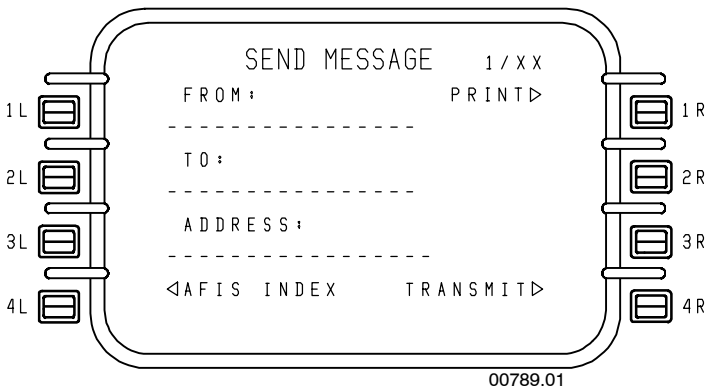


Figure 6-62

Figure 6-63 shows SEND MESSAGE page 2. The message on page 2 must conform to the following format and editing guidelines.

- Each message line can contain up to 20 characters.
- A TRANSMITTED message is generally limited to three pages. A RECEIVED message is generally limited to five pages. As the received message limits are reached, old messages are dropped and replaced by the new ones.
- When a message is entered, the slash (/) key inserts a space.
- Each message line can be edited while displayed in the scratchpad.
- Messages can be edited by use of the (DEL) key to delete entire lines.
- Lines can be inserted into a message using the left line select keys. The right line select keys replace the line.
- Pressing a left line select key with an empty scratchpad moves the message line to the scratchpad.
- Selecting the TRANSMIT option transmits the message.

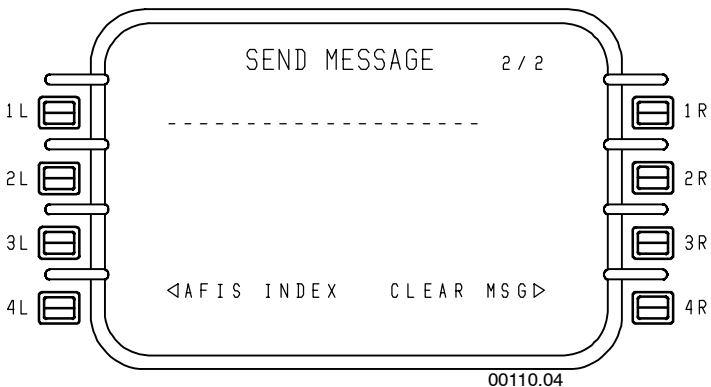


Figure 6-63

Send Flight Plan Request

Flight plans can be uplinked from the GDC to the FMS. AFIS provides two ways of requesting a flight plan: by flight plan number or by specifying the flight plan date, ETD, origin and destination. This is shown in Figure 6-64.

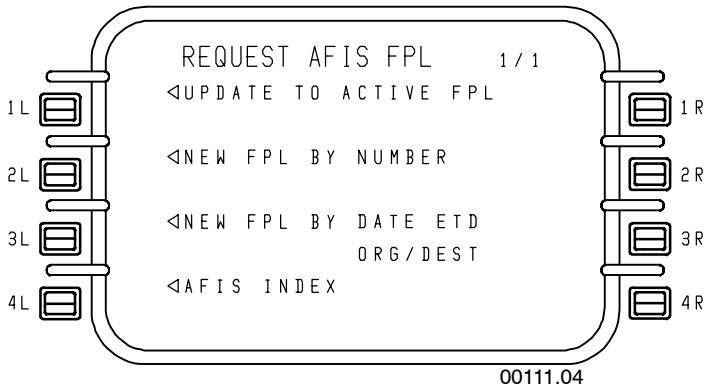


Figure 6-64

- **2L** - This prompt is selected to request a flight plan by number. When selected, the FMS displays the page shown in Figure 6-65. Insert the flight plan number at 1L and transmit the request. The FMS will send the request to the DMU. Upon receiving the flight plan from the DMU, the FMS posts the message FLT PLAN RECEIVED. The flight plan may then be loaded into the FMS using the load AFIS flight plan described in Procedure 6-6.

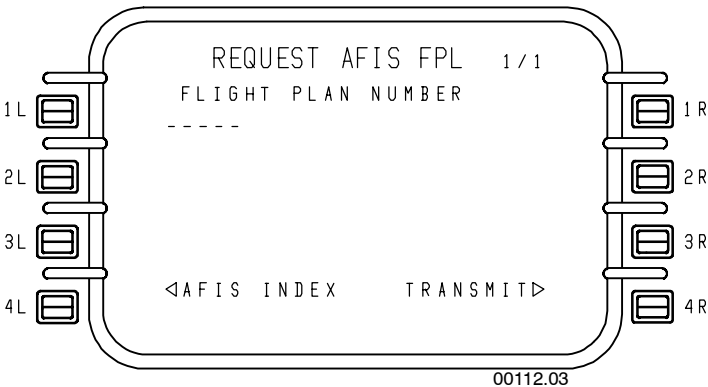


Figure 6-65

- **3L** - Selection of this prompt (Figure 6-64) results in the FMS displaying the page shown in Figure 6-66. Entry of DATE, Estimated Time of Departure (ETD), ORIGIN, and DEST is required. Upon entering the data, the FMS transmits the request to the DMU. Upon receiving the flight plan from the DMU, the FMS posts the scratchpad message FLT PLAN RECEIVED. The flight plan may then be loaded into the FMS using the load AFIS flight plan described in Procedure 6-6.

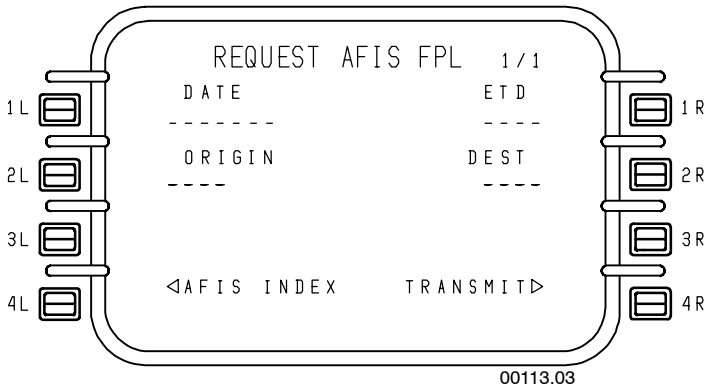


Figure 6-66

Data Management Unit Status

- **DMU STATUS 1/1** – This page is selected from page 2 of the AFIS index. This single page displays the condition of the various AFIS subsystems and is shown in Figure 6-67. No data entries are permitted on this page.

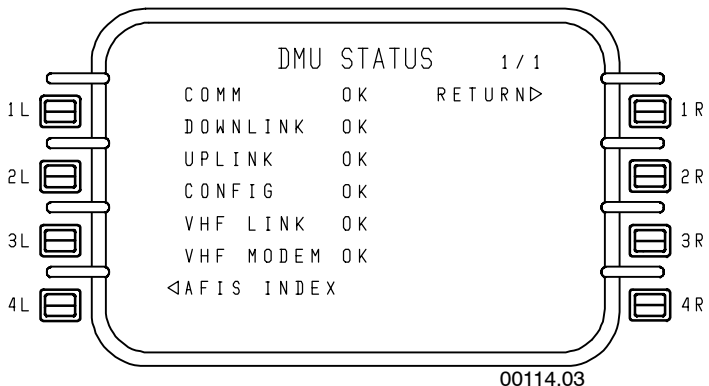


Figure 6-67

This page is also displayed each time the pilot initiates a send message or update request so the AFIS system status can be viewed.

If a sub-function of the DMU indicates a FAIL status, the pilot can take the following actions:

- COMM, DOWNLINK, UPLINK – Re-transmit the last request
- CONFIG – Configuration module requires maintenance
- VHF LINK, VHF MODEM – DMU requires maintenance.

When a request is acknowledged by the GDC, the message RQST RCVD is displayed. This is shown in Figure 6-68. To ensure that each transmission has been received and acknowledged by the data center, delay further transmissions until the message RQST RCVD is shown.

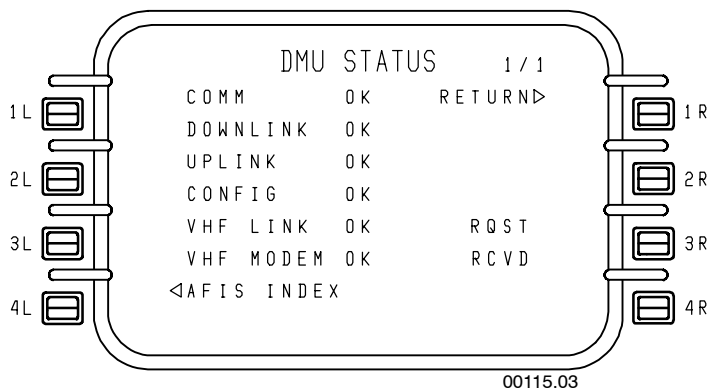


Figure 6-68

Caution should be used with the RQST RCVD annunciation. It is only an indication that the GDC received a request. For example, it does not ensure that a message has been delivered to the addressee. Also, the fact that no RQST RCVD is displayed does not mean the request was not received. Problems can occur in transmitting the RQST RCVD message back to the aircraft.

AFIS Configuration

- **AFIS CONFIG 1/3** - This page is selected from page 2 of the AFIS Index. As shown in Figure 6-69, this page is used to select the configuration for AUTO REPORT, AUTO WEATHER, and satellite links.

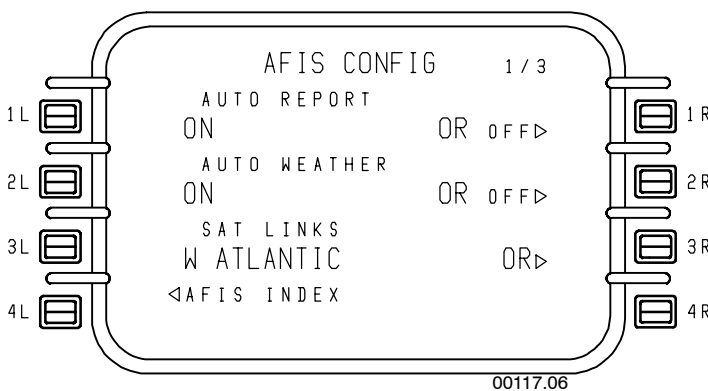


Figure 6-69

- **SATELLITE LINKS 1/1** - Figure 6-70 is used by the pilot to select a satellite link. The active link is designated with active mode (ACT). In addition, ALL or NONE of the satellite links can be selected active. RETURN displays the AFIS CONFIG 1/2 page.

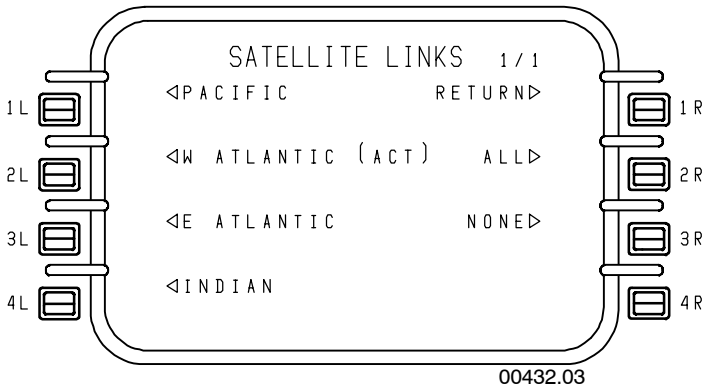


Figure 6-70

- **AFIS CONFIG 2/3** - Figure 6-71 shows the current configuration for the ARINC, SITA/AVICON, and AIR CANADA networks. AUTO enables automatic transmission to and from the specified network. OFF disables transmissions over the specified network.

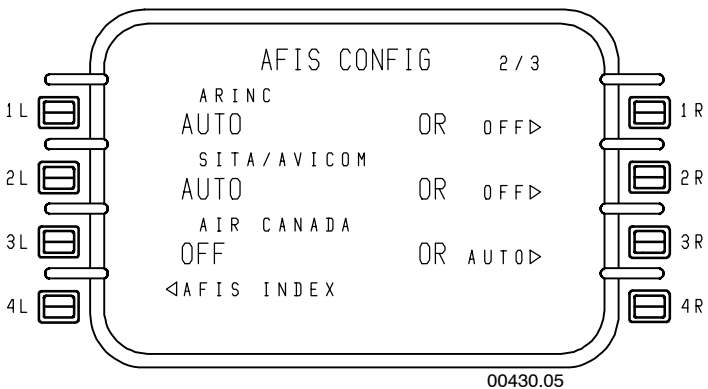


Figure 6-71

- **AFIS CONFIG 3/3** – Figure 6-72 displays the current AFIS print configuration.

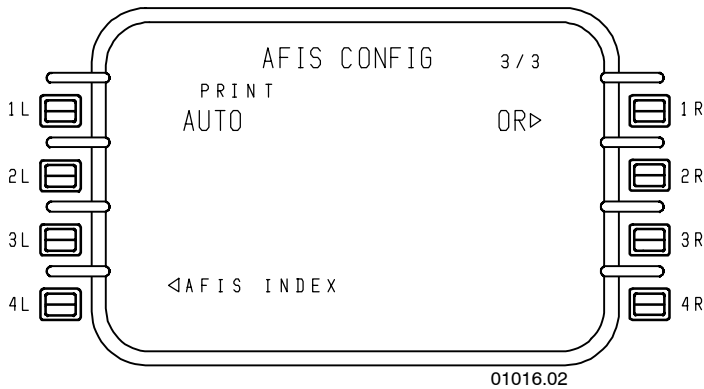


Figure 6-72

Selection of the OR prompt at 1R displays the AFIS PRINT CONFIG page.

- **AFIS PRINT CONFIG 1/1** – Figure 6-73 is used to select the AFIS print configuration.

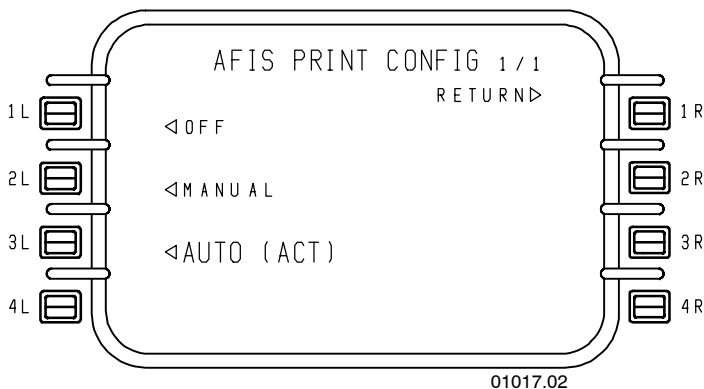


Figure 6-73

- **1L** – The OFF configuration is selected if no printer is installed on the flight deck or if the FMS is not interfaced to the printer. No PRINT prompts will be displayed on AFIS pages with this selection. This is the default mode for AFIS printing.
- **2L** – The MANUAL configuration allows for on-demand printing of AFIS data. The PRINT prompt is displayed on the AFIS pages and printing of data is possible.

- **3L** - The AUTO configuration allows for automatic printing of AFIS data. The data to be automatically printed is controlled via the AUTO PRINT CONFIG pages. In addition, the PRINT prompt is displayed on the AFIS pages to allow for on-demand printing.
- **AUTO PRINT CONFIG 1/2** - Figure 6-74 is used to configure what AFIS data will automatically be transmitted to the flight deck printer.

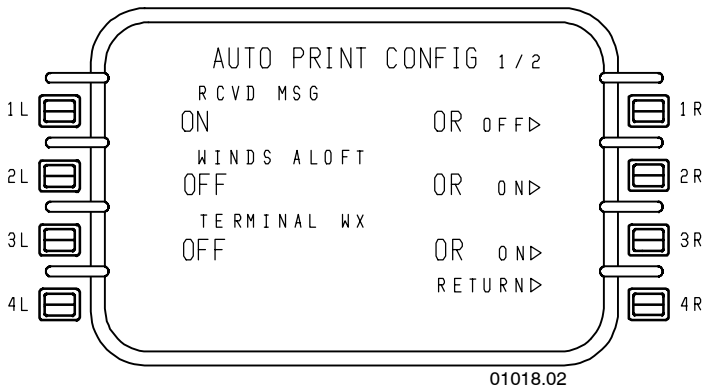


Figure 6-74

- **1L** - The configuration for automatic printing of received messages from the GDC is displayed on this line. If turned ON, all incoming messages will be automatically transmitted to the flight deck printer. Press 1R to toggle the configuration between ON and OFF. The default is OFF.
- **2L** - The configuration for automatic printing of winds aloft data from the GDC is displayed on this line. If turned ON, all winds aloft data will be automatically transmitted to the flight deck printer. Press 2R to toggle the configuration between ON and OFF. The default is OFF.
- **3L** - The configuration for automatic printing of received terminal weather from the GDC is displayed on this line. If turned ON, all incoming terminal weather will be automatically transmitted to the flight deck printer. Press 3R to toggle the configuration between ON and OFF. The default is OFF.

- **AUTO PRINT CONFIG 2/2** – Figure 6–75 is used to configure what AFIS data will automatically be transmitted to the flight deck printer.

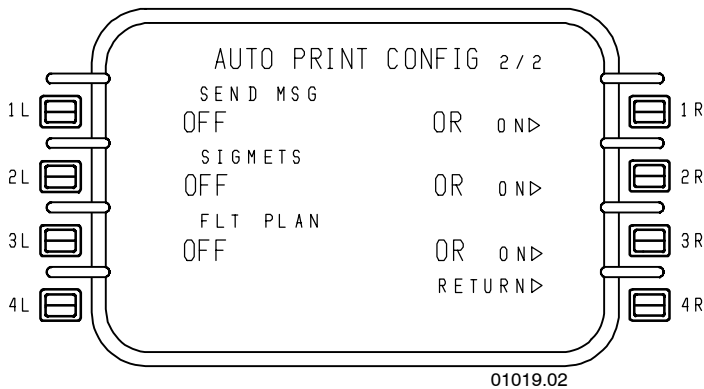


Figure 6-75

- **1L** – The configuration for automatic printing of sent messages to the GDC is displayed on this line. If turned ON, all transmitted messages will be automatically transmitted to the flight deck printer. Press 1R to toggle the configuration between ON and OFF. The default is OFF.
- **2L** – The configuration for automatic printing of SIGMETS received from the GDC is displayed on this line. If turned ON, any received SIGMET will be automatically transmitted to the flight deck printer. Press 2R to toggle the configuration between ON and OFF. The default is OFF.
- **3L** – The configuration for automatic printing of received flight plans from the GDC is displayed on this line. If turned ON, all incoming flight plans will be automatically transmitted to the flight deck printer. Press 3R to toggle the configuration between ON and OFF. The default is OFF.

DATALINK INDEX (OPTIONAL)

The DATALINK INDEX pages provide access to the datalink functions. The datalink functions originate from the air transport industry standard for the ARINC Communications Addressing and Reporting System (ACARS). This consists of airlines using the network to communicate to its operation center, maintenance facility, etc. The datalink function of the FMS uses the same ACARS network for transmission of data. The data to and from the aircraft is routed to a Ground Service Provider (GSP). Unlike AFIS, the GSP is not a single entity. Any company that conforms to the ARINC industry standard protocols can be a GSP. The GSP can provide a variety of services: flight plans, textual and/or graphical weather, position reporting, Pre-Departure Clearances (PDC), etc. The GSP services the aircraft request and routes the data back to the aircraft.

Figures 6-76 and 6-77 display the DATALINK INDEX pages. Page numbers adjacent to each button correspond with page numbers in this manual that describe the button function. The DATALINK INDEX page contents will vary with each GSP and the services chosen by the customer. These figures show examples of possible services that could be provided by a GSP.

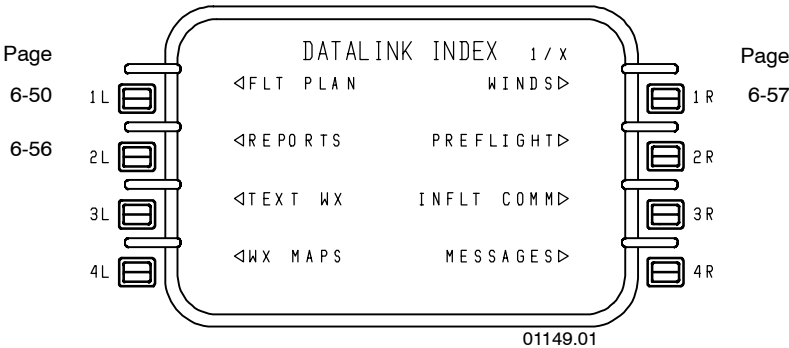


Figure 6-76



Figure 6-77

The Honeywell FMS does not control all the functions seen on the DATALINK INDEX pages. The FMS is responsible for the following datalink functions: flight plan, reports, winds, and addresses. If one of these functions are selected, the FMS will be involved in providing the necessary data to support the function. All other functions are controlled by the datalink Management Unit (MU). Upon pressing these prompts, the MU is controlling the contents displayed on the CDU. Refer to the MU and/or GSP operating manual for the operation of these functions.

Datalink Flight Plan

- **DATALINK FLT PLAN 1/1** - Upon selection of the FLT PLAN prompt (1L) on the DATALINK INDEX 1/X page, the DATALINK FLT PLAN page is displayed. This is shown in Figure 6-78.

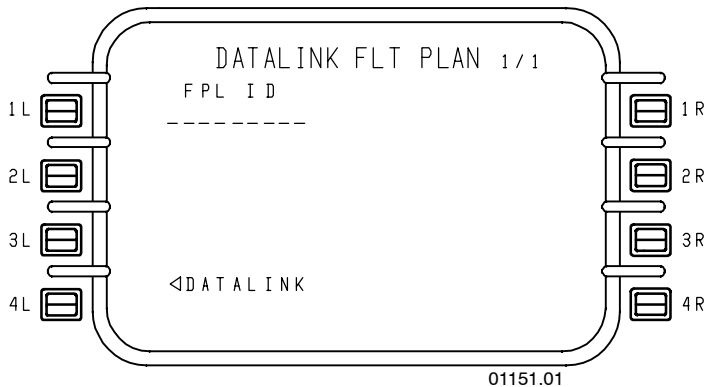
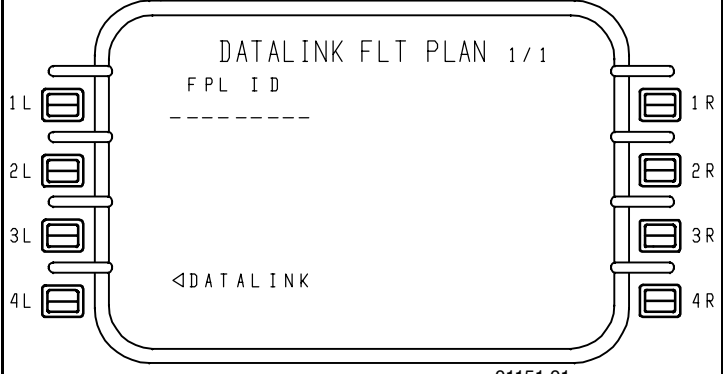
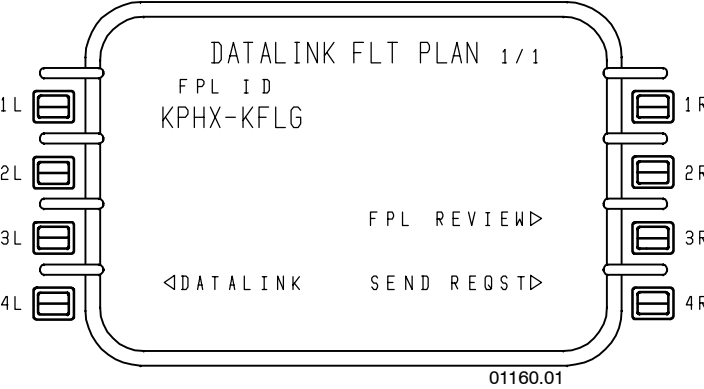
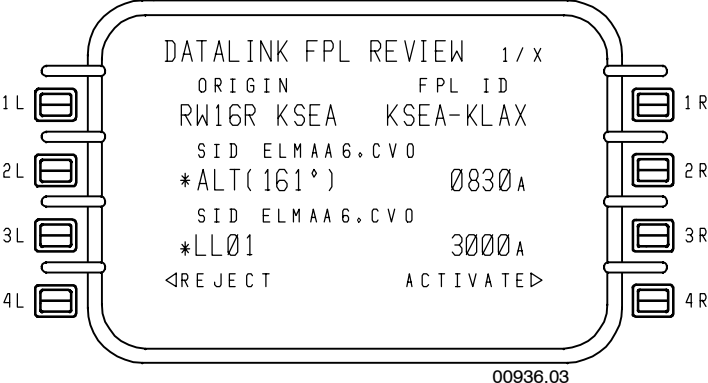


Figure 6-78

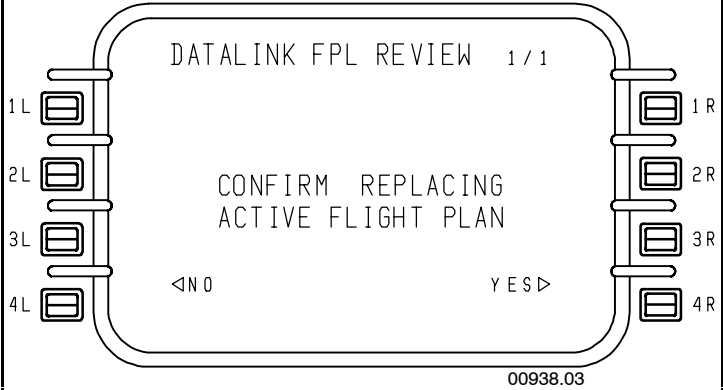
Flight plans can be uplinked from the GSP. Refer to Procedure 6-7 for details on how to uplink a flight plan from a GSP.

Step	Procedure 6-7 Uplinking a Flight Plan from a GSP
1	Select FLT PLAN (1L) from the DATALINK INDEX 1/X page.
2	The FMS displays the DATALINK FLT PLAN 1/1 page. This is shown in Figure 6-79. This page is used to enter the flight plan name to be uplinked from the GSP.  Figure 6-79
3	For this example, the flight plan KSEA-KLAX will be requested. Enter the flight plan name at 1L and select SEND REQST at 4R. This is shown in Figure 6-80.  Figure 6-80

Step	Procedure 6-7 Uplinking a Flight Plan from a GSP
4	The FMS sends the flight plan request to the GSP. During the transmission process, the FMS displays the SENDING prompt at 4R. This is shown in Figure 6-81.  The diagram shows a rectangular display screen with a rounded top and bottom. On the left side, there are four rectangular buttons labeled 1L, 2L, 3L, and 4L from top to bottom. On the right side, there are four rectangular buttons labeled 1R, 2R, 3R, and 4R from top to bottom. The screen displays the following text: 'DATALINK FLT PLAN 1/1' at the top center, 'FPL ID' below it, 'KSEA-KLAX' below that, and '<DATALINK' on the left and 'SENDING' on the right at the bottom. The identifier '01153.01' is located at the bottom right of the screen. Figure 6-81 Upon receiving the flight plan from the GSP, the FMS displays the prompt FPL REVIEW at 3R. This is shown in Figure 6-82. In addition, the scratchpad message FLIGHT PLAN RECEIVED is displayed.  The diagram shows a rectangular display screen with a rounded top and bottom. On the left side, there are four rectangular buttons labeled 1L, 2L, 3L, and 4L from top to bottom. On the right side, there are four rectangular buttons labeled 1R, 2R, 3R, and 4R from top to bottom. The screen displays the following text: 'DATALINK FLT PLAN 1/1' at the top center, 'FPL ID' below it, 'KPHX-KFLG' below that, 'FPL REVIEW>' on the right side, and '<DATALINK' on the left and 'SEND REQST>' on the right at the bottom. The identifier '01160.01' is located at the bottom right of the screen. Figure 6-82

Step	Procedure 6-7 Uplinking a Flight Plan from a GSP
5	Select the FPL REVIEW prompt at 3R. The FMS displays the uplinked flight plan on the DATALINK FPL REVIEW X/X pages. These pages are used to review the uplinked flight plan. Figures 6-83 and 6-84 are example review pages.  00936.03 Figure 6-83  01154.01 Figure 6-84

Step	Procedure 6-7 Uplinking a Flight Plan from a GSP
	The FMS displays the flight plan contents including descriptors. The following descriptors are used: • Origin Airport: ORIGIN • Departure Procedure: SID • Waypoint: Blank • Airway: AIRWAY • Arrival Procedure: STAR • Approach Procedure: APPR • Arrival Runway: RUNWAY • Missed Approach Procedure: MISSED APRCH • VI leg (Heading to Intercept): *INT(xxx°) • VM leg (Heading to a Manual Termination): FLY(xxx°) • VA leg (Heading to an Altitude): *ALT(xxx°) • FA leg (Course from a Fix to an Altitude): ALT It is important to note that procedure (SID/STAR/approach) contents are not transmitted by the GSP. Only the name of the procedure is transmitted in the flight plan. The FMS extracts the contents of the procedure from the onboard FMS navigation data base.

Step	Procedure 6-7 Uplinking a Flight Plan from a GSP
6	Select the ACTIVATE prompt (4R in Figure 6-84) to begin the loading process. If an active flight plan already exists, the FMS requests confirmation to replace the active flight plan. This is shown in Figure 6-85. The FMS also transmits to the GSP that the flight plan has been accepted.  Figure 6-85 If the REJECT prompt (4L in Figure 6-84) is selected, the flight plan is not loaded. In addition, The FMS transmits a rejected flight plan message to the GSP.

Datalink Reports

- **REPORTS 1/1** – Upon selection of the **REPORTS** prompt (2L) on the **DATALINK INDEX 1/X** page, the **REPORTS** page is displayed. This is shown in Figure 6-86.

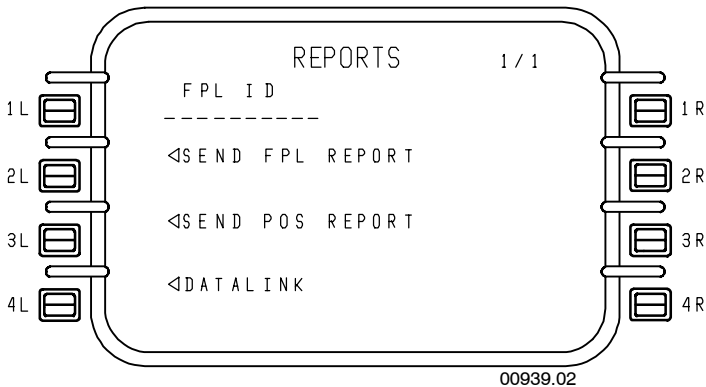


Figure 6-86

- **1L** – Any flight plan name that does not begin with a dash (-) can be entered. The default entry is the ACTIVE FLT PLAN origin and destination separated with a dash (-).
- **2L** – Pressing this prompt results in the transmission of a flight plan report. While a report is being sent, the line displays SENDING FPL REPORT.
- **3L** – Pressing this prompt results in the transmission of a position report. While a report is being sent, the line displays SENDING POS REPORT.
- **4L** – Pressing this DATALINK prompt returns the display to the DATALINK INDEX 1/X page.

Datalink Winds

The DATALINK WINDS pages provide the ability to request and receive winds aloft data. The data can be requested for waypoints on or off the active flight plan. Received data from the GSP for waypoints in the active flight plan can be loaded into the FMS wind model.

- **DATALINK WINDS 1/X** – Upon selection of the WINDS prompt (1R) on the DATALINK INDEX 1/X page, the DATALINK WINDS page is displayed. This is shown in Figure 6-87.

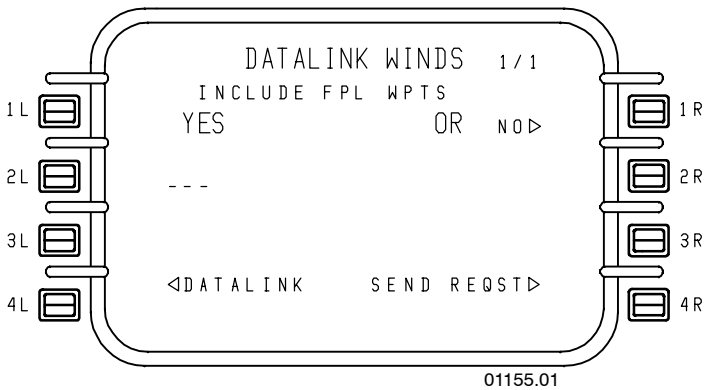


Figure 6-87

- **1L and 1R** – Selecting YES will result in the inclusion of the active flight plan waypoints into the wind request downlink. It is not necessary to manually enter the active flight plan waypoints on the page. Selecting NO will result in the active flight plan waypoints not being included in the downlink. YES is the default.
- **2L, 3L, 2R and 3R** – These lines allow for entry of waypoints to be included in the wind request downlink. A maximum of 52 waypoints are permitted. Upon entry of a waypoint at 2L, another entry prompt of dashes is provided at the next line select key. This is shown in Figure 6-88.

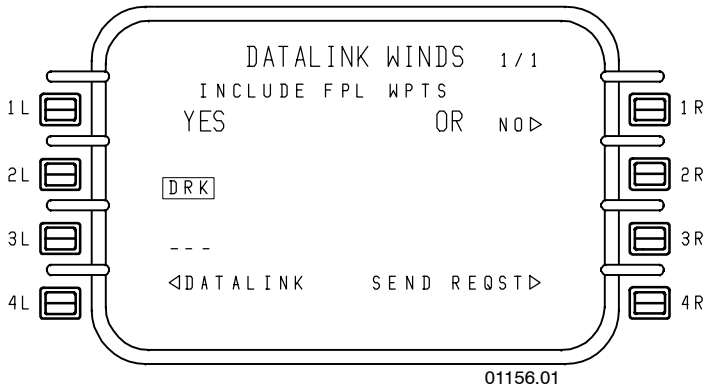


Figure 6-88

If a waypoint is entered and winds aloft data currently exists, the ► prompt is displayed to allow for display of the winds aloft data. The waypoints are displayed in inverse video upon entry without a ► prompt if no winds aloft data currently exists.

- **4R** - This key initiates the wind request downlink. The request is sent to the GSP. During this process, the FMS displays SENDING. Upon receiving the requested data from the GSP, the FMS displays the NEW WINDS AVAIL scratchpad message. The DATALINK WINDS page changes as shown in Figure 6-89.

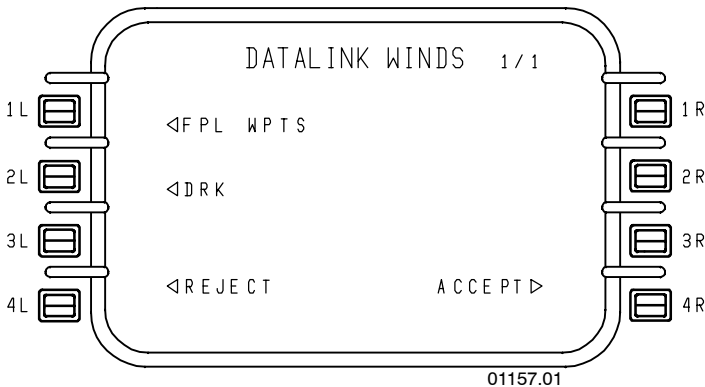


Figure 6-89

If the ACCEPT prompt (4R) is selected, the uplinked active flight plan waypoint wind data is loaded into the FMS wind model. In addition, an accept winds datalink response message is transmitted to the GSP. Selection of the REJECT prompt (4L) will result in the transmission of a rejected winds message being sent to the GSP and the FMS wind model is unchanged.

Winds Aloft

- **WINDS ALOFT 1/X** – This page is accessed from the DATALINK WINDS page. After receiving uplinked wind information, the desired waypoint is selected from the DATALINK WINDS page. The FMS will then display the WINDS ALOFT page. This is shown in Figure 6-90.

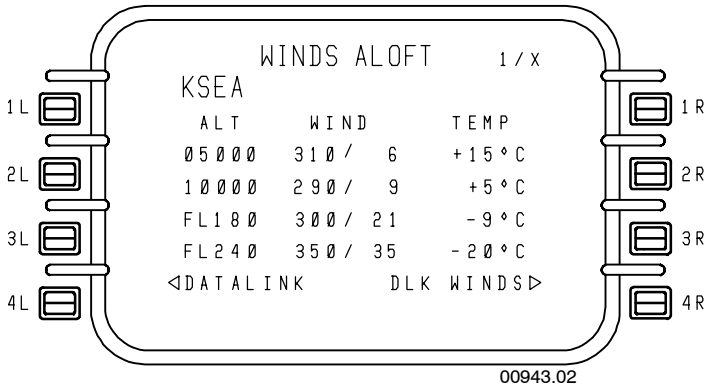


Figure 6-90

- **1L** – This line displays the waypoint identifier. No entry is permitted.
- **2L, 3L 2R and 3R** – These lines display the predicted waypoint winds aloft data: altitude, direction/speed, and temperature. Selection of the NEXT key results in the display of the next flight plan waypoint predicted wind data.
- **4R** – Pressing this DLK WINDS prompt returns the display to the DATALINK WINDS page.
- **4L** – Pressing this DATALINK prompt returns the display to the DATALINK INDEX 1/X page.

Address Configuration

Addressing is used for the routing of datalink messages to the correct recipient. The FMS can be configured to route flight plan, wind, and position reports to multiple recipients.

- **ADDRESS CONFIG 1/1** – Upon selection of the address prompt (1R) on the last DATALINK INDEX page, the ADDRESS CONFIG page is displayed. This is shown in Figure 6-91.

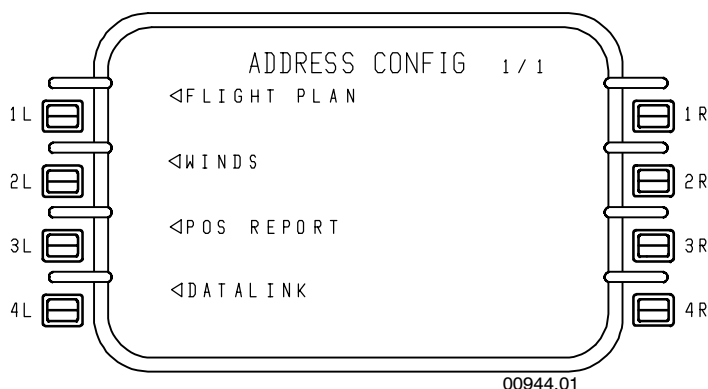


Figure 6-91

- **1L, 2L and 3L** – Selection of one of these prompts will result in the display of the appropriate address configuration page.
- **4L** – Pressing this DATALINK prompt returns the display to the DATALINK INDEX 1/X page.

Flight Plan Report Address Configuration

The FLIGHT PLAN ADDRESS page, shown in Figure 6-92, is used to define the recipients address for the flight plan request and report. The typical corporate jet application will use a single GSP recipient for all reports. Contact the GSP to determine the appropriate addressing to be used for flight plan reports.



Figure 6-92

- **1L** - The GSP company address identifier is entered on this line. A maximum of 10 characters may be entered.
- **2L** - The GSP ground address identifier is entered on this line. A maximum of 7 characters may be entered. Upon entry of a ground address, the next line select will display dashes to allow for another address. A maximum of seven ground addresses may be entered.
- **4L** - Pressing this ADDRESS prompt returns the display to the ADDRESS CONFIG page.

Winds Report Address Configuration

The WINDS ADDRESS page, shown in Figure 6-93, is used to define the recipients address for the wind request. The typical corporate jet application will use a single GSP recipient for all reports. Contact the GSP to determine the appropriate addressing to be used for wind report addressing.

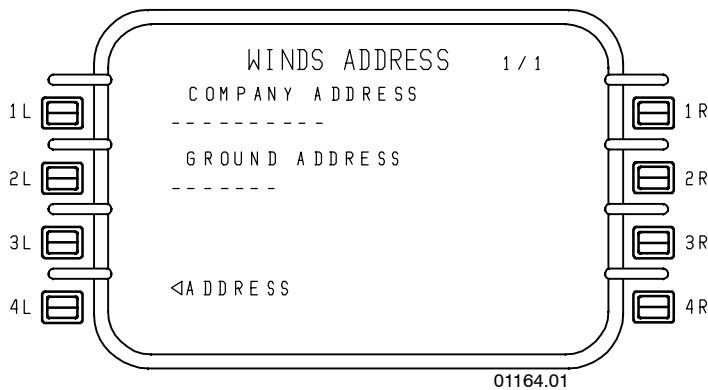


Figure 6-93

- **1L** - The GSP company address identifier is entered on this line. A maximum of 10 characters may be entered.
- **2L** - The GSP ground address identifier is entered on this line. A maximum of 7 characters may be entered. Upon entry of a ground address, the next line select will display dashes to allow for another address. A maximum of seven ground addresses may be entered.
- **4L** - Pressing this ADDRESS prompt returns the display to the ADDRESS CONFIG page.

Position Report Address Configuration

The POSITION REPORT ADDRESS page, shown in Figure 6-94, is used to define the recipients address for the position report. The typical corporate jet application will use a single GSP recipient for all reports. Contact the GSP to determine the appropriate addressing to be used for position report addressing.

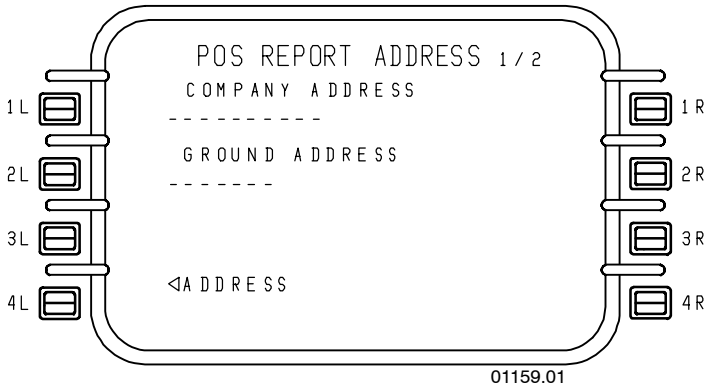


Figure 6-94

- **1L** - The GSP company address identifier is entered on this line. A maximum of 10 characters may be entered.
- **2L** - The GSP ground address identifier is entered on this line. A maximum of 7 characters may be entered. Upon entry of a ground address, the next line select will display dashes to allow for another address. A maximum of seven ground addresses may be entered.
- **4L** - Pressing this ADDRESS prompt returns the display to the ADDRESS CONFIG page.

DEPARTURES

The DEPARTURE function is used to examine and select departure runways and Standard Instrument Departures (SIDs) stored in the navigation data base.

Some SIDs are not in the data base. This is because of the way some procedures are defined by the controlling agency and the limitations of the FMS.

To illustrate the steps in the DEPARTURE function, San Jose, California (KSJC), is used as the origin of the active flight plan. Figure 6-95 displays the ALTAM6 departure for KSJC. Refer to Procedure 6-8 for DEPARTURE selection. At any point in the departure selection process, entering a new or the same airport at 1L returns the display to the beginning of the selection process.

Following selection of a SID, the following methods should be used to modify the departure procedure in the active flight plan:

- The DEPARTURE page may be used to:
 - Add a segment to the procedure already existing in the active flight plan.
 - Replace a procedure segment already in the active flight plan.
 - Delete a procedure segment from the active flight plan.
- Delete a portion, or all, of the activated procedure by performing a DIRECT-TO a waypoint in the active flight plan or alternate flight plan.
- Delete the procedure by activating a flight plan from the custom data base.
- Delete the FROM waypoint in the active flight plan.

SID

JEPPESEN

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10-3

SAN JOSE, CALIF
SAN JOSE INTL

BAY Departure (R) 120.1

ALTAM SIX DEPARTURE (ALTAM6.ALTAM) (PILOT NAV)
(RWYS 12L/R)

This SID requires a minimum climb gradient of 350' per NM to 5000' for obstruction clearance.

Grnd speed-Kts	75	100	150	200	250	300
350' per NM	438	583	875	1167	1458	1750

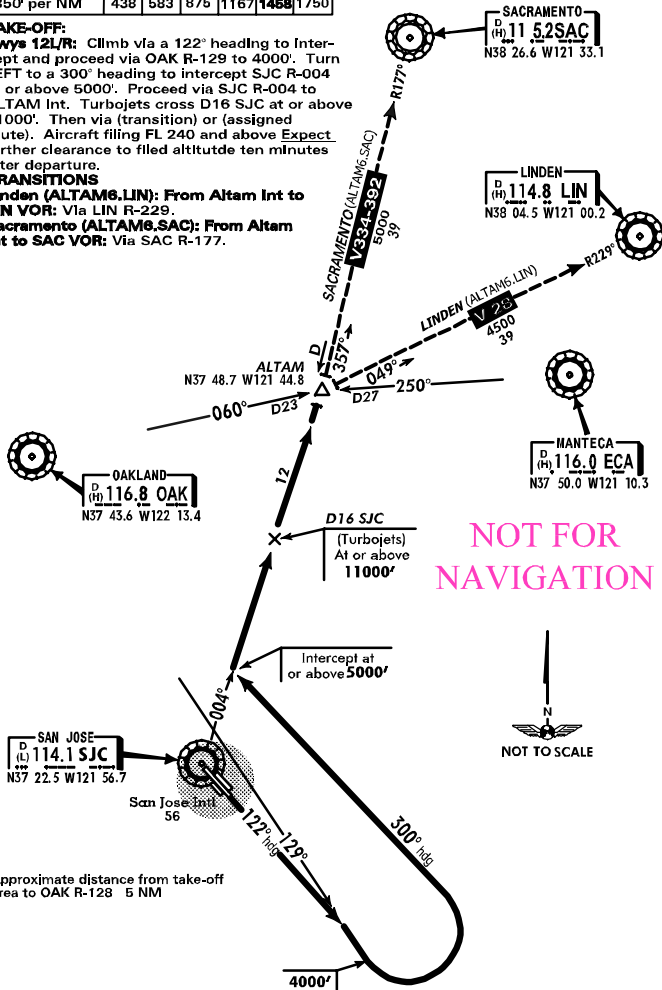
TAKE-OFF:

Rwys 12L/R: Climb via a 122° heading to Intercept and proceed via OAK R-129 to 4000'. Turn LEFT to a 300° heading to Intercept SJC R-004 at or above 5000'. Proceed via SJC R-004 to ALTAM Int. Turbojets cross D16 SJC at or above 11000'. Then via (transition) or (assigned route). Aircraft filing FL 240 and above Expect further clearance to filed altitude ten minutes after departure.

TRANSITIONS

Linden (ALTAM6.LIN): From Altam Int to LIN VOR: Via LIN R-229.

Sacramento (ALTAM6.SAC): From Altam Int to SAC VOR: Via SAC R-177.



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AD-58012@

San Jose, CA ALTAM6 Departure
Figure 6-95

- **DEPARTURE RUNWAYS 1/X** – Figure 6–96 is displayed when selecting the DEPARTURE function. From this page, the pilot can select a departure runway, Standard Instrument Departure (SID), and departure transition. Access to the DEPARTURE page from the ACTIVE FLT PLAN page is available only when the origin waypoint is an airport and the aircraft is within 50 NM of the origin. Access to the DEPARTURE page is always available from the NAV INDEX.

The default airport at 1L is the origin of the active flight plan. If the origin is not defined or if it is not an airport, prompts are displayed for entry of an airport. If the origin waypoint is not an airport, access to SIDs is for review only. If the active flight plan contains a SID, the selected departure runway, SID, and transition are displayed.

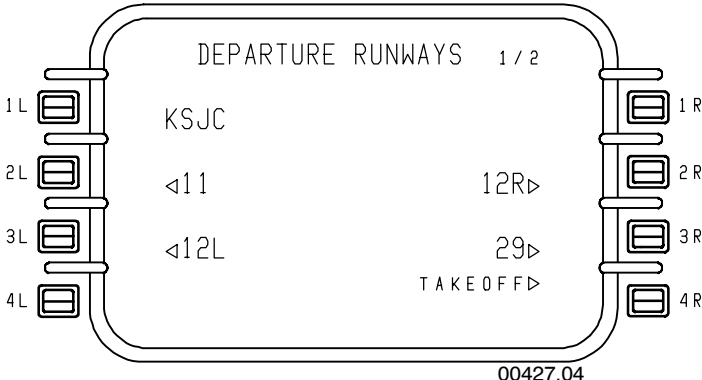
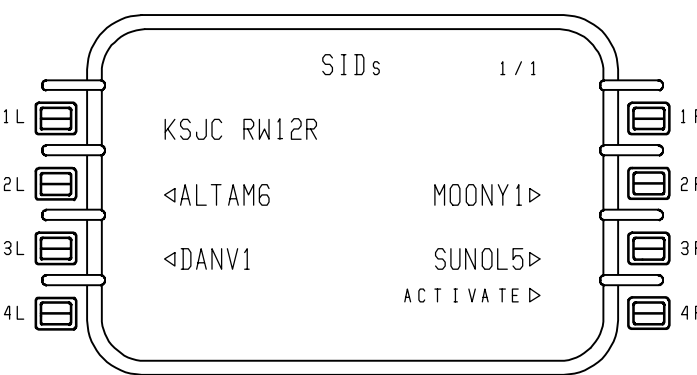
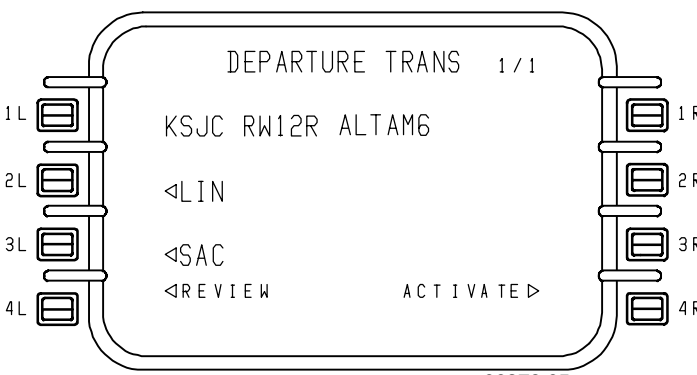
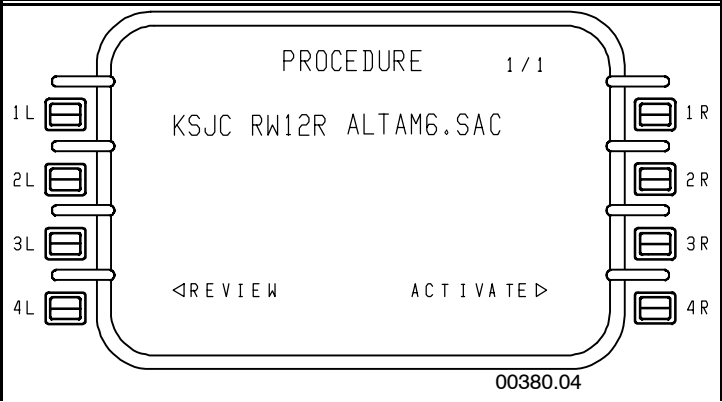
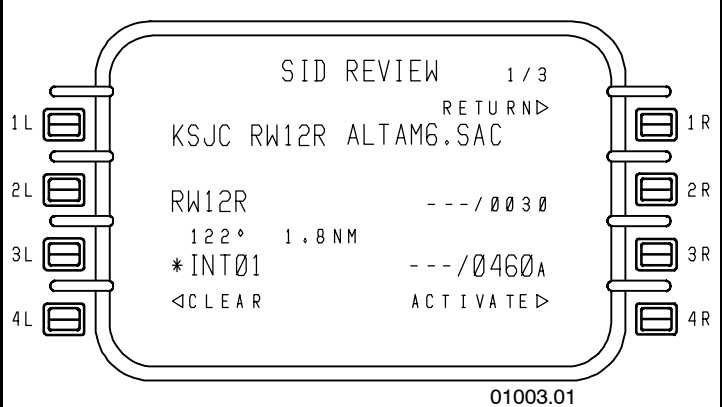
Step	Procedure 6-8 Departure Selection
1	Select DEPARTURE from the ACTIVE FLIGHT PLAN or NAV INDEX.
2	Select the desired runway from the DEPARTURE RUNWAY page. This is shown in Figure 6–96. Runway 12R (2R) is selected in this example. 

Figure 6-96

Step	Procedure 6-8 Departure Selection
3	Select the SID from the SIDs page. This is shown in Figure 6-97. ALTAM6 (2L) is selected in this example.  01002.01 Figure 6-97
4	Select the departure transition from the DEPARTURE TRANS page. This is shown in Figure 6-98. SAC (3L) is selected in this example.  00379.05 Figure 6-98
5	Select REVIEW (4L) or ACTIVATE (4R) from the PROCEDURE 1/1 page. This is shown in Figure 6-99. REVIEW is selected in this example.

Step	Procedure 6-8 Departure Selection
	 Figure 6-99 DETAILS – Select REVIEW to review the selected procedure or select ACTIVATE to insert the selected procedure into the active flight plan. The ACTIVATE prompt is displayed on these pages only if the airport is the origin airport of the flight plan. Selecting REVIEW or ACTIVATE partway through the selection procedure ends the departure selection process. The selected portion of the procedure can be reviewed and/or inserted into the flight plan.
6	Review the selection, shown in Figure 6-100, and select NEXT to move to the next review page.  Figure 6-100

Step	Procedure 6-8 Departure Selection
	SID REVIEW 1/X - Figure 6-100 displays the selected runway, SID, and transition as it would look if ACTIVATED into the flight plan. The runway threshold elevation of 30 feet is displayed in blue on the right side of the page. The first leg of the departure is to climb on a heading of 122° to intercept and proceed via OAK R-129 to 4000 feet. The intercept of the radial is the waypoint *INT01 in the ACTIVE FLT PLAN. The altitude constraint (blue lettering on the right side of the page) is followed by the letter A to indicate that the constraint is at or above constraint.
7	Review the selection, shown in Figure 6-101, and select NEXT to move to the next review page. Figure 6-101 SID REVIEW 2/X - Figure 6-101 consists of a heading of 131° to an altitude at or above 4000 feet (*ALT05). Since the *ALT05 waypoint has no fixed lateral position, it is sequenced when the aircraft reaches the altitude constraint, 4000 feet in this example. This is followed by a mandatory left turn (indicated by the inverse video L) immediately above *INT07. From here, the procedure requires flying a heading of 300° to intercept the course of 004° inbound to latitude/longitude waypoint number 1 (*LL01). The intercept leg contains an altitude restriction at or above 5000 feet. For *LL01, an 11,000-foot at or above restriction exists.

Step	Procedure 6-8 Departure Selection
8	Review the selection shown in Figure 6-102. This is the last page or review in this example. Select CLEAR (4L) or ACTIVATE (4R). 1L 2L 3L 4L SID REVIEW 004° 12.0NM ALTAM 358° 39.0NM SAC END OF PROCEDURE <CLEAR ACTIVATE> 3 / 3 --- --- --- 1R 2R 3R 4R 00383.04 Figure 6-102 SID REVIEW 3/X – Figure 6-102 shows a course of 004° inbound to the ALTAM intersection that is followed by the Sacramento transition leg. Press the CLEAR prompt (4L) to clear the selected procedure and display the DEPARTURE RUNWAYS page. Selecting the ACTIVATE prompt (4R) inserts the selected runway, SID, and transition into the active flight plan and ends the departure selection process. However, if the airport is not part of the active flight plan, the SID cannot be activated.

ARRIVAL

The ARRIVAL pages are used to examine and select runways, approaches, and Standard Terminal Arrival Routes (STARs) stored in the navigation data base.

Some approaches and STARs are not in the data base. This is because of the way some procedures are defined by the controlling agency and the limitations of the FMS.

To illustrate the steps in the ARRIVAL function, Minneapolis, Minnesota (KMSP) is used as the destination of the active flight plan. This example starts with the selection of a runway. However, there is no required selection order. Also, it is not necessary to make a selection from each

page. If a STAR has already been activated, it is possible to select a runway without affecting the previously selected procedure. At any point in the selection process, it is possible to return to the ARRIVAL page and review and/or activate the selected items.

On the ARRIVAL page, if a new runway is selected that is not supported by a previously selected STAR (or approach), the previous procedures are not displayed for selection into the active flight plan. In fact, only approaches to the selected runway are displayed on the APPROACH page. If these changes are activated while flying the previous procedure, the FMS prompts for CHANGE ACTIVE LEG confirmation.

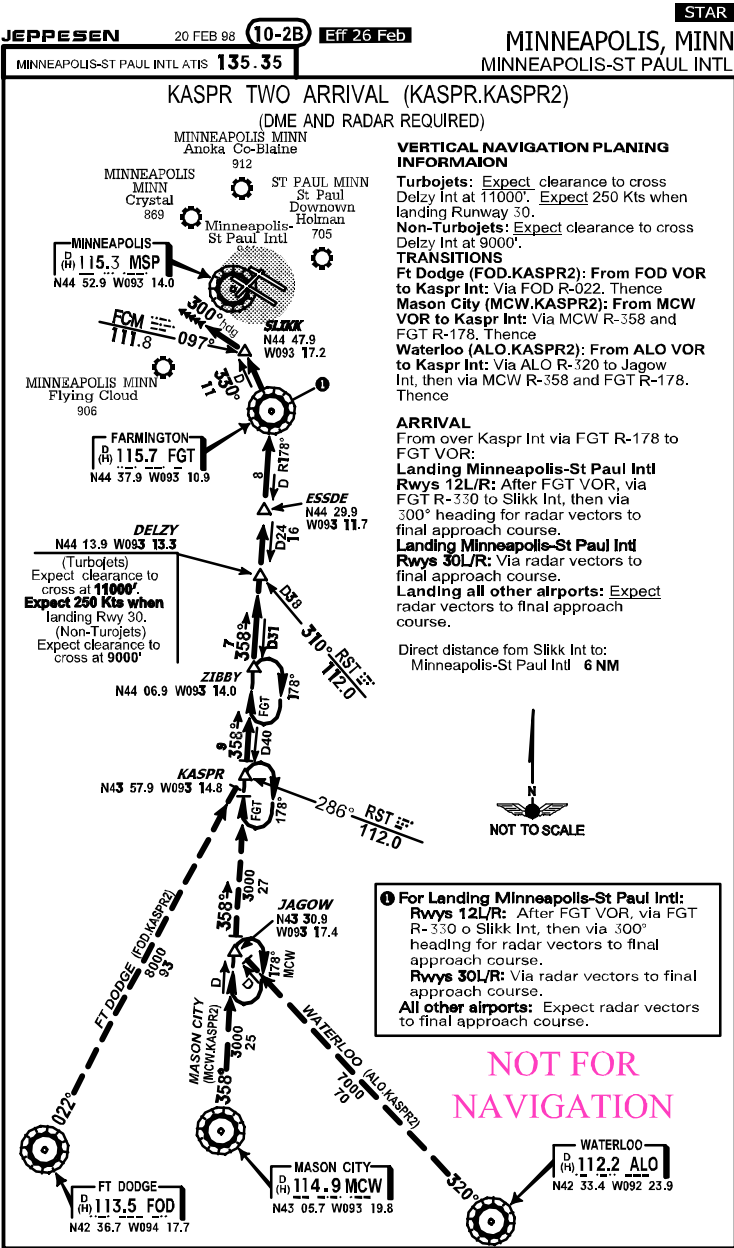
To select a new runway, return to the ARRIVAL page and select the RUNWAY prompt. Then, choose the desired runway, select the ARRIVAL prompt, and select the ACTIVATE prompt.

Following selection of an arrival procedure (STAR or approach), the following methods should be used to modify the arrival procedure in the active flight plan:

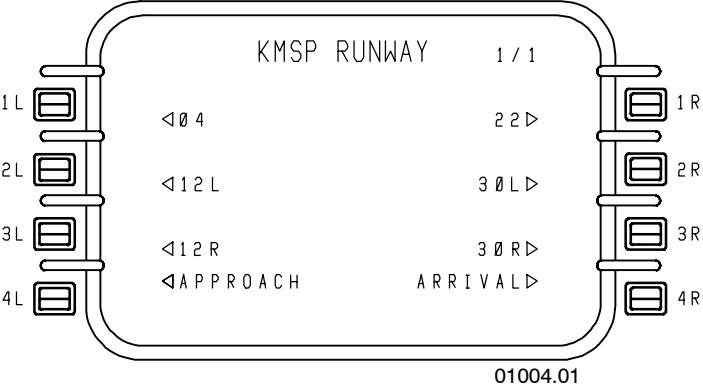
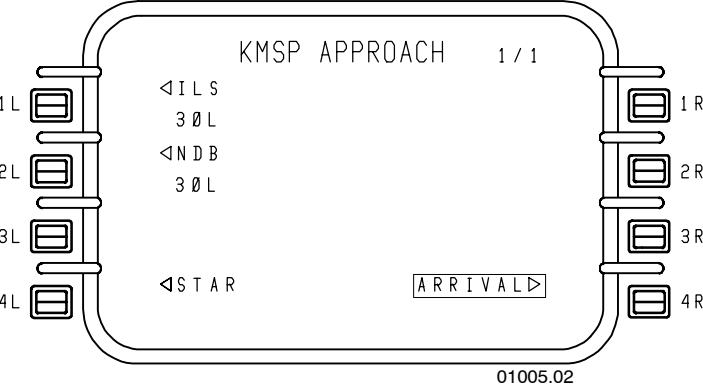
- The ARRIVAL page may be used to:
 - Add a segment to the procedure already existing in the active flight plan.
 - Replace a procedure segment already in the active flight plan.
 - Delete a procedure segment from the active flight plan.
- Delete a portion, or all, of the activated procedure by performing a DIRECT-TO a waypoint in the active flight plan or alternate flight plan.
- Delete the procedure by activating a flight plan from the custom data base.
- Delete the FROM waypoint in the active flight plan.
- Delete the procedure turn waypoint in the active flight plan.
- Delete the hold attribute from the course reversal hold waypoint.

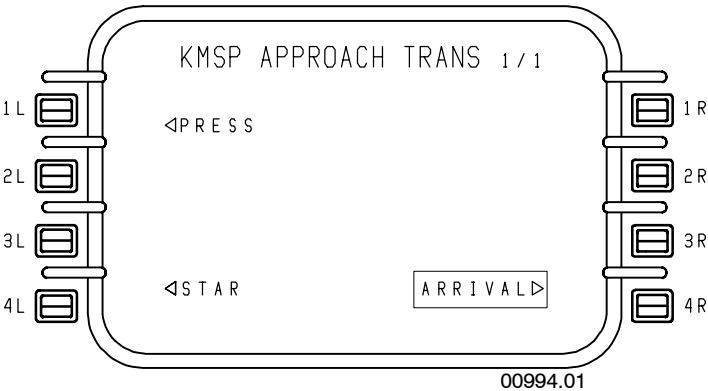
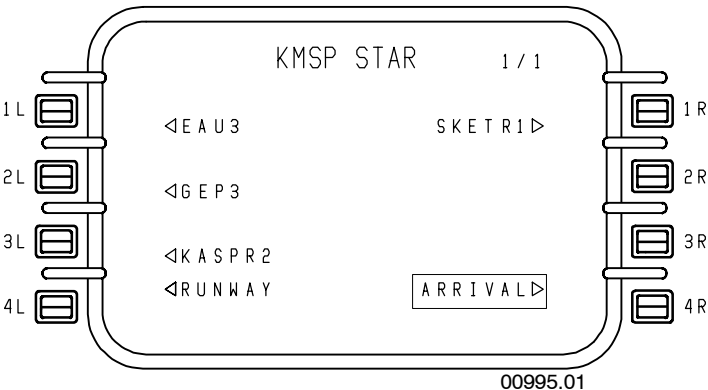
Circle-to-land approaches are not supported in the navigation data base.

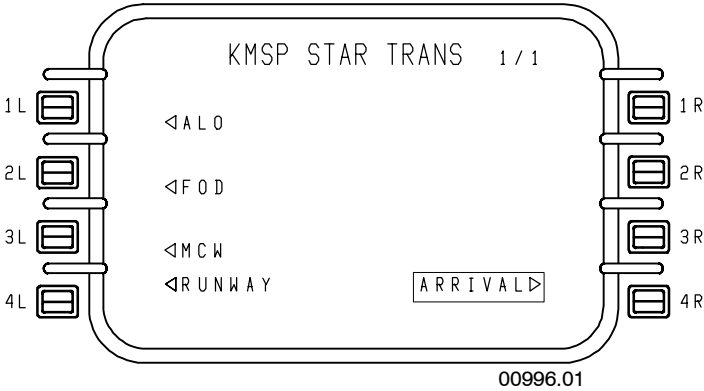
Figure 6-103 displays the STAR plate. Refer to Procedure 6-9 for arrival selection.

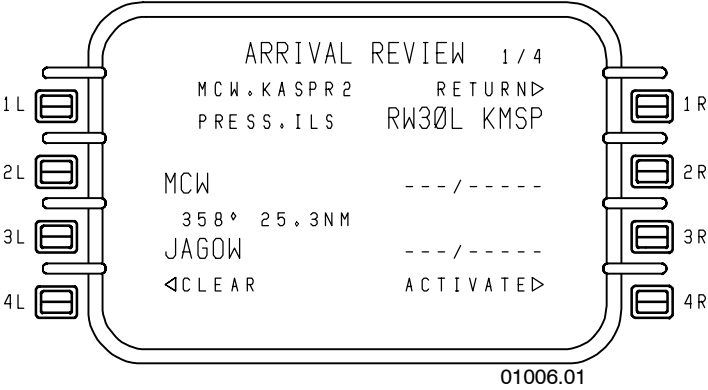
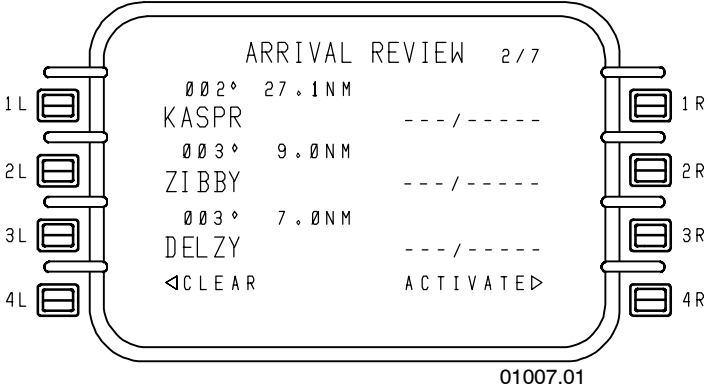


Step	Procedure 6-9 Arrival Selection
1	Select ARRIVAL from the active flight plan or NAV INDEX.
2	Select RUNWAY, APPROACH, or STAR from the ARRIVAL page. This is shown in Figure 6-104. Figure 6-104 DETAILS - Figure 6-104 is displayed when the ARRIVAL function is selected. From this page, the pilot can select which element, arrival runway, approach, or STAR is to be selected. This page can also be accessed from the ACTIVE FLT PLAN page when the aircraft is within 200 flight plan miles of the destination. The default airport at 1R is the destination of the active flight plan. If the destination is not defined, or if it is not an airport, prompts are displayed to enter the airport. If previous selections have been made, they are displayed on this page. Selections can only be deleted on this page. The runway, approach or STAR can be selected (or reselected) in any order. In each case, the ARRIVAL prompt is displayed in inverse video. It is used to return to the ARRIVAL. If an approach is going to be selected, a step can be saved by selecting APPROACH from this page. The runway is automatically selected when an approach is selected.

Step	Procedure 6-9 Arrival Selection
3	Select the desired runway from the RUNWAY page. This is shown in Figure 6-105. In this example, runway 30L (2R) is selected.  Figure 6-105 Any previously selected runway is labeled as (ACT) or (SEL). There can be more than one page of runways.
4	Select the approach from the APPROACH page. If the runway is selected first, the FMS displays only the approaches for the selected runway. This is shown in Figure 6-106. In this example, ILS 30L (1L) is selected.  Figure 6-106 If only the straight-in portion of an approach is desired, select the approach without selecting an approach transition.

Step	Procedure 6-9 Arrival Selection
5	Select the approach transition (includes feeder routes) from the APPROACH TRANS page. This is shown in Figure 6-107. In this example, PRESS (1L) is selected.  Figure 6-107
6	Select the STAR from the STAR page. This is shown in Figure 6-108. In this example, KASPR2 (3L) is selected.  Figure 6-108

Step	Procedure 6-9 Arrival Selection
7	Select the STAR transition from the STAR TRANS page. This is shown in Figure 6-109. In this example, MCW (3L) is selected.  Figure 6-109
8	Once all selections have been made, the ARRIVAL page is automatically displayed. This is shown in Figure 6-110. The choices from this page are to repeat the selection process, if necessary, ACTIVATE (4R) which inserts the selection in the flight plan, or REVIEW (4L). In this example, REVIEW (4L) is selected.  Figure 6-110

Step	Procedure 6-9 Arrival Selection
9	Review to verify the selection prior to activation into the active flight plan. From page 1/4, shown in Figure 6-111, select NEXT (paging keys) for display of page 2/4.  Figure 6-111
10	At any time in the review process, the ACTIVATE prompt (4R) can be used to activate the approach into the active flight plan. This is shown in Figure 6-112. The CLEAR prompt (4L) can be used to return to the selection process. The review process can be continued by using the paging keys through the end of the procedure, including the missed approach procedure.  Figure 6-112

Approach

Once an approach has been selected, there are many things the pilot should check and/or monitor during the approach. The following is a list of those items:

- **Before starting a non-precision approach transition or approach, the crew must review the published approach procedure and verify the FMS waypoints and altitude restrictions.**
- Before starting a non-precision approach transition that is flown by the FMS, it is important to verify that the transition is cleared by ATC. Selecting the transition fix is usually the path to selecting the actual transition.
- The APRCH annunciator must turn on 2 NM before the final approach fix. It will remain lit for the remainder of the approach. This is a positive cue to the flight crew that the sensor configuration is correct and sensor integrity is within limits for the approach. The approach annunciator is not lit during localizer based approaches since the FMS is not authorized to be coupled during localizer approaches. The DGRAD annunciator must be off throughout the approach. If the DGRAD annunciator turns on, the FMS should not be used for the remainder of the approach. The flight crew can continue the approach using raw data or perform the missed approach procedure.
- **If VNAV (VPATH) is used for vertical guidance on the approach, verify that the approach plate waypoint altitudes are shown on the FMS CDU. Verify that the altitude selector is set to the Minimum Descent Altitude (MDA).**

NOTE: If the aircraft is equipped with VGP mode, the preselector may be set to the missed approach altitude when the VGP mode is being used as the active flight director. See page 6-81 for additional details.

- Industry wide standards for data base information are currently inconsistent on many approaches. Some vertical paths are defined to 50 feet above the runway. Others do not arrive at MDA until at the MAP. Some approaches provide vertical guidance below the published MDA and some vertical paths differ from the VASI/PAPI angles.

- **Since charts are continually updated, the FMS waypoint names may not exactly match the chart names. Additionally, there may be differences between courses displayed on the chart and those displayed on the CDU and EFIS. These differences are the result of changes in magnetic variation and are normally less than 2 degrees. Verify possible changes before starting an approach.**
- The navigation data base does not have step down waypoints between the Final Approach Fix (FAF) and MAP if the VNAV path satisfies the step down restrictions. VNAV path guidance and a cross check with other navigation aids are the only assurance that all descent path restrictions are met. Using modes other than VNAV may be desirable for some approaches.
- Refer to the GPS, page 6-95, for information on GPS Receiver Autonomous Integrity Monitor (RAIM) for GPS only approaches.
- Approaches in the navigation data base consist of localizer based approaches and non-precision approaches. There are no circle-to-land procedures in the data base. The FMS is certified to fly all non-precision approaches (GPS, NDB, VOR/DME, VOR, RNAV, NDBDME, DME/DME). Approaches from the data base can contain DME arcs. The FMS flies the arc as specified in the approach. In some cases, clearance to intercept the arc other than specified in the approach is given. Refer to page 9-10 for information on intercepting an arc.
- The FMS cannot be used to fly localizer approaches (ILS, LOC, BAC, SDF, LDA, IGS, DGPS). These approaches are flown by displaying the localizer data and hand flying the aircraft or by using the flight director/autopilot. However, these procedures can be selected and activated on the FMS to enhance situational awareness. The FMS displays the approach on the EFIS map displays. The FMS can be used to fly the approach transition and the missed approach phases of precision approaches.
- An approach can be selected with or without an approach transition. For example, if receiving vectors to the final approach course, an approach transition need not be selected with the approach. The pilot flies the specified vectors and arms LNAV, or LNAV and VNAV. The FMS automatically captures the final approach course.

- The altitude selector is observed while in VNAV during all phases of flight, including the approach phase. The altitude selector should not be set below the published MDA until the runway is visible and the approach can be made.

NOTE: If the aircraft is equipped with VGP mode, the preselector may be set to the missed approach altitude when the VGP mode is being used as the active flight director. See page 6-81 for additional details.

- Before flying the approach, the waypoints, as well as constraints in the procedure, should be verified with the approach charts. If the data base contains more waypoints for the procedure than the chart actually shows, the flight plan should reflect the selected procedure. The data base does not contain step down fixes on the final approach if the constraint at the step down fix is satisfied by the vertical descent path into the MAP.
- Following selection of an approach, the following should NOT be performed to the approach procedure:
 - Add waypoints into the middle of an approach procedure.
 - Relocate procedure waypoints in the flight plan.
 - Remove waypoints from an approach procedure (other than by DELETING the FROM waypoint, performing a DIRECT-TO, activating another approach, or activating another flight plan), and then continue to fly the procedure.
 - Change an altitude or angle constraint associated with an approach waypoint.
 - Add holding patterns, orbits, or radial intercepts to approach waypoints.
 - Change the destination and then continue to fly the approach procedure to the original destination.

VERTICAL GLIDE PATH (VGP) MODE

The VGP mode is designed to allow operation of the altitude preselector during FMS non-precision approaches to be similar in operation as ILS approaches. During FMS non-precision approaches, it is necessary to dial the altitude preselector to the Minimum Descent Altitude (MDA) during the final approach segment. When a missed approach is executed, it is necessary to reset the altitude preselector to the missed approach altitude. With VGP, the altitude preselector can be set to the missed approach procedure altitude (similar to an ILS approach) once the approach light is lit. The FMS continues to descend the aircraft on a defined vertical path regardless of the altitude preselector. This is similar in concept to glideslope capture for ILS approaches.

Arming of the VGP mode occurs during the approach selection process. The following sequence of events occur for VGP to be enabled, armed, and active:

1. VNAV is selected on the Flight Guidance Control Panel (FGCP).
2. When the flight plan distance to the runway is less than 50 NM, VGP can be armed by pressing the APPR (approach) button.
3. At 2 NM prior to the FAF, the approach light is illuminated. If the aircraft is in VPATH at this point, VGP capture mode becomes active. If the aircraft is in VALT, VGP capture mode occurs when the aircraft sequences the TOD.
4. The altitude preselector can be dialed to the missed approach altitude while VGP is active. The FMS will disregard the altitude preselector and will descend to the Missed Approach Point (MAP) altitude constraint.

The VGP mode is cancelled by any of the following reasons:

1. If the approach light is extinguished during the approach, VNAV disengages and the FGC transitions to pitch hold. If the aircraft is above the altitude preselector, the FGC will level the aircraft at the preselector setting. If the aircraft is below the altitude preselector, it will continue the descent.
2. VGP is disengaged if the VNAV modes become VFLCH.

The examples, shown in Tables 6-1 and 6-2, illustrate approach transitions and how the FMS flies the transitions.

Approach Transition	Chart Depiction	FMS Groundtrack
DME Arc		
Procedure Turn		

Typical FMS Pattern Displays
Table 6-1

Approach Transition	Chart Depiction	FMS Groundtrack
Holding Pattern Course Reversal		
Teardrop		See Note below
Note: Following sequence of WPT, the FMS turns to capture the final approach course. The FMS is not flying a defined ground track during this maneuver. Depending upon speed and teardrop geometry, the FMS may roll wings level on a 45° intercept to the final approach course. Typically, the aircraft will be banked until the final approach course is captured.		

Typical FMS Pattern Displays
Table 6-2

Missed Approach

The FMS displays a MISSED APRCH prompt at 4L on the active flight plan pages. This occurs 2 NM before the FAF or 5 NM from the runway, whichever is reached first. If the prompt is selected, the missed approach procedure is activated and inserted in the flight plan following the MAP. To activate the go-around mode, the go-around button(s) must be selected.

The aircraft go-around button(s) can also be used to activate the missed approach procedure but only while the MISSED APRCH prompt is displayed.

When MISSED APRCH is selected, the APRCH annunciator extinguishes and the FMS transfers from the approach mode to the terminal mode.

POSITION SENSORS

One of the primary FMS tasks is to navigate the aircraft along a predefined flight plan. To do this, the FMS receives navigation data from various sensors on board the aircraft. From the available sensors, the FMS determines the best navigational mode, and combination of sensors, to provide the most accurate aircraft position.

Navigation Modes

The priority of the navigation modes is as follows:

- GPS
- DME/DME
- VOR/DME
- IRS.

The priority is based on sensor accuracy with GPS being the most accurate sensor. When GPS is available, it is weighted at 100%. In other words, the FMS position is equal to the GPS position. When more than one GPS position is available, the FMS position is equal to the blended GPS position. When GPS is used, other sensors are still monitored for position differences from the FMS position. Other sensors do not contribute to the FMS position unless GPS becomes unavailable or inaccurate.

DME/DME is the next most accurate position. The FMS automatically tunes the scanning DMEs to provide the best position from DME/DME.

VOR/DME updating is less accurate than DME/DME because of the VOR bearing error. The bearing error increases with distance from the navaid thus reducing the accuracy of the VOR/DME position as the aircraft moves away from a navaid.

IRS is the navigation mode where the FMS blends the available IRS sensors. This mode is used primarily when the aircraft is operating over water or in a sparse navaid environment.

All sensor positions are continuously compared to the FMS computed position. If any sensor differs by more than 10 NM from the FMS position, a scratchpad message is displayed (example: CHECK IRS 1 POSITION).

When the FMS is using GPS, DME/DME or VOR/DME for updating, a position error for each IRS is continuously calculated and stored within the FMS. This calculated error is called an IRS bias. If the FMS starts using the IRSs for position updating, the actual position used by the FMS is each IRS position plus the last calculated bias for each IRS. At this point, the FMS position starts to drift with the IRS position. Once GPS, DME/DME or VOR/DME updating is resumed, a new bias is calculated and IRS drift error has no impact on FMS position. For this reason, under normal circumstances, it is **not recommended** that the IRSs be updated at the end of the runway.

The change from one navigation mode to another is not instantaneous. For example, each time the radios are tuned, the radio position is lost for some time. However, the FMS annunciates the navigation mode as radio updating. Some mode changes require several minutes to complete.

The following is an example of a typical transoceanic flight with an aircraft equipped with VOR/DME and IRS. The flight begins with the FMS operating in DME/DME mode. As the aircraft leaves DME coverage, the FMS transitions to IRS navigation. As the aircraft approaches radio coverage, the system returns to radio updating.

For GPS equipped aircraft, the GPS is used for all phases of flight (departure, enroute, oceanic, terminal, and approach). While the GPS is available and valid for navigation, the radios and IRS positions are not used in computing the FMS position. If the GPS becomes unusable for navigation, the FMS uses the next highest priority available sensor for navigation.

Because of limits on the use of navaids, it is possible for the aircraft to approach controlled airspace before returning to radio updating. The pilot should assess the FMS position before entering controlled airspace. This assessment can be done by checking the navigation

mode on PROGRESS page 1 and cross-checking FMS position with raw VOR/DME information. The CROSSING POINTS page can assist in cross-checking by giving the FMS bearing and distance to the selected station and comparing that to raw VOR/DME data.

The POS SENSORS pages, shown in Figures 6-113 and 6-114, can be selected from the NAV INDEX page or the POSITION INIT page. Sensors are grouped by type and listed in numerical order. The group priority is as follows:

- IRS
- GPS.

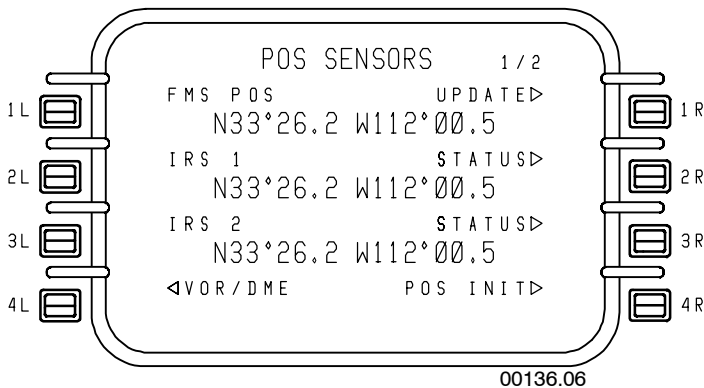


Figure 6-113

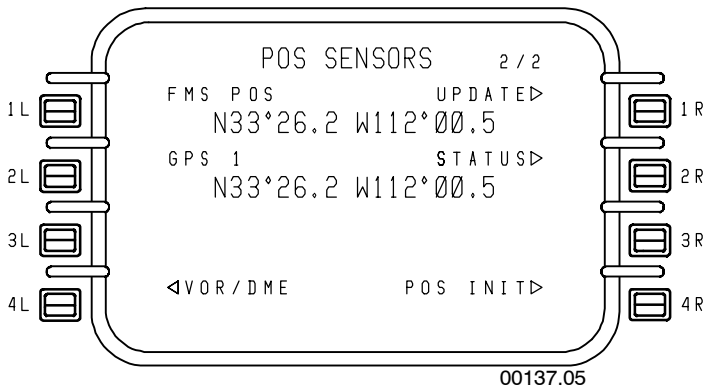


Figure 6-114

Using this page, it is possible to update the FMS position (UPDATE) and examine sensor positions and status (STATUS). This page can also be used to determine which sensors are being used by the FMS for computing the aircraft's position. From this page, the pilot can remove sensors from being used for position updating (refer to Procedure 6-13, page 6-105).

FMS Position Update

The pilot can update the FMS to a sensor position, or known position, using POSITION UPDATE. When POSITION UPDATE is activated, the FMS position is corrected to the selected position.

Pressing the line select key adjacent to the UPDATE prompt (1R) on the POS SENSORS pages, shown in Figures 6-113 and 6-114, displays the FMS UPDATE page, which is shown in Figure 6-115. This page displays the current FMS position (1L), MANUAL prompt (2L), and a SENSOR prompt (2R).

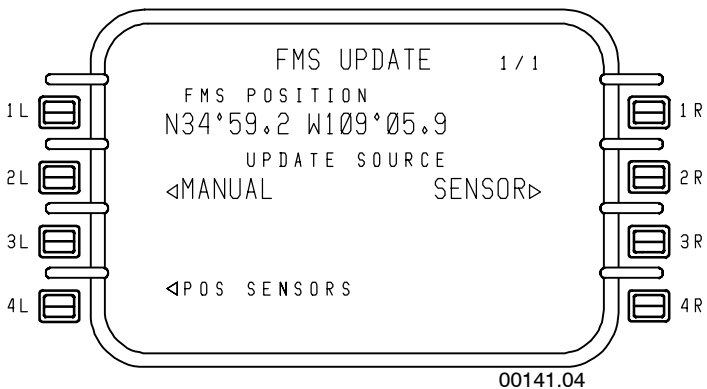
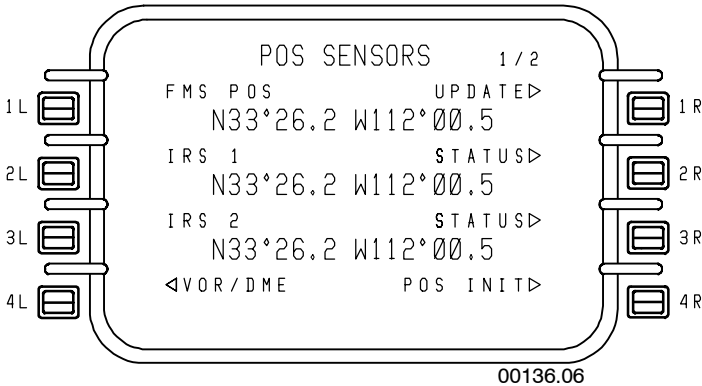
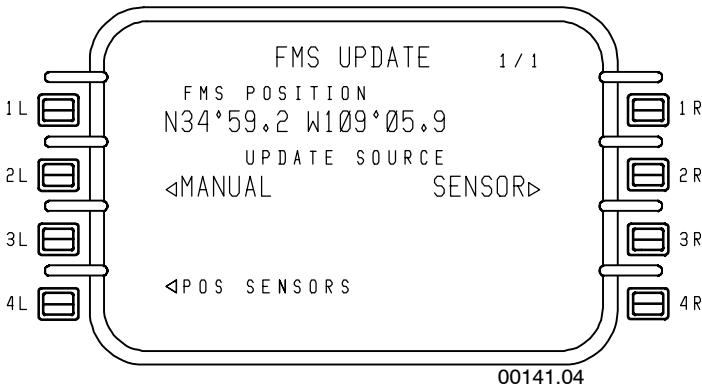
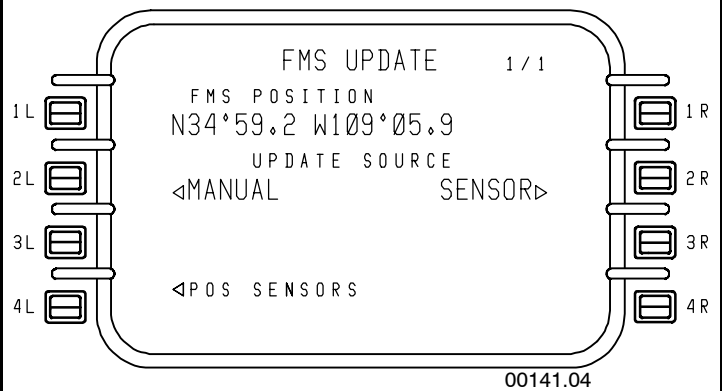


Figure 6-115

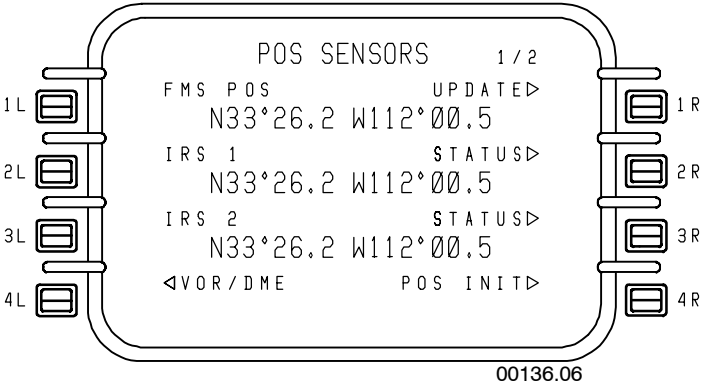
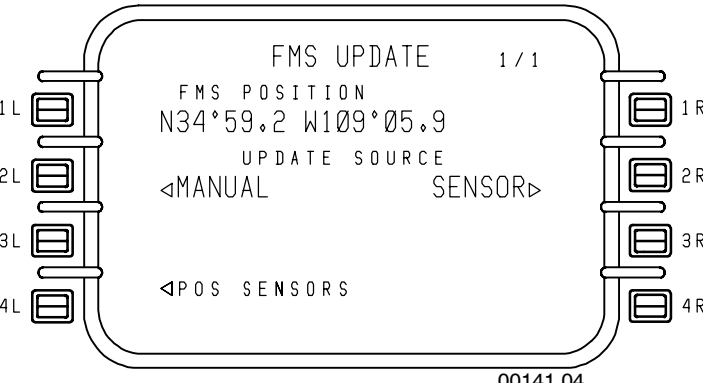
Procedure 6-10 uses the manual position UPDATE feature by flying over a known position. In this example, the FMS position is checked when the aircraft passes over the ZUN VORTAC.

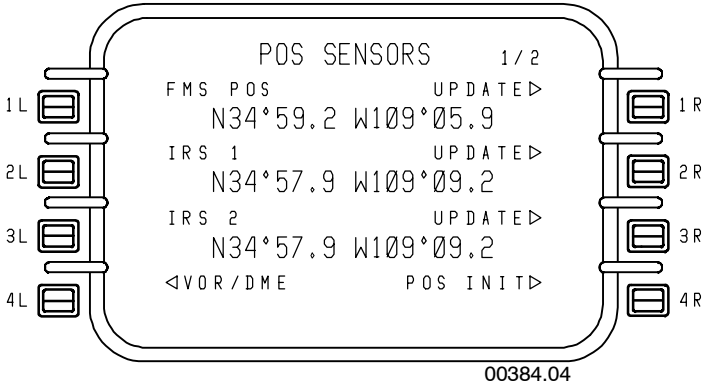
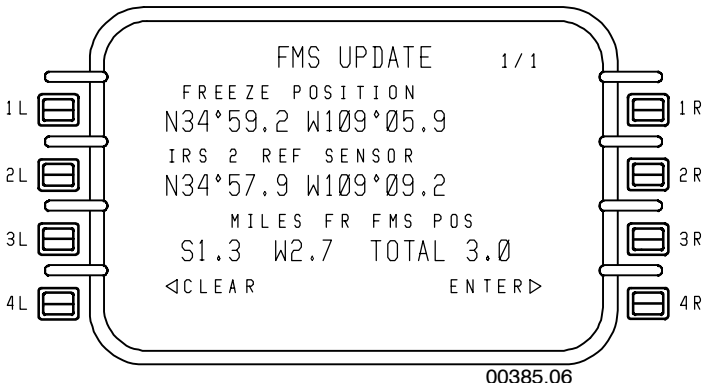
Step	Procedure 6-10 FMS Manual Position Update by Flyover
1	Select POS SENSORS from the NAV INDEX.
2	Before reaching ZUN, select the UPDATE prompt (1R). This is shown in Figure 6-116.  Figure 6-116
3	When the aircraft crosses over the navaid, select the MANUAL prompt (2L). This is shown in Figure 6-117.  Figure 6-117

Step	Procedure 6-10 FMS Manual Position Update by Flyover
	DETAILS - The FMS position is recorded when the MANUAL prompt is pressed as the aircraft crosses over ZUN. This recorded position, labeled FREEZE POSITION, is displayed on the CDU and shown in Figure 6-118. This is NOT the current FMS position. It is the FMS position when the manual prompt was pressed. The FMS continues to update current aircraft position.
4	Enter either an identifier or coordinates for the REF WPT. This is shown in Figure 6-118. For this example, enter ZUN as the REF WPT. The diagram shows a cockpit display with a central rectangular screen and four sets of four line select keys on each side, labeled 1L, 2L, 3L, 4L on the left and 1R, 2R, 3R, 4R on the right. The screen displays the following text: <pre> FMS UPDATE 1 / 1 FREEZE POSITION N34°59.2 W109°05.9 ----- REF WPT OR ----- ° ----- ° ----- MILES FR FMS POS TOTAL <CLEAR </pre> Below the screen, the identifier 00142.04 is visible. Figure 6-118
5	Review difference between the FREEZE POSITION and the reference position. Select either CLEAR (4L) or ENTER (4R), as shown in Figure 6-119. The diagram shows a cockpit display with a central rectangular screen and four sets of four line select keys on each side, labeled 1L, 2L, 3L, 4L on the left and 1R, 2R, 3R, 4R on the right. The screen displays the following text: <pre> FMS UPDATE 1 / 1 FREEZE POSITION N34°59.2 W109°05.9 ZUN REF WPT N34°57.9 W109°09.2 MILES FR FMS POS S1.3 W2.7 TOTAL 3.0 <CLEAR ENTER> </pre> Below the screen, the identifier 00143.04 is visible. Figure 6-119

Step	Procedure 6-10 FMS Manual Position Update by Flyover
	DETAILS - The FMS calculates the difference between ZUN and the FREEZE POSITION (FMS position when the aircraft overflow ZUN). Figure 6-119 shows the FMS position was 3.0 NM (1.3 NM South and 2.7 NM West) from ZUN when the aircraft flew over the navaid. At this point, one of two selections can be made. If the ENTER prompt is pressed, a 3 NM correction is added to the present FMS position (1.3 NM North and 2.7 NM East). This jumps the current FMS position (which is constantly changing) 1.3 NM North and 2.7 NM East. If the CLEAR prompt is selected, no correction is applied to the FMS position.
6	For either selection, the FMS displays the current FMS position on the FMS UPDATE page. This is shown in Figure 6-120.  The diagram shows a rectangular display screen with a rounded border. Inside the screen, the text is as follows: 'FMS UPDATE' at the top center, followed by '1 / 1' at the top right. Below that is 'FMS POSITION' followed by 'N34°59.2 W109°05.9'. Then 'UPDATE SOURCE' followed by '<MANUAL' on the left and 'SENSOR>' on the right. At the bottom is '<POS SENSORS'. The screen is flanked by two vertical columns of four rectangular buttons each, labeled '1L' through '4L' on the left and '1R' through '4R' on the right. Below the screen, the number '00141.04' is printed. Figure 6-120 DETAILS - Any position sensor set to receive an update is also updated to the new position.

It is also possible to update the FMS position to one of the long range sensors as described in Procedure 6-11. If the FMS position is invalid, this feature cannot be used to update the FMS position.

Step	Procedure 6-11 FMS Position Update to Long Range Sensor
1	Select POS SENSORS from the NAV INDEX.
2	Select the UPDATE prompt (1R). This is shown in Figure 6-121.  Figure 6-121
3	Select the SENSOR prompt. This is shown in Figure 6-122.  Figure 6-122

Step	Procedure 6-11 FMS Position Update to Long Range Sensor
4	Select the UPDATE prompt (right line selects), shown in Figure 6-123, for the sensor to be used for updating the FMS. In this example, IRS 2 (3R) is selected.  00384.04 Figure 6-123
5	Select ENTER at 4R to update the FMS position or CLEAR (4L) to reset the update function. This is shown in Figure 6-124. Following either selection, the FMS UPDATE page, shown in Figure 6-120, is displayed with the current FMS position.  00385.06 Figure 6-124 DETAILS – Any position sensors set to received an update are also updated to the new position.

Sensor Status Pages

To check the status of a sensor, press the line select key adjacent to the STATUS prompt, shown in Figure 6-125, for that sensor on the POS SENSORS page.

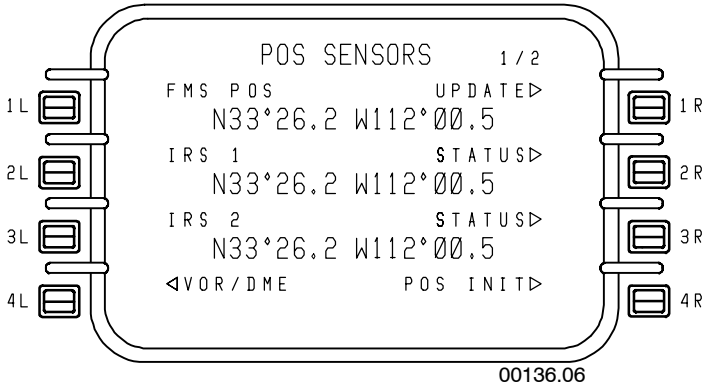


Figure 6-125

The paragraphs that follow describe the status pages used for each type of sensor (IRS, GPS). For all sensor types, selecting the POS SENSORS prompt at the bottom of any STATUS page returns the display back to the POS SENSORS page from which the sensor status was accessed. This is shown in Figure 6-125.

IRS STATUS

- **IRS(X) STATUS 1/1** – Figure 6-126 shows the IRS status page when the IRS is operating in the NAV mode. Values displayed are as follows:
 - IRS Position
 - Groundspeed
 - IRS Wind
 - Drift Rate
 - Miles from FMS Position.

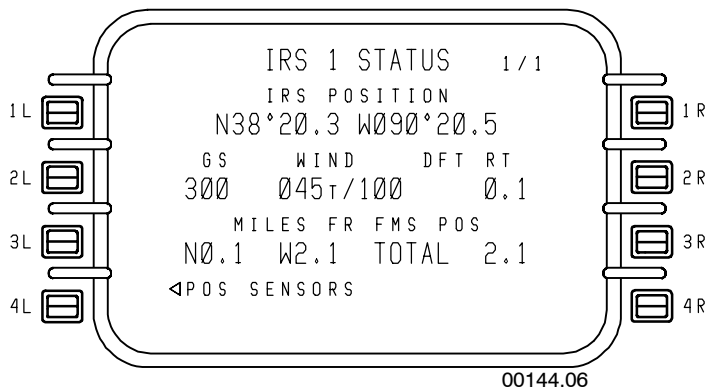


Figure 6-126

The drift rate, calculated by the FMS, is the difference between the IRS and FMS position divided by the length of time the IRS has been in the NAV mode.

When the IRS is in the ALIGN mode, the time to NAV is displayed. This is shown in Figure 6-127.

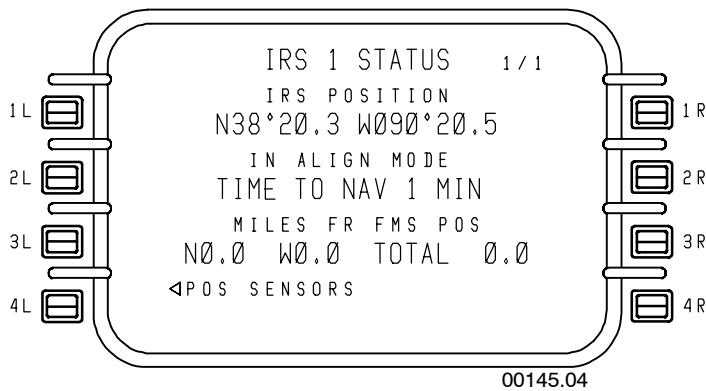


Figure 6-127

Figure 6-128 shows the information that is displayed when the IRS is in the ATTITUDE mode.

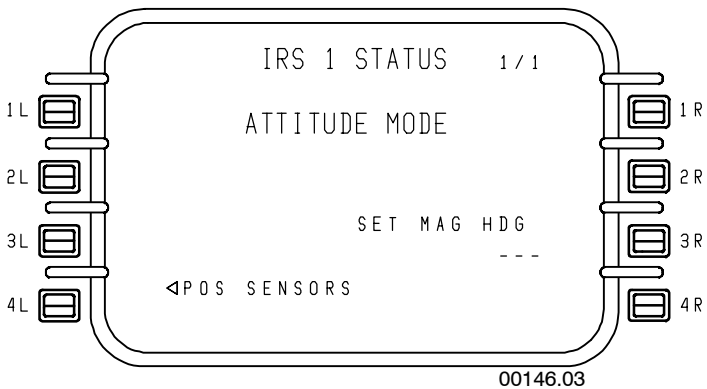


Figure 6-128

If the IRS is switched to the attitude mode, on the ground or in flight, the IRS magnetic heading is set to 000° . The correct magnetic heading must be entered on the STATUS page for proper navigation and autopilot/flight director operation. Use the magnetic heading from another, normally operating heading source, or the standby magnetic compass for input.

GPS STATUS

- **GPS(X) STATUS 1/2** - Figure 6-129 displays the following information:
 - GPS Position
 - Groundspeed
 - Altitude (altitude above the earth)
 - Miles from FMS Position.

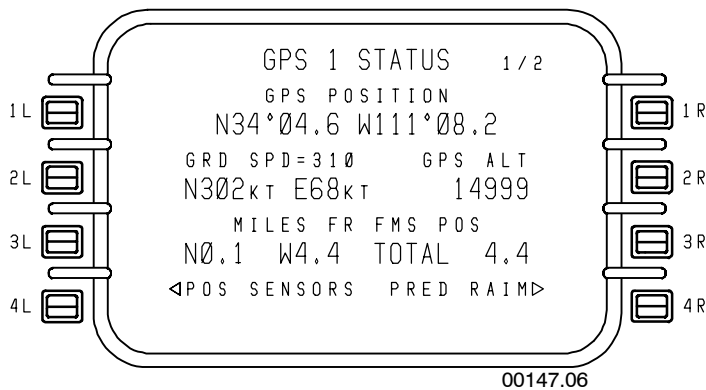


Figure 6-129

GPS altitude displayed is the World Geodetic System 1984 (WGS-84) height above the ellipsoid (geoid height + height above MSL). The GPS altitude is not relative to pressure altitude but is referenced to an Earth-Centered Earth-Fixed (ECEF) coordinate system. Pressure altitude is not relative to the same reference frame, but relative to the standard pressure or local pressure settings. Therefore, significant differences can be seen between GPS altitude and pressure altitude. This concept is illustrated in Figure 6-130.

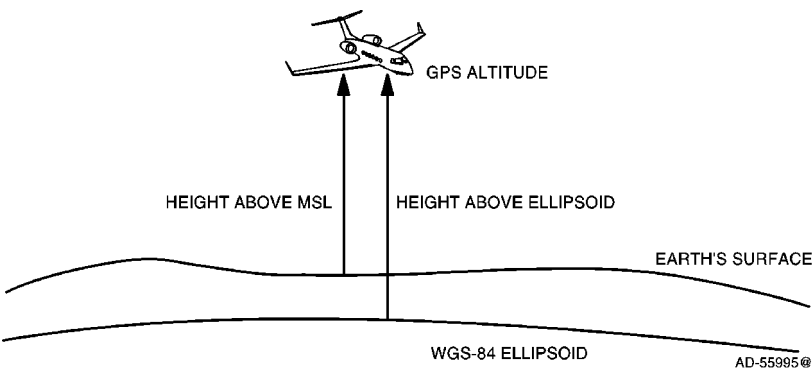


Figure 6-130

- **GPS(X) STATUS 2/2** - Figure 6-131 displays the following information:
 - Receiver Autonomous Integrity Monitor (RAIM)
 - Figure of Merit (FOM)
 - Horizontal Dilution of Precision (HDOP)
 - Vertical Dilution of Precision (VDOP)
 - Time (UTC) and Date
 - Operating Mode
 - Satellites Tracked.

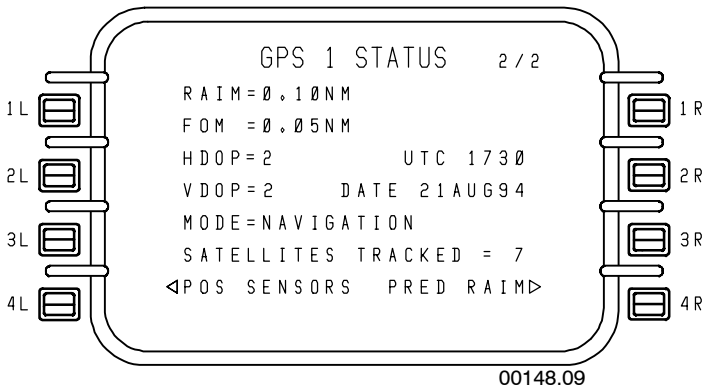


Figure 6-131

RAIM and FOM indicate current uncertainty of position expressed in nautical miles. HDOP and VDOP are numbers that rate current satellite geometry in the horizontal (HDOP) and vertical (VDOP) axis with 1 being the best geometry. Normally, HDOP and VDOP numbers are below 10.

The fifth line displays the operational mode of the GPS. Possible operational modes are displayed as follows:

- SELF-TEST
- INITIALIZATION
- ACQUISITION
- NAVIGATION
- DIFFERENTIAL
- ALTITUDE AIDING
- VELOCITY AIDING
- FAILED.

The acquisition mode is used to acquire satellites after power is applied. The GPS tracks four satellites to acquire its position.

After being in the navigation mode, altitude aiding is the mode entered when fewer than four satellites are being tracked. In this mode, the GPS uses altitude from the Digital Air Data Computer (DADC) to aid in determining position.

If the GPS is operated inside a hangar or other areas where signals cannot be received, the GPS can detect this as a failure. In this case, cycling the power is necessary to restart the GPS.

The last line of the GPS STATUS page indicates the number of satellites that are being tracked and used by the GPS.

PREDICTIVE RECEIVER AUTONOMOUS INTEGRITY MONITOR

In addition to RAIM for current conditions, the GPS receiver predictive RAIM calculation gives the pilot an indication as to whether the GPS satellite geometry will be satisfactory for approach at the selected or expected arrival time. YES indicates RAIM is predicted to be within approach criteria. NO indicates RAIM is predicted to be unacceptable or unavailable.

The predictive RAIM page is accessed by selecting the PRED RAIM prompt from any GPS STATUS page. When selected, the PREDICTIVE RAIM page, shown in Figure 6-132, is displayed.

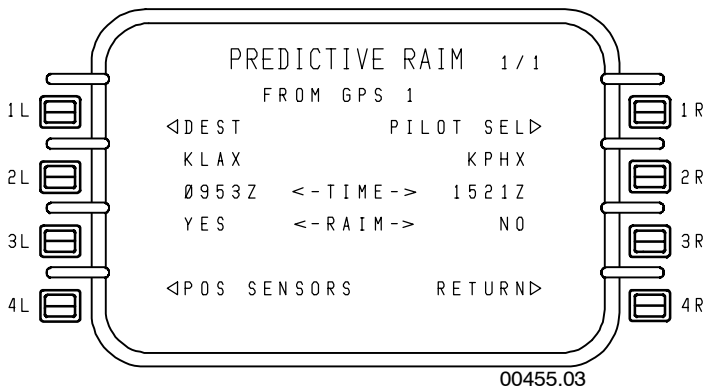


Figure 6-132

The PREDICTIVE RAIM page includes the following information:

- Predictive RAIM Source (1L)
- Destination RAIM Selection (DEST) prompt (1L)
- Destination Identifier (2L)
- ETA at Destination (2L)

- Predicted RAIM Solution for Destination (3L)
- Pilot Selection (PILOT SEL) prompt (1R)
- Pilot Selected Identifier (2R)
- Pilot Entered Time (3R)
- Predicted RAIM Solution for pilot defined place (3R)
- Access to the Position Sensors (POS SENSORS) prompt (4L)
- Return access to the GPS Status page (RETURN) (4R).

The FMS uses the high priority GPS for predictive RAIM. The priority order for FMS 1 is GPS 1, GPS 3, GPS 2. The priority order for FMS 2 is GPS 2, GPS 3, GPS 1. The priority order for FMS 3 is GPS 3, GPS 1, GPS2. If only a single GPS is available, both FMSs use it for predictive RAIM.

The ETA on the PREDICTIVE RAIM page is updated when the ETA from the active flight plan changes by more than 10 minutes.

Should the GPS fail or the interface between the FMS and GPS not work properly, the FMS displays the message PREDICTIVE RAIM UNAVAILABLE on the PREDICTIVE RAIM page.

Predictive RAIM is calculated using GPS almanac information. The almanac within the GPS is automatically updated whenever the GPS is on and tracking satellites. The almanac within the GPS is set invalid if it is older than 3.5 days. Should this occur, the message ALMANAC EXPIRED is displayed on the PREDICTIVE RAIM page. The almanac takes approximately 12–25 minutes to update once the GPS is tracking satellites. RAIM predictions are not possible with an expired almanac.

Selecting the DEST prompt from the PREDICTIVE RAIM page displays DESTINATION RAIM page 1/2. This is shown in Figure 6–133.

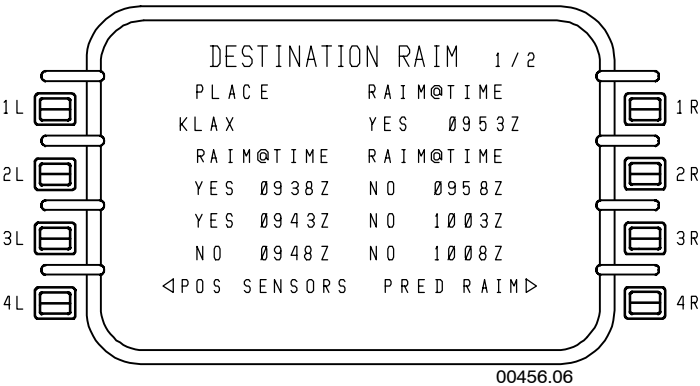


Figure 6–133

DESTINATION RAIM page 1/2 includes the following information:

- Destination Identifier (1L)
- Destination ETA from the Active Flight Plan (1R)
- Destination RAIM Predicted for the ETA (1R)
- Destination RAIM Predicted for ETA-15 minutes (2L)
- Destination RAIM Predicted for ETA-10 minutes (3L)
- Destination RAIM Predicted for ETA-5 minutes (3L)
- Destination RAIM Predicted for ETA+5 minutes (2R)
- Destination RAIM Predicted for ETA+10 minutes (3R)
- Destination RAIM Predicted for ETA+15 minutes (3R)
- Access to the Position Sensors (POS SENSORS) prompt (4L)
- Return access to the PREDICTIVE RAIM (PRED RAIM) page (4R).

DESTINATION RAIM page 2/2 supports satellite deselection, as shown in Figure 6-134. From this page, the pilot selects which GPS satellites are to be excluded from the DESTINATION RAIM predictions. The pilot enters the Pseudo-Random Noise (PRN) code for the satellite that is scheduled to be out of service according to published GPS NOTAMs.

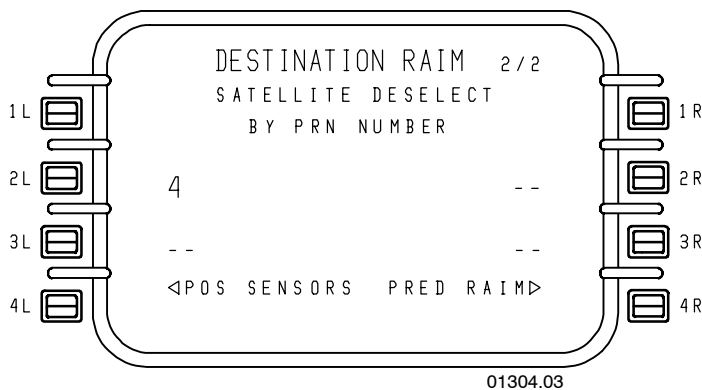


Figure 6-134

- **2L, 2R, 3L and 3R** - The satellite PRN is entered on these lines. Entry of *DELETE* results in the display of dashes. All PRN numbers are cleared after the aircraft has landed.

Selecting the PILOT SEL prompt from the PREDICTIVE RAIM page displays PILOT SELECT RAIM page 1/2. This is shown in Figure 6-135.

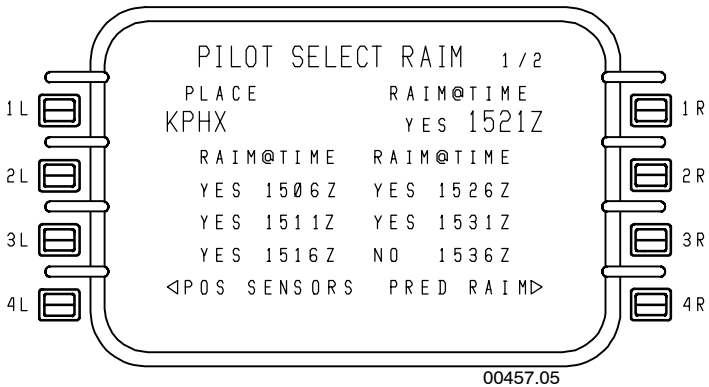


Figure 6-135

PILOT SELECT RAIM page 1/2 includes the following information:

- Identifier (1L)
- Time (1R)
- RAIM Predicted for the ETA (1R)
- RAIM Predicted for ETA-15 minutes (2L)
- RAIM Predicted for ETA-10 minutes (3L)
- RAIM Predicted for ETA-5 minutes (3L)
- RAIM Predicted for ETA+5 minutes (2R)
- RAIM Predicted for ETA+10 minutes (3R)
- RAIM Predicted for ETA+15 minutes (3R)
- Access to the Position Sensors (POS SENSORS) prompt (4L)
- Return access to the PREDICTIVE RAIM (PRED RAIM) page (4R).

PILOT SELECT RAIM page 2/2 supports satellite deselection, as shown in Figure 6-136. From this page, the pilot selects which GPS satellites are to be excluded from the PILOT SELECT RAIM predictions. The pilot enters the Pseudo-Random Noise (PRN) code for the satellite that is scheduled to be out of service according to published GPS NOTAMs.

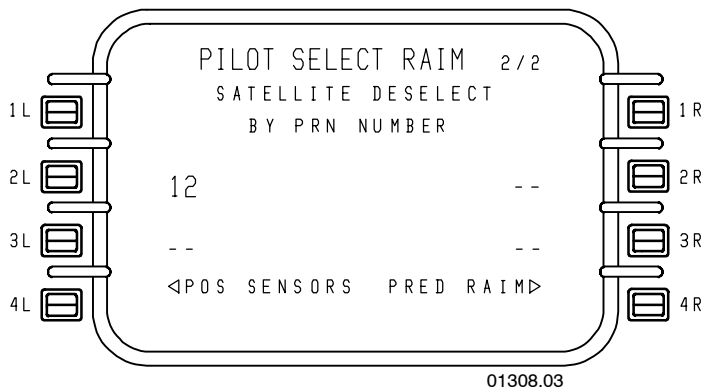


Figure 6-136

- **2L, 2R, 3L and 3R** – The satellite PRN is entered on these lines. Entry of ***DELETE*** results in the display of dashes. All PRN numbers are cleared after the aircraft has landed.

While the GPS is computing the predicted RAIM at the destination or pilot selected waypoint, the FMS displays the message **COMPUTING RAIM** on the **DESTINATION RAIM** and **PILOT SELECT RAIM** pages.

ADDITIONAL DETAILS ABOUT PRN

GPS satellites can be identified by one of two unique numbers: Satellite Vehicle Number (SVN) or Pseudo-Random Noise (PRN) code. The SVN is the permanent physical identification number assigned to each satellite when it is launched. The SVN increments with each launch of a satellite as new satellites replace older ones. There are only 32 PRN codes available for use by the GPS satellites in the current GPS constellation.

The PRN is a complex code of 1's and 0's, transmitted by a satellite, that uniquely identifies a satellite in the GPS constellation. The code is named Pseudo-Random because it is very long and appears to be a random sequence. The GPS system is designed for a maximum of 32 unique PRN codes transmitted by satellites within the constellation. A GPS receiver takes the satellite signal code and correlates it to one of the known stored 32 PRN codes within the receiver. By correlation with the satellite transmitted code, the receiver is able to determine which satellite it is receiving. Knowing this, the GPS receiver is able to make pseudo-range measurements in determining a given navigation solution.

VOR/DME PAGE

- **VOR/DME(X) X/2** – Figure 6-137 is selected using the VOR/DME prompt on the POS SENSORS page. The VOR and DME data received from the radio is displayed. Each NAV radio received by the FMS has its own page. Access to the NOTAM page is provided at 4R.

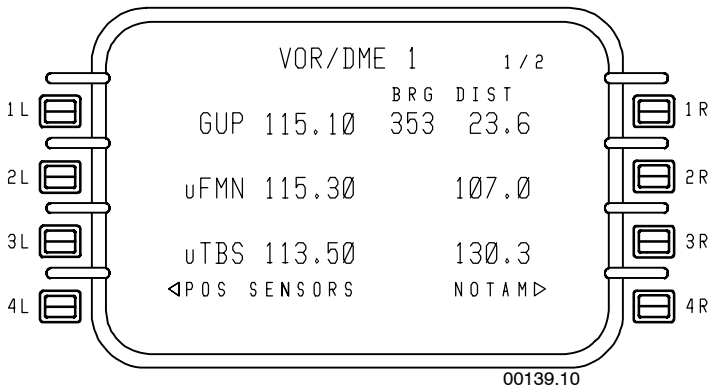
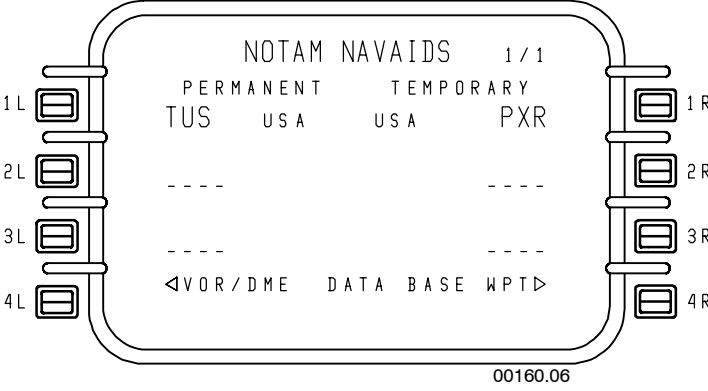


Figure 6-137

NOTICES TO AIRMEN

The pilot can prevent the FMS from using a particular VOR and/or DME station for position computations by using the NOTAM page. Stations can be entered as temporary or permanent. Entries in the temporary column (up to 3) are deleted after the FMS is powered down (upon completion of the flight). Entries in the permanent column (up to 3) are stored in FMS memory until removed by pilot action.

Procedure 6-12 explains how to enter and delete entries from the NOTAM page.

Step	Procedure 6-12 NOTAM Entries
1	Select POS SENSORS from NAV INDEX page 2. Select VOR/DME (4L) and then NOTAM (4R).
2	Enter the navaid identifier into the scratchpad. Press a line select key under either the permanent or temporary column. This is shown in Figure 6-138.  Figure 6-138
3	Delete an entry by pressing the delete key. *DELETE* is displayed in the scratchpad. Then press the line select key adjacent to the navaid identifier. An entry can be replaced with another navaid without first being deleted.

SENSORS BEING USED BY THE FMS

Position sensors in use are indicated by the letter **U** that appears before the latitude-longitude position on the POS SENSORS page.

When the FMS is using VOR and DME data for navigation, a **U** is displayed in front of the navaid identifier on the VOR/DME page. In Figure 6-137, for example, the FMS is using FMN and TBS. If an FMS is able to tune the VOR and DME and the letter **T** is displayed, the FMS is tuning the station and verifying the data from the navaid before it starts using the station to compute the aircraft position.

Each FMS tunes its onside radios. If the FMS is operating as the third FMS, it cannot tune the VOR/DME radios. However, a **T** may be displayed. The third FMS will always be in manual tune, as shown on the PROGRESS and RADIO TUNE pages.

The class of a navaid and the aircraft altitude determine if the FMS can tune and use a navaid for navigation. The class of a navaid can be determined by entering the navaid identification on the DATA BASE

WPT or PILOT WAYPOINT page. The class of the navaid can be different in the FMS than the published class. This is because the FMS data base class is adjusted to a lower class where stations on the same frequency interfere with each other at the higher class range limits. Table 6-3 summarizes the range and altitude limits used in selecting navaids for use.

VOR/DME Navaid Class	Aircraft Altitude	Lateral Distance
Terminal	≤ 12,000 ft MSL	≤ 40 NM
Low	≤ 18,000 ft MSL	≤ 70 NM
High	Don't Care	≤ Lesser of 130 NM or Line of Sight
Unrestricted	≤ 12,000 ft MSL	≤ Lesser of 130 NM or Line of Sight
	> 12,000 ft MSL	≤ Lesser of 200 NM or Line of Sight

Range and Altitude Limits for VOR/DME

Table 6-3

POSITION SENSOR DESELECTION

To prevent the FMS from using a sensor for position computations, use Procedure 6-13.

Step	Procedure 6-13 Position Sensor Deselection
1	Select POS SENSORS from the NAV INDEX.
2	Press the delete key (DEL). *DELETE* is displayed in the scratchpad.
3	Press the left line select key on the SENSOR page next to the sensor that should no longer be used. DESEL appears adjacent to the sensor identifier.
4	To reselect the deleted sensor, press the delete key and *DELETE* is displayed in the scratchpad.
5	Press the left line select key next to the sensor that is to be used. The DESEL adjacent to the sensor identifier is deleted and the FMS can use the sensor.

To prevent the FMS from using a VOR/DME radio, use Procedure 6–14.

Step	Procedure 6–14 VOR/DME Deselection
1	Select POS SENSORS from the NAV INDEX.
2	Select VOR/DME (4L).
3	Select the desired VOR/DME by using the NEXT/PREV keys.
4	Press the delete key (DEL). *DELETE* is displayed in the scratchpad.
5	Press one of the left line select keys next to one of station identifiers. DESEL is displayed adjacent to all three station identifiers. This action is removing the entire radio (VOR and all DME channels) from being used by the FMS.
6	To reselect the deleted radio, press the delete key and *DELETE* is displayed in the scratchpad.
7	Press one of the left line select keys next to a station identifier. DESEL is removed from all three station identifiers and the FMS can use the radio.

RADIO TUNING

The TUNE prompt accesses the RADIO TUNING page. This is shown in Figure 6–139 of Procedure 6–15. The pilot can use the FMS to tune aircraft radios through the CDU. Depending on aircraft configuration and radio types, tunable radios include the following:

- Two VOR/DME Receiver Pairs
- Three VHF Communication Radios (COMs)
- Two ADF Receivers
- Two HF Communication Radios
- Two ATC Transponders
- Two DGPS Data Link Receivers.

Refer to Radio Configuration, on page 6-161, for details on configuring the tuning page to match the aircraft configuration.

Tuning Nav Radios

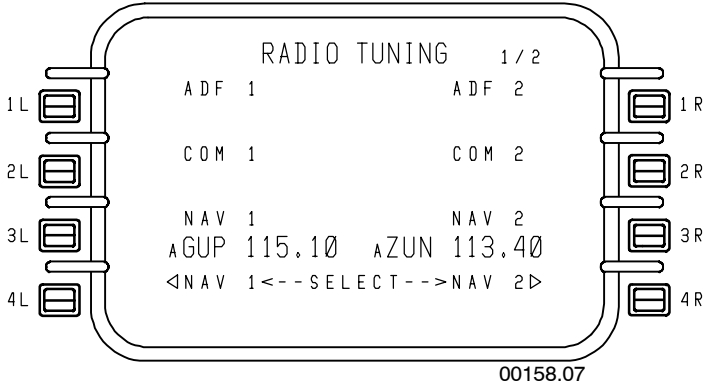
The last three lines of the RADIO TUNING page 1, shown in Figure 6-139 of Procedure 6-15, are dedicated to the VOR and DME (NAV) radios. The currently tuned frequencies and VOR identifiers for those radios are displayed under the headings NAV 1 and NAV 2. The same display and functions are also displayed on the PROGRESS 1 page.

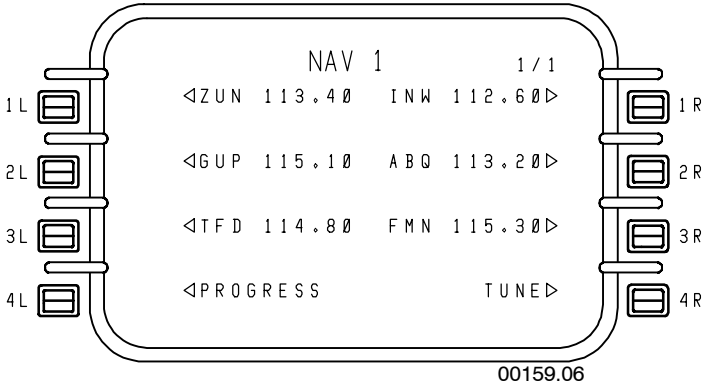
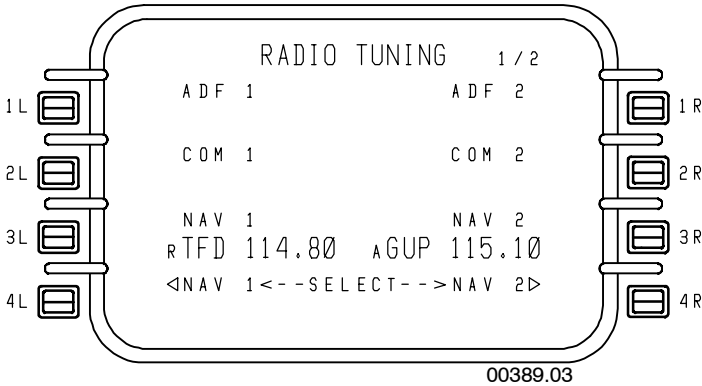
It is possible to tune the NAV radios through the FMS using the following three different methods:

- NAV page
- Identifier
- Frequency.

The FMS assists tuning by displaying the six closest navaids to the aircraft position.

To tune a NAV radio to one of the listed navaids, follow Procedure 6-15. While the example is for NAV 1, the procedure applies to both NAV 1 and NAV 2.

Step	Procedure 6-15 NAV Tuning from Six Closest Stations
1	Select TUNE from the NAV INDEX. This procedure can also be accomplished by selecting PROGRESS page 1.
2	Select the NAV 1 (4L) or NAV 2 (4R) prompt at the bottom of the RADIO TUNING page, shown in Figure 6-139, or PROGRESS page (not shown). In this example, NAV 1 is selected.  Figure 6-139

Step	Procedure 6-15 NAV Tuning from Six Closest Stations
3	Select the desired station from the six closest stations. This is shown in Figure 6-140. TFD is selected in this example.  Figure 6-140
4	The RADIO TUNING page, shown in Figure 6-141, or PROGRESS page (not shown), is displayed with TFD tuned.  Figure 6-141

To tune the NAV radios using the station identifier, use Procedure 6-16.

Step	Procedure 6-16 NAV Tuning by Identifier
1	Select TUNE from the NAV INDEX. This procedure can also be done using PROGRESS page 1.
2	Enter the station identifier into the scratchpad.
3	Press the line select key adjacent to NAV 1 (3L) or NAV 2 (3R).
4	The FMS tunes the NAV radio and displays the identifier and frequency on the RADIO TUNING and PROGRESS pages.

To tune a NAV radio by frequency, use Procedure 6-17.

Step	Procedure 6-17 NAV Tuning by Frequency
1	Select TUNE from the NAV INDEX. This procedure can also be done using PROGRESS page 1.
2	Enter the frequency into the scratchpad.
3	Press the line select key adjacent to NAV 1 (3L) or NAV 2 (3R).
4	The FMS tunes the radio to the entered frequency and searches the navigation data base for the closest navaid with the same frequency. The frequency and identifier are displayed on the RADIO TUNING and PROGRESS pages.

The FMS does not use ILS LOC/GS data for position computations. If a DME is associated with an ILS, the FMS can use it in position computation.

ILS frequency and identifier tuning is permitted on the RADIO TUNING page. ILS IDENTs do not appear on the RADIO TUNING and PROGRESS pages when the ILS is tuned by frequency. If the ILS is tuned by ident, the ident is displayed.

The small letter in front of the navaid identifier in the lower part of the RADIO TUNING and PROGRESS pages indicate the tuning mode for the NAV radios (VOR and DME). The tuning modes are as follows:

- A (auto tune)
- V (VOR displayed as navigation source, auto tune suspended)
- R (remote tune)
- M (manual tune).

Regardless of the tuning mode, the FMS constantly tunes the scanning channels of the DME (if available) for position update.

AUTOTUNE

The tuning mode is autotune when the FMS is tuning the VOR. To select autotune, use Procedure 6-18.

In autotuning, the FMS automatically selects a navaid, tunes it, and checks the data from the navaid. No pilot interaction is required.

During autotuning, the FMS tunes the VOR that the pilot would most likely tune whenever possible. If the VOR is required for navigation, the FMS tunes the VOR so the most optimum VOR/DME position can be established.

Step	Procedure 6-18 NAV Tuning by Selecting Autotune
1	Confirm that the VOR radio is not selected as the navigation source on either side EFIS. This includes the VOR mode, ILS mode or preview mode.
2	Confirm that the VOR radio is not in the manual tune mode.
3	Select TUNE from the NAV INDEX. This procedure can also be done using PROGRESS page 1.
4	Use the DEL key to enter *DELETE* into the scratchpad.
5	Line select to NAV 1 (3L) or NAV 2 (3R) on the RADIO TUNING or PROGRESS page. The FMS switches to autotuning and the letter A is displayed.

VOR TUNING

If autotuning is active when VOR is selected as the navigation source on EFIS, the letter **V** is displayed adjacent to the navaid identifier. The **V** indicates that autotuning is selected but is suspended while VOR is displayed. If EFIS is switched back to FMS, autotuning resumes. Remote tuning by the pilot is possible while **V** is displayed. If this is done, the tuning mode changes to remote (**R**).

If VOR has been selected with the EFIS preview display feature, autotuning is disabled.

REMOTE TUNING

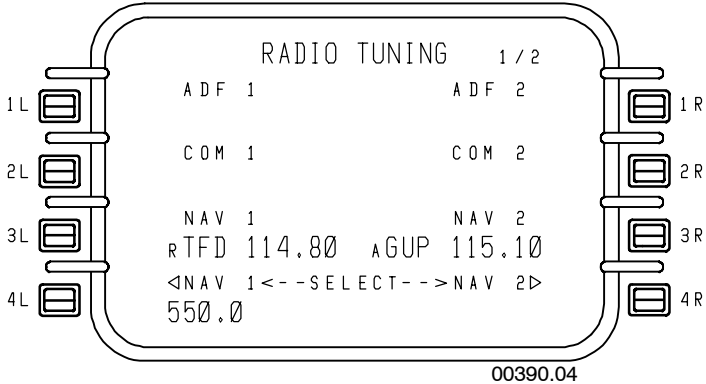
The tuning mode is remote if the pilot has tuned the NAV radios through the FMS or from the radio control head. The FMS does not change the frequency the pilot has selected.

MANUAL TUNING

If the manual tuning mode is active, the FMS cannot tune the VOR or associated DME channel. Tuning can be done only by the pilot through the radio control head. The FMS still tunes the blind channels of the scanning DME during this mode.

Tuning VHF, ADF, and ATC Radios

The VHF, ADF, and ATC radios on the RADIO TUNING page can be tuned by the pilot through the FMS. Procedure 6-19 is used to tune these radios.

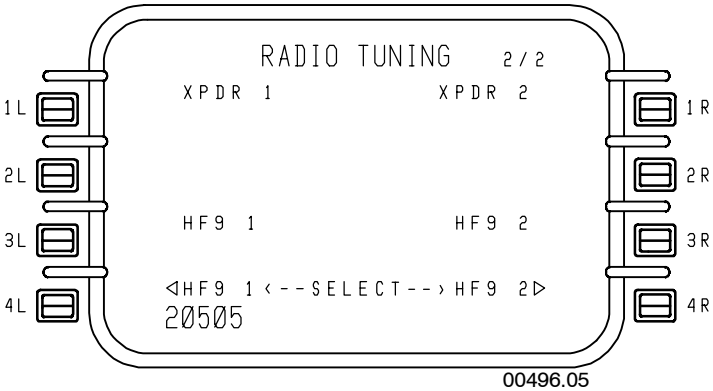
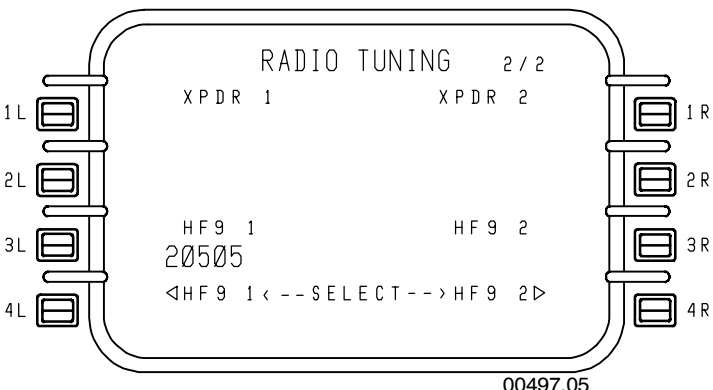
Step	Procedure 6-19 Tuning ADF, VHF, and ATC Radios
1	Select TUNE from the NAV INDEX.
2	Enter the frequency into the scratchpad. This example tunes ADF 1 to 550.0
3	Press the line select key adjacent to the desired radio (ADF 1 (1L)). This is shown in Figure 6-142.  Figure 6-142

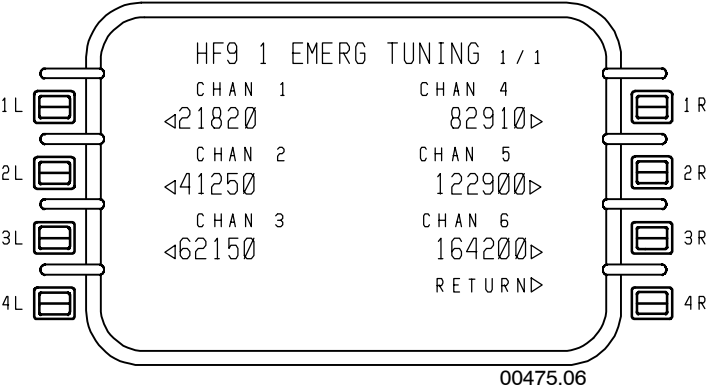
Step	Procedure 6-19 Tuning ADF, VHF, and ATC Radios
4	Confirm tuning as shown in Figure 6-143. Follow this same procedure for tuning any of the other radios. The diagram shows a 'RADIO TUNING' screen with a '1 / 2' indicator in the top right. The screen is divided into two columns for left (L) and right (R) side radios. On the left side, there are four radio slots labeled 1L, 2L, 3L, and 4L. On the right side, there are four radio slots labeled 1R, 2R, 3R, and 4R. The screen displays the following frequencies: ADF 1 is <550.0, ADF 2 is blank; COM 1 is blank, COM 2 is blank; NAV 1 is RTFD 114.80, NAV 2 is AGUP 115.1. At the bottom, there is a prompt: <NAV 1<--SELECT-->NAV 2>. The number 00391.04 is printed at the bottom right of the screen area. Figure 6-143

Tuning HF Radios

The HF radios on the RADIO TUNING page can be tuned by the pilot through the FMS. Procedure 6-20 is used to tune HF radios.

Step	Procedure 6-20 Tuning HF Radios
1	Select TUNE from the NAV INDEX. HF tuning is available only on page 2 of RADIO TUNING.
2	Enter the frequency into the scratchpad. This example tunes HF9 1 to 20505.

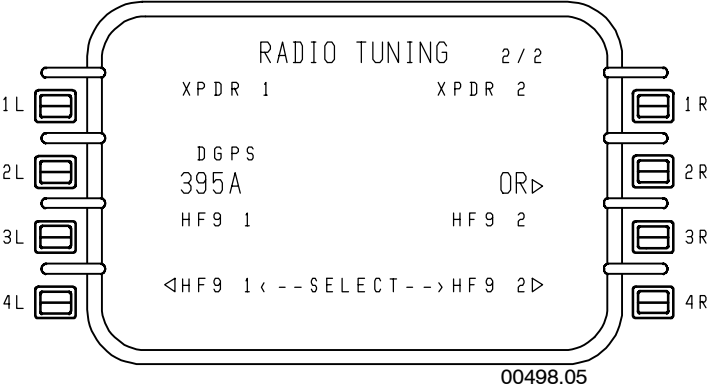
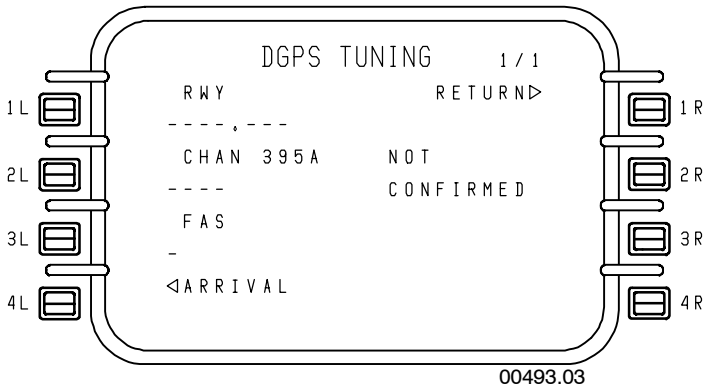
Step	Procedure 6-20 Tuning HF Radios
3	Press the line select key adjacent to the desired radio (HF9 1 (3L)). This is shown in Figure 6-144.  Figure 6-144
4	Confirm tuning as shown in Figure 6-145. Follow this same procedure for tuning the other HF radio.  Figure 6-145

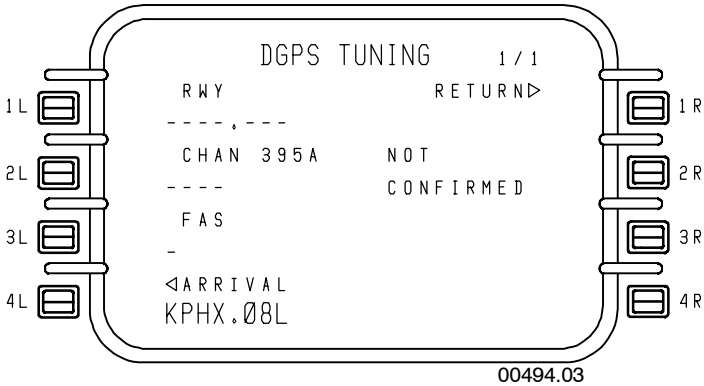
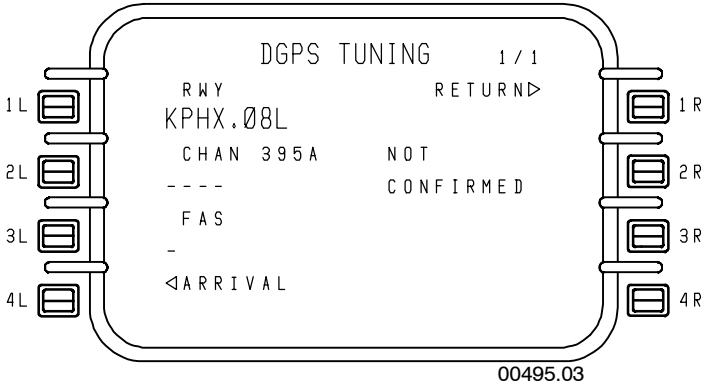
Step	Procedure 6-20 Tuning HF Radios
5	For tuning to emergency HF frequency, select HF9 1 (4L) or HF9 2 (4R).
6	The emergency frequency page is display is shown in Figure 6-146. Select the required frequency with the adjacent line select key.  Figure 6-146

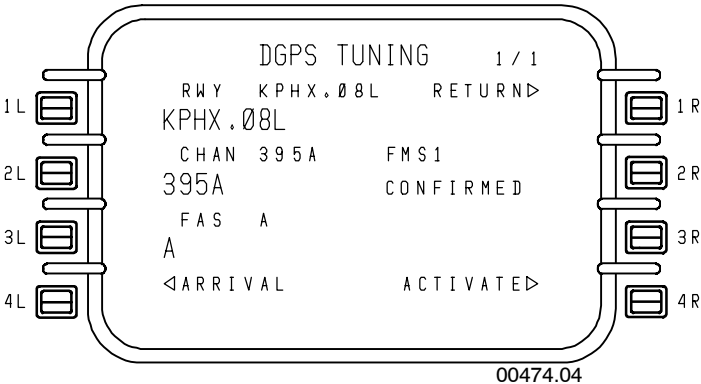
Tuning DGPS Data Link Radios

The Differential GPS (DGPS) VHF Data Link (VDL) radios can be tuned by the pilot on the radio tuning page of the FMS. Procedure 6-21 is used to tune the DGPS data link.

Step	Procedure 6-21 Tuning DGPS Data Link Radio
1	Select TUNE from the NAV INDEX.
2	Select the OR prompt for DGPS tuning. In the example, shown in Figure 6-147, DGPS tuning is on page 2 at 2L and 2R.

Step	Procedure 6-21 Tuning DGPS Data Link Radio
	 Figure 6-147
3	Enter the destination airport identifier and runway being used for the approach into the scratchpad. This is shown in Figure 6-148. The information entered on this page is on the DGPS approach plate.  Figure 6-148

Step	Procedure 6-21 Tuning DGPS Data Link Radio
4	Enter the airport and runway using line select 1L. This is shown in Figure 6-149.  DGPS TUNING 1 / 1 RWY KPHX.08L RETURN▷ CHAN 395A NOT FAS CONFIRMED <ARRIVAL 00494.03 Figure 6-149
5	Repeat the process for channel and Final Approach Segment (FAS). This is shown in Figure 6-150. FAS is not used on all approaches and is not a required entry.  DGPS TUNING 1 / 1 KPHX.08L RETURN▷ CHAN 395A NOT FAS CONFIRMED <ARRIVAL 00495.03 Figure 6-150
6	Activate the tuning using line select 4R. The ACTIVATE prompt is not displayed until a channel is entered. The RADIO TUNING page is displayed automatically after activation.

Step	Procedure 6-21 Tuning DGPS Data Link Radio
7	After activating, the DGPS TUNING page displays feedback for the DGPS data link. This is shown in Figure 6-151. Shown at 2R is the status of the tune request. Status messages are FMSX CONFIRMED, FMSX TUNING, NOT CONFIRMED, and DATA NOT RECEIVED. FMS1 CONFIRMED is shown in this example. See below for definition of each status message.  Figure 6-151
8	Status Message Definition FMSX CONFIRMED: The system is operating in the differential mode and the selected approach is being used. The system is ready for the approach. No pilot action required. FMSX TUNING: The system is operating in the differential mode but is still in the process of confirming the selected approach. The system is not ready for the approach. No pilot action required. NOT CONFIRMED: The system is operating in the differential mode but there is no selected approach or the selected approach cannot be confirmed. The system is not ready for the approach. Pilot action is required to either select an approach or change the selected approach to one supported by the ground station. DATA NOT RECEIVED: The system is not operating in the differential mode because no data is being received from the ground station. This may be because of range or equipment problems.

Configuring Radio Tuning Page

The pilot can choose from several options when displaying and operating the RADIO TUNING page. These options are selected on the radio configuration page. Refer to Radio Configuration, on page 6-161, for additional details.

CONVERSION

The CONVERSION pages allow the pilot to convert between commonly used units. The first two pages provide conversion between English and metric units. The third page provides weight/volume conversions. The last page supports QFE/QNH conversions.

- **CONVERSION 1/4** – Figure 6-152 provides conversion between English and metric units for length, weight and volume.

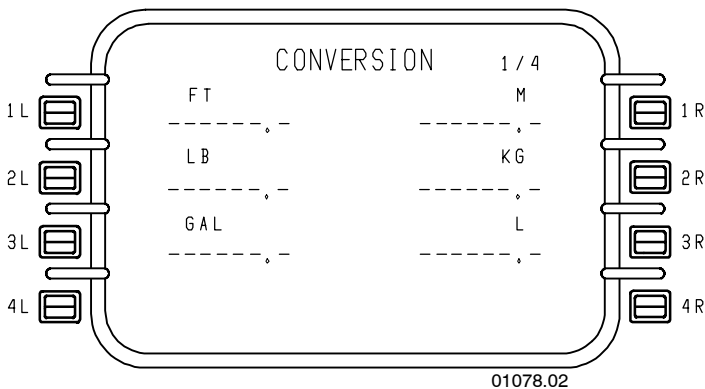


Figure 6-152

- **1L** – Entry of feet on this line will result in a display of the equivalent meters at 1R.
- **1R** – Entry of meters on this line will result in a display of the equivalent Flight Level (FL) and feet at 1L, as shown in Figure 6-153. Note that in some locations of the world, the metric altitude assigned by ATC does not round to the nearest FL. The FMS has been designed to accommodate these conditions. **The pilot is responsible to verify that the FL displayed by the FMS agrees with the metric altitude conversions displayed on enroute navigation charts.**

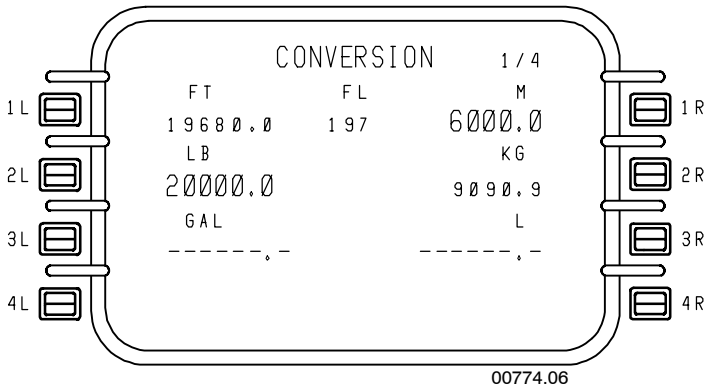


Figure 6-153

- **2L and 2R** – Entry of pounds or kilograms will result in a display of the equivalent weight in the opposite unit.
- **3L and 3R** – Entry of gallons or liters will result in a display of the equivalent weight in the opposite unit.
- **CONVERSION 2/4** – Figure 6-154 provides conversion between English and metric units for temperature, velocity, and distance.

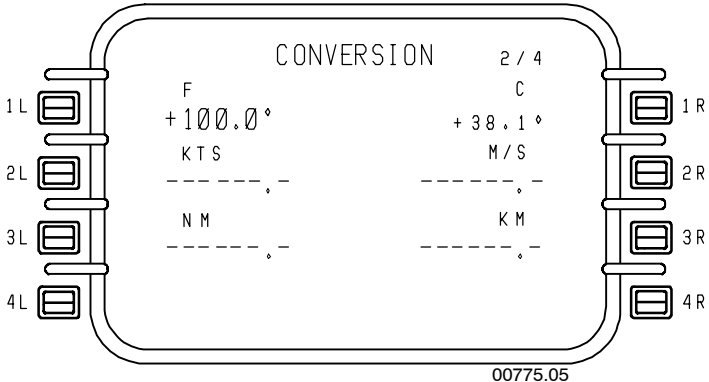


Figure 6-154

- **1L and 1R** – Entry of temperature on this line will result in a display of the equivalent temperature in the opposite unit.
- **2L and 2R** – Entry of knots or meters per second on this line will result in a display of the equivalent velocity in the opposite unit.
- **3L and 3R** – Entry of nautical miles or kilometers on this line will result in a display of the equivalent distance in the opposite unit.

- **CONVERSION 3/4** – Figure 6-155 provides conversion between English and metric units for weights and volumes. The conversion is based upon a specific weight which is displayed on the page. The specific weight can be changed by the pilot.

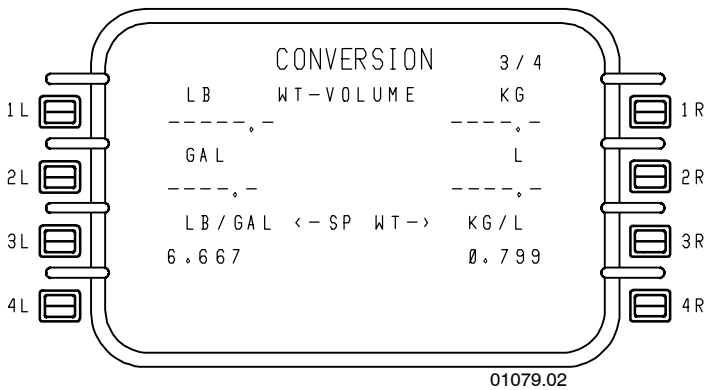


Figure 6-155

Entry of pounds, kilograms, gallons or liters will result in display of the remaining parameters. Figure 6-156 is an example with an entry of 10,000 pounds.

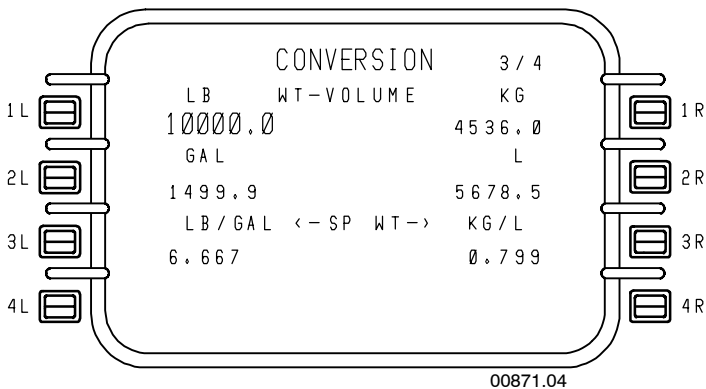
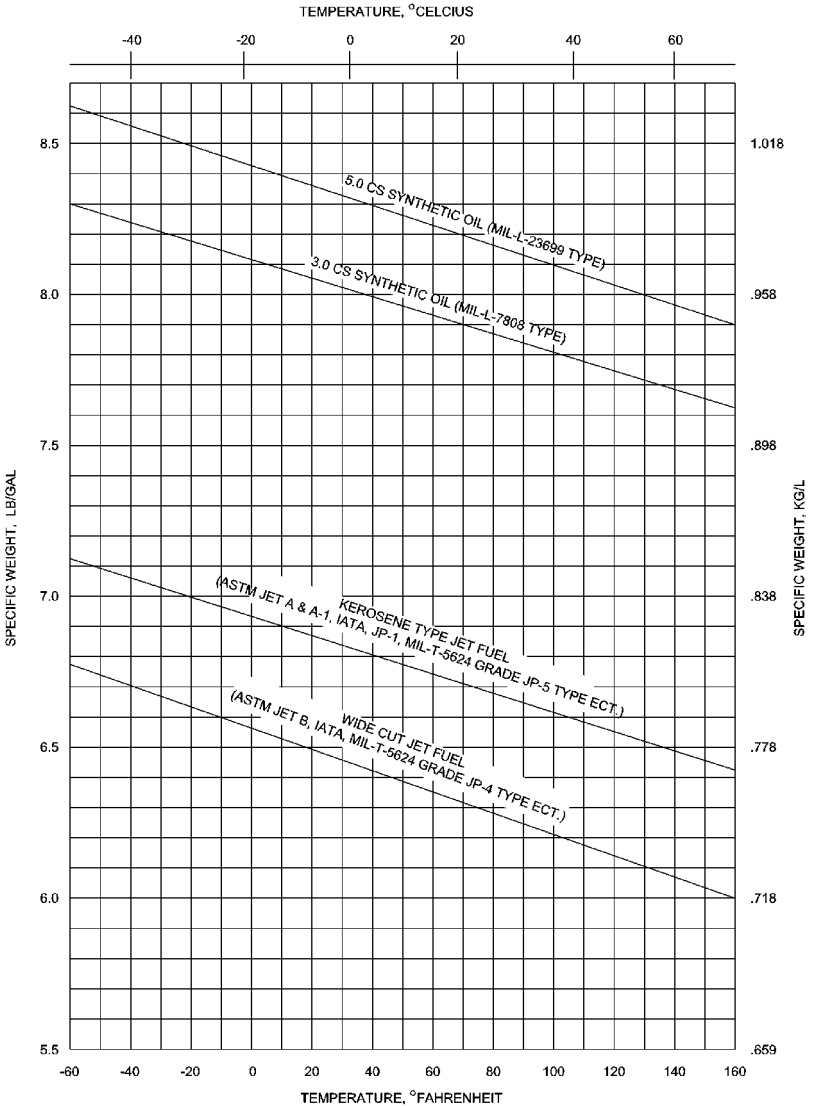


Figure 6-156

- **1L** – Entry of pounds on this line will result in a display of the equivalent gallons (2L), kilograms (1R), and liters (2R). The conversion is based upon the specific weights shown at 3L and 3R.
- **1R** – Entry of kilograms on this line will result in a display of the equivalent gallons (2L), pounds (1L), and liters (2R). The conversion is based upon the specific weights shown at 3L and 3R.

- **2L** - Entry of gallons on this line will result in a display of the equivalent pounds (1L), kilograms (1R), and liters (2R). The conversion is based upon the specific weights shown at 3L and 3R.
- **2R** - Entry of liters on this line will result in a display of the equivalent pounds (1L), kilograms (1R), and gallons (2L). The conversion is based upon the specific weights shown at 3L and 3R.
- **3L and 3R** - These lines display the specific weight (pounds per gallon and kilograms per liter) to be used for the conversion. Pilot entry of specific weight is permitted. The value will be retained in memory and will not be lost following shut down of the FMS. See Section 10 for entry ranges and format. Figure 6-157 shows the variation of the specific weight of fuel as temperature varies.



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Average Specific Weight Variation of
Aviation Fuels & Lubricants
Figure 6-157

- **CONVERSION 4/4** - Figure 6-158 shows the QFE-QNH conversion page. This page is designed to support QFE/QNH conversions and provide conversions between barometric altimeter units.

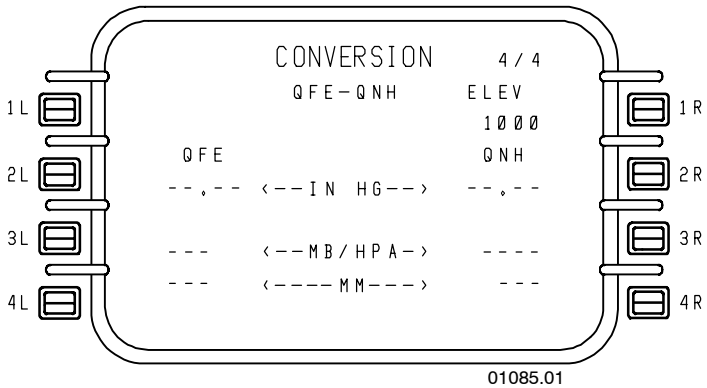


Figure 6-158

QNH altimeter settings result in the altimeter displaying the aircraft altitude above mean sea level based on the local station pressure. When an altimeter is set to QFE, it displays the aircraft altitude above a station. With the altimeter set to QFE and the aircraft on the ground, the altimeter will display zero (0). Inflight QFE provides height above ground level (without consideration for non-standard temperature).

Assuming an elevation exists at 1R, entry of a QNH or QFE (in any unit) will result in the display of the remaining parameters. Figure 6-159 is an example with a QNH entry of 29.92. If an elevation does not exist, the FMS is unable to convert to the QFE/QNH altimeter setting. Under this condition, the FMS will compute and display the equivalent unit(s) for the entered altimeter setting.

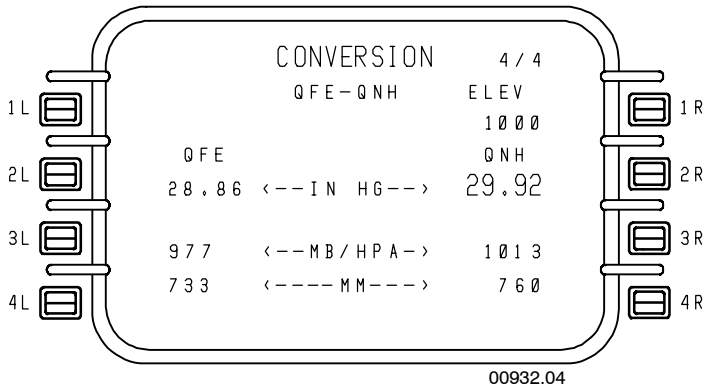


Figure 6-159

- **1R** - This line is used for entering the airport elevation. The default elevation is the destination elevation in the active flight plan. If an approach is selected, the runway elevation is used as the default. Pilot entry of elevation is permitted. Entering *DELETE* returns the default elevation. QFE/QNH conversions require an elevation. Elevation must be entered in feet.
- **2R** - Entry of QNH in inches of mercury on this line will result in the display of the equivalent QNH in millibars/hectopascals (3R) and millimeters (4R). If an elevation exists at 1R, the FMS will compute and display the equivalent QFE in inches of mercury (2L), millibars/hectopascals (3L), and millimeters (4L). Entering *DELETE* returns the default of dashes.
- **3R** - Entry of QNH in millibars/hectopascals on this line will result in the display of the equivalent QNH in inches of mercury (2R) and millimeters (4R). If an elevation exists at 1R, the FMS will compute and display the equivalent QFE in inches of mercury (2L), millibars/hectopascals (3L), and millimeters (4L). Entering *DELETE* returns the default of dashes.
- **4R** - Entry of QNH in millimeters on this line will result in the display of the equivalent QNH in inches of mercury (2R) and millibars/hectopascals (3R). If an elevation exists at 1R, the FMS will compute and display the equivalent QFE in inches of mercury (2L), millibars/hectopascals (3L), and millimeters (4L). Entering *DELETE* returns the default of dashes.
- **2L** - Entry of QFE in inches of mercury on this line will result in the display of the equivalent QFE in millibars/hectopascals (3L) and millimeters (4L). If an elevation exists at 1R, the FMS will

compute and display the equivalent QNH in inches of mercury (2R), millibars/hectopascals (3R), and millimeters (4R). Entering *DELETE* returns the default of dashes.

- **3L** - Entry of QFE in millibars/hectopascals on this line will result in the display of the equivalent QFE in inches of mercury (2L) and millimeters (4L). If an elevation exists at 1R, the FMS will compute and display the equivalent QNH in inches of mercury (2R), millibars/hectopascals (3R), and millimeters (4R). Entering *DELETE* returns the default of dashes.
- **4L** - Entry of QFE in millimeters on this line will result in the display of the equivalent QFE in inches of mercury (2L) and millibars/hectopascals (3L). If an elevation exists at 1R, the FMS will compute and display the equivalent QNH in inches of mercury (2R), millibars/hectopascals (3R), and millimeters (4R). Entering *DELETE* returns the default of dashes.

PATTERNS

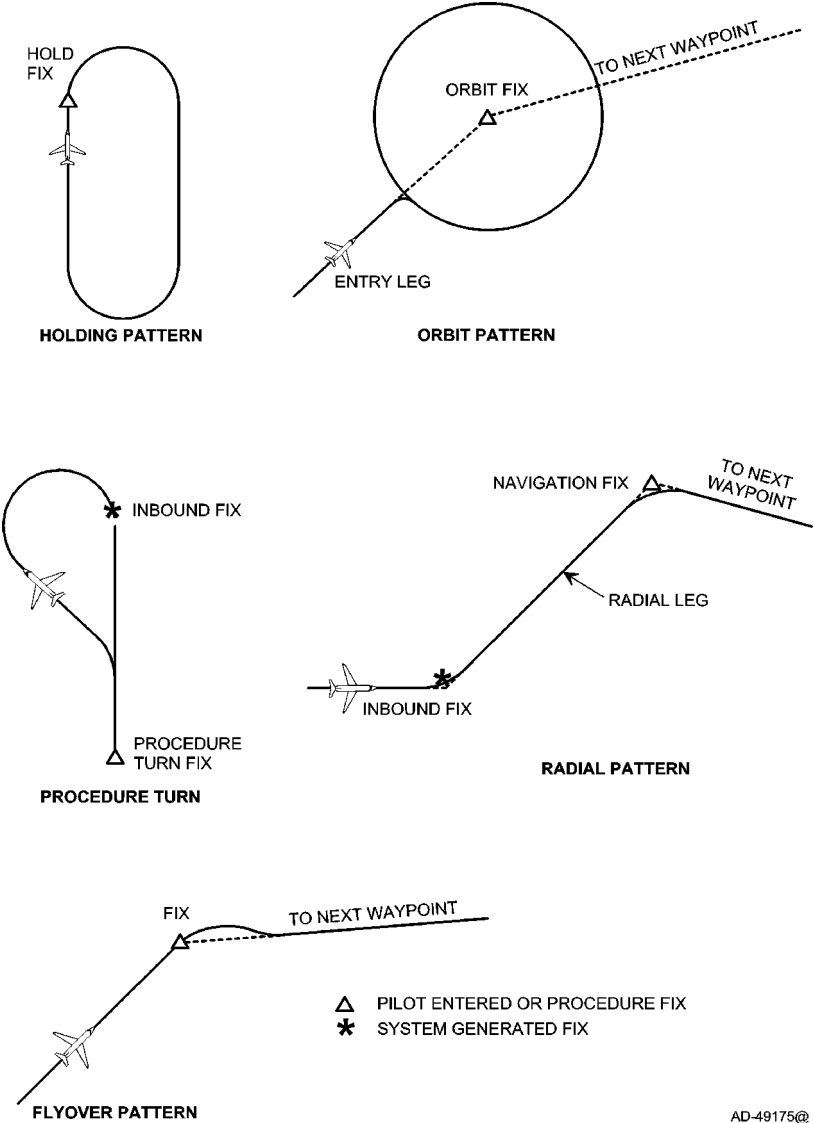
Patterns can be selected for both the active and stored flight plans. For active flight plans only, the PATTERN prompt at 4L is displayed when selecting the DIR key. For stored flight plans, the prompt at 4L is always PATTERN. The procedures for selecting and defining all patterns are similar. In addition to the pilot defined patterns, some procedures, such as approach procedures, contain patterns. These data base patterns are added to the flight plan when activating the approach procedure.

Pattern Definition

Figure 6-160 shows each pattern type. Procedures for using each pattern type are contained in this manual. The following patterns, along with page numbers for more detailed information, are available in the FMS:

- HOLD (page 6-127)
- PROCEDURE TURN (page 6-137)
- FLYOVER (page 6-142)
- ORBIT (page 6-143)
- RADIAL (page 6-146).

SPECIAL MISSION must be on to select the ORBIT and RADIAL patterns. See setting special mission under Flight Configuration, on page 6-166, for details.



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Pattern Formats
Figure 6-160

Pattern Review

Patterns activated into the flight plan can be reviewed at any time. This is performed by selecting the PATTERNS prompt at 1R, shown in Figure 6-161, or by selecting the DIR key and pressing 4L (PATTERN) and then selecting REVIEW (4L). The pilot can review all patterns of all types in the applicable flight plan.

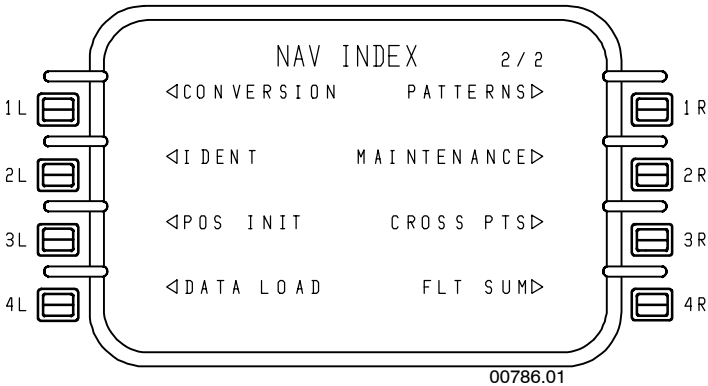
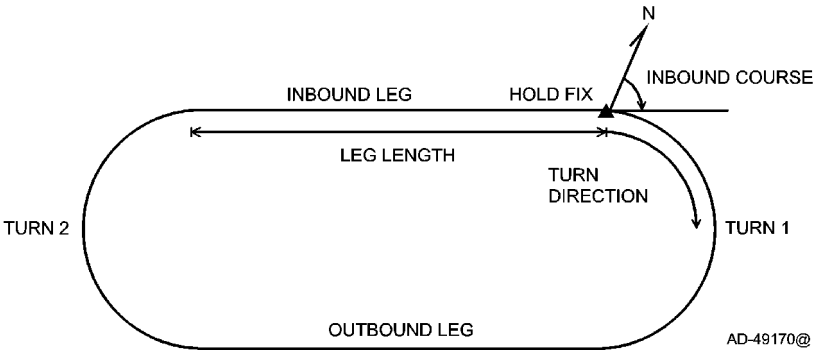


Figure 6-161

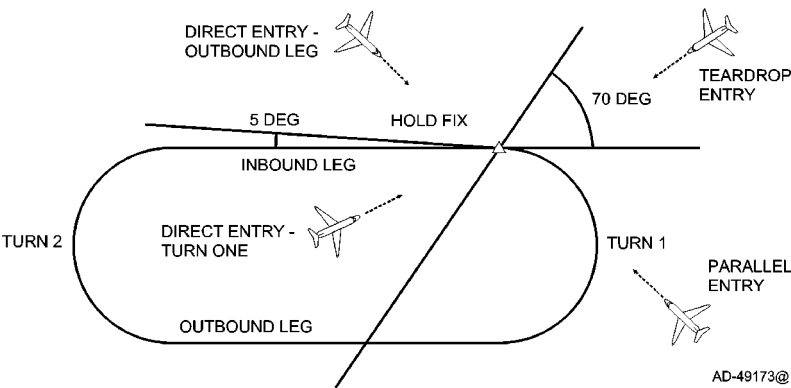
Holding Pattern

The HOLDING PATTERN page is used to define and review holding patterns. Holding quadrant, inbound course, turn direction, and leg length or time of the inbound leg of a holding pattern can be defined on the HOLDING PATTERN page. Figure 6-162 shows a typical holding pattern.



Typical Holding Pattern
Figure 6-162

The holding pattern entry type is based on the geometry shown in Figure 6-163.



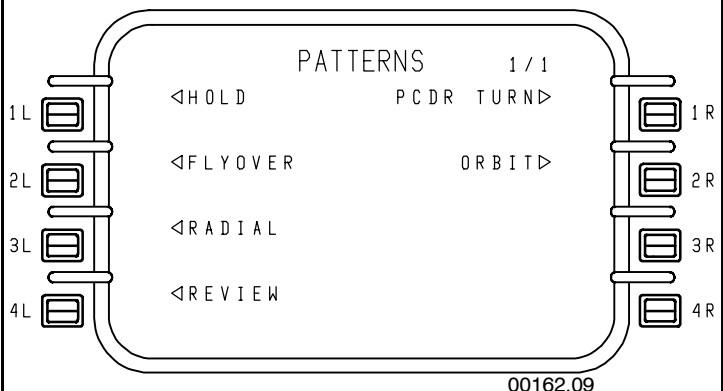
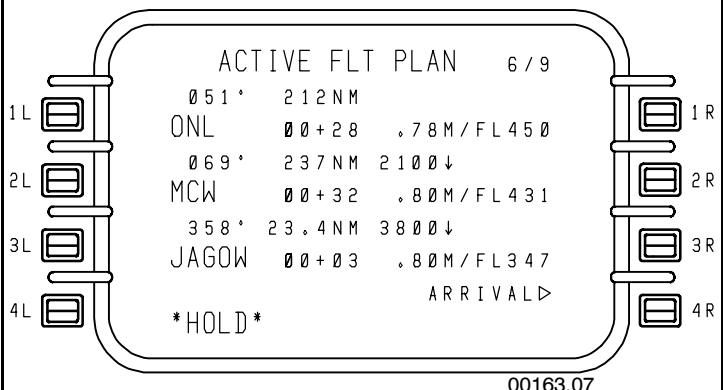
Entry Geometry
Figure 6-163

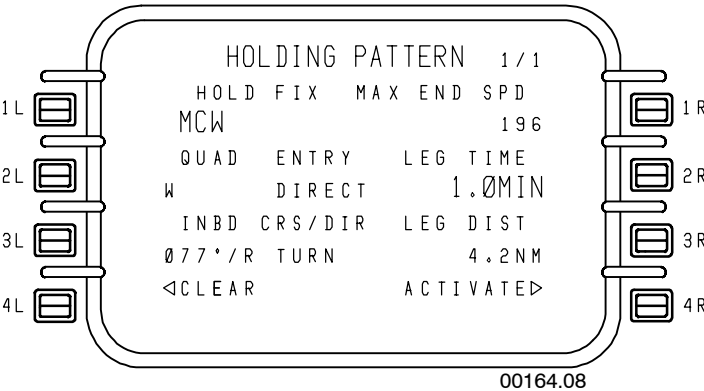
DEFINING A HOLDING PATTERN

A holding pattern can be defined and reviewed by following Procedure 6-22.

Step	Procedure 6-22 Holding Pattern Definition and Review
1	Select the DIR function key.
2	Select the PATTERN prompt (4L). This is shown in Figure 6-164. 1L 2L 3L 4L ACTIVE FLT PLAN6 / 9 ----- DIRECT ONL00+28.78M / FL 450 069°237NM2100↓ MCW00+32.80M / FL 431 358°23.4NM3800↓ JAGOW00+03.80M / FL 347 <PATTERNINTERCEPT> 00161.05

Figure 6-164

Step	Procedure 6-22 Holding Pattern Definition and Review
	DETAILS - As an alternative, the PATTERNS prompt can also be selected from the NAV INDEX (Page 2).
3	Select the HOLD prompt at 1L. This is shown in Figure 6-165. *HOLD* is placed in the scratchpad.  The figure shows a rectangular screen with a rounded border. On the left and right sides of the screen are vertical columns of four rectangular buttons each, labeled 1L, 2L, 3L, 4L on the left and 1R, 2R, 3R, 4R on the right. The screen displays the title 'PATTERNS' at the top left and '1 / 1' at the top right. Below the title, the text '<HOLD' is aligned with the 1L button, and 'PCDR TURN>' is aligned with the 1R button. Below that, '<FLYOVER' is aligned with the 2L button, and 'ORBIT>' is aligned with the 2R button. Below that, '<RADIAL' is aligned with the 3L button. Below that, '<REVIEW' is aligned with the 4L button. At the bottom right of the screen, the identifier '00162.09' is displayed. Figure 6-165
4	Press the select key that is adjacent to the desired holding fix waypoint. This is shown in Figure 6-166. In this example, MCW (2L) is selected.  The figure shows a rectangular screen with a rounded border, similar to Figure 6-165. It has the same 8 buttons (1L-4L, 1R-4R). The screen displays the title 'ACTIVE FLT PLAN' at the top left and '6 / 9' at the top right. Below the title, the text '051 * 212NM' is displayed. Below that, 'ONL 00+28 .78M/FL450' is displayed. Below that, '069 * 237NM 2100↓' is displayed. Below that, 'MCW 00+32 .80M/FL431' is displayed. Below that, '358 * 23.4NM 3800↓' is displayed. Below that, 'JAGOW 00+03 .80M/FL347' is displayed. Below that, '*HOLD*' is aligned with the 4L button. At the bottom right of the screen, the identifier '00163.07' is displayed. Figure 6-166

Step	Procedure 6-22 Holding Pattern Definition and Review
5	Review the default holding pattern definition. This is shown in Figure 6-167. If no changes are required, go to step 12. Make changes as necessary using the required steps.  Figure 6-167 DETAILS - The default holding is a standard holding pattern at the designated holding fix with the inbound course set to the flight plan course into the holding fix. Leg times are defaulted to 1 min below 14,000 ft and 1.5 minutes at or above 14,000 ft.
6	Enter any inbound course and/or turn direction and press line select 3L. The entry is made by entering the course followed by a slash (/) and then an L or R into the scratchpad. To change only the inbound course, enter the course into the scratchpad. To change only the turn direction, enter a slash (/) followed by an L or R.

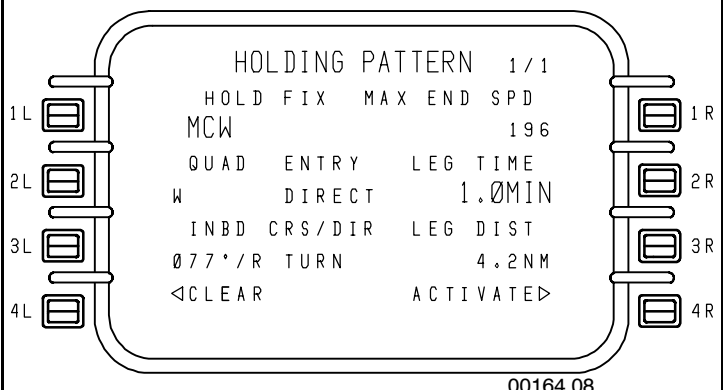
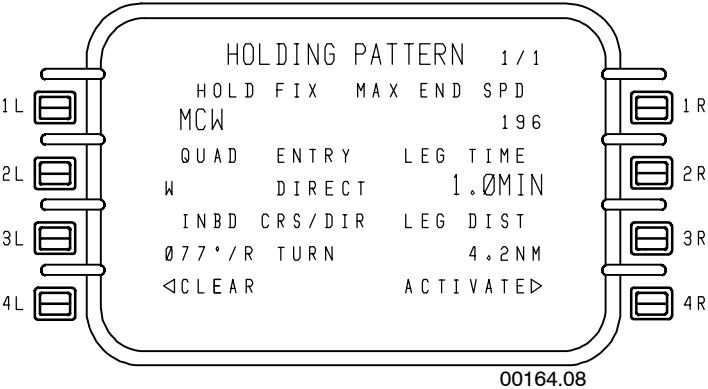
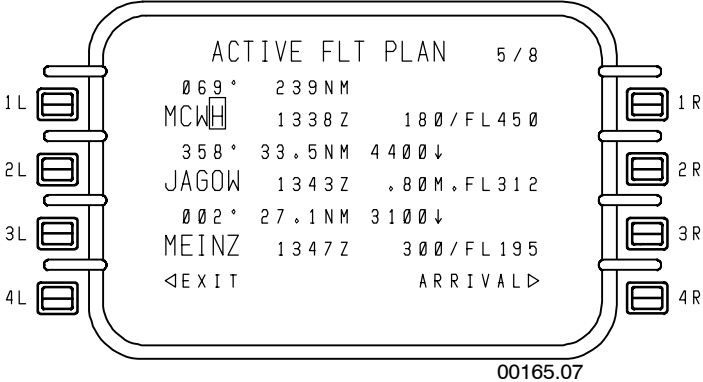
Step	Procedure 6-22 Holding Pattern Definition and Review																		
7	Review the holding quadrant and entry procedure. Holding quadrant entry is not required nor recommended. The FMS will display the holding quadrant based upon the inbound course entered by the pilot. No entries are permitted for the entry procedure. DETAILS – Holding quadrant can be entered by the pilot. When this occurs, the FMS sets the inbound course to the cardinal heading associated with the entered quadrant. This will overwrite any pilot entered inbound course. Thus, pilot entry is not recommended for holding quadrant. Possible entries for the quadrant are as follows: <table border="1"> <thead> <tr> <th>Quadrant</th><th>Inbound Course</th></tr> </thead> <tbody> <tr> <td>N</td><td>(180°)</td></tr> <tr> <td>NE</td><td>(225°)</td></tr> <tr> <td>E</td><td>(270°)</td></tr> <tr> <td>SE</td><td>(315°)</td></tr> <tr> <td>S</td><td>(000°)</td></tr> <tr> <td>SW</td><td>(045°)</td></tr> <tr> <td>W</td><td>(090°)</td></tr> <tr> <td>NW</td><td>(135°)</td></tr> </tbody> </table>	Quadrant	Inbound Course	N	(180°)	NE	(225°)	E	(270°)	SE	(315°)	S	(000°)	SW	(045°)	W	(090°)	NW	(135°)
Quadrant	Inbound Course																		
N	(180°)																		
NE	(225°)																		
E	(270°)																		
SE	(315°)																		
S	(000°)																		
SW	(045°)																		
W	(090°)																		
NW	(135°)																		
8	The FMS displays a speed for holding at 1R of the HOLDING PATTERN page, as shown in Figure 6-168. If FULL PERF is active, the predicted maximum endurance speed is displayed. For PILOT SPD/FF or CURRENT GS/FF, the speed is the predicted speed at the waypoint from the flight plan. Should a flight plan speed not be available, a default of 200 knots is displayed.  00164.08																		

Figure 6-168

Step	Procedure 6-22 Holding Pattern Definition and Review
9	If desired, enter an airspeed. Entering *DELETE* returns the default holding speed that was displayed when the page was accessed. DETAILS - The FMS automatically controls the FGS speed target. The speed is changed to the holding speed at an appropriate distance to decelerate the aircraft by the time the holding fix is reached. The holding speed is maintained until the holding fix is crossed when exiting hold.
10	Enter leg time (2R) or distance (3R). When a leg time is entered, the FMS computes the leg distance. If a distance is entered, time is computed. The FMS computation of leg time and distance use a groundspeed of 250 KTS for holding patterns below 14,000 feet and 350 KTS above 14,000 feet. Leg time defaults to 1.5 minutes at or above 14,000 feet and 1 minute below 14,000 feet.
11	Select the ACTIVATE (4R) or the CLEAR (4L) prompt. This is shown in Figure 6-169. ACTIVATE is selected in this example.  00164.08 Figure 6-169 DETAILS - When CLEAR is selected, the FMS does not insert the holding pattern into the active flight plan. The HOLDING PATTERN page shows the holding fix as undefined. When ACTIVATE is selected, the holding pattern is entered into the active flight plan.

Step	Procedure 6-22 Holding Pattern Definition and Review
12	Confirm placement of holding pattern in the flight plan. This is annunciated by the inverse video letter H next to the holding fix on the ACTIVE FLT PLAN page. This is shown in Figure 6-170.  00165.07 Figure 6-170

HOLDING AT PRESENT POSITION

Procedure 6-23 describes holding at present position. Refer to Procedure 6-22, page 6-128, for basic holding pattern definition.

Step	Procedure 6-23 Holding at Present Position
1	Press the DIR button.
2	Select the PATTERN prompt at 4L. As an alternative, PATTERNS could be selected from the NAV INDEX (page 2).
3	Select the HOLD prompt (1L).
4	Press the line select key (1L) of the FROM waypoint (first waypoint on the first page of the ACTIVE FLT PLAN).

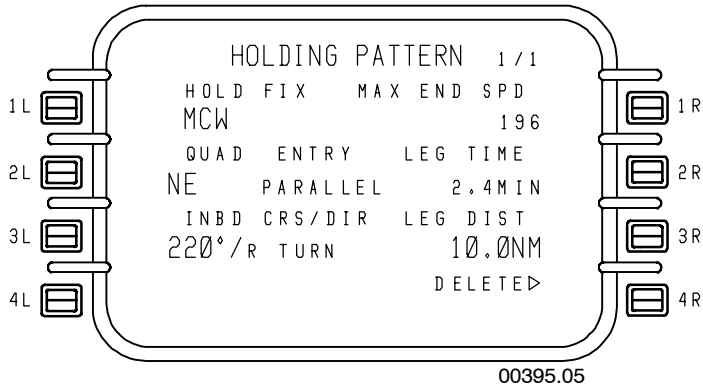
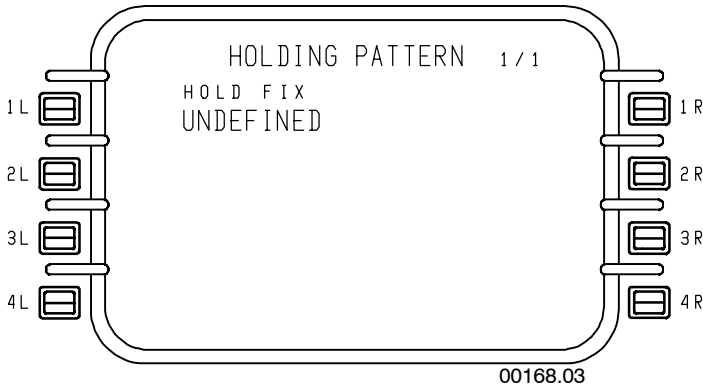
Step	Procedure 6-23 Holding at Present Position
5	The HOLDING PATTERN page with *PPOS (present position) as the holding fix is displayed. Make any necessary changes. Holding at the present position can only be done when LNAV is captured and the cross track error is less than 0.25 NM.
6	Select ACTIVATE (4R) or CLEAR (4L).

DELETING A HOLDING PATTERN

Once a holding pattern has been defined and activated, it is possible to delete the holding pattern before crossing the holding fix. This is performed by deleting the pattern from the ACTIVE FLIGHT PLAN page or from the HOLDING PATTERN page.

To delete the holding pattern from the ACTIVE FLT PLAN page, follow Procedure 6-24. Refer to Procedure 6-25 for deleting holding pattern from the HOLDING PATTERN page.

Step	Procedure 6-24 Deleting a Holding Pattern from the Active Flight Plan Pages
1	Display the active flight plan page showing the holding fix waypoint.
2	Press the delete key. *DELETE* is displayed in the scratchpad.
3	Press the line select key to the left of the waypoint with inverse video of H . This deletes the HOLD but not the waypoint. A second *DELETE* deletes the waypoint.

Step	Procedure 6-25 Deleting a Holding Pattern from the Holding Pattern Page
1	Display the HOLDING PATTERN page. Refer to Procedure 6-22 on page 6-128.
2	Select the DELETE prompt at 4R. This is shown in Figure 6-171.  The diagram shows a rectangular display area with rounded corners. Inside, the text is as follows: HOLDING PATTERN 1 / 1 HOLD FIX MAX END SPD MCW 196 QUAD ENTRY LEG TIME NE PARALLEL 2.4MIN INBD CRS/DIR LEG DIST 220°/R TURN 10.0NM DELETED> At the bottom right of the display area is the number 00395.05. Figure 6-171
3	The HOLDING PATTERN page is displayed as UNDEFINED. This is shown in Figure 6-172.  The diagram shows a rectangular display area with rounded corners. Inside, the text is as follows: HOLDING PATTERN 1 / 1 HOLD FIX UNDEFINED At the bottom right of the display area is the number 00168.03. Figure 6-172

EXITING A HOLDING PATTERN

The EXIT prompt is used to exit the holding pattern. This prompt is displayed on the ACTIVE FLT PLAN page.

One minute before the holding fix, the ACTIVE FLT PLAN page displays the EXIT prompt. This is shown in Figure 6-173. If selected before the holding fix is crossed, the holding pattern is deleted from the flight plan.

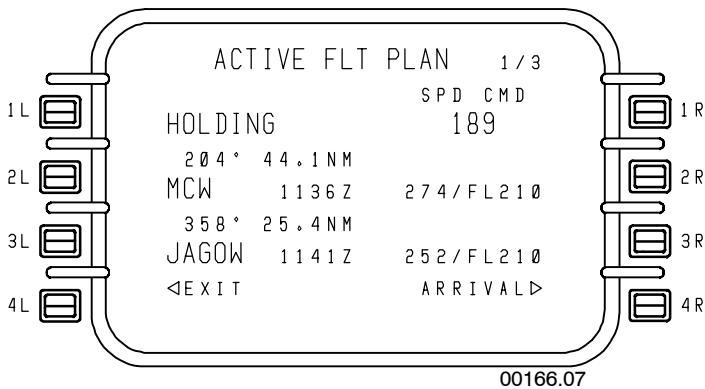


Figure 6-173

After crossing the holding fix, if the EXIT prompt is selected, the aircraft turns back to the holding fix, crosses the fix, and continues with the flight plan.

Once the FMS starts holding at the fix and the EXIT prompt has been selected, the prompt is changed to RESUME HOLD on the ACTIVE FLT PLAN. This is shown in Figure 6-174. When RESUME HOLD is selected, the FMS continues to the holding fix and then resumes the holding pattern.

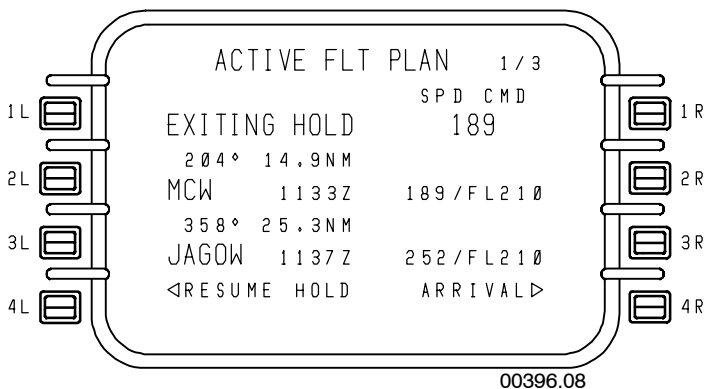


Figure 6-174

HOLDING PATTERN SIZE

The FMS has been designed to keep the aircraft within protected airspace during holding patterns. If the aircraft approaches a holding pattern at a groundspeed that results in the aircraft exceeding protected airspace, the scratchpad message HIGH HOLDING GRD SPD is displayed 30 seconds before the aircraft crosses the holding fix.

If this message is displayed, the groundspeed must be reduced and the aircraft position, relative to the holding pattern, must be monitored. If the high groundspeed is maintained, the aircraft can overshoot the outbound leg and possibly exceed protected airspace.

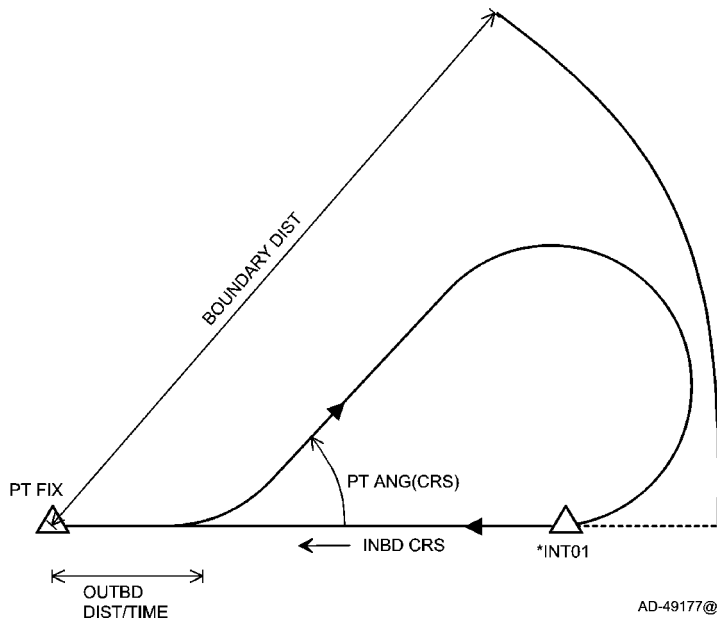
HOLDING PATTERN COURSE REVERSALS

Holding patterns that are part of the approach transition are used to reverse the aircraft's course and align the aircraft near the final approach course. These procedures are only available from approaches in the navigation data base. This is similar to the procedure turn described on page 6-137.

The procedure is to exit after entering the holding pattern. For both teardrop and parallel entries, the FMS automatically changes to exit hold at the beginning of the entry. For direct entries, the FMS automatically changes to exit hold at the turn inbound to the hold fix. In both cases, the pilot can resume holding at any time before exiting the holding pattern. Should holding be resumed, exiting the holding pattern requires pilot action.

Procedure Turn

The procedure turn is used to reverse course during an approach. **A procedure turn is only available from approaches in the navigation data base.** Using this data, the FMS constructs the procedure turn with an outbound leg, a turn out leg, an arc leg, and an inbound leg. This is shown in Figure 6-175. Only the outbound leg and the procedure turn (PT) angle are adjustable.



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Typical Procedure Turn
Figure 6-175

In the example, shown in Figure 6-176, the ILS Runway 5 at KHOT approach transition contains a procedure turn that begins at HOT VOR. The procedure turn begins with an outbound leg starting at the Initial Approach Fix (IAF) HOSSY.

The FMS displays the ACTIVE FLT PLAN page with a **P** in inverse video next to HOSSY. This is shown in Figure 6-177. In addition, the procedure turn consists of HOSSY and the next two waypoints in the active flight plan.

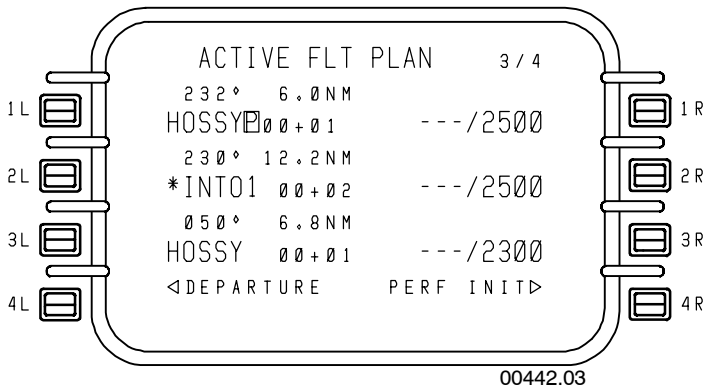


Figure 6-177

The FMS has been designed to keep the aircraft within protected airspace during procedure turns. If the aircraft approaches the procedure turn at a groundspeed that results in the aircraft exceeding protected airspace, the scratchpad message HIGH PCDR TURN GRD SPD is displayed 1 minute before the aircraft crosses the fix.

If this message is displayed, the groundspeed must be reduced and the aircraft position, relative to the procedure turn, must be monitored. If the high groundspeed is maintained, the aircraft can overshoot the turn inbound and possibly exceed protected airspace.

While flying the procedure turn, PROCEDURE TURN is displayed at 1L on the ACTIVE FLIGHT PLAN page. A TURN prompt is displayed at 4L while the aircraft is on the outbound leg. This is shown in Figure 6-178. The TURN prompt can be selected to immediately begin the turn out.

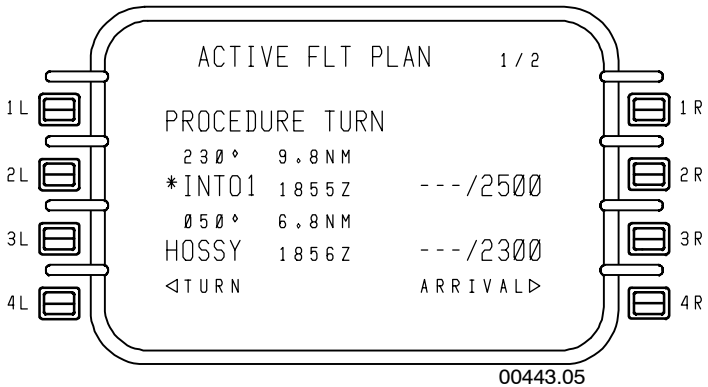


Figure 6-178

Once the procedure turn has started, the active waypoint is *INT01. This remains the active waypoint until *INT01 is overflowed on the way back to the FAF. In this example, the *INTXX waypoint (XX represents a number to distinguish from other *INTXX waypoints) is assigned the number 01 by the FMS.

DEFINING A PROCEDURE TURN

Selecting the PCDR TURN prompt on the PATTERNS page displays the PROCEDURE TURN page. This is shown in Figure 6-179. The procedure turn fix is displayed at 1L, the boundary distance at 1R, and the inbound course at 3L. No changes to this data are permitted. The outbound leg length defined by distance (3R) or time (2R) and procedure turn angle (2L) can be changed. The outbound leg from HOSSY has a 3.5 NM default leg length while the default procedure turn angle is L45°.

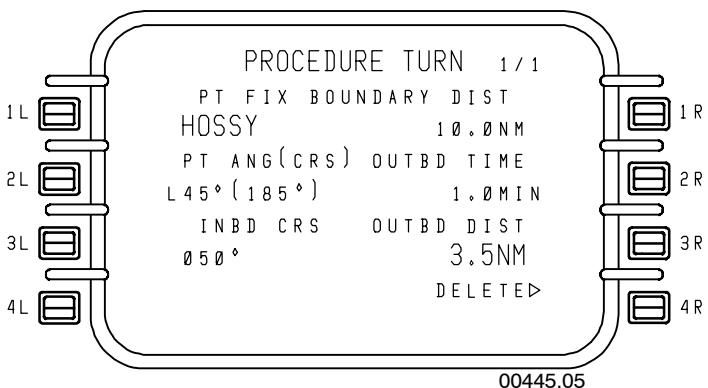


Figure 6-179

The default turn angle can be changed from the PROCEDURE TURN page. Enter an angle between 20° and 90°, prefixed with either an **L** (left) or **R** (right) that specifies the turn out direction. The outbound leg can also be changed by either specifying the outbound time (OUTBD TIME) in minutes or outbound distance (OUTBD DIST) in nautical miles. The controlling entry is in large capital letters. If time is specified, the distance is calculated based on a groundspeed at the procedure turn fix. The groundspeed used when further away than a minute to the procedure turn fix is 210 knots. When within one minute of the fix, the current groundspeed is used.

After changing any of the parameters, the ACTIVATE prompt at 4R is displayed. Select this prompt to redefine the procedure turn.

If the procedure turn is predicted to exceed the boundary distance, the outbound leg and the turn angle are displayed in inverse video. The procedure turn can still be defined with these values.

DELETING A PROCEDURE TURN

Select ***DELETE*** from the scratchpad to waypoint that has the inverse video **P**. The procedure turn is deleted including the following two waypoints, but not the waypoint selected. ***DELETE*** cannot be selected to either of the following two waypoints of a procedure turn. An INVALID DELETE message is displayed if an attempt is made to delete these waypoints.

EXITING A PROCEDURE TURN

The procedure turn is flown automatically by the FMS and requires no manual exit. It can be manually terminated while flying the procedure turn by selecting ***DELETE*** to either the PROCEDURE TURN header at 1L or the ***INTXY** waypoint at 2L. The inbound leg is made active and captured. The aircraft turns inbound according to the procedure turn direction. This process does not ensure compliance with procedure turn rules, but it does give a manual procedure for turning inbound when requested by ATC.

Flyover Pattern

Under normal circumstances, the FMS begins a turn before reaching the waypoint (i.e., the aircraft is turned inside the waypoint). In some cases, the requirement is to proceed to the waypoint before commencing the turn. This can be done by using the flyover pattern feature of the FMS. In many cases, flyovers are entered in the flight plan automatically when required from data base procedures.

DEFINING A FLYOVER

Unlike holding patterns, there are no pilot entered options required for flyovers. Therefore, there is no dedicated FLYOVER PATTERN page. Follow Procedure 6-26 to define a flyover.

Step	Procedure 6-26 Flyover Pattern Definition
1	Press DIR key.
2	Select PATTERN prompt at 4L. As an alternative, PATTERNS can be selected from the NAV INDEX (page 2).
3	Select the FLYOVER prompt at 2L. This action places *FLYOVER* in the scratchpad.
4	Press the left line select key adjacent to the desired flyover pattern fix waypoint. The flyover is displayed as an inverse video F adjacent to the course flown to the waypoint. With this option, the aircraft flies to the waypoint before the turn is started.

DELETING A FLYOVER

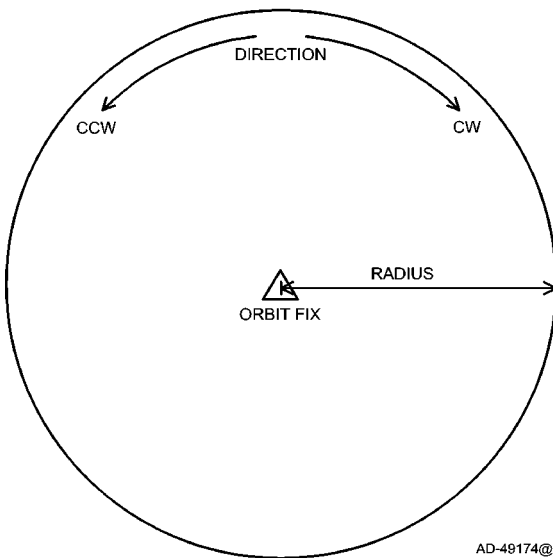
Select *DELETE* from the scratchpad to delete the flyover. Only the flyover is deleted, not the waypoint. A second delete can be used to delete the waypoint.

EXITING A FLYOVER

There are no exit procedures. Either delete the flyover or change the flight plan to eliminate the flyover waypoint.

Orbit Pattern

The orbit pattern is used to fly an orbit (circle) around a given waypoint at a distance from 1 NM to 99.9 NM. See Figure 6-180 for the orbit definition. Orbit patterns are available only when SPECIAL MISSION is selected (refer to page 6-166).

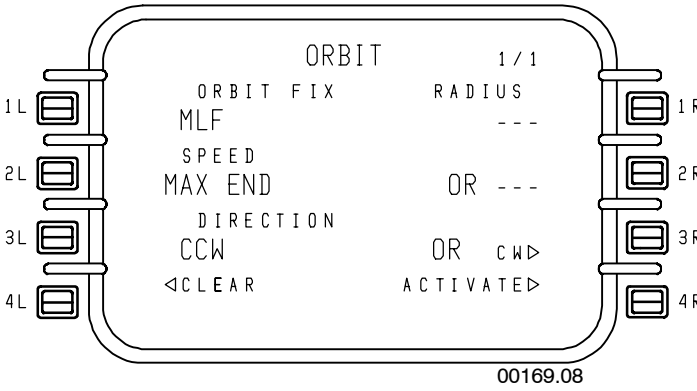


Orbit Definition
Figure 6-180

DEFINING AN ORBIT PATTERN

Follow Procedure 6-27 to define an orbit pattern.

Step	Procedure 6-27 Orbit Pattern Definition
1	Press the DIR key.
2	Select the PATTERN prompt at 4L. As an alternative, PATTERNS can be selected from the NAV INDEX (page 2).
3	Select the ORBIT prompt at 2R. This action places *ORBIT* in the scratchpad.
4	Press the left line select key adjacent to the desired orbit pattern fix waypoint.

Step	Procedure 6-27 Orbit Pattern Definition
5	The ORBIT page, shown in Figure 6-181, is displayed.  Figure 6-181
6	Enter the required radius at 1R.
7	Enter the required speed at 2R (if different from the default).
8	Enter the orbit direction at 3R (if different from the default). The direction is specified as counterclockwise (ccw) or clockwise (cw).
9	Select ACTIVATE (4R) or CLEAR (4L).

Orbit patterns are designated with an inverse video **O** on the pattern waypoint. As the aircraft approaches the orbit, it transitions onto the orbit and flies at the specified radius around the waypoint. A prompt on the active flight plan page can be used to reverse the direction of flight once in the orbit. The reversal turn is always executed to the outside of the orbit.

DELETING AN ORBIT PATTERN

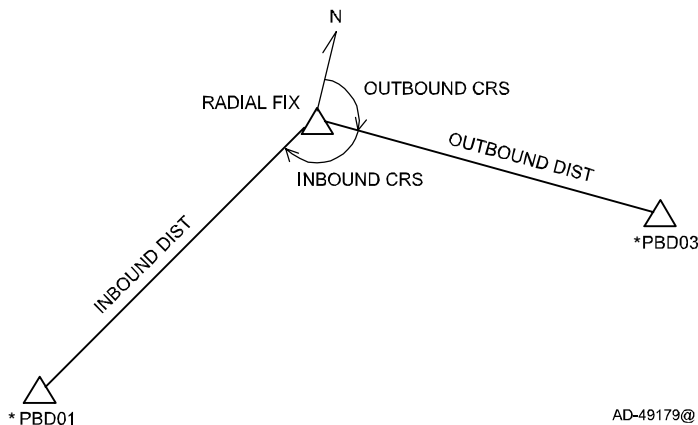
An orbit pattern can be deleted from the flight plan by selecting ***DELETE*** from the scratchpad to the appropriate waypoint. On the active flight plan pages, ***DELETE*** cannot be used within a minute of the pattern. In this case, pressing the EXIT prompt (4L) removes the pattern.

EXITING AN ORBIT PATTERN

One minute before an orbit is entered and while in the orbit, the EXIT prompt is displayed at 4L on the active flight plan page. If EXIT is selected, the aircraft immediately leaves the orbit and proceeds to the next waypoint in the flight plan.

Radial Pattern

A radial pattern is used to fly a radial inbound and/or outbound from a given waypoint. See Figure 6-182 for the radial definition. Radial patterns are only available when SPECIAL MISSION is selected (refer to page 6-166).

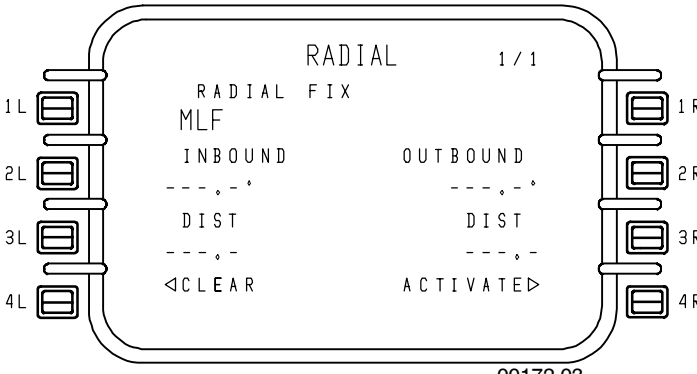


Radial Definition
Figure 6-182

DEFINING A RADIAL PATTERN

Follow Procedure 6-28 to define a radial pattern.

Step	Procedure 6-28 Radial Pattern Definition
1	Press the DIR key.
2	Select the PATTERN prompt at 4L. As an alternative, PATTERNS can be selected from the NAV INDEX (page 2).
3	Select the RADIAL prompt at 3L. This action places *RADIAL* into the scratchpad.
4	Press the left line select key that corresponds to the radial pattern fix waypoint.

Step	Procedure 6-28 Radial Pattern Definition
5	The RADIAL page, shown in Figure 6-183, is displayed.  Figure 6-183
6	At a minimum, define an inbound or outbound radial and associated distance to activate the pattern. Both can be defined.
7	Select ACTIVATE (4R) or CLEAR (4L).

A radial pattern is displayed as an inverse video **R** in the flight plan. Temporary waypoints are inserted in the flight plan to properly fly the radials as defined. The inserted waypoints are displayed in inverse video. Other waypoints cannot be inserted between radial waypoints. Radial patterns can be stored in a stored flight plan.

DELETING A RADIAL PATTERN

If both the inbound and outbound radials are defined, two temporary waypoints are inserted into the flight plan. In this case, either waypoint can be deleted individually and the remaining leg stays in the flight plan. If only one waypoint was inserted or remains in the flight plan, deleting it removes the waypoint and the pattern.

EXITING A RADIAL PATTERN

Since a radial pattern is flown as normal legs between waypoints, there is no exit procedure. The normal DIRECT-TO and waypoint delete procedures exit the radial pattern.

Multiple Patterns

It is possible to have multiple patterns in any given flight plan. It is also possible to have multiple patterns on a given waypoint. Refer to Table 6-4 for the possible combinations.

Pattern Name	Additional Pattern Permitted
ORBIT RADIAL HOLDING FLYOVER PROCEDURE TURN ARC TURN	NONE HOLDING, FLYOVER RADIAL RADIAL HOLDING, FLYOVER HOLDING, FLYOVER

Multiple Patterns
Table 6-4

If multiple patterns exist at a waypoint, the order of delete is FLYOVER, HOLD, RADIAL. If a HOLD or ORBIT is defined on a waypoint with a FLYOVER, the FLYOVER is automatically deleted.

NAVIGATION IDENTIFICATION

The NAV IDENT page, shown in Figure 6-184, displays information regarding the software of the FMS and the navigation data base. This page is accessed by pressing the IDENT prompt on the NAV INDEX page 2.

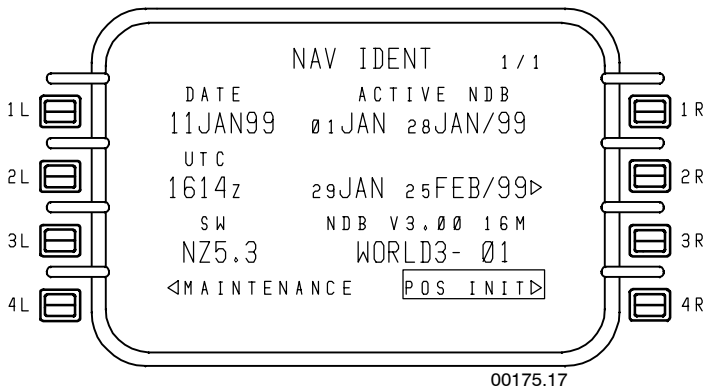


Figure 6-184

The NAV IDENT page displays the date, time, software version, and active navigation data base cycle. It also displays the version, size, and region of the navigation data base.

The date and time displayed on this page is synchronized with the GPS date and time. The date and time can be changed if the GPS is failed or does not have a valid date/time. To change date or time, enter the new date or time into the scratchpad. This is shown in Figure 6-185. Press the line key adjacent to the item being changed.

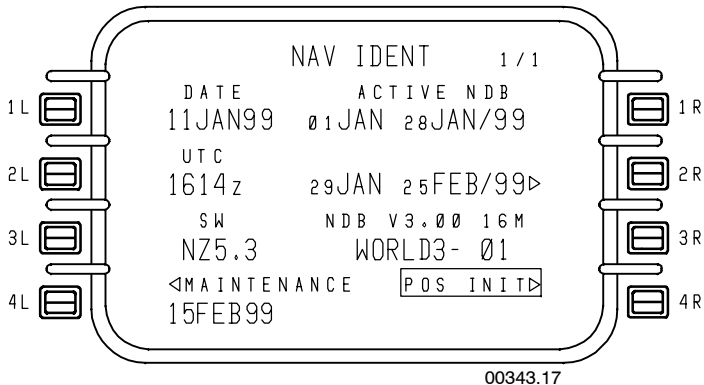


Figure 6-185

The navigation data base contains two 28-day effective cycles. To change the active navigation data base between the two cycles, press the 2R line select key.

If the FMS date corresponds to a day during one of the navigation data base cycles, that cycle is displayed in green. The remaining cycle is displayed in amber. If both cycles are displayed in amber, either the date is wrong or the navigation data base has expired and must be updated. The data base cycle can only be changed while on the ground. If an active flight plan exists, it is cleared when changing data base cycles.

The navigation data base automatically sequences to the data base cycle at 0900Z. Depending on the location, the data base cycle date may not agree with the current local date.

MAINTENANCE

The MAINTENANCE pages are used to control the selected and active dual system modes, list failed sensors, and select true or magnetic mode for the FMS. The MAINTENANCE pages also control the operating pair and flight plan mode for triple FMS installations.

Selected and Active Operating Modes

There are four configuration modes for the FMS.

- **Dual** – The active flight plan, performance entries, pilot defined waypoints, stored flight plans, and offside radio tuning commands are transferred to the offside FMS automatically (no pilot action required).
- **Initiated Transfer** – The active flight plan and performance entries are transferred on command through a line select key prompt on the last ACTIVE FLT PLAN page. Pilot defined waypoints, stored flight plans, and offside radio tuning commands are transferred to the offside FMS automatically.
- **Independent** – Only offside radio tuning commands are transferred to the offside FMS automatically.
- **Single** – No data is transferred between FMSs.

In all operating modes, position calculation is always independent in each FMS. Table 6-5 lists the requirements necessary for each operating mode. The FMS defaults to the SINGLE mode if the requirements for the DUAL, INITIATED TRANSFER or INDEPENDENT modes cannot be met.

Requirement	Dual	Initiated Transfer	Independent	Single
NZ software version identical	X	X	X	
Navigation data base and cycle identical	X	X		
Custom Data base Identical	X	X		
FMS positions within 10NM	X	X		
Configuration pins identical	X	X	X	

Operating Mode Requirements
Table 6-5

Dual FMS Installations

- **MAINTENANCE 1/3** - Figure 6-186 is dedicated to selecting and confirming the operating mode of dual FMSs. In Figure 6-186, the selected mode is INITIATED TRANSFER but the active mode is INDEPENDENT.

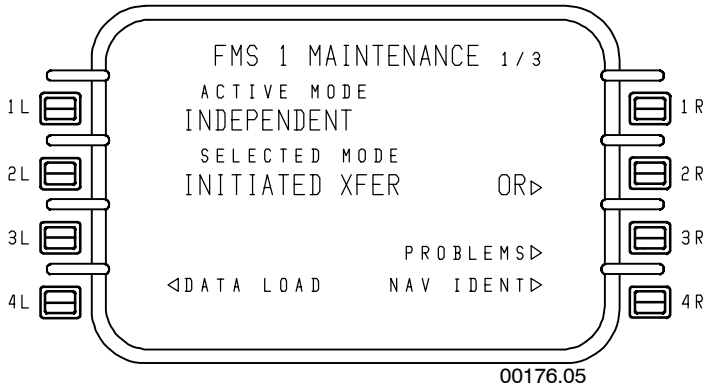


Figure 6-186

The selected operating mode can be changed by selecting the OR prompt (2R). When selected, the OPERATING MODE page, Figure 6-187, is displayed. The selected mode is indicated on the page. Any mode can be selected by using the appropriate line select key. After selecting a mode or the RETURN prompt (1R), the MAINTENANCE 1/3 page is displayed.

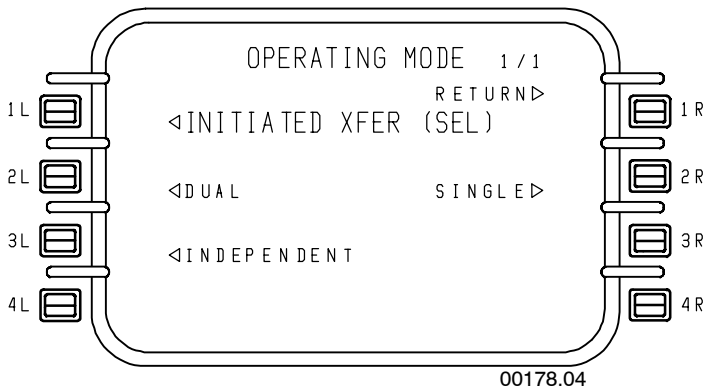


Figure 6-187

If the active mode is not the same as the selected mode, it is because of some problem. In this case, the PROBLEMS prompt (3R), shown in Figure 6-186, is displayed and can be selected.

Selecting the PROBLEMS prompt displays the OP MODE PROBLEMS page. This is shown in Figure 6-188. The OP MODE PROBLEMS page lists the problem(s) preventing the FMSs from operating in the selected mode. After the problems are resolved, the FMS can operate in the selected mode. If an automatic reversion to independent is made from initiated transfer or dual, the PROBLEMS prompt at 3R (Figure 6-186) is replaced with RET TO SEL MODE when the problem is corrected. The pilot must press this prompt to return to the selected mode. Refer to Table 12-2, on page 12-8, for the definition of messages displayed on this page and the actions that can be performed to resolve the problem.

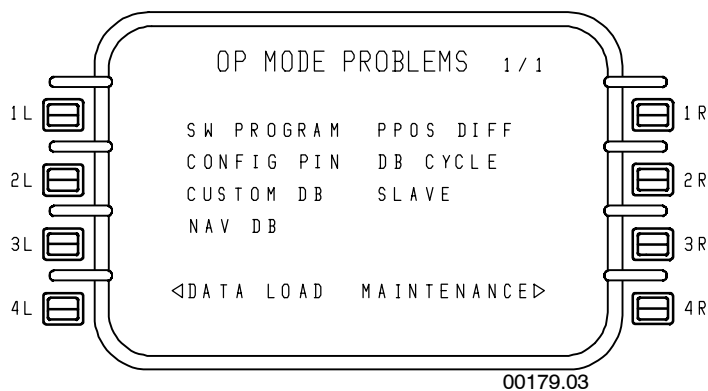


Figure 6-188

Triple FMS Installations

Some installations have three FMSs installed. The triple operation is different for NZ-2000 computer installations versus IC-800 installations. Each is described below.

TRIPLE NZ-2000 INSTALLATIONS

In triple NZ-2000 installations, the third FMS is referred to as a warm spare. The warm spare consists of a CDU and an NZ. The NZ is labeled as NZ 3.

The aircraft is wired such that the warm spare can be switched in place of FMS 1 or FMS 2. When this occurs, NZ 3 takes the place of NZ1 or NZ 2. This allows the operator to replace NZ 1 or NZ 2 when a failure occurs.

The following is an example of how the warm spare is switched into a system. Assume NZ 2 has failed during a flight. The warm spare (NZ 3) is then switched in place of NZ 2. At this point, NZ 3 is wired to CDU

2 (copilot's CDU), and NZ 2 is wired to CDU 3 (warm spare CDU). In order to have dual or initiated transfer capability in this configuration, it may be necessary to transfer the custom data base to NZ 3.

The warm spare operates in single. It does **NOT** receive active flight plans, pilot defined waypoints, stored flight plans from FMS 1 or FMS 2. The warm spare does **NOT** tune NAV 1 or NAV 2. The warm spare can tune other radios and interface to AFIS™ if this capability has been implemented by the installer.

TRIPLE IC-800 INSTALLATIONS

For installations with three FMSs in IC-800 computers, FMS 3 provides the same interface capability as FMS 1 and 2. It includes Long Range Navigation Sensors, EFIS display, autopilot coupling, lateral guidance, and vertical guidance. Any two of the three FMSs can be selected to operate as a pair via the CDU pages with no external switching.

Once two FMSs have been selected to operate as a pair, either dual, initiated transfer, independent, or single can be selected as the operating mode for these two FMSs. The active operating mode and resultant data transfers, including radio tuning, for these two FMSs are determined using the normal operating modes described on page 6-151.

When a different FMS is selected to be part of the pair, that FMS begins operating in the selected mode without a cold start. The two FMSs which are operating as a pair determine the master based on the EFIS selection. The new slave then synchronizes its flight plan and performance initialization with the master. If the custom databases do not match, the pilot must transfer the custom database before going to dual.

When an FMS is deselected from the pair, it begins single operation without a cold start. It also assumes INITIATED XFER as the flight plan mode. Thus it keeps its flight plan and present position. The FMS that is operating in the single system mode, can update its flight plan automatically or via initiated transfer from either of the other FMSs. It should be noted that if the FMS operating in the single system mode is in INITIATED XFER, then the pilot must go to the alternate flight plan page on that FMS to initiate the flight plan transfer. It should also be noted that the FMS operating in the single system mode does not receive performance initialization data from the other FMSs. The FMS in the single system mode monitors the VOR/DME radio inputs and computes a radio position if possible. The single FMS does not tune

the VOR and DMEs. However, it can tune all of the other radios (VHF COM, ATC Transponder, etc.) directly using its own tuning command outputs.

NOTE: The pilot should ensure that the FMS which is operating in the single system mode is in the INITIATED XFER flight plan updating mode prior to coupling the single system FMS to the autopilot. This is necessary to allow this FMS to sequence it's own flight plan for lateral and vertical guidance.

- **MAINTENANCE 1/3** - Figure 6-189 is dedicated to selecting the operating pair and selecting and confirming the operating mode of triple FMSs. In Figure 6-189, the operating pair is FMS 1-2. The selected mode is INITIATED TRANSFER. The active mode is INDEPENDENT. The operation of the selected and active mode is the same as for a dual system. Refer to page 6-151 for additional information.

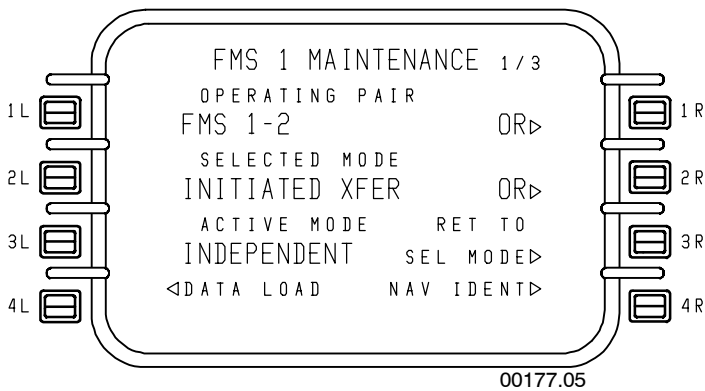
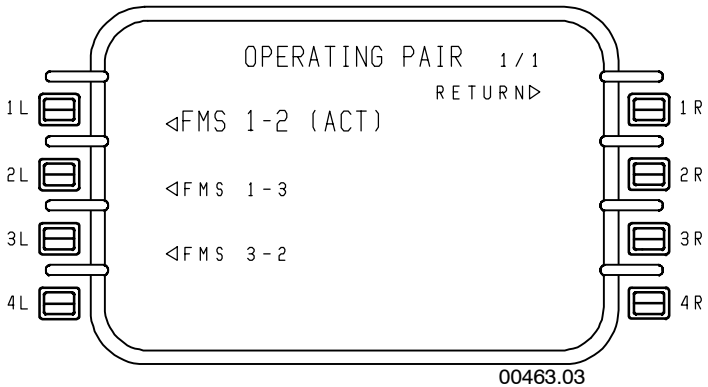
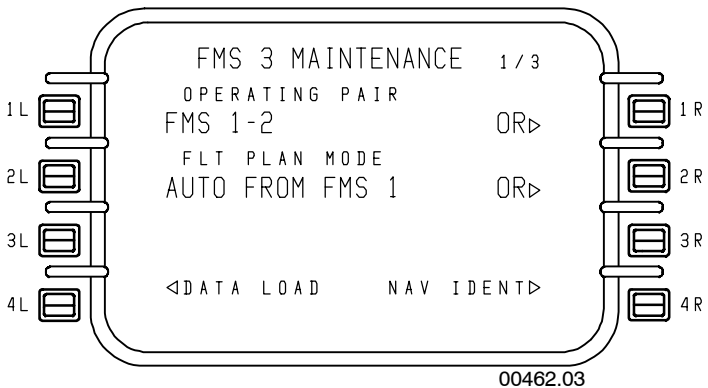


Figure 6-189

Operating pair identifies the two FMSs that can operate in dual or initiated transfer. The normal selection is FMS 1-2. The operating pair can be changed by selecting the OR prompt at 1R (Figure 6-189). The OPERATING PAIR page, Figure 6-190, is displayed with the selected pair indicated. The desired pair can be selected using the appropriate line select key. After selecting a pair or the RETURN prompt (1R), the MAINTENANCE 1/3 page is displayed.

**Figure 6-190**

The FMS, not selected as one of the pair, operates in the SINGLE mode. Even though the non-paired FMS is operating in SINGLE, the flight plan can be updated from the other FMSs. The selection of options for flight plan updating is made from MAINTENANCE 1/3 of the non-paired FMS. This is shown in Figure 6-191.

**Figure 6-191**

Selecting the OR prompt (2R), Figure 6-191, displays the FLT PLAN MODE page, Figure 6-192. The active mode is indicated and selection of modes can be made using the appropriate line select key. After selecting a mode or the RETURN prompt (1R), the MAINTENANCE 1/3 page is automatically displayed.

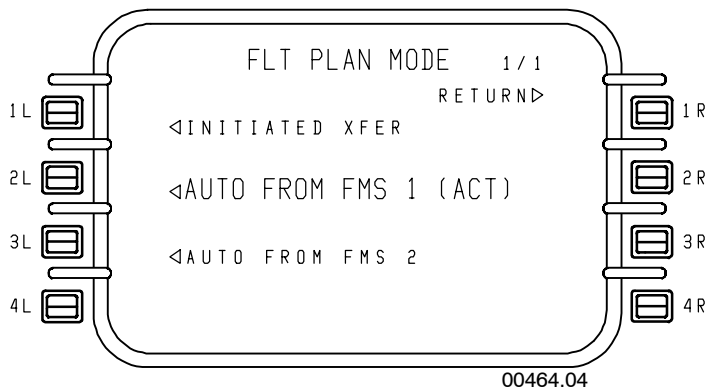


Figure 6-192

Failed Sensors

- **MAINTENANCE 2/3** - Figure 6-193 lists the currently failed sensors as determined by the FMS.

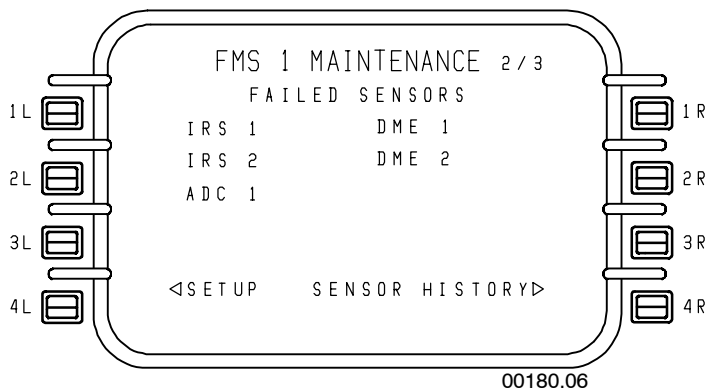


Figure 6-193

The SETUP prompt (4L) is used to access the setup pages. Refer to FMS Setup Pages, page 6-160, for further details on this function.

The SENSOR HISTORY prompt (4R) is used to display a list of sensors that have failed sometime after takeoff during the current flight, but are not failed at the present time. Figure 6-194 shows the SENSOR HISTORY page.

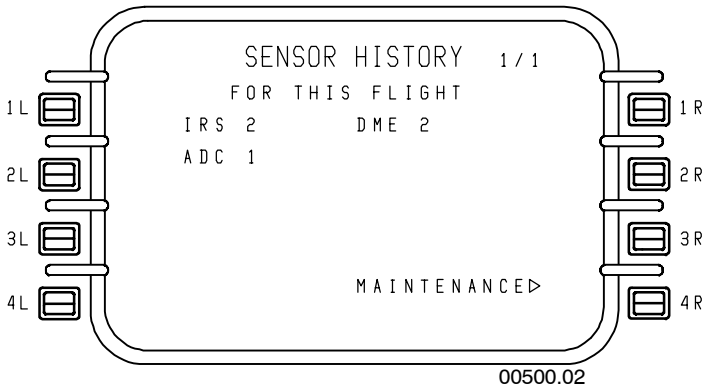


Figure 6-194

True/Magnetic Selection

- MAINTENANCE 3/3** – Figure 6-195 is dedicated to selecting true or magnetic headings for the FMS and the HSI heading display. If TRUE is the active mode, all courses and headings displayed by the FMS are followed by the letter **T**. If MAG is the active mode, all courses and headings displayed by the FMS are followed by a degree symbol (°) on the FMS pages.

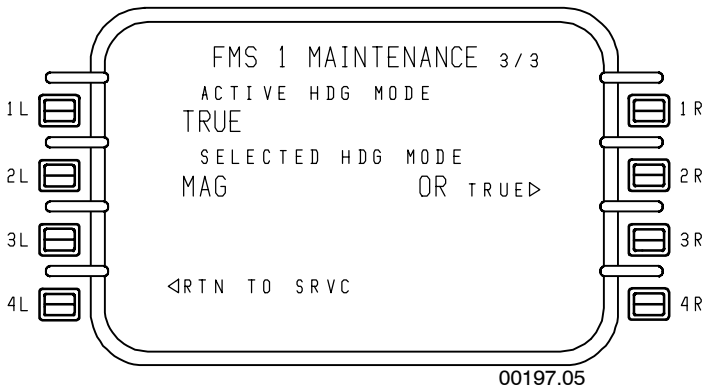


Figure 6-195

The active mode also reflects how courses are displayed on the HSI. If the FMS is selected as the navigation source for the HSI, the course displayed by the FMS is relative to the mode that is displayed for the ACTIVE HDG MODE on this page.

The pilot can toggle between magnetic and true by pressing the line select key at 2R.

The RETURN TO SERVICE page can be directly accessed by pressing the line select key at 4L. Refer to page 6-159 for additional details.

High Latitude Flying

Two areas are defined by the FMS for operations at high latitudes. The first area, called the high latitude area, is defined as being above 72° 30' N or below 59° 30' S when entering and below 72° N or above 59° S when leaving the area. The second area, called the polar region, is defined to be above 85° N or below 85° S when entering and below 84° N or above 84° S when leaving the area.

- **High Latitude Area** – The FMS automatically switches to true heading when entering the high latitude area (above 72° 30' N or below 59° 30' S). The EFIS heading is also switched to true. At the time this switch occurs, the message ACTIVE MODE IS TRUE HDG is displayed. This switch is necessary because the FMS calculates magnetic heading by using true heading and adding or subtracting the magnetic variation. Magnetic variation up to 73° N or 60° S is stored in the FMS. Above 73° N and below 60° S, magnetic heading cannot be calculated by the FMS.

After leaving the high latitude area (below 72° N or above 59° S), the FMS automatically switches back to magnetic heading, if MAG is the selected mode. The message ACTIVE MODE IS MAG HDG is displayed when the switch occurs.

- **Polar Region: IRS Equipped Aircraft** – Entering the polar region (above 85° N or below 85° S) results in the message ENTERING POLAR REGION being displayed. When entering the polar region, the FMS uses its highest priority sensor for navigation. Sensor blending is suspended and the FMS position is slowly ramped to the position of its highest priority sensor. Under normal circumstances, this means that FMS 1 uses IRS 1 and FMS 2 uses IRS 2. If the highest priority sensor has failed, the next priority sensor is used. The POS SENSORS page indicates which sensor is being used.

Under normal operations, the outside IRS is used as the heading source by EFIS (IRS 1 for the pilot and IRS 2 for the copilot). If the EFIS and FMS are using the same IRS, the EFIS will display a 180° reversal at the same time the FMS crosses the pole.

When leaving the region (below 84° N or above 84° S), the message EXITING POLAR REGION is displayed. The FMS resumes sensor blending and slowly ramps from the high priority sensor position to the blended sensor position.

The plan mode for the EFIS map display is not useful while at or near the pole. The information presented is correct, but the presentation is not useful because the plan mode is presented North up. When at the North pole for example, everything is South. Therefore, the plan mode must not be used during operations at or near either pole. Instead, use the regular map mode.

Correctly flown holding patterns are possible while in the polar region. However, the EFIS airplane symbol does not always show on the holding pattern. The display error is more pronounced the further away the aircraft is from the holding fix and/or the closer the aircraft is to the pole. If a holding pattern is hand flown in the polar region, the HSI presentation should be used for required track and deviation.

Since the FMS uses the highest priority IRS (GPS if no IRS is available) and the IRS position cannot be updated, manual FMS position update is not permitted in the polar region.

During operations in the polar region, FMS lateral offset is inhibited. Any entered lateral offset is removed when entering the polar region.

- **Polar Region: AHRS Equipped Aircraft** – AHRS equipped aircraft operate much the same as IRS equipped aircraft at the higher latitudes. Check the aircraft flight manual for any limitations concerning operation at high latitudes with AHRS. The following are exceptions for AHRS operations:
 - The FMS switches to TRUE when entering the high latitude area (above 72° 30' N or below 59° 30' S). However, EFIS does not have a source of true heading with AHRS. Therefore, EFIS displays MAG heading and, if the FMS is the selected NAV source, TRUE FMS information. FMS position is the blended position of available sensors.
 - Entering the polar region (above 85° N or below 85° S) in an AHRS equipped aircraft, results in the FMS using the highest priority GPS.

Return To Service

FMS software identification and configuration information is provided for display only, as shown in Figure 6-196. Displayed on this page are the functional software identifier, FMS software version, and Input/Output Processor (IOP) software version.

Aircraft configuration data is shown in hexadecimal characters. The least significant configuration byte starts at the upper left line. This page provides verifiable identification for an FMS being returned to aircraft service.

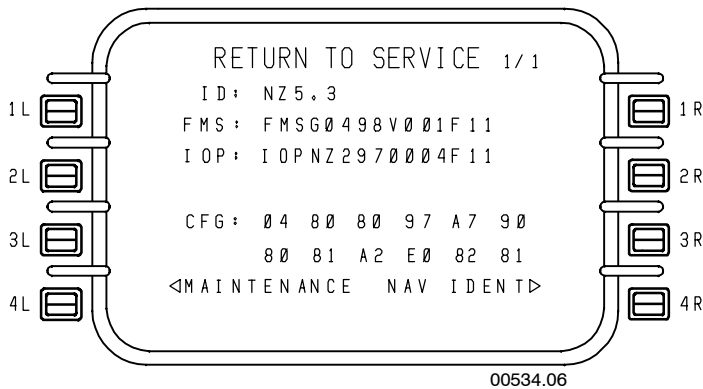


Figure 6-196

FMS Setup Pages

The FMS contains setup pages for configuring operational options. The setup pages are accessible from MAINTENANCE page 2 using line select 4L as describe in Procedure 6-29. From this index page, the various setup pages can be selected. The pages are described below.

Step	Procedure 6-29 FMS Setup Page Access
1	Select MAINTENANCE from the NAV INDEX (page 2).
2	Press the NEXT key to select page 2.
3	Select SETUP prompt at 4L. This is shown in Figure 6-197.

Diagram of the FMS 'FMS 1 MAINTENANCE' page. The display shows the following text:

```

FMS 1 MAINTENANCE 2 / 3
FAILED SENSORS
IRS 1      IRS 2
DME 1      DME 2

<SETUP    SENSOR HISTORY>
  
```

The display is flanked by control buttons labeled 1L, 2L, 3L, 4L on the left and 1R, 2R, 3R, 4R on the right. The identifier 00180.07 is at the bottom right.

Figure 6-197

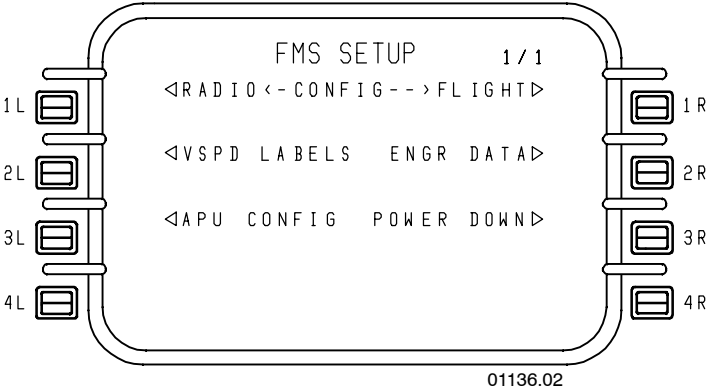
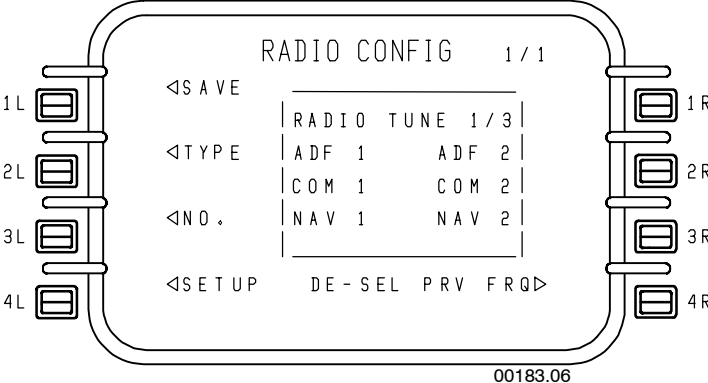
Step	Procedure 6-29 FMS Setup Page Access
4	The FMS SETUP page, shown in Figure 6-198, is displayed. Selectable options are as follows: • 1L - RADIO CONFIG (refer to page 6-161) • 1R - FLIGHT CONFIG (refer to page 6-164) • 2L - VSPD LABELS (refer to page 6-170) • 2R - ENGR DATA (refer to page 6-172) • 3L - APU CONFIG (refer to page 6-173) • 3R - POWER DOWN (refer to page 6-174).  01136.02

Figure 6-198

Radio Configuration

The RADIO CONFIG page is accessed from FMS SETUP line select 1L. As a default, the RADIO TUNING pages are configured for two ADFs, two VHF COM Radios, two NAV receivers, two HF's, and two transponders. If it becomes necessary to change these pages, select the RADIO CONFIG pages to make the changes. The NAV radio configurations cannot be changed.

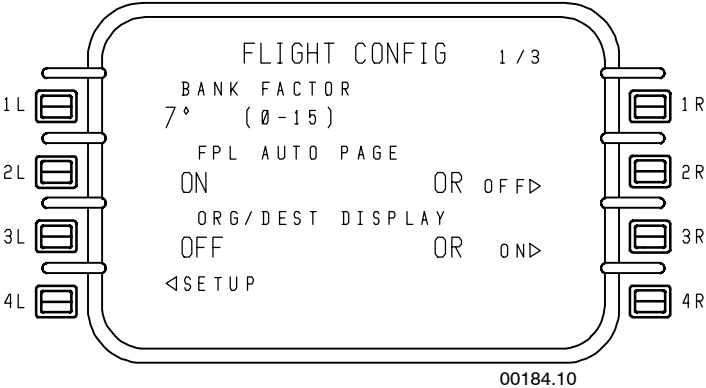
The RADIO CONFIG page shows a small box with the title RADIO TUNE 1/X. This box represents the RADIO TUNE page as currently configured. Procedure 6-30 describes how to change the configuration of the page.

Step	Procedure 6-30 Radio Configuration Setup														
1	Select RADIO CONFIG (1L) from the FMS SETUP page. Refer to Procedure 6-29, page 6-160.														
2	RADIO CONFIG 1/1, shown in Figure 6-199, is displayed. This page is used to configure the RADIO TUNING page to reflect the radios installed in the aircraft. <table><tr><td colspan="2">RADIO CONFIG 1 / 1</td></tr><tr><td><SAVE</td><td></td></tr><tr><td></td><td>RADIO TUNE 1 / 3</td></tr><tr><td><TYPE</td><td>ADF 1 ADF 2</td></tr><tr><td></td><td>COM 1 COM 2</td></tr><tr><td><NO.</td><td>NAV 1 NAV 2</td></tr><tr><td><SETUP</td><td>DE - SEL PRV FRQ></td></tr></table> 00183.06	RADIO CONFIG 1 / 1		<SAVE			RADIO TUNE 1 / 3	<TYPE	ADF 1 ADF 2		COM 1 COM 2	<NO.	NAV 1 NAV 2	<SETUP	DE - SEL PRV FRQ>
RADIO CONFIG 1 / 1															
<SAVE															
	RADIO TUNE 1 / 3														
<TYPE	ADF 1 ADF 2														
	COM 1 COM 2														
<NO.	NAV 1 NAV 2														
<SETUP	DE - SEL PRV FRQ>														
3	Select the radio type using line select 2L. Each press of 2L selects a different radio type. The choices are COM, HF, HF9, XPDR, ADF, DGPS, and blank. Blank means no radio tuning is available at the respective location on the RADIO TUNING page. HF tuning can be placed only on line 3 of page 2. HF9 is for tuning the Collins HF 9000 system. DGPS can be placed only on the left side and the adjacent right side must be blank.														

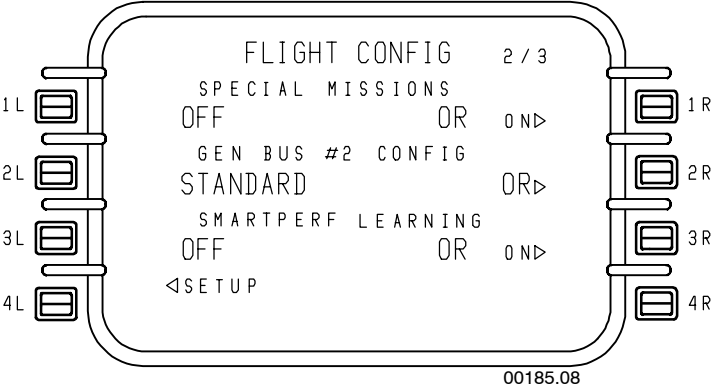
Step	Procedure 6-30 Radio Configuration Setup
4	Select the required number using line select 3L to choose the correct number for the radio. The choices are 1, 2, 3, and blank (no number). DGPS has no number.
5	Repeat steps 2 through 4 for each location to be changed on all 3 pages.
6	Select the frequency display option using 4R. The frequency display options are DE-SEL PRV FRQ or SEL PRV FRQ. In describing these options, note that the active option is not shown on the display. Only the inactive option is displayed so it can be selected. Therefore, in describing the options below, the readout that is displayed on the page is enclosed in parenthesis. • SEL PRV FRQ (DE-SEL PRV FRQ► Displayed) - In this option, the tuned frequency is displayed for five seconds and then is replaced with the previously tuned frequency. Selecting the respective line select tunes the previous frequency. • DE-SEL PRV FRQ (SEL PRV FRQ► Displayed) - In this option, the tuned frequency is displayed for five seconds and then is blanked. Selecting the respective line select keys displays the last tuned frequency in the scratchpad. In both of these options, the FMS does not have a previously tuned frequency following powerup. This means that operation does not work until the radio has been tuned once.
7	Select SAVE (1L) when all changes have been made. SAVE stores the configuration in memory for use on all subsequent flights. If SAVE is not selected, the changes are effective only until power is removed from the FMS.

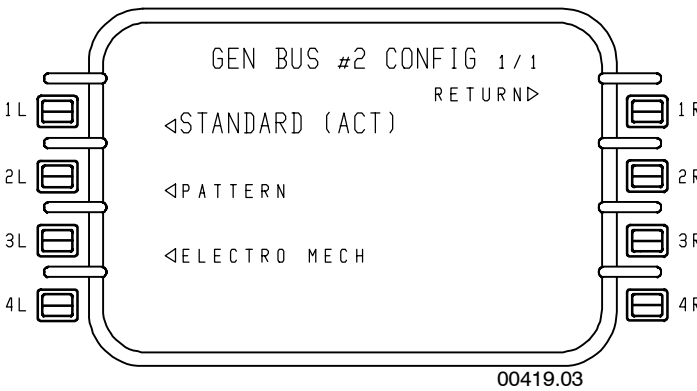
FLIGHT CONFIGURATION

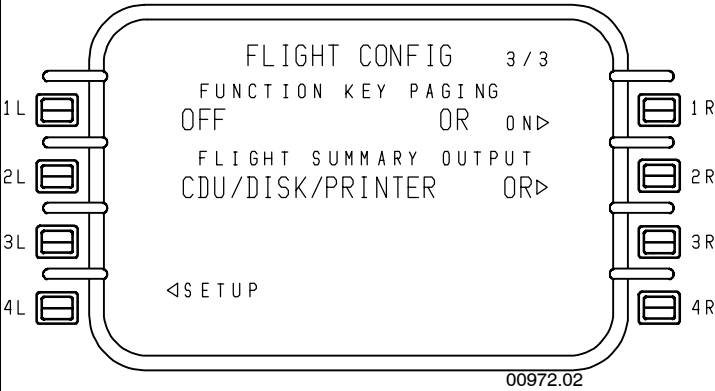
Flight configuration is used to set many operating conditions of the FMS. FLIGHT CONFIG is accessed from the FMS SETUP line select 1R. For details regarding flight configuration setup, refer to Procedure 6-31.

Step	Procedure 6-31 Flight Configuration Setup
1	Select FLIGHT CONFIG (1R) from the FMS SETUP page. Refer to Procedure 6-29, page 6-160.
2	Review the current configuration shown in Figure 6-200. Make changes as necessary using the required steps.  Figure 6-200

Step	Procedure 6-31 Flight Configuration Setup
4	Set FPL AUTO PAGE to ON or OFF at line select 2R. The FPL AUTO PAGE feature applies when building both active and stored flight plans. DETAILS • FPL AUTO PAGE ON - The FMS automatically advances the flight plan page, after a slight delay, when the third waypoint is entered on any given page. FPL AUTO PAGE continues until the destination is entered as a waypoint on the left side of the page. When an airway is entered, the FPL AUTO PAGE does not advance the pages. • FPL AUTO PAGE OFF - All flight plan page changes are done using the NEXT and PREV keys.
5	Set ORG/DEST DISPLAY to ON or OFF at 3R. The default for this setting is off. This option applies to how flight origins and destinations are displayed on EFIS. NOTE: Do NOT set ORG/DEST DISPLAY to ON unless the installed EFIS has been modified to support this feature. If attempted, the origin and destination waypoint symbols/identifiers are not displayed on EFIS. DETAILS • ORG/DEST DISPLAY ON - The FMS lists the closest airports for display on EFIS. When this option is selected ON, the origin and destination airports are included in the list even when they are not among the closest airports. This option also displays the origin and destination airports as runway symbols on modified EFIS. • ORG/DEST DISPLAY OFF - If the selection is OFF, the origin and destination airports are included only when among the closest airports. The origin and destination airports are displayed as normal waypoint symbols.

Step	Procedure 6-31 Flight Configuration Setup
6	Press NEXT to select page 2.
7	Review the current configuration shown in Figure 6-201. Make changes as necessary using the required steps.  Figure 6-201
8	Set SPECIAL MISSIONS to ON or OFF at 1R. The FMS contains special mission patterns. This selection makes those additional patterns available. The default for this setting is OFF. DETAILS • SPECIAL MISSIONS ON - All patterns in the FMS (HOLD, PROCEDURE TURN, FLYOVER, ORBIT, RADIAL) can be used. • SPECIAL MISSIONS OFF - Only standard patterns (HOLDING, PROCEDURE TURN, FLYOVER) can be used.

Step	Procedure 6-31 Flight Configuration Setup
9	Set GEN BUS #2 CONFIG to STANDARD, PATTERN, or ELECTRO MECH. FMS General Bus #2 can be configured for various applications. Selection of the OR prompt on the FLIGHT CONFIG page for GEN BUS #2 CONFIG displays the user options. This is shown in Figure 6-202.  00419.03 Figure 6-202 DETAILS • STANDARD - This is the default configuration for GEN BUS #2. In this configuration, the FMS outputs the standard General Bus data. • PATTERN - This configuration supports special missions operations. Special missions data is transmitted in place of standard GEN BUS data when this selection is active. Selecting PATTERN eliminates cabin display data from General Bus #2. Cabin displays may become inoperative with this selection active. • ELECTRO MECH - This selection is used when the FMS interfaces to electro mechanical displays instead of EFIS displays. Selecting ELECTRO MECH eliminates cabin display data from General Bus #2. Cabin displays may become inoperative with this selection active.

Step	Procedure 6-31 Flight Configuration Setup
10	Set SMARTPERF LEARNING to ON or OFF at 3R. This selection is only available when an aircraft data base has been loaded (refer to page 6-185). The installed aircraft performance data base (AIRCRAFT DB) determines if the default condition of SMARTPERF LEARNING is ON or OFF. This option is only for learning. The performance function continues to operate regardless of selection. This option is not displayed if the PZ is installed. DETAILS • SMARTPERF LEARNING ON - The learning which supports the FULL PERF performance method continues to update to reflect the aircraft performance. The rate of learning slows as more flights accumulate. • SMARTPERF LEARNING OFF - The aircraft performance learning that supports the FULL PERF method of performance calculation is not updated. The performance calculations are based on the previously learned data. Under normal circumstances, learning should be left on all the time. If problems occur in learning, it can be turned off until the problem can be resolved.
11	Press NEXT to select page 3.
12	Review the current configuration shown in Figure 6-203. Make changes as necessary using the required steps.  00972.02 Figure 6-203

Step	Procedure 6-31 Flight Configuration Setup
13	Set FUNCTION KEY PAGING to ON or OFF at 1R. When ON, function pages can be advanced by pressing the function key instead of the NEXT key. DETAILS • FUNCTION KEY PAGING OFF – Each press of a function key (PERF, NAV, FPL, PROG, DIR) results in the first page of the function being displayed. This is the default configuration. • FUNCTION KEY PAGING ON – Each press of a function key will result in the CDU displaying the next page of the function if the current function is being displayed. For example, assume FUNCTION KEY PAGING is ON and ACTIVE FLT PLAN page 3 of 10 is displayed. If the FPL key is pressed again, page 4 of 10 will be displayed.
14	The FLIGHT SUMMARY output selection is displayed at 2L. The FLIGHT SUMMARY output allows for the display and/or saving of the FLIGHT SUMMARY data following completion of the flight. Selection of the OR prompt at 2R displays the FLIGHT SUMMARY OUTPUT page, as shown in Figure 6-204. 00773.04

Figure 6-204

Step	Procedure 6-31 Flight Configuration Setup
	DETAILS • CDU – If selected ON, the FLIGHT SUMMARY page will automatically be displayed 15 seconds following landing. • DISK – If selected ON, the FLIGHT SUMMARY page data will automatically be saved to disk 15 seconds following landing. The file saved to disk will use the following naming convention: FS#HHMM.TXT Where: FS = Flight Summary # = FMS side (1 = left, 2 = right, 3 = third) hh = hour mm = minute The FMS will post error messages if it is configured to output the FLIGHT SUMMARY data but is unable to communicate to the DL-800/900. • PRINTER– If selected ON, the FLIGHT SUMMARY page will automatically be sent to the printer 15 seconds following landing. Multiple ON selections are permitted. The default configuration is OFF for all options.

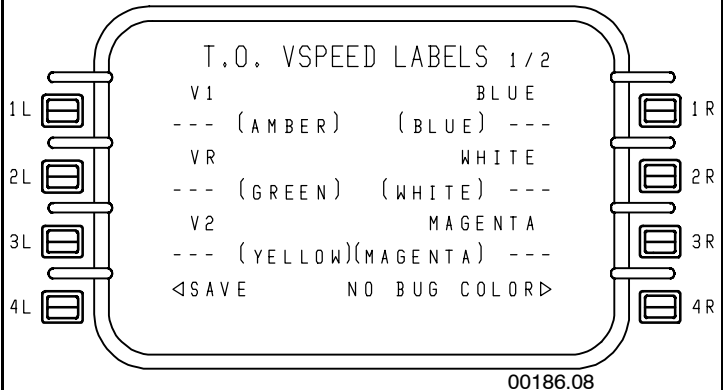
VSPEED LABELS

The VSPEED LABELS pages are used to configure the prompts displayed on the TAKEOFF and LANDING VSPEED pages. A maximum of six takeoff and six landing VSPEEDS can be configured on the CDU. Some EFIS installations support the display of four VSPEEDS while others do not support the display of any VSPEEDS.

If the EFIS supports display of the entered speeds, it is useful to configure the T.O. VSPEED LABELS and LDG VSPEED LABELS pages. Once the pages are configured, the FMS provides prompts to the pilot prior to takeoff and landing for the entry of VSPEEDS.

If the EFIS does not support the display of the entered speeds, the operator may choose not to configure these pages. This prevents the FMS from providing prompts to the pilot for the entry of VSPEEDS.

If these pages are not configured, TAKEOFF and LANDING pages (minus the VSPEED pages) are still available to select from the PERF INDEX. Follow Procedure 6-32 to configure the pages.

Step	Procedure 6-32 Takeoff and Landing Speed Setup
1	Select VSPD LABELS (2L) from FMS SETUP page. Refer to Procedure 6-29, page 6-160.
2	Review current T.O. VSPEED LABELS settings. This is shown in Figure 6-205. Make any changes using the following steps. In some installations, some or all of the labels are fixed and cannot be changed.  00186.08 Figure 6-205
3	Enter the title at 1L through 3R. The title can be any title using up to 8 characters. Examples would be V ₁ , V _{REF} , and other titles that describe aircraft requirements.
4	Use *DELETE* to remove the title and inhibit entry of a speed on the TAKEOFF page.
5	Press 4R to display or not display the names of the colors. If a monochrome CDU is being used, it is useful to display the color names. If a color CDU is being used, the speeds are displayed in the appropriate colors.
6	Once the titles are entered, press 4L to save the configuration. This saves the configuration that is used on all subsequent flights or until it is changed.
7	Select NEXT to display the LDG VSPEED LABELS page and repeat the steps.

ENGINEERING DATA

The ENGINEERING DATA page is accessed using 2R on the FMS SETUP page. Figure 6-206 shows the index of available options. These functions are primarily used under the direction of Honeywell engineering in finding and solving problems with the FMS.

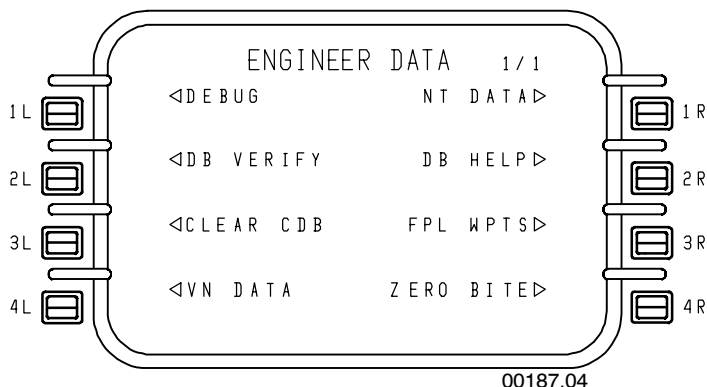


Figure 6-206

- **ENGINEERING DATA 1/1** – The ENGINEERING DATA 1/1 is used to select various functions. For each function, additional pages can be displayed.
 - **1L** – DEBUG is used to upload and download diagnostic information using the data loader. It can also be used to format a disk.
 - **1R** – NT (NAVAID TUNING) DATA displays pages of information about each navaid that can be tuned. These are display-only pages. No input is permitted.
 - **2L** – DB (DATA BASE) VERIFY tests the data base. If the navigation data base becomes invalid, DB VERIFY should be run. Select this prompt, load the same data base that is in the computer from disk, and record the EPROM failures (if any) at the end of the test.
 - **2R** – Use DB (DATA BASE) HELP to look at a specific location within the data base memory. It is useful only under the direction of Honeywell engineering, since memory locations change with each data base update.
 - **3L** – Use CLEAR CDB (CUSTOM DATA BASE) to clear the custom data base. The options are to clear pilot defined waypoints, stored flight plans, and NOTAMS. The FMS must be

operating in independent or single mode to have access to the page. It is not possible to clear the custom data base while operating in dual or initiated transfer.

- **3R** – Use FPL WPTS (FLIGHT PLAN WAYPOINT) to display FMS internal data about waypoints in the flight plan. These are display-only pages. No input is permitted.
- **4L** – Use VN (VERTICAL NAVIGATION) DATA to display FMS internal VNAV data about waypoints. These are display-only pages. No input is permitted.
- **4R** – ZERO BITE clears the previous recordings of Built In Test (BITE) results.

APU CONFIGURATION

This page is not available for all aircraft configurations.

The APU CONFIG page, shown in Figure 6-207, is accessed from FMS SETUP line select 3L. This page is used to configure the APU fuel flow for the four available run states. The fuel flow units are shown in the title of the page: KG for kilograms and LB for pounds. The fuel flow quantity is expressed in terms of hours (i.e., pounds/hour).

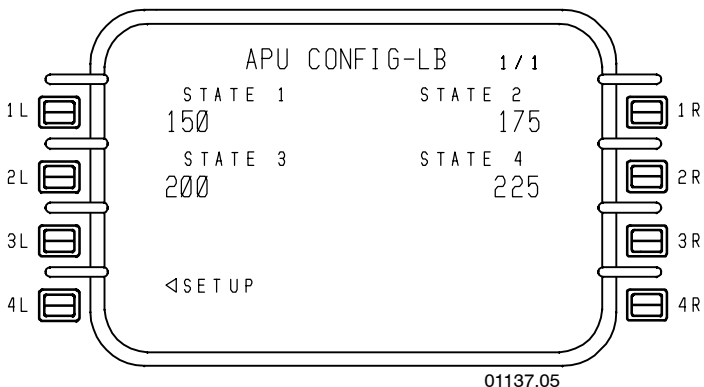


Figure 6-207

- **1L, 1R, 2L and 2R** – APU fuel flow is entered on these lines for the four APU states. The default values are zero. Selecting *DELETE* returns the default value of zero.

STANDBY POWER DOWN

The STANDBY POWER DOWN page, shown in Figure 6-208, is accessed from FMS SETUP line select 3R. This page is used to support extended power down of the FMS without loss of the active flight plan or other initialization data. The page is accessed only on the ground.

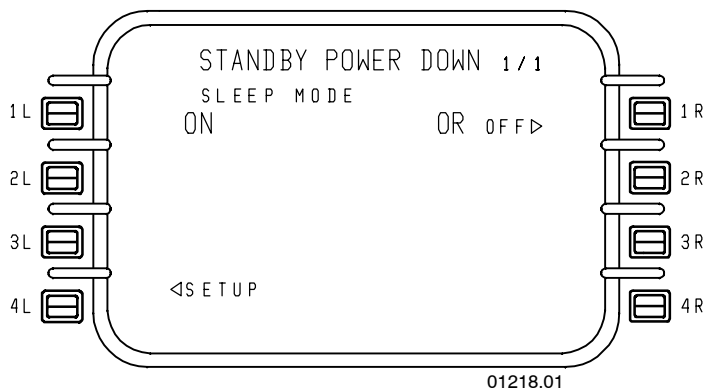


Figure 6-208

- **1L and 1R** – The selected sleep mode setting is displayed at 1L. The default is OFF. The setting can be changed at 1R.

Additional Details about Sleep Mode

The sleep mode supports aircraft which must power down the FMS during engine start. If the sleep mode is turned ON, the FMS can be powered down indefinitely without loss of initialization data (e.g., position initialization, active flight plan, performance initialization, etc.). The following rules apply to the sleep mode:

1. The sleep mode is set to OFF following takeoff.
2. The sleep mode setting is unchanged if a warm start is performed (power off for less than 60 seconds).

POSITION INITIALIZATION

- **POSITION INIT 1/1** – Figure 6-209 is used to initialize the FMS position. This page is accessed from the NAV IDENT page or from the NAV INDEX page.

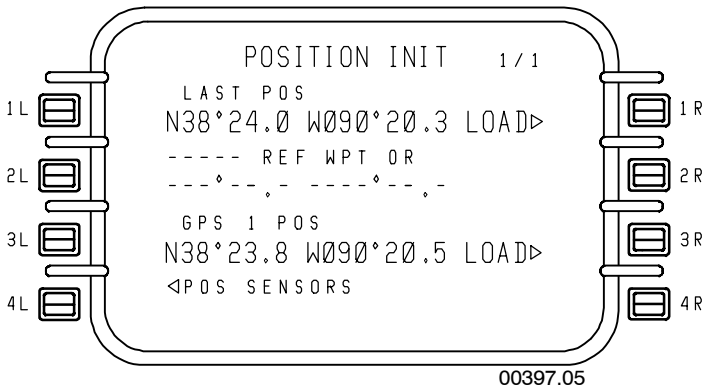


Figure 6-209

- **1L and 1R** – The last FMS position is displayed when the aircraft is on the ground. If the line select key adjacent to the LOAD prompt (1R) is pressed, the FMS is initialized to that position. After loading a position, the prompt at 4R displays FLT PLAN for access to the flight planning function.
- **2L and 2R** – The reference waypoint (REF WPT) line is below the last FMS position. This line can be filled automatically by the FMS or the pilot can make an entry at any time. In order of priority, the FMS fills in this line as follows:
 - **RUNWAY THRESHOLD** – If a departure runway has been selected in the active flight plan, the coordinates of the runway threshold are displayed. Using this feature, runway position can be updated when the aircraft is at the end of the runway ready for takeoff.
 - **RAMPX WAYPOINT** – If there is a last position available, the FMS compares the last position to the list of RAMPX waypoints. RAMPX waypoints are pilot defined waypoints with the name of the RAMP plus any alphanumeric (0 through 9, A through Z) character.

If one (or more) is found within 3 NM of the last position, the closest one is displayed. If more than one RAMPX waypoint is defined for the same airport, the FMS selects the closest

one to the last position. If multiple RAMPX waypoints are defined with the same latitude/longitude, the FMS selects the one with highest alphanumeric priority.

- AIRPORT REFERENCE POINT (ARP) - If there is a last position available and no RAMPX waypoints are found within 3 NM, the FMS displays the closest ARP within 3 NM.
- PROMPTS - If none of the above waypoints are displayed, the FMS displays prompts. This is shown in Figure 6-209.
- **3L and 3R** - The position of the highest priority GPS is displayed. The priority order, from highest to lowest, is as follows: GPS 1, GPS 2, GPS 3. This order of priority applies to all FMSs. If the line select key adjacent to the LOAD prompt (3R) is pressed, the FMS is initialized to the GPS position.

Once the correct coordinates are displayed, press the appropriate line select key (1R, 2R or 3R) to load the position. This is shown in Figure 6-210. The position is loaded to the FMS and transmitted to any long range sensors connected to the FMS.

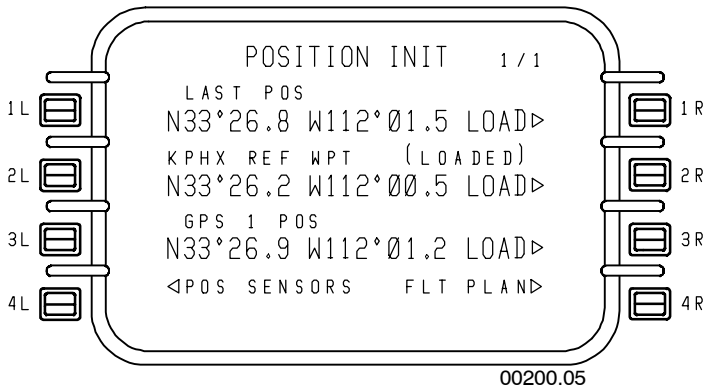


Figure 6-210

If the aircraft is in flight and the FMS position is valid, Figure 6-211 is displayed. The update feature of the FMS can be used only in flight. For additional details on updating the FMS position in flight, refer to page 6-87.

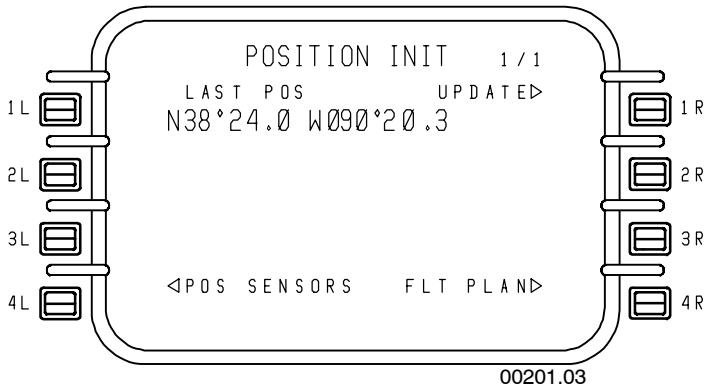


Figure 6-211

CROSSING POINTS

The CROSSING POINTS pages are used to determine the relationship of a waypoint relative to the current aircraft position.

The FMS computes the following types of crossing points:

1. Direct-To a waypoint from the current aircraft position.
2. Point abeam a waypoint for the current flight plan.
3. Crossing radial from a waypoint for the current flight plan.
4. Crossing latitude/longitude given latitude/longitude for the current flight plan.
5. Equal Time Point (ETP) between any two given waypoints. This option is only available when operating in FULL PERF mode (see page 5-9).
6. Point of No Return (PNR) from any given waypoint. This option is only available when operating in FULL PERF mode (see page 5-9).

- **CROSSING POINTS 1/1** – Figure 6-212 is displayed after selecting the CROSS PTS prompt from the NAV INDEX 2 page. This page is an index of the available crossing point options.

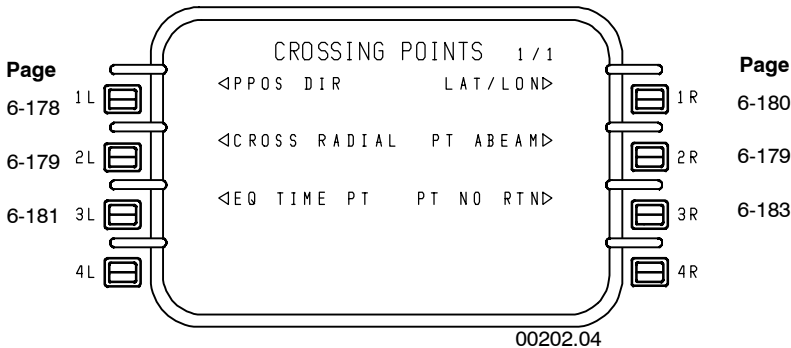


Figure 6-212

Present Position (PPOS) Direct

Select 1L from the display, shown in Figure 6-212, for direct-to information from the aircraft's present position to any given waypoint.

For example, to determine where DEN is relative to the current aircraft position, enter DEN into the scratchpad and press line select 1L. This is illustrated in Figure 6-213. At 1R, the radial and distance from DEN to the current aircraft position is displayed. The bottom half of the page displays the course, distance, ETE and the remaining fuel if the aircraft were to fly direct from the current position to DEN.

The CROSS PTS prompt at (4L) returns to the CROSSING POINTS index.

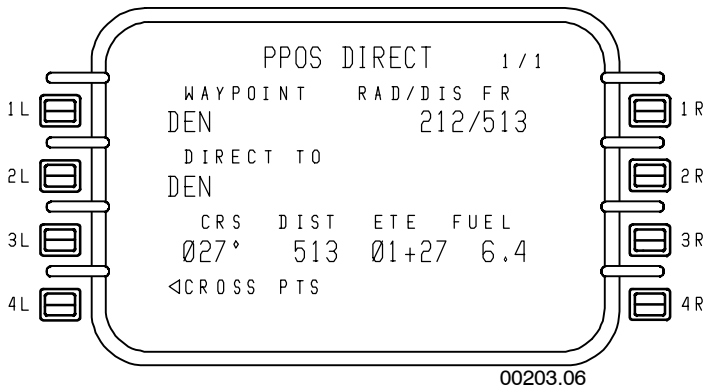


Figure 6-213

Point Abeam

If the PT ABEAM line select key (2R), shown in Figure 6-212, is pressed, the FMS computes the point, along the flight plan, where the aircraft passes abeam the entered waypoint. This is usually the flight plan's closest point to the selected waypoint. Figure 6-214 shows an example. If required, the PT ABEAM definition at 2L (DEN/132/109 in the example) can be selected to the scratchpad and inserted into the flight plan as a temporary waypoint.

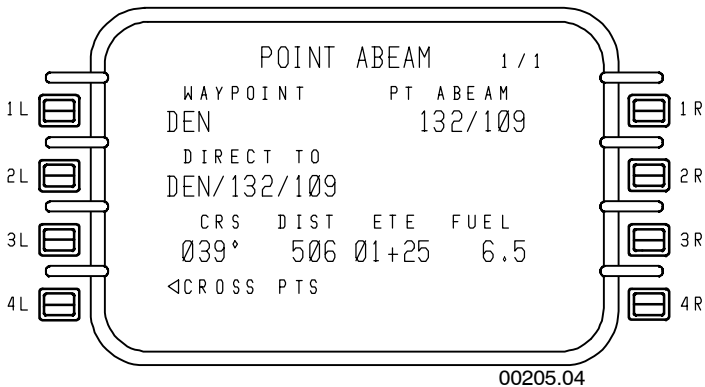


Figure 6-214

If no POINT ABEAM exists for the current flight plan, the message NO CROSSING POINT FOUND is displayed in the scratchpad.

Crossing Radial

If the CROSS RADIAL (crossing a radial) prompt is pressed (2L shown in Figure 6-212), the FMS computes the point along the flight plan where the aircraft crosses the designated radial. Enter the waypoint at 1L and the radial at 1R. This is shown in Figure 6-215. For example, entering the 180° radial, the FMS projects that the aircraft will cross the 180° radial 117 NM from DEN. The crossing radial definition at 2L can be inserted as a temporary waypoint.

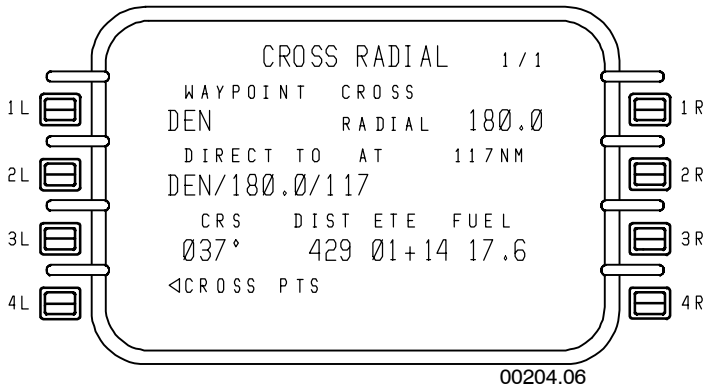


Figure 6-215

If the entered radial does not cross the flight plan, the message NO CROSSING POINT FOUND is displayed in the scratchpad.

Latitude/Longitude Crossing

Select 1R from the display, shown in Figure 6-212, to calculate the crossing latitude or longitude when either the longitude or latitude is entered. The course, distance, ETE, and fuel remaining are displayed if the aircraft proceeds directly to the waypoint.

For example, to know where the aircraft crosses the 100° West longitude line for the current flight plan, enter W100 at 1R. This is shown in Figure 6-216. The FMS computes the latitude. The FMS also displays the course, distance, ETE, and fuel remaining to fly directly from the current aircraft position to N33°24.9 W100°00.0. The computed point (2L) can be line selected to the scratchpad and inserted in the flight plan as a temporary waypoint. If required, latitude can be entered and the FMS calculates the longitude. If more than one intersection with the flight plan exists, the closest one is displayed.

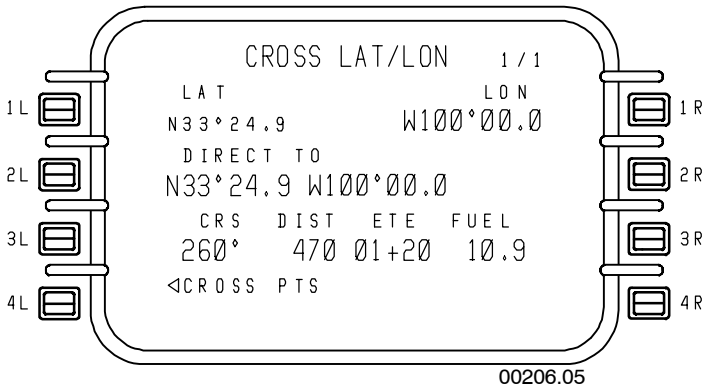


Figure 6-216

If the flight plan does not cross the entered latitude/longitude, the message NO CROSSING POINT FOUND is displayed in the scratchpad.

Equal Time Point

Select 3L from the display, shown in Figure 6-212, to calculate the Equal Time Point (ETP) between any given waypoints. The default waypoints are the origin and destination of the active flight plan. Any waypoints can be entered at 1L and 1R. This is shown in Figure 6-217.

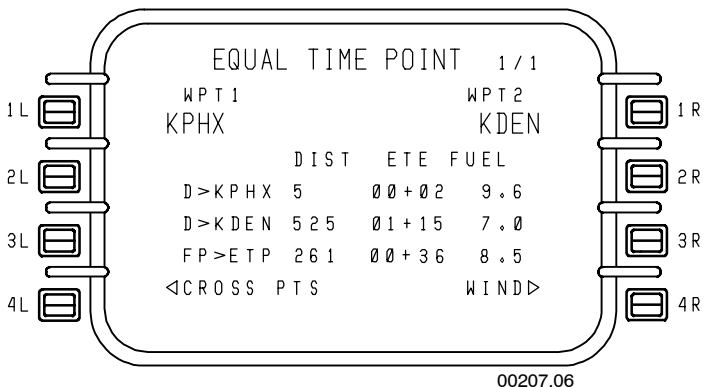


Figure 6-217

If the WPT 1 and WPT 2 are the origin/destination, the ETP is the physical point along the flight plan where time-to-go back to the origin is the same as the time-to-continue to the destination.

If WPT 1 and/or WPT 2 are not the origin/destination, the ETP is the physical point along the flight plan between WPT 1 and WPT 2, where the time-to-go back to WPT 1 is the same as the time-to-go to WPT 2.

The D> symbol indicates direct-to the identified waypoint. FP>ETP indicates along the active flight plan to the ETP. If the ETP location is behind the aircraft, PAST is displayed.

The FUEL digital readout is the amount of fuel remaining upon arrival at the waypoint or ETP. The fuel remaining does not necessarily represent the fuel required to satisfy reserve requirements. The FUEL values shown are always fuel remaining at a given waypoint.

If the decision is made to go to WPT 1 or WPT 2, the FMS operates under the assumption that current operating conditions continue to prevail (i.e., the same altitude, engine fuel flow, etc.).

The data on the EQUAL TIME POINT page is updated each time the page is selected, or each time a new wind entry is made. **If the page is left in view for an extended period of time, the data is not updated unless the page is deselected and then, reselected.**

Since the waypoints might not be on the flight plan, winds can be entered by selecting 4R. The FMS calculates default winds from the wind model (see wind model, page 6-36). Cruise winds, shown in Figure 6-218, can be entered for each of the two waypoints. Entries made on this page do not change the wind model. Select 4R to return to the EQUAL TIME POINT page.

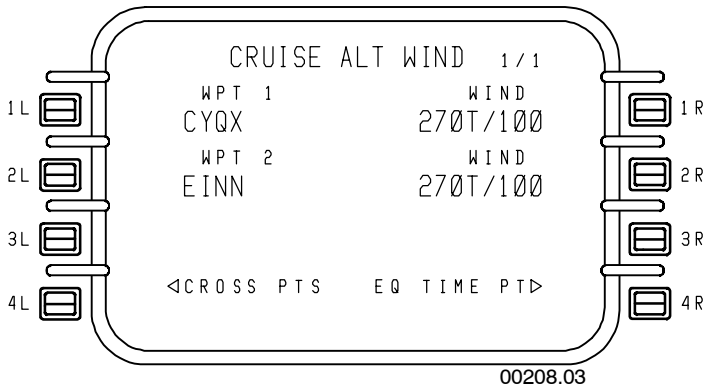


Figure 6-218

Point Of No Return

Select 3R from the display, shown in Figure 6-212, to calculate the Point of No Return (PNR) from any given waypoint. The default waypoint is the origin of the active flight plan. Any waypoint can be entered at 1L. This is shown in Figure 6-219. The default wind (1R) for the waypoint is supplied from the wind model. A cruise wind can be entered for the waypoint. Entries made on this page do not change the wind model.

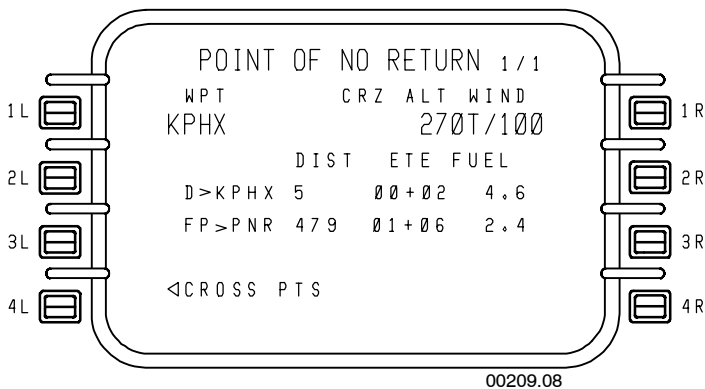


Figure 6-219

The PNR is the point along the flight plan where the fuel to reach the destination is less than the fuel to return to the WPT. The WPT can be the origin (default) or any other waypoint.

D> indicates direct-to the waypoint shown. FP> indicates the distance and fuel remaining along the flight plan to the PNR. If the PNR location is behind the aircraft, PAST is displayed. Similarly, if the PNR location is beyond the destination, BEYOND DEST is displayed.

The fuel remaining does not necessarily represent the fuel required to satisfy reserve requirements.

The data on the POINT OF NO RETURN page is updated each time the page is selected, or each time a new wind entry is made. **If the page is left in view for an extended period of time, the data is not updated unless the page is deselected and then, reselected.**

DATA LOAD

The DATA LOAD page, shown in Figure 6-220, is used to access the various data loading functions of the FMS. The load functions include uploading and downloading data from/to disk using the data loader or PCDL. Refer to page 3-14 for additional information on the data loader. Some data can also be crossloaded from one FMS to another.

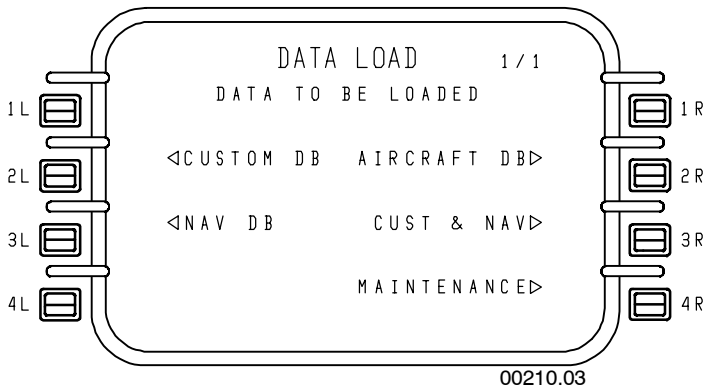


Figure 6-220

PC Data Loader (PCDL)

PCDL allows for the use of a PC to upload and download files from the NZ. The PC uses an Ethernet interface (10BaseT) to transfer data to the NZ. Ethernet provides a significant increase in speed compared to the DL-800/900. This makes it the fastest method for the loading of the navigation data base.

Refer to the PCDL Operational Manual for additional operation details.

Navigation Data Base Updating

Every 28 days, the navigation data base in the FMS must be updated. The update is supplied by Honeywell. The navigation data base is normally updated while the aircraft is on the ground. In-flight updating is permitted only when the navigation data base is invalid (an out-of-date data base is not an invalid navigation data base). Follow Procedure 6-33 to update the navigation data base using either the DL-800/900.

Uploading Navigation Data Base to Multiple FMSs

The navigation data base can be uploaded to all of the FMSs in the system at one time. The upload can be initiated from any FMS.

When the upload is initiated, the other FMSs that are running will switch to the DATA LOAD page for loading update status. Any FMS that powers-up during the upload will not upload the navigation data base.

Crossloading Custom and/or Navigation Data Base

The custom and/or navigation data bases can be transferred from one FMS to the other. Only the custom data base can be transferred in flight.

In order to transfer data, both FMSs must be turned on and have compatible software versions. All steps can be completed from just one of the FMSs. Refer to Procedure 6-33 for generalized data loading procedures.

Up/Down Loading Custom Data Base

The custom data base can be transferred to or from the data loader or PCDL. When loading the custom data base, the custom data base is completely replaced by the contents of the file (stored flight plans and pilot defined waypoints). When transferring the custom data base from the NZ, both pilot defined waypoints and flight plans are transferred. Using this option, the pilot can keep a permanent record of the custom data base for loading in case the computer is replaced or the custom data base is lost. In order to transfer the custom data base to the data loader, insert a formatted disk. If the disk is not formatted, it can be formatted using the MAINTENANCE page option (see DEBUG on page 6-172). Refer to Procedure 6-33 for generalized data loading procedures.

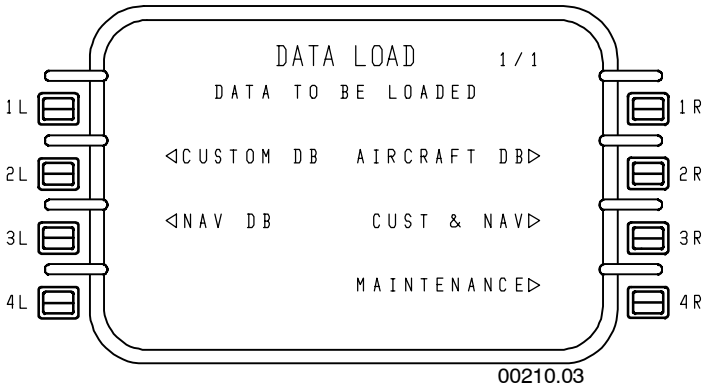
Up/Down Loading Aircraft Data Base

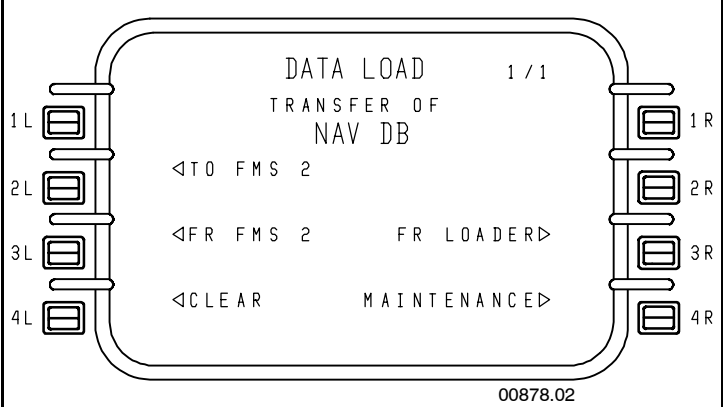
Aircraft data bases for each aircraft type are contained on the last disk of the navigation data base. These files are supplied with each navigation data base cycle. The aircraft data base can be transferred to or from the data loader or PCDL. When loading an aircraft data base from the loader, the available aircraft types and tail numbers are displayed for proper selection. When down loading an aircraft data base, the aircraft data base is identified by the tail number that was entered on PERF INIT 1/5 (1R).

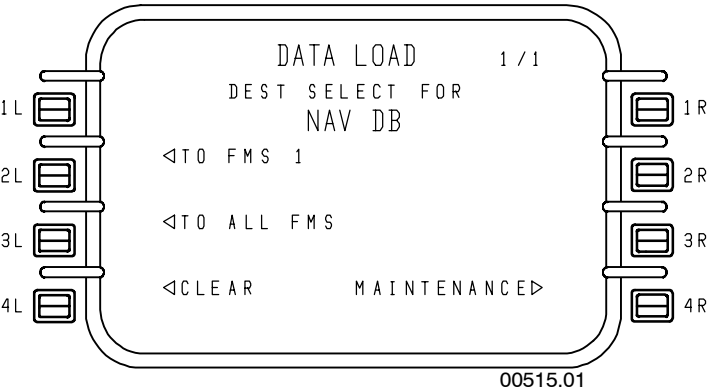
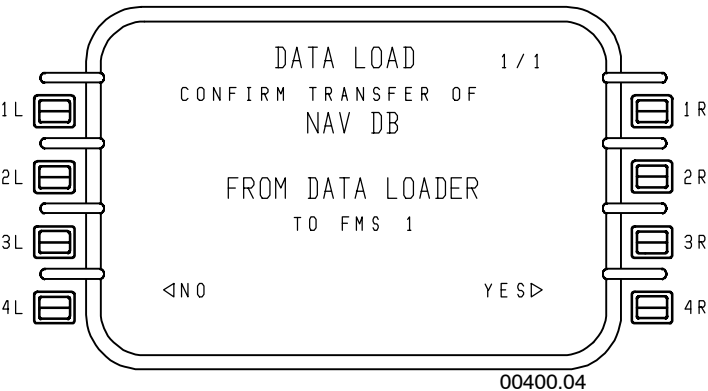
The aircraft data base should be downloaded from the aircraft if the navigation computer is going to be removed for maintenance. Later, the downloaded data can be uploaded and the FMS FULL PERF performance calculating process can begin with the uploaded data.

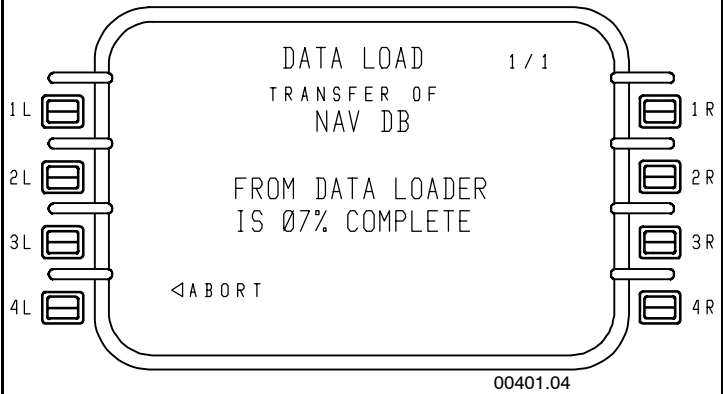
Both the DL-800 and the DL-900 Data Loader can be used for up/down loading the aircraft data base. However, DL-800 requires software Mod C and hardware Mod D.

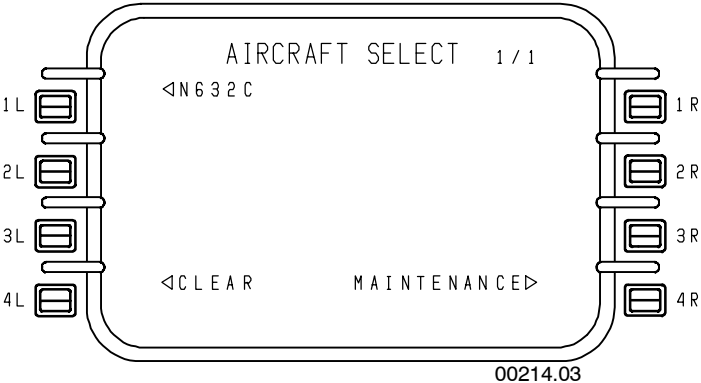
Refer to Procedure 6-33 for generalized DL-800/900 data loading procedures. Refer to the PCDL Operational Manual for PCDL data loading procedures.

Step	Procedure 6-33 Generalized DL-800/900 Data Base Updating
1	Set up the data loader. Skip this step if the data loader is not going to be used. If the DL-800/900 Data Loader is not installed in the aircraft, connect the data loader umbilical cable to the aircraft connector. Apply power to the data loader using the appropriate aircraft circuit breaker and press the data loader power switch. The power LED lights, and after the powerup BITE sequence has been completed, the data LED lights. Select LEFT, RIGHT, or AUX (third FMS) to load the respective FMS. Insert data base disk 1 into the loader.
2	Select DATA LOAD from the NAV INDEX (page 2).
3	Select the appropriate prompt, shown in Figure 6-221, for data to upload or download. In this example, the NAV DB prompt at 3L is selected.  Figure 6-221 DETAILS - In single FMS operation, prompts are not shown unless the data loader is selected ON.

Step	Procedure 6-33 Generalized DL-800/900 Data Base Updating
4	Select the prompt for the source or destination of the selected data from the menu. This is shown in Figure 6-222. In this example, the FR LOADER prompt at 3R is selected.  Figure 6-222 DETAILS - The selections are based on the type of data selected in the previous step. The data loader must be turned on and the appropriate FMS selected on its selector switch to display the TO LOADER and FR LOADER prompts.

Step	Procedure 6-33 Generalized DL-800/900 Data Base Updating
5	This step only applies if loading the navigation data base from the data loader. Select the prompt for the destination of the navigation data base. This is shown in Figure 6-223. In this example, the TO FMS 1 prompt at 2L is selected.  DATA LOAD 1 / 1 DEST SELECT FOR NAV DB <TO FMS 1 <TO ALL FMS <CLEAR MAINTENANCED 00515.01 Figure 6-223
6	Confirm selection and select YES (4R) or NO (4L) on the display. This is shown in Figure 6-224.  DATA LOAD 1 / 1 CONFIRM TRANSFER OF NAV DB FROM DATA LOADER TO FMS 1 <NO YES> 00400.04 Figure 6-224

Step	Procedure 6-33 Generalized DL-800/900 Data Base Updating
7	Progress monitoring is shown in Figure 6-225.  Figure 6-225 The FMS indicates the percentage complete. If the navigation data base uses more than one disk, the FMS prompts for insertion of each disk. Remove the completed disk and insert the next disk. The FMS automatically begins reading the next disk. When complete, the message DB TRANSFER COMPLETE is displayed and the FMS performs a restart. If power is interrupted, ABORT is selected, or other problems that stop the loading process occur, the data load process must be repeated from the beginning. Refer to page 12-1 for a listing of data loader fault codes.
8	Repeat steps 1 thru 7 for each FMS. Cross loading of the navigation and custom data base can also be done. The DL-800/900 data loader or PCDL is recommended for updating the navigation data base because it has a higher loading speed than the cross loading process.

Step	Procedure 6-33 Generalized DL-800/900 Data Base Updating
9	This step only applies to aircraft DB. Select the required aircraft data base. This is shown in Figure 6-226.  Figure 6-226 DETAILS – Aircraft data bases furnished with the navigation data base are identified by aircraft type. Data bases that have been downloaded from an aircraft are identified by tail number.
10	Turn off and store the data loader if it is not permanently mounted in the aircraft.

FLIGHT SUMMARY

Figure 6-227 shows the FLIGHT SUMMARY page. This page displays a summary of the flight. The FLIGHT SUMMARY page is accessed from the NAV INDEX 2/2 page or the PROGRESS 3/3 page.

The contents of the page are saved following power down of the FMS. The one exception is for FUEL USED. This is reset to zero. For quickturns, the parameters are retained until takeoff following the quickturn. The page is then reset to reflect the new flight.

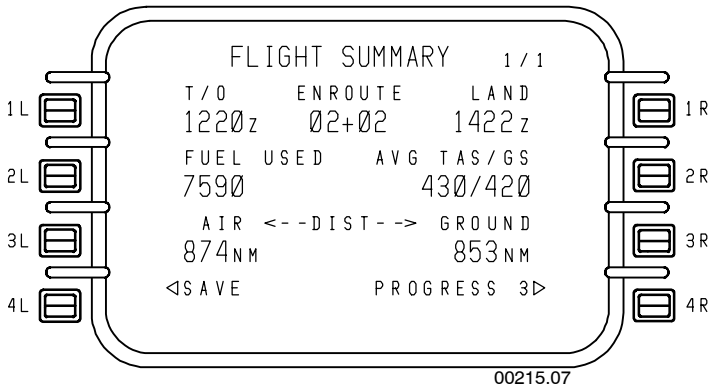


Figure 6-227

- **1L and 1R** – These lines display the takeoff, landing, and enroute time. No entry is permitted.
- **2L** – This line displays the fuel used for the flight. Entering *DELETE* results in the value being set to zero. FUEL USED will then increment from zero. Pilot entry of FUEL USED for the flight is not permitted. FUEL USED is automatically reset when power is removed from the FMS when the aircraft is on the ground. If a cold start is performed while airborne, the value is displayed in inverse video.
- **2R** – This line displays the average TAS and GS for the flight. No entry is permitted.
- **3L and 3R** – These lines display the air and ground distance for the flight. No entry is permitted.
- **4R** – This prompt provides access to the PROGRESS 3/3 page.
- **4L** – The SAVE prompt is used to save the FLIGHT SUMMARY data if the FLIGHT SUMMARY OUTPUT has been configured for DISK or PRINTER (see Procedure 6-31, Step 12, page 6-168, for more information on the configuration of FLIGHT SUMMARY OUTPUT). The SAVE prompt is not displayed if NONE is selected as the flight summary output configuration.

EFIS OPTIONS

Figure 6-228 is the EFIS OPTIONS page that is available when the FMS is installed in an aircraft with a Collins System.

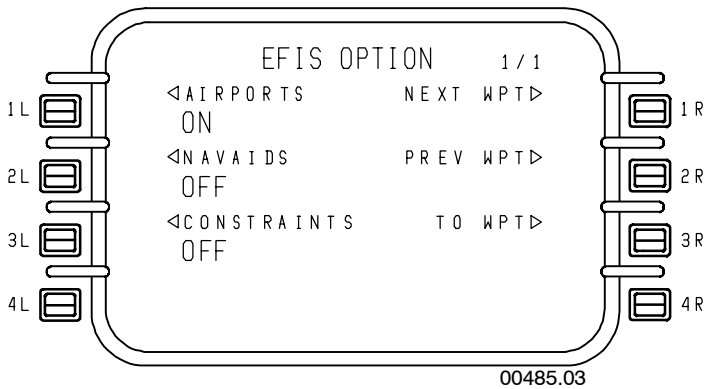


Figure 6-228

- **1L** - Selecting ON displays up to the 8 closest airports plus the origin and destination airports on the MFD. Pressing the line select key changes the selection. The default is OFF.
- **2L** - Selecting ON displays up to the 50 closest nav aids on the MFD. Pressing the line select key changes the selection. The default is OFF.
- **3L** - Selecting ON displays constraints (e.g., speed, altitude, descent angle) with the respective lateral waypoint on the MFD. Pressing the line select key changes the selection. The default is OFF.
- **1R** - When in the plan mode, this key allows for stepping through the flight plan by selecting the next waypoint as the center waypoint of the map.
- **2R** - Same as 1R except is the previous waypoint.
- **3R** - This sets the center waypoint to the TO waypoint.

7. Flight Plan

This section covers the elements and operation for the active and stored flight plan pages. Also included are a description of LNAV, VNAV, and speed commands.

DEFINITION OF TERMS

- **Flight Plan** – A flight plan is a series of waypoints that define an intended route of flight. Each waypoint in the flight plan must be defined laterally and vertically. The course between two waypoints in the flight plan is called a flight plan leg. The FMS calculates the great circle course for each leg in the flight plan. The active flight plan can include the route to a primary destination followed by the route to an alternate destination.
- **Flight Plan Names** – Flight plan names are used to keep track of stored flight plans. Flight plan names are used to recall a stored flight plan into the active flight plan. Flight plan names must have a minimum of six characters and a maximum of 10 characters. A convenient naming convention is to use the origin and destination. The airport identifiers are separated by a dash (-). For more than one flight plan between the same set of identifiers, add a number at the end of the name. For example, a flight between Phoenix and Minneapolis would use KPHX-KMSP1 for the flight plan name.
- **Flight Plan Capacity** – Stored or active flight plans can have up to 100 waypoints including the origin and destination. For active flight plans, the combined waypoints of the primary flight plan and the alternate flight plan cannot exceed the 100 waypoint capacity. If a flight plan is revised and then exceeds the 100 waypoint capacity, the revision is not performed and the message FLIGHT PLAN FULL is displayed in the scratchpad. If a SID, STAR, airway, or stored flight plan is added and exceeds the limit, none of the inserted waypoints are added to the flight plan.
- **Primary/Alternate Independence** – The primary and alternate flight plans are kept independent from one another. Revisions to either the primary or alternate flight plan do not affect the other. The following exceptions apply:
 - **ALTERNATE** – The ALTERNATE prompt is the revision function that incorporates the alternate into the active flight plan. The ALTERNATE prompt is displayed on the ACTIVE FLT PLAN page (4L) when the aircraft is within 25 flight plan miles of the primary destination. After ALTERNATE is selected, there are

two destinations in the flight plan: the original and the alternate. Both are treated as destinations. This means the FMS will flyover both destinations. In this case, flyover means that the FMS does not begin a turn before it flies over the destination.

The ALTERNATE prompt is not displayed if an approach is in the flight plan. However, if the missed approach is activated, the ALTERNATE prompt is displayed. A direct-to an alternate flight plan can be performed at any time.

- **ALTERNATE ORIGIN** – The alternate flight plan origin is also the primary flight plan destination.
- **Waypoint Names** – Waypoints exist in the navigation data base, the custom data base (pilot defined waypoints), or as temporary waypoints. Waypoint names are used for convenience in keeping track of waypoints and recalling waypoints. Waypoint names (called waypoint ident or identifier) must contain at least one and as many as five alphanumeric characters. In the case of temporary waypoints, the FMS adds an asterisk (*), ampersand (&), or pound sign (#) as the first character for a total of up to six characters. Therefore, the pilot has complete freedom in naming waypoints into the FMS with no conflict. Waypoint and flight plan names can be distinguished by the number of characters.

Unnamed airway intersections are also included when airways are added to the flight plan. This means airways can be changed at a point common to both airways.

The ampersand (&) symbol denotes waypoints with a radial pattern for the stored flight plan.

Nondirectional beacons are stored by their IDENT plus the NB suffix. For example, the ABC NDB is stored in the data base as ABCNB. This reduces the list of duplicate waypoint names.

- **Temporary Waypoints** – Temporary waypoints exist only in the active flight plan. They are erased when the flight plan is completed or deleted. Temporary waypoints are listed on the last WAYPOINT LIST pages at the time they are defined. Using this page the pilot can review the definition of the waypoint.

Temporary waypoints are used so the pilot can quickly enter the waypoint definition directly into the active flight plan. Temporary waypoints are useful when cleared to a fix. In this case, they have no meaning beyond the current flight. There is no need to create a named waypoint for the clearance fix.

Temporary waypoints are defined by entering the definition of the waypoint directly into the active flight plan. Acceptable definitions are latitude/longitude, place/bearing/distance, place/bearing/place/

bearing, and along the flight plan as place/distance. When the definition is entered in the flight plan, the waypoint is assigned a name that describes how it was defined and a number (XX). Temporary waypoints entered on the left FMS are assigned odd numbers while those entered on the right FMS are assigned even numbers. The name is also preceded by an asterisk (*) to indicate a temporary waypoint. The assigned names are as follows:

Entered Definition	Waypoint Name
Lat/Long	*LLXX
Place/Bearing/Distance	*PBDXX
Place/Bearing/Place/Bearing	*RRXX
Place/Distance	*PDXX

The definition can be entered into the scratchpad from the keyboard or retrieved for other sources. The Electronic Flight Instrument System (EFIS) joystick can be used to insert coordinates into the scratchpad. The CROSSING POINTS pages are also sources for definition. As the name indicates, temporary waypoints are not retained in the FMS past the current flight.

Temporary waypoints are also created when a flight plan is loaded from a disk, and either the FMS data base does not contain the same waypoint, or the waypoint definition is different. In this case, the regular name of the waypoint is used preceded by a pound sign (#). For example, a flight plan is loaded containing the waypoint named CEDA. CEDA is neither in the FMS navigation data base nor is it defined in the custom data base. In this case, #CEDA is displayed and the definition, specified in the loaded flight plan, is used.

Altitude constraints for temporary waypoints may be entered following the temporary waypoint lateral definition. For example, it is permitted to enter GBN/270/45/FL150 into the scratchpad. The FMS will create a temporary waypoint from GBN on the 270 radial and at 45 miles. The waypoint will also have an altitude constraint of FL150. See Section 10 for additional details on CDU entry format for temporary waypoints.

- Runway Extension Waypoints** – The FMS can create temporary waypoints on the runway extension line. Once a runway has been activated into the active flight plan, it can be line selected to the scratchpad. When displayed in the scratchpad, the runway is in the following format: AIRPORT.RUNWAY/BEARING/. A distance can be inserted to complete the definition of a waypoint on the extension line of the runway. It is also permitted to enter an altitude constraint following the distance. Insert this definition into the flight plan to create a temporary waypoint. Repeat the process with varying distances to create a number of waypoints on the extension line.

If the runway is at the origin, the bearing brought to the scratchpad is the runway heading that permits waypoints on the departure path.

If the runway is at the destination, the bearing brought to the scratchpad is the reciprocal of the runway heading that permits waypoints on the arrival path.

- **VNAV Offset Waypoints** – ATC often clears an aircraft to cross a specified distance before or after a waypoint at a specified altitude. These are called VNAV offset waypoints. Refer to VNAV OFFSET, page 7-18, for additional information.
- **Origins and Destinations** – Origins and destinations can be any waypoint that is contained in the data base. This includes any pilot defined waypoints. Origins and destinations of the active flight plan can be temporary waypoints. Origins and destinations are normally airports. The origin or destination must be an airport that is defined in the navigation data base to activate the respective runway, SID, STAR, or approach.
- **FROM Waypoint** – The FROM waypoint is the first waypoint on the first page of the flight plan. It is displayed in amber. Before takeoff, the FROM waypoint is normally the selected origin airport or runway. Under normal flight conditions, the FROM waypoint is the last waypoint that was sequenced and actual time passing is displayed. In flight, the FROM waypoint can be changed. Since changing the FROM waypoint impacts the current active leg and can cause an aircraft maneuver, a confirmation step is included.
- **TO Waypoint** – The TO waypoint is the second waypoint on the first page of the flight plan. It is displayed in magenta. The TO waypoint is the waypoint to which the aircraft is being steered along a course defined between the FROM and TO waypoints. When the leg sequences, the TO waypoint becomes the FROM waypoint. The TO waypoint can be changed. Since changing the TO waypoint impacts the current active leg and can cause an aircraft maneuver, a confirmation step is included.
- **Leg Sequencing** – During flight, the active flight plan automatically sequences so that the first leg of the active flight plan is the active leg that is referenced to the guidance parameters. Normally, the FMS sequences before the waypoint for an inside turn when the aircraft is on or close to on course. If the aircraft is not on course, the normal sequence occurs no later than a point abeam of the waypoint. Some waypoints have unique sequence criteria. For example, a holding fix is a flyover waypoint. The holding fix should be overflown before entering or exiting holding. Some waypoints in SID and STAR procedures also have unique sequence criteria. The FMS is programmed to automatically comply with these requirements.

There are situations where the sequence criteria can not be satisfied by the FMS. Under these conditions, the pilot must perform the sequence manually to aid the FMS. This requires the pilot to modify the active flight plan and it may consist of one of the following:

- The FROM waypoint can be changed to force a sequence. To accomplish this task, line select the waypoint to be sequenced into the scratchpad. Then, make the waypoint the FROM waypoint on the ACTIVE FLT PLAN page by selecting 1L. The FMS will then look through the flight plan to find the same waypoint. All waypoints between will be deleted from the ACTIVE FLT PLAN. The advantage of this method is that it preserves the leg definitions contained in the flight plan.
- A direct-to can be performed to the desired TO waypoint. This will delete all the waypoints prior to the waypoint and the FMS will create a direct leg to the waypoint. This will result in a new path to the waypoint which may be different than the previous path contained in the flight plan.

Some leg sequences indicate the direction of turn to the new leg by displaying an **L** or an **R** in reverse video. This notation is used when either the direction of turn is indicated (by a SID, STAR, or approach) or the new leg requires a large turn (near 180°) to track the new course.

When the destination waypoint is sequenced, it is retained by the FMS as the TO waypoint. Bearing, distance, and required track to the destination waypoint continue to be computed and displayed.

- **Discontinuities** – A discontinuity can exist in the flight plan. A discontinuity is a segment in the flight plan where there is no lateral flight plan definition. However, there must be a lateral definition before and after a discontinuity.

When making a change, discontinuities in the flight plan are kept to the minimum. There are times when it is necessary to have a discontinuity. The following rules apply:

- When adding or deleting a single waypoint, no discontinuity can be inserted in the flight plan. The flight plan is directly linked between the waypoints. Deleting several waypoints at a time does not cause a discontinuity.
- When linking flight plans or inserting a procedure, no discontinuity can exist when a common waypoint is used. If there is not a common waypoint, the inserted flight plan or procedure is linked at the point of insertion, but has a discontinuity at the

end. For example, if the last waypoint of a SID is also a waypoint in the flight plan, the flight plan and procedure are linked at that waypoint with no discontinuity. If the last waypoint of a SID is not in the flight plan, there is a discontinuity between the SID and the flight plan. Some procedures have embedded discontinuities that are inserted along with the procedure.

- A SID can only be replaced with another procedure and cannot be deleted. The linked portions of an arrival can be deleted via the ARRIVAL page. In both cases, the discontinuity depends upon the changed procedure. Linked flight plans or procedures can be deleted under the same operation for deleting waypoints. This operation does not cause discontinuity.
- DIRECT-TO does not cause a discontinuity even though several waypoints are deleted or a single waypoint is added.
- If an airway is inserted in the flight plan, there is no discontinuity since the pilot has to specify the beginning and end points.
- The INTERCEPT function does not create a discontinuity before or after the intercept point. When choosing the heading to intercept option, a fly heading select leg is inserted that disengages the FMS when the leg is sequenced.
- **Alternate Origin** - The alternate origin is the destination of the primary flight plan. No alternate flight plan can be specified until the primary destination has been specified. Changing the primary destination clears the alternate flight plan because the alternate origin changes.
- **Alternate Waypoints** - Alternate waypoints apply to the alternate portion of the flight plan only. The FMS guidance is not engaged until the pilot selects the alternate destination. If the alternate portion of the flight plan is enabled, the corresponding waypoints are incorporated into the primary portion of the flight plan. At that point, all active flight plan rules apply.
- **Alternate Destination** - The alternate destination is entered when defining a flight plan to an alternate. Like the primary flight plan, the alternate destination is entered as the final waypoint to close out the alternate flight plan.
- **Climb Constraints** - Climb constraints are altitude and speed constraints that are associated with waypoints in the climb or cruise portion of the flight plan. Altitude constraints can be AT, AT or ABOVE, or AT or BELOW. For example, an entry of 10000A (**A** following the altitude) indicates AT or ABOVE. An entry of 10000B

(B following the altitude) indicates AT or BELOW. An entry of 10000 (no letter following the altitude) indicates AT. Climb speed constraints are observed by the FMS until the waypoint containing the constraint is passed.

- **Speed Limit** – An example of speed limits is the 250 kts below 10,000 ft limit entered during performance initialization. Other limits can be imposed by the airframe such as V_{mo} or M_{mo} .
- **Speed Schedule** – Speed schedules are the default speeds used by the FMS for the departure, climb, cruise, descent, approach and go-around phase of flight. Speed schedules are defined during performance initialization.
- **Automatic Speed Command** – The automatic speed command is the current speed being output by the FMS for control of the aircraft. It may also be referred to as automatic speed target in this manual.
- **Top of Climb (TOC)** – A TOC waypoint is calculated and displayed on the vertical profile and shown on the PROGRESS 2 page. However, it is not in the active flight plan. There can only be one TOC waypoint at a time. The TOC is calculated based on current aircraft altitude, climb speed, and the cruise altitude.
- **Initial Cruise Altitude** – The initial cruise altitude is used by the FMS to determine the altitude where the cruise phase of flight commences. Upon reaching this altitude, the FMS changes the speed command and EPR rating from climb to cruise when the aircraft levels at the initial cruise altitude or higher. The initial cruise altitude is set during performance initialization on PERFORMANCE INIT page 4/5. See page 5-22 for additional information.
- **Cruise Altitude** – Cruise altitude is the current altitude that is used by the FMS to plan the cruise portion of the flight. Initially, the cruise altitude is set equal to the entered initial cruise altitude. The cruise altitude is automatically adjusted by the FMS using the altitude preselector settings. When the aircraft levels at the cruise altitude, the FMS changes to the cruise phase of flight with the corresponding change to cruise speed commands.
- **Top of Descent (TOD)** – A TOD waypoint is calculated and displayed on the vertical profile and shown on PROGRESS page 2. If there are no constraints during the descent, the TOD is calculated using the destination elevation (if available) and the descent speed schedule. If there are constraints during the descent, the TOD is calculated using the path mode. One minute before the TOD point is reached, a vertical track alert is given. An automatic descent is initiated at the TOD if the following is true:

- The altitude preselector is set to a lower altitude.
 - The FMS is selected as the navigation source.
 - Lateral navigation (LNAV) and vertical navigation (VNAV) are engaged.
- **Descent Constraints** – Descent constraints are altitude, speed, and angle constraints that are associated with waypoints in the descent portion of the flight plan. Altitude constraints can be AT, AT or ABOVE, or AT or BELOW. For example, entering 10000A (**A** following the altitude) indicates AT or ABOVE. Entering 10000B (**B** following the altitude) indicates AT or BELOW. Entering 10000 (no letter) indicates AT. The FMS obeys descent speed constraints at and after the waypoint that contains the constraint. The FMS obeys angle constraints from the TOD to the waypoint containing the constraint. Normally, the FMS calculates the angle constraint based on performance initialization; however, a specific angle constraint can be entered at a waypoint in the flight plan.

CREATING/CHANGING FLIGHT PLANS

An example of the ACTIVE FLT PLAN page before the flight plan is shown in Figure 7-1.

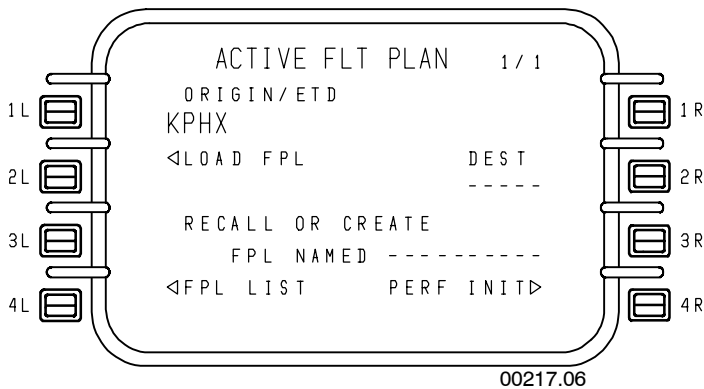


Figure 7-1

The following options can be made to recall or create an active flight plan:

- Load a flight plan from a disk (2L)
- Recall a previously stored flight plan (3R)
- Create a stored flight plan (3R)
- Build a flight plan by entering waypoints (2R).

Load a Flight Plan from a Disk

Disks loaded with flight plans can be created from a flight planning service such as Jeppesen or Global. Flight plans can also be created on a PC computer with flight planning software that produces Honeywell FMS compatible flight plans.

To load a flight plan from a disk, the following conditions must be met:

- No flight plan can exist in the ACTIVE FLT PLAN pages. If one has been defined, delete the origin to clear the flight plan.
- The DL-800/900 Data Loader must be connected and powered up.
- The DL-800/900 Data Loader left/right/aux switch must be in the proper position for the FMS to be loaded.

When these conditions are satisfied, the LOAD FPL prompt at key 2L is displayed on the ACTIVE FLT PLAN page. This is shown in Figure 7-1. Pressing line select key 2L displays a list of all flight plans that are on the disk. This is shown in Figure 7-2. Pressing the line select key adjacent to the desired flight plan begins the transfer from the disk. If there is only one flight plan on the disk, the directory is not displayed and the flight plan is transferred immediately. Typical transfer time is 2 to 4 seconds. Flight plans with an extension of HFP (e.g., KPHXPMSP.HFP), or FP* (e.g., KSAVKLG.BP1), or the file name SPERRY.DAT, are displayed for selection by the FMS. **The flight plan can only be loaded into the active flight plan pages.** It is then possible to save the active flight plan. Refer to page 7-19 for details on saving the active flight plan.

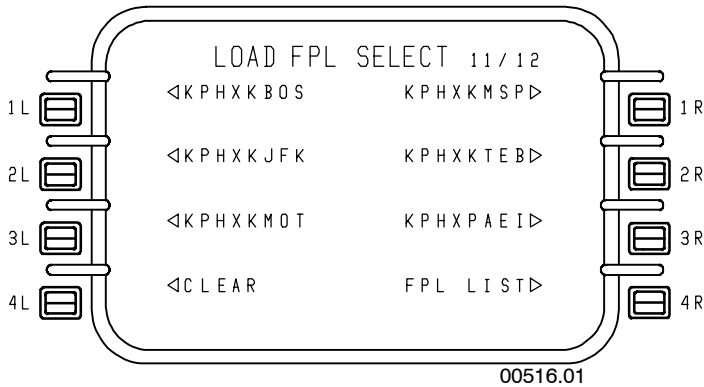


Figure 7-2

Following selection of the desired flight plan, the FMS will display the message asking if waypoint predicted wind/temperature data is to be loaded from the flight plan on disk. This is shown in Figure 7-3.



Figure 7-3

If YES is selected, the waypoint predicted wind/temperature data will be loaded into the wind/temperature model within the FMS. If NO is selected, the average wind/temperature data entered on the PERFORMANCE INIT pages will be used for the wind/temperature model and no data will be loaded from disk.

Recall a Previously Stored Flight Plan

If the name of a previously stored flight plan is known, it can be entered at 3R. This is shown in Figure 7-1. After entering, the FMS automatically recalls the flight plan and makes it the active flight plan. This is shown in Figure 7-4. It takes the FMS 2 or 3 seconds to complete the recall of the flight plan.

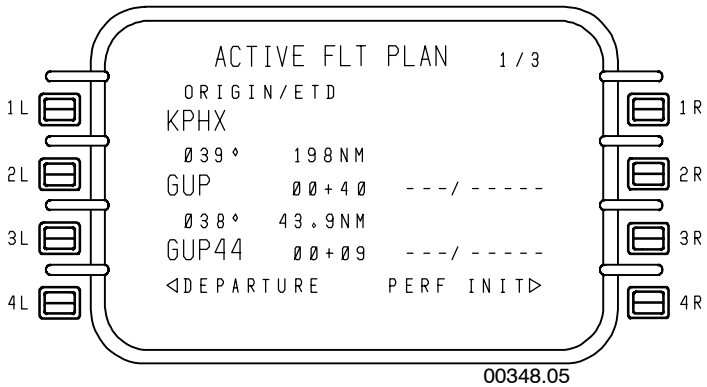


Figure 7-4

If the name of a previously stored flight plan cannot be remembered, enter the origin and destination. The FMS searches the stored flight plans for those plans with the same origin and destination. If any are found, the FLIGHT PLN LIST page is displayed with the stored flight plan names marked with an asterisk (*). This is shown in Figure 7-5. Select the required flight plan, shown in Figure 7-6, and press RETURN (1R). This activates the flight plan and returns the display to the ACTIVE FLT PLAN pages, shown in Figure 7-4. Even if the flight plan name can be remembered, this procedure saves steps over entering the flight plan name at 3R.

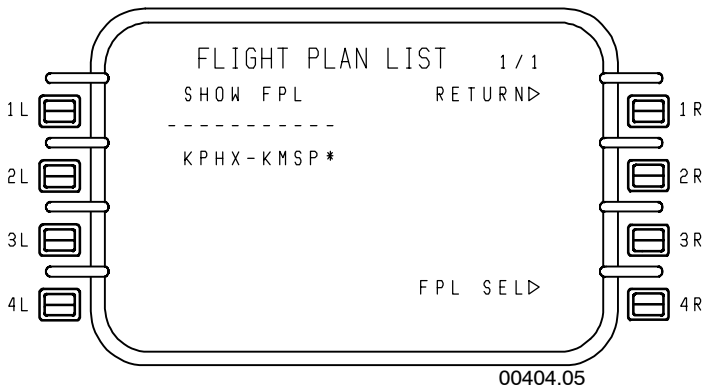


Figure 7-5

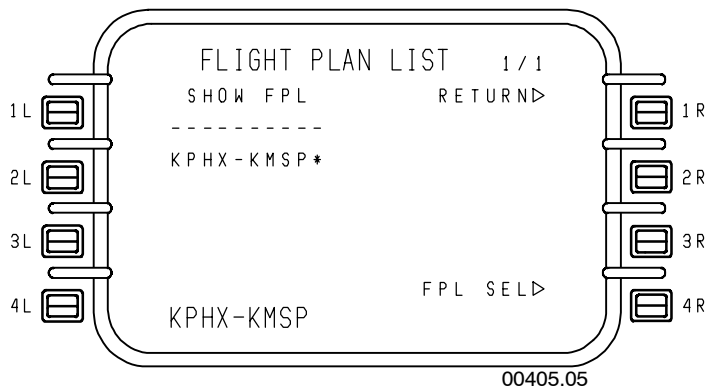


Figure 7-6

Store a Flight Plan and Activate

When building a flight plan, the flight plan can be retained in memory for use in the future. This is done by entering the flight plan identifier at 3R. This is shown in Figure 7-1. After entering the flight plan name at 3R, the FMS switches to the stored flight plan page to define the flight plan. This is shown in Figure 7-7. After it is defined, the flight plan can be activated. If a flight plan name that is already defined is entered at 3R, the flight plan becomes active.

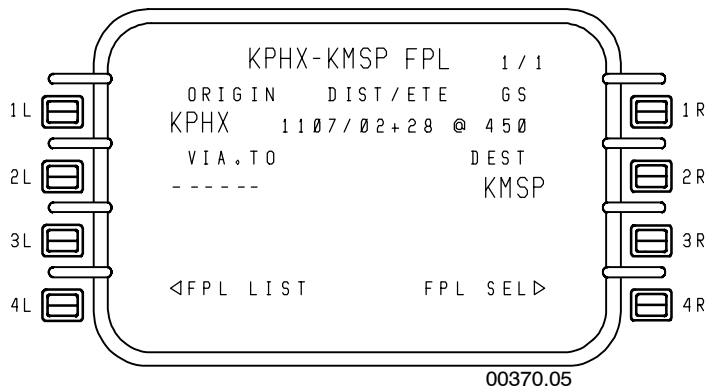


Figure 7-7

Build a Flight Plan by Entering Waypoints

When a destination is entered at 2R, the FMS searches for stored flight plans with the same origin and destination. This is shown in Figure 7-1. If any flight plans are found, the FLIGHT PLAN LIST page is displayed. Select RETURN at 1R to return to the active flight plan and input waypoints. If no flight plan is found during the search, the active flight plan is displayed and the FMS is ready for waypoint input. This is shown in Figure 7-8. When building a flight plan, waypoints are entered on the line showing the VIA.TO prompt (1L through 3L). The FMS accepts a variety of inputs at the VIA.TO prompt as described below.

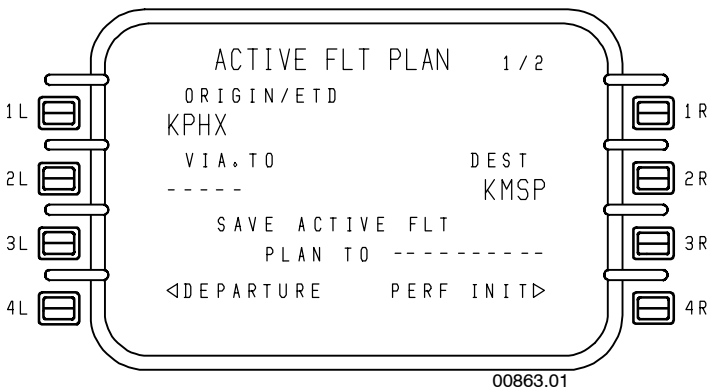


Figure 7-8

- **Waypoint** – Any waypoint contained in the navigation data base or the custom data base can be entered. If a waypoint name is entered that is not yet defined, the FMS automatically displays a page for waypoint definition. The waypoint can be defined and the RETURN prompt can be used to get back to the flight plan. If the waypoint name was entered in error, the RETURN prompt is used without a definition being entered.
- **Temporary Waypoint** – Any temporary waypoint can be entered.
- **Airway** – Any airway in the data base can be entered. When entering an airway, the waypoint in the flight plan preceding the point of entry must be a waypoint on the airway. The airway entry is made in the format of the VIA.TO prompt where VIA is the airway identifier and TO is the last waypoint to be used on the airway. For example, a portion of the flight plan is GUP, J102 to ALS. The first step is to insert GUP into the flight plan. This is followed by entering J102.ALS into the scratchpad. This is shown in Figure 7-9. The entry is completed by selecting 3L and the FMS automatically fills in all the waypoints along the airway from GUP up to and including ALS. The

airway can also be entered as a single input by entering GUP.J102.ALS into the scratchpad and selecting the appropriate line select key. Refer to page 10-2, Airway CDU Entry Format, for additional details.

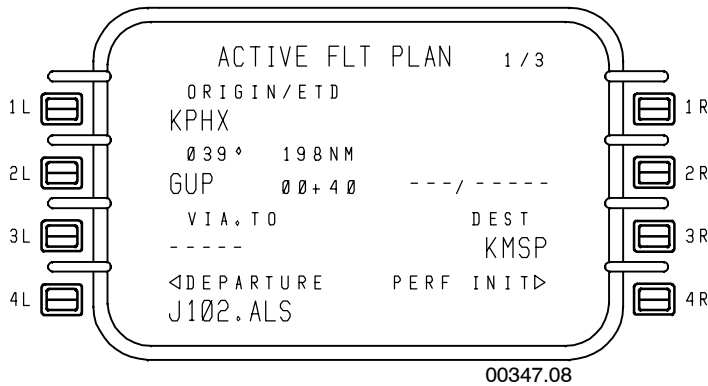


Figure 7-9

- **Flight Plan Names** – Any defined flight plan name can be entered. If a defined flight plan is entered, flight plans can be linked together. When inserting a flight plan, the FMS searches for common points between the two flight plans being linked. If the common waypoint is found in the stored flight plan, the two flight plans are linked at that point. Any waypoints in the stored flight plan preceding the common waypoint are eliminated. If no common waypoint is found, the stored flight plan is inserted beginning at the origin.

Flight plan names can also be entered using the VIA.TO format. In this case, the stored flight plan is inserted up to and including the waypoint specified in the VIA.TO entry. Any waypoints in the stored flight plan after the specified waypoint are eliminated.

After the flight plan is entered, the destination waypoint should be entered as the last waypoint to close the flight. To accomplish this, enter the destination at the VIA.TO prompt.

An alternate flight plan is entered using the same rules as a regular flight plan.

- **Vertical Entries** – Vertical definitions for waypoints are entered using the right hand line select keys (1R through 3R). This is shown in Figure 7-10.

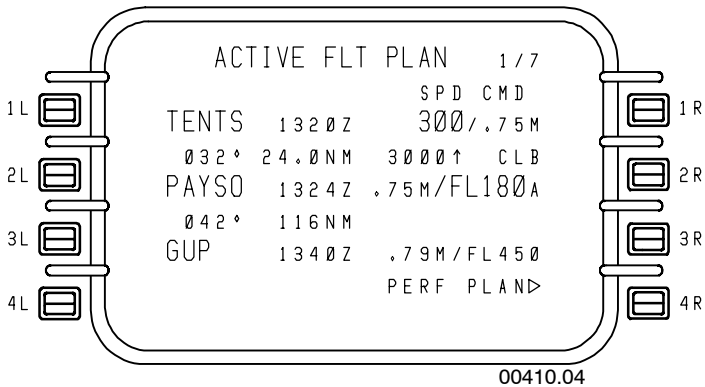


Figure 7-10

The FMS supplies vertical predicted information for each waypoint and displays it in small characters. Pilot entries are used to modify and further define the vertical profile. The following information is displayed and/or entered for each waypoint in the flight plan.

- **ALTITUDE** – Predicted altitudes are displayed in small characters for each waypoint. Pilot entries, displayed in large characters, become altitude constraints for VNAV. Altitude constraints from procedures are also displayed in large characters.
- **CONSTRAINT TYPE** – Constraint type is displayed directly above altitude constraints, as shown in Figure 7-11. The constraint type shows as CLB for climb constraints and DES for descent constraints. The FMS automatically assigns constraints in the first half of the flight plan as climb (CLB) and those in the last half as descent (DES). This automatic assignment is correct for most flights. The pilot can make an overriding entry. C, CLB, D, or DES are accepted as entries. Pilot entries are required for flights that climb, descend, and climb again.

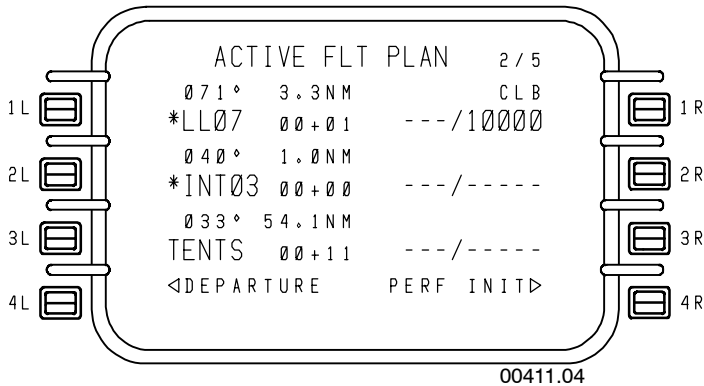


Figure 7-11

- SPEED – Speed is displayed except when an angle is entered. This is shown in Figure 7-12. The FMS calculates and displays a predicted speed for each waypoint. Speed can be entered in either CAS or MACH. If the waypoint is in a path descent, the angle is displayed.

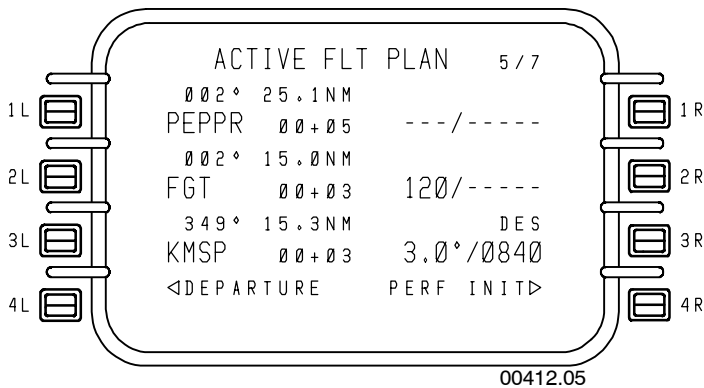


Figure 7-12

- ANGLE – A descent vertical path is displayed when the FMS will fly a vertical path to a waypoint. An altitude constraint for the waypoint is required for the FMS to be able to fly a vertical descent path. The vertical angle is calculated based on current conditions and performance initialization. FMS computed vertical descent angles are displayed in small font while pilot entered angles are displayed in large font.

- VERTICAL SPEED - The FMS predicted vertical speed is displayed unless a higher priority item is displayed. Pilot entry of vertical speed is not permitted.

When vertical angle and airspeed constraints are entered, airspeed is shown above the angle and is also a constraint.

- **Additions and Deletions to the Flight Plan** - There are several actions that result in adding and/or deleting waypoints in the flight plan. Any entry that is permitted at the VIA.TO prompt can also be made onto previously entered waypoints. The rules that apply are described as follows:

- Single waypoints, including temporary waypoints, can be added to or deleted from the flight plan. To add a waypoint to the flight plan, the waypoint is line selected from the scratchpad to the appropriate line. The added waypoint is displayed on the line that is selected. When adding a waypoint, the flight plan is searched forward of the point of insertion. If the waypoint appears in the flight plan, all the waypoints between the point of insertion and the first appearance of the added waypoint are deleted. If the waypoint does not appear forward of the inserted point, the flight plan is opened and the new waypoint inserted. Searching forward in the flight plan is restricted to the portion of the flight plan that is being modified (i.e., either the primary flight plan or the alternate flight plan).
- Waypoints are deleted using the DEL key. After entering *DELETE* in the scratchpad, line selecting a waypoint will delete it. When the waypoint is deleted, the flight plan is closed and linked together. Waypoints can be deleted by entering a waypoint that is also in the flight plan forward of the point of entry.

The pilot can delete both TO and FROM waypoints in some combinations of flight plan changes. In such cases, the FMS displays a CHANGE ACT LEG prompt.

- Stored flight plans, procedures, and airways can be called from the data base and inserted in the active flight plan. In all cases, flight plans, procedures, and airways are considered a string of waypoints and each waypoint in the string is inserted into the flight plan. In order to insert an airway, the starting point, the airway number, and the end point must be specified. Both the start point and the end point must be on the airway. When inserting a stored flight plan, the pilot has to specify only the flight plan name to insert the complete flight plan. To insert a portion of a stored flight plan, the entry is made in the form of FLIGHT PLAN NAME.WAYPOINT. When a stored flight plan is inserted,

flight planning takes the active flight plan waypoint before point of insertion and searches forward in the stored flight plan. If the waypoint is found in the stored flight plan, the waypoints earlier in the stored flight plan are not inserted. Flight planning also takes the specified end point, or last waypoint of the stored flight plan, and searches forward from the point of insertion in the active flight plan. If found, the waypoints earlier in the active flight plan are deleted.

- The DIRECT-TO function also adds or deletes waypoints. After selecting DIRECT-TO, line selecting a waypoint deletes all the waypoints before the selected waypoint. The selected waypoint then becomes the TO waypoint. A waypoint in the alternate flight plan can be selected from the primary flight plan. If this is done, all the waypoints including the original destination are deleted and the waypoint in the alternate flight plan becomes the TO waypoint. A waypoint can be entered into the scratchpad and line selected to the prompt. This makes the added waypoint the TO waypoint. The DIRECT-TO RECOVERY function can also be used. Refer to DIRECT-TO on page 9-1.
- Using the INTERCEPT function adds an intercept waypoint. No waypoints are deleted with the INTERCEPT function. If the pilot inserts an intercept waypoint in the flight plan and changes to another page before the definition is completed, the entire operation is canceled. Refer to INTERCEPT on page 9-4.
- **VNAV OFFSET** - ATC often issues a clearance that consists of crossing a specified distance before or after a waypoint, at a specific altitude. The FMS is capable of creating a temporary waypoint in the form of a *PDXX for these types of clearances. Refer to Procedure 7-1 for details.

Step	Procedure 7-1 VNAV Offset Definition
1	Define a PLACE. Use the keyboard or line select the place from the flight plan to the scratchpad.
2	Enter a slash (/) to indicate that the next entry is a bearing. If known, enter the bearing. If the bearing is not known, enter another slash (/) to indicate that the next entry is a distance.
3	Enter the distance to cross from the place. If DRK is the place, the entry is DRK//20.

Step	Procedure 7-1 VNAV Offset Definition
4	Enter this information into the flight plan either before or after the place (DRK). The FMS automatically places the waypoint on the flight plan at the specified distance.
5	Enter the altitude constraint.

- Storing of Active Flight Plan** – The active flight plan can be stored in memory for future use. This can be done at any point during entry of the active flight plan. As shown in Figure 7-13, a prompt is shown below the destination at 3R. Entering the flight plan identifier will result in the FMS displaying the flight plan on the stored flight plan pages to allow modification.

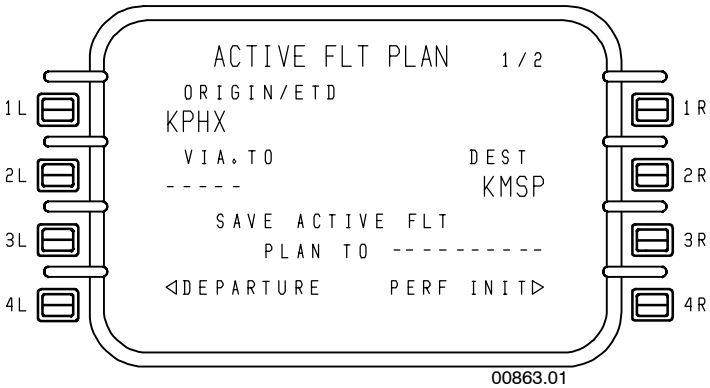


Figure 7-13

The saved active flight plan must follow the same rules that apply to stored flight plans. These rules are as follows:

1. All terminal procedures, temporary waypoints, heading select, and intercept legs will be removed from the active flight plan prior to being stored.
2. The saving of the active flight plan can only be performed when the aircraft is on the ground. The prompt is removed once the aircraft becomes airborne.
3. Each stored flight plan is required to have a unique name. If, when attempting to save the active flight plan, one already exists with the same name, the scratchpad message DUPLICATE FLT PLAN NAME is displayed. If this occurs, the active flight plan is not stored.

- **Clearing of Flight Plans** – The active flight plan is automatically cleared 60 seconds after power is removed when the aircraft is on the ground. It is cleared 60 seconds after power is removed when the aircraft is in flight.

A stored flight plan can be activated while on the ground or in flight. However, the pilot must confirm that the present active flight plan is being replaced. Flight plans can also be cleared one waypoint at a time using the DEL key on the CDU.

While on the ground, a new origin can be entered after some or all of the flight plan has been defined. If the new origin is already a waypoint in the flight plan, the waypoints earlier than the new origin are deleted. If the new origin is not already a waypoint in the flight plan, the whole flight plan is deleted. Deleting the origin clears the entire flight plan. This applies to both active and stored flight plans.

After landing (plus a 15 second time delay), the CLEAR FPL prompt is displayed on the active flight plan page. Selecting this prompt clears the entire active flight plan. The FMS defines landing as when groundspeed is below 50 knots, CAS is below 80 knots, and weight on wheels (WOW).

Changing the data base cycle (NAV IDENT page, line select 2R) clears the active flight plan. This rules out any discrepancies between flight plan information and the new data base cycle. The data base cycle can be changed only on the ground.

LATERAL NAVIGATION

LNAV is the function in the FMS that sends commands to the flight guidance computer to laterally steer the aircraft.

General LNAV Rules

- The FMS must be selected as the navigation source.
- A minimum of one leg must be defined for LNAV calculations.
- LNAV is available for all phases of flight.
- LNAV bank angles do not exceed 25° except in holding, procedure turns, orbit patterns, and on arc legs. For these cases, the limit is 30°.
- LNAV roll rate is 3° per second during the enroute phase of flight and 5.5° per second on the approach.

- The distance shown for each leg of the flight plan accounts for the distance traveled due to the change in course from one leg to the next.
- LNAV uses up to the limits of bank angle to stay within protected airspace.
- A lateral track alert is given for each waypoint sequence. The alert is given 30 seconds before starting a turn.

LNAV Submodes

- **LNAV ARM** – When initially selected, LNAV ARM becomes the active mode. While armed, the FMS monitors aircraft position and heading against the active leg. When within the capture zone, the FMS automatically changes from LNAV ARM to LNAV CAPTURE and guides the aircraft to capture the active leg. While in the armed mode, the FMS does not laterally control the aircraft. Usually, the HEADING lateral mode is used to control the aircraft until the FMS changes to LNAV CAPTURE.
- **LNAV CAPTURE** – The FMS begins lateral steering control when the mode changes from ARM to CAPTURE. The FMS uses a 3° per second roll rate during enroute operations and up to 5.5° per second on the approach. Banks are planned between 0° and 23° with 25° as a maximum. In holding, procedure turns and orbit patterns, and arc legs, the maximum is increased up to 30°.

One of the requirements of LNAV is to keep the aircraft within protected airspace. This is done by incorporating a model of protected airspace into the FMS. From the model, the FMS determines the bank angle required to stay within the protected airspace boundaries during leg changes. The actual bank angle used is the greater of the pilot entered bank factor or the bank angle from the protected airspace model.

VERTICAL NAVIGATION

VNAV is the function in the FMS that sends vertical commands to the flight guidance computer for vertical control of the aircraft. Using FMS VNAV, the operator can define vertical profile information that is automatically flown by the aircraft when a VNAV flight director mode has been selected. FMS VNAV can be used for all phases of flight. Additionally, descents can be set up for a path mode (similar to glideslope) to cross waypoints at a specified altitude. The two main areas for display of VNAV information are the ACTIVE FLT PLAN page and PROGRESS page 2.

Table 7-1 lists the VNAV submodes and the abbreviations used in this manual.

Flight Director Mode	Abbreviation
Flight Level Change	FLCH
VNAV Flight Level Change	VFLCH
VNAV Altitude Hold	VALT
VNAV Altitude Select	VASEL
VNAV Path	VPATH
Vertical Glide Path Mode	VGP

Mode Annunciation
Table 7-1

General VNAV Rules

- The FMS must be the selected navigation source **and** LNAV must be engaged for VPATH to be operational.
- VNAV does not function until all PERFORMANCE INIT information has been programmed into the CDU. If any of the PERFORMANCE INIT data is incomplete and VNAV is armed, a PERF-VNAV UNAVAILABLE message is displayed in the scratchpad.
- VNAV is available for all phases of flight.
- Climbs are flown using VFLCH only.
- Descents are flown using VFLCH or VPATH.
- VNAV never passes through the altitude preselector.
- The pilot should set the altitude preselector only to ATC cleared altitudes.
- VNAV keeps the aircraft as high as possible for as long as possible.
- VPATH angles are from 1° to 6°.
- Path guidance is always followed during VPATH descents unless the FMS transitions to speed reversion. In this condition, the FMS transitions out of VPATH to VFLCH. Refer to Speed Protection on page 7-43 for additional details.
- Speed protection and LATCHED SPEED are active in VFLCH. Refer to Speed Protection on page 7-43 for additional details.

- If the altitude preselector is set above (climbs) or below (descents) current altitude and VNAV is engaged, the FMS commands the autopilot to begin a climb (VFLCH) or descent (VFLCH or VPATH).
- VNAV is engaged by selecting the FMS as the navigation source and selecting the VNAV button on the guidance panel. EFIS annunciates the submode of VNAV.
- VPATH default descent angle is part of performance initialization. However, after the angle is displayed for each waypoint, the crew can change it.
- When the altimeter is adjusted to display height above the ground (Q_{FE}) rather than sea level, VNAV should not be used.
- If the altitude preselector is properly set, VNAV observes flight plan constraint altitudes.
- A vertical track alert is issued anytime the FMS commands a vertical track change. It is issued 60 seconds before a change from level flight to either a climb or descent. If the aircraft is completing a climb or descent, the vertical alert is issued 1000 feet before the level-off altitude. A vertical alert is not issued when the level-off altitude is set on the altitude preselector.

VNAV Submodes

- **VNAV ARM (VNAV)** – When initially selected, VNAV ARM becomes the active mode. While armed, the FMS monitors aircraft position and altitude against the altitude preselector and, if any, the next waypoint altitude constraint. From this, the FMS determines when to capture and which VNAV submode is appropriate.

There are a few conditions where VNAV ARM remains the active mode for some time. For example, the altitude preselector is set above aircraft altitude and the next constraint altitude is below the aircraft altitude. In this example, VNAV cannot determine whether to climb to the altitude preselector or to descend to the constraint. The net result is that VNAV stays in the ARM mode until the conflict is resolved.

While in the armed mode, the FMS does not vertically control the aircraft. Another vertical flight director mode is used to vertically control the aircraft until the FMS transitions out of VNAV ARM.

- **VNAV Flight Level Change (VFLCH)** – This mode is vertical flight level change. In this mode, aircraft speed is controlled by the Flight Guidance Computer (FGC) by the pitch of the aircraft. This mode is also referred to as **speed on elevator**. The speed command is displayed on ACTIVE FLIGHT PLAN page 1 and the Guidance Panel (if supported). For most operations, the autothrottle is set to climb power rating for climbs and idle for descents. Exceptions are when climbing or descending only a short distance. In this case, the throttle can be set to less than climb power or more than idle to avoid abrupt changes. Moving the throttle during VFLCH makes a change in the aircraft's pitch. This changes the vertical speed; however, the aircraft speed will remain the same.

VFLCH is used during all climbs and, unless a path is defined, during descents. When engaging VNAV, VFLCH is set as the active mode if the altitude preselector is above or below the current aircraft altitude and the current flight director mode is not altitude hold. When in other modes of VNAV, a transition to VFLCH is made by setting the altitude preselector to other than current altitude and pressing the FLCH button on the Guidance Panel.

- **VNAV Altitude Capture (VASEL)** – This mode is the same as altitude capture. It is used to level the aircraft at the VNAV supplied altitude target. The altitude target is either an altitude constraint or the altitude preselector setting. The Flight Guidance Computer (FGC) controls the pitch of the aircraft in order to capture the altitude. The autothrottle controls the speed command displayed on the guidance panel. Moving the throttle changes speed.
- **VNAV Altitude Hold (VALT)** – This mode is the same as altitude hold. The Flight Guidance Computer (FGC) controls altitude by controlling pitch. The autothrottle controls the speed command.

If VNAV is disengaged while in VALT, the flight director mode becomes PITCH HOLD, not altitude hold.

- **VNAV Path (VPATH)** – This mode is vertical path. In this mode, VNAV controls the aircraft along a geometric path downward to a waypoint altitude constraint. The path angle may be either an FMS computed value, procedure specified, or pilot entered. Path descents are identical to ILS approaches where the glideslope provides a constant angle descent. VNAV provides the same constant angle descent using barometric altitude to determine if the aircraft is on path.

The primary objective during VPATH descents is maintaining the geometric path. To accomplish this, VNAV computes the required vertical speed to maintain the path. It then sends the command to

the FGC. The FGC adjusts the pitch of the aircraft to maintain the requested vertical speed. During VPATH operations, the aircraft speed is allowed to increase or decrease to maintain the path. VNAV does provide speed protection as described on page 7-43.

During VPATH operations, the autothrottle will attempt to maintain the speed command displayed on ACTIVE FLT PLAN page 1 or the Guidance Panel. If the angle is too steep, the throttles will be at idle and the aircraft speed may continue to increase. Under these conditions, the FMS will display the INCREASED DRAG REQUIRED message. This message will indicate that the speed command cannot be maintained without an increase in drag during the VPATH descent. If autothrottles are not engaged, the pilot is responsible for adjusting the throttles to maintain aircraft speed.

- **Vertical Glide Path Mode (VGP)** – The VGP mode will allow the aircraft to descend along a defined path while ignoring the preselector. This mode is intended to allow the preselector to be dialed to the missed approach procedure altitude. This allows the FMS non-precision approach operation to mimic the cockpit procedures related to glideslope capture for the ILS approach.

VNAV Operation In Flight

- **Climb** – All VNAV climbs are flown using flight level change (VFLCH). Intermediate level offs are entered as waypoint constraints through the CDU or they are set with the altitude preselector. VNAV never flies through the altitude preselector in any VNAV mode.

If an intermediate level off is required due to an FMS waypoint altitude constraint, VNAV automatically resumes the climb after passing the waypoint if the selector is set above the current aircraft altitude. If the selector is not set above the current altitude, VNAV maintains the intermediate altitude when passing the waypoint. In this case, the climb is resumed by setting the altitude preselector higher and pressing VFLCH on the guidance panel.

- **Cruise** – The initial cruise altitude is entered during performance initialization. If the altitude preselector is set higher than the entered initial cruise altitude, the cruise altitude is adjusted to match the altitude preselector. When the aircraft levels off at the cruise altitude (initial cruise altitude or higher if set on the selector), the FMS enters the cruise phase of flight. The speed command is adjusted to the cruise values.

Cruise is flown by the autopilot in the altitude hold mode (VALT). From cruise, a climb or descent can be executed at any time by setting the altitude preselector to the desired altitude and pressing

the VFLCH button. There is a 2 to 3 second delay before VNAV resets the altitude target to the altitude preselector or next waypoint altitude constraint (whichever is closer), and the flight director changes to VFLCH.

When in VALT, the Flight Guidance System (FGS) Touch Control Steering (TCS) function can be used to maneuver the aircraft. However, when TCS is released, the aircraft returns to the original VALT altitude.

Automatic changes from cruise can be performed for Bottom of Step Climb (BOSC) and Top of Descent (TOD) points. In both cases, the altitude preselector must be properly set (i.e., above the current altitude for BOSC and below current altitude for TOD). If the altitude preselector remains at the current altitude, the aircraft remains in cruise as the points are passed.

- **Top of Descent (TOD)** – The TOD is the location at which the aircraft will commence a descent. The TOD can be displayed on the ND, but is always displayed on the PROGRESS pages. There can only be one TOD waypoint at a time. For each TOD, a vertical waypoint alert is given and an automatic descent is initiated if the altitude preselector has been selected to a lower altitude.
- **Descent** – Descents are flown as speed descents (VFLCH) or path descents (VPATH). The transition to descent is automatic, assuming the altitude preselector is set lower than the present altitude. One minute before TOD, the vertical track alert is given. Upon reaching the TOD, VNAV will initiate either a VFLCH or VPATH descent.
 - **Speed Descent (VFLCH)** – A speed descent is flown when no altitude constraints exist in the flight plan during the descent. The TOD is calculated to place the aircraft at 1500 feet above the destination 10 miles prior to the destination. Also, the TOD is based on any speed constraints in the descent such as slowing to 250 knots below 10,000 feet.

The pilot can initiate a VFLCH descent anytime by setting the altitude preselector to a lower altitude and pressing FLCH on the Guidance Panel. Following an intermediate level off at the altitude preselector value, the descent is resumed by dialing down the altitude preselector and pressing the FLCH button again on the Guidance Panel.
 - **Path Descent (VPATH)** – A VPATH descent is flown when there is an altitude constraint in the descent portion of the active flight plan. The path angle associated with the constraint is either a default angle computed by the FMS, procedure specified, or pilot entered.

During path descents, AT OR ABOVE or AT OR BELOW constraints are **not** treated as AT constraints. VNAV will look further in the flight plan to determine if other constraints exist. If so, VNAV will fly a single path that meets all constraints rather than multiple paths that treats each constraint as an AT constraint.

After passing the last waypoint with an altitude constraint, VNAV changes from path descent (VPATH) to a speed descent (VFLCH).

VNAV Special Operations

- **Vertical DIRECT-TO** – This function operates much like the lateral DIRECT-TO. Refer to page 9-2 for additional information on vertical direct-to.
- **VNAV and Holding or Orbit Patterns** – There are some special considerations for holding and orbits during VNAV operation.
 - If the holding or orbit pattern is entered while in VFLCH, the aircraft remains in VFLCH and continues the climb or descent.
 - If the holding or orbit pattern is entered while in VALT, the aircraft remains in VALT.
 - If a present position (PPOS) holding pattern is entered while in a path descent, the aircraft changes to VFLCH while in holding.
 - Path descents cannot be used during holding or orbit pattern operations. If the holding or orbit is entered while in VPATH, VNAV changes to VFLCH and continues the descent.
- **VNAV (VPATH and VFLCH) and Stored Instrument Approaches**
 - All stored approach procedures have altitude constraints and/or vertical path angles associated with them.
 - **It is possible to change the altitude constraint and/or the path descent angle once an approach procedure has been activated. However, the crew must verify that all the approach procedure altitude requirements are met.**
 - Industry wide standards for data base information are currently inconsistent on many approaches. Some vertical paths are defined to 50 feet above the runway. Others do not arrive at MDA until at the MAP. Some approaches provide vertical guidance below the published MDA and some vertical paths differ from the VASI/PAPI angles.

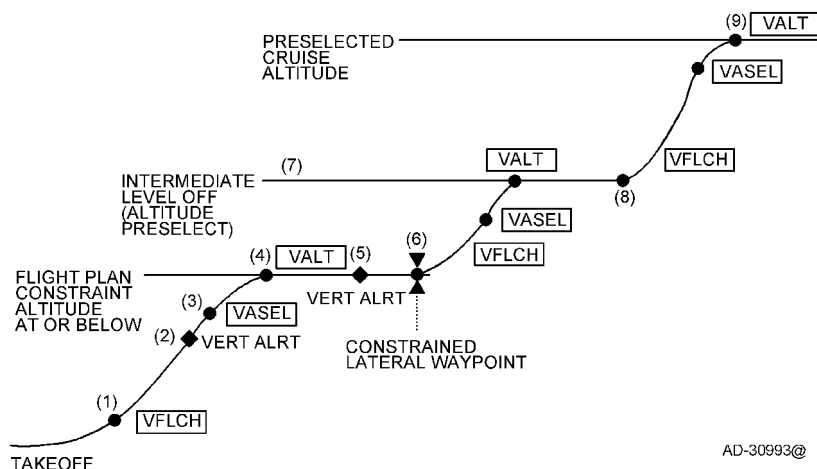
- The stored missed approach also contains altitude constraints. Some altitude constraints do not refer to any waypoint. VFLCH can be used to fly the missed approach to comply with this type of altitude constraint. During the missed approach, the speed command will be the PERFORMANCE INIT missed approach speed until the destination waypoint is changed or a flight plan change is made.

VNAV Operational Scenarios

The operational scenarios are presented as a series of figures showing typical vertical profile segments. Certain points on the figures are labelled with numbers. These numbers are used to describe events and are enclosed in parentheses in the text. Refer to the General VNAV Rules section, page 7-22, when reviewing these scenarios.

• VNAV Climb (VFLCH)

The elements of a VNAV climb profile are shown in Figure 7-14.



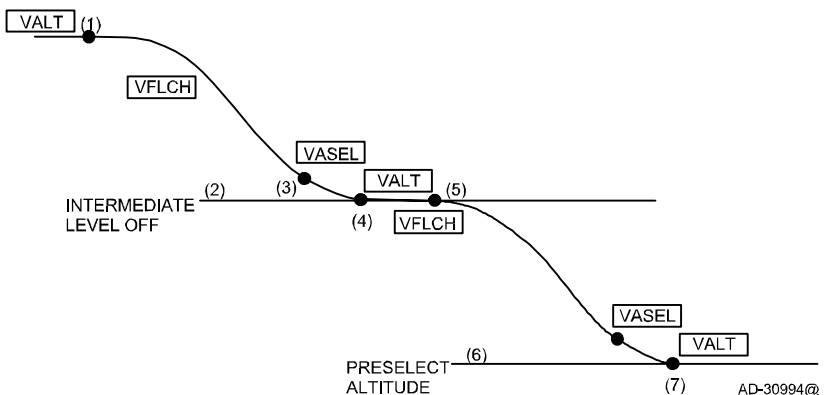
VNAV Climb Profile
Figure 7-14

A VNAV climb profile consists of the following:

- VNAV is engaged in a VFLCH airspeed climb (1) after takeoff.
- One thousand feet before reaching the constraint altitude, a VERT ALRT is given (2).
- The flight guidance computer changes to VASEL to capture the altitude constraint (3).

- The flight guidance computer switches to VALT at the constraint altitude (4).
 - One minute before the constrained lateral waypoint is reached, a VERT ALRT is given (5) indicating that an automatic climb begins at the waypoint.
 - The altitude preselector is set higher than the constraint altitude (5).
 - The flight guidance computer switches to VFLCH as the waypoint is passed (6).
 - The flight guidance computer performs a normal level off at the intermediate altitude preselector (7) switching from VFLCH to VASEL to VALT with the normal 1000 foot selector alert.
 - ATC clearance is received to the cruise altitude and the selector is dialed to the cleared altitude (8).
 - The FLCH button is pressed to resume the climb (8).
 - The flight guidance computer performs a normal level off at the cruise altitude (9) switching from VFLCH to VASEL to VALT with the normal 1000 foot selector alert and the speed command changes to the cruise value.
- **VNAV Flight Level Change Descent (VFLCH)**

The elements of a VNAV FLCH (IAS or MACH hold) descent profile are shown in Figure 7-15.



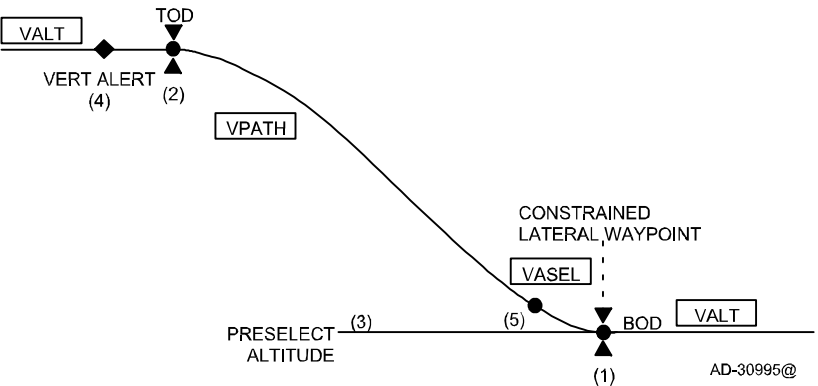
VNAV Flight Level Change Descent
Figure 7-15

A VFLCH descent can be engaged at any time by using the following:

- From cruise altitude (1), dial down the altitude preselector to the ATC cleared altitude (2).
- Press FLCH if already engaged in a VNAV mode or VNAV if not already in VNAV. The flight guidance computer switches to VFLCH and begins a descent (1).
- One thousand feet before the altitude preselector (2) is reached, the normal altitude alert is given and the flight guidance computer does a normal level off switching from VFLCH to VASEL (3) to VALT (4).
- An ATC clearance (5) is received to a lower altitude and the altitude preselector is lowered (6). FLCH is pressed (5) and the aircraft begins a descent.
- One thousand feet before the altitude preselector (6), the normal altitude alert is given and the flight guidance computer does a normal level off switching from VFLCH to VASEL to VALT (7).

● **VNAV Path Descent (VPATH)**

The elements of a VNAV path descent profile are shown in Figure 7-16.



VNAV Path Descent Profile
Figure 7-16

A VNAV path descent can be engaged from VALT at any time if the altitude preselector has been dialed down before the TOD point is reached. The VNAV path descent mode is used to descend to a new flight level at a calculated or prescribed angle (between 1° and 6°). The following steps apply:

- An altitude constraint is entered at a waypoint (1). The FMS calculates an angle and TOD (2) for the path descent.
- At the TOD, the flight guidance computer switches from VALT to VPATH and begins a descent (2).
- The altitude preselector is set to the ATC cleared altitude (3).
- One minute before reaching the TOD, a VERT ALERT is given (4) and the vertical deviation scale is displayed on the EFIS. If the altitude preselector is not at a lower altitude, the message RESET ALT SEL? is displayed.
- The flight guidance computer does a normal level off switching from VPATH to VASEL (5) to VALT (1).

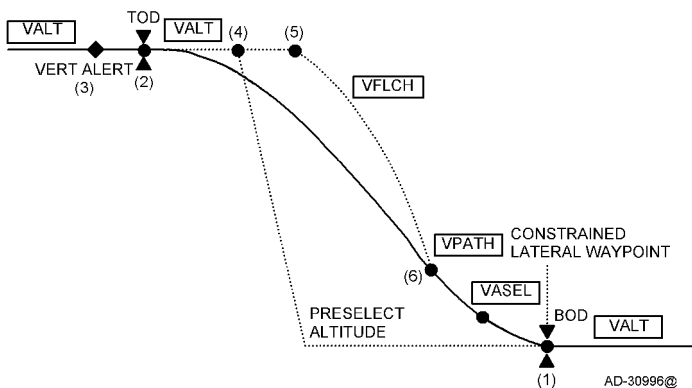
The VNAV angle is always displayed on CDU for path descents. The path is always followed except when the aircraft speed approaches the following:

- V_{mo}/M_{mo}
- Landing gear or flap placard speed
- V_{REF} .

VNAV tries to satisfy both the altitude preselector and the waypoint constraint altitude. However, VNAV **never** flies through the altitude preselector.

• VNAV Late Path Descent (VPATH)

A VNAV late path descent is shown in Figure 7-17.



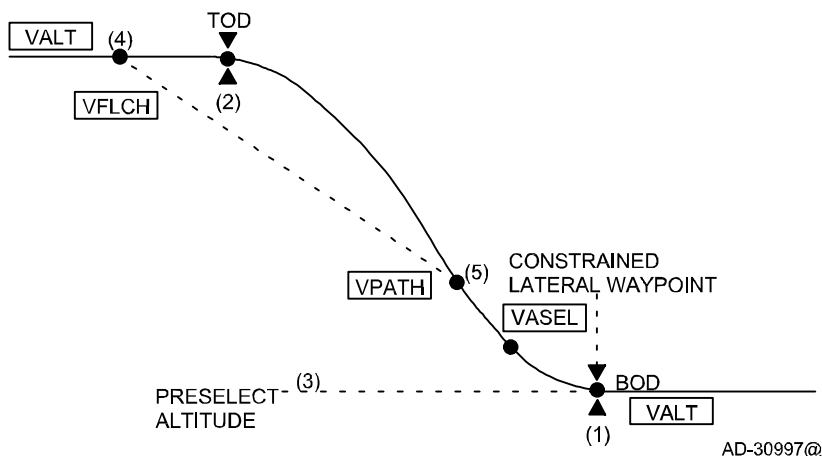
VNAV Late Path Descent
Figure 7-17

This scenario can occur if ATC has not given descent clearance by the time the TOD is reached. The steps are as follows:

- An altitude constraint is entered at a waypoint (1). The FMS calculates an angle and TOD (2) for the path descent.
- One minute before reaching the TOD, a VERT ALERT is given (3) and the vertical deviation scale is displayed on the EFIS. If the altitude preselector is not at a lower altitude, the message RESET ALT SEL? is displayed.
- When past the TOD and more than 500 feet above the path, the flight guidance computer remains in VALT.
- The altitude preselector is set (4) to the ATC cleared altitude.
- Press the FLCH button (5) to begin descent. The flight guidance computer transitions to VFLCH to begin the descent. If the aircraft is past the TOD but less than 500 feet from the path when the selector is set lower, the FMS switches directly to VPATH.
- When the path is intercepted, the flight guidance computer switches to VPATH (6).
- The flight guidance computer does a normal level off switching from VPATH to VASEL to VALT (1).

• VNAV Early Descent to Capture Path (VPATH)

An early descent to capture a path is shown in Figure 7-18.



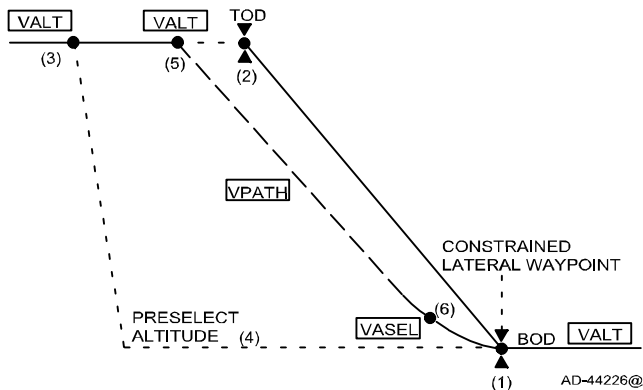
VNAV Early Descent to Capture Path
Figure 7-18

This scenario is typical, should ATC instruct a descent before the established TOD point is reached. The steps are as follows:

- An altitude constraint is entered at a waypoint (1). The FMS calculates an angle and TOD (2) for the path descent.
- The altitude preselector is set to the ATC cleared altitude (3).
- Press the FLCH button (4) to begin the descent. The flight guidance computer switches to VFLCH to begin the descent.
- As the path is approached, the vertical deviation is displayed on the EFIS. When the path is intercepted, the flight guidance computer switches to VPATH (5).
- The flight guidance computer does a normal level off, switching from VPATH to VASEL to VALT (1).

• VNAV Early Descent Using DIRECT-TO (VPATH)

The VNAV early path descent using vertical DIRECT-TO is shown in Figure 7-19.



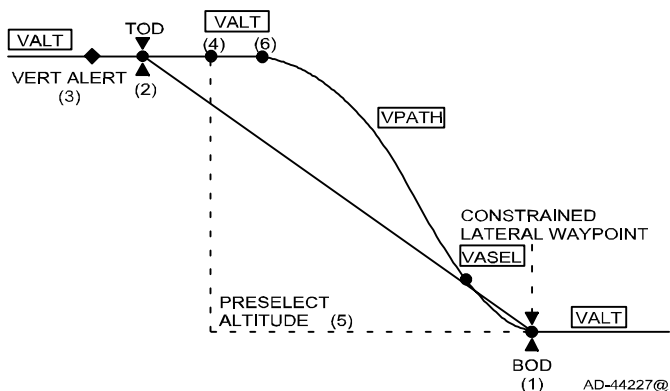
VNAV Early Path Descent Using Vertical DIRECT-TO
Figure 7-19

The following steps apply:

- An altitude constraint is entered at a waypoint (1). The FMS calculates an angle and TOD (2) for the path descent.
- The altitude preselector is set (3) to the ATC cleared altitude (4).
- A vertical direct-to is performed (5) to the constrained waypoint (1). The FMS calculates the new angle and the flight guidance computer transitions to VPATH.
- The flight guidance computer does a normal level off, switching from VPATH to VASEL (6) to VALT (1).

• VNAV Late Descent Using DIRECT-TO (VPATH)

A VNAV late path descent using vertical DIRECT-TO is shown in Figure 7-20.



VNAV Late Path Descent Using Vertical DIRECT-TO
Figure 7-20

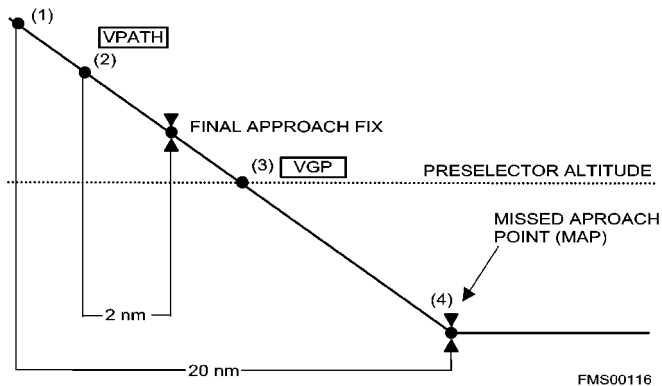
In this scenario, descent clearance is not received before the TOD is reached. The following applies:

- An altitude constraint is entered at a waypoint (1). The FMS calculates an angle and TOD (2) for the path descent.
- One minute before reaching the TOD, a VTA is given (3) and the vertical deviation scale is displayed on the EFIS. If the altitude preselector is not at a lower altitude, the message RESET ALT SEL? is displayed.
- At the TOD (2), the flight guidance computer remains in VALT and remains level through the TOD.
- The altitude preselector is set (4) to the ATC cleared altitude (5).
- A vertical direct-to is performed (6) to the constrained waypoint (1). The FMS calculates the angle and the flight guidance computer transitions to VPATH.
- The flight guidance computer does a normal level off, switching from VPATH to VASEL to VALT (1).

D VNAV Vertical Glide Path (VGP) Mode From a Path Descent

The VGP mode is designed to allow operation of the altitude preselector during FMS non-precision approaches to be similar in operation as ILS approaches. During FMS non-precision approaches, it is necessary to dial the altitude preselector to the Minimum Descent Altitude (MDA) during the final approach segment. When a missed approach is executed, it is necessary to reset the altitude preselector to the missed approach altitude. With VGP, the altitude preselector can be set to the missed approach altitude (similar to an ILS approach) once the approach light is lit. The FMS continues to descend the aircraft on a defined vertical path regardless of the altitude preselector. This is similar in concept to glideslope capture for ILS approaches.

A VGP non-precision approach descent from a path descent is shown in Figure 7-21.



VNAV Vertical Glide Path (VGP) Mode From a Path Descent
Figure 7-21

A VGP non-precision approach descent from a VNAV path descent consists of the following:

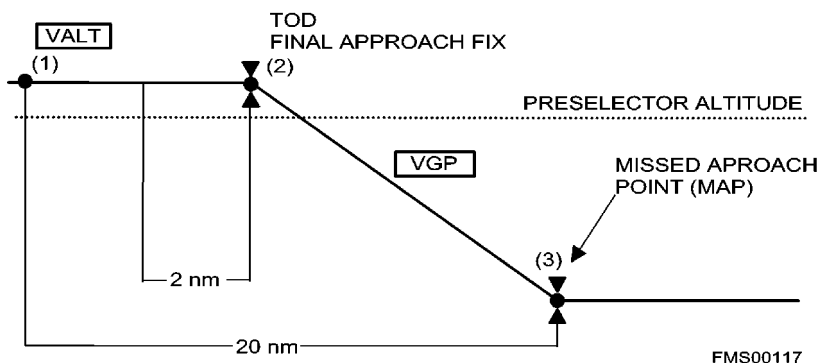
- Engage VNAV prior to entering the terminal area.
- VGP becomes armed 50 NM flight plan distance (1) from the runway waypoint (4). This is indicated on PROGRESS page 1.
- When the aircraft is 2 NM flight plan distance (2) from the FAF, VGP capture mode becomes active and the approach light illuminates. The altitude preselector can be set to the missed approach altitude at this time.

- During VGP operations, the FMS continues the vertical path descent through the altitude preselector (3) to the Missed Approach Point (MAP) altitude constraint (4).
- Following sequence of the MAP, VNAV disengages and the FGC transitions to pitch hold.

D VNAV Vertical Glide Path (VGP) Mode From Level Flight

The VGP mode is designed to allow operation of the altitude preselector during FMS non-precision approaches to be similar in operation as ILS approaches. During FMS non-precision approaches, it is necessary to dial the altitude preselector to the Minimum Descent Altitude (MDA) during the final approach segment. When a missed approach is executed, it is necessary to reset the altitude preselector to the missed approach altitude. With VGP, the altitude preselector can be set to the missed approach procedure altitude (similar to an ILS approach) once the approach light is lit. The FMS continues to descend the aircraft on a defined vertical path regardless of the altitude preselector. This is similar in concept to glideslope capture for ILS approaches.

A VGP non-precision approach descent from level flight is shown in Figure 7-22.



VNAV Vertical Glide Path (VGP) Mode From Level Flight Figure 7-22

A VGP non-precision approach descent from level flight consists of the following:

- Engage VNAV prior to entering the terminal area.
- VGP becomes armed 50 NM flight plan distance (1) from the Missed Approach Point (MAP) (4). This is indicated on PROGRESS page 1.

- At the TOD (2), VGP capture mode becomes active and the approach light illuminates. The altitude preselector can be set to the missed approach altitude at this time.
- During VGP operations, the FMS continues the vertical path descent through the altitude preselector (3) to the Missed Approach Point (MAP) altitude constraint (4).
- Following sequence of the runway waypoint, VNAV disengages and the FGC transitions to pitch hold.

SPEED COMMAND

The FMS is capable of controlling the aircraft speed during departure, climb, cruise, descent, approach, and go-around. The speed is either controlled automatically or manually. The automatic speed command contains three submodes: automatic, waypoint constraint, and speed intervention. In the manual speed command mode, the pilot enters the desired aircraft speed manually on the guidance control panel. The FMS then controls the aircraft to the manually entered speed. Manual speed command mode is not available on all aircraft types.

The FMS provides speed protection for automatic speed command modes. This speed protection is designed to prevent the aircraft from flying too slow or too fast. Refer to Speed Protection, on page 7-43, for additional information.

General Speed Command Rules

- D The current speed command is displayed on page 1 of the ACTIVE FLT PLAN. This is shown in Figure 7-23.
- D A CAS and MACH are both displayed when climbing or descending; otherwise, the cruise speed command (either CAS or a MACH) is displayed.
- D The active speed command, whichever is the smallest between CAS and MACH, is shown in large characters.
- D The active speed command is also displayed on EFIS and the Guidance Panel.

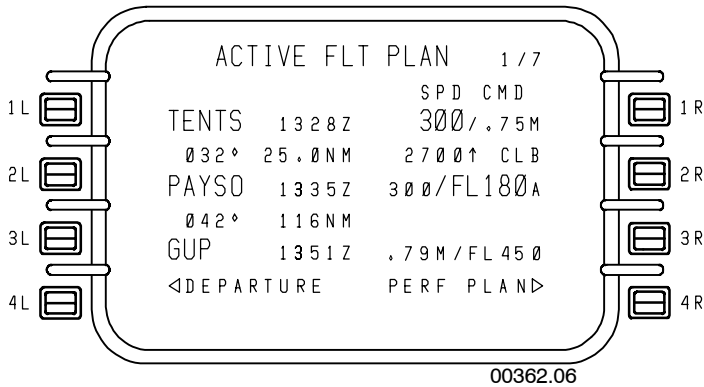


Figure 7-23

Automatic

As the name implies, the automatic speed command mode is the most automated mode. The FMS automatically changes the speed command throughout the flight to accommodate aircraft configuration and phase of flight. This automatically controlled speed command can be used by the autopilot or autothrottle. The following speed schedules for the automatic speed command are configured on the PERFORMANCE INIT 2/5 page:

- Departure
- Climb
- Cruise
- Descent
- Approach
- Go-Around.

The automatic speed command for a typical flight changes as follows:

- During departure, the speed command is set to the departure speed schedule selected during initialization. The departure speed schedule is designed to maintain the aircraft speed below the class D airspace speed limit of 200 KIAS. The default departure area is 4 NM from the departure airport and less than 2500 feet AGL.
- Once the aircraft is clear of the departure area, the speed command transitions to the climb speed schedule selected during initialization. The climb speed command can be limited by the speed/altitude limit defined during initialization. Once above the speed/altitude limit, the target will be the lower value of the CAS/MACH climb speed schedule. The change to MACH is automatic.
- As the aircraft levels off at the cruise altitude, as defined in the initialization, the speed command changes to cruise. Only one value of CAS or MACH is displayed.

The speed command transitions to cruise when the aircraft is in VALT or altitude hold and the aircraft altitude equals the PERFORMANCE INIT cruise altitude. If the aircraft levels off at an altitude below the PERFORMANCE INIT value for cruise altitude, the speed command will continue to be the climb speed command. It is necessary to manually enter the lower cruise altitude on either the PERF DATA 1 page or PERF INIT 4 page to enable the FMS to transition to the cruise speed command.

Step climbs use the cruise speed command if the altitude change is 5000 feet or less. Climbs greater than 5000 feet use the climb speed commands.

- When the aircraft begins descending below the cruise altitude, the speed command changes to the descent speed schedule and the descent CAS/MACH target is displayed. The descent speed command is used during any intermediate leveloffs. When the aircraft nears the speed/altitude limit, the speed command anticipates the speed limit and slows the aircraft prior to reaching the altitude.
- Nearing the destination, the speed command changes to the approach speed schedule defined during initialization. The default values for the transition to approach speed are 15 flight-plan miles from the destination or 5 miles from the first approach waypoint. Lowering the landing gear or flaps can also change the speed command to the approach speed schedule. For some aircraft installations, an approach speed command is permitted for each flap setting.
- Should the flight director transition to go-around, the speed command changes to the go-around speed schedule defined during initialization. For some aircraft installations, a go-around speed command is permitted for each flap setting. When the go-around speed command is active, modification of the active flight plan or selection of a new approach results in the FMS transitioning from go-around to the approach speed schedule. If the active flight plan destination is changed while the go-around speed schedule is active, the speed command transitions from go-around to climb speed schedule.

Waypoint Speed Constraint

The FMS provides the ability to cross a waypoint at a specified speed. This is referred to as a waypoint speed constraint. A waypoint speed constraint can be retrieved with a procedure (SID/STAR/approach) or it may be entered by the pilot.

Waypoint speed constraints are treated differently by the FMS depending upon the phase of flight. Waypoint speed constraints in the climb phase of flight will result in the FMS applying the speed constraint to all legs **prior** to the waypoint. The climb phase of flight is defined as the legs of the flight plan prior to the TOC. Upon sequencing the waypoint, the FMS will attempt to return to the automatic speed schedules if no other waypoint speed constraint exists.

Waypoint speed constraints in the cruise or descent phase of flight will result in the FMS applying the speed constraint to all legs **after** the waypoint. As the aircraft approaches the waypoint, the FMS will anticipate the speed constraint so that the aircraft will cross the waypoint at the speed constraint. The cruise phase of flight is defined as the legs of the flight plan past the TOC and prior to the TOD. The descent phase of flight is defined as the legs of the flight plan past the TOD.

To insert a waypoint speed constraint, follow Procedure 7-2.

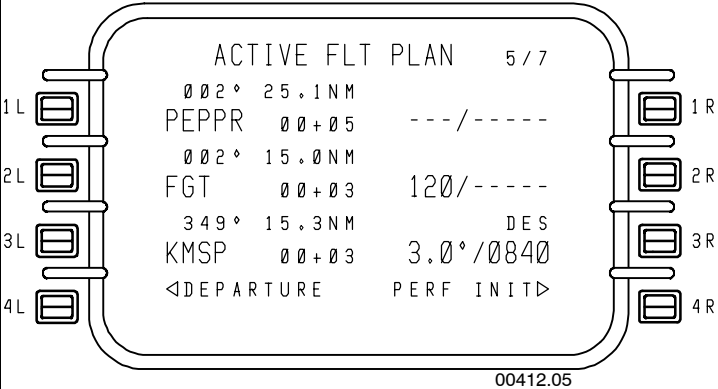
Step	Procedure 7-2 Inserting a Waypoint Speed Constraint
1	Completely initialize the PERFORMANCE INIT pages.
2	Enter the speed constraint into the scratchpad followed by a slash (/). The entered speed may be either a CAS or MACH.
3	Press the right line select key adjacent to the lateral waypoint on the ACTIVE FLT PLAN page. For example, Figure 7-24 shows a speed constraint of 120 knots desired for waypoint FGT. The speed constraint was entered into the scratchpad (e.g., 120/) and then line select 2R was pressed.  00412.05

Figure 7-24

To remove a waypoint speed constraint, follow Procedure 7-3.

Step	Procedure 7-3 Removing a Waypoint Speed Constraint
1	Press the DEL key.
2	Press the right line select key adjacent to the lateral waypoint on the ACTIVE FLT PLAN page.

Speed Intervention

Speed intervention is the lowest level of automatic speed commands. Speed intervention allows the pilot to enter into the FMS a specified speed to fly without the loss of FMS speed protection. The FMS changes the speed command to the pilot entered speed command. While flying the specified speed, the FMS will continue to provide speed protection. Procedure 7-4 explains how to activate speed intervention.

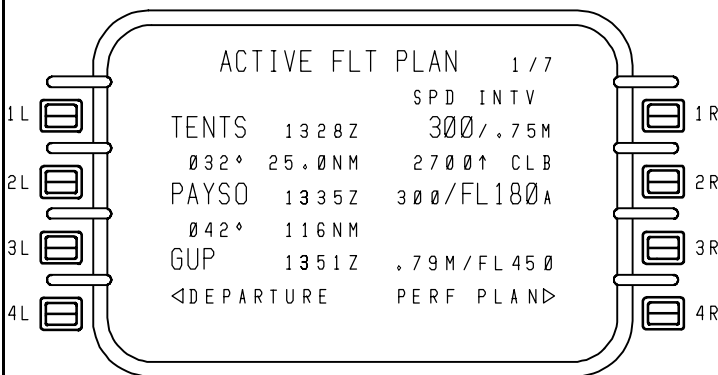
Step	Procedure 7-4 Activating Speed Intervention
1	Completely initialize the PERFORMANCE INIT pages.
2	Enter the required speed into the scratchpad.
3	Press line select key 1R on ACTIVE FLT PLAN page 1. The SPD CMD prompt at 1R will change to SPD INTV. This is shown in Figure 7-25.  00902.01

Figure 7-25

To deactivate speed intervention, follow Procedure 7-5.

Step	Procedure 7-5 Deactivating Speed Intervention
1	Press the DEL key.
2	Press line select key 1R on ACTIVE FLT PLAN page 1.

Normally, entering a CDU speed consists of both CAS and MACH separated by a slash (e.g., 300/.78). If only CAS (or MACH) is entered, a default MACH (or CAS) is appended. Pilot entered speeds in excess of current V_{mo}/M_{mo} are converted to current V_{mo}/M_{mo} when they are entered.

In some instances, the FMS cannot comply with the pilot entered speed command (i.e., V_{mo}/M_{mo}). The FMS displays the speed intervention target in inverse video as a reminder. These symbols and logic are also used for standard VFLCH waypoint speed commands when the FMS cannot comply with them. PROGRESS page 2/3 always displays the speed command actually sent to the autopilot.

To eliminate sudden and unexpected speed changes during switches from altitude capture to a VFLCH/FLCH descent, the speed command is deleted and the current airspeed is displayed. This is not applicable to aircraft equipped with a Collins system.

Speed intervention remains active until one of the following occurs:

1. Approaching the speed/altitude limit – PERFORMANCE INIT page 4/5 provides for pilot entry of a speed/altitude limit. As the aircraft approaches the speed limit altitude during the descent, the FMS compares the speed limit to the pilot entered airspeed. If the pilot entered airspeed is greater than the speed limit, the FMS replaces the pilot entered speed with the speed limit. The pilot may override the FMS by again entering the desired airspeed. The FMS will then remain in speed intervention and ignore the speed/altitude limit.
2. FMS phase of flight changes from descent to climb – This occurs whenever the altitude preselector is set above the current aircraft altitude.
3. Speed Reversion – Refer to Speed Protection on page 7-43.
4. Aircraft has landed.

Should any of the above conditions occur, speed intervention is canceled and the FMS switches to automatic speed command modes. When this occurs, ACTIVE FLT PLAN page 1 at 1R changes from SPD INTV to SPD CMD.

Manual

The pilot selects manual speed control from the Guidance Control Panel. In this mode, the FMS controls the aircraft speed to the manually entered speed. The active flight plan page displays the manually entered speed in line 1L. This is shown in Figure 7-26. Manual speed command mode is not available on all aircraft types.

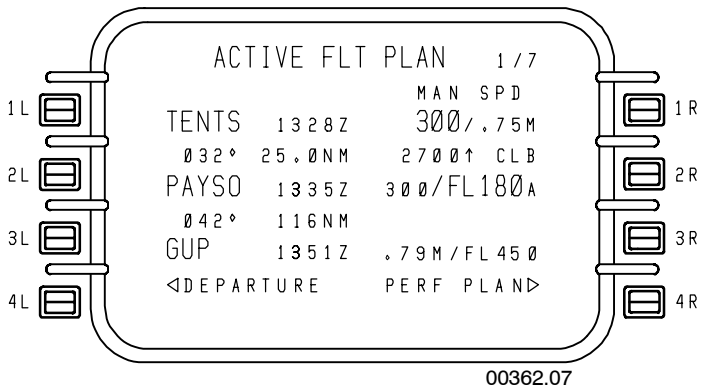


Figure 7-26

Speed Protection

The FMS provides two types of speed protection: automatic transition from VPATH to VFLCH (referred to as speed reversion) and latched speed.

During path descents, speed control is secondary to path control. If the path descent is too steep, the aircraft increases speed even at idle power. If this is the case, the FMS displays the message INCREASED DRAG REQUIRED. Should the aircraft speed continue to increase, the FMS transitions to speed reversion function. In this function, the FMS transitions from VPATH to VFLCH to enable the FMS to “pull off” the path and provide speed protection.

The FMS will automatically transition from VPATH to VFLCH for the following conditions:

- V_{mo}/M_{mo} - during a VPATH descent if CAS becomes greater than $V_{mo} + 10$ kts. The transition is canceled when the airspeed decreases to $V_{mo} + 2$ kts.
- Speed/Altitude limit - during a VPATH descent with autothrottles engaged, the FMS will output an altitude target equal to the speed limit altitude if the aircraft speed exceeds the speed

constraint (e.g., 250 knots at 10,000 feet) by more than 5 kts. Under these conditions, the FMS will level the aircraft at the speed limit altitude until the aircraft speed is 2 kts greater than the speed limit. The FMS will then request a VFLCH descent down to the altitude preselector.

If autothrottles are not engaged or the aircraft is not equipped with autothrottles, the FMS will continue the descent through the speed/altitude limit. The pilot is responsible for controlling the speed of the aircraft to meet the speed/altitude limit.

Speed/altitude limit protection is also provided during VFLCH descents. Under these conditions, the FMS will slow the aircraft to the speed limit when approaching the altitude associated with the speed limit.

- Landing gear or flap placard speed – during a VPATH descent, the aircraft speed exceeds the landing gear or flap placard speed by 10 kts.
- VREF – during a VPATH descent and the aircraft speed is less than VREF by 10 kts.

The second speed protection is latched speed mode. The FMS enters the latched speed mode during automatic transitions from one submode of VNAV to another. The latched speed mode is also entered if there is a significant difference between the actual aircraft speed and the speed command. Upon entering the latched speed mode, the FMS displays LATCHED at 1R of the ACTIVE FLT PLAN page. This is shown in Figure 7-27.

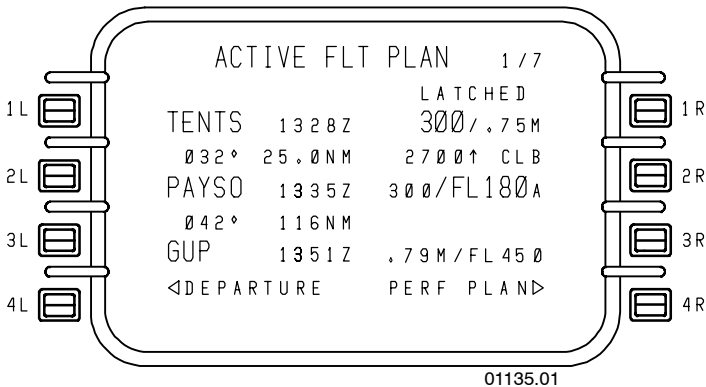


Figure 7-27

The conditions that can cause latched speed protection are as follows:

1. A latched speed can occur at the last BOD when the current speed command is more than 5 knots above the current airspeed. This is also true if the BOD altitude constraint is deleted.
2. A latched speed can occur if the altitude preselector is dialed while in VASEL to a BOD and the current target is greater than 5 knots more than the current speed.
3. If VNAV has transitioned out of VPATH and the current airspeed is not within 5 knots of the speed command.
4. If VNAV is in VPATH and the CAS becomes greater than $V_{mo} + 10$ knots, VNAV changes to VFLCH and latches to V_{mo} .

The LATCHED SPEED mode can be removed by entering *DELETE* from the scratchpad to line select 1R on page 1 of the ACTIVE FLT PLAN.

8. Progress

INTRODUCTION

The PROGRESS pages are accessed by pressing the PROG function key. These pages summarize important flight parameters and the aircraft's relationship to the flight plan.

- **PROGRESS 1/3** – Figure 8-1 is used to display the progress of the flight to the TO waypoint and the destination as well as the current navigation status.

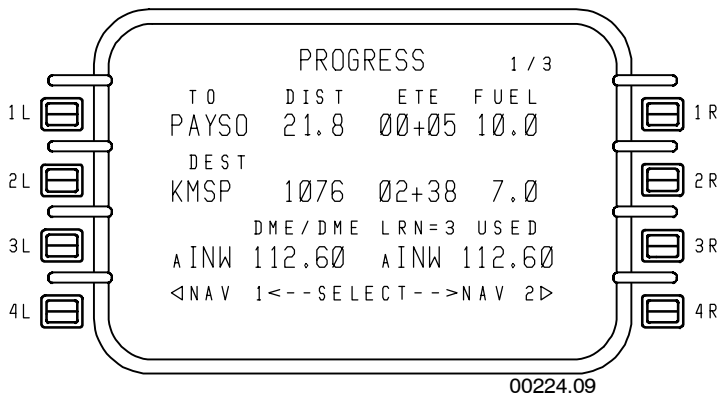


Figure 8-1

- **1L and 2L** – These lines display the Distance To Go (DTG), Estimated Time Enroute (ETE), and estimated fuel remaining for the TO waypoint and the destination. Pilot entry of any active flight plan waypoint is permitted at 1L or 2L. DTG, ETE and estimated fuel remaining will be displayed for the entered waypoint. No entry is permitted on 1R and 2R.
- **3L and 3R** – These lines display the current navigation mode of the FMS. In this example, the FMS is navigating using DME/DME and three long range NAV sensors (LRN=3). In addition, the NAV radios are tuned to the navaid INW (frequency 112.6). The **A** preceding the navaid identifier indicates the radio is in autotuning. Refer to Tuning NAV Radios, on page 6-107, for information on tuning the NAV radios.
- **4L and 4R** – These prompts provide access to the NAV 1 and NAV 2 pages. These pages list the six closest NAVAIDs to the aircraft. Refer to Tuning NAV Radios, on page 6-107, for information on tuning the NAV radios.

- **PROGRESS 2/3** – Figure 8-2 shows the current VNAV commands being transmitted to the FGC.

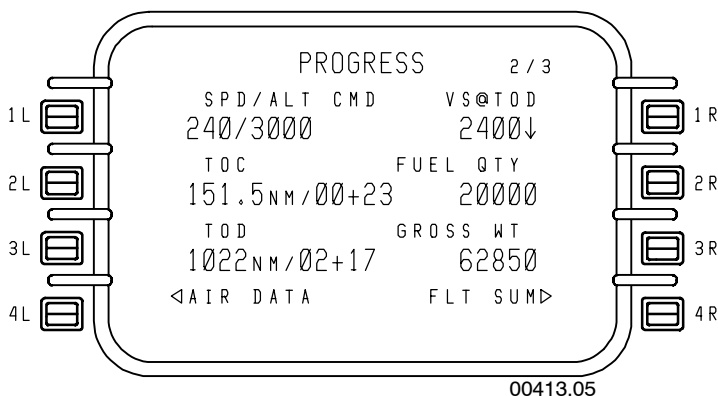


Figure 8-2

- **1L** – The current speed and altitude command is displayed on this line. No entry is permitted.
- **1R** – The estimated vertical speed at the TOD when a path descent is programmed is displayed on this line. If a path descent is not defined, the line is blank. No entry is permitted.
- **2L** – The distance and Estimated Time Enroute (ETE) to the Top Of Climb (TOC) is displayed on this line.
- **3L** – The distance and ETE to the TOD is displayed on this line. If the aircraft is past the TOD point, the prediction is replaced with the word PAST.
- **2R** – The current fuel quantity is displayed on this line.
- **3R** – The current aircraft gross weight is displayed on this line.
- **4L** – This prompt provides access to the AIR DATA page. Refer to page 8-5 for additional information on the AIR DATA page.
- **4R** – This prompt provides access to the FLIGHT SUMMARY page. Refer to page 6-190 for additional information on the FLIGHT SUMMARY page.

- **PROGRESS 3/3** – Figure 8–3 shows the PROGRESS 3/3 page.

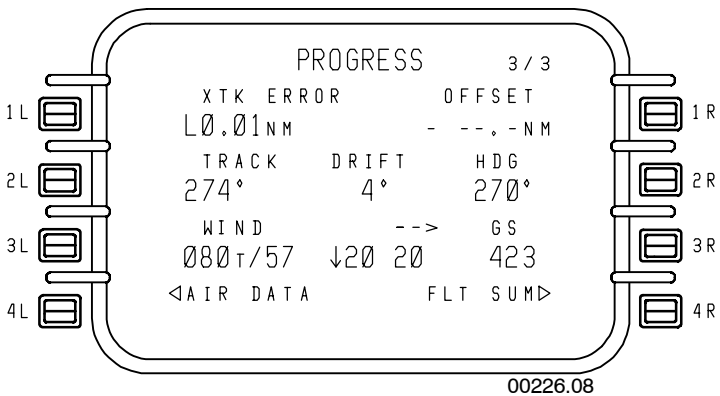
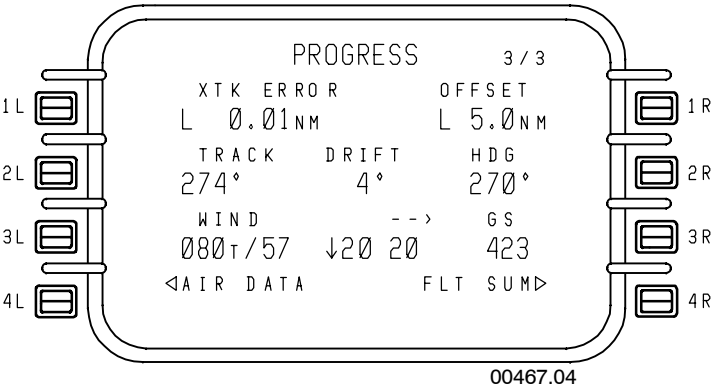


Figure 8-3

- **1L** – The current cross track error (XTK) relative to the active leg of the flight plan is displayed on this line. A 0.01 NM resolution is used when the cross track error is less than 1 NM. Larger cross track errors are displayed using a 0.1 NM resolution. No entry is permitted.
- **1R** – This line allows pilot entry of offset. Procedure 8–1 describes how to enter and remove an offset.
- **2L and 2R** – Aircraft track, drift and heading is displayed on this line. The heading shown is from the high priority heading source. In normal operations, this would be IRS 1 for FMS 1 and IRS 2 for FMS 2.
- **3L and 3R** – The FMS computed winds and groundspeed are displayed on this line.
- **4L** – This prompt provides access to the AIR DATA page. Refer to page 8-5 for additional information on the AIR DATA page.
- **4R** – This prompt provides access to the FLIGHT SUMMARY page. Refer to page 6-190 for additional information on the FLIGHT SUMMARY page.

LATERAL OFFSET

Lateral offsets are entered on the PROGRESS 3 page. The entry is described in Procedure 8–1.

Step	Procedure 8-1 Lateral Offset Entry
1	Select PROGRESS page 3.
2	Enter lateral offset into the scratchpad. Enter direction (L or R) and distance in nautical miles.
3	Enter the offset by pressing line select 1R.
4	The PROGRESS page is shown in Figure 8-4.  Figure 8-4 DETAILS - Lateral offsets cannot be entered while flying any of the following: 1. SIDs, STARs, approaches 2. Patterns 3. In the terminal area (10 NM from origin, 25 NM from destination) 4. In the polar region. Offsets are automatically canceled for the following: 1. Course changes greater than 90° 2. SIDs, STARs, approaches 3. Patterns 4. Intercepts. An OFFSET CANCEL NEXT WPT message is displayed before offset is automatically canceled.
5	To manually cancel the lateral offset waypoint, press the DEL key and line select *DELETE* to 1R.

AIR DATA

The AIR DATA page is shown in Figure 8-5. This page is accessed from PROGRESS page 2/3 or 3/3. The FMS displays and uses the active ADC selected for display on the EFIS. In typical operations, FMS 1 would display and use ADC 1. FMS 2 would display and use ADC 2. Should the copilot select ADC 1, FMS 2 would display and use ADC 1 data. The ADC data source is displayed as part of the title.

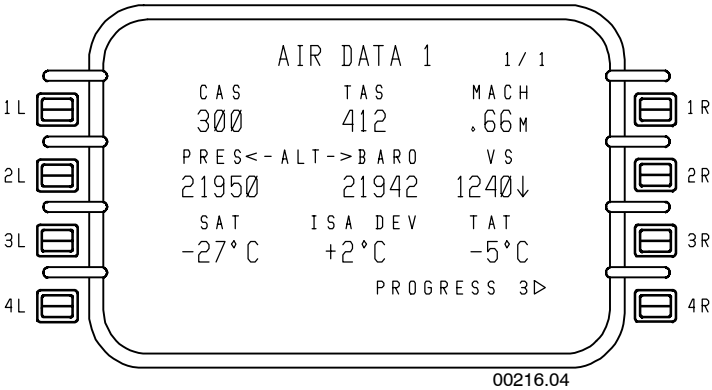


Figure 8-5

9. Direct/Pattern/Intercept

INTRODUCTION

The DIRECT, PATTERN, or INTERCEPT functions are accessed by pressing the DIR key. If the active flight plan is not being displayed when the DIR key is pressed, page 1 of the active flight plan is displayed. If the active flight plan is already displayed when pressing the DIR key, the display remains on the current page of the active flight plan. Pressing the DIR key inserts three prompts on the ACTIVE FLT PLAN pages. The three prompts, shown in Figure 9-1, are as follows:

- DIRECT (1L) (page 9-1)
- PATTERN (4L) (pages 6-125 and 9-3)
- INTERCEPT (4R) (page 9-4).

The three prompts are used to call up the respective function of the FMS. They remain displayed while paging through the active flight plan.

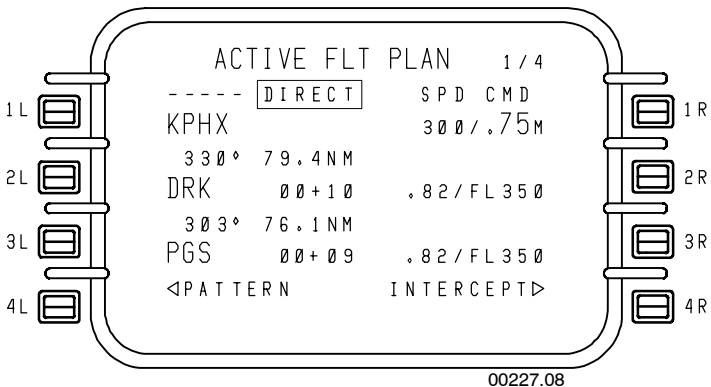


Figure 9-1

DIRECT-TO

The FMS direct-to function can be either lateral or vertical. The left line select keys are used for lateral direct-to and the right line select keys are used for vertical direct-to. The FMS also has a direct-to recovery function.

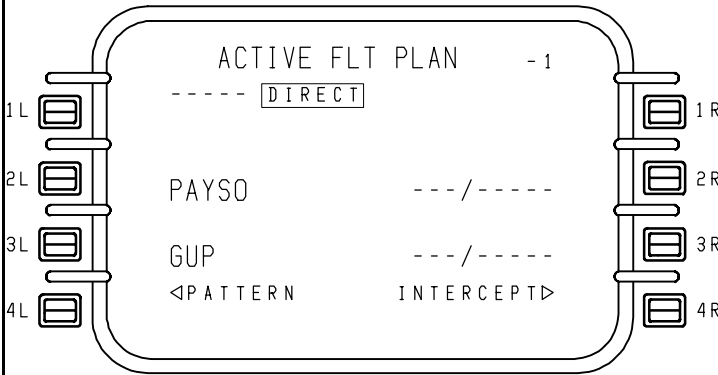
- **Lateral Direct-To** – There are two ways to operate the lateral direct-to after the DIR key is selected:
 - If the direct-to waypoint is in the flight plan, pressing the line select key next to the direct-to waypoint engages the direct-to. A direct-to course is calculated and the aircraft begins turning to the waypoint.
 - Enter the direct-to waypoint into the scratchpad and line select the waypoint to the dashed lines (1L on page 1). This completes the direct-to. This method is required when the direct-to waypoint is not already in the flight plan and is optional for waypoints in the flight plan.
- **Vertical Direct-To** – A vertical direct-to is operated in a similar manner as the lateral direct-to. A vertical direct-to is performed to an altitude constraint at a waypoint in the flight plan. The altitude constraint must be in the flight plan before the vertical direct-to is executed. Procedure 9-1 describes how to execute a vertical DIRECT-TO.

Vertical DIRECT-TO can be used for climbs and descents. The aircraft does not respond to the vertical DIRECT-TO unless the altitude selector is properly set above for climbs and below for descents.

Step	Procedure 9-1 Vertical Direct-To
1	Set the altitude selector to the cleared altitude.
2	Confirm that the altitude constraint is entered in the flight plan.
3	Press the DIR key.
4	Using the right-hand line selects (1R through 3R), press the line select adjacent to the altitude constraint.
5	If VNAV is engaged, the VNAV submode changes to VFLCH for climbs or VPATH for descents. All altitude constraints between the aircraft and the selected constraint are removed from the flight plan. No lateral changes are made to the flight plan. NOTE: If the altitude selector is still at the current altitude, the DIRECT-TO is performed. However, VNAV does not change to VFLCH or VPATH.

When performing a vertical DIRECT-TO for descent, VNAV calculates the angle from present position to the altitude constraint. The TOD is placed slightly ahead of the aircraft to allow a smooth descent transition. The calculated angle becomes the path angle for the descent. The calculated angle is limited between 1° and 6°. If the actual angle is less than 1° or greater than 6°, the FMS begins a descent to intercept the limiting angle of 1° or 6°.

- Direct-To Recovery** – Waypoints that were deleted by sequencing, or waypoints that were deleted when a lateral DIRECT-TO was entered, can be recalled. This is done as described in Procedure 9-2.

Step	Procedure 9-2 Direct-To Recovery
1	Press the DIR key.
2	Use the PREV key to select the page (or pages) displaying the waypoints that have been deleted or sequenced.
3	Use the line select keys to select the direct-to waypoint. This is shown in Figure 9-2. The FMS recalls the flight plan from the selected waypoint and proceeds directly to the selected waypoint.  Figure 9-2

PATTERN

The PATTERN prompt is displayed at 4L when the DIR key is pressed. The PATTERN prompt is used to start the pattern definition or review procedures. PATTERNS can also be selected from the NAV INDEX. Refer to the PATTERNS section, on page 6-125, for details.

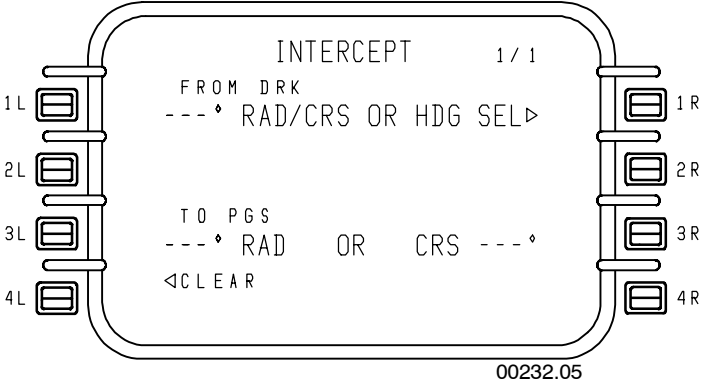
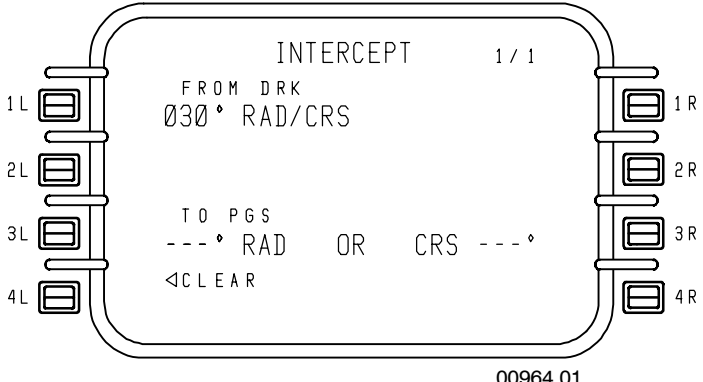
INTERCEPT

The FMS supports two types of intercept functions. The first type consists of defining a radial/course out of a waypoint until intercepting a radial or course into a second waypoint. The second type of intercept consists of the pilot flying a heading (either manually or via the flight director) towards the inbound radial/course for the waypoint. Both types of intercepts may be performed for waypoints or arcs.

Intercept Using Radial/Course

This type of intercept consists of the pilot defining a radial/course out of a waypoint until intercepting a radial or course into a second waypoint. This creates a defined latitude/longitude location and is placed into the active flight plan as a temporary (*RRxx) waypoint. Procedure 9-3 provides an example.

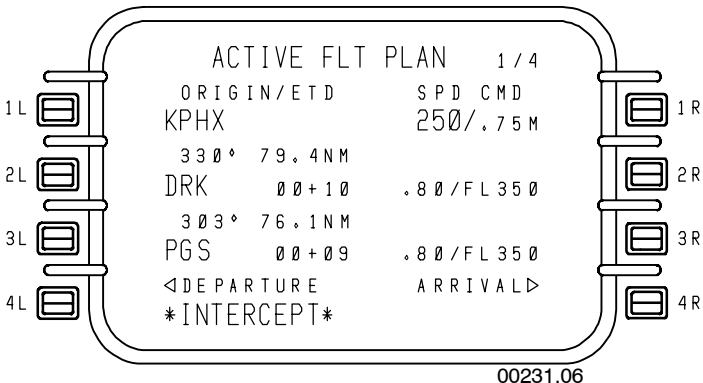
Step	Procedure 9-3 Intercept Using Radial/Course
1	Press the DIR key.
2	Press the line select key adjacent to the INTERCEPT prompt (4R).
3	*INTERCEPT* is displayed in the scratchpad. This is shown in Figure 9-3. 1L 2L 3L 4L ACTIVE FLT PLAN1 / 4 ORIGIN / ETD KPHX 330° 79.4NM DRK00+10 303° 76.1NM PGS00+09 <DEPARTURE *INTERCEPT* SPD CMD 250/.75M .80 / FL 350 .80 / FL 350 ARRIVAL > 1R 2R 3R 4R 00231.06 Figure 9-3
4	For this example, it is desired to fly outbound from DRK on the 30° radial until intercepting the 110° radial inbound to PGS. Insert *INTERCEPT* at 3L (where PGS is displayed in Figure 9-3) to define an intercept waypoint between DRK and PGS.

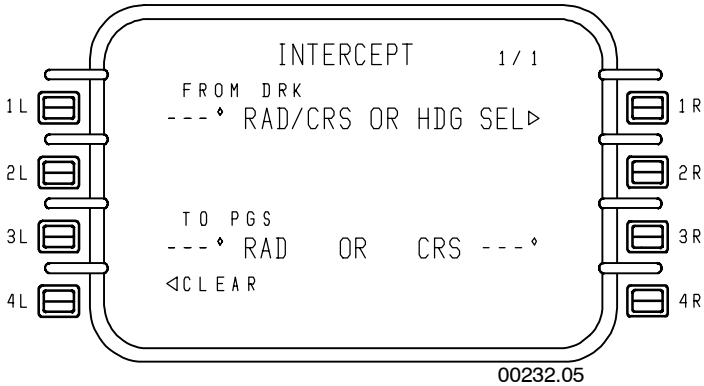
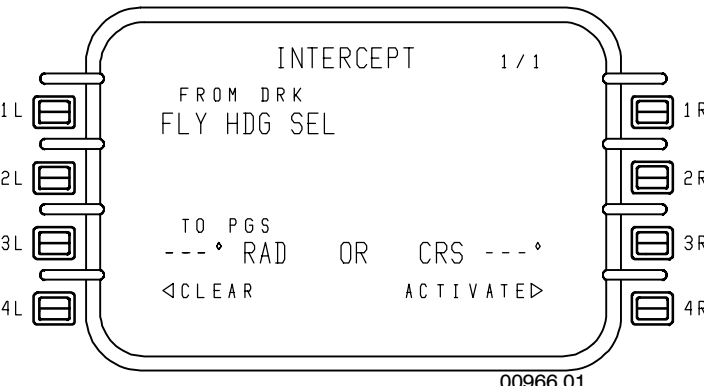
Step	Procedure 9-3 Intercept Using Radial/Course
5	The FMS displays the page that is used to define the *INTERCEPT* waypoint. This is shown in Figure 9-4.  Figure 9-4 shows the FMS Intercept page. The screen is framed by a rounded rectangle. On the left side, there are four input fields labeled 1L, 2L, 3L, and 4L. On the right side, there are four input fields labeled 1R, 2R, 3R, and 4R. The text on the screen is as follows: INTERCEPT 1 / 1 FROM DRK --- ° RAD/CRS OR HDG SEL> TO PGS --- ° RAD OR CRS --- ° <CLEAR The number 00232.05 is displayed at the bottom right of the screen. Figure 9-4
6	Define the radial/course out of the FROM waypoint (1L). For this example, it is desired to fly the 30° radial out of DRK. Figure 9-5 shows the INTERCEPT page following entry of the 30° radial.  Figure 9-5 shows the FMS Intercept page after entering 030° at the 1L input field. The screen is framed by a rounded rectangle. On the left side, there are four input fields labeled 1L, 2L, 3L, and 4L. On the right side, there are four input fields labeled 1R, 2R, 3R, and 4R. The text on the screen is as follows: INTERCEPT 1 / 1 FROM DRK 030° RAD/CRS TO PGS --- ° RAD OR CRS --- ° <CLEAR The number 00964.01 is displayed at the bottom right of the screen. Figure 9-5
7	Define the radial (3L) or course (3R) into the waypoint. For this example, it is desired to fly the 110° radial inbound to PGS. The number 110 is entered at 3L, as shown in Figure 9-6. The FMS will automatically display the course (290).

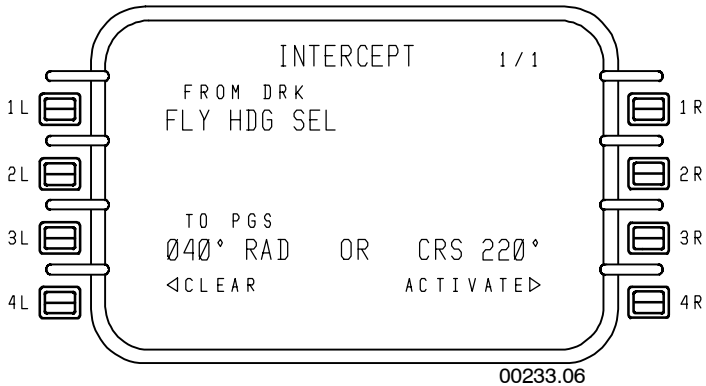
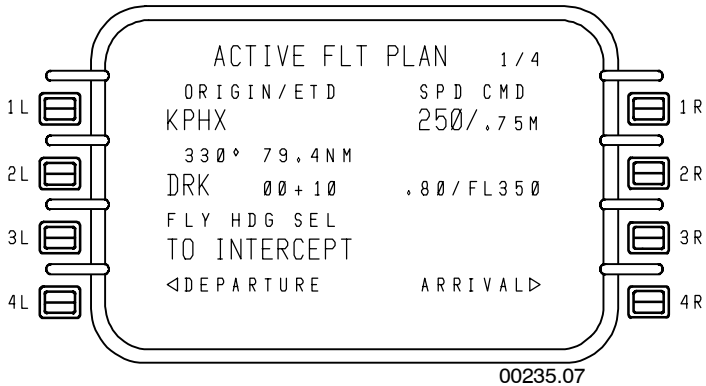
Step	Procedure 9-3 Intercept Using Radial/Course
	1L 2L 3L 4L INTERCEPT1 / 1 FROM DRK030° RAD/CRS T O P G S110° RAD OR CRS 290° <CLEAR ACTIVATED> 1R 2R 3R 4R 00965.01 Figure 9-6
8	Select ACTIVATE (4R) or CLEAR (4L). ACTIVATE is displayed at 4R after the intercept is defined.
9	1L 2L 3L 4L ACTIVE FLT PLAN1 / 4 ORIGIN/ETD SPD CMD KPHX 250 / .75M 330° 79.4NM DRK 00+10 .80 / FL350 030° 372NM *RR01 00+46 .80 / FL350 <DEPARTURE ARRIVAL> 1R 2R 3R 4R 00236.06 Figure 9-7

Intercept Using Heading Select

The heading select intercept consists of flying a heading out of the first waypoint until intercepting a radial or course into a second waypoint. The intercept point is not defined as a latitude/longitude since any heading may be flown out of the first waypoint. When flying outbound from the first waypoint, the FMS monitors the capture criteria for the radial or course inbound to the second waypoint. If LNAV is armed, the FMS will capture the inbound course to the second waypoint when the capture criteria is satisfied. Procedure 9-4 provides an example.

Step	Procedure 9-4 Intercept Using Heading Select
1	Press the DIR key.
2	Press the line select key adjacent to the INTERCEPT prompt (4R).
3	*INTERCEPT* is displayed in the scratchpad. This is shown in Figure 9-8.  00231.06 Figure 9-8
4	For this example, it is desired to fly outbound from DRK via radar vectors until intercepting the 040° radial inbound to PGS. Insert *INTERCEPT* at 3L (where PGS is displayed in Figure 9-8) to define an intercept between DRK and PGS.

Step	Procedure 9-4 Intercept Using Heading Select
5	The FMS displays the page that is used to define the *INTERCEPT*. This is shown in Figure 9-9.  Figure 9-9
6	For this example, heading vectors will be flown until intercepting the 040° radial inbound to PGS. Select HDG SEL at 1R in Figure 9-9. The FMS displays FLY HDG SEL at 1L, as shown in Figure 9-10.  Figure 9-10

Step	Procedure 9-4 Intercept Using Heading Select
7	Define the radial (3L) or course (3R) into the TO waypoint. For this example, it is desired to fly the 040° radial inbound to PGS. The number 040 is entered at 3L, as shown in Figure 9-11. The FMS will automatically display the course (220).  Figure 9-11
8	Select ACTIVATE (4R) or CLEAR (4L).
9	The defined temporary TO INTERCEPT waypoint is inserted into the flight plan. This is shown in Figure 9-12.  Figure 9-12

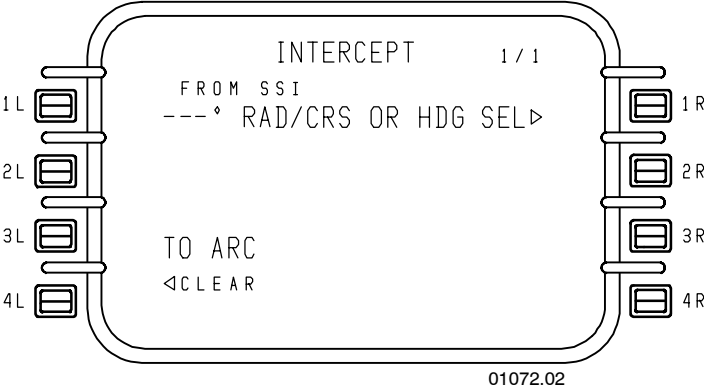
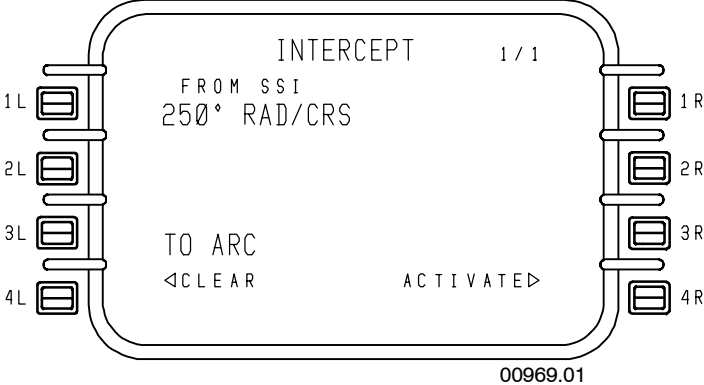
When this type of intercept is flown, the FMS disengages at the beginning of the heading select leg. For the example shown in Procedure 9-4, it would occur upon crossing DRK. The aircraft heading should be adjusted to intercept the inbound course. This can be done manually or by using the flight director heading function. LNAV should be armed in preparation for the intercept. **This feature is useful when the aircraft is being vectored for final or when flying heading select after takeoff to intercept a course onto the flight plan.**

Intercepting an Arc

If an arc exists in the active flight plan, the intercept function can be used to intercept the arc. The FMS supports intercepting the arc using a radial/course or heading select. Both types of intercepts are similar to intercepting a waypoint. Procedure 9-5 illustrates using the intercept function to fly a radial/course out of a waypoint to intercept an arc.

Step	Procedure 9-5 Intercept an Arc Using Radial/Course
1	Press the DIR key.
2	Press the line select key adjacent to the INTERCEPT prompt (4R).
3	*INTERCEPT* is displayed in the scratchpad. This is shown in Figure 9-13. 1 L 2 L 3 L 4 L ACTIVE FLT PLAN1 / 6 ORIGIN / ETDSPD CMD RW18 KSAV125 / .75 M 195 ° 65.8 NM SSI00 + 123.0 ° / 7600 302 ° 2.7 NM1400 ↓ D302GA00 + 003.0 ° / 6700 < DEPARTURERW POS > * INTERCEPT * 00967.01

Step	Procedure 9-5 Intercept an Arc Using Radial/Course
4	For this example, it is desired to fly outbound from SSI on the 250° radial until intercepting the 7 NM DME arc for the VOR Rwy 4 approach at KSSI. This arc starts at the 302° radial and proceeds counterclockwise around the VOR until it terminates at the 207° radial. Line select *INTERCEPT* to the second waypoint that has the inverse video A (this signifies the end of the arc leg). For this example, this would be waypoint D207G at 1L on page 2 of the ACTIVE FLT PLAN, as shown in Figures 9-14 and 9-15. ACTIVE FLT PLAN 1/6 ORIGIN/ETD SPD CMD RW18 KSAV 125/.75M 195° 65.8NM SSI 00+12 3.0°/7600 302° 2.7NM 1400↓ D302G A 00+00 3.0°/6700 <DEPARTURE RW POS> * INTERCEPT* 00967.01 Figure 9-14 ACTIVE FLT PLAN 2/6 212° 10.0NM 1000↓ DES D207G A 00+02 3.0°/1800 A 027° 6.6NM 800↓ DES SSI 00+01 3.0°/1600 A 027° 6.4NM 500↓ DES RW04 00+01 2.2°/0060 <DEPARTURE RW POS> * INTERCEPT* 00968.01 Figure 9-15

Step	Procedure 9-5 Intercept an Arc Using Radial/Course
5	The FMS displays the INTERCEPT page. This is shown in Figure 9-16. The FROM waypoint at 1L (SSI) is the waypoint in the active flight plan that precedes the arc.  01072.02 Figure 9-16
6	Enter an intercept radial/course (1L) from SSI to the arc. For this example, the 250 radial is entered at 1L. This is shown in Figure 9-17. If no intercept is found on the arc, the message NO CRS TO ARC INTERCEPT is displayed in the scratchpad.  00969.01 Figure 9-17
7	No entry is required for the TO waypoint since the intercept is to the arc. This is shown in Figure 9-17.

Step	Procedure 9-5 Intercept an Arc Using Radial/Course
8	Select ACTIVATE (4R) or CLEAR (4L). ACTIVATE is displayed after the intercept is defined. This is shown in Figure 9-17.
9	The defined *INTERCEPT* waypoint (now labeled *INTxx) is inserted into the flight plan as shown in Figure 9-18 and Figure 9-19. This temporary waypoint is the latitude/longitude location where the 250 radial from SSI intercepts the 7 NM DME arc. This waypoint has replaced D302G, the published starting point for the arc. ACTIVE FLT PLAN 1/6 ORIGIN/ETD SPD CMD RW18 KSAV 125/.75M 195° 65.8NM SSI 00+12 3.0°/6900 250° 6.3NM 1100↓ *INT01A 00+01 3.0°/4900 <DEPARTURE RW POSD> 00970.01 Figure 9-18 ACTIVE FLT PLAN 2/6 160° 4.3NM 1000↓ DES D207G 00+01 3.0°/1800 A 027° 6.6NM 800↓ DES SSI 00+01 3.0°/1600 A 027° F 6.4NM 500↓ DES RW04 00+01 2.2°/0060 <DEPARTURE RW POSD> 00971.01 Figure 9-19

10. Control Display Unit (CDU) Entry Format

INTRODUCTION

Each entry made to the CDU must be checked for correct syntax or format at the time the entry is line selected from the scratchpad. Table 10-1 defines the requirements for each type of entry.

- NOTES:**
1. Leading zeros and zeros after a decimal are not required.
 2. Data entry limits shown for some parameters can be exceeded.

LIST OF ENTRIES AND DEFINITION

Entry	Format
AGL (Above Ground Level)	• Entry in feet up to 4 digits • Leading zeros not required • Range from 0 to 9999
Airport Identifiers	The Flight Management System (FMS) uses four-character International Civil Aviation Organization (ICAO) or ICAO-format airport identifiers. If a U.S. airport has a 3-letter identifier in the Jeppesen charts, it is usually prefixed with a K in the data base. Alaskan and Hawaiian airports with a 3-letter identifier are usually prefixed with a P. Canadian airports with 3-letter identifiers are usually prefixed with a C. Airports with numbers in the identifier (such as P07) are also included in the navigation data base. Any other entry on an airport line is assumed to be a navaid, an intersection or a pilot defined waypoint. Runway data, including SIDs, STARs and approaches are available only with an airport from the Jeppesen data base.

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Airway	- Entry format is either <i>start.airway.end</i> or <i>airway.end</i> Where: Start = entry waypoint onto airway Airway = airway name End = exit waypoint of airway - If format <i>airway.end</i> is used, the entry waypoint onto airway must be in active flight plan and airway must be inserted into active flight plan following the waypoint - Airway is always followed by a decimal point - It is permitted to enter an airway into the active flight plan if the entry and exit waypoint are adjacent waypoints in the flight plan. In this case, enter the airway into the scratchpad (followed by a decimal point) and place it after the entry waypoint in the active flight plan
Alternate Destination	- The name can be from one to five alphanumeric characters - First character cannot be a dash (-)
Altitude (Any Altitude Entry)	- Limited to certified ceiling if Aircraft Data Base (ACDB) is valid - Entry in feet up to five digits - Entry in flight levels (FL) - Negative altitude permitted - Automatic conversion to flight levels above transition altitude - Range from FL000 to FL600; -1300 to 60000 feet

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Angle	• Entry in degrees and tenths of degrees; decimal required only when entering tenths • Range from 1.0 to 6.0
APU Configuration	See APU Fuel Flow
APU Fuel Flow	• Entry is pounds/hour or kilograms/hour depending upon configuration • Range from 0 to 99999
Bank Factor	• Entry is whole degrees • Range from 0 to 15
Barometer (BARO) Set	• Entry in millibars or inches of mercury (decimal required) • Leading zero not required • Range from 16.00 to 32.00 (in. Hg), 542 to 1083 (millibars)
Basic Operating Weight (BOW)	• Entry is pounds or kilograms depending upon configuration • Entry is four to six digits • Range is from 1000 to 999999
Cargo Weight	• Entry is pounds or kilograms depending upon configuration • Entry is one to six digits • Range is from 0 to 999999
Celsius (CONVERSION page format)	• Entry range is from -999.9° to 999.9° in 0.1 increments (decimal required for tenths) • A decimal is not required if tenths position is zero
Clearway	• Entry in feet up to four digits • Range is from 0 to 9999

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Coordinate Universal Time (UTC)	• Entry is one to four digits • Range is from 0 to 2359 • Leading zeros are not required
Date	• Entry in day month year (no spaces) • Day is one or two digits • Month is three-letter abbreviation • Year is two digits
Destination	• The name can be from one to five alphanumeric characters • First character cannot be a dash (-)
Direct-To Waypoint	• The name can be from one to five alphanumeric characters • First character cannot be a dash (-)
Elevation	• Entry format is identical to the Altitude entry format defined on page 10-2
EPR	• Entry range is from 1.00 to 2.00 • Trailing decimal and/or zeros not required
Fahrenheit (CONVERSION page format)	• Entry range is from -999.9° to 999.9° in 0.1 increments (decimal required for tenths) • A decimal is not required if tenths position is zero
Feet (CONVERSION page format)	• Entry range is from 0 to 999999.9 Ft in 0.1 increments (decimal required for tenths)

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Flight Plan Name (Any Entry)	• Use six to 10 alphanumeric characters • First character cannot be a dash (-) • If QABC-QCDF(x) format is used, QABC and QCDF are automatically used as the origin and destination of the stored flight plan
Frequency (ADF)	• The minimum entry is three digits • A decimal is not required if tenths position is zero • Range is 100.0 to 1799.5 KHz, 2179.0 to 2185.0 KHz in 0.5 increments
Frequency (DGPS)	Runway • The minimum entry is 1 letter airport identifier and runway number Channel • The minimum entry is 1 number and a letter • Numeric range is 0 through 399 • Letter range is A through H Final approach segment • Entry is optional • Range is letters A through Z
Frequency (HF)	• The minimum entry is five digits • Range is 20000 to 299999 MHz in increments of 1

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Frequency (NAV)	• The minimum entry is two digits • A decimal is not required if tenths and hundredths are zero • Leading digit (1) is not required • Range is 108.00 to 117.95 MHz; 133.30 to 134.25 MHz; 134.40 to 135.95 MHz in 0.05 increments NOTE: Not all radios are capable of this range.
Frequency (TRANSPONDER)	• A four-digit entry is required • The range for each digit is 0 to 7
Frequency (VHF COM)	• The minimum entry is two digits • Decimal point and/or trailing zeros are not required • Leading digit (1) is not required • Range is 118.000 to 151.975 MHz in 0.005 increments
Fuel Flow	• Entry is pounds or kilograms depending upon configuration • Range is from 0 to 99999
Fuel Weight	• Entry is pounds or kilograms depending upon configuration • Entry is one to six digits • Range is from 0 to 999999
Gallons	• Entry range is from 0 to 999999.9 GAL in 0.1 increments (decimal required for tenths) • A decimal is not required if tenths position is zero

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Hold Inbound Course/Direction	• Entry of one to three digits is required for course • Entry of L or R is for turn direction • Slash (/) is required when making both entries or turn direction only • The range of course is 0 to 360 degrees in increments of 1
Hold Leg Distance	• The minimum entry is one digit • Range is 1.0 to 20.0 NM in 0.1 increments
Hold Leg Time	• The minimum entry is one digit • Range is 0.5 to 3.0 minutes in 0.1 increments
Instrument Landing System (ILS) Identifier	• The minimum entry is one character • The maximum entry is four characters
Intercept Radial/Course	• The minimum entry is one digit • Range is from 0 to 360 degrees in 1 increments
International Standard Atmosphere (ISA) Deviation	• Entry is degrees, up to two digits and negative sign if required • Range is from -59° to +20° Celsius
Kilograms (CONVERSION page format)	• Entry range is from 0 to 999999.9 KG in 0.1 increments (decimal required for tenths) • A decimal is not required if tenths position is zero
Kilometers (CONVERSION page format)	• Entry range is from 0 to 999999.9 KM in 0.1 increments (decimal required for tenths) • A decimal is not required if tenths position is zero

CDU Entry Format
Table 10-1 (cont)

Entry	Format																
Knots (CONVERSION page format)	- Entry range is from 0 to 999.9 KTS in 0.1 increments (decimal required for tenths) - A decimal is not required if tenths position is zero																
Latitude	- The first character must be N or S - Degrees range from 0 to 90 - Minutes range is from 0.0 to 59.99 in 0.01 increments - Example of entries:<table><tr><td><u>Entry</u></td><td><u>Display</u></td></tr><tr><td>N0</td><td>N0000.00</td></tr><tr><td>N1</td><td>N0100.00</td></tr><tr><td>N12</td><td>N1200.00</td></tr><tr><td>N123</td><td>N1230.00</td></tr><tr><td>N1234</td><td>N1234.00</td></tr><tr><td>N1234.5</td><td>N1234.50</td></tr><tr><td>N1234.56</td><td>N1234.56</td></tr></table>	<u>Entry</u>	<u>Display</u>	N0	N0000.00	N1	N0100.00	N12	N1200.00	N123	N1230.00	N1234	N1234.00	N1234.5	N1234.50	N1234.56	N1234.56
<u>Entry</u>	<u>Display</u>																
N0	N0000.00																
N1	N0100.00																
N12	N1200.00																
N123	N1230.00																
N1234	N1234.00																
N1234.5	N1234.50																
N1234.56	N1234.56																
Latitude/Longitude	Entry of both latitude and longitude is made by combining the latitude and longitude entry with no space between (Example: N50W50).																
Latitude/Longitude/ Altitude Constraint	- Similar to Latitude/Longitude, but with the addition of an altitude constraint - The altitude constraint entry format is identical to the Altitude entry format defined on page 10-2																
Liters (CONVERSION page format)	- Entry range is from 0 to 999999.9 L in 0.1 increments (decimal required for tenths) - A decimal is not required if tenths position is zero																

CDU Entry Format
Table 10-1 (cont)

Entry	Format																		
Longitude	- The first character must be E or W - Range of degrees is from 0 to 180 - Range of minutes is from 0 to 59.99 in 0.01 increments - Example of entries: <table> <tr> <td><u>Entry</u></td><td><u>Display</u></td></tr> <tr> <td>W0</td><td>W00000.00</td></tr> <tr> <td>W1</td><td>W00100.00</td></tr> <tr> <td>W12</td><td>W01200.00</td></tr> <tr> <td>W123</td><td>W12300.00</td></tr> <tr> <td>W1234</td><td>W12340.00</td></tr> <tr> <td>W12345</td><td>W12345.00</td></tr> <tr> <td>W12345.6</td><td>W12345.60</td></tr> <tr> <td>W12345.67</td><td>W12345.67</td></tr> </table>	<u>Entry</u>	<u>Display</u>	W0	W00000.00	W1	W00100.00	W12	W01200.00	W123	W12300.00	W1234	W12340.00	W12345	W12345.00	W12345.6	W12345.60	W12345.67	W12345.67
<u>Entry</u>	<u>Display</u>																		
W0	W00000.00																		
W1	W00100.00																		
W12	W01200.00																		
W123	W12300.00																		
W1234	W12340.00																		
W12345	W12345.00																		
W12345.6	W12345.60																		
W12345.67	W12345.67																		
Meters (CONVERSION page format)	- Entry range is from 0 to 999999.9 M in 0.1 increments (decimal required for tenths) - A decimal is not required if tenths position is zero																		
Meters/Second	- Entry range is from 0 to 999.9 M/S in 0.1 increments (decimal required for tenths) - A decimal is not required if tenths position is zero																		
N1	- Entry range is from 70.0 to 99.0 - Trailing decimal and/or zeros not required																		
Nautical Miles (CONVERSION page format)	- Entry range is from 0 to 999999.9 NM in 0.1 increments (decimal required for tenths) - A decimal is not required if tenths position is zero																		

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Nondirectional Beacons	All nondirectional beacons in the NAV data base are accessed by appending the NB suffix to the beacon identifier • The minimum entry is three characters • The maximum entry is five characters NOTE: If the NDB also has a waypoint identifier, it is in the NAV data base <u>only</u> under the waypoint name.
Obstacle Distance	• Entry is one to six digits • Range is from 0 to 1220
Obstacle Elevation	• Entry is one to five digits • Range is from -2000 to 16500
Oceanic Waypoints	• These waypoints are named according to ARINC 424 navigation data base specification • Southern hemisphere uses the letters S or W • Northern hemisphere uses the letters N or E • Latitude always proceeds longitude • Only the last two digits of longitude are used • Placement of the letter designator (N, S, E, W) in the string of five characters indicates the value of the longitude one-hundredths digit - The letter in the last position indicates longitude is less than 100 - The letter in the third position indicates longitude is 100 or greater

CDU Entry Format
Table 10-1 (cont)

Entry	Format															
Oceanic Waypoints (cont)	- Letters are used for position designation as follows:<table><tr><th><u>Letter</u></th><th><u>Lat</u></th><th><u>Lon</u></th></tr><tr><td>N</td><td>North</td><td>West</td></tr><tr><td>E</td><td>North</td><td>East</td></tr><tr><td>S</td><td>South</td><td>East</td></tr><tr><td>W</td><td>South</td><td>West</td></tr></table> - Examples: N 52 00/W 075 00 = 5275N N 75 00/W 170 00 = 75N70 S 50 00/E 020 00 = 5020S N 50 00/E 020 00 = 5020E S 52 00/W 075 00 = 5275W NOTE: All oceanic waypoints may not be active in the navigation data base.	<u>Letter</u>	<u>Lat</u>	<u>Lon</u>	N	North	West	E	North	East	S	South	East	W	South	West
<u>Letter</u>	<u>Lat</u>	<u>Lon</u>														
N	North	West														
E	North	East														
S	South	East														
W	South	West														
Offset (lateral)	- The minimum entry is L or R plus one digit - Range is 0.1 to 30.0 NM in 0.1 increments															
Orbit Radius	- Entry is in tenths of NM - Range is from 1.0 to 99.9 in 0.1 increments															
Orbit Speed	- Minimum entry for CAS is two digits - Range of CAS is from 75 to 340 kts															
Origin	- The name can be from one to five alphanumeric characters - First character cannot be a dash (-)															
Outside Air Temperature	- Entry is in degrees up to two digits and negative sign if required - Range is from -80° to 54° Celsius - Range is from -112° to 129° Fahrenheit															

CDU Entry Format**Table 10-1 (cont)**

Entry	Format
Passengers	• Entry is pounds or kilograms depending upon configuration • The minimum entry is one digit • Range is 0 to 999
Passenger Weight	• Entry is pounds or kilograms depending upon configuration • The minimum entry of slash (/) plus one digit • Range is 0 to 300
Place/Bearing/ Distance (P/B/D)	• Place is any defined waypoint name • Bearing entry minimum is one digit • Distance minimum entry is one digit • Bearing range is from 0 to 360 degrees in 0.1 increments (decimal required for tenths) • Bearing is True by placing T after the number (e.g., PXR/090T/30) • Distance range is from 0 to 9999.9 NM in 0.1 increments (decimal required for tenths)
Place/Bearing/ Distance/Altitude Constraint (P/B/D/ALT)	• Similar to P/B/D, but with the addition of an Altitude constraint • The altitude constraint entry format is identical to the Altitude entry format defined on page 10-2
Place/Bearing/Place/ Bearing (P/B/P/B)	• Place is any defined waypoint name • Bearing entry minimum is one digit • Bearing range is from 0 to 360 degrees in 0.1 increments (decimal required for tenths) • Bearing is True by placing T after the number (e.g., PXR/090T/30)

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Place/Bearing/Place/ Bearing/Altitude Constraint (P/B/P/B/ALT)	• Similar to P/B/P/B, but with the addition of an Altitude constraint • The altitude constraint entry format is identical to the Altitude entry format defined on page 10-2
Place//Distance (P//D)	• Place is any defined waypoint name • Distance entry minimum is one digit • Distance range is from 0 to 9999.9 NM in 0.1 increments (decimal required for tenths)
Place//Distance/ Altitude Constraint (P//D/ALT)	• Similar to P//D, but with the addition of an Altitude constraint • The altitude constraint entry format is identical to the Altitude entry format defined on page 10-2
Pounds (CONVERSION page format)	• Entry range is from 0 to 999999.9 LB in 0.1 increments (decimal required for tenths) • A decimal is not required if tenths position is zero
Procedure Turn Outbound Dist	• The minimum entry is one digit • Range is 0.1 to Boundary Dist – 4 NM in 0.1 increments
Procedure Turn Outbound Time	• The minimum entry is one digit • Range is 0.1 to (Boundary Dist – 4 NM)/groundspeed in 0.1 increments
Procedure Turn Out Angle	• The turn out angle is prefixed with the turn out direction L or R • The turn out angle range is 20 to 90 degrees in 1 increments
Pseudo-Random Noise (PRN)	• Entry is one or two digits • Range is from 1 to 32

CDU Entry Format
Table 10-1 (cont)

Entry	Format
QFE/QNH	• Entry in inches of Mercury, millibars/hectopascals, or millimeters • Entry range is from 16.00 to 32.00 in Hg, 542 to 1084 mb, and 407 to 813 mm • A decimal is not required if all zeros follow decimal point
Quadrant	• The minimum entry is one alpha character • Possible entries are N, NE, E, SE, S, SW, W, NW
Radial	• The minimum entry is one digit • Range is from 0.0 to 360 in 0.1 increments
Radial Distance	• Minimum entry of one digit • Range from 1.0 to 999.9 NM in 0.1 increments
Radial Inbound and Outbound Radials	• Minimum entry of one digit • Range from 0.0 to 360.0 in 0.1 increments
Reference Waypoint	• The name can be from one to five alphanumeric characters • First character cannot be a dash (-)
Reserve Fuel (Minutes)	• Entry is in minutes up to three digits • Range is from 0 to 999 minutes
Reserve Fuel	• Entry is pounds or kilograms depending upon configuration • Entry is one to six digits • Range is from 0 to 999999

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Runway Elevation	• Entry is in feet up to five digits and negative sign if required • Range is from -2000 to 19999 feet
Runway Heading	• Entry is in degrees or runway numbers • Range is from 0 to 360, or 00 to 36 runway number
Runway Identifier	• Entry is Airport.Runway • Range for airport name is from 1 to 5 alphanumeric characters • The runway is the runway number with an optional suffix (e.g., L, R, or C) • Range for runway number is from 01 to 36
Runway Length	• Entry is in feet from 2000 to 16000
Runway Slope	• Entry may have a minus sign (-) • Range is from -2.0% to 2.0%
Runway Stopway	• Entry is in feet up to four digits • Range is from 0 to 9999
Runway Threshold	• Entry is in feet up to four digits • Range is from 0 to 9999
Specific Weight	• Entry range is from 1.000 to 9.999 LB/GAL (-.1198 to 1.1982 KG/L) in 0.001 increments (decimal required for tenths) • A decimal is not required if all numbers following are zero

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Speed (Any CAS/MACH Entry)	• Limited to VMO/MMO if Aircraft Data Base (ACDB) is valid • Minimum entry for CAS is two digits • Minimum entry for MACH is decimal plus one digit • Range of CAS is from 75 to 450 kts • Range of MACH is from .30 to .95 in 0.01 increments
Speed (Any Ground Speed Entry)	• Minimum entry is two digits • Range from 75 to 750 kts
Speed Set Title	• Entry is 1 to 11 characters
State 1, State 2, State 3, State 4	See APU Fuel Flow
Step Increment	• Entry in feet up to five digits • Range is from 0 to 30000 in increments of 1000 • Entries less than 1000 are interpreted as thousands
Stopway	• Entry is in feet up to four digits • Range is from 0 to 9999
Temperature	• Entry is in degrees and negative sign if required • Range from -80° to 54° Celsius • Range from -112° to 129° Fahrenheit

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Temporary Waypoint	Active flight plan entries that create temporary waypoints: • Coordinates • Place/Bearing/Distance • Place/Bearing/Place/Bearing • Place/Distance • Intercept Function Refer to page 7-2 for additional details about temporary waypoints.
Threshold	• Entry is in feet up to four digits • Range is from 0 to 9999
VIA.TO	The VIA.TO prompt is used in flight planning. A variety of entries are possible with the prompt. The same entries can be made to the flight plan without the prompt (such as when adding waypoints). The following is a list of possible entries: • Airway.Waypoint • Flight Plan Name.Waypoint • Flight Plan Name • Waypoint • Temporary Waypoint
VOR Identifier	• The minimum entry is one character • The maximum entry is three characters
Waypoint Name	• The name can be from one to five alphanumeric characters • First character cannot be a dash (-)
Weight (any weight entry)	• Entry is pounds or kilograms depending on configuration • Entry is one to six digits • Range is from 0 to 999999

CDU Entry Format
Table 10-1 (cont)

Entry	Format
Wind (Any Wind Entry)	• Entry is made in the form of direction/speed • The minimum entry for direction is one digit • The minimum entry for speed is one digit • The range of direction is 0 to 360 degrees • The range of speed is 0 to 250 kts

CDU Entry Format
Table 10-1

11. Messages

INTRODUCTION

The FMS generates messages that alert the pilot to certain conditions. The messages are displayed in the scratchpad and light the MSG light on the CDU. Any entry already in the scratchpad is placed in a stack. The CLEAR key clears a message and displays the next message or entry from the stack. Correcting whatever caused the message clears some of the messages.

Two types of messages are contained in the FMS, alerting and advisory. Alerting messages are more important. The external annunciator, located on the pilot's and copilot's instrument panel, and the message annunciator are lit for alerting messages. Advisory messages only turn on the message annunciator on the CDU.

Table 11-1 contains an alphabetical list of all messages. The list includes the type of message and a brief explanation of what the message means.

MESSAGE LIST AND DEFINITION

Message	Type	Definition
ACARS DMU FAILED	ALERTING	An ACARS I/O failure has occurred.
ACTIVE MODE IS MAG HDG	ALERTING	The magnetic heading has been automatically selected.
ACTIVE MODE IS TRUE HDG	ALERTING	The true heading has been automatically selected.
ADC 1 FAILED ADC 2 FAILED	ALERTING	The FMS senses an ADC failure.
AFIS DMU FAILED	ALERTING	The FMS senses an AFIS DMU failure.
AIRCRAFT DB REQD	ADVISORY	The pilot must load an aircraft data base before selecting the FULL PERF mode.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
ALREADY EXISTS	ADVISORY	A duplicate entry has been entered into a list and is not permitted.
ATT/HDG 1 FAILED ATT/HDG 2 FAILED	ALERTING	The FMS is no longer receiving heading and attitude data for the identified unit.
APPROACH CLIMB LIMITED	ALERTING	This message is displayed when the landing calculations are approach climb limited.
BRG/CRS MUST BE IN TRUE	ALERTING	The bearing entry must be in true (entered xxxT) because the reference waypoint is outside the coverage of the magnetic variation table.
BUSY-REENTER LAST CHG	ADVISORY	This message indicates that a change to the custom data base was attempted when the cross side had locked the custom data base for a change it is making.
CAPTURE DISK IS FULL	ADVISORY	The disk in the data loader is full.
CHECK ALT CONSTRAINT	ALERTING	The pilot must check altitude constraints for a conflict between type of constraints (CLB or DES) and current flight mode (climbing or descending).
CHECK ATT/HDG CONFIG	ALERTING	More than one input port has been configured with the same ASCB ATT/HDG sensor number.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
CHECK BARO SET	ALERTING	The aircraft has passed the transition altitude by more than 1,000 feet or is leveling and the baro set has not been adjusted to the proper value. This message appears during climbs and descents.
CHECK DATA LOAD (xx)	ADVISORY	The attempted data loader operation has failed. The failure reason is indicated by the value xx. Refer to Section 12, Maintenance, for decoding xx value.
CHECK DEST FUEL	ALERTING	The destination fuel equals zero.
CHECK DMU	ALERTING	The FMS has been waiting for a flight plan from the AFIS DMU for over 30 seconds.
CHECK GPS CONFIG	ALERTING	More than one input port has been configured with the same GPS sensor number OR multiple GPS are configured and one of the sensors has an SDI of 0.
CHECK GPS POSITION CHECK GPS 1 POSITION CHECK GPS 2 POSITION CHECK GPS 3 POSITION	ALERTING	The position from the identified GPS sensor is more than 10 NM from the FMS position.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
CHECK IRS CONFIG	ALERTING	More than one input port has been configured with the same IRS sensor number OR multiple IRSs are configured and one of the sensors has an SDI of 0.
CHECK IRS POSITION CHECK IRS 1 POSITION CHECK IRS 2 POSITION CHECK IRS 3 POSITION CHECK IRS 4 POSITION	ALERTING	The position from the identified IRS sensor is more than 10 NM from the FMS position.
CHECK LOADED WIND/TEMP	ADVISORY	This message indicates that there was a problem with some of the wind/temperature data that was loaded with the flight plan when it was activated.
CHECK RADIO CONFIG	ALERTING	The onside radio has been configured to an illegal configuration.
CHECK RESERVE FUEL	ALERTING	The planned reserve fuel is equal to or less than the reserve fuel required.
CHECK SPD/ ALTITUDE LIMIT	ALERTING	The upcoming speed and/or altitude constraint must be checked and proper action taken in order to meet the constraints.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
CHECK SPEED CONSTRAINT	ALERTING	In cruise or descent in VNAV, the aircraft is approaching a waypoint that has a speed constraint if the FMS predicts that (based on current speed and deceleration) the constraint speed will be exceeded.
CHECK VOR/DME POSITION	ALERTING	The position from the identified VOR/DME is more than 10 NM from the FMS position.
CHECK *PD PLACEMENT	ADVISORY	The waypoint was inserted someplace other than the exact spot indicated by the entry.
COMPARE FMS POSITIONS	ALERTING	The positions of the FMSs have a difference greater than 5 NM. The systems continue to operate normally.
COMPARE FUEL QUANTITY	ALERTING	The FMS fuel quantity, decremented by fuel flow and the sensed fuel quantity, differ by more than 2% of the Basic Operating Weight (BOW).
CONFIG DATA INVALID	ALERTING	Configuration module failed at power up.
CROSSWIND EXCEEDS 22KTS	ADVISORY	Crosswind components exceed the 22 KT limit.
DATA BASE OUT-OF-DATE	ADVISORY	On powerup, or on completion of NAV data base loading, the NAV data base is not current to the date entered in the FMS.
DATALOADER IN USE	ADVISORY	Indicates that the data loader is being used.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
DATALOADER UPDATE NEEDED	ADVISORY	Indicates that the data loader needs an update for the requested function.
DB TRANSFER ABORTED	ADVISORY	Indicates that transfer of the data base has been aborted.
DB TRANSFER COMPLETE	ADVISORY	Indicates that transfer of the data base has been completed.
DB TRANSFER IN PROGRESS	ADVISORY	Indicates that transfer of the data base is in progress.
DISK IS NOT FORMATTED	ADVISORY	Indicates that the disk in the data loader needs to be formatted.
DISK IS WRITE PROTECTED	ADVISORY	Indicates that the disk in the data loader is write protected.
DME 1 FAILED DME 2 FAILED	ALERTING	Indicates that the FMS senses a DME failure for the identified unit.
DUPLICATE FLT PLAN NAME	ADVISORY	A stored flight plan already exists with the entered flight plan name.
END OF FLIGHT PLAN	ALERTING	Indicates the last defined waypoint. It does not apply to the destination waypoint.
ENDING WPT NOT FOUND	ADVISORY	The ending waypoint of an airway or flight plan cannot be found.
ENTERING POLAR REGION	ALERTING	The polar region at 85° North or South has been entered.
EXCEEDS CEILING ALTITUDE	ALERTING	This message is displayed when the cruise altitude exceeds the recommended performance altitude.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
EXCEEDS CERT CEILING	ADVISORY	This message is displayed when the entered altitude is above the certified ceiling for the aircraft.
EXCEEDS MAX GROSS WEIGHT	ADVISORY	The gross weight exceeds the maximum ramp weight in the aircraft data base.
EXCEEDS MAX LANDING WT	ALERTING	The projected landing weight exceeds the maximum landing weight.
EXCEEDS MAX TAKEOFF WEIGHT	ALERTING	This message is displayed when takeoff weight exceeds the maximum allowable. In this case, takeoff data is computed at the maximum allowable takeoff weight.
EXCEEDS P ALTITUDE LIMIT	ALERTING	This message is displayed when the pressure altitude limit is exceeded.
EXCEEDS WIND LIMITS	ALERTING	This message is displayed when the wind limits for takeoff or landing are exceeded.
EXITING POLAR REGION	ALERTING	The aircraft is leaving the polar region at 84° North or South.
FIELD LENGTH LIMITED	ALERTING	This message is displayed when the landing calculations are field length limited.
FILE NOT FOUND	ADVISORY	The requested file is not on the disk.
FLT PATH ANGLE TOO STEEP	ALERTING	The VNAV flight path angle exceeds the limit (6°).

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
FLT PLAN CHANGED	ADVISORY	The fix location at which a pattern is defined is different from when it was defined in the stored flight plan.
FLT PLAN RECEIVED	ALERTING	An AFIS flight plan has been received.
FLIGHT PLAN FULL	ADVISORY	The flight plan is full and is displayed when the pilot attempts to enter more than 100 waypoints in a flight plan.
FMS BATTERY MAINT REQD	ALERTING	The FMS battery is low and requires maintenance within 3 weeks.
FMS POSITIONS DIFFERENT	ALERTING	The FMS positions differ by 10 nautical miles or more.
FPL AUTO LOAD DISABLED	ALERTING	Automatic loading of the active flight plan to the warm spare FMS has been disabled. This occurs if the warm spare FMS is coupled to the flight director.
FPL CONTAINS INVALID WPT	ADVISORY	The stored flight plan has undefined or invalid waypoints.
FPL STORAGE FULL	ADVISORY	The storage area for flight plans is full.
FULL PERF UNAVAIL	ALERTING	A numerical fault has occurred in the active predictions and the FULL PERF mode is not available.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
GPS FAILED GPS 1 FAILED GPS 2 FAILED GPS 3 FAILED	ALERTING	Indicates that inputs from the identified GPS have failed.
GPS RAIM ABOVE LIMIT	ALERTING	The RAIM value is above the limit for the current phase of flight.
GPS RAIM UNAVAILABLE	ALERTING	RAIM is not being generated by the GPS receiver.
HIGH PCDR TURN GRD SPD	ALERTING	The groundspeed exceeds the limit for the defined procedure turn.
HIGH HOLDING GRD SPD	ALERTING	The groundspeed exceeds the limits for the FAA allowable size of holding pattern.
INDEPENDENT OPERATION	ALERTING	The system reverted to independent operation.
INTERSECTION NOT FOUND	ADVISORY	PD waypoint does not intersect the active flight plan.
INVALID AIRCRAFT DB	ALERTING	The aircraft data base has been corrupted and has been cleared and initialized.
INVALID CUSTOM DB	ALERTING	The custom DB has been corrupted and has been cleared and initialized.
INVALID DELETE	ADVISORY	Indicates invalid entry of the named parameter.
INVALID DIRECT TO	ADVISORY	Indicates invalid entry of the named parameter.
INVALID ENTRY	ADVISORY	Entry is not in the correct format.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
INVALID NAV DB	ALERTING	The navigation data base is invalid and is not useable. Reload the data base.
INVALID NOTAM LIST	ADVISORY	Indicates that the NOTAM is invalid and has been cleared.
INVALID OBSTACLE ENTRY	ALERTING	The obstacle distance and/or elevation entry causes the limits of a table used in the calculation of obstacle clearance to be exceeded.
IRS FAILED IRS 1 FAILED IRS 2 FAILED IRS 3 FAILED IRS 4 FAILED	ALERTING	The FMS senses the identified IRS has failed.
ISA DEV EXCEEDED	ADVISORY	The entered temperature has caused the ISA deviation to be exceeded at the altitude.
LABEL CANNOT BE CHANGED	ADVISORY	Indicates that the label specified in the aircraft data base is a required label for the aircraft and may not be changed.
LANDING CLIMB LIMITED	ALERTING	This message is displayed when the landing calculations are landing climb limited.
LANDING OUT OF LIMITS	ALERTING	This message is displayed anytime the landing calculation is out of limits after the initial calculation.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
LAST LEG	ALERTING	The active leg is the last leg of the flight plan and the TO waypoint is not the destination.
LIST FULL	ADVISORY	Entry into a list is not permitted because the list is full.
MULTI FMS LOAD UNAVAIL	ADVISORY	This message indicates that it is not possible to load the navigational data base to all FMSs.
NEW MESSAGE AVAIL	ALERTING	A new AFIS message is available.
NEW SIGMETS AVAIL	ALERTING	New SIGMETS are available (AFIS).
NEW WINDS AVAIL	ALERTING	New winds are available (AFIS).
NEW WX REPORTS AVAIL	ALERTING	New weather reports are available (AFIS).
NO ACTIVE FPL	ADVISORY	There is no active flight plan when requesting a flight plan update from AFIS.
NO CRS TO ARC INTERCEPT	ADVISORY	No intercept to the arc can be found for the input definition.
NO CROSSING POINT FOUND	ADVISORY	No crossing points can be found for the CROSSING POINTS page.
NO DISK INSTALLED	ADVISORY	No disk is installed in the data loader.
NO FLIGHT PLAN	ADVISORY	Origin or origin/destination is entered on the FLIGHT PLAN LIST page and there is no flight plan with the same origin or origin/destination.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
NO INPUT ALLOWED	ADVISORY	No input is allowed.
NO POSITION SENSORS	ALERTING	The DR light is turned on.
NO PRESENT POSITION	ADVISORY	An action is requested that requires present position.
NO REQUIRED SENSORS	ALERTING	The DEGRAD light is turned on.
NO UPLINK FPL AVAIL	ADVISORY	An AFIS flight plan has not been received when requesting to load an AFIS flight plan.
NOT ALLOWED IN AUTO LOAD	ADVISORY	An entry to the active flight plan has been made to the FMS operating in SINGLE and Auto load in a triple FMS installation.
NOT A NAVAID	ADVISORY	An entry was made that requires a navaid and the entry is other than a navaid.
NOT AN AIRPORT	ADVISORY	An entry was made that required an airport name and other than an airport name was entered.
NOT IN DATA BASE	ADVISORY	The pilot requested some data that was not in the data base and cannot be pilot defined.
OAT/ISA LIMIT EXCEEDED	ALERTING	This message is displayed when the sensed OAT or ISA deviation exceeds the limit.
OBSTACLE DIST CONFLICT	ALERTING	This message indicates that an entry of an obstacle distance is less than an entry of stopway or clearway.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
OFFSET CANCEL	ALERTING	The offset has been canceled.
OFFSET CANCEL NEXT WPT	ALERTING	The offset is canceled at the next waypoint in the flight plan. This message can be cleared by pilot action or is automatically cleared when the offset is canceled.
ORBIT RADIUS/GS CONFLICT	ADVISORY	The ground speed is too high to fly the orbit at the defined radius.
PERF CEILING LIMITED	ALERTING	This message indicates that the initial cruise altitude is above the computed ceiling altitude and performance is being limited to the computed ceiling altitude.
PERF-VNAV UNAVAILABLE	ALERTING	The pilot requested a performance/VNAV function before sufficient data had been entered.
PREV NOT ALLOWED	ADVISORY	This message indicates that selection of the previous page is not allowed.
RADIALS DO NOT INTERSECT	ADVISORY	The radials defined for the intercept function do not cross.
RAIM WILL EXCEED LIMIT	ALERTING	RAIM at the time requested, will exceed the limit for the phase of flight.
REGIONAL NDB ONLY	ADVISORY	Loading a world wide navigation data base was attempted on an FMS that accepts a regional NDB only.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
RESET ALT SEL?	ALERTING	The FMS is commanding a change of altitude but the altitude selector has not been reset. The aircraft cannot change altitude until the selector has been reset.
RUNWAY NOT FOUND	ADVISORY	The data base does not contain the entered runway at the designated airport.
S.E. PERF UNAVAIL	ALERTING	Indicates that single engine performance is not available.
SINGLE/ INDEPENDENT REQD	ADVISORY	The operating mode needs to be single or independent before accessing the CLEAR CDB page.
SINGLE OPERATION	ALERTING	There is a problem between the two FMSs that precludes full communication between the two systems.
SLAVE FP CHNG OVERRIDDEN	ADVISORY	A change made on the slave side could not be accepted because of a conflict. The change was overridden by the master FMS.
STORED FPL PERF UNAVAIL	ALERTING	A numerical fault in the stored flight plan predictions.
TAKEOFF OUT OF LIMITS	ALERTING	This message is displayed anytime the takeoff calculation is out of limits after the initial calculation.
TO ENTRIES INHIBITED	ADVISORY	This message indicates that no entries can be made to takeoff. This happens when making an entry to takeoff and power has been advanced for takeoff.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
TO WEIGHT LIMITED	ALERTING	The current gross weight is between the maximum takeoff weight and the maximum ramp weight for the aircraft and the takeoff gross weight used by the Takeoff and Landing function has been limited to the maximum takeoff weight for the aircraft.
UNABLE HOLD CHANGE	ADVISORY	The pilot attempted to change the holding pattern definition while in holding and not on the inbound leg.
UNABLE MASTER TIME RQST	ADVISORY	This message indicates that the FMS time and date is being slaved to outside time and date (e.g. GPS or aircraft) and cannot be changed.
UNABLE NEXT ALT	ALERTING	The aircraft is unable to meet the altitude constraint.
UNABLE OFFSET	ADVISORY	An attempt was made to insert an offset during holding, a STAR, or a SID.
UNABLE PCDR TURN CHANGE	ADVISORY	Changing the procedure turn definition is inhibited after sequencing onto the procedure turn.
UNABLE *PD PLACEMENT	ADVISORY	The PD waypoint has been restricted from placement in the flight plan.
UNABLE TO SEND DOWNLINK	ADVISORY	The FMS has been waiting for a network acknowledge for a linked message for 5 minutes.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
UNABLE TUNE REQUEST	ADVISORY	The pilot entered a frequency while the radios were in the manual mode.
USED BY ACTIVE FPL	ADVISORY	The pilot tried to delete a waypoint from storage that is used in the active flight plan.
USED BY OFFSIDE ACT FPL	ADVISORY	The pilot attempted to delete a waypoint from storage that is used in the offside active flight plan.
USING CURRENT GS/FF	ALERTING	Indicates the current PERF mode.
V1VR CNST OUT OF BOUNDS	ALERTING	One of the inputs to the table used to calculate V1VR ratio is outside the limits of the table.
VERT DIR OVER MAX ANG	ADVISORY	The angle computed during a VERTICAL DIRECT TO exceeds the limit. In this case, the angle is set to the maximum limit (6°).
VERT DIR UNDER MIN ANG	ADVISORY	The angle computed during a VERTICAL DIRECT TO is under the limit. In this case, the angle is set to the minimum limit (1°) and descent is started at that time.
VOR 1 FAILED VOR 2 FAILED	ALERTING	The FMS senses the identified VOR has failed.
WAYPOINT NOT FOUND	ADVISORY	The entered waypoint cannot be found. If this results when attempting to enter an airway into a flight plan, the waypoint is not part of the referenced airway.

FMS Messages
Table 11-1 (cont)

Message	Type	Definition
WEIGHT DEFAULT - LB	ALERTING	Indicates that the weight option has defaulted to pounds. Usually the result of the configuration module being invalid or not read.
WHAT-IF PERF UNAVAIL	ALERTING	A numerical fault has occurred in the WHAT-IF predictions.
WIND EXCEEDED AT CRZ ALT	ADVISORY	The wind entered at altitude has caused the wind at the cruise altitude to be exceeded.
WPT STORAGE FULL	ADVISORY	The storage area for pilot defined waypoints is full.

FMS Messages

Table 11-1

12. Maintenance

DATA LOADER FAULT CODES

When the CDU displays a message of CHECK DATA LOAD (XX) after an attempted disk operation, the numeric value in the XX position is interpreted using the data loader fault codes listed in Table 12-1.

Code	Error Title	Description
01	OPEN CMD NO RESPONSE	Check electrical connections. Either the FMS cannot talk to the dataloader (the red drive activity light does not go on) or the FMS does not hear the response from the dataloader (the drive light turns on).
02	STATUS CMD NO RESPONSE	See 01
03	ILLEGAL DB FILE HEADER	The database disk file (db.bn_) is not a legal database file.*
04	READ CMD NO RESPONSE	The dataloader was unable to open and read data on the disk.
05	GET 1ST FP RECORD FAILED	The data in a flightplan file (sperry.dat) is incorrectly formatted.
06	FP_RECORD TOO LONG	See 05
07	NO DISK	No disk is installed in the dataloader.
08	STATUS CMD OPEN FAILED	The disk does not contain the needed file, or there was a disk read error while attempting to open the file.
09	CRC REM NE 0 IS ILLEGAL	The database disk was produced improperly, or the data in a file has been modified.*
0A	DB SIZE IN HEADR GT EE SIZE	The stored FMS database flash memory is too small for the size of the database being downloaded.*
0B	DB SIZE IN HDR NE FILE SIZE	See 09*

Data Loader Fault Codes

Table 12-1 (cont)

Code	Error Title	Description
0C	DB SIZE OR SERIAL NBR EQ 0	The FMS contains an illegal serial number, or an incorrect stored FMS flash memory size.*
0D	DB SIZE IN HEADER IS ODD	The FMS flash memory size was initialized improperly - it must be an even number.*
0E	SERIAL NUM LOCKOUT	The FMS being downloaded is not authorized to download this nav database.*
0F	NM0 FILE CRC LOCKOUT	The FMS serial number authorization file has been corrupted.*
10	BAD BOW VALUE	The flightplan file contains an illegal basic operating weight value.†
11	BAD FUEL VALUE	The flightplan file contains an illegal fuel value.†
12	BAD CARGO VALUE	The flightplan file contains an illegal cargo weight value.†
13	BAD PASSENGERS VALUE	The flightplan file contains an illegal passenger count.†
14	BAD INITIAL CRUISE	The flightplan file contains an illegal initial cruise altitude.†
15	BAD CRUISE SPEED	The flightplan file contains an illegal cruise speed.†
16	BAD CRUISE WIND	The flightplan file contains an illegal cruise wind.†
17	BAD CRUISE FUEL FLOW	The flightplan file contains an illegal fuel flow.†
18	BAD NUM WAYPOINTS	The syntax of the waypoint count is illegal or the waypoint count does not match the actual number of waypoints.†
19	NUM WPTS OUT OF RANGE	The flightplan file contains a waypoint count less than 2 or greater than 50.†

Data Loader Fault Codes

Table 12-1 (cont)

Code	Error Title	Description
1A	BAD NUM ALT WPTS	The flightplan file contains an illegal number of waypoints in the alternate flightplan.†
1B	NUM ALTS OUT OF RANGE	The flightplan file contains an illegal number of alternate destinations.†
1C	ODD NUM BYTES IN BLOCK	The dataloader transmitted an illegal data record length.*
1D	NM0 FILE HEADER LOCKOUT	The database disk contains a serial number file that does not match the database file.*
1E	GET IDENT FAILED	The flightplan file contains an illegal waypoint identifier.†
1F	GET LATITUDE FAILED	The flightplan file contains an illegal waypoint latitude.†
20	GET LONGITUDE FAILED	The flightplan file contains an illegal waypoint longitude.†
21	GET SPD CONSTR FAILED	The flightplan file contains an illegal waypoint speed constraint.†
22	GET FL CONSTR FAILED	The flightplan file contains an illegal waypoint flight level constraint.†
23	GET SPOT WIND FAILED	The flightplan file contains an illegal waypoint spot wind value.†
24	GET SPOT TEMP FAILED	The flightplan file contains an illegal waypoint temperature value.†
25	GET METERO FL FAILED	The flightplan file contains an illegal meteorological flight level.†
26	DM FIRST GET RECORD FAILED	Unused error code.
27	DM RECORD GET 80 CHARS	A record in the currently open disk file contains more than 80 bytes.
28	READ FILE NOT OPEN	A read file command was sent to the dataloader before a file was successfully opened.
29	READ ATTEMPTED AT EOF	A read file command was sent to the dataloader but the current open file does not contain any more data.

Data Loader Fault Codes**Table 12-1 (cont)**

Code	Error Title	Description
2A	COMMAND IN WORK	Internal status command from dataloader – should not be seen by an operator.
2B	UNKNOWN OP CODE	An illegal command was sent to the dataloader.
2C	DISK ERROR DURING READ	A disk read error was encountered. Check the disk for errors and try another disk in the dataloader.
2D	DISK ERROR DURING WRITE	See 2C
2E	DISK WRITE PROTECTED	The write protect tab on the disk is preventing the dataloader from writing to the disk.
2F	DISK IS FULL	There is no more free space on the disk for writing data files.
30	WRITE CMD NO RESPONSE	The dataloader is not responding to the FMS write request.
31	CLOSE CMD NO RESPONSE	The dataloader is not responding to the FMS open file command.
32	STATUS CMD ILLEGAL VALUE	The dataloader sent an undecodable status response to the FMS.
33	DEBUG MONITOR NO RESPONSE	Unused
34	DISK IS NOT FORMATTED	The inserted disk is not formatted correctly.
35	FORMAT CMD NO RESPONSE	The dataloader did not respond to the FMS format disk command.
36	DATALOADER UPDATE NEEDED	An FMS operation requires a newer dataloader.
37	ILLEGAL CHARS IN READ BUFFER	Unused
38	PREV READ BUFFER OVERFLOW	Internal software error (buffer overflowed) – probably a software error.

Data Loader Fault Codes**Table 12-1 (cont)**

Code	Error Title	Description
39	TOO MANY AFIS FPLS	An internal software error.
3A	ILLEGAL OPEN RO FILE	Unable to open for write access a file that is marked read only.
3B	ILLEGAL DIR SIZE RETURNED	Internal software error - returned directory size is too large.
3C	INCORRECT CUST FILE SIZE	The stored custom database file has been corrupted.
3D	WRONG CUST VERSION ON DISK	The stored custom database file version does not match the current FMS version.
3E	WRONG NAV VERSION ON DISK	The nav database disk is not compatible with the current FMS version (or the file is corrupted).
3F	WRONG PERF VERSION ON DISK	The stored learning curve data files are not compatible with the current FMS version.
80	ASYNC OPEN CMD NO RESPONSE	Unused
81	ASYNC DL STOPPED RESPONDING	In asynchronous download mode, the dataloader stopped responding to the FMS.
82	ASYNC RCVQUE OVERFLOW	Internal software error.
83	ASYNC GT10 UNUSED PACKETS	The asynchronous dataloader is sending data packets out of sequence. This is due to excessive line noise.
84	UNKNOWN ASYNC PACKET	Internal software error.
85	NO ASYNC DATA RCVD	See 01 (this error number will be seen instead of 01 if the FMS has been updated with the new asynchronous download mode)
86	ASYNC CMD NO RESPONSE	Unused

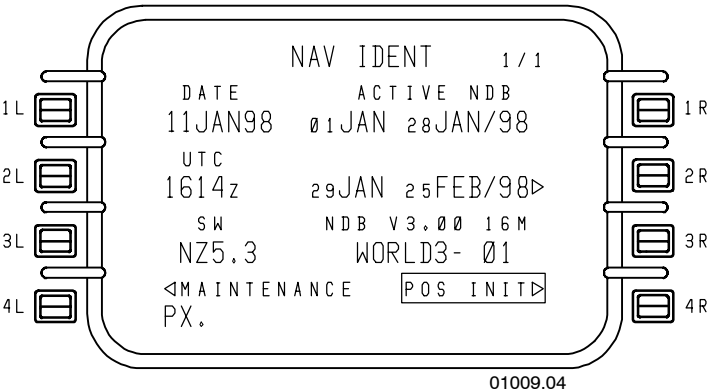
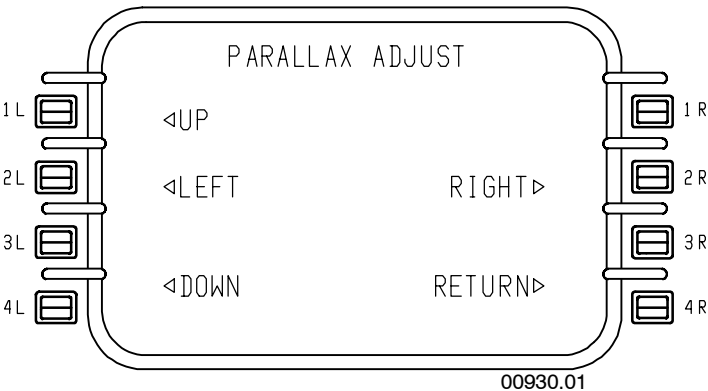
Data Loader Fault Codes
Table 12-1 (cont)

Code	Error Title	Description
87	ASYNCR CMD BAD RESPONSE	Unused
90-9F	ASYNCR PACKET CHECK ERRORS	Data errors are being received from the dataloader and the retransmit count has been exceeded. This is due to excessive line noise.
F1	FLASH SETUP ERROR	The FMS flash memory devices are defective, or have exceeded their rated erase/write cycles.
F2	FLASH CHARGE ERASE ERROR	The FMS flash memory devices are defective, or have exceeded their rated erase/write cycles.
F3	FLASH WRITE ERROR	The FMS flash memory devices are defective, or have exceeded their rated erase/write cycles.
* These codes are associated with the navigation database disks. Contact local Honeywell support for assistance.		
† These codes are associated with errors in flight plan format requirements. Contact flight plan provider for assistance.		

Data Loader Fault Codes
Table 12-1

CD-815 PARALLAX ADJUSTMENT

The CD-815 is capable of being adjusted for parallax. This feature is used when the CD-815 is mounted in the cockpit such that the pilot does not have a direct viewing angle to the CDU. When this occurs, the line select prompts appear out of alignment with the physical line select keys. This is called parallax. Procedure 12-1 explains how to adjust the CDU for parallax.

Step	Procedure 12-1 CD-815 Parallax Adjustment
1	From any page, enter PX. in the scratchpad, as shown in Figure 12-1.  01009.04 Figure 12-1
2	The CDU will display the PARALLAX ADJUST page, as shown in Figure 12-2.  00930.01 Figure 12-2

Step	Procedure 12-1 CD-815 Parallax Adjustment
3	Press the UP prompt (1L) or DOWN prompt (4L) to vertically adjust the CDU display.
4	Press the LEFT prompt (2L) or RIGHT prompt (2R) to horizontally adjust the CDU display.
5	Press the RETURN key (4R) to save the current settings in memory. The saved settings will be used for all subsequent flights. After pressing RETURN, the FMS returns to the page from which PARALLAX ADJUST was initiated.

FMS OPERATION MODE PROBLEMS

The FMS is capable of four different operating modes: dual, initiated transfer, independent, single. The FMS attempts to operate in the selected operating mode shown on the OPERATING MODE page, Figure 12-3. Refer to page 6-151 for details on selecting and confirming operating modes.

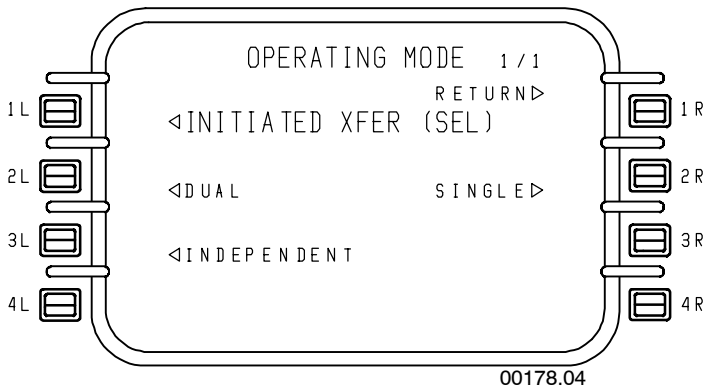


Figure 12-3

If the FMS is unable to operate in the selected mode, a message is displayed on the OP MODE PROBLEMS page. Table 12-2 lists possible messages and descriptions.

Displayed Message	Resulting Operating Mode for Dual Installation	Description
SW PROGRAM	SINGLE	The software version differs between the FMSs. Single operation is the only operating mode available.
CONFIG PIN	SINGLE	The configuration pins (or configuration module) required for dual, initiated transfer, and independent operating modes are not identical. The following items are compared between FMSs: 1. SDI setting discretes 2. Performance computer installed discrete 3. Overspeed protection disabled discrete 4. Version B ASCB discrete 5. Fuel flow configuration discretes 6. Operational mode discretes 7. Radio type discretes 8. Pounds/Kilograms discrete. Verify that the configuration settings are identical between FMSs.
CUSTOM DB	INDEPENDENT	The custom data base is not identical between the operating FMS pair. Dual and initiated transfer is not permitted unless the custom data bases are identical. Crossload the custom data base from one FMS to the other. The message will then be removed. Refer to page 6-185 for additional details on crossloading the custom data base.

Operation Mode Problem Messages
Table 12-2 (cont)

Displayed Message	Resulting Operating Mode for Dual Installation	Description
NAV DB	INDEPENDENT	The navigation data base is not identical between the operating FMS pair. Dual and initiated transfer is not permitted unless the navigation data bases are identical. Crossload the navigation data base from one FMS to the other. The message will then be removed. Refer to page 6-185 for additional details on crossloading the navigation data base.
PPOS DIFF	INDEPENDENT	The FMS positions between the operating pair differ by more than 10 NM. Dual and initiated transfer is not permitted unless the positions are within 10 NM. Reinitialize the FMS positions within 10 NM to return to dual or initiated transfer. Refer to page 6-175 for additional details on position initialization on the ground. Refer to page 6-87 for additional details on updating the FMS position while airborne.
DB CYCLE	INDEPENDENT	The selected cycle of the navigation data base differ between the operating pair. Dual and initiated transfer is not permitted unless the cycles are identical between the operating pair. Refer to page 6-148 for additional details on how to select the navigation data base cycle.

Operation Mode Problem Messages
Table 12-2 (cont)

Displayed Message	Resulting Operating Mode for Dual Installation	Description
MODE DIFF	SINGLE	The FMSs have attempted to operate in dual, initiated transfer, or independent. Due to a problem, one FMS is operating in the desired mode while the other FMS continues to operate in a different mode. This could be due to an ASCB problem. Verify that the ASCB is operational and properly connected to the FMS.
SLAVE	SINGLE	There is NOT one unique master FMS within the selected DN pair. This could be due to SDI strapping being identical between the FMS operating pair. Verify the SDI strapping for both FMSs.
ASCB INOP	SINGLE	The FMS detects that the ASCB is not operational. Dual, initiated transfer, and independent operating modes are not permitted under this condition. Verify that the ASCB is operational and properly connected to the FMS.
FMS1 INOP	SINGLE	The FMS displaying this message is unable to receive FMS1 transmissions on the ASCB. For triple FMS installations, this message is displayed by the opposite FMS selected in the DN pair. Verify that the ASCB is operational and properly connected to the FMS.

Operation Mode Problem Messages

Table 12-2 (cont)

Displayed Message	Resulting Operating Mode for Dual Installation	Description
FMS2 INOP	SINGLE	The FMS displaying this message is unable to receive FMS2 transmissions on the ASCB. For triple FMS installations, this message is displayed by the opposite FMS selected in the DN pair. Verify that the ASCB is operational and properly connected to the FMS.
FMS3 INOP	SINGLE	The FMS displaying this message is unable to receive FMS3 transmissions on the ASCB. For triple FMS installations, this message is displayed by the opposite FMS selected in the DN pair. Verify that the ASCB is operational and properly connected to the FMS.
DUAL INOP	SINGLE	DUAL operation is prohibited because excessive transitions to SINGLE operation have occurred within too small of a specified time interval. Verify that the ASCB is operational and properly connected to the FMS

Operation Mode Problem Messages**Table 12-2**

13. Honeywell Product Support

Honeywell SPEX[®] program for corporate operators provides an extensive exchange and rental service that complements a worldwide network of support centers. An inventory of more than 9000 spare components assures that your Honeywell equipped aircraft will be returned to service promptly and economically. This service is available both during and after warranty.

The aircraft owner/operator is required to ensure that units provided through this program have been approved in accordance with their specific maintenance requirements.

All articles are returned to Reconditioned Specifications limits when they are processed through a Honeywell repair facility. All articles are inspected by quality control personnel to verify proper workmanship and conformity to Type Design and to certify that the article meets all controlling documentation. Reconditioned Specification criteria are on file at Honeywell facilities and are available for review. All exchange units are updated with the latest performance reliability MODs on an attrition basis while in the repair cycle.

When contacting a Honeywell Dealer or Customer Support Center for service under the SPEX[®] program, the following information regarding the unit and the aircraft are required:

- Complete part number with dash number of faulty unit
- Complete serial number of faulty unit
- Aircraft type, serial number and registration number
- Aircraft Owner
- Reported complaint with faulty unit
- Service requested (Exchange or Rental)
- Ship to address
- Purchase order number.
- If faulty unit is IN WARRANTY:
 - Type of warranty (NEW PRODUCT or Exchange)
 - Date warranty started
- If faulty unit is covered under a Maintenance Contract:
 - Type of contract
 - Contract date
 - Plan ID number
- If faulty unit is NOT IN WARRANTY, provide billing address

The Honeywell Support Centers listed below will assist with processing exchange/rental orders.

24-HOUR EXCHANGE/RENTAL SUPPORT CENTERS

U.S.A. - DALLAS 800-872-7739 972-402-4300	CANADA - OTTAWA 800-267-9947 613-728-4681
ENGLAND - BASINGSTOKE 44-1256-72-2200	AUSTRALIA - TULLAMARINE 61-3-9330-1411
FRANCE - TOULOUSE 33-5-6171-9662	GERMANY - AOA GAUTING 0172-8207300 (in Germany) 49-172-8207300 (outside Germany)
SINGAPORE 65-542-1313	

CUSTOMER SUPPORT CENTERS - NORTH AMERICA

Dallas Support Center

Honeywell
7825 Ridgepoint Dr.
IRVING, TX 75063
TEL: 972-402-4300
FAX: 972-402-4999

Miami Support Center

Honeywell
7620 N.W. 25th Street
Bldg. C Unit 6
MIAMI, FL 33122
TEL: 305-436-8722
FAX: 305-436-8532

Minneapolis Support Center

Honeywell
8840 Evergreen Boulevard
MINNEAPOLIS, MN 55433-6040
TEL: 612-957-4051
FAX: 612-957-4698

Ohio Support Center

Honeywell
8370 Dow Circle
STRONGSVILLE, OH 44136
TEL: 440-243-8877
FAX: 440-243-1954

Central Support Center

Honeywell
1830 Industrial Avenue
WICHITA, KS 67216
TEL: 316-522-8172
FAX: 316-522-2693

Northwest Support Center

Honeywell
4150 Lind Avenue Southwest
RENTON, WA 98055
TEL: 425-251-9511
TLX: 320033
FAX: 425-243-1954

CUSTOMER SUPPORT CENTERS - REST OF THE WORLD

United Kingdom Support Center

Honeywell Avionics Systems Ltd
Edison Road, Ringway North
BASINGSTOKE, HANTS,
RG21 6QD
ENGLAND
TEL: 44-1256-72-2200
FAX: 44-1256-72-2201
AOG: 44-1256-72-2200
TLX: 51-858067

France Support Center

Honeywell Aerospace
1 Rue Marcel-Doret, B.P.14
31701 BLAGNAC CEDEX,
FRANCE (Toulouse)
TEL: 33-5-6212-1500
FAX: 33-5-6130-0258
AOG: 33-5-6171-9662
TLX: 521635F

Singapore Support Center

Honeywell Aerospace Pte. Ltd.
2 Loyang Crescent
SINGAPORE 1750
TEL: 65-542-1313
FAX: 65-542-1212
AOG: 65-542-1313
TLX: RS 56969 HWLSSC

Australia Support Center

Honeywell Ltd.
Trade Park Drive
TULLAMARINE, 3043, VICTORIA
AUSTRALIA (Melbourne)
TEL: 61-3-9330-1411
FAX: 61-3-9330-3042
AOG: 61-3-9330-1411
TLX: 37586 HWLTUL

Germany Support Center

AOA Apparatebau Gauting GmbH
Ammerseestrasse 45-49
D82131 Gauting
GERMANY
TEL: 49-89-89317-0
FAX: 49-89-89317-183
After Hours AOG Service:
0172-8207300 (in Germany)
49-172-8207300 (outside Germany)
TLX: 0521702

FMS PRODUCT SUPPORT

Support for FMS products, including data base support, can be obtained by contacting the local Honeywell customer support or the FMS Product Support Line.

FMS Product Support Line Phoenix, Arizona

1-888-TALK FMS (1-888-825-5367)

OR

1-602-436-7700 (outside toll free coverage)

PUBLICATION ORDERING INFORMATION

Additional copies of this manual can be obtained by contacting:

Honeywell
Aerospace Electronic Systems
CES-Phoenix
P.O. Box 21111
Phoenix, Arizona 85036-1111
Attention: Publication Distribution, Dept. M/S V19A1

Telephone No.:	(602) 436-6900
FAX:	(602) 436-1588
E-MAIL	CAS-publications-distribution@ honeywell.com

14. Abbreviations

Abbreviations used in this manual are defined as follows:

<u>ABBREVIATION</u>	<u>EQUIVALENT</u>
A	AT or ABOVE
A/C, ACFT	Aircraft
AC	Advisory Circular
ACARS	ARINC Communications Addressing and Reporting System
ACK	Acknowledgement
ACT	Active Mode
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADS	Automatic Dependant Surveillance
AFCS	Automatic Flight Control System
AFDS	Autopilot Flight Director System
AFIS	Airborne Flight Information System
AFM	Aircraft Flight Manual
AFN	ATS Facilities Notification
AHRS	Attitude Heading Reference System
AGL	Above Ground Level
ALT	Altitude
ALTN	Alternate
AMLCD	Active Matrix Liquid Crystal Display
APPR, APRCH	Approach
APU	Auxiliary Power Unit
ARINC	Aeronautical Radio, Inc.
ARP	Airport Reference Point
ASC	Aircraft Specification Change
ASCB	Avionics Standard Communications Bus
ASEL	Altitude Select
ATC	Air Traffic Control
ATS	Air Traffic Services
AUX	Auxiliary
B	AT or BELOW
BARO	Barometric
BFL	Balanced Field Length
BOD	Bottom of Descent
BOSC	Bottom of Step Climb

ABBREVIATION

EQUIVALENT

BOW	Basic Operating Weight
BTMS	Brake Temperature Monitoring System
C	Celsius
CAS	Calibrated Airspeed
CATMET	Categorical Meteorological Airport Report
CCW	Counterclockwise
CDB	Custom Data Base
CDI	Course Deviation Indicator
CDU	Control Display Unit
CF	Course to a Fixed Waypoint (Navigation leg type)
CLB	Climb
CLR	Clear
CMD	Command
COMM	Communication
CPU	Central Processing Unit
CROSSFILL	Data Transfer Between NAV Computers
CRS	Course
CRT	Cathode Ray Tube
CRZ	Cruise
CW	Clockwise
DADC	Digital Air Data Computer
DB	Data Base
DBDI	Distance Bearing Direction Indicator
DEG	Degree
DEL	Delete
DES	Descent
DEST	Destination
DGPS	Differential Global Positioning System
DGRAD	Degraded
DIR	Direct
DIST	Distance
DL	Data Loader
DME	Distance Measuring Equipment
DR	Dead Reckoning
DSPLY	Display
DTG	Distance To Go

ABBREVIATION**EQUIVALENT**

ECEF	Earth-Centered Earth-Fixed
EDS	Electronic Display System
EEPROM	Electrically Erasable Programmable Read Only Memory
EFIS	Electronic Flight Instrument System
EHSI	Electronic Horizontal Situation Indicator
ELEV	Elevation
EO	Engine Out
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETE	Estimated Time Enroute
ETP	Equal Time Point
F	Fahrenheit
FA	Fix to an Altitude (Navigation Leg Type)
FAF	Final Approach Fix
FANS	Future Air Navigation System
FAS	Final Approach Segment
FF	Fuel Flow
FGS	Flight Guidance System
FL	Flight Level
FLC, FLCH	Flight Level Change
FLT	Flight
FMS	Flight Management System
FMZ	Flight Management System Designation
FOM	Figure of Merit
FPA	Flight Path Angle
FPL	Flight Plan
FPLN	Flight Plan
FPM	Feet per Minute
FREQ	Frequency
FT	Foot/Feet
GAL	Gallon
GDC	Global Data Center
GMT	Greenwich Mean Time
GPS	Global Positioning System (Navstar)

<u>ABBREVIATION</u>	<u>EQUIVALENT</u>
GRD	Ground
GS	Glideslope, Groundspeed
GSPD	Groundspeed
GW	Gross Weight
HA	High Altitude
HDOP	Horizontal Dilution of Precision
HF	High Frequency
HM	Holding Pattern With Manual Termination (Navigation Leg Type)
HP	High Pressure Engine Turbine Speed
HPA	Hectopascal
HSI	Horizontal Situation Indicator
HUD	Head-Up Display
IAF	Initial Approach Fix
IAC	Integrated Avionics Computer
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organization
ID	Identification
IDENT	Identifier
IFR	Instrument Flight Rules
IGS	Instrument Guidance System
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INBD	Inbound
INC	Increment
IN HG	Inches of Mercury
INIT	Initialization
INTV	Intervention
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
JEPPESEN	Name of Navigation Data Base Supplier
Kg	Kilogram
Kg/L	Kilogram Per Liter
Khz	Kilohertz

ABBREVIATION**EQUIVALENT**

Km	Kilometer
kt	Knot/Knots
L	Left
L	Liter
LA	Low Altitude
LAT	Latitude
LB	Pound(s)
LB/GAL	Pounds Per Gallon
LDA	Landing Directional Aid
LDG	Landing
LFL	Landing Field Length
LIM, LMT	Limit
LNAV	Lateral Navigation
LOC	ILS Localizer
LORAN	Low Frequency Radio Range
LRC	Long Range Cruise
LRN	Long Range Navigation
M	Meter
MAG	Magnetic
MAP	Missed Approach Point
MAX	Maximum
MB	Millibars
MDA	Minimum Descent Altitude
METAR	Meteorological Airport Report
MHZ	Mega-Hertz
MIN	Minimum
MKR	Marker
MLS	Microwave Landing System
M _{MO}	Maximum Operating Mach
MM	Millimeter
M/S	Meter Per Second
mS	Microsecond
ms(msec)	Millisecond
MSG	Message
MSL	Mean Sea Level
MTOW	Maximum Takeoff Gross Weight
MU	Management Unit

ABBREVIATION

EQUIVALENT

NAV	Navigation
NAVAID	Navigation Aid (Typically a Radio Station Providing VOR and/or DME Position Data)
NBAA	National Business Aircraft Association
NCD	No Computed Data
ND	Navigation Display
NDB	Navigation Data Base
NDB	Nondirectional Beacon
NEXRAD	Next Generation Radar
NM	Nautical Miles
NOTAM	Notice to Airmen (Navaid Information)
NT	Navaid Tuning
NZ	Navigation Computer (Product Designator)
OAT	Outside Air Temperature
Offside	Unit on the Other Side of the Airplane (Left Sensor Is Offside to Right FMS)
OFST	Offset
Onside	Unit on the Same Side of the Airplane (Left Sensor Is Onside to Left FMS) Computer (refer to Offside)
ORG, ORIG	Origin
OSS	Omega Sensor System
OUTBD	Outbound
PB	Place/Bearing
PBD	Place/Bearing/Distance
PC	Personnel Computer
PCDL	PC Data Loader
PCDR	Procedure
PD	Place//Distance
PDC	Pre-Departure Clearances
PERF	Performance
PFD	Primary Flight Display
PLN	Plan
PNR	Point of No Return
POS	Position
PPOS	Present Position
PRED	Predictive

ABBREVIATION**EQUIVALENT**

PREV	Previous
PROG	Progress
Proline	A Mnemonic Used to Describe a Bus Patented by the Collins Corp
PROM	Programmable Read Only Memory
PT	Procedure Turn
PTS	Points
PZ	Performance Computer Series (e.g., PZ-800)
QF	Quality Factor
QFE	Aircraft Altitude Above a Station
QNH	Aircraft Altitude Above Mean Sea Level Base on Local Station Pressure
R	Right
RAD	Radial or Roll Anticipation Distance
RAIM	Receiver Autonomous Integrity Monitor
RCVD	Received
REF	Reference
REM	Remaining
REQ	Required
REQ	Request
RFMU	Radio Frequency Management Unit
RNAV	Area Navigation
RNG	Range
RNWX	Runway
RTCA	Radio Technical Commission for Aeronautics
RTE	Route
RW, RWY	Runway SAT
SAT	Static Air Temperature
SDF	Simplified Directional Facility
SDI	Source Destination Indicator
SE	Single Engine
SEL	Select
SID	Standard Instrument Departure
SOB	Souls On Board
SPD	Speed
SP WT	Specific Weight
STA	Station

ABBREVIATION

EQUIVALENT

STAR	Standard Terminal Arrival Route
T	Terminal
T-P	Turn Point
TACAN	Tactical Air Navigation
TAS	True Airspeed
TCH	Threshold Crossing Height
TCS	Touch Control Steering
TF	Track to a Fixed Waypoint
TLA	Throttle Lever Angle
TOC	Top of Climb
TOD	Top of Descent
TOLD	Takeoff and Landing
TRM	Thermal
UR	Unrestricted
UTC	Universal Coordinated Time
VAR	Variation
VASL, VASEL	VNAV Altitude Select
VALT	VNAV Altitude Hold
VAPP	VOR Approach
VDL	VHF Data Link
VDOP	Vertical Dilution of Precision
VEL	Velocity
VERT	Vertical
VFLC, VFLCH	Vertical Flight Level Change
VG	Velocity Over the Ground
VGP	Vertical Glide Path
VHF	Very High Frequency
VLf	Very Low Frequency
Vmin	Minimum Velocity
V _{MO}	Maximum Operating Velocity
VREF	Final Landing Configuration Speed
V ₁	Takeoff Decision Speed
VN, VNAV	Vertical Navigation
VOR	Very High Frequency Omni Bearing Range
VORTAC	Very High Frequency Omni Bearing Range and TACAN (a Station Broadcasting Both VOR and DME Data)

ABBREVIATION

EQUIVALENT

VPTH, VPATH	Vertical Path, VNAV Path
VS, VSPD	Vertical Speed
VTA	Vertical Track Alert
WOW	Weight on Wheels
WGS	World Geodetic System
WPT	Waypoint
W/T	Wind Temperature
WT	Weight
XFR	Transfer
XTK, XTRK	Crosstrack

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