OPERATOR'S MANUAL

SCN 1002.X and 1102.X
Flight Management Systems

EAR CONTROLLED - The information contained herein is subject to the Export Administration Regulations ("EAR"), 15 C.F.R. Parts 730-774. Diversion contrary to U.S. law is prohibited. Export Control Classification Number (ECCN): 7E994.

Universal Avionics
3260 E. Universal Way
Tucson, AZ 85756-5097 USA
+1 520 295 2300 • 800 321 5253

Report No. 2423sv1002/1102
19 January 2024

This publication and all associated updates are available at www.universalavionics.com. Universal Avionics bears no responsibility for the use of outdated material.

WARNING: **DO NOT CROSSFILL (XFILL) FLIGHT PLAN INFORMANTION IF YOUR FMS IS OPERATING SCN 1000.0/1100.0 OR 1000.1/1100.1. FAILURE TO COMPLY MAY CREATE THE POTENTIAL FOR A MAJOR HAZARD INSIDE THE FINAL APPROACH FIX (FAF).**

Universal Avionics identified a software defect in SCNs 1000.0/1100.0 and 1000.1/1100.1. SCN 1000.2/1100.2 was subsequently released to correct the defect.

To determine whether the FMS is configured for Crossfill or Synchronous mode:

From DATA page 1 press **MAINT/CONFIG /ARINC/RECEIVE**.

The ARINC RCV page will display. If CROSSFILL 1 or CROSSFILL 2 appears on the page, then it is configured for Crossfill mode. If SYNC appears on the page, then it is configured for Synchronous mode.

APPLICATION

This Operator’s Manual,

2423sv1002/1102

is applicable to all

FLIGHT MANAGEMENT SYSTEM (FMS)
and
MULTI-MISSION MANAGEMENT SYSTEM (MMMS)
possessing:

**Software Control Number (SCN) 1002.0/1102.0
and later 1002.X/1102.X**

SCN 1002/1102 evolved from previous SCNs 1001/1101. Service Bulletins issued by UA provide a complete description of the changes introduced with the new software.

The software program version is found on the Initialization Page and the S/W Versions Page.

This Operator’s Manual contains detailed information about FMS functionality and procedures accomplished during flight operations. Information pertaining to additional FMS functionality and ground-based procedures is provided in the Universal Avionics FMS Reference Guide, Report No. 2423sv100X/110X.01.

NOTICE

When the FMS is configured for the Advanced Performance Option, a Performance Supplement is provided for insertion in the SUPPLEMENTS tab.

Refer to approved
Airplane Flight Manual Supplement
for certified version.

RECORD OF REVISIONS

Rev No.	Issue Date	Insertion Date	Initials
Original	12 July 2017	12 July 2017	UA
1	11 December 2017	11 December 2017	UA
2	9 January 2018	9 January 2018	UA
3	15 April 2019	15 April 2019	UA
4	19 January 2024	18 January 2024	UA

Retain this record in front of the manual. Upon receipt of revision, insert and remove pages according to the *List of Effective Pages*. Then enter on this page the revision number, issue date, insertion date and your initials.

TABLE OF CONTENTS

1 SYSTEM DESCRIPTION

INTRODUCTION

The Universal Avionics Flight Management System (FMS) is a multi-sensor navigation system designed to provide centralized control for the aircraft's navigation sensors, computer-based flight planning and fuel management.

SYSTEM FUNCTIONS

Flight Planning

Flight planning is accomplished by accessing the internal navigation data, which includes the Navigation Database, pilot defined data and externally defined routes that were created with the Universal Flight Planning (UFP) PC software program. The pilot selects from waypoints, routes, airways, arrivals, departures, approaches and runways to create the desired flight plan. The user may also create temporary pilot defined waypoints limited. The FMS supports Terminal Area Procedures, SIDs, STARs and Approaches using procedural legs. Refer to the Universal Avionics FMS Reference Guide for more information about leg types.

Navigation and Steering Outputs

The FMS provides desired track, bearing, crosstrack and related data to the flight guidance system (FGS) for the Horizontal Situation Indicator (HSI) displays and pitch/roll steering command for the autopilot/flight director system. Lateral and vertical deviations from the flight plan are provided for enroute, terminal and approach operations, including GPS and SBAS approaches. The roll steering output limits for both normal and DTO leg-to-leg changes are set during initial configuration of the system for each aircraft type.

Databases

FMS databases include the Navigation Database and the Pilot Defined Database, which includes a Company Routes Database. In addition, when the Collins Pro Line 4 800 system is configured, the FMS has provisions to maintain a Checklist Database. A Performance Database is also provided for certain aircraft. Data and database management information is provided in the FMS Reference Guide.

Vertical Navigation

The Vertical Navigation (VNAV) function allows the flight crew to define a desired vertical descent profile. It also computes aircraft deviation from that profile.

Additional VNAV features include a computed Top-of-Descent (TOD) and Target Vertical Speed (TVS), support for holding patterns and Vertical-To procedures.

Fuel

Depending on configuration, the aircraft's engine fuel flow system may provide the inputs necessary to integrate real time fuel management information with navigational functions. During the pre-departure phase, the pilot inputs or acknowledges the fuel on board the aircraft to initialize the fuel management functions. During flight, the FMS automatically updates the fuel on board and gross weight as well as provides continuous estimates of fuel remaining for the programmed flight plan based upon fuel flow and groundspeed. The FMS also provides specific range and endurance data to aid the pilot in optimizing fuel consumption to obtain maximum range or endurance.

NOTE: The fuel flow management information provided by the FMS has not been evaluated to the requirements of TSO C44a (Fuel Flow meters).

Fuel display parameters are advisory only and do not replace primary fuel quantity or fuel flow gauges for fuel load and range planning.

Radio Tuning

The FMS optional Tune mode provides the pilot with a centralized means to tune the aircraft's radios, select and store preset frequencies for each radio and view the selected (preset or active) frequencies for each radio. The aircraft must be configured with a Radio Tuning Unit (RTU), Radio Control Unit (RCU), Primus, Pro Line 4, AN/ARN TACAN or 709 DME & 711 VOR for this mode to be operational. Refer to Tune Function in the Operations section for detailed information about radio tuning.

SYSTEM COMPONENTS

The basic FMS installation consists of the FMS (containing the Control Display Unit, navigation computer and an internal GPS/SBAS sensor), an Electronic Flight Information System, a configuration module, and a Data Transfer Unit.

FMS Navigation Computer

The FMS has a central processing unit (navigation computer), navigation sensor interface circuits, FGS interface and the Navigation Database. The unit processes data from the Air Data Computer (ADC), the fuel flow system, the internal GPS/SBAS sensor, DME and VOR sensors, Attitude and Heading Reference System (AHRS), and up to five long range navigation sensors. At installation, the system is configured with the number and type of long-range navigation sensors to optimize the FMS to the aircraft’s specific characteristics. The long-range navigation sensors act in addition to the multi-channel scanning DME and VOR sensing capability integrated into the basic circuit. Data from these sensors are used to determine the Best Computed Position (BCP). This position is used by the FMS for navigating the aircraft along the programmed flight plan.

Control Display Unit

The Control Display Unit (CDU) contains a 4 or 5-inch active-matrix liquid crystal color flat panel display and keyboard. The dimmable display allows for eleven lines with 24 characters each in two different character sizes. Graphic displays for special photo, search and surveillance flight patterns are provided.

Configuration Module

A configuration module is installed on the FMS rear connector. It is programmed at the time of installation and defines all the aircraft interfaces unique to the installation.

Data Transfer Unit

The Data Transfer Unit (DTU) is designed to be mounted in the aircraft and connected directly to the FMS. Data is transmitted directly to the FMS during the update process. Three types of DTUs are available for aircraft installation. The DTU-100 which is a disk-drive unit using 100-megabyte (MB) Zip disks. The Solid-State Data Transfer Unit (SSDTU) that is fully interchangeable with the DTU-100. The SSDTU loads and saves data using Universal Serial Bus (USB) or Secure Digital (SD) Memory. The SSDTU+ contains the same disk operations as the SSDTU using SD Memory, but also supports external systems interfacing with the FMS over a Wi-Fi network via a wireless adapter installed in the USB port on the front panel. This precludes the use of USB storage devices. A portable SSDTU is also available for multi-aircraft operations.

The following functions may be performed with the DTU:

- Update the Navigation Database
- Load pilot defined and external data created with UFP
- Download FMS in-flight data parameters to a disk
- Download maintenance log diagnostic history to disk
- Load FMS software updates
- Load and Download aircraft configuration data.

The DTUs will power up automatically when power is applied to the aircraft. The DTU-100 will show red and green lights on the front when initially powered, then just green when ready for operation.

The SSDTU and SSDTU+ faceplate LEDs will flash yellow-green-blue, and then the Status LED will show a constant green to indicate the SSDTU/SSDTU+ is ready for operation. For the SSDTU, a blue LED will indicate the currently active data storage device port on the SSDTU. For the SSDTU+, blue LEDs indicate the wireless network, and the SD Memory are functioning normally.

SYSTEM INTERFACES

Interfaces

The FMS interfaces to the following components:

- Radio Tuning Unit

  The RTU allows the operator to use the FMS CDU to tune Collins Pro Line II radios and store up to four preset frequencies for later use by each selected radio. Communications, navigation, air traffic control, automatic direction finders and TACAN are selectable through the RTU, depending upon the specific aircraft configuration. Both 25 kHz and 8.33 kHz spacing is supported

- Video Interface Option

  This feature allows interface with video cameras and cabin display systems for viewing on the FMS color flat panel display. National Television Standards Committee (NTSC) Red-Green-Blue video format is required for input to the FMS

- Radio Control Unit

  The RCU system provides the flight crew with a primary means of controlling all onboard radios and is designed to operate in a duel or single RCU environment, providing radio tuning (frequencies and preset frequencies) and mode control functions.

- Electronic Flight Instrumentation System (EFIS) and other displays
- Multifunction Control Display Unit (MCDU)
- Terrain Awareness and Warning System (TAWS)
- Universal Avionics Vision-1
- Airborne Flight Information System (AFIS)/UniLink

  When the FMS is interfaced with a UA UniLink data link system or AFIS equipment, the FMS also serves as the send/receive terminal for UniLink or AFIS messages.

Sensors

The FMS accepts primary position information from short- and long-range navigation sensors. Inputs from short range sensors such as DME, Radio Reference sensor, VOR or TACAN and long-range sensors such as Doppler, LORAN C, IRS, GPS, GPS-aided IRS, GPS/GLONASS (GNSS), SBAS, and GPS Landing System (GLS), can be used to determine the aircraft's position. Because each type of navigation sensor has unique capabilities and functions, the type and number of sensors can be tailored to optimize the user's specific operational requirements.

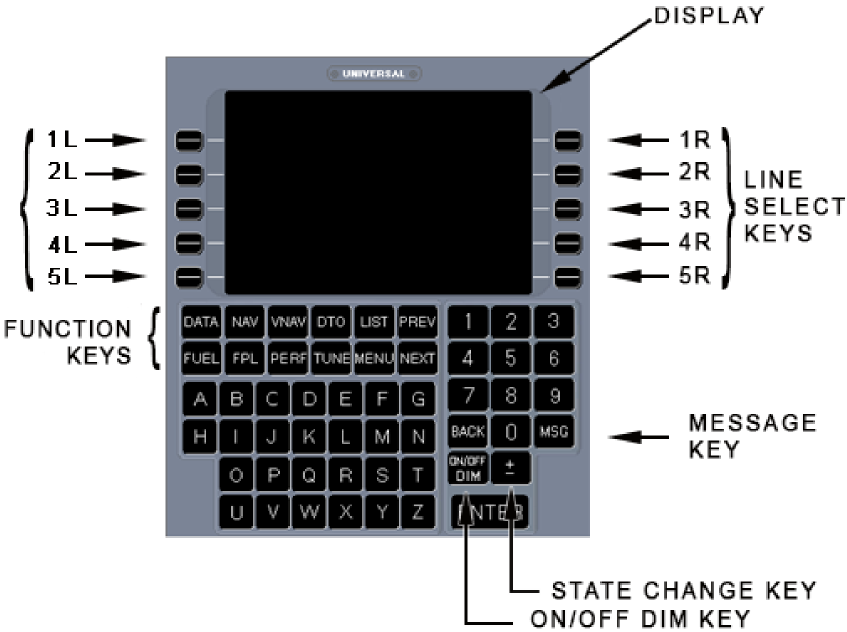
For satellite-based navigation, the FMS provides CDU pages to allow selection/de-selection of the sensor as well as the satellites, also to display the sensor’s status, integrity, and mode, and to display diagnostic data.

Air Data Computer

The FMS accepts data from either digital or analog Air Data Computers (ADC). True airspeed, barometrically corrected or non-corrected altitude, and static air temperature are monitored. Barometrically corrected altitude is required for vertical guidance display during approaches and for VNAV below 18,000 feet. ADCs from various manufacturers can be interfaced with the FMS.

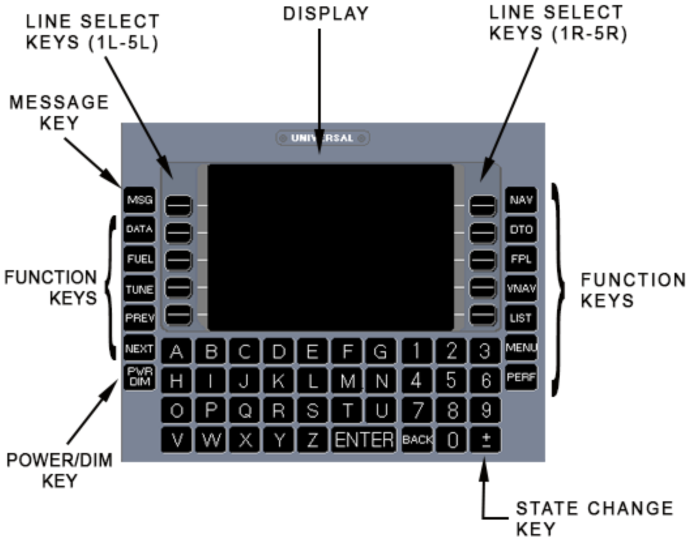
CONTROL DISPLAY UNIT (CDU)

The 5" Flat Panel Control Display Unit (FPCDU) utilizes a daylight-readable 5-inch diagonal Liquid Crystal Display (LCD). This FPCDU can display 15.7 kHz National Television Standards Committee (NTSC) Red-Green-Blue-S-video (RGBS) video from external sources.



5" FPCDU & FMS

The 4" FPCDU utilizes a daylight-readable 4-inch diagonal LCD



4" FPCDU

CDU Keyboard

The full alphanumeric keyboard contains dedicated function keys that, when used in conjunction with the ten line select keys, provides the pilot with all the controls necessary to operate the FMS.

Alphabetic and Numeric Keys

There are 36 alphabetic and numeric keys used to input characters into a variable field marked by the cursor.

Line Select Keys

There are 10 line select keys (LSKs), five on each side of the screen. LSKs are used to position the cursor over the adjacent field. The text herein refers to the LSK (from top down) on the left side as [1L] thru [5L], and the right side as [1R] thru [5R].

Control Keys

There are seven control keys on the keyboard used to control the power status of the FMS, Messages, enter special characters and cycle function pages. These are: ON/OFF DIM, PREV, NEXT, BACK, ±, MSG, ENTER.

ON/OFF DIM Key

The ON/OFF DIM key provides power-up, display dimming and unit shutdown functions.

Pressing **[ON/OFF DIM]** for initial power-up will energize the system and initiate self-test of the navigation computer.

When the system is on, pressing ON/OFF DIM will display a control window on the right side of the active page. BRIGHT, DIM, CANCEL, DISPLAY and OFF/STBY options are displayed and selectable using the LSKs. The Standby mode is a configurable option.

NOTE: BRIGHT/DIM provides display dimming only and does not dim the key backlighting. Dimming the key backlighting is accomplished with aircraft instrument dimming.

BRIGHT – Press the associated LSK to cause the display to steadily brighten as the key is held down.

DIM – Press the associated LSK to cause the display to steadily dim as the key is held down.

NOTE: If the display is dimmed completely off and other keys are pressed or the location of the BRIGHT key can’t be remembered, press **[ON/OFF DIM]** twice to restore display.

CANCEL – Press the associated LSK to exit the control window and return to the active display page.

DISPLAY – Press the associated LSK to view the display adjustment window. The display adjustment window presents four options (UP, DOWN, CANCEL and VIDEO) selectable using the LSKs. (VIDEO is only applicable to certain CDU part numbers.) Selecting UP will cause the entire display to shift upwards by as much as one-half character to adjust the parallax. Selecting DOWN will adjust the display downwards similarly. Selecting video will cause the display to switch to the video source. Pressing any key while in video mode will cancel video mode. Selecting CANCEL will return the display to the main (BRIGHT/DIM/CANCEL/DISPLAY/OFF) window.

OFF/STBY – Pressing the LSK for OFF will cause the CONFIRM OFF window to be displayed. This window has three options (CONFIRM OFF, CANCEL and CONFIRM STANDBY) selectable using the LSKs. Selecting CONFIRM OFF will turn the system off. Selecting CANCEL will return the display to the main (BRIGHT/DIM/CANCEL/OFFSET/OFF) window. Selecting CONFIRM STANDBY will display the Standby Page. Refer to the Standby Mode section for more information about this functionality.

PREV Key

The PREV (previous) key is used to cycle backward, one page at a time, through multiple pages of the same function.

NEXT Key

The NEXT key is used to cycle forward, one page at a time, through multiple pages of the same function.

BACK Key

When the cursor is over a data entry field, the BACK key serves as a delete or backspace key.

± Key

The State Change Key (±) is used in conjunction with the alpha numeric keys to enter data. It changes plus (+) to minus (-), North (N) to South (S), and left (L) to right (R). It is also used in strictly alpha fields as a dash (-) or period (.).

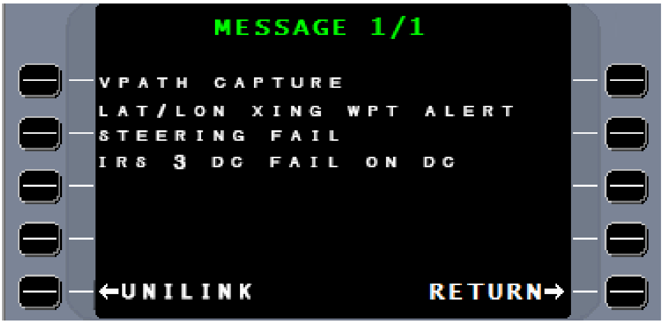
ENTER Key

The ENTER key is used to store input data. Pressing the ENTER key completes entry of data and is required for all data entries.

MSG Key

When a system message becomes active, MSG will appear on the far-right side of the top line on the display.

Press the MSG key to display the Message Page, which lists current system messages (those messages generated since the page was last accessed). After the messages are viewed, the display may be returned to the previous page by selecting the RETURN option on the Message Page, by pressing the MSG key again, or by pressing the BACK key. Some messages prompt the user to view additional pages via a LSK option (e.g., UniLink, AFIS or Approach LOS Page).

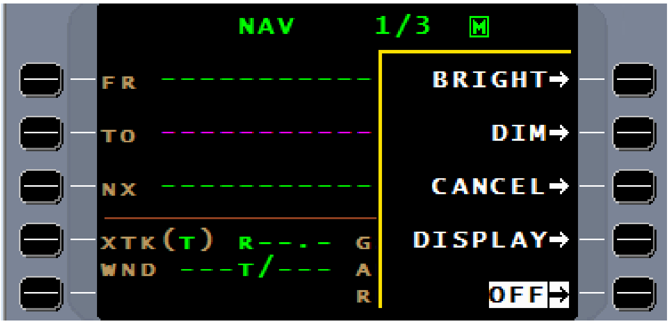


Function Keys

Function keys are used to select the basic operating modes of the system for data entry or command inputs. When a function key is pressed, the display will immediately change to the first display page of the selected mode. Where multiple pages exist, subsequent presses of the function key will cycle the display forward one page at a time.

For a detailed description of each mode and its various display pages, refer to Function Pages in the Operations section.

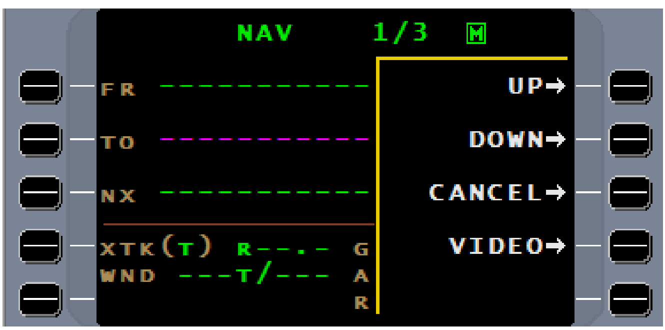
Adjust Screen Brightness



1. Press **[ON/OFF DIM]** to access the dimming control window.
2. Hold the **BRIGHT** or **DIM** LSK to adjust screen intensity.
3. Select the **CANCEL** LSK to return to the previous display.

Adjust Display/Key Alignment

1. Press **[ON/OFF DIM]** to access the dimming control window.
2. Press DISPLAY, **LSK [4R]**, to access the display option window.



3. Press **UP** or **DOWN** LSK as desired to align display arrows with the LSKs.
4. Select **CANCEL** to exit display window.

DATA ENTRY

Data may be entered into the system at locations which are highlighted. When appropriate, these locations align with one of the ten LSKs that are used to control the cursor. The cursor is usually off when a page is initially accessed, although some pages have a cursor default position on the screen. Pressing ENTER completes the entry of data. **Until the ENTER key is pressed, the value in the cursor has no effect on other parameters in the computer**. Some cursor fields, such as latitude and longitude entry fields, are restricted to numeric input only. Pressing BACK will delete an entry. If there is a logical next field for data entry, the cursor will automatically advance to this next field when ENTER is pressed.

NOTE: If the cursor field flashes after pressing ENTER, the entry is invalid.

Selections are made with the LSKs whenever possible. In some cases, a combination of LSKs and reference numbers are used on the same display page. This allows two levels of selection to exist simultaneously on the same display. For example, while the LSKs control the contents of a list, an item from that list can be selected by using a reference number.

Some selections that change the active flight plan, guidance of the aircraft or stored database require confirmation. Confirmation is accomplished by pressing the LSK a second time or by pressing ENTER. Selection of fields, which do not require confirmation, will cause the page or mode change to occur immediately when the corresponding LSK is pressed.

Waypoint Entry Process

Waypoint identifiers may be input into the highlighted field by using any of three input processes: the Reference Number Input Process, the List Input Process, or the Direct Entry Process.

Reference Number Input Process

At appropriate times, the pilot is presented with a menu of waypoint identifiers, routes, or navaids. Each option is preceded by a reference number which is used to make the selection. The selection is made by inputting the reference number into the cursor field and pressing [ENTER].

NOTE: If the desired choice is not among those shown on the page, pressing the [PREV] or [NEXT] key to page forward or backward will display additional choices when available.

If the reference number input into the cursor is in error, pressing the [BACK] key will delete the entry.

List Input Process

The List Input Process is the easiest to use when the desired waypoint identifier is not presented as an available selection.

1. With the cursor over a waypoint entry field, press **[LIST]** to display the Normal List Page. A list of numbered selections available for entry in this field will be displayed in a window, and other LIST categories will be displayed next to the LSKs.
2. Select the LIST category by pressing the corresponding LSK.

3. Select the desired reference number.
4. Press [ENTER].

NOTE: When selecting waypoint identifiers, routes, or navaids using the List Input Process, the FMS will present the most optimum lists possible. For example, in selecting a flight plan, the lists present those routes originating closest to the departure airport first.

Direct Entry Process

Data entry may be accomplished by simply typing in the required data then pressing ENTER.

If the identifier is in the database – The Waypoint Identification Page for that identifier will appear. This page displays the identifier's position coordinates and other pertinent data about the identifier.

1. If the coordinates shown are correct, pressing [ENTER] or the ACCEPT LSK will confirm the correct waypoint is being used.
2. If the coordinates shown are incorrect and the identifier was spelled correctly, there is more than one identifier in the database with that identifier. If this is the case, 1/X is displayed where X indicates the number of possible waypoints with the same identifier. Press the PREV or NEXT keys to access the other Waypoint Identification Pages. Locate the cursor over the waypoint and press [ENTER] or the ACCEPT LSK to confirm. If the desired data is not located, a pilot waypoint can be defined by selecting the CREATE PLT option.

If the identifier is not in the database – The Define Waypoint Page will be displayed where the pilot may create a pilot defined waypoint.

Refer to the UA FMS Reference Guide for more information about creating Pilot Defined data.

FUNCTION PAGE

Menu Function Key

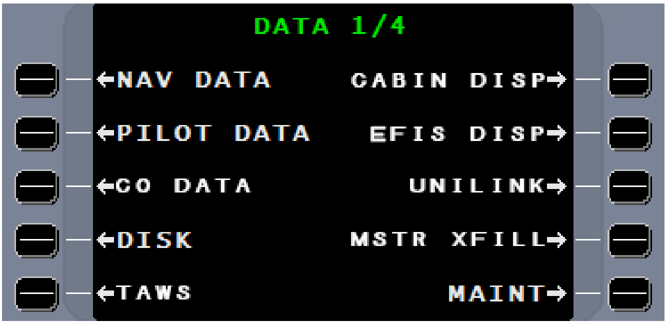
The Menu function key is used to present a list of submenus or options for the Fuel, Flight, Vertical Navigation (VNAV) or Tune functions. The letter "M" in a box will appear on the title line of any page in which the Menu key is active. Refer to the applicable function section under Operations for further details.

Data Function

The Data function is used to obtain information and status about the FMS, the Navigation Database and sensors interfaced with the FMS. Although sensor control is completely automatic, selection and de-selection of individual sensors can be accomplished using this function. The Data function is also used to make additions, deletions, or changes to pilot defined locations.

Data Page 1

Data Page 1 allows selection of Navigation Data, Pilot Data, Company Data, the Disk Menu, TAWS, Cabin Display, EFIS Display, UniLink or AFIS Menu, Master Crossfill and Maintenance Menu. The CABIN DISP, EFIS DISP, UNILINK or AFIS and MSTR XFILL options are installation dependent.



NAV DATA – The NAV DATA line select key (LSK) accesses the Navigation Database.

PILOT DATA – The PILOT DATA LSK accesses the Pilot Defined Database.

CO DATA – The CO DATA (Company Database) LSK accesses the CO DATA page.

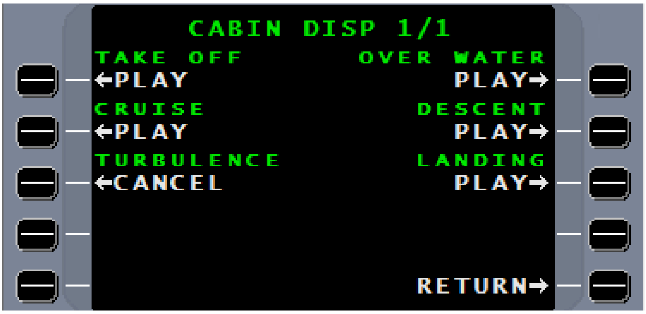
DISK – The DISK LSK accesses the Disk Menu Page.

TAWS – This selection is only displayed when the FMS is configured for Terrain Awareness Warning System (TAWS) interface. Pressing this LSK accesses the TAWS pages. Refer to the applicable Universal Avionics TAWS Operator’s Manual for more information.

CABIN DISP – This selection is only displayed when the FMS is configured for cabin display. Pressing this LSK accesses the Cabin Display Page. When a UA CD-2000 Cabin Display or UniVision is installed, the FMS can be configured to control the passenger briefing messages through this LSK.

To activate a passenger briefing message, press the appropriate key next to the desired message. The key will change from PLAY to CANCEL for the duration of the message, and then automatically revert to PLAY when the message ends. The message may be canceled by pressing CANCEL at any time.

NOTE: The different types of messages and their titles are defined during the installation configuration of the FMS; therefore, the actual page appearance in your aircraft might differ from that shown below. From one to six messages can be enabled, and their titles might differ from that shown. The following page is a typical example.



In this example, the TURBULENCE message is now playing, and CANCEL will remain displayed for the duration of the message, as defined during configuration of the FMS.

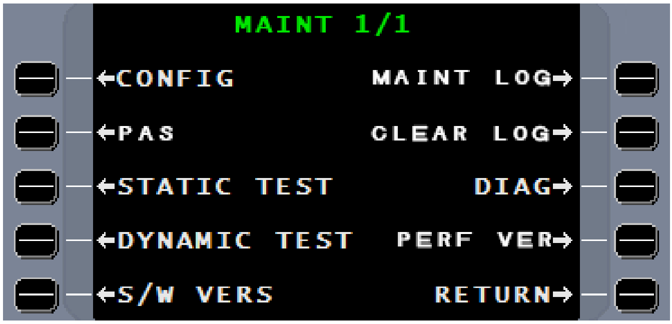
EFIS DISP – The EFIS DISP LSK accesses the Electronic Flight Instrumentation System (EFIS) Display Page. This page is only available in either a Collins Pro Line 4 800 or 4000 (Basic, Enhanced and CRJ) installation and allows control of the number of background waypoints that are displayed on the MFD. Refer to the applicable EFIS Operator's Manual.

UNILINK – The UNILINK LSK accesses the UniLink Page when this option is configured. Refer to the applicable UniLink Operator's Manual.

MSTR XFILL – Pressing the Master Crossfill LSK crossfills initialization, flight plan and fuel data from or to the other system in a multiple FMS installation. This prompt will not appear unless the system is configured for Master Crossfill. Crossfill options are not available in dual FMS installations configured for SYNC mode.

MAINT – The MAINT LSK accesses the Maintenance Page.

Maintenance Page 1
[DATA/MAINT]



CONFIG, STATIC TEST and **DYNAMIC TEST** options are available for installation checkouts.

PAS – [DATA/MAINT/PAS]. This option displays the PAS Maintenance page allowing the options to dynamically test the Precision Approach Subsystem (PAS) (guidance bus), confirm the antenna offsets, test the LOS discretes, reset the GG12W Almanac Data, or reset the GG12W Ephemeris Data. These four modes are only available on the ground, if PAS is not failed and a SBAS approach is not armed or active.

PERF VER – **[DATA/MAINT/PERF VER]**. This option displays the Performance Database Version Page when the aircraft is configured for Advanced Performance.

S/W VERS – [DATA/MAINT/S/W VERS]. This page displays all software versions applicable to the installation.

The system software version numbers are displayed as follows:

FMC – The system software version number. The basic software version number (e.g., 1002) is followed by a decimal point and additional number. The original software release will be .0, and any subsequent variations on that basic software will be .1, .2, etc. These variations of the basic software version will contain changes of minor impact only and will not require a new Operator's Manual.

CDU – The software version number for the CDU.

AUX – The software version number of the auxiliary processor in the FMS.

ANA – The analog-to-digital input board software version number.

RRS – The software version number of the optional Radio Reference Sensor (RRS).

BSTRP – The bootstrap software version.

ASCB – The software version of the ASCB board.

PAS – The PAS software version.

GG12W – The GG12W software version.

ERP – Appears in lieu of Radio Tuning Unit (RTU) when EFIS Radar Panel is installed.

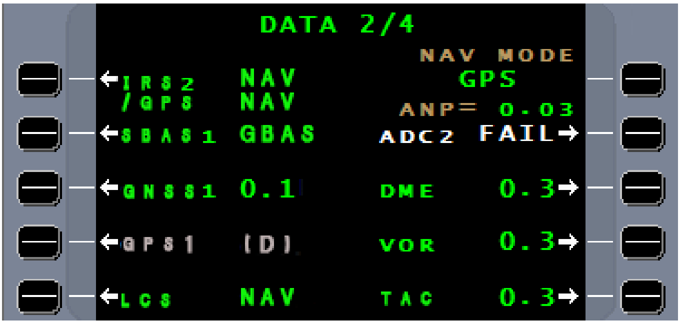
RTU – For configurations with the optional frequency management capabilities, this is the RTU software version number.

Data Page 2

Data Page 2 provides a synopsis of input sensor operation. The second line (following the page title) shows the most significant sensor and the estimated position uncertainty (i.e., ANP) associated with the FMS best computed position.

Navigation modes include:

Navigation Mode	Condition
GPS/DME	Valid GPS/SBAS navigation data received, GPS/SBAS sensor selected, more than 1 DME station received and DMEPOS variance less than 0.5 nautical miles (nm).
GPS	Valid GPS/SBAS navigation data received and GPS/SBAS sensor selected.
DME-DME	More than 1 DME station received and DMEPOS variance less than 2.2 nm.
DME-TACAN	1 DME and TACAN received and DMEPOS variance less than 2.2 nm.
LCS/TACAN	LCS valid and selected, TACAN data received and valid. DME-TACAN conditions are not met.
LCS-DME	LCS valid and selected, 1 DME station received and DMEPOS variance less than 2.2 nm.
TACAN	TACAN data received and valid. Conditions above not met.
DME-VOR	1 DME and VOR received and DMEPOS variance less than 2.2 nm.
DME	Only 1 DME station received and DMEPOS variance less than 2.2 nm.
LCS/IRS	LCS and IRS inputs received and valid. Conditions above not met.
LCS	LCS received and selected.
IRS	IRS inputs valid. Conditions above not met.
DOP	All other sensors are invalid or deselected and Doppler is available. (Heading and true air speed are required; they can be either manually entered or sensed).
DR	TAS and HDG only valid sensor inputs.
NO SENSOR	No valid sensor inputs present and selected.



The estimate of position error is displayed under the NAV MODE sensor field. Refer to Estimate of Position Accuracy in the Navigation Function section for a description of Required Navigational Performance/Actual Navigational Performance (RNP/ANP).

Next to the LSKs is the status (SBAS, GPS/GPIRS and Doppler sensors) or Estimate of Position Uncertainty (EPU) (DME, VOR and TACAN) of the individual navigation sensors installed. If VOR or TACAN is not being used for position calculation, the sensor accuracy is not displayed, and the corresponding field will be blank. The status displayed next to each sensor will be one of the following:

- **(D)** – The associated sensor has been either manually or automatically deselected
- **FAIL** – The associated sensor has been detected as failed or the system has been turned on and no data was received within the specified timeout period. Each sensor has a specified timeout period, however, 2-3 seconds is typical
- **ALIGN** – The associated IRS is in the align mode. The aircraft must remain stationary until alignment is complete
- **ATT** – The associated IRS is in the attitude mode. No navigational data is available
- **NAV** – The GPIRS, GLS, SBAS, GNSS, GPS or IRS sensor is in the navigation mode (alignment is complete) and navigational data is available

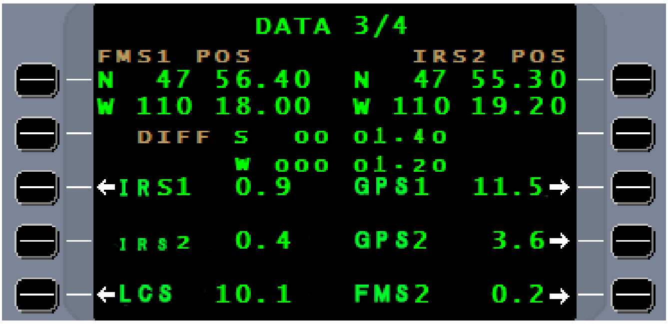
- **TEST** – Doppler, GLS, GNSS, GPS/SBAS or GPS is in self-test mode
- **UNLOCK** – Doppler is in unlock mode
- **DGPS** – GLS is receiving differential corrections
- **NORM** – All Doppler velocity labels are being received and indicating normal status
- **MEM** – All Doppler labels are being received, none indicate fail, and one or more indicates memory
- **ALT** – GPS/SBAS, GPS, GPIRS, GNSS or GLS is in altitude aiding mode
- **ACQ** – GPS/SBAS, GPS, GPIRS, GNSS or GLS is acquiring satellite data
- **INIT** – GPS, GPIRS, GNSS or GLS is initializing
- **SBAS** – Satellite Based Augmentation System (SBAS) is receiving data from the GPS satellites as well as at least one geosynchronous SBAS satellite.

NOTE: SBAS is always displayed on the FMS screen to indicate any SBAS Provider. The FMS automatically receives information from the SBAS when operating in the geographical boundaries of an SBAS provider if the provider is configured as ENABLED during FMS installation. The FMS screen display does not differentiate between SBAS Providers.

Each individual sensor's status page may be displayed by pressing the LSK corresponding to the desired sensor. From this Sensor Status Page, the sensor may then be deselected or reselected by pressing the LSK corresponding to the SEL (select) or DESEL (deselect) option.

Data Page 3

Data Page 3 displays FMS system position and all long-range sensors with their position differences expressed in radial nautical miles from the FMS position.

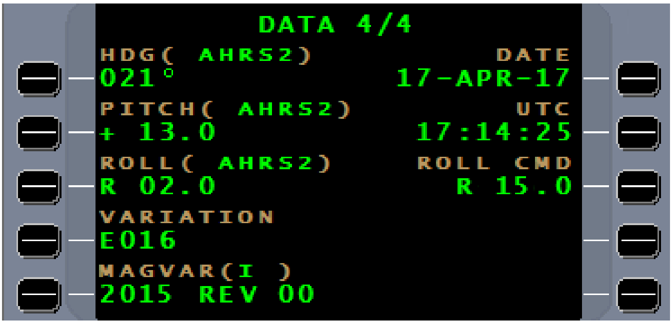


When the LSK corresponding to one of the sensors is pressed, that sensor's position is displayed in the upper right of the page and the position difference (broken into N-S and E-W components) is displayed just below the FMS position. The selected sensor will be displayed in small characters and its selection arrow will be removed from the display.

Press LSK [1L] to access the Define Position Page, where the aircraft position may be manually entered. Refer to Correct Data on Initialization Page in the Pre-departure section for more information.

Data Page 4

Data Page 4 is a general-purpose data page. If desired, manual entries may be made for heading, date, time, and variation. A manual heading entry is normally made in the event of failure of all heading inputs. Advisory information is provided concerning software version numbers and current aircraft steering commands.



HDG – The source of the heading data being used by the FMS. Next to this is the present aircraft heading. A "T" indicates that this is a true heading. With the cursor over the HDG entry field, pressing LIST will access the heading source page from which optional heading source selections may be made. If the heading is input manually, (MAN) will be displayed. Refer to Manually Enter an RNP in the Pre-departure section for more information.

PITCH – Display of analog pitch (degrees) being received from external Vertical Gyro, IRS or AHRS. "+" is up and "-" is down.

ROLL – Display of analog roll (degrees) being received from external Vertical Gyro, IRS or AHRS.

VARIATION – The magnetic variation is automatically computed and displayed between the latitudes of S60 and N73. (MAN), if displayed, indicates the variation has been manually input.

MAGVAR – If the FMS is using internal MagVar data, (I) displays the year for the MagVar data being used otherwise, (DB) will display the year and the revision of the MagVar Database being used.

ROLL CMD – Display of roll steering command being sent from the FMS to the flight guidance system. An "R" indicates a right roll, and an "L" indicates left roll. The digits following the “R” or “L” indicate the number of degrees of bank being commanded.

DATE – The date shown is that corresponding to the date in Greenwich, England. The value is derived from the GPS if installed. But can be manually changed. Input of the date is numerical by Day-Month-Year, e.g., 040907 would be the 4th of September 2007.

UTC – Coordinated Universal Time is entered as hours and minutes on a 24-hour format. The value is derived from the GPS if installed.

Navigation Function

The NAV function and pages display all the navigation data normally required by the pilot as well as provide a means of altering the current navigation leg. For all flight phases and non-SBAS approaches, the FMS navigates and generates guidance using a multi-sensor filter. Refer to the How Best Computed Position is Determined section in the FMS Reference Guide for information.

There are normally three navigation pages; however, when another navigation mode such as Approach or FMS Heading is selected, there will be four or more pages. Pages are cycled through by pressing the NAV, NEXT or PREV keys.

Normally, leg changes along a flight plan are automatic. Automatic leg changes will not occur if there is no Next (NX) waypoint on the Nav Page. For example, no automatic leg change will occur when the TO waypoint is followed by a gap (*GAP* or *NO LINK*) or the TO waypoint is the last waypoint on the flight plan. In this situation, the message NEXT LEG INVALID will appear. When the aircraft passes the TO waypoint there will be no leg sequencing, TO/FROM will change to FROM, distance will begin to increase, and the message CURRENT LEG EXTENDED will appear. This will alert the pilot that the aircraft is proceeding on an extension of the last valid desired track from the last waypoint.

Fifteen seconds prior to an automatic leg change (or arrival at the TO waypoint) the WPT ALERT message will become active and the WPT alert annunciator will illuminate steadily. Automatic leg changes occur before the TO waypoint at a distance based upon groundspeed, leg change magnitude and roll steering bank limit for the present altitude. The maximum distance before the waypoint at which the leg change will occur is 12 nautical miles (nm). If the aircraft passes to the side of a TO waypoint, the leg change will occur abeam the waypoint.

If the TO waypoint is designated as a flyover waypoint (delayed automatic leg change), the leg change will begin over the waypoint.

When the current navigation leg is valid (that is, the TO waypoint is displayed on the Nav Page) and the position is certain, the desired track and related data will be displayed. Roll steering outputs for flight guidance will be available if the navigation leg and velocity are valid. Velocity will be valid if sensor velocities or heading and TAS are available to the navigation computer.

The FMS outputs maximum indicated airspeed for AF and RF procedural leg types for display in aircraft equipped to do so.

The roll steering output limits for both normal and DTO leg-to-leg changes are configuration-specific and are set during initial configuration of the system. These specified limits are restricted to a maximum roll angle of 30°. The roll rate is limited to 3° per second in all installations.

Refer to the following table for operational roll angle limits.

Heading Change	Roll Angle Limit
Normal/DTO Leg Sequence	Standard rate turn not to exceed configured limits
Procedure Turn	27.8º
Holding	27.8º
FMS Heading	Equal to heading error; not to exceed configured limits
Procedural Headings (SIDs, STARs)	Equal to heading error; not to exceed configured limits
Tear-Drop Procedure Turn	10° to 20° (Refer to Procedure Turns in the Arrivals section)

When Approach mode is active, leg changes at the approach waypoints are automatic. In Approach mode, the WPT ALERT message becomes active and the WPT alert annunciator illuminates steadily five seconds prior to an automatic leg change. When the approach mode has been activated within 50 nm of the end-of-approach point (either the missed approach point or runway) and the required navigational aid is tuned, the FMS will generate the Approach mode outputs. These will include bearing and distance to waypoint, desired track, crosstrack, lateral valid, approach annunciator, vertical deviation (glideslope), and vertical valid. During SBAS approaches, the FMS uses the GPS/SBAS sensor position/velocity directly for navigation and guidance. Refer to GPS/SBAS Approach Guidance in the Arrivals Section for more information about SBAS approaches and the GPS/SBAS sensor.

Estimate of Position Accuracy

The FMS computes and displays an estimate of position uncertainty (EPU) to advise the user of the system’s position accuracy. The estimate is the 95% probability that the FMS position is within a certain distance of the actual position. This is displayed on the FMS as Actual Navigation Performance (ANP)/Required Navigation Performance (RNP).

ANP is composed of an estimate of position uncertainty and a very limited allowance for flight technical error. Whenever the resulting value is less than or equal to RNP, aircraft position is determined to be statistically within RNP limits. When ANP is greater than RNP, an annunciation is presented to the flight crew (POSITION UNCERTAIN).

The RNP value is the limit to position uncertainty the system will allow for continued flight and are specified for each phase of flight. RNP values are derived from three sources: manual entry, published database values, or FMS default values.

The FMS default RNP values are determined by the phase of flight. Manually entered RNP values override published values, which override FMS default values.

Refer to the table below for RNP priority, source, and limits.

Priority	Source	RNP Limit (nm)
1	Manual Entry	5.0
2	Navigation Database	Procedure dependent
3	Default Flight Phase:	
	Oceanic	4.0
	Enroute	2.0
	Terminal	1.0
	Approach	0.3

If there is a published Navigation Database RNP value associated with a specific leg or procedure, the database RNP value is displayed and indicated with a (P) on the Navigation Pages.

Upon change of flight phase, the FMS automatically sequences to the appropriate default RNP value for that flight phase. The FMS clears manual entries when an SBAS approach becomes active and uses the FMS default value.

A position uncertain message will be displayed when the ANP value is greater than the RNP limit.

Dual multi-sensor FMS installations which integrate dual GPS/SBAS sensors in the FMS meet the equipage and accuracy requirements of FAA Order 8400.12A paragraph 12b (4) for operations in RNP-10 airspace and FAA Order 8400.33 paragraph 8a(2)(b)I for operations in RNP-4 airspace. Operational approval must be obtained from the appropriate authority.

The FMS also complies with equipage and accuracy requirements of AC-90-96A paragraph Appendix 1 for BRNAV (RNP-5) when operating in Class I airspace, without time limits.

Inclusion of this function in the FMS does not constitute an Operational Approval for RNAV RNP SAAAR procedures.

Course Deviation Display

The FMS provides both analog and digital deviation information for display on the flight instruments. Where analog data are utilized (for example, with electro-mechanical flight instruments), instrument display sensitivity is determined solely by the FMS. EFIS equipment may use the digital deviation data, in which the display sensitivities will be determined by the EFIS computer.

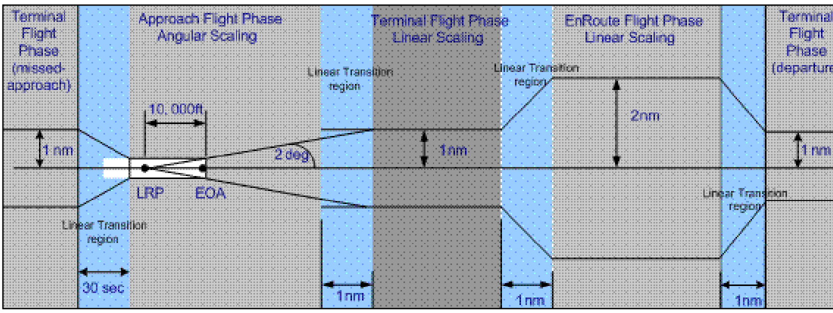
For normal FROM/TO legs where the FROM and TO waypoints are fixed waypoints, the deviation indication will agree with the great circle course between the waypoints.

Certain procedures found in SIDs and missed approaches contain legs that are not made up of fixed waypoints but a series of flight path instructions that have no fixed terminator. These include Course to an Altitude or Heading to a Radial leg. In these situations, the system calculates a predicted waypoint based on the aircraft's current trajectory. This predicted waypoint will be displayed on the EFIS (if equipped), and the course deviation indication will display cross track deviation to the predicted waypoint. When a heading is specified in a procedure, the course deviation indication will display zero deviation. The bearing pointer will indicate the proper procedural heading.

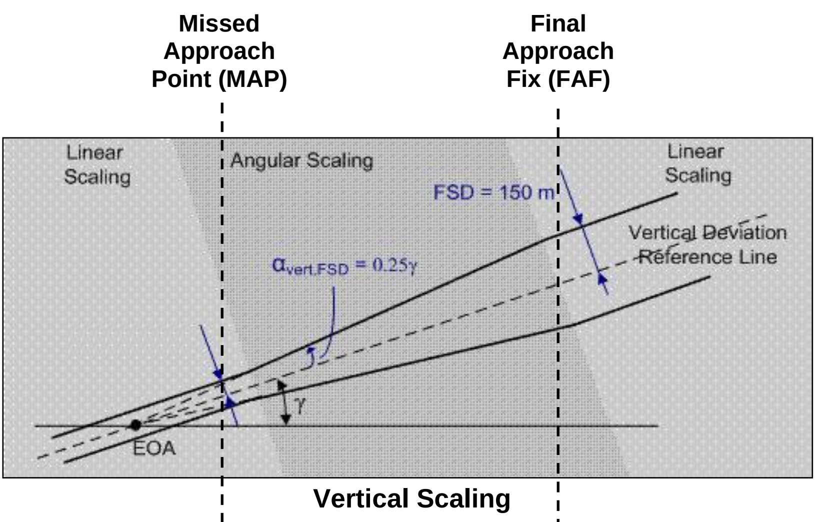
CDI Course Deviation Scaling

Consult the operator's manual or technical manual for the EFIS equipment to determine the display sensitivity for these instruments. Deviations less than 1.0 nm are displayed to 0.01 nm resolution.

Scaling



Lateral Scaling



Vertical Scaling

NOTE: Full scale vertical scaling is ¼ of the glide path angle. The maximum sensitivity is 15 meters for LPV and 45 meters for all other approach types.

In accordance with TSO C146b, the following apply to crosstrack display sensitivity. When the FMS is operating in terminal mode, the normal course deviation indicator (CDI) scaling is ± 1.0 nm. When the FMS is operating in the enroute mode, the normal CDI scaling is ± 2.0 nm. When the FMS is operating in the approach mode, the normal CDI scaling is angular.

Approach Armed Scaling

When 50 miles from end of approach (EOA) (direct distance to the runway), the APPR ARM option becomes available at LSK [3R] on Navigation Page 1.

Selecting APPR ARM changes the CDI scale sensitivity to ± 1.0 nm, which remains until approach is activated or canceled.

If an approach is linked into the flight plan and is not armed before reaching 30 nm from the destination, the system will automatically arm the approach, and the CDI scaling will change to 1.0 nm.

Approach Activated Scaling

The Approach mode may be activated automatically or manually. When the Approach mode is active, the FMS invokes angular CDI scaling. The CDI sensitivity is then ± 2.0°, approximately that of a normally sited localizer on a runway of about 10,000 feet in length.

NOTE: The FMS will maintain terminal scaling on SID, STAR, and approach transitions beyond the 30 nautical mile limit.

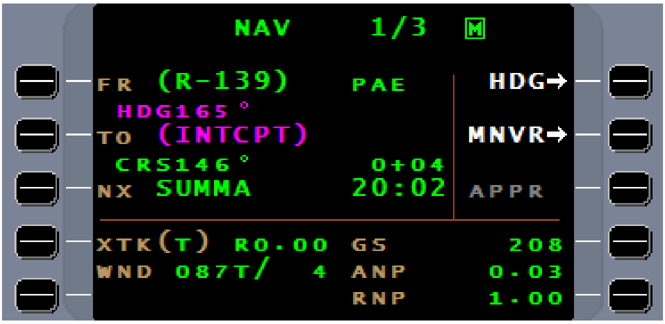
Missed Approach Scaling

CDI deviation scaling remains angular as in approach mode until the EOA is sequenced. After sequencing the EOA:

- If the first leg of the missed-approach procedure is a TF leg aligned within 3° of the inbound course, then the scaling is 0.3 nm
- If a non-TF leg, then the scaling is 1.0 nm.

Navigation Page 1

NAV 1/3 page is accessed by pressing **[NAV]**.



The page is divided by a dark horizontal line. Information above the line is formatted in the manner of non-radar position report.

Current steering or guidance status is displayed in the field directly above the FROM waypoint. Indications include: HDG SEL, HDG INTERCEPT, PROC HEADING, APPR ACTIVE, HOLDING, HOLD ARMED, APPR ARMED.

FR – Displays the identifier of the current FROM waypoint and the time of waypoint passage.

Additional navigational information is displayed under the waypoint identifier. This data depends on the current leg type:

AF or RF: Turn direction, arc radius (nm) and the identifier of the reference fix or waypoint at the center of the arc.

NOTE: Depending on the FMS configuration and installation, the following RF leg display options are available:

- RF leg radius displayed and Distance To Go (DTG) is output as straight leg distance to the EFIS
- RF leg Along Track Distance (ATK) displayed and DTG is output to EFIS
- RF leg ATK displayed and ATK is output to EFIS.

TF or DF:	Turn direction, desired course, and the great circle distance (nm) from present position to the leg terminator.
VA, VD, VI, VM or VR:	Turn direction and desired heading.
HA, HF or HM:	Turn direction, desired course and (HA and HM only) the identifier for the reference (hold) fix.
All Other Leg Types:	Turn direction, desired course and (FA, FC, FD and FM only) designation of the reference fix.

NOTE: Refer to the Universal Avionics FMS Reference Guide for a description of procedural leg types.

Additionally, Estimated Time Enroute (ETE) is displayed for TF, CF, DF, RF or HF leg types. If ETE is greater than 99:59, "++.++" is displayed. ETE is distinguished from clock time by the use of plus (+) sign, clock times use the colon (:) separation.

Desired course is the course (or desired track) between FROM and TO waypoints. Distance and ETE are from present position to the TO waypoint.

TO – The identifier of the current TO waypoint and either the estimated time of arrival (ETA) for that waypoint (leg types TF, CR, DR, RF or HF) or the identifier for the reference waypoint for the TO terminator (leg types CD, CR, FC, FD, VD or VR). For all other leg types, only the TO waypoint identifier is displayed.

Additional navigational data for the leg between the TO and the NX waypoints is displayed under the waypoint identifier. This data depends on current leg type:**TF:**	Turn direction, desired course, and the great circle distance (nm) from present position to the leg terminator.
DF:	Turn direction and the text "(DIRECT)".
AF or RF:	Turn direction, arc radius (nm) and the identifier of the reference fix or waypoint at the center of the arc.
VA, VD, VM or VR:	Turn direction and desired heading.
HA, HF or HM:	Turn direction, desired course and the identifier for the reference (hold) fix (HA and HM only).
VI, CI or PI:	Turn direction and IF identifier (if Next leg is IF/TF) or flight plan leg length in nm (if Next leg is TF without IF) from present position to the leg terminator.
All Other Leg Types:	Turn direction, desired course and (FA, FC, FD and FM only) designation of the reference fix.

NX – The identifier of the current NX waypoint and either the ETA for that waypoint (leg types TF, CR, DR or RF), the identifier for the reference waypoint for the TO terminator (leg types CD, CR, FC, FD, VD or VR) or either "LEFT" or "RIGHT" (leg type PI). For all other leg types, only the NX waypoint identifier is displayed.

XTK/SXTK – Crosstrack/Selected Crosstrack. This is the lateral distance in nm left (L) or right (R) of the extended course centerline between the FR and TO waypoints. Crosstrack (XTK) is appended with (E), (T), (R) or (A) indicating enroute, terminal, RNP or approach CDI scaling. A manually selected crosstrack (SXTK) may be entered in this field except when in FMS Heading mode. When SXTK is entered, XTK moves up one line. Refer to Maneuver Page in the Operations section for more information.

WND – This field displays the FMS calculated wind direction and wind speed, in knots, as computed by the NAV function. Wind direction is differentiated with a "T" for True or a degree sign (º) for Magnetic. Wind direction is True, regardless of the position of the panel mounted Mag/True selector switch, except while in Approach Mode. When operating in Polar Regions (above N72 or below S60 degrees latitude), wind display remains in degrees True in Approach mode.

GS – Displays current groundspeed.

ANP –This field displays the ANP value - the measure of EPU.

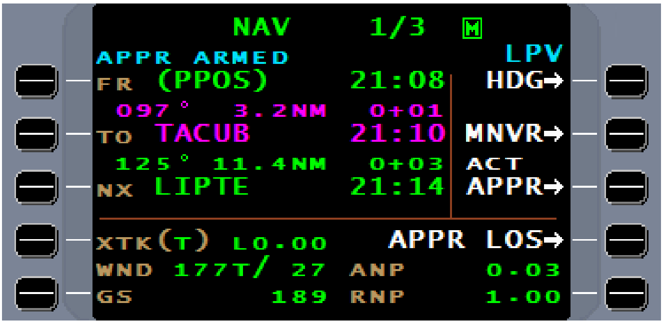
RNP – This field displays the RNP value. If the pilot manually enters a value for RNP, (M) is displayed next to the value indicating a manual entry. If the value displayed is a published value, (P) is displayed next to the value. If no indication is displayed in parentheses, the value is a system default value. Refer to Estimate of Position Accuracy in the Navigation Function section for more information.

HDG – Commanded Heading is an option configurable at time of installation. Pressing this LSK will access the Commanded Heading Page. Refer to Commanded Heading Page under Navigation Function in the Operations section for more information.

MNVR – Pressing this LSK will access the Maneuver Page. From this page, PVOR, SXTK and Holding Patterns can be defined and activated. Refer to Maneuver Page under Navigation Function in the Operations section for more information.

APPR or **ARM APPR** or **ACT APPR** or **TUNE APPR** or **CANCEL APPR** or **MISSD APPR** – Pressing this LSK will access the FMS Approach mode if there is an approach programmed into the flight plan. If the approach geometry is invalid, only APPR will appear, and this option will not be selectable. When the approach geometry is valid, the option becomes selectable. Refer to Arrivals – STARs and Approaches in the Operations section for more information about approaches.

Navigation Page 1 (Approach Armed)



Navigation Page 1, SBAS Approach Armed

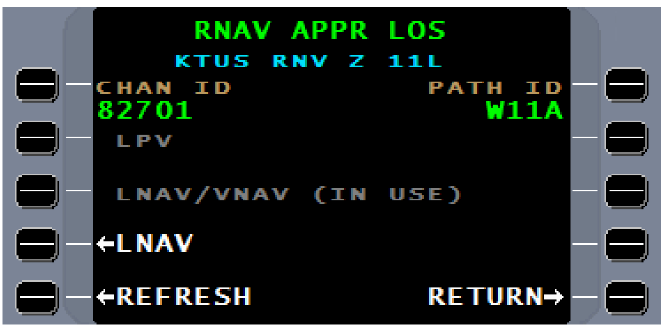
When an approach is armed, APPR ARMED is displayed directly above the FROM waypoint and the ACT APPR option is available adjacent LSK [3R]. Refer to Activate Approach Mode in the Arrivals section for more information about this option.

When an SBAS approach is armed, the selected Level of Service (LOS) is displayed above LSK [1R] and the APPR LOS option is displayed adjacent LSK [4R]. Selecting APPR LOS displays the RNAV Approach LOS Page from which the desired LOS may be manually selected if it is available. The groundspeed is moved adjacent LSK [5L].

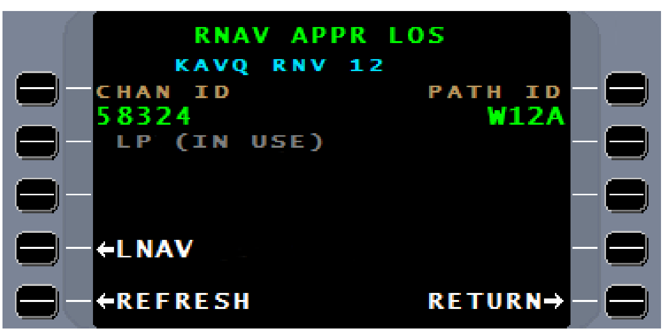
RNAV Approach LOS Page

[NAV/APPR LOS] When an SBAS approach is armed or activated, the RNAV Approach LOS Page is accessed via LSK [4R] on Navigation Page 1 or Navigation Approach Page 1.

All currently available LOS for an SBAS approach are displayed on this page for manual selection.



LNAV/VNAV APPR LOS



LP APPR LOS

CHAN ID – If a Channel ID is available for the selected approach, it is displayed adjacent LSK [1L].

PATH ID – If a Path ID is available for the selected approach, it is displayed adjacent LSK [1R].

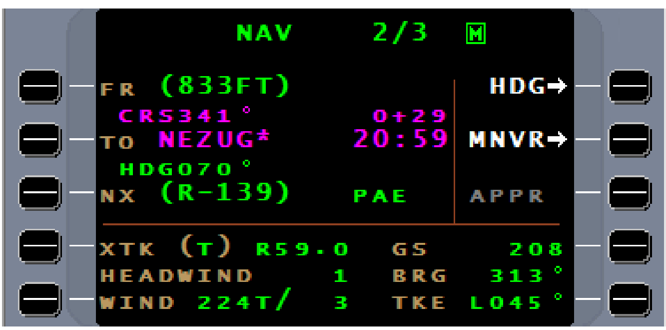
LP, LPV, **LNAV/VNAV** and **LNAV** LOS are listed adjacent LSK [2L], LSK [3L] and LSK [4L], respectively. The text (IN-USE) is displayed adjacent the currently selected LOS.

If a LOS is not available for the selected approach, it is displayed in small font and cannot be selected.

If the sensor has been deselected, its status will be indicated adjacent the LOS field, i.e., LPV (SBAS DESEL).

Navigation Page 2

Navigation Page 2 displays FR/TO/NX waypoint information and crosstrack, wind and groundspeed information similar to Navigation Page 1. In addition, headwind/tailwind, bearing to current terminator and track angle error are displayed.



HEADWIND/TAILWIND – Displays wind component as computed by the FMS.

BRG – Displays the bearing to the current terminator.

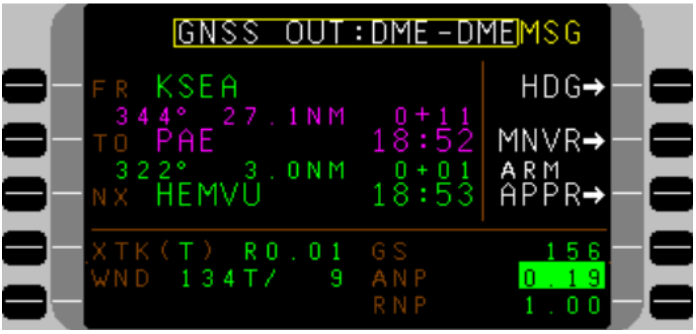
TKE – Displays the track angle error (TKE). TKE is the difference between desired track and actual track, both in relation to true north. For procedural heading legs, this field displays field heading error, which is the difference between actual heading and desired heading. A positive value of TKE (i.e., desired track greater than actual track, or desired heading greater than actual heading) will be indicated by an "L" preceding the three-digit angular value and a negative value will be preceded by an "R".Navigation Position Page.

Navigation Reference Page – The Navigation Reference Page (NAV REF) provides the capability to deselect all configured GNSS sensors at one time except for two sensor types: EGI, and a military GNSS anti-jamming sensor. The NAV REF page also displays the RNP, ANP, navigation mode (NAV MODE), and a navigation timer (TIME IN) to display the duration since the FMS entered the current navigation mode.

In the event of a loss of GNSS sensors, the FMS will utilize other multi-sensor-based navigation such as DME-DME, IRS, LCS and doppler navigation modes.

If all GNSS sensors are lost the FMS will display a pop-up window message stating "GNSS OUT: 'NAVMODE'" (where NAVMODE is the current navigation mode). This message alerts the operator that all configured GNSS sensors are unavailable, resulting from invalid navigation mode or failure; current navigation mode is still valid.

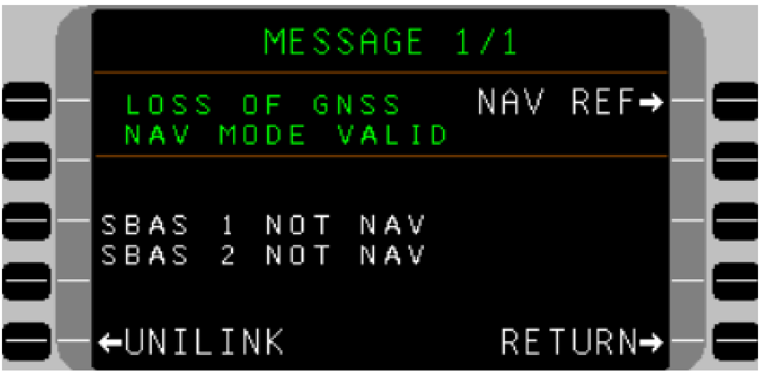
NOTE: The pop-up window message will not display if the operator manually deselects all configured GNSS sensors.



GNSS OUT Pop-up Window MSG, NAV 1/3 page (SCN 1002/1102.6 and later)

The pop-up window message is cleared when the Message [MSG] mode key is selected, GNSS sensors become available or are deselected or when NAV MODE transitions to DR or NO SENSOR.

The Loss of GNSS Message Prompt is triggered by the same conditions as the "GNSS OUT" pop-up window message. When the "GNSS OUT" pop-up window message is displayed in the FMS title line, simultaneously the Loss of GNSS Prompt Message is displayed on the MESSAGE page. The MSG indicator will be flashing, and a new message is displayed on the MESSAGE page.



Loss of GNSS Message on MESSAGE Page (SCN 1002/1102.6 and later)

The Loss of GNSS Prompt Message will display "LOSS OF GNSS NAV MODE VALID" and direct access to the NAV REF page by selecting LSK [1R]. The operator can then review current navigation mode, RNP, ANP and the navigation timer.

The Navigation Reference Page is accessed by selecting NAV REF at LSK [4L] on the Navigation Position Page or LSK [1R] in the GNSS Loss Prompt Message when displayed on the MESSAGE page.

NOTE: The Navigation Position Page is the NAV 3/3 page in enroute or terminal phases of flight, or the NAV 4/4 page when an approach is active.

NAV REF Page with GNSS SELECT set to AUTO (SCN 1002/1102.6 and later)

GNSS SELECT – This field provides the pilot with the capability to manually deselect all configured GNSS sensors and can be toggled between AUTO and OFF. If an approach is armed or active or an EGI sensor is selected, the FMS inhibits selection of the GNSS SELECT field.

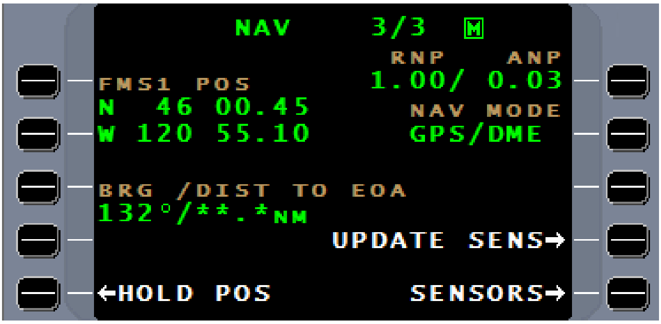
NAV REF Page with GNSS SELECT set to OFF (SCN 1002/1102.6 and later)

RNP/ANP – The NAV REF page displays the current RNP and ANP values. The RNP field can be entered manually, selecting LSK [1R]. The ANP color is inverted as shown above when the FMS navigation mode changes from a GNSS-based mode to a radio-only based mode.

TIME IN – The TIME IN field is the navigation timer. The timer is always displayed and resets at navigation mode transition. TIME IN is displayed HH+MM (hours/minutes).

Navigation Position Page

The Navigation Position Page shows the FMS system position and position certainty associated with the FMS best computed position.



FMS# POS – This field displays the current FMS position. Pressing either LSK [1L] or LSK [2L] will access the Define Position Page for entry of present position coordinates.

BRG/DIST TO EOA – This field displays the bearing and distance information for the EOA point when an approach is loaded into the flight plan.

HOLD POS – Pressing this LSK will access the Hold Position Page.

RNP/ANP – Pressing LSK [1R] allows entry of an RNP value. Refer to Manually Enter an RNP under Pre-departure in the Operations section for more information.

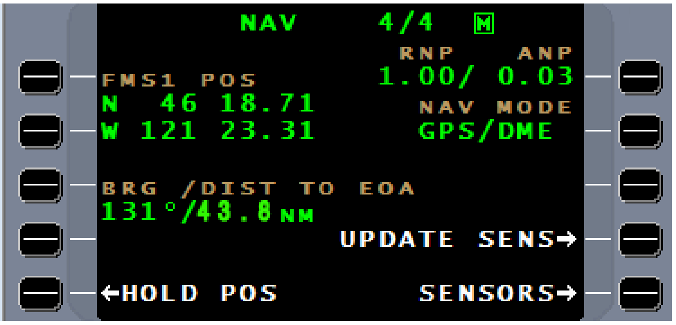
UPDATE SENS – (Update Sensor) Pressing this LSK will send current FMS best computed position (BCP) latitude/longitude to Loran and inertial (ground-only) sensors. Pressing this key is equivalent to pressing HOLD POS and accepting the current latitude/longitude.

NOTE: Pressing the Update Sensor LSK will cause no change in this page display.

SENSORS – Pressing this LSK will access Data Page 3.

Navigation Page 4/4

If the flight plan contains an active approach, the NAV 4/4 page will display.

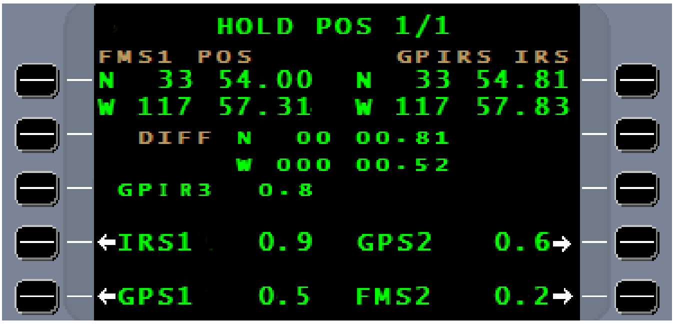


NOTE: The NAV 4/4 page will contain all the information and LSK options available on NAV 3/3. It will also contain End of Approach (EOA) data.

BRG/DIST TO EOA – This field displays the bearing and distance information for the EOA point when an approach is loaded into the flight plan.

Hold Position Page

[NAV/HOLD POS]



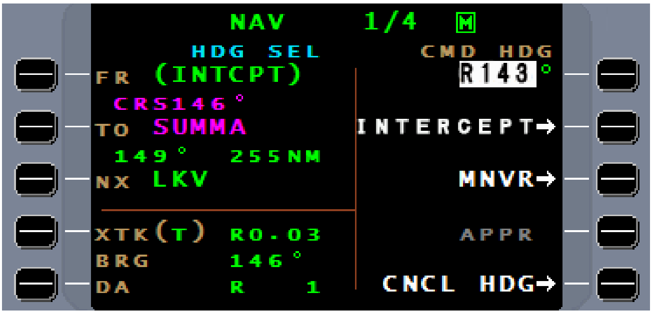
The position in the upper left of the page is supplied by the FMS. Pressing LSK [1L] displays the Define Position Page where position can be manually updated, if desired.

Configured long range navigation sensors appear adjacent to LSKs [3L] through [5L], [3R] and [4R]. A crossfilled FMS, if one is available, will appear adjacent to LSK [5R]. Pressing the associated LSK for each sensor will cause its position to be displayed in the upper right of the page. For example, sensor GPIR3 is currently selected in the illustration above.

The difference in position between the FMS and the selected sensor is displayed below the two positions. In addition, the difference in distance between the FMS calculated position and the selected sensor position is displayed next to the identifier of each sensor in nm. For example, the difference in distance between the FMS position and the position for GPS2 in the illustration above is 0.6 nm.

Commanded Heading Page

[NAV/HDG] or **[NAV/MNVR/HDG]** Commanded Heading is an option configurable at time of installation. The Commanded Heading Page allows control of the aircraft heading from the FMS, while maintaining a display of information pertaining to the current navigation leg.



The heading mode in effect, either HDG SEL or INTERCEPT is displayed immediately below the page heading.

NOTE: The current navigation leg may sequence due to maneuvering the aircraft with respect to the flight plan.

NOTE: If Commanded Heading is flown abeam a holding pattern fix, the hold fix will sequence and the leg after the hold will be the active leg.

The data presented on the left side of the page is identical to the data shown on Navigation Page 1 and can be altered using the procedures described for Navigation Page 1.

CMD HDG – This is the heading which the FMS will use, as directed by the heading mode selection made with LSK [2R] (INTERCEPT or HDG SEL). The cursor's position defaults to this entry field so heading changes can be made easily. When the page is first accessed, the current heading will be flashing. A new heading may be entered or ENTER may be pressed to confirm the current heading. When a new heading is typed into this field, the FMS assumes the shortest direction of turn. This may be changed to the long direction with the sign reversal key (±) or the BACK key. After a new heading is entered, ENTER must be pressed a second time for confirmation.

TURN R (or L) nnn° – Pressing R, L or ± key when cursor is over CMD HDG field will result in display of “TURN R (or L) ______”. Enter the number of degrees from current heading that it is desired to turn (for instance TURN L 10°). In this example, 10° will be subtracted from current heading, and the aircraft will turn to and roll out on that new heading.

INTERCEPT/HDG SEL – This LSK is used to change the heading mode currently in use. The line will read HDG SEL or INTERCEPT depending upon the mode. If the Heading Select (HDG SEL) mode is in use, INTERCEPT will be the selectable option and vice versa. If the CMD HDG does not intercept the current navigation leg, the INTERCEPT option will not be available and the field will read NO INTCPT. The heading mode in use is displayed below the page title. In Heading Select mode, the FMS will follow the commanded heading until changed or canceled regardless of the active navigation leg. In Intercept mode, the FMS will follow the commanded heading until intercepting the active navigation leg. When the navigation leg is intercepted, the FMS will revert to normal navigation and will display Navigation Page 1.

MNVR – Pressing LSK [3R] will access the Maneuver Page.

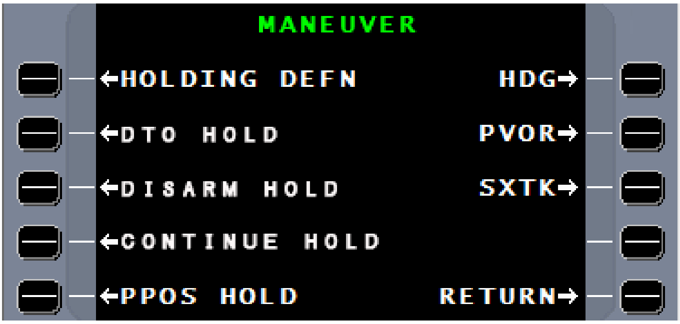
ARM APPR/ACT APPR – If an approach is linked to the flight plan, LSK [4R] indicates ARM APPR when 50 nm from destination. If ARM APPR is selected, the key will change to ACT APPR. The reference navaid in the approach will be tuned. If ACT APPR is selected, the flight plan will sequence to the INBOUND course of the approach, and the FMS will automatically enter HDG mode (when configured).

CNCL HDG/RETURN – With CNCL HDG displayed, selecting this option immediately cancels the heading mode and the FMS provides steering to intercept the active navigation leg at a 45° angle. If the heading mode is not active, RETURN is displayed and pressing the LSK will return the display to the previous page.

In installations interfaced with Collins C-14 or Compatible EFIS Software, there is a two-way interface with the heading select knob. This function allows the FMS to receive selected heading settings driven from the heading select knob. Conversely, when the FMS is in FMS HDG, any entry on the FMS will be received by the EFIS, and the heading bug will slew to that value. In either case, the flight guidance system (FGS) flies these headings when NAV mode is engaged.

Maneuver Page

[NAV/MNVR] or **[NAV/HDG/MNVR]**



HOLDING DEFN – If no hold is defined, selection of **LSK [1L]** displays the Hold Fix Page. If a Hold is armed, it displays the Holding Pattern Definition Page for the next hold in the flight plan. If Hold is activated, it displays the Holding Pattern Definition Page for the active hold.

DTO HOLD/PROCEED – If a holding pattern is not defined, there are no options at this LSK.

If a holding pattern is defined, **DTO HOLD** is displayed. Selecting this LSK will display the Holding Pattern Definition Page for the next hold in the flight plan.

If a holding pattern is active, **PROCEED** is displayed at this LSK. Selecting this LSK displays the Navigation Page 1 if the current holding fix in the flight plan. If no holding fix is in the flight plan, the Navigation Leg Page is displayed.

DISARM HOLD – Displays at LSK [3L] whenever an armed (not activated yet) holding pattern is present in the flight plan (from the TO waypoint and beyond). Selecting this LSK displays the Holding Pattern Definition Page for the next hold with DISARM HOLD highlighted at LSK [5L].

CONTINUE HOLD – This option is displayed whenever a holding pattern that terminates automatically (HA or HF legs) is active or when PROCEED is selected for any holding pattern after the hold fix has been sequenced for the first time.

PPOS HOLD – Holds at present position (PPOS). Pressing this LSK displays the Holding Page with the current position in the Hold Fix field. Refer to Hold at Present Position under Enroute in the Operations section for more information.

HDG – Commanding Heading is an option configurable at time of installation. Pressing this LSK will access the Commanded Heading Page. Refer to Commanded Heading Page in the Navigation Function section for more information.

PVOR – Displays the Pseudo-VOR Page.

SXTK/CNCL SXTK – SXTK is displayed when selected crosstrack is not active. Selecting this LSK displays Navigation Page 1 with the SXTK field highlighted for manual crosstrack entry.

CNCL SXTK is displayed when selected crosstrack is active. Selecting LSK [3R] cancels selected crosstrack and displays Navigation Page 1. Selected Crosstrack (SXTK) General Information.

The FMS provides a selected crosstrack (SXTK) Mode, which enables the FMS to fly a parallel path at a desired offset distance from the normal flight plan.

SXTK is available in the Departure, Enroute, and standard terminal arrival route (STAR) flight plan segments and can be initiated when the current leg is a CF, DF, RF, or TF leg. SXTK mode can also be initiated on a DTO and precision VHF omnidirectional range (PVOR) inbound leg.

NOTE: AF, CA, FA, FC, and FM legs are no longer supported because these are not required by RTCA/DO-229D.

SXTK is not available in the Approach Transition or Approach segments.

Activating SXTK Mode

SXTK mode is initiated by entering a SXTK value on the NAV page or by selecting SXTK on the MANEUVER page. SXTK entries can be made in increments of 0.1 nm up to 99.9 nm. The minimum radius that is allowed for an RF leg is 1.0 nm.

Cancelling SXTK Mode

SXTK mode is cancelled by:

- Sequencing the last SXTK reference waypoint
- Entering a zero SXTK entry, or entering <BACK>, <ENTER> at the SXTK field on the NAV page
- Selecting CANCEL SXTK on the MANEUVER page
- Performing a DTO, PVOR, or Manual Leg Change or activating a hold
- Activating approach mode.

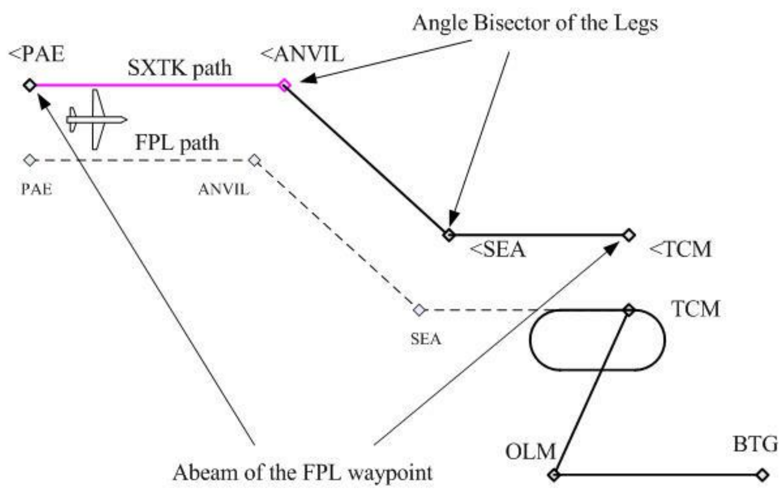
The SXTK CANCEL message is displayed when approaching the end of the SXTK path allowing the flight crew sufficient time to return to the original FPL prior to the end of the SXTK path. The SXTK CANCEL message is not displayed when the last SXTK reference waypoint is followed by a GAP, NO LINK, or the end of flight plan and cannot be sequenced. For these situations, SXTK mode remains active, and the CURRENT LEG EXTENDED and NEXT LEG UNDEFINED messages are displayed.

SXTK mode is automatically cancelled when it sequences the last SXTK reference waypoint, and the flight crew has not taken action after the SXTK CANCEL message is displayed. Guidance and steering is returned to the original FPL.

SXTK Path

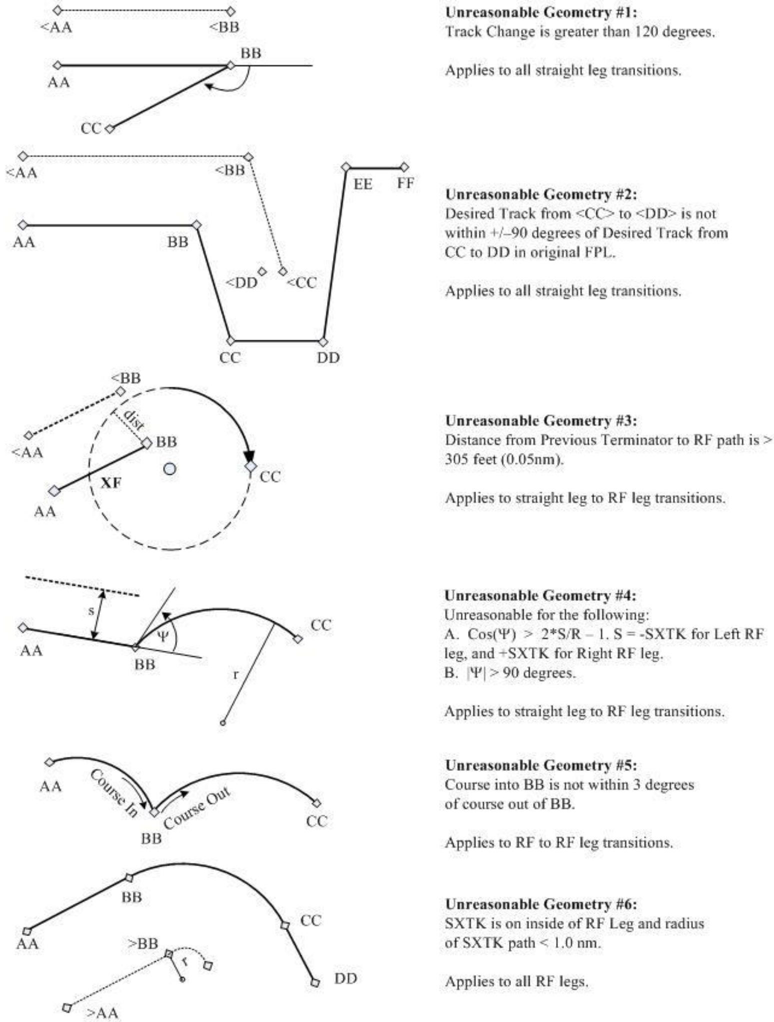
For RF and TF legs, once SXTK is initiated, it is applied to the current leg and is propagated down path until an invalid leg, a route discontinuity, or unreasonable geometry is encountered.

The SXTK reference waypoints that define the SXTK path are computed by the FMS. The SXTK reference waypoints are located at the angle-bisector of the leg transition. The SXTK reference waypoint is computed abeam of the FPL waypoint for the FROM waypoint and the last SXTK reference waypoint.



Location of SXTK Reference Waypoints

The original FPL waypoint attributes including RNP, Altitude Constraint, Speed Limit, Wind, Overfly, and Forced Turn Direction are applied to the SXTK reference waypoints. These waypoints are displayed with the original identifiers preceded with a < for a left SXTK or a > for a right SXTK. (e.g., <SEA, >TUS, > DINGO).



Unreasonable Geometry

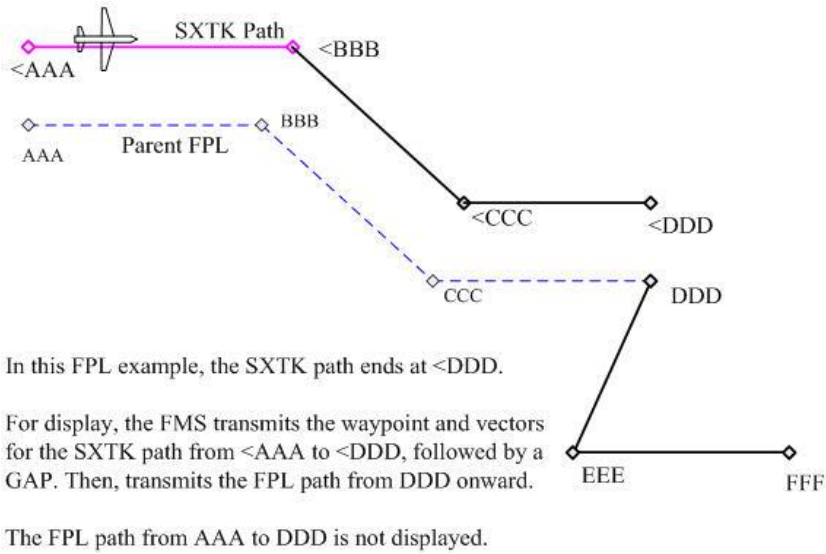
Guidance and Performance

Guidance, steering, and performance computations are switched by the FMS to the SXTK path when SXTK mode is active. Computations for XTK, track error, desired track, bearing to waypoint, estimated time enroute (ETE), estimated time of arrival (ETA), fuel at waypoint, and distance to go (DTG) use the SXTK path.

VNAV is inhibited when SXTK mode is active.

SXTK Display Outputs

The FMS transmits the SXTK reference waypoints to the EFIS when SXTK mode is active. The FMS does not transmit the original FPL waypoints that correspond to the SXTK reference waypoints.



Sample FPL Output to EFIS

The original FPL waypoints that follow the SXTK path may or may not be displayed depending on the capability of the EFIS. A GAP is inserted after the last SXTK waypoint to prevent connecting the SXTK path to the original FPL because the displayed leg is not the leg that will be flown.

Holding Pattern General Information

Holding patterns may be programmed at any waypoint on or off the flight plan or stored in the Navigation Database as part of SID, STAR and approach procedures.

Holding patterns are identified by ARINC 424 as HA, HF and HM leg types. They are all defined in the same manner except for the type of terminator of the leg. The FMS will fly each of these legs as follows:

1. HA (hold to an altitude terminator) – The aircraft will stay in the holding pattern until the specified altitude is reached then sequence to next leg the next time it crosses the holding fix. HA type holding are generally found in SIDs.
2. HF (hold to a fix terminator) – The aircraft will sequence to the next leg after crossing the holding fix the second time. HF holding patterns are usually used as course reversals in lieu of procedure turns.
3. HM (hold to a manual terminator) – The aircraft will remain in the holding pattern until an action is taken by the pilot to depart. HM holding patterns are most commonly found at missed approach holding fixes and are the only type of holding patterns the pilot can program manually.

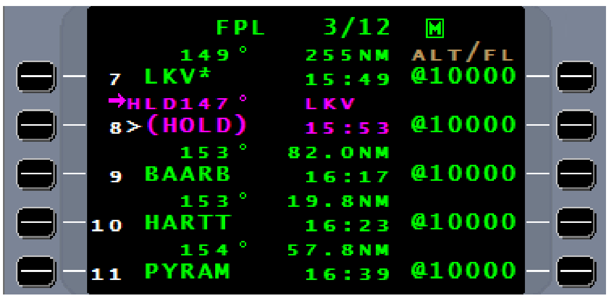
When a holding pattern is defined at a fix on the flight plan, it may be either armed or directly activated. If armed (ARM HOLDING) the aircraft will continue to fly the flight plan and enter holding upon reaching the holding fix. If directly activated (DTO HOLD), the aircraft will proceed directly to the holding fix and commence holding. If the fix is not on the flight plan, the hold may only be directly activated.

Once established in the pattern, the FMS will fly the correct legs, compensating for existing wind conditions. ETA over the holding fix is constantly displayed.

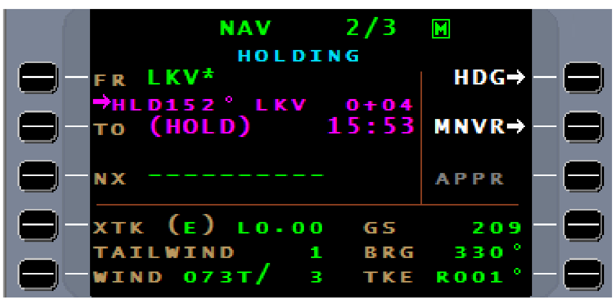
If a holding pattern is defined and the hold is not armed or activated, the definition of the last hold defined will be retained even if the Holding Page is exited.

Holding Pattern Depiction on Navigation and Flight Plan Pages

Holding pattern definitions and terminators are displayed below as they appear on Navigation and Flight Plan Pages. Holding fixes are designated as overfly waypoints on the pages. An asterisk "*" appears following the waypoint on these pages. The letters HLD, preceded by a turn direction arrow and followed by the inbound course designates the holding pattern. A "T" or "°" follows the course and indicates true or magnetic respectively. The terminator will be depicted as an altitude for HA legs, a waypoint name for HF legs and HOLD for HM legs. The following are examples:



Example Flight Plan Page Showing HA Leg



Example Navigation Page Showing HM Leg

Holding Pattern Depiction on HOLD FIX, NAV LEG and DTO Pages

Waypoints with holding patterns, whether obtained from the procedural database or defined by the pilot, are depicted as shown. The "*" designates the waypoint as a flyover waypoint while a subsequent waypoint designating an HX leg follows with a "/H" to indicate the hold.

Pseudo-VOR Page

[NAV/MNVR/PVOR] or **[DTO/PVOR] -** The Pseudo-VOR (PVOR) Page provides the capability to track to or from any known waypoint on a programmed course or radial.

WPT – This field is prefilled with the identifier of the terminator for the current guidance leg, or the first fix in the flight plan beyond the current leg if it is not a fix.

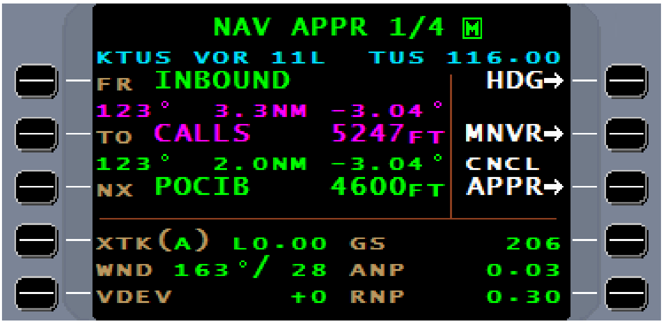
DESIRED TRK – Displays the desired track, in degrees or (T) true.

RADIAL INBOUND – Displays the radial to be used to fly inbound toward the PVOR.

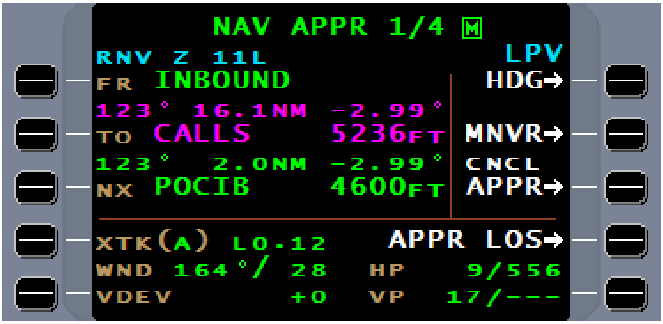
OUTBOUND – Displays the radial to be used to fly outbound from the PVOR.

Navigation Approach Page 1

The Navigation Approach Pages are available when an approach is active in the flight plan and the **[NAV]** is pressed.



Navigation Approach Page, Approach Active



Navigation Approach Page, SBAS Approach Active

The second line of text on Navigation Approach Page 1 displays the airport, approach type, approach runway, navaid, and frequency of navaid, respectively. When a DME or multiple approach indicator is associated with an approach, the airport is not displayed due to space constraints. When an SBAS approach is active, the LOS is displayed in place of the navaid identifier and frequency. The remaining items are explained below.

FR – This field displays the previous leg identifier. Pressing LSK [1L] displays the Manual Leg Page. Making a leg change on this page cancels the Approach mode.

For Course to Fix legs and Track from Fix-to-Fix legs, the text below the FR line displays the desired track for the next leg, length of next leg and flight path angle of next leg. For Precision Arc to Fix legs, the text below the FR line displays the turn direction and radius of the arc.

TO – This field displays the terminator fix for the current leg and its altitude. If the FR waypoint is a fix, then pressing LSK [2L] displays the Manual Leg Page. Making any change on this page will cancel Approach mode. If the FR waypoint is a floating waypoint, pressing LSK [2L] will display the DTO Page. Performing a DTO cancels Approach mode.

For Track from Fix-to-Fix legs, the text below the TO line displays the desired track for the next leg, length of next leg and flight path angle of next leg. For Precision Arc to Fix legs, the text below the TO line displays the turn direction and radius of the arc.

NX – Displays the terminator for the next leg and altitude. Pressing LSK [3L] when no NX leg is identified will display the Manual Leg Page. Making a change or entering a next leg on this page will cancel Approach Mode.

HDG – Pressing LSK [1R] will display the Commanded Heading Page, if configured.

MNVR – Pressing LSK [2R] displays the Maneuver Page.

CNCL/MISSD APPR – Pressing LSK [3R] when MISSD is displayed will execute a missed approach procedure. Pressing LSK [3R] when CNCL is displayed will cancel Approach mode.

XTK – The crosstrack distance from the current leg. An (E), (T), (R) or (A), approach in this field indicates wither enroute, terminal, RNP or approach phase of flight crosstrack scaling is active, respectively.

WND – This field displays the filter wind direction and wind speed, in knots, as computed by the NAV function. Wind direction is differentiated with a “T” for True or a degree sign (°) for Magnetic. Wind direction is True, regardless of the position of the panel mounted Mag/True selector switch, except while in Approach Mode. When operating in Polar Regions (above N72 or below S60 degrees latitude), wind display remains in degrees True in Approach mode.

VDEV – The vertical deviation from the current leg measured in feet. A negative number indicates that the current aircraft position is below the pseudo glideslope while a positive number indicates that the current aircraft position is above the pseudo glideslope.

GS/APPR LOS – Groundspeed is displayed when a non-SBAS approach is active. When an SBAS approach is active, APPR LOS selection is displayed. Refer to the Navigation Function and Arrivals section for more information about the RNAV Approach LOS Page.

ANP/HP – For non-SBAS approaches, this field displays ANP as a measure of EPU.

For SBAS approaches, this field displays the Horizontal Protection Level (HPL) and the Horizontal Alert Level (HAL) for the approach.

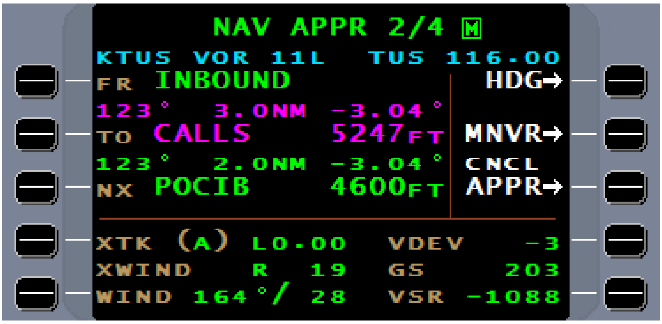
The HPL is determined by the GPS/SBAS sensor. The HAL is based on the SBAS approach LOS. For LNAV/VNAV LOS, the HAL is 556 meters (0.3 nm). For LP and LPV LOS, the HAL is provided by the Final Approach Segment Data Block (FAS DB) information for the selected approach. For LNAV or no LOS, HAL is not applicable, and dashes are displayed in this field.

RNP/VP – For non-SBAS approaches, this field displays the RNP value. An (M) indicates a manual entry. A (P) indicates a published database RNP value. If no indication is displayed in parentheses, the value is a system default value. To manually enter an RNP, press LSK [5R] to highlight the field, and then enter the desired value.

For SBAS approaches, this field displays the Vertical Protection Level (VPL) and Vertical Alert Level (VAL) for the approach. The VPL is determined by the GPS/SBAS sensor. The VAL is based on the SBAS approach LOS. For LNAV/VNAV LOS, the VAL is 50 meters. For LPV LOS, the VAL is provided by the FAS DB information of the selected approach. For LNAV, LP approaches, or no LOS, VAL is not applicable, and dashes are displayed in this field.

Navigation Approach Page 2

Navigation Approach Page 2 displays similar information as Navigation Approach Page 1. The information below the horizontal line differs and is explained in the following text.



XWIND/WIND – For non-SBAS approach, the crosswind component in knots is displayed. For SBAS approaches, this field displays the computed wind direction and wind speed as shown on Navigation Approach Page 1.

WIND/GS – For non-SBAS approaches, the computed wind direction and speed are displayed here as shown on Navigation Approach Page 1. For SBAS approaches, groundspeed is displayed.

VDEV/APPR LOS – For non-SBAS approaches, the vertical deviation from the current leg is displayed in feet. When an SBAS approach is active, APPR LOS selection is displayed.

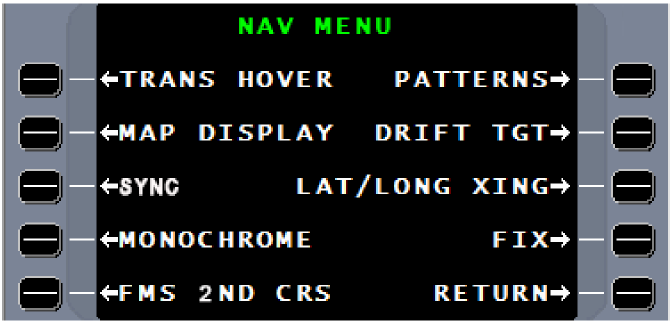
GS/HP – For non-SBAS approaches, the groundspeed is displayed. When an SBAS approach is active, the HPL is displayed as described on Navigation Approach Page 1.

VSR/VP – For non-SBAS approaches, the vertical speed required to fly the current leg is displayed. For SBAS approaches, the VPL is displayed as described on Navigation Approach Page 1.

Navigation Approach Pages 3 and 4 present the same information as Navigation Pages 2 and 3, respectively, when not in Approach mode.

Navigation Menu Page

The Navigation Menu Page is accessed by pressing **[MENU]** from any Navigation Page.



TRANS HOVER – This option is only available in FMS SCN 1102.X. Refer to the Multi-Missions section of this manual (applicable to FMS SCN 1102.X only) for detailed information.

MAP DISPLAY –Selecting LSK [2L] displays the MAP Display Page, where missed approach points (MAP) are displayed. Active flight plan data on the InSight EFIS map display can be turned on or off on the MAP Display Page for SCN 1102.1 and later when a search pattern is active. Refer to Missed Approach Points Display under Arrivals in the Operations section and MAP DISPLAY in the Multi-Mission section of this manual for more information.

SYNC – This is a selectable option when dual FMSs are configured for synchronous mode. Pressing this LSK displays the SYNC Page.

MONOCHROME – This option is only available in FMS SCN 1102.X. Refer to the Multi-Missions section of this manual (applicable to FMS SCN 1102.X only) for detailed information.

FMS 2ND CRS – This is a configurable option for Collins Pro Line 2 and Pro Line 4 4000 systems which enable the autopilot to respond to FMS roll steering commands. Selecting this LSK toggles the FMS 2ND CRS on and off.

PATTERNS – This option is only available in FMS SCN 1102.X. Refer to the Multi-Missions section of this manual (applicable to FMS SCN 1102.X only) for detailed information.

DRIFT TGT – This option is only available in FMS SCN 1102.X Refer to the Multi-Missions section of this manual (applicable to FMS Software Version 1102.X only) for detailed information.

LAT/LONG XING – Selecting LSK [3R] displays the Latitude/Longitude Crossing Points Page.

For an entered latitude, the FMS computes the longitude at which the aircraft will cross that latitude. For an entered longitude, the FMS computes the latitude at which the aircraft will cross that longitude. The FMS then displays the ETA and Distance to Go to intersection (DTG) values. Refer to the Latitude/Longitude Crossing Points in the Enroute section more information.

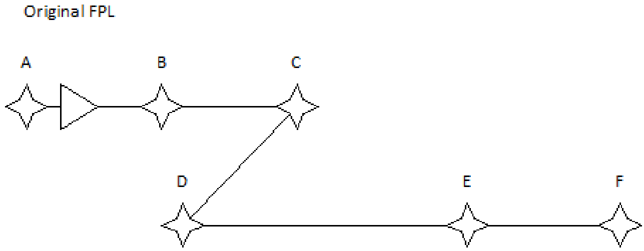
FIX – Selecting LSK [4R] displays the Fix Page.

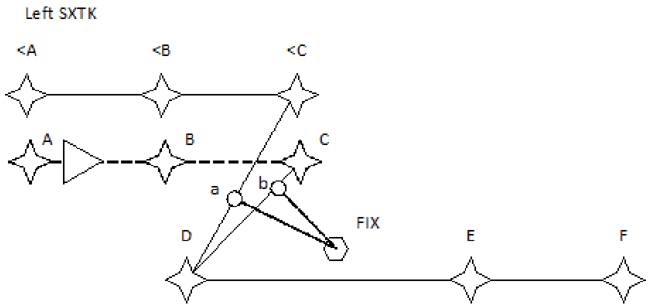
The Fix Pages are used to compute the relative position of the aircraft (with respect to any fix and the intersection points of a radial or a distance) from the fix to present position on the flight plan.

This page displays the calculated radial distance and ETA to abeam, radial or distance intersections between any one of up to nine fixes and the present position on the flight plan. A message annunciator alerts the flight crew when the abeam intersection is sequenced.

Refer to Define a Fix in the Enroute Section for more information.

On occasion, the abeam, distance, and radial intersections computed by the NAV/MENU/FIX pages may be placed on a track between a SXTK waypoint and a non-SXTK flight plan waypoint, which is not the true path. When leg sequencing causes SXTK mode to cancel, these intersections will be recomputed based on the flight plan waypoints, remedying the problem.





In the example FPL, the flight crew selects a left SXTK, which is applied to waypoints A, B, and C. The SXTK ends abeam C because the turn at C is larger than 135 degrees.

If the FIX function is used to create an abeam fix, the FMS computes the abeam fix at "a". The abeam fix should be computed at "b" on the leg from C to D.

After sequencing <C, the SXTK is canceled. The FMS then steers to the leg from C to D and the abeam fix is recomputed and correctly placed at "b".

RETURN – Selecting LSK [5R] returns to the Navigation Pages.

SYNC Page

In dual FMS installations, synchronous (SYNC) mode is a configurable option at time of installation. Triple FMS installations cannot operate in SYNC mode but can utilize the crossfill feature (Pull) to crossfill data from the two synchronized FMSs to the third FMS.

In SYNC mode, data is automatically (and bi-directionally) transferred between the onside and offside FMSs when entries are made to the following pages/operations:

- Flight plan entry or modification, including SBAS approach data
- FMS Selected Crosstrack input
- Commanded Heading state
- Temperature Compensation
- FMS Approach Arm or Activation
- Direct-To operations
- VNAV operations
- PVOR operations
- Manual RNP entry
- Manual leg changes
- Fuel Page 1 entries, local time difference on Fuel Page 2, average passenger weight on Fuel Options Page

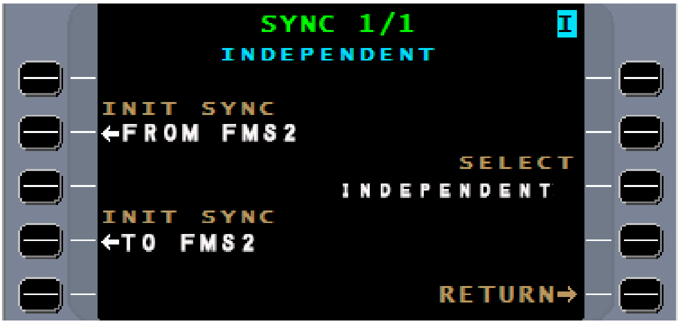
Each FMS will maintain its own navigation, sensor monitoring, databases, performance, and radio management. Coupling with external guidance systems, manual sensor selection/deselection and the inhibiting of NAVAIDs is independent. Navigation cues are independent (time-to-go, distance-to-waypoint, crosstrack error, bearing-to-waypoint, etc). Moving map displays, manual selections of pilot preferences such as map declutter and EFIS scaling are independent. The message function is also independent.

When entries are made while the FMSs are in the process of synchronizing, a SYNC IN PROGRESS message is displayed, and the FMS will not allow entry until all data is updated.

Upon power-up, the FMSs will automatically synchronize once initialized (**[ACCEPT]** has been selected on the Initialization Page). The FMS that is second to power-up will automatically synchronize to the first FMS. If FMS #2 has not powered up or initialized, FMS #1 stays in Independent mode until FMS # 2 has initialized. Once FMS #2 is initialized, SYNC mode is obtained.

An inverse "I" is displayed at the top of the display when in independent mode. When in Independent mode, SYNC may be manually initiated to or from either FMS, except when an approach is activated.

The current state is displayed under the page title, either INDEPENDENT or SYNCHRONIZED.



INIT SYNC FROM FMS X – Pressing this LSK twice will synchronize to the state of the offside FMS, that is, data will be sent from the offside FMS to the onside FMS.

INIT SYNC TO FMS X – Pressing this LSK twice will synchronize the offside FMS to the state of the onside FMS, that is, send data from the onside FMS to the offside FMS.

SELECT INDEPENDENT – Available when in SYNC mode, this LSK allows each FMS to operate independently of each other. Entries made while in Independent mode are not transmitted between FMSs.

Manually Synchronize FMSs

1. From any **[NAV]** page, press **[MENU]**.
2. Press **LSK [3L]**, SYNC to display the Sync Page.
3. Select **LSK [2L]** to SYNC from FMS, or **LSK [4L]** to SYNC to FMS as desired.

NOTE: FMSs cannot be manually synchronized once an approach is activated.

NOTE: The FMSs may transition to independent mode (not synced) during certain operations if the active navigation database is different between the onside and offside FMS.

NOTE: Flight plans with Airway waypoints with database coded RNP attributes may display differently on the flight plan clearance language pages.

NOTE: Entering fuel values immediately after SYNC is established may cause SYNC loss.

VNAV Function

The Vertical Navigation (VNAV) function allows the flight crew to define a desired vertical flight profile along the flight plan. It then computes the aircraft deviation from that profile for display.

Two VNAV pages displaying six VNAV waypoints are available in the VNAV function. Up to eight VNAV waypoints are automatically prefilled in reference to flight plan waypoints. Waypoints not on the flight plan cannot be accepted.

The vertical flight profile consists of a series of vertical waypoints, each of which contains a reference flight plan fix, an along-track offset and a target altitude.

All VNAV waypoints must be ahead of the FMS present position and must be sequenced in the same order they occur on the lateral flight plan.

A flight profile which results in a climb will provide Vertical Speed Required (VSR) information only. Vertical waypoint identifiers are prefilled automatically with the current flight plan waypoints (but with no offsets or altitudes). VNAV altitudes at flight plan waypoints can also be programmed on the Flight Plan Pages.

Some installations provide for flight director/autopilot-coupled Enroute VNAV and Approach VNAV operations while others may provide only advisory displays of VNAV information.

VNAV operations are controlled by the target vertical speed entered by the pilot for the first waypoint and the vertical speed computed, based on the altitudes, for second and subsequent vertical waypoints.

Upon reaching the target VNAV altitude, the target altitude is automatically filled into the subsequent waypoint, provided no other vertical navigation is programmed into the flight plan (including vertical guidance in a destination approach). If the target altitude is not filled into the subsequent waypoint, VNAV is canceled.

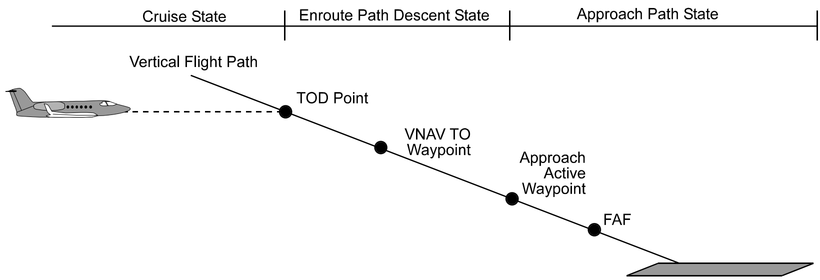
A manual leg change or direct-to operation along the lateral flight path which causes the TO VNAV waypoint to be bypassed will cause the TGT V/S to become invalid. VNAV will remain in the Inactive mode until the VNAV TO waypoint is defined and either a valid target vertical speed is entered or VTO is selected (which activates the Descent mode and the VNAV Descent Page).

The VNAV function has four operating states: Inactive, Cruise, Enroute Path Descent and Approach Path. The current state is determined by the aircraft position relative to the defined path.

INACTIVE: VNAV will be in the Inactive state until a VNAV TO waypoint and a vertical flight path (target vertical speed) to that waypoint have been defined.

CRUISE: The VNAV function will enter the Cruise state when the VNAV TO waypoint and the vertical flight path have been defined, the aircraft is not more than 200 feet below the reference altitude of the VNAV TO waypoint and the vertical flight path will be intercepted ahead of the aircraft. VNAV Cruise state is activated by entry of a valid VNAV TO waypoint and entry of a target vertical speed.

The Cruise state shows the distance to the Top of Descent (TOD) point in nm; that is, the distance along the flight plan until the current altitude intersects the pitch over point to intersect the vertical flight path. Flight Path Angle (FPA) is displayed in degrees. When VNAV is selected for display on the aircraft instruments, vertical deviation will be displayed prior to TOD capture point.



ENROUTE PATH DESCENT: The Descent state is activated by crossing the TOD point while in the Cruise state or by selecting the VTO function. Aircraft deviation from the vertical flight path is displayed.

APPROACH PATH: The Approach Path state is entered when activated automatically or manually by the pilot from either the Inactive or Enroute Path Descent state.

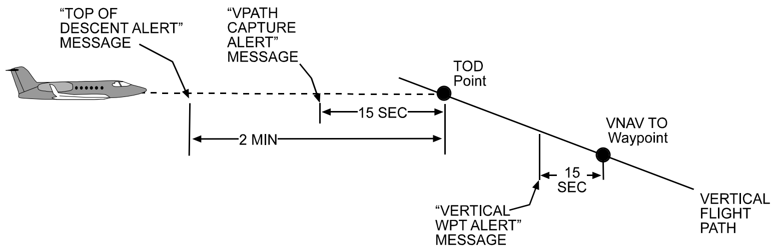
VNAV mode will cancel under any of the following conditions:

- The ADC altitude becomes invalid
- The ADC altitude is not barometer-corrected below 18,000 feet
- The ADC is deselected
- A manual altitude is entered
- A POSITION UNCERTAIN message appears
- Selected crosstrack mode is activated
- The Cancel VNAV LSK is pressed
- Crosstrack deviation becomes greater than 12.5 nm
- A GAP in the Enroute flight plan is encountered
- An Enroute/Approach VNAV waypoint GAP is encountered
- A valid vertical leg does not exist after sequencing a Hold Fix.

If any of these occur prior to entering a VNAV leg, the system will revert to the Inactive state and TOD will be removed. Vertical deviation will be set invalid.

Landing the aircraft (as determined by the air/ground sensor) or entering the number "99" as a vertical waypoint will cancel VNAV mode and delete the VNAV flight path.

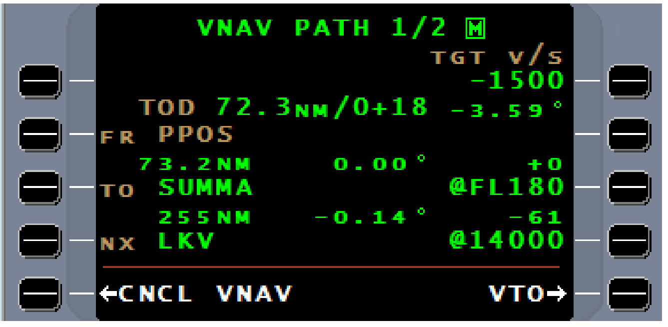
Two minutes prior to TOD, a TOP OF DESCENT ALERT message will activate on the Message Page. At fifteen seconds prior to TOD, the WPT annunciator will flash and a VPATH CAPTURE message will activate on the Message Page. At fifteen seconds prior to any vertical waypoint, a VERTICAL WPT ALERT message will activate. The WPT alert annunciator will remain illuminated until vertical leg sequencing occurs. If lateral and vertical waypoints are co-located, the WPT annunciator will flash, as vertical waypoints take precedence over lateral waypoints.



Message Annunciations

VNAV Path Page 1 – Cruise State

VNAV Path Page 1 is accessed when the VNAV key is pressed while in the Inactive or Cruise state. This page is used to define the vertical flight profile and is active prior to intercepting the vertical flight path (at which time the VNAV Descent Page becomes active).



TGT V/S – This entry of TVS, in feet per minute, is used for computing the vertical flight path to the TO VNAV waypoint.

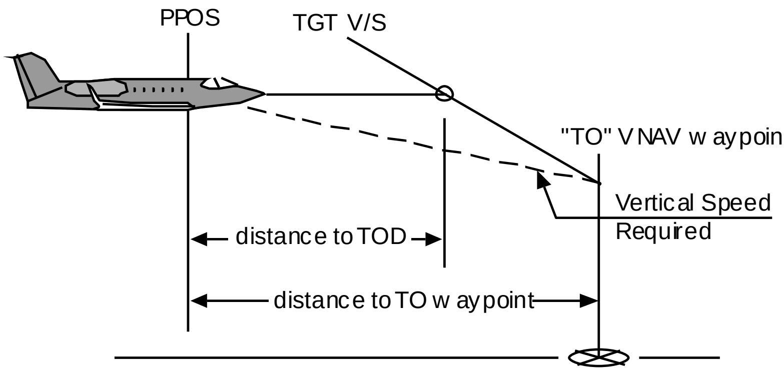
The maximum TVS that can be entered is one which results in a Flight Path Angle (FPA) not exceeding the maximum configured at the time of installation.

If a TVS is entered which exceeds the maximum, then the entry will flash and not be accepted, and a message will be presented to the pilot. Similarly, TVS will not be accepted if there is insufficient time to descend to the vertical waypoint, if crosstrack is greater than 12 nm, or SXTK is in use.

TOD xx.x NM – The distance remaining, in nm, and time from the aircraft's present position to the TOD. The TOD is based upon present groundspeed, present altitude, the altitude for the VTO waypoint location and the TVS the pilot has entered for the descent.

When the TVS is valid, the FPA for the current leg is displayed next to the TOD field.

FR PPOS – The FROM waypoint is always PPOS and is used for calculating the vertical speed required to reach the TO VNAV waypoint at the specified altitude.



Between the FR and TO lines are:

- The VNAV TO Waypoint **Distance**, expressed in nm. The distance from PPOS to the first vertical waypoint. If the vertical waypoint is above current altitude, then this field displays “CLIMB”. If the aircraft is in a hold, this field displays dashes
- The VNAV TO Waypoint **Flight Path Angle**, in degrees. Displays the FPA for the current vertical leg
- The VNAV TO Waypoint **Vertical Speed Required**, in feet per minute. Displays the vertical speed required to obtain the target altitude at the VNAV TO waypoint from PPOS.

TO and NX – Each TO and NX VNAV waypoint is defined by a flight plan waypoint and the offset distance prior to (-) or beyond (+) that flight plan waypoint. Next to the VNAV waypoint offset distance is the target altitude for that vertical waypoint.

Between the TO and NX lines are:

- The NX Vertical Waypoint **Distance**, in nm. Displays the distance from the VNAV TO waypoint to the NX vertical waypoint
- The NX Vertical Waypoint **Flight Path Angle**, in degrees. Displays the FPA for the next vertical leg
- The NX Vertical Waypoint **Vertical Speed Required**, in feet per minute. Displays the vertical speed required to obtain the target altitude at the NX vertical waypoint from the VNAV TO waypoint.

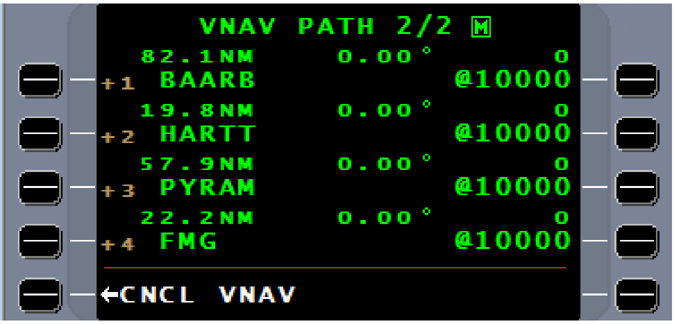
For waypoints after the last programmed VNAV waypoint, altitude of the last waypoint will automatically pre-fill into succeeding waypoints. When the aircraft reaches the last programmed VNAV waypoint, VNAV guidance will be to zero VSR and will maintain level flight.

CNCL VNAV – This option is displayed when VNAV is active. Pressing LSK [5L] cancels VNAV mode.

VTO – This LSK is used to access the Vertical-To Page. This allows vertical flight guidance from the aircraft's present position and altitude to the selected VNAV waypoint target altitude. Refer to Vertical-To Procedure in the VNAV Setup and Activation section for more information.

VNAV Path Page 2 – Cruise State

VNAV Path Page 2 is accessed by pressing **[NEXT]** or **[PREV]** from VNAV Path Page 1. The pilot can enter altitudes and offsets associates with flight plan waypoints and a vertical speed to descent to the desired altitude on this page.



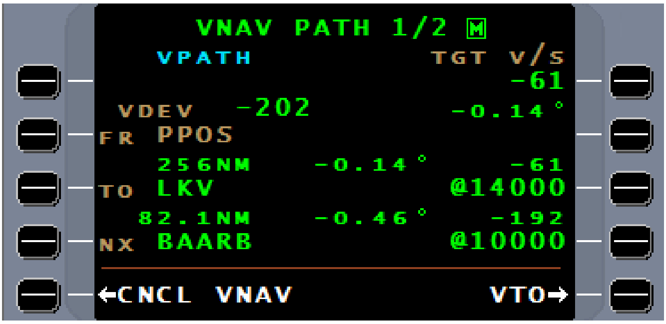
This page displays subsequent vertical waypoints, and their distance, FPA, VSR and altitude as described on VNAV Path Page 1.

LSK [1L] thru [4L] – Pressing any of these LSKs displays the Vertical Waypoint Select Page.

LSK [1R] thru [4R] – Pressing any of these LSKs places the cursor over the altitude field where the altitude may be entered or edited. When altitude is entered in these fields, the flight plan is automatically updated with the new values.

VNAV Path Page 1 – Enroute Path Descent State

VNAV Descent state is activated by crossing the TOD point while in the Cruise state or by selecting the VTO function.



TGT V/S – TGT V/S is the vertical speed required that was computed for the next leg. If that results in an FPA higher than configured limits, then VSR is recalculated to be within the FPA limit.

VDEV – Vertical deviation above (+) or below (-) the vertical flight path is displayed above the FR PPOS field.

All other fields and functions are identical to Cruise mode VNAV Path Page 1. Refer to the Cruise state portion of this section for their descriptions.

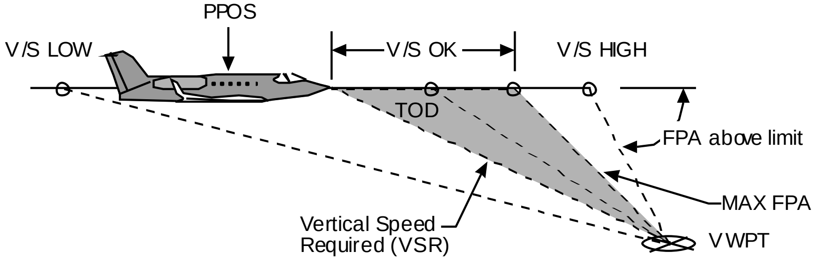
Target Vertical Speed

The target vertical speed (TVS) entry represents a commanded rate of descent to the first VNAV waypoint from the TOD (not present position). The VNAV function calculates the TOD to achieve the FPA dictated by the commanded descent rate.

When the TVS to the first waypoint is entered, the flight path angle will be calculated and "locked in". Subsequent groundspeed changes prior to TOD will cause the displayed TGT V/S to vary proportionately to maintain the flight path angle.

The TVS entry must exceed the minimum vertical speed required but be less than the maximum vertical speed allowed. The maximum vertical speed allowed is defined as roughly ten times GS for fixed-wing aircraft and sixteen times GS for rotary-wing aircraft. Maximum FPA is configured at the time of installation.

The following figure is a representation of three scenarios produced by three different vertical speed entries and their corresponding TOD points.



TVS Entry between Maximum and Minimum Vertical Speed Allowed

In this scenario, the TVS entry will be accepted, and all values are within limits. A typical TVS entry would be approximately five times groundspeed to result in a 3° descent angle. As a rule of thumb, a 3° descent FPA will result in a smooth descent (e.g., @ 400 knots use 2000 fpm).

TVS Entry Above Maximum Vertical Speed Allowed

In the second scenario, the TVS entry is too high, and the TOD is delayed achieving the desired descent rate. As shown in the figure, the descent angle is increased and the computed change in FPA will exceed the limit configured for FPA. This occurs independently of the distance between vertical waypoints. When a high TVS entry causes the calculated path to exceed the FPA limit, the TVS entry will blink, and the drop-down message (TGT VS HIGH) is displayed. The maximum TVS that can be entered is 6000 fpm.

TVS Entry Lower than Minimum Vertical Speed Required

In the third scenario, V/S LOW, a low TVS entry results in a descent rate where the path will not intercept the waypoint at the desired altitude. When the TVS entry is too low, the TVS value will blink, and a message (TGT VS LOW) is displayed at the top of the page. In the figure, notice that the descent angle as indicated by V/S LOW falls behind the present position of the aircraft.

The FMS is designed to execute a smooth transition to the downward pitch angle when the top of descent is reached. If the TOD is behind or too far ahead of the present position of the airplane (as indicated in the figure), a rapid downward pitch angle with a descent rate exceeding the entered TVS would be required. The FMS is designed to prevent this from occurring and will not allow the descent rate to exceed the commanded TVS entered by the pilot.

The FMS also implements a pitch change anticipation function, so the vertical speed is increased gradually until the desired TVS value is reached. This avoids a rapid pitch down to achieve the TVS. To do this, the FMS calculates a transition and adds it to the distance needed to reach the vertical waypoint.

VNAV Path – Approach State

The FMS computes crossing altitudes to allow construction of an uninterrupted VNAV path from the enroute waypoints to approach activation and allows the pilot to establish an uninterrupted VNAV profile from the initial approach fix to MAP.

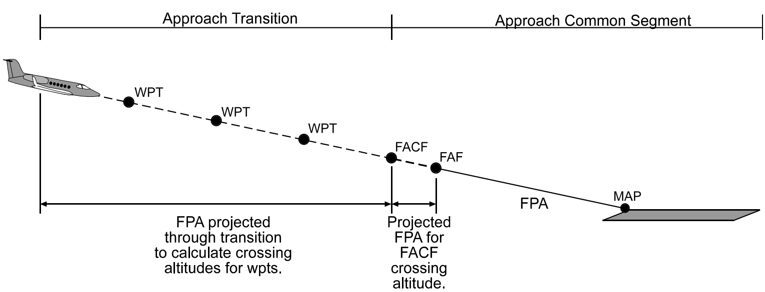
When an approach is linked into the flight plan, the Flight Plan and Vertical Navigation Pages will display At (@) altitudes or crossing (X) altitudes at the Final Approach Fix (FAF). At (@) altitudes are displayed at the MAP or runway fix. The vertical path between these points is the reference for deviation displays.

NOTE: It is possible to program an enroute VNAV segment to terminate at a published minimum enroute altitude that is below the FMS computed crossing altitude for the FAF. If VNAV is active when sequencing to the FAF, the FMS will interpret this segment as a climb segment and cancel VNAV mode. To ensure availability of VNAV guidance for the final approach segment, pilots must either ensure that no vertical discontinuities exist between the enroute segment and the approach segment or ensure that VNAV is not active when sequencing to the FAF. For the latter case, normal approach VNAV arming, and activation occurs 2 nm prior to the FAF.

The FMS computes a crossing altitude at a constrained waypoint such that the descent path to the next waypoint is within FPA limits. The FPA limit can be configured to achieve the desired path descent performance and can be modified by the pilot during flight. The target FPA can vary from 0.0º to a maximum of 9.0º. The enroute FPA limit for an aircraft installation is programmed at installation. Initial default value for target FPA is 3.0º. In no case can the pilot select a target FPA that exceeds the configured enroute FPA limit value.

If the approach common segment also includes a Final Approach Course Fix (FACF), and the published FACF has an altitude constraint associated with it in the Navigation Database, a crossing altitude for the FACF will be calculated and displayed with an "X" designator in the flight plan and Vertical Navigation Pages. Crossing altitudes at the FACF are calculated by projecting the final approach FPA from the FAF to the FACF and checking that this crossing altitude is at or above the published restriction. At no time will crossing altitudes for the FACF be allowed to be set below the published restriction.

Crossing altitudes for waypoints in approach transition segments are calculated for waypoints with published and coded altitude constraints by using the target FPA from the VNAV menu.



The target FPA is projected back up the transition. Crossing altitudes are calculated and displayed on the lateral and VNAV flight plan with an "X" next to the altitude to indicate it is an FMS calculated altitude. These crossing altitudes may be higher than the altitudes published on the approach plates as selected by the target FPA, but in no case will they be lower than the published altitudes. If a waypoint is coded with a constraint that is higher than the FMS target FPA calculated crossing altitude, the published constraint will be displayed. Crossing altitudes are not computed for variable constraints on the following legs:

- Legs terminated with an altitude: Heading to Altitude, Course to Altitude, Fix to Altitude or Hold to Altitude
- Heading legs: Heading to intercept, Heading to Radial, Heading to DME distance, or Heading to manual termination
- Course legs: Course to Intercept, Course to Radial, Course to DME Distance, Fix to Manual Termination

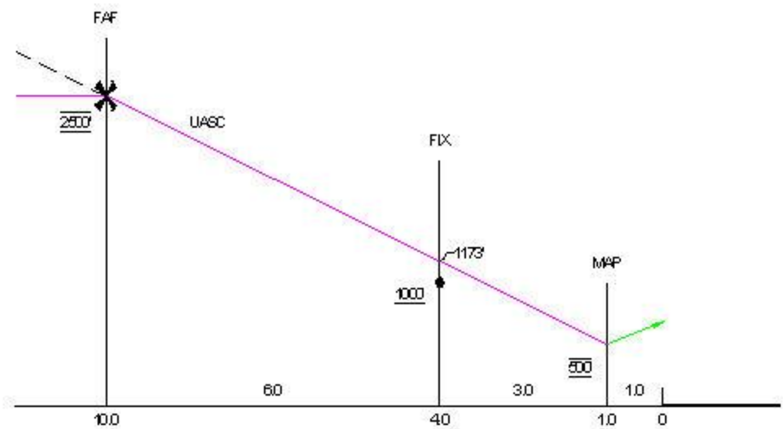
Altitude constraints, whether manually entered or sourced from selected procedures, take precedence over FMS computed crossing altitudes.

The FMS does not construct a level segment to intercept an approach glidepath. When approach mode becomes active, vertical guidance is to the extended glidepath, the same as for an ILS approach. This results in operations similar to that of intercepting an ILS.

The FMS computes the actual crossing altitude of the flight path angle at the fix when the FAF constraint is an AT or ABOVE. If VNAV is used to fly to the point, the VNAV path is to the intercept altitude rather than the lowest altitude of the AT or ABOVE constraint. If the waypoint has an AT constraint, the FMS will construct the VNAV path to the next constraint as a geometric point to point path rather than as a 3-degree (or as specified) VNAV approach path.

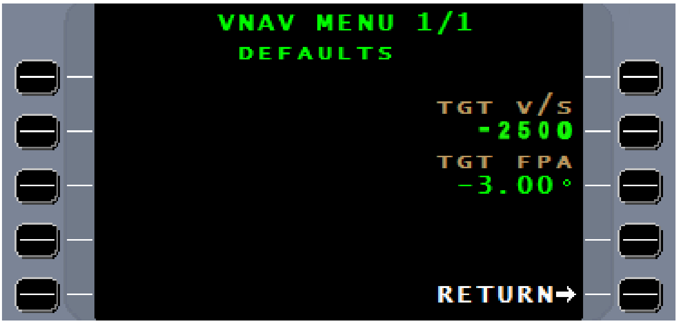
For the case where the flight path descent angle is not altitude referenced, such as for LPV approaches, the FMS makes the transition onto the SBAS altitude defined geometric path prior to the FAF.

There are situations where step down fix altitudes are coded as AT or ABOVE, causing them to be VNAV fly past waypoints. This situation typically occurs when the VNAV path (as defined by the FAF altitude and the MAP altitude) is calculated to be above the step-down fix altitude. In these cases, the FMS calculates a constant VNAV path honoring the minimum altitude at the step-down fix and provides the flight crew with a constant VNAV path angle on the approach. In all cases, the FMS honors the step-down fix published minimum altitudes.



VNAV Menu Page

The VNAV Menu Page is accessible from any VNAV Page by pressing **[MENU]**.



The pilot may enter a default target vertical speed and flight path angle for VNAV from this page. Press the applicable LSK to highlight the field, then enter the desired value and press **[ENTER]**. Entries cannot be greater than the value configured during installation.

Holding Pattern while in VNAV Enroute Descent State

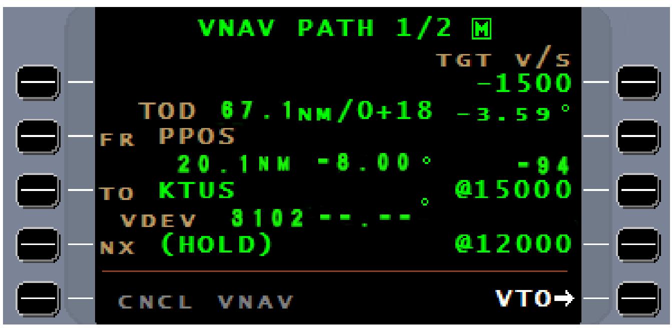
A holding pattern can be a valid vertical leg for VNAV if both the Hold Entry Fix (waypoint preceding the hold leg terminator) and Hold Fix have an AT altitude constraint, either manually entered or input to the flight plan from the Navigation Database. The FMS can provide VNAV path steering during holding patterns if the preceding conditions are valid and the altitude constraint at the Hold Fix is less than or equal to the constraint at the Hold Entry Fix. If the altitude constraint at the Hold Fix is equal to the constraint at the Hold Entry Fix, VNAV will remain in the path mode and hold altitude at the Hold Entry Fix.

When a holding pattern is inserted into a flight plan, an entry altitude may be programmed at the holding fix. VNAV descent to this altitude, prior to entering the hold, may be performed by entering the TVS as with any enroute waypoint.

NOTE: Entering a holding pattern into the flight plan between PPOS and the TOD will cancel the TOD calculation. An attempt to reenter the TOD information will result in a LEG RESTRICTION message. The TOD is recalculated when the holding pattern is completed or removed from the flight plan.

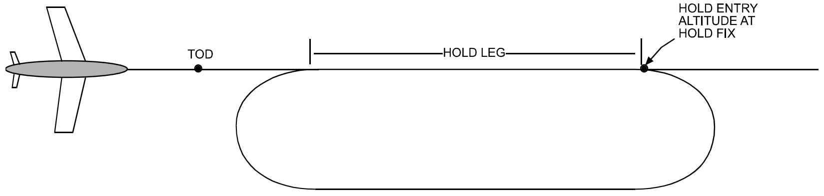
Entry of an along track vertical VNAV offset is not allowed at a Hold Entry Fix.

Once a holding pattern is programmed and armed, a (HOLD) waypoint field is inserted into the flight plan as illustrated below.



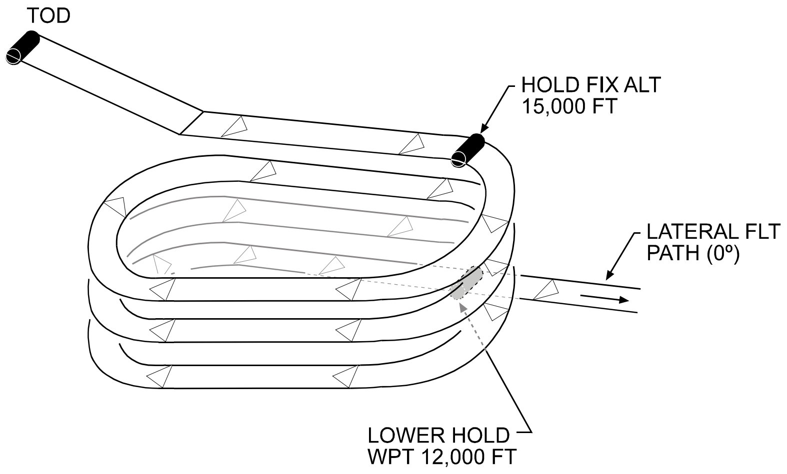
NOTE: If Temp Comp is applied to the flight plan altitudes, verify that the hold entry fix altitude and the hold exit fix have the same altitude. Manually enter the temperature compensated altitude at the hold exit fix.

To descend during the holding pattern, VNAV must be active and a (HOLD) altitude lower than or equal to the entry altitude must be entered for the (HOLD) waypoint on the Flight Plan or Vertical Navigation Pages before the holding pattern is sequenced. This allows descending to the holding fix with VNAV active and descending to a lower altitude during the hold.



Top View VNAV Descent in Hold

The lower altitude represents a level VNAV path. The initial vertical deviation in the hold will equal the difference between the entry altitude and the holding altitude.



Side View VNAV Descent in Hold

CAUTION: **DEPENDING ON THE VERTICAL SCALING OF THE PARTICULAR INDICATOR OR EFIS, THIS MAY RESULT IN A FULL-SCALE DOWN DEFLECTION OF THE VDEV INDICATOR WHEN THE DIFFERENCE BETWEEN THE CURRENT ALTITUDE AND THE LEVEL PATH OF THE LOWER HOLD @ ALTITUDE EXCEEDS THE SCALE OF THE DISPLAY.**

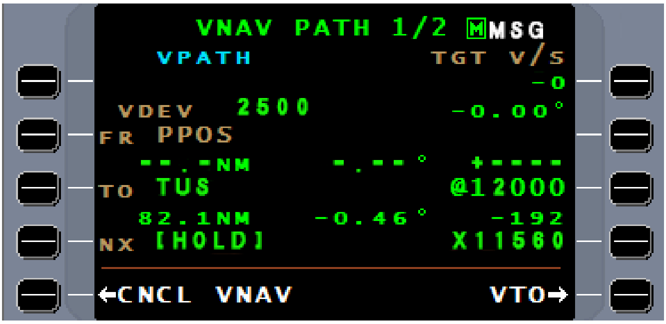
When flying a holding pattern and arriving at the constraint altitude, VNAV will remain in the path mode and hold altitude at the Hold Fix. When PROCEED is selected, VNAV will sequence the Hold Fix at the same time as LNAV sequences the Hold Fix.

NOTE: When flying a holding pattern while in VNAV mode, the FMS commanded bank angle may exceed the configured roll angle limit to fly the defined flight path.

In installations that provide coupled VNAV enroute operations, the FMS will provide vertical steering to the entry altitude and subsequent vertical steering in the hold at a constant vertical speed (approximately 650 fpm). Pitch steering commands to FGSs with coupled VNAV will provide smooth transitions during the hold entry to hold descent path change and level off commands when the lower altitude is reached.

In installations that do not provide coupled enroute VNAV, but provide VDEV displays, the pilot must use a manual descent or vertical guidance mode appropriate to descend to the holding altitude.

VNAV Descent while in a holding pattern is depicted on VNAV Path Page 1 as shown below:



VNAV Descent in Hold

The TVS and FPA are zero. VDEV represents the altitude remaining during the descent and will display zero once the lower holding altitude has been reached. The VNAV TO waypoint distance, FPA and vertical speed required fields display dashes. When the aircraft levels at the holding altitude, VDEV will be zero.

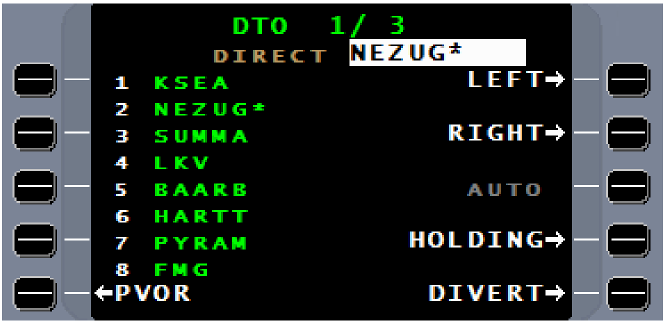
Vertical deviation scaling (feet per dot) is determined by the display device and may be different for Cruise, Enroute Descent and Approach states. Consult the Aircraft Flight Manual or AFMS for the specific scaling. As the aircraft descends during the hold to the HOLD @ altitude, the deviation will decrease to centered deviation when reaching the level VPATH of the HOLD altitude.

DTO Function

The Direct-To (DTO) function is specifically dedicated to changing the flight plan in response to "direct to" clearances. If the DTO location is off the flight plan, provisions are made to link the location into the flight plan.

A DTO command will cancel Approach mode and VNAV operation. If a DTO is activated during a Hold, the Hold is automatically cancelled and the DTO Page is displayed.

When the DTO Page is displayed, a leg change from PPOS direct to a flight plan waypoint, a database waypoint, a pilot defined location, an airport or runway may be made. The turn direction will default to shortest turn; however, the pilot can override this by specifying LEFT or RIGHT direction. Pressing AUTO will cancel LEFT or RIGHT and return default to shortest direction.



A waypoint may be selected from the flight plan by entering the reference number, entered by using the LIST function, or entered manually by typing in the waypoint identifier. When the ENTER key is pressed, the aircraft will steer directly to that waypoint unless the waypoint is a PVOR.

PVOR – Pressing the adjacent LSK will access the PVOR Page for selection of a radial to be followed into the DTO waypoint.

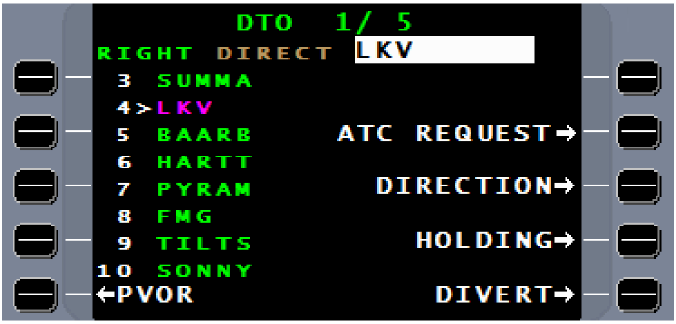
If a PVOR radial has been entered, the FMS will provide steering for a 45° intercept with the selected PVOR radial.

LEFT, RIGHT, AUTO – These LSKs allow the specification of a turn direction. AUTO specifies the shortest turn direction.

HOLDING – Pressing the adjacent LSK will access the Holding Pattern Page.

DIVERT – By selecting this option, the pilot can perform an emergency divert to the closest suitable airport. Refer to Emergency Divert in the Enroute section for more information.

DTO function (FMS SCN 1102.1 and later)



SCN 1002.1 and Later

PVOR – Pressing the adjacent LSK will access the PVOR Page for selection of a radial to be followed into the DTO waypoint.

If a PVOR radial has been entered, the FMS will provide steering for a 45° intercept with the selected PVOR radial.

ATC REQUEST – Pressing the adjacent key will initiate a REQUEST DIRECT TO [position] message through the DTO page. Selecting the ATC REQUEST prompt on the DTO page brings up options to enter the position data. When the position data is entered, the operator presses ENTER or selects ACCEPT. The data is then sent to UniLink to be contained in the downlink message, and the appropriate UniLink page is displayed.

DIRECTION – Pressing the adjacent LSK will access the DTO DIRECTION page which allows the specification of a turn direction. AUTO specifies the shortest turn direction and is the default setting.

HOLDING – Pressing the adjacent LSK will access the Holding Pattern Page.

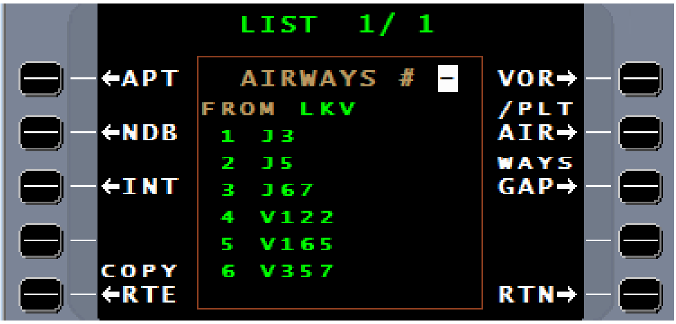
DIVERT – By selecting this option, the pilot can perform an emergency divert to the closest suitable airport. Refer to Emergency Divert in the Enroute section for more information.

List Function

While performing data entry, pressing the LIST key presents a list of selections appropriate to the entry being made.

List Page

The List Page displays the selected list and presents options for selecting other lists. The page is accessed by pressing **[LIST]** whenever the cursor is over a field where a database item is normally entered.



A control window is in the center of the display. Any list may be placed into the control window by pressing the LSK for that list. The selectable lists are APT (airports), NDB, INT (intersections), COPY RTE (routes), Airways and VOR/PLT (a mixture of VORs and pilot defined waypoints). PLN LANG (plain language) is displayed in place of APT, VOR/PLT or NDB when those are selected.

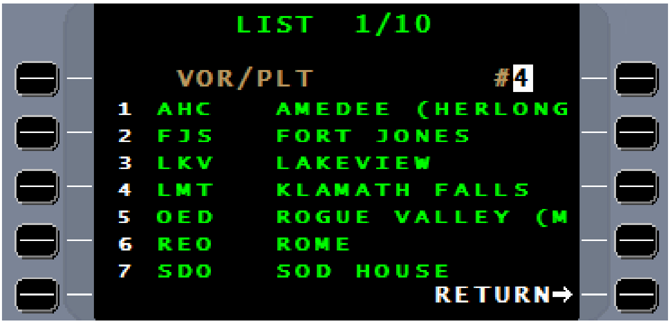
RWY – The list of runways contains all Pilot Defined or Navigation Database runways that exist for the reference airport, and is accessible only in the Pilot SID, Pilot STAR, Pilot Approach Transition, and Pilot Missed Approach Definition Pages, in addition to PVOR, Hold Fix, DTO and Divert.

COPY RTE – The Copy Route Page is displayed when LSK [5L] is pressed.

GAP – Pressing this LSK when the page has been accessed from a Flight Plan or Route Page will insert a gap (identified onscreen by the symbol “*GAP*”) into the flight plan or route.

<u>CAUTION</u>: **WHEN A GAP HAS BEEN INSERTED, THE FLIGHT PLAN WILL *NOT* AUTO-SEQUENCE TO THE NEXT LEG. RATHER, THE AIRCRAFT WILL FLY AN EXTENSION OF THE LAST LEG WITH NAV AND VNAV FLAGS OUT OF VIEW ON THE HSI. *<u>IT IS THE RESPONSIBILITY OF THE PILOT TO TAKE APPROPRIATE ACTION TO CONTINUE ACCURATE NAVIGATION OF THE AIRCRAFT.</u>* THE PILOT MAY GO "DIRECT-TO" OR EDIT THE GAP OUT OF THE FLIGHT PLAN**.

PLN LANG – By pressing the Plain Language LSK when APT, VOR/PLT or NDBs are listed, the plain language name of the APT, VOR or NDB will be displayed (up to 15 characters). The reference number can still be used to select the desired item.



Fuel Function

The Fuel function provides access to all fuel management functions.

There are five fuel pages. Fuel Page 1 is used during the pre-departure phase to enter the initial fuel on board, to calculate the gross weight of the airplane and to construct a reserves plan. The other four fuel pages provide a summary of all fuel management functions for the current flight plan, fuel flow and fuel used.

NOTE: The fuel flow management information provided by the FMS has not been evaluated to the requirements of TSO C44a (Fuel Flow meters).

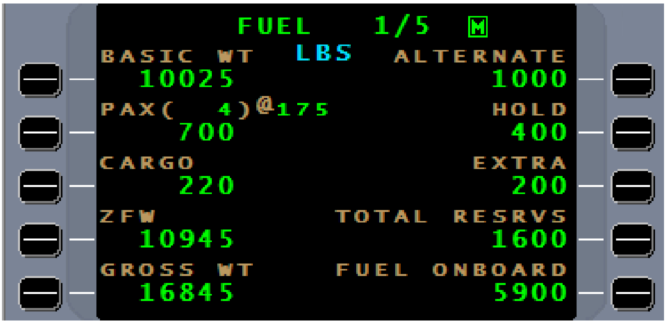
It is extremely important to understand that all FMS fuel mode calculations are based on the pilot's initial entry of fuel on board and subsequent automatic or manual fuel flow measurements subtracted over time. There is no direct connection to the aircraft's fuel quantity system by the FMS, so the aircraft's system remains the primary reference for all fuel and range calculations.

Fuel display parameters are advisory only and do not replace primary fuel quantity or fuel flow gauges for fuel load and range planning.

All fuel quantity and gross weight displays are computed values based upon the initial fuel on board as entered by the pilot. These values are constantly corrected through inputs from the fuel flow sensors as fuel is consumed.

Fuel Page 1

Fuel Page 1 is the fuel and weight entry page. It is used to determine the gross weight of the aircraft by entering the values to be used in calculating the weight and to plan the fuel reserves required. Unit of measure is displayed as LBS or KGS, as configured during installation.



BASIC WT – The basic operating weight of the aircraft (i.e., empty weight), up to six digits, max 999,999. The basic weight value shown in this field is programmed into the configuration module. Entry of a new weight will override the configuration module weight and will be retained in memory for future use.

PAX – There are two methods of entering the total passenger weight. The number of passengers (up to 999) can be entered in the PAX field. The computer multiplies the number of passengers by the default weight per passenger. This weight may be changed on the Fuel Options Page. Total passenger weight can also be entered manually in the passenger weight field. This method will recalculate the displayed average passenger weight (max 999).

CARGO – The cargo weight is input up to six digits (max 999,999).

ZFW – The zero-fuel weight (ZFW) is automatically calculated based upon the basic operating weight, total passenger weight and cargo weight. If desired, this value may be directly entered (max 999,999 lbs./kgs).

GROSS WT – The sum of the ZFW and FUEL ONBOARD values. Gross weight will not be calculated until FUEL ONBOARD entry is made or confirmed. No direct entry is possible.

ALTERNATE – The fuel required to the alternate landing field.

HOLD – The fuel loaded for holding at the destination.

EXTRA – Additional reserve fuel loaded beyond that for alternate landing field and holding.

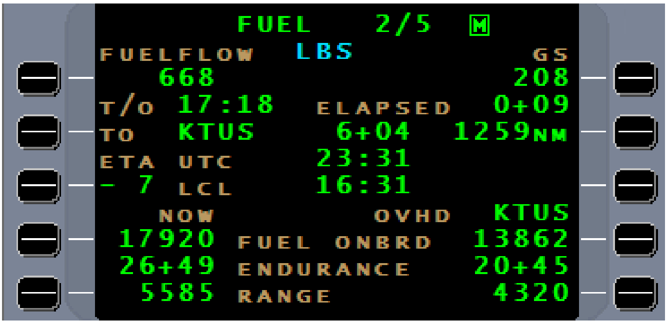
TOTAL RESRVS – The total reserves value is automatically calculated based upon the three prior reserve fuel entries. If desired, this value may be directly entered (300,000 max) (max accepted is 299,997).

FUEL ONBOARD – The total fuel onboard value is stored in memory until manually changed (max 600,000). The fuel onboard value may also be entered through systems that support digital fuel quantity. Confirmation is required following initialization.

Fuel Page 2

This page displays range and endurance estimates based upon departure time and current parameters. Manual FUEL FLOW and GS (groundspeed) entries may be made to evaluate their effect on the other parameters displayed.

If all entries have been made on Fuel Page 1, then this will be the first page display when the FUEL key is pressed from another mode.



FUEL FLOW – Cumulative fuel consumption in pounds or kilograms per hour for up to four engines. Placing the cursor over the FUEL FLOW entry field allows a manual fuel flow entry to be made. A manual entry is indicated by "(EST)" to the right of the entry. When a manual entry is made, the performance displayed on this page will be referenced to that value.

GS – The groundspeed expressed in knots. Placing the cursor over the GS entry field allows a manual groundspeed entry to be made. A manual entry is indicated by "(EST)" to the left of the entry. When a manual entry is made, the performance displayed on this page will be referenced to that value.

NOTE: Manually entered Fuel Flow or GS values are not saved when the fuel pages are exited.

T/O – Takeoff time.

ELAPSED – The time elapsed since takeoff.

TO – Time and distance to the final waypoint. The alternate landing field destination may be entered to show predictions for the great circle distance and bearing to the alternate. Press this key to place the cursor over the destination identifier and enter a new identifier as an alternate. The LIST function will present an airport list. "(A)" will appear next to the new destination.

ETA – The ETA at the TO waypoint location. ETA is based upon the present time and the current groundspeed over the flight planned route. ETA is displayed in terms of UTC and LCL (local) time. The local time zone difference from the zero meridians can be entered up to ±13 hours. The ± key is used to toggle the sign with the cursor over the LCL entry field. The sign will pre-fill with a minus (-) when the longitude of the TO waypoint location is W and pre-fill with a plus (+) when the longitude is E.

FUEL ONBRD – To the left, under "NOW", is the present fuel on board the aircraft in pounds or kilograms. The value is equal to the FUEL ONBOARD value last entered on FUEL Page 1 (on the ground or in flight) minus the fuel used since that entry was made. To the right, under "OVHD (DESTINATION)," is the calculated fuel remaining over the destination based upon present fuel on board, present groundspeed, and present fuel flow.

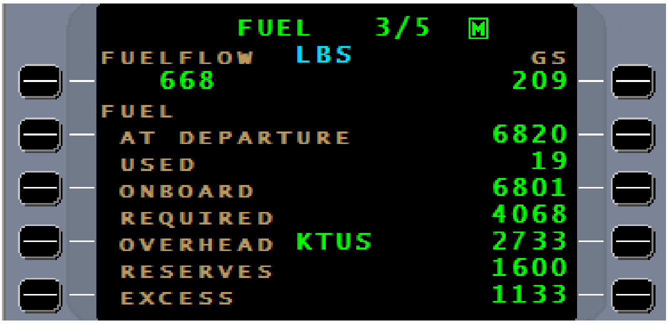
ENDURANCE – Under NOW, the amount of time in hours and minutes that the flight can continue with the present fuel flow. Under "OVHD (DESTINATION)," the estimated amount of time the flight could continue after the destination is reached based upon the calculated FUEL ON BOARD at that location and present fuel flow. ENDURANCE is based on using all available fuel on board the aircraft, including reserves.

RANGE – Under NOW, the distance in nm that can be traversed with the present fuel flow, fuel on board and groundspeed. Under OVHD (DESTINATION), the estimated distance in nm which could be traversed after the destination is reached. This range is based upon the calculated FUEL ON BOARD at that location, present fuel flow, and present groundspeed. RANGE is based upon using all fuel on board the aircraft, including reserves.

Fuel Page 3

Fuel Page 3 provides a summary of the fuel requirements for the flight plan. Manual FUEL FLOW and GS entries may be made to evaluate their effect on the other parameters displayed.

NOTE: None of the predictions listed on the page will be displayed until the quantity of fuel onboard is confirmed.



FUEL FLOW – The fuel flow in pounds (kilograms) per hour. The values shown are obtained from inputs from the engine fuel flow sensors. If the fuel flow for an engine drops to zero for four minutes, FAIL will be displayed. The FAIL can be removed, and input restored by placing the cursor over the FAIL and pressing **[BACK]** and **[ENTER]**. If fuel flow input has returned (such as after engine shut down and restart), it will be restored to normal operation.

Manual fuel flow entries can be made. The LSKs are used to position the cursor to enter fuel flows for the individual engines. If a manual fuel flow entry is made, (MAN) will be displayed. The maximum fuel flow entry for each engine is 20,000 pph. A manual fuel flow entry can be removed by pressing the BACK and then ENTER keys while the cursor is over then fuel flow entry field.

GS – The groundspeed expressed in knots. Placing the cursor over the GS entry field allows a manual groundspeed entry to be made. When a manual entry is made, the performance displayed on this page will be referenced to that value.

NOTE: Manually entered Fuel Flow or GS values are not saved when the fuel pages are exited.

AT DEPARTURE – The total fuel entered on Fuel Page 1 prior to departure. This value will display dashes if a new fuel entry is made while airborne.

USED – The total fuel used. USED is set to zero whenever a FUEL ONBOARD entry is made on Fuel Page 1 while on the ground.

ONBOARD – The fuel on board the aircraft is equal to the total FUEL ON BOARD value last entered on Fuel Page 1 (on the ground or in flight) minus the fuel used since that entry was made.

REQUIRED – The estimated fuel required to the destination. Required fuel is based upon present fuel flow and ETE to destination.

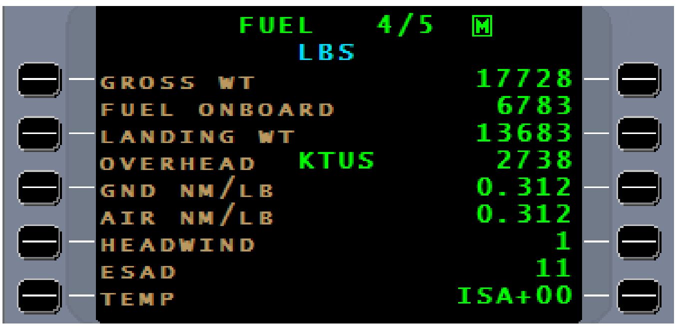
OVERHEAD – The estimated fuel on board at the destination. OVERHEAD fuel is equal to ONBOARD minus REQUIRED. The figure flashes if its value is less than zero.

RESERVES – The total reserves value as entered on Fuel Page 1.

EXCESS – Excess fuel at destination. EXCESS is equal to OVERHEAD minus RESERVES. The figure flashes if its value is less than zero.

Fuel Page 4

This Fuel Page displays projected landing weight based upon current fuel conditions. All fuel quantity and gross weight displays are computed values based upon the initial values input by the pilot and inputs from the engine fuel flow sensors. The values displayed on this page may not be edited.



GROSS WT – The current gross weight of the aircraft is based on zero fuel weight plus present fuel on board.

FUEL ONBOARD – The current fuel onboard is calculated from the last fuel on board entry and fuel flow inputs subsequent to that entry.

LANDING WT – The landing weight is based on current gross weight minus fuel burn to destination (or the last waypoint prior to a gap). The estimated fuel burn is calculated using present groundspeed and fuel flow.

OVERHEAD (DESTINATION) – The calculated fuel remaining over the destination (or the last waypoint prior to a gap) based upon present fuel on board, present groundspeed, and present fuel flow.

GND NM/LB (KG) – Ground nm per pound (kg) of fuel. The value shown is based on the present groundspeed and fuel flow.

AIR NM/LB – Air nm per pound (kg) of fuel. AIR NM/LB (kg) is based on TAS and fuel flow.

HEADWIND/TAILWIND – The wind component in knots.

ESAD – Equivalent Still Air Distance. This is either the distance the aircraft would have flown since takeoff under zero wind conditions, or the air miles flown.

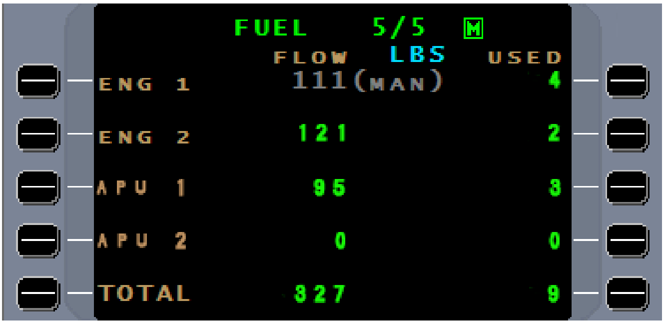
TEMP – The temperature in terms of the difference between the actual SAT (static air temperature) and the International Standard Atmosphere (ISA) standard SAT based upon current altitude.

Fuel Page 5

Fuel Page 5 shows the fuel flow and fuel consumption in pounds (LBS) or kilograms (KGS) per hour for engines and Auxiliary Power Units (APUs). The page can show the fuel flow for:

- Four engines
- Three engines and one APU
- Two engines and two APUs.

The number of engines listed depends upon the installation. The fuel flows shown are supplied by the aircraft's fuel flow sensors. APU fuel flow data will appear on Fuel Page 5 when an APU fuel flow source is configured. The total fuel value is entered on Fuel Page 1.



FLOW – Similar to Fuel Flow on Fuel Page 3.

USED – The cumulative fuel used in lbs (kg) for each engine and the total for all engines.

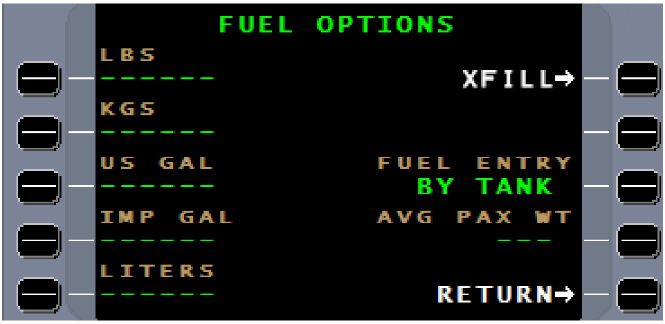
Manual fuel used entries can be made. The LSKs are used to position the cursor to enter fuel used for the individual engines. In the event of a power failure, the fuel used figures will be corrected by an amount equal to the present fuel flow times the duration of the power failure.

CAUTION: **NOTE THAT APU FUEL FLOW IS A CONFIGURABLE OPTION. WITH SOME DIGITAL FUEL FLOW DISPLAYS, IT IS DISPLAYED AUTOMATICALLY. A MANUAL ENTRY IS POSSIBLE ON ALL INSTALLATIONS SO CONFIGURED.**

If fuel flow is not monitored by the FMS, fuel on board entries should be updated as required to compensate.

Fuel Options Page

With any Fuel Page displayed, pressing **[MENU]** will access the Fuel Options Page.



The left side of the display is for viewing conversions. Pressing any left LSK will place the cursor over that respective entry field. Entry of a value into one field will cause all other fields to display the same value converted per the entry field heading.

XFILL – Available only in installations requiring two or more FMSs not configured for SYNC mode, the XFILL feature causes the fuel onboard to be crossfilled (copied) to or from the other FMS. The system can be configured with either the PUSH or PULL option.

FUEL ENTRY – Pressing LSK [3R] will result in display of a list page with options BY TANK or BY TOTAL. Select the appropriate number and press ENTER. When TANK is selected, fuel will be entered per tank. When the FUEL ONBOARD LSK of Fuel Page 1 is pressed, per tank format is presented, allowing fuel onboard to be entered individually for up to six tanks. When TOTAL is selected, the fuel onboard entry can be made directly on Fuel Page 1 as a total amount.

AVG PAX (CREW) WEIGHT – This field allows the entry an average passenger weight value to be used for calculating total passenger weight on Fuel Page 1. Once entered, the default weight will be saved for subsequent use.

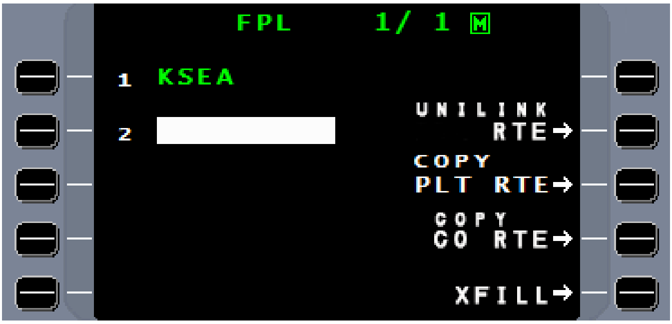
RETURN – The display will return to the last Fuel Page viewed prior to pressing the MENU key.

Flight Plan Function

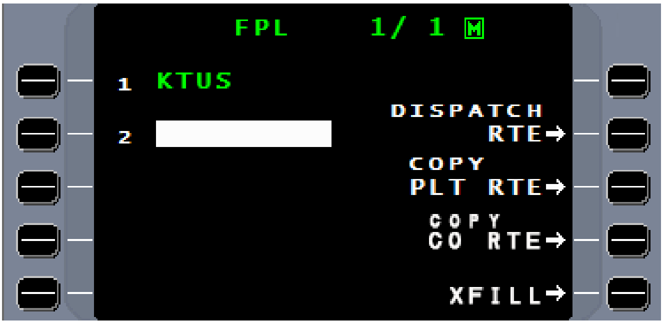
The FPL key is used to access the Flight Plan Pages, or to access stored arrivals and routes. The Flight Plan Pages may be accessed to construct a new flight plan, alter the current flight plan, or to insert a SID, STAR, or approach into the flight plan.

Flight Plan Pages – No Flight Plan Entered

The Empty Flight Plan Page will be displayed whenever **[FPL]** is pressed and there is no flight plan in the system. This page is used to build flight plans.



SCN 1002.0



SCN 1002.1 and Later

UNILINK RTE – If UniLink is configured and the UPLINK RTE option is enabled, UniLink Route option [2R] is displayed as an available option. Pressing LSK [2R] displays the UniLink Route Page. This page allows the user to request a flight plan from a ground host computer and to review, load, or reject an uplinked flight plan. Refer to the applicable UniLink manual.

DISPATCH RTE – This option is available in FMS SCN 1102.1 and later. If UniLink is configured DISPATCH RTE option [2R] is displayed as an available option. Pressing LSK [2R] displays the DISPATCH RTE Page. This page allows the user to request a flight plan from a ground host computer and to review, load, or reject an uplinked flight plan. Refer to the applicable UniLink manual.

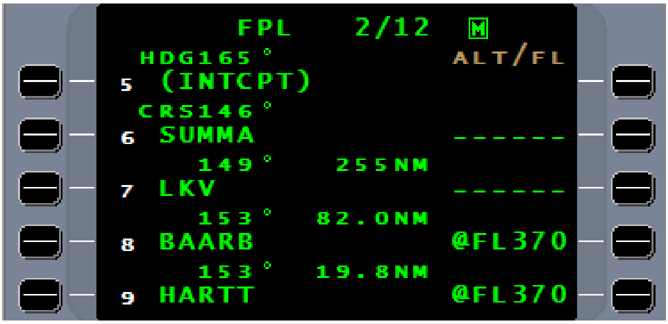
COPY PLT RTE – Pressing the COPY RTE LSK will cause a listing of routes appropriate for the initial waypoint position to be displayed. Entering the reference number of one of the stored routes will copy that route into the flight plan.

COPY CO RTE – If a Company Routes Database is installed, COPY CO RTE is displayed as an option at LSK [4R]. Pressing this LSK displays the CO RTE Page. This option is displayed when an airport is defined at LSK [1L] and a waypoint is not defined at LSK [2L].

XFILL – Pressing this LSK will cause the flight plan to crossfill from or to the other FMS in a dual installation, depending on the crossfill configuration. This option will not be available in a single FMS installation, dual FMS installations configured for SYNC mode, or if no flight plan is available for crossfill in the originating FMS.

Flight Plan Pages – Flight Plan Entered

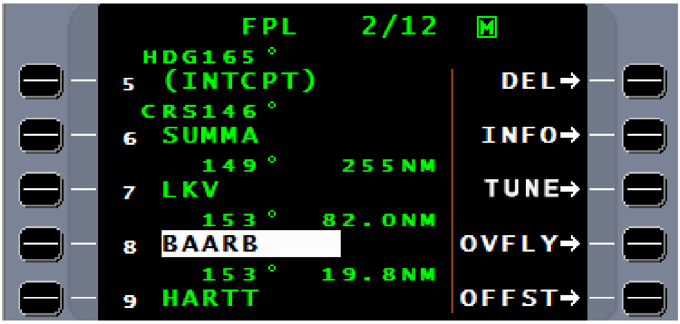
The Flight Plan Pages are accessed by pressing the FPL key when a flight plan has been defined. These pages show the flight plan waypoints, ETA, altitudes (when defined in VNAV), bearings and distances between waypoints. In the case of procedural legs of SIDs, STARs and approaches, path type and terminator are shown. The page also allows editing of the flight plan. Other pages of the flight plan may be displayed by pressing the PREV or NEXT keys, as appropriate.



A caret (>) marks the current TO waypoint. An overfly waypoint is marked with an asterisk (*).

Waypoint Options

When the cursor is placed over a waypoint, up to five options will appear in the right-hand column.



DEL – Pressing this LSK twice will delete the selected waypoint from the flight plan.

INFO – Pressing this key will display all information from the Navigation or Pilot Defined Database concerning the waypoint or navigational aid.

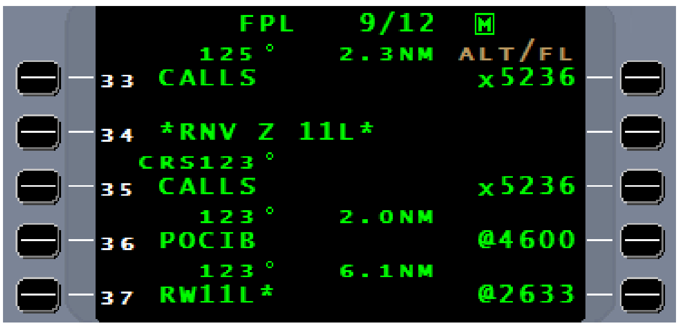
TUNE – This option only appears when the cursor is over a navigational aid such as VOR or NDB. When the system is enabled for remote tuning of navigational aids, and the frequency management function is enabled, pressing this LSK will tune radio to the frequency stored in the database.

OVFLY – Pressing this LSK will define the selected waypoint as an overfly waypoint. An overfly waypoint is a waypoint which will cause the navigation computer to delay making an automatic leg change until the aircraft is directly overhead. An overfly waypoint is indicated by an asterisk (*) following the waypoint identifier on the Flight Plan Pages. If the selected waypoint is already an overfly waypoint, this option will read CNCL OVFLY, and the overfly designation can be removed by pressing this LSK. Only geographic points, not procedural legs, can be designated as overfly.

OFFST – If the selected waypoint has an altitude constraint and is within the next six vertical waypoints, then OFFST is displayed. Pressing this LSK displays the VNAV Path Page with the cursor over the corresponding vertical waypoint's offset field.

Approach Depiction on Flight Plan Pages

An approach is designated on the Flight Plan Pages by asterisks. The first waypoint in the approach is denoted by an asterisk on each side of the label, as shown on Flight Plan Page 1 below. The approach type, DME indicator, multiple indicator, and runway designator, if applicable, are enclosed by asterisks. The DME indicator consists of “/D” and indicates that DME is required for the approach. The multiple indicator is the database code for more than one of the same type approach to a runway and consists of a single alphanumeric character, i.e. *VOR 18R*, *RNV/D Z 17L*. The EOA is designated by *EOA* as shown on Flight Plan Page 2 below.



Flight Plan Page indicating beginning of approach

<u>NOTE</u>: True procedures are displayed with a TRUE reference on the relevant FPL page.

Flight Plan Page indicating end of approach

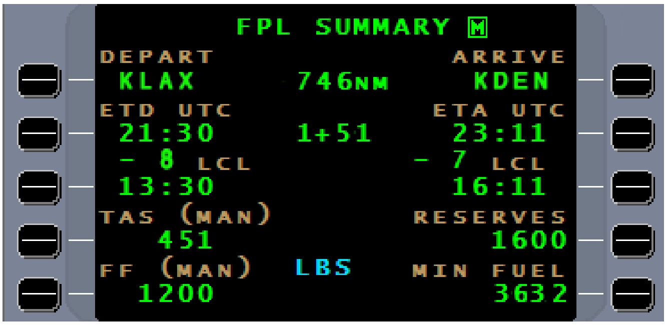
When an approach is linked into the flight plan, the Flight Plan Page will display At (@) altitudes at the FAF and MAP or runway fix. These altitudes are the coded altitudes from the Navigation Database that are published on the approach plates.

Editing any approach (EOA) label or waypoint between the approach/EOA labels on the Flight Plan Pages will invalidate the approach. The waypoints will remain on the Flight Plan Pages, but the approach will not arm or activate, and the FMS will fly the waypoints as terminal waypoints. Subsequently, the APPR indication and ARM APPR or ACT APPR selectable option will not appear on the Navigation Page. To restore the use of the approach segment, the approach must be re-entered into the flight plan.

NOTE: Bearing information is corrected for magnetic variation and displayed on FPL pages, for course and heading legs when the system MAG/VAR is invalid and a manual variation is entered, and the Magnetic/True reference is based on the state of the MAG/TRUE input to the FMS. The FMS will use airport MAG/VAR when system MAG/VAR is not defined at the airport reference location. This value is used for the approach legs in the flight plan.

Flight Plan Summary Page

Available only during ground operations prior to departure, the Flight Plan Summary Page provides a synopsis of distance, time, and fuel requirements for the planned flight. This page is accessed from the Flight Plan Pages by using the PREV and NEXT keys. The Flight Plan Summary Page follows the last Flight Plan Page.



ETD UTC – Displays the estimated time of departure in UTC (Coordinated Universal Time) format. Under the UTC ETD field is the local time zone difference field (LCL). The time zone sign (±) will be prefilled according to the longitude of the first waypoint on the flight plan. It is used to calculate ETA.

ETD LCL – Displays the estimated time of departure according to the local time zone.

TAS (MAN) – Displays the estimated true airspeed (in knots). It is used to calculate the ETE and estimated ETA values. This value of TAS will be applied to each leg in the flight plan and will consider any wind information that has been entered for waypoints to predict a groundspeed for each leg.

FF (MAN) – Displays the estimated fuel flow, which will be used to compute minimum fuel (MIN FUEL).

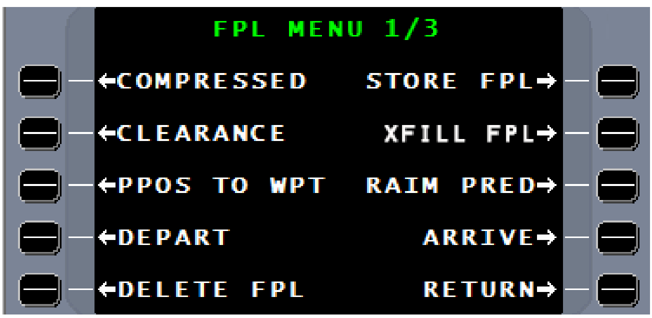
ETA UTC – Displays the ETA as calculated from the ETD. Under the ETA field is the local time zone difference field. The time zone sign (±) will be prefilled according to the longitude of the last waypoint on the flight plan (prior to a GAP).

ETA LCL – Displays the ETA according to the local time zone.

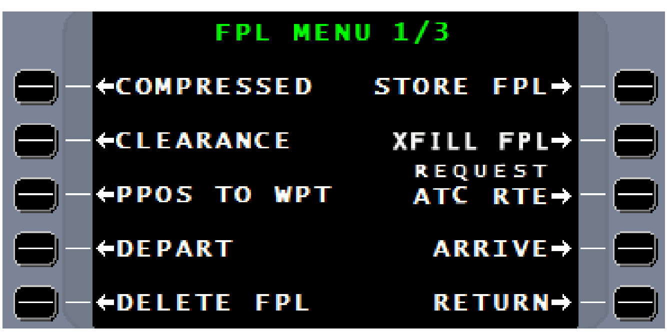
RESERVES – The estimated reserve fuel, which is used to compute the MIN FUEL value.

Flight Plan Menu Page 1

The Flight Plan Menu Pages are accessed from any Flight Plan Page by pressing **[MENU]**. From any of these pages, press **[FPL]** to return to the Flight Plan Pages.

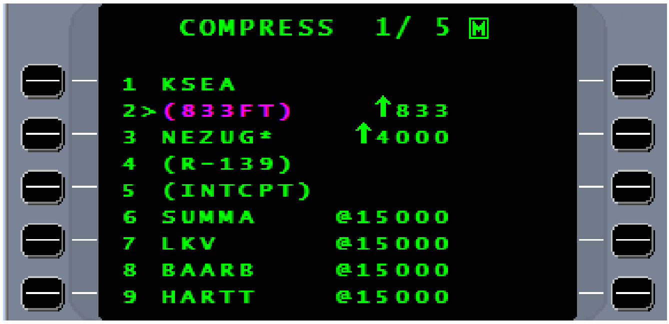


SCN 1002.0



SCN 1002.1 and Later

Compressed Flight Plan

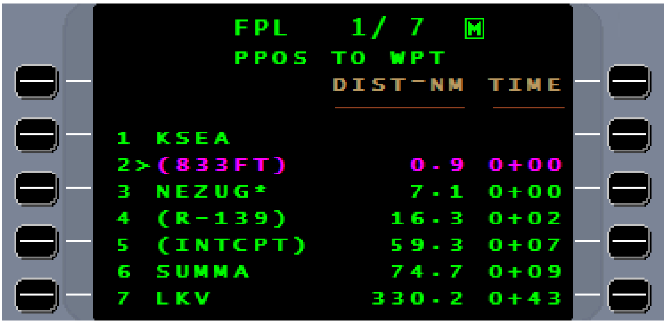


[FPL/MENU/COMPRESSED] These pages allow viewing of up to nine flight plan waypoints at one time. The current TO waypoint is shown on the first page with a caret (>). Also shown for each waypoint is any altitude or altitude window constraints. No entries can be made to these pages.

Clearance Language Page

[FPL/MENU/CLEARANCE] The Clearance Language Page displays the SID, airway sequence, STAR, and approach in Clearance language. No entries can be made to these pages.

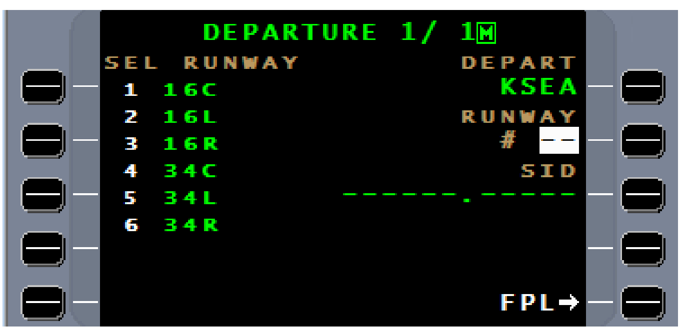
Present Position to Waypoint Page



[FPL/MENU/PPOS TO WPT] The Present Position to Waypoint Page displays distance and time from present position to each flight plan waypoint. Procedural legs (also known as "floating waypoints") will not display distances or times. If the time to a waypoint is greater than 9+59, the time to that waypoint will appear as "++++". No entries can be made on these pages.

Departure Page

[FPL/MENU/DEPART] The Departure Page is used to select departure procedures to be inserted in a flight plan or pilot route. The Departure Page is also accessed from the Pilot Route Menu, but for review only; no changes can be made to departure data in that case.



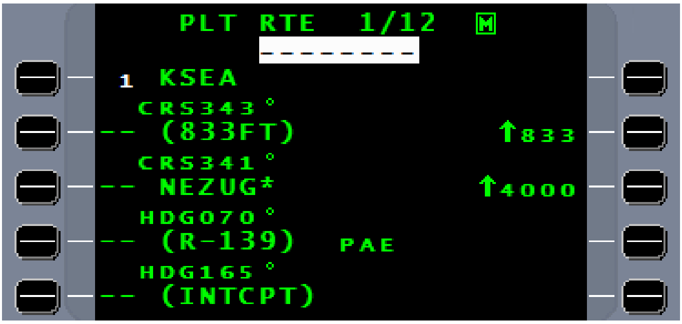
All entry fields [1R thru 4R] will display dashes until an entry has been made. After a valid departure airport has been entered, the cursor will advance to the RUNWAY field and available runways for that airport will be displayed on the left side of the screen.

When a runway has been entered, the cursor will advance to the SID field. Any predefined SIDs will be displayed. After the SID is entered, a list of enroute transitions is displayed, if available. Enter a transition, if applicable.

NOTE: A pop-up message, SID RNP<CONFIG is displayed when a selected SID [3R] contains a leg RNP less than the configured RNP value. The pop-up message is removed when the SID is no longer active.

Store Flight Plan

Selecting **[STORE FPL]**, LSK [1R] on Flight Plan Menu Page 1, displays the Pilot Route Page, with the cursor over the route name field. The current flight plan is saved as a route in the Pilot Defined Database. The route name can be changed to any eight-character name to uniquely identify a particular route.

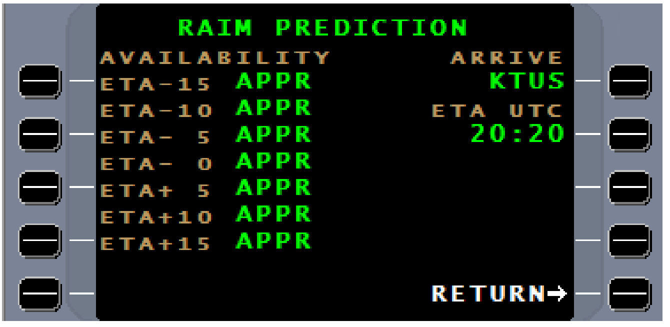


Crossfill Flight Plan

The XFILL FPL option, LSK [2R] from the Flight Plan Menu Page 1, is an available option on multiple FMS installations not configured for SYNC mode. Selecting this LSK crossfills a flight plan modified on one system to the other. Each system may be configured to PUSH or PULL flight plan data from one system to the other.

RAIM Prediction

[FPL/MENU/RAIM PRED] The RAIM Prediction option is displayed only when GPS/SBAS or other RAIM capable GPS sensor is configured. RAIM Prediction is not required for SBAS approaches.



When using a GLS to fly a non-precision approach, the Predictive RAIM feature is inaccessible. The GLS performs an integrity check equal to a Predictive RAIM and subsequently displays dashed on the Predictive RAIM Page.

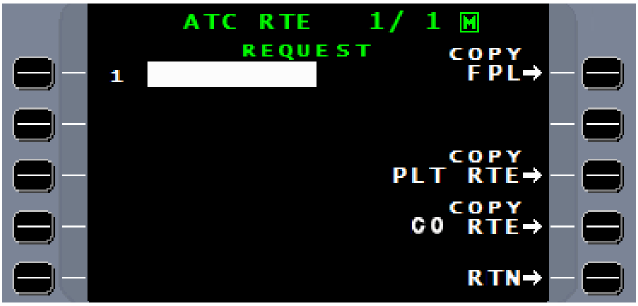
During enroute and approach operations, the FMS provides pilot-requested predictions of RAIM availability at the selected ARRIVE waypoint for a period of ETA ±15 minutes in five-minute increments.

NOTE: The FMS does not provide automatic RAIM prediction at approach arming and activation.

RAIM availability is displayed in terms of meeting enroute, terminal and approach criteria (i.e., 2.0 nm, 1.0 nm, and 0.3 nm respectively) at the destination airport at the estimated arrival time shown. If ETA is not defined, dashes ("---") are displayed for RAIM availability. If a prediction has been requested and the FMS is waiting for a response, a question mark ("?") is displayed. Once valid data is received, RAIM availability is displayed. If any RAIM availability is shown to be other than APPR for the ±15-minute window, then the pilot should not plan to rely on GPS for position determination during the approach.

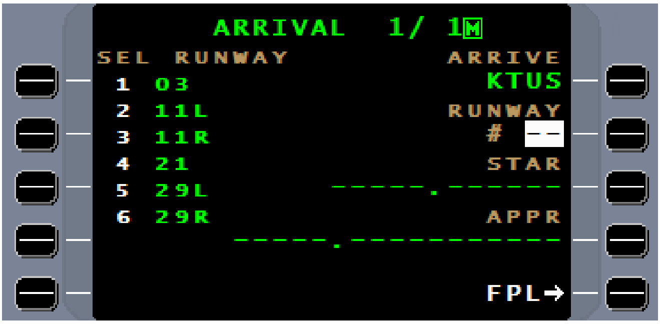
REQUEST ATC RTE

[FPL/MENU/REQUEST ATC RTE] This option is available in FMS SCN 1102.1 and later. REQUEST ATC RTE, LSK [3R] is displayed when UniLink is configured and UNILINK MSG LOADING is enable. When selected, the REQUEST ATC RTE options display the ATC RTE page.



Arrival Page

[FPL/MENU/ARRIVAL] or for review only (no changes can be made): **[DATA/PILOT DATA/ROUTE/PILOT RTE 1/X/MENU/ARRIVE]**

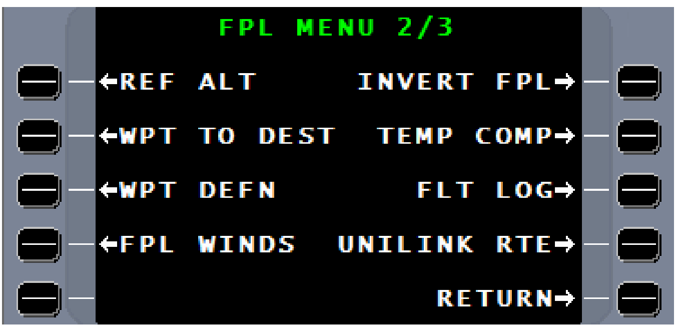


The Flight Plan Arrival Page is used to select the arrival procedures to be inserted in a flight plan or pilot route. A selection list is displayed on the left side of the page. Data for each field at LSK [1R] through [4R] is entered using the reference number and pressing ENTER. Refer to Insert Approach or STAR into the Flight Plan in the Arrival section for more information.

NOTE: A pop-up message, STAR RNP<CONFIG is displayed when a selected STAR [3R] contains a leg RNP less than the configured RNP value. The pop-up message is removed when the STAR is no longer active.

Flight Plan Menu Page 2

Flight Plan Menu Page 2 is accessed from any Flight Plan Page by pressing **[MENU]**, then **[NEXT]** or **[PREV]**.



Reference Altitude Page

[FPL/MENU/REF ALT] The REF ALT option is available only if a UA TAWS or Vision-1 system is installed and configured.

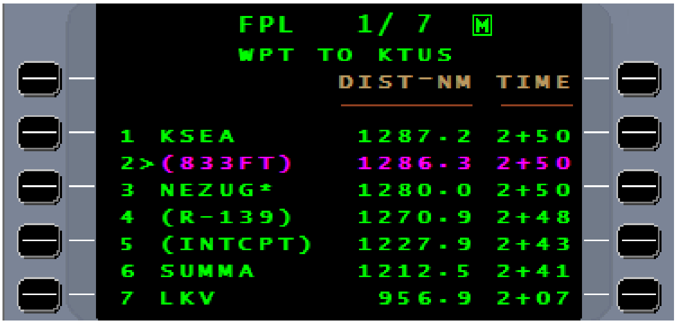
The Reference Altitude Pages display the waypoint altitude constraints (if any) that are supplied by the FMS to TAWS or Vision-1. If a waypoint does not have an altitude constraint associated with it but lies between two waypoints that do, the FMS will attempt to interpolate an altitude for that waypoint. The current TO waypoint is shown in the second position on the first page with a caret (>). The PREV and NEXT keys are used to scroll through the flight plan waypoints.

The pilot should review these pages if a Flight Path Intent Alert from TAWS or Vision-1 is received, to determine how the FMS has interpreted the flight plan profile. If necessary, the pilot should enter an additional waypoint altitude on the Flight Plan Pages to define the profile more precisely, since the FMS interpolation might not match the path intended.

Symbols are placed in front of each altitude to define the constraint:

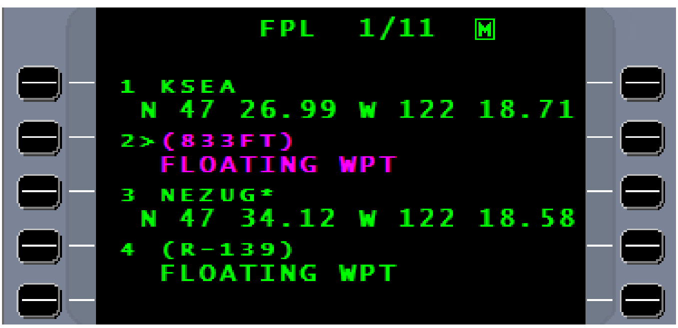
- @: AT altitude
- c: variable constraint
- - (dash): no altitude constraint
- x: Vertical Navigation altitude
- (blank space): reference altitude.

Waypoint to Destination Page



[FPL/MENU/WPT TO DEST] This page displays the distance and time from each waypoint to the destination. No entries can be made to these pages.

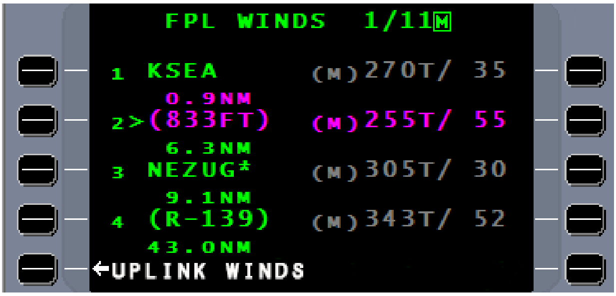
Waypoint Definition Page



[FPL/MENU/WPT DEFN] This page displays the coordinates of every flight plan waypoint, or "FLOATING WPT" in the case of procedural legs. No entries can be made to these pages.

Flight Plan Winds Page

[FPL/MENU/FPL WINDS] On this page, wind information may be added to individual waypoints in the flight plan to provide a more accurate estimate of the trip duration and ETA.

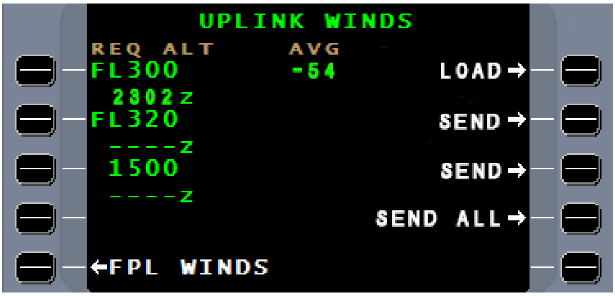


The current TO waypoint is indicated by a caret (>). Manually entered wind data is indicated by (M) to the left of the wind data. If a waypoint (or waypoints) with no manually entered wind data lies between two waypoints that do have manually entered wind data, the FMS will calculate interpolated wind data for that waypoint or waypoints. Interpolated wind data is displayed in parentheses. This interpolated data can be overwritten with manual data at any time.

Uplink Winds Page

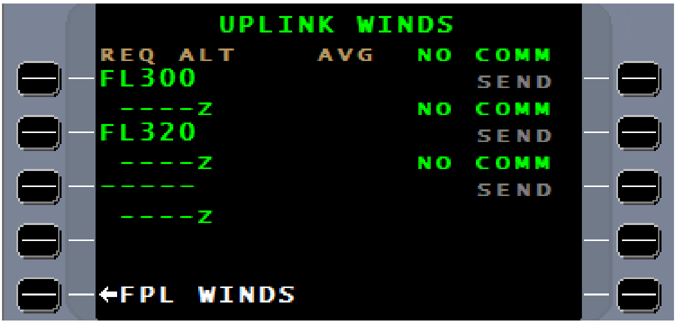
[FPL/MENU/FPL WIND/UPLINK WINDS]

The UPLINK WINDS page allows the pilot to enter altitudes/flight levels, request winds at those levels and load a selected altitude winds profile into the flight plan.



Upon entering at least one altitude on the UPLINK WINDS page, the SEND (for a single altitude) or SEND ALL (for multiple altitudes) prompts become available for selection as appropriate. Selecting the SEND or SEND ALL prompt composes a winds request message consisting of the entered altitude(s) on the UPLINK WINDS page and enroute waypoints in the flight plan at that time. After a SEND request, the average winds for the enroute FPL, headwind (-) or tailwind (+) will be displayed at the requested altitudes/FLs.

Pressing the LOAD prompt associated with the altitude desired for loading into the flight plan winds causes the FPL WINDS page to be displayed, containing the loaded winds.



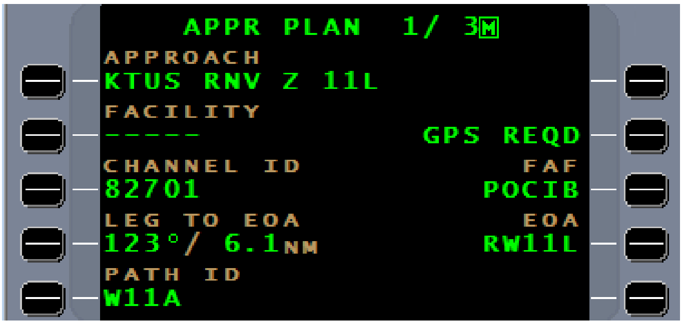
If, for any reason, UniLink is unavailable, the SEND prompt becomes unavailable, and NO COMM is displayed.

NOTE: Pressing the LOAD prompt will cause the FMS to revert to independent mode of operation indicated by the inverse "I" in the upper right corner of the CDU. The FMS can be manually re-synced by following the SYNC procedure found in the SYNC Page section of this manual.

Approach Plan Pages

[FPL/MENU/APPR PLAN] Approach Plan is an option only if an approach is entered in the flight plan. Otherwise, this field is blank.

The Approach Plan Pages provide the pilot with a convenient summary of pertinent approach information.



APPROACH – This field displays the airport, approach type and runway number.

FACILITY – This field displays the facility identifier if one is supplied by the database. If one is not supplied, this field is blank.

FREQUENCY/CHANNEL ID/CHAN ID – If the approach type is GLS or SBAS, this field displays the Channel ID. If a facility is defined, this field displays the frequency or channel for that facility. If not defined, this field displays dashes.

LEG TO EOA – This field displays the inbound course and distance of the leg to the EOA. However, if the leg to the EOA is an RF leg, this field displays only dashes.

PATH ID – If the approach type is RNAV (GPS), this field displays the path identifier.

GPS REQUIREMENT/APPROVAL – If GPS is required for this approach, the field displays GPS REQD. If GPS is not required, but GPS is approved for the approach, this field displays GPS APRVD. Otherwise, this field is blank. It is the responsibility of the crew to deselect the GPS/WAAS sensor if GPS in not approved for the approach.

NOTE: Localizer-based approaches retain the GPS sensor during approach, but do not use GPS for final approach guidance and therefore will not display GPS APRVD. Refer to ILS, LOC, and BC Approaches in the Arrivals section for more information.

FAF – This field displays the designation of the FAF waypoint.

EOA – This field displays the designation of the EOA waypoint.

The remaining Approach Plan Pages list the waypoints in the approach.

Invert Flight Plan

[FPL/MENU/INVERT FPL] The Invert Flight Plan option is an available option only when a flight plan is entered. Refer to Invert Flight Plan in the Pre-departure section for more information.

Temperature Compensation Pages

[FPL/MENU/TEMP COMP] The TEMP COMP option is only available when temperature compensation is configured at time of installation.

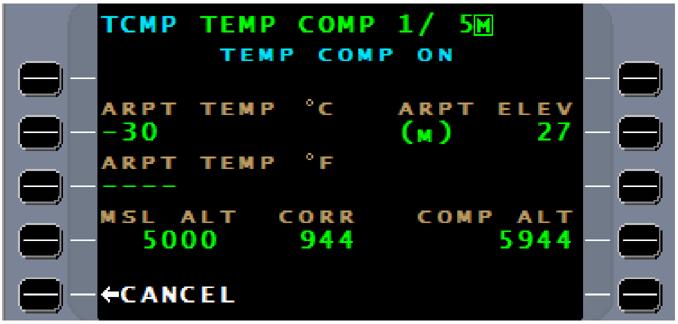
Under conditions of extreme cold, barometric altimetry may be inaccurate, causing the actual aircraft altitude to be lower than that indicated by the altimeter. Some countries (e.g., Canada and Norway) have procedures defined whereby the pilot must refer to a table of information relative to landing airport elevation and temperature and derive altitude corrections which are then added to charted approach altitudes. The temperature compensation feature automates that process and relieves the pilot of this manual task.

Temperature-compensated altitudes will be displayed on the Flight Plan Pages, the Approach Plan Pages, the Path Vertical Navigation Page, the Navigation Approach Page, and the Temperature Compensation Page. After the temperature compensation feature is activated, temperature-compensated altitudes may be overwritten by entering a manual altitude on the Path VNAV Pages or the Flight Plan Pages.

Temperature will not be compensated for manually entered altitudes. All manually entered altitudes must consider the temperature correction before they are entered into the FMS, even if Temperature Compensation function is not active.

Temperature compensation is automatically canceled if either a new airport or approach is entered in the flight plan.

Temperature Compensation Page 1 displays the data entries needed to calculate the temperature adjusted altitudes.



Temperature correction (compensation) values computed by the FMS may differ from the widely used ICAO temperature correction chart. The FMS uses a different algorithm to determine temperature corrections which produces more accurate correction values (especially at greater altitudes above the airport). This in turn provides more precise correction of the approach segment barometric glideslope angle. The accuracy of the computed correction can be reviewed on the APPR PLAN pages, accessed via the FLT PLAN MENU page 2/2.

ARPT TEMP ºC – Temperature at the destination airport, in degrees Celsius (ranging from 0º to -70º C).

ARPT TEMP ºF – Temperature at the destination airport, in degrees Fahrenheit (ranging from 32º to -94º F).

MSL ALT – Displays the MSL altitude. The amount of altitude correction is displayed next to the MSL altitude.

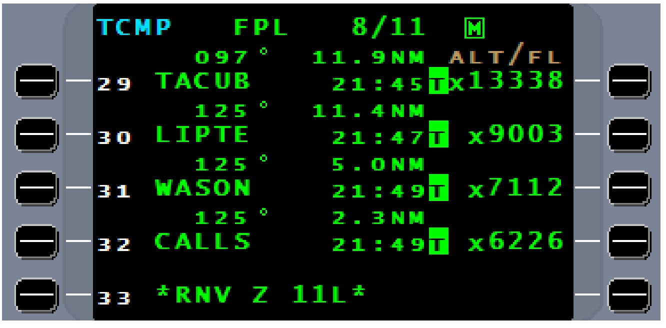
ARPT ELEV – Displays the airport elevation

COMP ALT – Displays the compensated altitude, as computed by the FMS.

ACTIVATE/CANCEL – LSK [5L] displays **ACTIVATE** when temperature compensation is not yet activated. Pressing this LSK will activate TEMP COMP and all approach transition altitudes, approach altitudes and missed approach altitudes will have an altitude correction factor added.

CANCEL is displayed when temperature compensation is activated. Selecting this LSK will cancel the temperature-compensated altitudes.

An inverse "T" is displayed next to all altitudes on the flight plan pages to indicate temperature compensation is active and that these altitudes have had an altitude correction applied (either manually or by the Temp Comp function).



The remaining Temperature Compensation Pages lists relevant data for temperature-compensated altitudes for all approach legs in the flight plan.

An identifier is displayed to the left of the approach leg to indicate the segment of the approach. A “T” indicates an approach transition segment, “A” identifies an approach segment and “M” identifies a missed approach segment.

HAA – Height above airport. This is equal to the difference, in feet, between the MSL altitude and the airport elevation.

CORR – The amount of altitude correction for all waypoints with a temperature-compensated altitude.

COMP ALT – The temperature-compensated altitude.

Flight Number / Flight Log

[FPL/MENU/FLT NBR] When Flight Number is configured at time of installation, FLT NBR is displayed at LSK [3R]. Refer to Enter a Flight Number in the Pre-departure section for more information.

NOTE: When neither Flight Log nor Flight Number is configured, LSK [3R] field is blank.

When an FMS ARINC TX port is configured to XPDR LS429 or GPS XPDR, the assigned flight ID number data will be transmitted to the Mode S Transponder for aircraft identification.

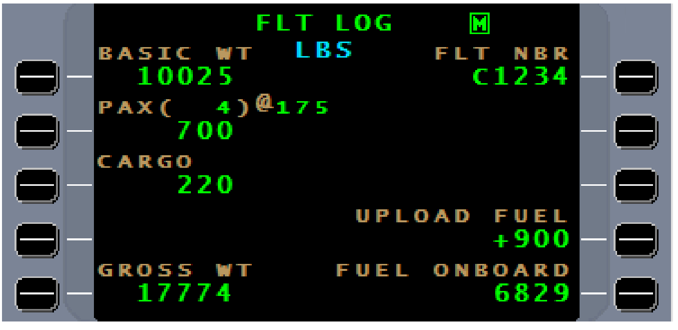
Press **LSK [3R]** to highlight the field, input the flight ID number and press **[ENTER]**.

[FPL/MENU/FLT LOG] When Flight Log is configured at time of installation, FLT LOG is displayed at LSK [3R] on the Flight Plan Menu Page 2. Selecting LSK [3R] will display the Flight Log Page.

The Flight Log function records data to the FMS for later download to a disk. This function is only active if the aircraft has been specifically configured for Flight Log. That is, the FLIGHT LOG and FUEL mode configuration option must both be enabled.

Data saved under this function includes time and location of engines running, APU, parking brake, rotors turning, time and location of takeoff and landing, fuel values at takeoff/landing/shutdown/download and flight number. The specific configuration and pilot entry determine the actual data.

Flight data recorded during flight, including entries on the FLT LOG page, is saved to disk by selecting the FLT LOG DNLD option on the Disk Menu page. This option is available upon landing.



NOTE: BASIC WT, PAX, CARGO, and FUEL ONBOARD entries on this page duplicate those on Fuel Page 1, including the relationship to zero fuel weight. Values can be entered on either page and both pages will be updated to reflect the changes.

BASIC WT – The weight of the aircraft minus passengers, cargo, and fuel. The default value in this field is programmed into the configuration module. Manual entries can be made in this field by placing the cursor over the field and typing in the desired value. These manual entries are retained through power cycles.

PAX – The passenger weight is input by entering the number of passengers (up to 999). The computer multiplies the number of passengers by the default weight per passenger (175 pounds). This weight may be changed on the Fuel Menu Page. Once entered, the default weight will be saved for subsequent use. If passenger value is zero, then zero should be entered rather than leaving the field dashed.

CARGO – The cargo weight is input at this location by placing the cursor over this field and entering the desired weight. If cargo value is zero, then enter zero rather that leaving the field dashed.

GROSS WT – Gross weight is not entered but is computed as the sum of Empty Weight, PAX, Cargo and Fuel Onboard.

FLT NBR – Flight number is entered at this location by placing the cursor over this field and entering the desired number. A maximum of 10 digits may be entered. The flight number is retained through touchdown and liftoff and need not be entered unless a change is desired.

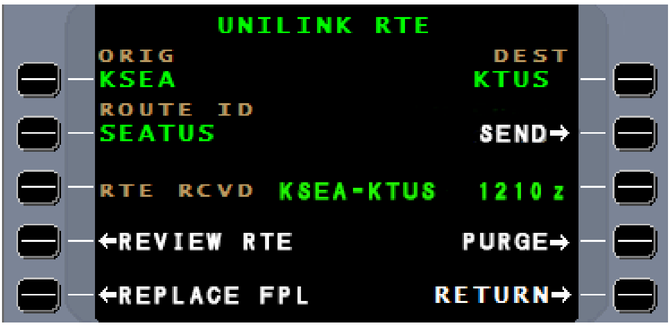
UPLOAD FUEL – Fuel upload and download entries are made at this location by placing the cursor over this field and entering the desired amount. Upload is indicated by using a "+" and download in indicated by using a "-". A total of six numbers may be inputted including +/-. Upload fuel values are reset after takeoff and do not need to be entered if no change is made.

FUEL ONBOARD – The total fuel onboard value is stored in memory until manually changed. Confirmation is required following initialization.

UniLink Route (If Configured)

[FPL/MENU/UNILINK RTE] If UniLink is configured and the UniLink Route option is enabled, selecting UNILINK RTE, LSK [4R] on Flight Plan Menu Page 2 displays the UniLink Route Page.

The UniLink Route Page allows the flight crew to request a flight plan from a ground host computer and accept, reject, and review an uplinked flight plan.



SEND – Initiates the flight plan downlink request. SENDING is displayed in this field during transmission and SENT is displayed once the flight plan is obtained.

REVIEW RTE – Displays the Review Route Page, where the uplinked flight plan may be viewed. The uplinked flight plan is stored separately from the active flight plan and displayed in clearance language format.

NOTE: If the uplinked flight plan erroneously contains a GAP in the flight plan, the REVIEW RTE pages may not display the GAP. The GAP will be inserted and displayed correctly when the flight plan is replaced by the uplinked flight plan.

REPLACE FPL – Pressing this line select key replaces the current flight plan with the uplinked route.

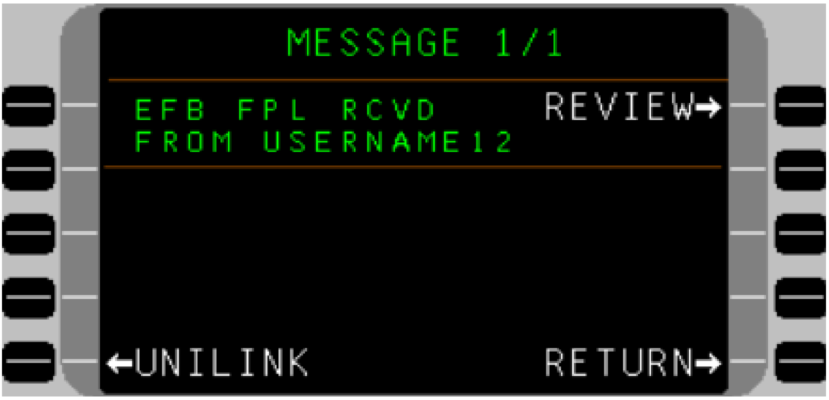
PURGE – Pressing this line select key removes the currently uplinked flight plan, causing the UniLink Route page to display dashes.

Refer to the applicable UniLink Operator's Manual for more detailed information.

Route Review Pages – FMS can get flight plans from different outside places. This can be a flight plan file load from DTU using FPL FV2.X, an EFB that sends FMS the flight plan in FPL FV2.X through FCDB, or as part of ATC clearance through CPDLC. A flight plan from outside is called a route before it replaces the one in use. When FMS gets a route from these places, FMS shows a way to check the route's flight plan data and some flight plan data details before replacing the one in use.

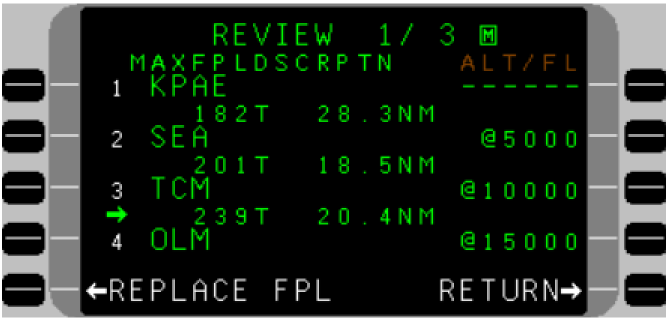
The FMS provides the capability to edit the flight plan data displayed to the crew, store the route, and delete the route. The Route Review (REVIEW) pages display the flight plan, leg terminator identifiers, leg path data and any altitude constraints defined for each leg terminator identifier.

The FMS provides a prompt message on the MESSAGE page when the aircraft receives an external source in-air (such as UniLink or EFB).



Example EFB FPL RCVD from "EFB ID" Prompt Message (SCN 1002/1102.6 and later)

Selection of LSK [1R] access the REVIEW 1/3 page.



Example FMS Route REVIEW Page 1/3 Received from FPL FV2.X (SCN 1002/1102.6 and later)

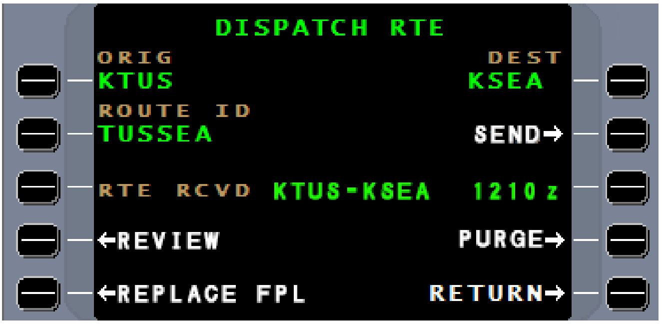
Example FMS Route REVIEW Page 1/3 Received from EFB 1 with SID Included in Flight Plan (SCN 1002/1102.6 and later)

Dispatch RTE (If Configured)

[FPL/MENU/DISPATCH RTE] This option is available in FMS SCN 1102.1/1102.1 and later.

If UniLink is configured, selecting DISPATCH RTE, LSK [3R] on Flight Plan Menu Page 2 displays the Dispatch Route Page.

The Dispatch Route Page allows the flight crew to request a flight plan from a ground host computer and accept, reject and review an uplinked flight plan from UniLink.



SEND – Initiates the flight plan downlink request. SENDING is displayed in this field during transmission and SENT is displayed once the flight plan is obtained.

REVIEW – Displays the Review Route Page, where the uplinked flight plan may be viewed. The uplinked flight plan is stored separately from the active flight plan and displayed in clearance language format.

REPLACE FPL – Pressing this line select key replaces the current flight plan with the dispatch route.

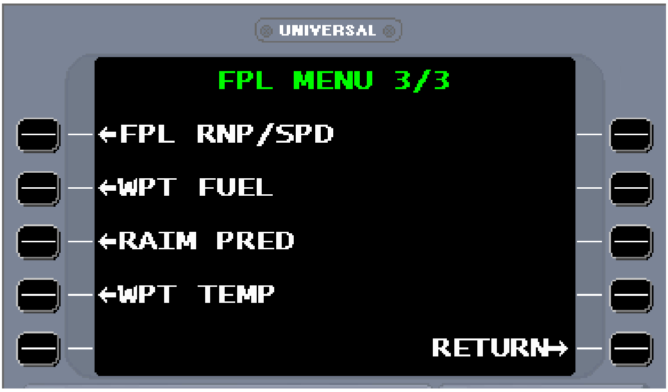
PURGE – Pressing this line select key removes the currently uplinked flight plan, causing the Dispatch Route page to display dashes.

Refer to the applicable UniLink Operator's Manual for more detailed information.

Flight Plan Menu Page 3

Flight Plan Menu Page 3 is accessed from any Flight Plan Page by pressing **[MENU]**, then **[NEXT]** or **[PREV].**

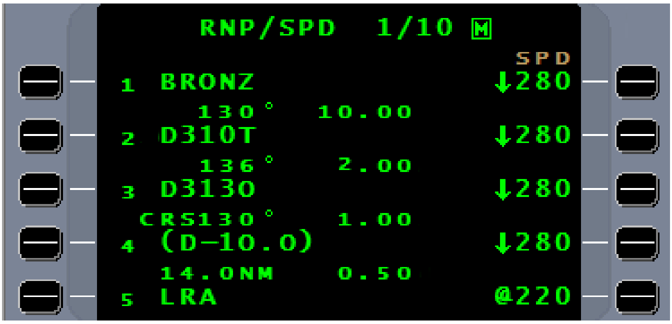
Flight Plan Menu 3/3 (SCN 1002.3 and earlier)



Flight Plan Menu 3/3 (SCN 1002.4 and later)

Flight Plan RNP/SPD Page

[FPL/MENU/FPL RNP/SPD] The FPL RNP/SPD Page is accessed on the FPL MENU 3/3 page.



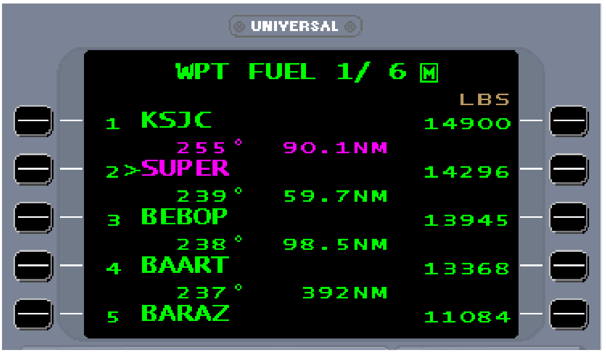
RNP/SPD Page (STAR)

The FPL RNP/SPD page is similar to the Normal FPL page except that the Flight Plan waypoints cannot be modified on this page.

The FMS displays the leg path RNP from the nav database if the RNP is defined for an FPL leg. The RNP on this page is the RNP into the waypoint containing the RNP value.
The FMS does not allow manual entry of RNP values and speed limits on the FPL RNP/SPD page.

WPT FUEL Page

[FPL/MENU/WPT FUEL] The WPT FUEL Page, when configured for the DAPA computer, is accessed by selecting LSK [2L] on the FPL MENU 3/3 page.

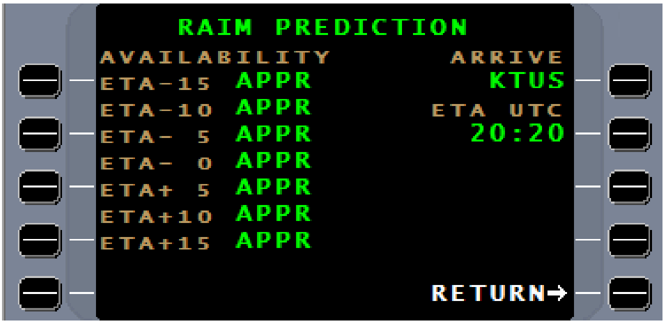


WPT FUEL Page

The WPT FUEL pages display the flight plan leg information, fuel on-load/offload (aerial refuel adjustment), fuel remaining at each leg terminator (waypoint), and fuel burn for each leg. The unit of the fuel information is also displayed under the page title.

RAIM Prediction

[FPL/MENU/RAIM PRED] The RAIM Prediction option is displayed only when GPS/SBAS or other RAIM capable GPS sensor is configured. RAIM Prediction is not required for SBAS approaches.



When using a GLS to fly a non-precision approach, the Predictive RAIM feature is inaccessible. The GLS performs an integrity check equal to a Predictive RAIM and subsequently displays dashed on the Predictive RAIM Page.

During enroute and approach operations, the FMS provides pilot-requested predictions of RAIM availability at the selected ARRIVE waypoint for a period of ETA ±15 minutes in five-minute increments.

NOTE: The FMS does not provide automatic RAIM prediction at approach arming and activation.

RAIM availability is displayed in terms of meeting enroute, terminal and approach criteria (i.e., 2.0 nm, 1.0 nm, and 0.3 nm respectively) at the destination airport at the estimated arrival time shown. If ETA is not defined, dashes ("---") are displayed for RAIM availability. If a prediction has been requested and the FMS is waiting for a response, a question mark ("?") is displayed.

Once valid data is received, RAIM availability is displayed. If any RAIM availability is shown to be other than APPR for the ±15-minute window, then the pilot should not plan to rely on GPS for position determination during the approach.

WPT TEMP Page

[FPL/MENU/WPT TEMP] The Waypoint Temperature page, when configured, displays the forecast OAT in degrees Celsius (C) for each waypoint in the flight plan.

The temperatures can be loaded from a flight plan into the FMS or can be manually entered by the flight crew.

The WPT TEMP page is accessed from the FPL MENU 3 page by selecting WPT TEMP LSK [4L].

Select [MENU] to returns to the FPL MENU pages.

Temperatures received by the FMS from a flight plan are considered manual entries. The flight plan format version 2 (FPL FV2) supports loading OAT values as part of the flight plan.

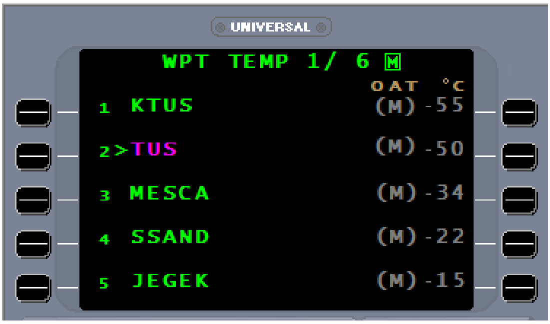


Figure 3-1 Example WPT TEMP Page

The flight crew can modify the OAT field by selecting the right LSK next to the OAT field which allows the flight crew to enter a new value in degrees Celsius (°C) for the OAT. The valid range for entry for the OAT field is −70 to 60°C.

When the OAT value has been modified by the crew, or received as part of a flight plan, it will be displayed as manual data with an (M) before the entered value.

A temperature entry is considered a manual entry if the temperature is manually entered by the crew or received as part of a flight plan.

When in a dual FMS configuration, any manual entry is synchronized from the onside FMS to the offside FMS while SYNC mode is active.

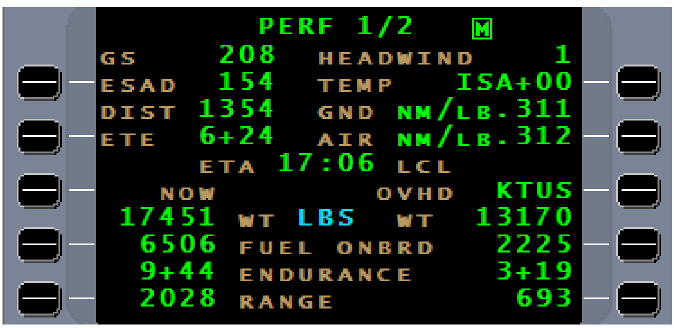
Performance Function

The Performance Pages provide pertinent in-flight performance information. There are three Performance options available, depending on aircraft configuration. If the Basic option is configured, there is one Performance Page. If the Manual option is configured, there are two Performance pages. If the Advanced option is configured, there are four Performance pages.

Operational information for Advanced Performance mode is contained in the applicable Advanced Performance Database Aircraft Performance Supplement. Basic and Manual Performance mode information is contained herein.

Performance Page 1

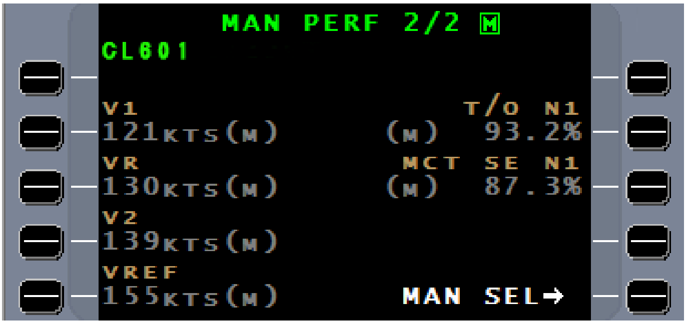
Performance Page 1 is read-only; no entries can be made.



NOTE: The number of Performance Pages will vary depending on which Performance option is configured. If Basic, 1 page is available; if Manual, 2 pages are available.

Performance Page 2

Performance Page 2 is displayed when the Performance Option is set to Manual mode.



The aircraft identification is displayed in the upper left corner of the page. Performance data entered on the Manual Selection Page 1 is displayed in the fields below it.

DESELECT – Select a left LSK to highlight a data field. Then press LSK [5R] to remove that parameter from performance calculations.

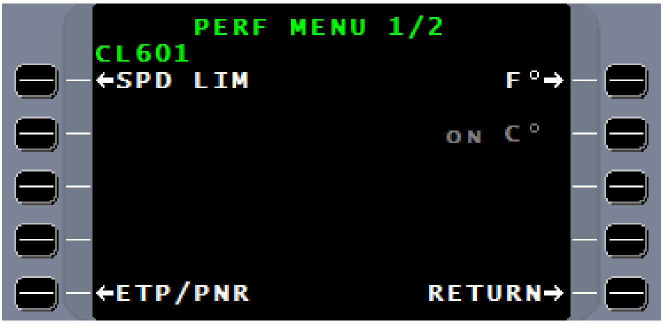
MAN SEL – Displays the Manual Selection Page. A list of the performance parameters that may be added or deleted from displaying on Performance Page 1 is on the left side of this page. Enter the reference number of the parameter at LSK [1R] or LSK [3R], as applicable, to add or delete that parameter. A caret (>) is displayed next to the parameters that have been chosen for display.

Performance Menu Pages

The Performance Menu Pages are accessed by pressing **[MENU]** from any of the Performance Pages.

Performance Menu Page 1

PERF MENU 1/2 displays the aircraft identification as well as selections for access to the Speed Limit pages and the ETP/PNR pages.



Performance Menu Page 1/2 – Basic Mode

Aircraft Identification – If Basic Performance Mode is configured, aircraft identification is displayed.

SPD LIM – Accesses the Speed Limit Page which displays the provided FMS speed limit function that computes an advisory active speed constraint (SPD CSTR).

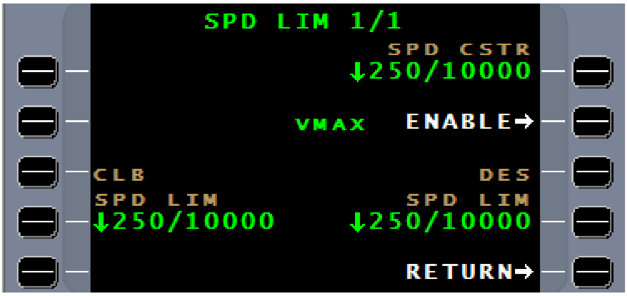
ETP/PNR – Equal Time Point/Point of No Return (ETP/PNR) is the enroute point where flying to the destination will take as long as flying back to the point of departure. The ETP is adjusted for winds and may not be the equidistant point of the trip. The PNR is the enroute point to which the aircraft can travel and from which it can return (under the same wind conditions) to the departure point without requiring extra fuel.

F° – When selected, displays the temperature units in Fahrenheit.

C° – When selected, displays the temperature units in Centigrade.

SPD LIM Page 1/1

[PERF/MENU/SPD LIM] SPD LIM Page 1 is accessed from the Performance Menu Page by selecting LSK [1L]. The Speed Limit Page displays the Active Speed Constraint (SPD CSTR), VMAX ENABLE/DISABLE selection, Climb Speed Limit (CLB SPD LIM), and the Descent Speed Limit (DES SPD LIM).



Example SPD LIM Page

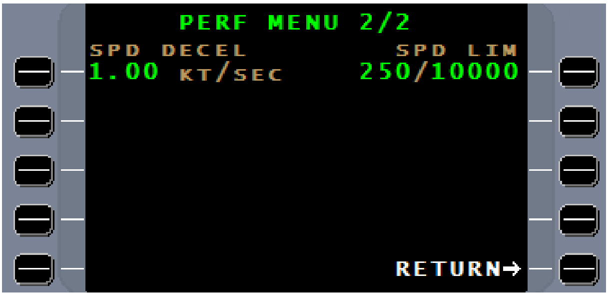
SPD CSTR - The active SPD CSTR is read-only; no entries can be made. It is designed to be a visual alert of an impending speed constraint and should not be used as an input to a speed controller. In all cases, the impending speed constraint is the descent SPD LIM, the TO waypoint on a STAR or approach procedure, a hold leg, or an RF/AF leg. Speed Limits can also be published for SID legs.

VMAX ENABLE/DISABLE - The FMS transmits the active SPD CSTR as a VMAX output which is displayed by the Universal Avionics display system as a "maximum allowable speed" bug and can be ENABLED/DISABLED by the flight crew.

CLB SPD LIM – The speed limit defined for use during climb. The climb SPD LIM is effective when the FMS is on the ground and while altitude is below both the climb and descent SPD LIM altitudes. The FMS provides a default speed limit that can be set on the PERF MENU 2/2 page. At powerup, the FMS updates the climb SPD LIM and descent SPD LIM to the default speed restriction. The climb SPD LIM is set on the SPD LIM and CLB PERF page.

Performance Menu Page 2

The PERF MENU 2/2 page allows the user to change the default values for DES SPD and SPD LIM.



Performance Menu 2/2-Basic Mode

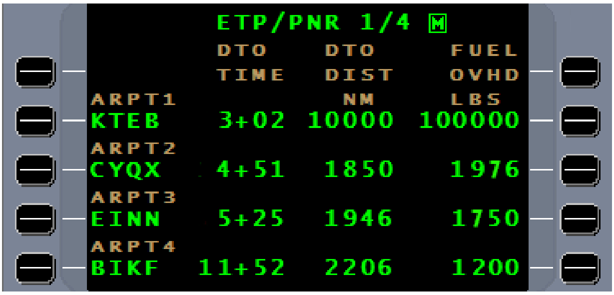
SPD DECEL - When deceleration is required to the next SPD CSTR, the FMS annunciates the next SPD CSTR prior to reaching the constraint waypoint or altitude to give the pilot time to decelerate. The user can adjust the time for deceleration by changing the SPD DECEL entry to values ranging from 0.01 to 2.00 knot/second. The SPD DECEL defaults to 1.00 knot/second.

The deceleration time is limited to within 15 seconds minimum and 180 seconds maximum.

SPD LIM - The FMS provides a default speed limit that can be set to values ranging from 0 to 512 IAS. After a valid speed entry is accepted, the FMS updates the Default SPD LIMIT Speed and allows entry of a Default SPD LIMIT Altitude. After a valid Speed entry is accepted, the FMS updates the Default SPD LIMIT Speed and advance the cursor to the Default SPD LIMIT Altitude field. The FMS allows entries in the range of 0 to 64000ft, in either Altitude or Flight Level format for the Default SPD LIMIT Altitude.

ETP/PNR Page 1

[PERF/MENU/ETP/PNR] ETP/PNR Page 1 is accessed from the Performance Menu Page by selecting LSK [5L] if there is a blank entry on ETP/PNR Page 2 (if there are no blank entries on ETP/PNR Page 2, selecting LSK [5L] on the Performance Menu Page will access ETP/PNR Page 4). The operator can enter up to four airport identifiers, any two of which can be used as the starting point and ending point for the ETP/PNR calculations.



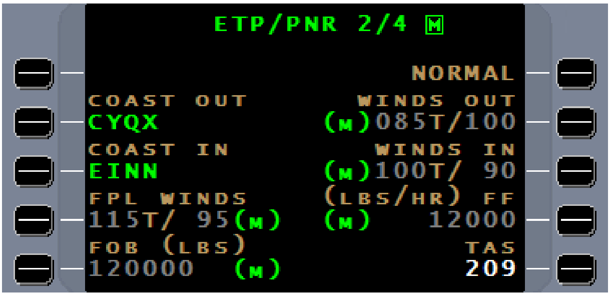
For each airport, the screen shows the direct time to the airport from present position, the direct distance to the airport from present position and the fuel overhead from present position for each airport.

NOTE: If fuel overhead is a negative number, the entry will be displayed in red characters and preceded by a minus sign.

Upon entering ETP/PNR Page 1, the cursor lies in the field adjacent to LSK [2L]. If no airport code has been entered, the field will display dashes. The pilot can manually enter a new airport code or change a preexisting code, or press **[LIST]** to select from a list of airport identifiers. If the identifier entered by the operator is not in the Navigation Database, the Define Airports Page will be displayed so that the operator can define and add the airport the database. The pilot may access the field for each airport by pressing the associated LSK.

ETP/PNR Page 2

ETP/PNR Page 2 is accessed from ETP/PNR Page 1 by pressing **[NEXT]**.



This page displays some of the data required to calculate the ETP/PNR between two airports. The airports are selected from those entered on ETP/PNR Page 1.

COAST OUT – The Coast Out airport is the starting point for the ETP/PNR calculations. Pressing LSK [2L] accesses the Airport Selection Menu from which a Coast Out Airport may be selected.

Press the number key corresponding to the desired airport and then press [ENTER]. The number selected will appear in the highlighted field adjacent to LSK [1R].

COAST IN – The Coast In airport is the ending point for the ETP/PNR calculations. The operator enters the code for this airport by pressing the LSK [3L]. This will access the Airport Selection Menu, and the operator selects the Coast In airport in the same manner as the Coast Out airport.

FPL WINDS – This field displays cruising wind information for the current flight plan. If sensed winds are not available, the field will display dashes. Current wind information may be entered manually at LSK [4L]. A manual entry will be indicated by the letter "M" in parentheses next to the item.

FOB – This field displays the amount of fuel on-board. If sensed fuel is not available, the field will display dashes. Fuel on-board may be entered manually at LSK [5L]. A manual entry will be indicated by the letter "M" in parentheses next to the item.

WINDS OUT – This field displays information for winds aloft at the Coast Out airport if the airport is along the current flight plan and flight plan wind information is available. If the information is not available, the field will display dashes. Winds may be entered manually at LSK [2R]. A manual entry will be indicated by the letter “M” in parentheses next to the entry.

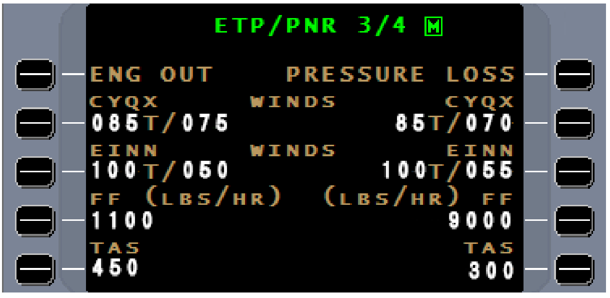
WINDS IN – This field displays information for winds aloft at the Coast In airport if the airport is along the current flight plan and flight plan wind information is available. If the information is not available, the field will display dashes. Winds may be entered manually at LSK [3R]. A manual entry will be indicated by the letter “M” in parentheses next to the entry.

FF – This field displays fuel flow. If sensed fuel flow is not available, the field will display dashes. Fuel flow may be entered manually at LSK [4R]. A manual entry will be indicated by the letter “M” in parentheses next to the item.

TAS – This field displays true air speed. If sensed true air speed is not available, the field will display dashes. True air speed may be entered manually at LSK [5R]. A manual entry will be indicated by the letter “M” in parentheses next to the item.

ETP/PNR Page 3

ETP/PNR Page 3 is accessible from ETP/PNR Page 2 by pressing **[NEXT]**.



This page displays information that must be entered for the FMS to calculate engine out and pressure loss cases for the ETP/PNR waypoints. All fields must be entered manually.

ENG OUT – This field displays information for winds at the predicted engine out altitude at the Coast Out airport.

ENG IN – This field displays information for winds at the predicted engine out altitude at the Coast In airport.

FF – This field displays the fuel flow for the predicted engine out scenario.

TAS – This field displays the true air speed for the predicted engine out scenario.

COAST OUT – This field displays information for winds at the predicted pressure loss altitude at the Coast Out airport.

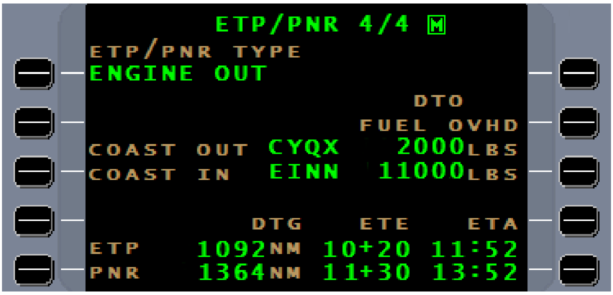
COAST IN – This field displays information for winds at the predicted pressure loss altitude at the Coast In airport.

FF – This field displays the fuel flow for the predicted pressure loss scenario.

TAS – This field displays the true air speed for the predicted pressure loss scenario.

ETP/PNR Page 4

If there are no blank entries on ETP/PNR Page 2, selecting **LSK [5L]** on the Performance Menu Page will access ETP/PNR Page 4. ETP/PNR Page 4 is also accessible from ETP/PNR Page 3 by pressing **[NEXT]**.



This page displays the ETP and PNR as calculated with the information entered or supplied on the ETP/PNR Pages 2/4 and 3/4. The ETP and PNR are displayed as Distance To Go (DTG), ETE and ETA. The page also displays the Coast Out and Coast In airports as selected on ETP/PNR Page 2 and allows the operator to select which data set to use in calculating the ETP and PNR, either the Engine Out set or Pressure Loss set.

Pressing LSK [1L] accesses the Case Selection Menu where the type of ETP/PNR to be calculated is selected, which may be NORMAL, ENGINE OUT or PRESSURE LOSS.

Tune Function

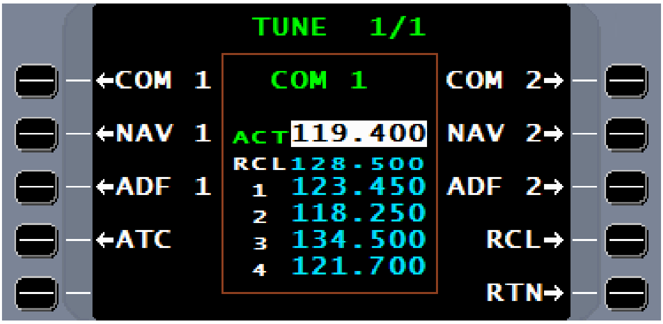
The Tune function is used to tune the aircraft's radios, select, and store pre-selected frequencies for each radio, and to view the selected frequencies (active and preset) for each radio, when any of the following are installed and configured:

- RCU
- Pro Line 4 800 (Standard or FIAS)
- 709 DME and 711 VOR
- RTU
- Pro Line 4 4000
- ARN-118 TACAN
- ARN-154 TACAN
- ARN-153 TACAN

Tuning radios or storing preset frequencies does not affect the normal operation of the radio control heads. Manual frequency selections made on the radio control heads, which have priority over the remote tune input, can be viewed on the FMS display as the new active frequency. Both 25 kHz and 8.33 kHz spacing is supported.

In dual installations configured for Tune crossfill, preset frequencies are automatically and bi-directionally updated in the other FMS.

Tune Page 1



(25 kHz Configured)

When first accessed, Tune Page 1 will initially display the last tuned radio with the cursor over the active frequency. A second Tune Page is available when a third COM is configured.

The selectable radios are displayed next to the LSKs, and a control window is located in the center of the display. Any configured radio may be placed into the control window by pressing the LSK for that radio.

The control window shows the selected radio, the active frequency, and up to four preset frequencies. When 8.33/25 kHz is configured, the frequency is displayed in thousandths. When 25 kHz is configured, the frequency is displayed in hundredths.

A new frequency may be entered into the active frequency either directly through the numeric keys or by inputting the reference number (1-4) of one of the preset frequencies. The frequency input is completed by pressing the ENTER key. ACT is displayed next to the actively received frequency from the radio. When a new frequency is being entered, ACT disappears until [ENTER] is pressed and the radio responds.

The Tune Page has a Recall (RCL) line, which will always contain the last frequency used when a new frequency is entered into the active window. The RCL LSK swaps the RCL frequency with the current ACTIVE frequency. Each of the four preset frequencies remains intact until modified by entering a different frequency.

Cursor movement in the control window is controlled using the ENTER key. If [ENTER] is pressed and nothing new has been entered into the active frequency, the cursor will advance to preset position 1. Each time the ENTER key is pressed, the cursor will move down one preset position. After preset position 4, the cursor will return to the home position (active frequency).

The preset frequencies are changed or entered by placing the cursor over the desired preset position, inputting the new frequency, and then pressing [ENTER]. The new frequency may be input directly through the numeric keys or by inputting the reference number (1-4) of one of the preset frequencies. When typing in the frequency, the decimal point will be automatically placed in the proper position. For example, if a frequency of 135.65 is desired, input the numbers 13565. If 118.00 is desired, the number can be input as 118, 1180, or 11800. In any case, when the ENTER key is pressed, the display will read 118.00.

When tuning VOR and ADF frequencies, the operator has the option of either entering the actual frequency or the identifier.

The ATC LSK is used to gain access to control of the transponder codes. Preselects 3 and 4 are prefilled with codes 1200 and 7700.

Communication List Pages

Placing the cursor over any COM option on a Tune Page and then pressing **[LIST]** accesses the Communication List Pages.

The pilot can choose the desired communication frequency by entering its reference number.

Tuning Flight Phase – This field will display one of the following five states:

PREDEPARTURE – This flight phase becomes active either upon FMS power-up, or when, in the Landing flight phase, the active flight plan is changed.

The FMS will display airport communications from the closest database airport within 50 nm of present position.

DEPARTURE – This flight phase becomes active when, in the pre-departure flight phase or the landing flight phase, the aircraft transitions from On-Ground to In-Air.

If transitioning from the pre-departure flight phase, the FMS will display the same airport communications as listed in the pre-departure flight phase.

If transitioning from the landing flight phase, the FMS will display airport communications within 50 nm of the point where the aircraft transitions from On-Ground to In-Air.

In both cases, selected enroute communications are also displayed.

ENROUTE – This flight phase becomes active either:

- When in the Departure flight phase, the aircraft's distance from the departure point becomes greater than 15 nm from the departure point AND is either greater than 40 nm from the arrival point or a flight plan is not active, or
- When in the Arrival flight phase, the active flight plan is changed.

The FMS will display enroute communications along the flight path based on present position. If a flight plan is active, the FMS will also display airport communications from the flight plan's destination airport. If a flight plan doesn't exist, communications are displayed are from the closest database airport within 50 nm of the arrival point.

ARRIVAL – This flight phase becomes active when, in either the Departure or the Enroute flight phase, the aircraft is In-Air and less than 40 nm from the arrival point.

The FMS will display airport communications from the flight plan's destination airport. If the arrival point is not an airport, the FMS will display airport communications from the closest airport in the Navigation Database within 50 nm of the last waypoint in the flight plan.

LANDING – This flight phase becomes active when, in either the Departure, the Enroute or the Arrival flight phase, the aircraft transitions from In-Air to On-Ground.

The FMS will display airport communications from the closest database airport within 50 nm of present position.

Airport Identifier or FIR/RDO Indicator – Either an airport identifier or a Flight Information Region Radio (FIR/RDO) indicator, depending on whether the listed communication is airport or enroute.

Communication Type – The following table lists all communication types.

Displayed Com Acronym	Communication Type
ACC	Area Control Center
APP	Approach Control
ARR	Arrival Control
ASO	Automatic Surface Observing System (ASOS)
ATI	Automatic Terminal Information Service (ATIS)
AWO	Automatic Weather Observing Service (AWIS)
CLD	Clearance Delivery
CPT	Clearance Pre-Taxi
CTL	Control
DEP	Departure Control
DIR	Director (Approach Control Radar)
EFS	Enroute Flight Advisory Service (EFAS)
FSS	Flight Service Station
GCO	Ground Comm Outlet
GND	Ground Control
INF	Information
MUL	Multicom
RDO	Radio
RDR	Radar
RMP	Ramp/Taxi Control
RSA	Airport Radar Service Area (US Class C Airspace) (ARSA)
TCA	Terminal Control Area (US Class B Airspace)
TWR	Tower, Air Traffic Control
UNI	Unicom

IN-FLIGHT PROCEDURES

Introduction

This section of the manual contains FMS flight operating procedures designed to be used on a typical flight and arranged in the order in which they would normally be employed. This section also contains procedures which may be used in the event of an electrical power failure, engine shutdown, or fuel flow system failure.

NOTE: Given the capabilities and versatility of the FMS, many programming options are available to the pilot through which the same results can be achieved. This section does not discuss all the possible programming options for each operation.

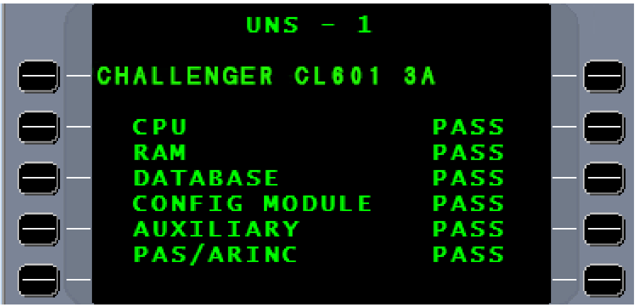
NOTE: Some differences may be observed between FMS displayed courses and those published on aeronautical charts. The aeronautical charts are published using the VOR radials that define the route, whereas the FMS displays the computed course using local magnetic variation. Flight Plan legs with XXX° displays may vary from the published data by the amount of difference between the defining VOR facility declination (i.e., the angle formed between the VOR 0° radial and True North) and the magnetic variation at the originating waypoint. Magnetic variation constantly shifts with time, whereas the station declination is constant until the station is realigned. Station declination may vary by several degrees from local magnetic variation, depending upon how long ago the station was realigned with local variation. Legs that have CRS XXX° or HDG XXX° displays on the Flight Plan Pages should agree with the published data on the charts, since these are provided as part of the Navigation Database and are not computed by the FMS.

PREDEPARTURE

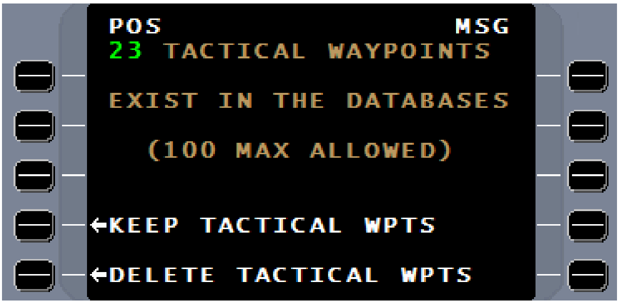
Start-Up

1. Press **[ON/OFF/DIM]** to activate the system.

   The system will turn on and perform a self-test. A Self-Test Page will display the results of each test performed.



2. If the Self-Test is successful, the Copyright Page is automatically displayed for two seconds.
3. If tactical waypoints exist in the FMS memory, the Tactical Waypoints Page is displayed after the Copyright Page. Press **LSK [4L]** to keep tactical waypoints. Press **LSK [5L]** twice to delete tactical waypoints.



Self-Test Failures

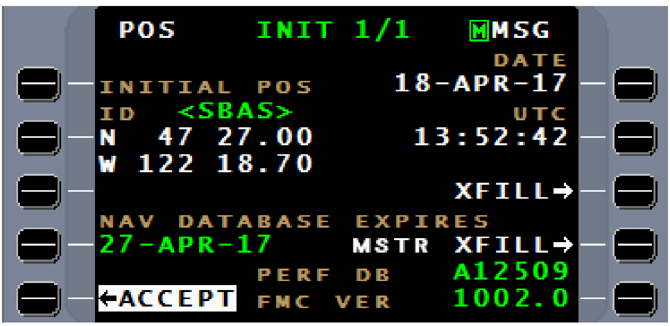
Should a failure message appear while the system is performing the self-test, one of the following will occur:

If a serious failure occurs, the Self-Test Page will remain onscreen.

If a minor failure occurs, the FMS will continue with the initialization process after alerting the pilot of the failure. Press **[MSG]** to view the message. No other page, except the Message Page, may be viewed until the initialization process is completed.

Initialization

The Initialization Page is automatically displayed after successful self-test (and, if applicable, Tactical Waypoint Page).



Position, date and time fields on the Initialization Page are prefilled with information obtained from a valid sensor (as indicated by <SBAS>, <GPS>, <GNSS> or <GLS> at LSK [1L]). For non-GPS installations, position will be the same as when the system was last powered down.

1. Press the **[ACCEPT]** LSK to accept the GPS position, time and date. All data will turn green; indicating that initialization is complete.

2. If any of these fields are incorrect, refer to “Correcting Data on the Initialization Page” below to manually enter or correct initialization data.

   NOTE: The ACCEPT prompt is only available when all data fields display valid data.

   NOTE: If ACCEPT is not selected, the FMS will only allow access to the initialization, Tune, Crossfill, DISK Menu, Message Pages, and the ON/OFF/CANCEL Window Page. Pressing RETURN, **LSK [5R]** will take you back to INIT page 1/1.

Correcting Data on the Initialization Page

Position, date and time information may be entered manually on the Initialization Page if any of the initial data is incorrect.

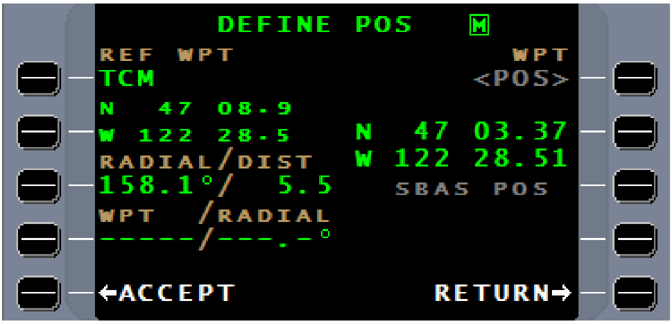
Position Data

Position data can be entered in three ways:

1. Press **LSK [1L]** to highlight the field and enter a valid waypoint identifier. The Waypoint Selection Page is displayed. **[ACCEPT]** the waypoint on the Waypoint Selection Page to fill the coordinates of that waypoint on the Initialization Page.

   Entering an invalid identifier into this field will display the Define Alignment Waypoint Page. Refer to the UA FMS Reference Guide for instructions on entering data on the Define Alignment Waypoint Page.
2. Press **LSK [1L]** to highlight the field. Press **[LIST]** to display the List Page, from which an airport/pilot align point can be selected. The coordinates of the selected waypoint will prefill on the Initialization Page.

3. Press **LSK [1L]** to highlight the field. Press **[ENTER]** to display the Define Position Page.



Initialization data can be entered on this page five ways:

- Latitude/Longitude – enter the coordinates of the pilot defined waypoint directly
- Radial/Distance – enter a reference waypoint (which can be a waypoint, VOR, NDB or airport) and a radial/distance offset
- Radial/Radial – enter two reference waypoints and the radial from each. This method is useful in identifying the unnamed intersection of two airways
- GPS Position – enter the present GPS position data to define the waypoint.

FMS position – enter the present FMS position data (best computed position) to define the waypoint.

LAT/LON

1. Press **LSK [2L]** to display the Define Position Page.
2. Enter valid latitude and longitudes. Pressing +/- or "N", "S", "E", "W" will change the N/S/E/W field.
3. Press **[ENTER]**.
4. Press **LSK [5L]** twice to accept.

DATE

1. Press **LSK [1R]** to highlight this field.
2. Enter the Coordinated Universal date numerically (DDMMYY).

UTC

1. Press **LSK [2R]** to highlight this field.
2. Enter Coordinated Universal Time (hours: minutes).
3. Press the **[ACCEPT]** LSK to accept the initialization data.

At power-up, the FMS initializes the Date and UTC Time fields (on INIT 1/1 page) based on its internal clock. When the configured GPS sensor transitions into Nav Mode and starts providing valid data, the FMS uses that data to update the Date and UTC Time fields on INIT 1/1 page, and then on DATA 4/4 page, once every ten seconds. If invalid data is received, the FMS will not use the data from the GPS sensor and will continue updating the Date and UTC Time fields based on its internal clock.

To verify the proper operation of the Date and UTC on the FMS:

1. Power up the FMS and initialize it by accepting the position/date/time on the Initialization Page.
2. Wait until the SBAS sensor is in Nav Mode.
3. Access DATA 4/4 page and enter an arbitrary time in the UTC Time field (e.g., 00:00:00).
4. Verify that within 10 seconds the UTC Time field is updated with the correct UTC time.

   NOTE: If an independent timing source is used for the verification of the FMS UTC time, make sure that the time provided by the timing source is “UTC” time and not “GPS” time. Currently, the time offset between the UTC time and the GPS time is 16 seconds (e.g., 00:00:00 UTC = 00:00:16 GPS).

   NOTE: If an error message appears indicating an entry on the Initiation Page (and prior to leaving the Initiation Page), the erroneous field can be corrected by repeating the previous steps.

Crossfill Options

Initialization, flight plan and fuel data from the Initialization Page may be crossfilled to another FMS using the Crossfill and Master Crossfill features. These can either be crossfilled separately or all at once. Crossfill is configured at installation to either PULL data to the requesting FMS or PUSH data to the receiving FMS. The default crossfill configuration is PULL.

NOTE: Crossfill is not available in dual installations configured for SYNC mode except when configured for SYNC and Crossfill, which allows crossfill of initialization data upon power-up.

The XFILL, **LSK [3R]** allows separate crossfill of initialization, flight plan and fuel data. The prompt appears on the Initialization Page, Flight Plan Page, and Fuel Options Page (accessed by FUEL/MENU).

XFILL is an available option on the Initialization Page when it is configured for at time of installation, and valid date, time and coordinate data are available from at least one onside FMS (Push) offside FMS (Pull).

The **MSTR XFILL** LSK allows the pilot to crossfill all data (initialization, flight plan and fuel data) at the same time. The prompt appears on the Initialization Page and Data Page 1.

MSTR XFILL is an available option on the Initialization Page when:

Configured as Pull:

- Configured for at time of installation
- Fuel units on at least one transmitting FMS the same as on the receiving FMS
- Valid date, time and coordinate and verified fuel data on at least one transmitting FMS.

Configured as Push:

- Configured for at time of installation
- Fuel units on the local FMS the same as on at least one receiving FMS
- Valid and verified date, time and coordinate and fuel data on the local FMS.

Crossfill Data

From Initialization Page

1. Press the applicable crossfill LSK, **[3R]** or **[4R]**.

   In a dual crossfill bus configuration, the Initiate Crossfill Page is displayed when XFILL is selected, and the Master Crossfill Page is displayed when MSTR XFILL is selected.
2. Select the applicable LSK for the FMS from which information will be sought. Data will then crossfill from the chosen FMS to the other.
3. Press **[ACCEPT]**, LSK [1L], on the receiving FMS to complete the crossfill and validate the data.

From Flight Plan Page

1. Open the FPL XFILL 1/1 page:
   a. If no flight plan or origin is defined, press **LSK [5R]**, XFILL.
   b. If a flight plan or origin is defined, press **[MENU]** then **[XFILL FPL]**.
2. Select the applicable LSK for the FMS from which information will be sought. Data will then crossfill from the chosen FMS to the other.
3. Press **LSK [1L]**, ACCEPT, on the receiving FMS to complete the crossfill and validate the data.

Flight Plan Construction

Detailed information about offline flight planning is contained in the Universal Avionics FMS Reference Guide.

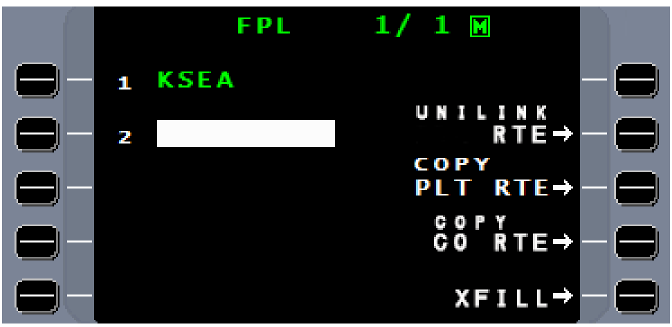
Flight Planning

After initialization, the system is ready to accept the flight plan. A flight plan can be created on the Flight Plan Pages, crossfilled from another FMS or copied from a route contained in the Pilot or Company Databases. A flight plan can contain up to 98 route elements.

Construct a Flight Plan

With no flight plan defined in the FMS, pressing **[FPL]** displays the empty Flight Plan Page.

1. Press **[FPL]** to access Flight Plan Page 1.



   The cursor appears over an empty field and is ready to accept the next waypoint. Waypoint number "1" will pre-fill with the airport from the initialization process, or the closest waypoint as derived from the GPS.

2. Type in the identifier for the waypoint or press **[LIST]** to locate the desired waypoint. The **[NEXT]** and **[PREV]** keys are used to page through up to 10 List Pages of the closest waypoints. Enter the reference number of the desired waypoint and press **[ENTER]** to insert into the flight plan. The cursor will move to the next empty field in the flight plan.

3. To insert a SID into the flight plan, refer to Insert a SID into a Flight Plan in the Flight Plan Editing section.
4. To insert an airway:
   a. Verify the previous waypoint is on the desired airway.
   b. Press **[LIST]** to access the LIST Page and the **[AIRWAYS]** LSK to list the airways. Enter the reference number of the desired airway.
   c. Enter the airway terminator on the Airway Terminator Page and return to Flight Plan Page 1.
5. Continue entering waypoints into the flight plan to the destination airport.
6. Type in the identifier for the destination airport or press **[LIST]** to locate the desired airport. The **[NEXT]** and **[PREV]** keys are used to page through up to 10 List Pages of the closest airports. Enter the reference number of the desired airport and press **[ENTER]** to insert into the flight plan.
7. To insert an approach or STAR, refer to Insert Approach or STAR into the Flight Plan in the Arrivals section.

   NOTE: The navigation data base contains several non-unique identifiers (i.e., multiple items using the same identifier). VORs and NDBs often occur with the same identifier at the same or nearly the same location. Airports and enroute waypoints also sometimes occur with the same identifier at the same location.

   NOTE: The FMS checks inserted routes: Pilot, Company, and UniLink, for RNP leg data contained in SIDs, STARs, and Approaches and displays a message when any procedure leg containing an RNP value is lower than the FMS configured RNP capability. The message will read [SID/STAR/APPR] RNP < CONFIG If leg RNP values lower than configured are found in multiple procedures, then multiple messages will be displayed.

WARNING: **FLIGHT** crews must use extreme caution to make sure they are selecting the desired item. Because the navigation data base has numerous duplicate identifiers, the **FLIGHT** crew has the ultimate responsibility of properly identifying their selected item to ensure it is correct.

Copy a Flight Plan

Copy a Pilot Route

1. Press **[FPL]**.
2. Press **LSK [3R]**, COPY PILOT ROUTE.
3. Enter the reference number of the desired pilot route and press **[ENTER]**.

Copy a Company Route

1. Press **[FPL]**.
2. Press **LSK [4R]**, COPY CO ROUTE.
3. Enter the reference number of the desired company route and press **[ENTER]**.

UniLink Flight Plan Uplink

1. Press **[FPL]**, then **[MENU]** to display Flight Plan Menu Page 2
2. Press **LSK [4R]** to display the UniLink Route Page.
3. Enter the Origin, Destination, and/or Route Identifier. Refer to the Uplink Flight Plan procedures provided by the ground service provider.
4. Press SEND, **LSK [2R]**, to place this message in queue for transmission. The SEND prompt will not be enabled if the information on this page is incomplete.
5. To replace the current flight plan, press REPLACE FPL, **LSK [5L]** to accept. This replaces the current flight plan with the uplinked flight plan. This new flight plan will remain available for review and loading until the user presses the PURGE, **LSK [4R]**.

UniLink Flight Plan Uplink (FMS SCN 1002.1 and later)

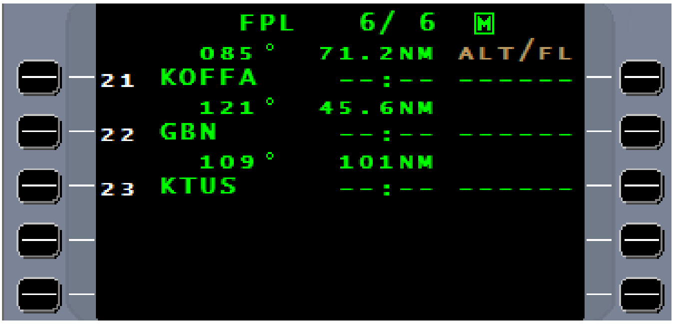
1. Press **[FPL]**, **[MENU],** then **[NEXT]** to display Flight Plan Menu Page 2.
2. Press **LSK [3R]** to display the Dispatch Route Page.
3. Enter the Origin, Destination, and/or Route Identifier. Refer to the Uplink Flight Plan procedures provided by the ground service provider.
4. Press SEND, **LSK [2R]**, to place this message in queue for transmission. The SEND prompt will not be enabled if the information on this page is incomplete.
5. To replace the current flight plan, press REPLACE FPL, **LSK [5L]** to accept. This replaces the current flight plan with the uplinked flight plan. This new flight plan will remain available for review and loading until the user presses the PURGE, **LSK [4R]**.

Flight Plan Editing

Enter an Altitude

An altitude may be entered for appropriate waypoints in the flight plan, which are those associated with the following leg types: CF, FC, FD, TF, PI, AF, DF, IF and RF.

Altitude constraints are edited with the same procedures as entering an altitude. Refer to VNAV Flight Path Definition Procedure in the Enroute section for information about entering offset altitudes.



1. Press **[FPL]** to access the Flight Plan Pages.
2. Press the applicable **LSK [1R-5R]** to highlight the ALT/FL field. Altitude for the waypoint can be entered three ways:
   a. Flight Level – Enter the three numeral designations for the flight level. (370 = FL370).
   b. Altitude – Enter the altitude (16000).
   c. Altitude Below 640 ft. – Enter the altitude with a lead 0. (0137 = 137 ft.).
3. Press **[ENTER]**.

Insert a SID into a Flight Plan

NOTE: All Standard Instrument Departure (SID) procedure altitudes are based on QNH altitude and not QFE. Each altitude type is defined as follows:

- QNH – Used in all FMS procedures. This is the altitude above sea level based on local station pressure (i.e., MSL altitude)
- QFE – Do Not Use. This is the height above airport elevation (or runway threshold elevation) based on local station pressure.

If a SID has been issued as part of the ATC clearance, it may be linked to the flight plan.

1. From any Flight Plan Page, press **[MENU]**.
2. On Flight Plan Menu Page 1/2, press **[DEPART]**, LSK [4L].

4. The Departure Page will pre-fill with the departure airport. Enter the reference number of the runway at LSK [2R]. The cursor will advance to the SID field and a list of available SIDs will appear.
5. Select the SID by entering the reference number. A list of transitions will appear.
6. Select a transition by entering the reference number.

NOTE: A SID containing a RADAR vector might specify guidance actions to the FMS resulting in not maintaining an existing heading. The pilot should compare the SID chart to the FMS flight plan to ensure that the correct heading is coded prior to the RADAR vector leg. If it is not, the pilot must be prepared to discontinue FMS guidance after the waypoint where the vector leg starts.

If the SID chart does not specify a heading, the pilot must assume that ATC requires the existing heading maintained until specified otherwise. If the SID provided by the database contains headings not shown on the SID chart, the pilot must discontinue FMS guidance unless such headings are specifically authorized by ATC.

If the SID provided by the database does not contain a RADAR vector heading or required course from the waypoint where the RADAR vector on the chart begins, the pilot must discontinue FMS guidance of the RADAR vector waypoint and maintain the present heading until instructed otherwise by ATC.

7. Press FPL, **LSK [5R]**, to return to the active flight plan. The procedural legs of the SID will now be a part of the flight plan.
8. REVIEW THE RESULTING FLIGHT PLAN FOR CONTINUITY – WITH NO GAPS OR "NO LINKS", AND THAT IS CONFORMS TO THE INTENDED PATH OF FLIGHT.

CAUTION: **IT IS THE RESPONSIBILITY OF THE PILOT TO RESOLVE THESE DISCONTINUITIES AND EDIT THE FLIGHT PLAN ACCORDINGLY.**

- When a SID, STAR and approach are linked into a flight plan, *NO LINK* will be inserted at the transition points if the end waypoint of one procedure is not the same as the beginning waypoint of the next procedure. These can occur at the SID-to-Enroute, the Enroute-to-STAR and/or the STAR-to-Approach transitions

  Delete the *NO LINK* using Flight Plan editing techniques or go Direct-To another waypoint after the *NO LINK* to maintain a continuous flight plan sequence
- Inserting a SID or STAR procedure may produce a "GAP" between existing waypoints when linked into a flight plan. Refer to Insert or Delete a Gap in Flight Plan in the Predeparture section for more information.

When a SID utilizes a Direct-to-Fix (DF) leg type as the first guidance leg, flight guidance may be incorrect. The SID can be verified to be using a DF leg by checking the flight plan for DIRECT to be positioned between the first two flight plan waypoints. A named TO waypoint, rather than a conditional altitude, is also a good indication of a DF first leg condition.

Use the following procedure when a SID is linked into a flight plan:

- Review the FMS flight plan and NAV page to determine the first leg type
- If the first leg IS NOT a DF leg type, no further action is necessary
- If the first leg IS a DF leg type, perform a manual Direct-To the second waypoint using the DTO key after taxiing to the departure end of the runway. When the DTO key is pressed, the DTO page will open with the second waypoint already prefilled as the desired TO waypoint. Press ENTER to execute the command
- Confirm that the NAV page shows (PPOS) as the FR waypoint and the correctly named waypoint as the TO waypoint with the correct desired track and distance displayed between the FR and TO lines.

Confirm that correct guidance is now available by noting the HSI after lineup with the runway.

Insert Waypoint into Flight Plan

1. Press **[FPL]** to access the Flight Plan Pages.
2. Press **[NEXT]** or **[PREV]** to locate the waypoint that will follow the inserted waypoint.
3. Press the applicable LSK to highlight the waypoint that will follow the new waypoint.
4. Enter the new waypoint using the LIST function or by typing in the identifier. When the new waypoint is entered, it will be inserted in the position selected and the highlighted waypoint will advance to the next position.

Delete Waypoint from Flight Plan

1. Press **[FPL]** to access the Flight Plan Pages.
2. Press **[NEXT]** or **[PREV]** to locate the waypoint to be deleted.
3. Press the applicable LSK to highlight the waypoint to be deleted.
4. Press DEL, **LSK [1R]**, twice.

   NOTE: If it is desired to delete the remainder of the flight plan, enter a reference number greater than the reference number of the last waypoint on the flight plan. Do not enter 99 or the entire flight plan will be deleted.

Edit Waypoint in Flight Plan

1. Press **[FPL]** to access the Flight Plan Pages.
2. Press **[NEXT]** or **[PREV]** to locate the waypoint to be changed.
3. Press the applicable LSK to highlight the waypoint to be changed.
4. Press DEL, **LSK [1R]**, twice.
5. Enter the new waypoint using the LIST function or by typing the identifier. When the new waypoint is entered, it will be inserted at the position selected and the highlighted waypoint will advance to the next position.

View Information about a Waypoint in Flight Plan

1. Press **[FPL]** to access the Flight Plan Pages.
2. Press the LSK adjacent to the desired waypoint.
3. Press **LSK [2R]**, INFO to display the Information Page for that waypoint.

Insert or Delete a Gap in Flight Plan

A gap is a break in the flight plan designed to prevent the FMS from automatically sequencing a leg. A gap may be desirable, for example, between the destination airport and the alternate airport. Gaps may occur in the stored routes when a new database is loaded. To insert a gap in a flight plan:

1. Press **[FPL]** to access the Flight Plan Pages.
2. Press **[NEXT]** or **[PREV]** to locate the waypoint to follow the gap.
3. Press the applicable LSK to highlight the waypoint to follow the gap.
4. Press **[LIST]** to access the LIST Page.
5. Press GAP, **LSK [3R]**.

When a *GAP* or *NO LINK* exists in the flight plan, the message NEXT LEG INVALID will occur whenever the *GAP* or *NO LINK* sequences to the NX position.

Gaps are deleted from the flight plan in the same manner as waypoints. To delete a gap from the flight plan, refer to the Delete Waypoint from Flight Plan in the Predeparture section.

<u>CAUTION</u>: **WHEN A GAP IS ENCOUNTERED, THE FLIGHT PLAN WILL *NOT* AUTO SEQUENCE TO THE NEXT LEG. THE AIRCRAFT WILL CONTINUE TO FLY OVER THE TO WAYPOINT ON LAST DESIRED TRACK (0° ROLL STEERING) WITH NAV AND VNAV FLAGS OUT OF VIEW ON THE HSI. *<u>IT IS THE RESPONSIBILITY OF THE PILOT TO TAKE APPROPRIATE ACTION TO CONTINUE ACCURATE NAVIGATION OF THE AIRCRAFT.</u>* PERFORM A DIRECT-TO OR EDIT THE GAP OUT OF THE FLIGHT PLAN. UPON PASSING THE TO WAYPOINT, THE FMS ISSUES THE MESSAGE “CURRENT LEG EXTENDED.”**

The fuel management data presented on the Fuel Mode Pages is referenced to the last waypoint prior to a gap on the flight plan if the pilot has not chosen a DESTINATION on the Flight Plan Arrival Page. If a destination has been chosen, the data will be referenced to the destination.

Delete Entire Flight Plan

If a flight plan is deleted during flight, the current navigation leg will remain active. The Normal Navigation Page will display the FR and TO waypoint active when the flight plan was deleted. The NX identifier will be deleted.

1. Press **[FPL]** to access the Flight Plan Page 1.
2. Press **LSK [1L]** and enter "99."
3. Press **[ENTER]**.

   or

4. Press **[MENU]** from any Flight Plan page.
5. Select DELETE FPL, **LSK [5L]**, twice.

Invert Flight Plan

1. From any Flight Plan Page, press **[MENU]**.
2. Press **[NEXT]**.
3. Press **LSK [1R]**, INVERT FPL twice. This deletes any SID, STAR, or approach from the current flight plan, and then inverts the flight plan.

   The pilot must perform a manual FR/TO leg change (or select DTO) to use the new flight plan.

Route Clearance Loading

The FMS supports an interface with UniLink to send and receive flight plan data. The FMS can automatically generate a new route for the flight plan from specific route clearance uplinks from ATC. The FMS can also send flight data to UniLink to inform ATC of intentions or requests via downlinks. Refer to the applicable UniLink Operator's Manual for detailed information concerning Route Clearance Loading.

Route Clearance Uplinks

When UniLink has received a CPDLC uplink message containing route clearance data from ATC, the crew is given the option to load the route. If they choose to load the received route, the route clearance data is sent to the FMS.

The route data is used by the FMS to construct a new ATC route which is then displayed by the FMS. The route constructed is dependent on the type of uplink, the data included in the uplink, and the flight plan. Upon receiving the uplink data from UniLink, the constructed route is displayed on the ATC RTE Received page. Refer to the applicable UniLink Operator's Manual for detailed information concerning Route Clearance Uplinks.

Route Clearance Downlinks

The FMS sends route data to UniLink to support four downlink elements sent to ATC. Some are initiated by UniLink or occur in the background; others are initiated by the crew through the FMS.

Direct To (dM22) Downlink

The FMS can be used to initiate a REQUEST DIRECT TO [position] message through the DTO page. Refer to the DTO Function section of this manual for detailed information of the Direct To Downlinks.

Request Clearance (dM24) Downlink

If a UniLink is configured, the route loading function enabled, and the UniLink has an ATC connection, the ATC RTE REQUEST function is available on the FMS menu pages. Selecting this function displays the ATC RTE REQUEST page and allows the crew to compose the route clearance data of the downlink message element on that screen in the same way as a flight plan. Refer to the applicable UniLink Operator's Manual for detailed information concerning Route Clearance Downlinks.

Weight and Fuel Initialization

Enter Fuel Data

1. Press **[FUEL]** to access Fuel Page 1. The BASIC WT and Reserves plan values will be pre-filled with the values last used or loaded from the configuration module programmed at the time of installation.
2. Enter Zero Fuel Weight (ZFW):
   a. Enter the aircraft's ZFW in pounds or kilograms at **LSK [4L]**.

      or

   b. Calculate the ZFW by entering BASIC WT, PAX, and CARGO.
   c. Enter the number of passengers (PAX) at **LSK [2L]** and press **[ENTER]**. The passenger weight is automatically calculated at the default weight setting.

      The default weight setting may be changed by pressing **[MENU]** to access the Fuel Options Page and entering an average passenger weight at LSK [4R], AVG PAX WT.

   d. Enter the Cargo Weight at **LSK [3L]**. Enter "0" if appropriate. The ZFW is then calculated.
3. Enter the FUEL ONBOARD.

   Fuel onboard can be entered BY TOTAL or BY TANK.

   NOTE: To change BY TOTAL or BY TANK: Press **[MENU]** to access the Fuel Options Page, and then press **LSK [3R]** to display the FUEL ENTRY 1/1 page. Select the reference number of the desired fuel entry method and press **[ENTER]**. The Fuel Entry field, LSK [3R], on the Menu page displays the selection. Press **LSK [5R]** to return to the FUEL 1/5 page.

a. If the FUEL ENTRY is configured for BY TOTAL, press **LSK [5R]** to highlight the field and then enter the total fuel onboard.

b. If the FUEL entry is configured to BY TANK, press **LSK [5R]** to display the FUEL ONBOARD page.

c. Enter the fuel, in lbs., for each tank on the aircraft. When the TANK 1 quantity is entered, the cursor moves to TANK 2. Press **[ENTER]**.

d. Press **LSK [5R]** to return to FUEL 1/5 page.

4. Enter the TOTAL RESERVES.

   a. Press **LSK [4R]** to highlight TOTAL RESRVS and enter the total reserves for the planned flight in pounds.

   b. Or, the total reserves may be computed with the entry of the ALTERNATE, HOLD and EXTRA field values, LSKs [1-3R].

The zero-fuel weight and total fuel on board are used by the system to compute the aircraft's gross weight.

Crossfill Fuel data

1. Press **[FUEL]**.
2. Press **[MENU]**.
3. Press **LSK [1R]** to open the FUEL XFILL 1/1 page.
4. Select the applicable LSK for the FMS from which information will be sought. Data will then crossfill from the chosen FMS to the other.
5. Press **[RETURN]**.

Fuel Conversion Calculator

For a conversion calculator between pounds, kilograms, U.S. Gal., Imperial Gal., or Liters, press **[MENU]** while on any Fuel Page to display the Fuel Options Page. Entering a value in any of these fields will cause the other values to be calculated. The weight/volume conversion is based upon a fuel density of 6.7 lb./gal.

Enter Data on Flight Plan Summary Page

The Flight Plan Summary Page follows the last Flight Plan Page. Available during ground operations prior to departure, distance, time, and fuel requirements may be manually entered on this page.

1. Press **[FPL]** to access Flight Plan Page 1.
2. Use the **[PREV]** and **[NEXT]** keys to access the Flight Plan Summary Page (located following the last Flight Plan Page).
3. Use the LSKs to position the cursor over each entry field and enter the planned data as applicable.
4. Enter the ETD in UTC format. If desired, this may be skipped by pressing **[ENTER]** and entering the ETD according to local time in the next entry field. The cursor will then advance to the local time zone difference entry field.
5. Enter the local time zone difference from the zero meridians (up to ± 13 hours). The time zone sign (±) will be prefilled according to the longitude of the first waypoint on the flight plan. The cursor will advance to the local time entry field allowing entry of ETD according to local time.
6. If the local time zone difference from the zero meridians was not entered correctly, it can be changed. To alter the value, press LSK [2L] to place the cursor on the ETD UTC entry field. Press **[ENTER]** to advance the cursor to the time zone difference entry field and enter the correct value.
7. Enter the estimated TAS (in knots). This value of TAS will be applied to each leg in the flight plan and will take into account any wind information that has been entered for waypoints in order to predict a groundspeed for each leg.
8. Enter the estimated fuel flow, FF (MAN).
9. A manual entry of ETA at LSK [2R] will change the displayed ETD according to the ETE. Enter the local time zone difference from the zero meridians (up to ± 13 hours).

If the local time zone difference from the zero meridians was not correctly entered, it can be changed. To alter the value, press **LSK [2R]** to highlight the ETA UTC entry field. Press **[ENTER]** to advance the cursor to the time zone difference entry field and enter the correct value.

10. Enter the estimated reserve fuel, which is used to compute the MIN FUEL value.

Calculate Arrival Time

1. Press **[FPL]** to access Flight Plan Page 1.
2. Use the **[PREV]** and **[NEXT]** keys to access the Flight Plan Summary Page (located following the last Flight Plan Page).
3. Enter the groundspeed, fuel flow, reserves and estimated time of departure in the applicable fields.
4. To enter the local time differential, press **LSK [2L]** and then **[ENTER]** to highlight the LCL field. Enter the differential to GMT (2) time and press **[ENTER]** to accept.

Enter a Flight Number

Entry of a Flight Number is optional and configured for at time of installation.

1. Press **[MENU]** from any FPL page.
2. Press **[NEXT]** to display FPL MENU 2/2.
3. Press **LSK [3R]** to highlight the field.
4. Enter the desired number and press **[ENTER]**.

Manually Enter an RNP

1. Press **[NAV]** to access Nav Page 1.
2. Press **LSK [5R]** to highlight the RNP field.
3. Enter a numerical value for RNP between 0.01 and 99.99.
4. Press **[ENTER]** to accept the data.

Delete Manually Entered RNP

1. Press **[NAV]** to access Nav Page 1.
2. Press **LSK [5R]** to highlight the RNP field.
3. Press **[BACK]**, then **[ENTER]**.

Magnetic Variation

The VAR WARNING message is displayed when operating above 72 degrees 45 minutes north latitude or below 59 degrees 45 minutes south latitude. This message occurs 15 minutes latitude prior to leaving the valid region for the magnetic variation model. This gives the flight crew time to enter a manual variation or take other action if operating an aircraft without a true heading source.

Manual Variation Input

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4.
2. Press **LSK [4L]** to position the cursor on the VARIATION entry field.
3. Enter the desired variation. If required, use the ± key to change the E/W prefix prior to making the entry. When the variation is entered, (MAN) will be displayed to indicate that VARIATION is a manual input.

Cancel Manual Variation Input

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4.
2. Press **LSK [4L]** to position the cursor on the VARIATION entry field.
3. Press **[BACK]** and then **[ENTER]** to cancel the manual variation and to return to automatic computation of variation.

Manual Heading Source Selection

A manually selected heading source will not be automatically changed. To select a heading source:

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4. The current heading source is listed in parentheses next to LSK [1L].
2. Press **LSK [1L]** to highlight the HDG entry field, and then press **[LIST]** to display the Heading Source page.
3. Press the LSK of the desired heading source. This accepts the corresponding source as the new source and returns the display to Data Page 4.

Manual Heading Input

In the unlikely event that all other heading sources have failed, the following procedure can be used to manually enter a heading.

NOTE: If a Laser-type IRS must be selected to ATTITUDE on the IRS Mode Selector Unit (MSU), the heading for that unit can be manually set. Refer to Inertial Reference Sensor in the Sensors section for the procedure.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4.
2. Press **LSK [1L]** to highlight the HDG entry field.
3. Enter the desired heading. When the heading is entered, (MAN) will be displayed to indicate that HDG is a manual input.

Cancel Manual Heading Input

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4.
2. Press **LSK [1L]** to highlight the HDG entry field.
3. Press **[LIST]** to display the Heading Source Page.
4. Press the LSK of the desired heading source. This accepts the corresponding source as the new source and returns the display to Data Page 4.

ENROUTE

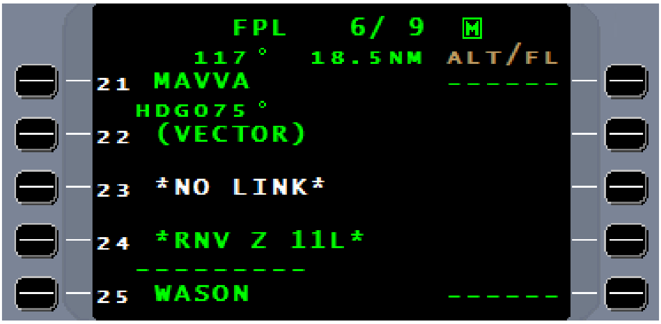
Flight Plan Navigation

Once the flight plan is entered and the system is in Navigation mode, the FMS is ready to navigate the aircraft along the flight plan. No further entries or procedures are necessary. GPS and IRS sensors will be selected on the ground as shown on Data Page 2. All other sensors will be deselected until the aircraft is airborne. Other sensors are selected via a landing gear squat switch at takeoff. In the event of a squat switch failure the sensors select at 150 kts TAS.

When the current navigation leg is valid (TO waypoint displayed on the Navigation Page) and the position is certain, the HSI flag will be out of view and the desired track and related data will be displayed. Roll steering outputs for flight guidance will be available if the navigation leg and velocity are valid. Velocity will be valid if IRS velocities or heading and TAS are available to the navigation computer. Once coupled to the autopilot, the FMS will navigate the aircraft along a great circle leg between flight plan waypoints. Care should be taken when directly coupling to NAV MODE of the autopilot since this will cause the FMS to steer the aircraft to a 45° intercept of the active FROM-TO leg. Consider using CMD HDG to intercept the FROM-TO leg instead.

Effect of Procedural VECTOR Legs on Fuel/Time Calculations

Each VM leg in a flight plan adds 20 nm to the flight plan length. VM leg paths are designated on Flight Plan Pages as HDG ###, and VM leg terminator waypoints are designated as "(VECTOR)", as illustrated by waypoint 6 on the screen shown below. When procedures with VM legs are linked to the flight plan, a "*NO LINK*" might or might not follow the VM terminator waypoint.



For such legs, the FMS creates a leg terminator waypoint at the end of the heading vector leg 20 nm from the origin. This allows EFIS & MFD systems to present a leg for display. The leg segment appears on these displays at the waypoint from which the vector begins and terminates 20 nm from the fix. When a VM leg becomes the active navigation leg, the waypoint is always 20 nm ahead of the aircraft on the specified heading. VM legs require either a manual leg change or a Direct-To operation for the FMS to sequence to the next leg.

Once the FMS has sequenced to the next leg of the flight plan, the additional distance is included in certain fuel and time calculations. The results of these calculations are displayed on:

- Fuel Page 2
- Performance Page 1
- Flight Plan Present Position to Waypoint Pages
- Flight Plan Waypoint to Destination Pages

Consequently, the FMS will indicate on these pages that more fuel and time are required to complete the flight than is needed.

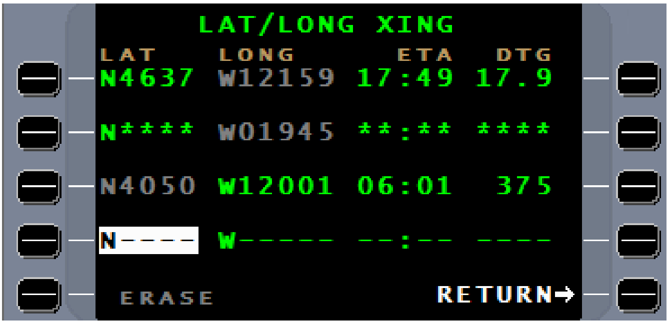
FMS 2nd CRS

This is a configurable option for Collins Pro Line 2 and Pro Line 4 4000 systems which enables the autopilot to respond to FMS roll steering commands.

1. From any **[NAV]** page, press **[MENU]** to display the Nav Menu Page.
2. Press **LSK [5L]** to toggle the FMS 2nd CRS on and off.

Latitude/Longitude Crossing Points

1. From any **[NAV]** page, press **[MENU]** to display the Nav Menu Page.
2. Select LAT/LONG XING, **LSK [3R]**.



Define a Crossing Point

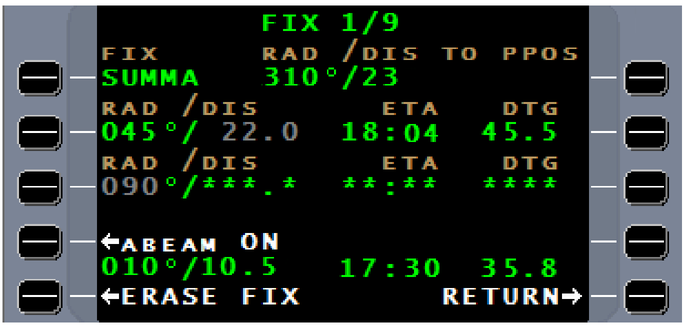
1. If computing a crossing longitude is desired, press **LSK [1L]** to move the cursor to the LAT field and enter the latitude of the first crossing point. The corresponding longitude, ETA and DTG will automatically fill their respective fields.
2. If computing crossing latitude is desired, press **[ENTER]** to advance the cursor to the LONG field and enter the longitude of the first crossing point. The corresponding latitude, ETA and DTG will automatically fill their respective fields.
3. Repeat this process up to three more times as desired by pressing LSK [2L], [3L] or [4L].

Delete a Crossing Point

1. With the cursor over a crossing point, selecting **LSK [5L]** will erase the point.
2. Press RETURN, **LSK [5R]**, to return to the Navigation Menu Page.

Define a Fix

1. From any **[NAV]** page, press **[MENU]** to display the Nav Menu Page.
2. Select FIX, **LSK [4R]**.



3. Enter a fix identifier at **LSK [1L**]. Press **[ENTER].** The radial and distance from the fix to present position is displayed.
4. Enter a radial value at **LSK [2L]**. The distance from the fix to the radial intersection, DTG and ETA will be displayed.

   <u>NOTE</u>: Pressing **[ENTER]** instead of entering a radial in the RAD field will move the cursor to the DIS field where the distance from the fix to the radial intersection can be entered. The radial from the fix to the radial intersection, ETA and DTG will be displayed.

5. Another radial or distance can be entered at **LSK [3L]**.
6. If desired, define additional fixes by pressing **[NEXT**] or **[PREV]** to access additional Fix pages and repeating steps 1 through 3.

Delete a Fix

1. From any **[NAV]** page, press **[MENU]** to display the Nav Menu Page.
2. Select FIX, **LSK [4R]** to display the Fix Page.
3. Select **LSK [5L]** to erase all data from the current Fix Page.

Turn Abeam On or Off

An Abeam intersection is the intersection of the shortest line from a fix to the flight plan. If an intersection is ahead for the entered fix and if the abeam distance is less than 200 nm and within five waypoints of the present position, abeam information is automatically displayed at LSK [4L] on the Fix page. The radial and distance from the fix to the intersection, DTG and ETA are displayed.

1. From any **[NAV]** page, press **[MENU]** to display the Nav Menu Page.
2. Select FIX, **LSK [4R]** to display the Fix Page.
3. Select **LSK [4L]** to turn abeam on or off.

Automatic Leg Change

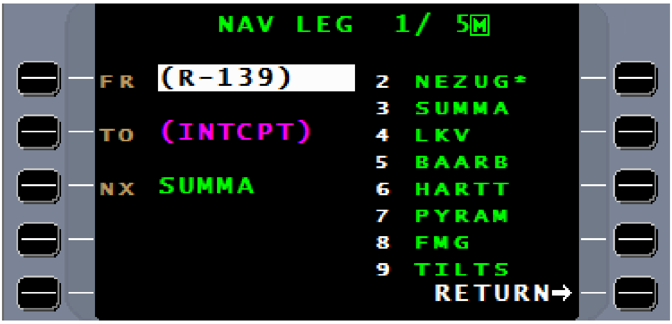
Normally, leg changes along a flight plan are automatic. Automatic leg changes will not occur if there is a discontinuity in the flight plan, including situations where no NX waypoint is defined, the TO waypoint is followed by a *GAP* or *NO LINK*, or the TO waypoint is the last waypoint on the flight plan. Fifteen seconds prior to an automatic leg change (or arrival at the TO waypoint), the WPT ALERT message will become active and the WPT alert annunciator will illuminate steady. Pressing the MSG key will display the message.

Automatic leg changes occur before the TO waypoint at a distance based upon groundspeed, degrees of heading change and roll steering bank limit for the present altitude. The maximum distance before the waypoint at which the leg change will occur is 12 nm. If the aircraft passes to the side of a TO waypoint, the leg change will still occur at a distance before the waypoint to smoothly intercept next leg. If the TO waypoint is designated as a overfly waypoint (i.e., delayed automatic leg change), the leg change will begin over or abeam the waypoint.

When the Approach mode is entered, leg changes at the approach waypoints are automatic. In the Approach mode, the WPT ALERT message becomes active and the WPT alert annunciator illuminates steady 5 seconds prior to an automatic leg change. When the Approach mode has been selected within 50 nm of the end-of-approach point (MAP or runway) and the required navaid is tuned, the FMS will generate the Approach mode outputs. These will include bearing and distance to waypoint, desired track, crosstrack, lateral valid, approach annunciator, vertical deviation (glideslope) and vertical valid.

Manual Leg Change

Manual leg changes may be defined with either the FR and TO waypoint either on or off the flight plan. If a TO waypoint is chosen that is off the flight plan, the system prompts the pilot to redefine the NX waypoint in order to link the newly defined leg into the flight plan.



1. Press **[NAV]** to access Nav Page 1.
2. Use the **LSKS [1L-2L]** to highlight the FR or TO entry field as desired. The Nav Leg Page is displayed with a listing of flight plan waypoints on the right side of the page.
3. Enter the identifier of the desired waypoint. If the desired waypoint is on the flight plan, enter the associated reference number. If the desired waypoint is not on the flight plan, use the LIST function or type in the identifier or enter the identifier directly.

If a new FR waypoint was entered, the cursor will advance to the TO waypoint entry field for entry of a new TO waypoint. If the TO waypoint displayed is acceptable, pressing the ENTER key will accept the waypoint and clear the cursor.

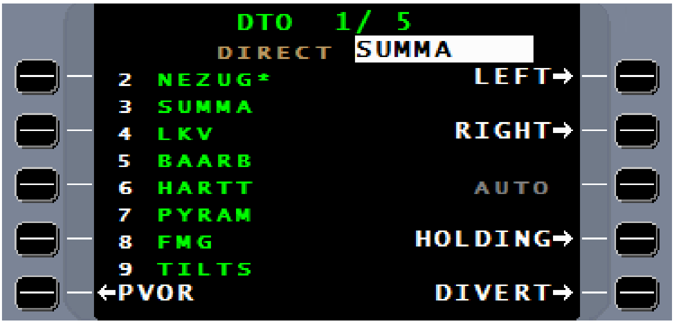
If a new TO waypoint was entered that was not on the flight plan, the cursor will automatically advance to the NX identifier entry field to allow the new TO waypoint to be linked into the flight plan.

4. If the cursor advances to the NX identifier entry field and it is desired to link the TO waypoint into the flight plan, enter the reference number of the flight plan waypoint that is to come after the new TO waypoint.

When the new leg is defined, the system will provide flight guidance steering to capture the new leg at an intercept angle of 45°. The FMS HDG function may be used to select a different intercept heading.

Direct-To Waypoints

A Direct-To leg change can be defined for waypoints, airports, or runways on or off the flight plan. If a TO waypoint not on the flight plan is chosen, the system will prompt the pilot to redefine the NX waypoint to link the newly defined leg into the flight plan.



1. Press **[DTO]** to access the DTO Page. The cursor will be over the Direct-To waypoint entry field and a listing of flight plan waypoints is shown.
2. Enter the DTO waypoint in one of three ways:
   a. Enter the identifier of the desired DTO waypoint. Runways can be entered in “AAAA.RR” format (i.e., KSEA.16L).
   b. Use the **[LIST]** function.
   c. Enter the associated reference number from the list on the left side of the page. This is a listing of the waypoints on the current flight plan.

   If the DTO waypoint entered is in the flight plan:

   - The display returns to the Navigation Page,
   - PPOS displays in the FR waypoint position,
   - The DTO waypoint identifier displays in the TO waypoint position, and
   - The next flight plan waypoint after the new TO waypoint displays in the NX position.

   If the DTO waypoint entered is not in the flight plan:

   - The Navigation Page displays the flight plan waypoints listed on the right and the FR, TO, and NX waypoints on the left,
   - PPOS displays in the FR waypoint position, and
   - The DTO waypoint identifier displays in the TO waypoint position.

   The cursor will be over the NX identifier entry field to allow the new TO waypoint to be linked into the flight plan.

   NOTE: If the DTO point is an airport not on the flight plan AND a STAR for the original destination airport has not already been linked to the flight plan, the FMS will automatically change the default airport on the Arrival Page to the DTO airport. If a STAR for the original destination airport has already been linked to the flight plan, that airport will remain the default airport on the Arrival Page, and the pilot must select the DTO airport as the new default airport on the Arrival Page before linking a STAR to the flight plan.

   Refer to Insert Approach or STAR into the Flight Plan in the Arrival section for more information.

3. The FMS automatically calculates the shortest turn direction; however, it may be changed by selecting LSKs [1R] and [2R], LEFT or RIGHT direction. Pressing LSK [3R], AUTO, will cancel LEFT or RIGHT and return to the default shortest direction.
4. Press **[ENTER]**. If the cursor advances to the NX identifier entry field on the Nav Page, and it is desired to link the DTO leg into the flight plan, enter the reference number of the flight plan waypoint that is to come after the new TO waypoint.

When the TO waypoint is entered, the system will compute a course to the DTO waypoint and provide flight guidance steering for a circular turn towards the course to roll out on the new course with no crosstrack error.

Crossfill of Flight Plan during Flight

When the flight plan is modified during flight, the modified flight plan can be crossfilled to the other FMS if configured for Crossfill rather than SYNC.

1. Press **[FPL]**.
2. Press **[MENU]**.
3. Select **[XFILL FPL]**.

The new flight plan will replace the old one, and the current FR-TO leg will be automatically linked to the new flight plan if it is contained in that flight plan. If it is not, you must perform a manual FR-TO leg change on Nav Page 1, or a Direct-To a waypoint in the new flight plan.

Enter Flight Plan Winds

1. Press **[FPL],** then **[MENU]** to display Flight Plan Menu page 2.
2. Select FPL WIND, **LSK [4L]** on Flight Plan Menu Page 2:
3. Use the right hand LSKs to place the cursor over the desired waypoint and enter the wind direction (as True). The cursor will advance to the velocity field.
4. Enter the velocity in knots. Use **[PREV]** and **[NEXT]** to access the waypoints on each FPL WIND page as desired.

In flight, when a waypoint with manually entered or calculated wind becomes the TO waypoint, the manual or calculated wind will be overridden by the current FMS wind data. Winds at downstream waypoints will be automatically recalculated.

RAIM Prediction

RAIM Prediction is displayed only if any configured GPS has RAIM capability.

1. From any **[FPL]** page, press **[MENU]**.
2. Press [RAIM PRED], **LSK [3R]** to display the RAIM Prediction Page.

   RAIM is automatically displayed for VOR, RNV, TAC, GPS and NDB approaches. Manual entries may be made at LSKs [1R] and [2R] for calculating RAIM Prediction for other approach types, if applicable.

Navigation Maneuver Functions

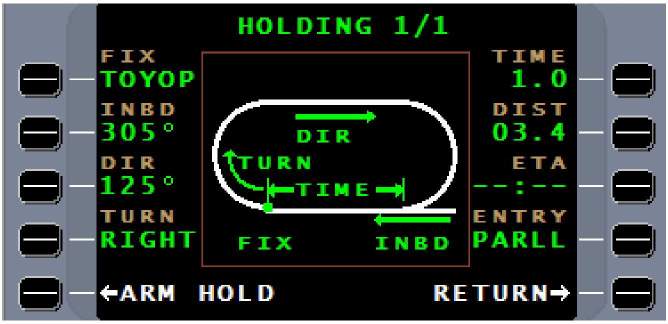
Program a Holding Pattern

1. From any **[NAV]** page, select the **LSK [2R]** to access the Maneuver Page.
2. Press **LSK [1L]**, HOLDING DEFN. If a holding pattern is in the Navigation Database, or a holding pattern has been previously programmed, the Holding Page is displayed. Refer to Edit Holding Patterns in the Enroute section. Otherwise, the Hold Fix page is displayed.
3. On the Hold Fix Page, define the Hold Fix waypoint by directly entering the identifier, using the reference number, or the LIST function. Runways can be entered in “Apt_Id.Rwy_ID” format (i.e. KSEA.16L).

NOTE: Creating a hold fix to an EOA, approach label, GAP, or NO LINK is not supported.

NOTE: When flying a course leg to a holding fix, and a circling turn is required at the hold fix prior to holding, the aircraft will not execute the first turn and enter the holding pattern directly. This may cause an unexpected holding pattern entry.

4. Press **[ENTER]**. The Holding Page is displayed.
5. Press **LSK [5L]**, ARM HOLD, to accept the holding pattern with the default values. To modify information in the INBD, DIR, TURN direction, TIME or DIST fields, press the LSK associated with the field. Enter the correct data then press **[ENTER]** to accept the data.



6. To redefine the Hold Fix, press **LSK [1L]** to display the Hold Fix Page.

7. Press **LSK [2L]** to highlight the inbound radial (INBD) field, edit the holding pattern inbound radial, then press **[ENTER]**. The DIR field is the course outbound. If the clearance is to hold on a radial, the radial field will be automatically calculated and entered. The cursor advances to the TURN field.

8. Press **LSK [4L]** to highlight the TURN field. The turn direction defaults to Right but can be changed to Left with the +/- function key or entry of "L" or "R". Press **[ENTER]**.

9. Press **LSK [1R]** to highlight the TIME field. Edit as needed and press **[ENTER]**.

10. By pressing **LSK [2R]** for DIST, distance can be used for leg measurement in lieu of TIME.

    NOTE: ETA is always displayed in UTC. ETA will be updated each time the FIX is over-flown and accounts for current TAS and wind conditions.

11. If the hold is being approached from a position ± 20 degrees of the inbound course, the FMS allows for selection of entry type to the pattern. Parallel, teardrop or direct are selectable at **LSK [4R]**. The Hold Entry Page is displayed where the entry can be selected. Otherwise, entry cannot be edited, and the FMS determines the appropriate entry automatically.

12. If the Hold Fix is a flight plan waypoint, the holding pattern is entered into the flight plan by pressing **LSK [5L]**, ARM HOLD. The aircraft flies the active flight plan and then automatically activates the holding pattern when reaching the holding FIX.

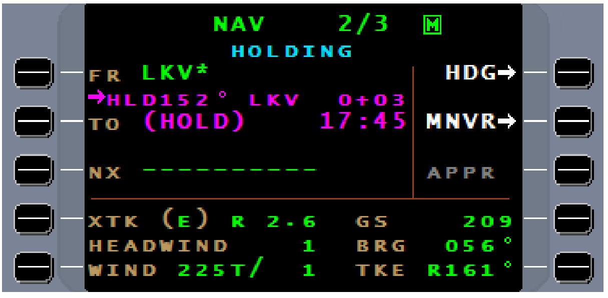
    The ARM HOLD prompt changes to DTO HOLD after the LSK is pressed. Holding patterns cannot be armed on the ground.

13. If the Holding FIX is not part of the flight plan, DTO HOLD is displayed at LSK [5R]. The Holding Pattern cannot be armed, but the holding definition created on the Holding Page is retained for later use. Refer to DTO Hold in the Enroute section for more information.

    NOTE: Holding pattern turns are made at standard rate and configuration bank limits do not apply. Should the aircraft Automatic Flight Control System limits the bank angle the holding pattern will not be flown to the standard turn rate requirement.

If the TAS and/or wind are too high for the holding pattern, the message HIGH HOLDING GRNDSPEED is annunciated. This message will only appear when within 3 minutes of the holding fix. The resulting holding pattern may exceed the lateral limits of protected airspace. Groundspeed should be reduced prior to the holding waypoint alert, which occurs 15 seconds prior to the holding fix.

When the holding pattern requires a manual termination, “HOLD” is displayed after the holding pattern on the Nav Page.



Hold at Present Position

1. From any **[NAV]** page, select the **LSK [2R]** to access the Maneuver Page.
2. Press **LSK [5L]**, PPOS HOLD. The Holding Page is displayed. The hold FIX field is prefilled with present position, PPOSX, where X equals 1-9. Also prefilled is the hold inbound course to the current flight plan track.
3. To change the default turn direction, time, distance and entry type, press the adjacent LSK, enter the new value and press **[ENTER]**.
4. Press **LSK [5L]**, DTO HOLD.

   The PPOS hold is positioned 15 seconds ahead of the aircraft along the aircraft's current track.

View a Previously Defined Holding Pattern

1. From any **[NAV]** page, press **[LSK 2R]** to access the Maneuver Page.

2. Press **LSK [1L]**, HOLDING DEFN. If a holding pattern is in the Navigation Database, or a holding pattern has been previously programmed, the Holding Page is displayed.
3. The TO waypoint for the next hold fix in the flight plan is in the FIX field. Information from the Navigation Database or information previously programmed is displayed in its applicable field.
4. To change the holding pattern, press **LSK [1L]**. The Hold Fix Page is displayed.

5. Enter the reference number for the hold fix. The Holding Pattern Definition Page is displayed with the previously defined holding pattern information filled.

Edit Holding Patterns

Prior to activation of a holding pattern, all variable fields on the Holding Pattern Definition Page are editable. After activation of the holding pattern, only the TIME and DIST fields are editable.

Procedural holding patterns are considered part of the procedure and any editing of the holding pattern will be treated as procedural edits. Edits to the FIX, INBD/DIR, TURN DIR and TIME/DIST fields on the Holding Page will remove the procedure. Changing the entry type will not affect the procedure since entry types are not part of the published procedure.

The procedure will be cleared on the Arrive/Departure Page as appropriate, and the Flight Plan Clearance Page will display the procedural legs rather than the procedure name.

1. From any **[NAV]** page, press **LSK [2R]** to access the Maneuver Page.
2. Press **LSK [1L]**, HOLDING DEFN. The Holding Page is displayed.
3. To redefine the Hold Fix, press **LSK [1L]** to display the Hold Fix page. To modify information in the INBD, DIR, TURN direction, TIME or DIST fields, press the LSK associated with the field. Enter the correct data then press **[ENTER]** to accept the data.

Exit a Holding Pattern

1. From any **[NAV]** page, press **LSK [2R]** to access the Maneuver Page.
2. While holding, press **LSK [2L]**, PROCEED.
   - If the Hold Fix was not on the flight plan, pressing **[PROCEED]** displays the Nav Leg Page. Enter a NX waypoint and press **[ENTER]**.
   - If the Hold Fix is on the flight plan, pressing **[PROCEED]** continues the hold until crossing the FIX, then will proceed on course as the flight plan directs.

   NOTE: Hold can also be exited with a DTO command, the HDG mode, or manual leg change. HDG mode may require manual leg change to allow a leg intercept.
3. Once **[PROCEED]** has been pressed, the CONTINUE HOLD prompt is available on the Maneuver Page at LSK [4L]. This option will be available until the Holding Fix is sequenced for the final time.
4. If the hold is at a fix in the flight plan, when exiting the holding pattern it will continue in the pattern until reaching the hold fix before exiting. Then it exits and continues the flight plan.

Disarm Holding Pattern

The DISARM HOLD prompt is available on the Maneuver Page when a holding pattern, is armed but not active.

1. From any **[NAV]** page, press **LSK [2R]** to access the Maneuver Page.
2. Press **LSK [3L]**, DISARM HOLD. The Holding Page is displayed with DISARM HOLD, LSK [5L] highlighted.
3. Press **LSK [5R]** to confirm.

DTO Hold

A Holding Pattern must be defined to perform a DTO HOLD.

1. From any **[NAV]** page, press **LSK [2R]** to access the Maneuver Page.
2. If the Holding Pattern is on the flight plan and armed:
   d. Press **LSK [2L]**, DTO HOLD. The Holding Page is displayed with DTO HOLD, LSK [5L] highlighted.
   e. Press **LSK [5R]** to confirm.
3. If the HOLD FIX is not on the flight plan:
   f. Press **LSK [1L]**, HOLDING DEFN. The Holding Definition Page is displayed with DTO HOLD at LSK [5L] is highlighted.
   g. Press **[ENTER]** to confirm.
4. The aircraft will proceed from PPOS direct to the FIX.

Emergency Divert

1. Press **[DTO]**.
2. Press **LSK [5R]** to display the Divert Page. This page displays a list of up to 12 closest suitable airports with associated bearing, range, and longest runway based on current present position.

3. Select an airport by entering the reference number, using the LIST function or directly entering the identifier.

4. Press **[ENTER].** If the NX waypoint is not defined, the Nav Leg Page is displayed, and the waypoint can be defined.

   The FMS will divert to the chosen airport. If the airport is not contained in the flight plan, it is added to the end.

   NOTE: The airports are sorted by direct distance from the aircraft position. Only airports within 950 nm range of the aircraft and having a runway longer than the MIN DIVERT RWY defined on the PERF OPT page (MAINT > CONFIG > FMS CONFIG > PERF) will be selected. Pilot-defined airports and pilot-defined runways are included in the database search.

   If the LIST key is selected from the DIVERT page the list will be based on distance from the last sequenced waypoint. It is highly recommended that the list already presented on the DIVERT pages are used

Program a PVOR

1. Press **[DTO]**, then **LSK [5L]** to display the PVOR Page.
2. The current To waypoint is displayed in the WPT field. Press [enter] to accept that entry. Alternatively, enter the appropriate reference number of another waypoint from the flight plan (listed on the left side of the page), or use the LIST function. If there are more waypoints in the flight plan, they can be viewed by pressing **[PREV]** or **[NEXT]**. Manually entered runways can be entered in "AAAA.RR" format (i.e., KSEA.16L). When the waypoint is entered, the cursor will advance to the DESIRED TRK entry field.

   NOTE: When performing a PVOR to a runway waypoint, the PVOR is considered an enroute operation and therefore retains enroute scaling sensitivity (not approach scaling).

3. Enter the DESIRED TRK. To follow a desired track outbound from a PVOR, a gap (*GAP*) must follow the PVOR waypoint on the flight plan.

   Or

4. Enter the RADIAL INBND/OUTBND. The desired track to be flown to or from the PVOR may be identified here by defining a radial to be flown inbound to or outbound from the PVOR waypoint. When selecting a radial to fly outbound from the PVOR waypoint, the waypoint name is changed to <VECTOR>. An external (dashed) course line is drawn through the waypoint to Collins advanced EFIS.

5. Press **LSK [5L]** to accept the PVOR. The PVOR is active and the display returns to the Nav Page with "PVOR" in the FR position and the PVOR waypoint in the TO position. Steering commands will provide a 45° intercept of the PVOR desired track, or the CMD HDG function may be used to define a desired intercept heading.

Delete a PVOR

To delete a PVOR, perform a DTO function or a manual leg change, or select the Approach mode.

Selected Crosstrack – Parallel Course

A parallel course may be established to provide guidance with respect to an offset course, which is parallel to the leg, defined by the FR/TO waypoints. The amount of offset is defined by the pilot in this procedure.

1. Press **[NAV]**, then **LSK [2R]** to display the Maneuver Page.

2. Press **LSK [3R]**, SXTK. Nav Page 1 will be displayed with cursor over the SXTK entry field. XTK will move up one line.

3. If necessary, press the sign reversal **(±)** key or the appropriate alpha **(L, R)** key to change the direction (left or right) of offset.

4. Enter the desired offset in nm and tenths, then press **[ENTER]**.

When SXTK is entered, the SXTK annunciator on the instrument panel will illuminate, XTK will indicate crosstrack from the selected crosstrack, the system will provide steering to fly an appropriate intercept to the selected crosstrack, and the CDI will be referenced to the parallel (offset) course.

NOTE: FMS HDG mode will take priority over selected crosstrack if both modes are active. Both FMS HDG and SXTK annunciators will be illuminated, and the deviation display will be referenced to the parallel (offset) course.

Cancel Selected Crosstrack Mode

1. Press **[NAV]**, then **LSK [2R]** to display the Maneuver Page.
2. Press **LSK [3R]**, CNCL SXTK.

(An alternate method is to enter a value of 0.0 nm in the SXTK data field on Nav Page 1 or highlight the SXTK field on the Nav Page and press **[BACK]** then **[ENTER]**).

Refer to Maneuver Page under Navigation Function in the Operations section for more information about the conditions in which selected crosstrack mode is canceled.

VNAV Setup and Activation

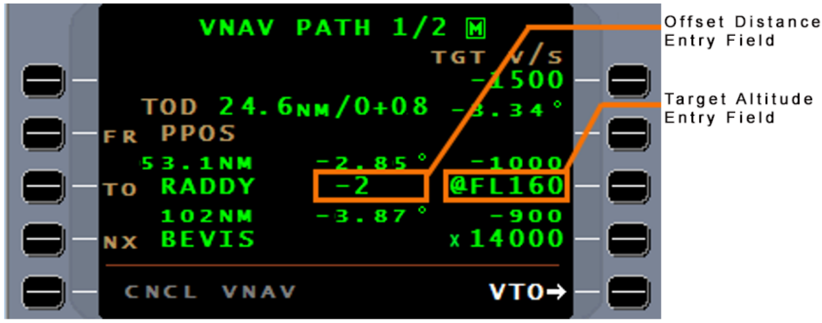
Vertical Navigation (VNAV) requires at least one defined vertical waypoint in the flight plan. The reference Flight Plan fix, offset distance and target altitude must be entered to define each vertical waypoint. Target Vertical Speed (TVS) must also be entered to activate VNAV mode.

Entering Vertical Waypoints

Vertical waypoint altitudes may be manually entered on the VNAV Path Page or on the Flight Plan Pages. If an offset VNAV waypoint is required, the function can be entered only on the VNAV Path Page by entering an offset (in nautical miles) before or after the fix. The VNAV Path Page can be accessed from the Flight Plan Pages by pressing the left LSK adjacent to the waypoint identifier, then OFFSET, LSK [5R].

VNAV Flight Path Definition Procedure

1. Press **[VNAV]**. The VNAV Path Page is displayed, and all entry fields are prefilled with the current fight plan waypoints.



NOTE: The VNAV PATH page may show FL altitude without the leading zero. For example: FL090 for 9000' may display as FL {space} 90.

2. If desired, press **LSK [3L]** to define the VNAV TO waypoint. The Vertical Waypoint Select Page is displayed.

On the right side of the display is a list of flight plan waypoints. The list includes all flight plan waypoints starting with the first waypoint ahead of the aircraft. View additional flight plan waypoints (ahead of the FMS present position) by pressing **[NEXT]** and **[PREV]**.

The terminators of the following leg types are not displayed: Heading to Manual Terminator, Course from Fix to Manual Terminator, Course to Altitude, Heading to Altitude, Hold to Altitude, Course to Intercept, Heading to Intercept, Course to Radial, Heading to Radial, Heading to DME Distance.

3. Enter a waypoint by selecting the reference number of the waypoint and pressing **[ENTER]**.

   A valid vertical leg may include conditional legs (Heading to Intercept, Heading to Radial, Heading to DME Distance, Course to Intercept, Course to Radial, and Course to DME Distance), hold legs (Hold to Fix, and Hold to Manual Terminator) or manual termination legs (Course from Fix to Manual Terminator and Heading to Manual Terminator).

   The following vertical legs are invalid: Heading to Altitude, Course to Altitude, Course from Fix to Altitude and Hold to Altitude. VNAV processes these legs as a gap in the flight plan and will cancel when the FMS enters one of these legs. VNAV may be activated after transitioning out of the leg to continue with the flight path.

   Altitude constraints for conditional legs and manual termination legs are advisory information only; therefore the terminators of such legs are invalid vertical waypoints.

4. The cursor expands to cover the offset distance entry field. Use the **±** key to change the offset sign ("-" for offset prior to the flight plan waypoint, "+" for offset beyond the flight plan waypoint). Enter the offset distance, if desired, or press ENTER for no offset.

5. The cursor expands to cover the target altitude entry field. Entries to this field may be either altitudes or flight levels.

   If an altitude is entered which results in a FPA greater than the configured maximum FPA, it will flash and not be accepted. A drop-down message (FPA TOO STEEP) is displayed.

   NOTE: Under certain circumstances, manually entered altitude constraints used in conjunction with Temperature Compensation may produce a VNAV disconnect. Refer to Temperature Compensation Pages under Flight Plan Function in the Operations for further information about how manually entered VNAV altitude constraints are affected by this feature.

6. Press **LSK [4L]** to access the NX entry field and repeat the above process to define the NX waypoint.

7. Press **[NEXT]** to view succeeding VNAV waypoints on VNAV Path Page 2. Repeat the above process to define all succeeding waypoints.

8. Press **LSK [1R]** to access the target vertical speed field and enter the desired vertical speed. This field will pre-fill with dashes until an altitude entry is made. It then displays the default target vertical speed from the VNAV Menu Page. Accept the value by pressing **[ENTER]**.

   Invalid entries will cause the V/S entry to flash, and an error message will be displayed (refer to Target Vertical Speed later in this section for more information).

9. When the TO VNAV waypoint and the target vertical speed entries have been made, the distance and time to the TOD will be displayed, as well as FPA. Vertical deviation indication will be with respect to the flight path defined by the first VNAV waypoint and VSR. TOD is the point at which the pilot should begin the capture maneuver for the FPA.

10. When the aircraft reaches the last programmed VNAV waypoint, subsequent VNAV waypoints will automatically fill with current VNAV altitude, causing guidance to be to zero VSR and maintaining level flight.

NOTE: Entering a vertical TO waypoint entry of non-fix legs, for example heading to altitude legs, is not supported even though these legs are listed with all the waypoints when selecting the VTO key.

Refer to VNAV Transition from Enroute to Approach in the Enroute section for more information about VNAV mode during approach.

VNAV Error Messages

VNAV Error Messages appear on the Vertical Navigation Page whenever an invalid entry is made in TVS or altitude data fields.

ADC ALT INVAL – (1) Aircraft altitude is < FL180 and only pressure altitude is available, or (2) ADC altitude has failed.

APPR ALT - RESTR – An altitude entry for an approach waypoint that violates the database constraints is entered.

CLEAR MAN ALT – A manual entry for altitude was made on the ADC Status Page.

CLR SEL XTK – Aircraft is flying a selected crosstrack distance prior to VNAV activation. SXTK must be canceled before TVS can be entered.

CLR XFILL ALT – A VNAV plan is defined, but crossfilled altitude is being used by the system.

FPA TOO STEEP – FPA is steeper than maximum FPA configured at time of installation.

LEG RESTRICTION – Entry is attempted when the active vertical leg is a GAP, HA, FA, CA, VA, HM, HF or PI leg that does not have an altitude constraint.

LINK NAV/FPL – VNAV distance is invalid because the VNAV plan is not linked to the guidance legs.

NO CLIMB VTO – The FMS does not permit a VTO procedure which results in a climb.

NO ENTRY - APPR – Entry is attempted for an approach waypoint when the approach is active.

NO ENTRY - HOLD – Entry is attempted during an active vertical holding leg.

NO ENTRY- VERT – Entry is attempted when the aircraft is in active VM or FM leg.

NO VWPT ALT – VNAV distance is invalid because the VNAV TO waypoint is undefined.

TGT V/S HIGH – Value exceeds 6000 fpm or maximum flight path angle programmed in configuration module.

TGT V/S LOW – Entered value is less than minimum required value.

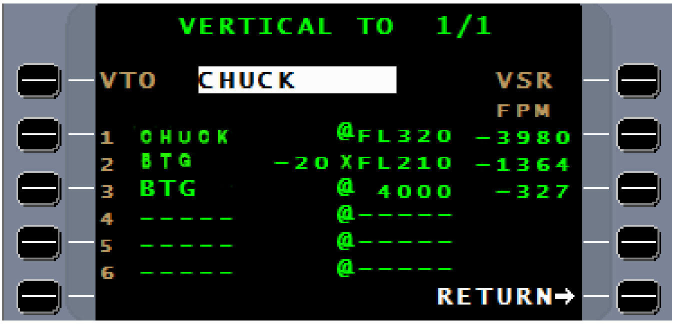
XTK TOO GREAT – Current crosstrack is > 12.5 nm.

Cancel VNAV Flight Profile

1. Press **[VNAV]** to access the Vertical Navigation Page.
2. Press **LSK [5L]**, CNCL VNAV.

The vertical flight profile will be deleted, and the Vertical Navigation Pages will fill with the next six waypoints on the flight plan.

Vertical-To Procedure



This procedure is similar to the Direct-To procedure for lateral flight paths but is used in vertical flight paths. It is designed to redefine an already established VNAV leg.

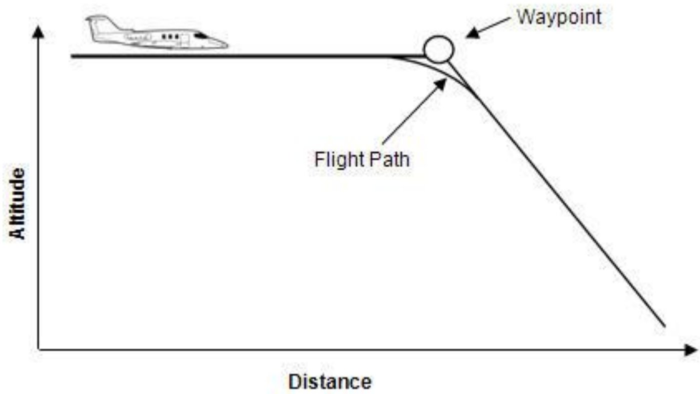
1. Press **[VNAV]** to access the VNAV Page.
2. Press **LSK [5R]**, VTO to access the Vertical-To Page.
3. Vertical waypoints are listed below the VTO entry field. The offset distance, altitude and vertical speed required are displayed next to the respective vertical waypoint. Invalid waypoints are displayed in small font.
4. Enter the reference number of the desired VNAV Direct-To waypoint and press **[ENTER]**.

Entries which result in a calculated flight path angle greater than the configured limit or result in a climb will flash and not be accepted. The FMS does not allow climbs during VNAV. The drop-down message NO CLIMB VTO will display on the message screen.

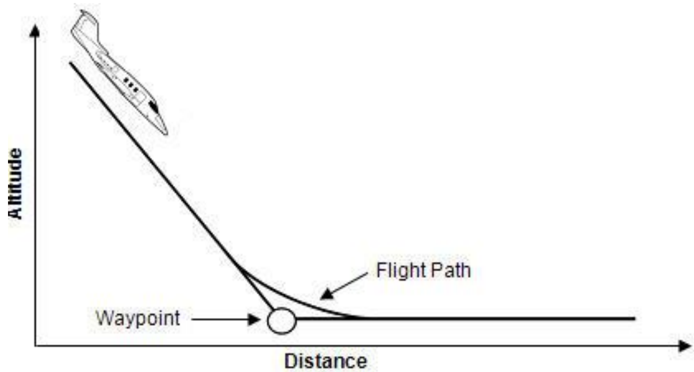
VNAV Transition from Enroute to Approach

For the FMS to provide VPATH approach operation, the database approach must have AT altitude constraints from the FAF and RWY or MAP waypoints. Circle to land approaches and approaches where the MAP is beyond the runway threshold do not have AT altitude coding, therefore, VPATH approach operation is not available.

In some instances, the FMS will initiate the descent prior to the vertical waypoint to capture the next vertical path.



For a "steeper-to-shallower" path capture, will fly above the vertical waypoint to capture the level segment.



If VNAV has been activated to the destination airport without an approach previously loaded in the flight plan, and an approach is subsequently loaded into the flight plan, the FMS will not compute the crossing altitudes for the approach waypoints. The current TO lateral and vertical waypoint leg does not change when an approach is loaded by design. The flight crew must make a change to the current TO leg to change lateral and vertical navigation.

On the NAV page select LSK [2L] to link the current TO leg to the desired waypoint or perform a DTO to the desired waypoint. When this is done VNAV will disconnect. To reengage VNAV go to the VNAV page and select the new waypoint for a VNAV solution.

VNAV After Manual Approach Activation

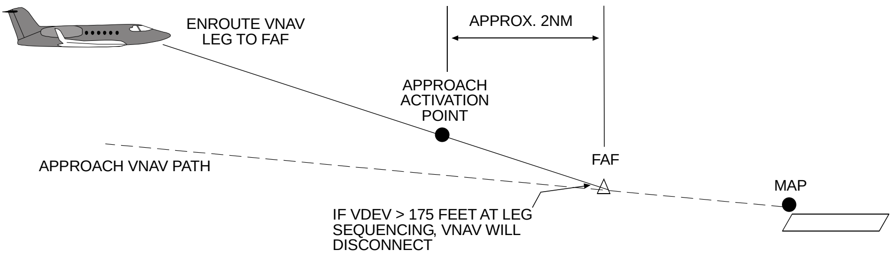
When an approach is manually activated, VNAV disconnects when transitioning from Enroute to Approach mode. This automatic VNAV disconnect is intentional and provides protection from a sudden pitchover or pitch up to capture the final approach VNAV path.

There are two recommended operational procedures to fly VNAV during Approach mode.

- The pilot can manually fly the aircraft to the approach VNAV path and reselect VNAV mode on the flight director, or,
- The aircraft can be maneuvered (using some other vertical mode) to a level altitude below the VNAV path. Then select VNAV mode, which will arm the flight director/autopilot for capture.

Automatic Approach Activation

For automatic approach activation, the VNAV approach path will become valid when the VNAV sequences onto the FAF/RWY (or MAP) leg. If enroute VNAV was active prior to the sequence, the system attempts to provide a smooth transition from the enroute path to the approach FPA path.



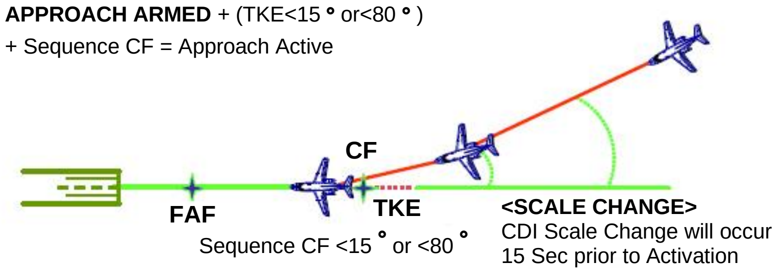
<u>NOTE</u>: VNAV will disconnect if the vertical deviation is greater than 175 feet relative to the approach VNAV Path at the time of VNAV leg sequence to the approach VNAV path. If it is less than 175 feet, VNAV mode will stay coupled through the transition.

<u>NOTE</u>: If flying an active VNAV profile to an airport waypoint only (VNAV active to the destination airport where the airport is the only waypoint in the flight plan) and the approach is subsequently loaded, verify that the approach waypoint crossing altitudes are inserted correctly.

<u>NOTE</u>: When flying approach transition legs ending in an intercept leg to the final approach, the calculated flight path may be too shallow. In this case, pilot action is required to initiate a descent back the procedural vertical path.

<u>NOTE</u>: If performing a DTO to the destination airport it is possible that a VNAV along track offset will not be allowed. It is recommended that he VNAV offset be entered prior to the DTO to the airport.

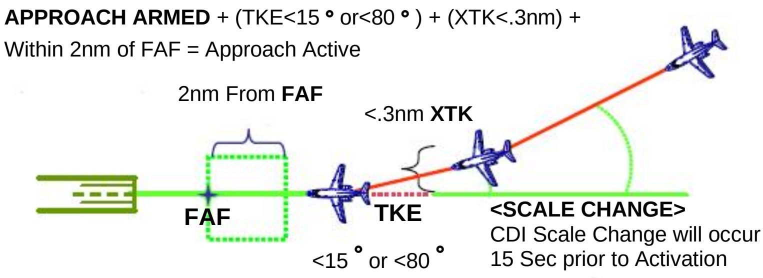
Automatic Activation with Approach Capture Fix



At the approach capture fix, the FMS will begin automatic approach activation with a “<SCALE CHANGE>” banner at the top of the NAV page that will occur 15 seconds prior to activation. The approach should already be armed due to automatic arming at the 30nm point as a result the FMS gives priority to the angle of intercept and capture fix sequencing.

- If the leg prior to the capture fix is directly in line with the final approach course, angle of intercept is not a factor and as the FMS sequences the capture fix the FMS will automatically activate the approach
- If the leg prior to the capture fix is an arc or a 90° turn to final, the FMS will sequence and begin the turn to final. As the angle decreases past 80° or 15° degrees, depending on FMS configuration, the FMS will automatically activate the approach.

Automatic Activation without Approach Capture Fix



Without a designated waypoint as the approach capture fix, the FMS will, again, begin automatic approach activation with a “<SCALE CHANGE>” banner at the top of the NAV page that will occur 15 seconds prior to activation. The angle of intercept of either 80° or 15° degrees will be a factor. To the above, the FMS will add a criterion of crosstrack of less than 0.3nm from the final approach course to ensure the aircraft is within the CDI approach scale of 0.3nm. Without a designated capture fix the FMS will automatically activate the approach 2nm prior to the final approach fix. This will give the FMS the required buffer allowing time for the FMS to activate all approach components.

VNAV Enroute Pitch Commands with Collins, Honeywell, or Thales EFIS

If the installation includes an interface with a Collins, Bendix/King or Honeywell FGS compatible with the FMS pitch commands (refer to specific AFMS), then enroute VNAV profiles may be flown while coupled to the FGS. The FMS computes a vertical pitch command, which is recognized when VNAV is selected on the FGS Mode Select Panel.

NOTE: Honeywell ASCB configurations can couple with Vertical Speed Command outputs in both VPATH and VALT, or in VPATH only modes.

When the aircraft is two minutes from the TOD, the MSG light flashes and the TOP OF DESCENT ALERT message appears on the Message Page. Pressing the MSG key will acknowledge the message and remove it from the page. The autopilot will attempt to capture the VNAV path. During this two-minute period, the pilot may arm VNAV on the FGS Mode Select Panel. (Note that the Altitude Preselector, if installed, must be set to an altitude at least 200 feet below the current altitude before VNAV can be armed on the FGS Mode Select Panel.)

At 15 seconds to TOD or any other vertical waypoint, a WPT annunciator flashes, and VERTICAL WPT ALERT appears on the Message Page. After acknowledgment of the message, the aircraft will capture and fly the defined VNAV profile. Vertical deviation at capture is dependent upon aircraft speed and the path angle. The VNAV pointer on the Collins EFIS display may still be off the scale when the path is initially captured. If the pilot fails to arm VNAV during this period, the FGS will not allow VNAV to be coupled. This is to preclude any abrupt pitch over maneuver that may occur after the capture point. If the pilot manually flies the aircraft near the vertical profile with vertical deviation and aircraft vertical speed within limits, then VNAV may be re-selected on the FGS Mode Panel.

NOTE: During VNAV descents involving large course changes, the flight director may command descent rates which do not center the vertical deviation symbol. Flight director cues should be followed, and vertical deviation will re-center after the new course is tracked.

NOTE: VNAV messaging is a configuration option and not used in an ASCB integration.

VNAV Coupling for ASCB Configurations

When configured for ASCB and the FMS is in VNAV Cruise, Enroute Descent, or Approach, the FMS will couple with the Honeywell FGS in VALT and VPATH modes and transition between the modes as indicated by the following:

NOTE: Enroute VNAV with a "GAP or "NO LINK" between the present position and the vertical TO waypoint is not supported. In this situation delete the GAP or NO LINK before VNAV activation.

1. Couple in VALT mode when the pilot selects VNAV on the FGS before reaching TOD.
2. Couple in VPTH mode when the pilot selects VNAV on the FGS while the FMS is guiding to a descent path (that is, after TOD, or after a VTO, or FMS Approach mode is active) and the altitude alerter is more than 200 feet below the aircraft.
3. Transition from VALT to VPATH at Top of Descent and when capturing the approach descent path.
4. Transition from VPATH to VALT when capturing the alerter altitude during Enroute Descent.
5. Transition to Inactive state when FLCH is selected on the FGS.

Exceptions:

Selecting VNAV on the FGS will have no effect under the following circumstances:

1. FMS VNAV mode Is not active, or
2. FMS VNAV is in Cruise mode, and aircraft is climbing or descending more than 200 fpm, or
3. FMS VNAV is in Enroute Descent or Approach mode, and aircraft is climbing more than 200 fpm, or
4. FMS VNAV is in Enroute Descent mode, and the altitude alerter is not at least 200 feet below the aircraft, or
5. FMS VNAV is in Approach mode, and VDEV exceeds 175 feet.

Position Checks and Updates

In-flight Accuracy Checks

In-flight accuracy checks can be accomplished by pressing **LSK [5L]**, HOLD POS from Nav Page 3 while over a known ground reference. With the position held, the FMS BCP can be compared with the known reference, or the position determined using other navigation equipment such as GPS, LORAN or IRS to establish the aircraft position.

Check Distance/Radial from a Known Position

This procedure can be used to automatically calculate the distance and radial from any waypoint in the database to the aircraft's held position.

1. Press **[DATA]** to access Data Page 1.
2. Press **[NEXT]** to access Data Page 3.
3. Press FMS # POS, **LSK [1L]**, to access the Define Position Page.
4. Verify the cursor is over the reference waypoint identifier entry field.
5. Enter the identifier of the known position. When the identifier is entered, the distance and radial to the aircraft's HOLD position will be computed and displayed.
6. Press **LSK [5R]**, RETURN to exit the page with no changes.

Check or Change Distance/Radial of Pilot Waypoint from REF WPT

1. Press **[DATA]** to access Data Page 1.
2. Press **LSK [2L]**, PILOT DATA.
3. Press **LSK [3R]**, WAYPOINT to access the Pilot Waypoints directory. Press **[NEXT]** and **[PREV]** as necessary to locate the desired waypoint.
4. Enter the reference number associated with the desired waypoint or enter the identifier in the waypoint entry field. When the identifier is entered, the Waypoint Identification Page for that identifier is displayed.

5. Press **LSK [4R]**, MODIFY to display the Define Position Page for the waypoint.

   NOTE: If the waypoint is being used in a route, flight plan, approach, etc., then MODIFY PLT will not appear; rather, IN USE will indicate that the waypoint cannot be edited. Disregard the remainder of this procedure.

6. Verify the cursor is over the reference waypoint identifier entry field, and then enter the desired identifier. When the identifier is entered, the Waypoint Identification Page for the waypoint will be displayed. When **[ACCEPT]** is selected, the distance and radial from the reference waypoint to the pilot waypoint will be computed and displayed. The radial or distance may be changed provided the waypoint is not in use, or you may enter a second reference waypoint and cross radial.

7. Press **LSK [5L]**, ACCEPT twice to verify a change to the pilot waypoint position.

Best Computed Position Update

All Universal FMS systems are designed to automatically calculate the BCP. However, a manual enroute FMS BCP update over a known point can be performed. In general, a BCP update is accomplished by positioning the cursor over a set of FMS position coordinates and then changing them. The update can be accomplished from the Nav Page 2, the Data Page 3 or a Hold Position Page as described in the following procedure:

NOTE: This procedure affects the system ANP/RNP factor.

1. Press **[NAV]**, then **[NEXT]** to access Nav Page 3.

2. Press **LSK [3L]** to access the Hold Position Page. When over a known geographic position press the HOLD POS LSK.

3. Press **LSK [1L]**, FMS # POS to access the Define Position Page. Press the LSK to position the cursor over the system's latitude coordinate.

4. Enter the desired latitude and longitude as necessary. First, enter the corrected latitude. When the latitude in entered, the cursor will expand to cover the longitude entry field. Enter the corrected longitude. The ± key may be used prior to change the hemisphere (N, S, E, W).

5. Select **[ACCEPT]** to accept the coordinate entries. When the coordinates are accepted, the FMS BCP will be updated.

   NOTE: If the manual input position differs from the frozen position by more than 10.0 arc minutes, a VERIFY POSITION message will be displayed below the coordinates. If the input coordinates are correct, press the ACCEPT LSK.

A snapshot of FMS position will be taken when the HOLD POS LSK is pressed. The FMS will continue to navigate normally. When the new position is entered, the FMS will project current position based on current time and velocities.

ARRIVALS – STARS AND APPROACHES

The Navigation Database contains STARs and the majority of approaches found on commercially available navigation charts. Although the following procedure for linking these procedures into a flight plan is shown in one continuous process, STARs and approaches can be programmed independently of each other.

Approach Guidance

Approach guidance furnished by the FMS is intended to provide a stabilized approach to an appropriate runway threshold crossing height. No “level-off” is provided at minimum descent altitude (MDA) since MDA will often vary as a function of the aircraft approach speed category. The database altitudes provide for a threshold crossing height of 30 to 50 feet above the touchdown zone of the runway. It is the pilot’s responsibility to terminate the descent at MDA if visual contact with the runway environment has not been established.

When Approach mode is activated, the FMS APPR annunciator will illuminate, and the following data will be supplied for flight guidance.

- Bearing to the currently active TO waypoint.
- Desired track or inbound course for the approach.
- Crosstrack error (lateral deviation) – The HSI course deviation display will be like a localizer in that full scale (two dot) deflection indicates a course error of 2° to 350 feet except for approaches with defined RNP values, which will show scaling based on those RNP values.
- Lateral valid (NAV flag out of view) – When the lateral output is valid, the HSI NAV flag will be out of view and the lateral deviation signal can be used. The NAV flag will be out of view when the approach navaid is tuned with a valid signal, there are valid ADC inputs, and the approach integrity requirements are met.
- Pseudo-glideslope (vertical deviation) – The vertical deviation display will be like an ILS glideslope in that full scale (2 dot) deviation indicates an angular deviation of 0.7° (0.35° per dot). An exception is that on Honeywell EFIS, full scale deviation (2 dot) is equal to 250 feet. On most systems, full scale deviation at the End of Approach equals approximately 148 feet for LP, LNAV and LNAV/VNAV approaches or 49 feet for LPV LOS.

- Vertical valid (glideslope G/S flag out of view) – When the vertical output is valid, the G/S flag will be out of view and the vertical deviation signal can be used. The G/S flag will be out of view when the lateral output is valid, the aircraft's position is on the "TO" side of the approach, a valid vertical path is part of the approach, the aircraft's position is within the system's vertical approach geometry limits, and the approach integrity requirements are met. (The geometry limits are similar to those limits imposed while using an ILS glideslope, based upon distance and altitude).

NOTE: In some installations, EFIS equipment may use the digital deviation data, in which the display sensitivities will be determined by the EFIS computer.

With some FGSs (such as FCC 850 or KFC 3100) during an FMS approach, the FGS must be in Approach mode (not Navigation mode) to allow FGS VNAV mode to couple.

NOTE: When the FAF is co-located with another approach waypoint (for example when the FAF is also a procedure hold exit) verify the FAF altitude matches the published altitude constraint.

Regardless of actual position, the waypoints will not sequence and the TO waypoint will remain the same until the aircraft is within 5 nm of the inbound course and the intercept track is within 80° of the inbound course. Once these conditions are satisfied and the aircraft passes the TO waypoint, an automatic leg change to the next approach waypoint will occur.

While outside the sequencing parameters (5 nm of course or 80° of intercept), an aircraft position which is past the TO waypoint will be reflected with a "FROM" flag on the CDI.

An FMS approach which includes a course change between the approach label and EOA of more than 6° from the inbound final approach course is defined as an Advanced Approach. Any approach containing an RF (precision arc) leg will also be labeled as Advanced. Many approaches include several initial approach fixes as “feeder fixes”, depending upon the direction from which the aircraft approaches the airport. These are coded as Approach Transitions in the database, and one may be selected when linking the approach to the flight plan.

If any modification, insertion, or deletion (to include deleting the approach name or EOA label) are made to the approach inserted into the flight plan, the system will cancel (or not allow activation of) Approach mode. However, in the normal NAV mode, the additional waypoints along with the approach waypoints will be sequenced. If a missed approach is flown and the EOA is passed without selecting MISSD APPR on Nav Page 1 or if a go around input is configured, the system will continue to give left-right guidance on an extension of the inbound course. The TO/FR flag will change to FROM, and the distance-to-waypoint will increase.

If missed approach navigation is desired, the pilot must select MISSD APPR on Nav Page 1 or TOGA if configured. This action removes the EOA gap from the lateral guidance leg set. Since the EOA is designated as an overfly waypoint, the approach will continue until that waypoint is sequenced. The missed approach legs will then sequence normally and will provide guidance to the Missed Approach Holding Fix. The pilot may initiate another approach by pressing ARM APPR and then ACT APPR on Nav Page 1. The text INBOUND TO the first approach waypoint will appear.

To regain an approach VNAV plan, the vertical legs must be manually re-sequenced on VNAV Page 2. Canceling and reactivating the approach too soon while climbing straight out during the go-around will cause leg sequencing through all the approach waypoints as the auto sequencing criteria are all satisfied (aircraft track equal to approach course and XTK less than 5 nm).

NOTE: Do not fly any approach under IFR unless the FMS is in active Approach mode. The pilot must select either ARM APPR or ACT APPR at some time prior to the final approach segment if attempting the same approach again following a missed approach.

Approach While in SYNC Mode

If the FMS is in SYNC mode and independent mode is not initiated, the FMS will stay in SYNC mode. This is true throughout the approach, including Arming, Activation, and Missed Approach.

NOTE: Conflict between FMSs will result in SYNC mode cancelling and cause the FMSs to go into independent mode.

When configured for SYNC and performing an SBAS approach, the manual selection of Level of Service (LOS) is synchronized to the offside FMS. If manual selection of LOS is available on one FMS but not available on the receiving FMS, both FMSs will go into independent mode and the FMS SYNC LOSS message will display. However, on initial synchronization, the approach LOS will be independently selected by each FMS.

GPS/SBAS Approach Guidance

The FMS provides localizer performance with vertical guidance for SBAS approach procedures using a GPS/SBAS sensor calculated position. An SBAS Approach is one that is charted as RNAV (GPS) and approved for SBAS.

In addition to standard Lateral Navigation (LNAV) guidance, the FMS provides lateral and vertical guidance for Lateral Navigation/Vertical Navigation (LNAV/VNAV), localizer Performance (LP), and localizer Performance with Vertical guidance (LPV) approach.

LNAV/VNAV approaches use lateral and SBAS vertical guidance from the FMS for a controlled descent to the runway. The FMS provides barometric VNAV vertical descent guidance for LNAV only approaches.

An LP or an LPV approach is similar to an LNAV/VNAV approach except it may have lower approach minimums and requires dual FMS installation. LP approaches use SBAS lateral guidance and advisory barometric vertical guidance data provided by the FMS.

LP is not a fail-down mode for LPV. LP and LPV are independent. LNAV is not a fail-down mode for LP. LP will not be published with lines of minima that contain approved vertical guidance (i.e., LNAV/VNAV or LPV). Both LP and LNAV lines of minima are Minimum Descent Altitudes (MDA) rather than DAs. It is possible to have LP and LNAV minima published on the same approach chart. Based on criteria, designers should only publish LP minima if it provides lower minima than LNAV.

The lateral and vertical precision accuracy provided by the FMS for SBAS approaches is referred to as the approach Level of Service (LOS). Refer to Automatic and Manual Level of Service Selection sections for more information.

SBAS approaches include unique information coded in the Navigation Database used to verify the integrity and validity of the final approach segment. When an approach is approved for SBAS and has LP, LPV or LNAV/VNAV LOS, the FMS will provide the LOS as applicable. When an approach is charted for LP or LPV, the Navigation Database will include a Final Approach Segment Data Block (FAS DB) and a “G” designator is displayed. When the approach is charted for LNAV/VNAV LOS and not LP or LPV LOS, the WGS-84 EOA altitude is included in the Navigation Database to allow the FMS to use GPS/SBAS altitude for the approach.

(SCN 1002.5 and Later)

A gradual transition of the VNAV vertical deviation from the baro-referenced to the WGS-84 referenced glidepath at the Final Approach Fix on an FMS-guided LNAV/VNAV approach is applied. During the transition period, the VNAV target vertical speed is adjusted to improve path tracking performance. If the vertical path into the FAF is level, vertical anticipation is suppressed so that the FAF is vertically sequenced at the same time it is laterally sequenced.

Prior to approach activation, the FMS provides lateral and vertical guidance using multi-sensor filter position/velocity output and corrected barometric altitude. After the final approach fix (FAF), the FMS uses GPS/SBAS sensor outputs for LP and LNAV approach lateral guidance, and lateral and vertical guidance for LNAV/VNAV and LPV approaches. Corrected barometric altitude provides vertical guidance for LP and LNAV approaches.

NOTE: Whether the FMS vertical approach guidance is referenced to Baro Altitude or GNSS elevation is a function of the approach LOS. FMS approach vertical guidance is always referenced to GNSS elevation for RNAV (GPS) approaches when LPV or LNAV/VNAV LOS is provided. FMS approach vertical guidance is always referenced to barometric altitude when neither the LPV nor LNAV/VNAV LOSs are annunciated.

The use of GNSS altitude for LPV and LNAV/VNAV approaches makes Temperature Compensation corrections not applicable, and it will not be applied to final approach segment altitudes. Refer to Temperature Compensation Pages in the Operations section for more information about Temperature Compensation.

NOTE: The GPS/SBAS sensor will be retained for all approaches. Any approach with a "G" suffix to the approach identifier on the approach arrival page signifies that GPS is approved or required for the approach. GPS will not be automatically deselected for any approach type. It is the responsibility of the crew to deselect the GPS/WAAS sensor if GPS is not approved for the approach.

SBAS Approach Annunciation

Valid LNAV/VNAV, LP or LPV approach is annunciated prior to reaching the FAF by a LOS indicator on the NAV Approach Pages. Discrete signals are also provided for external LOS annunciators. If the approach does not contain the Final Approach Segment Database (FASDB) from the Navigation Database, the approach is flown as a standard LNAV approach with advisory barometric VNAV guidance.

Automatic Level of Service Selection

The FMS performs a LOS prediction for the selected SBAS approach upon approach arming and again upon approach activation. At approach arm, the FMS will automatically select the highest available LOS for the selected approach. The selected LOS is annunciated on the Message Page and NAV Page one.

The LOS available for an approach is based on predicted Horizontal and Vertical Protection Levels (HPL/VPL) and the Horizontal and Vertical Alert Limits (HAL/VAL). The highest available LOS is determined by comparing the predicted HPL/VPL against the HAL/VAL. The alert limits are either fixed values or specified in the FAS DB, depending on the LOS (refer to the table below). Predicted HPL/VPL must be within the HAL/VAL for valid GPS/SBAS sensor integrity.

HAL/VAL Limits

Approach LOS	HAL (m)	VAL (m)
LNAV (including non-precision approaches)	556 (0.3 nm)	n/a
LNAV/VNAV	556 (0.3 nm)	50
LPV	NAV DB defined	NAV DB defined
LP	NAV DB defined	N/A

Manual Level of Service Selection

After the approach is armed, LOS is available for manual selection any time prior to sequencing the FAF. The FMS will only allow the selection of a LOS if the predicted HPL/VPL is within the HAL/VAL for that approach LOS. Once the FAF is sequenced, no change to LOS can be made.

1. Press [NAV] to access NAV Approach Page one.
2. Press LSK [4R] to access the RNAV Approach LOS Page. All available LOSs are displayed.
3. Press the left LSK adjacent the desired LOS to select the LOS. The text "(IN-USE)" will be displayed next to the selected LOS and the LOS indicator on NAV Approach Page one will be updated.

CAUTION: **CHANGING FROM A HIGHER APPROACH LOS TO A LOWER LOS MAY CAUSE THE FMS TO SWITCH FROM GNSS ELEVATION TO BARO ALTITUDE. THIS CAN CAUSE THE AIRCRAFT TO DESCEND OR CLIMB TO INTERCEPT THE VERTICAL PATH.**

Dual FMS Cross-Channel Monitoring for SBAS Approach

The FMS utilizes cross-channel (XC) monitoring to meet the integrity requirement for severe-major hazard levels during LP and LPV LOS for SBAS approaches. When an FMS is flying an LP or an LPV approach, the offside FMS monitors the onside guidance using independent hardware, and independently assert guidance flags on the primary flight display (PFD) of the guiding FMS.

NOTE: Either or both FMSs could be a "guiding" FMS during an approach, and each would also act as a "monitoring" FMS for the other.

The FMS can provide guidance to an LP or LPV approach while monitoring the same LP or LPV approach, a different LP or LPV approach, or no LP or LPV approach from the other FMS. Both monitoring and guiding FMSs use aircraft position from their respective internal SBAS receiver, and the FAS DB from the guiding FMS.

Cross-channel monitoring is initiated when the guiding FMS indicates an approach is active and LP or LPV is selected, and the monitoring FMS detects that the aircraft is either inside the FAF or less than 1,000 feet above the runway. Cross-channel monitoring is suspended when the FMS is no longer in Approach mode.

Requirements for LP or LPV Approaches:

- Dual FMS installation with both FMSs powered-up and operational (or a single FMS with an LPV monitor, as described in UA Service Bulletin 3116.52.( )-34-3292)
- The GPS/SBAS sensor must be receiving valid integrity and position information
- The pilot must verify that LP or LPV is properly annunciated and there are no NAV flags in view. This check should take place inside the FAF and no later than 1,000 feet above the runway threshold.

In addition, the following sequence of events must occur:

1. At initial installation of the FMS, the installer must configure the antenna offsets, guidance busses, and monitor ports correctly, and must confirm the configuration via a PAS dynamic test. Confirmation must be performed, or the FMS will inhibit selection of LP or LPV LOS.
2. At power-up, each FMS runs a Built-In Test (BIT) of the hardware used for cross-channel (XC) monitoring (XC BIT). The testing FMS waits for the monitoring FMS to power-up, then it sends test guidance labels to the monitoring FMS on the cross-channel bus. The test passes if it receives those same test labels on the guidance bus from the monitoring FMS. If the test fails or is interrupted for any reason, the testing FMS prohibits LP or LPV LOS selection when the approach is armed. Additionally, the CDU message LPV APPR INHIBITED or LP APPR INHIBITED is displayed after power-up. Interrupts of the testing FMS can be caused by running a dynamic test, arming/activating an approach, or when a ground-to-air transition occurs. The LP or LPV APPR INHIBITED message will remain on the Message page until the self-test is re-run and passes, e g. power must be cycled in both FMSs.
3. When an LP or LPV approach is loaded into the flight plan of the guiding FMS, the guiding FMS validates the cyclic redundancy check (CRC) of the FAS DB and forwards it to the monitoring FMS, which also validates the CRC. If the guiding FMS detects a CRC mismatch, the PA DATABASE FAIL message is displayed and LP or LPV LOS cannot be selected.
4. When the approach is armed or activated, the FMSs perform a LOS prediction. If the monitoring FMS detects a CRC mismatch at approach arm, it will signal the guiding FMS to prohibit LP or LPV LOS. The guiding FMS then selects the next highest level of service published for that approach that is supported by the predictions. However, it will not select LP or LPV if any of the above steps failed to validate the availability of LP or LPV.

   When the approach is activated, each FMS repeats the LOS prediction. If the prediction no longer supports the selected level of service, the "LPV NOT AVAILABLE", "LP NOT AVAILABLE", or "LNAV/VNAV NOT AVAILABLE" message is displayed.

5. When sequencing the FAF with LP or LPV LOS selected, the monitoring FMS begins cross-channel monitoring.

   For LPV and LNAV/VNAV approaches, if the monitoring FMS is unable to monitor for any reason, it will command the guiding FMS to revert to LNAV, or NONE if LNAV minima is not published for the approach.

   LP approaches do not automatically revert, if an issue is encountered with the LP approach, the LOS will remain LP and the guidance data will be flagged. LNAV LOS (if available), must be manually selected prior to the FAF in order to change LOS if LP is the original LOS selected.

   NOTE: If the LOS is NONE, the LNAV annunciation will not be illuminated.

6. After passing the FAF, if the monitoring FMS detects a guidance error, it will command the guiding FMS to flag its guidance outputs. If the guiding FMS does not flag guidance, the monitoring FMS will force the guiding FMS to remove output to the PFD, causing guidance flags on that side only.

Step-down Fixes on LPV Approaches

In accordance with FAA AC 20-138D, 12-8.c: Many U.S. RNAV (GPS) approach procedures include an LPV line of minima along with the LNAV and LNAV/VNAV lines of minima. However, a final approach segment step-down fix published on an approach procedure chart that has coincident LNAV, LNAV/VNAV and LPV lines of minima does not apply to the LPV minima. An LPV approach mimics an ILS approach in its construction, presentation, and execution by the flight crew so that LPV has no unique training requirements. Step-down fixes on an LPV approach have no effect on the approach vertical path, but are presented on the map display, and should be ignored by the flight crew.

NOTE: Bearing and Distance to Waypoint displayed on PFD/HSI are always to the next waypoint, including step-down fixes on LPV approaches. Distance to the approach LTP/FTP are displayed on the FMS CDU, NAV page 4/4.

Dissimilar LOS Annunciations with Dual FMSs

Safety analysis requires the guiding and monitoring functionality described herein. Each FMS computes guidance independently. Therefore, each FMS can fly the best available LOS without regard to the LOS selected on the other FMS.

Possible causes of dissimilar LOS selection include (assuming the same approach is loaded in both FMSs):

- XC BIT fails on only one FMS because it was interrupted (may be caused by faulty wiring or pilot actions)
- A hardware failure or wiring fault that prevents guidance monitoring
- Weak satellite reception caused by airframe masking, poor antenna bonding, etc.

Pilot Action

If dissimilar LOSs are annunciated, the approach may be continued to the published minimum using the best LOS available. The LOS flight guidance to be used must be displayed on the pilot-flying PFD. This may require transfer of control to the other pilot. If the approach is coupled, the same FMS providing flight guidance to the PFD for the pilot-flying must be used for the autopilot.

In a two-pilot aircraft, UA recommends that Standard Operating Procedures (SOPs) be established for contingency actions in the unlikely event of having split or dissimilar LOS annunciations, especially at or inside the FAF. These SOPs should cover how the flight crew will respond and what actions should be taken.

With dissimilar LOS annunciations, as long as one of the FMSs is showing LP or LPV LOS, it is possible to continue to those minima on the approach as long as the Pilot Flying (PF) or the side coupled to that FMS is in control. If the PF side does not have LP or LPV LOS annunciated and LP or LPV is required to complete the approach successfully, then one the following SOPs should be adopted.

- Establish an SOP for the orderly transfer of control from the PF to the PNF. This would be similar to a case where glideslope or localizer is lost to the PF, and hand off to the PNF would be accomplished, or
- Establish an SOP for the transfer of navigation source for the PF to the FMS which has LP or LPV annunciated, or
- Establish an SOP to brief all the available LOSs for the approach, so that in the event of dissimilar LOS, the flight crew will be able to use the higher minima without control transfer or navigation source change, or
- Establish an SOP to “GO MISSED” if there is a split of LOS annunciation.

CAUTION: **UNDER NO CIRCUMSTANCES SHALL THE APPROACH BE CONTINUED TO LP OR LPV MINIMA WITHOUT LP OR LPV ANNUNCIATED ON THE CONTROLLING SIDE.**

SBAS Approach Integrity Loss

If the actual HPL or VPL degrade after the approach arm prediction but before approach activation, the FMS will activate the approach, and flag the appropriate lateral and/or vertical guidance. A message is displayed indicating LP, LPV or LNAV/VNAV NOT AVAILABLE from which the RNAV approach LOS Page may be accessed. Prior to sequencing the FAF, the pilot may manually select an available LOS from the RNAV Approach LOS Page.

Upon sequencing the FAF, if the required HPL or VPL exceeds the required HAL or VAL for the selected LOS, the FMS will automatically downgrade to LNAV LOS and flag vertical guidance LPV or LNAV/VNAV approaches.

LP approaches will not be downgraded to LNAV; the LP LOS will remain as the selected LOS with the lateral/vertical flags in view. The FMS LP indicator will be displayed in caution font.

NOTE: If the HPL does not support LNAV LOS, the FMS will flag both lateral and vertical guidance. The FMS LOS indicator will display LNAV in caution font (typically yellow). The pilot may select missed approach, which will return the FMS to standard multi-sensor navigation.

Arm Approach Mode

Automatic Arming – If the approach has not been manually armed by the time the aircraft reaches 30 nm from the destination, the FMS will automatically arm the approach.

Manual Arming – When the aircraft is within 50 nm of the runway (direct distance), the ARM APPR option will become available on the **[NAV]** Page 1. Press **LSK [3R]**, ARM.

Once armed, the following occurs:

- The FMS determines the highest available LOS, activates the LP or LPV annunciator if applicable, and annunciates this on the Nav Page 1. Unless changed manually, this is the selected LOS for the approach
- The XTK will display a (T) to indicate that the HSI sensitivity is 1-mile full scale deflection
- If the Remote Tune option is available, the ARM APPR prompt changes to TUNE APPR if the appropriate VOR or ILS frequency is not tuned. Pressing this prompt tunes the VHF receiver.

NOTE: If an ILS approach is linked into the flight plan, but the FMS is not configured for advanced EFIS, then ARM APPR will not appear. The FMS will fly all approach transitions up to the FAF, but prior to that point the pilot should transition the navigation source and FGS mode to ILS guidance.

Sensors (Loran C and non-TSO C146b GPS) that cannot meet the terminal or approach accuracy criteria are automatically deselected for VOR, RNV, GPS, GLS, NDB and TACAN approaches. If available, IRS(s) will remain selected during all approaches for position smoothing computations.

If the pilot takes no further action, the entire approach procedure including DME arcs, procedure turns, etc. will be flown. Upon sequencing through the Approach label (e.g., *RNV 11L*) in the flight plan and maneuvering inbound to the final approach course, the FMS will automatically sequence to the ACTIVE APPR mode.

At any time, if a DTO is performed to a waypoint in the approach, and the approach was previously armed, then the approach will automatically activate.

Activate Approach Mode

Automatic Activation – An approach will automatically activate when any approach waypoint is sequenced with approach mode armed and the aircraft track angle is within the Approach Track Angle Tolerance (80 degrees for roll-steered autopilot or 15 degrees for dev-steered/no autopilot.

Manual Activation – From any **[NAV]** page, press **LSK [3R]**, ACT APPR.

- All intervening waypoints from the present FR-TO leg to the first approach waypoint will be sequenced, and course guidance will be to that waypoint
- Desired track pointer will be set to the inbound course of the approach
- The FMS will transition to FMS HDG mode, and the pilot must manually set up the correct approach intercept angle. Normally this will coincide with radar vectors given by ATC

  NOTE: Some aircraft may be configured to skip auto-activation of heading mode at manual approach activation. In this case, the pilot should select Heading Mode on the FGS prior to manually activating the approach on the FMS.

- Once the correct intercept angle is established, press the INTERCEPT LSK on Nav Page 1 to allow interception of the final approach course. **Failure to activate INTERCEPT mode will cause the aircraft to maintain current heading and fly through the final approach course.**

Insert Approach or STAR into the Flight Plan

NOTE: All arrival procedure altitudes are based on QNH (MSL) altitude and not QFE.

NOTE: The FMS will default to departure procedures (SIDs) being applied to the first airport in the flight plan. The FMS will default to arrival and approach procedures being applied to the last airport in the flight plan.

A STAR may be linked into the flight plan in a manner similar to that for linking a SID.

Pilot Defined Runways and STAR enroute transition are denoted by a percent sign (%) next to the identifier.

1. From the Flight Plan Pages, press **[MENU]** to display Flight Plan Menu Page 1. Press ARRIVE, **LSK [4R]**, to access the Arrival Page. The destination airport will pre-fill the ARRIVE field.

   An approach may also be entered via the selection list on the left side of the Arrival Page, or by entering a Channel ID.

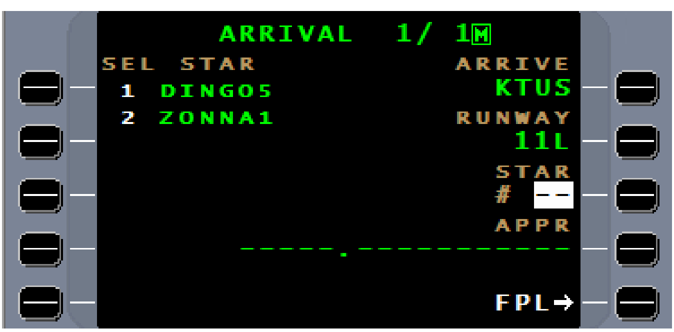
2. If an SBAS approach contains a Channel ID (refer to the published approach plate), the approach may be selected by entering its Channel ID at **LSK [4R]**. If an invalid Channel ID is entered, the field will flash.

   The FMS will automatically fill in the approach field (and runway if necessary). A STAR and/or transition may then be entered as described below. Or select FPL, **LSK [5R]**, to return the display to the Flight Plan Pages where the approach will now be a part of the flight plan.

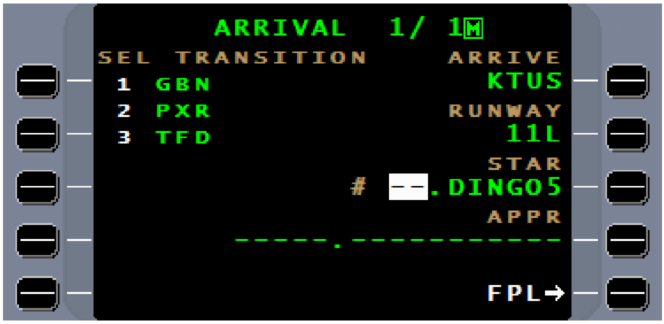
3. To enter a non-LPV or non-LP approach, select a landing runway from the selection list on the left side of the page and press **[ENTER]**.

   After the runway is selected, the cursor will advance to the STAR field and a list of STARs for that airport will appear.

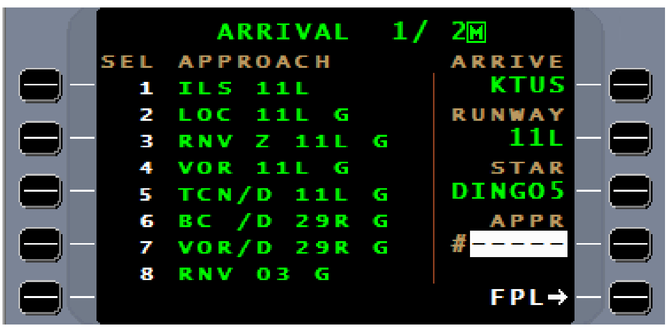
4. If desired, select the STAR by entering the reference number from the list and press **[ENTER]**.



5. A list of transitions for the selected STAR is displayed. Select the transition and press **[ENTER]**.



6. A list of approaches is displayed. Select the approach and press **[ENTER]**. If the Channel ID of the approach is known, it may be entered in the APPR field.



A "G" next to the identifier denotes that the GPS sensor is either approved or required for the approach. Advanced approaches are denoted by an "A" to the left of the identifier.

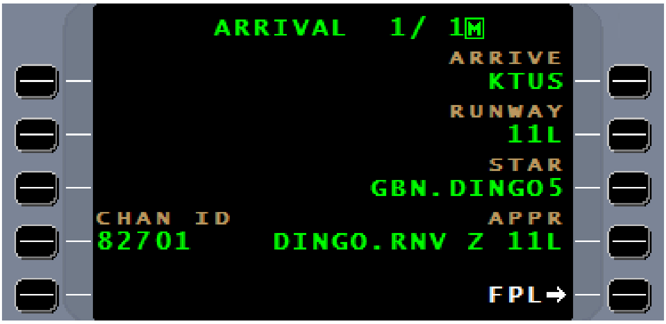
Pilot defined approaches are denoted by a percent sign (%). A "R" next to the identifier for approaches denotes an RNAV(RNP) approach type. The display of "R" will take precedence over the display of "G".

NOTE Approach Lateral Steering must be configured as ROLL; or in certain autopilot installations, Lateral Steering must be configured to DEV and Advanced Approach Steering configured to ENABLED to utilize advanced approaches. An advanced approach can be selected from this page when not configured for advanced approaches; however, the FMS will not arm or activate the approach.

7. Select the desired approach transition, if any, by entering the reference number.

NOTE: Selecting the approach and its transition may be delayed until later in the flight.

When an SBAS approach is selected, the Channel ID is displayed adjacent LSK 4L.



8. Select FPL, **LSK [5R]**, returns the display to the Flight Plan Pages, where the STAR legs and approach will now be a part of the flight plan, as shown.

NOTE: A STAR containing a RADAR vector might specify guidance actions to the FMS resulting in not maintaining an existing heading. The pilot should compare the arrival chart to the FMS flight plan to ensure that the correct heading is coded prior to the RADAR vector leg. If it is not, the pilot must be prepared to discontinue FMS guidance after the waypoint where the vector leg starts.

If the STAR chart does not specify a heading, the pilot must assume that ATC requires the existing heading be maintained until further clearance is issued. If the STAR provided by the database contains headings not shown on the STAR chart, the pilot must discontinue FMS guidance unless such headings are specifically authorized by ATC.

If the STAR provided by the database does not contain a RADAR vector heading or required course from the waypoint where the RADAR vector on the chart begins, the pilot must discontinue FMS guidance of the RADAR vector waypoint and maintain the present heading until instructed otherwise by ATC.

In many cases, linking a STAR and approach creates a NO LINK between the last STAR waypoint and the first approach waypoint. Leaving the NO LINK in the flight plan ensures that the RADAR vector waypoint is over flown, and the last heading maintained.

9. Review the resulting flight plan for continuity – with no GAPS, "NO LINKS" or duplicated waypoints, and that it confirms to the intended path of flight.

CAUTION: **IT IS THE RESPONSIBILITY OF THE PILOT TO RESOLVE THESE DISCONTINUITIES AND EDIT THE FLIGHT PLAN ACCORDINGLY.**

- When a SID, STAR and approach are linked into a flight plan, *NO LINK* will be inserted at the transition points if the end waypoint of one procedure is not the same as the beginning waypoint of the next procedure. These can occur at the SID-to-Enroute, the Enroute-to-STAR and/or the STAR-to-Approach transitions

Delete the *NO LINK* using Flight Plan editing techniques or go Direct-To another waypoint after the *NO LINK* to maintain a continuous flight plan sequence

- Inserting a SID or STAR procedure may duplicate existing waypoints when linked into a flight plan. For instance, if the flight plan were generated on J-45 from STL to Atlanta KATL, the waypoints LAJUG, Nashville (BNA) and Atlanta (ATL) would be inserted automatically at the end. The flight plan would read:

5	....
6	LAJUG
7	BNA
8	ATL
9	KATL

The redundant waypoints should be edited out of the flight plan before reaching BNA. This procedure will then "close up" the flight plan which will now read correctly as follows:

6	LAJUG	DELETE
7	BNA	
8	BNA	
9	DRAKK	
10	NEUTO	
11	RMG	
12	ERLIN	
13	DALAS	
14	ATL	
15	KATL	

- Inserting a SID or STAR procedure may produce a "GAP" between existing waypoints when linked into a flight plan. Refer to Insert or Delete a Gap in Flight Plan in the Predeparture section for more information.

Edit Altitudes

Procedures for entering altitudes during arrival and/or approach are identical to entering altitudes during enroute operations. Refer to Enter an Altitude in the Pre-departure section for more information.

However, an altitude cannot be entered if the waypoint is active in approach. If a waypoint is part of the approach common segment, an altitude that is less than the Navigation Database altitude cannot be entered or edited.

Altitudes of Pilot Defined approaches cannot be edited on the Flight Plan pages; the approach definition must be redefined.

ILS, LOC and BC Approaches

When ILS, LOC and BC approaches are configured as Advisory only, the approaches utilize terminal mode Course Deviation Scaling instead of approach mode scaling.

ILS, LOC, and BC approaches can be linked into the flight plan using normal procedures. However, when the aircraft is 50 nm from the destination, the ARM APPR option will not appear, and the approach can never be activated. If the waypoints are flown in sequence, including transitions, the FMS will provide roll steering to each waypoint, but all navigation will be predicated upon whatever short range and long range sensors are being used at the time. Localizer and glideslope signals will not be available for display nor to couple to the flight director/autopilot.

After the FAF is sequenced, the Missed Approach option [NAV]/LSK [3R], MISSD APPR is available from the Nav Page (or TOGA) for activation of the missed approach procedure.

When LOC and BC approaches are configured as ENABLED, the LOC STEERING ACTIVE message is displayed on the message page, the FMS XTK and roll steering calculations are based on the raw localizer signal input.

Holding During Approach Operations

Holding pattern setup is described in more detail in the ENROUTE portion of this section. Holding while in VNAV Descent mode is described in the VNAV portion of this section.

When both a holding pattern and an approach are armed, either the HOLD ARMED or the APPR ARMED banner will appear on Nav Page 1. When a holding pattern is programmed at a waypoint in the approach transition, the FMS will enter the hold and HOLD ARMED will display. When the holding pattern is exited, Approach mode will arm automatically and APPR ARMED will again annunciate.

Normal approach activation will occur when the approach label sequences through the TO waypoint and the aircraft is inbound to the runway. If the pilot determines not to enter the holding pattern, the DISARM HOLD function on the Maneuver Page can be used to eliminate the holding pattern.

Either Holding or Approach mode may be active. If Approach mode is armed at the time that a holding pattern is activated, it will remain armed until the holding pattern is exited.

Automatic or manual termination of a holding pattern is determined by examining the waypoint depiction on the Navigation or Flight Plan Pages. Automatic termination applies to a procedural hold usually used as course reversals instead of procedure turns. When the holding pattern automatically terminates, the next waypoint to be sequenced is listed after the hold on the Nav Page.

Activate Temperature Compensation

CAUTION: **WHEN ALTITUDES ARE MANUALLY ENTERED, IT MAY PRODUCE VNAV PATHS WITH CLIMB SEGMENTS, AND RESULT IN A VNAV DISCONNECT.**

1. Press **[FPL]** to access the Flight Plan Pages.
2. Press **[MENU]**, then **[NEXT]** to access Flight Plan Menu Page 2.
3. Press **[TEMP COMP]** to display the Temperature Compensation Page(s).

Initially, the Temperature Compensation Page will indicate 1 of 1 until all required data is entered and the feature activates.

4. Enter ARPT TEMP (in either °C at LSK [2L] or °F at **LSK [3L]**). The temperature must be entered manually by the pilot, and can be in the range of 0° C to -70°C or 32° F to -94° F.
5. Enter ARPT ELEV at **LSK [2R]**. The ARPT ELEV will be prefilled with the airport or runway elevation from the flight plan approach but can be manually overwritten.
6. Press **LSK [5L]**, ACTIVATE.

When activated, the subtitle will show TEMP COMP ON and LSK [5L] will change to CANCEL. The number of available Temperature Compensation Pages will increase to show all waypoints of the approach, including transition and missed approach. The compensated altitudes will be used in the VNAV calculations for enroute VNAV and pseudo-glideslope.

A "calculator function" is available such that any altitude can be entered on Temperature Compensation Page 1 at LSK [4L], and the resulting temperature correction will be displayed.

Cancel Temperature Compensation

1. Press **[FPL]** to access the Flight Plan Pages.
2. Press **[MENU]**, then **[NEXT]** to access Flight Plan Menu Page 2.
3. Press **[TEMP COMP]** to display the Temperature Compensation Page(s).
4. Press **LSK [5L]**, CANCEL.

   Altitude correction will be removed from all previously corrected altitudes.

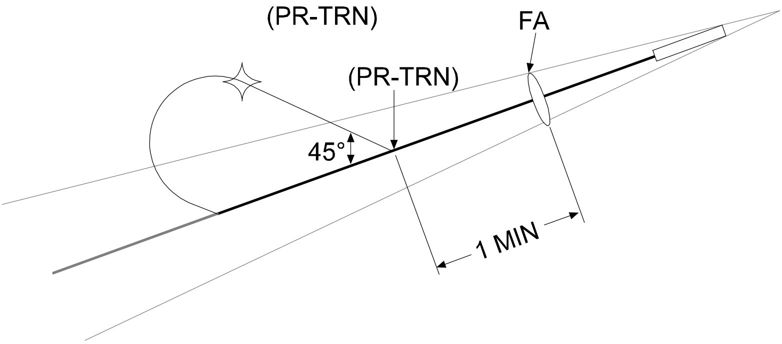
Alternately, if a new airport and approach are entered in the flight plan, Temp Comp will cancel, altitude corrections will be removed, and the charted altitudes from the database will be used.

NOTE: Any manual change to airport temperature or elevation will deactivate Vertical Navigation if it is active.

Procedure Turns

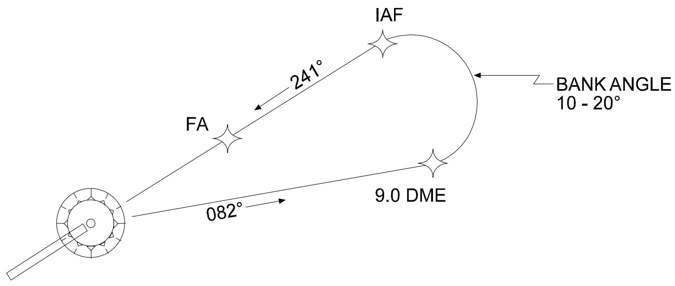
The FMS can fly two different types of procedure turns: the standard procedure turn and the teardrop procedure turn.

Standard Procedure Turn



The standard procedure turn is defined per ARINC 424 (called a PI leg type). When proceeding outbound, the aircraft will cross the fix and continue for one minute (or less, depending upon turn boundary and groundspeed) before turning to the 45° reversal leg. On ARINC 429 displays, the notation (PR-TRN) may be displayed at the beginning and end of the 45° outbound leg as shown above. When groundspeed is high, causing the aircraft to violate the procedure turn boundary limit (typically 10 nm), then the one-minute outbound leg will be shortened accordingly.

Teardrop Procedure Turn



Some approaches are coded such that a teardrop is used to accomplish course reversal for the initial approach transition. In these cases, the aircraft will proceed outbound from the navaid using a "Course-from-Fix-to-DME" type leg that is 15° to 30° from the inbound leg, then turn to capture the Course-to-Fix leg inbound to the initial approach fix or FAF. During the turn, the FMS will command the correct bank angle, typically in the order of 10° - 20°, to cause an intercept at or outside of the IAF or FACF.

NOTE: The limited bank angle algorithm will only be flown if crosstrack deviation is less than 6 nm at the time of transition from the outbound to the inbound leg. If crosstrack is greater than 6 nm, the FMS will command maximum bank angle to capture the inbound leg. Typically, this is not a problem, as these types of approaches are defined such that initial crosstrack deviation is in the order of 3 to 5 nm.

Missed Approach Procedure

1. From any **[NAV]** page, press **LSK [3R]**, MISSD APPR.

   MISSD APPR option is available when a missed approach procedure is defined in the flight plan, the approach is active and FAF has been sequenced.

   The MISSD APPR option is available when a missed approach procedure is defined in the flight plan and the approach is active. The MISSD APPR option is available both outside and inside the FAF.

   The MISSD APPR option will not be displayed for advisory approaches.

2. Or, in certain configurations, press the Go-Around button.

   - The current approach will be canceled
   - FMS sequences beyond the *EOA* gap, allowing normal leg sequencing after passing the MAP (usually MAxx or RWxx)
   - Lateral deviation will revert to ±1.0 nm scaling and vertical deviation will flag.

   NOTE: Pressing the Go-Around button causes the FGS to enter GA mode. Navigation mode should be re-selected to couple FMS lateral missed approach guidance.

The initial legs of missed approaches are often of type CA or VA; however, the aircraft might or might not already be at or above the specified altitude when the initial leg sequences.

NOTE: If the missed approach is activated prior to reaching the missed approach waypoint (MAWP), the full-scale deflection (FSD) will change to 0.3 NM. At the MAWP, the FMS will maintain the FSD crosstrack value of 0.3 NM if the first leg of the missed approach is a TF leg aligned within 3 degrees of the approach inbound course. Otherwise, the FSD will be 1.0 NM.

NOTE: After a missed approach has been initiated, do not re-arm the approach until sequencing into the missed approach section or performing a tactical maneuver, such as DTO or PVOR.

On certain EFIS or multifunction displays (MFDs), if the initial leg of a missed approach procedure is of type CA or VA, the waypoint identifier will not appear on the EFIS MAP display (the identifier field will be blank) until the leg becomes the active navigation leg. If the aircraft is at or above the specified altitude, the FMS will immediately sequence past the waypoint. If the aircraft is below the specified altitude, the EFIS will display the specified altitude adjacent to the leg terminator identifier. The leg identifier will appear as XXXX, where XXXX is the specified altitude for the leg.

Missed Approach Points Display

1. From any **[NAV]** page, press **[MENU]** to display the Nav Menu Page.
2. Select MAP DISPLAY, **LSK [2L]**.

3. Press **LSK [1L]** to toggle between ENABLE and DISABLE of the Missed Approach Map display.
4. Press RETURN, **LSK [5R]**, to return to the Nav Menu Page.

When the MAP Display is on, the FMS transmits the missed approach legs along with flight plan records for depiction on the navigation display. This does not occur when the MAP Display is off.

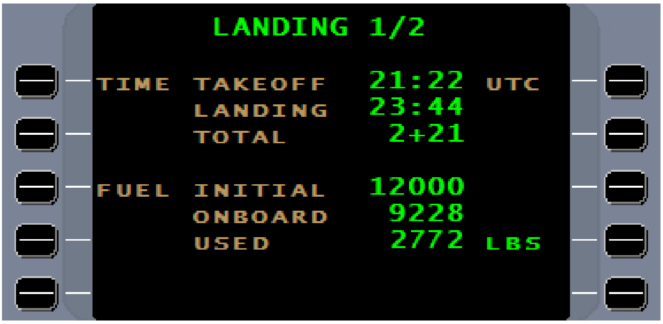
The MAP Display automatically turns on when either the TO or NX waypoint is a missed approach waypoint.

Equipment Limitations

In accordance with FAA AC 20-138D, 5-3.2.b: GPS/SBAS equipment that complies with the standards implemented by TSO-C146c (UNS-1 ( )w FMS/GPS/SBAS equipment operating software SCN 1002.X/1102.X covered by this manual) does not have an equipment limitation for the aircraft to be equipped with other navigation systems appropriate to the operation. It is also acceptable to flight plan an alternate using an RNAV approach to LNAV minimums at the alternate airport rather than a ground-based approach aid (see AC 20-138D, paragraph 15-7.1 and Aeronautical Information Manual sections 1-1-19, 1-1-20, 1-2-3, and 5-4-5). Additionally, GPS/SBAS equipment may be used on RNAV 'T' and 'Q' routes within the contiguous United States and Alaska. AC 90-100 (latest revision) contains specific information on performance requirements for RNAV routes.

After Landing

Upon touchdown, the Landing Summary Pages are displayed (the Landing Page may not be displayed when landing at high pressure altitude airports).



Check Best Computed Position Accuracy

At the pilot's discretion, the accuracy of the FMS BCP can be checked against the actual airport coordinates. In addition, each sensor's derived position can be checked against the BCP.

Best Computed Position/Sensor Accuracy

To compare each sensor's derived position coordinates against the FMS best computed position:

1. Access Landing Summary Page 2 by pressing **[NEXT]**. This page will display the FMS BCP (FMS # POS) coordinates, the most significant sensor's derived position coordinates, and the difference between the two.

2. Use the LSKs to select other sensors' position coordinates as desired.

   NOTE: Minor individual sensor inaccuracies are not always apparent, as the FMS BCP is derived from multiple inputs. For this reason, it is recommended that each sensor's accuracy be checked individually. Significant differences between an individual sensor's position and the FMS BCP are continuously guarded against by the sensor "watchdog."

Best Computed Position/Airport Coordinates Accuracy

To compare the BCP with the actual airport coordinates while on Landing Page 2:

1. Press the **[FMS # POS]** LSK to access the Define Position Page.

2. Use the **[REF WPT]** LSK to position the cursor over the reference waypoint identifier entry field.

3. Enter the airport identifier or the PILOT WPT identifier for the parking ramp coordinates. When the identifier is entered, the distance and radial to the aircraft's present position will be computed and displayed.

4. Press **[RETURN]** to exit the page with no changes.

System Shutdown

1. Press **[ON/OFF/DIM]**. The dimming control window will be displayed.
2. Select **LSK [5R]**, OFF/STBY.
3. Press **LSK [1R]**, CONFIRM OFF. The system will shutdown.

Standby Mode

Standby mode is a configurable option only available when the aircraft is on the ground. This mode allows the flight crew to shut down and restart the system within a specified period of standby time and still retain pilot data, certain flight plan data, and fuel data. Standby data is not retained when the current aircraft position is greater than 2 nm from the shutdown position.

NOTE: When a flight plan is created that contains SIDs, STARs, or approaches, anomalies in these procedure legs can occur if the FMS is powered on after a standby power cycle.

CAUTION: **IF STANDBY MODE IS USED, DO NOT INSERT SID, STAR, OR APPROACH PROCEDURES INTO THE FLIGHT PLAN PRIOR TO PLACING THE FMS IN STANDBY.**

Set Standby Mode

1. Press **[ON/OFF/DIM]**. The dimming control window will be displayed.
2. Select **LSK [5R]**, OFF/STBY.
3. Press **LSK [1R]**, CONFIRM STBY.

Standby Resume

1. Press **[ON/OFF/DIM]** to activate the system.

The system will turn on and perform a self-test.

If the self-test is successful, the Standby Resume Page is displayed. Press any function key to continue. The flight plan data, weights and fuel is retained upon power.

Engine Failure/Shutdown

Should an engine fail or be shut down in flight, a FUEL FLOW FAIL message will be displayed on the FMS. In addition, the digital fuel flow readout on the Fuel Flow Page (Fuel Page 5) will read FAIL for that engine. The FUEL FLOW FAIL message and FAIL display will also occur if the fuel flow sensor fails.

If the engine is still operating properly and a false message is suspected, or if the engine was temporarily shut down and restarted, a reset may be attempted:

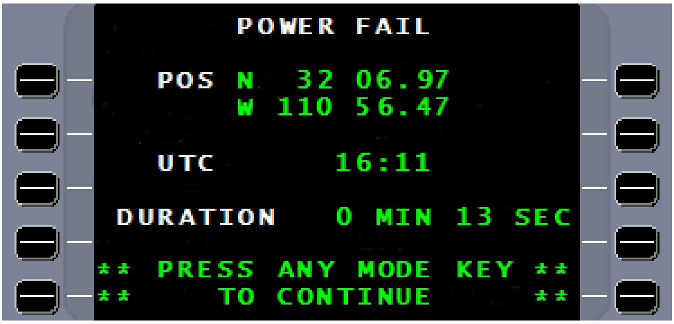
1. Press FUEL, then **[NEXT]** to display Fuel Page 5.
2. Use the LSKs to position the cursor over the FAIL indication.
3. Press **[BACK]** and then **[ENTER]** to reset the readout.

If the sensor or interface has failed, the FAIL indication will reoccur after a four-minute delay. If this occurs, manually input a fuel flow over the word FAIL and press **[ENTER]**.

If the engine has been shut down or has failed, the pilot may manually enter a zero value for the fuel flow of the failed engine (in place of the word FAIL). This will reinstate fuel related estimates such as fuel over destination, specific range, etc., for the remainder of the trip.

Power Failure (In-flight Initialization)

These procedures are to be followed after electrical power is restored following a power failure to the FMS. This may include a simultaneous power loss to the GPS/SBAS and Loran C sensors. For in-flight initialization refer to Power Failure for Over Seven Minutes in Abnormal Procedures.



Power Failure For Up To Seven Minutes

1. Press **[ON/OFF]**. If power is interrupted for less than seven minutes, but more than seven seconds, the Power Fail page is displayed. If power interrupt time span is less than seven seconds, the display will show the same page that had been in view prior to the power interruption. In either case, the remainder of this procedure remains the same.

   <u>NOTE</u>: The latitude/longitude displayed on the Power Fail Page represents the BCP coordinates at the time of power failure. The UTC shown is the time of that failure, and the duration of the interruption is displayed in minutes and seconds.

2. Press **[DATA]** to access the FMS Position Page (Data Page 3).

3. Use the LSKs to individually select the best long-range sensor that has a position available (GPS preferred).

NOTE: If the sensor latitude/longitude coordinates are displayed, the power interruption lasted less than seven seconds. The sensor is continuing to supply the FMS with position information, although it will be in error by the distance traveled during those few seconds.

If dashes appear on all sensors, the power interruption lasted longer than seven seconds. The latitude/longitude coordinates displayed after POS represent the FMS dead reckoning position estimate calculated using the last known groundspeed and track angle for the duration of power loss.

4. Press **[DATA]** to access the Sensor Summary Page (Data Page 2). Verify the sensors return to navigation and reselect if necessary. After a short delay, the EPU should decrease to a normal value.

   If a short-term power fail of less than seven seconds occurs while in SYNC mode, the FMS that lost power will sync to the FMS retaining power. If both FMSs experience a power fail, the FMS second to initialize will synchronize to the first after recovering from the power fail.

5. Press **[MSG]** and check the display for messages. The POS UNCERTAIN message should disappear.

NOTE: If an inertial sensor is installed, its backup power supply will have kept the IRS navigating through the power loss.

If desired, the IRS1 or IRS2 Nav Page can be selected. This is accomplished by positioning the cursor over each FMS BCP (POS) coordinate line and write down the IRS's latitude and longitude coordinates. When the coordinates are entered, the FMS and all Loran C sensors (if still in the SEARCH mode) will be updated to the new position.

It is not possible or necessary to update or change the IRS latitude/longitude position coordinates once the initial alignment is correct.

Power Failure for Over Seven Minutes

If power is interrupted for more than seven minutes, the FMS will initiate full power-up sequence when restarted. The following procedure can be applied when electrical power is restored or when the system is powered up in flight for the first time:

1. Press **[ON/OFF]**. The system will run through the self-test and then display the Initialization Page. The latitude/longitude displayed will be coordinates displayed at the time of the power loss.
2. Press **LSK [5L]**, ACCEPT to accept the initialization data.

   NOTE: The system must be initialized before any updated coordinates may be input onto one of the Nav Pages.

3. Refer to Best Computed Position Update in the Arrival section to update sensor and FMS BCP before selecting a flight plan.

Navigation Sensor Accuracy Messages

Should one or more messages concerning navigation sensor accuracy be active, the corrective action(s) required will vary with the number and type of sensors installed. Rather than attempt to cover every combination of messages possible for the mix of sensors installed on an aircraft, included in the following paragraphs are the factors and general thought processes which should be considered in an assessment of the situation.

The FMS integrates information from all available navigation sensors to derive a BCP. Because each type of sensor has different characteristics affecting its ability to provide accurate latitude/longitude information, the FMS computer must assign a priority to each sensor for use in the position calculations. A conservative approach has been used for automatic sensor de-selection to eliminate errant sensors; however, the pilot must still monitor sensor input and evaluate sensor de-selection or the need for such de-selection.

Messages concerning navigation sensor inaccuracies are especially important on over water flights where DME-DME position is not available to determine which sensor is inaccurate. Proper action by the flight crew in manually deselecting the faulty sensor and possibly updating the FMS is necessary to assure accurate tracking.

A sensor comparator gives position differential warnings with FMS messages for GPS and Loran C sensors and for a second FMS in dual installations, at 6, 12, 18, and 24 nm from the FMS BCP. For IRSs, the comparator sensor evaluates the rate of change of the IRS position against that of the FMS BCP. A decision on the part of the pilot to update or to deselect a sensor must take into account the position error involved, the error growth rate, and the stations being received.

For highly divergent sensors, based on the average position of all the other sensor positions, an individual sensor will be automatically deselected if that sensor's position differs from the average position by more than 50 nm, or if the sensor position is changing from that position at a rate exceeding 50 knots.

Always check the latitude/longitude position of all sensors when any navigation sensor's accuracy message becomes active. Action should be taken by checking the following items.

- Which sensor(s) was more accurate upon leaving DME coverage?
- Are the coordinates of more than one sensor in agreement?
- Because of drift, how long has the IRS(s) been in NAV?
- What is the ANP of each sensor?
- How many stations is the Loran C sensor working with?
- Which sensor has performed best in the past?
- How does the navigation information compare with the flight plan?

5 MULTI-MISSIONS

INTRODUCTION

When Universal Avionics FMS contains Multi-Mission Management (MMMS) System Software 1102.X, this section shall apply. All other sections of the Operator's Manual also apply to Multi-Mission Management Systems.

The MMMS provides the capability to automatically steer along one of six search patterns and drifting targeting functions, integrating the use of TACAN and Doppler for navigation.

Flight Plan Erase

The MMMS provides a flight plan erase discrete which, when connected to a cockpit switch will erase flight plan, route memory and pilot defined waypoints. This process is nonreversible and does not affect the Navigation Database. The Internal Flight Data Recording data is erased when the Flight Plan Erase function is used.

Toggle Monochrome Color

Selecting monochrome changes the FMS display to bright green only. When COLOR is selected, the FMS display returns to full color.

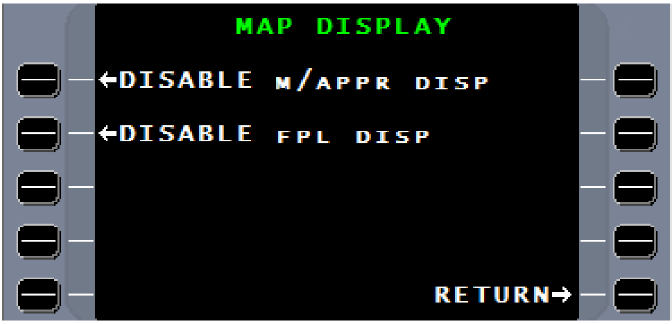
1. Press **[NAV]**.
2. Press **[MENU]**.
3. Press **LSK [4L]** to toggle between MONOCHROME and COLOR.

MAP DISPLAY

[NAV/MENU/MAP DISPLAY]

The Map Display Page allows the operator to enable or disable the missed approach waypoints on certain EFIS map displays.

For InSight EFIS map displays, the Map Display page allows the operator to enable or disable the display of the active flight plan while a search pattern is active. This allows the operator to declutter the map display as needed. This option will be available only if the FCDB interface is configured for use and the FMS is configured for special missions.



DISABLE/ENABLE M/APPR DISP [1L] – Selecting LSK [2L] disables or enables the display of missed approach points (MAP).

When the MAP Display is on, the FMS transmits the missed approach legs along with flight plan records for depiction on the navigation display. This does not occur when the MAP Display is off.

The MAP Display automatically turns on when either the TO or NX waypoint is a missed approach waypoint. Refer to Missed Approach Points Display under Arrivals in the Operations section for more information.

DISABLE/ENABLE FPL DISP [2L] – This option is available in FMS SCN 1102.1 and later. Selecting LSK [2L] toggles the active flight plan data map display to enabled (the active flight plan is displayed on the map) or disabled (the active flight plan is not displayed on the map) on the InSight EFIS map display.

This selection allows declutter of the InSight map display if a flight plan exists and a search pattern is active. The FPL DISP (flight plan display) field is only available when a search pattern is active. The FPL DISP field becomes unavailable when a search pattern is exited, or no search patterns are currently active.

NOTE: The pilot selection to remove the active flight plan while search patterns are active only affects the EFIS map display when the EFIS map is drawn by data the FMS sends over FCDB. If the FCDB fails, and the backup 429 INSIGHT bus is providing the flight plan for the EFIS map, the pilot selection field will not have any impact on the EFIS map display.

RETURN [5R] – Returns the display to the Search Patterns Page.

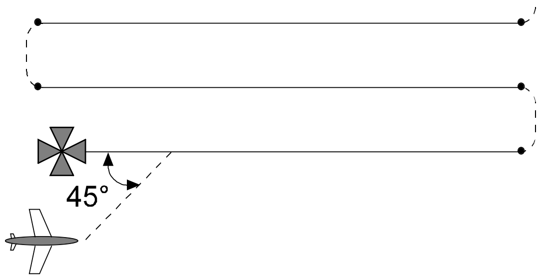
SEARCH PATTERNS

Search Patterns Page

[NAV/MENU/PATTERNS] The Search Patterns Page displays a menu of images representing the available search patterns.

Search patterns are defined and then activated from their respective definition pages. Following the entry of pilot defined search pattern parameters, selecting the ACTIVATE option will cause initial flight guidance to be provided to the search pattern entry point and along the search pattern route. When a search pattern is activated, a "direct-to" (DTO) leg to the initial waypoint of the search pattern is created. If the DTO leg is within 60 degrees of the initial search pattern course, the MMMS will turn directly onto the initial search pattern leg upon sequencing the initial waypoint.

If the DTO leg is greater than 60 degrees, alignment guidance to the initial waypoint is very similar to the guidance provided for procedure turns.



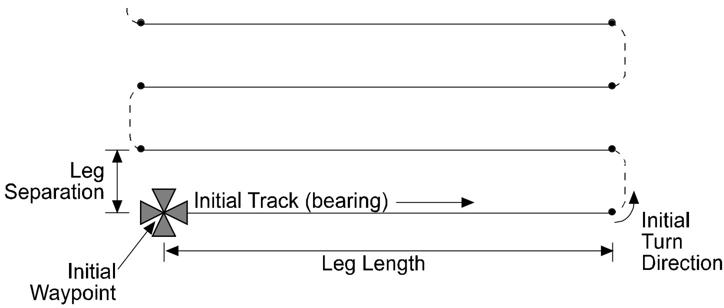
Typical Intercept

Selecting the SEARCH option then causes the MMMS to automatically steer the aircraft along the predefined search pattern. Automatic leg sequencing will not occur until the SEARCH option has been selected.

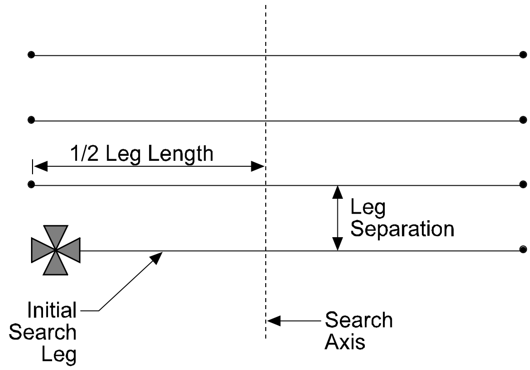
The search pattern may be interrupted at any time. During a period of "interruption" another search pattern may be selected and flown. The original search pattern will be retained in memory and may be reselected simply by pressing one line select key. When reselected, flight guidance will be provided to resume the search pattern at the point of interruption.

Rising Ladder

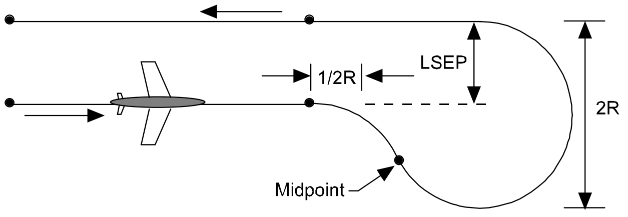
The Rising Ladder search pattern consists of an alternating series of parallel legs, adjoining fly-over waypoints, which are connected by special turn sequences. These turn sequences are designed to assure that the aircraft is on track at the beginning of each new leg. The initial waypoint, initial track, initial turn direction (left or right), leg separation distance, and leg length will be input to the MMMS by the flight crew. Crosstrack distance, desired track, distance, bearing and time to the next waypoint will be displayed to the flight crew on the Nav Search Page.



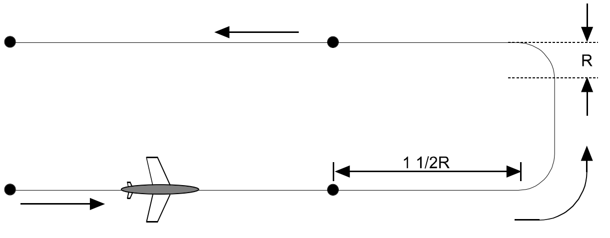
Utilizing the pilot entered parameters; waypoints defining the parallel legs are formed in reference to a search axis which is perpendicular to the initial track. This search axis is positioned at the midpoint of the initial search leg. Leg separation is measured along the search axis. Each new waypoint is computed using a great circle calculation to form a waypoint one half the leg-length distance from the search axis. Although the pilot may remotely select True or Magnetic referenced output data for display, internal calculations are made in True. The aircraft will be guided along a great circle path between these waypoints. Some difference between the displayed desired track and the entered initial track may result from these conventions.



The rising ladder and racetrack search patterns present the problem of connecting the alternate straight legs with varying separation distances. For the purposes of the following examples, the minimum turn radius is abbreviated "R."



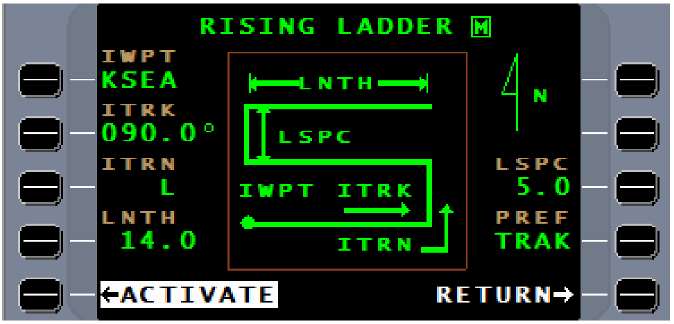
If the separation between legs is less than 2R, the aircraft will continue to a point 1/2 R past the end waypoint of the leg and then turn in the direction to increase crosstrack to the new leg. At a crosstrack distance equal to the midpoint between the leg separation (LSEP) and the 2R separation, the aircraft will reverse its turn direction and fly on a circular arc to intercept the new leg. It will intercept the new leg before the endpoint and then fly the great circle path between the leg waypoints.



If the separation between legs is greater than or equal to 2R, the aircraft will continue the straight path to a point 1 1/2 R beyond the end waypoint. It will then command a turn onto a track perpendicular to the new desired track. With a crosstrack of 1R the MMMS will command steering on a circular arc to intercept the new leg. It will intercept the new leg before the end waypoint and then fly the great circle path between the leg waypoints.

Rising Ladder Definition Page

[NAV/MENU/PATTERNS/LSK 1L] The Rising Ladder Definition Page displays a graphic representation of the search pattern.



IWPT [2L] – Initial Waypoint. The waypoint may be input using either the List or Direct Entry process. An alphanumeric waypoint entry will cause a database search to be performed and the coordinates of the selected waypoint displayed on the Info Page. If no such waypoint is in the database, the Define Waypoint Page may be used to create a new pilot defined waypoint.

ITRK [3L] – The course of the initial track. A degree sign (°) signifies a magnetic track and "T" signifies a true track. Magnetic or True is externally selectable depending upon installation of the MMMS.

ITRN [4L] – Initial turn direction (left or right). The L/R symbol will alternate with the ± key or may be entered directly by pressing the desired (L or R) key.

LSPC [3R] – Leg separation distance in nautical miles. A maximum value of 99.9 may be entered.

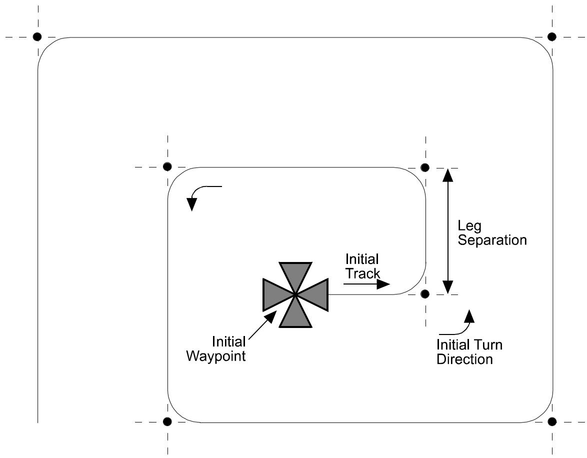
PREF [4R] – Sets the Rising Ladder Turn Preference to NX LEG TRACK (TRAK) or to MIN TRN TIME (TIME).

ACTIVATE [5L] – When pressed, this LSK activates the defined search pattern and displays the Nav Search Page.

RETURN [5R] – Returns the display to the Search Patterns Page.

Expanding Square

The Expanding Square search pattern consists of a series of legs flown with conventional turn anticipation. The leg length will be increased by the leg separation distance after every other leg is flown. The initial waypoint, initial track, initial turn, and separation of parallel legs will be input by the flight crew. Crosstrack distance, desired track, distance to the next waypoint, bearing to the next waypoint, and time to the next waypoint will be displayed to the flight crew on the Nav Search Page.

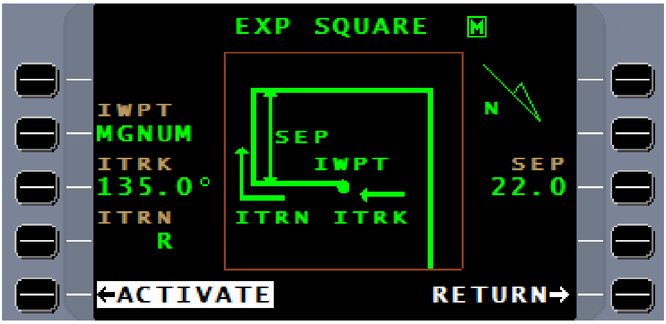


Utilizing the pilot entered parameters, waypoints defining the legs are formed from the initial waypoint, initial track, leg length, and leg separation data by forming a search axis along the initial track. Each new waypoint will be displaced along the search axis the correct distance. Although the pilot may remotely select True or Magnetic referenced output data for display, internal calculations are made in True. The leg length will be increased by the separation distance after every second leg. The aircraft will be guided along a great circle path between these waypoints. Some difference between the displayed desired track and the entered initial track may result from these conventions.

The initial leg length in the expanding square is not pilot selected but is automatically computed. The initial leg length will be the greater of the specified leg separation or twice the minimum aircraft turn radius. The initial leg length will be established when the expanding square is "activated."

Expanding Square Definition Page

[NAV/MENU/PATTERNS/LSK 2L] The Expanding Square Definition Page displays a graphic representation of the expanding square search pattern.



IWPT [2L] – Initial Waypoint. The waypoint may be input using either the List or Direct Entry process. An alphanumeric waypoint entry will cause a database search to be performed and the coordinates of the selected waypoint displayed on the Info Page. If no such waypoint is in the database, the Define Waypoint Page may be used to create a new pilot defined waypoint.

ITRK [3L] – The course of the initial track. A degree sign (°) signifies a magnetic track and "T" signifies a true track. Magnetic or True is externally selectable depending upon installation of the MMMS.

ITRN [4L] – Initial turn direction (left or right). The L/R symbol will alternate with the ± key or may be entered directly by pressing the desired (L or R) key.

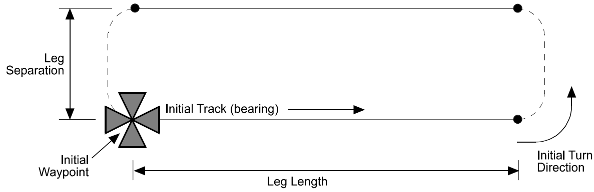
SEP [3R] – Separation of parallel legs on same track. A maximum value of 99.9 may be entered.

ACTIVATE [5L] – When pressed, this LSK activates the defined search pattern and displays the Nav Search Page.

RETURN [5R] – Returns the display to the Search Patterns Page.

Race Track

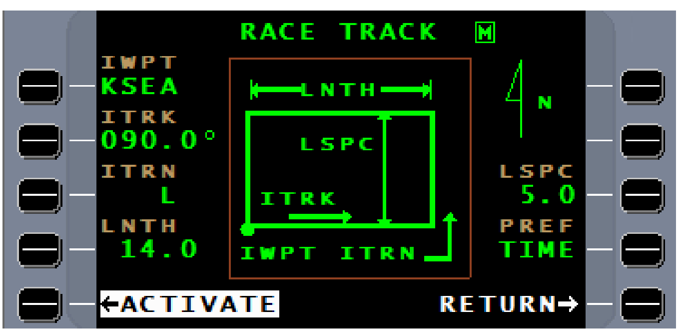
The Race Track search pattern consists of two parallel legs. The initial waypoint, initial track, initial turn direction (left or right), leg separation distance, and leg length will be entered into the MMMS by the flight crew. Crosstrack distance, desired track, distance, bearing and time to the next waypoint will be displayed to the flight crew on the Nav Search Page.



Utilizing the pilot entered parameters, waypoints defining the parallel legs are formed from the initial waypoint, initial track, leg length, and leg separation data by forming a search axis that is perpendicular to the initial track. This search axis is positioned at the midpoint of the initial search leg. Leg separation is measured along the search axis. Each new waypoint is computed using a great circle calculation to form a waypoint one half the leg length distance from the search axis. The aircraft will be guided along a great circle path between these waypoints. Some difference between the displayed desired track and the entered initial track may result from these conventions.

Race Track Definition Page

[NAV/MENU/PATTERNS/LSK 3L] The Race Track Definition Page displays a graphic representation of the race track search pattern.



IWPT [1L] – Initial Waypoint. The waypoint may be input using either the List or Direct Entry process. An alphanumeric waypoint entry will cause a database search to be performed and the coordinates of the selected waypoint displayed on the Info Page. If no such waypoint is in the database, the Define Waypoint Page may be used to create a new pilot defined waypoint.

ITRK [2L] – The course of the initial track. A degree sign (°) signifies a magnetic track and "T" signifies a true track. Magnetic or True is externally selectable depending upon installation of the MMMS.

ITRN [3L] – Initial turn direction (left or right). The L/R symbol will alternate with the ± key or may be entered directly by pressing the desired (L or R) key.

LNTH [4L] – Straight leg length in nautical miles. A maximum value of 999.9 may be entered.

LSPC [3R] – Leg separation distance in nautical miles. A maximum value of 99.9 may be entered.

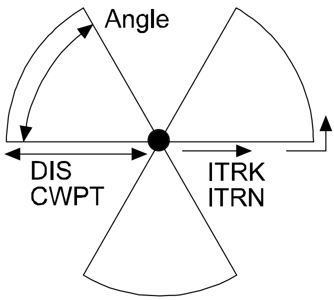
PREF [4R] – Sets the Race Track Turn Preference to NX LEG TRACK (TRAK) or to MIN TRN TIME (TIME).

ACTIVATE [5L] – When pressed, this LSK activates the defined search pattern and displays the Nav Search Page.

RETURN [5R] – Returns the display to the Search Patterns Page.

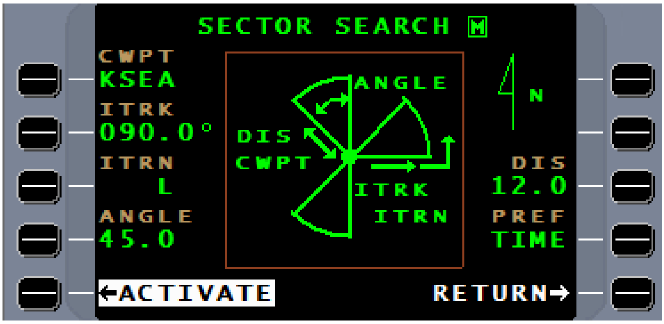
Sector Search

The Sector Search pattern consists of a series of legs, utilizing a center waypoint, that resemble a cloverleaf. The center waypoint, radius of the turn, initial track, angle of turn and turn direction will be entered by the flight crew. Distance and time referenced to the point closest to the aircraft position at the time ACTIVATE is selected, crosstrack distance, desired track and angle are referenced to the track. The first leg bearing and distance to the outside point are displayed to the flight crew on Nav Search Page. When inbound, distance displayed is to the center point and when outbound, distance displayed is to outside point.



Sector Search Definition Page

[NAV/MENU/PATTERNS/LSK 1R] The Sector Search Definition Page displays a graphic representation of the sector search pattern.



CWPT [1L] – Center Waypoint. The waypoint may be input using either the List or Direct Entry process. An alphanumeric waypoint entry will cause a database search to be performed and the coordinates of the selected waypoint displayed on the Info Page. If no such waypoint is in the database, the Define Waypoint Page may be used to create a new pilot defined waypoint.

ITRK [2L] – The course of the initial track. A degree sign (°) signifies a magnetic track and "T" signifies a true track. Magnetic or True is externally selectable depending upon installation of the MMMS.

ITRN [3L] – Initial turn direction (left or right). The L/R symbol will alternate with the ± key or may be entered directly by pressing the desired (L or R) key.

ANGLE [4L] –The desired angle between legs. A maximum value of 99.9 may be entered.

DIS [3R] – Leg distance in nautical miles. A maximum value of 99.9 may be entered.

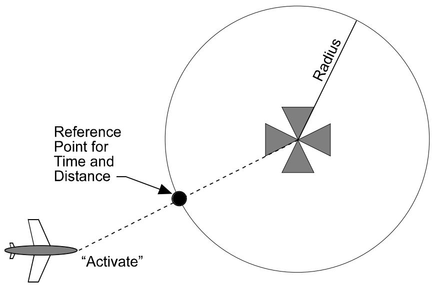
PREF [4R] – Sets the Sector Search Turn Preference to NX LEG TRACK (TRAK) or to MIN TRN TIME (TIME).

ACTIVATE [5L] – When pressed, this LSK activates the defined search pattern and displays the Nav Search Page.

RETURN [5R] – Returns the display to the Search Patterns Page.

Orbit

The Orbit search pattern consists of flying a constant radius circle in a pre-defined direction around a point. The location of the center of the circle, the direction of turn and the radius of the circle will be entered by the flight crew. Distance and time referenced to the point on the circle closest to the aircraft position at the time ACTIVATE is selected, crosstrack distance and desired track referenced to the orbit track, and bearing to the center point of the orbit will be displayed to the flight crew on the Nav Search Page.



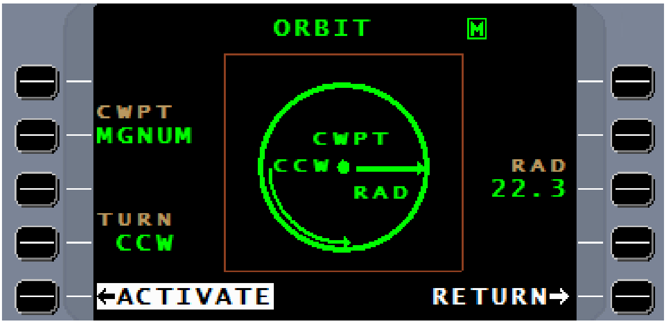
The orbit search pattern will be flown with circular arc steering where a nominal bank angle is computed for current conditions to fly an arc of the desired radius. A correction to the nominal bank angle is made using crosstrack and track angle error in the same manner as normal steering.

Interruption and resumption of steering may be accomplished while flying the orbit search pattern. During the period of interruption, flight guidance will be provided to the point of interruption on the orbit pattern. When RESUME is selected to resume the search pattern and the aircraft position is past the point of interruption, distance and time will again be referenced to the original reference location on the circle.

A message, "RADIUS REQ EXCESS BANK," will be generated and displayed to the flight crew if the orbit radius is less than the minimum aircraft turn radius (under current conditions) when the orbit is "activated.

Orbit Definition Page

[NAV/MENU/PATTERNS/LSK 2R] The Orbit Definition Page displays a graphic representation of the orbit search pattern.



CWPT [2L] – Center Waypoint. The waypoint may be input using either the List or Direct Entry process. An alphanumeric waypoint entry will cause a database search to be performed and the coordinates of the selected waypoint displayed on the Info Page. If no such waypoint is in the database, the Define Waypoint Page may be used to create a new pilot defined waypoint.

TURN [4L] – Turn direction (clockwise or counterclockwise). The CW/CCW symbol will alternate with the ± key.

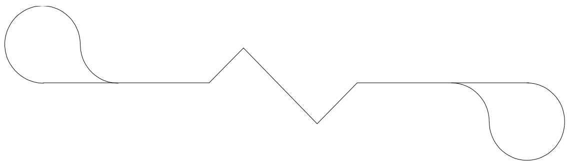
RAD [3R] – The orbit radius in nautical miles. A maximum value of 99.9 may be entered.

ACTIVATE [5L] – When pressed, this LSK activates the defined search pattern and displays the Nav Search Page.

RETURN [5R] – Returns the display to the Search Patterns Page.

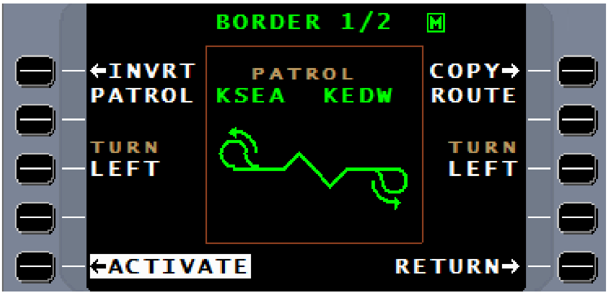
Border Patrol

The Border Patrol search pattern consists of flying a track between pilot defined waypoints with a course reversal at the final waypoint. Crosstrack distance, desired track, distance, bearing and time to the next waypoint is displayed to the flight crew on NAV SEARCH 1/1.

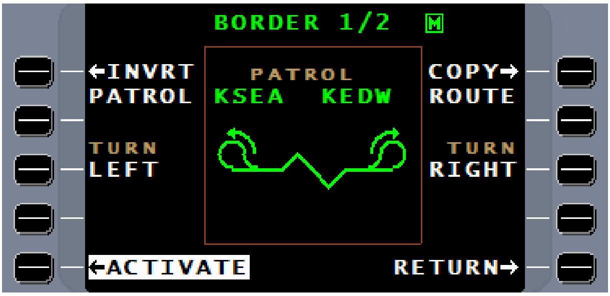


Border Patrol Definition Page

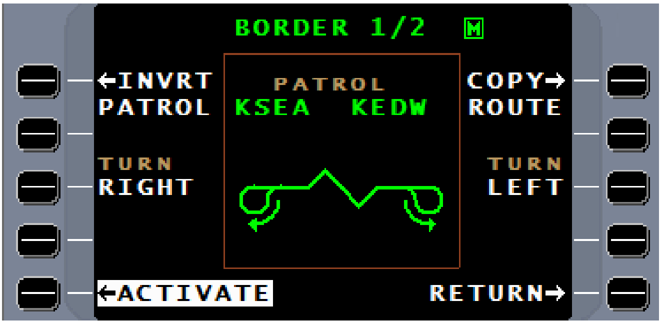
[NAV/MENU/PATTERNS/LSK 3R] The Border Patrol Definition Pages display a graphic representation of the border patrol search pattern.



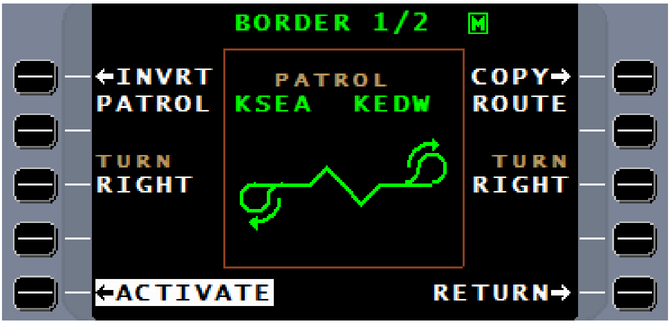
Standard Left Turns



Initial Left and Final Right Turns



Initial Right and Final Left Turns



Two Right Turns

INVRT PATROL [1L] – When selected, this allows the flight crew to fly the flight plan waypoint in reverse order.

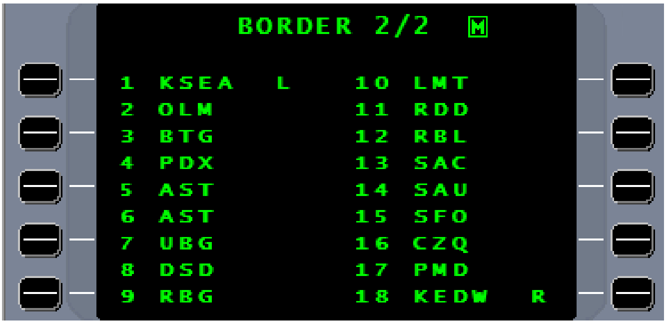
TURN [3L] – Pressing this LSK brings the cursor over the turn direction field (LEFT or RIGHT) for the first waypoint of the search patterns. The default is LEFT TURN. Turn direction is changed by pressing the L or R key on the CDU keyboard, or by using the ± key. **[ENTER]** must then be pressed. The turn direction on the pattern shown within the box will change to reflect the entered selection.

TURN [3R] – Pressing this LSK brings the cursor over the turn direction field (LEFT or RIGHT) for the last waypoint of the search pattern. The default is LEFT TURN. Turn direction is changed by pressing the L or R key on the CDU keyboard, or by using the ± key. **[ENTER]** must then be pressed. The turn direction on the pattern shown within the box will change to reflect the entered selection.

COPY ROUTE [1R] – This displays the Copy Route List. If the desired route is not shown, use **[NEXT]** or **[PREV]** keys to display additional routes.

ACTIVATE [5L] – When pressed, this LSK activates the defined search pattern and displays the Nav Search page.

RETURN [5R] – Returns the display to the Search Patterns Page.



The BORDER 2/2 page is accessed by pressing **[NEXT]** or **[PREV]** when BORDER 1/2 is displayed. This page displays the waypoints used in the border patrol search patterns. The first and last waypoints of the search pattern show the turn direction selected on the BORDER 1/2 page.

Activate Search Pattern

1. Press **[NAV]** to access the Nav Pages.
2. Press **[MENU]** to access the Nav Menu Page.
3. Press **LSK [1R]**, PATTERNS to access the Search Patterns Page.
4. Select the desired search pattern by pressing the associated LSK. The Search Pattern Definition Page will be displayed.
5. Using the LSKs to position the cursor over the search pattern parameters, enter the data which defines the search pattern.

The preference (PREF) option, LSK [4R], is available on the Search Pattern Definition Page. This option is only available when the Race Track, Rising Ladder, or Sector search pattern is selected.

When PREF LSK is pressed, the Turn Preference (TRN PREF) page displays.

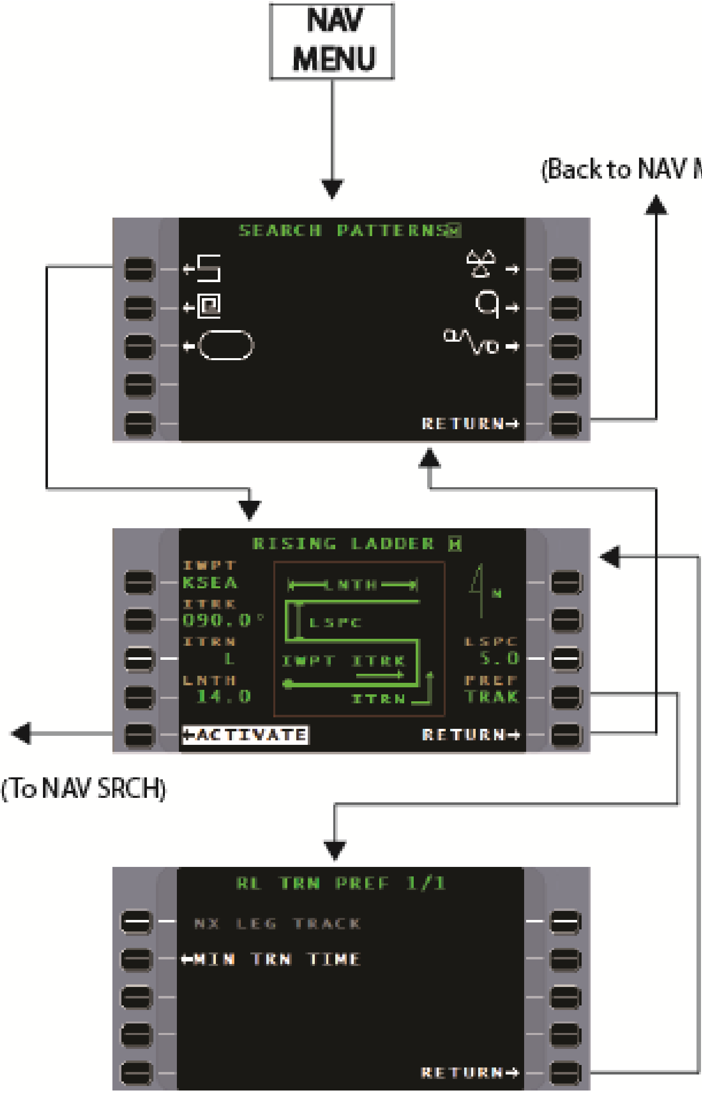
NOTE: The title of the Turn Preference Page will depend on the search pattern chosen. Either RL (Rising Ladder), SEC (Sector), or RT (Race Track) will precede TRN PREF in the page title.

The Turn Preference Page will display the following options:

- NX LEG TRACK - designed to navigate to the next Search Pattern leg such that the aircraft will be on course with minimal bank at the beginning of the Search Pattern leg regardless of aircraft speed, configured bank angle, and the leg separation distance
- The MIN TURN TIME - designed to minimize the time spent transiting between Search Pattern legs and to ensure that the FMS guidance always provides a turn in the direction of the next Search Pattern leg.

Both leg transition options only affect transitions between RACE TRACK, RISING LADDER, and SECTOR Search Patterns. The other Search Pattern leg transitions are not pilot-selectable.

Search Pattern Definition Page Option Logic (showing Rising Ladder as the chosen search pattern)



6. Press **LSK [1L]**, ACTIVATE to activate the defined search pattern.

   Leg sequencing will be suppressed to allow the flight crew to maneuver the aircraft to a position lined up with the initial fix in the search pattern. Flight guidance is now provided to the initial leg of the search pattern. If the MMMS HDG mode is not used to capture this leg, automatic steering will be output on a 45° intercept to the initial leg, or an extension of the leg. Leg sequencing will not occur until the SEARCH option is selected.
7. Press **LSK [5R]**, SEARCH to commence the search pattern. The displayed status changes from ACTIVE to SEARCH.

Interrupt Search Pattern

When an active search pattern is interrupted, the position symbol and flight guidance information continue to be displayed on the Nav Search Page (unless a new search pattern has been selected). Interruption will stop the sequencing of legs on the interrupted search pattern. Crosstrack distance and desired track displays are to the interrupted track, and distance, time and bearing are to the point of interruption. This allows the flight crew to fly the aircraft back to the point of interruption.

During the period of interruption, the Nav Search Page displays crosstrack to the leg the aircraft was on when the search pattern was interrupted and distance to the point of interruption. Leg sequencing will not occur until the search pattern is resumed. This allows the flight crew to maneuver the aircraft freely, while allowing resumption of the search pattern with no loss of coverage.

1. Press **[NAV]** to display Nav Page 1.
2. Press **LSK [5R],** INTERRUPT. (Or LSK [3R] from Nav Page 2).

   The status will change from SEARCH to INTERRUPTED.
3. The flight crew is free to maneuver the aircraft at will, or to select another search pattern. If another search pattern is activated, the original pattern may again be selected starting at the point of interruption by pressing LSK [4R] identified by the search pattern icon next to it.
4. When ready to resume the search pattern, select **[RESUME]**. The status will return to SEARCH. Upon resume, the FMS navigates to the last active leg, extended if required, to accommodate a 45° intercept.

Cancel Search Pattern

If INTERRUPT is selected prior to cancellation, the search pattern will not be reset. It will be flown from the interrupt point if selected again.

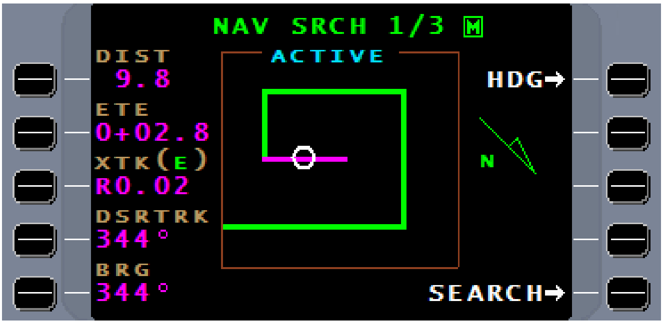
Press **[DTO]** to conduct a direct-to operation, or from Nav Search Page 2 select **[MNVR]**, then **[PVOR]**. The search pattern will be canceled and removed from the NAV display.

A search pattern which is active at the time of cancellation will be reset to its initial condition. If selected again, the flight guidance will be to the initial leg of the search pattern and the search pattern commenced from there.

Nav Search Page 1

When a search pattern is activated, Nav Search Page 1 is displayed. This page presents a graphical display of the search pattern, with an aircraft position symbol in the center of the aircraft's current guidance leg.

The status (ACTIVE, SEARCH, or INTERRUPTED) will be displayed above the search pattern. The option to begin the search pattern is controlled with **LSK [5R]** labeled "SEARCH." After beginning the search pattern, interruption or resumption is controlled by the same LSK [5R] labeled "INTERRUPT" or "RESUME." The aircraft position symbol is triangular when in the SEARCH mode and circular when in the ACTIVE or INTERRUPTED mode.



DIST – This is the distance in nautical miles to the next search pattern waypoint or point of search pattern interruption. DIST may be any value up to 999.9 NM.

ETE – The estimated time in hours and minutes to the next search pattern waypoint or point of search pattern interruption. ETE may be any value up to 9+59.

XTK – The crosstrack distance from the present leg. XTK may be any value up to 99.9 NM. (E), (T), (R) or (A) will appear next to the XTK display indicating Enroute, Terminal, RNP or Approach phase of flight crosstrack scaling. Crosstrack display resolution will be in hundredths when crosstrack is less than 1.0 nm, otherwise resolution is in tenths.

DSRTRK – Desired Track. A magnetic track is signified with a degree sign (°) and a true track with a "T."

BRG – The bearing from the aircraft's present position to the next search pattern waypoint or point of search pattern interruption. A magnetic bearing is signified with a degree sign (°) and a true bearing with a "T."

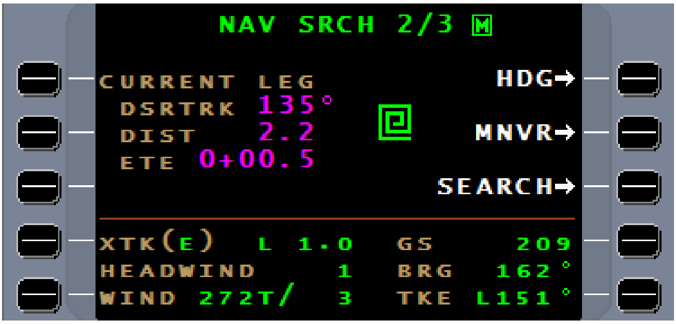
HDG [1R] – This LSK is used to access the MMMS Heading mode.

Search Pattern Icon [4R] – When a search pattern is interrupted and another search pattern subsequently selected, the original search pattern is retained in memory and the stored pattern's icon is displayed adjacent to this LSK. Pressing this LSK returns the display to the original search pattern Nav Search Page.

SEARCH/INTERRUPT/RESUME [5R] – This LSK is used to alternately activate, interrupt, or resume a selected search pattern.

Nav Search Page 2

The information presented on Nav Search Page 2 correlates with the information displayed on the HSI. Complete information is provided about the current navigation leg. An icon depicting the search pattern selected is displayed on the screen.



DSRTK – The desired track (course) of the current search leg. A degree sign (°) signifies a magnetic course and a "T" designates a true course. The selection of true or magnetic is made with the panel mounted True/Mag selector switch, so the CDU will reflect what is displayed on the HSI.

DIST – The great circle distance, expressed in nautical miles, between the aircraft's present position and the next search pattern waypoint.

ETE – The estimated time enroute, in hours and minutes, between the aircraft's present position and the next search pattern waypoint. If the time is greater than 9:59, "--+--" will be displayed.

HDG [1R] – Pressing this LSK will access the MMMS Heading mode of the Nav Search pages. This allows the flight guidance to be controlled by the flight crew during an active search pattern.

MNVR [2R] – Pressing this LSK will access the Maneuver Definition Page from which PVOR and holding patterns can be defined and activated.

INTERRUPT/SEARCH [3R] – This LSK is used to alternately select the INTERRUPT or SEARCH mode for the search pattern.

XTK – Crosstrack. This is the lateral distance in NM left or right of the extended course centerline of the present search pattern leg. A maximum of 99.9 may be displayed. Outputs from the navigation computer drive the course deviation display on the HSI to a scale of 3.75 NM per dot, or 1.0 NM per dot if installed for expanded enroute linear deviation.

(E), (T), (R) or (A) will appear next to the XTK display indicating Enroute, Terminal, RNP or Approach phase of flight crosstrack scaling. Crosstrack display resolution will be in hundredths when crosstrack is less than 1.0 nm, otherwise resolution is in tenths.

BRG – The bearing between the aircraft's present position and the next search pattern waypoint.

TKE – Track Angle Error display.

GS – The aircraft's groundspeed expressed in knots.

HEADWIND/TAILWIND – The present headwind or tailwind component expressed in knots.

WIND – The wind direction and speed in knots. Wind direction, as with course, will be differentiated with a "T" for true and a degree sign (°) for magnetic.

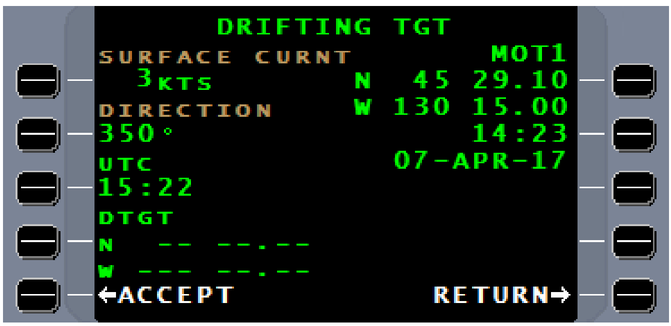
Nav Page 3 (Nav Position)

Nav Page 3 of the Search Pattern pages is the same as Nav Page 2 of the normal Nav Pages. It displays the MMMS position and ANP/RNP associated with the MMMS best computed position.

DRIFTING TARGET

Drifting Target Page

[NAV/MENU/DRIFT TGT] The Drifting Target Page displays drifting target information for search and rescue missions. Entries are made on this page which result in the display of MMMS calculated values representing drifting target location. During Drifting Target operations, bearing and distance information is displayed on the EFIS.



SURFACE CURNT [1L] – Displays MMMS calculated value of surface current speed. This value is derived from the difference between the Doppler and MMMS velocities.

DIRECTION [2L] – Displays MMMS calculated value of surface current direction. This value is derived from the difference between the Doppler and MMMS velocities.

NOTE: Manual values for surface current and direction can be entered by the pilot.

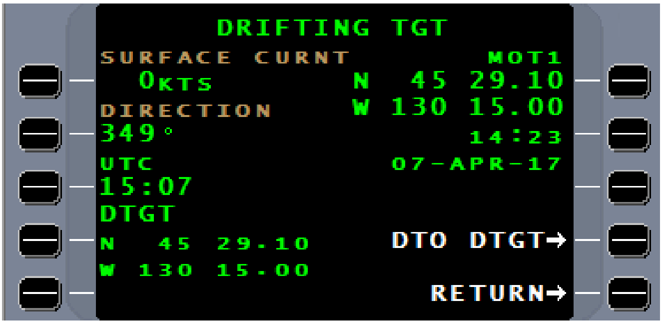
SURFACE CURRENT = 0-500 kts, DIRECTION = 0-360°.

UTC/ETA [3L] – If no manual input is made in this field, UTC will be displayed. The pilot can enter a value of ETA in this field and the title will change to display ETA.

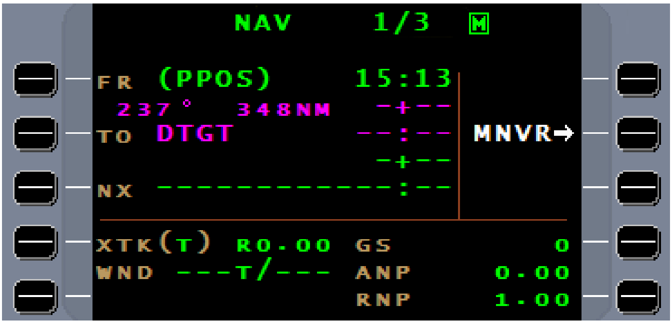
DTGT – This coordinate is the present estimated position for the drifting target, using the current displayed information. To accomplish this display, the MMMS calculates a delta position using current speed, direction and ETA, then adds the delta position to the original position to generate the estimated DTGT location.

ACCEPT [5L] – This option becomes active after a MOT waypoint has been entered. Pressing the ACCEPT LSK will cause the MMMS to compute and display the DTGT coordinates.

MOT # [1R] – Through the use of this field the pilot can either manually or by utilizing the List function, enter the coordinates, time, and date of creation for a MOT (Mark on Target) waypoint. Also, if installed, the pilot can automatically enter a MOT waypoint into the system by pressing a cockpit mounted MOT switch. This will pre-fill the MOT field with the aircraft's present position, current time, and date.

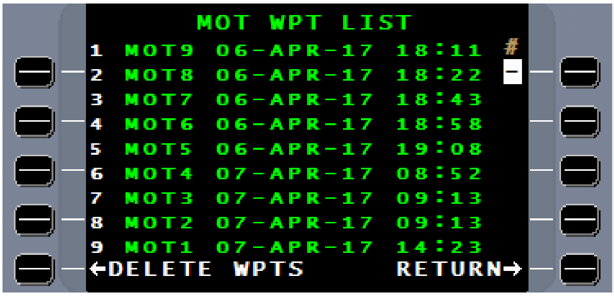


DTO DTGT # [4R] – Pressing this LSK will cause the MMMS to exit the Drifting Target Page and go to Nav Page 1 and display DTGT in the TO waypoint field. Thus, causing the aircraft to turn and fly direct to the DTGT coordinates.



Mark on Target Waypoint List Page

[NAV/MENU/DRIFT TGT/LSK 1R/LIST]



Up to nine MOT waypoints can be stored by the MMMS and displayed on this page for future reference.

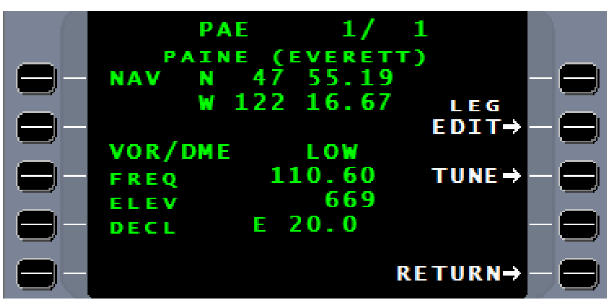
DELETE WPTS [5L] – Pressing this LSK, deletes all the waypoints in the MOT WPT LIST.

RETURN [5R] – Pressing this LSK will return the display to the Drifting Target Page.

Leg Options Page

[FPL/Waypoint Info/Leg Edit]

For flight plan waypoints which are not the current leg, selection of the waypoint INFO prompt will display the waypoint info page with a LEG EDIT prompt. This function allows the selection of a DF leg with a specified turn direction to be assigned to that FPL leg. This function is available in MMMS configurations only.



Example VOR Waypoint Identification Page with LEG EDIT Selection

If this page is displayed and the waypoint becomes the TO waypoint, all selections on the page are unavailable to prevent the user from modifying the current leg. Selecting updates the leg in the flight plan.

Example LEG OPTIONS Page

AT– Displays the Waypoint Identifier of the terminator of the preceding leg.

TURN DIR [2L] – When available and selected, sets the selected Turn Direction to AUTO.

LEFT [3L] – When available and selected, sets the selected Turn Direction to LEFT.

RIGHT [4L] – When available and selected, sets the selected Turn Direction to RIGHT.

TO– Displays the Waypoint Identifier of the terminator of the leg being edited.

LEG TYPE [2R] – When available and selected, sets the selected leg type to TF Leg Type.

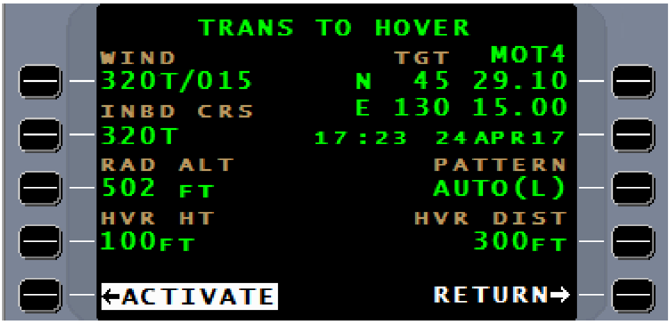
DIRECT [3R] – When available and selected, sets the selected leg type to DF Leg Type.

TRANSITION TO HOVER

Transition to Hover Page

[NAV/MENU/TRANS HOVER]

When enabled, the Transition to Hover (TTH) function supports transitioning a helicopter from its present position to a top of descent point at which the helicopter can begin a transition down to a hover. The TTH function supports a generic helicopter platform, as well as the AS332 helicopter with the CDV-155 flight director/coupler computer.



WIND – Displays the FMS filtered wind direction and magnitude based on the MAG/TRUE Heading Reference Selection.

INBD CRS [2L] – Displays the inbound course to target based on the MAG/TRUE Heading Reference Selection. The FMS filtered wind direction is automatically used or can be manually entered with a range of 0 to 360 degrees.

RAD ALT [3L] – Displays the Radar Altitude height in feet. RAD ALT data can be manually entered with a rage of 0 to 9,999 feet.

HVR HT [4L] – Displays the selected hover height in feet (if a CDV-155 flight director/coupler computer is configured). HVR HT data can be manually entered with a range of 0 to 999 feet.

TGT [1R] – Displays the selected target information based on Mark-On-Target (MOT), Navigation waypoint or Pilot defined waypoint. Time and date stamp only display for MOT fixes. Selection of TGT, LSK [1R] allows for target fix selection.

The LIST function may also be used to enter a target fix. The TGT data will be automatically updated whenever a new MOT waypoint is created.

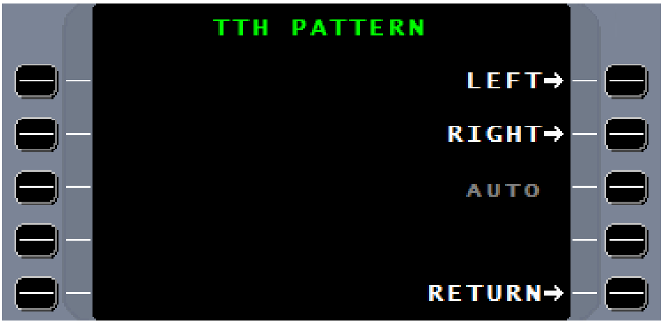
Pattern [3R] – Displays the selected pattern type. When selected, the available options are Left, Right or Auto. The AUTO (L or R) predicted pattern type is based on the current selected settings on the TTH page and the present position of the helicopter.

HAV DIST [4R] – Displays the selected hover distance (the distance to go to the target after the TTH maneuver ends) in feet. The default is configured at installation and can also be manually updated with a range of 0 to 9,999 feet.

Initiation of the TTH requires the following data:

TTH DATA	SOURCE TYPE
TARGET LATITUDE	User Defined
TARGET LONGITUDE	User Defined
INBOUND COURSE	User Defined or System Supplied **NOTE:** User will always be able to manually define inbound course.
HOVER HEIGHT	User defined or System Supplied **NOTE:** Hover height data must be manually defined when hover height data is not available.
RADAR ALTIMER HEIGHT	User Defined or System Supplied **NOTE:** RADALT height data must be manually defined when radar altimeter data is not available.
TRUE AIRSPEED	System Supplied
WIND SPEED	System Supplied
WIND DIRECTION	System Supplied

TTH Pattern

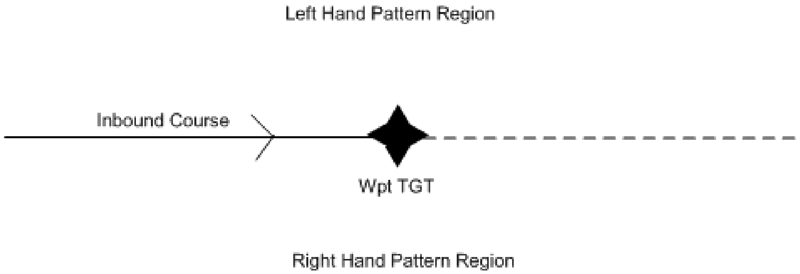


LEFT [1R] – Sets the selected pattern type to LEFT.

RIGHT [2R] – Sets the selected pattern type to RIGHT.

AUTO [3R] – Allows the FMS to automatically determine the pattern type (left or right).

Pattern Types



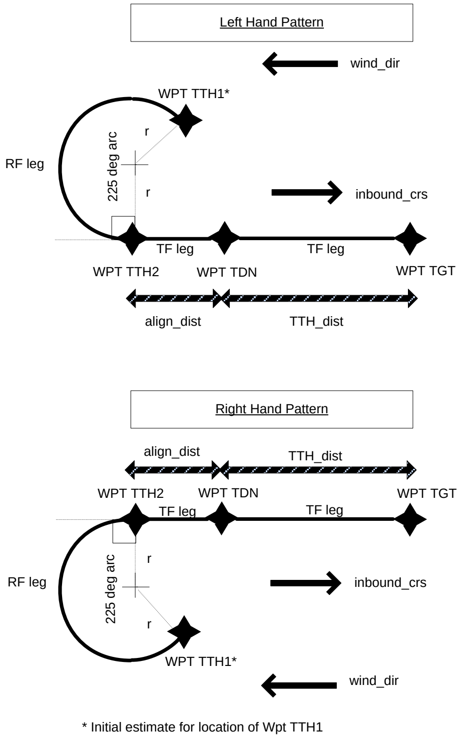
TTH Auto Pattern Type Region based on PPOS

TTH Pattern types is the pattern type (LEFT or RIGHT) used to construct the TTH pattern based on the PPOS to the target.

If PPOS is in the Left-Hand Pattern Region, then the TTH Auto Pattern is LEFT.

If PPOS is in the Right-Hand Pattern Region, then the TTH Auto Pattern is Right.

Auto is the pattern type that the FMS automatically determines based on POS relative to inbound course to target (Left or right).



TTH Pattern

Installations with FMS SCN 1002.1 and later, in certain scenarios:

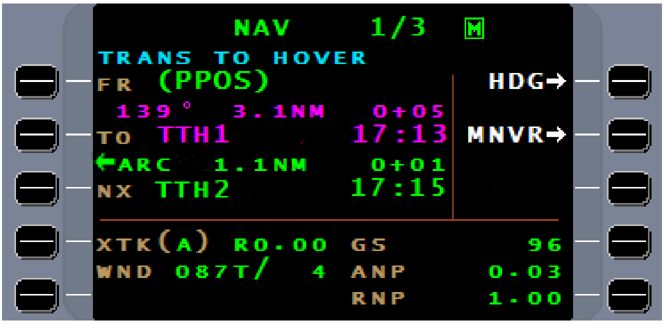
- The alignment distance is a nominal 15 seconds (at the anticipated ground speed on the inbound leg) but may be increased to allow more room for the helicopter to capture the TTH pattern.
- The RF leg may be extended another 45 degrees (for a total arc angle of 225 degrees) to allow for better capture of the RF leg.
- The initial turn of the DF leg, for specific corner conditions, is forced to turn leg in the opposite direction to avoid turning inside of the RF leg. Turning inside the RF leg is unacceptable since this leads to overshoots of the RF leg.

Activate Transition to Hover

1. Press **[NAV]** to access the Nav Pages.
2. Press **[MENU]** to access the Nav Menu Page.
3. Press **TRANS HOVER**, **LSK [1L]** to access the TRANS TO HOVER Page.
4. If necessary, press the adjacent LSK to the INBD CRS, RAD ALT, HVR HT, PATTERN, or HVR DIST fields for manual entry of data into the respective field.
5. With **TGT**, **LSK [1R]** active, enter the target fix.

The Transition to Hover page can also be accessed from any page by pressing the MOT button if the TTH page jump option is configured.

6. Press **ACTIVATE, LSK [5L]** to activate the Transition to Hover and display the Navigation page.

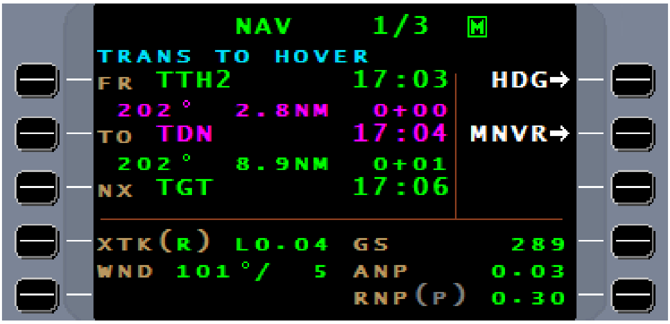


.

Transition to Hover is canceled when any of the following functions are performed:

- DTO
- PVOR
- Manual Leg Change
- Holding Pattern
- Search Pattern.

Installations with FMS SCN 1002.1 and later display the Transition Down (TDN) waypoint in the TTH pattern. In addition, while TTH is active and magnetic variation is valid, the wind direction on the NAV Page 1 shows as magnetic. True winds are still available on NAV Page 2 during TTH.



6 SENSORS AND INTERFACES

SENSORS

The FMS interfaces with a variety of long- and short-range navigation sensors, including radio-based sensors, inertial, air data and satellite-based systems. Radio-based sensors include: VOR, DME, ILS, Doppler, RRS, TACAN and LORAN-C. Inertial sensors include IRS, GPIRS, and AHRS systems. Satellite-based sensors include the GPS-950, GPS-1000, GPS-1000A, GPS-1200, GLS-1250, GNSS-2400 (with or without GLONASS capability), Trimble GPS TASMAN sensor; Honeywell YG1845 combined IRS/GPS sensor, and SBAS sensors. In addition, the FMS can be configured for either analog or all digital Air Data systems.

The FMS Reference Guide contains detailed information about sensor management and position certainty. Loran C sensor information is contained in a separate Operator's Manual supplement.

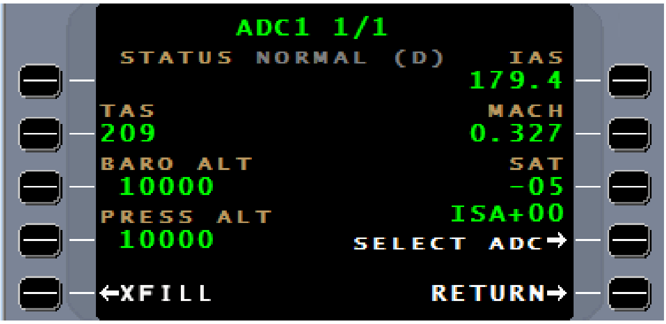
Equipment Limitations of Other Navigation Systems

In accordance with FAA AC 20-138D, 5-3.2.c: Although the TSO-C146c UNS-1( )w FMS/GPS/SBAS equipment operating software SCN 1002.X/1102.X covered by this manual does not have an equipment limitation for other navigation systems onboard the aircraft, operators are encouraged to retain back-up navigation systems to guard against outages or interference events.

Air Data Computer

ADC Status

The ADC Status Page, accessed from DATA 2/4, LSK [2R], displays the status of the ADC. The ADC is automatically deselected during ground operations and is automatically selected at liftoff. The ADC can be manually deselected or reselected by using LSK [4R].



The top of the page shows the page title (ADC) and the status of the system. The status field (beneath ADC) will show NORMAL if the ADC is operational and selected, FAILED if the ADC has failed, XFILL if the data is cross filled from a second ADC, and (D) if the ADC has been deselected.

TAS – The true airspeed being used by the FMS. Dashes will be displayed if there is no TAS input. (MAN) will be displayed to the right of the value if the TAS is a manual entry and (XFL) will be displayed to the right of the value if the XFILL option has been selected. A manually selected TAS overrides a sensor supplied TAS input and will be used even if the ADC is failed. A manual TAS entry is deleted by pressing the BACK and ENTER keys while the cursor is over the TAS entry field.

BARO and PRESS ALT – The altitude in feet as supplied by the air data computer. (MAN) will be displayed to the right of the value if the altitude is a manual entry and (XFL) will be displayed to the right of the value if the XFILL option has been selected. A manually selected altitude overrides a sensor supplied altitude. A manual ALT entry is deleted by pressing the BACK and ENTER keys while the cursor is over the ALT entry field.

XFILL – XFILL will be a LSK option when two or more FMSs are installed. This will cause TAS, SAT and ALT to be displayed from the transferring ADC. When XFILL is selected, XFL is displayed next to the TAS, SAT and ALT values, and the IAS and MACH data and titles will not appear. The SELECT/DESELECT ADC option will also not appear.

NOTE: The aircraft must be airborne for ADC XFILL to be active and available.

IAS – The indicated airspeed in knots as supplied by the ADC. IAS will not be displayed on installations which do not receive IAS from the ADC.

MACH – The Mach value as supplied by the ADC. Mach will not be displayed on installations which do not receive Mach from the ADC.

SAT – The static air temperature received from the ADC. Dashes are displayed if there is no input data.

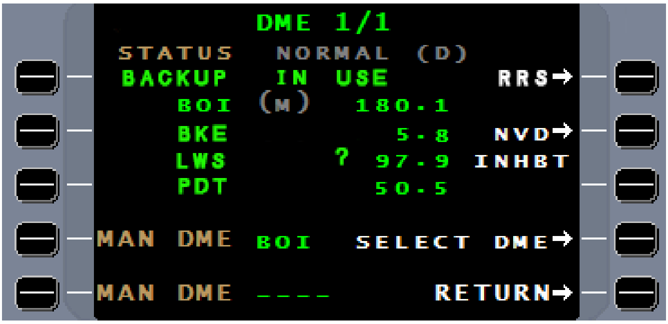
ISA – The difference between SAT and ISA (International Standard Atmosphere) for the current altitude.

DESEL ADC/SELECT ADC [4R] – This LSK is used to alternately select or deselect the ADC sensor. If deselected, (D) will be displayed following the sensor status.

Short Range Sensors

Distance Measuring Equipment

If DME is configured, the DME-DME status and data is displayed on the DME Status Page. This page is accessed from Data Page 2.



An (M) following a station identifier indicates a manually selected station. Manually selected DMEs are automatically deselected when the range exceeds 300 nm. The letter I preceding the three-letter designator indicates ILS-DMEs and LOC-DMEs.

The distance display is as follows:

- Distance is expressed to the nearest one-tenth nautical mile
- Dashes indicate no response from the DME station
- A question mark (?) indicates the distance received from the DME is questionable. The system will not use this input
- Parentheses ( ) are used for manually selected DME stations to indicate that the distance shown is a computed distance from the aircraft to the DME station, not an actual DME measurement. The parentheses disappear when a DME lock–on is established.

BACKUP/RRS/TAC – Only indicated when an RRS or TACAN is installed. The RRS, backup DME (the aircraft's primary DME) or TACAN can be alternately selected via LSK [1R]. When the backup radio is in use, it will continue to automatically tune stations.

NVD INHBT – Pressing LSK [2R] will display Navaid Inhibit Page 1 (described later in this section).

DESELECT DME/SELECT DME – Pressing LSK [4R] will allow manual selection/deselection of DME as desired. When deselected, D will appear following DME Status.

During system initialization and ground operations, the DME will be deselected. Upon takeoff, the DME will automatically be selected. In the event of an aircraft weight-on-gear switch failure, the DME will automatically be selected when the TAS reaches 150 kts.

Manual DME Station Selection

Normally, the DME-DME Status Page will display four lines showing four different DME stations and their respective distance readings. As the computer automatically tunes all the available DME stations in the vicinity of the aircraft, the four stations displayed will continually change.

This procedure provides the pilot with the option of directing the computer to tune, and constantly display, one or two specific DME stations.

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the DME option to display the DME Status Page.
2. Press the MAN DME LSK to position the cursor over the MAN DME entry field.
3. Enter the identifier of the desired DME using the LIST function. The symbol (M) will be displayed after the identifier on the tuned DME listing to indicate a manual selection.

   NOTE: When initially selected, the FMS estimate of what the DME distance should be will appear in parentheses. When a DME lock-on is established, the parentheses will be removed.

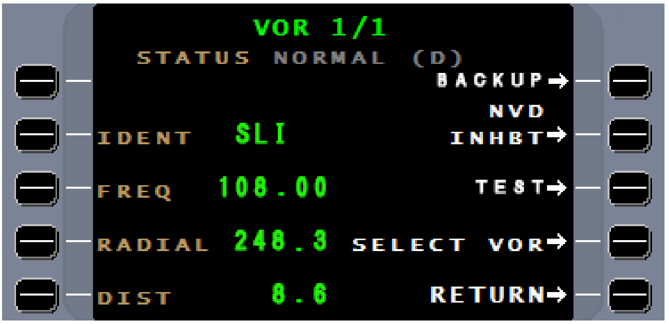
Return to Automatic DME Station Selection

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the DME option to display the DME Status Page.
2. Press the MAN DME LSK to position the cursor over the MAN DME entry field.
3. Press the BACK and then ENTER keys to delete the manual input.

   NOTE: Manually selected stations will be automatically deselected and automatic station selection resumed when the distance to the manually selected station exceeds 300 nm.

VHF Omnidirectional Radio

When VOR is configured, VOR status and data are displayed on the VOR Status Page. The page is accessed from Data Page 2.



STATUS – This is the operational status of the VOR. The status displayed will be one of the following:

- NORMAL
- TEST – when in Test tuning mode
- MANUAL – when in Manual tuning mode
- FAIL – when the RRS has failed and the RRS is the VOR in use (not the backup).

In addition, (D) will appear to the right of any of the above when the VOR has been deselected.

IDENT – The VOR station identifier. If RRS is installed, LSK [2L] and the LIST key can be used to manually select a station by identifier. In these cases, the identifier will be followed by (M). Manual mode is excited by either pressing LSK [3R], by pressing the sequence [2L] > BACK > ENTER. Manual mode is automatically entered when the distance to the manually selected VOR station exceeds 180 nm.

FREQ – The VOR station frequency. The frequency can be entered manually by pressing LSK [3L] to highlight the field, then entering the desired frequency. If an invalid frequency is entered, or a valid frequency is entered but a signal is not detected within eight seconds, the value will flash.

RADIAL – The radial from the VOR station to the aircraft's present position. If no VOR radial is received, the radial field will be blank. If the radial is invalid, the field will display dashes. If the received radial is not within six degrees of the expected value, it will be followed by a question mark (?).

DIST – The received DME distance in nm from the VOR to the aircraft's present position. If no DME is associated with the VOR or no distance is received, a computed distance will be displayed in parentheses. If the received distance is not within 45 nm of the expected value, it will be followed by a question mark (?).

BACKUP/RRS – Only indicated when an RRS is installed. The RRS or a backup VOR receiver can be alternately selected. When backup information is being used, the message "BACKUP IN USE" will appear beneath the Status line.

NVD INHBT – Pressing LSK [2R] will display Navaid Inhibit Page 1 (described later in this section).

TEST – This option only appears on the master FMS in installations with two or more FMSs. It is always available in single FMS installations.

During Normal mode, this option reads TEST. Pressing LSK [3R] will select Test tuning mode; this option will then read CANCEL TEST. Selecting CANCEL TEST will revert to Normal mode.

When Manual tuning mode is active, this option reads CANCEL MANUAL. Pressing LSK [3R] will revert to Normal mode.

DESEL VOR/SELECT VOR – This LSK is used to alternately select or deselect the VOR. When deselected, (D) is displayed following the VOR status.

NOTE: If an RRS is installed the VOR test in accordance with FAR Part 91.25 is performed on this page by entering the appropriate VOR frequency.

During system initialization and ground operations, the VOR will be deselected. Upon takeoff, the VOR will automatically be selected. In the event of an aircraft weight-on-gear failure, the VOR will automatically be selected when the TAS reaches 150 kts.

Manual VOR Station Selection

This procedure provides the pilot with the option of directing the computer to tune, and constantly display, one specific VOR station.

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the VOR option.
2. Press the IDENT LSK to position the cursor over the IDENT entry field.
3. Enter the identifier of the desired VOR using the LIST function. STATUS MANUAL indicates a manual selection.

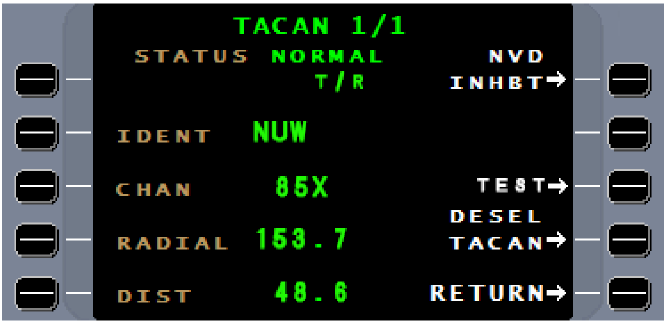
Return to Automatic VOR Station Selection

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the VOR option to display the VOR Status Page.
2. Press CANCEL MANUAL, LSK [3R].

VOR automatically reverts to nearest VOR station and indicates STATUS NORMAL.

TACAN

TACAN status and data are on the TACAN Status Page. The page is accessed from Data Page 2 and is accessible only when an RRS or a TACAN is configured.



STATUS – This is the operational status of the TACAN. The status displayed will be one of the following:

- NORMAL
- TEST – when in Test tuning mode
- MANUAL – when in Manual tuning mode
- FAIL – when an RRS communications failure is detected.

In addition, (D) will appear to the right of any of the above when the TACAN has been deselected.

The current TACAN mode is displayed below the status, which will be one of the following:

- A/A - Air to Air
- A/A TR – Air to Air Transmit and Receive
- A/A REC – Air to Air Receive
- REC T/R – Receive
- T/R – Transmit and Receive. Indicates the TACAN or RRS frequency and channel are received and valid.

IDENT – The TACAN station identifier. If RRS is installed, LSK [2L] and the LIST key can be used to manually select a station by identifier. In these cases, the identifier will be followed by (M). Manual mode is excited by either pressing LSK [2R], by pressing the sequence LSK [2L] > BACK > ENTER or when the distance to the manually selected TACAN station exceeds 180 nm.

CHAN – The TACAN station channel. The channel can be entered manually by pressing LSK [3L] to highlight the field, then entering the desired channel. If an invalid channel is entered, or a valid channel is entered but a signal is not detected within eight seconds, the value will flash.

RADIAL – The radial from the TACAN station to the aircraft’s present position. If no TACAN radial is received, the radial field will be blank. If the radial is invalid, the field will display dashes. If the received radial is not within six degrees of the expected value, it will be followed by a question mark (?).

DIST – The received distance in nm from the TACAN to the aircraft’s present position. If no distance is received, a computed distance will be displayed in parentheses. If the received distance is not within 45 nm of the expected value, it will be followed by a question mark (?).

NVD INHBT – Pressing LSK [1R] will display Navaid Inhibit Page 1 (described later in this section).

TEST – During Normal mode, this option reads TEST. Pressing LSK [2R] will select Test tuning mode; this option will then read CANCEL TEST. Selecting CANCEL TEST will revert to Normal mode].

When Manual tuning mode is active, this option reads CANCEL MANUAL. Pressing LSK [2R] will revert to Normal mode.

DESEL TACAN/SELECT – This line is used to alternately select or deselect the TACAN. When deselected, (D) is displayed following the TACAN status.

During system initialization and ground operations, the TACAN will be deselected. Upon takeoff, the TACAN will automatically be selected. In the event of an aircraft weight-on-gear switch failure, the TACAN will automatically be selected when the TAS reaches 150 kts.

Manual TACAN Station Selection

This procedure provides the pilot with the option of directing the computer to tune, and constantly display, one specific TACAN station.

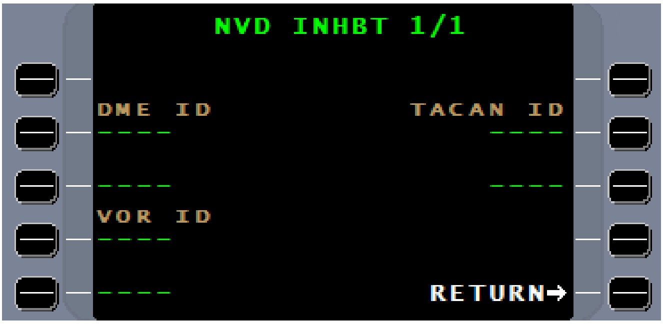
1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the TACAN option to display the TACAN Status Page.
2. Press the IDENT LSK to position the cursor over the IDENT entry field.
3. Enter the identifier of the desired TACAN using the LIST function. STATUS MANUAL indicates a manual selection.

Return to Automatic TACAN Station Selection

NOTE: ARN-154 TACAN does not have the capability for automatic station selection. ARN-154 TACAN stations must be manually selected; therefore, the following information does not apply.

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the TACAN option to display the TACAN Status Page.
2. Press CANCEL MANUAL, LSK [2R].
3. TACAN automatically reverts to nearest TACAN station and indicates STATUS NORMAL.

Navaid Inhibit Page



This page is accessed by pressing the NVD INHBT option from the DME Status Page, the VOR Status Page or the TACAN Status Page.

The pilot can disable up to two navigational aids (navaids) of each type by pressing the LSK next to the desired field to highlight it, then by either directly entering the station identifier or by pressing **[LIST]** to access a list of stations. If the pilot attempts to inhibit a navaid that is already inhibited, the entered value will flash.

The navaid is uninhibited by pressing the LSK next to the desired navaid to highlight it, the pressing the sequence BACK > ENTER.

Radio Reference Sensor

During system initialization and ground operations, the VOR, DME and TACAN will be deselected. Upon takeoff, all three sensors, if installed, will automatically be selected. In the event of an aircraft weight-on-gear failure, they will automatically be selected when the TAS reaches 150 kts.

Radio Reference Sensor Deselect

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the VOR, DME or TAC LSK.
2. Press the DESEL DME/VOR/TACAN LSK to deselect the VOR, DME or TACAN portion of the RRS/TAC.

Radio Reference Sensor Reselect

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select the VOR, DME or TAC option to access the VOR, DME or TACAN Status Page.
2. Press the SELECT DME/VOR/TACAN LSK to reselect the VOR, DME or TACAN portion of the RRS/TAC.

Doppler

The FMS supports three types of Doppler sensors: RACAL 91, CMC 2012 and ASN-137. The Doppler sensor is automatically selected at takeoff and is deselected at landing. Doppler is also deselected at power-up and approach arm.

Doppler Sensor Deselect

1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select DOP to access the Doppler Status Page.
2. Press the DESEL DOPLR LSK. The Doppler status field will show a (D) when the Doppler is selected.

Doppler Sensor Reselect

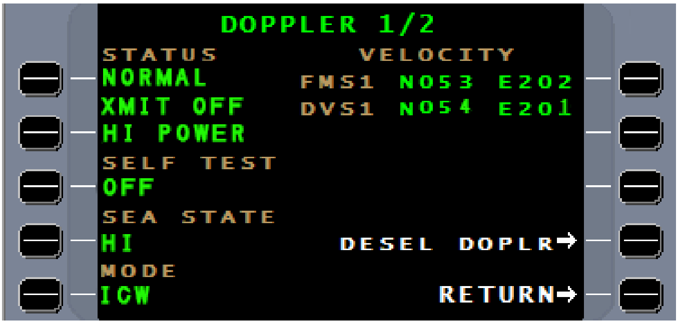
1. Press **[DATA]** then **[NEXT]** to access Data Page 2. Select DOP to access the Doppler Status Page.

   Press the SELECT DOPLR LSK. When the Doppler is selected, the (D) in the status field will no longer be displayed.

Doppler Status

Racal 91 Doppler Status

Racal 91 Doppler Status Page 1 is accessed from Data Page 2 by pressing the DOP LSK.



Doppler Status Page 1 displays the operational status of the Doppler 91. Doppler Status Page 2 displays diagnostic information for use by maintenance personnel. Doppler Status Page 1 is explained below:

STATUS – The status displayed will be displayed as either NORMAL, TEST, UNLOCK or FAIL.

XMIT – Transmit status displayed as either ON or OFF.

POWER – The power level will be displayed as either HI POWER or LO POWER.

SELF TEST – This LSK is used to start or cancel Doppler self-test. Pressing this LSK initiates self-test indicated by START in the status field. Pressing the LSK during self-test will cancel self-test indicated by OFF in the status field.

SEA STATE – Pressing this LSK will toggle Sea State between LO and HI.

MODE – Pressing this LSK toggles the mode between CW (Continuous Wave) and ICW (Intermittent Continuous Wave).

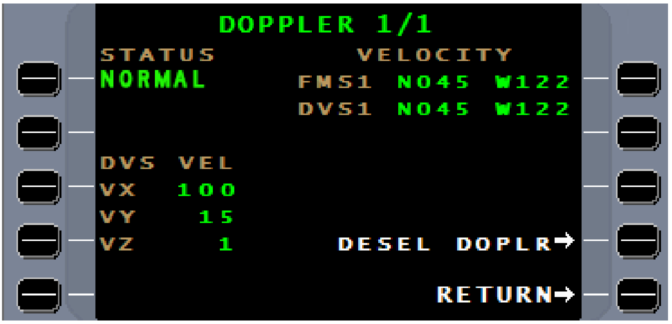
FMS1 – FMS velocity.

DVS1 – Doppler velocity.

DESEL DOPLR – This LSK is used to deselect and reselect the Doppler. When Doppler is deselected, a (D) will appear after the STATUS description.

ASN-137 Doppler Status

ASN-137 Doppler Status Page 1 is accessed from Data Page 2 by pressing the DOP LSK.



Doppler Status Page 1 displays the operational status of the ASN-137 Doppler. Doppler Status Page 1 is explained below.

STATUS – Status is NORMAL, MEMORY or FAIL.

DVS VEL – Doppler velocities for the x, y and z components in nm/hr. If any velocity is not received for 1/2 second, the field will be dashed, and the information will not be used for navigation solution.

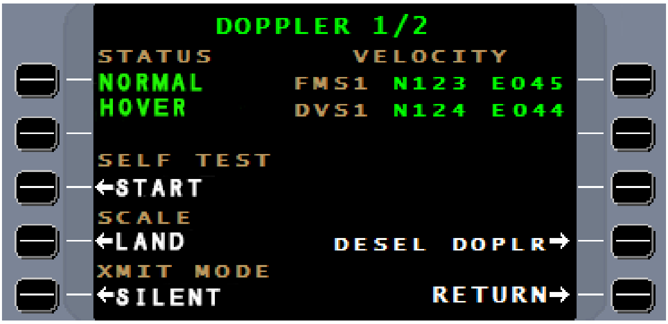
FMS1 – FMS velocity.

DVS1 – Doppler velocity.

SELECT DOPLR – This LSK is used to deselect and reselect the Doppler. When Doppler is deselected, a (D) will appear after the STATUS description.

CMC 2012 Doppler Status

The 2012 Doppler Status Page is accessed from Data Page 2 by pressing the DOP LSK.



Doppler Status Page 1 displays the operational status of the 2012 Doppler. Doppler Status Page 2 displays diagnostic information for use by maintenance personnel. Doppler Status Page 1 is explained below.

STATUS – The status displayed will be NORMAL, TEST or FAIL.

TRACK MODE – Displayed as either CRUISE or HOVER.

SELF TEST – This LSK is used to initiate a Doppler self-test. Pressing LSK [3L] once will bring the cursor over the START prompt. Pressing LSK [3L] a second time will initiate self-test. Self-test cannot be canceled once it has begun.

SCALE – This LSK commands scale factor changes between SEA and LAND. Pressing LSK [4L] once will bring the cursor over the field. Pressing LSK [4L] a second time will change the scale factor.

XMIT MODE – This LSK commands the transmit mode between SILENT and NORMAL. Pressing LSK [5L] once brings the cursor over the field. Pressing LSK [5L] a second time will change the transmit mode. When SILENT is selected, the Vx, Vy and Vz velocities will not be used for navigation.

FMS1 – FMS velocity.

DVS1 – Doppler velocity.

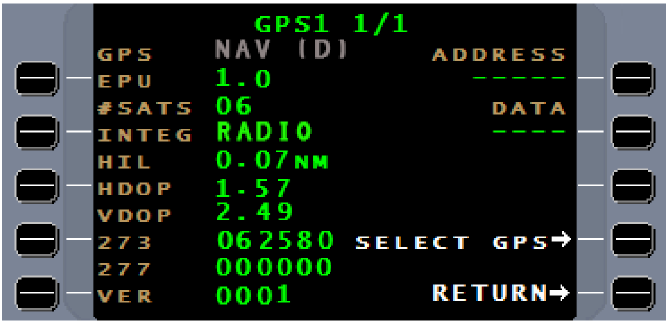
SELECT DOPPLER – This LSK is used to deselect and reselect the Doppler. When Doppler is deselected, a (D) will appear after the STATUS description.

Long Range Sensors

Global Positioning System

GPS Status Page 1

GPS status and data are displayed on the GPS Status Pages. These pages are accessed from Data Page 2 by pressing the appropriate LSK.



GPS – The status of the sensor. The following are possible:

- NAV – The sensor is in NAV mode
- ACQ – The sensor is acquiring satellites
- INIT – The sensor is in startup initialization
- ALT – The sensor is using altitude to supplement poor satellite geometry
- TEST – The sensor is in SELF-TEST mode
- FAIL – The sensor has failed, or 429 data is not being received from the sensor.

EPU – The error estimate describing the radius of the circle-of-position of 95% probability. EPU will be a value in x.x format, indicating the radius in nautical miles; e.g., an EPU of 0.5 indicates a circle of 0.5 nm radius.

 # SATELLITES – The number of satellites currently being tracked by the sensor.

INTEG – Integrity status is displayed on this line and defined below.

- RAIM – Receiver Autonomous Integrity Monitoring (only displayed with a RAIM capable sensor)
- RADIO – Radio based (i.e., DME-DME) integrity monitoring
- NONE – No integrity monitoring available. GPS position accuracy is not affected and will continue to be used for navigation. However, the pilot should monitor the FMS accuracy by comparing to other navigation sources, if available
- ALARM – Integrity monitoring indicates a GPS horizontal position error outside alarm limits applicable to the phase of flight.

HIL – Horizontal Integrity Limit in nautical miles. RAIM is available when HIL is equal to or less than 2 nm enroute, 1 nm terminal or 0.3 nm approach.

HDOP – Horizontal Dilution of Precision. For reference only.

VDOP – Vertical Dilution of Precision. For reference only.

273 & 277 – ARINC data on labels 273 and 277 from the GPS sensor. These items are used primarily by technicians for diagnostics and troubleshooting.

VER – The internal software version.

ADDRESS & DATA – A five-digit hex address may be entered at LSK [1R], which will be transmitted to the GPS and displayed adjacent LSK 2[R]. These fields are used primarily by technicians for diagnostics and troubleshooting.

SELECT/DESELECT GPS – Used to manually select or deselect the GPS sensor.

GPS Sensor Deselect/Reselect

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the GPS LSK to access GPS Status Page 1.
3. Press **LSK [4R]** (DESEL GPS or SELECT GPS option) to deselect/reselect the GPS sensor. The status field will automatically update the status of the sensor.

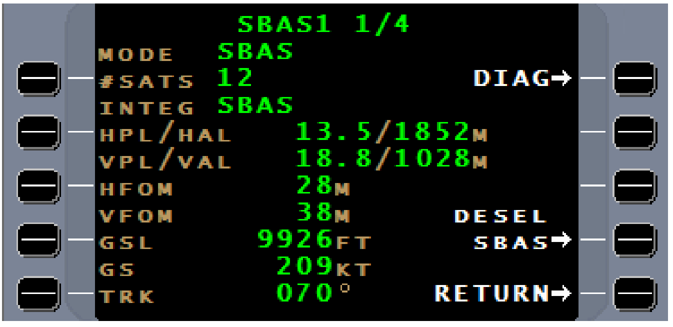
Satellite Based Augmented System

Inputs into the FMS for Satellite Based Augmented System (SBAS) navigation is provided by the GPS/SBAS sensor, which uses GPS augmented by GPS/ SBAS sensor computations. GPS/ SBAS sensor inputs are used by the FMS like a GNSS sensor, i.e., all integrity monitoring, sensor monitoring and standard GNSS displayed output requirements.

GPS/SBAS sensor inputs to the FMS Navigation solution include position (dynamically independent), time and velocity.

SBAS Status Page 1

The SBAS Status Pages are accessed from Data Page 2 by pressing the appropriate LSK.



MODE – The status of the sensor. The following are possible:

- SBAS – GPS/SBAS sensor is in SBAS mode
- NAV – GPS/SBAS sensor is in NAV mode
- ALT – The sensor is using altitude to supplement poor satellite geometry
- ACQ – The sensor is acquiring satellites
- FAIL – The sensor has been detected as failed or the system has been turned on and no data was received within the specified timeout period
- TEST – GPS/SBAS sensor is in self-test mode.

#SATS – The number of satellites (GPS and GEO) currently being tracked by the sensor.

INTEG – Integrity status is displayed on this line and defined below.

- SBAS – SBAS integrity is being applied
- RAIM – Receiver Autonomous Integrity Monitoring (only displayed with a RAIM capable sensor)
- RADIO – Radio based (i.e., DME-DME) integrity monitoring
- NONE – No integrity monitoring available. GPS position accuracy is not affected and will continue to be used for navigation. However, the pilot should monitor the FMS accuracy by comparing to other navigation sources, if available
- ALARM – Integrity monitoring indicates a GPS horizontal position error outside alarm limits applicable to the phase of flight.

HPL/HAL – GPS/SBAS Horizontal Protection Level (HPL) and Horizontal Alert Limit (HAL).

VPL/VAL – GPS/SBAS Vertical Protection Level (VPL) and Vertical Alert Limit (VPL)

HFOM – Horizontal Figure of Merit. Also known as GPS Probable Error and refers to the quality of the GPS satellite geometry. If HFOM is received and valid, it is displayed here. If it is overflow, then displays "++++", otherwise displays dashes.

VFOM – Vertical Figure of Merit.

GLS – GPS Landing System (GLS) Altitude.

GS – Global Navigation Satellite System (GNSS) Groundspeed.

TRK – GNSS Track.

DIAG – Displays the SBAS Diagnostic page.

GPS/SBAS Sensor Deselect/Reselect

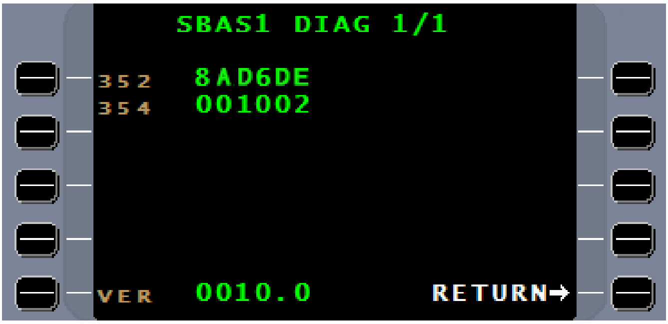
The GPS/SBAS sensor cannot be selected/deselected when an approach is armed or activated.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the SBAS LSK to access SBAS Status Page 1.
3. Press **LSK [4R]** (DESEL SBAS or SELECT SBAS option) to deselect/reselect the GPS/SBAS sensor. The status field will automatically update the status of the sensor.

SBAS Diagnostic Page

This page is accessed from the SBAS Sensor Status 1/N page.

The SBAS Diagnostic page displays diagnostic data from the respective SBAS sensor.



Example SBAS Diagnostic Page

352 – Displays Label 352 of the 743A bus in Hex format.

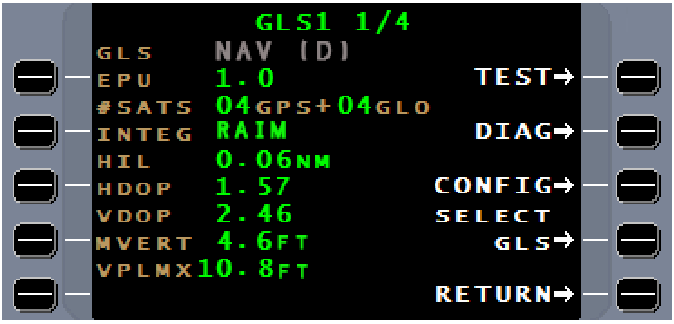
354 – Displays Label 354 of the 743A bus in Hex format.

VER – Software version and revision of the SBAS sensor.

GLS

The GLS-1250 sensor can track the signals of up to twelve GPS and GLONASS satellites in any combination. The signals from all satellites tracked can be used in the position solution. However, the FAA prohibits use of GLONASS either for predicting RAIM availability for non-precision approaches or for predicting FDE availability in remote/oceanic areas.

When GLS approach is loaded and GLS is in ARMED or ACTIVE mode, FMS selects GLS as master GPS if aircraft is within 30nm to destination and GLS is displayed as navigation source on the CDU navigation page.



GLS – The status of the sensor. The following are possible:

- NAV – The sensor is in NAV mode
- ACQ – The sensor is acquiring satellites
- INIT – The sensor is in startup initialization
- ALT – The sensor is using altitude to supplement poor satellite geometry
- TEST – The sensor is in SELF-TEST mode
- FAIL – The sensor has failed, or 429 data is not being received from the sensor
- DGPS – The sensor is in the differential mode.

EPU – The error estimate describing the radius of the circle-of-position of 95% probability. EPU will be a value in x.x format, indicating the radius in nautical miles, e.g., an EPU of 0.5 indicates a circle of 0.5 nm radius.

 # SATELLITES – The number of satellites currently being tracked by the sensor, broken down into GPS and GLO satellites.

INTEG – Integrity status is displayed on this line and defined below.

- DGPS – The sensor is in the differential mode.
- RAIM – Receiver Autonomous Integrity Monitoring (only displayed with a RAIM capable sensor).
- RADIO – Radio based (i.e., DME-DME) integrity monitoring.
- NONE – No integrity monitoring available. GPS position accuracy is not affected and will continue to be used for navigation. However, the pilot should monitor the FMS accuracy by comparing to other navigation sources, if available.
- ALARM – Integrity monitoring indicates a GPS horizontal position error outside alarm limits applicable to the phase of flight.

HIL – Horizontal Integrity Limit in nautical miles. RAIM is available when HIL is equal to or less than 2 nm enroute, 1 nm terminal or 0.3 nm approach.

HDOP – Horizontal Dilution of Precision.

VDOP – Vertical Dilution of Precision.

MVERT – Vertical aircraft offset. This value is a constant computed at system installation; for UA systems, it is set to zero.

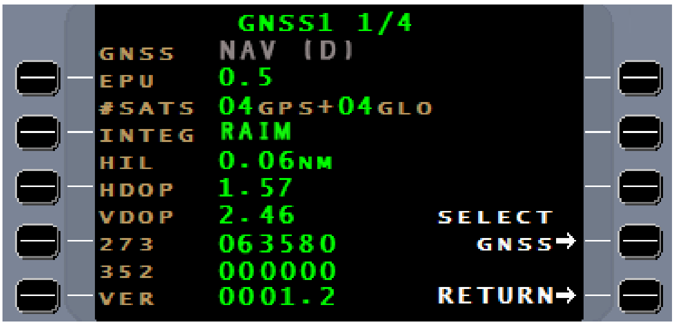
VPLMX – Maximum vertical protection limit allowed before approach. Not exceeding this limit ensures that the GLS will meet continuity requirements for precision approaches.

TEST, DIAG & CONFIG – These items are used primarily by technicians for diagnostics and troubleshooting by installation personnel.

SELECT/DESELECT GLS – Used to manually select or deselect the sensor.

GNSS

The GNSS-2400 sensor can track the signals of up to twelve GPS and GLONASS satellites in any combination. The signals from all satellites tracked can be used in the position solution. However, the FAA prohibits use of GLONASS either for predicting RAIM availability for non-precision approaches or for predicting FDE availability in remote/oceanic areas.



GNSS – The status of the sensor. The following are possible:

- NAV – The sensor is in NAV mode
- ACQ – The sensor is acquiring satellites
- INIT – The sensor is in startup initialization
- ALT – The sensor is using altitude to supplement poor satellite geometry
- TEST – The sensor is in SELF-TEST mode
- FAIL – The sensor has failed or ARINC 429 data is not being received from the sensor.

EPU – The error estimate describing the radius of the circle-of-position of 95% probability. EPU will be a value in x.x format, indicating the radius in nautical miles, e.g., an EPU of 0.5 indicates a circle of 0.5 nm radius.

SATELLITES – The number of satellites currently being tracked by the sensor. For the GLS-1250 and the GNSS-2400, this number is further broken down into GPS and GLO satellites.

INTEG – Integrity status is displayed on this line and defined below.

- RAIM – Receiver Autonomous Integrity Monitoring (only displayed with a RAIM capable sensor)
- RADIO – Radio based (i.e., DME-DME) integrity monitoring
- NONE – No integrity monitoring available. GPS position accuracy is not affected and will continue to be used for navigation. However, the pilot should monitor the FMS accuracy by comparing to other navigation sources, if available
- ALARM – Integrity monitoring indicates a GPS horizontal position error outside alarm limits applicable to the phase of flight.

HIL – Horizontal Integrity Limit in nautical miles. RAIM is available when HIL is equal to or less than 2 nm enroute, 1 nm terminal or 0.3 nm approach.

HDOP – Horizontal Dilution of Precision.

VDOP – Vertical Dilution of Precision.

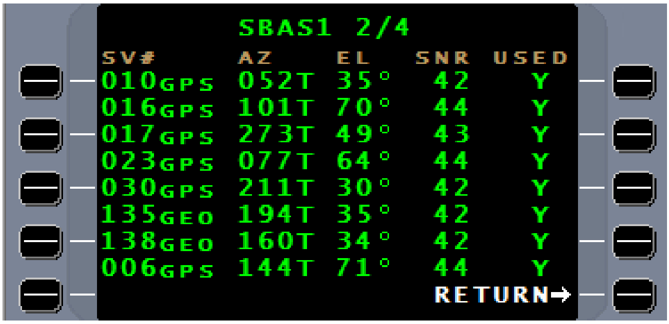
273 & 352 – These items are used primarily by technicians for diagnostics and troubleshooting.

VER – The internal software version.

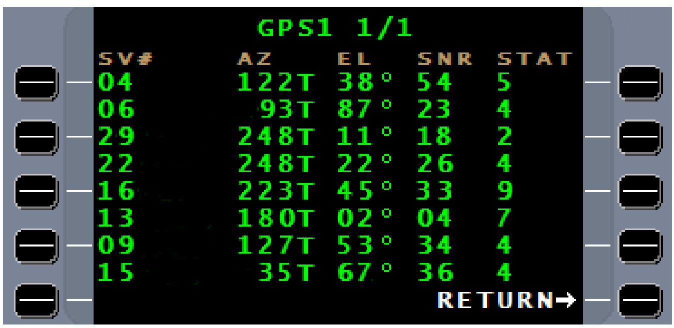
SELECT/DESELECT GNSS – Used to manually select or deselect the sensor.

SBAS/GPS/GLS/GNSS Satellite Status

NOTE: Status Pages 2 and 3 are available for SBAS, GLS, GNSS, and low speed GPS only.



SBAS Satellite Status Page 2



GPS/GLS/GNSS Satellite Status Page 2

Status Pages 2 and 3 display the satellites most likely to be in current use by the sensor. Each line displays:

SV# – Satellite Vehicle Number. The SBAS sensor page displays GPS or GEO for SBAS GPS satellite or Geo satellite, respectively. The GLS and GNSS sensors page displays GLO or GPS to designate GLONASS or GPS satellites respectively.

AZ – Azimuth. Azimuth will always be true direction from the aircraft for GLS, GNSS and SBAS.

EL – Elevation (deg). Elevation is in degrees above the horizon (90º is directly overhead the aircraft position). EL may be negative, indicating a satellite below the horizon.

SNR – Signal to Noise Ratio. SNR is a number from 0 to 63 in dB Hz.

USED (SBAS**)** – Indicates whether the satellite is used in ranging.

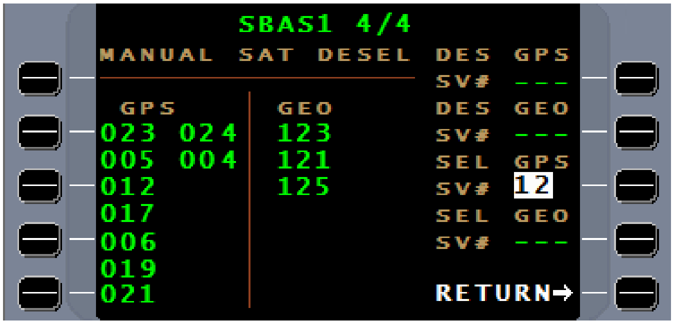
STAT (GPS/GLS/GNSS) – Status. Status is a number from 0 to 9 defined as follows:

Status	**Definition**
0	Satellite is assigned to a channel
1	FIND command issued
2	Waiting to receive almanac and ephemeris data
3	Waiting to receive complete pseudo range data block
4	Performing the acquisition/tracking process
5	Fast sequencing of satellite signal (tracking mode)
6	Satellite is not assigned to a channel
7	Lost satellite lock during sequencing process
8	Waiting for clock message
9	Satellite not found
D	Satellite is deselected

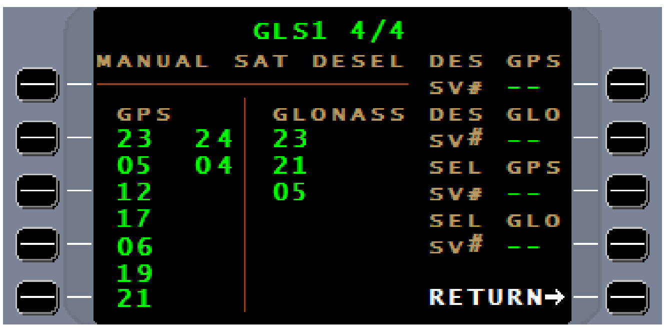
If the sensor is receiving more than eight satellites, their data are displayed on Status Page 3, which is identical in structure to Status Page 2. If the sensor is receiving eight or fewer satellites, Status Page 3 will still be active, but all of its data fields will be blank.

Select/Deselect Sensor Satellites

[DATA/NEXT/LSK<X>/PREV]



SBAS /GNSS Status Page 4



GPS/GLS Status Page 4

Sensor Status Page 4 is accessed using the PREV or NEXT key from other Status Pages. This page applies to the internal GPS/SBAS, GPS, GPS-1000, GPS-1000A, GNSS-2400 and the GLS-1250. It might appear with other sensors but will not be functional.

This page displays satellites that have been deselected. In addition to displaying a list of deselected satellites, this page is also used to manually select or deselect satellites.

A list of satellites appears showing the satellite vehicle (SV) number. For GPS configurations, the status of each satellite is also shown. Status is shown as DES (deselected), REQ (requested for deselection by the FMS) or AUTO (automatically deselected by the GPS).

The flight crew can deselect a satellite by pressing LSK [1R] to bring the cursor over the DESEL SV# field. The satellite vehicle number is typed in at the cursor location and entered by pressing the ENTER key. The list status will read REQ until the GPS acknowledges the deselection at which time the status becomes DES. The selection and deselection of a satellite performed from the onside FMS will automatically be propagated to the offside FMS in dual FMS installations. Deselecting a satellite removes it from the navigation solution in both FMSs.

For GLS installations configured as GLS-GLO, all GLONASS satellites are automatically deselected and cannot be manually selected; the DES GLO SV#-- and SEL GLO SV#-- fields are unavailable.

The flight crew can reselect a satellite by pressing LSK [3R] to bring the cursor over the SELECT SV# field. The satellite vehicle number is typed in at the cursor location and entered by pressing the ENTER key. The satellite will be removed from the list once the sensor acknowledges.

For the GNSS-2400 satellites may be deselected individually by entering the SV# in the DES GPS or DES GLO field. Up to 14 satellites of each type may be manually deselected. Entering a 99 in these fields will deselect all the satellites of that type and ALL will display in the list of deselected satellites.

NOTE: Deselection of individual satellites is never used for normal or abnormal operations. It is only used for engineering and maintenance purposes.

Inertial Reference Sensor

IRSs will accept latitude/longitude position information from the FMS only during their alignment mode, i.e., during the initialization procedure.

During initialization, all IRSs that are in the alignment mode will accept latitude/longitude position information from either FMS. This is true regardless of whether both FMS systems are ON, only one is ON, or if one is failed. While in the alignment mode, all inertial sensors will use the last position update they receive from either FMS for their alignment point. Once in the NAV mode, no inertial sensor will accept an update. Manually updating the inertial sensor position while enroute is not necessary.

Battery protection of inertial sensors negates the need for a position information update following a power failure.

RNAV (RNP) APPROACHES

RNAV (RNP) Approach procedures are available when the FMS is loaded with the special RNAV Authorization Required database and an RNAV(RNP) approach is selected.

When an RNAV(RNP) approach is active and the GPS fails (deselect, or sensor fail), then based on the configuration option setting the FMS allows IRS Coasting (drift) until the computed ANP exceeds RNP (at which point the lateral and vertical guidance will be flagged).

Based on RNP Configuration Options the FMS allows for automatic deselection of NAV Radio Sensors when an approach is Armed or Activated.

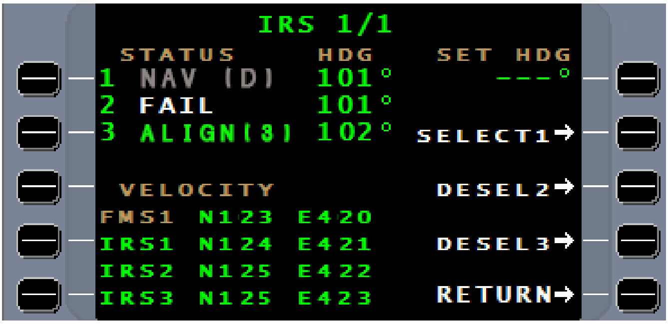
The sensors will be automatically reselected once the approach and missed approach is exited, a hold is entered after the missed approach, or ANP>RNP.

(SCN 1002.5 and Later)

A field is provided via the RNV (RNP) Options page to enter the RNP threshold value used to activate Approach Roll Gains during Terminal flight phase. The default RNP for Approach Gains value is 0.30, RNP values in the range of 0.01 to 1.00 inclusive are valid and allowed.

IRS Status Page

The IRS Status Page displays the status of the installed IRS(s). This page is accessed from Data Page 2.



STATUS – This is the operational status of the IRS. The status displayed will be one of the following:

- ALIGN indicates that the IRS is in alignment mode. The aircraft should not be moved. If the IRS is in the alignment mode and is selected, then time to NAV information in minutes is displayed in parentheses
- NAV indicates the IRS is in the normal navigational mode
- ATT indicates the IRS is available for attitude outputs only. Navigational outputs are not being provided
- FAIL indicates the unit is not operational.

HDG – The magnetic or true (whichever is configured) heading received by the FMS from the IRS. Dashes are displayed if no valid data are available.

VELOCITY – Position movement broken into N-S/E-W velocity components.

FMS – The FMS best computed position velocity components.

IRS# – The velocity components being received by the FMS from that IRS.

SET HDG – For use with a Laser-type IRS when selected to ATTITUDE on the IRS Mode Selector Unit. In the ATTITUDE mode, the Laser IRS will output both attitude and heading. The heading output is similar to uncorrected DG; that is, it must be manually set once.

1. Press the SET HDG LSK to position the cursor over the SET HDG entry field.
2. Enter the desired heading. The TRUE/MAG panel switch will determine whether the entry required, and the heading displayed are relative to True or Magnetic North. When the heading is entered, it will be sent to all IRS sensors in the ATT mode.

The IRS position coordinates are displayed by the FMS for comparative purposes only.

IRS Deselect/Reselect

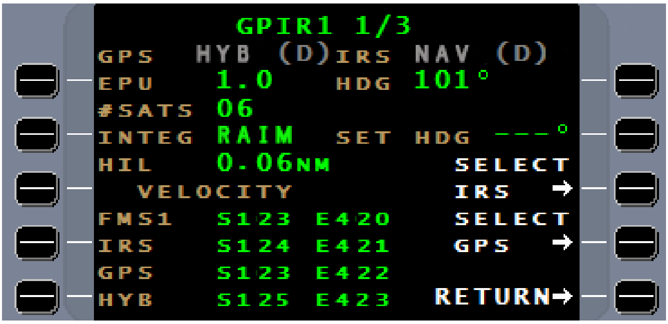
1. Access the IRS Status Page by pressing **[DATA]** and then any IRS # LSK.
2. Press the appropriate DESEL # or SELECT # LSK to deselect or select the desired IRS. When an IRS is deselected, the appropriate IRS STATUS field will indicate (D). When an IRS is selected, the appropriate IRS STATUS field will indicate either NAV, ALIGN, ATT or FAIL.

Example: IRS 1 is deselected by FMS1. IRS1 continues to function normally, but FMS1 disregards the IRS1 inputs in its own best computed position computations. FMS2 would continue to use the inputs from IRS1 in computing its latitude/longitude position. De-selection of a sensor by any or all FMSs never shuts down that sensor or causes it to cease its own position computations.

GPS/IRS Sensors

GPIR# Status Page 1

This page is accessed from Data Page 2, and provides GPS and IRS sensor data.



GPIRS Laseref V Status Page 1

GPS – Displays the status of the GPS sensor:

- **HYB** – Navigation mode is using hybrid position from IRS and GPS
- **NAV** – GPS position alone is being used without IRS aiding
- **ALT** – Altitude aiding mode (ADC altitude being used to supplement poor satellite geometry)
- **INIT** – GPIRS is in initialization
- **ACQ** – GPS is acquiring satellites for navigation
- **TEST** – GPS is in test mode
- **FAIL** – GPS has failed, or no 429 data is being received
- **IRS** – Displays the status of the IRS sensor
- **NAV** – IRS has correctly aligned and is in NAV
- **ALIGN** – IRS is in alignment mode. The Time to Nav information in minutes is displayed in parenthesis next to the status
- **FAIL** – No ARINC 429 data received from GPIRS, or else GPIRS is sending FAIL status on 429 bus
- **ATT** – IRS is in ATTITUDE mode. Sensor will not be used for navigation.

EPU – EPU, the number of satellites being tracked and the North and East component velocities from the IRS, GPS, FMS, and Hybrid IRS/GPS.

SET HDG [2R] – IRS heading may be initialized by entering a heading in this field. The value entered is displayed and transmitted to the IRS for 12 seconds, after which dashes are displayed in the field again and transmission ceases. This function is used for setting IRS heading when in ATT mode. The field will indicate ° for magnetic and T for true heading.

The IRS and GPS can be independently selected or deselected from this page at LSKs [3R] and [4R], respectively.

INTEG – GPS Integrity status is displayed on this line and defined below.

RAIM – Receiver Autonomous Integrity Monitoring (only displayed with a RAIM capable GPS).

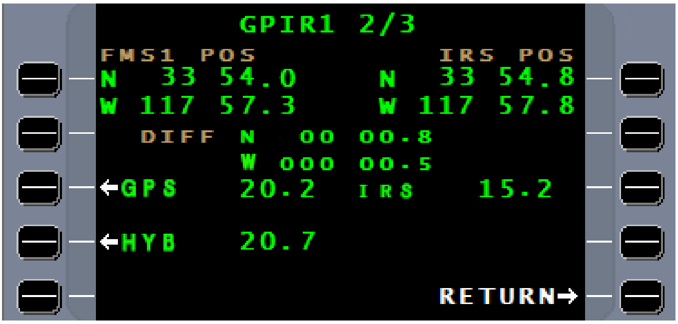
RADIO – Radio based (i.e., DME-DME) integrity monitoring.

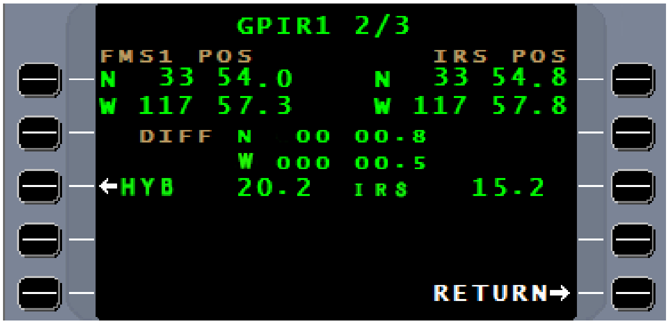
NONE – No integrity monitoring available. GPS position accuracy is not affected and will continue to be used for navigation. However, the pilot should monitor the FMS accuracy by comparing to other navigation sources, if available.

ALARM – Integrity monitoring indicates a GPS horizontal position error outside alarm limits applicable to the phase of flight.

HIL – Horizontal Integrity Limit in nautical miles. RAIM is available when HIL is equal to or less than 2 nm enroute, 1 nm terminal or 0.3 nm approach.

GPIR# Status Page 2





GPIRS Laseref V Status Page 2

This page is similar to Data Page 3, but only Hybrid, GPS and IRS positions are shown for comparison to FMS position. Pressing a LSK next to GPS, HYB or IRS will display that position in the upper right-hand fields and show the difference from the FMS position. The selected sensor identifier will be shown in small font and become unavailable as an option.

GPIR# Status Page 3

This page shows the values of key ARINC 429 labels from GPIRS, listed in the left-hand column. This page is for use primarily by technicians for diagnostic and troubleshooting purposes and is identical for all GPIRS sensors.

Heading Source

The heading source is displayed on Data Page 4 (General Data). The heading source is automatically selected upon system initialization, depending upon sensor availability, according to the following priority list:

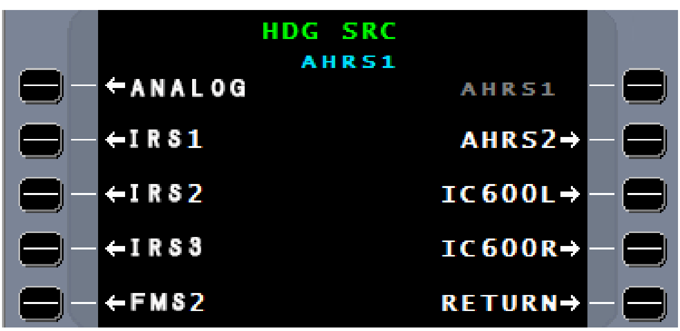
The heading source priority list is different for each installed FMS in a multiple system. The heading priority list for FMS1 is: IRS 1, AHRS 1, ANALOG, IRS 3, IRS 2, AHRS 2

For FMS 2: IRS 2, AHRS 2, ANALOG, IRS 3, IRS 1, AHRS 1

For FMS 3: IRS 3, AHRS 1, ANALOG, IRS 1, IRS 2, AHRS 2

NOTE: ANALOG represents the aircraft compass heading analog output converted to digital format. ANALOG is not used in some installations with multiple IRS sources. The priority list for individual installations is a function of the sensors available; however, the list will always follow the order shown here.

The Heading Source Page is used for manual heading source selection. It is accessed from Data Page 4 by pressing the LIST key with the cursor over the HDG entry field.



NOTE: The IC00L and IC00R options are only available on Embraer installations.

The current heading source is displayed just below the title line. Pressing a LSK will activate that heading source and return the display to Data Page 4.

ANALOG [1L] – This denotes the aircraft synchro compass heading converted to digital format.

OTHER FMS [5L] – This selects the same heading source used by the opposite system in a dual installation.

RETURN [5R] – This returns the display to Data Page 4 with no change in the heading source.

The system continuously scans the available sources selecting the source with both a valid heading output and the highest priority. For example, if the aircraft is configured with two sensors, IRS 1 and AHRS 1, then AHRS 1 would be initially selected as the heading source while IRS 1 is aligning. However, IRS 1 would automatically be selected as soon as it switched to NAV mode.

If the heading source in use should fail, the FMS will automatically switch to the next available source according to the priority list and the appropriate message (IRS # HEADING FAIL, AHRS # HEADING FAIL, or ANALOG HEADING FAIL) will become active on the Message Page. The system will not, however, automatically switch away from a heading source that has been manually selected, even if that source should fail. Also, the system will never automatically switch to either another FMS or the MAN heading input mode in search of a valid heading source. These choices do not appear on the automatic selection priority list above and must be manually selected if desired. The pilot should check the HDG SRC (source) menu for possible valid selections. The NO HEADING message will become active whenever the system does not have a valid heading input.

INTERFACES

Radar/MFD Interface

The FMS and RADAR/MFD interfaces have been accomplished in such a manner that the FMS flight plan waypoints and legs can be selected for display on the weather radar display. These external Radar and MFD interfaces include: ASCB MFD, CSDB MFD, CSDB TRU, Primus 1000, and Pro Line 4 systems. When the FMS is interfaced with Collins Pro Line 4 Avionics System, unique operational differences exist which are discussed in the applicable Pro Line 4 Supplement.

Radar Waypoints

With the mode selector switch on the RADAR/MFD control unit in the NAV position, the "joystick" on the display unit may be used to position the cursor to any point on the RADAR/MFD display where a radar waypoint is desired. For example, a radar waypoint may be desirable to the side of any on-course CB activity. Pressing the ENTER key on the RADAR/MFD control unit will then define a radar waypoint <R1> in the FMS. Up to 25 radar waypoints, <R1> thru <R25>, may be defined.

When CSDB MFD is configured, the FMS will create a new radar waypoint if a valid Distance to Joystick Cursor and valid Bearing to Joystick Cursor is received, and the bearing or distance to the cursor position has changed, and the Cursor is valid.

Radar waypoints must be selected from a list, which is accessed from either the Flight Plan Page or the DTO Page by pressing **[LIST]**.

Radar waypoints are used in the same manner as any other database waypoint. Either going direct-to the radar waypoint or modifying the flight plan to include it eliminates any need to "decouple" from the FMS or NAV mode of the flight guidance system by switching to the Heading mode. All radar waypoints will be automatically erased upon FMS initialization.

Radar waypoints are not part of the 200 Pilot Defined locations. They will appear on the FMS, as does any other waypoint. When the FPL DTO Page is displayed, the last radar waypoint defined is always the first choice on the page.

NOTE: Entry of more than 25 Radar Waypoints will create a DATABASE FULL system message to display.

Collins EFIS Interface

The following features are only available to the operator when the FMS system is interfaced to a Collins C-14 EFIS, Pro Line 4 or compatible.

NOTE: For aircraft interfaces that support the two-way interface with the heading bug, the FMS is displayed or coupled to the Flight Director/Autopilot System. The EFIS heading bug should be monitored for proper values and reset as required.

Two-Way Interface with Heading Bug

This function allows the FMS to receive selected heading settings that are driven from the heading select knob. These will appear in the command heading window on the FMS. Conversely, when the FMS is in FMS HDG, any entry on the FMS will be received by the EFIS, and the heading bug will slew to that value. In either case the Flight Guidance System (FGS) will fly to these heading when NAV is engaged. This feature is NOT supported in the CRJ 700 aircraft interface.

Go-Around Function

When the pilot presses the Go-Around button, the current Approach will be canceled. If there are additional waypoints in the flight plan between the end of approach and the destination, then the TO waypoint becomes the first waypoint following the end of approach. This is then referred to as the Missed Approach Procedure.

The Creation and Use of ILS Approaches

ILS approaches may be defined and linked into a flight plan using the same procedures as VOR, RNV, VFR and TCN approaches. When ARM APPR is selected on the FMS, the ILS receiver is automatically tuned to the ILS frequency by the FMS, and the EFIS arms for capture. If the pilot arms APPR on the Flight Guidance System, the aircraft will transition from lateral and vertical FMS mode to Approach mode using the localizer and glideslope signals from the ILS receiver. If the pilot flies the approach with only NAV mode selected on the FGS, then only lateral transitions will be made from FMS to Localizer.

Automatic Display of Second Course

If an approach is linked into the FMS flight plan, at 50 nautical miles from the end of approach the ARM APPR option will become available. When the approach is armed, the EFIS will automatically display the inbound approach course as the second course on the EHSI.

Enroute VNAV Pitch Commands

Enroute VNAV profiles may be flown while coupled to the Flight Guidance System. The FMS computes a Vertical Pitch Command, which is recognized when VNAV is selected on the FGS Mode Select Panel.

Honeywell MD80 EFIS Interface

The FMS can be configured to support Honeywell MD-80 EFIS. Coupled LNAV is supported. Coupled VNAV is NOT supported by this interface.

Collins Pro Line 21 Interface

The FMS can be configured to interface with Collins Pro Line 21 system, which provides ADC, AHRS, Digital Fuel, Go-Around and air-ground indications obtained by weight on wheels and weight off wheels data.

Air Data Computer

The Pro Line 21 system may have either single or dual ADC installations. When the FMS is receiving valid ADC data, it will display the ADC in use on Data Page 2 and on the ADC STATUS Page. On dual ADC installations there is an external ADC reversion switch in the cockpit; Pro Line 21 allows only one reverted ADC at a time.

Attitude Heading Reference System

The Pro Line 21 has dual AHRS installed. If the AHRS in use should fail, the FMS will annunciate the AHRS FAIL message and automatically switch to the other AHRS. The pilot can manually select as a heading source, any valid AHRS via the Heading Source Page. The FMS will not automatically revert to the offside AHRS when the reversion switch is activated but rather, the offside AHRS must manually be selected via the Heading Source Page.

Sextant IMS 100

The FMS can be configured to support the Sextant IMS. The IMS supports both LNAV and VNAV functions along with cockpit advisories. Radio Tuning of the onside DME and VOR is available through the FMS.

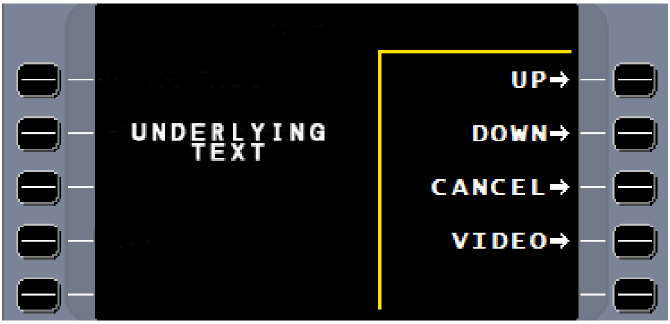
Video Interface

Support of external video sources is an optional feature of systems using a video compatible CDU. This feature allows interface with video cameras and cabin display systems.

During video mode, the FMS continues to navigate in a normal manner and no CDU messaging will occur. The remote message annunciator will operate in a normal manner. Pressing any CDU key will cause the display to exit video mode.

To Access Video Mode

1. Press **[ON/OFF]** to access the dimming control window.
2. Press **LSK [4R]**, to access the display options window.



3. Press **LSK [4R]** to access video mode. The active video source will be displayed.

Adjust Video Brightness

Refer to Adjust Screen Brightness in the Control and Display section.

Adjust Video Brightness

Refer to Adjust Screen Brightness in the Control and Display section.

Exit Video Mode

Press any key to exit video mode (except for LSKs **[1R]** and **[2R]**). Pressing a function key will cause that function screen to be displayed. Pressing any other key will return the display to the content that was being viewed prior to entering video mode.

ANNUNCIATIONS

Position Uncertain Annunciation

If the Position Uncertain message is active, "POS" will be displayed on the far-left side of the top line on the CDU display.

Remote Annunciations

The FMS outputs data for ten external annunciators to alert the pilot of system status or flight plan sequencing. These annunciations may be incorporated into the EFIS display:

MSG	A new message has been generated.
WPT	(Steady) Lateral waypoint alert. (Flashing) Vertical waypoint Flight Path Angle alert.
SXTK	FMS is in selected Crosstrack mode.
FMS HDG	FMS is in Heading Mode.
FMS APPR	FMS is in Approach Mode.
LNAV	LNAV Level of Service.
LNAV/VNAV	LNAV/VNAV Level of Service.
LP	LP Level of Service.
LPV	LPV Level of Service.
GPS INTEG	RAIM is not available, or a fault is detected. DME may be still in use.

MESSAGES

The FMS contains an array of messages that alert the operator to system status and flight plan sequencing. When a message is active, "MSG" will appear on the display and the message can be accessed by pressing the MSG key.

Each message the FMS can display is detailed in this section. A box around the procedures following the message definition indicates flight crew action. No action is specified for messages that are of an advisory nature only.

System messages are presented in alphabetical order on the following pages. Messages specifying the sensor number (GPS1, IRS2 and SBAS 2) are listed below with the number symbol (#) in place of the sensor number. However, the sensor number is used in the actual message. All messages are suppressed for the first thirty seconds after takeoff to minimize distractions to the pilot.

The Message function also is used for the airborne flight information system (AFIS) and UA's UniLink two-way data link in applicable installations.

MSG Key

When a new system message becomes active, "MSG" will appear on the far-right side of the top line on the CDU display. Pressing the MSG key will display the Message Page, which lists the active messages. The current messages (those messages generated since the page was last accessed) will be displayed at the top of the list. After the messages are viewed, the CDU display is returned to the previous page by pressing **LSK [5R]** on the Message Page or either **[MSG]** or **[BACK]**.

System Messages

400 Hz REF FAIL – 400 Hz AC power has failed and there is no input to the analog roll steering. This message is suppressed if the system is installed in an "all-digital" aircraft. It remains on the Message Page if the condition exists.

+1.5V PWR SUPPLY FAIL – Self-test for power supply has failed.

+3.3V PWR SUPPLY FAIL – Self-test for power supply has failed.

+5V PWR SUPPLY FAIL – Self-test for power supply has failed.

+12.2V PWR SUPPLY FAIL – Self-test for power supply has failed.

–12.2V PWR SUPPLY FAIL – Self-test for power supply has failed.

+13V PWR SUPPLY FAIL – Self-test for power supply has failed.

A/D CODE # – The A/D (Analog/Digital Board) self-test failed during self-test. "#" is the error code from 1 to 9. This message will only appear following system initialization. Heading and fuel flow inputs may be affected and should be checked if the system must be used. Codes are as follows:

- A/D Program Checksum Fail
- +15 VDC Self-test Fail
- -15 VDC Self-test Fail
- No Communication between A/D board and FMS.

A/D HEADING FAIL – The present system heading source, A/D (synchro analog-to-digital), was serving as the primary heading source but has failed. This message will be removed after it is displayed. Unless a NO HEADING message is also active, the system will have automatically selected another valid heading source. No action is necessary if another valid heading was selected. A check should be made on the appropriate Data Page to ensure that the heading source selected is the one desired and the heading is correct. This message is suppressed while the aircraft is on the ground.

Check the heading source on Data Page 4:
1. Press **[DATA]**, then **[NEXT]** to display Data Page 4.
2. Press **LSK [1L]**.
3. Press **[LIST]** to access a display of alternate heading sources.
4. Select an alternate heading source and press **[ENTER]**.
5. Or, enter a manual heading in the HDG field on Data Page 4.

ABEAM WAYPOINT ALERT – This message is displayed fifteen seconds prior to the sequencing time for an abeam intersection.

ABNORMAL CKLIST DB FAIL – Appears if the abnormal Checklist Database has failed (only with Collins Pro Line 4 800 configuration).

Reload the Checklist Database.

ADC ALT REQD FOR APRCH – Approach is active and the pilot has selected either a manual or crossfill altitude, which cannot be used for approach guidance.

ADC ALT REQD FOR VNAV – VNAV mode is either cruise or descent and the pilot has selected either a manual or crossfill altitude, which cannot be used for VNAV guidance.

ADC INPUT FAIL – An Air Data Computer (ADC) failure is detected. If the failure cannot be cleared, manual entries of TAS and altitude may be made on ADC Page 1.

1. Press **[DATA]**, then **[NEXT]** to display Data Page 2.
2. Press the LSK at ADC to access ADC Page 1.
3. Press **LSK [2L]**. Enter current true airspeed. A manual TAS overrides any ADC input.
4. Press **LSK [3L]**. Enter the current BARO altitude.
5. TAS and altitude inputs must be updated as required.
6. If a second FMS is installed, air data may be crossfilled from the other system.

NOTE: Without valid air data inputs to the FMS, VNAV is not available and any leg type terminators requiring altitudes will not be sequenced.

ADS-B OUT #n FAIL – Where n is 1 or 2 based on the XPDR position, this message is displayed when a failure is detected in a transponder's ADS-B OUT function. This message will remain until the failed condition is cleared.

AFIS ARINC FAILURE – A failure is present on the AFIS ARINC bus. If this message is the result of no acknowledgment from AFIS when the Aircraft Data file is sent every 60 seconds, then it will only be set once.

AFIS CONFIG INVALID – The AFIS DMU has invalid configuration data. This will disable the air/ground data link.

AFIS DOWNLINK FAIL – The AFIS DMU has determined that a downlink communication has failed. The last request should be repeated.

AFIS FPL RCVD – An uplinked FPL from the Global Data Center or a disk FPL from the AFIS DTU has been received and processed.

AFIS NO COMM – The AFIS DMU has failed to establish contact with the ground station. The last request should be repeated.

AFIS UPLINK FAIL – The AFIS DMU has determined an uplink communication has failed. The last requested information will probably not be received.

AFIS VHF LINK DISABLED – The AFIS DMU has determined the VHF link is disabled. This may be the result in a shared antenna system of the VHF antenna being used by the aircraft voice communication system. It may also occur when all in-range VHF ground networks have been disabled. This message will only be displayed on the FMS when a downlink request has been performed for Terminal Weather, Sigmets, Winds Aloft, Messages, or a Recall FPL and the AFIS has the VHF Link Status bit set to "disabled."

AFIS VHF MODEM FAILURE – The AFIS DMU has determined the VHF Modem unit within the AFIS is not operational. This message will remain on the MSG page until the condition clears.

AHRS # HEADING FAIL – The AHRS heading has failed while in use as the FMS heading source. This message is suppressed while the aircraft is on the ground.

1. Press **[DATA]**/**[PREV]**/**LSK [1L]**.
2. Press **[LIST]** to access a display of alternate heading sources.
3. Select an alternate heading source and press **[ENTER]**.

AHRS # INPUT FAIL – The AHRS input has failed, or its status word indicates failure.

AIRPORT DATABASE FAIL – A problem has been found in the airport section of the Navigation Database. Verify airport coordinates of interest. There is a high probability that the system will fail the initial self-tests the next time it is turned on. After landing and shutdown, turn the system off and then on again to troubleshoot.

Reload the Navigation Database.

AIRWAY DATABASE FAIL – A problem has been detected in the airway section of the Navigation Database.

Reload the Navigation Database.

ALERTER ABOVE VNAV ALT – In the Primus 1000 installation, VNAV is in descent mode and the altitude alerter has been dialed above the VNAV altitude.

ALERTER ALT INVALID – In the Primus installation for Cessna Excel, the selected altitude is either not received over the Primus input bus or it is invalid. This message will display until alerter altitude is received and valid.

ALIGN PT DATABASE FAIL – A problem has been detected in the alignment waypoints database.

Reload Pilot Defined Database.

ALIGN TO SEARCH – A search pattern is active and because the course to the search waypoint is greater than 60 degrees from the search course, guidance is actively being provided to align the aircraft with the initial or interrupted search pattern leg.

ALT INVALID FOR VNAV – VNAV is in descent mode, but (1) only pressure altitude is available, and the aircraft is below 18,000 feet, or (2) ADC altitude has failed.

ALTITUDE INVALID – The ADC altitude input is invalid. This message is suppressed while a GWS approach is active since baro altitude is not used for guidance. A manual entry of altitude may be made on the ADC Status Page.

1. Press **[DATA]**, then **[NEXT]** to display Data Page 2.
2. Press the LSK adjacent to ADC to access the ADC Status Page.
3. Press **LSK [3L]**. Enter the current BARO altitude.

ANALOG ATTITUDE FAIL – Displayed if analog inputs are being used for Doppler navigation and become invalid for more than five seconds. This message remains while inputs are invalid.

ANALOG BOARD FAIL – A failure is detected on the Analog Board. The outputs to the HSI may be affected, and depending upon installation, heading and fuel flow in some systems may also be affected. Verify on the Data Pages that the heading, TAS, and altitude inputs are reasonable.

1. Press **[DATA]**, then **[NEXT]** to display Data Page 2.
2. Press the LSK adjacent to ADC to access the ADC Status Page.
3. Verify TAS and altitude.
4. Press **[DATA]**, then **[NEXT]** to display Data Page 4.
5. Verify HDG.
   If HSI is analog type, do not use for navigation display.

ANALOG INST FAIL – The Analog Waypoint Bearing or Desired Track self-test has failed, or the instrument reference is missing.

APC INPUT FAIL – In the RC-135 aircraft installation, the aircraft performance computer (APC) Receive Bus is configured but no signal has been received for seven seconds.

APC STATUS – In the RC-135 aircraft installation, the APC has detected a partial failure or sensor input failure.

APPR CRS, PATH MISMATCH – Displays when the PAS approach mode status is active, but the FMC Approach Mode is inactive:

The flight crew should abort the approach.

APPR FACILITY INVALID – Presented with no message annunciator if the approach facility becomes invalid during an approach.

APPR RNP<CONFIG – Displayed when an approach has been inserted into the FPL via Company Route, Pilot Route, UniLink Route, or FCDB FPL insertion, which contains an RNP value less than the configured RNP Capability.

APPROACH DATABASE FAIL – A problem has been detected in the approach section of the Navigation Database that has rendered it unusable.

Reload the Navigation Database.

APPROACH IN USE – The currently accessed approach is in use in the flight plan and cannot be modified or deleted.

APPROACH SEGMENT FULL – A leg has been inserted into the approach segment and the approach segment leg limit has been reached.

ARPT COMS DATABASE FAIL – A failure has been detected in the airport communications section of the Navigation Database. Access to some airport communications will be prevented.

Reload the Navigation Database.

ARPT NAME DATABASE FAIL – A failure has been detected in the airport geographical names database. Access to some airport names will be prevented.

Reload the Navigation Database.

ASCB FAIL – ASCB board failure has been detected during or after the power-up self-test. This message will remain on the Message Page until the condition clears.

ASCB TX INOPERATIVE - The ASCB board will not transmit. This message will clear when acknowledged or when the condition clears.

ASCB LEFT BUS FAIL – ASCB left system bus has failed. FMS operation may be degraded. This message will clear when acknowledged or when condition clears.

ASCB RIGHT BUS FAIL – ASCB right system bus has failed. FMS operation may be degraded. This message will clear when acknowledged or when condition clears.

AUXILIARY BOARD FAIL – The Auxiliary Board has failed self-test.

BACKUP DATABASE FAIL – The backup navaid database has failed.

BARO ALT NOT AVAILABLE – Barometric altitude is not available from installation of an ADC without barometric altitude or from loss of barometric altitude. This message will clear after acknowledgement or when the condition clears.

CANCELED LOC STEERING – This message is displayed when prior to the FAF and a LOC, or BC approach is active and the localizer signal and computed crosstrack has exceeded limits.

CDU DATA BUS FAIL – This message is generated by the CDU when it has not been refreshed by the FMS. The message indicates that the CDU is functioning properly and that either an FMS problem or a wiring problem might exist.

1. Press **[ON/OFF/DIM]** to power down the FMS (do NOT use the circuit breaker to cycle power to the FMS, and do NOT secure power to the aircraft without first properly powering down the FMS).
2. Press **[ON/OFF/DIM]** to power-up the FMS again and observe the indicators and annunciators for the FMS power-up self-test.
3. If the CDU DATA BUS FAIL message appears again and the FMS power-up self-test occurs normally, a wiring problem exists.
4. If the CDU DATA BUS FAIL message appears again and the FMS power-up self-test does not occur, then a problem exists with the FMS.

CFG DATA LOAD MODIFIED – The FMS configuration data loaded from disk does not fully specify all configuration parameters. The FMS retains existing settings for undefined parameters. This condition occurs when the disk revision number is less than the FMS revision number.

CKLIST DATABASES FAIL – Appears if all Checklist Databases have failed (only with Collins Pro Line 4 interface).

Reload the Checklist Database.

CLOCK TIMER FAIL – The clock timer on the CPU board has failed self-test.

COMP ARPTS DATABASE FAIL – A part or the entire company airports database has failed.

COMP ROUTE DATABASE FAIL – A part or the entire company route database has failed.

COMP WPTS DATABASE FAIL – A part or the entire company waypoints database has failed.

CONFIG DATA FAILED – The FMS configuration data has failed.

CONFIG MODULE FAILED – Communication with or data in the configuration module has failed. Attempt to store configuration to determine cause.

CONFIG UPDATE REQUIRED – Configuration module and FMS configuration data has failed, requiring the FMS to be configured for installation.

CREW CKLIST DB FAIL – Appears if the crew notes database has failed (only with Collins Pro Line 4 interface).

CROSSFILL FAIL: BAD DATA – A flight plan crossfill task has failed due to a communications error.

CROSSFILL FAIL: BUS – A crossfill task has failed due to a crossfill bus timing out or an ARINC board failure.

CROSSFILL FAIL: FPL CHGD – A flight plan crossfill task has failed due to the flight plan being edited in the other FMS during crossfill.

CSDB SELFTEST FAIL – CSDB serial ports have failed self-test. VOR, DME, or RTU function may be disabled.

CURRENT LEG EXTENDED – Presented when the aircraft flies past the terminator of the current leg and no next leg is defined, resulting in guidance displays being an extension of the current leg. TO/FROM will show FROM and distance from waypoint will increase.

DATABASE CORRECTING – A minor failure has been detected in the database and an error correcting process is being run. Access to the database is restricted until the correction process has been completed and the database passes its self-test.

DATABASE EXPIRED – The current date is past the Navigation Database Expiration Date as displayed on the Initialization Page and the Data Pages.

NOTE: The DATABASE EXPIRED message may still appear if the active database is expired, and a database is loaded that has not reached its effective date.

Load an up-to-date Navigation Database.

DATABASE FAIL – Part or all the Navigation Database has failed.

Reload the Navigation Database.

DATABASE FULL – The Pilot Defined Database (SID, STAR, or Approach) is full, and a procedure is created or modified that exceeds the database capacity, or the number of entered radar waypoints has exceeded 25.

DATABASE VAX LOADED – The database was loaded from a VAX host computer instead of a DDU.

DEAD RECKONING MODE – (DR) True air speed and heading are the only sensors being used for navigation.

DEMONSTRATION MODE – The aircraft identification is configured as "DEMO" and sensor data is simulated internally.

Do NOT use this FMS for navigation.

DISCRETE I/O FAIL – The discrete input/output self-test has failed.

DISK FORMAT FAILURE – An attempt to format a disk was unsuccessful. This message will only be displayed when not in the disk submenu.

DISK FULL - REPLACE IT – The disk in the DTU has become full while Data Recording was active and a Disk Page is not currently displayed. If a Disk Page was displayed when the disk became full, then the message is displayed on a Disk Error Page.

DISK WRITE FAILURE – An attempt to write to a disk in the DTU was unsuccessful. This message will only occur when a Disk submenu page is not being displayed.

DME TUNE FAIL – An ARINC 709 series DME has not tuned to the pilot requested frequency. The message appears regardless of the select status of the DME and is cleared when the radio successfully tunes.

DOPPLER MODE CONTROL FAULT – Doppler status is a state other than that commanded for more than ten seconds.

DOPPLER ARINC FAIL – One or more specific labels from the Doppler have not been received by the FMS for ten seconds. The message will clear once the label(s) are read.

DOPPLER BASED DR – All sensors except Doppler are deselected or failed.

DOPPLER DESELECT – The specified Doppler data is questionable and has been deselected for navigation.

DOPPLER FAIL – Doppler is selected and has failed.

EFIS #1 SEL HDG FAIL – The pilot's heading bug input from the interactive heading interface has failed.

EFIS #2 SEL HDG FAIL – The copilot's heading bug input from the interactive heading interface has failed.

EMERGENCY CKLIST DB FAIL – Appears if the emergency Checklist Database has failed (only with Collins Pro Line 4 interface).

END OF SXTK ALERT – This message displays prior to the current leg sequencing when selected crosstrack is active and SXTK is not available on the next leg.

ENROUTES DATABASE FAIL – The enroute intersections section of the Navigation Database has failed.

Reload the Navigation Database.

ENRT COMS DATABASE FAIL – The enroute communications section of the Navigation Database has failed.

Reload the Navigation Database.

ERP # FAIL – This message will be on the #1 FMS if the #1 EFIS Radar Panel (ERP) has failed. The message will be on the #2 FMS if the #2 ERP has failed (only with Collins Pro Line 4 interface).

ETP ALERT – This message displays when the distance to go (DTG) to the equal time point (ETP) is five nm.

FLEXPERF BASE DB FAIL – Message is displayed upon detecting a CRC failure on the FlexPerf Base database.

FLEXPERF OP DB FAIL – Message is displayed upon detecting a CRC failure on the FlexPerf Operational database.

FLEXPERF DB MISMATCH – Message is displayed if a FlexPerf Base database exist in internal memory and the database identifier in the FlexPerf Base database is not identical to the database identifier specified in the FMS Configuration.

FMC BATTERY LOW – Self-test has detected that the FMC battery is out of range. Navigation is still possible; however, at shutdown the position, date and time may be lost.

Return the FMS to Universal Avionics for repair.

FMC DATALINK QUEUE FULL – The FMC datalink queue is full and subsequent FMC transmission attempts may result in the loss of the datalink message.

FMS # GLS MISMATCH – GLS and FMS deviations differ by more than one dot (that is, 10°).

FMS-BC DIFFERENCE WARN – The FMS is in approach mode on a backcourse type approach, and the track angle error is less than 3°, crosstrack error is less than 0.2 nm and the localizer deviation is greater than 0.039 DDM (1/2 dot).

FMS DIFFERENCE > xxnm – The sensor "watchdog" has sensed that the latitude/longitude positions of the two systems in a dual installation differ from each other by an amount that warrants pilot attention. "xx" can be six, twelve, eighteen or twenty-four nm. Since both FMSs normally use the same sensors, this should not happen. If it does:

1. Check the Nav Pages on each FMS and follow the system displaying the smallest difference between the FMS and sensor latitude/longitude positions.
2. If the FMSs are using different sensor inputs, refer to Navigation Sensor Accuracy Messages in the Abnormal Procedures section.

FMS-FLOC DIFF WARN – During an FMS-ILS approach, the aircraft is inbounded on the same desired track as the ILS, and FMS deviation is less than 0.2 nm while ILS localizer deviation is greater than 1/2 dot.

FMS INIT NOT COMPLETE – A disallowed mode key was pressed while on the Disk Menu Page when it was accessed from the Initialization Page. Only the TUNE and MSG keys are allowed.

FMS NETWORK COMM FAIL – Indicates the FMS's internally programmed Ethernet address has failed. The FMS will operate normally but cannot communicate with the DTU or other line replaceable units on the network.

FMS OVERTEMP – The internal NCU temperature rises above a preset hardware limit. This message will be inhibited while Approach is Active. This message is removed from the MSG page when the temperature falls below the hardware limit.

FMS PART NUMBER MISMATCH – The FMS installed has a different part number from that stored in the configuration module. Verify installation is correct.

FMS SYNC LOSS – FMS displays this message whenever synchronized operation has terminated without flight crew selecting INDEPENDENT on the SYNC Page. This message may occur when a manual synchronization fails, when an automatic synchronization update occurs and fails (such as initial synchronization upon power-up and the offside FMS is not yet powered-up, or any other pilot action which updates the synchronization mode).

FPL CAPACITY EXCEEDED – The pilot attempted to enter more than 98 waypoints in a flight plan.

FPL DISK MINOR ERROR – When a flight plan disk is loaded, the number of records found on the disk do not match the number of records in the header file on the disk. The flight plan should be completely reviewed for accuracy.

FUELFLOW FAIL – A fuel flow failure is detected. Manual fuel flow entries may be made.

FUEL FLOW SELFTEST FAIL – Self-test of the fuel flow measurement circuitry has failed.

FUEL NOT CONFIRMED – The FMS was powered up from the Standby mode and the fuel has not been confirmed on Fuel Page 1.

GLONASS DEPENDENT NAV – The FMS is in GPS Navigation mode, the GLS/GNSS sensor is in Navigation mode and the total number of GPS satellites is less than four and at least one GLONASS satellite is in use for navigation.

GLS FACILITY INVALID – A GLS ground station failure is indicated.

GLS # CONFIG MODULE FAIL – A mismatch has occurred between data stored in the configuration module and data calculated by the GLS sensor.

GLS # DESELECT – The sensor monitor has determined that the GLS data is unreasonable and has deselected the sensor. This message will be removed after it is read.

GLS # DIFFERENCE > xxnm – The sensor “watchdog" has sensed that the latitude/longitude position as determined by GLS #1 or #2 differs from the FMS best computed position by an amount that warrants pilot attention. "xx" can be six, twelve, eighteen or twenty-four nm.

GLS # FAIL – A failed status has been determined for the indicated GLS.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the LSK adjacent the sensor to access the Sensor Status Page.
3. Check the sensor status.

GLS # NOT NAV – The specified GLS has changed to a non-navigational condition (that is, it is none of the following: DGPS, Navigation, Altitude-Aiding or Fault). The GLS Status Page will show the cause of the change. This message is delayed 3 minutes on ground after the initial failure condition to avoid nuisance alerts, or 6 seconds in-air. The timer will reset when the GPS transitions to DGPS, NAV, Altitude Aiding, or after power-up.

GLS# VDL FAIL – This message will follow an APPR FACILITY INVALID message. It informs the flight crew that the approach facility may be operational, but the GLS VHF datalink board has failed.

GNSS # DESELECT – The sensor monitor has determined that the specified GNSS data is unreasonable and has deselected the GNSS sensor for use in navigation. The message will be removed after it is displayed once.

GNSS # DIFFERENCE > xxnm – The sensor “watchdog" has sensed that the latitude/longitude position as determined by the GNSS differs from the FMS best computed position by an amount that warrants pilot attention. "xx" can be six, twelve, eighteen or twenty-four nm.

GNSS # FAIL – A failed status has been determined for the indicated GNSS.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the LSK adjacent the sensor to access the Sensor Status Page.
3. Check the sensor status.

GNSS # NOT NAV – The specified GNSS has changed to a non-navigational condition (that is, it is none of the following: Navigation, Altitude-Aiding or Fault). This message will be removed when the GNSS goes into Navigation or Altitude-Aiding mode. The GNSS Status Page will show the cause of the change. This message is delayed 3 minutes on ground after the initial failure condition to avoid nuisance alerts, or 6 seconds in-air. The timer will reset when the GNSS transitions to a valid navigation mode or after a power-up.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the LSK adjacent the sensor to access the Sensor Status Page.
3. Check the sensor status.

GPIRS # DESLECT – The sensor monitor has determined that the specified GPS data is unreasonable and has deselected the GPS portion of the sensor.

GPIRS # DIFFERENCE > xxnm – The sensor “watchdog" has sensed that the latitude/longitude position as determined by the GPS portion of the GPIR# (1, 2 or 3) differs from the FMS best computed position by an amount that warrants pilot attention. "xx" can be six, twelve, eighteen or twenty-four nm.

GPIRS # FAILED – A Fail status has been determined for the GPS portion of the indicated GPIRS, because the position data is missing or invalid or the status label indicates a Fail status exists.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the LSK adjacent the sensor to access the Sensor Status Page.
3. Check the sensor status.

GPIR # GPS NOT NAV – The GPS portion of the specified GPIRS has changed to a non-navigational condition (that is, it is none of the following: Navigation, Altitude-Aiding or Fault). The GPS Status Page will show the cause of the change. This message is delayed 3 minutes on ground after the initial failure condition to avoid nuisance alerts, or 6 seconds in-air. The timer will reset when GPS goes NAV or Altitude Aiding mode, or after a power-up.

GPS # DESELECT – The sensor monitor has determined that the specified GPS data is unreasonable and has deselected the sensor for use in navigation. The message will be removed after it is displayed once.

GPS # DIFFERENCE > xxnm – The sensor "watchdog" has sensed that the latitude/longitude position as determined by GPS# (1, 2, or 3) differs from the FMS best computed position by an amount that warrants pilot attention. "xx" can be six, twelve, eighteen or twenty-four nm.

GPS # FAILED – A failed status has been determined for the indicated GPS either because the position data is missing, invalid or because the status label indicates that a Fail status exists.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the LSK adjacent the sensor to access the Sensor Status Page.
3. Check the sensor status.

GPS # NOT NAV – The specified GPS has changed to a non-navigational condition (that is, it is none of the following: Navigation, Altitude-Aiding or Fault). The GPS Status Page will show the cause of the change. This message is delayed 3 minutes on ground after the initial failure condition to avoid nuisance alerts, or 6 seconds in-air. The timer will reset when GPS goes NAV or Altitude Aiding mode, or after a power-up.

GPS ONLY NAVIGATION – Displayed if a non-RAIM GPS is the only position sensor available. This message is displayed sixty seconds after the condition appears and remains if the condition exists. This message is suppressed on the ground.

GPS-RADIO POS DIFFERENCE – The sensor monitor detected an exceedance in the position difference or divergence rate with only a GPS-based and radio-based position. This message is displayed when all three of the following conditions are true: (1) The positions being monitors by the Sensor Monitor consist of only a GPS-based position and radio-based position (DME, VOR or TACAN). (2) The sensor monitor detected an exceedance in the position difference or divergence rate. (3) The HIL input of the GPs sensor sis invalid.

HEADING REF FAIL – The AC reference for the Analog Heading input has failed.

HIGH GROUNDSPEED FOR ARC – The current leg is an AF or RF and the groundspeed is too high for the aircraft to stay within the bounds of the arc.

HIGH GNDSPD FOR HOLDING – In holding mode, the current groundspeed is excessive for holding airspace. This may be due to either high winds or high TAS. The pilot should lower airspeed if feasible.

IC600L HEADING FAIL – In the Cessna Bravo, Cessna Ultra, or Embraer 145, the heading source has failed while in use.

IC600R HEADING FAIL – In the Cessna Bravo, Cessna Ultra, or Embraer 145, the heading source has failed while in use.

IC-L BUS FAIL – In the Cessna Bravo, Cessna Bravo II, Cessna Ultra, Cessna Excel, Cessna Ultra II or Embraer 145 configuration, label 371 has reported invalid hardware equipment condition, operational mode, or data word content, or is not detected on the left-side bus.

IC-R BUS FAIL – In the Cessna Bravo, Cessna Bravo II, Cessna Ultra, Cessna Excel, Cessna Ultra II or Embraer 145 configuration, label 371 has reported invalid hardware equipment condition, operational mode, or data word content, or is not detected on the right-side bus.

ILLEGAL FACILITY TYPE – The entered facility is of an invalid type for this approach.

ILLEGAL WAYPOINT – A turn center waypoint has been entered for a Pilot Defined RF leg that defines a radius greater than 32 nm.

ILS DATABASE FAIL – An error has been detected in the ILS database and access to the ILS database is not allowed.

IMS BUS FAIL – Either invalid hardware equipment condition, operational mode or data word content is detected on the bus, or specific data word content is not detected. This applies to the Sextant IMS-01 and IMS-02 configuration used on Bombardier DHC-8 Q400.

INSIDE LOA – The aircraft is inside a defined LORAN Operating Area (LOA). This message will be removed after it is displayed.

INVALID ARINC VERSION – ARINC circuit boards are installed with software versions that are not compatible with the FMS software version.

INVALID CONFIGURATION – The FMS configuration is invalid. Further information can be found in the applicable FMS Configuration Manual.

INVALID CONFIG - TAWS – Any of several errors or mismatches made during FMS configuration for TAWS can cause this message to display.

INVALID CONFIG - VISION-1 – Vision-1 is configured as enabled but the high speed UNS-429 bus is not configured.

INVALID FUEL CONFIG – The fuel flow sensor configuration is invalid or incomplete. The fuel flow function will be disabled.

INVALID ROUTE UPLINK – UniLink has detected an error during a flight plan uplink.

INVALID EDM PASSCODE – Displayed when, upon power up, the FMC EDM status is enabled while the PAS EDM status is disabled. This message is displayed until the condition is cleared.

INVALID XC MON PASSCODE - The stored FMS Xchan monitor status is disabled while the PAS Xchan monitor status is enabled.

IRS # ALIGN – The specified IRS is in the alignment mode. The aircraft must remain stationary at this time.

IRS # ALIGN FAULT – The entered position failed the 3+3T test or the latitude comparison test. Re-enter position.

IRS # ATTITUDE – The specified IRS is in the attitude reference mode. Navigation data is not available.

IRS # CODE 01 – (Delco only) Turn specified NAV unit off.

IRS # CODE 02 – (Delco only) Select ATT mode on specified IRS.

IRS # CODE 03 – (Delco only) Check heading output from the specified IRS.

IRS # DC FAIL – The backup battery or DC bus is below 17 VDC.

IRS # DC FAIL ON DC – The last shutdown of the system was due to a power interrupt and not because of IRS failure.

IRS # DESELECT – The sensor monitor has determined that the specified IRS data is unreasonable and has deselected the sensor for use in navigation.

IRS # DIFFERENCE WARNING – IRS position difference exceeds a rate of two knots.

IRS # FAIL – An inertial reference system failure is detected in the IRS indicated.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 2.
2. Press the LSK adjacent the sensor to access the Sensor Status Page.
3. Check the sensor status.

IRS # HEADING FAIL – The system heading source, IRS# (1, 2, or 3) has failed. Unless a NO HEADING message is also active, the system will automatically select another valid heading source. A check should be made on the appropriate DATA Page to ensure that the heading source selected is the one desired and the heading is correct.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4.
2. Press **LSK [1L]**.
3. Press **[LIST]** to access the Heading Source Page.
4. Check the heading source and change if desired.

IRS # NAV – IRS Alignment is complete, and the specified IRS is in Navigation Mode.

IRS # ON BATTERY – The specified IRS is being powered by a DC power source or standby battery.

IRS # READY NAV – In installations using Delco IRS only, the IRS align status is 5.

LAT/LONG XING WPT ALERT – This message displays fifteen seconds prior to sequencing time for latitude or longitude intersection.

LCS DESELECT – The sensor monitor has determined the LCS position is unreasonable and has deselected the sensor for use in navigation.

LCS DIFFERENCE > xxnm – The FMS and LCS differ from one another by an amount that warrants pilot attention. "xx" can be 6, 12, 18, or 24 nm.

LCS FAIL n – Message displayed where n is the failure code for the type failure the LCS has detected.

LCS NAV – The LCS status has changed to the navigational mode. This message will not appear is the LCS is deselected, and the aircraft is airborne. This message will be removed after it is displayed.

LCS NOT NAV – The LCS status has changed to a not navigational condition. The cause of the change is displayed on the LORAN STATUS page (DATA mode). This message will be removed after it is displayed.

LEFT IOC-OFFSIDE FAIL – This message will be displayed on the #2 FMS if the offside input/output concentrator has failed (only with Collins Pro Line 4 or Pro Line 21 configuration).

LEFT IOC-ONSIDE FAIL – This message will be displayed on the #1 FMS if the onside input/output concentrator has failed (only with Collins Pro Line 4 or Pro Line 21 configuration).

LNAV/VNAV NOT AVAILABLE – LNAV/VNAV is the highest charted level of service, and it is not available at approach arm or approach activation.

1. Press **LSK [4L]** to display the RNAV APPR LOS Page.
2. Manually select an available alternative LOS for the approach.

LOC STEERING ACTIVE – An LOC or BC Approach is active, and the localizer signal is used in the roll steering equation. FMS XTK calculation is based on the raw localizer signal input.

<LOS> AVAILABLE – This message is displayed when the following conditions are met:

- The FMS is approach active or approach armed
- The FMS is not on the FAS
- The LOS is enabled and available
- The LOS is higher than the automatically selected LOS at approach arming
- The Currently selected LOS was not manually selected.

NOTE: If this message is triggered, the FMS displays an "APPR LOS" prompt at LSK [5L] on the Message Page. Pressing LSK [5L] displays the Approach Category (LOS) Selection page.

<LOS> NOT AVAILABLE – This message is displayed when the highest-charted LOS of an SBAS approach is not available at approach arming. The <LOS> is replaced with the LOS from the FASDB, e.g., LP, LPV, LNAV/VNAV, or LNAV. This message is removed when the condition clears.

LOW ALTITUDE ALERT – An LPV or LNAV approach is active, and the aircraft altitude falls below the FAF altitude by VPL.

NOTE: Prior to sequencing the Final Approach Way Point (FAWP), the FMS will provide an altitude alert if the estimated position is lower than the desired FAWP height by more than 50m + VPL (approximately 165 feet).

LP APPR INHIBITED – The FMS will display this message, one to five minutes after power-up, when the LP functions are inhibited (as indicated by the PAS).

NOTE: If equipped with an LP/LPV Monitor and this message remains after re-running the power-up self-test, it may indicate a LP/LPV Monitor failure in which case Universal Avionics Product Support should be contacted.

NOTE: The FMS will display the LP APPR INHIBITED messages when the cross channel built-in-test (XC BIT) is interrupted or fails during power-up self-test. These messages are intended to predict unavailability of LP LOS at approach arm and will remain on the Messages Page until the XC BIT is successful. In dual installations, both FMSs must pass the XC BIT for the message to extinguish.

LP NOT AVAILABLE – LP highest charted level of service and it is not available at approach arm or approach activation.

1. Press **LSK [4L]** to display the RNAV APPR LOS Page.
2. Manually select an available alternative LOS for the approach.

LPV APPR INHIBITED – The FMS will display this message, one to five minutes after power-up, when the LPV function is inhibited (as indicated by the PAS).

NOTE: If equipped with an LPV Monitor and this message remains after re-running the power-up self-test, it may indicate a LPV Monitor failure in which case Universal Avionics Product Support should be contacted.

NOTE: The FMS will display the LPV APPR INHIBITED messages when the cross channel built-in-test (XC BIT) is interrupted or fails during power-up self-test. These messages are intended to predict unavailability of LPV LOS at approach arm and will remain on the Messages Page until the XC BIT is successful. In dual installations, both FMSs must pass the XC BIT for the message to extinguish.

LPV NOT AVAILABLE – LPV highest charted level of service and it is not available at approach arm or approach activation.

1. Press **LSK [4L]** to display the RNAV APPR LOS Page.
2. Manually select an available alternative LOS for the approach.

MAGVAR DB FAIL – A problem has been found in the navigation MagVar database. Access to this database will not be permitted. The FMS will instead use the backup MagVar database.

MANUAL LEG CHANGE REQD – The aircraft is on a CA, FA, or VA leg and barometric altitude is not available to the FMS. The flight crew must make a manual leg change to sequence the waypoint.

MAX GS FOR TURN:XXX KTS (where XXX is the maximum ground speed limit for the turn) – When the MMMS is in the RISING LADDER, RACE TRACK, or SECTOR search pattern and MIN TRN TIME is the selected turn preference (PREF). This message displays if the aircraft ground speed is too high for the selected turn preference. The message will indicate the maximum recommended ground speed in KTS.

MEMORY BANK # FAIL – In dual cycle memory bank FMSs, either memory bank 1 or memory bank 2 has failed and all databases in the failed bank are unusable.

Reload the Navigation Database into the other bank.

MODE KEYS INOP - DISK PAGE – A disallowed mode key was pressed while any Disk Page (except Disk Menu) is displayed. The MSG key is the only key allowed.

MOT WPT LIST FULL – For MMMSs only. The next mark-on-target (MOT) waypoint added to the list will scroll the oldest waypoint from the circular buffer.

MOT WPT MEMORY FAIL – For MMMSs only. The MOT waypoint memory section has failed during power-up self-test.

NAV DATABASES FAILED – All segments of the Navigation Database failed simultaneously. This message replaces all individual segment messages.

Reload the Navigation Database.

NAV RADIO DESELECT – This message is displayed when position data is not valid, and two or more radio sensors are configured. All configured radio sensors are deselected (DME, VOR, TACAN).

NDB DATABASE FAIL – A problem has been found in the non-directional beacon (NDB) section of the Navigation Database. Access to this database will not be permitted.

Reload the Navigation Database.

NDB NAME DATABASE FAIL – An error was detected in the NDB plain language name database.

Reload the Navigation Database.

NEW MAINT LOG EXISTS – Displayed on the FMS CDU one minute after the completion of flight (air to ground transition) when any diagnostic history event has been recorded on that flight.

NEXT LEG UNDEFINED – A gap is in the next flight plan waypoint position. The flight plan must be edited by the pilot to eliminate the gap. If the gap is not eliminated, the aircraft will fly to the current TO waypoint, and after waypoint passage will continue to fly the same desired track with the TO/FROM flag now indicating FROM. The WPT annunciator will remain illuminated after waypoint passage and a **CURRENT LEG EXTENDED** message will appear on the Message Page.

NOTE: The gap placed at the end of the approach before the destination airport does not trigger this message.

1. Press **[FPL]** to access the Flight Plan pages. 2. Edit the flight plan to remove the gap.

NEXT VNAV LEG INVALID – The VNAV leg following the current leg is either undefined, too steep, or a climb; FMS vertical guidance will become invalid after crossing the current vertical TO waypoint in ILS advisory approaches; or the current VNAV leg is not the EOA. The pilot must take action to define a valid NEXT VNAV leg. This message will apply to procedural legs in SIDs, STARs and approaches which are "floating waypoints", e.g., heading to intercept a VOR radial.

This message also appears if the TO vertical waypoint is the second or subsequent approach waypoint of an ILS approach with the ILS approach configured as "advisory."

NO HEADING – No heading information is being received. This message will not be displayed while on the ground. If a valid heading source was available, it should have already been automatically selected.

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4.
2. Press **LSK [1L]** to place the cursor over the heading field.
3. Press **[LIST]** to access the Heading Source Page.
4. Change the heading source if desired.
5. If no other heading source is available, manually input the aircraft's heading on Data Page 4.

NO INTERCEPT – The system is in the heading intercept mode and the selected heading will not intercept the current navigation leg.

NO SATELLITE INTEG – GPS integrity monitoring is not available for twenty-seven seconds in Enroute flight phase and for seven seconds in Terminal flight phase. In Approach phase after FAF, GPS integrity monitoring is not available and HDOP is greater than 4.0 for seven seconds. While on the ground, the first occurrence of this message is suppressed. This message is suppressed for the GLS when the sensor is in precision approach mode.

NONVOLATILE MEMORY FAIL – The non-volatile memory (NVM) has failed the power-up test. Some or all of the NVM parameters may be lost. This message can only occur following system initialization.

NORMAL CKLIST DB FAIL – Appears if the normal Checklist Database has failed (only with Collins Pro Line 4 interface).

Reload the Checklist Database.

OFFSIDE FLAP POS FAILED – No offside flap position input is detected in the Lear 45 Primus 1000 installation.

ONSIDE FLAP POS FAILED – No onside flap position input is detected in the Lear 45 Primus 1000 installation.

OTHER FMS HEADING FAILED – An FMS is using the heading source from another FMS, and that heading source has failed.

1. Press **[DATA]** to access Data Page 4.
2. Press **LSK [1L]** to place the cursor over the HDG field.
3. Press **[LIST]** to access the Heading Source Page and select another source if available.

OUTSIDE LOA – The aircraft is outside of a defined LORAN operating area. This message will be removed after it is displayed.

OVERSPEED INVALID – The FMS doesn’t receive one or more of the following input labels required for Overspeed mode: Label 206, Indicated Airspeed, label 207, Max allowable Airspeed, label 331, Longitudinal Acceleration and Pitch Angle, label 324.

PA DATABASE FAIL – The SBAS Subsystem has rejected the FAS DB due to either an invalid CRC or unreasonable data content. This message occurs when an SBAS approach is linked to the flight plan and the CRC check has failed due to an invalid FAS DB.

If message occurs when loading an SBAS approach into a flight plan, clear the selection and reload it into the flight plan. If this does not resolve the error, reload the Navigation Database.

PAS/ANALOG FAIL – The PAS/Analog board has failed. This message will be displayed until the failed condition is cleared.

PAS/ARINC FAIL – The PAS/ARINC board has failed. This message will be displayed until the failed condition is cleared.

PAS CONFIG FAILED – Communication with or data in the PAS configuration data has failed. This message will be displayed until the failed condition is cleared.

PAS CONFIG UNCONFIRMED – This message is displayed as indicated by the PAS, when its Critical PAS Configuration data is unconfirmed. Installer/Operator must manually confirm the data.

PERF DATABASE FAILED – The Performance Database has failed. Advanced performance features will be disabled.

Reload the Performance Database.

PERF DB ID MISMATCH – The Performance Database identifier entered on the configuration pages does not agree with the Performance Database identifier on the disk that is loaded. Advanced performance features will be disabled.

PERF T/O GW UPDATE REQD – The current takeoff gross weight differs by more than 2.5% from the value entered in the takeoff gross weight field.

1. Press the key sequence **[BACK]** > **[ENTER]** to update, or 2. Enter a manual value in the T/O gross weight field.

PILOT ALIGN DB UPDATED – This message appears after the Check All process. It indicates a change to the pilot alignment waypoint database based on loaded or resident navigation data and requires redefinition or confirmation by the pilot.

PILOT APPR DATABASE FAIL – A problem has been detected in the Pilot Defined Approach Database.

Reload data from the Pilot Data Save disk.

PILOT APPR DB UPDATED – Displayed following the Check All Process. Indicates pilot approach data has been updated by the system as a result of a navigation data update. Requires definition or confirmation by the pilot.

PILOT ARPT DATABASE FAIL – A problem has been detected in the Pilot Defined Airport Database.

Reload data from Pilot Data Save disk.

PILOT ARPT DB UPDATED – This message appears after the Check All process. It indicates a change to the pilot airport database based on loaded or resident navigation data and requires redefinition or confirmation by the pilot.

PILOT DATABASES FAILED – The database of all pilot defined locations has failed.

Reload data from Pilot Data Save disk.

PILOT RNWY DATABASE FAIL – A problem has been detected in the Pilot Defined Runway Database.

Reload data from Pilot Data Save disk.

PILOT ROUTE DATABASE FAIL – A problem has been detected in the Pilot Defined Route Database.

Reload data from Pilot Data Save disk.

PILOT ROUTE DB UPDATED – This message appears after the Check All process. It indicates a change to the pilot route database based on loaded or resident navigation data and requires redefinition or confirmation by the pilot.

PILOT SID DATABASE FAIL – A problem has been detected in the Pilot Defined Database.

Reload data from Pilot Data Save disk.

PILOT SID DB UPDATED – This message appears after the Check All process. It indicates a change to the Pilot Defined Database based on loaded or resident navigation data and requires redefinition or confirmation by the pilot.

PILOT STAR DATABASE FAIL – A problem has been detected in the Pilot Defined Database.

Reload data from Pilot Data Save disk.

PILOT STAR DB UPDATED – This message appears after the Check All process. It indicates a change to the Pilot Defined Database based on loaded or resident navigation data and requires redefinition or confirmation by the pilot.

PILOT WPT DATABASE FAIL – A problem has been detected in the Pilot Defined Database.

Reload data from Pilot Data Save disk.

PILOT WPT DB UPDATED – This message appears after the Check All process. It indicates a change to the Pilot Defined Database based on loaded or resident navigation data and requires redefinition or confirmation by the pilot.

PNR ALERT – This message displays when the distance to go (DTG) to the point of no return (PNR) is five nm.

POSITION CORRECTING – This message normally occurs when reacquiring DMEs following overwater or other non-DME environment flight segment. Best computed position is in the process of being corrected.

POSITION UNCERTAIN – The FMS position is uncertain (not verified).

ANP values have reached the maximum limit per phase of flight. The RNP value in use may be a manual RNP or System RNP (refer to Estimate of Position Accuracy in the Navigation Function section for more information on the RNP limits).

Refer to the Best Computed Position Update procedure. Performing this procedure will deactivate this message.

PROGRAM CHECK FAIL – A problem has been found in the program software.

1. Monitor the system closely. There is a high probability that the system will fail the initial self-tests the next time it is turned on.
2. After landing and shutdown, power down the system and then up again to troubleshoot.

PRO LINE 21-L BUS FAIL – In the Pro Line 21 configuration, label 360 is not detected on the left bus for two seconds.

PRO LINE 21-R BUS FAIL – In the Pro Line 21 configuration, label 360 is not detected on the right bus for two seconds.

RADIUS REQ EXCESS BANK – The orbit radius entered is less than the minimum aircraft turn radius required under current conditions. This message is presented in MMMSs only.

RCU # FAIL – A failure has been detected in the specified radio control unit.

RESET ALT PRESELECT – The aircraft is within two minutes of a VNAV Top of Descent, and the altitude preselector has not been reset to an altitude at least 200 feet below current altitude. VNAV cannot be armed on the flight guidance system until the altitude preselector has been reset to a lower altitude.

RIGHT IOC-OFFSIDE FAIL – This message will be displayed on the #1 FMS if the offside input/output concentrator has failed (only with Collins Pro Line 4 interface).

RIGHT IOC-ONSIDE FAIL – This message will be displayed on the #2 FMS if the onside input/output concentrator has failed (only with Collins Pro Line 4 interface).

ROUTE CAPACITY EXCEEDED – An attempt has been made to create a route with over 98 waypoints or to store more than 200 routes

ROUTE DATABASE FULL – An attempt has been made to use more than 3000 waypoints in all routes.

RRS DATA BUS FAIL – RRS communication link with the FMS has failed.

RRS (DME, TACAN, VOR) RECOVER – RRS begins matching frequency requests from the FMS after failing to respond to FMS frequency requests. Not displayed if Collins or ARINC VOR is in use, or RRS is deselected.

RRS (DME, TACAN, VOR) SELF-TEST FAIL – The FMS has detected a failure during RRS (DME, TACAN, VOR) self-test mode.

RRS (DME, TACAN, VOR) TUNE FAIL – The RRS did not tune the requested frequency within eight seconds. This message is not displayed if Collins or ARINC VOR is in use, or RRS is deselected.

RRS RECOVER – RRS resumes response to FMS frequency requests after previously failing to respond to FMS requests.

RRS TUNE BUS FAIL – The RRS does not detect any tune requests from the FMS for at least two seconds.

RTU # FAIL – A failure has been detected in the specified radio tuning unit.

RUNWAY DATABASE FAIL – The runway section of the Navigation Database has failed.

Reload the Navigation Database.

RUNWAY IN USE – The specified runway is part of a SID, STAR or approach and cannot be modified or deleted.

RX READER CONFIGURED – This message is displayed when any ARINC Receiver port is configured as an RX READER.

SATELLITE POS ALARM – This message displays when the RAIM algorithm has detected a satellite failure that has not been excluded within the time to alarm for the current phase of flight. In addition to this alarm message, the FMS will turn on the GPS Integrity annunciator and change the INTEG field on the GPS or GNSS Sensor Status page from "RAIM" to "ALARM." Removed after the message has been read or if the GPS/GLS/GNSS sensor is deselected.

WARNING: THE SATELLITE POS ALARM AND THE GPS INTEGRITY ANNUNCIATOR ARE INDICATORS OF INTEGRITY LOSS FOR THE POSITION OUTPUT BY THE GPS/GNSS SENSOR. WHEN INTEGRITY LOSS IS DECLARED, THE GPS/GNSS POSITION CANNOT BE TRUSTED, AND NAVIGATION MUST BE BASED ON OTHER NAVIGATION SOURCES.

SBAS DATABASE FAIL – A problem has been found in the SBAS (FAS DB) approach database, rendering it unusable. The FMS will limit SBAS Approach to the LNAV level of service.

Reload the Navigation Database.

SBAS# DESELECT –The sensor monitor has determined the specified SBAS data is unreasonable and has deselected the sensor for use in navigation.

SBAS# DIFFERENCE>xxnm –The sensor "watchdog" has sensed the latitude/longitude position as determined by SBAS # (1, 2 or 3) differs from the BCP by an amount that warrants pilot attention. "xx" can be 6, 12, 18 or 24 nm. For SBAS sensors, a message is displayed if the distance between sensor position and FMS position is greater than 6 nm. At 6, 12, 18, and 24 nm a new message is displayed indicating the increasing (or decreasing) amount of the discrepancy.

SBAS # FAIL – A FAIL status has been determined for the indicated SBAS. This message will be delayed for 15 seconds when the FMS is in an "On-Ground" state.

SBAS # NOT NAV –The selected SBAS status has changed to an invalid navigation condition (that is, it is none of the following: SBAS, Navigation, or Fault). This message is delayed 3 minutes on ground after the initial failure condition to avoid nuisance alerts, or 6 seconds in-air. The timer will reset when the SBAS sensor enters a valid navigation condition or after a power-up.

SCAT-1 UNAVAILABLE – The GLS sensor has detected either an FMS or GLS failure that prevents flying the SCAT-1 approach type.

SID DATABASE FAIL – The SID section of the Navigation Database has failed.

SID RNP<CONFIG – Displayed when a departure has been inserted into the FPL via Company Route, Pilot Route, UniLink Route, or FCDB FPL insertion, which contains an RNP value less than the configured RNP Capability.

SIGMETS RCVD – SIGMETS data has been received via AFIS Uplink or AFIS DTU.

Reload the Navigation Database.

SOFTWARE CONFIG MISMATCH – The loaded version of software does not match the version number stored in the configuration module.

SPCL MISSION MEMORY FAIL – A failure of non-volatile memory that contained search pattern or navigation data has been detected (MMMSs only).

SPEED TOO FAST FOR TURN – RF or AF leg is the current lateral guidance leg, and the groundspeed is too high for the aircraft to stay within the bounds of the arc.

If selected Crosstrack is active, this message applies to the arc radius adjusted for SXTK. For search patterns with a MIN TURN TIME preference, this message is suppressed.

STAR DATABASE FAIL – The STAR section of the Navigation Database has failed.

Reload the Navigation Database.

STAR RNP<CONFIG – Displayed when an arrival has been inserted into the FPL via Company Route, Pilot Route, UniLink Route, or FCDB FPL insertion, which contains an RNP value less than the configured RNP Capability.

STEERING FAIL – A continuous roll steering self-test failure has occurred. This failure can be reset as follows:

1. Press **[DATA]**, then **[NEXT]** to access Data Page 4.
2. Press **LSK [3L]** to position the cursor over the ROLL CMD field.
3. Press **[BACK]**/**[ENTER]** to reset.

SYNC CONFIG MISMATCH – After power-up and initialization, FMS detects mismatch in one of the configuration settings (VNAV, Fuel, Temp Comp, Lateral Steering, Approach types, heading select, TGT FPA).

TACAN FAIL – TACAN input has failed.

TACTICAL DATABASE FULL – All 100 available tactical waypoint slots have been used.

TAS INVALID – The true airspeed data from the ADC is not usable. A manual input of true airspeed may be made on the ADC Status Page.

1. Press **[DATA]**, then **[NEXT]** to display Data Page 2.
2. Press the LSK adjacent ADC to access the ADC Status Page.
3. Press **LSK [2L]**. Enter current true airspeed. A manual TAS overrides any ADC input.

TAWS FAIL – TAWS A739 is configured and is not receiving a valid 172 label. Or TAWS FMS fixed pages are configured and label 123 is not valid.

TAWS FPL/TERRAIN THREAT – Label 272, bit 12 is set to 1 by the TAWS.

TCAS NOT CONFIGURED - The TFC button on the EFIS radar panel has been pressed and the FMS is not configured for Traffic Collision Avoidance System (TCAS) (only with Collins Pro Line 4 800 interface).

TERMINALS DATABASE FAIL– The terminal intersection section of the Navigation Database has failed.

TERMINAL WEATHER RCVD– Terminal weather data has been received via AFIS Uplink or AFIS DTU.

Reload the Navigation Database.

TEST MODE – The FMS is in test mode.

TOP OF DESCENT ALERT– Estimated time to the top of descent point is less than two minutes. Appears two minutes prior the TOD to indicated approaching TOD.

TUNE NAV# - TO XXX ON FFF.FF – When not in approach mode, there are fewer than two DME stations available, the navigation mode is not GPS/DME, GPS or DME/DME and the current tuned VOR is greater than eighty nm away or is invalid. The XXX and FFF.FF are filled with the identifier and frequency of the nearest valid VOR.

Press the TUNE LSK to remotely tune the VOR receiver to the displayed frequency if Remote Tune is enabled (programmed into the Configuration Module at installation). Otherwise, manually tune the VOR using the control head.

UNILINK ATC ALERT – An ATC Advisory has been received by UniLink. This message is seen on the FMS MSG page and is only accessible by pressing the MSG key. Specifically, the CDU page will display UNILINK ATC ALERT in the message list. It will then require the pilot to go to the UNILINK CDU pages to read the message.

UNILINK FAIL – The FMS monitoring the UniLink has determined the UniLink to be in the failed state.

UNILINK MSG RCVD – A new UniLink text message has been received.

1. Press the UNILINK LSK to access the UniLink Main Menu Page.
2. Press the NEW MSG prompt on the UniLink Main Menu Page to view message.

UNILINK RTE INVALID – An FMS uplink message containing route data that has failed error check and been rejected has been received.

UNILINK ROUTE RCVD – An FMS uplink message containing route data that has passed error check and is ready for review has been received.

UNILINK WX MAP RCVD – A new UniLink weather map has been received from Universal Weather and Aviation, Inc.

1. Press the UNILINK LSK to access the UniLink Main Menu Page.
2. Press NEW WX prompt on the UniLink Main Menu Page to view the new weather map.

UPLINK MESSAGE RCVD – A message has been received from the Global Data Center.

UPLINK WINDS INVALID – This message is displayed when an uplink message is received containing enroute winds data that fails error checking and is deemed not usable by the FPL.

UPLINK WINDS RCVD – This message is displayed when not on the UPLINK WINDS page and receipt of an FMC uplink message containing enroute winds data which passes error checking and is deemed usable by the FPL.

VARIATION WARNING – The aircraft is out of the auto-variation model range (above N72 degrees, 45 minutes and below S59 degrees, 45 minutes latitudes), there is no manual input, and the TRUE MAGNETIC switch is in the MAGNETIC position.

1. Press **[DATA]** to access Data Page 4.
2. Press **LSK [4L]** to highlight the variation field.
3. Enter a manual east or west variation.

VERIFY MANUAL RNP – A manual RNP has been entered and then a flight phase transition occurs and the new RNP limit is less than the manually entered RNP. Or, a manual RNP has been entered and a leg with a lower database RNP value is sequenced to in a linked flight plan.

VERTICAL WPT ALERT – This message appears approximately fifteen seconds prior to a VNAV mode vertical leg change. The WPT and MSG annunciators on the instrument panel flash, along with the FMS MSG light. Pressing the MSG key will change the flashing WPT to steady, turn off the MSG light, and show the VNAV WPT ALERT message. This message is not displayed if the VTA ALERT MSG configuration is DISABLED.

VHF NAME DATABASE FAIL – The VHF plain language name section of the Navigation Database has failed.

Reload the Navigation Database.

VHF NAVAID DATABASE FAIL – The navaid section of the Navigation Database has failed. The backup navaid database, containing navaids and airports, will be used.

Reload the Navigation Database.

VNAV DISCONNECT – An altitude or flight level has been entered on a flight plan page that has resulted in a VNAV disconnect; Temp Comp is activated or cancelled; the current VNAV leg is undefined, too steep or a climb segment; in Cessna Primus, FMS transitions to the approach armed state before VPATH is active. Return to the VNAV Path Page to re-activate VNAV. This message will clear after it is read.

VOR TUNE FAIL – An ARINC 711 VOR has not tuned to the pilot requested frequency.

VPATH CAPTURE – This message is annunciated fifteen seconds prior to sequencing to Top of Descent or initiating the capture to vertical path from a tactical mode. This message is not displayed if the VTA ALERT MSG configuration is DISABLED.

WAAS LATERAL LIMIT – This message is displayed when HPL_{WAAS} > HAL_{MSG} AND GWS Approach Active with the GWS sensor indicating SBAS NAV or GBAS NAV mode.

WAAS VERTICAL LIMIT—This message is displayed when VPL_{WAAS} > VAL_{MSG} AND HPL_{WAAS} < HAL_{MSG} AND GWS Approach Active with the GWS sensor indicating SBAS NAV or GBAS NAV mode).

WAYPOINT ALERT – The aircraft position is within fifteen seconds of a leg change while enroute, (or five seconds while using approach procedural legs) prior to the TO waypoint. The MSG light will not illuminate for this message. The instrument panel WPT alert annunciator will illuminate to alert the pilot of an impending leg change.

WAYPOINT IN USE – This message occurs when attempting to delete a waypoint from the Pilot Defined Database that is in use in the flight plan.

WINDS ALOFT RCVD – Winds aloft data has been received via AFIS Uplink or AFIS DTU.

XFILL CONFIG MISMATCH – Crossfill data has been pushed to an FMS not configured to receive that data type. This message alerts the flight crew that crossfill data was sent and received but not accepted. Once read, this message is removed from the Message Page.

XPDR #n FAIL – Where n is 1 or 2 based on the XPDR position, this message is displayed for the active transponder, or when the active/inactive status is not provided, the transponder is failed or is not outputing data. For the inactive transponder, the FMS determines the transponder is failed and aircraft is on the ground. This message will remain until the failed condition is cleared.

GLOSSARY

absolute accuracy – The ability to determine true geographic position.

ACARS – Aircraft Communications Addressing and Reporting System.

ADC – Air Data Computer. Provides True Air Speed (TAS) and altitude. Refer also to DADC.

additional secondary factor – Calibration factors designed to compensate for the difference in propagation characteristics between land and sea.

ADS – Air Data Sensor; also, Automatic Dependent Surveillance.

AFCS – Automatic Flight Control System.

AFIS – Airborne Flight Information Systems.

AHRS – Attitude Heading Reference System.

air data system – A sophisticated system for measuring air temperature, pitot pressure, and static pressure. Used to obtain highly accurate TAS, Mach, altitude, and static air temperature. Also called an "Air Data Computer". Refer also to ADC.

ALTERR – Altitude Error displayed when the VNAV mode is in use. The number displayed is the difference, in feet, between the actual aircraft altitude and VNAV computed on-glideslope altitude for that point.

ANP – Actual Navigation Performance.

ANT – Antenna.

APPR – Approach.

APU – auxiliary power unit.

area navigation – Navigation along random routes within the area of coverage of referenced facilities, or within the limits of self-contained area navigational aids, precluding the need to overfly specific navigational facilities.

ARINC – Data interface format (e.g., ARINC 429); ARINC is an abbreviation of "Aeronautical Radio, Inc."

ARPT – Airport.

ARTU – ARINC Radio Tune Unit.

ASU – Antenna Switching Unit.

BCD – Binary Coded Decimal (number representation).

BCP – Best Computed Position; as determined by Universal's FMS. A typically installed fully integrated FMS processes range information from the DME, true airspeed from the Air Data Computer, velocity data from an inertial reference sensor, position data from the Loran C, GPS/SBAS, GPS and aircraft heading in order to derive the one best computed position and velocity as a weighted average of the various sensor inputs.

BRG – Bearing.

CCU – Cockpit Control Unit.

CDI – Course Deviation Indicator.

CDU – Control Display Unit.

CEP – Circular Error Probable.

Checksum – A process (transparent to the user) which generates and checks, special control characters used in validating that data is properly transferred/stored between (computer) components.

CHP – Course Heading Panel.

Clutter – In radar operations, clutter refers to the reception and visual display of radar returns caused by precipitation, chaff, terrain, numerous aircraft targets, or other phenomena.

coast-in – The first point of land reached when flying from seaward.

coast-out – The last point of land crossed when departing seaward.

COMM – Communication.

CPDLC – Controller-Pilot Data Link Communications.

CPU – A computer's Central Processing Unit.

CRC – Cycle Redundancy Check. A coding technique that can be used to detect errors during the transfer or storage of data. A 32-bit CRC can yield bit-level error detection to an accuracy of approximately $1E^{-10}$.

crosstrack distance – The distance and direction right or left between the aircraft and the desired track.

CRS – Course.

CRT – Cathode Ray Tube.

CSDB – Commercial Standard Data Bus.

DA – Drift Angle.

DADC – Digital Air Data Computer - Refer also to ADC.

DB – Database.

dead reckoning – The directing of an aircraft and the determination of its position by the application of direction and speed information to a previous position.

desired track – In VOR/DME based RNAV, the Rhumb Line course between selected waypoints. In long-range navigation, the Great Circle course between selected waypoints.

DEV – Deviation; compass error caused by magnetism within the aircraft.

deviation – Compass error caused by magnetism within the aircraft.

DEXP – Date of Expiration of stored navaid database.

DGPS – Differential GPS.

DGPS mode – Differential GPS. DGPS is a method of improving the accuracy of your receiver by adding a local reference station to augment the information available from the satellites. It improves the integrity of the whole GPS system by identifying certain errors.

DGT – Distance To Go.

differential GPS – An addition to the NAVSTAR/GPS system which uses corrections from a ground station for the purpose of enhancing GPS accuracy for all users within range of the associated ground station.

direct wave – Radiated energy which follows a line-of-sight path between the source and the receiver or sensor.

diurnal effect – Variation in the height of the ionosphere caused by sunlight; a daily phenomenon.

DME/P – Precision Distance Measuring Equipment.

DMU – Data Management Unit.

DOD – Department of Defense.

dP – Pressure Differential (e.g., cabin to outside).

DR – Dead Reckoning.

DRIFT – Drift angle in degrees left (L) or right (R) of the aircraft heading (caused by wind).

drift – Displacement from the direction in which the aircraft is headed caused by a crosswind component.

drift angle – The angle between aircraft heading and the ground track, expressed in terms of right or left according to the direction in which the aircraft has drifted.

DTK – Desired Track.

DTG – Distance to Ground.

DTO – Direct-To; direct route or course.

DTU – Data Transfer Unit.

DZH – Drop Zone (Axis) Heading.

DZL – Drop Zone Length.

EADI – Electronic Attitude Director Indicator.

EFIS – Electronic Flight Information System.

EFIS/MFD – Electronic Flight Information System Multifunction Display.

EHSI – Electronic Horizontal Situation Indicator.

EMI – Electromagnetic Interference.

EOA – End of Approach.

ephemeris – The position of an astronomical body.

EPU – Estimate of Position Uncertainly.

ERP – EFIS Radar Panel.

ESAD – Equivalent Still Air Distance. Distance aircraft has flown through air mass eliminating the effect of the wind. This is used extensively by airlines flying fixed routes for comparing operational efficiency.

ETE – Estimated Time Enroute.

ETA – Estimated Time of Arrival.

FACF – Refer to Final Approach Course Fix.

FAF – Refer to Final Approach Fix.

FAP – Refer to Final Approach Point.

FAS DB – Final Approach Segment Data Block. Contains all the parameters required to perform a precision LP or LPV approach procedure, including: information pertaining to whether or not vertical guidance is supported, the SBAS provider ID, LTP/FTP latitude and longitude, LTP/FTP height, change in FPAP latitude/longitude, FPAP lat/long, approach threshold crossing height, glidepath angle, course width at threshold, change in length offset, and HAL/VAL values.

FGS – Flight Guidance System.

Final Course Approach Fix – UA designation for a waypoint often outside the FAF used for approach alignment.

Final Approach Fix – The fix from which the final approach (IFR) to an airport is executed and which identifies the beginning of the final approach segment.

Final Approach - IFR – The flight path of an aircraft which is inbound to an airport on a final instrument approach course, beginning at the final approach fix or point and extending to the airport or the point where a circle to land maneuver or a missed approach is executed.

Final Approach Point – The point, applicable only to a non-precision approach with no depicted FAF (such as an on-airport VOR), where the aircraft is established inbound on the final approach course from the procedure turn and where the final approach descent may be commenced.

Flight Management System – A computer system that uses a database to allow routes to be preprogrammed and fed into the system by means of a data loader. The system is constantly updated with respect to position accuracy by reference to conventional navigation aids. The sophisticated program and its associated database insures that the most appropriate aids are automatically selected during the information update cycle.

FMS – Refer to Flight Management System.

FMS XFILL – Transfer data from one FMS to another in a multiple FMS configuration.

FPA – Flight Path Angle (glide slope) in degrees required for the approach segment between the FR and TO waypoints (current leg).

FPCDU – Flat Panel Control Display Unit. Consists of a color liquid crystal display and a keyboard with function and alphanumeric keys. Main interface between the operator and the Navigation and Flight Management Systems on other Universal products.

FSS – Flight Service Station.

G.C. – Grid Course.

G/S – Glide Slope

GCA – Refer to Ground Controlled Approach.

GCS – Ground Clutter Suppression.

GDC – Global Data Center.

GDOP – Geometric Dilution of Position.

GLS – GPS Landing System. A system allowing a GPS precision approach by using differentially corrected satellite data.

GNSS – Global Navigation Satellite System.

GPIRS – Global Positioning System and Inertial Reference System combination sensor.

GPS – Global Positioning System (Satellite navigation).

GPWS – Ground Proximity Warning System.

great circle – The circle formed by a plane passing through the center of a sphere.

Ground Controlled Approach – A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR). Usage of the term "GCA" by pilots is discouraged except when referring to a GCA facility. Pilots should specifically request a "PAR" approach when a precision radar approach is desired or request an "ASR" or "surveillance" approach when a non-precision radar approach is desired.

ground wave – Radiated energy which follows the surface of the earth.

GWS – FAA FIAS GPS SBAS Sensor.

HDOP – Horizontal Dilution of Position. It is a measure of position accuracy supported by the satellite geometry.

HFOM – Horizontal Figure of Merit. Also known as GPS Probable Error; refers to the quality of the GPS satellite geometry.

HSI – Horizontal Situation Indicator.

HUD – Heads-Up Display.

IAF – Refer to Initial Approach Fix.

ILS – Instrument Landing System.

Initial Approach Fix – The fixes depicted on instrument approach procedure charts that identify the beginning of the initial approach segment(s).

INS – Inertial Navigation System.

IRS – Inertial Reference System.

ISS – Inertial Sensor System; Refer to IRS.

ISA – International Standard Atmosphere.

Jet Route – A network of air routes based on radials from VOR navigational facilities extending from 18,000 feet MSL up to and including Flight Level 450. Used in the U.S.A.

Kalman Filter – A (computer) processing technique which integrates several similar signals and statistically determines their proper mix to create a composite, best fit, single output.

latitude – Angular distance measured north or south of the Equator from 0 to 90.

line of position – A line containing all possible geographic positions of an observer at a given instant of time.

LNAV – Lateral Navigation

LNAV/VNAV – Lateral with Vertical Navigation

longitude – Any Great Circle which passes through the earth's poles. Measured in angular distance east or west from the zero meridians.

LOS – Level of Service for SBAS approaches

LP - Localizer Performance without Vertical Guidance for SBAS approaches

LPV - Localizer Performance with Vertical guidance for SBAS approaches

LSK – Line Select Key.

MAP – Missed Approach Point.

MCU – Modular Concept Unit.

meridian – A line of longitude.

MFD – Multi-Function Display.

MDA – Minimum Descent Altitude.

MLS – Microwave Landing System.

MMMS – Multi-Mission Management System.

MNPS – Minimum Navigational Performance Specifications.

MNVR – Maneuver.

modal interference – Error resulting from the inability of the receiver to differentiate between ground and sky waves.

MOT – Mark On Target.

MPP – Most Probable Position.

MSL altitude – Mean Sea Level altitude. The altitude of the aircraft measured from Mean Sea Level.

MSG – Message.

MSU – Mode Selector Unit.

NAS – National Airspace System.

NAT OTS – North Atlantic - Organized Track System.

NAT-MNPS – North Atlantic – Minimum Navigation Performance Specification.

NAVSTAR/GPS – Global Positioning System.

NCU – Navigation Computer Unit.

NDB – Non-Directional Beacon.

night effect – An overlapping of ground and sky waves, common at sunrise and sunset, resulting in temporarily erratic indications.

NOS – National Oceanic Service.

NOTAM – Notice to Airmen.

NPU – Navigation Processor Unit.

NVG – Night Vision Goggles.

NVIS – Night Vision.

NVRAM – Non-Volatile RAM; independently power protected computer memory, Refer to also RAM.

ONC – Operational Navigation Chart.

OOOI – Out, Off, On, In. A set of events describing the time at which an aircraft leaves the departure gate (Out), leaves the ground (Off), touches down (On), and opens its doors at the arrival gate (In).

orthogonal – Mutually perpendicular. The primary aircraft axes are orthogonally related.

P – Precision.

PAR – Precision Approach Radar.

PAX – Average passenger weight.

PCA – Polar Cap Anomaly.

PGS – Pseudo-Glide Slope.

pilotage – Navigation by reference to terrain features, both natural and man-made, usually with the aid of an appropriate aeronautical chart.

PLOC – Pseudo Localizer.

PNR – Point of No Return.

polar cap anomaly – In OMEGA/VLF systems, a propagation anomaly affecting signals traversing polar regions; caused by solar flares.

PPOS – Present Position.

PREV – Previous.

propagation anomalies – Inconsistencies in signal phase or frequency.

pseudo range – Distance determined by an uncorrected time measurement.

PT – Procedure Turn.

PVOR – Pseudo-VOR.

QNE – The barometric pressure used for the standard altimeter setting (29.92 inches Hg).

QNH – The barometric pressure as reported by a particular station.

q Theta – Azimuth.

r Rho – Distance.

R-Nav – Area Navigation.

RAIM – Receiver Autonomous Integrity Monitoring.

RAM – Computer Random Access Memory; each location (e.g., byte) is directly and individually addressable.

rate aiding – The process of correcting LOPs (lines of position) taken at different times.

repeatable accuracy – The ability to return to a previous position, normally measured in nautical miles.

RFI – Radio Frequency Interference.

rho – Navigational term for distance.

rhumb line – A line which makes the same angle with each meridian it crosses.

RNP – Required Navigational Performance.

ROLL STRG – Roll Steering.

Route – A progression of waypoints, headings, intersections, etc. that are normal and usual in completing a flight between two points.

RP – Release Point.

RPU – Receiver/Processor Unit.

RRS – Radio Reference Sensor. Provides DME, DME/VOR, and TACAN navigation capabilities to the FMS.

RSU – Radio Select Unit.

S/W – Software.

SAR – Search And Rescue.

SBAS – Satellite Based Augmentation System. A general term for GPS-based navigation and landing system that provides precision guidance to aircraft at thousands of airports and airstrips where there may be no other precision landing capability.

SBAS NPA – SBAS Non-precision Approach.

SBAS PA – SBAS Precision Approach.

SCN – Software Control Number.

SEP – Spherical Error Probable.

shore line effect – A refraction ground wave caused by the difference in conductivity between land and water.

SID – Standard Instrument Departure.

skip zone – The gap in radio wave transmission that exists between the outer limits of ground wave reception.

sky wave – Radiated energy which has been refracted by an ionized layer of the atmosphere back toward the surface of the earth.

slant range – The straight line distance between the aircraft and the DME range facility.

slant range error – The difference between slant range and range over the ground.

SMC – Special Mission Computer. Universal's Multi-Missions and Flight Management System.

SNN – Signal to Noise Numbers.

SNR – Signal to noise ratio. Ratio between the maximum possible signal and the background noise.

SPS – GPS Standard Positioning Service.

Standard Service Volume – Reception limits, expressed in nautical miles, by altitude, of unrestricted navigational facilities for random and unpublished (direct) route navigation.

STAR – Standard Terminal Arrival Route.

SV# – Satellite Vehicle Number.

SX – Selected Crosstrack.

SXTK – Selected Crosstrack.

TACAN – Tactical Air Navigation.

TERPS – Terminal Instrument Procedures.

theta – Navigational term for azimuth.

time bias – An error caused by differences between time standards.

TKE – Track angle Error.

TOD – Top-Of-Descent.

torqueing – A process of applying force to a gyro to intentionally induce precession (drift) so as to correct for the effects of earth rotation and aircraft movement.

track – The actual flight path of an aircraft over the surface of the earth.

track angle error – The difference, in degrees and direction right or left, between the actual aircraft track and the desired track.

TRDRP – Teardrop.

triple mixing – A process of statistically integrating the outputs from three separate inertial navigational systems for increased overall accuracy.

TRK – Track.

TSO – Technical Standard Order; FAA certification standard.

TTG – Time To Go.

TTH – Transition To Hover.

TVS – Target Vertical Speed.

UA – Universal Avionics.

UNS – Universal Navigation System, also FMS.

UTC – Coordinated Universal Time. (formerly GMT).

VDL – VHF Data Link.

VDOP – Vertical Dilution of Position.

VFR – Visual Flight Rules.

Victor Airways – A network of air routes based on radials from VOR navigational facilities extending from a minimum of 1200 feet above ground level, up to but not including 18000 feet MSL.

VNAV – Vertical Navigation.

VOR – VHF Omnidirectional Radio.

voting – A process of comparing the outputs of multiple systems for the purpose of identifying and eliminating the least correct system.

VSR – Vertical Speed Required.

VTO – Vertical Direct-To.

Waypoint – Any geographical fix defined either in terms of radial and distance from a VOR facility, or in terms of latitude and longitude. Used in area navigation to describe route segments.

WCA – Wind Correctional Angle.

WGS84 – World Geodetic System. WGS84 is an earth fixed global reference frame used for determining the orbits of GPS navigation satellites.

WND – This field displays the filter wind direction and wind speed, in knots, as computed by the NAV function. Wind direction is differentiated with a "T" for True or a degree sign (°) for Magnetic. Wind direction is True, regardless of the position of the panel mounted Mag/True selector switch, except while in Approach Mode. When operating in Polar Regions (above N72 or below S60 degrees latitude), wind display remains in degrees True in Approach mode.

wind component (or factor) – That part of the wind vector that is aligned with the aircraft track; tailwind components are positive factors, increasing groundspeed over airspeed, and headwind components are negative factors, decreasing groundspeed.

wind correction angle – The difference, in degrees, between aircraft heading and course. Also called a "drift correction", and sometimes called a "crab angle", or "cut".

WP or WPT – Waypoint.

XFILL – Crossfill.

XTK – Crosstrack. Lateral distance in nm left (L) or right (R) of the extended course centerline.

XTK DEVIATION – Deviation from desired track.

XWIND – The current crosswind component direction (L or R) and velocity in knots.

ZFW – Zero Fuel Weight.

9 INDEX

INDEX

%

>

±

A

B

C

D

F

G

H

L

M

N

O

P

R

S

T

U

V

W

X

Z