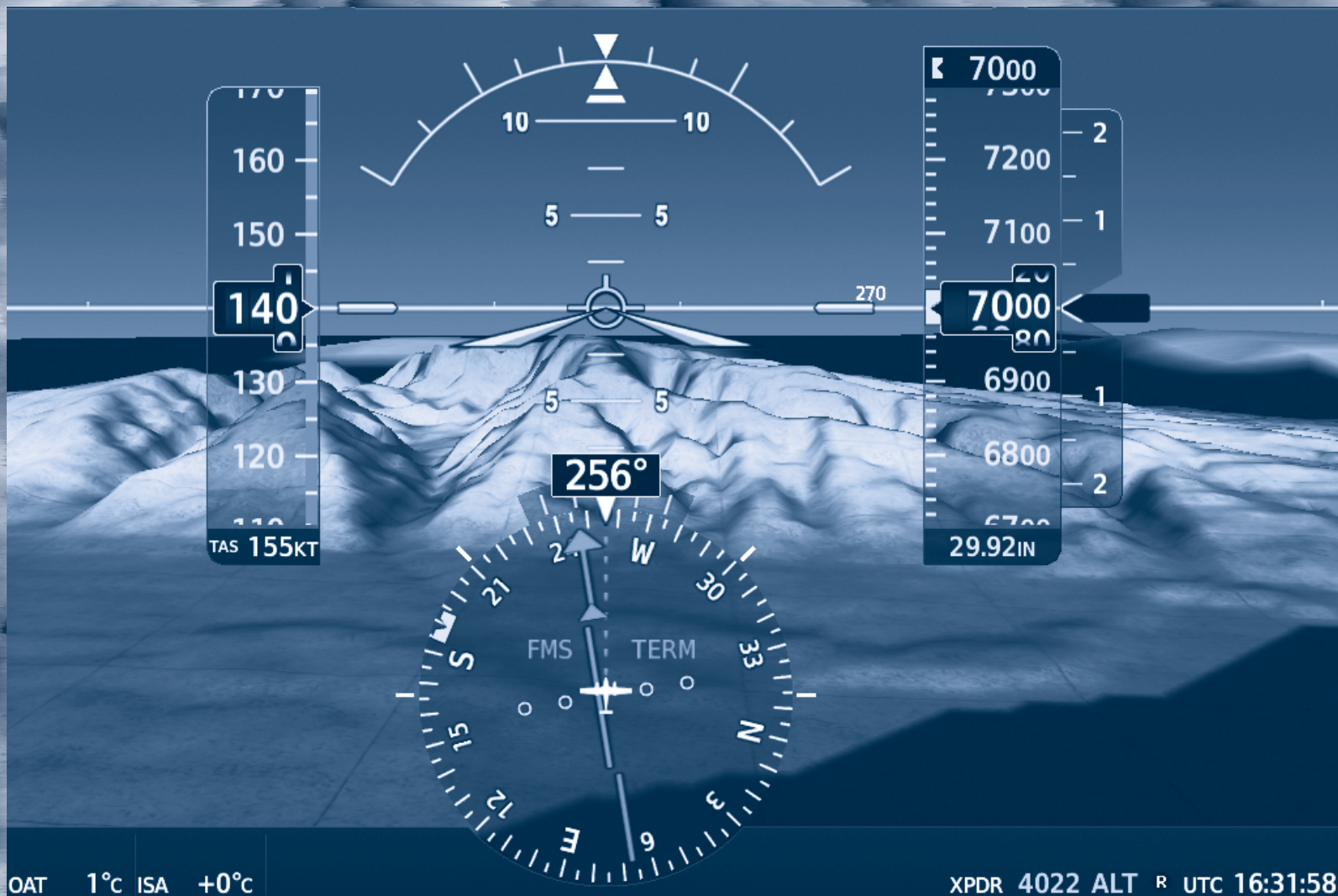


GARMIN[®]

G1000[®] NXi

Pilot's Guide



Piper PA-44-180 Seminole

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

ENGINE INDICATION SYSTEM

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AUTOMATIC FLIGHT CONTROL SYSTEM

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This manual reflects the operation of System Software version 2694.04 or later for the PA-44-180. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

Garmin International, Inc.

1200 East 151st Street
Olathe, Kansas 66062, U.S.A.
Tel: 913.397.8200
Fax: 913.397.8282
Aircraft On Ground (AOG) Hotline: 913.397.0836
Aviation Dealer Technical Support: 888.606.5482

Garmin AT, Inc.

2345 Turner Road SE
Salem, OR 97302, U.S.A.
Tel: 503.581.8101
Fax 503.364.2138

Garmin (Europe) Ltd.

Liberty House, Hounsdown Business Park
Southampton, Hampshire SO40 9LR U.K.
Tel: +44 (0) 238 052 4000
Fax: +44 (0) 238 052 4004
Aviation Support: +44 (0) 370 850 1243

Garmin Corporation

No. 68, Zhangshu 2nd Road
Xizhi District, New Taipei City, Taiwan
Tel: 34-93-357-2608
Fax: 34-93-429-4484

Website Address: www.garmin.com

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May 2017


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-
-  **WARNING:** Do not use terrain avoidance displays as the sole source of information for maintaining separation from terrain and obstacles. Garmin obtains terrain and obstacle data from third party sources and cannot independently verify the accuracy of the information.
-
-  **WARNING:** Always refer to current aeronautical charts and NOTAMs for verification of displayed aeronautical information. Displayed aeronautical data may not incorporate the latest NOTAM information.
-
-  **WARNING:** Do not use geometric altitude for compliance with air traffic control altitude requirements. The primary barometric altimeter must be used for compliance with all air traffic control altitude regulations, requirements, instructions, and clearances.
-
-  **WARNING:** Do not use basemap information (land and water data) as the sole means of navigation. Basemap data is intended only to supplement other approved navigation data sources and should be considered only an aid to enhance situational awareness.
-
-  **WARNING:** Do not rely solely upon the display of traffic information to accurately depict all of the traffic within range of the aircraft. Due to lack of equipment, poor signal reception, and/or inaccurate information from aircraft or ground stations, traffic may be present that is not represented on the display.
-
-  **WARNING:** Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information contained within data link weather products may not accurately depict current weather conditions.
-
-  **WARNING:** Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be older than the indicated weather product age.
-
-  **WARNING:** The displayed minimum safe altitude (MSAs) are only advisory in nature and should not be relied upon as the sole source of obstacle and terrain avoidance information. Always refer to current aeronautical charts for appropriate minimum clearance altitudes.
-
-  **WARNING:** Always obtain qualified instruction prior to operational use of this equipment.
-
-  **WARNING:** Do not use a QFE altimeter setting with this system. System functions will not operate properly with a QFE altimeter setting. Use only a QNH altimeter setting for height above mean sea level, or the standard pressure setting, as applicable.
-


 **WARNING:** Do not use GPS to navigate to any active waypoint identified as a 'NON WGS84 WPT' by a system message. 'NON WGS84 WPT' waypoints are derived from an unknown map reference datum that may be incompatible with the map reference datum used by GPS (known as WGS84) and may be positioned in error as displayed.


 **WARNING:** When using the autopilot to fly an approach with vertical guidance, the autopilot will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.


 **CAUTION:** Do not clean display surfaces with abrasive cloths or cleaners containing ammonia. They will harm the anti-reflective coating.


 **CAUTION:** Repairs should only be made by an authorized Garmin service center. Unauthorized repairs or modifications could void both the warranty and affect the airworthiness of the aircraft.


 **NOTE:** Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) information. Always confirm TFR information through official sources such as Flight Service Stations or Air Traffic Control.


 **NOTE:** All visual depictions contained within this document, including screen images of the system panel and displays, are subject to change and may not reflect the most current system and aviation databases. Depictions of equipment may differ slightly from the actual equipment.


 **NOTE:** The United States government operates the Global Positioning System and is solely responsible for its accuracy and maintenance. The GPS system is subject to changes which could affect the accuracy and performance of all GPS equipment. Portions of the system utilize GPS as a precision electronic NAVigation AID (NAVAID). Therefore, as with all NAVAIDs, information presented by the system can be misused or misinterpreted and, therefore, become unsafe.


 **NOTE:** This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.


 **NOTE:** Interference from GPS repeaters operating inside nearby hangars can cause an intermittent loss of attitude and heading displays while the aircraft is on the ground. Moving the aircraft more than 100 yards away from the source of the interference should alleviate the condition.

 **NOTE:** Use of polarized eyewear may cause the flight displays to appear dim or blank.


 **NOTE:** This product, its packaging, and its components contain chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. This notice is being provided in accordance with California's Proposition 65. If you have any questions or would like additional information, please refer to our web site at www.garmin.com/prop65.


 **NOTE:** Operating the system in the vicinity of metal buildings, metal structures, or electromagnetic fields can cause sensor differences that may result in nuisance miscompare annunciations during start up, shut down, or while taxiing. If one or more of the sensed values are unavailable, the annunciation indicates no comparison is possible.


 **NOTE:** The system responds to a terminal procedure based on data coded within that procedure in the Navigation Database. Differences in system operation may be observed among similar types of procedures due to differences in the Navigation Database coding specific to each procedure.


 **NOTE:** The FAA has asked Garmin to remind pilots who fly with Garmin database-dependent avionics of the following:

- It is the pilot's responsibility to remain familiar with all FAA regulatory and advisory guidance and information related to the use of databases in the National Airspace System.
 - Garmin equipment will only recognize and use databases that are obtained from Garmin or Jeppesen. Databases obtained from Garmin or Jeppesen that have a Type 2 Letter of Authorization (LOA) from the FAA are assured compliance with all data quality requirements (DQRs). A copy of the Type 2 LOA is available for each applicable database and can be viewed at <http://fly.garmin.com> by selecting 'Aviation Database Declarations.'
 - Use of a current Garmin or Jeppesen database in your Garmin equipment is required for compliance with established FAA regulatory guidance, but does not constitute authorization to fly any and all terminal procedures that may be presented by the system. It is the pilot's responsibility to operate in accordance with established AFM(S) and regulatory guidance or limitations as applicable to the pilot, the aircraft, and installed equipment.
-

 **NOTE:** The pilot/operator must review and be familiar with Garmin's database exclusion list as discussed in SAIB CE-14-04 to determine what data may be incomplete. The database exclusion list can be viewed at www.flygarmin.com by selecting 'Database Exclusions List.'

 **NOTE:** The pilot/operator must have access to Garmin and Jeppesen database alerts and consider their impact on the intended aircraft operation. The database alerts can be viewed at www.flygarmin.com by selecting 'Aviation Database Alerts.'

 **NOTE:** If the pilot/operator wants or needs to adjust the database, contact Garmin Product Support.

 **NOTE:** Garmin requests the flight crew report any observed discrepancies related to database information. These discrepancies could come in the form of an incorrect procedure; incorrectly identified terrain, obstacles and fixes; or any other displayed item used for navigation or communication in the air or on the ground. Go to FlyGarmin.com and select 'Aviation Data Error Report'.



NOTE: The system supports approval of AC 120-76C Hardware Class 3, Software Type B Electronic Flight Bag (EFB) electronic aeronautical chart applications. Possible additional requirements may make a secondary source (traditional paper or additional electronic display) necessary onboard the aircraft. If the secondary source is a Portable Electronic Device (PED), its use must be consistent with guidance in AC 120-76C.



NOTE: Operate system power through at least one cycle in a period of four days of continuous operation to avoid an autonomous system reboot.



NOTE: Terrain and obstacle alerting is not available north of 89° North latitude and south of 89° South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.

Record of Revisions				
Part Number	Revision	Date	Page Range	Description
190-02198-00	A	11/22/16	i – I-6	Initial Release
	B	11/29/16	i – I-6	Clerical Revision
190-02198-01	A	5/16/17	i – I-6	Added HSI Map Added Bluetooth functionality Added other GDU 20.10 parameters

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SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the G1000 NXi Integrated Avionics System as installed in the Piper PA-44-180 Seminole. The system presents flight instrumentation, position, navigation, communication, and identification information to the pilot through large-format displays.

LINE REPLACEABLE UNITS (LRU)

- **GDU 1050 / 1054** (2) – The system features two 10 inch, high resolution LED backlit display units. The left display is a GDU 1050 is configured as a Primary Flight Display (PFD). The right display may be either a GDU 1050 or a GDU 1054, and is configured as an Multi Function Display (MFD). The displays communicate with each other through a High-Speed Data Bus (HSDB) Ethernet connection. Each display is also paired with an Ethernet connection to the GIA 63W.
- **GIA 63W** (2) – Functions as the main communication hub, linking all LRUs with the PFD and MFD. Each GIA 63W contains a GPS SBAS receiver, VHF COM/NAV/GS receivers, a flight director (FD) and system integration microprocessors. Each GIA 63W is paired with the PFD and MFD via HSDB connection. The GIA 63Ws are not paired together and do not communicate with each other directly.
- **GMU 44** (1) – The Magnetometer measures local magnetic field and sends data to the AHRS for processing to determine aircraft magnetic heading. This unit receives power directly from the AHRS and communicates with it via an RS-485 digital interface.
- **GRS 79** (1) – The Attitude and Heading Reference System (AHRS) provides aircraft attitude and heading information via ARINC 429 to both GDUs and both GIAs. The AHRS contains advanced sensors (including accelerometers and rate sensors) and interfaces with the Magnetometer to obtain magnetic field information, with the ADC to obtain air data, and with both GIAs to obtain GPS information.
- **GDC 72** (1) – The Air Data Computer (ADC) processes data from the pitot/static system and outside air temperature (OAT) sensor. The ADC provides pressure altitude, airspeed, vertical speed, and OAT information to the system. It communicates with the GIAs, displays, and AHRS using an ARINC 429 digital interface.
- **GEA 71** (1) – Receives and processes signals from the engine and airframe sensors. This unit communicates with both GIA 63Ws using an RS-485 digital interface.
- **GMA 1347** (1) – The Audio Panel integrates navigation/communication radio (NAV/COM) digital audio, intercom, and marker beacon controls, and is installed between the displays. This unit also provides manual control of display reversionary mode (red **DISPLAY BACKUP** Button, and communicates with both GIAs using an RS-232 digital interface.
- **GTX 335R/345R** (1) – Solid-state transponders that provide Modes A, C, S and ADS-B capability. The optional GTX 345R also provides ADS-B In/Out. The transponder can be controlled from the PFD. The transponder communicates with the both GIA 63Ws through an RS-232 digital interface.
- **GTP 59** (1) – Provides Outside Air Temperature (OAT) data.
- **GDL 59** (1) (Optional) – The GDL 59 is connected to the PFD via HSDB and provides wireless data transfer.

- **GDL 69A SXM** (1) (Optional) – A satellite radio receiver that provides data link weather information to the MFD (and, indirectly, to the PFD Map) as well as digital audio entertainment. The GDL 69A SXM communicates with the MFD via HSDB connection. Subscriptions to the SiriusXM Weather or SiriusXM Satellite Radio services are required to enable the GDL 69A SXM capability.
- **GTS 800** (Optional) – The GTS 800 Traffic Advisory System (TAS) uses active interrogations of Mode S and Mode C transponders to provide traffic information to the pilot independent of the air traffic control system.
- **GSA 80** (1) / **GSA 81** (2) (only with Garmin AFCS option) – The GSA 80 servo is used for the automatic control of pitch trim. The GSA 81 servos are used for the automatic control of pitch and roll. These units interface with each GIA 63W.
The GSM 86 servo gearboxes are responsible for transferring the output torque of the GSA 80/81 servo actuators to the mechanical flight-control surface linkage.

Figure 1-1 shows interactions between the LRUs. Additional/optional equipment are also shown in Figure 1-1. The system is capable of interfacing with the following optional equipment:

- **GDL 59** WiFi Data Link
- **Flight Stream 510** WiFi and Bluetooth® connectivity
- **GDL 69A SXM** Sirius XM Data Link Receiver
- KN 63 DME
- **GTS 800** Traffic Advisory System
- KR-87 ADF

The optional Flight Stream 510 device (SD Card) provides a Bluetooth® connection between the system and a mobile device. GPS, AHRS, ADS-B, traffic, Sirius XM audio, and FIS-B weather data can then be shared with the mobile device, and flight plans can be transferred to or from the mobile device. Also, database updates may also be performed using the Flight Stream 510 WiFi link.

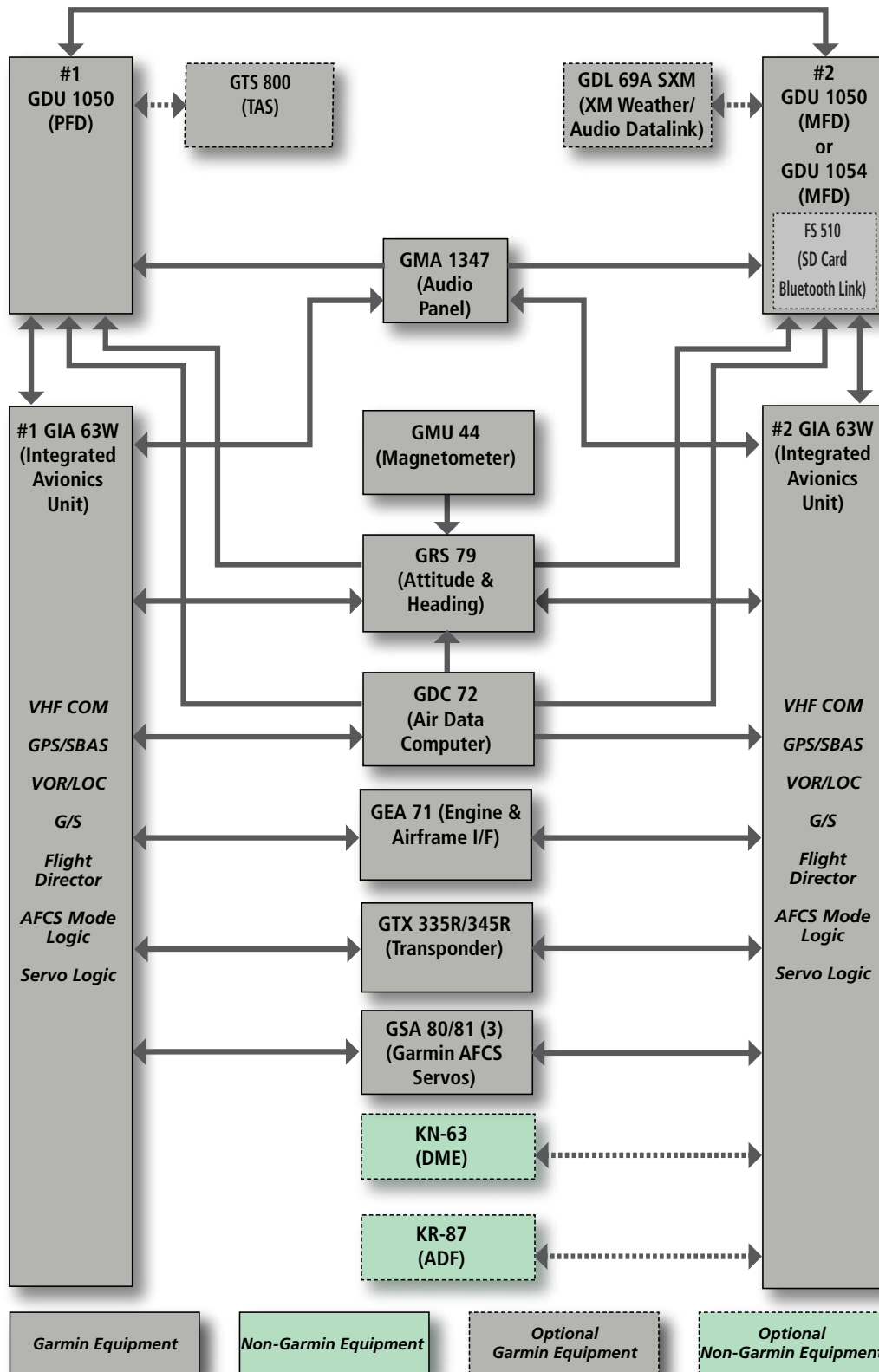


Figure 1-1 System (LRU Configuration)



NOTE: For information on non-Garmin equipment, consult the applicable optional interface user's guide. This document assumes that the reader is already familiar with the operation of this additional equipment.

1.2 SYSTEM CONTROLS

NOTE: The Audio Panel (GMA 1347) is described in the Audio Panel & CNS section.

The system controls are located on the PFD and MFD bezels and audio panel. The controls for the PFD and MFD are discussed within the following pages of this section.

PFD/MFD CONTROLS

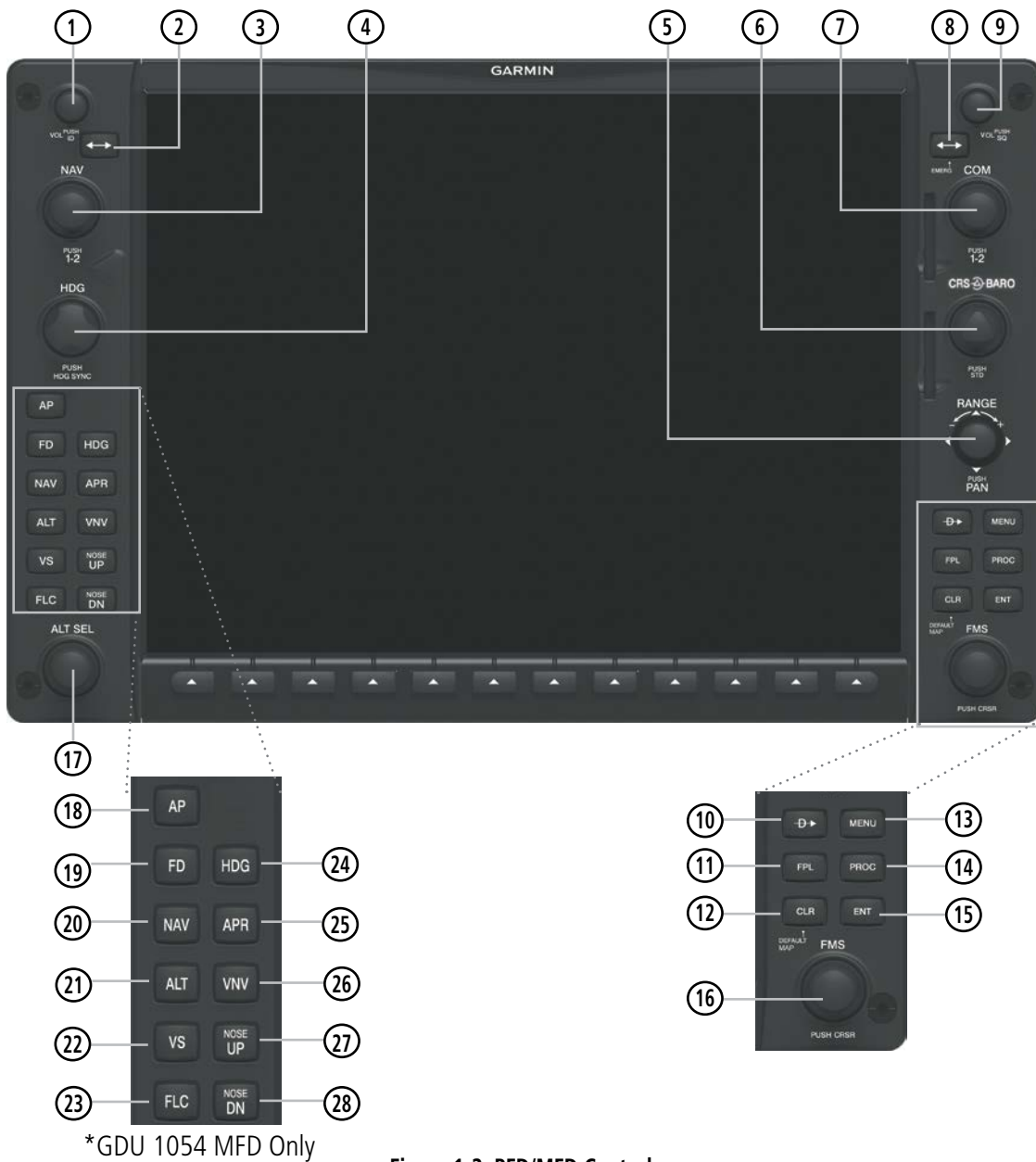



Figure 1-2 PFD/MFD Controls

- ① **NAV VOL/ID Knob** Turn to control NAV audio volume (shown in the NAV Frequency Box as a percentage)
Press to toggle Morse code identifier audio ON/OFF
- ② **NAV Frequency Transfer Key** Transfers the standby and active NAV frequencies
- ③ **NAV Knob** Turn to tune NAV receiver standby frequencies (large knob for MHz; small for kHz)
Press to toggle light blue tuning box between NAV1 and NAV2
- ④ **Heading Knob** Turn to manually select a heading. When operating in Heading Select mode, this knob provides the heading reference to the flight director.
Press to display a digital heading momentarily to the left of the HSI and synchronize the Selected Heading to the current heading
- ⑤ **Joystick** Turn to change map range
Press to activate Map Pointer for map panning
- ⑥ **CRS/BARO Knob** Turn large knob for altimeter barometric pressure setting
Turn the small knob to set the pilot-selected course on the HSI when the VOR1, VOR2, or OBS/SUSP mode is selected. Pressing this knob centers the CDI on the currently selected VOR. The pilot-selected course provides course reference to the pilot-side flight director when operating in Navigation and Approach modes.
Press to re-center the CDI and return course pointer directly TO bearing of active waypoint/station
- ⑦ **COM Knob** Turn to tune COM transceiver standby frequencies (large knob for MHz; small for kHz)
Press to toggle light blue tuning box between COM1 and COM2
The selected COM (green) is controlled with the **COM MIC Key** (Audio Panel).
- ⑧ **COM Frequency Transfer Key (EMERG)** Transfers the standby and active COM frequencies
Press and hold two seconds to tune the emergency frequency (121.5 MHz) automatically into the active frequency field
- ⑨ **COM VOL/SQ Knob** Turn to control COM audio volume level (shown as a percentage in the COM Frequency Box)
Press to turn the COM automatic squelch ON/OFF
- ⑩ **Direct-to Key**  Activates the direct-to function and allows the user to enter a destination waypoint and establish a direct course to the selected destination (specified by identifier, chosen from the active route)
- ⑪ **FPL Key** Displays flight plan information
- ⑫ **CLR Key (DFLT MAP)** Erases information, cancels entries, or removes menus
Press and hold to display the MFD Navigation Map Page (MFD only).
- ⑬ **MENU Key** Displays a context-sensitive list of options for accessing additional features or making setting changes
- ⑭ **PROC Key** Gives access to IFR departure procedures (DPs), arrival procedures (STARs), and approach procedures (IAPs) for a flight plan or selected airport
- ⑮ **ENT Key** Validates/confirms menu selection or data entry

- 16 FMS Knob**
(Flight Management System Knob)
- Press to turn the selection cursor ON/OFF.
- Data Entry:** With cursor ON, turn to enter data in the highlighted field (large knob moves cursor location; small knob selects character for highlighted cursor location)
- Scrolling:** When a list of information is too long for the window/box, a scroll bar appears, indicating more items to view. With cursor ON, turn large knob to scroll through the list.
- Page Selection:** Turn knob on MFD to select the page to view (large knob selects a page group; small knob selects a specific page from the group)
- 17 ALT Knob**
- Sets the selected altitude in the Selected Altitude Box (the large knob selects the thousands, the small knob selects the hundreds). In addition to providing the standard system altitude alerter function, selected altitude provides an altitude setting for the Altitude Capture/Hold mode of the AFCS.
- 18 *AP Key**
- Engages/disengages the Autopilot and Flight Director in the default vertical and lateral modes.
- 19 *FD Key**
- Activates/deactivates the Flight Director only. Pressing the **FD** key turns on the Flight Director in the default vertical and lateral modes. Pressing the **FD** key again deactivates the Flight Director and removes the command bars, unless the Autopilot is engaged. If the Autopilot is engaged, the **FD** key is disabled.
- 20 *NAV Key**
- Selects/deselects the Navigation mode.
- 21 *ALT Key**
- Selects/deselects the Altitude Hold mode.
- 22 *VS Key**
- Selects/deselects the Vertical Speed mode.
- 23 *FLC Key**
- Selects/deselects the Flight Level Change mode.
- 24 *HDG Key**
- Selects/deselects the Heading Select mode.
- 25 *APR Key**
- Selects/deselects the Approach mode.
- 26 *VNV Key**
(if equipped)
- Selects/deselects Vertical Navigation mode
- 27 *NOSE UP Key**
- Controls the active pitch reference for the Pitch Hold, Vertical Speed, and Flight Level Change modes.
- 28 *NOSE DN Key**
- Controls the active pitch reference for the Pitch Hold, Vertical Speed, and Flight Level Change modes.

***Only available on MFD
with the GDU 1054**

SECURE DIGITAL CARDS

NOTE: Refer to the Appendices for instructions on updating the aviation databases.

NOTE: Ensure that the system is powered off before inserting the SD card.

The GDU 1050/1054 data card slots use Secure Digital (SD) cards and are located on the top right portion of the display bezels. Each display bezel is equipped with two SD card slots.

Inserting and Removing an SD card:

Insert the SD card in the SD card slot, pushing the card in until the spring latch engages. The front of the card should remain flush with the face of the display bezel. To remove, gently press on the SD card to release the spring latch and eject the card.



Figure 1-3 PFD/MFD Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

This section discusses powering up the system, normal and reversionary display operation, system status, AHRS modes of operation, and GPS receiver operation.

SYSTEM POWER-UP



NOTE: See the Appendices for additional information regarding system-specific annunciations and alerts.



NOTE: See the Pilot's Operating Handbook (POH) for specific procedures concerning avionics power application and emergency power supply operation.

The system is integrated with the aircraft electrical system and receives power directly from electrical busses. The PFD, MFD, and supporting sub-systems include both power-on and continuous built-in test features that exercise the processor, RAM, ROM, external inputs and outputs to provide safe operation.

When powering up the system, test annunciations are displayed and key annunciator lights also become momentarily illuminated on the audio panel and the display bezels. On the PFD, the AHRS begins to initialize and displays 'AHRS ALIGN: Remain Stationary'. All system annunciations should disappear typically within one minute of power-up.

When the MFD powers up, the MFD Power-up Page displays the following information:

- System version
- Land database name and version
- Safe Taxi database name and effective dates
- Terrain database name and version
- Obstacle database name and effective dates
- Navigation database name and effective dates
- Airport Directory name and effective dates
- FliteCharts/ChartView database information
- IFR/VFR charts database information
- Crew Profile
- Copyright

Current database information includes the valid operating dates, cycle number and database type. When this information has been reviewed for currency (to ensure that no databases have expired), the pilot is prompted to continue. Pressing the **ENT** Key acknowledges this information and displays the Weight Planning Page.

NORMAL OPERATION

NOTE: In normal operating mode, backlighting can only be adjusted from the PFD (see Section 1.5). In reversionary mode, it can be adjusted from the remaining display.

In normal operating mode, the PFD presents graphical flight instrumentation (attitude, heading, airspeed, altitude, vertical speed), replacing the traditional flight instrument cluster (see the Flight Instruments Section for more information). The MFD normally displays a full-color moving map with navigation information (see the Flight Management Section), while the left portion of the MFD is dedicated to the Engine Indication System (see the EIS Section). Both displays offer control for COM and NAV frequency selection.



Figure 1-4 System Normal Operation

REVERSIONARY MODE



NOTE: The system alerts the pilot when backup paths are utilized by the LRUs. Refer to the Appendices for further information regarding system-specific alerts.

In the event of an MFD failure, the system automatically switches to reversionary (backup) mode. In reversionary mode, all important flight information is presented on the remaining display in the same format as in normal operating mode.

- **PFD failure** – MFD remains in normal mode.
- **MFD failure** – PFD automatically switches to reversionary mode.

If a display fails, the appropriate GIA Ethernet interface is cut off. Thus, the GIA 63W can no longer communicate with the remaining display (refer to Figure 1-1), and the NAV and COM functions provided to the failed display by the GIA 63W are flagged as invalid on the remaining display. The system reverts to backup paths for the AHRS, ADC, Engine/Airframe Unit, and Transponder, as required. The change to backup paths is completely automated for all LRUs and no pilot action is required.

NAV1 and COM1 Flagged Invalid (provided by the failed PFD)




DISPLAY BACKUP Button
Manually Activates/Deactivates Reversionary Mode on All Displays

Figure 1-5 Reversionary Mode (Failed PFD)

Reversionary mode may also be manually activated by pressing the Audio Panel's red **DISPLAY BACKUP** Button. Pressing this button again deactivates reversionary mode.

SYSTEM ANNUNCIATIONS


 **NOTE:** Upon power-up, certain windows remain invalid as system equipment begins to initialize. All windows should be operational within one minute of power-up. If any window continues to remain flagged, the system should be serviced by a Garmin-authorized repair facility.

When an LRU or an LRU function fails, a large amber or red 'X' is typically displayed on windows associated with the failed data (refer to Table 1-1 for all possible flags and the responsible LRUs). Refer to the Pilot's Operating Handbook (POH) for additional information regarding pilot responses to these annunciations.

The status of detected LRUs can be checked on the System Status Page. Active LRUs are indicated by green check marks; failed by red 'X's. Failed LRUs should be noted and a service center or Garmin-authorized dealer informed.

Viewing LRU information:

- 1) Use the **FMS** Knob to select the 'Aux - System Status' Page.
- 2) To place the cursor in the 'LRU Info' Box,
Press the **LRU** Softkey.
Or:
 - a) Press the **MENU** Key.
 - b) With 'Select LRU Window' highlighted, press the **ENT** Key.
- 3) Use the **FMS** Knob to scroll through the box to view LRU status information.

 **NOTE:** Refer to the POH for additional information regarding pilot responses to these annunciations.

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System Annunciation	Comment
	Air Data, Attitude and Heading Reference System is aligning.
	Display system is not receiving attitude information from the AHRS.
	AHRS calibration incomplete or configuration module failure.
	GPS information is either not present or is invalid for navigation use. Note that AHRS utilizes GPS inputs during normal operation. AHRS operation may be degraded if GPS signals are not present (see POH).
	Display system is not receiving airspeed input from the air data computer.

System Annunciation	Comment
	Display system is not receiving vertical speed input from the air data computer.
	Display system is not receiving valid heading input from the AHRS or magnetometer.
	Display system is not receiving altitude input from the air data computer.
	Display system is not receiving valid ISA information from the air data computer.
	Display system is not receiving valid OAT information from the air data computer.
	Display system is not receiving valid transponder information.
Other Various Red X Indications	A red 'X' through any other display field (such as engine instrumentation fields) indicates that the field is not receiving valid data.

Table 1-1 System Annunciations

SYSTEM STATUS

The System Status Page displays the status and software version numbers for all detected system LRUs. Pertinent information on all system databases is also displayed. Active LRUs are indicated by green check marks and failed LRUs are indicated by red “X”s. Failed LRUs should be noted and a service center or Garmin dealer informed.

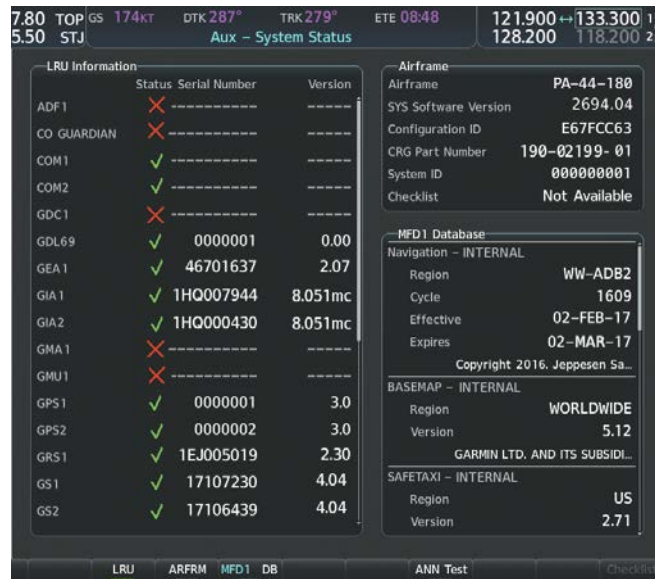


Figure 1-6 Example System Status Page

The **LRU** and **ARFRM** Softkeys on the System Status Page select the applicable list (LRU Information or Airframe window) through which the **FMS** Knob can be used to scroll information within the selected window.

Pressing the **MFD1 DB** Softkey (label annunciator turns green indicating the softkey is selected) places the cursor in the database window. Use the **FMS** Knob to scroll through database information for the MFD. Pressing the softkey again will change the softkey label to **PFD1 DB**. PFD 1 database information is now displayed in the database window. Pressing the softkey a third time will change the softkey label back to **MFD1 DB**. MFD database information is displayed again in the database window.

The **ANN Test** Softkey, when pressed, causes an annunciation test tone to be played.

AHRS OPERATION



NOTE: Refer to the Appendices for specific AHRS alert information.



NOTE: Aggressive maneuvering while AHRS is not operating normally may degrade AHRS accuracy.

In addition to using internal sensors, the AHRS uses GPS information, magnetic field data and air data to assist in attitude/heading calculations. In normal mode, the AHRS relies upon GPS and magnetic field measurements. If either of these external measurements is unavailable or invalid, the AHRS uses air data information for attitude determination. Four AHRS modes of operation are available and depend upon the combination of available sensor inputs. Loss of air data, GPS, or magnetometer sensor inputs is communicated to the pilot by message advisory alerts.

The AHRS corrects for shifts and variations in the Earth’s magnetic field by applying the Magnetic Field Variation Database. The Magnetic Field Variation Database is derived from the International Geomagnetic Reference Field (IGRF). The IGRF is a mathematical model that describes the Earth’s main magnetic field and its annual rate of change. The database is updated approximately every 5 years. See the Appendices for information on updating the Magnetic Field Variation Database. The system will prompt you on startup when an update is available. Failure to update this database could lead to erroneous heading information being displayed to the pilot.

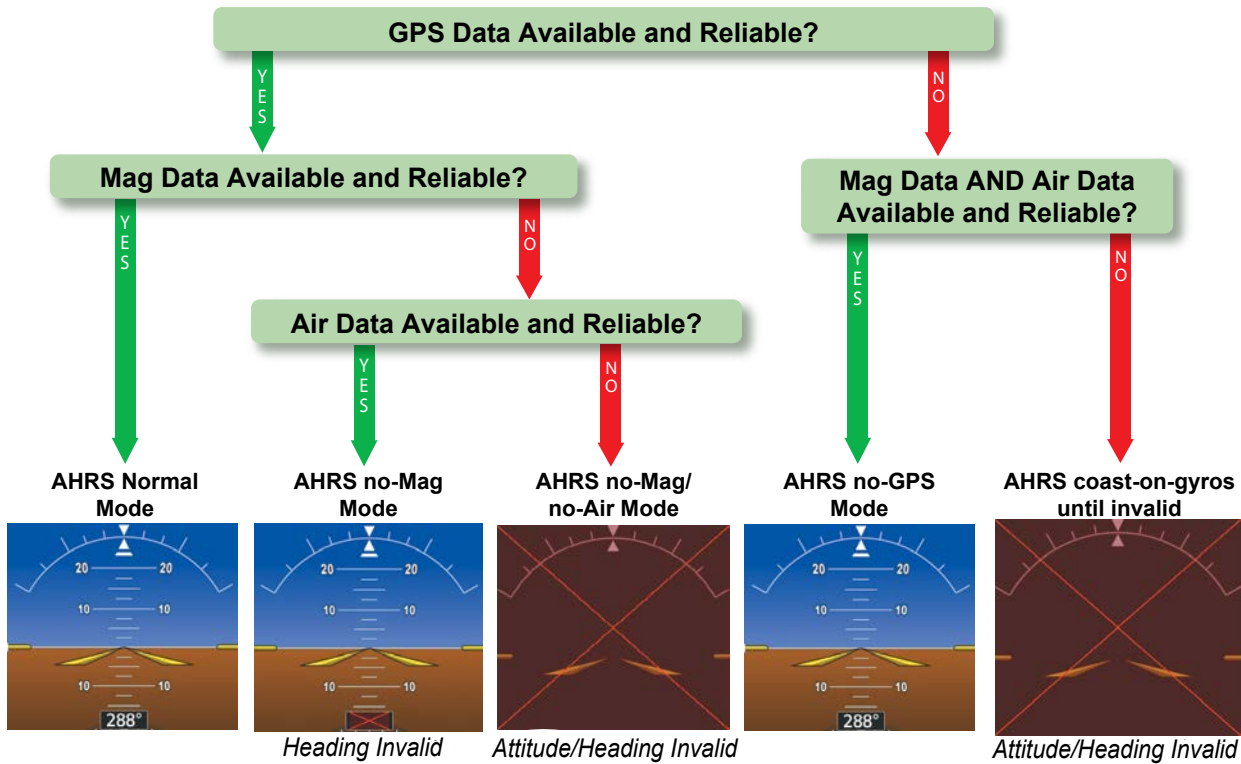


Figure 1-7 AHRS Operation

GPS INPUT FAILURE



NOTE: *In-flight initialization of AHRS, when operating without any valid source of GPS data and at true air speed values greater than approximately 200 knots, is not guaranteed. Under these rare conditions, it is possible for in-flight AHRS initialization to take an indefinite amount of time which would result in an extended period of time where valid AHRS outputs are unavailable.*

The system provides two sources of GPS information. If a single GPS receiver fails, or if the information provided from one of the GPS receivers is unreliable, the AHRS seamlessly transitions to using the other GPS receiver. An alert message informs the pilot of the use of the backup GPS path. If both GPS inputs fail, the AHRS continues to operate in reversionary No-GPS mode so long as the air data and magnetometer inputs are available and valid.

AIR DATA INPUT FAILURE

A failure of the air data input has no effect on AHRS output while AHRS is operating in normal mode. A failure of the air data input while the AHRS is operating in reversionary No-GPS mode results in invalid attitude and heading information on the PFD (as indicated by red “X” flags).

MAGNETOMETER FAILURE

If the magnetometer input fails, the AHRS transitions to one of the reversionary No-Magnetometer modes and continues to output valid attitude information. However, if the aircraft is airborne, the heading output on the PFD does become invalid (as indicated by a red “X”).

GPS RECEIVER OPERATION

Each GIA 63W Integrated Avionics Unit (IAU) contains a GPS receiver. Information collected by the specified receiver (GPS1 for the #1 GIA or GPS2 for the #2 GIA) may be viewed on the Aux - GPS Status Page.

These GPS sensor annunciations are most often seen after system power-up when one GPS receiver has acquired satellites before the other, or one of the GPS receivers has not yet acquired a SBAS signal. While the aircraft is on the ground, the SBAS signal may be blocked by obstructions causing one GPS receiver to have difficulty acquiring a good signal. Also, while airborne, turning the aircraft may result in one of the GPS receivers temporarily losing the SBAS signal.

If the sensor annunciation persists, check for a system failure message in the Messages Window on the PFD. If no failure message exists, check the GPS Status Page and compare the information for GPS1 and GPS2. Discrepancies may indicate a problem.

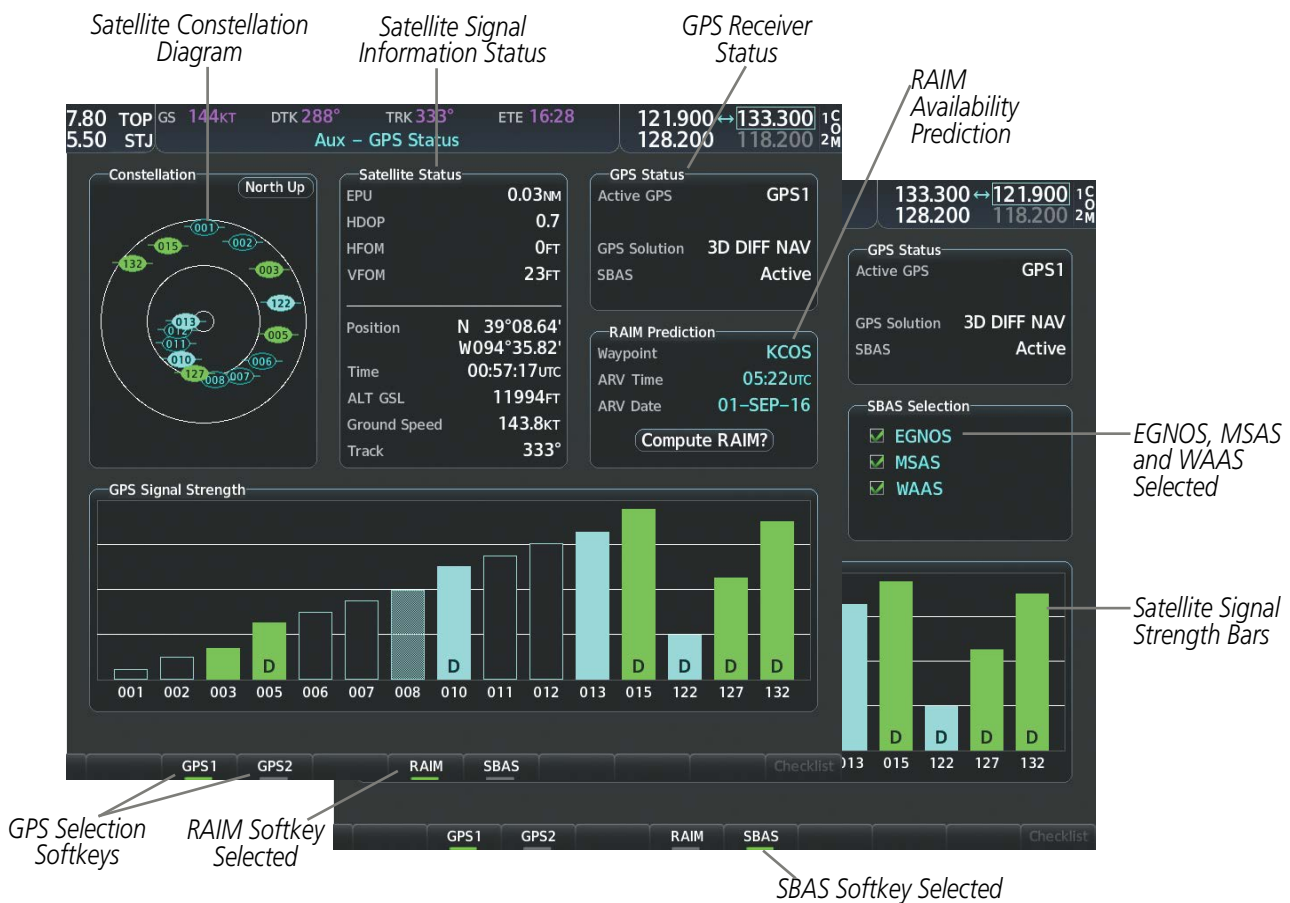


Figure 1-8 GPS Status Page (RAIM or SBAS Selected)

The GPS Status Page provides the following information:

- Constellation

Satellites currently in view are shown at their respective positions on a sky view diagram. The sky view is always in a north-up orientation, with the outer circle representing the horizon, the inner circle representing 45° above the horizon, and the center point showing the position directly overhead.

Each satellite is represented by an oval containing the Pseudo-random noise (PRN) number (i.e., satellite identification number). Satellites whose signals are currently being used are represented by solid ovals.

- Satellite Status

This box provides information regarding signal status. The accuracy of the aircraft's GPS fix is calculated using Estimated Position Uncertainty (EPU), Dilution of Precision (DOP), and horizontal and vertical figures of merit (HFOM and VFOM). EPU is the radius of a circle centered on an estimated horizontal position in which actual position has 95% probability of laying. EPU is a statistical error indication and not an actual error measurement.

DOP measures satellite geometry quality (i.e., number of satellites received and where they are relative to each other) on a range from 0.0 to 9.9, with lower numbers denoting better accuracy. HFOM and VFOM, measures of horizontal and vertical position uncertainty, are the current 95% confidence horizontal and vertical accuracy values reported by the GPS receiver.

The current calculated GPS position, time, altitude, ground speed, and track for the aircraft are displayed below the satellite signal accuracy measurements.

- GPS Status

The GPS solution type (ACQUIRING, 2D NAV, 2D DIFF NAV, 3D NAV, 3D DIFF NAV) for the active GPS receiver (GPS1 or GPS2) is shown in the upper right of the GPS Status Page. When the receiver is in the process of acquiring enough satellite signals for navigation, the receiver uses satellite orbital data (collected continuously from the satellites) and last known position to determine the satellites that should be in view. 'Acquiring' is indicated as the solution until a sufficient number of satellites have been acquired for computing a solution.

When the receiver is in the process of acquiring a 3D differential GPS solution, 3D NAV is indicated as the solution until the 3D differential fix has finished acquisition. SBAS (Satellite-Based Augmentation System) indicates 'Inactive'. When acquisition is complete, the solution status indicates 3D DIFF NAV and SBAS indicates 'Active'.

Viewing GPS receiver status information:

- 1) Use the large **FMS** Knob to select the 'Aux' Page Group (see Section 1.4 for information on navigating MFD page groups).
- 2) Use the small **FMS** Knob to select the 'GPS Status' Page.

Selecting the GPS receiver for which data may be reviewed:

- 1) Use the **FMS** Knob to select the 'Aux - GPS Status' Page.
- 2) To change the selected GPS receiver:

Press the desired **GPS** Softkey.

Or:

- a) Press the **MENU** Key.
- b) Use the **FMS** Knob to highlight the receiver which is not selected and press the **ENT** Key.

- RAIM (Receiver Autonomous Integrity Monitoring) Prediction (**RAIM** Softkey is selected)

In most cases performing a RAIM prediction is not necessary. However, in some cases, the selected approach may be outside the SBAS coverage area and it may be necessary to perform a RAIM prediction for the intended approach.

Receiver Autonomous Integrity Monitoring (RAIM) is a GPS receiver function that performs a consistency check on all tracked satellites. RAIM ensures that the available satellite geometry allows the receiver to calculate a position within a specified RAIM protection limit (2.0 nautical miles for oceanic and enroute, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). During oceanic, enroute, and terminal phases of flight, RAIM is available nearly 100% of the time.

The RAIM prediction function also indicates whether RAIM is available at a specified date and time. RAIM computations predict satellite coverage within ± 15 min of the specified arrival date and time.

Because of the tighter protection limit on approaches, there may be times when RAIM is not available. The system automatically monitors RAIM and warns with an alert message when it is not available. If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the messages 'Approach is not active' and 'RAIM not available from FAF to MAP'. If RAIM is not available when crossing the FAF, the missed approach procedure must be flown.

Predicting RAIM availability at a selected waypoint:

- 1) Select the 'Aux - GPS Status' Page.
- 2) If necessary, press the **RAIM** Softkey.
- 3) Press the **FMS** Knob. The 'Waypoint' Field is highlighted.
- 4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window.
- 5) Enter the desired waypoint:

Use the **FMS** Knob to enter the desired waypoint by identifier, facility, or city name and press the **ENT** Key.

Or:

- a) Turn the small **FMS** Knob counter-clockwise to display a list of flight plan waypoints (the FPL list is populated only when navigating a flight plan).
 - b) Turn the small **FMS** Knob clockwise to display the Flight Plan, Nearest, Recent, or User waypoints, if required.
 - c) Turn the large **FMS** Knob clockwise to select the desired waypoint. The system automatically fills in the identifier, facility, and city fields with the information for the selected waypoint.
 - d) Press the **ENT** Key to accept the waypoint entry.
- 6) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.
 - 7) Use the **FMS** Knob to enter an arrival date and press the **ENT** Key.
 - 8) With the cursor highlighting 'Compute RAIM?', press the **ENT** Key. Once RAIM availability is computed, one of the following is displayed:
 - 'Compute RAIM?'—RAIM has not been computed for the current waypoint, time, and date combination
 - 'Computing Availability'—RAIM calculation in progress
 - 'RAIM Available'—RAIM is predicted to be available for the specified waypoint, time, and date
 - 'RAIM not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date

Predicting RAIM availability at present position:

- 1) Select the 'Aux - GPS Status' Page.
- 2) If necessary, press the **RAIM** Softkey.
- 3) Press the **FMS** Knob. The 'Waypoint' Field is highlighted.
- 4) Press the **MENU** Key.
- 5) With 'Set WPT to Present Position' highlighted, press the **ENT** Key.
- 6) Press the **ENT** Key to accept the waypoint entry.
- 7) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.
- 8) Use the **FMS** Knob to enter an arrival date and press the **ENT** Key.
- 9) With the cursor highlighting 'Compute RAIM?', press the **ENT** Key. Once RAIM availability is computed, one of the following is displayed:
 - 'Compute RAIM?'—RAIM has not been computed for the current waypoint, time, and date combination
 - 'Computing Availability'—RAIM calculation in progress
 - 'RAIM Available'—RAIM is predicted to be available for the specified waypoint, time, and date
 - 'RAIM not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date

SBAS Selection (SBAS Softkey is selected)

In certain situations, such as when the aircraft is outside or on the fringe of the SBAS coverage area, it may be desirable to disable EGNOS, WAAS or MSAS (although it is not recommended). When disabled, the SBAS field in the GPS Status box indicates Disabled. There may be a small delay for the GPS Status box to be updated upon WAAS and MSAS enabling/disabling.

Disabling SBAS:

- 1) Select the 'Aux - GPS Status' Page.
- 2) If necessary, press the **SBAS** Softkey.
- 3) Press the **FMS** Knob, and turn the large FMS Knob to highlight 'EGNOS', 'MSAS' or 'WAAS'.
- 4) Press the **ENT** Key to uncheck the box.
- 5) Press the **FMS** Knob to remove the cursor.

- GPS Satellite Signal Strengths

The GPS Status Page can be helpful in troubleshooting weak (or missing) signal levels due to poor satellite coverage or installation problems. As the GPS receiver locks onto satellites, a signal strength bar is displayed for each satellite in view, with the appropriate satellite PRN number (01-32 or 120-138 for WAAS) below each bar. The progress of satellite acquisition is shown in three stages, as indicated by signal bar appearance:

- No bar—Receiver is looking for the indicated satellite
- Hollow bar—Receiver has found the satellite and is collecting data
- Cyan bar—Receiver has collected the necessary data and the satellite signal can be used
- Green bar—Satellite is being used for the GPS solution
- Checkered bar—Receiver has excluded the satellite (Fault Detection and Exclusion)
- "D" indication—Denotes the satellite is being used as part of the differential computations

Each satellite has a 30-second data transmission that must be collected (signal strength bar is hollow) before the satellite may be used for navigation (signal strength bar becomes solid).

1.4 ACCESSING SYSTEM FUNCTIONALITY

SOFTKEY FUNCTION

Selection softkeys are located along the bottom of the displays. The softkeys shown depend on the softkey level previously selected. The bezel keys below the softkey labels can be used to select the appropriate softkey. There are three types of softkeys. One selects a simple on/off state, indicated by an annunciator on the softkey label displayed as green (on) or gray (off). The next type of softkey selects among several options, indicated by the softkey label changing (with the exception of the Map Range keys) to reflect the name of the chosen option. The last type of softkey, when pressed displays another set of softkeys available for the selected function. Also, these softkeys revert to the previous level after 45 seconds of inactivity. When a softkey function is disabled, the softkey label is subdued (dimmed)



Figure 1-9 Softkeys (First-Level PFD Configuration)

PFD SOFTKEYS

The PFD softkeys provide control over the PFD display and some flight management functions, including GPS, NAV, terrain, traffic, and weather (optional). Each softkey sublevel has a **Back** Softkey which can be pressed to return to the previous level. If messages remain after acknowledgement, the **Message** Softkey is black on white. The **Messages** Softkey is visible in all softkey levels. For the top level softkeys and the transponder (XPDR) levels, the **Ident** Softkey remains visible.

The following table describes PFD Softkey functions. Softkeys which display another set of softkeys are indicated in the table by showing the given set as an increased level. For example, the Map/HSI softkey is shown in the Level 1 column. When pressed, the **Map/HSI** softkey will display another set of softkeys and these softkeys are explained in the Level 2 column. If a softkey on Level 2 provides yet another set of softkey functions, those new available softkeys are then explained in the Level 3 column, etc.

Level 1	Level 2	Level 3	Level 4	Description
Map/HSI				Displays the PFD Map display settings softkeys.
	Layout			Displays the PFD Map selection softkeys.
		Map Off		Removes the PFD map from display (Inset or Traffic).
		Inset Map		Displays the Inset Map
		HSI Map		Displays the HSI Map.
		TFC Map		Replaces the PFD Map with a dedicated traffic display.

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Level 1	Level 2	Level 3	Level 4	Description
		Wx LGND		Displays/removes the name of the selected data link weather provider (SiriusXM) and the weather product icon and age box (for enabled weather products) (optional).
	Detail			Selects desired amount of map detail: All (No Declutter): All map features visible Detail 1 : Declutters land data Detail 2 : Declutters land and SUA data Detail 3 : Removes everything except for the active flight plan
	Traffic			Displays traffic information on PFD Map.
	Topo			Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on PFD Map.
	Rel Ter			Displays relative terrain information on the PFD Map.
	NEXRAD			Displays XM NEXRAD weather and coverage on PFD Map (optional).
	METAR			Displays METAR information on Inset Map (optional).
	Lightning			Adds/removes the display of SiriusXM lightning information on PFD Map (optional).
		LTNG Off		Disables lightning function on PFD Map. The softkey annunciator is green when the lightning function is off.
		Datalink		Selects the data link weather source for the PFD Map (optional).
TFC Map				Replaces the PFD Map with a dedicated traffic display.
PFD Opt				Displays second-level softkeys for additional PFD options.
	SVT			Displays additional SVT overlay softkeys
		Pathways		Displays Pathway Boxes on the Synthetic Vision Display.
		Terrain		Enables synthetic terrain depiction.
		HDG LBL		Displays compass heading along the Zero-Pitch line.
		APT Sign		Displays position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are displayed when the airport is within approximately 9 nm.
	Wind			Displays the wind option softkeys.
		Option 1		Headwind/Tailwind and crosswind components.
		Option 2		Wind direction arrow and speed.
		Option 3		Wind direction arrow with direction and speed.
		Off		Wind information not displayed.
	DME			Displays DME Information Window (optional).
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, FMS/ waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	Bearing 2			Cycles the Bearing 2 Information Window through NAV1, NAV2, FMS/ waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.

Level 1	Level 2	Level 3	Level 4	Description
	ALT Units			Displays softkeys to select altitude unit parameters.
		Meters		When enabled, displays altimeter in meters.
		IN		Press to display the BARO setting as inches of mercury.
		HPA		Press to display the BARO setting as hectopascals.
	STD Baro			Sets barometric pressure to 29.92 in Hg (1013 hPa if metric units are selected).
OBS				Selects OBS mode on the CDI when navigating by GPS (only available with active leg). When OBS is on, the softkey annunciator is green.
CDI				Cycles through FMS, NAV1, and NAV2 navigation modes on the CDI.
ADF/DME				Displays/removes ADF/DME Tuning Window (optional; may appear as blank, ADF, DME, or ADF/DME depending on installation)
XPDR				Displays the transponder selection softkeys.
	Standby			Selects transponder Standby Mode (transponder does not reply to any interrogations).
	On			Activates transponder (transponder replies to identification interrogations).
	ALT			Altitude Reporting Mode (transponder replies to identification and altitude interrogations).
	VFR			Automatically enters the VFR code (1200 in the U.S.A. only)
	Code			Displays transponder code selection softkeys 0-7.
		0 - 7		Use numbers to enter code.
		Ident		Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
		BKSP		Removes numbers entered, one at a time.
	Ident			Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
Ident				Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
Tmr/Ref				Displays Timer/References Window.
Nearest				Displays Nearest Airports Window.
Messages				Displays the Messages Window when pressed. System generated messages cause the Messages Softkey label to change to a flashing white with black text label. Pressing the Messages Softkey acknowledges the message, and the softkey reverts to the black label with white text.

Table 1-2 PFD Softkeys

MFD SOFTKEYS

The MFD softkeys provide control over flight management functions, including GPS, NAV, terrain, traffic, and weather (optional). There are many softkey functions available on the MFD depending on the page group and screen selected.

The following table provides an example of the MFD Softkey functions accessed from the Navigation Map screen. Further information concerning softkeys providing more navigation and flight planning functions may be found in the Flight Management Section. Terrain, traffic, and weather softkey descriptions may be found in the Hazard Avoidance section. Further description of optional equipment and corresponding softkey functions may be found in the Additional Features Section.

Level 1	Level 2	Level 3	Description
Engine			Displays EIS - Engine Page and second-level engine softkeys; press again to exit page (see the EIS Section for more information)
	Tabs		Resets displayed fuel remaining to filler tab level and fuel used to zero
	DEC Fuel		Decreases displayed fuel remaining in 1-gal increments
	INC Fuel		Increases displayed fuel remaining in 1-gal increments
	RST Fuel		Resets displayed fuel remaining to maximum fuel capacity for aircraft and fuel used to zero
	CO RST		Resets the Co Gaurdian.
Map Opt			Displays the second level map options softkeys.
	Traffic		Displays traffic information on Navigation Map Page.
	Inset		Displays inset window second level softkeys.
		Off	Removes VSD inset from Navigation Map Page.
		VSD	Displays VSD profile information of terrain/obstacles along the current track, vertical track vector, and selected altitude. Auto: Automatically displays either VSD profile information for active flight plan information or along current track with no active flight plan. FPL: Displays VSD profile information for active flight plan. TRK: Displays VSD profile information along current track.
	TER		Displays terrain on the map; cycles through the following: Off: No terrain information shown on MFD Map. Topo: Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on MFD Map. REL: Displays relative terrain information on the MFD Map.

Level 1	Level 2	Level 3	Description
	AWY		Displays airways on the map; cycles through the following: Off: No airways are displayed. On: All airways are displayed. LO: Only low altitude airways are displayed. HI: Only high altitude airways are displayed.
	NEXRAD		Displays XM NEXRAD weather and coverage on Navigation Map Page (optional).
	XM LTNG		Displays XM lightning information on Navigation Map Page (optional).
	METAR		Displays METAR information on Inset Map (subscription optional).
	Legend		Displays legends for the displayed XM Weather products (optional).
Detail			Selects desired amount of map detail; cycles through the following levels: Detail All: All map features visible. Detail-1: Declutters land data. Detail-2: Declutters land and SUA data. Detail-3: Removes everything except for the active flight plan.
Charts			When available, displays optional airport and terminal procedure charts.
	CHRT Opt		Displays chart display settings softkeys.
		Fit WDTN	Changes the chart size to fit the available screen width.
		Full SCN	Removes data window to display chart on screen.
	Show Map or Chart		Displays the WPT–Airport Information page with the procedure for the airport selected. Displays the chart with the procedure for the airport selected.
	Info		Displays airport information: Info 1: Displays Airport Information Page Info 2: Displays Airport Directory Page
	DP		Displays departure procedure chart.
	STAR		Displays standard terminal arrival procedure chart.
	APR		Displays approach procedure chart.
	WX		Displays airport weather information chart.
	NOTAM		Displays NOTAM information for selected airport, when available.
Checklist			When available, displays optional checklists

Table 1-3 MFD Navigation Map Page Softkeys

MENUS

The system has a **MENU** Key that, when pressed, displays a context-sensitive list of options. This options list allows the user to access additional features or make settings changes which specifically relate to the currently displayed window/page. There is no all-encompassing menu. Some menus provide access to additional submenus that are used to view, edit, select, and review options. Menus display 'No Options' when there are no options for the window/page selected. The main controls used in association with all window/page group operations are described in Section 1.2. Softkey selection does not display menus or submenus.

Navigating the Page Menu Window:

- 1) Press the **MENU** Key to display the 'Page Menu'.
- 2) Turn the **FMS** Knob to scroll through a list of available options (a scroll bar appears to the right of the window when the option list is longer than the window).
- 3) Press the **ENT** Key to select the desired option.
- 4) The **CLR** Key may be pressed to remove the menu and cancel the operation. Pressing the **FMS** Knob also removes the displayed menu.

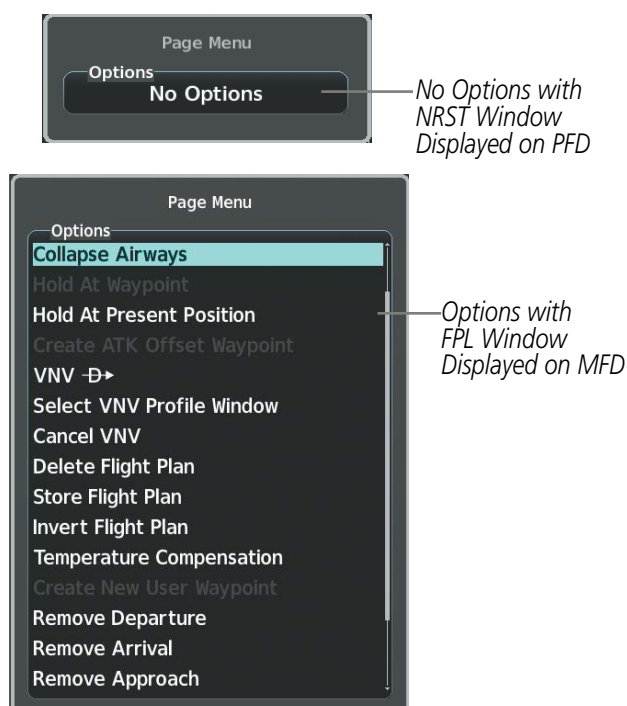


Figure 1-10 Page Menu Examples

MFD PAGE GROUPS



NOTE: Refer to other supporting sections in this Pilot's Guide for details on specific pages.

Information on the MFD is presented on pages grouped according to function. The page group and active page title are displayed in the upper center of the screen, below the Navigation Data Bar. In the bottom right corner of the screen, a page group window is displayed by turning either **FMS** Knob. The page group tabs are displayed along the bottom of the window. The page titles are displayed in a list above the page group tabs. The current page group and current page within the group are shown in cyan. For some of these pages (Airport/Procedures/Weather Information, XM, Procedure Loading), the active title of the page changes while the page name in the list remains the same.

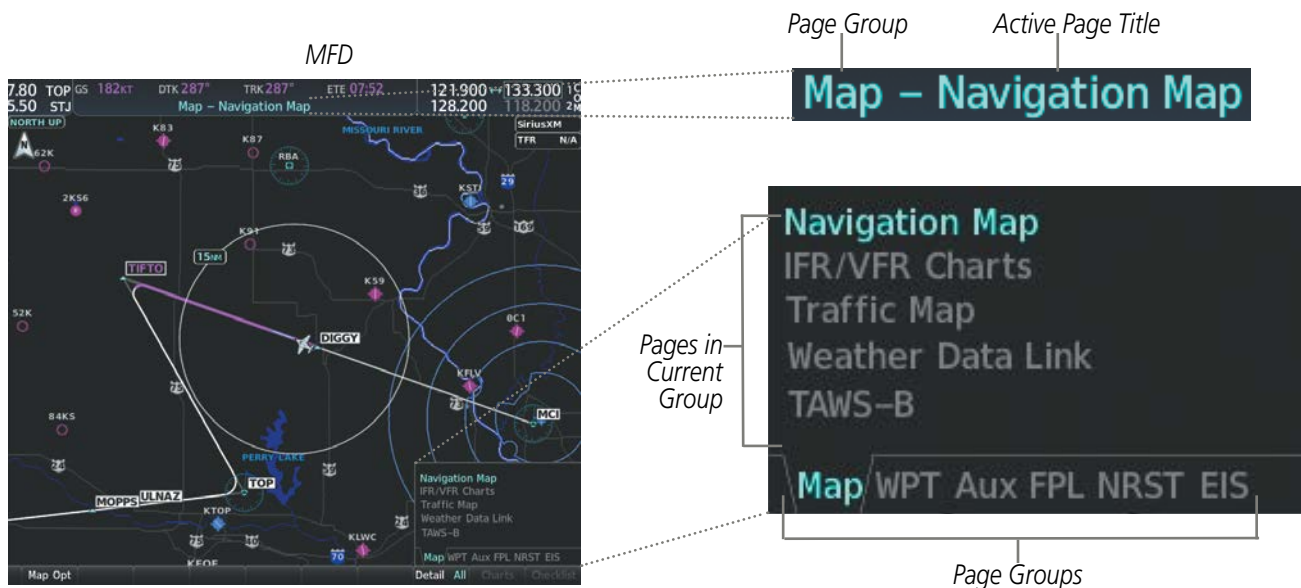


Figure 1-11 Page Title and Page Groups

The main page groups are navigated using the **FMS** Knob; specific pages within each group can vary depending on the configuration of optional equipment.

Selecting a page using the FMS Knob:

- 1) Turn the large **FMS** Knob to display the list of page groups; continue turning the large **FMS** Knob until the desired page group is selected
- 2) Turn the small **FMS** Knob to display the desired page within a specific page group.

There are several pages which may be selected by selecting the appropriate softkey at the bottom of the page (or from the page menu). In this case, the active page title will change when a different page softkey is selected, but the page will remain the same (i.e. the **Radio** and **Info** softkeys show different active page titles ('Aux - XM Radio' and 'Aux - XM Information' respective) within the same page, 'XM Radio'.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Page Group	Pages within Page Group
Map (Map Page Group)	<ul style="list-style-type: none"> • Navigation Map • IFR/VFR Charts • Traffic Map • Weather Data Link (<i>optional</i>) • Terrain Proximity/Terrain-SVT (<i>optional</i>)/ TAWS-B (<i>optional</i>)
WPT (Waypoint Page Group)	<ul style="list-style-type: none"> • Airport/Procedures/Weather Information Pages <ul style="list-style-type: none"> - Airport Information (Info 1 Softkey) - Airport Directory Information (Info 2 Softkey) - Departure Information (DP Softkey) - Arrival Information (STAR Softkey) - Approach Information (APR Softkey) - Weather Information (<i>optional</i>) (WX Softkey) • Intersection Information • NDB Information • VOR Information • VRP Information • User Waypoint Information
Aux (Auxiliary Page Group)	<ul style="list-style-type: none"> • Weight and Balance • Trip Planning • Utility • GPS Status • System Setup 1/2 • XM Radio Pages (SiriusXM <i>optional</i>) <ul style="list-style-type: none"> - XM Radio (Radio Softkey) - XM Information (Info Softkey) • Maintenance WiFi Setup • System Status • ADS-B Status • Connex Setup • Databases

Page Group	Pages within Page Group
FPL (Flight Plan Page Group)	<ul style="list-style-type: none"> • Active Flight Plan <ul style="list-style-type: none"> - Wide View, Narrow View (View Softkey) • Flight Plan Catalog <ul style="list-style-type: none"> - Stored Flight Plan (via New Softkey)
NRST (Nearest Page Group)	<ul style="list-style-type: none"> • Nearest Airports • Nearest Intersections • Nearest NDB • Nearest VOR • Nearest VRP • Nearest User WPTS • Nearest Frequencies • Nearest Airspaces
EIS (Engine Instruments Page Group)	<ul style="list-style-type: none"> • Engine

Table 1-4 Page Group and Pages

PROCEDURE PAGES (PROC)

The Procedure Pages may be accessed at any time on the MFD by pressing the **PROC** Key. A menu is initialized, and when a departure, approach, or arrival is selected, the appropriate Procedure Loading Page is opened. Turning the **FMS** Knob does not scroll through the Procedure pages

- Departure Loading
- Arrival Loading
- Approach Loading

SYSTEM SETTINGS

System settings and crew profiles are managed from the System Setup Pages. Fields shown in cyan text may be edited. Managing crew profiles and editing the system time format, display units, arrival alerts, and audio voice format settings are discussed in this section. For other system settings, see the reference given to their respective sections.

If desired, the default system settings may be restored at any time.

Restoring system setup defaults:

- 1) Select the 'Aux - System Setup 1' Page.
- 2) Press the **Defaults** Softkey; or press the **MENU** Key, highlight 'Restore Page Defaults', and press the **ENT** Key. The message 'Restore Setup X Page Defaults?' is displayed.
- 3) With 'OK' highlighted, press the **ENT** Key.

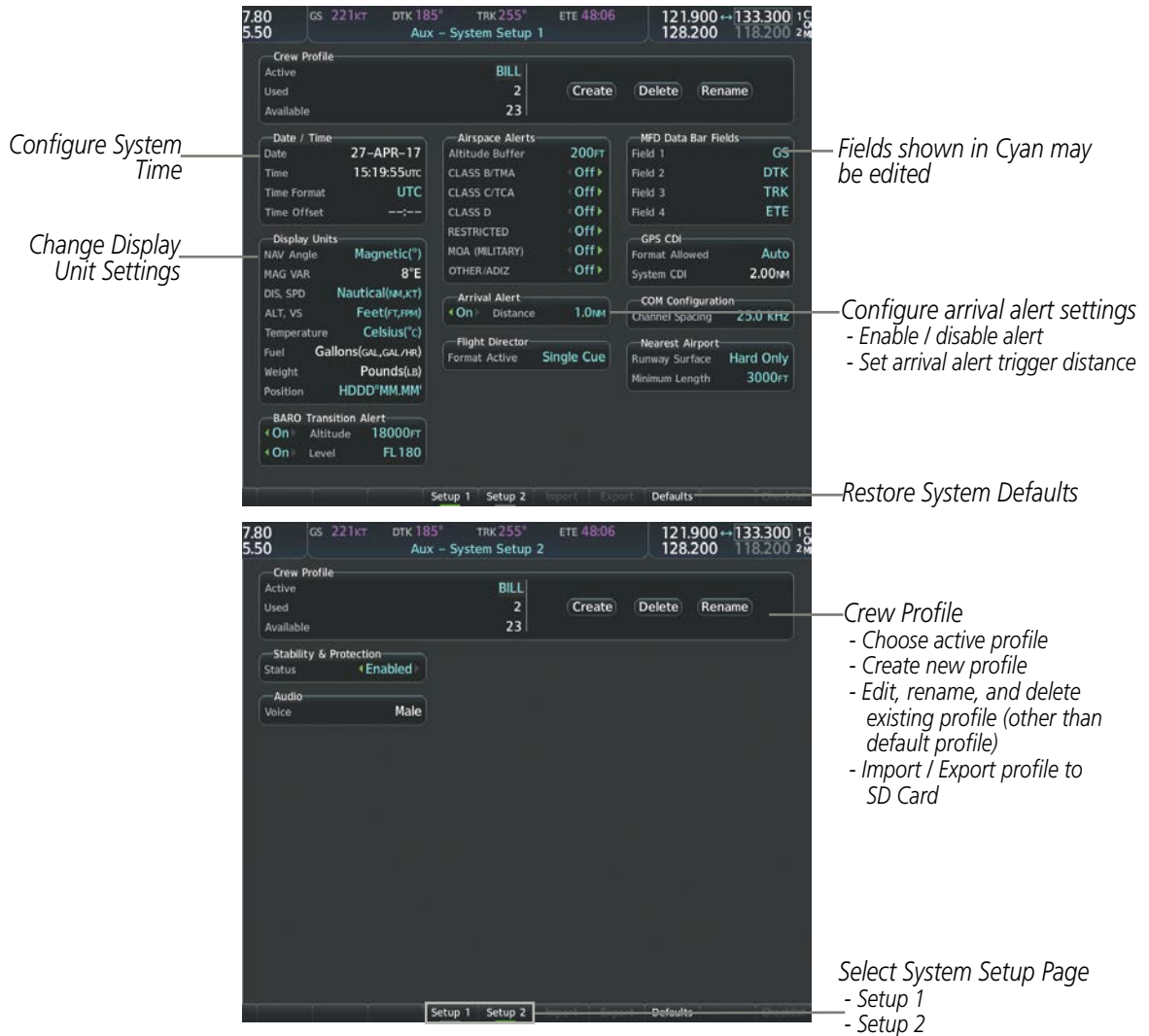


Figure 1-12 System Setup 1/2 Pages

CREW PROFILES

System settings may be saved under a crew profile. When the system is powered on, the last selected crew profile is shown on the MFD Power-up Splash Screen. The system can store up to 25 profiles; the currently active profile, the amount of memory used, and the amount of memory available are shown at the top of the System Setup Page in the box labeled 'Crew Profile'. From here, crew profiles may be created, selected, renamed, or deleted. Crew profiles may also be imported and exported via SD card.

Creating a profile:

- 1) Select the 'Aux - System Setup 1' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight 'Create' in the 'Crew Profile' Box.
- 4) Press the **ENT** Key. A 'Create Profile' window is displayed.
- 5) Use the **FMS** Knob to enter a profile name up to 16 characters long and press the **ENT** Key. Crew profile names cannot begin with a blank as the first letter.
- 6) In the next field, use the small **FMS** Knob to select the desired settings upon which to base the new profile. Profiles can be created based on Garmin factory defaults, default profile settings (initially based on Garmin factory defaults unless edited by the pilot), or other previously created profile settings.
- 7) Press the **ENT** Key.
- 8) With 'Create' highlighted, press the **ENT** Key to create the profile

Or:

Use the large **FMS** Knob to select 'Create & Activate' and press the **ENT** Key to activate the new profile.

- 9) To cancel the process, select 'Cancel' with the large FMS Knob and press the **ENT** Key.

Selecting an active profile:

- 1) Select the 'Aux - System Setup' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the active profile field in the 'Crew Profile' Box.
- 4) Turn the small **FMS** Knob to display the crew profile list and highlight the desired profile.
- 5) Press the **ENT** Key. The system loads and displays the system settings for the selected profile.

Renaming a profile:

- 1) Select the 'Aux - System Setup' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight 'Rename' in the 'Crew Profile' Box.
- 4) Press the **ENT** Key.
- 5) In the 'Rename Profile' Window, turn the **FMS** Knob to select the profile to rename.
- 6) Press the **ENT** Key.
- 7) Use the **FMS** Knob to enter a new profile name up to 16 characters long and press the **ENT** Key.
- 8) With 'Rename' highlighted, press the **ENT** Key.
- 9) To cancel the process, use the large **FMS** Knob to select 'Cancel' and press the ENT Key.

Deleting a profile:

- 1) Select the 'Aux - System Setup' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight 'Delete' in the 'Crew Profile' Box.
- 4) Press the **ENT** Key.
- 5) In the 'Delete Profile' window, turn the **FMS** Knob to select the profile to delete.
- 6) Press the **ENT** Key.
- 7) With 'Delete' highlighted, press the **ENT** Key.
- 8) To cancel the process, use the large **FMS** Knob to select 'Cancel' and press the **ENT** Key.

Importing a profile from an SD card:

- 1) Insert an SD card containing the crew profile(s) into the top card slot on the MFD.
- 2) Turn the **FMS** Knob to select the 'Aux - System Setup' Page.
- 3) Press the **Import** Softkey.
 - Or:**
 - a) Press the **MENU** Key.
 - b) Turn the **FMS** Knob to highlight 'Import Crew Profile' and press the **ENT** Key.
- 4) The system displays the 'Crew Profile Importing' Window with 'Import' highlighted. Turn the large **FMS** Knob to highlight the 'Profile Name' field, then scroll to the desired profile name with the large and small **FMS** Knobs, then press the **ENT** Key. Then press the **ENT** Key with 'Import' highlighted.
- 5) If the imported profile name is the same as an existing profile on the system, the system displays an 'Overwrite existing profile? OK or CANCEL' prompt. Press the **ENT** Key to replace profile on the system with the profile imported from the SD card, or turn the **FMS** Knob to highlight 'CANCEL' and press the **ENT** Key to return to the Crew Profile Importing window.
- 6) If successful, the system displays 'Crew profile import succeeded.' in the window below. With 'OK' highlighted, press the **ENT** or **CLR** Keys or press the **FMS** Knob to return to the 'Aux - System Setup' Page. The imported profile becomes the active profile.



Crew Profile Importing and Import Results Window



Crew Profiles Available for Import from SD Card

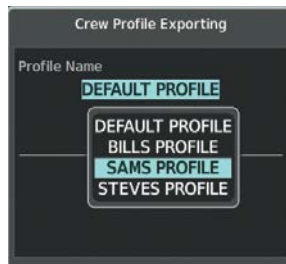


Import Successful

Figure 1-13 Pilot Profile Import (Aux - System Setup Page)

Exporting a profile to an SD card:

- 1) Insert the SD card for storing the Crew Profile into the top card slot on the MFD.
- 2) Turn the **FMS** Knob to select the 'Aux - System Setup' Page.
- 3) Press the **Export** Softkey. The system displays the 'Crew Profile Exporting' Window.
Or:
 - a) Press the **MENU** Key.
 - b) Turn the **FMS** Knob to highlight 'Export Crew Profile' and press the **ENT** Key.
- 4) To export the crew profile using the current selected profile, press the **ENT** Key with 'Export' highlighted. To change the selected profile, turn the large **FMS** Knob to highlight the 'Profile Name' field, then scroll to the desired profile name with the large and small FMS Knobs, then press the **ENT** Key. Then press the **ENT** Key with 'Export' highlighted.
- 5) If the selected profile to be exported is the same as an existing profile file name on the SD card, the system displays an 'Overwrite existing profile? OK or CANCEL' prompt. Press the **ENT** Key to replace the profile on the SD card with the profile to be exported, or turn the FMS Knob to highlight 'CANCEL' and press the **ENT** Key to return to the Pilot Profile Exporting window without exporting the profile.
- 6) If successful, the window displays 'Crew profile export succeeded.' With 'OK' highlighted, press the **ENT** or **CLR** Keys, or press the **FMS** Knob to return to the 'Aux - System Setup' Page.



Crew Profile Exporting Window, Enter a Name to Use for Exported Profile



Export Successful

Figure 1-14 Pilot Profile Export on the Aux - System Setup Page

PILOT PROFILE IMPORT/EXPORT MESSAGES

In some circumstances, some messages may appear in conjunction with others:

'No pilot profile plan files found to import.'	Displayed if the SD card does not have one or more valid pilot profile filenames.
'Overwrite existing profile?'	Displayed if the profile name matches the name of existing profile.
'Profile name invalid. Enter a different profile name.'	Displayed if the profile name is invalid.
'All available pilot profiles in use. Delete a profile before importing another.'	Displayed if the maximum number for pilot profiles has been reached.
'Pilot profile import failed.'	Displayed if the importing operation fails for any other reason.
'Pilot profile import succeeded.'	Displayed if the importing operation succeeds.
'Overwrite existing file?'	Displayed if the filename matches the name of an existing file on the SD card.
'Pilot profile export failed.'	Displayed if the export operation fails.
'Pilot profile export succeeded.'	Displayed if the export operation succeeds.

Table 1-5 Pilot Profile Import/Export Messages

DATE/TIME

The system obtains the current Universal Coordinated Time (UTC) date and time directly from the GPS satellite signals (shown on the Aux - GPS Status Page). System time (displayed in the lower right corner of the PFD) can be displayed in three formats: local 12-hr, local 24-hr, or UTC. Local time is set by adding/subtracting an offset (hours:minutes) to/from UTC.

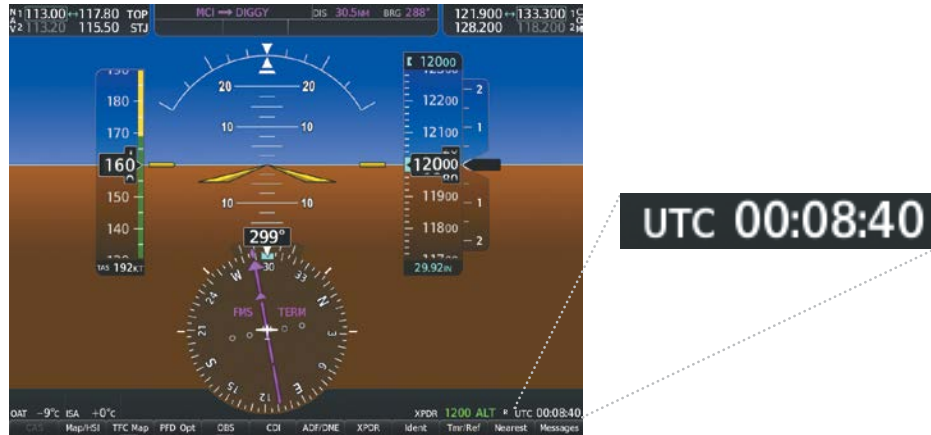


Figure 1-15 System Time (UTC Format)

Configuring the system time:

- 1) Select the 'Aux - System Setup 1' Page.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Time Format' field.
- 4) Turn the small **FMS** Knob to select the desired format and press the **ENT** Key to confirm selection. If local time format is selected, the 'Time Offset' field is highlighted.
- 5) If necessary, use the **FMS** Knob to enter the desired time offset (\pm HH:MM) and press the **ENT** Key to confirm selection.



Figure 1-16 Date/Time Settings (System Setup 1 Page)

DISPLAY UNITS

Units in which various quantities are displayed on the system screens are listed on the System Setup Page. The Navigation Angle reference, the Temperature units, and the Position units can be set from here.

Category	Settings	Affected Quantities	Exceptions
Navigation Angle	Magnetic (North)* True (North)	Heading Course Bearing Track Desired Track Wind direction (Trip Planning Page)	
Distance and Speed	Metric Nautical*	Crosstrack error (HSI) Bearing distances (information windows) DME distance (information window) Flight plan distances Map ranges DIS, GS, TAS, XTK fields (Navigation Status Box) All distances on MFD Altitude buffer distance (System Setup) Arrival Alert trigger distance (System Setup) All speeds on MFD	Airspeed Indicator True Airspeed (PFD) Wind speed vector Map range (Traffic Page, Terrain Proximity/TAWS Page) CDI scaling (System Setup) Fuel range calculation (EIS)
Altitude and Vertical Speed	Feet* Meters	All altitudes on MFD All elevations on MFD	Altimeter Vertical Speed Indicator VNV altitudes (Active Flight Plan)
Temperature	Celsius* Fahrenheit	All temperatures on PFD Total Air Temperature (Trip Planning Page)	Engine Indication System (EIS)
Fuel and Fuel Flow***	Gallons	Fuel parameters (Trip Planning Page)	Engine Indication System (EIS)
Weight**	Pounds* Kilograms	N/A	N/A
Position	HDDD°MM.MM' * HDDD°MM'SS.S"	All positions	N/A

* Default setting

** Contact a Garmin-authorized service center to change this setting

*** Not configurable

Table 1-6 Display Units Settings (System Setup Page)

Changing a display unit setting:

- 1) While on the 'Aux - System Setup 1' Page, press the **FMS** Knob momentarily to activate the flashing cursor.
- 2) Turn the large **FMS** Knob to highlight the desired field in the 'Display Units' Box.
- 3) Turn the small **FMS** Knob to select the desired units.
- 4) Press the **ENT** Key. Press the **CLR** Key to cancel the action without changing the units.

BARO TRANSITION ALERT

See the Flight Instruments section for a discussion on setting the Baro Transition Alert.

AIRSPACE ALERTS

See the Flight Management section for a discussion on Airspace Alerts settings.

ARRIVAL ALERTS

The 'Arrival Alert' Box on the 'Aux - System Setup 1' Page allows the arrival alerts in the PFD 'Messages' Window to be turned 'On/Off' and the alert trigger distance (up to 99.9 units) set for alerts in the 'Messages' Window and Navigation Status Box on the PFD. An arrival alert can be set to notify the pilot with a message upon reaching a user-specified distance from the final destination (the direct-to waypoint or the last waypoint in a flight plan). When Arrival Alerts is set to 'On', and the set distance is reached, an "Arrival at waypoint" message is displayed in the PFD Navigation Status Box, and a "WPT ARRIVAL - Arriving at waypoint - [xxxx]" is displayed in the 'Messages' Window. When Arrival Alerts is set to 'Off', only the PFD Navigation Status Box message "Arriving at waypoint" is displayed, and it is displayed when the time to the final destination is approximately ten seconds.

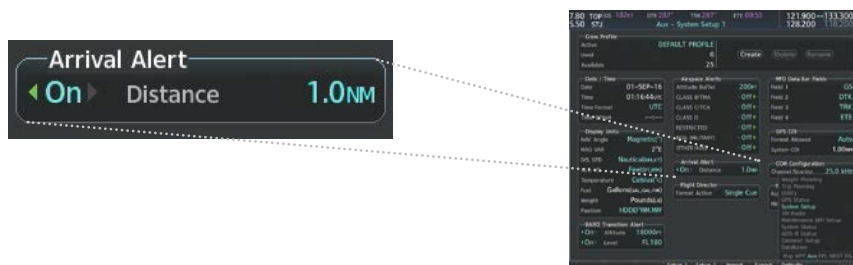


Figure 1-17 Arrival Alert Settings (System Setup 1 Page)

Enabling/disabling the arrival alert:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to select the 'On/Off' field in the 'Arrival Alert' Box.
- 4) Turn the small **FMS** Knob clockwise to turn the airspace alert On or counterclockwise to turn the alert Off.

Changing the arrival alert trigger distance:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the distance field in the 'Arrival Alert' Box.
- 4) Use the **FMS** Knob to enter a trigger distance and press the **ENT** Key.

FLIGHT DIRECTOR

See the Flight Instruments section for a discussion setting the Flight Director format.

MFD DATA BAR FIELDS

See the Flight Management section for a discussion on the MFD Data Bar Fields settings.

GPS CDI

See the Flight Instruments section for a discussion on setting the GPS CDI format.

COM CONFIGURATION

See the Audio Panel & CNS section for a discussion on the COM Configuration for channel spacing.

NEAREST AIRPORT

See the Flight Management section for a discussion on the Nearest Airport settings.

STABILITY & PROTECTION

See the Additional Features section for a discussion on the Electronic Stability and Protection (Garmin ESP™).

AUDIO ALERTS

The audio alert voice setting is set to male and is not editable.

SYSTEM UTILITIES

For flight planning purposes, timers, trip statistics, and a scheduler feature are provided on the 'Aux - Utility' Page. The timers available include a stopwatch-like generic timer, a total time in flight timer, and a record of the time of departure. Trip statistics—odometer, trip odometer, and average trip and maximum groundspeeds—are displayed from the time of the last reset.

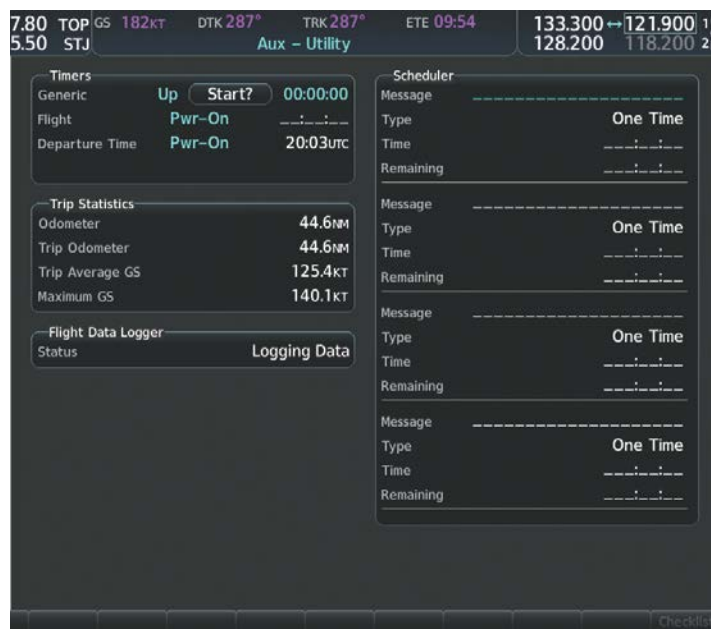


Figure 1-18 Utility Page

TIMERS

The system timers available on the 'Aux - Utility' Page include:

- Stopwatch-like generic timers
- Total-time-in-flight timer
- Time since departure

The generic timer can be set to count up or down from a specified time (HH:MM:SS). When the countdown on the timer reaches zero the digits begin to count up from zero. If the timer is reset before reaching zero on a countdown, the digits are reset to the initial value. If the timer is counting up when reset, the digits return to zero.

Setting the generic timer:

- 1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the small **FMS** Knob to select the timer counting direction (Up/Dn) and press the **ENT** Key.

- 4) If a desired starting time is desired:
 - a) Use the large **FMS** Knob to highlight the HH:MM:SS field.
 - b) Use the **FMS** Knob to enter the desired time and press the **ENT** Key.
- 5) Turn the large **FMS** Knob to highlight 'Start?' and press the **ENT** Key to start the timer. The field changes to 'Stop?'
- 6) To stop the timer, press the **ENT** Key with 'Stop?' highlighted. The field changes to 'Reset?'
- 7) To reset the timer, press the **ENT** Key with 'Reset?' highlighted. The field changes back to 'Start?' and the digits are reset.

The flight timer can be set to count up from zero starting at system power-up or from the time that the aircraft lifts off; the timer can also be reset to zero at any time.

Setting the flight timer starting criterion:

- 1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the field next to the flight timer.
- 4) Turn the small **FMS** Knob to select the starting criterion (Pwr-On or In-Air) and press the **ENT** Key.

Resetting the flight timer:

- 1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
- 2) Press the **MENU** Key.
- 3) With 'Reset Flight Timer' highlighted, press the **ENT** Key.

The system records the time at which departure occurs, depending on whether the pilot prefers the time to be recorded from system power-up or from aircraft lift off. The displayed departure time can also be reset to display the current time at the point of reset. The format in which the time is displayed is controlled from the System Setup Page.

Setting the departure timer starting criterion:

- 1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the field next to the departure time.
- 4) Turn the small **FMS** Knob to select the starting criterion (Pwr-On or In-Air) and press the **ENT** Key.

Resetting the departure time:

- 1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
- 2) Press the **MENU** Key.
- 3) Use the **FMS** Knob to highlight 'Reset Departure Time' and press the **ENT** Key.

TRIP STATISTICS

The odometer and trip odometer record the total mileage traveled from the last reset; these odometers can be reset independently. Resetting the trip odometer also resets the average trip groundspeed. Maximum groundspeed for the period of time since the last reset is also displayed.

Resetting trip statistics readouts:

- 1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
- 2) Press the **MENU** Key. The following reset options for trip statistics are displayed:
 - Reset Trip ODOM/AVG GS—Resets trip average ground speed readout and odometer
 - Reset Odometer—Resets odometer readout only
 - Reset Maximum Speed—Resets maximum speed readout only
 - Reset All—Resets flight timer, departure timer, odometers, and groundspeed readouts
- 3) Use the **FMS** Knob to highlight the desired reset option and press the **ENT** Key. The selected parameters are reset to zero and begin to display data from the point of reset.

SCHEDULER

The system's Scheduler feature can be used to enter and display reminder messages (e.g., "Change oil", "Switch fuel tanks", "Overhaul") in the Alerts Window on the PFD. Messages can be set to display based on a specific date and time (event), once the message timer reaches zero (one-time; default setting), or recurrently whenever the message timer reaches zero (periodic). Message timers set to periodic alerting automatically reset to the original timer value once the message is displayed. When power is cycled, messages are retained until deleted, and message timer countdown is restarted.

Entering a scheduler message:

- 1) Select the 'Aux - Utility' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the first empty scheduler message naming field.
- 4) Use the **FMS** Knob to enter the message text to be displayed in the PFD 'Messages' Window and press the **ENT** Key.
- 5) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the field next to 'Type'.
- 6) Turn the small **FMS** Knob to select set the message alert type:
 - Event—Message issued at the specified date/time
 - One-time—Message issued when the message timer reaches zero (default setting)
 - Periodic—Message issued each time the message timer reaches zero
- 7) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.

- 8) For periodic and one-time message, use the **FMS** Knob to enter the timer value (HHH:MM:SS) from which to countdown and press the **ENT** Key.
- 9) For event-based messages:
 - a) Use the **FMS** Knob to enter the desired date (DD-MM-YYY) and press the **ENT** Key.
 - b) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.
 - c) Use the **FMS** Knob to enter the desired time (HH:MM) and press the **ENT** Key.
- 10) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to enter the next message.

Deleting a scheduler message:

- 1) Select the 'Aux - Utility' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the name field of the scheduler message to be deleted.
- 4) Press the **CLR** Key to clear the message text. If the **CLR** Key is pressed again, the message is restored.
- 5) Press the **ENT** Key to confirm message deletion.

Scheduler messages appear in the 'Messages' Window on the PFD and cause the **Messages** Softkey label to change to a flashing white label. Pressing the **Message** Softkey opens the 'Messages' Window and acknowledges the scheduler message. The softkey reverts to the black label. Pressing the **Messages** Softkey again removes the 'Messages' Window from the display and the scheduler message is deleted from the message queue.

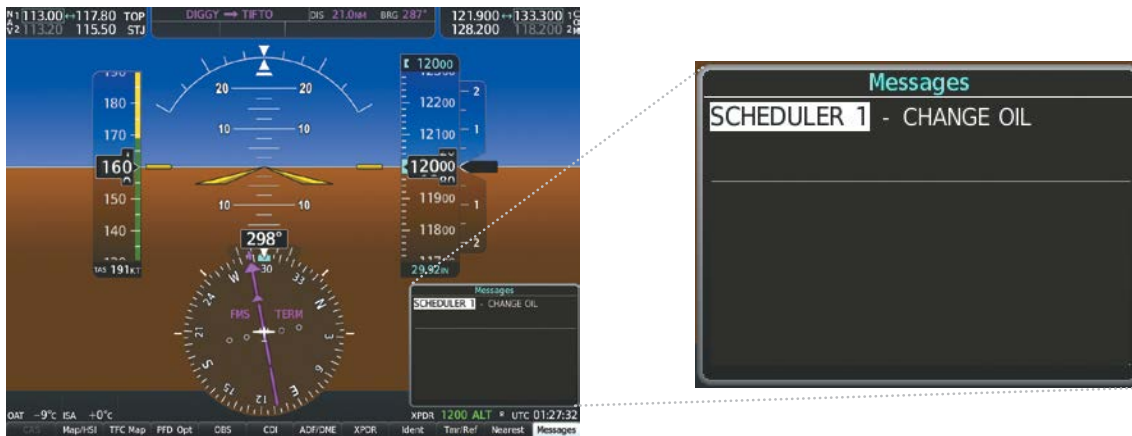


Figure 1-19 PFD Alerts Window

1.5 DISPLAY BACKLIGHTING

The PFD and MFD display backlighting, the PFD and MFD bezel, and the Audio Panel keys can be adjusted manually in one of two ways:

- Using the individual dimmer bus control for the desired display, or
- Using the PFD Setup Menu and the following procedures. In normal operating mode, backlighting can only be adjusted from the PFD. In reversionary mode, adjustments can be made from any remaining displays.

Adjusting display backlighting:

- 1) Press the PFD **MENU** Key to display the 'PFD Setup Menu'. 'Auto' is now highlighted next to 'PFD Display'. If desired, turn the large **FMS** Knob to select 'Auto' next to 'MFD Display'.
- 2) Turn the small **FMS** Knob to select 'Manual' and press the **ENT** Key. The intensity value is now highlighted.
- 3) Use the **FMS** Knob to enter the desired backlighting then press the **ENT** Key.
- 4) To remove the menu, press the **CLR** or **MENU** Key.

Adjusting key backlighting:

- 1) Press the PFD **MENU** Key to display the 'PFD Setup Menu'. 'Auto' is now highlighted next to 'PFD Display'.
- 2) Turn the large **FMS** Knob to highlight 'PFD Display' or 'MFD Display', as desired.
- 3) Turn the small **FMS** Knob in the direction of the green arrowhead to display 'PFD Key' or 'MFD Key'.
- 4) Turn the large **FMS** Knob to highlight 'AUTO'.
- 5) Turn the small **FMS** Knob to select 'Manual' and press the **ENT** Key. The intensity value is now highlighted.
- 6) Use the **FMS** Knob to enter the desired backlighting and press the **ENT** Key.
- 7) To remove the menu, press the **CLR** or **MENU** Key.



Figure 1-20 PFD Setup Menu

SECTION 2 FLIGHT INSTRUMENTS



NOTE: The Automatic Flight Control System (AFCS) provides additional readouts and bugs on selected flight instruments. Refer to the AFCS Section for details on these bugs and readouts, as they appear on the display during certain AFCS flight director modes.

The system includes an easy-to-scan Primary Flight Display (PFD) that features a large horizon, airspeed, attitude, altitude, vertical speed, and course deviation information. In addition to the flight instruments, navigation, communication, terrain, traffic, and weather information are also presented on the PFD and explained in other sections of this Pilot's Guide.

The following flight instruments and supplemental flight data are displayed on the PFD:

- Airspeed Indicator, showing
 - Indicated airspeed
 - True airspeed
 - Airspeed awareness ranges
 - Vspeed reference bugs
- Attitude Indicator with slip/skid indication
- Altimeter, showing
 - Trend vector
 - Barometric setting
 - Selected altitude
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Vertical Navigation (VNV) indications
- Outside air temperature (OAT)
- ISA temperature deviation
- Horizontal Situation Indicator, showing
 - Turn Rate Indicator
 - Bearing pointers and information windows
 - Navigation source
 - Course Deviation Indicator (CDI)
 - DME Information Window (optional)
 - HSI Map
- ADF/DME Tuning Window
- Timer/References Window, showing
 - Generic timer
 - Vspeed values
 - Barometric or temperature compensated minimum descent altitude (MDA) or decision height (DH)
- Wind data

The PFD also displays various alerts and annunciations.



- | | |
|--|----------------------------------|
| ① Airspeed Indicator | ⑩ Barometric Altimeter Setting |
| ② True Airspeed | ⑪ Vertical Speed Indicator (VSI) |
| ③ Current Heading | ⑫ Selected Altitude Bug |
| ④ Horizontal Situation Indicator (HSI) | ⑬ Altimeter |
| ⑤ ISA Temperature Deviation | ⑭ Selected Altitude |
| ⑥ Outside Air Temperature (OAT) | ⑮ Navigation Status Box |
| ⑦ Softkeys | ⑯ Slip/Skid Indicator |
| ⑧ Selected Heading Bug | ⑰ Attitude Indicator |
| ⑨ Turn Rate Indicator | |

Figure 2-1 Primary Flight Display (Default)

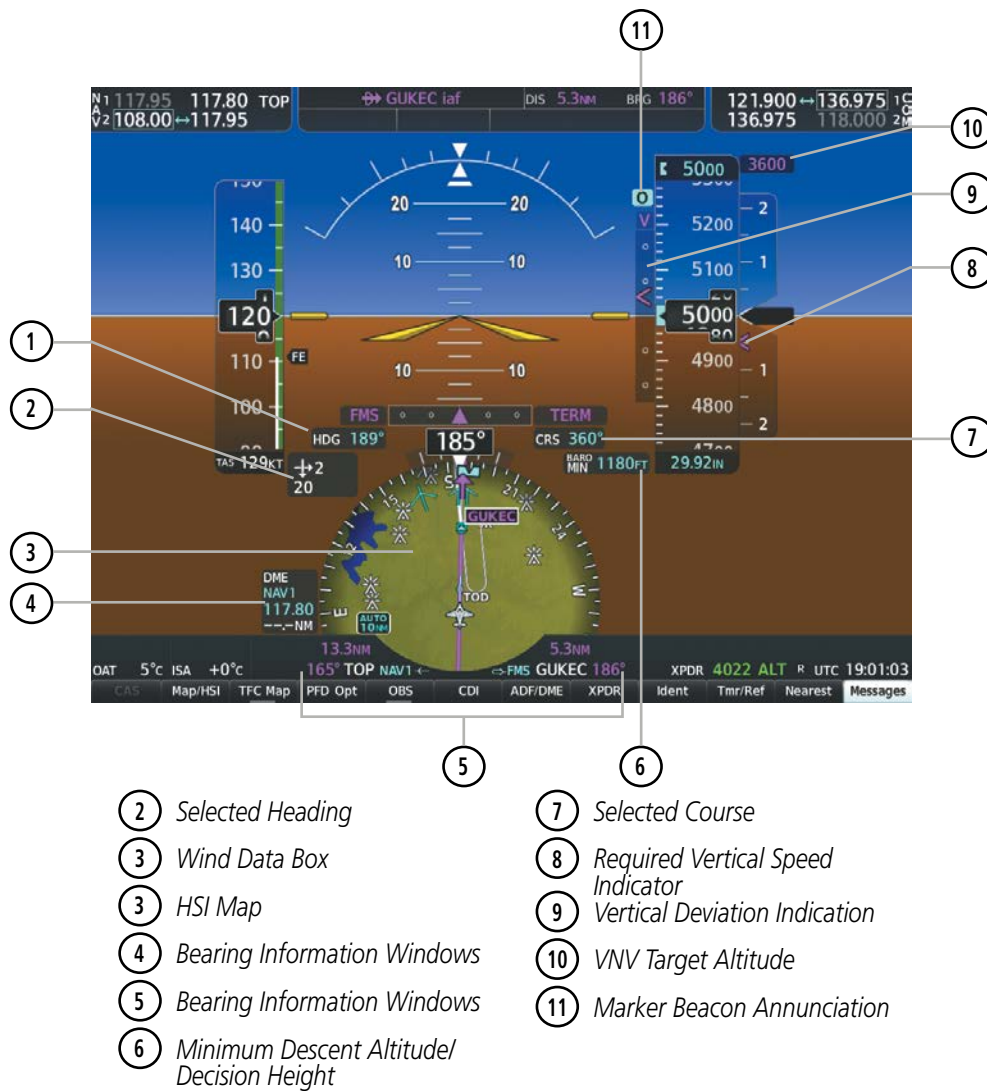


Figure 2-2 Additional PFD Information

2.1 FLIGHT INSTRUMENTS

ATTITUDE INDICATOR

Attitude information is displayed over a virtual blue sky and brown ground with a white horizon line. The Attitude Indicator displays the pitch, roll, and slip/skid information.

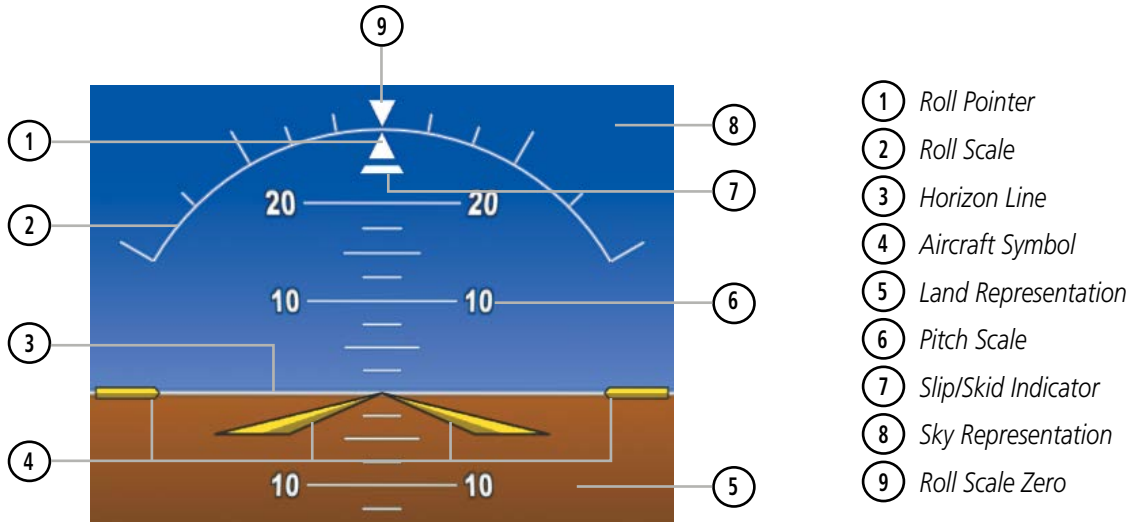


Figure 2-3 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 80°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°.

The inverted white triangle indicates zero on the roll scale. Major tick marks at 30° and 60° and minor tick marks at 10°, 20°, and 45° are shown to the left and right of the zero. Angle of bank is indicated by the position of the pointer on the roll scale. When the optional Electronic Stability and Protection System (Garmin ESP™) system is installed and enabled, additional indications also appear on the roll scale; refer to the Additional Features Section for more information about Garmin ESP.

The Slip/Skid Indicator is the bar beneath the roll pointer. The indicator bar moves with the roll pointer and moves laterally away from the pointer to indicate uncoordinated flight. Slip (inside the turn) or skid (outside the turn) is indicated by the location of the bar relative to the pointer.



Figure 2-4 Slip/Skid Indication

The amber symbolic aircraft on the Attitude Indicator changes appearance based on selection of AFCS Flight Director Command Bar format (see the AFCS Section for details). The Command Bar format (single-cue or cross-pointer) may be selected from the 'Aux - System Setup 1' Page.

Changing Command Bar format:

- 1) Turn the **FMS** Knobs to select the 'Aux' page group on the MFD.
- 2) Turn the small **FMS** Knob to select the System Setup Page.
- 3) If necessary, press the **Setup 1** Softkey to display the 'Aux - System Setup 1' Page.
- 4) Press the **FMS** Knob to activate the cursor.
- 5) Turn the large **FMS** Knob to highlight 'Format Active' in the 'Flight Director' box.
- 6) Turn the small **FMS** Knob to highlight the desired format.

'Single Cue' to display the aircraft symbol and Command Bars as a single cue.

Or:

'X Pointer' to display the aircraft symbol and Command Bars as a cross-pointer.

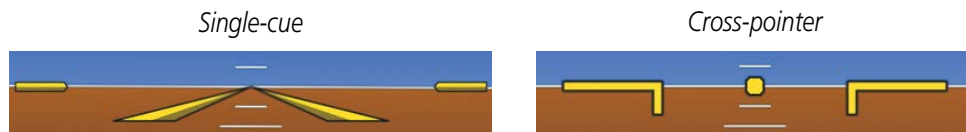


Figure 2-5 Flight Director Format

AIRSPEED INDICATOR



NOTE: Refer to the Airplane Flight Manual (AFM) for airspeed criteria and Vspeed values.

The Airspeed Indicator displays airspeed on a moving tape rolling number gauge. The true airspeed is displayed in knots below the Airspeed Indicator. The numeric labels and major tick marks on the moving tape are shown at intervals of 10 knots. The minor tick marks on the moving tape are shown at intervals of 5 knots. Speed indication starts at 20 knots, with 60 knots of airspeed viewable at any time. The indicated airspeed is displayed inside the black pointer. The pointer remains black until reaching never exceed speed (V_{NE}), then it becomes red.

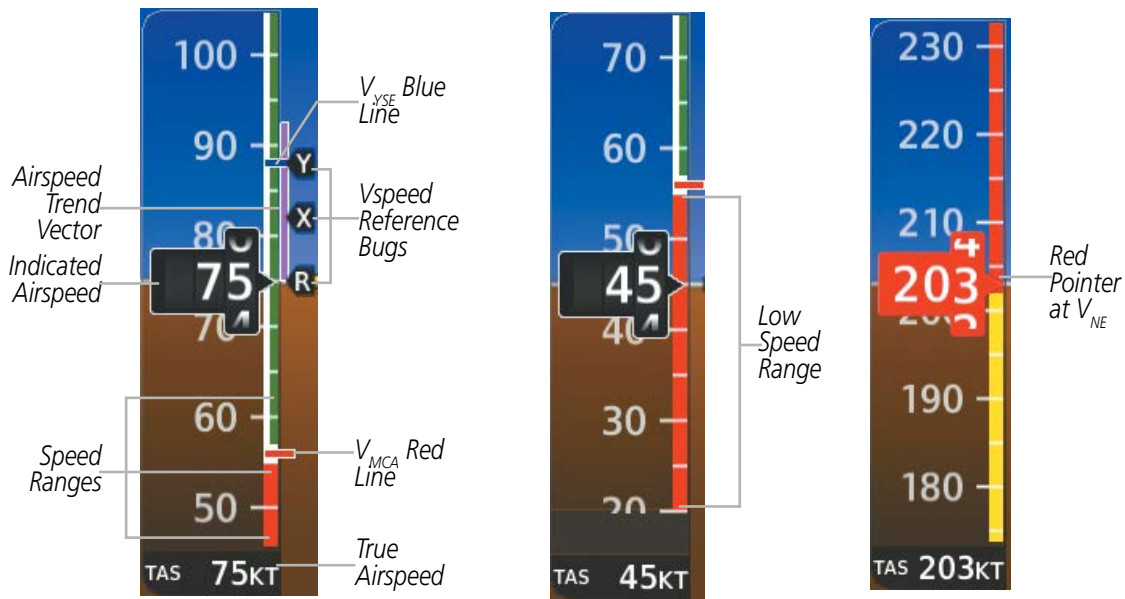


Figure 2-6 Airspeed Indicator Ranges

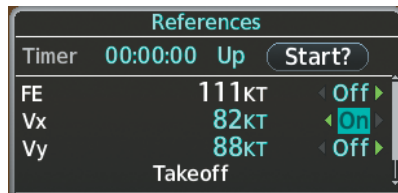
A color-coded (red, white, green, amber) speed range strip is located on the moving tape. The colors denote flaps operating range, normal operating range, caution range, and never-exceed speed (V_{NE}). A red range is also present for low speed awareness.

The Airspeed Trend Vector is a vertical magenta line that appears to the right of the color-coded speed range strip when airspeed is either accelerating or decelerating. One end of the magenta line is anchored to the tip of the airspeed pointer while the other end moves continuously up or down corresponding to the rate of acceleration or deceleration. For any constant rate of acceleration or deceleration, the moving end of the line shows approximately what the indicated airspeed value will be in six seconds. If the trend vector crosses V_{NE} , the number in the indicated airspeed pointer changes to amber. The trend vector is absent if the speed remains constant or if any data needed to calculate airspeed is not available due to a system failure.

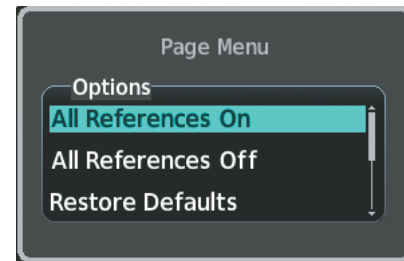
The pilot can enable/disable the display of Vspeed Reference Bugs for V_R , V_X , V_Y , and V_{FE} . When enabled, the Vspeed Reference Bugs appear in their respective positions to the right of the airspeed scale. When the indicated airspeed is below 20 knots, enabled Vspeeds Reference Bugs and their numeric values appear in a list at the bottom of the airspeed tape, ordered from highest to lowest. The pilot cannot change the values of the Vspeed Reference Bugs.

Enabling/disabling individual Vspeed Reference Bugs:

- 1) Press the **Tmr/Ref** Softkey.
- 2) Turn the large **FMS** Knob to highlight the On/Off field for the desired bug.
- 3) Turn the small **FMS** Knob clockwise to On or counterclockwise to Off.
- 4) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.



References Window



References Window Menu

Figure 2-7 References Window and Menu

The pilot can also enable/disable all Vspeed Reference Bugs as a group.

Enabling/disabling Vspeed Reference Bugs as a group:

- 1) Press the **Tmr/Ref** Softkey.
- 2) Press the **MENU** Key.
- 3) Turn the **FMS** Knob to scroll as needed to highlight the desired selection.
- 4) Press the **ENT** Key.
- 5) To remove the References Window, press the **CLR** Key or the **Tmr/Ref** Softkey.

ALTIMETER

The Altimeter displays 600 feet of barometric altitude values at a time on a moving tape rolling number gauge. Numeric labels and major tick marks are shown at intervals of 100 feet. Minor tick marks are at intervals of 20 feet. The indicated altitude is displayed inside the black pointer.

The Selected Altitude is displayed above the Altimeter in the box indicated by a selection bug symbol. A bug corresponding to this altitude is shown on the tape. If the Selected Altitude exceeds the range shown on the tape, the bug appears at the upper or lower edge of the tape. When the metric value is selected it is displayed in a separate box above the Selected Altitude.

A magenta Altitude Trend Vector extends up or down the left of the altitude tape, the end resting at the approximate altitude to be reached in six seconds at the current vertical speed. The trend vector is not shown if altitude remains constant or if data needed for calculation is not available due to a system failure.

Setting the Selected Altitude:

Turn the **ALT** Knob to set the Selected Altitude. Turn the large knob for 1000-ft increments, small knob for 100-ft increments. If set to Metric mode, the large knob adjusts the Selected Altitude in 500-meter increments; the small knob adjusts the Selected Altitude in 50-meter increments.

If a Minimum Descent Altitude/Decision Height (MDA/DH) value has been set, this altitude is also available for the Selected Altitude.

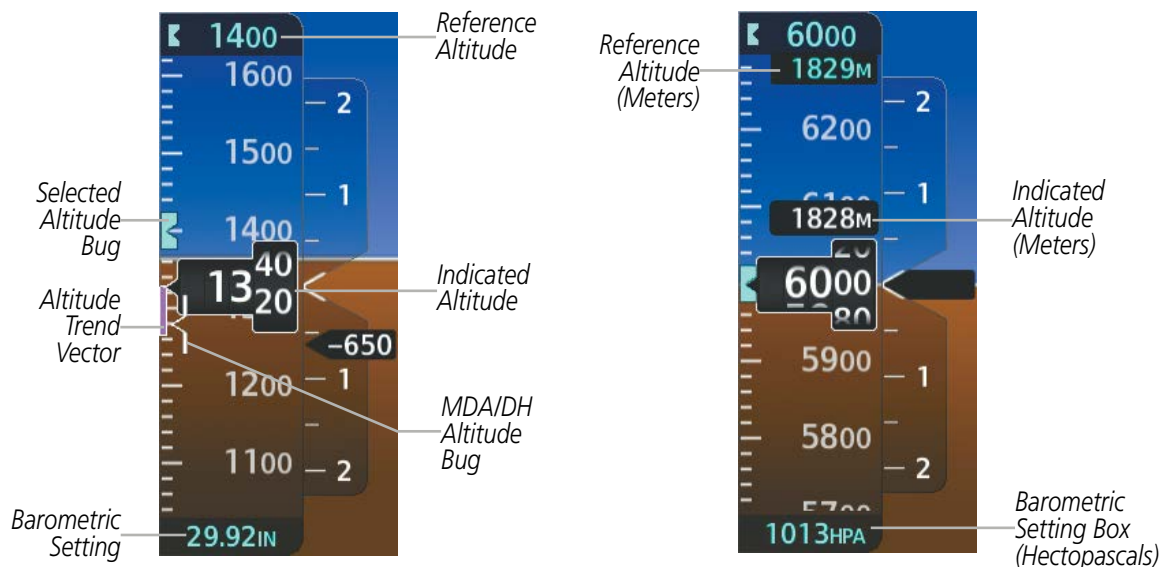


Figure 2-8 Altimeter

Altitudes can also be displayed in meters as an overlay (Figure 2-8). Note that the altitude tape does not change scale.

Displaying altitude in meters:

- 1) Press the **PFD Opt** Softkey to display the second-level softkeys.
- 2) Press the **ALT Units** Softkey.
- 3) Press the **Meters** Softkey to turn on metric altitude readouts.
- 4) Press the **Back** Softkey twice to return to the top-level softkeys.

The barometric pressure setting is displayed below the Altimeter in inches of mercury (in Hg) or hectopascals (hPa) when metric units are selected. Adjusting the altimeter barometric pressure setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent patch. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.



WARNING: Do not use a QFE altimeter setting with this system. System functions will not operate properly with a QFE altimeter setting. Use only a QHN altimeter setting for the height above mean sea level, or the standard pressure setting, as applicable.

Selecting the altimeter barometric pressure setting:

Turn the **BARO** Knob to select the desired setting.

Selecting standard barometric pressure (29.92 in Hg):

- 1) Press the **PFD Opt** Softkey to display the second-level softkeys.
- 2) Press the **STD Baro** Softkey.
- 3) Press the **Back** Softkey to return to the top-level softkeys.

STD BARO

Figure 2-9 Standard Barometric Setting

Changing altimeter barometric pressure setting units:

- 1) Press the **PFD Opt** Softkey to display the second-level softkeys.
- 2) Press the **ALT Units** Softkey.
- 3) Press the **IN** Softkey to display the barometric pressure setting in inches of mercury (in Hg).
Or, press the **HPA** Softkey to display the barometric pressure setting in hectopascals (hPa).
- 4) Press the **Back** Softkey twice to return to the top-level softkeys.

The Baro Transition Alerts flash the barometric pressure setting to remind the pilot to change the barometric pressure setting to or from standard. Two alerts are available. The altitude Baro Transition Alert occurs when climbing through the transition altitude beginning at 200 feet below this altitude. The flight level Baro Transition Alert occurs when descending through the transition flight level beginning at 200 feet above this flight level. The barometric pressure setting stops flashing after the pilot changes the barometric pressure setting. The pilot can enable/disable either Baro Transition Alert, and choose the altitude or flight level used to trigger the alerts.

Setting the Baro Transition Alert:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) To enable/disable the Baro Transition Alert based on altitude, turn the large **FMS** Knob to highlight the 'On' or 'Off' field for the BARO Transition Alert Altitude in the BARO Transition Alert Box.
- 4) If desired, turn the small **FMS** Knob to set the BARO Transition Alert Altitude On or Off.
- 5) Turn the large **FMS** Knob to highlight the Altitude field.
- 6) Use the **FMS** Knobs to change the altitude and press the **ENT** Key to accept or press the **CLR** Key to return to the previous altitude selection.
- 7) Turn the large **FMS** Knob to highlight the 'On' or 'Off' field for the BARO Transition Alert Level.
- 8) If desired, turn the small **FMS** Knob to set the BARO Transition Alert Flight Level On or Off.
- 9) Turn the large **FMS** Knob to highlight the Flight Level field.
- 10) Use the **FMS** Knobs to change the Flight Level for the alert and press the **ENT** Key to accept or press the **CLR** Key to return to the previous altitude selection.
- 11) Push the **FMS** Knob to deactivate the cursor.

VERTICAL SPEED INDICATOR (VSI)

NOTE: The Glidepath Indicator is only available on GPS approaches supporting SBAS vertical guidance when SBAS is available.

The Vertical Speed Indicator (VSI; Figure 2-10) displays the aircraft vertical speed on a fixed scale with labels at 1000 and 2000 fpm and minor tick marks every 500 fpm. Digits appear in the pointer when the climb or descent rate is greater than 100 fpm. If the rate of ascent/descent exceeds 2000 fpm, the pointer appears at the edge of the tape and the rate appears inside the pointer.

A magenta chevron is displayed on the VSI to indicate the Required Vertical Speed for reaching a VNV target altitude once the “TOD [Top of Descent] within 1 minute” alert has generated.

VERTICAL DEVIATION

When Vertical Navigation (VNV) is being used (Figure 2-10), the Vertical Deviation Indicator (VDI) appears to the left of the altimeter and is displayed with a magenta ‘V’ at the top of the scale and a magenta chevron indicating the baro-VNAV vertical deviation. The VDI appears in conjunction with the “TOD within 1 minute” alert. The VDI is removed from the display if vertical deviation becomes invalid. See the Flight Management Section for details on VNV features, and refer to Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

The Glideslope Indicator (Figure 2-11) appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV field and the selected course and heading are within 107°. A green diamond acts as the Glideslope Indicator, like a glideslope needle on a conventional indicator. If a localizer frequency is tuned and there is no glideslope, “NO GS” is displayed in place of the diamond.

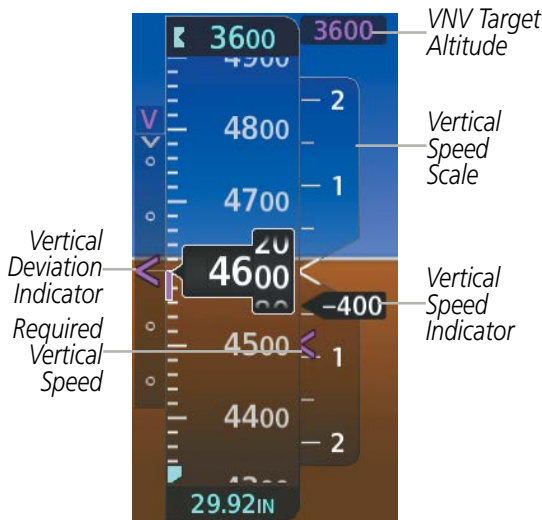


Figure 2-10 Vertical Speed and Deviation Indicator (VSI and VDI)

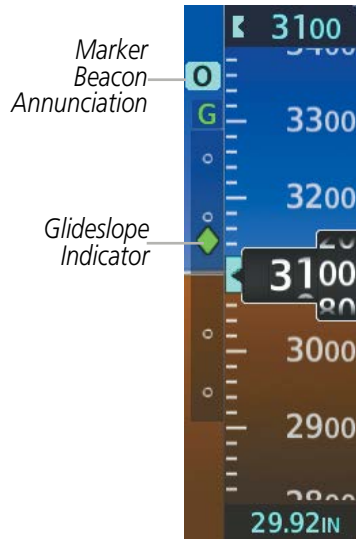


Figure 2-11 Glideslope Indicator

The Glidepath Indicator is a vertical deviation scale for RNAV GPS approaches supporting SBAS vertical guidance (LNAV+V, L/VNAV, LNAV+V, LPV, LP+V). The Glidepath Indicator, a magenta diamond (Figure 2-13) appears on the display as soon as the Final Approach Fix (FAF) becomes the active waypoint, and FMS is the selected navigation source. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is +/-492 feet (150 meters) and lower limits depend on approach service level.

- LNAV/VNAV, LNAV+V, LP+V is +/- 148 feet (45 meters).
- LPV is +/- 49 feet (15 meters).

If the approach downgrades past the final approach fix (FAF), “NO GP” is displayed in place of the diamond.



NOTE: The Glidepath Indicator appears on the display as soon as the Final Approach Fix (FAF) becomes the active waypoint. Depending on procedure design, pilot action, and/or ATC clearance, the aircraft may be centered on or above the glidepath when the Glidepath Indicator appears.

While executing an SBAS approach with an LNAV/VNAV approach service level, and between the FAF and MAP, the Vertical Deviation Limit Indicators appear as vertical white lines (Figure 2-14) indicating the area where deviation exceeds allowable limits for the glidepath. The Vertical Deviation Limit Indicator provides a scaled representation of +/- 75 feet of the calculated glidepath. The “window” between the lines represents the area of acceptable deviation. The length of the lines change while progressing through the final approach. When the Glidepath Indicator enters an excessive deviation area, the Glidepath and Vertical Deviation Limit Indicators become amber.

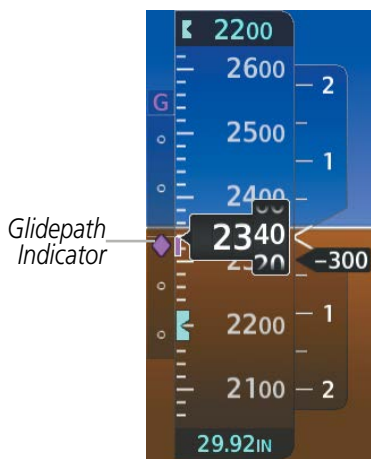


Figure 2-12 Glidepath Indicator

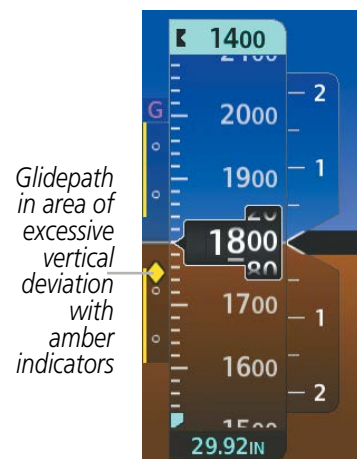
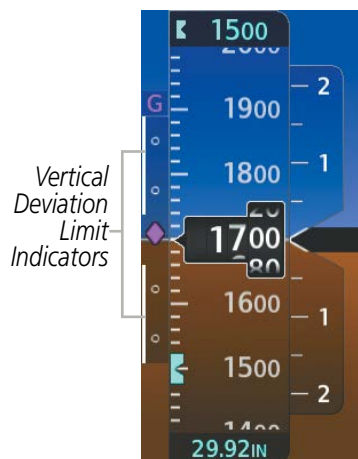


Figure 2-13 Glidepath Indicator and Vertical Deviation Limit Indicators

VERTICAL NAVIGATION (VNV) INDICATIONS

When a VNV flight plan has been activated, VNV indications (VNV Target Altitude, RVSI, VDI) appear on the PFD in conjunction with the “TOD within 1 minute” message and “Vertical track” voice alert. See the Flight Management and AFCS sections for details on VNV features. VNV indications are removed from the PFD according to the criteria listed in the table.



Figure 2-14 Vertical Navigation Indications (PFD)

Criteria	VNV Indication Removed		
	Required Vertical Speed (RVSI)	Vertical Deviation (VDI)	VNV Target Altitude*
Aircraft > 1 min before the next TOD due to flight plan change	X	X	X
VNV cancelled (CNCL VNV Softkey pressed on MFD)	X	X	X
Distance to active waypoint cannot be computed due to unsupported flight plan leg type (see Flight Management Section)	X	X	X
Aircraft > 250 feet below active VNV Target Altitude	X	X	X
Current crosstrack or track angle error has exceeded limit	X	X	X
Active altitude-constrained waypoint can not be reached within maximum allowed flight path angle and vertical speed	X	X	

Table 2-1 VNV Indication Removal Criteria

HORIZONTAL SITUATION INDICATOR (HSI)

The Horizontal Situation Indicator (HSI) displays a rotating compass card in a heading-up orientation. Letters indicate the cardinal points with numeric labels every 30°. Major tick marks are at 10° intervals and minor tick marks are at 5° intervals. A digital reading of the current heading appears on top of the HSI. The HSI also presents turn rate, course deviation, bearing, and selected navigation source information. The HSI is available in two formats: a 360° compass rose and a 210° HSI Map. The HSI Map is mutually exclusive with the Inset Maps.

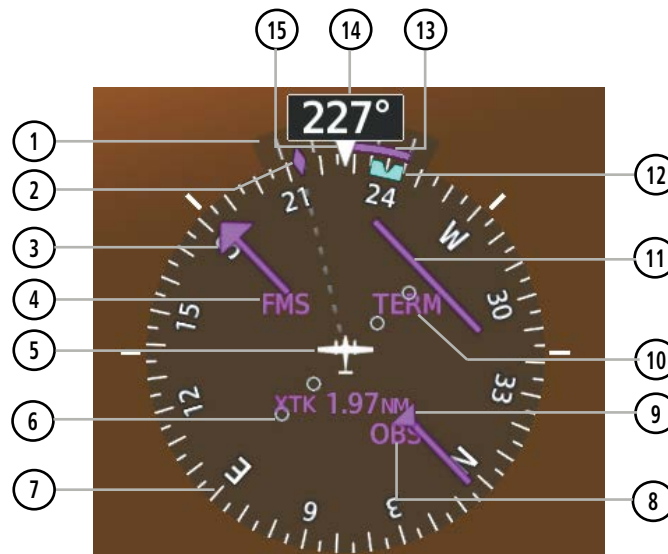
Enabling/disabling the HSI Map on the PFD:

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **Layout** Softkey.
- 3) Press the **HSI Map** Softkey to enable the HSI Map.

Or:

Press the **Map Off** Softkey to disable the HSI Map.

The HSI with the HSI Map disabled presents a Course Deviation Indicator (CDI) with a Course Pointer, To/From Indicator, and a sliding deviation bar and scale. The Course Pointer is a single line arrow (GPS, VOR1, and LOC) or a double line arrow (VOR2 and LOC2) which points in the direction of the set course. The To/From Indicator rotates with the Course Pointer and appears when the system is receiving the active NAVAID.



- | | |
|---------------------------|--------------------------------------|
| ① Turn Rate Indicator | ⑨ To/From Indicator |
| ② Current Track Indicator | ⑩ Flight Phase |
| ③ Course Pointer | ⑪ Course Deviation Indicator (CDI) |
| ④ Navigation Source | ⑫ Heading Bug |
| ⑤ Aircraft Symbol | ⑬ Turn Rate and Heading Trend Vector |
| ⑥ Lateral Deviation Scale | ⑭ Current Heading |
| ⑦ Rotating Compass Card | ⑮ Lubber Line |
| ⑧ OBS Mode Active | |

Figure 2-15 Horizontal Situation Indicator (360° HSI)

The HSI Map is a 210° expanded compass rose which also includes a navigation map with overlay capabilities such as topographical, weather, traffic, and land information. The HSI Map contains a Course Pointer, a combined To/From Indicator with a sliding deviation indicator, and a lateral deviation scale. Upon passing a station, the To/From Indicator points to the tail of the aircraft. Depending on the navigation source, the CDI on the HSI Map can appear either as an arrowhead (GPS, VOR, OBS) as a diamond (LOC). Refer to the Flight Management Section for information about using HSI Map overlays.

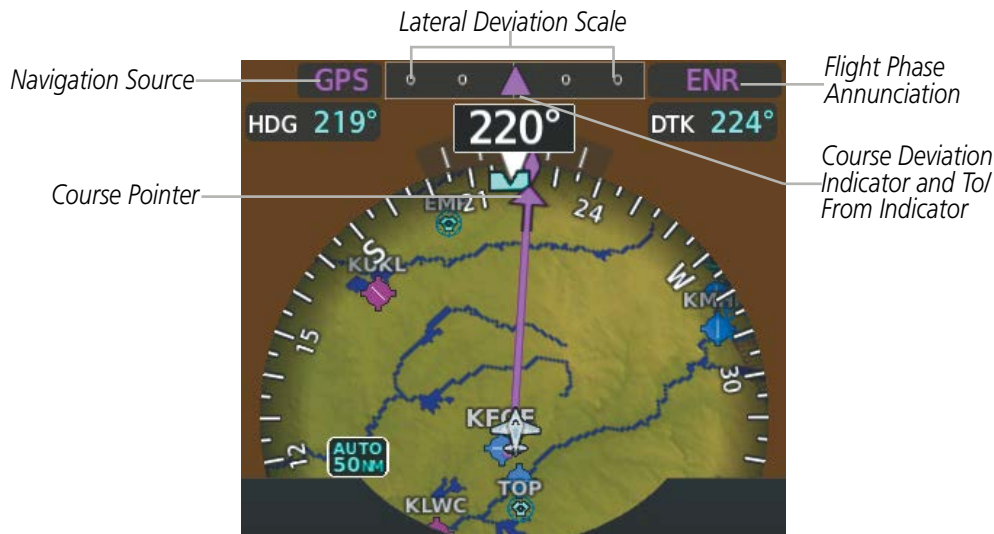


Figure 2-16 HSI Map Enabled

The following information appears above the Current Heading when the HSI Map is enabled:

- A sliding deviation indicator (the To/From and deviation indicators are combined)
- Deviation scale
- Navigation Source
- Flight Phase
- OBS Mode/Suspend Mode Status
- Dead Reckoning (DR) Mode Annunciation
- Crosstrack Error (XTK)
- Back Course Annunciation (BC)

For the HSI Map, when a localizer is the active navigation source and the difference between the selected course and current heading is greater than 107°, a 'BC' annunciation appears instead of the Flight Phase above the selected course readout to indicate backcourse sensing is active. This annunciation does not apply to the HSI when the HSI Map is disabled. In either case, when the system detects LOC BC guidance is active, the localizer guidance behaves as if a front course were selected.

Adjusting the Selected Heading:

Turn the **HDG** Knob to set the Selected Heading.

Press the **HDG** Knob to synchronize the bug to the current heading.

The Selected Course is shown to the upper right of the HSI for three seconds after being adjusted.

Adjusting the Selected Course:

Turn the **CRS** Knob to set the Selected Course.

Press the **CRS** Knob to re-center the CDI and return the course pointer to the bearing of the active waypoint or navigation station.



Figure 2-17 Heading and Course Indications

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation (Mag Var) or referenced to true north (T), set on the 'Aux - System Setup 1' Page. When an approach referenced to true north has been loaded into the flight plan, the system generates an alert to remind the pilot to change the navigation angle setting to 'True' at the appropriate time.



Figure 2-18 Heading and Course Indications (True)

Changing the navigation angle true/magnetic setting:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight 'NAV Angle' in the 'Display Units' box.
- 4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.
 - True - References angles to true north (T)
 - Magnetic - Angles corrected to the computed magnetic variation (Mag Var)

COURSE DEVIATION INDICATOR (CDI)

The Course Deviation Indicator (CDI) moves left or right from the course pointer along a lateral deviation scale to display aircraft position relative to the course. If the course deviation data is not valid, the CDI is not displayed.



Figure 2-19 Course Deviation Indicator

The CDI can display two sources of navigation, FMS or VOR/LOC. The color indicates the current navigation source, magenta for FMS and green for VOR and LOC. The full scale limits for the CDI are defined by an FMS-derived distance when coupled to the FMS. If the CDI exceeds the maximum deviation on the scale (two dots) while navigating with FMS, the crosstrack error (XTK) is displayed below the white aircraft symbol. When navigating using a VOR or localizer (LOC), the CDI uses the same angular deviation as a mechanical CDI.



Figure 2-20 Navigation Sources

Changing navigation sources:

- 1) Press the **CDI** Softkey to change from FMS to VOR1 or LOC1. This places the cyan tuning box over the NAV1 standby frequency in the upper left corner of the PFD.
- 2) Press the **CDI** Softkey again to change from VOR1 or LOC1 to VOR2 or LOC2. This places the cyan tuning box over the NAV2 standby frequency.
- 3) Press the **CDI** Softkey a third time to return to FMS.

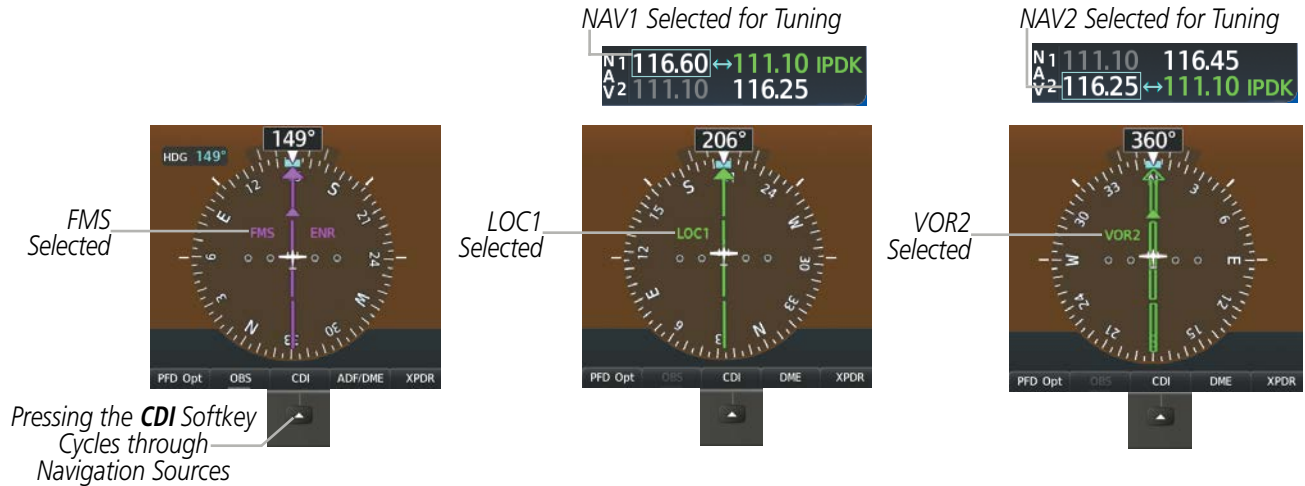


Figure 2-21 Selecting a Navigation Source

The system automatically changes from FMS to LOC navigation source and changes the CDI scaling accordingly when all of the following occur:

- A localizer or ILS approach has been loaded into the active flight plan
- The final approach fix (FAF) is the active leg, the FAF is less than 15 nm away, and the aircraft is moving toward the FAF
- A valid localizer frequency has been tuned
- The FMS CDI deviation is less than 1.2 times full-scale deflection

FMS steering guidance is still provided after the CDI automatically changes to LOC until LOC capture, up to the Final Approach Fix (FAF) for an ILS approach, or until FMS information becomes invalid. Activating a Vector-to-Final (VTF) also causes the CDI to switch to LOC navigation source. FMS steering guidance is not provided after the change.

On some ILS approaches where the glideslope intercept point is at or in close proximity to the fix prior to the FAF (see Figure 2-22), it is possible to be above the glideslope when the navigation source automatically changes from FMS to LOC. The probability of this occurring varies based on air temperature.

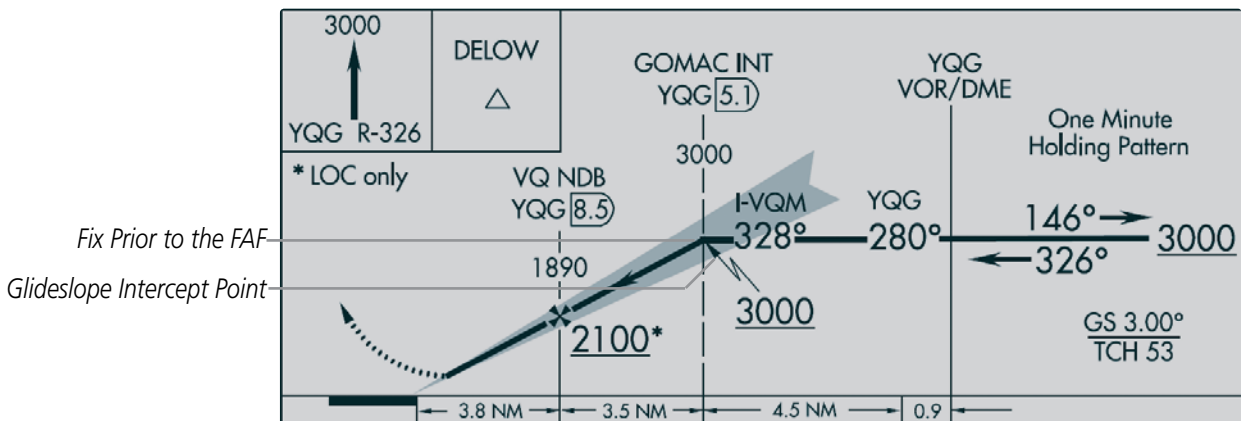


Figure 2-22 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

GPS CDI SCALING (FMS NAVIGATION SOURCE)

When FMS is the selected navigation source, the flight plan legs are sequenced automatically and annunciations appear on the HSI for the flight phase. Flight phase annunciations are normally shown in magenta, but when cautionary conditions exist the color changes to amber. If the current leg in the flight plan is a heading leg, HDG LEG is annunciated in magenta beneath the aircraft symbol.

The current GPS CDI scale setting is displayed as System CDI on the 'Aux - System Setup 1' Page and the full-scale deflection setting may also be selected (2.0 nm, 1.0 nm, 0.3 nm, or Auto) from this page. If the selected scaling is smaller than the automatic setting for enroute and terminal phases, the CDI is scaled accordingly and the selected setting is displayed rather than the flight phase annunciation.

Changing the selected FMS CDI setting:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Format Allowed' selection in the 'GPS CDI' box.
- 4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.
- 5) To cancel the selection, press the **FMS** Knob or the **CLR** Key.

When set to 'Auto' (default), the GPS CDI scale automatically adjusts to the desired limits based upon the current phase of flight (Figure 2-23, Table 2-2).

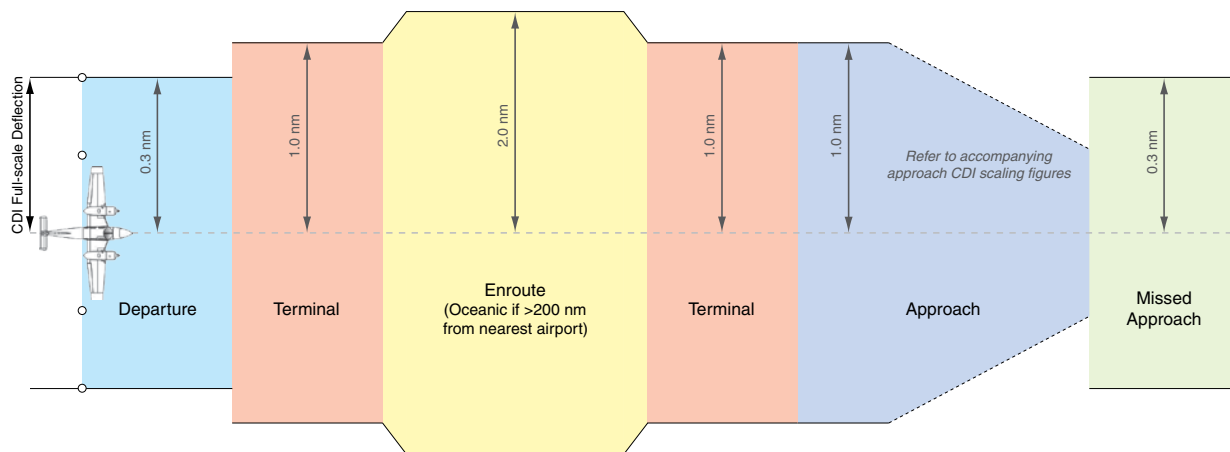


Figure 2-23 Automatic CDI Scaling

- Once a departure procedure is activated, the CDI is scaled for **departure** (0.3 nm).
- The system switches from departure to **terminal** CDI scaling (1.0 nm) under the following conditions:
 - The next leg in the departure procedure is not aligned with the departure runway
 - The next leg in the departure procedure is not a CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see Glossary for leg type definitions)
 - After any leg in the departure procedure that is not a CA or FA
- At 30 nm from the departure airport, the **enroute** phase of flight is automatically entered and CDI scaling changes to 2.0 nm over a distance of 1.0 nm, except under the following conditions:

- When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.
- If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for **oceanic** flight (2.0 nm).
- Within 31 nm of the destination airport (**terminal** area), the CDI scale gradually ramps down from 2.0 nm to 1.0 nm over a distance of 1.0 nm, except under the following conditions:
 - Upon reaching the first waypoint of an arrival route that is more than 31 nm from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 nm to 1.0 nm over a distance of 1.0 nm.
- During **approach**, the CDI scale ramps down even further (Figures 2-26 and 2-27). This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vectors-To-Final (VTF) are selected.
 - If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.
 - If the active waypoint is part of the missed approach procedure, the active leg and the preceding missed approach legs must be aligned with the final approach segment course and the aircraft must not have passed the turn initiation point.

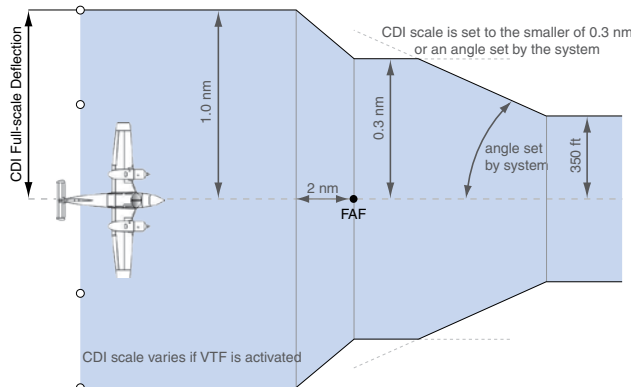


Figure 2-24 Typical LNAV and LNAV+V Approach CDI Scaling

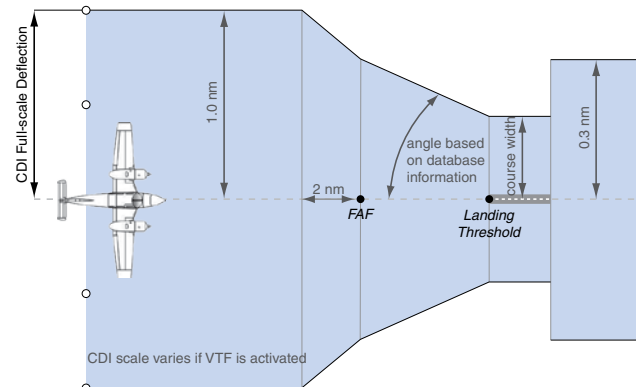


Figure 2-25 Typical LNAV/VNAV, LPV and LP Approach CDI Scaling

- When a **missed approach** is activated, the CDI scale changes to 0.3 nm.
- The system automatically switches back to **terminal** mode under the following conditions:
 - The next leg in the missed approach procedure is not aligned with the final approach path
 - The next leg in the missed approach procedure is not a CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF
 - After any leg in the missed approach procedure that is not a CA or FA

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Flight Phase	Annunciation*	Automatic CDI Full-scale Deflection
Departure	DPRT	0.3 nm
Terminal	TERM	1.0 nm
Enroute	ENR	2.0 nm
Oceanic	OCN	4.0 nm
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables (Figure 2-24)
Approach (Non-precision with Advisory Vertical Guidance)	LNAV + V	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (Figure 2-25)
Approach (LPV)	LPV	
Approach (Non-precision with Advisory Vertical Guidance)	LP+V	
Approach (LP)	LP	
Missed Approach	MAPR	0.3 nm

* Flight phase annunciations are normally shown in magenta, but when cautionary conditions exist the color changes to amber.

Table 2-2 Automatic GPS CDI Scaling

OBS MODE



NOTE: VNV is inhibited while automatic waypoint sequencing has been suspended.

Enabling Omni-bearing Selector (OBS) Mode suspends the automatic sequencing of waypoints in a GPS flight plan (GPS must be the selected navigation source), but retains the current Active-to waypoint as the navigation reference even after passing the waypoint. OBS is annunciated to the lower right of the aircraft symbol when OBS Mode is selected.

While OBS is enabled, a course line is drawn through the Active-to waypoint on the moving map. If desired, the course to/from the waypoint can now be adjusted. When OBS Mode is disabled, the FMS flight plan returns to normal operation, with automatic sequencing of waypoints, following the course set in OBS Mode. The flight plan on the moving map retains the modified course line.

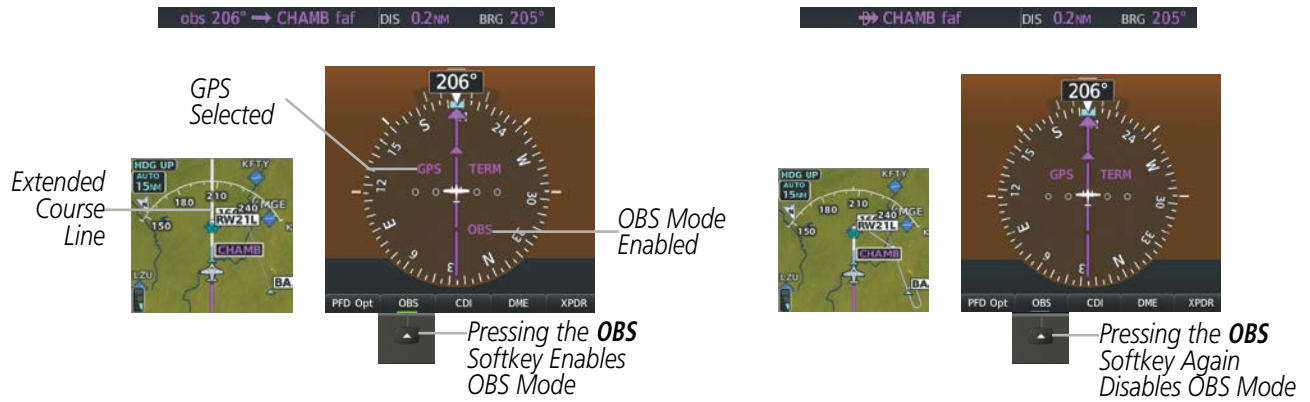


Figure 2-26 Omni-bearing Selector (OBS) Mode

Enabling/disabling OBS Mode while navigating a GPS flight plan:

- 1) Press the **OBS** Softkey to select OBS Mode.
- 2) Turn the **CRS** Knob to select the desired course to/from the waypoint. Press the **CRS** Knob to synchronize the Selected Course with the bearing to the next waypoint.
- 3) Press the **OBS** Softkey again to return to automatic waypoint sequencing.

As the aircraft crosses the missed approach point (MAP), automatic approach waypoint sequencing is suspended. **SUSP** appears on the HSI at the lower right of the aircraft symbol. The **OBS** Softkey label changes to indicate the suspension is active as shown in Figure 2-27. Pressing the **SUSP** Softkey, deactivates the suspension and resumes automatic sequencing of approach waypoints.

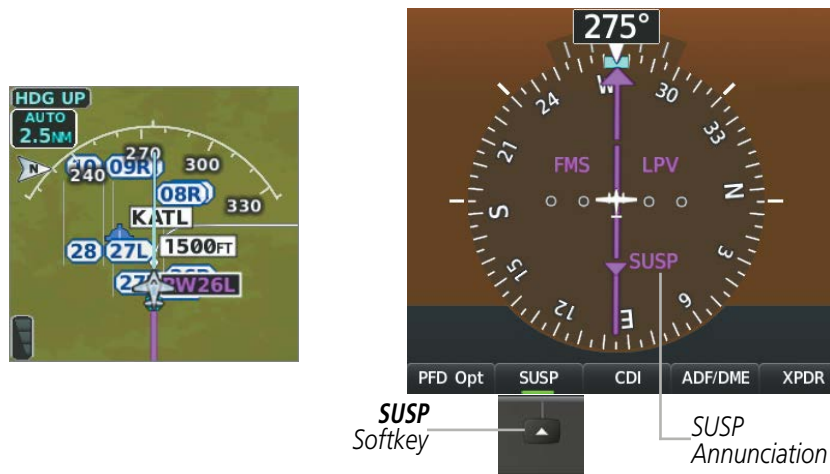


Figure 2-27 Suspending Automatic Waypoint Sequencing

TURN RATE INDICATOR

The Turn Rate Indicator is located directly above the rotating compass card. Tick marks to the left and right of the lubber line denote half-standard and standard turn rates. A magenta Turn Rate Trend Vector shows the current turn rate. The end of the trend vector gives the heading predicted in 6 seconds, based on the present turn rate. A standard-rate turn is shown on the indicator by the trend vector stopping at the standard turn rate tick mark, corresponding to a predicted heading of 18° from the current heading. At rates greater than 4 deg/sec, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.



Figure 2-28 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

Two bearing pointers and associated information can be displayed on the HSI for NAV and FMS sources by pressing the **PFD Opt** Softkey then either the **Bearing 1** or **Bearing 2** Softkey. The bearing pointers are cyan and are single-line (BRG1) or double-line (BRG2). A pointer symbol is shown in the information window to indicate the navigation source. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring. Bearing pointers may be selected but not necessarily visible due to data unavailability.

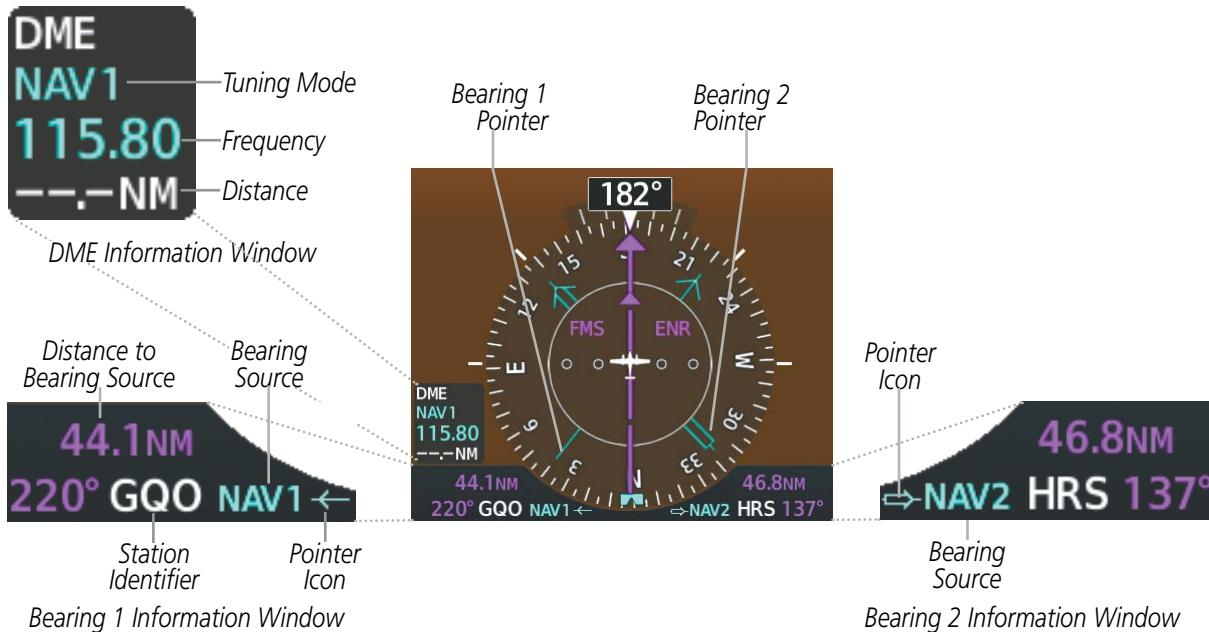


Figure 2-29 HSI with Bearing and DME Information

When a bearing pointer is displayed, the associated information window is also displayed. The Bearing Information windows (Figure 2-29) are displayed at the lower sides of the HSI and give the following information:

- Bearing source (NAV, FMS, ADF)
- Pointer icon (BRG1 = single line, BRG2 = double line)
- Station/waypoint identifier (NAV, FMS)
- GPS-derived great circle distance to bearing source
- Frequency (NAV)

When the NAV radio is tuned to an ILS frequency the bearing source and the bearing pointer is removed from the HSI. When NAV1 or NAV2 is the selected bearing source, the frequency is replaced by the station identifier when the station is within range. If FMS is the bearing source, the active waypoint identifier is displayed instead of a frequency.

The bearing pointer is removed from the HSI and dashes are displayed in the information window if the NAV radio is not receiving a VOR station or if FMS is the bearing source and an active waypoint is not selected.

Selecting bearing display and changing sources:

- 1) Press the **PFD Opt** Softkey.
- 2) Press either **Bearing 1** or **Bearing 2** Softkey to display the desired bearing pointer and information window with a NAV source.
- 3) Press either **Bearing 1** or **Bearing 2** Softkey again to change the bearing source to GPS.
- 4) Press either **Bearing 1** or **Bearing 2** Softkey a third time to change the bearing source to ADF (note: ADF radio installation is optional).
- 5) To remove the bearing pointer and information window, press either **Bearing 1** or **Bearing 2** Softkey again.

DME INFORMATION WINDOW



NOTE: DME radio installation is optional.

The DME Information Window is displayed above the BRG1 Information Window and shows the DME label, tuning mode (NAV1, NAV2, or HOLD), frequency, and distance. When a signal is invalid, the distance is replaced by “-. – NM”. Refer to the Audio Panel and CNS Section for information on tuning the radios.

Displaying the DME Information Window:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **DME** Softkey to display the DME Information Window above the BRG1 Information Window.
- 3) To remove the DME Information Window, press the **DME** Softkey again.

2.2 SUPPLEMENTAL FLIGHT DATA

In addition to the flight instruments, the PFD also displays various supplemental information, including a generic timer, temperatures, wind data, and Vertical Navigation (VNV) indications.

GENERIC TIMER

The generic timer can be accessed via softkeys on the PFD and allows for quick access for timing functions (either counting up or down) for the pilot.

- 1) Press the **Tmr/Ref** Softkey.
- 2) Turn the large **FMS** Knob to select the timer field (HH:MM:SS).
- 3) Use the **FMS** Knob to enter the desired time.
- 4) Press the **ENT** Key. The Up/Dn field is now highlighted.
- 5) Turn the small **FMS** Knob to display the Up/Dn Window.
- 6) Turn the small **FMS** Knob to select 'Up' or 'Dn'.
- 7) Press the **ENT** Key. 'Start?' is now highlighted.
- 8) Press the **ENT** Key to start the timer. The field changes to 'Stop?'. If the timer is counting down, it will start counting up after reaching zero.
- 9) To stop the timer, press the **ENT** Key with 'Stop?' highlighted. The field changes to 'Reset?'
- 10) To reset the timer, press the **ENT** Key with 'Reset?' highlighted. The field changes back to 'Start?' and the digits are reset.
- 11) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.

TEMPERATURE DISPLAYS

The Outside Air Temperature (OAT) and deviation from International Standard Atmosphere (ISA) temperature are displayed in the lower left corner of the PFD. Both temperatures are displayed in degrees Celsius (°C) or Fahrenheit (°F), depending on the selected temperature units on the 'Aux - System Setup 1' Page.

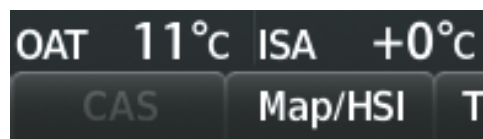


Figure 2-30 Air Temperatures

WIND DATA

Wind direction and speed in knots can be displayed relative to the aircraft in a window to the upper left of the HSI. When the window is selected for display, but wind information is invalid or unavailable, the window displays NO WIND DATA. Wind data can be displayed in three different ways.

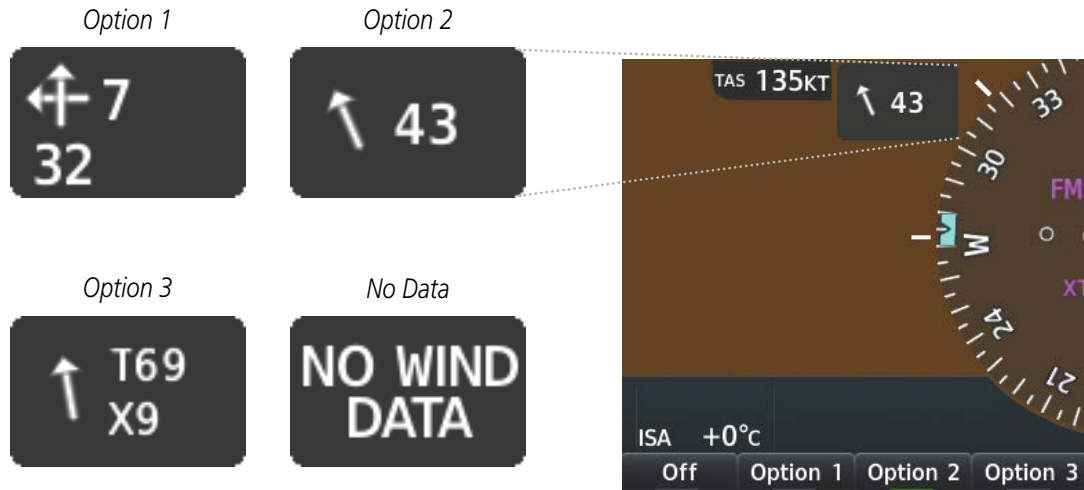


Figure 2-31 Wind Data

Displaying wind data:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **Wind** Softkey to display wind data to the left of the HSI.
- 3) Press one of the numbered **Option** softkeys to change how wind data is displayed:
 - **Option 1:** Headwind/tailwind and crosswind arrows with numeric speed components
 - **Option 2:** Wind direction arrow and speed
 - **Option 3:** Wind direction arrow with headwind (H)/tailwind (T) and crosswind (X) components
- 4) To remove the window, press the **Off** Softkey.

2.3 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

The following annunciations and alerting functions pertaining to flight instruments are displayed on the PFD. Refer to Appendix A for more information on alerts and annunciations.

ALTITUDE ALERTING

Altitude Alerting provides the pilot with a visual alert when approaching the Selected Altitude. Whenever the Selected Altitude is changed, the Altitude Alerter is reset. The following occur when approaching the Selected Altitude:

- Upon passing through 1000 feet of the Selected Altitude, the Selected Altitude changes to black text on a cyan background and flashes for five seconds.
- When the aircraft passes within 200 feet of the Selected Altitude an aural tone is heard. The Selected Altitude changes to cyan text on a black background and flashes for five seconds.
- After reaching the Selected Altitude, if the pilot flies outside the deviation band (± 200 feet of the Selected Altitude) an aural tone is heard. The Selected Altitude changes to amber text on a black background and flashes for five seconds.



Figure 2-32 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION



NOTE: A Low Altitude Annunciation is available only when SBAS is available. This annunciation is only available when TAWS-B alerting has been inhibited.

When the Final Approach Fix (FAF) is the active waypoint in a GPS SBAS approach using vertical guidance, a Low Altitude Annunciation may appear if the current aircraft altitude is at least 164 feet below the prescribed altitude at the FAF. A black-on-amber LOW ALT annunciation appears to the top left of the Altimeter, flashes for several seconds, then remains displayed until the condition is resolved.



Figure 2-33 Low Altitude on GPS SBAS Approach

MARKER BEACON ANNUNCIATIONS

Marker Beacon Annunciations are displayed on the PFD to the left of the Selected Altitude. Outer marker reception is indicated in blue, middle in amber, and inner in white. Refer to the Audio Panel and CNS Section for more information on Marker Beacon Annunciations.

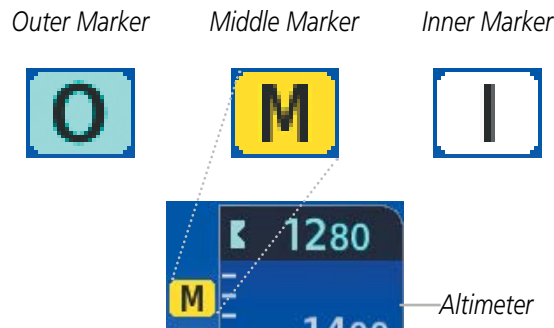


Figure 2-34 Marker Beacon Annunciations

MINIMUM DESCENT ALTITUDE/DECISION HEIGHT ALERTING

For altitude awareness, a barometric Minimum Descent Altitude (MDA) or Decision Height (DH) can be set in the References Window and is reset if the current approach is deleted, another approach is loaded, or the system power is operated off then on. When active, the altitude setting is displayed to the bottom left of the Altimeter. Once the altitude is within the range of the tape, a bug appears at the reference altitude on the Altimeter. The following visual annunciations occur when approaching the MDA/DH:

- When the aircraft altitude descends to within 2500 feet of the MDA/DH setting, the BARO MIN or COMP MIN box appears with the altitude in cyan text. The bug appears on the altitude tape in cyan (or magenta for COMP MIN) once in range.

- When the aircraft passes through 100 feet of the MDA/DH, the bug and text turn white.
- Once the aircraft reaches MDA/DH, the bug and text become amber and a “Minimums. Minimums” voice alert occurs.



Figure 2-35 Barometric MDA/DH Alerting Visual Annunciations

Alerting is inhibited while the aircraft is on the ground and until the aircraft reaches 150 feet above the MDA. If the aircraft proceeds to climb after having reached the MDA, once it reaches 50 feet above the MDA, alerting is disabled. The function is reset when the power is cycled or a new approach is activated.

Setting the Minimum Descent Altitude/Decision Height and bug:

- 1) Press the **Tmr/Ref** Softkey.
- 2) Turn the large **FMS** Knob to highlight the Minimums field.
- 3) Turn the small **FMS** Knob to select BARO or TEMP COMP. OFF is selected by default. Press the **ENT** Key or turn the large **FMS** Knob to highlight the next field.
- 4) Use the small **FMS** Knob to enter the desired altitude.
- 5) If TEMP COMP was selected, press the **ENT** Key or turn the large **FMS** Knob to highlight the next field and then enter the temperature (-59°C to 59°C)
- 6) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.

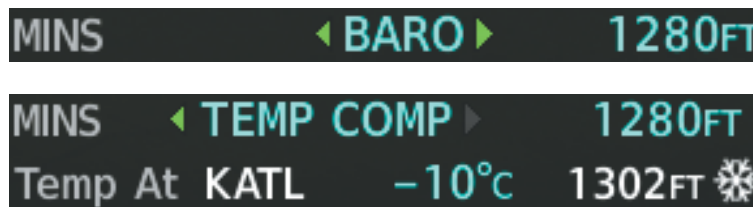


Figure 2-36 BARO and TEMP COMP MDA/DH

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2.4 GARMIN SVT (SYNTHETIC VISION TECHNOLOGY)



WARNING: Use appropriate primary systems for navigation, and for terrain, obstacle, and traffic avoidance. SVT is intended as an aid to situational awareness only and may not provide either the accuracy or reliability upon which to solely base decisions and/or plan maneuvers to avoid terrain, obstacles, or traffic.



NOTE: Do not use the flight path marker as a flight director.



NOTE: Terrain alerting is not available north of 89° North latitude and south of 89° South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.

Garmin SVT™ (Synthetic Vision Technology) is an optional visual enhancement to the system. SVT depicts a forward-looking attitude display of the topography immediately in front of the aircraft. The field of view is 29 degrees to the left and 35.5 degrees to the right. In Reversionary Mode, the field of view is 21.5 degrees to the left and 35.5 degrees to the right. SVT information is shown on the Primary Flight Display (PFD), or on the Multifunction Display (MFD) in Reversionary Mode. The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and a 4.9 arc-second database of terrain, obstacles, and other relevant features. The terrain data resolution is 4.9 arc-seconds, meaning that the terrain elevation contours are stored in squares measuring 4.9 arc-seconds on each side, is required for the operation of SVT. Loss of any of the required data, including temporary loss of the GPS signal, will cause SVT to be disabled (although the softkeys will still appear functional) until the required data is restored.

The SVT terrain display shows land contours (colors are consistent with those of the topographical map display), large water features, towers, wind turbines, and other obstacles over 200' AGL that are included in the obstacle database. Cultural features on the ground such as roads, highways, railroad tracks, cities, and state boundaries are not displayed even if those features are found on the MFD map. The terrain display also includes a north-south east-west grid with lines oriented with true north and spaced at one arc-minute intervals to assist in orientation relative to the terrain.

Terrain-SVT, which is included with the Garmin-SVT option, or the optional Terrain Awareness and Warning System (TAWS) provide visual and auditory alerts to indicate the presence of terrain and obstacle threats relevant to the projected flight path. Terrain alerts are displayed in red and yellow shading on the PFD.

Garmin-SVT can be displayed on the Multifunction Display (MFD) in Reversionary Mode. If SVT is enabled when switching to Reversionary Mode, it will take up to 30 seconds to be displayed. The standard, non-SVT PFD display will be shown in the interim.

The terrain display is intended for situational awareness only. It may not provide the accuracy or fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles. Navigation must not be predicated solely upon the use of the Garmin-SVT or TAWS-B terrain or obstacle data displays.

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Figure 2-37 Synthetic Vision Imagery

SVT OPERATION

SVT is activated from the PFD using the softkeys located along the bottom edge of the display. Pressing the softkeys turns the related function on or off. When SVT is enabled, the pitch attitude scale is reduced from 20 degrees up and down to 10 degrees up to 7.5 degrees down.

SVT functions are displayed on three levels of softkeys. The **PFD Opt** Softkey leads into the PFD function Softkeys, including synthetic vision. Pressing the **SVT** Softkey displays the SVT feature softkeys. The softkeys are labeled **Pathways**, **Terrain**, **HDG LBL**, and **APT Sign**. The **Back** Softkey returns to the previous level of softkeys. Synthetic Terrain must be active before any other SVT feature may be activated.

Pathways, **HDG LBL**, and **APT Sign** Softkeys are only available when the **Terrain** Softkey is activated (gray with black characters). After activating the **Terrain** Softkey, the **Pathways**, **HDG Lbl**, and **APT Sign** softkeys may be activated in any combination to display desired features. On the next avionics power cycle, the last selected state (on or off) of the **Pathways**, **Terrain**, **HDG LBL**, and **APT Sign** Softkeys is remembered by the system.

- **Pathways** Softkey enables display of rectangular boxes that represent course guidance.
- **Terrain** Softkey enables synthetic terrain depiction.
- **HDG LBL** Softkey enables horizon heading marks and digits.
- **APT Sign** Softkey enables airport signposts.

Activating and deactivating SVT:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **SVT** Softkey.
- 3) Press the **Terrain** Softkey. The SVT display will cycle on or off with the **Terrain** Softkey.

Activating and deactivating Pathways:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **SVT** Softkey.
- 3) Press the **Pathways** Softkey. The Pathway feature will cycle on or off with the **Pathways** Softkey.

Activating and deactivating Horizon Headings:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **SVT** Softkey.
- 3) Press the **HDG LBL** Softkey. The horizon heading display will cycle on or off with the **HDG LBL** Softkey.

Activating and deactivating Airport Signs:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **SVT** Softkey.
- 3) Press the **APT Sign** Softkey. Display of airport signs will cycle on or off with the **APT Sign** Softkey.

SVT FEATURES

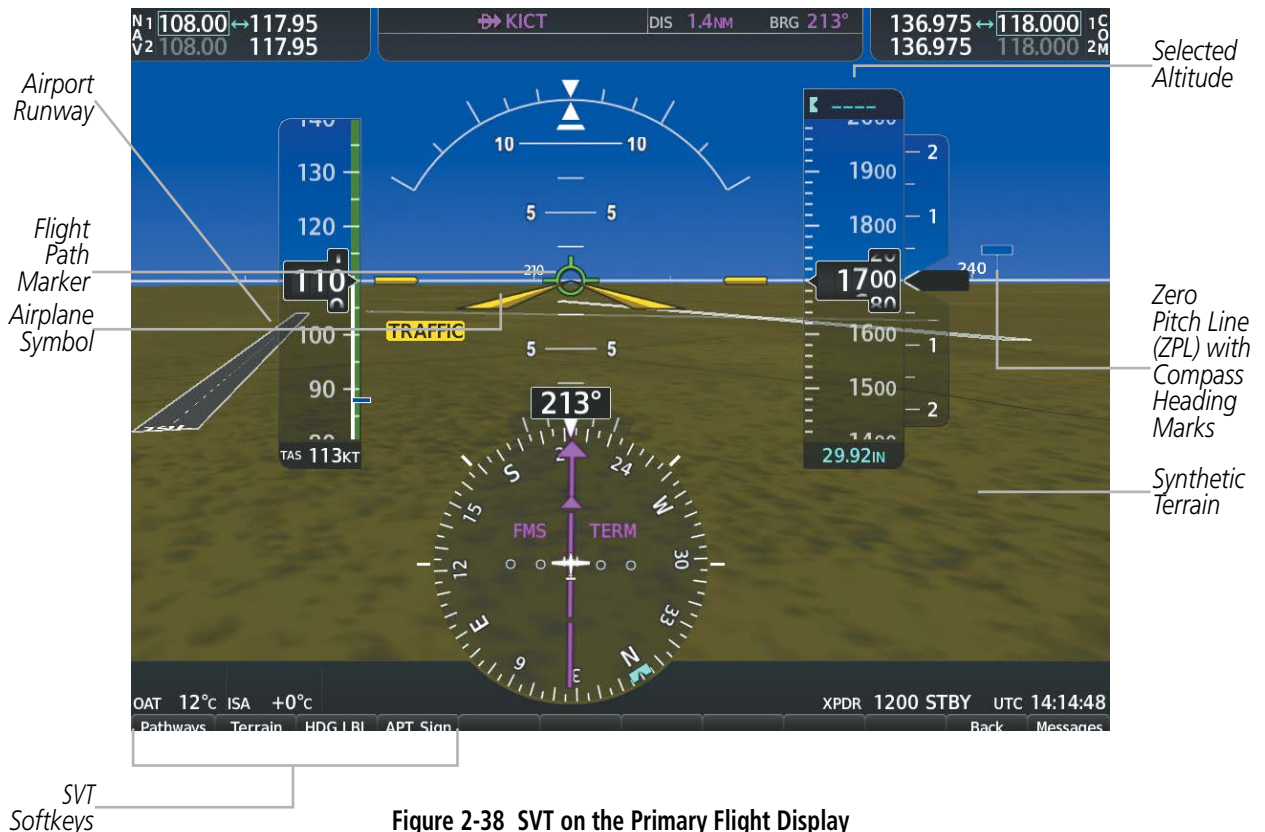


Figure 2-38 SVT on the Primary Flight Display



NOTE: Pathways and terrain features are not a substitute for standard course and altitude deviation information provided by the altimeter, CDI, and VDI.

AIRPORT SIGNS

Airport Signs provide a visual representation of airport location and identification on the synthetic terrain display. When activated, the signs appear on the display when the aircraft is approximately 15 nm from an airport and disappear at approximately 4.5 nm. Airport signs are shown without the identifier until the aircraft is approximately eight nautical miles from the airport. Airport signs are not shown behind the airspeed or altitude display. Airport signs are activated and deactivated by pressing the **APT Sign** Softkey.



Figure 2-39 Airport Signs

FLIGHT PATH MARKER

The Flight Path Marker (FPM), also known as a Velocity Vector, is displayed on the PFD at groundspeeds above 30 knots. The FPM depicts the approximate projected path of the aircraft accounting for wind speed and direction relative to the three-dimensional terrain display.

The FPM is always available when the Synthetic Terrain feature is in operation. The FPM represents the direction of the flight path as it relates to the terrain and obstacles on the display, while the airplane symbol represents the aircraft heading.

The FPM works in conjunction with the Pathways feature to assist the pilot in maintaining desired altitudes and direction when navigating a flight plan. When on course and altitude the FPM is aligned inside the pathway boxes as shown.

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The FPM may also be used to identify a possible conflict with the aircraft flight path and distant terrain or obstacles. Displayed terrain or obstacles in the aircraft's flight path extending above the FPM could indicate a potential conflict, even before an alert is issued by Terrain-SVT or the optional TAWS system discussed in the Hazard Avoidance section. However, decisions regarding terrain and/or obstacle avoidance should not be made using only the FPM.



Figure 2-40 Flight Path Marker and Pathways

HORIZON HEADING

The Horizon Heading is synchronized with the HSI and shows approximately 60 degrees of compass heading in 30-degree increments on the Zero Pitch Line. Horizon Heading tick marks and digits appearing on the zero pitch line are not visible behind either the airspeed or altitude display. Horizon Heading is used for general heading awareness, and is activated and deactivated by pressing the **HDG LBL** Softkey.

PATHWAYS

Pathways provide a three-dimensional perspective view of the selected route of flight shown as colored rectangular boxes representing the horizontal and vertical flight path of the active flight plan. The box size represents 700 feet wide by 200 feet tall during enroute, oceanic, and terminal flight phases. During an approach, the box width is 700 feet or one half full scale deviation on the HSI, whichever is less. The height is 200 feet or one half full scale deviation on the VDI, whichever is less. The altitude at which the pathway boxes are displayed is determined by the higher of either the selected altitude or the VNV altitude programmed for the active leg in the flight plan.

The color of the rectangular boxes may be magenta, green, or white depending on the route of flight and navigation source selected. The active GPS or GPS overlay flight plan leg is represented by magenta boxes that correspond to the magenta CDI. A localizer course is represented by green boxes that correspond to a green CDI. An inactive leg of an active flight plan is represented by gray boxes corresponding to a white line drawn on the navigation map indicating an inactive leg.

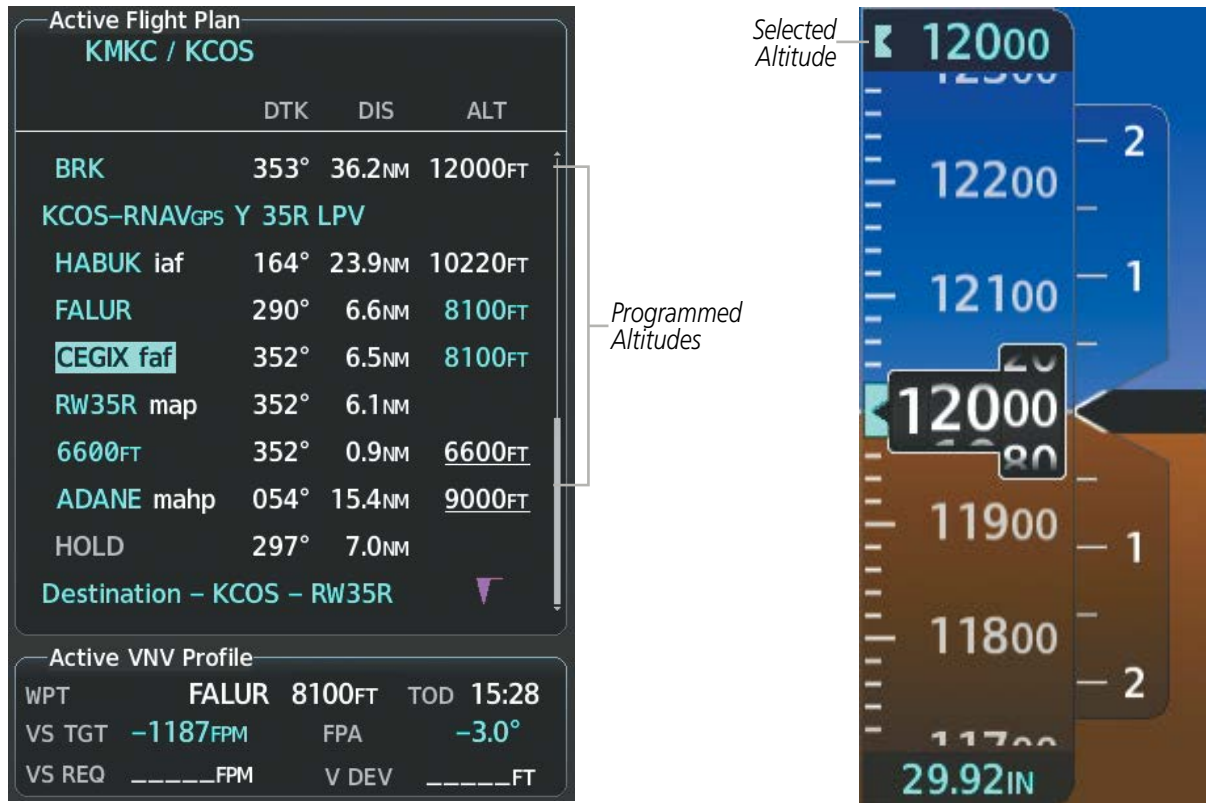


Figure 2-41 Programmed and Selected Altitude

Pathways provide supplemental glidepath/glideslope information on an active ILS, LPV, LNAV/VNAV, and some LNAV approaches. Pathways are intended as an aid to situational awareness and should not be used independent of the CDI, VDI, glide path indicator, and glide slope indicator. They are removed from the display when the selected navigation information is not available. Pathways are not displayed beyond the active leg when leg sequencing is suspended and are not displayed on any portion of the flight plan leg that would lead to intercepting a leg in the wrong direction.

DEPARTURE AND ENROUTE

Prior to intercepting an active flight plan leg, pathways are displayed as a series of boxes with pointers at each corner that point in the direction of the active waypoint. Pathways are not displayed for the first leg of the flight plan if that segment is a Heading-to-Altitude leg. The first segment displaying pathways is the first active GPS leg or active leg with a GPS overlay. If this leg of the flight plan route is outside the SVT field of view, pathways will not be visible until the aircraft has turned toward this leg. While approaching the center of the active leg and prescribed altitude, the number of pathway boxes decreases to a minimum of four.

Climb profiles cannot be displayed due to the variables associated with aircraft performance. Flight plan legs requiring a climb are indicated by pathways displayed at a level above the aircraft at the altitude selected or programmed.

DESCENT AND APPROACH

During an approach, Pathways can be shown for the programmed descent, level transition flight, and at the Selected Altitude within the approach segments. When an approach providing vertical guidance is activated, the corresponding approach glideslope or glidepath will be displayed using a color corresponding to the selected navigation source and conditions.

White Pathways represent the next segment of the approach that is not yet active. Magenta Pathways represent the active segment with GPS as the navigation source. Green Pathways indicate the ILS/LOC navigation source. With active approach vertical guidance, the selected altitude will be displayed as a level gray Pathway if the selected altitude is lower than the glidepath/glideslope. The gray Selected Altitude preview Pathways are displayed until they converge with the green glideslope or magenta glidepath Pathways. If approach vertical guidance is not yet active, pathways at the Selected Altitude will be displayed in magenta throughout the arrival/approach.

During an ILS approach, the initial approach segment is displayed in magenta at the segment altitudes if GPS is the selected as the navigation source on the CDI. When switching to localizer inbound with the LOC selected as the navigation source on the CDI, pathways are displayed in green along the localizer and glideslope. VOR, LOC, BC, and ADF approach segments that are approved to be flown using GPS are displayed in magenta boxes. Segments that are flown using other than GPS or ILS, such as heading legs or VOR final approach courses are not displayed.

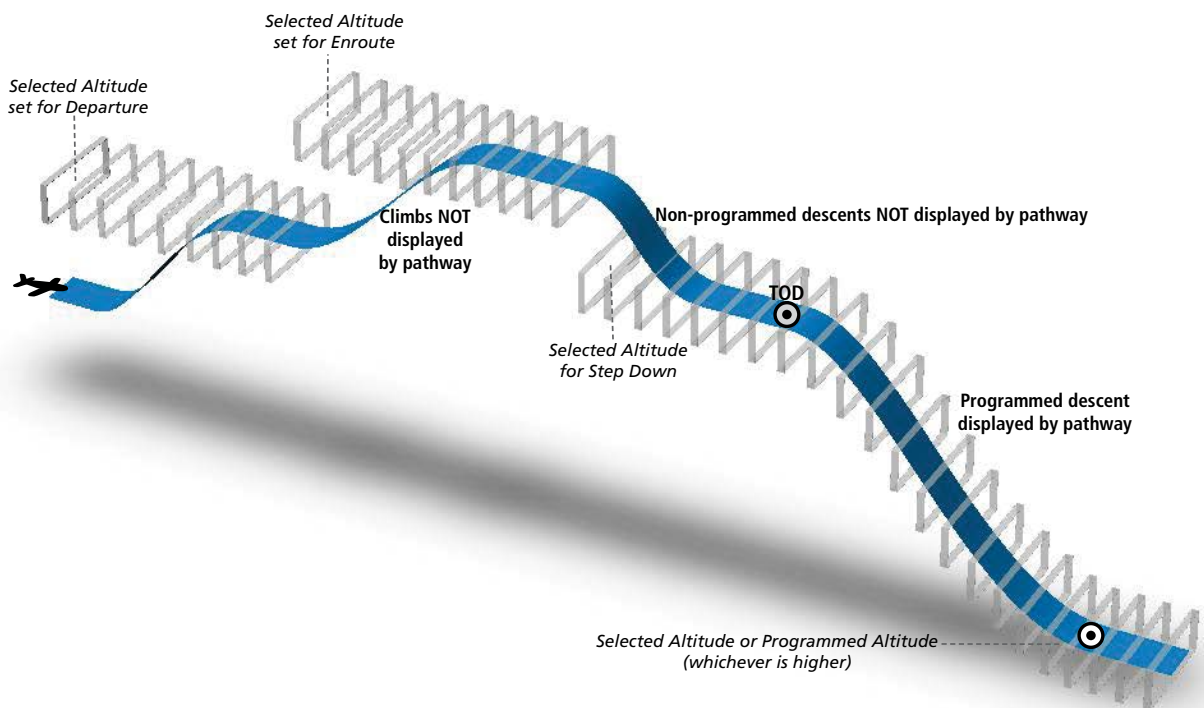


Figure 2-42 SVT Pathways, Enroute and Descent

MISSED APPROACH

Upon activating the missed approach, pathways lead to the Missed Approach Holding Point (MAHP) and are displayed as a level path at the published altitude for the MAHP, or the selected altitude, whichever is the highest. If the initial missed approach leg is a Course-to-Altitude (CA) leg, the pathways boxes will be displayed level at the altitude published for the MAHP. If the initial missed approach leg is defined by a course using other than GPS, pathways are not displayed for that segment. In this case, the pathways displayed for the next leg may be outside the field of view and will be visible when the aircraft has turned in the direction of that leg.

Pathways are displayed along each segment including the path required to track course reversals that are part of a procedure, such as holding patterns. Pathways boxes will not indicate a turn to a MAHP unless a defined geographical waypoint exists between the MAP and MAHP.

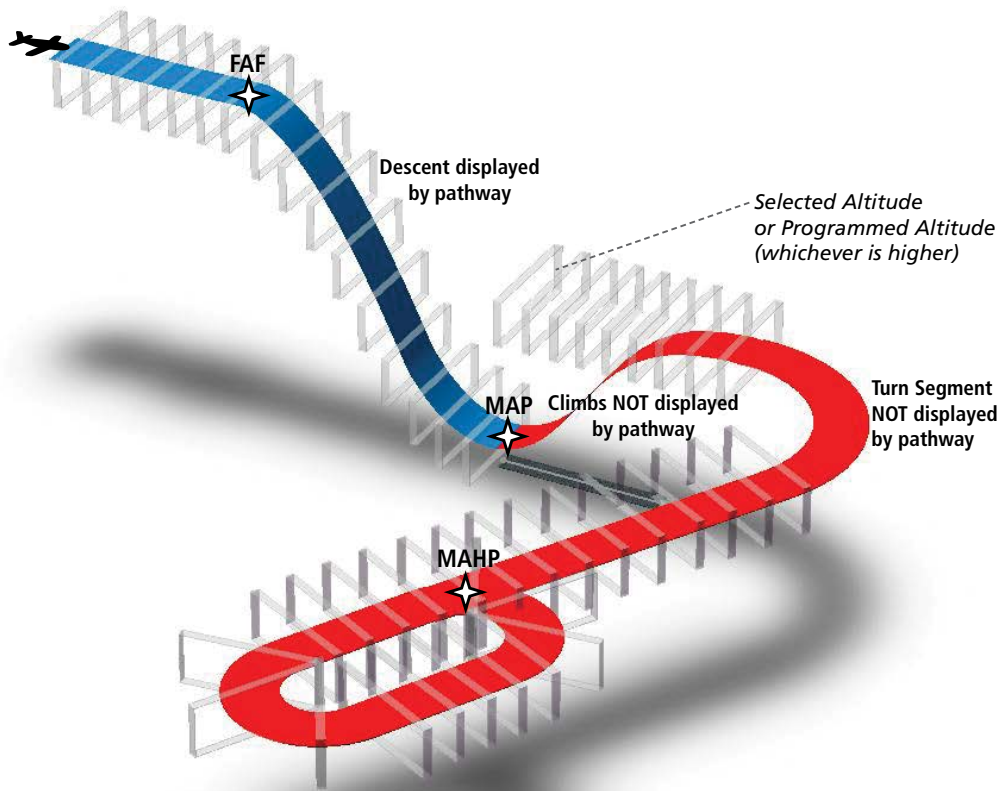


Figure 2-43 SVT Pathways, Approach, Missed Approach, and Holding

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RUNWAYS

WARNING: Do not use SVT runway depiction as the sole means for determining the proximity of the aircraft to the runway or for maintaining the proper approach path angle during landing.

NOTE: Not all airports have runways with endpoint data in the database, therefore, these runways are not displayed.

Runway data provides improved awareness of runway location with respect to the surrounding terrain. All runway thresholds are depicted at their respective elevations as defined in the database. In some situations, where threshold elevations differ significantly, crossing runways may appear to be layered. As runways are displayed, those within 45 degrees of the aircraft heading are displayed in white. Other runways will be gray in color. When an approach for a specific runway is active, that runway will appear brighter and be outlined with a white box, regardless of the runway orientation as related to aircraft heading. As the aircraft gets closer to the runway, more detail such as runway numbers and centerlines will be displayed.



Figure 2-44 Airport Runways

TRAFFIC



WARNING: Intruder aircraft at or below 500 ft. AGL may not appear on the SVT display or may appear as a partial symbol.

Traffic symbols are displayed in their approximate locations as determined by the related traffic systems. Traffic symbols are displayed in three dimensions, appearing larger as they are getting closer, and smaller when they are further away. Traffic within 250 feet laterally of the aircraft will not be displayed on the SVT display. The SVT traffic symbols and colors are the same as the traffic symbols and colors shown on maps, with the exception of ADS-B symbols. The SVT display shows non-directional traffic symbols for traffic with ADS-B information. If the traffic altitude is unknown, the traffic will not be displayed on the SVT display. For more details refer to the traffic system discussion in the Hazard Avoidance section.

TERRAIN ALERTING

Terrain alerting on the synthetic terrain display is triggered by Forward-looking Terrain Avoidance (FLTA) alerts, and corresponds to the yellow terrain shading for a caution alert and the red shading for a warning alert on the navigation maps and ‘Map - Terrain-SVT’ or ‘Map - TAWS-B’ Pages. For more detailed information regarding Terrain-SVT and TAWS-B, refer to the Hazard Avoidance Section.

In some instances, a terrain or obstacle alert may be issued with no conflict shading displayed on the synthetic terrain. In these cases, the conflict is outside the SVT field of view to the left or right of the aircraft.

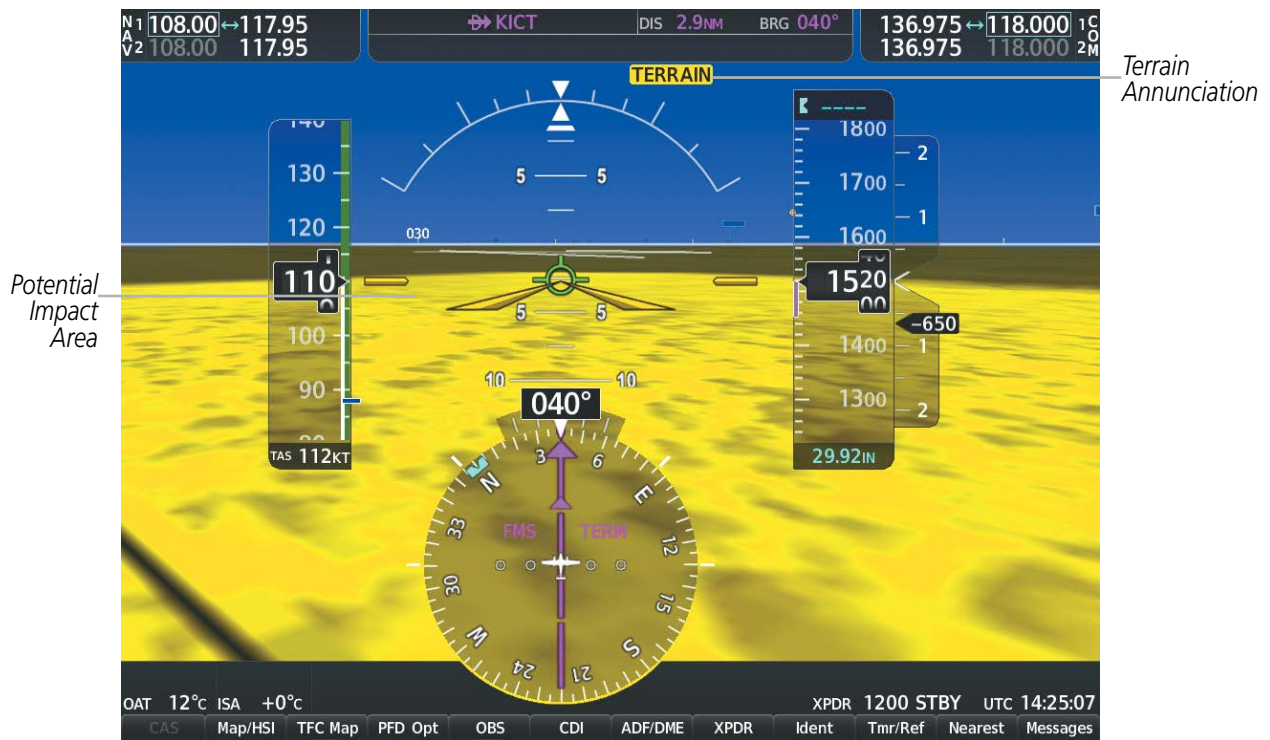


Figure 2-45 Terrain Alert

Obstacles are represented on the synthetic terrain display by standard two-dimensional tower or wind turbine symbols found on map displays. Obstacle symbols appear in the perspective view with relative height above terrain and distance from the aircraft. Unlike the map displays, which color obstacles relative to the aircraft's altitude, obstacles on the synthetic terrain display do not change colors to warn of potential conflict with the aircraft's flight path until the obstacle is associated with an actual FLTA alert. Obstacles greater than 1000 feet below the aircraft altitude are not shown. Obstacles are shown behind the airspeed and altitude displays.



Figure 2-46 SVT with Obstacle Cautions

ZERO PITCH LINE

The Zero Pitch Line is drawn completely across the display and represents the horizon when the terrain horizon is difficult to distinguish from other terrain being displayed. It may not align with the terrain horizon, particularly when the terrain is mountainous or when the aircraft is flown at high altitudes.

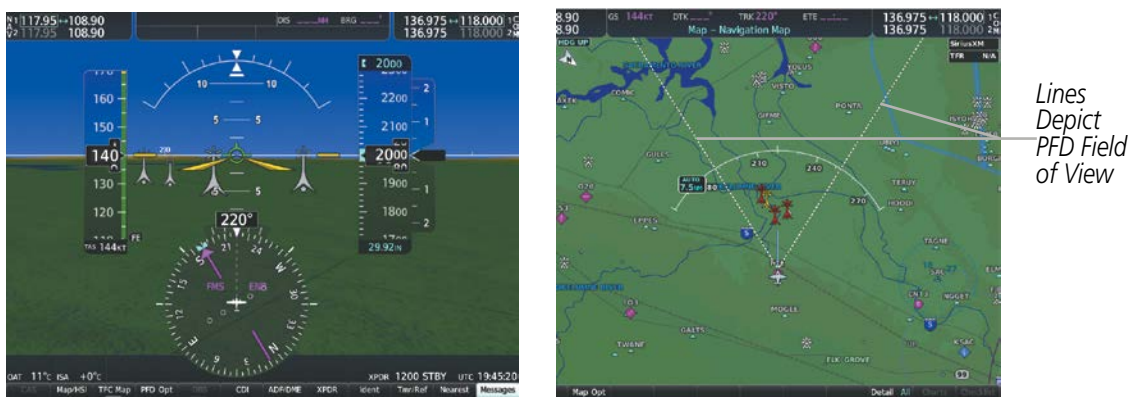
FIELD OF VIEW

The PFD field of view can be represented on the MFD 'Map - Navigation Map' Page. Two dashed lines forming a V-shape in front of the aircraft symbol on the map, represent the forward viewing area shown on the PFD.

Configuring field of view:

- 1) While viewing the 'Map - Navigation Map' Page, press the **MENU** Key to display the Page Menu.
- 2) Turn the large **FMS** Knob to highlight 'Map Settings' and press the **ENT** Key.
- 3) Turn the **FMS** Knob to select the 'Map' Group and press the **ENT** Key.
- 4) Turn the large **FMS** Knob to scroll through the Map Group options to 'Field of View'.
- 5) Turn the small **FMS** Knob to select 'On' or 'Off'.
- 6) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The following figure compares the PFD forward looking depiction with the MFD plan view and Field of View enabled.



SVT View on the PFD

Field of View on the MFD

Figure 2-47 PFD and MFD Field of View Comparison

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in the following table can appear on the HSI when abnormal GPS conditions occur. Refer to the Flight Management Section for more information on Dead Reckoning Mode.

Annunciation	Location	Description
GPS LOI	Right of HSI	Loss of Integrity Monitoring—GPS integrity is insufficient for the current phase of flight
GPS INTEG OK	Right of HSI	Integrity OK—GPS integrity has been restored to within normal limits (annunciation displayed for 5 seconds)
DR	Lower left of aircraft symbol if HSI Map is disabled, or on aircraft icon if HSI Map enabled	Dead Reckoning—System is using projected position rather than GPS position to compute navigation data and sequence active flight plan waypoints

Table 2-3 Abnormal GPS Conditions Annunciated on HSI



Figure 2-48 Example HSI Annunciations

In Dead Reckoning Mode the CDI is removed from the display when FMS is the selected navigation source. The following items on the PFD are then shown in amber:

- Current Track Bug
- Wind Data
- Ground Speed
- Distances in the Bearing Information Windows
- FMS bearing pointers

These items should be verified when operating in Dead Reckoning Mode as they become increasingly inaccurate over time.

SVT TROUBLESHOOTING

SVT is intended to be used with traditional attitude, heading, obstacle, terrain, and traffic inputs. SVT is disabled when valid attitude or heading data is not available for the display. In case of invalid SVT data, the PFD display reverts to the standard blue-over-brown attitude display.

SVT becomes disabled without the following data resources:

- Attitude data
- Heading data
- GPS position data
- 4.9 Arc-second Terrain data
- Obstacle data
- TAWS function is not available, in test mode, or failed
- The position of the aircraft exceeds the range of the terrain database.

SVT IN REVERSIONARY MODE

SVT can be displayed on the Multifunction Display (MFD) in Reversionary Mode. If it is enabled when switching to Reversionary Mode, SVT will take up to 30 seconds to be displayed. The standard, non-SVT PFD display will be shown in the interim.

UNUSUAL ATTITUDES

When the aircraft enters an unusual pitch attitude, red chevrons pointing toward the horizon warn of extreme pitch. The chevrons are displayed on the Attitude Indicator, starting at 50° above and 30° below the horizon line.

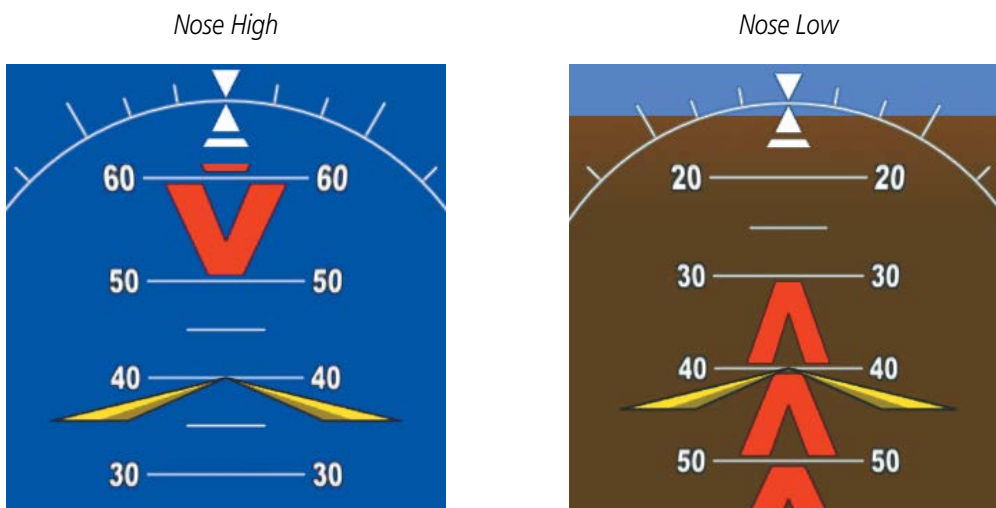


Figure 2-49 Pitch Attitude Warnings

During an excessively high pitch attitude, the Synthetic Terrain display (if enabled) uses a solid blue bar to represent the sky, and a solid brown bar to represent the earth. During an excessively low pitch attitude, a

solid blue bar represents the sky, while the terrain continues to be displayed. This prevents losing sight of the horizon during extreme pitch attitudes.

If pitch exceeds +30°/-20° or bank exceeds 65°, some information displayed on the PFD is removed. The Altimeter and Airspeed, Attitude, Vertical Speed, and Horizontal Situation indicators remain on the display and the Bearing Information, Alerts, and Annunciation windows can be displayed during such situations. The following information is removed from each PFD and their softkeys are disabled when the aircraft experiences unusual attitudes:

- | | | |
|---------------------------------|---|--|
| • Traffic Annunciations | • System Time | • Minimum Descent Altitude/ Decision Height readout |
| • AFCS Annunciations | • PFD Setup Menu | • Vertical Deviation, Glideslope, and Glidepath Indicators |
| • Inset Map | • Windows displayed in the lower right corner of the PFD: | • Altimeter Barometric Setting |
| • Outside Air Temperature (OAT) | – References Window | • Selected Altitude |
| • ISA temperature deviation | – Nearest Airports | • VNV Target Altitude |
| • Wind data | – Flight Plan | • Ground Speed |
| • Selected Heading readout | – Messages | • True Airspeed |
| • Selected Course readout | – Procedures | |
| • Transponder Status Box | | |

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SECTION 3 ENGINE INDICATION SYSTEM (EIS)

NOTE: Refer to the Aircraft Flight Manual (AFM) for limitations.

The system offers improved flight operations and reduces crew workload by automatically monitoring critical system parameters during all phases of flight using the following:

- The **Engine Indication System** (EIS) displays electrical, fuel, engine, and flight control information on the left side of the Multi Function Display (MFD). EIS information can also be fully expanded to an entire page by pressing the **ENGINE** Softkey or turning the large **FMS** Knob to select the EIS - Engine Page.

In combination with the EIS, aural alerts, additional avionics messages, and master indicators are used to inform the crew of aberrant flight conditions. The system also provides an improved level of maintenance data for the ground crew.



Figure 3-1 MFD with EIS Display (Normal Mode)

Green bands on the instruments indicate normal ranges of operation; yellow and red bands indicate caution and warning, respectively. White or uncolored bands indicate areas outside of normal operation not yet in the caution or warning ranges. When unsafe operating conditions occur, the corresponding readouts flash to indicate cautions and warnings. If sensory data to an instrument becomes invalid or unavailable, an “X” is displayed across the instrument.

3.1 ENGINE DISPLAY

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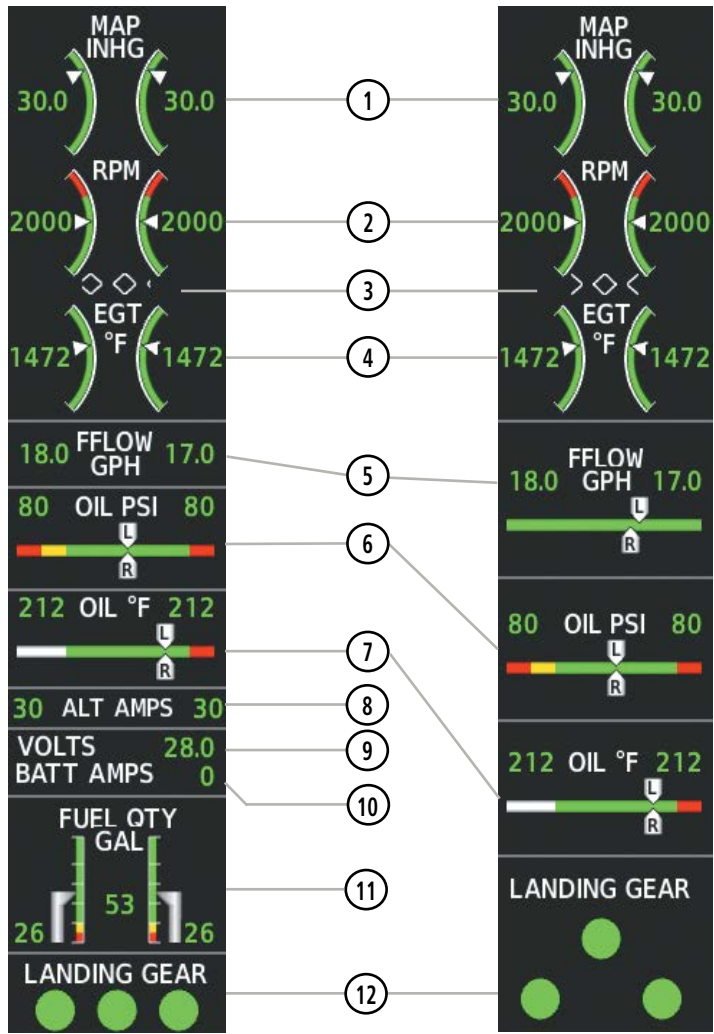


Figure 3-2 Engine Display

Figure 3-3 Engine Display when Engine Page is Displayed

- ① **Engine Manifold Pressure Gauge (MAP INHG)** Displays manifold pressure in inches of Mercury (in Hg) to indicate engine power
- ② **Tachometer (RPM)** Displays propeller speed in revolutions per minute (rpm)
- ③ **Propeller Sync Indicator** Points towards the higher-speed propeller when the propellers are out of sync.
- ④ **Exhaust Gas Temperature (EGT °F)** Displays the exhaust gas temperature in °F
- ⑤ **Fuel Flow Indicator (FFLOW GPH)** Displays fuel flow in gallons per hour (gph)

- ⑥ **Oil Pressure Indicator (OIL PSI)** Displays oil pressure in pounds per square inch (psi)
- ⑦ **Oil Temperature Indicator (OIL °F)** Displays oil temperature in degrees Fahrenheit (°F)
- ⑧ **Alternator Current (ALTR AMPS)** Displays each alternator current in amperes
- ⑨ **Voltage (VOLTS)** Displays the bus voltage.
- ⑩ **Battery Current(BATT AMPS)** Displays the battery current in amperes
- ⑪ **Fuel Quantity Indicator (FUEL QTY GAL)** Displays the amount of fuel in gallons (gal) for each side of a standard fuel tank.
- ⑫ **Landing Gear Status (LANDING GEAR)** Displays landing gear status

3.2 ENGINE PAGE

The EIS - Engine Page displays all engine, fuel, fuel calculation, and electrical. To access this page, press the **Engine** Softkey or turn the large **FMS** Knob and select the EIS - Engine Page.

Level 1	Level 2	Description
Engine		Displays EIS - Engine Page and second-level engine softkeys; press again to exit page
	DEC Fuel	Decreases displayed fuel remaining in 1-gal increments
	INC Fuel	Increases displayed fuel remaining in 1-gal increments
	RST Fuel	Resets displayed fuel remaining to maximum fuel capacity for aircraft and fuel used to zero
	CO RST	Resets the CO Detector (optional)

Press the **Engine** Softkey or turn the large **FMS** Knob and select the EIS - Engine Page.

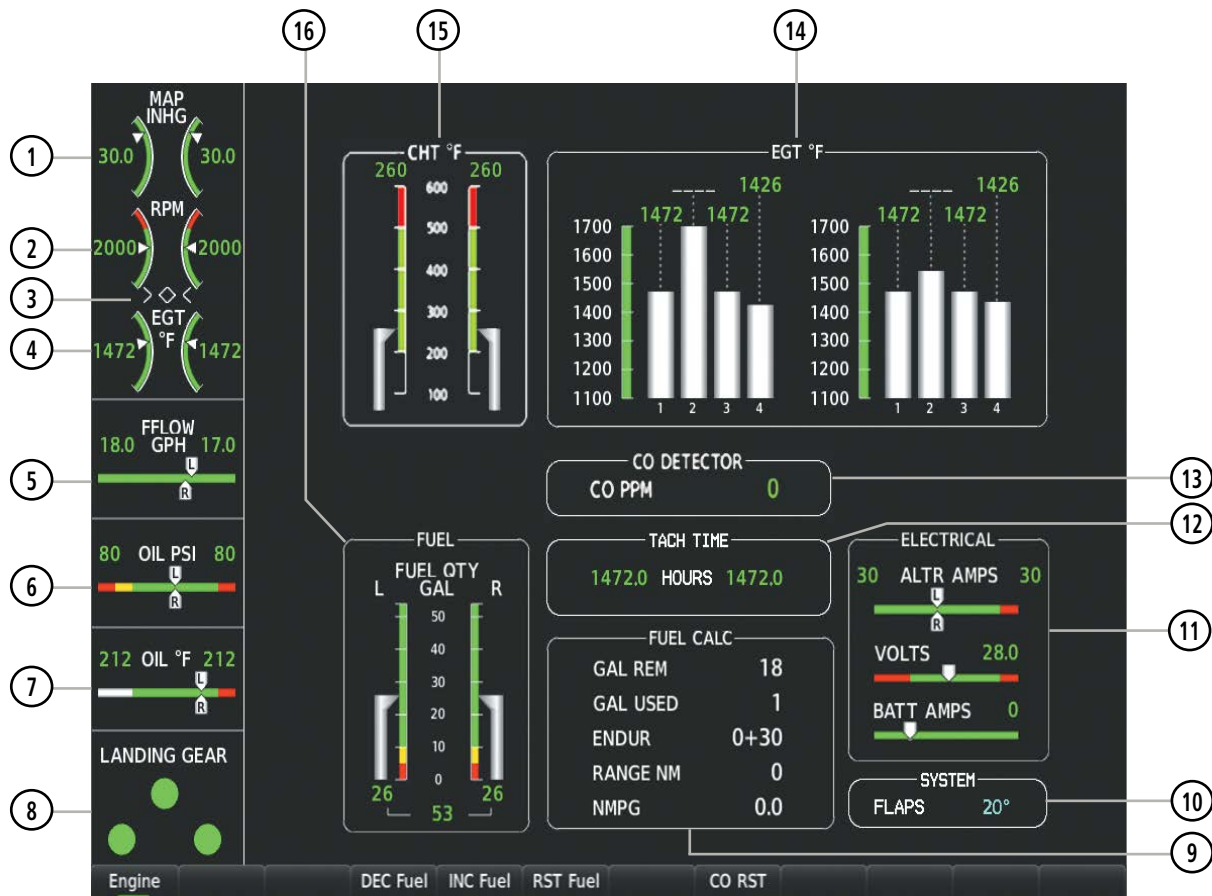


Figure 3-4 Engine Page

- ① **Engine Manifold Pressure Gauge (MAP INHG)** Displays manifold pressure in inches of Mercury (in Hg) to indicate engine power
- ② **Tachometer (RPM)** Displays propeller speed in revolutions per minute (rpm)
- ③ **Propeller Sync Indicator** Points towards the higher-speed propeller when the propellers are out of sync.

- ④ **Exhaust Gas Temperature (EGT °F)** Displays the exhaust gas temperature in °F
- ⑤ **Fuel Flow Indicator (FFLOW GPH)** Displays fuel flow in gallons per hour (gph)
- ⑥ **Oil Pressure Indicator (OIL PSI)** Displays oil pressure in pounds per square inch (psi)
- ⑦ **Oil Temperature Indicator (OIL °F)** Displays oil temperature in degrees Fahrenheit (°F)
- ⑧ **Landing Gear Status (LANDING GEAR)** Displays landing gear status
- ⑨ **Fuel Calculations Group (FUEL CALC)** Displays calculated fuel used (GAL USED), endurance (ENDUR), and range (in nautical miles, RANGE NM), and fuel efficiency (in nautical miles per gallon, NMPG) based on the displayed fuel remaining (GAL REM) and the fuel flow totalizer
- ⑩ **Flap Setting Indicator (SYSTEM)** Displays the setting of the flaps in degrees.
- ⑪ **Electrical Group (ELECTRICAL)** Displays alternator (ALTR AMPS) and battery (BATT AMPS) currents in amperes and bus voltage (VOLTS)

DC current for the alternator (shown in amperes) and voltage (shown in volts) for the DC bus are shown along color-coded horizontal scales, with displays above each scale. The ammeter displays the battery load in amperes (amps) along a horizontal scale, with a white tick mark indicating zero amps. The horizontal scales and pointers will not appear in Reversionary Mode.
- ⑫ **Engine Hours (TACH TIME)** Displays the total time in hours the engine has been in service
- ⑬ **Carbon Monoxide Detector (CO DETECTOR)** Displays carbon monoxide information in Parts Per Million (PPM).

Reset the Carbon Monoxide Detector:
On the Engine Page, push **CO RST** softkey.
(Optional)
- ⑭ **Exhaust Gas Temperature Bar Graph (EGT °F)** Displays the exhaust gas temperatures for all cylinders in °F
- ⑮ **Cylinder Head Temperatures (CHT °F)** Displays cylinder head temperatures in °F
- ⑯ **Fuel Quantity Gauges (FUEL)** Displays the total amount of fuel and the amount of fuel in gallons (gal) for each side of a standard fuel tank

FUEL CALCULATIONS



NOTE: Fuel calculations do not use the aircraft fuel quantity indicators and are calculated from the last time the fuel was reset.

Fuel used (GAL USED), endurance (ENDUR), range (in nautical miles, RANGE NM), and fuel efficiency (in nautical miles per gallon, NMPG) are calculated based on the displayed fuel remaining (GAL REM) and the fuel flow totalizer. The calculated range also takes into account the aircraft's heading and the wind direction and speed.

ADJUSTING THE FUEL TOTALIZER QUANTITY:

On the Engine Page, use the **DEC Fuel** and **INC Fuel** softkeys to obtain the desired fuel remaining (GAL REM).

RESETTING THE FUEL TOTALIZER:

On the Engine Page, select the **RST Fuel** Softkey; this resets displayed fuel remaining (GAL REM) to the maximum fuel capacity for the aircraft and fuel used to zero.

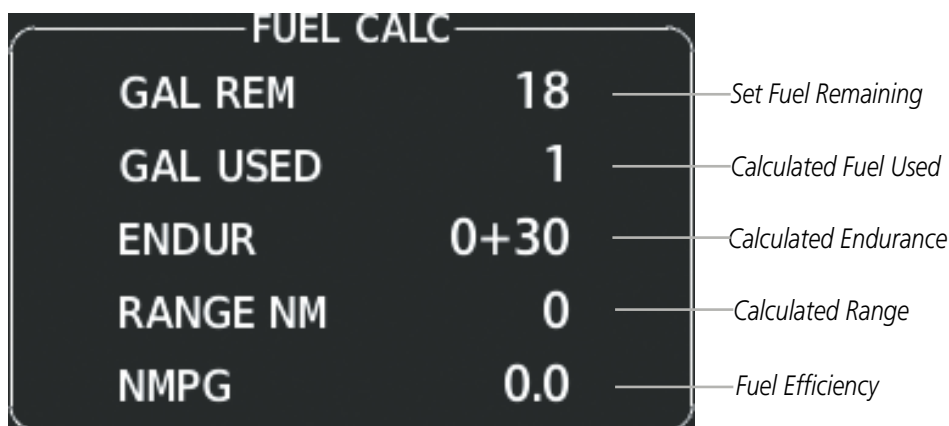


Figure 3-5 Fuel Calculations Group

A map feature related to the EIS Fuel Calculations is the Fuel Range Ring, which graphically illustrates the aircraft's remaining range based on the endurance (ENDUR), heading, groundspeed, and wind direction and speed. The solid green circle represents the range until all the remaining fuel is depleted. The dashed green circle indicates the aircraft range until only reserve fuel remains. Once on reserve fuel, the range is indicated by a solid amber circle.

The Fuel Range Ring shifts position in relation to the aircraft according to wind effects. For example, more fuel is required for flying into a headwind, and the aircraft's decreased range in that direction is indicated by the Fuel Range Ring shifting toward the tail of the Aircraft Symbol.

The amount of reserve fuel (only for purposes of the Fuel Range Ring) is set on the Navigation Map Page Setup Menu in terms of remaining flight time. When enabled the Fuel Range Ring appears on the Navigation Map Page, the Weather Data Link Page, and PFD Inset Map. (Refer to Flight Management for more information on the Fuel Range Ring).

LANDING GEAR INDICATIONS

Landing Gear statuses are shown using the indications in the following table.

Position	EIS	Engine Page
Up & Locked	<p>LANDING GEAR</p>	<p>LANDING GEAR</p>
In Transition	<p>LANDING GEAR</p>	<p>LANDING GEAR</p>
Down and Locked	<p>LANDING GEAR</p>	<p>LANDING GEAR</p>
Warning	<p>LANDING GEAR</p>	<p>LANDING GEAR</p>
No Signal	<p>LANDING GEAR</p>	<p>LANDING GEAR</p>

Figure 3-6 Landing Gear Indications

3.3 EIS DISPLAY (REVERSIONARY MODE)

Should a system detected failure occur on the MFD, the PFD automatically enters reversionary mode. Should a system detected failure occur on the PFD, reversionary mode must be activated manually, if desired. Refer to the System Overview section for more information.

The Engine Display, in reversionary mode, is identical to the normal EIS Display on the MFD.



Figure 3-7 Reversionary Mode (EIS Shown)

SECTION 4 AUDIO PANEL AND CNS

4.1 OVERVIEW

The Communication/Navigation/Surveillance (CNS) system includes the Audio Panel, communication radios, navigation radios, and Mode S transponder. The System Overview Section provides a block diagram description of the Audio Panel and CNS system interconnection.

CNS operation is performed by the following Line Replaceable Units (LRUs):

- Primary Flight Display (PFD)
- Multifunction Display (MFD)
- Integrated Avionics Unit (2)
- Audio Panel
- Mode S Transponder

The MFD/PFD controls are used to tune the communication transceivers and navigation radios.

The Audio Panel provides the traditional audio selector functions of microphone and receiver audio selection. The Audio Panel includes an intercom system (ICS) between the pilot, copilot, and passengers, a marker beacon system, and a COM clearance recorder. Ambient noise from the aircraft radios is reduced by a feature called Master Avionics Squelch (MASQ). When no audio is detected, MASQ processing further reduces the amount of background noise from the radios.

The Mode S Transponder is controlled with softkeys and the **FMS** Knob located on the Primary Flight Display (PFD). The Transponder Data Box is located to the left of the System Time Box. The data box displays the active four-digit code, mode, and a reply status (Figure 4-1).

PFD CONTROLS AND FREQUENCY DISPLAY



Figure 4-1 PFD Controls, NAV/COM Frequency Tuning Boxes, and NRST Window

- ① **NAV VOL/ID Knob** – Controls NAV audio volume level. Press to turn the Morse code identifier audio on and off. Volume level is shown in the NAV frequency field as a percentage.
- ② **NAV Frequency Transfer Key** – Transfers the standby and active NAV frequencies.
- ③ **NAV Knob** – Tunes the standby frequencies for the NAV receiver (large knob for MHz; small knob for kHz). Press to move the tuning box (light blue box) and Frequency Transfer Arrow between NAV1 and NAV2.
- ④ **NAV Frequency Box** – Displays NAV standby and active frequency fields, volume, and station ID. The frequency of the NAV radio selected for navigation is displayed in green.
- ⑤ **COM Frequency Box** – Displays COM standby and active frequency fields and volume. The selected and decoded COM transceiver frequency is displayed in green.
- ⑥ **COM Knob** – Tunes the standby frequencies for the COM transceiver (large knob for MHz; small knob for kHz). Press to move the tuning box (light blue box) and Frequency Transfer Arrow between COM1 and COM2.
- ⑦ **COM Frequency Transfer Key** – Transfers the standby and active COM frequencies. Press and hold this key for two seconds to tune the emergency frequency (121.500 MHz) automatically into the active frequency field.
- ⑧ **COM VOL/SQ Knob** – Controls COM audio volume level. Press to turn the COM automatic squelch on and off. Volume level is shown in the COM frequency field as a percentage.
- ⑨ **Nearest Airports Window** – Display by pressing **NRST** Softkey.
- ⑩ **ENT Key** – Validates or confirms an Auto-tune selection.
- ⑪ **FMS Knob** – Flight Management System Knob, used to enter transponder codes and Auto-tune entries when NRST Window is present. Press the **FMS** Knob to turn the selection cursor on and off. The large knob moves the cursor in the window. The small knob selects individual characters for the highlighted cursor location.
- ⑫ **Transponder Data Box** – Indicates the selected transponder code, operating mode, reply, and ident status for the applicable transponder.

GMA 1347 AUDIO PANEL CONTROLS

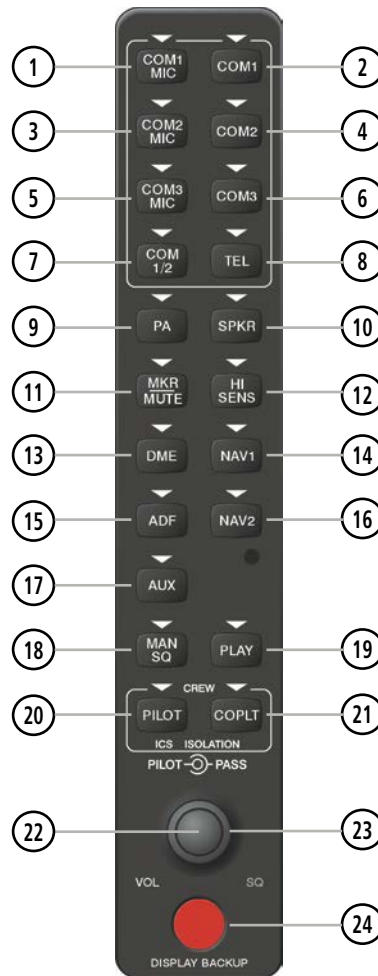


Figure 4-2 Audio Panel Controls

NOTE: When a key is selected, a triangular annunciator above the key is illuminated.

- ① **COM1 MIC** – Selects the #1 transmitter for transmitting. COM1 receive is simultaneously selected when this key is pressed allowing received audio from the #1 COM receiver to be heard. COM2 receive can be added by pressing the **COM2** Key.
- ② **COM1** – When selected, audio from the #1 COM receiver can be heard.
- ③ **COM2 MIC** – Selects the #2 transmitter for transmitting. COM2 receive is simultaneously selected when this key is pressed allowing received audio from the #2 COM receiver to be heard. COM1 receive can be added by pressing the **COM1** Key.
- ④ **COM2** – When selected, audio from the #2 COM receiver can be heard.
- ⑤ **COM3 MIC** – Reserved for optional COM radio.

- ⑥ **COM3** – Reserved for optional COM radio.
- ⑦ **COM 1/2** – Split COM operation key. When selected, the pilot uses the COM 1 transceiver and the copilot uses COM 2.
- ⑧ **TEL** – Selects and deselects telephone audio.
- ⑨ **PA** – Selects the passenger address system. The selected COM transmitter is deselected when the **PA** Key is pressed.
- ⑩ **SPKR** – Selects and deselects the cabin speaker (if installed). COM and NAV receiver audio can be heard on the speaker.
- ⑪ **MKR/MUTE** – Selects marker beacon receiver audio. Mutes the currently received marker beacon receiver audio. Unmutes automatically when new marker beacon audio is received. Also, stops play of recorded COM audio.
- ⑫ **HI SENS** – Press to increase marker beacon receiver sensitivity. Press again to return to low sensitivity.
- ⑬ **DME** – Turns optional DME audio on or off.
- ⑭ **NAV1** – When selected, audio from the #1 NAV receiver can be heard.
- ⑮ **ADF** – Turns optional ADF receiver audio on or off.
- ⑯ **NAV2** – When selected, audio from the #2 NAV receiver can be heard.
- ⑰ **AUX** – Not used in the PA-44-180.
- ⑱ **MAN SQ** – Enables manual squelch for the intercom. When the intercom is active, press the **PILOT** Knob to illuminate SQ. Turn the **PILOT/PASS** Knobs to adjust squelch.
- ⑲ **PLAY** – Press once to play the last recorded COM audio. Press again while audio is playing and the previous block of recorded audio will be played. Each subsequent press plays each previously recorded block. Pressing the **MKR/MUTE** Key during play of a memory block stops play.
- ⑳ **PILOT** – Selects and deselects the pilot intercom isolation.
- ㉑ **COPLT** – Selects and deselects the copilot intercom isolation.
- ㉒ **PILOT Knob** – Press to switch between volume and squelch control as indicated by illumination of VOL or SQ. Turn to adjust intercom volume or squelch. The **MAN SQ** Key must be selected to allow squelch adjustment.
- ㉓ **PASS Knob** – Turn to adjust Copilot/Passenger intercom volume or squelch. The **MAN SQ** Key must be selected to allow squelch adjustment.
- ㉔ **DISPLAY BACKUP Button** – Manually selects Reversionary Mode.

4.2 COM OPERATION

COM TRANSCIVER SELECTION AND ACTIVATION

NOTE: During PA Mode, the COM MIC Annunciator is extinguished and the COM active frequency color changes to white, indicating that neither COM transmitter is active.

NOTE: When turning on the G1000 for use, the system remembers the last frequencies used and the active COM transceiver state prior to shutdown.

The COM Frequency Box is composed of four fields; the two active frequencies are on the left side and the two standby frequencies are on the right. The COM transceiver is selected for transmitting by pressing the **COM MIC** Keys on the Audio Panel. During reception of audio from the COM radio selected for transmission, audio from the other COM radio is muted.

An active COM frequency displayed in green indicates that the COM transceiver is selected on the Audio Panel (**COM1 MIC** or **COM2 MIC** Key). Both active COM frequencies appearing in white indicate that no COM radio is selected for transmitting (**PA** Key is selected on the Audio Panel).

Frequencies in the standby field are displayed in either white or gray. The standby frequency in the tuning box is white. The other standby frequency is gray.

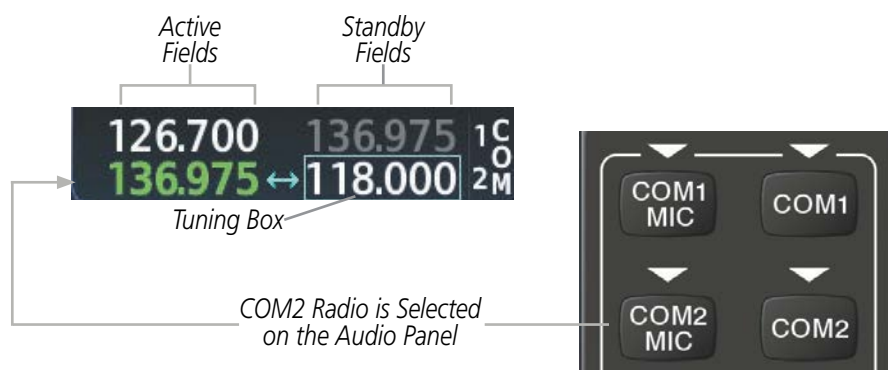


Figure 4-3 Selecting a COM Radio for Transmit

COM3 is reserved for an optional COM radio.

TRANSMIT/RECEIVE INDICATIONS

During COM transmission, a white TX appears by the active COM frequency replacing the Frequency Transfer Arrow. On the Audio Panel, when the active COM is transmitting, the active transceiver **COM MIC** Key Annunciator flashes approximately once per second.

During COM signal reception, a white RX appears by the active COM frequency replacing the Frequency Transfer Arrow.



Figure 4-4 COM Radio Transmit and Receive Indications

COM TRANSCEIVER MANUAL TUNING

The COM frequency controls and frequency boxes are on the right side of each PFD.

Manually tuning a COM frequency:

- 1) Turn the **COM** Knob to tune the desired frequency in the COM Tuning Box (large knob for MHz; small knob for kHz).
- 2) Press the **Frequency Transfer** Key to transfer the frequency to the active field.
- 3) Adjust the volume level with the COM **VOL/SQ** Knob.
- 4) Press the COM **VOL/SQ** Knob to turn automatic squelch on and off.

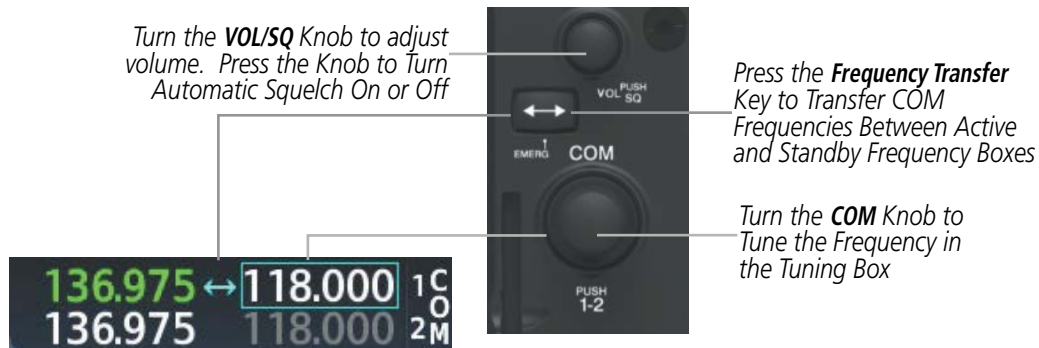


Figure 4-5 COM Frequency Tuning

SELECTING THE RADIO TO BE TUNED

Press the small **COM** Knob to transfer the frequency tuning box and Frequency Transfer Arrow between the upper and lower radio frequency fields.

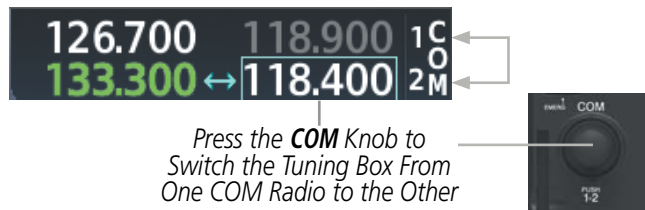


Figure 4-6 Switching COM Tuning Boxes

QUICK-TUNING AND ACTIVATING 121.500 MHZ

Pressing and holding the COM **Frequency Transfer** Key for two seconds automatically loads the emergency COM frequency (121.500 MHz) in the active field of the COM radio selected for tuning (the one with the transfer arrow). In the example shown, pressing the Audio Panel **COM2 MIC** Key activates the transceiver.



Figure 4-7 Quickly Tuning 121.500 MHz

AUTO-TUNING THE COM FREQUENCY

COM frequencies can be automatically tuned from the following:

- Nearest Airports Window (PFD)
- WPT – Airport Information Page
- NRST – Nearest Airports Page
- NRST – Nearest Frequencies Page (ARTCC, FSS, WX)
- NRST – Nearest Airspaces Page

AUTO-TUNING FROM THE PFD

COM frequencies for the nearest airports can be automatically tuned from the Nearest Airports Window on the PFD. When the desired frequency is entered, it becomes a standby frequency. Pressing the **Frequency Transfer** Key places this frequency into the COM Active Frequency Field.

Auto-tuning a COM frequency for a nearby airport from the PFD:

- 1) Press the **NRST** Softkey on the PFD to open the Nearest Airports Window. A list of 25 nearest airport identifiers and COM frequencies is displayed.
- 2) Turn the **FMS** Knob to scroll through the list and highlight the desired COM frequency.
- 3) Press the **ENT** Key to load the COM frequency into the COM Standby Tuning Box.
- 4) Press the **Frequency Transfer** Key to transfer the frequency to the COM Active Frequency Field.



Select the **NEAREST** Softkey to Open the Nearest Airports Window

Figure 4-8 Nearest Airports Window

AUTO-TUNING FROM THE MFD

Frequencies can be automatically loaded into the COM Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key (Figures 4-10, 4-11, and 4-12).

Auto-tuning a COM frequency from the WPT and NRST Pages:

- 1) From any page that the COM frequency can be auto-tuned, activate the cursor by pressing the **FMS** Knob or selecting the appropriate softkey.
- 2) Turn the **FMS** Knob to place the cursor on the desired COM frequency (Figure 4-11).
- 3) Press the **ENT** Key to load the COM frequency into the standby field of the selected COM radio.
- 4) Press the **Frequency Transfer** Key to transfer the frequency to the COM Active Frequency Field.

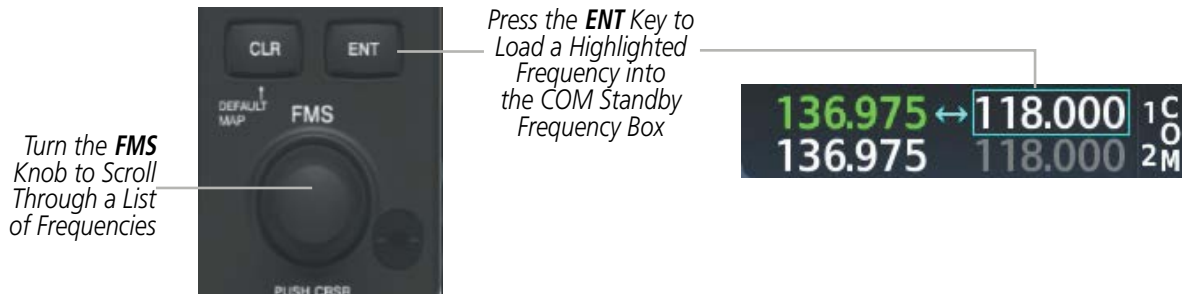


Figure 4-9 Frequency Auto-Tuning from the MFD

Or:

- 1) On the Nearest Airports, Frequencies, or Airspaces page, press the **MENU** Key to display the page menu.
- 2) Turn the large **FMS** Knob to scroll through the menu options.
- 3) Press the **ENT** Key to place the cursor on the desired selection.
- 4) Scroll through the frequency selections with the **FMS** Knob.
- 5) Press the **ENT** Key to load the COM frequency into the standby field of the selected COM radio.
- 6) Press the **Frequency Transfer** Key to transfer the frequency to the COM Active Frequency Field.

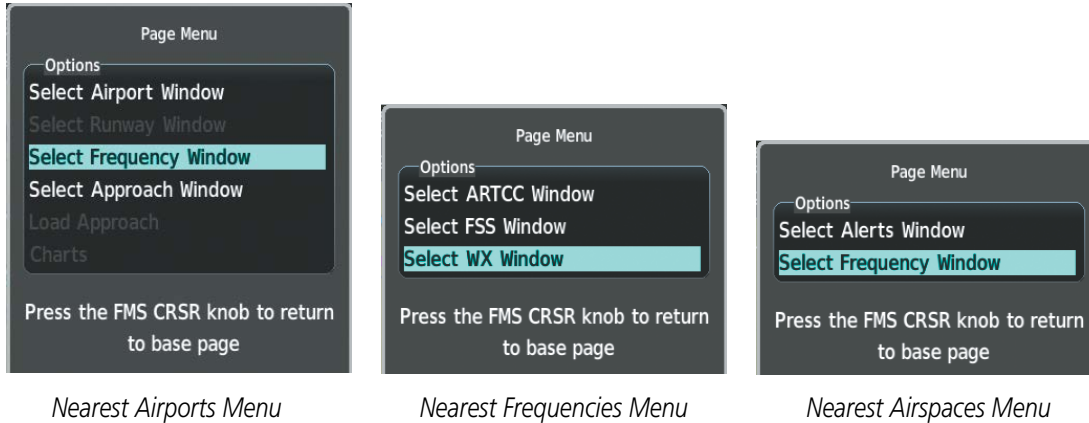


Figure 4-10 Nearest Pages Menus

On the WPT - Airport Information Page, the cursor can be placed on the frequency field by pressing the **FMS** Knob and scrolling through the list. The frequency is transferred to the COM Standby Field with the **ENT** Key.



Selected Airport Identifier and Information

Runway Information

Press **ENT** Key to load frequency into PFD COM Standby Field. Cursor then advances to the next frequency.

Select **INFO** Softkey for AIRPORT, RUNWAYS, and FREQUENCIES Windows

Figure 4-11 WPT – Airport Information Page

COM frequencies can also be auto-tuned from the NRST – Nearest Airspaces, NRST – Nearest Frequencies, and NRST – Nearest Airports Pages on the MFD in a similar manner using the appropriate softkeys or **MENU** Key, the **FMS** Knob, and the **ENT** Key.

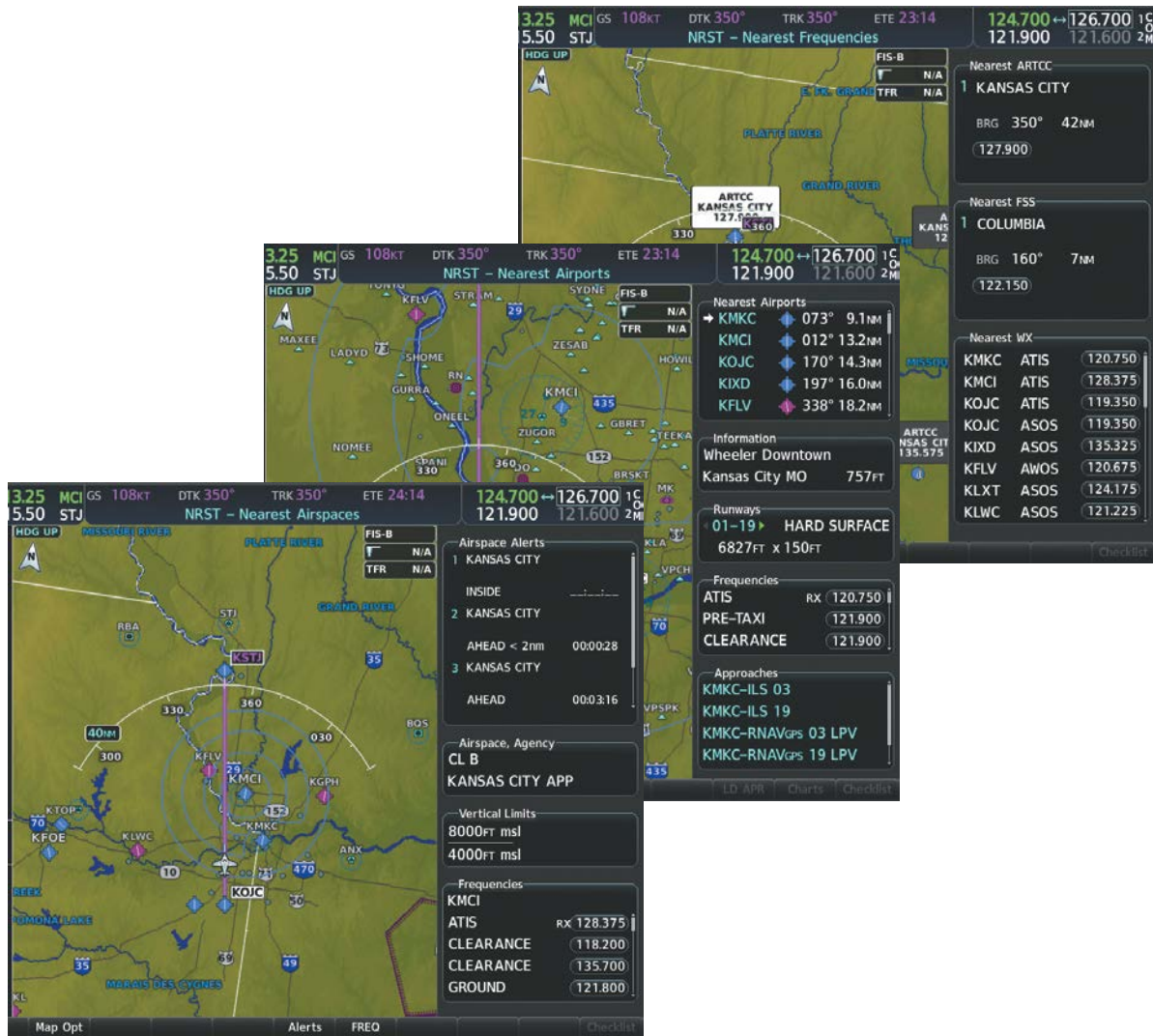


Figure 4-12 NRST – Nearest Airspaces, NRST – Nearest Airports, and NRST – Nearest Frequencies Pages

FREQUENCY SPACING

The G1000 COM radios can tune either 25-kHz spacing (118.000 to 136.975 MHz) or 8.33-kHz spacing (118.000 to 136.990 MHz) for 760-channel or 3040-channel configuration. When 8.33-kHz channel spacing is selected, all of the 25-kHz channel spacing frequencies are also available in the complete 3040-channel list.

COM channel spacing is set on the System Setup Page of the AUX Page Group.

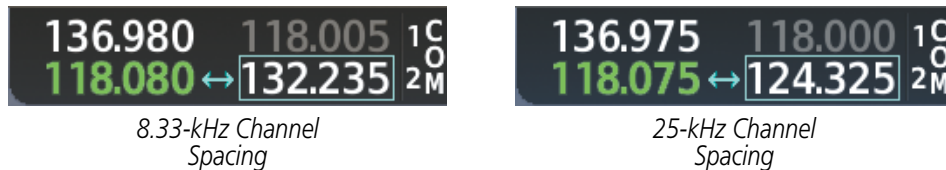


Figure 4-13 COM Channel Spacing

Changing COM frequency channel spacing:

- 1) Select the AUX – System Setup Page.
- 2) Press the **FMS** Knob to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the Channel Spacing Field in the COM Configuration Box.
- 4) Turn the small **FMS** Knob to select the desired channel spacing.
- 5) Press the **ENT** Key to complete the channel spacing selection.

While the COM CONFIG Window is selected, the G1000 softkeys are blank.



Select 8.33-kHz or 25.0-kHz COM Frequency Channel Spacing

Figure 4-14 AUX – System Setup Page

AUTOMATIC SQUELCH

Automatic Squelch quiets unwanted static noise when no audio signal is received, while still providing good sensitivity to weak COM signals. To disable Automatic Squelch, press the **VOL/SQ** Knob. When Automatic Squelch is disabled, COM audio reception is always on. Continuous static noise is heard over the headsets and speaker, if selected. Pressing the **VOL/SQ** Knob again enables Automatic Squelch.

When Automatic Squelch is disabled, a white SQ appears next to the COM frequency.



Figure 4-15 Overriding Automatic Squelch

VOLUME

COM radio volume level can be adjusted from 0 to 100% using the **VOL/SQ** Knob. Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. When adjusting volume, the level is displayed in place of the standby frequencies. Volume level indication remains for two seconds after the change.



Figure 4-16 COM Volume Level

4.3 NAV OPERATION

NAV RADIO SELECTION AND ACTIVATION

The NAV Frequency Box is composed of four fields; two standby fields and two active fields. The active frequencies are on the right side and the standby frequencies are on the left.

A NAV radio is selected for navigation by pressing the **CDI** Softkey located on the PFD. The active NAV frequency selected for navigation is displayed in green. Pressing the **CDI** Softkey once selects NAV1 as the navigation radio. Pressing the **CDI** Softkey a second time selects NAV2 as the navigation radio. Pressing the **CDI** Softkey a third time activates GPS mode. Pressing the **CDI** Softkey again cycles back to NAV1.

While cycling through the **CDI** Softkey selections, the NAV Tuning Box and the Frequency Transfer Arrow are placed in the active NAV Frequency Field and the active NAV frequency color changes to green.

The three navigation modes that can be cycled through are:

- VOR1 (or LOC1) – If NAV1 is selected, a green single line arrow (not shown) labeled either VOR1 or LOC1 is displayed on the HSI and the active NAV1 frequency is displayed in green.
- VOR2 (or LOC2) – If NAV2 is selected, a green double line arrow (shown) labeled either VOR2 or LOC2 is displayed on the HSI and the active NAV2 frequency is displayed in green.
- GPS – If GPS Mode is selected, a magenta single line arrow (not shown) appears on the HSI and neither NAV radio is selected. Both active NAV frequencies are then displayed in white.

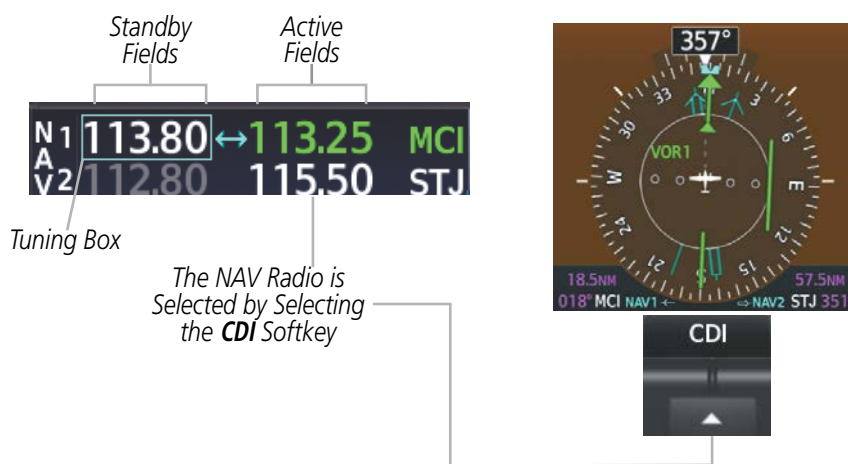


Figure 4-17 Selecting a NAV Radio for Navigation

See the Flight Instruments Section for selecting the DME and Bearing Information windows and using VOR as the source for the bearing pointer.

NAV radios are selected for listening by pressing the corresponding keys on the Audio Panel. Pressing the **NAV1**, **NAV2**, **DME**, or **ADF** Key selects and deselects the navigation radio source. Selected audio can be heard over the headset and the speakers (if selected). All radios can be selected individually or simultaneously.



Figure 4-18 Selecting a NAV Radio Receiver

NAV RECEIVER MANUAL TUNING

The NAV frequency controls and frequency boxes are on the left side of the MFD and PFDs.

Manually tuning a NAV frequency:

- 1) Turn the **NAV** Knob to tune the desired frequency in the NAV Tuning Box.
- 2) Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.
- 3) Adjust the volume level with the NAV **VOL/ID** Knob.
- 4) Press the NAV **VOL/ID** Knob to turn the Morse code identifier audio on and off.

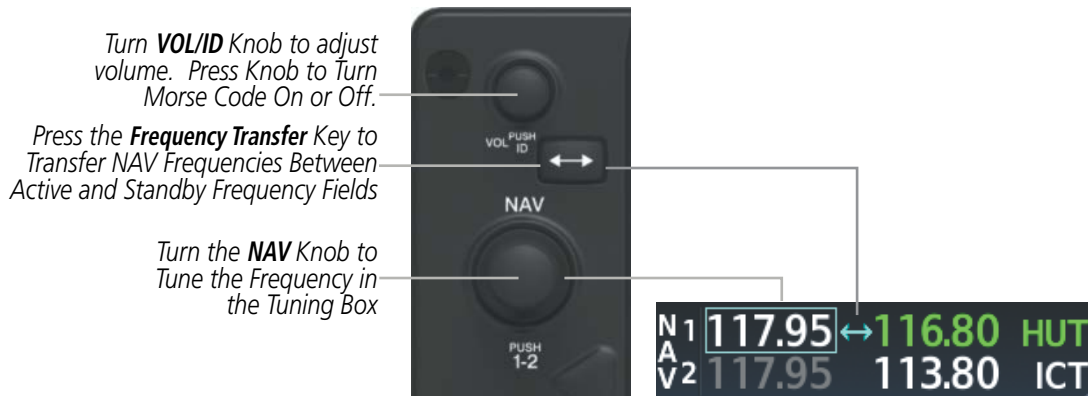


Figure 4-19 NAV Frequency Tuning

SELECTING THE RADIO TO BE TUNED

Press the small **NAV** Knob to transfer the frequency tuning box and Frequency Transfer Arrow between the upper and lower radio frequency fields.

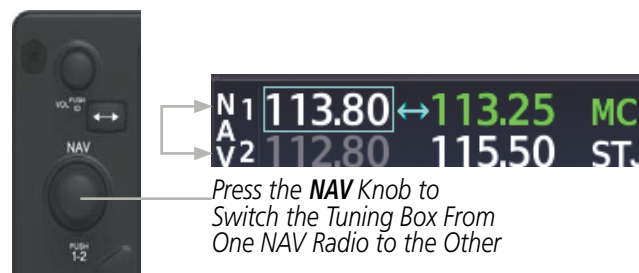


Figure 4-20 Switching NAV Tuning Boxes

VOR/LOC ID

When the Morse code Identifier audio is on for a NAV radio, a white ID appears to the left of the active NAV frequency.

In the example shown, in order to listen to either station identifier, press the **NAV1** or **NAV2** Key on the Audio Panel. Pressing the **VOL/ID** Knob turns off the Morse code audio only in the radio with the NAV Tuning Box. To turn off both NAV IDs, transfer the NAV Tuning Box between NAV1 and NAV2 by pressing the small **NAV** Knob and pressing the **VOL/ID** Knob again to turn the Morse code off in the other radio.



Figure 4-21 NAV Radio ID Indication

VOLUME

NAV Radio volume level can be adjusted from 0 to 100% using the **VOL/ID** Knob. Turning the knob clockwise increases volume, counterclockwise decreases volume.

When adjusting, the level is displayed in place of the standby frequencies. Volume level indication remains for two seconds after the change.



Figure 4-22 NAV Volume Levels

AUTO-TUNING A NAV FREQUENCY FROM THE MFD

NAV frequencies can be selected and loaded from the following MFD pages:

- WPT – Airport Information
- WPT – VOR Information
- NRST – Nearest Airports
- NRST – Nearest VOR
- NRST – Nearest Frequencies (FSS, WX)
- NRST – Nearest Airspaces

The MFD provides auto-tuning of NAV frequencies from waypoint and nearest pages. During enroute navigation, the NAV frequency is entered automatically into the NAV standby frequency field. During approach activation the NAV frequency is entered automatically into the NAV active frequency field.

Frequencies can be automatically loaded into the NAV Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key.

Auto-tuning a NAV frequency from the WPT and NRST Pages:

- 1) From any page that the NAV frequency can be auto-tuned, activate the cursor by pressing the **FMS** Knob or selecting the appropriate softkey.
- 2) Turn the **FMS** Knob to place the cursor on the desired NAV identifier or NAV frequency.
- 3) On the Nearest VOR, Nearest Airspaces, and Nearest Airports pages, select the **FREQ** Softkey to place the cursor on the NAV frequency (Figure 4-25).
- 4) Press the **ENT** Key to load the NAV frequency into the standby field of the selected NAV radio.
- 5) Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.

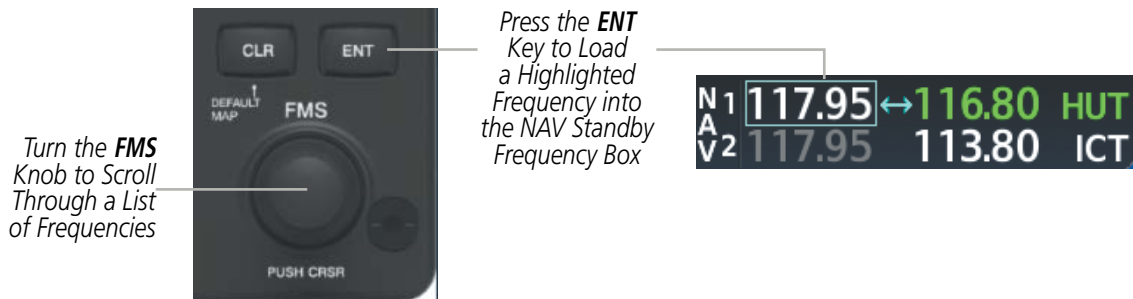


Figure 4-23 NAV Frequency Auto-Tuning from the MFD

Or:

- 1) When on the NRST pages, press the **MENU** Key to display the page menu.
- 2) Turn the large **FMS** Knob to scroll through the menu options.
- 3) Press the **ENT** Key to place the cursor in the desired window.
- 4) Scroll through the frequency selections with the **FMS** Knob.
- 5) Press the **ENT** Key to load the NAV frequency into the standby field of the selected NAV radio.
- 6) Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.

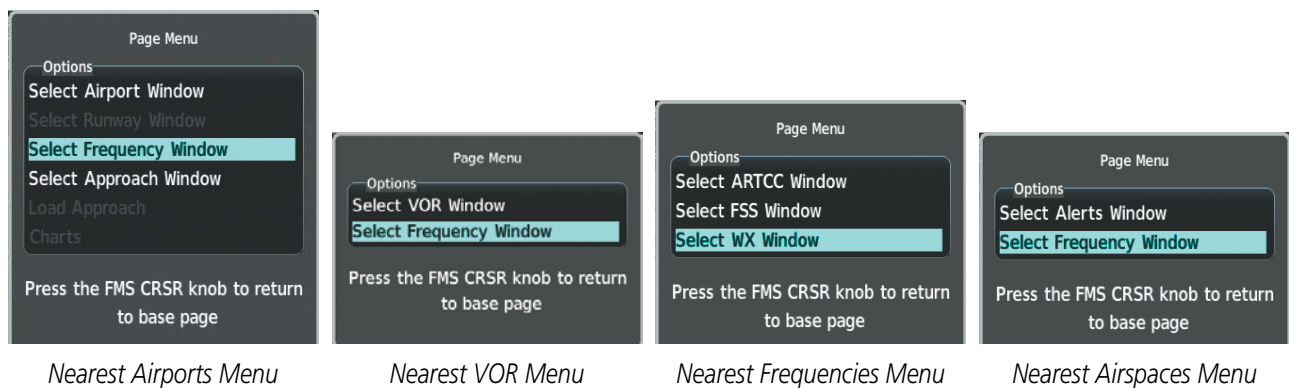


Figure 4-24 Nearest Pages Menus

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

In the example shown, the VOR list is selected with the **VOR** Softkey or from the page menu. The **FMS** Knob or **ENT** Key is used to scroll through the list. The cursor is placed on the frequency with the **FREQ** Softkey and loaded into the NAV Tuning Box with the **ENT** Key.



Press the **ENT** Key to Load the Frequency into the NAV Standby Field.

Select the **VOR** Softkey to Place the Cursor on the VOR Identifier

Select the **FREQ** Softkey to Place the Cursor on the VOR Frequency

Figure 4-25 Loading the NAV Frequency from the NRST – Nearest VOR Page

While enroute, NAV frequencies can also be auto-tuned from the NRST – Nearest Airports, WPT – Airport Information, WPT – VOR Information, and NRST – Nearest Frequencies Pages on the MFD in a similar manner using the appropriate softkeys or **MENU** Key, the **FMS** Knob, and the **ENT** Key.

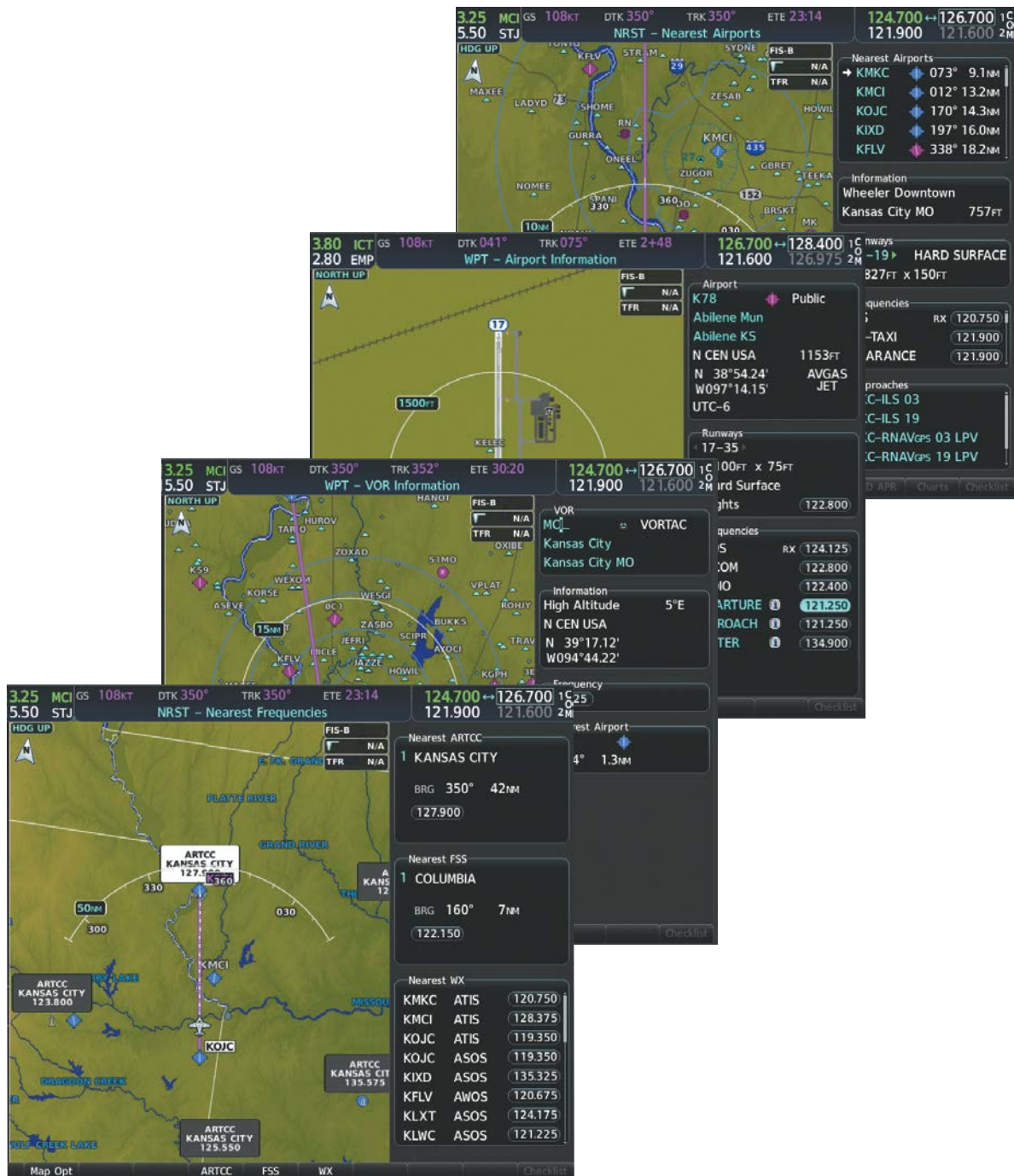




Figure 4-26 NRST – Nearest Frequencies, WPT – VOR Information, WPT – Airport Information, and NRST – Nearest Airports Pages

AUTO-TUNING NAV FREQUENCIES ON APPROACH ACTIVATION

 **NOTE:** The primary NAV frequency is auto-tuned upon loading a VOR or ILS/Localizer approach.


 **NOTE:** When an ILS/LOC approach has been activated in GPS Mode, the system switches to NAV Mode as the final approach course is intercepted (within 15 nm of the FAF). See the Flight Management Section for details.

NAV frequencies are automatically loaded into the NAV Frequency Box on approach activation.

When loading or activating a VOR or ILS/LOC approach, the approach frequency is automatically transferred to a NAV frequency field as follows:

- If the current CDI navigation source is GPS, the approach frequency is transferred to the NAV1 or NAV2 active frequency fields. The frequency that was previously in the NAV1 or NAV2 active frequency fields are transferred to standby.
- If the current CDI navigation source is GPS, and if the approach frequency is already loaded into the NAV1 or NAV2 standby frequency field, the standby frequency is transferred to active.
- If the current CDI navigation source is NAV1 or NAV2, the approach frequency is transferred to the standby frequency fields of the selected CDI NAV radio.

MARKER BEACON RECEIVER

 **NOTE:** The marker beacon indicators operate independently of marker beacon audio and cannot be turned off.

The marker beacon receiver is used as part of the ILS. The marker beacon receiver is always on and detects any marker beacon signals within the reception range of the aircraft.

The receiver detects the three marker tones – outer, middle, and inner – and provides the marker beacon annunciations located to the left of the Altimeter on the PFD.

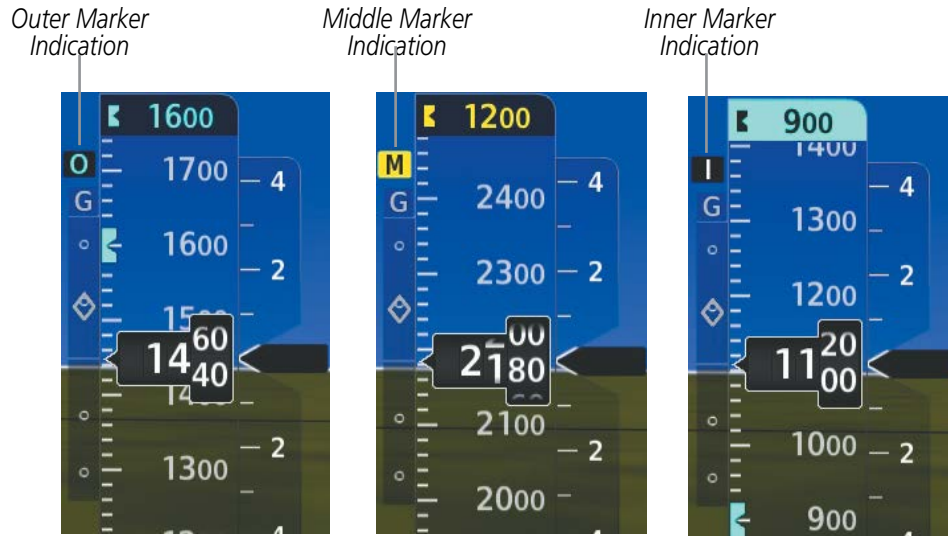


Figure 4-27 Marker Beacon Annunciations on the PFD



Figure 4-28 Marker Beacon Keys

The Audio Panel provides three different states of marker beacon operation; On, Muted, and Deselected. Pressing the **MKR/MUTE** Key selects and deselected marker beacon audio. The key annunciator indicates when marker beacon audio is selected.

During marker beacon audio reception, pressing the **MKR/MUTE** Key mutes the audio but does not affect the marker annunciations. The marker tone is silenced, then waits for the next marker tone. The **MKR/MUTE** Key Annunciator is illuminated, indicating audio muting. The audio returns when the next marker beacon signal is received. If the **MKR/MUTE** Key is pressed during signal reception (O, M, I indication) while marker beacon audio is muted, the audio is deselected and the **MKR/MUTE** Key Annunciator is extinguished.

Pressing the **HI SENS** Key switches between high and low marker beacon receiver sensitivity. The HI SENS function (annunciator illuminated) is used to provide an earlier indication when nearing a marker during an approach. The LO SENS function (annunciator extinguished) results in a narrower marker dwell while over a station.

ADF/DME TUNING

NOTE: When another auxiliary window is turned on, the ADF/DME Tuning Window is replaced on the PFD.

See the Flight Instruments Section for displaying the DME and bearing information windows (ADF) and using the ADF as the source for the bearing pointer.

The G1000 system tunes the ADF receiver (optional) and DME transceiver (optional). The ADF is tuned by entering the frequency in the ADF standby frequency field of the ADF/DME Tuning Window. (The softkey may be labeled **ADF/DME**, **ADF**, or **DME**, depending on installed equipment.)

The UHF DME frequency is tuned by pairing with a VHF NAV frequency. DME frequency pairing is automatic and only the VHF NAV frequency is shown.

The following ADF/DME information is displayed in the ADF/DME Tuning Window:

- Active and standby ADF frequencies
- ADF receiver mode
- ADF receiver volume
- DME tuning mode (DME transceiver pairing)

When the ADF/DME Tuning Window is displayed, the selection cursor is placed over the standby ADF frequency field.

Turning the large **FMS** Knob moves the selection cursor through the various fields (standby ADF frequency, ADF receiver mode, ADF radio volume, and DME tuning mode). Pressing the **FMS** Knob activates/deactivates the selection cursor in the ADF/DME Tuning Window. The ADF frequency is entered using the **FMS** Knob and the **ENT** Key.

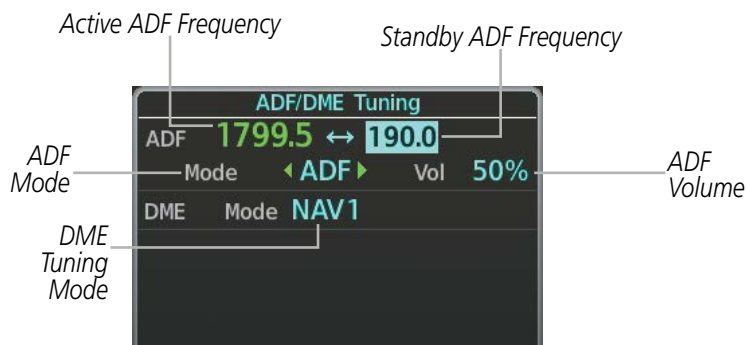


Figure 4-29 ADF/DME Tuning Window

ADF TUNING

ADF frequencies in the 190.0-kHz to 1799.5-kHz range are entered in the standby ADF frequency field of the ADF/DME Tuning Window. The G1000 System does not tune the ADF emergency frequency, 2182.0-kHz.

Tuning an ADF frequency:

- 1) Press the **ADF/DME** Softkey to display the ADF/DME Tuning Window.
- 2) Turn the large **FMS** Knob to place the selection cursor over the standby ADF frequency field.
- 3) Turn the small **FMS** Knob to begin data entry and change each digit.
- 4) Turn the large **FMS** Knob to move the cursor to the next digit position.
- 5) Press the **ENT** Key to complete data entry for the standby frequency.

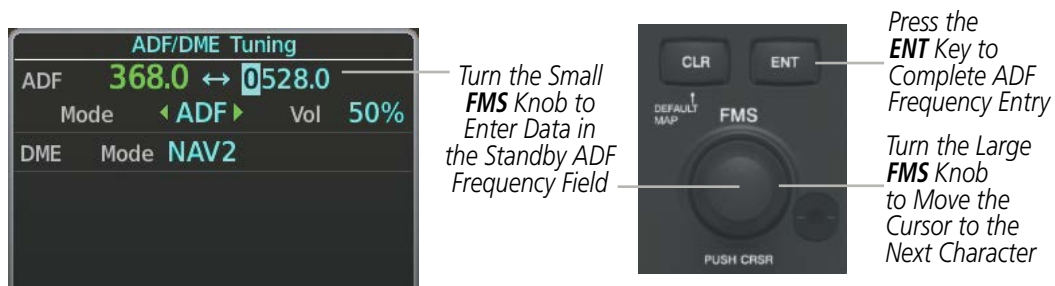


Figure 4-30 Entering ADF Standby Frequencies

Pressing the **CLR** Key before completing frequency entry cancels the frequency change and reverts back to the previously entered frequency.

Pressing the **CLR** Key when the cursor is flashing, clears the frequency and replaces the standby field with 0000.0.

Transferring the active and standby ADF frequencies:

- 1) Turn the large **FMS** Knob to place the selection cursor over the standby ADF frequency field.
- 2) Press the **ENT** Key to complete the frequency transfer.

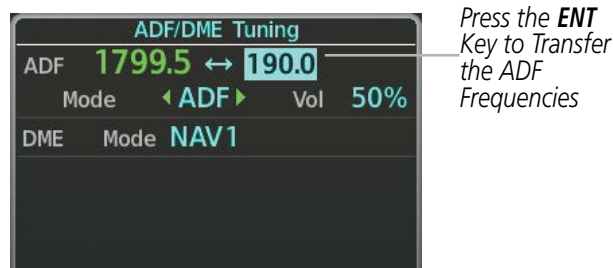


Figure 4-31 Transferring ADF Frequencies

SELECTING ADF RECEIVER MODE

The following modes can be selected: (In all modes NDB audio can be heard by selecting the **ADF** Key on the Audio Panel.)

- ANT (Antenna) – The ADF bearing pointer parks on the HSI at 90 degrees. Best mode for listening to NDB audio.
- ADF (Automatic Direction Finder) – The ADF pointer points to the relative bearing of the NDB station.
- ADF/BFO (ADF/Beat Frequency Oscillator) – The ADF pointer points to the relative bearing of the NDB station and an audible tone confirms signal reception. This mode allows identification of the interrupted carrier beacon stations used in various parts of the world.
- ANT/BFO (Antenna/Beat Frequency Oscillator) – The ADF bearing pointer parks on the HSI at 90 degrees while an audible tone is provided when a signal is received. This mode also allows identification of the interrupted carrier beacon stations and confirms signal reception.

Selecting an ADF receiver mode:

- 1) Turn the large **FMS** Knob to place the selection cursor over the ADF mode field.
- 2) Turn the small **FMS** Knob to select the desired ADF receiver mode.



Figure 4-32 Selecting ADF Receiver Mode

ADF receiver volume level can be adjusted in the tuning window from 0 to 100%. The default volume level is set to 50%. The ADF volume level is the same for both Audio Panels.

Adjusting ADF receiver volume:

- 1) Turn the large **FMS** Knob to place the selection cursor over the ADF volume field.
- 2) Turn the small **FMS** Knob to adjust volume as desired.



Figure 4-33 Adjusting ADF Receiver Volume

DME TUNING



NOTE: When turning on the G1000 for use, the system remembers the last frequency used for DME tuning and the NAV1, NAV2, or HOLD state prior to shutdown.

The DME transceiver is tuned by selecting NAV1, NAV2, or HOLD in the ADF/DME Tuning Window.

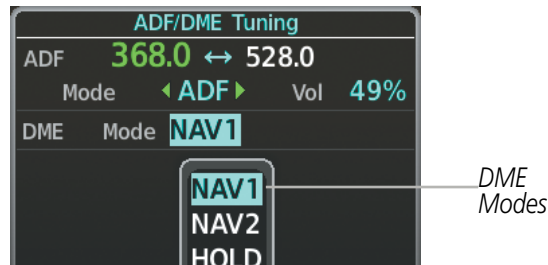


Figure 4-34 ADF/DME Tuning Window, DME Modes

The following DME transceiver pairing can be selected:

- NAV1 – Pairs the DME frequency from the selected NAV1 frequency.
- NAV2 – Pairs the DME frequency from the selected NAV2 frequency.
- HOLD – When in the HOLD position, the DME frequency remains paired with the last selected NAV frequency.

Selecting DME transceiver pairing:

- 1) Press the **ADF/DME** Softkey to display the ADF/DME Tuning Window.
- 2) Turn the small **FMS** Knob to select the DME tuning mode.
- 3) Press the **ENT** Key to complete the selection.

Pressing the **CLR** Key or **FMS** Knob while in the process of DME pairing cancels the data entry and reverts back to the previously selected DME tuning state. Pressing the **FMS** Knob activates/deactivates the cursor in the ADF/DME Tuning Window.

4.4 GTX 335 OR GTX 345 MODE S TRANSPONDER

The GTX 335 and GTX 345 (optional) Mode S Transponders provide Mode A, Mode C, and Mode S interrogation and reply capabilities. Selective addressing or Mode Select (Mode S) capability includes the following features:

- Level-2 reply data link capability (used to exchange information between aircraft and ATC facilities)
- Surveillance identifier capability
- Flight ID (Flight Identification) reporting – The Mode S Transponder reports aircraft identification as either the aircraft registration or a unique Flight ID.
- Altitude reporting
- Airborne status determination
- Transponder capability reporting
- Mode S Enhanced Surveillance (EHS) requirements
- Acquisition squitter – Acquisition squitter, or short squitter, is the transponder 24-bit identification address. The transmission is sent periodically, regardless of the presence of interrogations. The purpose of acquisition squitter is to enable Mode S ground stations and aircraft equipped with a Traffic Avoidance System (TAS) to recognize the presence of Mode S-equipped aircraft for selective interrogation.
- Extended squitter – The extended squitter is transmitted periodically and contains information such as altitude (barometric and GPS), GPS position, and aircraft identification. The purpose of extended squitter is to provide aircraft position and identification to ADS-B Ground-Based Transceivers (GBTs) and other aircraft.

The Hazard Avoidance Section provides more details on traffic avoidance systems.

TRANSPONDER CONTROLS

Transponder function is displayed on three levels of softkeys on the PFD: Top-level, Mode Selection, and Code Selection. When the top-level **XPDR** Softkey is selected, the Mode Selection softkeys appear: **STBY, ON, ALT, VFR, CODE, IDENT, BACK**.

When the **CODE** Softkey is selected, the number softkeys appear: **0, 1, 2, 3, 4, 5, 6, 7, IDENT, BKSP, BACK**. The digits 8 and 9 are not used for code entry. Selecting the numbered softkeys in sequence enters the transponder code. If an error is made, selecting the **BKSP** Softkey moves the code selection cursor to the previous digit. Selecting the **BKSP** Softkey again moves the cursor to the next previous digit.

Selecting the **BACK** Softkey during code selection reverts to the Mode Selection Softkeys. Selecting the **BACK** Softkey during mode selection reverts to the top-level softkeys.

The code can also be entered with the **FMS** Knob on either PFD. Code entry must be completed with either the softkeys or the **FMS** Knob, but not a combination of both.

Selecting the **IDENT** Softkey while in Mode or Code Selection initiates the ident function and reverts to the top-level softkeys.

After 45 seconds of transponder control inactivity, the system reverts back to the top-level softkeys.

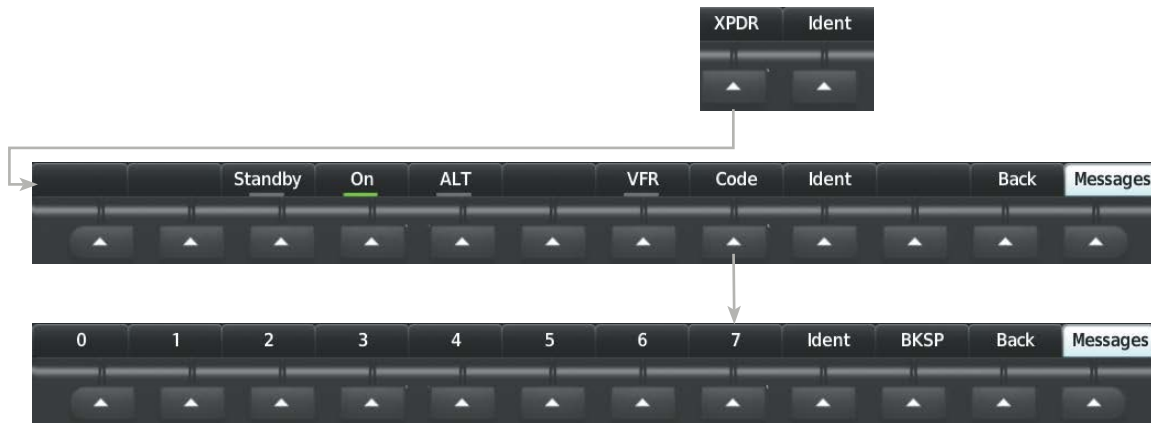


Figure 4-35 XPDR Softkeys (PFD)

TRANSPONDER MODE SELECTION

Mode selection can be automatic (Ground and Altitude Modes) or manual (Standby, ON, and Altitude Modes). The **STBY**, **ON**, and **ALT** Softkeys can be accessed by selecting the **XPDR** Softkey.

Selecting a transponder mode:

- 1) Select the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.
- 2) Select the desired softkey to activate the transponder mode.

STANDBY MODE (MANUAL)

NOTE: In Standby Mode, the IDENT function is inhibited.

Standby Mode can be selected at any time by pressing the **STBY** Softkey. In Standby, the transponder is powered and new codes can be entered, but no replies or squitters are transmitted. When Standby is selected, a white STBY indication and transponder code appear in the mode field of the Transponder Data Box.

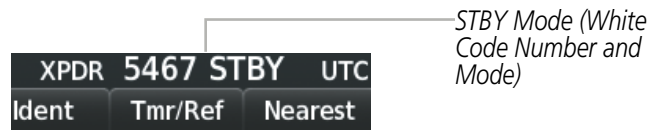


Figure 4-36 Standby Mode

MANUAL ON MODE

ON Mode can be selected at any time by pressing the **ON** Softkey. ON Mode generates Mode A and Mode S replies as well as transmission of acquisition and extended squitters, including ADS-B out. Mode S replies will not include altitude information. Mode C altitude reporting is inhibited.

The ON indication and transponder code in the Transponder Data Box will appear green while airborne and white while on the ground.



Figure 4-37 ON Mode

ALTITUDE MODE (AUTOMATIC OR MANUAL)

The white Altitude Reporting Mode is normally selected automatically when the aircraft is on the ground. White Altitude Mode may also be selected manually by pressing the **ALT** Softkey while on the ground. White Altitude Mode generates Mode S replies to discrete interrogations as well as transmission of acquisition and extended squitters, including ADS-B out. Mode A, Mode C, and Mode S all-call replies are inhibited.

If Altitude Mode is selected while on the ground, a white ALT indication and transponder code appear in the mode field of the Transponder Data Box.

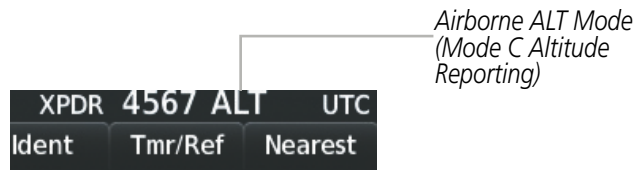


Figure 4-38 Altitude Mode

The green Altitude Mode is automatically selected when the aircraft becomes airborne. Green Altitude Mode may also be selected manually by pressing the **ALT** Softkey while airborne. Green Altitude Mode generates Mode A, Mode C, and Mode S replies as well as transmissions of acquisition and extended squitters including ADS-B out.

If Altitude Mode is selected while airborne, a green ALT indication and transponder code appear in the mode field of the Transponder Data Box, and all transponder replies requesting altitude information are provided with pressure altitude information.

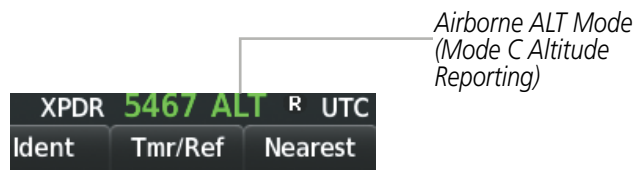


Figure 4-39 Altitude Mode

REPLY STATUS

When the transponder sends replies to interrogations, a white R indication appears momentarily in the reply status field of the Transponder Data Box.



Figure 4-40 Reply Indication

ENTERING A TRANSPONDER CODE

Entering a transponder code with softkeys:

- 1) Select the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.
- 2) Select the **CODE** Softkey to display the Transponder Code Selection Softkeys, for digit entry.
- 3) Select the digit softkeys to enter the code in the code field. When entering the code, the next softkey in sequence must be selected within 10 seconds, or the entry is cancelled and restored to the previous code. Selecting the **BKSP** Softkey moves the code selection cursor to the previous digit. Five seconds after the fourth digit has been entered, the transponder code becomes active.

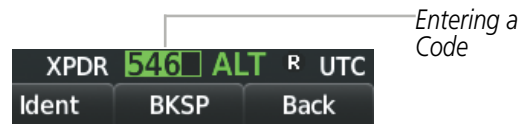


Figure 4-41 Entering a Code

Entering a transponder code with the PFD FMS Knob:

- 1) Select the **XPDR** and the **CODE** Softkeys as in the previous procedure to enable code entry.
- 2) Turn the small **FMS** Knob to enter the first two code digits.
- 3) Turn the large **FMS** Knob to move the cursor to the next code field.
- 4) Enter the last two code digits with the small **FMS** Knob.
- 5) Press the **ENT** Key to complete code digit entry.

Pressing the **CLR** Key or small **FMS** Knob before code entry is complete cancels code entry and restores the previous code. Waiting for 10 seconds after code entry is finished activates the code automatically.



Figure 4-42 Entering a Code with the FMS Knob

VFR CODE

The VFR code can be entered either manually or by pressing the **XPDR** Softkey, then the **VFR** Softkey. When the **VFR** Softkey is pressed, the pre-programmed VFR code is automatically displayed in the code field of the Transponder Data Box. Pressing the **VFR** Softkey again restores the previous identification code.

The pre-programmed VFR Code is set at the factory to 1200. If a VFR code change is required, contact a Garmin-authorized service center for configuration.



Figure 4-43 VFR Code

IDENT FUNCTION

NOTE: In Standby Mode, the **IDENT** Softkey is inoperative.

Selecting the **IDENT** Softkey sends a distinct identity indication to Air Traffic Control (ATC). The indication distinguishes the identifying transponder from all the others on the air traffic controller’s screen. The **IDENT** Softkey appears on all levels of transponder softkeys. When the **IDENT** Softkey is selected, a green IDNT indication is displayed in the mode field of the Transponder Data Box for a duration of 18 seconds.

After the **IDENT** Softkey is selected while in Mode or Code Selection, the system reverts to the top-level softkeys.

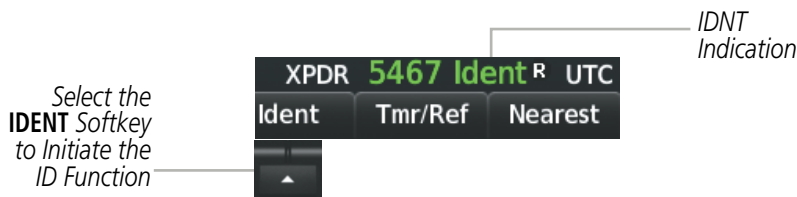


Figure 4-44 IDENT Softkey and Indication

FLIGHT ID REPORTING

NOTE: If the Flight ID is required but the system is not configured for it, contact a Garmin-authorized service center for configuration.

When the Flight ID must be entered before flight operation, the identifier is placed in the Timer/References Window on the PFD. The Flight ID is not to exceed seven characters. No space is needed when entering Flight ID. When a Flight ID contains a space, the system automatically removes it upon completion of Flight ID entry. If configuration is set to “SAME AS TAIL” the aircraft tail number will always be displayed.

Entering a Flight ID:

- 1) Select the **TMR/REF** Softkey to display the Timer/References Window.
- 2) Press the **FMS** Knob to activate the selection cursor, if not already activated.
- 3) Turn the large **FMS** Knob to scroll down to the Flight ID.
- 4) Turn the small **FMS** Knob to enter the desired Flight ID.
- 5) Press the **ENT** Key to complete Flight ID entry. The word "updating" appears until the new entry is completed.

If an error is made during Flight ID entry, pressing the **CLR** Key returns to the original Flight ID entry. While entering a Flight ID, turning the **FMS** Knob counterclockwise moves the cursor back one space for each detent of rotation. If an incorrect Flight ID is discovered after the unit begins operation, reenter the correct Flight ID using the same procedure.

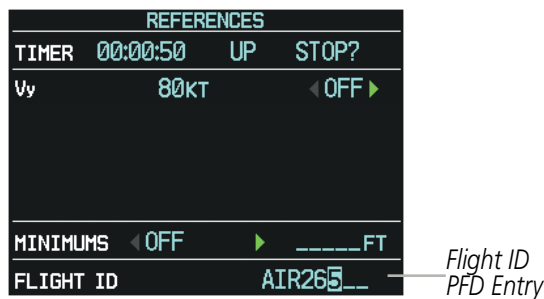


Figure 4-45 Timer/References Window, Entering Flight ID

4.5 ADDITIONAL AUDIO PANEL FUNCTIONS

POWER-UP

The Audio Panel performs a self-test during power-up. During the self-test all Audio Panel annunciator lights illuminate for approximately two seconds. Once the self-test is completed, most of the settings are restored to those in use before the unit was last turned off.

MONO/STEREO HEADSETS

Stereo headsets are recommended for use with the G1000.

Using a monaural headset in a stereo jack shorts the right headset channel output to ground. While this does not damage the Audio Panel, a person listening on a monaural headset hears only the left channel in both ears. If a monaural headset is used at one of the passenger positions, any other passenger using a stereo headset hears audio in the left ear only.

SPEAKER

All of the radios can be heard over the cabin speaker (if installed). Pressing the **SPKR** Key selects and deselects the cabin speaker. Speaker audio is muted when the PTT is pressed. Certain aural alerts and warnings (autopilot, traffic, altitude) are always heard on the speaker, even when the speaker is not selected.

The speaker volume is adjustable within a nominal range. Volume can be adjusted through configuration.



Figure 4-46 Speaker Key

INTERCOM

The Audio Panel includes a four-position intercom system (ICS) and a stereo music input for the pilot, copilot and up to four passengers. The intercom provides Pilot and Copilot isolation from the passengers and aircraft radios.



Figure 4-47 Intercom Controls

PILOT KEY Annunciator	COPLT KEY Annunciator	Pilot Hears	Copilot Hears	Passenger Hears
OFF	OFF	Selected radios, aural alerts, pilot, copilot, passengers, music	Selected radios, aural alerts, pilot, copilot, passengers, music	Selected radios, aural alerts, pilot, copilot, passengers, music
ON	OFF	Selected radios, aural alerts, pilot	Copilot, passengers, music	Copilot, passengers, music
OFF	ON	Selected radios, aural alerts, pilot; passengers, music	Copilot	Selected radios, aural alerts, pilot, passengers, music
ON	ON	Selected radios, aural alerts, pilot, copilot	Selected radios, aural alerts, pilot, copilot	Passengers; music

Table 4-1 ICS Isolation Modes

Pilot isolation is selected when the PILOT Annunciator is illuminated. During Pilot isolation, the pilot can hear the selected radios and aural alerts and warnings. The copilot and passengers can communicate with each other. The copilot is isolated from aural alerts and warnings.

Copilot isolation is selected when the COPLT Annunciator is illuminated. The copilot is isolated from the selected radios, aural alerts and warnings, and everyone else. The pilot and passengers can hear the selected radios, aural alerts, and communicate with each other.

When both the PILOT and COPLT Annunciators are illuminated, the pilot and copilot can hear the selected radios, aural alerts, and communicate with each other. The passengers are isolated from the pilot and copilot but can communicate with each other.

When both the PILOT and COPLT Annunciators are extinguished, everyone hears the selected radios, aural alerts, and is able to communicate with everyone else.

INTERCOM VOLUME AND SQUELCH

The **PILOT/PASS** Knob controls volume or manual squelch adjustment for the pilot and copilot/passenger. The small knob controls the pilot volume and squelch. The large knob controls the copilot/passenger volume and squelch. The VOL and SQ annunciators at the bottom of the unit indicate which function the knob is controlling. Pressing the **PILOT/PASS** Knob switches between volume and squelch control as indicated by the VOL or SQ annunciation being illuminated.

The **MAN SQ** Key allows either automatic or manual control of the squelch setting.

- When the MAN SQ Annunciator is extinguished (Automatic Squelch is on), the **PILOT/PASS** Knob controls only the volume (pressing the **PILOT/PASS** Knob has no effect on the VOL/SQ selection).
- When the MAN SQ Annunciator is illuminated (Manual Squelch), the **PILOT/PASS** Knob controls either volume or squelch (selected by pressing the **PILOT/PASS** Knob and indicated by the VOL or SQ annunciation).

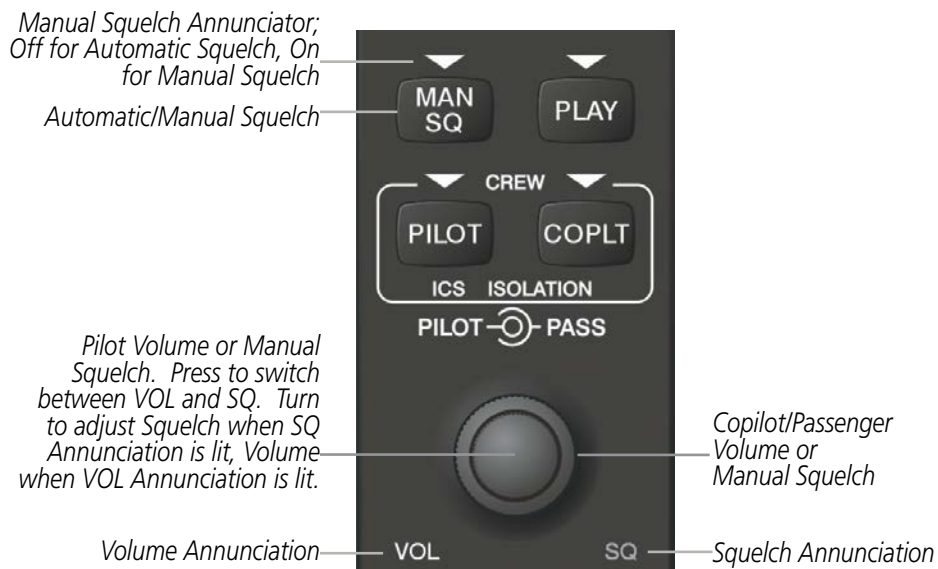


Figure 4-48 Volume/Squelch Control

PASSENGER ADDRESS (PA) SYSTEM

A passenger address system is available for delivering voice messages over the cabin speaker. When the **PA** Key is pressed on the Audio Panel, the COM MIC Annunciator is extinguished, and the active COM frequency changes to white, indicating that there is no COM selected. A Push-to-Talk (PTT) must be pressed to deliver PA announcements. The PA Annunciator flashes about once per second while the PTT is depressed.

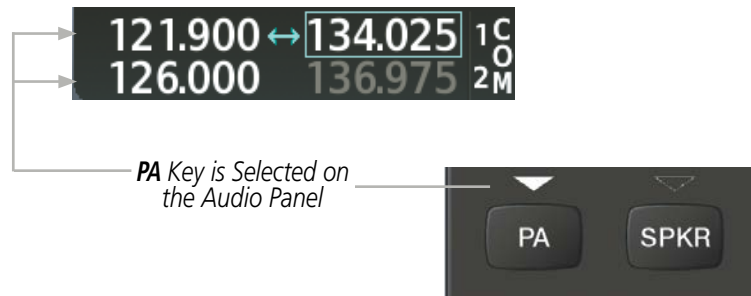


Figure 4-49 PA Key Selected for Cabin Announcements

CLEARANCE RECORDER AND PLAYER

The Audio Panel contains a digital clearance recorder that records up to 2.5 minutes of the selected COM radio signal. Recorded COM audio is stored in separate memory blocks. Once 2.5 minutes of recording time have been reached, the recorder begins recording over the stored memory blocks, starting from the oldest block.

The **PLAY** Key controls the play function. Pressing the **PLAY** Key once plays the latest recorded memory block. The PLAY Annunciator flashes to indicate when play is in progress. The PLAY Annunciator turns off after the present memory block has finished playing.

Pressing the **MKR/MUTE** Key during play of a memory block stops play. If a COM input signal is detected during play of a recorded memory block, play is halted.

Pressing the **PLAY** Key while audio is playing begins playing the previously recorded memory block. Each subsequent press of the **PLAY** Key selects the previously recorded memory block.

Powering off the unit automatically clears all recorded blocks.



Figure 4-50 Play Key

SPLIT COM OPERATION

NOTE: Split COM performance is affected by the distance between the COM antennas and the separation of the tuned frequencies. If the selected COM1 and COM2 frequencies are too close together, interference may be heard during transmission on the other radio.

During Split COM operation, both the pilot and the copilot can transmit simultaneously over separate radios. The pilot can still monitor NAV1, NAV2, ADF, DME, and MKR Audio as selected, but the copilot is only able to monitor COM2.

Pressing the **COM 1/2** Key selects Split COM operation. The COM 1/2 Annunciator is illuminated indicating Split COM operation. COM1 and COM2 frequencies are displayed in green indicating that both transceivers

are active. Split COM operation is cancelled by pressing the **COM 1/2** Key again, at which time the annunciator is extinguished.

When Split COM operation is selected, COM1 is used by the pilot and COM2 is used by the copilot. The COM1 MIC Annunciator flashes when the pilot's microphone PTT is pressed. The COM2 MIC Annunciator flashes when the copilot's microphone PTT is pressed.

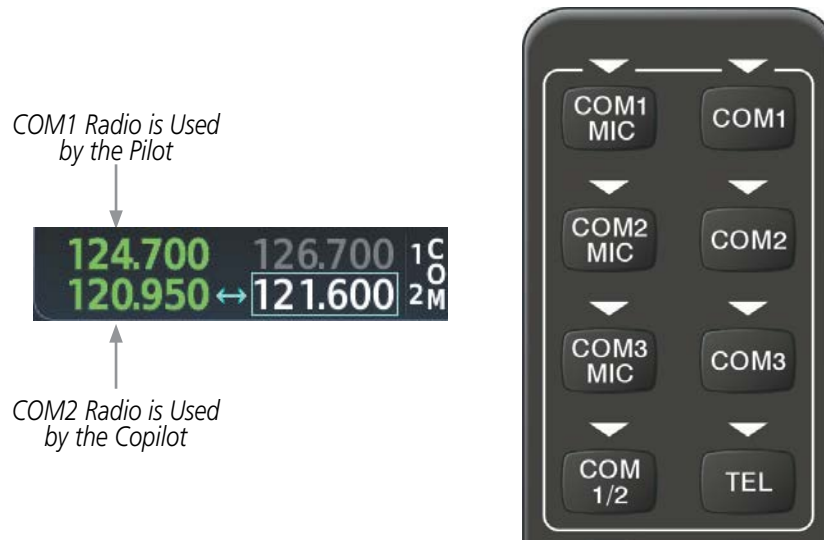


Figure 4-51 Split COM Operation

ENTERTAINMENT INPUTS



NOTE: *Music1 and Music2 audio cannot be completely turned off. Audio level for the crew and passengers can be adjusted by a Garmin-authorized service center.*

The Audio Panel provides two stereo auxiliary entertainment inputs: Music1 and Music2. The pilot and copilot hear Music1 and the passengers hear Music2. These inputs are compatible with popular portable entertainment devices such as MP3 and CD players. Two 3.5-mm stereo phone jacks can be installed in convenient locations for audio connection. The headphone outputs of the entertainment devices are plugged into the Music1 or Music2 jacks.

The current ICS state of isolation affects the distribution of the entertainment input (see Table 4-1).

CREW MUSIC

Crew music (Music1) can be heard by the pilot and copilot when both the PILOT and the COPLT ICS Annunciators are extinguished. Crew music can also be heard by the pilot when the COPLT Annunciator is illuminated and by the copilot when the PILOT Annunciator is illuminated.

MUSIC MUTING

Crew music muting occurs when aircraft radio or marker beacon activity is heard. Crew music is always soft muted when an interruption occurs from these sources. Soft muting is the gradual return of music to its original volume level. The time required for music volume to return to normal is between one-half and four seconds.

MUSIC MUTING ENABLE/DISABLE

Pressing and holding the **MKR/MUTE** Key for three seconds switches crew music muting on and off. When switching, either one or two beeps are heard; one beep indicates that music muting is enabled, two beeps indicate music muting is disabled. Crew music muting is reset (enabled) during power up.

PASSENGER MUSIC

Passenger music (Music2) can be heard only by the passengers and is never muted.

4.6 AUDIO PANEL PREFLIGHT PROCEDURE

NOTE: If the pilot and/or copilot are using headsets that have a high/low switch or volume control knob, verify that the switch is in the high position and the volume control on the headsets are at maximum volume setting. On single-pilot flights, verify that all other headsets are not connected to avoid excess noise in the audio system.

NOTE: When the MAN SQ is activated, the ICS squelch can be set manually by the pilot and copilot. If manual squelch is set to full open (SQ annunciated and the knobs turned counterclockwise) background noise is heard in the ICS system as well as during COM transmissions.

After powering up the G1000 System, the following steps aid in maximizing the use of the Audio Panel as well as prevent pilot and copilot induced issues. These preflight procedures should be performed each time a pilot boards the aircraft to insure awareness of all audio levels in the Audio Panel and radios.

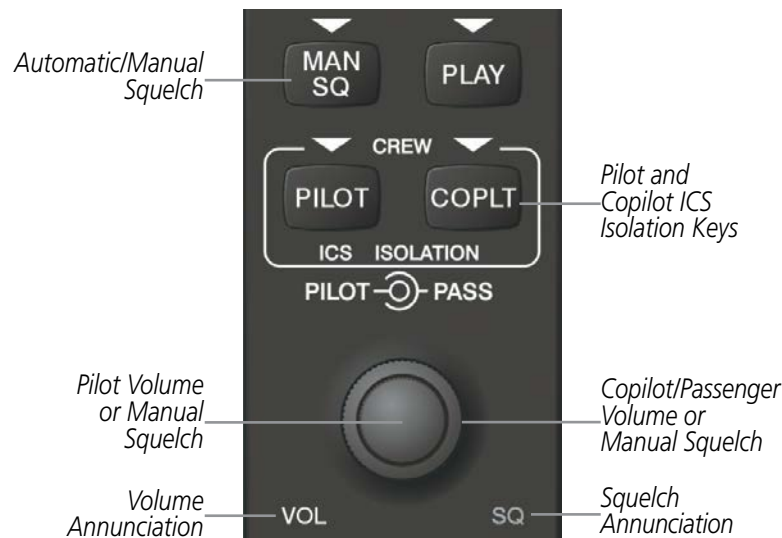


Figure 4-52 Audio Panel Controls

Setting the Audio Panel during preflight:

- 1) Verify that the PILOT and COPLT Annunciators are extinguished.
- 2) Verify that manual squelch is set to full open.
- 3) Turn the **PILOT** Knob and **COPILOT** Knob fully clockwise. This will set the headset intercom audio level to max volume (least amount of attenuation).
- 4) Adjust radio volume levels (COM, NAV, etc.) to a suitable level.
- 5) Adjust the **PILOT** Knob and **COPILOT** Knob volume to the desired intercom level.
- 6) Reset squelch to automatic, or adjust to the appropriate level manually.

Once this procedure has been completed, the pilot and copilot can change settings, keeping in mind the notes above.

4.7 ABNORMAL OPERATION

Abnormal operation of the G1000 includes equipment failures of the G1000 components and failure of associated equipment, including switches and external devices.

STUCK MICROPHONE

If the push-to-talk (PTT) Key becomes stuck, the COM transmitter stops transmitting after 35 seconds of continuous operation. An alert appears on the PFD to advise the crew of a stuck microphone.

The **COM1 MIC** or **COM2 MIC** Key Annunciator on the Audio Panel flashes as long as the PTT Key remains stuck.

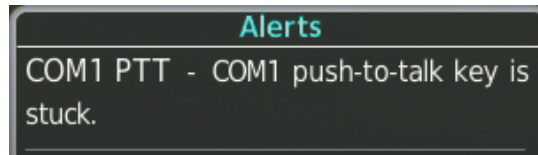


Figure 4-53 Stuck Microphone Alert

COM TUNING FAILURE

In case of a COM system tuning failure, the emergency frequency (121.500 MHz) is automatically tuned in the radio in which the tuning failure occurred. Depending on the failure mode, a red X may appear on the frequency display.



Figure 4-54 COM Tuning Failure

AUDIO PANEL FAIL-SAFE OPERATION

If there is a failure of the Audio Panel, a fail-safe circuit connects the pilot's headset and microphone directly to the COM1 transceiver. Audio will not be available on the speaker.

PFD FAILURE (REVERSIONARY MODE)

The red **DISPLAY BACKUP** Button selects the Reversionary Mode. See the System Overview Section for more information on Reversionary Mode.



Figure 4-55 Display Backup Button

SYSTEM
OVERVIEW

FLIGHT
INSTRUMENTS

EIS

AUDIO PANEL
& CNS

FLIGHT
MANAGEMENT

HAZARD
AVOIDANCE

AFCS

ADDITIONAL
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APPENDICES

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SECTION 5 FLIGHT MANAGEMENT

5.1 INTRODUCTION

The system is an integrated flight, engine, communication, navigation and surveillance system. This section of the Pilot's Guide explains flight management using the system.

The most prominent part of the system are the two full color displays: one Primary Flight Display (PFD) and a Multi Function Display (MFD). The information to successfully navigate the aircraft using the GPS sensors is displayed on the PFD and the MFD. A brief description of the GPS navigation data on the PFD follows.

Navigation mode indicates which sensor is providing the course data (e.g., GPS, VOR) and the flight plan phase (e.g., Departure (DPRT), Terminal (TERM), Enroute (ENR), Oceanic (OCN), RNAV Approach (LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV), or Missed Approach (MAPR)). L/VNAV, LP, LP+V, and LPV approach service levels are only available with SBAS.

The Inset Map is a small version of the Navigation Map and can be displayed in the lower left corner of the PFD. When the system is in reversionary mode, the Inset Map is displayed in the lower right corner. The Inset Map is displayed by pressing the **Map/HSI** Softkey, pressing the **Layout** Softkey, then pressing the **Inset Map** Softkey. Pressing the **Map Off** Softkey removes the Inset Map. The HSI Map is also a small version of the Navigation Map and is displayed in the center of the HSI. The Inset Map and the HSI Map may both be referred to as the PFD Map.

The Navigation Map displays aviation data (e.g., airports, VORs, airways, airspaces), geographic data (e.g., cities, lakes, highways, borders), topographic data (map shading indicating elevation), and hazard data (e.g., traffic, terrain, weather). The amount of displayed data for the PFD Map can be reduced by pressing the **Map/HSI** Softkey on the PFD, then pressing the **Detail** Softkey. The amount of displayed data for the Navigation Map can be reduced by pressing the **Detail** Softkey on the MFD. The Navigation Map can be oriented three different ways: North Up (NORTH UP), Track Up (TRK UP), or Heading Up (HDG UP).

An aircraft icon is placed on the Navigation Map at the location corresponding to the calculated present position. The aircraft position and the flight plan legs are accurately based on GPS calculations. The basemap upon which these are placed are from a source with less resolution, therefore the relative position of the aircraft to map features is not exact. The leg of the active flight plan currently being flown is shown as a magenta line on the navigation map. The other legs are shown in white.

There are 28 different map ranges available, from 250 feet to 1000 nm. The current range is indicated in the upper left corner of the map and represents the top-to-bottom distance covered by the map. To change the map range on any map, turn the **Joystick** counter-clockwise to zoom in (-, decreasing), or clockwise to zoom out (+, increasing).

The Direct-to Window, the Flight Plan Window, the Procedures Window, and the Nearest Airports Window can be displayed in the lower right corner of the PFD. Details of these windows are discussed in detail later in the section.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX



Figure 5-1 GPS Navigation Information on the PFD Inset Map



Figure 5-2 GPS Navigation Information on the PFD HSI Map



Figure 5-3 GPS Navigation Information on the MFD Navigation Page

NAVIGATION STATUS BOX AND DATA BAR

The Navigation Status Box located at the top of the PFD contains two fields displaying the following information:



Figure 5-4 PFD Navigation Status Box

- Active flight plan leg (e.g., ‘D-> KICT’ or ‘KIXD -> KCOS’) **or** flight plan annunciations (e.g., ‘Turn right to 021° in 8 seconds’)
- Distance (DIS) and Bearing (BRG) to the next waypoint **or** flight plan annunciations (e.g., ‘TOD within 1 minute’)

The symbols used in the PFD Status Box are:

Symbol	Description	Symbol	Description
	Active Leg		Left Holding Pattern
	Direct-to		Vector to Final
	Right Procedure Turn		Right DME Arc/Radius to Fix Leg
	Left Procedure Turn		Left DME Arc/Radius to Fix Leg
	Right Holding Pattern		

Table 5-1 PFD Status Box Symbols

The Navigation Data Bar located at the top of the MFD contains four data fields, each displaying one of the following items:

BRG	Bearing	FOB	Fuel on Board
DEST	Destination Airport Identifier	FOD	Fuel over Destination
DIS	Distance	GS	Ground Speed
DTG	Distance to Go	ISA	Temperature at Standard Pressure
DTK	Desired Track	LDG	ETA at Final Destination
END	Endurance	MSA	Minimum Safe Altitude
ENR	ETE to Final Destination	TAS	True Airspeed
ESA	Enroute Safe Altitude	TKE	Track Angle Error
ETA	Estimated Time of Arrival	TRK	Track
ETE	Estimated Time Enroute	VSR	Vertical Speed Required
FLT	Flight Timer	XTK	Cross-Track Error

Table 5-2 MFD Data Bar Field Items



Figure 5-5 MFD Navigation Data Bar

The navigation information displayed in the four data fields can be selected on the ‘MFD Data Bar Fields’ Box on the ‘Aux-System **Setup 1**’ Page. The default selections (in order left to right) are GS, DTK, TRK, and ETE.

Changing a field in the MFD Navigation Data Bar:

- 1) Select the ‘Aux - System Setup 1’ Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the desired field number in the ‘MFD Data Bar Fields’ Box.
- 4) Turn the small **FMS** Knob to display and scroll through the data options list to select the desired data.
- 5) Press the **ENT** Key. Pressing the **Defaults** Softkey returns all fields to the default setting.

5.2 USING MAP DISPLAYS

Map displays are used extensively in the system to provide situational awareness in flight. Most system maps can display the following information:

- Airports, NAVAIDs, airspaces, airways, land data (highways, cities, lakes, rivers, borders, etc.) with names
- Map range
- Wind direction and speed
- Map orientation
- Icons for enabled map features
- Aircraft icon (representing present position)
- Obstacle data
- Topography scale
- Map Pointer information (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Fuel range ring
- Flight plan legs
- User waypoints
- Track vector
- Terrain
- Topography data

The information in this section applies to the following maps unless otherwise noted:

- | | |
|----------------------------------|---------------------------|
| All Map Group Pages ('Map') | Flight Plan Pages ('FPL') |
| All Waypoint Group Pages ('WPT') | Direct-to Window |
| Trip Planning Page ('Aux') | PFD Maps |
| All Nearest Group Pages ('NRST') | Procedure Loading Pages |

MAP ORIENTATION

Maps are shown in one of three different orientation options, allowing flexibility in determining aircraft position relative to other items on the map (north up) or for determining where map items are relative to where the aircraft is going (track up or heading up). The map orientation is shown in the upper left corner of the map.



Figure 5-6 Map Orientation

- North up (North up) aligns the top of the map display to north (default setting).
- Track up (Track up) aligns the top of the map display to the current ground track.
- Heading up (HDG up) aligns the top of the map display to the current aircraft heading.

NOTE: When panning or reviewing active flight plan legs in a non-North Up orientation, the map does not show the map orientation nor the wind direction and speed.

NOTE: Map orientation can only be changed on the Navigation Map Page. Any other displays that show navigation data reflect the orientation selected for the Navigation Map Page.

Changing the Navigation Map orientation:

- 1) With the 'Map - Navigation Map' Page displayed, press the **MENU** Key. The cursor flashes on the 'Map Settings' option.

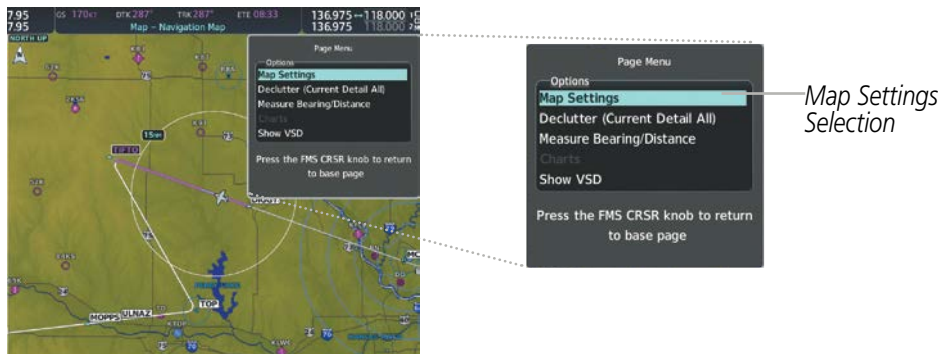


Figure 5-7 Navigation Map Page Menu Window

- 2) Press the **ENT** Key to display the 'Map Settings' Window.
- 3) Turn the large **FMS** Knob, or press the **ENT** Key once, to select the 'Orientation' field.



Figure 5-8 Map Settings Menu Window - Map Group

- 4) Turn the small **FMS** Knob to select the desired orientation.
- 5) Press the **ENT** Key to select the new orientation.
- 6) Press the **FMS** Knob to return to the base page.

The map can be configured to switch automatically to a north up orientation when the map range reaches a minimum range.

Enabling/disabling Auto North Up and selecting the minimum switching range:

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Select the 'Map' group.
- 4) Press the **ENT** Key.
- 5) Highlight the 'North Up Above' field.
- 6) Select 'On' or 'Off' using the small **FMS** Knob.
- 7) Press the **ENT** Key to accept the selected option. The flashing cursor highlights the range field.
- 8) Use the small **FMS** Knob to select the desired range.
- 9) Press the **ENT** Key to accept the selected option.
- 10) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

MAP RANGE

There are 28 different map ranges available, from 250 feet to 1000 nm. The current range is indicated in the upper left corner of the map and represents the top-to-bottom distance covered by the map. When the map range is decreased to a point that exceeds the capability of the system to accurately represent the map, a magnifying glass icon is shown to the left of the map range. To change the map range turn the **Joystick** counter-clockwise to decrease the range, or clockwise to increase the range.



Figure 5-9 Map Range

AUTO ZOOM

Auto zoom allows the system to change the map display range to the smallest range clearly showing the active waypoint. Auto zoom can be overridden by adjusting the range with the Joystick, and remains until the active waypoint changes, a terrain or traffic alert occurs, the aircraft takes off, or the manual override times out (timer set on 'Map Settings' Window). Auto zoom is suspended while the map pointer is active.

If a terrain caution or warning occurs, all navigation maps automatically adjust to the smallest map range clearly showing the potential impact areas. If a new traffic advisory alert occurs, any map page capable of displaying traffic advisory alerts automatically adjusts to the smallest map range clearly showing the traffic advisory. When terrain or traffic alerts clear, the map returns to the previous auto zoom range based on the active waypoint.

The auto zoom function can be turned on or off independently for the PFD and MFD. Control of the ranges at which the auto zoom occurs is done by setting the minimum and maximum 'look forward' times (set on the 'Map Settings' Window for the 'Map' Group). These settings determine the minimum and maximum distance to display based upon the aircraft's ground speed.

- Waypoints that are long distances apart cause the map range to increase to a point where many details on the map are decluttered. If this is not acceptable, lower the maximum look ahead time to a value that limits the auto zoom to an acceptable range.
- Waypoints that are very short distances apart cause the map range to decrease to a point where situational awareness may not be what is desired. Increase the minimum look ahead time to a value that limits the auto zoom to a minimum range that provides acceptable situational awareness.
- Flight plans that have a combination of long and short legs cause the range to increase and decrease as waypoints sequence. To avoid this, auto zoom can be disabled or the maximum/minimum times can be adjusted.
- The 'time out' time (configurable on the 'Map Settings' Window for the Map Group) determines how long auto zoom is overridden by a manual adjustment of the range knob. At the expiration of this time, the auto zoom range is restored. Setting the 'time out' value to zero causes the manual override to never time out.
- When the maximum 'look forward' time is set to zero, the upper limit becomes the maximum range available (1000 nm).
- When the minimum 'look forward' time is set to zero, the lower limit becomes 1.5 nm.

Configuring automatic zoom:

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Select the 'Map' Group.
- 4) Press the **ENT** Key.
- 5) Highlight the 'Auto Zoom' on/off field, and select 'Off' or 'On' using the small **FMS** Knob.
- 6) Press the **ENT** Key to accept the selected option. The flashing cursor highlights the 'Auto Zoom' display selection field.
- 7) Select 'MFD', 'PFD', or 'All' using the small **FMS** Knob.
- 8) Press the **ENT** Key to accept the selected option. The flashing cursor highlights the 'Max Look FWD' Field. Times are from zero to 999 minutes.

- 9) Use the **FMS** Knobs to set the time. Press the **ENT** Key.
- 10) Repeat step 9 for 'Min Look FWD' (zero to 99 minutes) and 'Time Out' (zero to 99 minutes).
- 11) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

MAP PANNING

Map panning allows the pilot to:

- View parts of the map outside the displayed range without adjusting the map range
- Highlight and select locations on the map
- Review information for a selected airport, NAVAID or user waypoint
- Designate locations for use in flight planning
- View airspace and airway information

When the panning function is selected by pushing the **Joystick**, the Map Pointer flashes on the map display. A window also appears at the top of the map display showing the latitude/longitude position of the pointer, the bearing and distance to the pointer from the aircraft's present position, and the elevation of the land at the position of the pointer.

Panning the map:

- 1) Push the **Joystick** to display the Map Pointer.
- 2) Move the **Joystick** to move the Map Pointer around the map.
- 3) Push the **Joystick** to remove the Map Pointer and recenter the map on the aircraft's current position.



NOTE: The map is normally centered on the aircraft's position. If the map has been panned and there has been no pointer movement for about 60 seconds, the map reverts back to centered on the aircraft position and the flashing pointer is removed.



Figure 5-10 Navigation Map - Map Pointer Activated

When the Map Pointer is placed on an object, the name of the object is highlighted (even if the name was not originally displayed on the map). When any map feature or object is selected on the map display, pertinent information is displayed.



Figure 5-11 Navigation Map - Map Pointer on Point of Interest

Reviewing information for an airport, NAVAID, or user waypoint:

- 1) With the desired map page displayed, push the **Joystick** to display the Map Pointer and place the Map Pointer on a waypoint.
- 2) Press the **ENT** Key to display the 'WPT - Waypoint Information' Page for the selected waypoint.
- 3) Press the **Go Back** Softkey, the **CLR** Key, or the **ENT** Key to exit the 'WPT - Waypoint Information' Page and return to the Navigation Map showing the selected waypoint.

When the Map Pointer crosses an airspace boundary, the boundary is highlighted and airspace information is shown. The information includes the name and class of airspace, the ceiling in feet above Mean Sea Level (MSL), and the floor in feet MSL.

Reviewing information for a special-use or controlled airspace:

- 1) With the desired map page displayed, push the **Joystick** to display the Map Pointer and place the Map Pointer on an open area within the boundaries of an airspace. (As the Map Pointer crosses the airspace boundary, the boundary is highlighted and airspace information is shown.)
- 2) Press the **ENT** Key to display an options menu.
- 3) 'Review Airspaces' should already be highlighted, if not select it. Press the **ENT** Key to display the 'Information' Window for the selected airspace.
- 4) Press the **FMS** Knob, the **CLR** Key, or the **ENT** Key to exit the 'Information' Window.

MEASURING BEARING AND DISTANCE

Distance and bearing from the aircraft's present position to any point on the viewable navigation map may be calculated using the 'Measure Bearing and Distance' selection from Navigation Map page menu. The bearing and distance tool displays a dashed Measurement Line and a Measure Pointer to aid in graphically identifying points with which to measure. Lat/Long, distance and elevation data for the Measure Pointer is provided in a window at the top of the navigation map.

Measuring bearing and distance between any two points:

- 1) Press the **MENU** Key (with the 'Map - Navigation Map' Page displayed).
- 2) Highlight the 'Measure Bearing/Distance' field.
- 3) Press the **ENT** Key. A Measure Pointer is displayed on the map at the aircraft's present position.
- 4) Move the **Joystick** to place the reference pointer at the desired location. The bearing and distance are displayed at the top of the map. Elevation at the current pointer position is also displayed. Pressing the **ENT** Key changes the starting point for measuring.
- 5) To exit the Measure Bearing/Distance option, push the **Joystick**; or select 'Stop Measuring' from the 'Page Menu' and press the **ENT** Key.



Figure 5-12 Navigation Map - Measuring Bearing and Distance

TOPOGRAPHY

All navigation maps can display various shades of topography colors representing land elevation, similar to aviation sectional charts. Topographic data can be displayed or removed as described in the following procedures. Topographic data can also be displayed on the selectable VSD Inset at the bottom of the Navigation Map Page.

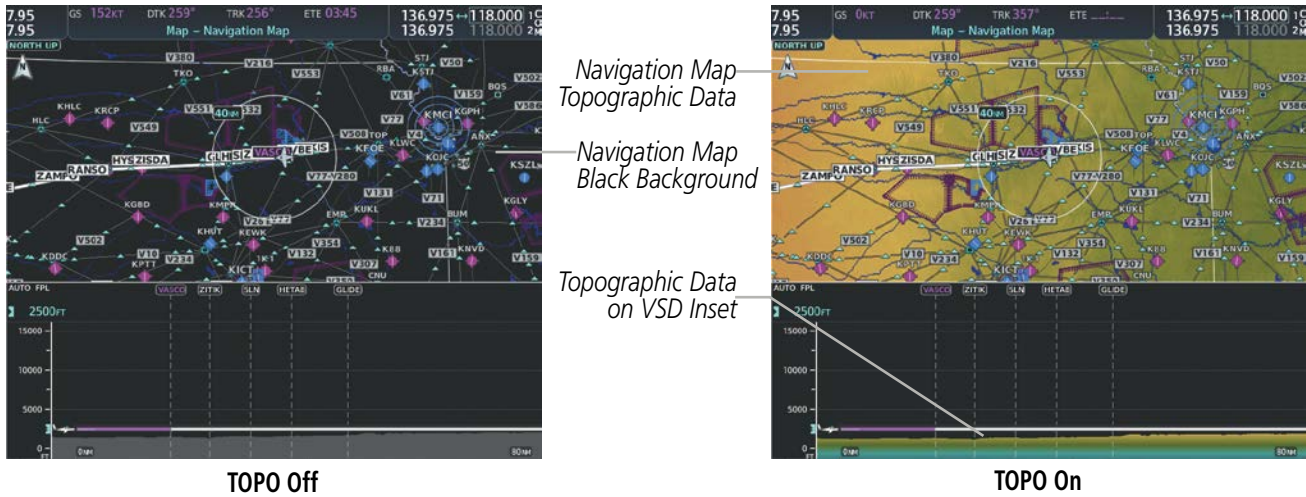


Figure 5-13 Navigation Map - Topographic Data

Displaying/removing topographic data on all MFD pages displaying navigation maps:

- 1) Press the **Map Opt** Softkey.
- 2) Press the **TER** Softkey until 'Topo' is shown on the softkey to display topographic data.
- 3) Press the **TER** Softkey until 'Off' is shown on the softkey to remove topographic data from the navigation map. When topographic data is removed from the page, all navigation data is presented on a black background.

Displaying/removing topographic data on the PFD Map:

- 1) Press the **Map/HSI** Softkey .
- 2) Press the **Topo** Softkey.
- 3) Press the **Topo** Softkey again to remove topographic data from the PFD Map. When topographic data is removed from the PFD Map, all navigation data is presented on a black background.

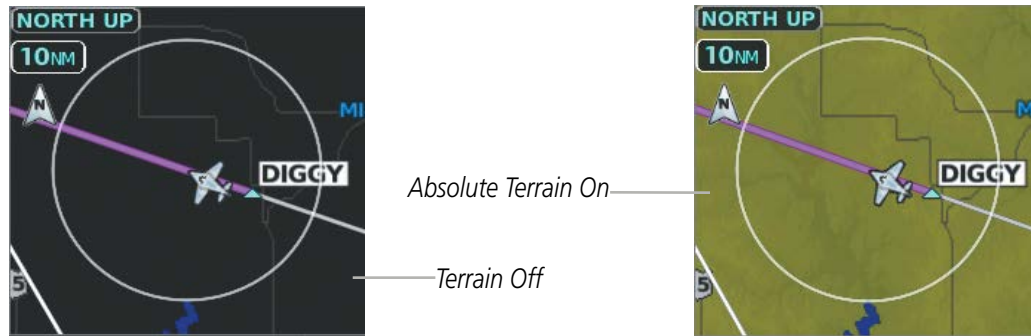


Figure 5-14 PFD Inset Map - Terrain Data

Displaying/removing topographic data using the Navigation Map Page Menu:

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Select the 'Map' Group.
- 4) Press the **ENT** Key.
- 5) Highlight the 'Terrain Display' Field.
- 6) Select 'Topo' or 'Off'.
- 7) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The topographic data range is the maximum map range on which topographic data is displayed.



NOTE: Since the PFD Map is much smaller than the MFD navigation maps, items are removed on the PFD Map two range levels smaller than the range selected in the Map Settings pages (e.g., a setting of 100 nm removes the item at ranges above 100 nm on MFD navigation maps, while the PFD Map removes the same item at 50 nm).

Selecting a topographical data range (Terrain Display):

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Select the 'Map' Group.
- 4) Press the **ENT** Key.
- 5) Highlight the 'Terrain Display' range field. Ranges are from 1 nm to 1000 nm.
- 6) To change the Terrain Display range setting, turn the small **FMS** Knob to display the range list.
- 7) Select the desired range using the small **FMS** Knob.
- 8) Press the **ENT** Key.
- 9) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

In addition, the Navigation Map can display a topographic scale (located in the lower right hand side of the map) showing a scale of the terrain elevation and minimum/maximum displayed elevations.

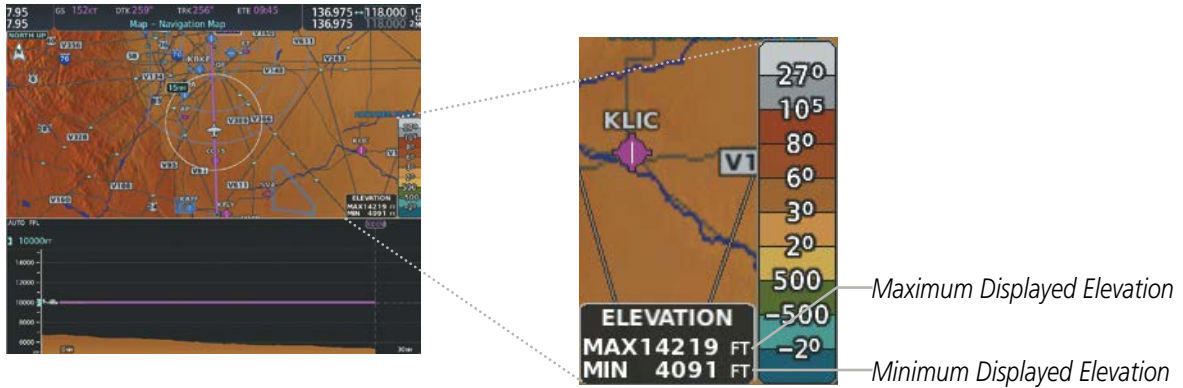


Figure 5-15 Navigation Map - TOPO SCALE

Displaying/removing the topographic scale (Topo Scale):

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Select the 'Map' Group and select the **ENT** Key.
- 4) Highlight the 'Topo Scale' field.
- 5) Select 'On' or 'Off'.
- 6) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

MAP SYMBOLS

This section discusses the types of land and aviation symbols that can be displayed. Each listed type of symbol can be turned on or off, and the maximum range to display each symbol can be set. The decluttering of the symbols from the map using the **Detail** Softkey is also discussed.

LAND SYMBOLS

The following items are configured on the land menu:

Land Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
User Waypoint		25	40
Highways and Roads			
Interstate Highway (Freeway)		50	400
International Highway (Freeway)		50	400
US Highway (National Highway)		15	150
State Highway (Local Highway)		2.5	100







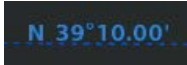
Land Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Local Road (Local Road)	N/A	4	25
Railroads (RAILROAD)		7.5	25
Large City (> 200,000)		100	1000
Medium City (> 50,000)		50	400
Small City (> 5,000)		25	100
State/Province		400	1000
River/Lake		75	100
Latitude/Longitude (LAT/LON)		1	1000

Table 5-3 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the aviation menu:








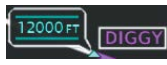
Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Large Airport (Longest Runway ≥ 8100 ft)		100	1000
Medium Airport (8100 ft > Longest Runway ≥ 5000 ft)		50	400
Small Airport (Longest Runway < 5000 ft) (Medium Airport if it has a tower frequency)		25	150
Taxiways (SafeTaxi)	See Additional Features	1.5	5
Runway Extension		7.5	150
Missed Approach Preview On/Off (Missed APR)	N/A	N/A	N/A
Intersection (INT)		25	40
Non-directional Beacon (NDB)		25	50
VOR		50	250
VOR Compass Rose On/Off	N/A	N/A	N/A
Visual Reporting Point (VRP)		25	1000
Temporary Flight Restriction (TFR)		250	1000
VNAV Constraints		1000	1000

Table 5-4 Aviation Symbol Information

AIRSPACE SYMBOLS

The following items are configured on the airspace menu:




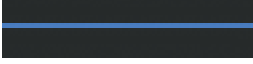
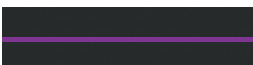




Airspace Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Smart Airspace On/Off	N/A	N/A	N/A
Airspace Altitude Labels (Airspace ALT LBL) On/Off			
Class B Airspace Altitude Label (ceiling/floor)		N/A	N/A
Class C Airspace Altitude Label (ceiling/floor)		N/A	N/A
Class D Airspace Altitude Label (ceiling)		N/A	N/A
Class B Airspace/TMA (CLASS B/TMA)		50	150
Class C Airspace/TCA (CLASS C/TCA)		50	100
Class D Airspace (CLASS D)		10	100
Alert/Prohibited/Restricted/Warning Areas (RESTRICTED)		50	100
Military Operations Area [MOA(MILITARY)]		50	250
Other/Air Defense Interdiction Zone (OTHER/ADIZ)		50	250

Table 5-5 Airspace Symbol Information

SYMBOL SETUP

All navigation maps can display land, aviation and airspace symbols. Symbol types (e.g. runway extensions, railroads) can be removed individually. The range sets the maximum range at which items appear on the display. For example, enabling “Runway Extension” displays a dashed line on the map extending from each runway of an airport in the flight plan when the range is set at or below the value of the map settings option.

Setting up the ‘Land’, ‘Aviation’ or ‘Airspace’ group items:

- 1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the ‘Map Settings’ option.
- 2) Press the **ENT** Key. The Map Settings Menu is displayed.
- 3) Turn the small **FMS** Knob to select the desired group.
- 4) Press the **ENT** Key. The cursor flashes on the first field.
- 5) Turn the large **FMS** Knob to select the desired option.
- 6) Turn the small **FMS** Knob to select the desired setting (e.g. On/Off or maximum range).
- 7) Press the **ENT** Key to accept the selected option and move the cursor to the next item.
- 8) Repeat steps 5-7 as necessary.
- 9) Press the **FMS** Knob to return to the Navigation Map Page.

MAP DECLUTTER

The declutter feature allows the pilot to progressively step through four levels of removing map information. The declutter level is displayed in the **Detail** Softkey and next to the Declutter Menu Option.

Decluttering the map:

Press the **Detail** Softkey with the Navigation Map Page displayed. The current declutter level is shown. With each softkey press, another level of map information is removed.

Or:

- 1) Press the **MENU** Key with the Navigation Map Page displayed.
- 2) Select ‘Declutter’. The current declutter level is shown.
- 3) Press the **ENT** Key.

Decluttering the PFD Map:

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **Detail** Softkey. The current declutter level is shown. With each selection, another level of map information is removed.

Table 5-4 lists the items that are decluttered at each map detail level. The ‘X’ represents map items decluttered for each level of detail.

Item	Detail 3	Detail 2	Detail 1
Data Link Radar Precipitation			X
Data Link Lightning			X
Graphical METARs			X
Airports			X
Safe Taxi			X
Runway Labels			X
TFRs			X
Restricted			X
MOA (Military)			X
Intersections		X	X
NDBs		X	X
VORs		X	X
VRPs		X	X
User Waypoints		X	X
Latitude/Longitude Grid		X	X
NAVAIDs (does not declutter if used to define airway)		X	X
Intersections (does not declutter if used to define airway)		X	X
Class B Airspaces/TMA		X	X
Class C Airspaces/TCA		X	X
Class D Airspaces		X	X
Other Airspaces/ADIZ		X	X
Obstacles		X	X
Cities	X	X	X
Roads	X	X	X
Railroads	X	X	X
State/Province Boundaries	X	X	X

Table 5-6 Navigation Map Items Decluttered for each Detail Level

Displaying/removing airways:

- 1) Press the **Map Opt** Softkey.
- 2) Press the **AWY** Softkey. Both High and Low Altitude Airways are displayed (AWY On).
- 3) Press the softkey again to display Low Altitude Airways only (AWY LO).
- 4) Press the softkey again to display High Altitude Airways only (AWY HI).
- 5) Press the softkey again to remove High Altitude Airways. No airways are displayed (AWY Off).

Or:

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Turn the small **FMS** Knob to select the 'Airways' group, and press the **ENT** Key.
- 4) Turn the large **FMS** Knob to highlight the 'Low ALT Airways' On/Off field.
- 5) Turn the **FMS** Knob to select 'Off' or 'On'.
- 6) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The airway range is the maximum map range on which airways are displayed.

Selecting an airway range (Low ALT Airways or High ALT Airways):

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Turn the small **FMS** Knob to select the 'Airways' Group, and press the **ENT** Key.
- 4) Highlight the 'Low ALT Airways' or 'High ALT Airways' range field.
- 5) To change the range setting, turn the small **FMS** Knob to display the range list.
- 6) Select the desired range using the small **FMS** Knob.
- 7) Press the **ENT** Key.
- 8) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The following items are configured on the airways menu:


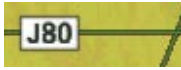
Airways Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Low Altitude Airways (V Routes and T Routes)		50	100
High Altitude Airways (J Routes and Q Routes)		50	100

Table 5-7 Airways Symbol Information

ADDITIONAL NAVIGATION MAP ITEMS

Navigation maps can display some additional items. These items (e.g. track vector, wind vector, fuel range ring, SVT field of view, and selected altitude intercept arc) can be displayed/removed individually.

Setting up additional 'Map' group items:

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Turn the small **FMS** Knob to select the 'Map' Group.
- 4) Press the **ENT** Key. The cursor flashes on the first field.
- 5) Turn the large **FMS** Knob to select the desired option.
- 6) Turn the small **FMS** Knob to select 'On' or 'Off'.

Or:

If it is a data field, use the **FMS** Knob to select the range or time value.

- 7) Press the **ENT** Key to accept the selected option and move the cursor to the next item.
- 8) Repeat steps 5-7 as necessary.
- 9) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

TRACK VECTOR

The map can display a track vector that is useful in minimizing track angle error. The track vector is a solid cyan line segment extended to a predicted location. The track vector look-ahead time is selectable (30 sec, 60 sec (default), 2 min, 5 min, 10 min, 20 min) and determines the length of the track vector. The track vector shows up to 90 degrees of a turn for the 30 and 60 second time settings. It is always a straight line for the 2 min, 5 min, 10 min and 20 min settings.

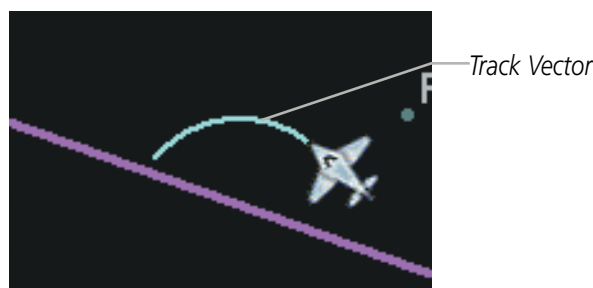


Figure 5-17 Navigation Map -Track Vector

WIND VECTOR

The map displays a wind vector arrow in the upper right-hand portion of the screen. Wind vector information is displayed as a white arrow pointing in the direction in which the wind is moving for wind speeds greater than or equal to 1 kt.



Figure 5-18 Navigation Map - Wind Vector



NOTE: The wind vector is not displayed until the aircraft is moving. It is not displayed on the Waypoint Information pages.

FUEL RANGE RING

The map can display a fuel range ring which shows the remaining flight distance. A dashed green circle indicates the selected range to reserve fuel. A solid green circle indicates the total endurance range. If only reserve fuel remains, the range is indicated by a solid amber circle.



Figure 5-19 Navigation Map - Fuel Range Ring

FIELD OF VIEW (SVT)

The map can display the boundaries of the PFD Synthetic Vision Technology (SVT) lateral field of view. The field of view is shown as two dashed lines forming a V shape in front of the aircraft symbol on the map. This is only available if SVT is installed on the aircraft.



Figure 5-20 Navigation Map - Field of View

SELECTED ALTITUDE INTERCEPT ARC

The map can display the location along the current track where the aircraft will intercept the selected altitude. The location will be shown as a cyan arc when the aircraft is actually climbing or descending.



Figure 5-21 Navigation Map - Range to Altitude Arc

IFR/VFR CHARTS

The system can display GPS navigation information on a VFR chart, a low altitude IFR chart, or a high altitude IFR chart, if installed. The information overlaid on the IFR/VFR Charts is selected and setup on the Navigation Map, but the IFR/VFR charts will not display some of the selected items. Only the following items will be overlaid on the chart:

- Map Pointer (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Map Range (17 range choices from 1 nm to 150 nm)
- Map Orientation (always North Up for IFR/VFR Charts)
- Aircraft Icon (representing present position)
- Wind Direction and Speed
- Icons for enabled map features (Traffic only)
- Flight Plan Legs
- Track Vector
- Runway Extension
- Missed Approach Preview
- Intersections (only as part of active flight plan)
- Visual Reporting Points
- VNAV Constraints
- Selected Altitude Intercept Arc

Map panning on the IFR/VFR Charts works the same as on the Navigation Map. Map range selected on either the Navigation Map or the IFR/VFR Charts applies to both. However, if the range selected on the Navigation Map it is not a valid chart range, the chart is shown with a range of 7.5 nm.

When different VFR charts exist for the same area the chart type will automatically display according to the range chosen. For example, in an area where both a Sectional and a Terminal Area Chart (TAC) are available, a range of 6 nm or more will show the Sectional chart. Once the range is decreased below 6 nm, the system will automatically change the displayed chart from the Sectional to the TAC.

Due to the potential error involved with the electronic depiction of maps, charts will display a gray 'circle of uncertainty' centered upon the aircraft icon. The aircraft's actual position can be anywhere within the range of the gray circle. The range of the circle will change based on the chart displayed and current zoom range.



Figure 5-22 GPS Navigation Information on the VFR Chart

Selecting the chart to display:

- 1) Use the **FMS** Knob to select the 'Map - IFR/VFR Charts' Page.
- 2) Press the **VFR** Softkey, **IFR Low** Softkey, or **IFR High** Softkey to display the desired chart.

Or:

- 1) Use the **FMS** Knob to select the 'Map - IFR/VFR Charts' Page. Press the **MENU** Key.
- 2) Turn the **FMS** Knob to highlight 'Display VFR', 'Display IFR Low', or 'Display IFR High'.
- 3) Press the **ENT** Key. The selected chart is displayed.

Modifying IFR chart settings:

- 1) Press the **MENU** Key with the IFR Low / IFR High Chart displayed. The cursor flashes on the 'Settings' option.
- 2) Press the **ENT** Key. The cursor flashes on the 'Color Scheme' setting.
- 3) Turn the small **FMS** Knob to select 'Day', 'Auto', or 'Night'. The IFR/VFR Chart display changes to reflect the setting.
- 4) If 'Auto' was selected, turn the large **FMS** Knob to select the backlight threshold field (sets value for automatic day/night switching).

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX



Figure 5-23 GPS Navigation Information on the IFR Low Altitude Chart

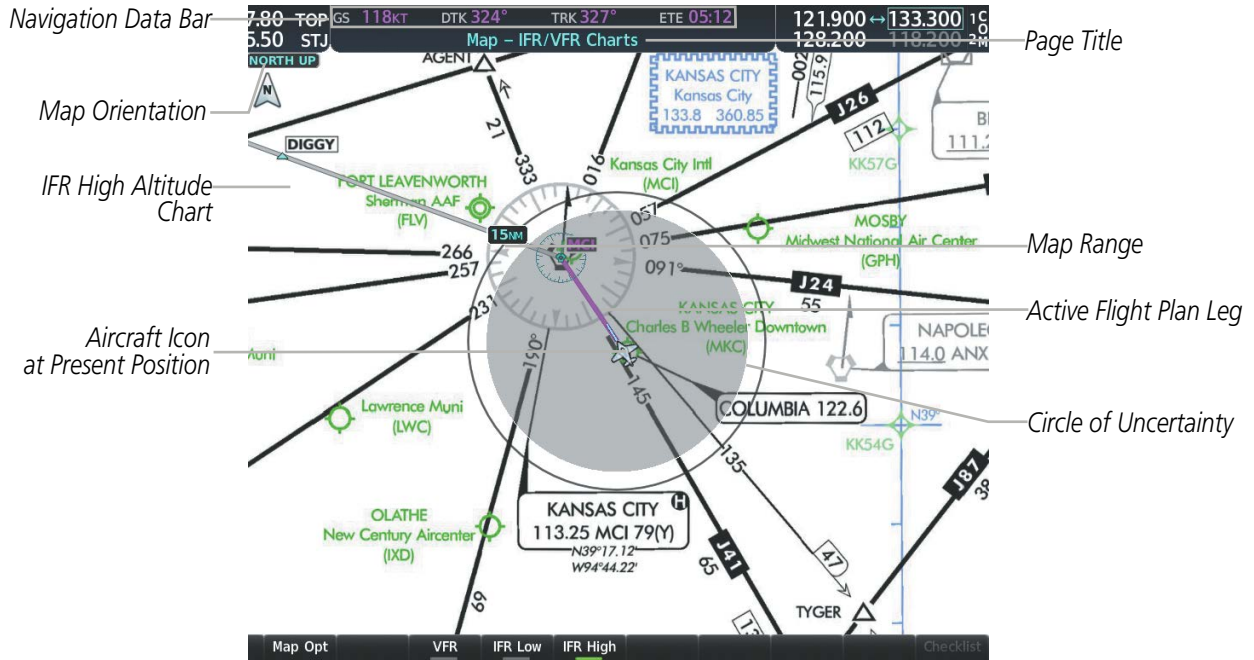


Figure 5-24 GPS Navigation Information on the IFR High Altitude Chart

5.3 WAYPOINTS

Waypoints are predetermined geographical positions (internal database) or pilot-entered positions, and are used for all phases of flight planning and navigation.

Communication and navigation frequencies can be tuned “automatically” from various Waypoint Information (WPT) pages, Nearest (NRST) pages, and the Nearest Airports Window (on PFD). This auto-tuning feature simplifies frequency entry over manual tuning. Refer to the Audio Panel and CNS section for details on auto-tuning.

Waypoints can be selected by entering the ICAO identifier, entering the name of the facility, or by entering the city name. See the System Overview section for detailed instructions on entering data in the system. As a waypoint identifier, facility name, or location is entered, the Spell’N’Find feature scrolls through the database, displaying those waypoints matching the characters which have been entered to that point. A direct-to navigation leg to the selected waypoint can be initiated by pressing the **Direct-to** Key on any of the waypoint pages.



Figure 5-25 Waypoint Information Window

If duplicate entries exist for the entered facility name or location, additional entries may be viewed by continuing to turn the small **FMS** Knob during the selection process. If duplicate entries exist for an identifier, a ‘Duplicate Waypoints’ Window is displayed when the **ENT** Key is pressed.



Figure 5-26 Waypoint Information Window - Duplicate Identifier

AIRPORTS



NOTE: ‘North Up’ orientation on the Airport Information Page cannot be changed; the pilot needs to be aware of proper orientation if the Navigation Map orientation is different from the Airport Information Page Map.

The ‘Airport Information’ Page is the first page in ‘WPT’ page group and allows the pilot to view airport information, load frequencies (COM, NAV, and lighting), review runways, and review instrument procedures that may be involved in the flight plan. See the Audio Panel and CNS Section for more information on loading frequencies (auto-tuning). After engine startup, the ‘Airport Information Page’ defaults to the airport where the aircraft is located. After a flight plan has been loaded, it defaults to the destination airport. On a flight plan with multiple airports, it defaults to the airport which is the current active waypoint.

In addition to displaying a map of the currently selected airport and surrounding area, the Airport Information Page displays airport information in three boxes labeled 'Airport', 'Runways', and 'Frequencies'. For airports with multiple runways, information for each runway is available. This information is viewed on the 'Airport Information' Page by pressing the **Info** softkey until '1' is displayed.



Figure 5-27 Airport Information Page

The following descriptions and abbreviations are used on the Airport Information Page:

- Usage type: Public, Military, Private, or Heliport
- Runway surface type: Hard, Turf, Sealed, Gravel, Dirt, Soft, Unknown, or Water
- Runway lighting type: No Lights, Part Time, Full Time, Unknown, or PCL Freq (for pilot-controlled lighting)
- COM Availability: TX (transmit only), RX (receive only), PT (part time), i (additional information available)

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Figure 5-28 Airport Directory Page Example

The airport directory information is viewed on the ‘Airport Directory’ Page by pressing the **Info** Softkey until ‘2’ is displayed. The following are types of airport directory information shown (if available) on the ‘Airport Directory’ Page:

- **Airport:** Identifier, Site Number, Name, City, State
- **Phones:** Phone/Fax Numbers
- **Hours:** Facility Hours, Light Hours, Tower Hours, Beacon Hours
- **Location:** Sectional, Magnetic Variation
- **Frequencies:** Type/Frequency
- **Transportation:** Ground Transportation Type Available
- **Approach:** Approach Facility Name, Frequency, Frequency Parameter
- **Traffic Pattern Altitudes (TPA):** Aircraft Class/Altitude
- **Weather:** Service Type, Frequency, Phone Number
- **Flight Service Station (FSS):** FSS Name, Phone Numbers
- **Instrument Approaches:** Published Approach, Freq.
- **NAVAIDS:** Type, Identifier, Frequency, Radial, Distance
- **Noise:** Noise Abatement Procedures
- **Charts:** Low Altitude Chart Number
- **Runway:** Headings, Length, Width, Obstructions, Surface
- **Obstructions:** General Airport Obstructions
- **Special Operations at Airport**
- **Services Available:** Category, Specific Service
- **Notes:** Airport Notes
- **Pilot Controlled Lighting:** High/Med/Low Clicks/Second
- **FBO:** Type, Frequencies, Services, Fees, Fuel, Credit Cards, Phone/Fax Numbers

Selecting an airport for review by identifier, facility name, or location:

- 1) From the 'WPT - Airport Information' Page (**Info 1** Softkey), press the **FMS** Knob.
- 2) Use the **FMS** Knobs and enter an identifier, facility name, or location.
- 3) Press the **ENT** Key.
- 4) Press the **FMS** Knob to remove the cursor.

Selecting a runway:

- 1) With the 'WPT - Airport Information' Page (**Info 1** Softkey) displayed, press the **FMS** Knob to activate the cursor.
- 2) Turn the large **FMS** Knob to place the cursor in the 'Runways' Box, on the runway designator.
- 3) Turn the small **FMS** Knob to display the desired runway (if more than one) for the selected airport.
- 4) To remove the flashing cursor, press the **FMS** Knob.

Viewing a destination airport:

From the 'WPT - Airport Information' Page (**Info 1** Softkey) press the **MENU** Key. Select 'View Destination Airport'. The Destination Airport is displayed.

The airport 'Frequencies' Box uses the descriptions and abbreviations listed in the following table:

Communication Frequencies			Navigation Frequencies
Approach *	Control	Pre-Taxi	ILS
Arrival *	CTA *	Radar	LOC
ASOS	Departure *	Ramp	
ATIS	Gate	Terminal *	
AWOS	Ground	TMA *	
Center	Helicopter	Tower	
Class B *	Multicom	TRSA *	
Class C *	Other	Unicom	
Clearance			
* May include Additional Information			

Table 5-8 Airport Frequency Abbreviations

A departure, arrival, or approach can be loaded using the softkeys on the Airport Information Page. See the Procedures section for details. METARs or TAFs applicable to the selected airport can be selected for display (see the Hazard Avoidance section for details about weather).

The system provides a **Nearest** Softkey on the PFD, which gives the pilot quick access to nearest airport information (very useful if an immediate landing is required). The 'Nearest Airports' Window displays a list of up to 25 of the nearest airports (three entries can be displayed at one time). If there are more than three they are displayed in a scrollable list. If there are no nearest airports available, "None Within 200nm" is displayed.

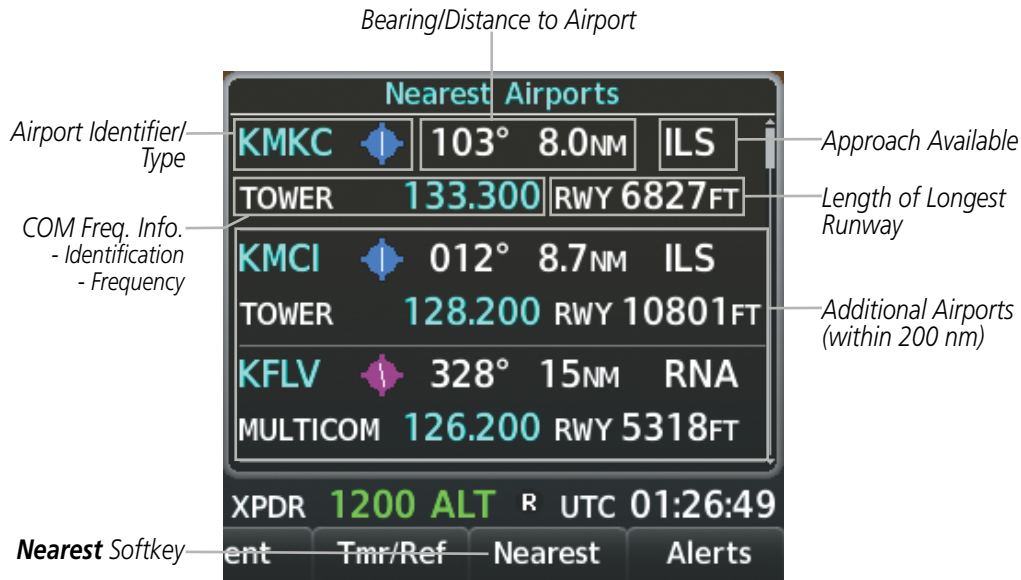


Figure 5-29 Nearest Airports Window on PFD

Pressing the **ENT** Key while the Nearest Airports Window is shown displays the PFD 'Airport Information' Window for the highlighted airport. Pressing the **ENT** Key again returns to the 'Nearest Airports' Window with the cursor on the next airport in the list. Continued presses of the **ENT** Key sequences through the information pages for all airports in the Nearest Airports list.

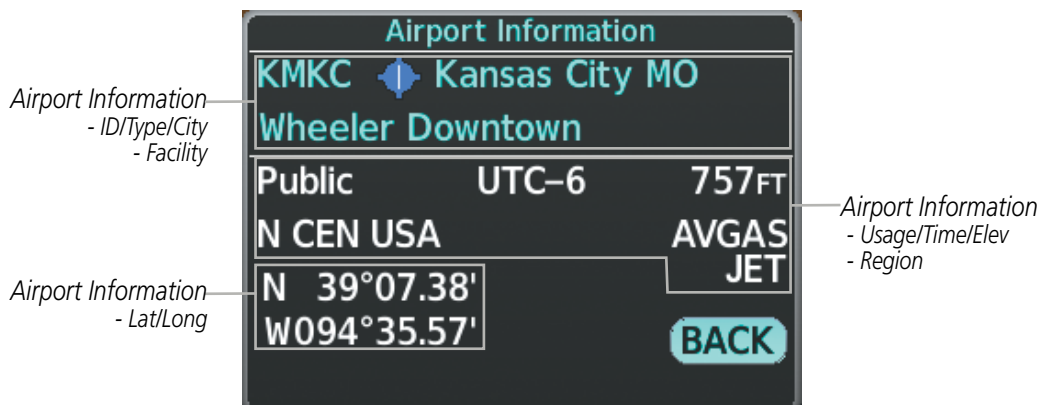


Figure 5-30 Airport Information Window on PFD

Viewing information for a nearest airport on the PFD:

- 1) Press the **Nearest** Softkey to display the Nearest Airports Window.
- 2) Highlight the airport identifier with the **FMS** Knob and press the **ENT** Key to display the Airport Information Window.
- 3) To return to the Nearest Airports Window press the **ENT** Key (with the cursor on 'BACK') or press the **CLR** Key. The cursor is now on the next airport in the nearest airports list. (Repeatedly pressing the **ENT** Key moves through the airport list, alternating between the Nearest Airports Window and the Airport Information Window.)
- 4) Press the **CLR** Key or the **Nearest** Softkey to close the PFD Nearest Airports Window.

The Nearest Airports Page on the MFD is first in the group of NRST pages because of its potential use in the event of an in-flight emergency. In addition to displaying a map of the currently selected airport and surrounding area, the page displays nearest airport information in five boxes labeled ‘Nearest Airports’, ‘Information’, ‘Runways’, ‘Frequencies’, and ‘Approaches’.

The selected airport is indicated by a white arrow, and a dashed white line is drawn on the navigation map from the aircraft position to the nearest airport. Up to five nearest airports, one runway, up to three frequencies, and up to four approaches are visible at one time. If there are more than can be shown, each list can be scrolled. If there are no items for display in a boxed area, text indicating that fact is displayed. The currently selected airport remains in the list until it is unselected.



Figure 5-31 Nearest Airport Page

Viewing information for a nearest airport on the MFD:

- 1) Turn the large **FMS** Knob to select the ‘NRST’ page group.
- 2) Turn the small **FMS** Knob to select the ‘Nearest Airports’ Page (it is the first page of the group, so it may already be selected). If there are no Nearest Airports available, ‘None Within 200nm’ is displayed.
- 3) Press the **APT** Softkey; or press the **FMS** Knob; or press the **MENU** Key, highlight ‘Select Airport Window’ and press the **ENT** Key. The cursor is placed in the ‘Nearest Airports’ Box. The first airport in the nearest airports list is highlighted.
- 4) Turn the **FMS** Knob to highlight the desired airport. (Pressing the **ENT** Key also moves to the next airport.)
- 5) Press the **FMS** Knob to remove the flashing cursor.

Viewing runway information for a specific airport:

- 1) With the ‘NRST - Nearest Airports’ Page displayed, press the **RNWX** Softkey; or press the **MENU** Key, highlight ‘Select Runway Window’; and press the **ENT** Key. The cursor is placed in the ‘Runways’ Box.
- 2) Turn the small **FMS** Knob to select the desired runway.
- 3) Press the **FMS** Knob to remove the flashing cursor.

See the Audio Panel & CNS Section for frequency selection and the Procedures section for approaches.

The 'Nearest Airports' Box on the System Setup Page defines the minimum runway length and surface type used when determining the 25 nearest airports to display on the MFD Nearest Airports Page. A minimum runway length and/or surface type can be entered to prevent airports with small runways or runways that are not appropriately surfaced from being displayed. Default settings are 3000 feet (or meters) for runway length and "Hard Only" for runway surface type.

Selecting nearest airport surface and minimum runway length matching criteria:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the runway surface field in the 'Nearest Airport' Box.
- 4) Turn the small **FMS** Knob to select the desired runway option (Any, Hard Only, Hard/Soft).
- 5) Press the **ENT** Key. The cursor moves to the 'Minimum Length' Field in the 'Nearest Airport' Box.
- 6) Use the **FMS** Knob to enter the minimum runway length (zero to 25,000 feet) and press the **ENT** Key.
- 7) Press the **FMS** Knob to remove the flashing cursor.

INTERSECTIONS

NOTE: The VOR displayed on the Intersection Information Page is the nearest VOR, not necessarily the VOR used to define the intersection.

The Intersection Information Page is used to view information about intersections. In addition to displaying a map of the currently selected intersection and surrounding area, the Intersection Information Page displays intersection information in three boxes labeled 'Intersection', 'Information', and 'Nearest VOR'.

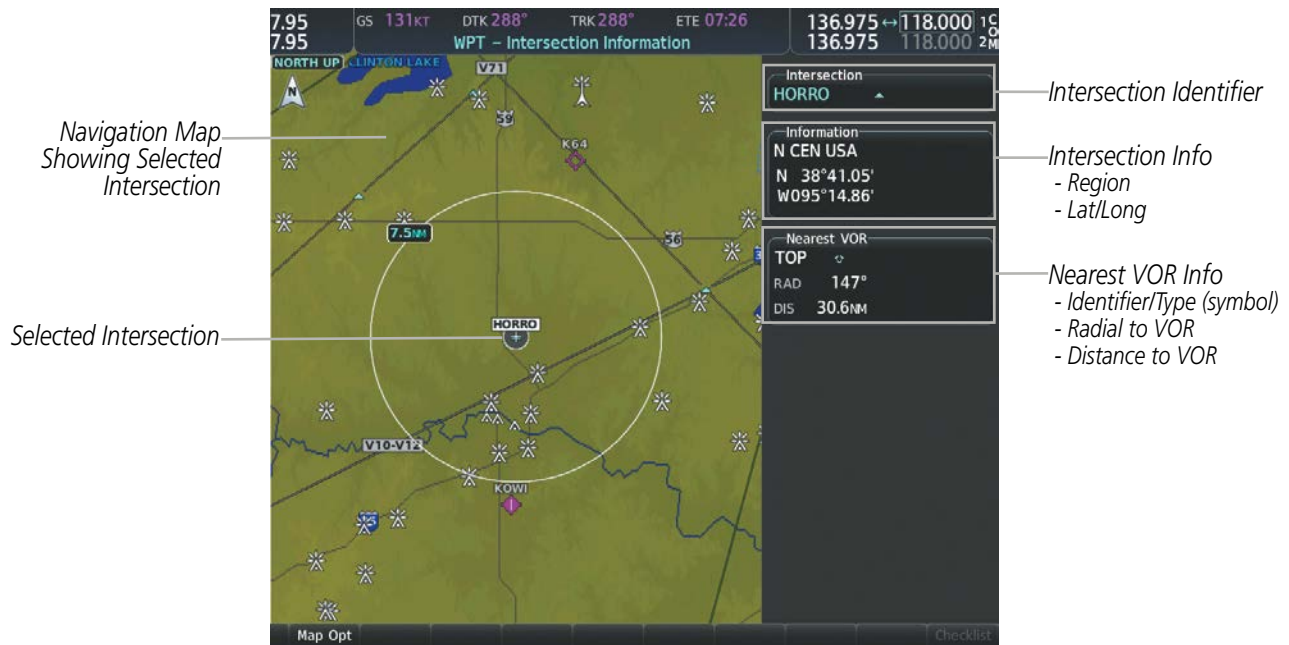


Figure 5-32 Intersection Information Page

Selecting an intersection:

- 1) With the 'WPT - Intersection Information' Page displayed, enter an identifier in the 'Intersection' Box.
 - 2) Press the **ENT** Key.
 - 3) Press the **FMS** Knob to remove the flashing cursor.
- Or:**
- 1) With the 'NRST - Nearest Intersections' Page displayed, press the **FMS** Knob.
 - 2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest INT' Box.
 - 3) Press the **FMS** Knob to remove the flashing cursor.

The Nearest Intersections Page can be used to quickly find an intersection close to the flight path. In addition to displaying a map of the surrounding area, the page displays information for up to 25 nearest intersections in three boxes labeled 'Nearest INT', 'Information', and 'Reference VOR'.

The selected intersection is indicated by a white arrow. Up to 12 intersections are visible at a time. If there are more than can be shown, the list can be scrolled. If there are no items for display, text indicating that fact is displayed.



NOTE: The list only includes waypoints that are within 200 nm.



Figure 5-33 Nearest Intersections Page

NDBs

The NDB Information Page is used to view information about NDBs. In addition to displaying a map of the currently selected NDB and surrounding area, the page displays NDB information in four boxes labeled 'NDB', 'Information', 'Frequency', and 'Nearest Airport'.



Figure 5-34 NDB Information Page



NOTE: Compass locator (LOM, LMM): a low power, low or medium frequency radio beacon installed in conjunction with the instrument landing system. When LOM is used, the locator is at the Outer Marker; when LMM is used, the locator is at the Middle Marker.

Selecting an NDB:

- 1) With the 'WPT - NDB Information' Page displayed, enter an identifier, the name of the NDB, or the city in which it's located in the 'NDB' Box.
 - 2) Press the **ENT** Key.
 - 3) Press the **FMS** Knob to remove the flashing cursor.
- Or:**
- 1) With the Nearest NDB Page displayed, press the **FMS** Knob.
 - 2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest NDB' Box.
 - 3) Press the **FMS** Knob to remove the flashing cursor.

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The Nearest NDB Page can be used to quickly find a NDB close to the flight path. In addition to displaying a map of the surrounding area, the page displays information for up to 25 nearest NDBs in three boxes labeled 'Nearest NDB', 'Information', and 'Frequency'.

A white arrow before the NDB identifier indicates the selected NDB. Up to 12 NDBs are visible at a time. If there are more than can be shown, each list can be scrolled. The list only includes waypoints that are within 200nm. If there are no NDBs in the list, text indicating that there are no nearest NDBs is displayed. If there are no nearest NDBs in the list, the information and frequency fields are dashed.



Figure 5-35 Nearest NDB Page

VORs

The VOR Information Page can be used to view information about VOR and ILS navigation signals, or to quickly auto-tune a VOR or ILS frequency. Localizer information cannot be viewed on the VOR Information Page. If a VOR station is combined with a TACAN station it is listed as a VORTAC on the VOR Information Page and if it includes only DME, it is displayed as VOR-DME.

In addition to displaying a map of the currently selected VOR and surrounding area, the VOR Information Page displays VOR information in four boxes labeled 'VOR', 'Information', 'Frequency', and 'Nearest Airport'.



Figure 5-36 VOR Information Page

The VOR classes used in the VOR information box are: Low Altitude, High Altitude, and Terminal.

Selecting a VOR:

- 1) With the 'WPT - VOR Information' Page displayed, enter an identifier, the name of the VOR, or the city in which it's located in the 'VOR' Box.
- 2) Press the **ENT** Key.
- 3) Press the **FMS** Knob to remove the flashing cursor.

Or:

- 1) With the 'NRST - Nearest VOR' Page displayed, press the **FMS** Knob or press the **VOR** Softkey.
- 2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest VOR' Box.
- 3) Press the **FMS** Knob to remove the flashing cursor.

Or:

- 1) With the 'NRST - Nearest VOR' Page displayed, press the **MENU** Key.
- 2) Highlight 'Select VOR Window', and press the **ENT** Key.
- 3) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest VOR' Box.
- 4) Press the **FMS** Knob to remove the flashing cursor.

The Nearest VOR Page can be used to quickly find a VOR station close to the aircraft. Also, a NAV frequency from a selected VOR station can be loaded from the Nearest VOR Page. In addition to displaying a map of the surrounding area, the Nearest VOR Page displays information for up to 25 nearest VOR stations in three boxes labeled 'Nearest VOR', 'Information', and 'Frequency'. The list only includes waypoints that are within 200 nm.

A white arrow before the VOR identifier indicates the selected VOR. Up to 12 VORs are visible at a time. If there are more than can be shown, each list can be scrolled. If there are no VORs in the list, text indicating that there are no nearest VORs is displayed. If there are no nearest VORs in the list, the information is dashed.



Figure 5-37 Nearest VOR Page

VRPs

The VRP Information Page is used to view information about visual reporting points (VRPs). In addition to displaying a map of the currently selected VRP and surrounding area, the VRP Information Page displays VRP information in two boxes labeled 'VRP' and 'Information'.



Figure 5-38 VRP Information Page

Selecting a VRP:

- 1) With the 'WPT - VRP Information' Page displayed, enter the identifier or the name of the VRP in the 'VRP' Box.
 - 2) Press the **ENT** Key.
 - 3) Press the **FMS** Knob to remove the flashing cursor.
- Or:**
- 1) With the 'NRST - Nearest VRP' Page displayed, press the **FMS** Knob.
 - 2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest VRP' Box.
 - 3) Press the **FMS** Knob to remove the flashing cursor.

The Nearest VRP Page can be used to quickly find a VRP close to the aircraft. In addition to displaying a map of the surrounding area, the Nearest VRP Page displays information for up to 25 nearest VRPs in two boxes labeled 'Nearest VRP' and 'Information'. The list only includes VRPs that are within 200 nm.

A white arrow before the VRP identifier indicates the selected VRP. Up to 12 VRPs are visible at a time. If there are more than can be shown, the list can be scrolled. If there are no VRPs in the list, text indicating that there are no nearest VRPs is displayed. If there are no nearest VRPs in the list, the information is dashed.



Figure 5-39 Nearest VRP Page

USER WAYPOINTS

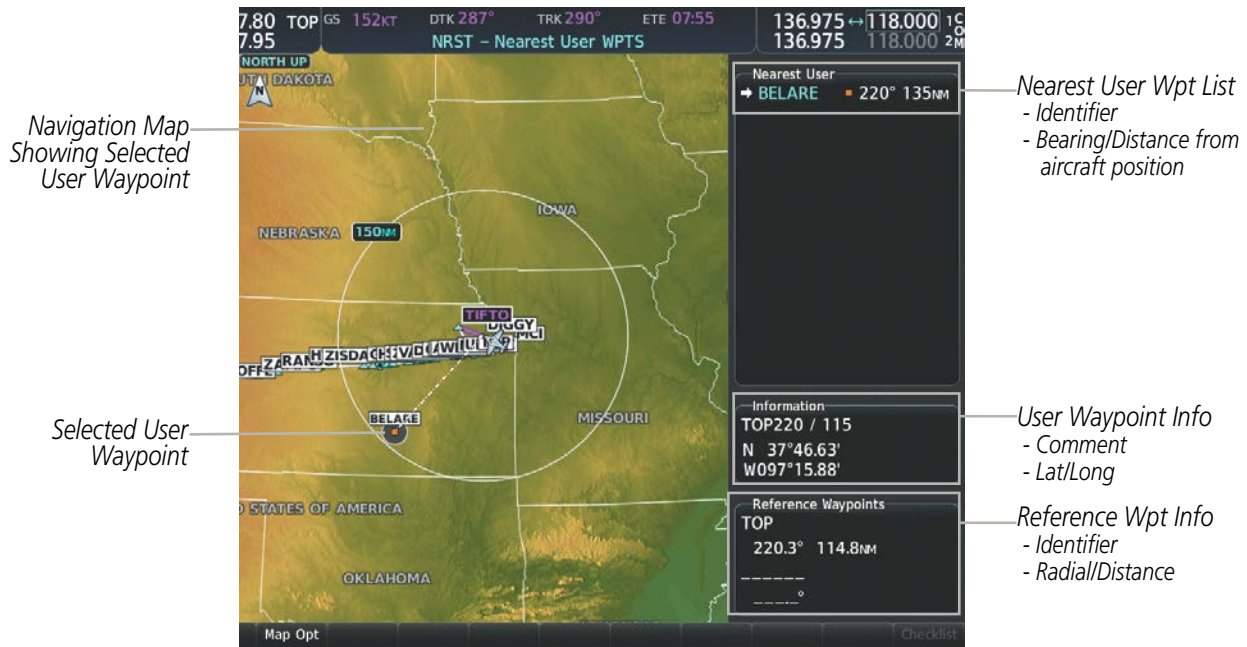
The system can create and store up to 1,000 user-defined waypoints. User waypoints can be created from any map page (except PFD Maps, Aux-Trip Planning Page, or Procedure Pages) by selecting a position on the map using the **Joystick**, or from the User Waypoint Information Page by referencing a bearing/distance from an existing waypoint, bearings from two existing waypoints, or a latitude and longitude. Once a waypoint has been created, it can be renamed, deleted, or moved. Temporary user waypoints are erased upon system power down.



Figure 5-40 User Waypoint Information Page

Selecting a User Waypoint:

- 1) With the 'WPT - User WPT Information' Page displayed, enter the name of the User Waypoint, or scroll to the desired waypoint in the 'User Waypoint List' Box using the large **FMS** Knob.
 - 2) Press the **ENT** Key.
 - 3) Press the **FMS** Knob to remove the flashing cursor.
- Or:**
- 1) With the 'NRST - Nearest User WPTS' Page displayed, press the **FMS** Knob.
 - 2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest User' Box.
 - 3) Press the **FMS** Knob to remove the flashing cursor.



Navigation Map Showing Selected User Waypoint

Selected User Waypoint

Nearest User Wpt List
- Identifier
- Bearing/Distance from aircraft position

User Waypoint Info
- Comment
- Lat/Long

Reference Wpt Info
- Identifier
- Radial/Distance

Figure 5-41 Nearest User Waypoint Page

CREATING USER WAYPOINTS

User waypoints can be created from the User Waypoint Information Page in the following ways:

Creating user waypoints from the User WPT Information Page:

- 1) Press the **New** Softkey, **or** press the **MENU** Key and select 'Create New User Waypoint'.
- 2) Enter a user waypoint name (up to six characters).
- 3) Press the **ENT** Key. The current aircraft position is the default location of the new waypoint.
- 4) If desired, define the type and location of the waypoint in one of the following ways:
 - Select "RAD/RAD" using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Box using the **FMS** Knobs.
 - Or:**
 - Select "RAD/DIS" using the small **FMS** Knob, press the **ENT** Key, and enter the reference waypoint identifier, the radial, and the distance into the 'Reference Waypoints' Box using the **FMS** Knobs.
 - Or:**
 - Select "LAT/LON" using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the 'Information' Box using the **FMS** Knobs.
- 5) Press the **ENT** Key to accept the new waypoint.
- 6) If desired, change the storage method of the waypoint to temporary by moving the cursor to 'Temporary' and selecting the **ENT** Key to check the box.
- 7) Press the **FMS** Knob to remove the flashing cursor.
 - Or:**
 - 1) Press the **FMS** Knob to activate the cursor.
 - 2) Enter a user waypoint name (up to six characters).
 - 3) Press the **ENT** Key. The message 'Are you sure you want to create the new user waypoint AAAAAA?' is displayed.

- 4) With 'YES' highlighted, press the **ENT** Key.
- 5) If desired, define the type and location of the waypoint in one of the following ways:
 - Select "RAD/RAD" using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Box using the **FMS** Knobs.
 - Or:**
 - Select "RAD/DIS" using the small **FMS** Knob, press the **ENT** Key, and enter the reference waypoint identifier, the radial, and the distance into the 'Reference Waypoints' Box using the **FMS** Knobs.
 - Or:**
 - Select "LAT/LON" using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the 'Information' Box using the **FMS** Knobs.
- 6) Press the **ENT** Key to accept the new waypoint.
- 7) If desired, change the storage method of the waypoint to temporary by moving the cursor to 'Temporary' and selecting the **ENT** Key to check the box.
- 8) Press the **FMS** Knob to remove the flashing cursor.

Creating user waypoints from map pages:

- 1) Push the **Joystick** to activate the panning function and pan to the map location of the desired user waypoint.
- 2) Press the **ENT** Key. The 'WPT - User Waypoint Information' Page is displayed with the captured position.



NOTE: *If the pointer has highlighted a map database feature, one of three things happens upon pressing the ENT Key: 1) information about the selected feature is displayed instead of initiating a new waypoint, 2) a menu pops up allowing a choice between 'Review Airspaces' or 'Create User Waypoint', or 3) a new waypoint is initiated with the default name being the selected map item.*

- 3) Enter a user waypoint name (up to six characters).
- 4) Press the **ENT** Key to accept the selected name. The first reference waypoint box is highlighted.
- 5) If desired, define the type and location of the waypoint in one of the following ways:
 - Select "RAD/RAD" using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Box using the **FMS** Knobs.
 - Or:**
 - Select "RAD/DIS" using the small **FMS** Knob, press the **ENT** Key, and enter the reference waypoint identifier, the radial, and the distance into the 'Reference Waypoints' Box using the **FMS** Knobs.
 - Or:**
 - Select "LAT/LON" using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the 'Information' Box using the **FMS** Knobs.
- 6) Press the **ENT** Key to accept the new waypoint.
- 7) If desired, change the storage method of the waypoint to temporary or normal by moving the cursor to 'Temporary' and selecting the **ENT** Key to check or uncheck the box.
- 8) Press the **FMS** Knob to remove the flashing cursor.
- 9) Press the **Go Back** Softkey to return to the map page.

EDITING USER WAYPOINTS

Editing a user waypoint comment or location:

- 1) With the 'WPT - User WPT Information' Page displayed, press the **FMS** Knob to activate the cursor.
- 2) Select a user waypoint in the 'User Waypoint List' Box, if required, and press the **ENT** Key.
- 3) Move the cursor to the desired field.
- 4) Turn the small **FMS** Knob to make any changes.
- 5) Press the **ENT** Key to accept the changes.
- 6) Press the **FMS** Knob to remove the flashing cursor.

Renaming user waypoints:

- 1) With the 'WPTS - User WPT Information' Page displayed, highlight a user waypoint in the 'User Waypoint List' Box. Press the **Rename** Softkey, or press the **MENU** Key and select 'Rename User Waypoint'.
- 2) Enter a new name.
- 3) Press the **ENT** Key. The message 'Do you want to rename the user waypoint AAAAAA toBBBBBB?' is displayed.
- 4) With 'YES' highlighted, press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

Changing the location of an existing waypoint to the aircraft present position:

- 1) With the 'WPT - User WPT Information' Page displayed, enter a waypoint name or select the waypoint in the 'User Waypoint List' Box, then press the **ENT** Key.
- 2) Press the **MENU** Key.
- 3) Select 'Use Present Position'.
- 4) Press the **ENT** Key twice. The new waypoint's location is saved.
- 5) Press the **FMS** Knob to remove the flashing cursor.

A system generated comment for a user waypoint incorporates the reference waypoint identifier, bearing, and distance. If a system generated comment has been edited, a new comment can be generated.

Resetting the comment field to the system generated comment:

- 1) With the 'WPT - User WPT Information' Page displayed, enter a waypoint name or select the waypoint in the 'User Waypoint List' Box, then press the **ENT** Key.
- 2) Press the **MENU** Key.
- 3) Select 'Auto Comment'.
- 4) Press the **ENT** Key. The generated comment is based on the reference point used to define the waypoint.

The default type of user waypoint (normal or temporary) can be changed using the user waypoint information page menu. Temporary user waypoints are automatically deleted upon the next power cycle.

Changing the user waypoint storage duration default setting:

- 1) With the 'WPT - User WPT Information' Page displayed, press the **MENU** Key.
- 2) Move the cursor to select 'Waypoint Setup', and press the **ENT** Key.
- 3) Select 'Normal' or 'Temporary' as desired, and press the **ENT** Key.
- 4) Press the **FMS** Knob to remove the flashing cursor and return to the 'WPT - User WPT Information' Page.

DELETING USER WAYPOINTS

Deleting a single user waypoint:

- 1) With the 'WPT - User WPT Information' Page displayed, highlight a User Waypoint in the 'User Waypoint List' Box, or enter a waypoint in the 'User Waypoint' Box.
- 2) Press the **Delete** Softkey or press the **CLR** Key. 'YES' is highlighted in the confirmation window.
- 3) Press the **ENT** Key.
- 4) Press the **FMS** Knob to remove the flashing cursor.

Or:

- 1) With the 'WPT - User WPT Information' Page displayed, highlight a User Waypoint in the 'User Waypoint List' Box, or enter a waypoint in the 'User Waypoint' Box.
- 2) Press the **MENU** Key.
- 3) Select 'Delete User Waypoint'.
- 4) Press the **ENT** Key twice to confirm the selection.
- 5) Press the **FMS** Knob to remove the flashing cursor.



NOTE: The option to 'Delete All User Waypoints' is not available while the aircraft is in flight.

Deleting all user waypoints:

- 1) With the 'WPT - User WPT Information' Page displayed, highlight a User Waypoint in the 'User Waypoint List' Box.
- 2) Press the **MENU** Key.
- 3) Select 'Delete All User Waypoints.'
- 4) Press the **ENT** Key twice to confirm the selection.
- 5) Press the **FMS** Knob to remove the flashing cursor.

5.4 AIRSPACES

The system can display the following types of airspaces: Class B/TMA, Class C/TCA, Class D, Restricted, MOA (Military), Other Airspace, Air Defense Identification Zone (ADIZ), and Temporary Flight Restriction (TFR). For detailed information concerning TFRs, see the Hazard Avoidance Section.

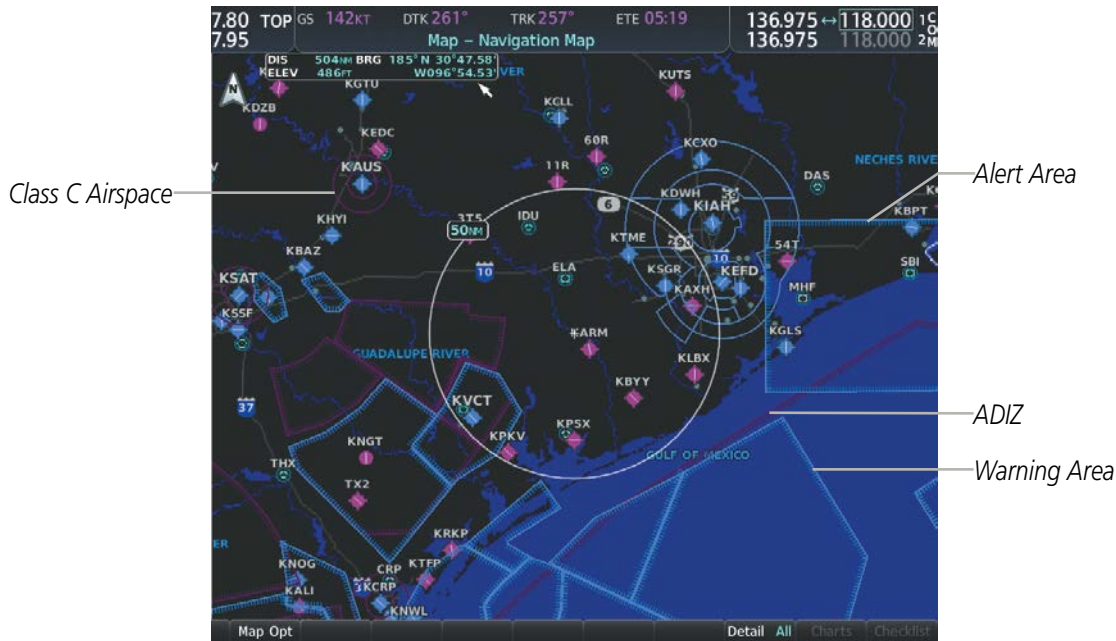
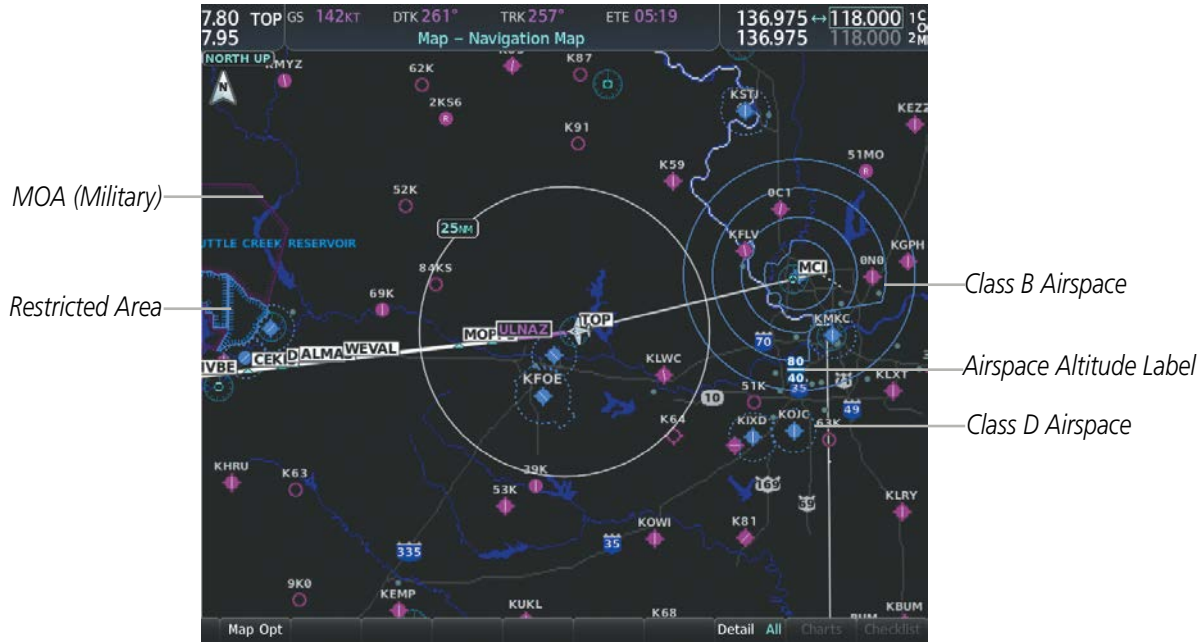


Figure 5-42 Airspaces

Displaying and removing airspace altitude labels:

- 1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
- 3) Turn the small **FMS** Knob to select the 'Airspace' Group, if necessary, and press the **ENT** Key.
- 4) Turn the large **FMS** Knob to select the 'Airspace ALT LBL' Field.
- 5) Turn the small **FMS** Knob to select 'On' to display labels and 'Off' to remove labels.
- 6) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The Nearest Airspaces Page, Airspace Alerts Window, and Airspace Alerts on the PFD provide additional information about airspaces and the location of the aircraft in relationship to them.

The Airspace Alerts Box allows the pilot to turn the controlled/special-use airspace message alerts on or off. This does not affect the alerts listed on the Nearest Airspaces Page or the airspace boundaries depicted on the Navigation Map Page. It simply turns on/off the warning provided when the aircraft is approaching or near an airspace.

An altitude buffer is also provided which "expands" the vertical range above or below an airspace. For example, if the buffer is set at 500 feet, and the aircraft is more than 500 feet above/below an airspace, an alert message is not generated, but if the aircraft is less than 500 feet above/below an airspace and projected to enter it, the pilot is notified with an alert message. The default setting for the altitude buffer is 200 feet.

Changing the altitude buffer distance setting:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page (**Setup 1** Softkey).
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Altitude Buffer' Field in the 'Airspace Alerts' Box.
- 4) Use the **FMS** Knob to enter an altitude buffer value and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

Turning an airspace alert on or off:

- 1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page (**Setup 1** Softkey).
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the desired field in the 'Airspace Alerts' Box.
- 4) Turn the small **FMS** Knob clockwise to turn the airspace alert On or counterclockwise to turn the alert Off.
- 5) Press the **FMS** Knob to remove the flashing cursor.

Map ranges for the airspace boundaries are selected from the 'Airspace' Group in the 'Map Settings' Window. See Table 5-2 for the default and maximum ranges for each type of airspace and the symbol used to define the airspace area.

The Nearest Airspaces Page can be used to quickly find airspaces close to the flight path. In addition, a selected frequency associated with the airspace can be loaded from the Nearest Airspaces Page. In addition to displaying a map of airspace boundaries and surrounding area, the Nearest Airspaces Page displays airspace information in four boxes labeled 'Airspace Alerts', 'Airspace Agency', 'Vertical Limits', and 'Frequencies'.

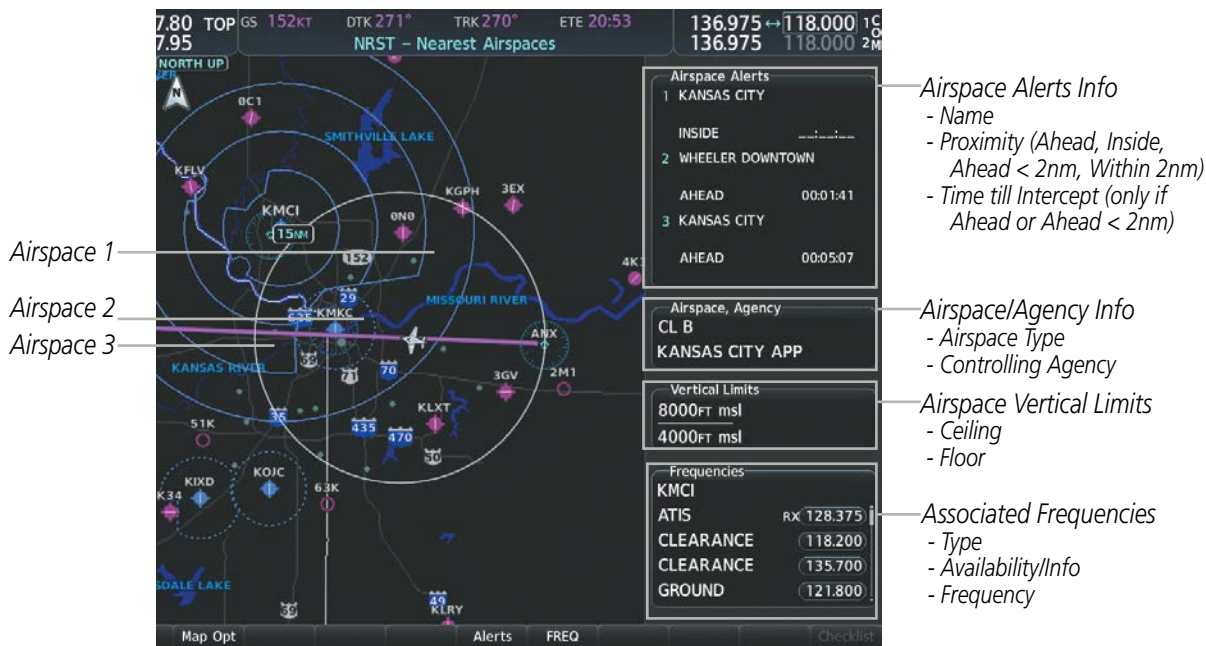


Figure 5-43 Nearest Airspaces Page

Airspace alerts and associated frequencies are shown in scrollable lists on the Nearest Airspaces Page. The **Alerts** and **FREQ** softkeys place the cursor in the respective list. The **FREQ** Softkey is enabled only if one or more frequencies exist for a selected airspace.

Selecting and viewing an airspace alert with its associated information:

- 1) Use the **FMS** Knob to select the 'NRST - Nearest Airspaces' Page.
- 2) Press the **Messages** Softkey; or press the **FMS** Knob; or press the **MENU** Key, highlight 'Select Alerts Window', and press the **ENT** Key. The cursor is placed in the 'Airspace Alerts' Box.
- 3) Select the desired airspace.
- 4) Press the **FMS** Knob to remove the flashing cursor.

Pressing the PFD **Messages** Softkey displays the Messages window on the PFD. The following airspace alerts are displayed in the Messages Window:

Message	Comments
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
ARSPC AHEAD – Airspace ahead – less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft penetrates the airspace within 10 minutes.
ARSPC NEAR – Airspace near and ahead.	Special use airspace is near and ahead of the aircraft position.
ARSPC NEAR – Airspace near – less than 2 nm.	Special use airspace is within 2 nm of the aircraft position.

Table 5-9 PFD Airspace Alert Messages

The Smart Airspace function de-emphasizes airspaces above or below the current aircraft altitude. The function does not require the aircraft present position or flight path to enter the lateral boundaries of the airspace. If the current aircraft altitude is within 1100 feet of the vertical boundaries of the airspace, the airspace boundary is shown normally. If the current aircraft altitude is not within 1100 feet of the vertical boundaries of the airspace, the airspace boundary is shown subdued.



Smart Airspace Off

Smart Airspace On

Figure 5-44 Smart Airspace

Turning smart airspace on or off:

- 1) Use the **FMS** Knob to select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key, and press the **ENT** Key. The cursor is placed in the 'Group' Box.
- 3) Turn the small **FMS** Knob to highlight the 'Airspace' and press the **ENT** Key.
- 4) Turn the large **FMS** Knob to highlight the 'Smart Airspace' Field.
- 5) Turn the small **FMS** Knob clockwise to turn smart airspace On or counterclockwise to turn smart airspace Off.
- 6) Press the **FMS** Knob to remove the flashing cursor.

5.5 DIRECT-TO-NAVIGATION

The Direct-to method of navigation, initiated by pressing the **Direct-to** Key, is quicker to use than a flight plan when the desire is to navigate to a single point such as a nearby airport.

Once a direct-to is activated, the system establishes a point-to-point course line from the present position to the selected direct-to destination. Course guidance is provided until the direct-to is replaced with a new direct-to or flight plan, or cancelled.

A vertical navigation (VNV) direct-to creates a descent path (and provides guidance to stay on the path) from the current altitude to a selected altitude at the direct-to waypoint. Vertical navigation is based on barometric altitudes, not on GPS altitude, and is used for cruise and descent phases of flight.

The Direct-to Window allows selection and activation of direct-to navigation. The Direct-to Window displays selected direct-to waypoint data on the PFD and the MFD.



Figure 5-45 Direct-to Window - MFD

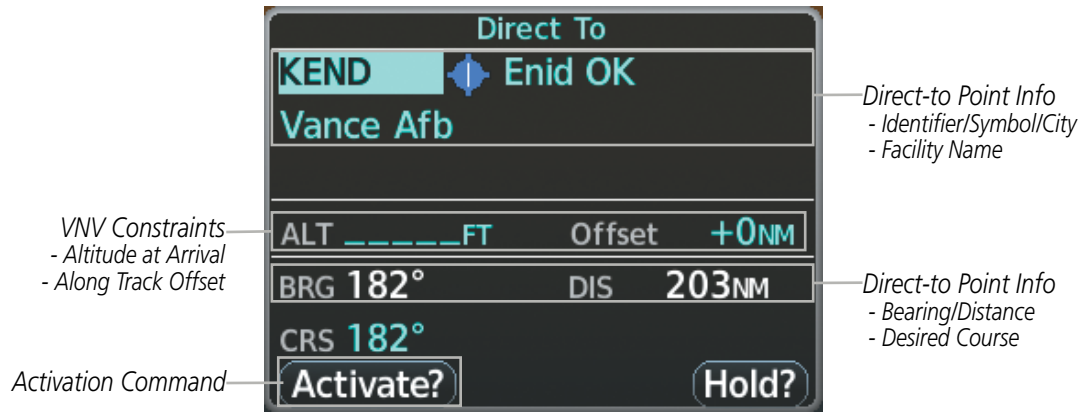


Figure 5-46 Direct-to Window - PFD

Any waypoint can be entered as a direct-to destination from the Direct-to Window.

Entering a waypoint identifier, facility name, or city as a direct-to destination:

- 1) Press the **Direct-to** Key. The 'Direct To' Window is displayed (with the active flight plan waypoint as the default selection or a blank waypoint field if no flight plan is active).
- 2) Turn the small **FMS** Knob clockwise to begin entering a waypoint identifier (turning it counter-clockwise brings up the waypoint selection submenu - press the **CLR** Key to remove it), or turn the large **FMS** Knob to select the facility name, or city field and turn the small **FMS** Knob to begin entering a facility name or city. If duplicate entries exist for the entered facility or city name, additional entries can be viewed by turning the small **FMS** Knob during the selection process.
- 3) Press the **ENT** Key. 'Activate?' is highlighted.
- 4) Press the **ENT** Key to activate the direct-to.

Any waypoint contained in the active flight plan can be selected as a direct-to waypoint from the Direct-to Window, the Active Flight Plan Page, or the Flight Plan Window.



Figure 5-47 Waypoint Submenu

Selecting an active flight plan waypoint as a direct-to destination:

- 1) While navigating an active flight plan, press the **Direct-to** Key. The 'Direct To' Window is displayed with the active flight plan waypoint as the default selection.
- 2) Turn the small **FMS** Knob counter-clockwise to display a list of flight plan waypoints (the FPL list is populated only when navigating a flight plan).
- 3) Select the desired waypoint.
- 4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 5) Press the **ENT** Key again to activate the direct-to.

Or:

- 1) Select the 'FPL - Active Flight Plan' Page on the MFD, or the 'Flight Plan' Window on the PFD.
- 2) Select the desired waypoint.
- 3) Press the **Direct-to** Key.
- 4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 5) Press the **ENT** Key again to activate the direct-to.

Any Nearest, Recent or User waypoint can be selected as a direct-to destination in the Direct-to Window.

Selecting a Nearest, Recent or User waypoint as a direct-to destination:

- 1) Press the **Direct-to** Key. The 'Direct To' Window is displayed (with the active flight plan destination as the default selection or a blank destination if no flight plan is active).
- 2) Turn the small **FMS** Knob counter-clockwise to display a list of flight plan waypoints (the FPL list is populated only when navigating a flight plan).
- 3) Turn the small **FMS** Knob clockwise to display the Nearest, Recent or User waypoints.
- 4) Turn the large **FMS** Knob clockwise to select the desired waypoint.
- 5) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 6) Press the **ENT** Key again to activate the direct-to.

The Direct-to Window can be displayed from any page and allows selection and activation of direct-to navigation. If the direct-to is initiated from any page except the WPT pages, the default waypoint is the active flight plan waypoint (if a flight plan is active) or a blank waypoint field. Direct-to requests on any WPT page defaults to the displayed waypoint.

Selecting any waypoint as a direct-to destination:

- 1) Select the page or window containing the desired waypoint type and select the desired waypoint.
- 2) Press the **Direct-to** Key to display the 'Direct To' Window with the selected waypoint as the direct-to destination.
- 3) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 4) Press **ENT** again to activate the direct-to.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Selecting a nearby airport as a direct-to destination:

- 1) Press the **Nearest** Softkey on the PFD; or turn the **FMS** Knob to display the 'NRST - Nearest Airports' Page on the MFD and press the **FMS** Knob.
- 2) Select the desired airport (the nearest one is already selected).
- 3) Press the **Direct-to** Key.
- 4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 5) Press the **ENT** Key again to activate the direct-to.

Direct-to destinations may also be selected by using the pointer on the navigation map pages. If no airport, NAVAID, or user waypoint exists at the desired location, a temporary waypoint named 'MAPWPT' is automatically created at the location of the map arrow.

Selecting a waypoint as a direct-to destination using the pointer:

- 1) From a navigation map page, push the **Joystick** to display the pointer.
- 2) Move the **Joystick** to place the pointer at the desired destination location.
- 3) If the pointer is placed on an existing airport, NAVAID, or user waypoint, the waypoint name is highlighted.
- 4) Press the **Direct-to** Key to display the 'Direct To' Window with the selected point entered as the direct-to destination.
- 5) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 6) Press the **ENT** Key again to activate the direct-to.

Cancelling a Direct-to:

- 1) Press the **Direct-to** Key to display the 'Direct To' Window.
- 2) Press the **MENU** Key.
- 3) With 'Cancel Direct-To NAV' highlighted, press the **ENT** Key. If a flight plan is still active, the system resumes navigating the flight plan along the closest leg.

When navigating a direct-to, the system sets a direct great circle course to the selected destination. The course to a destination can also be manually selected using the course field ('Course') on the Direct-to Window.

Selecting a manual direct-to course:

- 1) Press the **Direct-to** Key. The 'Direct To' Window is displayed with the destination field highlighted.
- 2) Highlight the course field.
- 3) Enter the desired course.
- 4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 5) Press the **ENT** Key again to activate the direct-to.

Reselecting the direct course from the current position:

- 1) Press the **Direct-to** Key. The 'Direct To' Window is displayed with the destination field highlighted.
- 2) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
- 3) Press the **ENT** Key again to activate the direct-to.

A direct-to with altitude constraints creates a descent path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if an offset distance has been entered. All VNV altitudes prior to the direct-to destination are removed from the active flight plan upon successful activation of a direct-to destination that is part of the active flight plan. All VNV altitudes following the direct-to waypoint are retained. See the section on Vertical Navigation for more information regarding the use and purpose of VNV altitudes and offset distances.

Entering a VNV altitude and along-track offset for the waypoint:

- 1) Press the **Direct-to** Key to display the 'Direct To' Window.
- 2) Turn the large **FMS** Knob to place the cursor over the VNV altitude field.
- 3) Enter the desired altitude.
- 4) Press the **ENT** Key to accept the altitude constraint; if the selected waypoint is an airport, an additional choice is displayed. Turn the small **FMS** Knob to choose 'MSL' or 'AGL', and press the **ENT** Key to accept the altitude.
- 5) Press the **ENT** Key. The cursor is now flashing in the VNV offset distance field.
- 6) Enter the desired along-track distance before the waypoint.
- 7) Press the **ENT** Key. 'Activate?' is highlighted.
- 8) Press the **ENT** Key to activate.

Removing a VNV altitude constraint:

- 1) Press the **Direct-to** Key to display the 'Direct To' Window.
- 2) Press the **MENU** Key.
- 3) With 'Clear Vertical Constraints' highlighted, press the **ENT** Key.

5.6 FLIGHT PLANNING

Flight planning on the system consists of building a flight plan by entering waypoints one at a time, adding waypoints along airways, and inserting departures, airways, arrivals, or approaches as needed. The system allows flight planning information to be entered from either the MFD or PFD. The flight plan is displayed on maps using different line widths, colors, and types, based on the type of leg and the segment of the flight plan currently being flown (departure, enroute, arrival, approach, or missed approach).










Flight Plan Leg Type	Symbol
Active Course Leg*	
Active Heading Leg*	
Active Roll Steering Path*†	
Course Leg in the current flight segment	
Course Leg not in the current flight segment	
Heading Leg	
Roll Steering Path †	
Future Roll Steering Path ‡	
Turn Anticipation Arc	
<p>* The active leg or path is the one currently being flown, and is shown in magenta. † A roll steering path is a computed transition between two disconnected legs. ‡ A roll steering path in the flight plan that is beyond the next leg appears as a future roll steering path. When a future roll steering path becomes the next leg in the flight plan, it appears as a roll steering path.</p>	

Table 5-10 Flight Plan Leg Symbols

Up to 99 flight plans with up to 100 waypoints each can be created and stored in memory. Upon power up, the previously active flight plan is retained and automatically repopulated if the aircraft position is at the origin airport and the aircraft is on the ground. If, however, the aircraft is not at the origin, on the ground, or if more than 12 hours have passed since the last active flight plan modification, the previously active flight plan is not retained. One flight plan can be activated at a time and becomes the active flight plan. The active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, departure, or arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information if the procedure has not been modified. If an approach, departure, or arrival procedure is no longer available, the procedure is deleted from the affected stored flight plan(s), and an alert is displayed (see Miscellaneous Messages in Appendix A) advising that one or more stored flight plans need to be edited.

Whenever an approach, departure, or arrival procedure is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan along with a header line describing the instrument procedure the pilot selected. The original enroute portion of the flight plan remains active (unless an instrument procedure is activated) when the procedure is loaded.

When the database is updated, the airways need to be reloaded also. Each airway segment is reloaded from the database given the entry waypoint, the airway identifier and the exit waypoint. This reloads the sequence of waypoints between the entry and exit waypoints (the sequence may change when the database is updated). The update of an airway can fail during this process. If that happens, the airway waypoints are changed to regular (non-airway) flight plan waypoints, and an alert is displayed (see Miscellaneous Messages in Appendix A).

The following could cause the airway update to fail:

- Airway identifier, entry waypoint or exit waypoint not found in the new database.
- Airway entry/exit waypoint is not an acceptable waypoint for the airway – either the waypoint is no longer on the airway, or there is a new directional restriction that prevents it being used.
- Loading the new airway sequence would exceed the capacity of the flight plan.

FLIGHT PLAN CREATION

There are three methods to create or modify a flight plan:

- Active Flight Plan Page on the MFD (create/modify the active flight plan)
- Flight Plan Window on the PFD (create/modify the active flight plan)
- Flight Plan Catalog Page on the MFD (create/modify a stored flight plan)



Figure 5-48 Active Flight Plan Page



Figure 5-49 Active Flight Plan Window on PFD

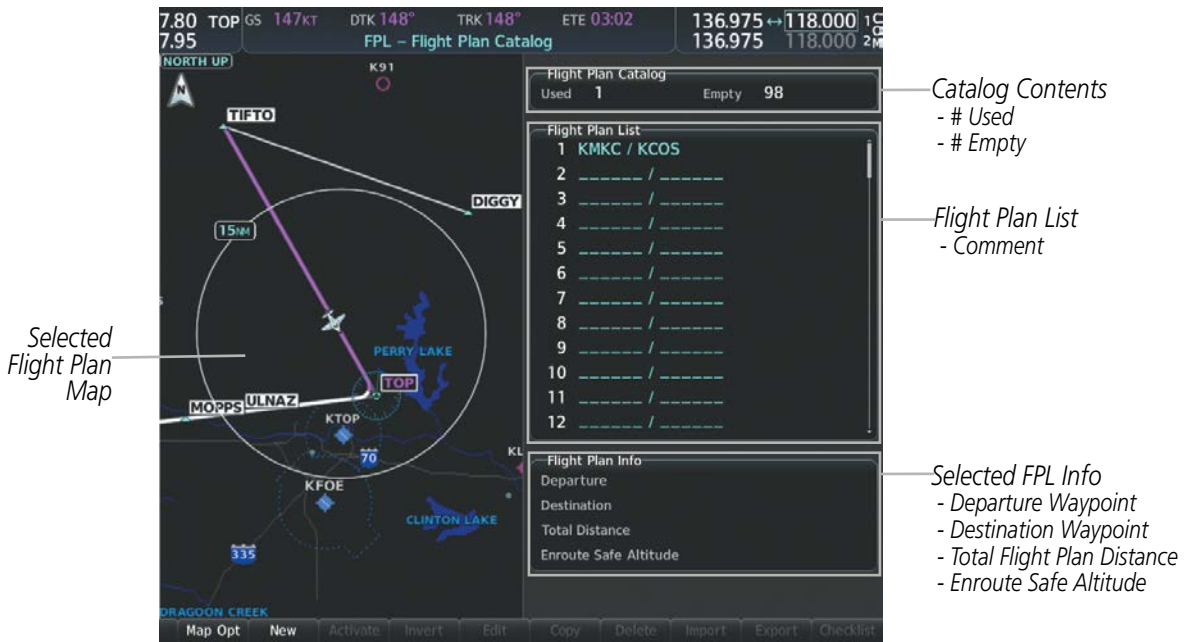


Figure 5-50 Flight Plan Catalog Page

The active flight plan is listed on the Active Flight Plan Page on the MFD, and in the Flight Plan Window on the PFD. It is the flight plan to which the system is currently providing guidance, and is shown on the navigation maps. Stored flight plans are listed on the Flight Plan Catalog Page on the MFD, and are available for activation (becomes the active flight plan).

Creating an active flight plan:

- 1) Press the **FPL** Key. Press the small **FMS** Knob to activate the cursor (only on MFD).
- 2) Select the origin airport and runway.
 - a) Highlight the field below the Origin header to enter the origin airport identifier using the **FMS** Knob.
 - b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the departure waypoint.
 - c) Press the **ENT** Key. The 'Set Runway' Window is displayed with the 'Runway' Field highlighted.
 - d) Turn the small **FMS** Knob to select the runway, and press the **ENT** Key.
 - e) Press the **ENT** Key again to add the origin airport/runway to the flight plan.
- 3) Repeat step number 2 for the destination airport and runway.
- 4) Select the enroute waypoints.
 - a) Highlight the location to insert the waypoint using the **FMS** Knob (If the enroute header is selected, the new waypoint is placed following the header. If an enroute waypoint or the dashes are selected, the new waypoint will be placed ahead of the selected item).
 - b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the waypoint. The active flight plan is modified as each waypoint is entered.
- 5) Repeat step number 4 to enter each additional enroute waypoint.
- 6) When all waypoints have been entered, press the **FMS** Knob to remove the cursor (if required).

Creating a stored flight plan:

- 1) From the MFD, press the **FPL** Key.
- 2) Turn the small **FMS** Knob clockwise to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **New** Softkey; or press the **MENU** Key, highlight 'Create New Flight Plan', and press the **ENT** Key to display a blank flight plan for the first empty storage location.
- 4) Select the origin airport and runway.
 - a) Highlight the field below the Origin header to enter the origin airport identifier using the **FMS** Knob.
 - b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the departure waypoint.
 - c) Press the **ENT** Key. The 'Set Runway' Window is displayed with the 'Runway' Field highlighted.
 - d) Turn the small **FMS** Knob to select the runway, and press the **ENT** Key.
 - e) Press the **ENT** Key again to add the origin airport/runway to the flight plan.
- 5) Repeat step number 4 for the destination airport and runway.
- 6) Select the enroute waypoints.
 - a) Highlight the location to insert the waypoint using the **FMS** Knob (If the enroute header is selected, the new waypoint is placed following the header. If an enroute waypoint or the dashes are selected, the new waypoint will be placed ahead of the selected item.)
 - b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the waypoint.
 - c) Press the **ENT** Key. The stored flight plan is modified as each waypoint is entered.
- 7) Repeat step number 6 to enter each additional enroute waypoint.
- 8) When all waypoints have been entered, press the **FMS** Knob to remove the cursor.

FLIGHT PLAN IMPORT/EXPORT

Flight plans can be imported from an SD Card or exported to an SD Card from the Stored Flight Plan Page.

Importing a Flight Plan from an SD Card:

- 1) Insert the SD card containing the flight plan in the top card slot on the MFD.
- 2) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
- 3) Turn the small **FMS** Knob to select the 'FPL - Flight Plan Catalog' Page.
- 4) Press the **FMS** Knob to activate the cursor.
- 5) Turn either **FMS** Knob to highlight an empty or existing flight plan.
- 6) Press the **Import** Softkey; or press the **MENU** Key, select "Import Flight Plan", and press the **ENT** Key.

If an empty slot is selected, a list of the available flight plans on the SD card will be displayed.

Or:

If an existing flight plan is selected, an 'Overwrite existing flight plan? OK or CANCEL' prompt is displayed. Press the **ENT** Key to choose to overwrite the selected flight plan and see the list of available flight plans on the SD card. If overwriting the existing flight plan is not desired, select 'CANCEL' using the **FMS** Knob, press the **ENT** Key, select another flight plan slot, and press the **Import** Softkey again.

- 7) Turn the small **FMS** Knob to highlight the desired flight plan for importing.
- 8) Press the **ENT** Key to initiate the import.
- 9) Press the **ENT** Key again to confirm the import.



NOTE: If the imported flight plan contains a waypoint with a name that duplicates the name of a waypoint already stored on the system, the system compares the coordinates of the imported waypoint with those of the existing waypoint. If the coordinates are different, the imported waypoint is automatically renamed by adding characters to the end of the name.

Exporting a Flight Plan to an SD Card:

- 1) Insert the SD card into the top card slot on the MFD.
- 2) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
- 3) Turn the small **FMS** Knob to select the 'FPL - Flight Plan Catalog' Page.
- 4) Press the **FMS** Knob to activate the cursor.
- 5) Turn the large **FMS** Knob to highlight the flight plan to be exported.
- 6) Press the **Export** Softkey; or press the **MENU** Key, select 'Export Flight Plan'.
- 7) If desired, change the name for the exported file by turning the large **FMS** Knob to the left to highlight the name, then use the small and large **FMS** knobs to enter the new name, and press the **ENT** Key.
- 8) Press the **ENT** Key to initiate the export.
- 9) Press the **ENT** Key to confirm the export.



NOTE: The exported flight plan will not contain any procedures or airways.

FLIGHT PLAN IMPORT/EXPORT MESSAGES

Under certain conditions, some messages may appear in conjunction with others.

Flight Plan Import/Export Results	Description
'Flight plan successfully imported.'	A flight plan file stored on the SD card was successfully imported as a stored flight plan.
'File contained user waypoints only. User waypoints imported successfully. No stored flight plan data was modified.'	The file stored on the SD card did not contain a flight plan, only user waypoints. These waypoints have been saved to the system user waypoints. No flight plans stored in the system have been modified.
'No flight plan files found to import.'	The SD card contains no flight plan data.
'Flight plan import failed.'	Flight plan data was not successfully imported from the SD card.
'Flight plan partially imported.'	Some flight plan waypoints were successfully imported from the SD card, however others had errors and were not imported. A partial stored flight plan now exists in the system.
'File contained user waypoints only.'	The file stored on the SD card did not contain a flight plan, only user waypoints. One or more of these waypoints did not import successfully.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints that the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

Table 5-11 Flight Plan Import/Export Messages

Flight plans can be transferred to or from a mobile device via the Flight Stream 510 Bluetooth wireless connection. Transfer of a flight plan to a mobile device is controlled by the mobile device.

Previewing a pending flight plan transfer from a wireless connection:

- 1) When a flight plan transfer has been initiated from a mobile device, a Pending Flight Plan pop-up alert appears in the lower right corner of the MFD, and an Connex announcement appears to the right of the MFD page name.
- 2) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.

Or:

Press the **Preview** Softkey to display the 'FPL - Preview Flight Plan' Page on the MFD.

Or:

- a) Press the **MENU** Key,
- b) Turn the **FMS** Knob to highlight 'Preview Flight Plan'.
- c) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.

Ignoring a pending flight plan transfer from a wireless connection:

- 1) When a flight plan transfer has been initiated from a mobile device, a Pending Flight Plan pop-up alert appears in the lower right corner of the MFD, and an Connex announcement appears to the right of the MFD page name.
- 2) Press the **CLR** Key to remove the pop-up alert and ignore the pending flight plan. The pending flight plan will still be available on the 'FPL - Flight Plan Catalog' Page.

Or:

Press the **Ignore** Softkey to remove the pop-up alert and ignore the pending flight plan. The pending flight plan will still be available on the 'FPL - Flight Plan Catalog' Page.



Figure 5-51 Pending Flight Plan Transfer



Figure 5-52 Preview Flight Plan Page

Storing a pending flight plan:

- 1) Press the **FPL** Key on the MFD.
- 2) Turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor, and
- 4) Turn the **FMS** Knob to highlight the pending flight plan.
- 5) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.
- 6) Press the **Store** Softkey to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

Or:

- a) Press the **FMS** Knob to activate the cursor.
- b) Turn the **FMS** Knob to highlight 'Store?'
- c) Press the **ENT** Key to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

Or:

- a) Press the **MENU** Key,
- b) Turn the **FMS** Knob to highlight 'Store Flight Plan'.
- c) Press the **ENT** Key to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

Activating a pending flight plan:

- 1) Press the **FPL** Key on the MFD and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the pending flight plan.
- 3) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page.
- 4) Press the **Activate** Softkey. The 'Activate Flight Plan?' window is displayed.

Or:

- a) Press the **FMS** Knob to activate the cursor.
- b) Turn the **FMS** Knob to highlight 'Activate?'
- c) Press the **ENT** Key. The 'Activate Flight Plan?' window is displayed.

Or:

- a) Press the **MENU** Key.
 - b) Turn the **FMS** Knob to highlight 'Activate Flight Plan'.
 - c) Press the **ENT** Key. The 'Activate Flight Plan?' window is displayed.
- 5) With 'OK' highlighted, press the **ENT** Key to activate the pending flight plan. The pending flight plan becomes the active flight plan and is removed from the Flight Plan Catalog Page. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

Deleting a pending flight plan:

- 1) Press the **FPL** Key on the MFD.
- 2) Turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor.
- 4) Turn the **FMS** Knob to highlight the desired pending flight plan.
- 5) Press the **Delete** Softkey. The 'Delete Flight Plan XX?' window is displayed.

Or:

Press the **CLR** Key. The 'Delete Flight Plan XX?' window is displayed.

Or:

- a) Press the **MENU** Key.
- b) Turn the **FMS** Knob to highlight 'Delete Flight Plan'.
- c) Press the **ENT** Key. The 'Delete Flight Plan XX?' window is displayed.
- 6) With 'OK' highlighted, press the **ENT** Key to delete the pending flight plan. The pending flight plan is removed from the Flight Plan Catalog Page. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

Deleting all pending flight plans:

- 1) Press the **FPL** Key on the MFD.
- 2) Turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **MENU** Key.
- 4) Turn the **FMS** Knob to highlight 'Delete All Pending'.
- 5) Press the **ENT** Key. A 'Delete all pending flight plans?' confirmation window is displayed.
- 6) With 'OK' highlighted, press the **ENT** Key to delete all pending flight plans. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

ADDING WAYPOINTS TO AN EXISTING FLIGHT PLAN

Waypoints can be added to the active flight plan or any stored flight plan. Choose the flight plan, select the desired point of insertion, enter the waypoint, and it is added in front of the selected waypoint. Flight plans are limited to 100 waypoints (including waypoints within airways and procedures). If the number of waypoints in the flight plan exceeds 100, the message “Flight plan is full. Remove unnecessary waypoints.” appears and the new waypoint(s) are not added to the flight plan.



NOTE: Manually adding waypoints to a flight plan after a MANSEQ leg creates a lateral gap in the flight plan. Time, fuel, and distance values for legs beyond the gap do not include the distance across the gap.



- Stored Flight Plan Selected
- Memory Slot
 - Comment
 - Procedure Identifier
 - Waypoint Identifier
 - Airway Identifier
 - Desired Track to Waypoint
 - Distance to Waypoint
 - Waypoint Altitude Constraint

Figure 5-53 Stored Flight Plan Page

Adding a waypoint to a stored flight plan:

- 1) On the ‘FPL - Flight Plan Catalog’ Page, press the **FMS** Knob to activate the cursor.
- 2) Highlight the desired flight plan.
- 3) Press the **Edit** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select “EDIT” and press the **ENT** Key. The Stored Flight Plan Page is displayed.
- 4) Select the point in the flight plan to add the new waypoint. The new waypoint is placed directly in front of the highlighted waypoint.
- 5) Turn the small **FMS** Knob to display the ‘Waypoint Information’ Window. (Turning it clockwise displays a blank ‘Waypoint Information’ Window, turning it counter-clockwise displays the ‘Waypoint Information Window’ with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, user, or airway waypoints).
- 6) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The new waypoint now exists in the flight plan.



NOTE: If the identifier entered in the Waypoint Information Window has duplicates, a Duplicate Waypoint Window is displayed. Use the FMS Knob to select the correct waypoint.

Adding a waypoint to the active flight plan:

- 1) Press the **FPL** Key.
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD).
- 3) Select the point in the flight plan to add the new waypoint. The new waypoint is placed prior to the highlighted waypoint.
- 4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window. (Turning it clockwise displays a blank 'Waypoint Information' Window, turning it counter-clockwise displays the 'Waypoint Information' Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, user, or airway waypoints).
- 5) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The active flight plan is modified as each waypoint is entered.

Creating and adding user waypoints to the active flight plan:

- 1) Push the **Joystick** on the MFD to activate the panning function on the 'FPL - Active Flight Plan' Page and pan to the map location of the desired user waypoint.
- 2) Press the **LD WPT** Softkey; or press the **MENU** Key, select 'Load Waypoint', and press the **ENT** Key. The user waypoint is created with a name of USRxxx (using the next available in sequence) and is added to the active flight plan.

ADDING AIRWAYS TO A FLIGHT PLAN

Airways can be added to the active flight plan or any stored flight plan. Choose a flight plan (add the desired airway entry point if not already in the flight plan), select the waypoint after the desired airway entry point, select the airway, and it is added in front of the selected waypoint. An airway can only be loaded if there is a waypoint in the flight plan that is part of the desired airway and is not part of an arrival or approach procedure. The system also anticipates the desired airway and exit point based on loaded flight plan waypoints.



Figure 5-54 Select Airway Page - Selecting Airway

Adding an airway to a flight plan:

- 1) Press the **FPL** Key.
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD).
- 3) Turn the large **FMS** Knob to highlight the waypoint after the desired airway entry point. If this waypoint is not a valid airway entry point, a valid entry point should be entered at this time.
- 4) Turn the small **FMS** Knob one click clockwise and press the **LD AIRWY** Softkey, or press the **MENU** Key and select 'Load Airway'. The Select Airway Page/Window is displayed. The **LD AIRWY** Softkey or the 'Load Airway' menu item is available only when a valid airway entry waypoint has been chosen (the waypoint ahead of the cursor position).
- 5) Turn the **FMS** Knob to select the desired airway from the list, and press the **ENT** Key.
- 6) Turn the **FMS** Knob to select the desired airway exit point from the list, and press the **ENT** Key. 'Load?' is highlighted.
- 7) Press the **ENT** Key. The system returns to editing the flight plan with the new airway inserted.



Figure 5-55 Select Airway Page - Selecting Exit Point

RESTRICTIONS ON ADDING AIRWAYS

Some airways have directional restrictions on all or part of the route. Airway “A2” in Europe has a directional restriction over the whole route such that it can be flown only one direction.

For example, airway “UR975” in North Africa has more complicated directional restrictions within the list of airway waypoints. That is, each waypoint may have its own conditional route in relation to another waypoint.

In the US, airways that are “one-way” for specified hours of operation are not uncommon. These airways are always bidirectional in the system database.

The system only allows correct airway sequences to be inserted. If the pilot subsequently inverts the flight plan, the system inverts the airway waypoint sequence and removes the airway header.

ADDING PROCEDURES TO A STORED FLIGHT PLAN

The system allows the pilot to insert pre-defined instrument procedures from the navigation database into a flight plan. The procedures are designed to facilitate routing of traffic leaving an airport (departure), arriving at an airport (arrival), and landing at an airport (approach). See the procedures section for more details.

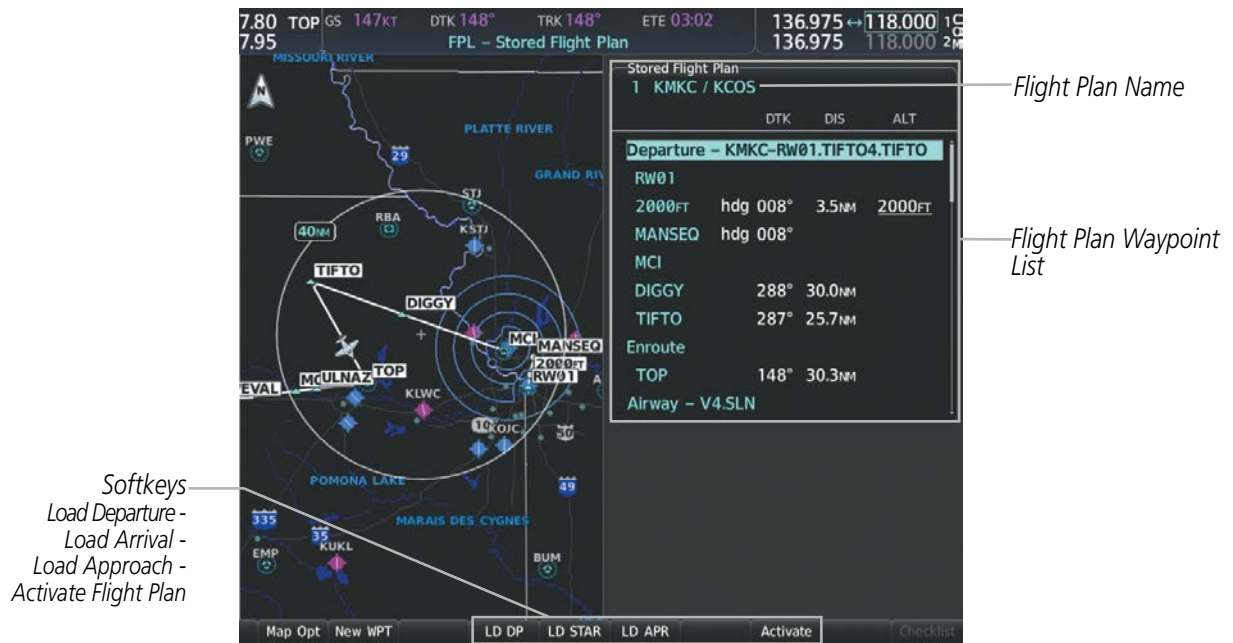


Figure 5-56 Stored Flight Plan Page

DEPARTURE

A Departure Procedure (DP) is loaded at the departure airport in the flight plan. Only one departure can be loaded at a time in a flight plan. The route is defined by selection of a departure, the transition waypoints, and a runway.



Figure 5-57 Departure Loading Page - Selecting the Departure

Loading a departure procedure into a stored flight plan:

- 1) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 3) Press the **LD DP** Softkey; or press the **MENU** Key, select 'Load Departure', and press the **ENT** Key. The 'PROC - Departure Loading' Page is displayed.
- 4) Select a departure. Press the **ENT** Key.
- 5) Select a runway served by the selected departure, if required. Press the **ENT** Key.
- 6) Select a transition for the selected departure. Press the **ENT** Key.
- 7) Press the **ENT** Key to load the selected departure procedure.

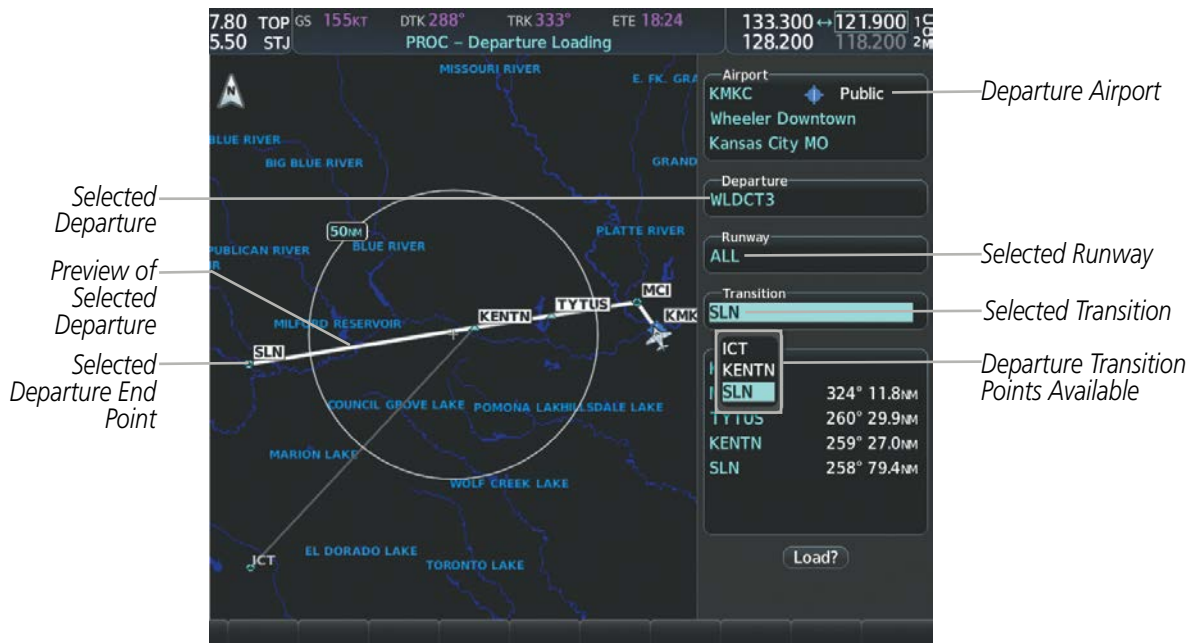


Figure 5-58 Departure Loading Page - Selecting Transition

ARRIVAL

A Standard Terminal Arrival (STAR) is loaded at the destination airport in the flight plan. Only one arrival can be loaded at a time in a flight plan. The route is defined by selection of an arrival, the transition waypoints, and a runway.



Figure 5-59 Arrival Loading Page - Selecting the Arrival

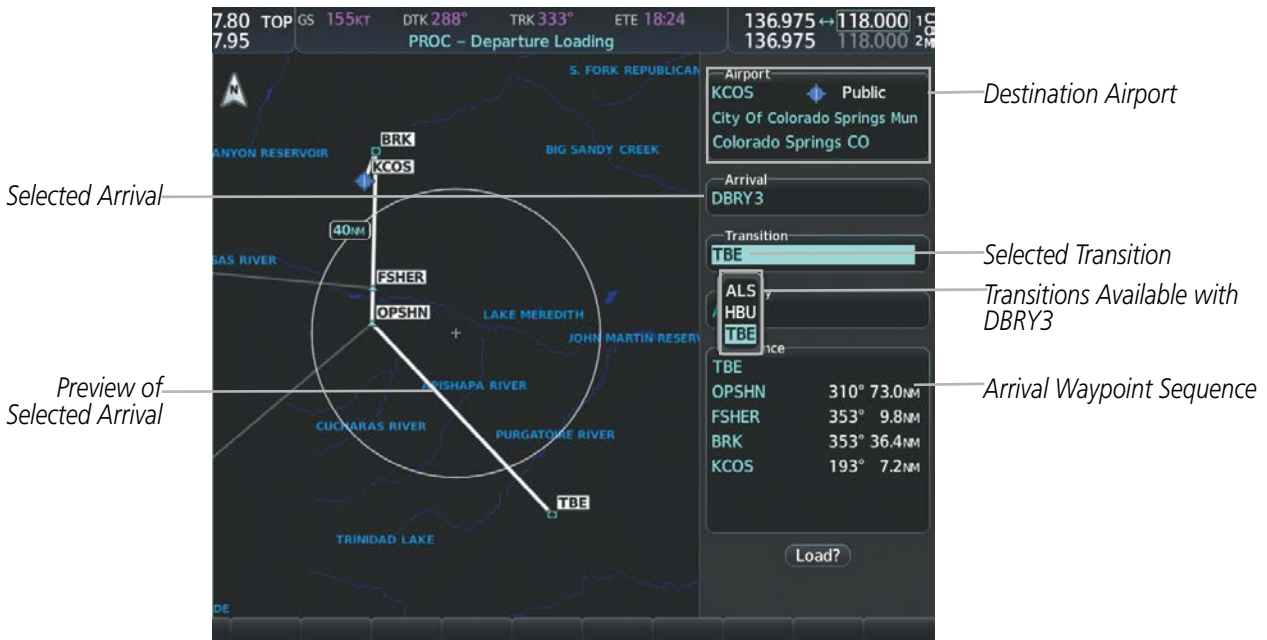


Figure 5-60 Arrival Loading Page - Selecting the Transition

Loading an arrival procedure into a stored flight plan:

- 1) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 3) Press the **LD STAR** Softkey; or press the **MENU** Key, select "Load Arrival", and press the **ENT** Key. The 'PROC - Arrival Loading' Page is displayed.
- 4) Select an arrival. Press the **ENT** Key.
- 5) Select a transition for the selected arrival. Press the **ENT** Key.
- 6) Select a runway served by the selected arrival, if required. Press the **ENT** Key.
- 7) Press the **ENT** Key to load the selected arrival procedure.

APPROACH

An Approach Procedure (APR) can be loaded at any airport that has an approach available. Only one approach can be loaded at a time in a flight plan. The route for a selected approach is defined by designating transition waypoints.

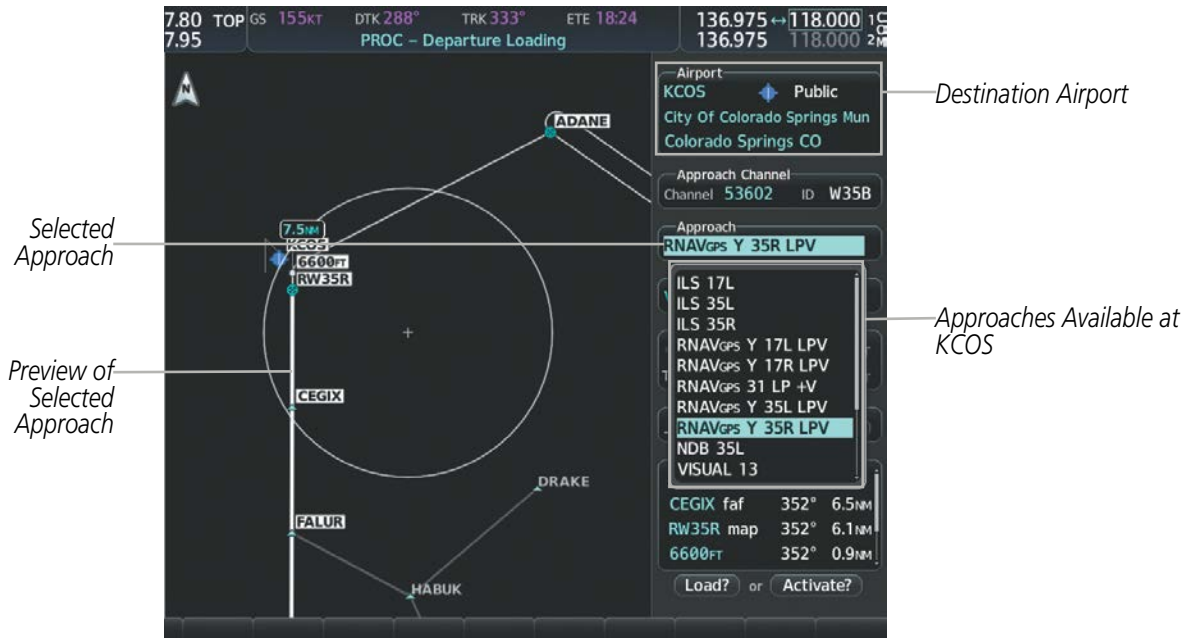


Figure 5-61 Approach Loading Page - Selecting the Approach

Loading an approach procedure into a stored flight plan:

- 1) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 3) Press the **LD APR** Softkey; or press the **MENU** Key, select 'Load Approach', and press the **ENT** Key. The 'PROC - Approach Loading' Page is displayed.
- 4) Select the airport and approach:
 - a) Use the **FMS** Knob to select an airport and press the **ENT** Key.
 - b) Select an approach from the list and press the **ENT** Key.

Or:

 - a) If necessary, push the **FMS** Knob to exit the approach list, and use the large **FMS** Knob to move the cursor to the 'Approach Channel' Field.
 - b) Use the **FMS** Knob to enter the approach channel number, and press the **ENT** Key to accept the approach channel number. The airport and approach are selected.
- 5) Select a transition for the selected approach. Press the **ENT** Key.
- 6) Press the **ENT** Key to load the selected approach procedure.

7.80 TOP GS 155KT DTK 288° TRK 333° ETE 18:24 136.975 ↔ 118.000 10
7.95 PROC - Departure Loading 136.975 118.000 20

ADANE

KCOS
7.5NM Out
RW35R

CEGIX

FALUR

HABUK

DRAKE

Airport
KCOS Public
City Of Colorado Springs Mun
Colorado Springs CO

Destination Airport

Approach Channel
Channel 53602 ID W35B

Approach
RNAVaps Y 35R LPV

Transition
HABUK iaf

Selected Transition

VECTORS
HABUK iaf
DRAKE
PUB

Transitions Available with Selected Approach

Sequence
HABUK iaf
FALUR 290° 7.0NM
CEGIX faf 352° 6.5NM
RW35R map 352° 6.1NM

Approach Waypoint Sequence

Selected Approach

Preview of Selected Approach

Figure 5-62 Approach Loading Page - Selecting the Transition

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FLIGHT PLAN STORAGE

The system can store up to 99 flight plans, numbered 1 through 99. The active flight plan is erased when the system is powered off or when another flight plan is activated. Details about each stored flight plan can be viewed on the Flight Plan Catalog Page and on the Stored Flight Plan Page.

Viewing information about a stored flight plan:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired flight plan.
- 4) The 'Flight Plan Info' Box displays departure, destination, total distance, and enroute safe altitude information for the selected flight plan.
- 5) Press the **Edit** Softkey to open the 'FPL - Stored Flight Plan' Page and view the waypoints in the flight plan.
- 6) Press the **FMS** Knob to exit the 'FPL - Stored Flight Plan' Page.



Figure 5-63 Stored Flight Plan Information

Storing an active flight plan from the Active Flight Plan Page or the Active Flight Plan Window:

- 1) Press the **MENU** Key.
- 2) Highlight 'Store Flight Plan'.
- 3) Press the **ENT** Key.
- 4) With 'OK' highlighted, press the **ENT** Key. The flight plan is stored in the next available position in the flight plan list on the 'FPL - Flight Plan Catalog' Page.

ACTIVATE A FLIGHT PLAN

Activating a stored flight plan erases the active flight plan and replaces it with the flight plan being activated. Inverting a stored flight plan reverses the waypoint order, erases the active flight plan, and replaces it with the flight plan being activated (the stored flight plan is not changed).

Activating a stored flight plan on the MFD:

- 1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
- 3) Press the **Activate** Softkey; or press the **ENT** Key twice; or press the **MENU** Key, highlight 'Activate Flight Plan', and press the **ENT** Key. The 'activate stored flight plan?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

COPY A FLIGHT PLAN

The system allows copying a flight plan into a new flight plan memory slot, allowing editing, etc., without affecting the original flight plan. This can be used to duplicate an existing stored flight plan for use in creating a modified version of the original stored flight plan.

Copying a stored flight plan on the MFD:

- 1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
- 3) Press the **Copy** Softkey; or press the **MENU** Key, highlight 'Copy Flight Plan', and press the **ENT** Key. The 'Copy to flight plan XX?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key to copy the flight plan. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

DELETE A STORED FLIGHT PLAN

Individual or all stored flight plans can be deleted from the system memory.

Deleting a stored flight plan:

- 1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
- 3) Press the **Delete** Softkey; press the **CLR** Key; or press the **MENU** Key, highlight 'Delete Flight Plan', and press the **ENT** Key. The 'Delete flight plan XX?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key to delete the flight plan. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.



NOTE: The option to delete all stored flight plans is not available while the aircraft is in flight.

Deleting all stored flight plans:

- 1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **MENU** Key.
- 3) Highlight 'Delete All' and press the **ENT** Key. A 'Delete all flight plans?' confirmation window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key to delete all flight plans. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

FLIGHT PLAN EDITING

The active flight plan or any stored flight plan can be edited. The edits made to the active flight plan affect navigation as soon as they are entered.

DELETING THE ACTIVE FLIGHT PLAN

The system allows deleting an active flight plan. Deleting the active flight plan suspends navigation by the system.

Deleting the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, highlight 'Delete Flight Plan', and press the **ENT** Key. The 'Delete all waypoints in flight plan?' window is displayed.
- 3) With 'OK' highlighted, press the **ENT** Key to delete the active flight plan. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

DELETING FLIGHT PLAN ITEMS

Individual waypoints, entire airways, and entire procedures can be deleted from a flight plan. Some waypoints in the final approach segment (such as the FAF or MAP) can not be deleted individually. Attempting to delete a waypoint that is not allowed results in a window displaying 'Invalid flight plan modification.'



NOTE: If removal of a flight plan item (waypoint, procedure, etc.) results in deletion of the end waypoint of the active leg, an off-route direct-to to the deleted waypoint is created and activated.

Deleting an individual waypoint from the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint to be deleted.
- 3) Press the **CLR** Key. The 'Remove XXXXX?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

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Deleting an entire airway from the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the header of the airway to be deleted.
- 3) Press the **CLR** Key. The 'Remove <airway name> from flight plan?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire procedure from the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the header of the procedure to be deleted.
- 3) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

Or:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key to display the Page Menu and turn the **FMS** Knob to highlight 'Remove <procedure>'.
- 3) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

Deleting an individual waypoint from a stored flight plan:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
- 4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 5) Turn the large **FMS** Knob to highlight the waypoint to be deleted.
- 6) Press the **CLR** Key. The 'Remove XXXXX?' window is displayed.
- 7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.
- 8) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire airway from a stored flight plan:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
- 4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 5) Turn the large **FMS** Knob to highlight the header of the airway to be deleted.
- 6) Press the **CLR** Key. The 'Remove <airway name> from flight plan?' window is displayed.
- 7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.
- 8) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire procedure from a stored flight plan:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
- 4) Press the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 5) Turn the large **FMS** Knob to highlight the header of the procedure to be deleted.
- 6) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' window is displayed.
- 7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.
- 8) Press the **FMS** Knob to remove the flashing cursor.

Or:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
- 4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 5) Press the **MENU** Key to display the Page Menu and turn the **FMS** Knob to highlight 'Remove <procedure>'.
- 6) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' window is displayed.
- 7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.
- 8) Press the **FMS** Knob to remove the flashing cursor.

CHANGING FLIGHT PLAN COMMENTS (NAMES)

The comment field (or name) of each flight plan can be changed to something that is useful for identification and sorting.

Changing the active flight plan comment:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob to activate the cursor and turn the large **FMS** Knob to highlight the comment field.
- 3) Use the **FMS** Knobs to edit the comment.
- 4) Press the **ENT** Key to accept the changes.
- 5) Press the **FMS** Knob to remove the flashing cursor.

Changing a stored flight plan comment:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
- 3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
- 4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
- 5) Turn the large **FMS** Knob to highlight the comment field.
- 6) Use the **FMS** Knobs to edit the comment.
- 7) Press the **ENT** Key to accept the changes.
- 8) Press the **FMS** Knob to remove the flashing cursor.

ALONG TRACK OFFSETS

A waypoint having an "along track offset" distance from an existing waypoint can be entered into a flight plan. Along track offset waypoints lie along the path of the existing flight plan, and can be used to make the system reach a specified altitude before or after reaching the specified flight plan waypoint. Offset distances can be entered from 1 to 999 nm in increments of 1 nm. Entering a negative offset distance results in an along track offset waypoint inserted before the selected waypoint, whereas entering a positive offset distance results in an along track offset waypoint inserted after the selected waypoint. Multiple offset waypoints are allowed.

A waypoint must be adjacent to its parent waypoint in the flight plan, so the system limits the along-track distance to less than the length of the leg before or after the selected waypoint. If the selected waypoint is the active waypoint, the distance is limited to less than the distance to go to the active waypoint. Assigning an along track offset to a leg with indeterminate length is not permitted. An along track offset is not allowed at or after the final approach fix of an approach.

An along track offset distance cannot be modified once entered. If the along track offset distance must be changed, the existing along track offset waypoint must be deleted and a new one created with the new offset distance.



Figure 5-64 Along Track Offset

Entering an along track offset distance:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the along track offset.
- 3) Press the **ATK OFS** Softkey (MFD only); or press the **MENU** Key, highlight 'Create ATK Offset Waypoint', and press the **ENT** Key.
- 4) Enter a positive or negative offset distance in the range of +/- 1 to 999 nm (limited by leg distances).
- 5) Press the **ENT** Key to create the offset waypoint.
- 6) Press the **FMS** Knob to remove the flashing cursor.

PARALLEL TRACK

The Parallel Track (PTK) feature allows creation of a parallel course offset of 1 to 50 nm left or right of the current flight plan. When Parallel Track is activated, the course line drawn on the map pages shows the parallel course, and waypoint names have a lower case "p" placed after the identifier.

While flying a parallel track:

- Initiating a direct-to will cancel the parallel track and fly direct-to the selected waypoint.
- Initiating a hold at the present position will cancel the parallel track and fly the holding pattern.
- Initiating a hold at a waypoint will result in the aircraft flying the parallel track until a turn is required to fly to the hold waypoint. If the hold is removed prior to reaching the hold waypoint, the parallel track will be resumed. Once the holding pattern is active, the parallel track will not be resumed upon exiting the hold.

Parallel Track is also cancelled if a course change occurs greater than 120° or the parallel tracks overlap as a result of the course change.



NOTE: Vertical navigation is unavailable while the Parallel Track feature is active.

Activating parallel track:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, highlight 'Parallel Track', and press the **ENT** Key. The 'Parallel Track' Window is displayed with the 'Direction' Field highlighted.
- 3) Turn the small **FMS** Knob to select 'LEFT' or 'RIGHT' and press the **ENT** Key. The 'Distance' Field is highlighted.
- 4) Turn the small **FMS** Knob to enter a distance from 1-99 nm and press the **ENT** Key. 'Activate Parallel Track' is highlighted.
- 5) Press the **ENT** Key to activate parallel track. Press the **FMS** Knob or the **CLR** Key to cancel the parallel track activation.



Figure 5-65 Parallel Track Window



Figure 5-66 Parallel Track Active

If the parallel track proposed by the offset direction and distance is not allowed by the system, the activation prompt is displayed, but disabled. If an approach leg is active, the status indicates that the system is unable to activate the parallel track with the message 'Parallel Track Unavailable Approach Leg Active'. If the offset direction and distance results in an unreasonable route geometry (e.g., there is a sharp turn of more than 120 degrees), the status indicates that the system is unable to activate the parallel track because of invalid geometry ('Parallel Track Unavailable Invalid Route Geometry'). If the active leg is not a track between two fixes (TF) or a course to a fix (DF) leg, the status indicates that the system is unable to activate the parallel track because parallel track is not available for the active leg type ('Parallel Track Unavailable Not Allowed for Active Leg'). Parallel track is also unavailable for a leg if there are no legs remaining in the flight plan after the given leg, or OBS mode is active. Parallel track will be cancelled if the active leg changes to a leg where one of the preceding is true.

Activation of parallel track will apply from the current position along the flight plan until a leg that does not meet the criteria for parallel track. Guidance will be computed to return to the original track at the beginning of that leg.

Cancelling parallel track:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, highlight 'Parallel Track', and press the **ENT** Key. The 'Parallel Track' Window is displayed with 'Cancel Parallel Track?' highlighted.
- 3) Press the **ENT** Key.

ACTIVATING A FLIGHT PLAN LEG

The system allows selection of a highlighted leg as the "active leg" (the flight plan leg which is currently used for navigation guidance).

Activating a flight plan leg:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the destination waypoint for the desired leg.
- 3) Press the **ACT Leg** Softkey (MFD only); or press the **MENU** Key, highlight 'Activate Leg', and press the **ENT** Key. A confirmation window is displayed with 'Activate' highlighted.
- 4) Press the **ENT** Key to activate the flight plan leg. To cancel, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

INVERTING A FLIGHT PLAN

Any flight plan may be inverted (reversed) for navigation back to the original departure point.

Inverting the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, highlight 'Invert Flight Plan', and press the **ENT** Key. An 'Invert active flight plan?' confirmation window is displayed.
- 3) Select 'OK'.
- 4) Press the **ENT** Key to invert and activate the active flight plan. To cancel, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

Inverting and activating a stored flight plan on the MFD:

- 1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
- 2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
- 3) Press the **Invert** Softkey; or press the **MENU** Key, highlight 'Invert & Activate FPL?', and press the **ENT** Key. The 'Invert and activate stored flight plan?' window is displayed.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

FLIGHT PLAN VIEWS

Information about flight plans can be viewed in more than one way. The active flight plan can be configured to show cumulative distance over the length of the flight plan or the distance for each leg of the flight plan; and the active flight plan can be viewed in a narrow or wide view. In the wide view, additional information is displayed: Fuel Remaining (FUEL REM), Estimated Time Enroute (ETE), Estimated Time of Arrival (ETA), and Bearing to the waypoint (BRG).

Changing the flight plan view:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **View** Softkey to display the **Wide**, **Narrow**, **Leg-Leg**, and **CUM** Softkeys.
- 3) Press the **CUM** Softkey to view cumulative waypoint distance, or press the **Leg-Leg** Softkey to view leg-to-leg waypoint distance.
- 4) Press the **Wide** Softkey to display the wide view, or select the **Narrow** Softkey to display the narrow view.
- 5) Press the **Back** Softkey to return to the top level active flight plan softkeys.

COLLAPSING AIRWAYS

The system allows airways on the active flight plan to be collapsed or expanded from the Stored or Active Flight Plan Page/Window. When airways have been collapsed, it is indicated on the airway heading.

When airways are collapsed, leg-to-leg computed values such as DIS or ETE shown for the exit waypoint reflect the total of all the legs on the airway that have been hidden in the collapsed display. The DTK value is inhibited because it is not usable in this context.

The Active Flight Plan Page always keeps the following three waypoints visible: “From” waypoint, “To” waypoint, and “Next” waypoint. To prevent one or more of these waypoints from being hidden in a collapsed airway segment, the airway segment that contains either the “To” or the “Next” waypoint is automatically expanded. When an airway is loaded, airways are automatically expanded to facilitate flight plan review.

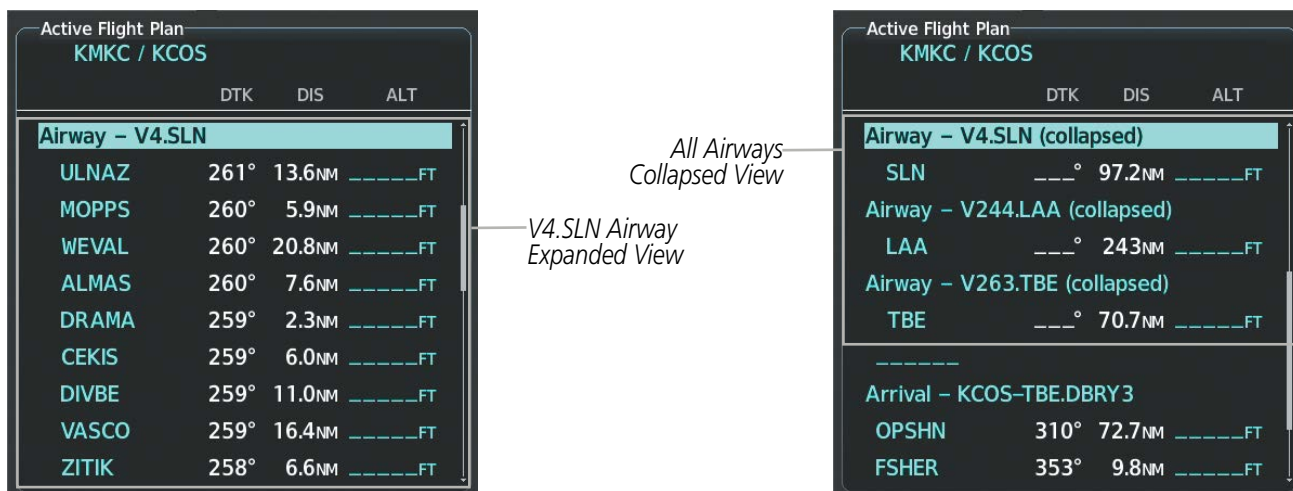


Figure 5-67 Expanded/Collapsed Airways

Collapsing/expanding the airways in the active flight plan:

- 1) Press the **FPL** Key to display the ‘FPL - Active Flight Plan’ Page (MFD) or the ‘Flight Plan’ Window (PFD).
- 2) Press the **MENU** Key, highlight ‘Collapse Airways’ or ‘Expand Airways’, and press the **ENT** Key. The airways are collapsed/expanded.

CLOSEST POINT OF FPL

‘Closest Point of FPL’ calculates the bearing and closest distance at which a flight plan passes a reference waypoint, and creates a new user waypoint along the flight plan at the location closest to a chosen reference waypoint.

Determining the closest point along the active flight plan to a selected waypoint:

- 1) Press the **FPL** Key to display the ‘FPL - Active Flight Plan’ Page (MFD) or the ‘Flight Plan’ Window (PFD).
- 2) Press the **MENU** Key, highlight ‘Closest Point Of FPL’, and press the **ENT** Key. A window appears with the reference waypoint field highlighted.
- 3) Enter the identifier of the reference waypoint. The system displays the bearing (BRG) and distance (DIS) to the closest point along the flight plan to the selected reference waypoint and creates a user waypoint at this location. Press the **ENT** Key. The name for the new user waypoint is derived from the identifier of the reference waypoint.

USER-DEFINED HOLDING PATTERNS

A holding pattern can be defined at any active flight plan waypoint, at the aircraft present position, or at a direct-to waypoint.

Creating a user-defined hold at an active flight plan waypoint:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the hold.
- 3) Press the **MENU** Key, highlight 'Hold At Waypoint', and press the **ENT** Key. The 'Hold at' Window appears with the course field highlighted.
- 4) Use the **FMS** Knobs to edit the course, and press the **ENT** Key.
- 5) Use the small **FMS** Knob to select 'Inbound' or 'Outbound' course direction, and press the **ENT** Key.
- 6) Use the small **FMS** Knob to select 'Time' or 'Distance' length mode, and press the **ENT** Key.
- 7) Use the **FMS** Knobs to edit the length, and press the **ENT** Key.
- 8) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
- 9) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC Time), and press the **ENT** Key.
- 10) Press the **ENT** Key while 'Load?' is highlighted to insert the hold into the flight plan.

Creating a user-defined hold at the aircraft present position:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, highlight 'Hold At Present Position', and press the **ENT** Key. The 'Hold at' Window appears with the course field highlighted.
- 3) If desired, use the **FMS** Knobs to edit the course, and press the **ENT** Key.
- 4) Use the small **FMS** Knob to select 'Inbound' or 'Outbound' course direction, and press the **ENT** Key.
- 5) Use the small **FMS** Knob to select 'Time' or 'Distance' length mode, and press the **ENT** Key.
- 6) Use the **FMS** Knobs to edit the length, and press the **ENT** Key.
- 7) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
- 8) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC Time), and press the **ENT** Key.
- 9) Press the **ENT** Key while 'Activate?' is highlighted to create an Offroute Direct-to hold waypoint at the aircraft present position and activate the hold.

Creating a user-defined hold at a direct-to waypoint:

- 1) Press a **Direct-to** Key and set up the direct-to waypoint as desired, but select 'Hold?' instead of 'Activate?' when finished (MFD or PFD).
- 2) Use the **FMS** Knobs to edit the course, and press the **ENT** Key.
- 3) Use the small **FMS** Knob to select 'Inbound' or 'Outbound' course direction, and press the **ENT** Key.
- 4) Use the small **FMS** Knob to select 'Time' or 'Distance' length mode, and press the **ENT** Key.
- 5) Use the **FMS** Knobs to edit the length, and press the **ENT** Key.
- 6) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
- 7) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC TIME), and press the **ENT** Key.
- 8) Press the **ENT** Key while 'Activate?' is highlighted to activate the direct-to with the user-defined hold defined at the direct-to waypoint. (If the direct-to waypoint is part of the active flight plan, the hold is inserted into the active flight plan. If the direct-to waypoint is not part of the active flight plan, an off-route direct-to hold is created.)

Editing a user-defined hold:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the hold.
- 3) Press the **MENU** Key, highlight 'Edit Hold', and press the **ENT** Key. The 'Hold at' Window appears with the course field highlighted.
- 4) Use the **FMS** Knobs to edit the course, and press the **ENT** Key.
- 5) Use the small **FMS** Knob to select 'Inbound' or 'Outbound' course direction, and press the **ENT** Key.
- 6) Use the small **FMS** Knob to select 'Time' or 'Distance' length mode, and press the **ENT** Key.
- 7) Use the **FMS** Knobs to edit the length, and press the **ENT** Key.
- 8) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
- 9) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC Time), and press the **ENT** Key.
- 10) Press the **ENT** Key while 'Update?' is highlighted to update the hold.

Active Flight Plan
KMKC / KCOS

	DTK	DIS	ALT
RW01			
2000FT	hdg	°	_____NM _____FT
MANSEQ	hdg	°	
MCI			
DIGGY	288°	29.8NM	_____FT
TIFTO	287°	25.7NM	_____FT
Enroute			
TOP	148°	30.4NM	_____FT
Airway - V4.SLN			
ULNAZ	261°	13.6NM	_____FT

Waypoint Selected

Page Menu

- Options
- Activate Leg
- Load Airway
- Collapse Airways
- Hold At Waypoint**
- Hold At Present Position
- Create ATK Offset Waypoint
- VNV -B>
- Select VNV Profile Window
- Cancel VNV
- Delete Flight Plan
- Store Flight Plan
- Invert Flight Plan
- Temperature Compensation
- Create New User Waypoint
- Remove Departure

Hold At Waypoint Menu Selection

Press the FMS CRSR knob to return to base page

Hold at

Direction, Course

Hold East of TIFTO

Course **287°** **Inbound**

Hold Entry Course

Location of Hold

Course Direction Inbound or Outbound

Leg Time, Distance

Leg **Time** **1:00**

Leg Length Mode Button (Time or Distance)

Leg Length (Time in nm or Distance in minutes)

Turns

Turn Direction **Right**

Turn Direction (Right or Left)

Map

Map of Hold Location

1.5NM

TIFTO

Expect Further Clearance

EFC Time **__: __ UTC**

Expect Further Clearance Time

Load?

Load Hold in Active Flight Plan

Figure 5-68 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Active Flight Plan
KMKC / KCOS

	DTK	DIS	ALT
RW01			
2000FT	hdg	°	___NM ___FT
MANSEQ	hdg	°	
MCI			
DIGGY	288°	29.8NM	___FT
TIFTO	287°	25.7NM	___FT
Enroute			
TOP	148°	30.4NM	___FT
Airway - V4.SLN			
ULNAZ	261°	13.6NM	___FT

Waypoint Selected

Direct To
Ident, Facility, City
TIFTO ▲ N CEN USA

VNV
___FT +0NM

Map
NORTH UP
7.5NM
TIFTO
52K KK57E

Location
BRG 288° DIS 56.8NM

Course
287°

Activate? Hold?

Hold at
Direction, Course
Hold East of TIFTO
Course 287° Inbound

Leg Time, Distance
Leg Time 1:00

Turns
Turn Direction Right

Map
1.5NM
TIFTO

Expect Further Clearance
EFC Time ___:___UTC

Activate?

- Hold Entry Course
- Location of Hold
- Course Direction (Inbound or Outbound)
- Leg Length (Time in nm or Distance in minutes)
- Turn Direction (Right or Left)
- Leg Length Mode Button (Time or Distance)
- Map of Hold Location
- Expect Further Clearance Time
- Load Hold and Activate Direct To

Hold At Direct To Waypoint Selection

Figure 5-69 Creating a User Defined Holding Pattern at a Direct To Waypoint

Exiting a user-defined hold inserted into the active flight plan:

Press the **SUSP** Softkey. The system will provide guidance to follow the holding pattern to the inbound course and resume automatic waypoint sequencing.

Removing a user-defined hold inserted into the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the 'HOLD' waypoint.
- 3) Press the **CLR** Key. A 'Remove Holding Pattern?' confirmation window is displayed.
- 4) Select 'OK' and press the **ENT** Key. The holding pattern is removed from the active flight plan. Select 'CANCEL' and press the **ENT** Key to cancel the removal of the holding pattern.

Removing a user-defined hold at an off-route direct-to:

- 1) Press a **Direct To** Key to display the 'Direct To' Window (PFD or MFD).
- 2) Press the **MENU** Key to display the Page Menu with the cursor on the 'Cancel Direct-To NAV' selection.
- 3) Press the **ENT** Key. The holding pattern is removed.

5.7 VERTICAL NAVIGATION



NOTE: The system supports vertical path guidance and altitude constraints for the following leg types: AF, CD, CF, CI, CR, DF, FC, FD, PI, RF, and TF. Altitude constraints are not retained in stored flight plans.

The system Vertical Navigation (VNV) feature provides vertical profile guidance during the enroute and terminal phases of flight. Guidance based on specified altitudes at waypoints in the active flight plan or to a direct-to waypoint is provided. It includes vertical path guidance to a descending path, which is provided as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with specified altitudes or as a vertical angle from a specified waypoint/altitude. The vertical waypoints are integrated into the active flight plan. Both manual and autopilot-coupled guidance are supported.

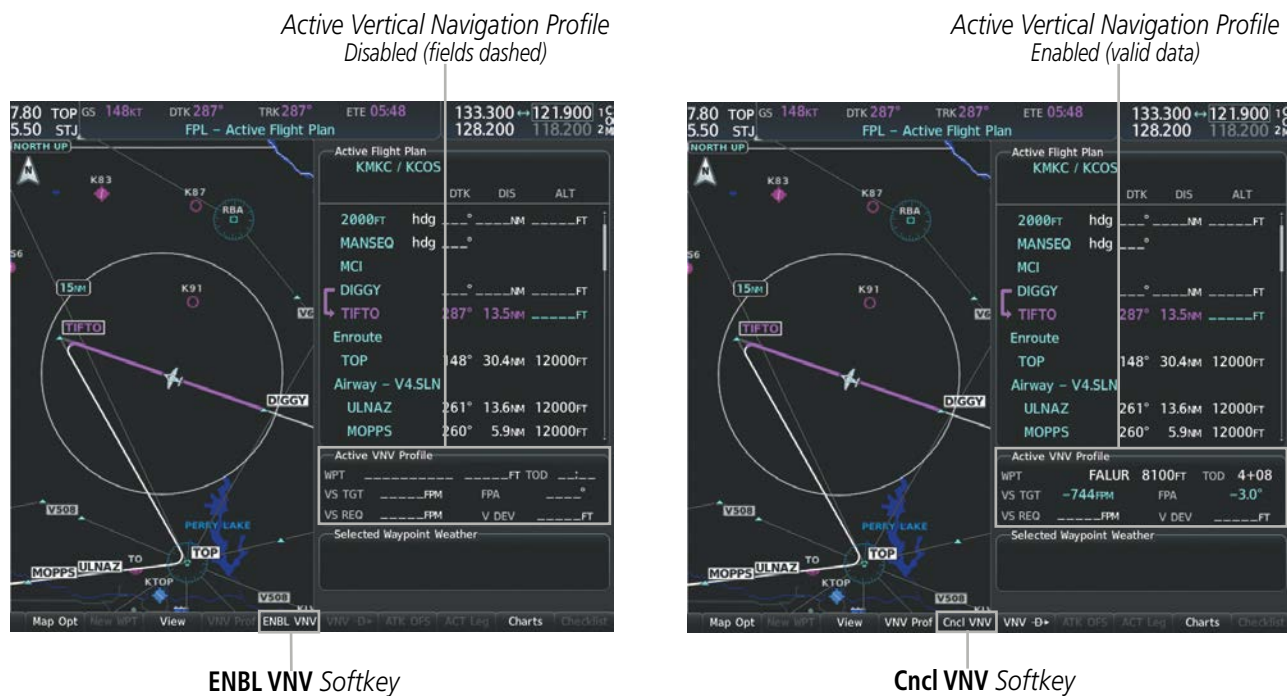


Figure 5-70 Enabling/Disabling Vertical Navigation

Enabling and Disabling VNV guidance:

- 1) Press the **FPL** Key on the MFD to display the 'FPL- Active Flight Plan' Page.
- 2) Press the **ENBL VNV** Softkey; or press the **MENU** Key, highlight 'Enable VNV', and press the **ENT** Key. Vertical navigation is enabled, and vertical guidance begins with the waypoint shown in the 'Active VNV Profile' Box (defaults first waypoint in the active flight plan with an altitude enabled for vertical navigation (e.g., FALUR)).
- 3) To Disable VNV guidance, press the **Cncl VNV** Softkey; or press the **MENU** Key, highlight 'Cancel VNV', and press the **ENT** Key. Vertical navigation is disabled.

Canceling vertical navigation results in vertical deviation (V DEV), vertical speed required (VS REQ), and time to top of descent/bottom of descent (TOD/BOD) going invalid. The Vertical Deviation Indicator (VDI) and Required Vertical Speed Indicator (RVSI) on the PFD are removed, and the V DEV, VS REQ, and TOD items displayed in the Active VNV Profile box are dashed. VNV remains disabled until manually enabled. Vertical guidance in reversionary mode can only be enabled for a direct-to waypoint.

The system allows a vertical navigation direct-to for any waypoint in the active flight plan with an altitude constraint “designated” for vertical guidance. Pressing the **VNV Direct-to** Softkey on the Active Flight Plan Page allows the flight plan to be flown, while vertical guidance based on the altitude constraint at the VNV direct-to waypoint is provided. The altitude change begins immediately and is spread along the flight plan from current position to the vertical direct-to waypoint, not just along the leg for the direct-to waypoint. A direct-to with altitude constraint activated by pressing the **Direct-to** Key also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint. A top of descent (TOD) point is computed based on the default flight path angle; descent begins once the TOD is reached.

Activating a vertical navigation direct-to:

- 1) Press the **FPL** Key on the MFD to display the ‘FPL - Active Flight Plan’ Page.
- 2) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired waypoint.



NOTE: *The selected waypoint must have a designated altitude constraint (cyan number) to be used. If not, the first waypoint in the flight plan with a designated altitude constraint is selected.*

- 3) Press the **VNV Direct-To** Softkey; or press the **MENU** Key, highlight ‘VNV Direct-To’, and press the **ENT** Key. An ‘Activate vertical Direct-to to: NNNNNFT at XXXXXX?’ confirmation window is displayed.
- 4) Press the **ENT** Key. Vertical guidance begins to the altitude constraint for the selected waypoint.
- 5) Press the **FMS** Knob to remove the flashing cursor.

The vertical navigation profile can be modified by directly entering a vertical speed target (VS TGT) and/or flight path angle (FPA) in the ‘Active VNV Profile’ Box.

Modifying the VS TGT and FPA:

- 1) Press the **FPL** Key on the MFD to display the ‘FPL - Active Flight Plan’ Page.
- 2) Press the **VNV Prof** Softkey; or press the **MENU** Key, highlight ‘Select VNV Profile Window’, and press the **ENT** Key. The cursor is now located in the ‘Active VNV Profile’ Box.
- 3) Turn the **FMS** Knobs as needed to edit the values.
- 4) Press the **FMS** Knob to remove the flashing cursor.

ALTITUDE CONSTRAINTS

The system can use altitude constraints associated with lateral waypoints to give guidance for vertical navigation. These altitudes are, depending on the specific instance, manually entered or retrieved from the published altitudes in the navigation database.

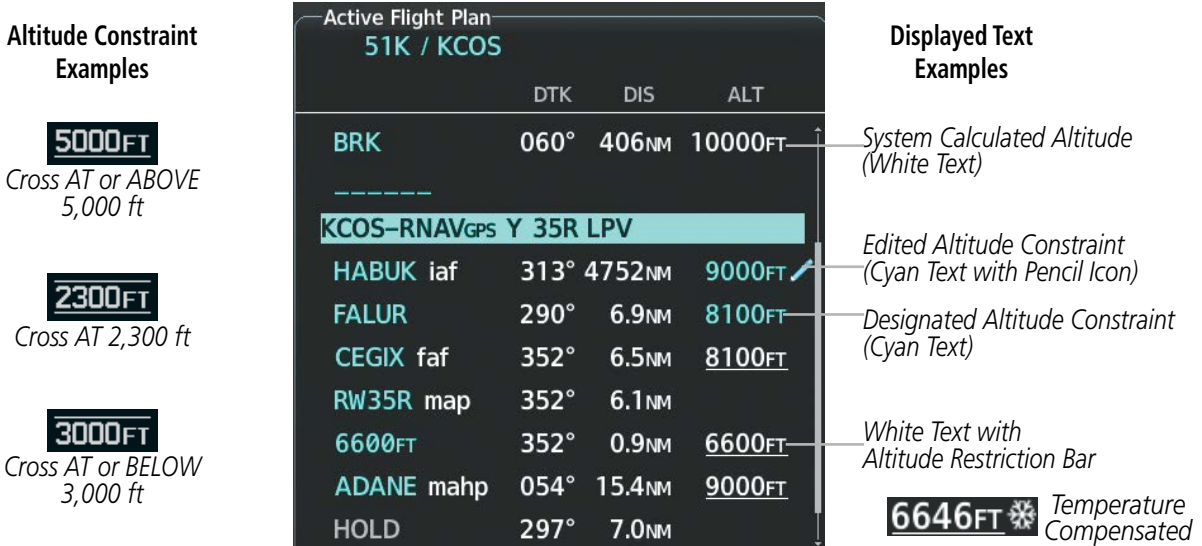


Figure 5-71 Waypoint Altitude Constraints

White Text	Cyan Text
<p>5000FT</p> <p>Altitude calculated by the system estimating the altitude of the aircraft as it passes over the navigation point. No white line above or below to indicate a potential constraint.</p>	<p>8100FT ✎</p> <p>Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manually edited data entry.</p>
<p>5000FT</p> <p>Altitude retrieved from the navigation database. White line above or below indicates the type of constraint, as shown in the preceding figure. These altitudes are provided as a reference, and are not designated to be used in determining vertical guidance.</p>	<p>8100FT</p> <p>The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.</p>

Table 5-12 Altitude Constraint Color Coding

Altitudes associated with arrival and approach procedures are not “auto-designated” by the system. This means the system does not automatically provide descending vertical speed and deviation guidance to a waypoint loaded into the system. Therefore, these altitudes are displayed as white text. The pilot can, however, choose to manually designate an altitude for vertical guidance, and all altitudes prior to the FAF can be manually designated. The FAF can be manually designated if the selected approach provides no vertical guidance (i.e. glidepath). Manually designated altitudes are displayed as cyan text.

The system will automatically calculate altitude constraints prior to the manually designated altitude, which are displayed as white text. System calculated altitudes can also be manually designated. Other displayed altitudes may change due to re-calculations or be rendered invalid as a result of manually changing an altitude to a designated altitude.



NOTE: All designated altitudes (cyan text) will be displayed in the Active Flight Plan Page and Flight Plan Window without restriction bars regardless of what is shown on the published procedure.

Designating a waypoint altitude to be used for vertical guidance:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude.
- 3) Turn the small **FMS** Knob to enter editing mode.
- 4) Press the **ENT** Key. The altitude is now shown in cyan, indicating it is usable for vertical guidance.

Designating a procedure waypoint altitude to be used for vertical guidance:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob, and highlight the desired waypoint altitude. Turn the small **FMS** Knob to enter editing mode.
- 3) Press the **ENT** Key. The altitude is now shown in cyan, indicating it is usable for vertical guidance.

Altitude constraints are displayed and entered in feet mean sea level (MSL) values to the nearest hundred. An altitude constraint in feet above ground level (AGL) format is supported for airports. When a database altitude restriction is displayed, the system allows entry of a different altitude when creating a waypoint, effectively overriding the database restriction (only before the FAF). When a database altitude restriction of type "AT or ABOVE" or "AT or BELOW" is activated, the system uses the "AT" portion of the restriction to define the vertical profile.

Altitudes that have been designated for use in vertical guidance can be "un-designated" using the **CLR** Key. The altitude is now displayed only as a reference (white text). It is not used to give vertical guidance. Other displayed altitudes may change due to re-calculations or be rendered invalid as a result of manually changing an altitude to a non-designated altitude.

An altitude constraint is invalid if:

- Meeting the constraint requires the aircraft to climb
- Meeting the constraint requires the maximum flight path angle or maximum vertical speed to be exceeded
- The altitude constraint results in a TOD behind the aircraft present position
- The constraint is within a leg type for which altitude constraints are not supported
- The altitude constraint is added to the FAF of an approach that provides vertical guidance (i.e., ILS or GPS SBAS approach)
- The altitude constraint is added to a waypoint past the FAF

Entering/modifying an altitude constraint:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
- 3) Enter an altitude constraint value using the **FMS** Knobs. To enter altitudes as a flight level, turn the small **FMS** Knob counter-clockwise past zero or clockwise past 9 on the first character, and the system automatically changes to show units of Flight Level. Turn the large **FMS** Knob clockwise to highlight the first zero and enter the three digit flight level.
- 4) Press the **ENT** Key to accept the altitude constraint; if the selected waypoint is an airport, an additional choice is displayed. Turn the small **FMS** Knob to choose 'MSL' or 'AGL', and press the **ENT** Key to accept the altitude.

Altitude constraints can be modified or deleted after having been added to the flight plan. In the event an altitude constraint is deleted and the navigation database contains an altitude restriction for the lateral waypoint, the system displays the altitude restriction from the database provided no predicted altitude can be provided. The system also provides a way to reinstate a published altitude constraint that has been edited.

Deleting an altitude constraint provided by the navigation database:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
- 3) Press the **CLR** Key. A 'Remove VNV altitude?' confirmation window is displayed.
- 4) Select 'OK' and press the **ENT** Key.

Deleting an altitude constraint that has been manually entered:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
- 3) Press the **CLR** Key. A 'Remove or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.
- 4) Select 'REMOVE' and press the **ENT** Key. The manually entered altitude is deleted (it is replaced by a system calculated altitude, if available).

Reverting a manually entered altitude constraint back to the navigation database value:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
- 3) Press the **CLR** Key. A 'Remove or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.
- 4) Select 'REVERT' and press the **ENT** Key. The altitude is changed to the navigation database value.
- 5) Press the **FMS** Knob to remove the flashing cursor.

Modifying a system calculated altitude constraint:

- 1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
- 2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
- 3) Press the **CLR** Key. An 'Edit or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.
- 4) Select 'EDIT' and press the **ENT** Key.
- 5) Edit the value using the **FMS** Knobs, and press the **ENT** Key.
- 6) Press the **FMS** Knob to remove the flashing cursor.

VERTICAL SITUATION DISPLAY (VSD)

A Vertical Situation Display (VSD) can be shown on the bottom of the Navigation Map Page. The terrain, obstacles, vertical track vector, selected altitude, and active flight plan information (active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, BOC/TOC, TOD/BOD, and destination runway) can be displayed on the VSD, depending on the selected mode. See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.



NOTE: *Certain leg types (e.g. holds, heading legs) do not support VNAV PATH descents because the lateral distance of those legs is unknown. The VSD will not show a VNAV profile for any legs that have no vertical path guidance.*

The VSD horizontal range is equal to the navigation map indicated range when the VSD is in Track mode. When the VSD is in Flight Plan mode, the horizontal range is the lower of twice the navigation map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the navigation map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

The aircraft symbol is displayed on the left side of the VSD. The position of the aircraft symbol on the vertical scale is close to the top for a descent phase, at the bottom for on-ground or a climb phase, and in the middle for a cruise phase or if the phase is unknown.

If two waypoints are close together, and their labels or constraint values overlap enough to obscure any text, one waypoint label/constraint value is removed and the vertical dashed line for that waypoint is displayed as darker gray. The priority for which waypoint remains displayed is: (1) the current TO waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Enabling the Vertical Situation Display

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **Inset** Softkey.
- 4) Press the **VSD** Softkey to enable the Vertical Situation Display.
- 5) Press the VSD Mode softkey to choose between **Auto**, **FPL**, or **TRK**.

Or:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) Turn the **FMS** Knob to highlight 'Show VSD' and press the **ENT** Key.
- 4) Press the VSD Mode softkey to choose between **Auto**, **FPL**, or **TRK**.

Terrain/obstacles are available on the VSD, and will be shown if the aircraft altitude is low enough for the terrain/obstacles to be in view (terrain will be shown in gray if the terrain is selected Off on the navigation map). The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan between the aircraft present position and the end of the map range or active flight plan. The predefined width is determined by the flight phase.

Flight Phase	Width of Swath
Approach, Departure	0.6 nm
Terminal	2.0 nm
En Route, Oceanic	4.0 nm

Table 5-14 VSD Width of Swath

VSD MESSAGES

Under certain conditions, some messages may appear in conjunction with others.

Message	Description
'Loading...'	VSD is loading data due to a range change, full/half switch, or first being selected for display.
'Flight Plan Not Available'	Flight Plan mode is selected and there is not a flight plan loaded with at least one leg.
'Flight Plan mode unavailable because aircraft off course and active leg over 200 NM'	All of the following are true: - Flight Plan mode is selected - The active leg is greater than 200 nm - The aircraft is outside the swath
'Aircraft Beyond Active Leg'	Flight Plan mode is selected and the aircraft's position, as projected on the flight plan, is past the end of the active leg.
'Active Leg Begins Beyond Aircraft Position'	Flight Plan mode is selected and the aircraft's position, as projected on the flight plan, is prior to the beginning of the active leg.
'VSD Not Available'	At least one of the following is true: - Valid terrain database not available - GPS MSL altitude not available - Current barometric altitude not available - Neither current track nor current heading available - GPS position not available - Map range setting is less than 1 nm
'VSD Data Old. Deselect and Reselect VSD'	VSD data has failed to update for 2 seconds or more.

Table 5-15 VSD System Messages

5.8 PROCEDURES

The system can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARs), and non-precision and precision approaches (APRs) are stored within the database and can be loaded using any Procedures (**PROC**) Key.

The selected procedure for the departure or arrival airport is added to the active flight plan. No waypoints are required to be in the active flight plan to load procedures; however, if the origin and destination airport are already loaded, the procedure loading window defaults to the appropriate airport, saving some time selecting the correct airport on the Procedure Loading Page. Whenever an approach is selected, the choice to either “load” or “activate” is given. “Loading” adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available on the Active Flight Plan Page for quick activation when needed. “Activating” also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

The system adds terminal procedures to the flight plan based on leg types coded within that procedure in the navigation database. If the terminal procedure in the flight plan contains an identifier like ‘6368FT’, that indicates a leg that terminates when the specified altitude (6368 feet) has been exceeded. A heading leg in the flight plan displays ‘hdg’ preceding the DTK (e.g. ‘hdg 008°’). A flight plan leg requiring the pilot to manually initiate sequencing to the next leg displays ‘MANSEQ’ as the identifier.

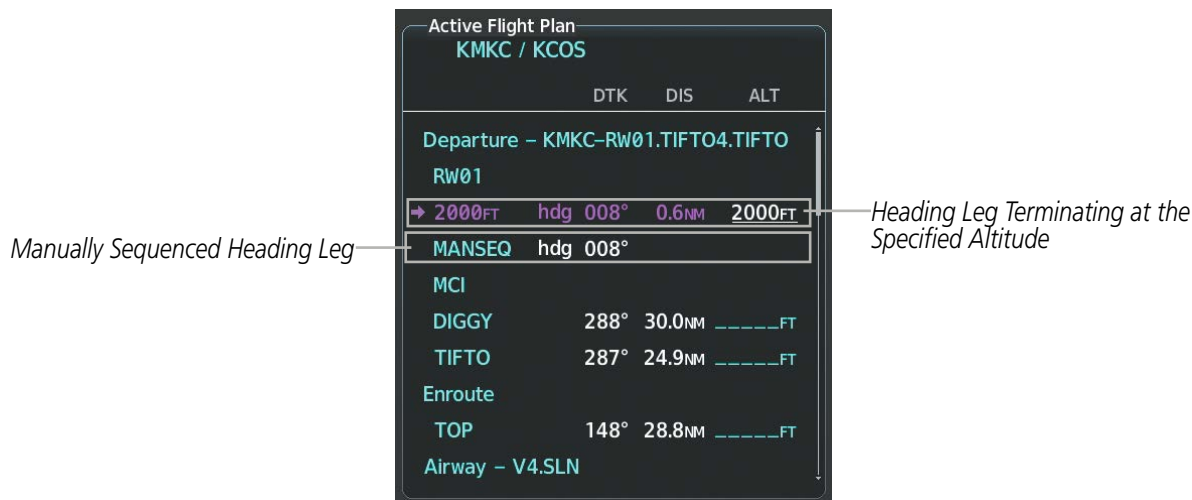


Figure 5-73 Procedure Leg Identifiers

Viewing available procedures at an airport:

- 1) From the 'WPT - Airport Information' Page:

Press the **DP** Softkey. The 'WPT - Departure Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

Or.

Press the **STAR** Softkey. The 'WPT - Arrival Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

Or.

Press the **APR** Softkey. The 'WPT - Approach Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

- 2) To select another airport, press the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
- 3) Turn the large **FMS** Knob to highlight the procedure. The procedure is previewed on the map.
- 4) Turn the small **FMS** Knob to view the available procedures. Press the **ENT** Key to select the procedure. The cursor moves to the next box (runway or transition). The procedure is previewed on the map.
- 5) Turn the small **FMS** Knob to view the available runway or transition. Press the **ENT** Key to select the runway or transition. The cursor moves to the next box (if available). The procedure is previewed on the map.
- 6) Turn the small **FMS** Knob to view the available runway or transition. Press the **ENT** Key to select the runway or transition. The cursor moves to the 'Sequence' Box or the 'Minimums' Box. The procedure is previewed on the map.
- 7) Press the **Info 1** Softkey or the **Info 2** Softkey to return to the 'WPT - Airport Information' Page.

Loading a procedure into the active flight plan from the <Procedure> Information Page:

- 1) From the 'WPT - Airport Information' Page:

Press the **DP** Softkey. The 'WPT - Departure Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

Or.

Press the **STAR** Softkey. The 'WPT - Arrival Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

Or.

Press the **APR** Softkey. The 'WPT - Approach Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

- 2) To select another airport, press the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
- 3) Select a different procedure, if desired.
 - a) Turn the large **FMS** Knob to highlight the procedure. The procedure is previewed on the map.
 - b) Turn the small **FMS** Knob to view the available procedures. Press the **ENT** Key to select the procedure. The cursor moves to the next box (runway or transition). The procedure is previewed on the map.
 - c) Turn the small **FMS** Knob to view the available runway or transition. Press the **ENT** Key to select the runway or transition. The cursor moves to the next box (if available). The procedure is previewed on the map.
 - d) Turn the small **FMS** Knob to view the available transitions. Press the **ENT** Key to select the transition. The cursor moves to the 'Sequence' Box or the 'Minimums' Box. The procedure is previewed on the map.
- 4) Press the **MENU** Key to display the <Procedure> Information Page Menu.
- 5) Turn the **FMS** Knob to highlight 'Load <procedure>'.
- 6) Press the **ENT** Key to load the procedure into the active flight plan.

DEPARTURES

A Departure Procedure (DP) is loaded at the departure airport in the flight plan. Only one departure can be loaded at a time in a flight plan. If a departure is loaded when another departure is already in the active flight plan, the new departure replaces the previous departure. The route is defined by selection of a departure, the transition waypoints, and a runway.

LOADING A DEPARTURE INTO THE ACTIVE FLIGHT PLAN

Loading a departure into the active flight plan using the **PROC** Key:

- 1) Press the **PROC** Key. The 'Procedures' Window is displayed.
- 2) Highlight 'Select Departure'.
- 3) Press the **ENT** Key. The Departure Loading Page/Window is displayed.
- 4) Use the **FMS** Knob to select an airport, if necessary, and press the **ENT** Key.
- 5) Select a departure from the list and press the **ENT** Key.
- 6) Select a runway (if required) and press the **ENT** Key.
- 7) Select a transition (if required) and press the **ENT** Key. 'Load?' is highlighted.
- 8) Press the **ENT** Key to load the departure procedure.

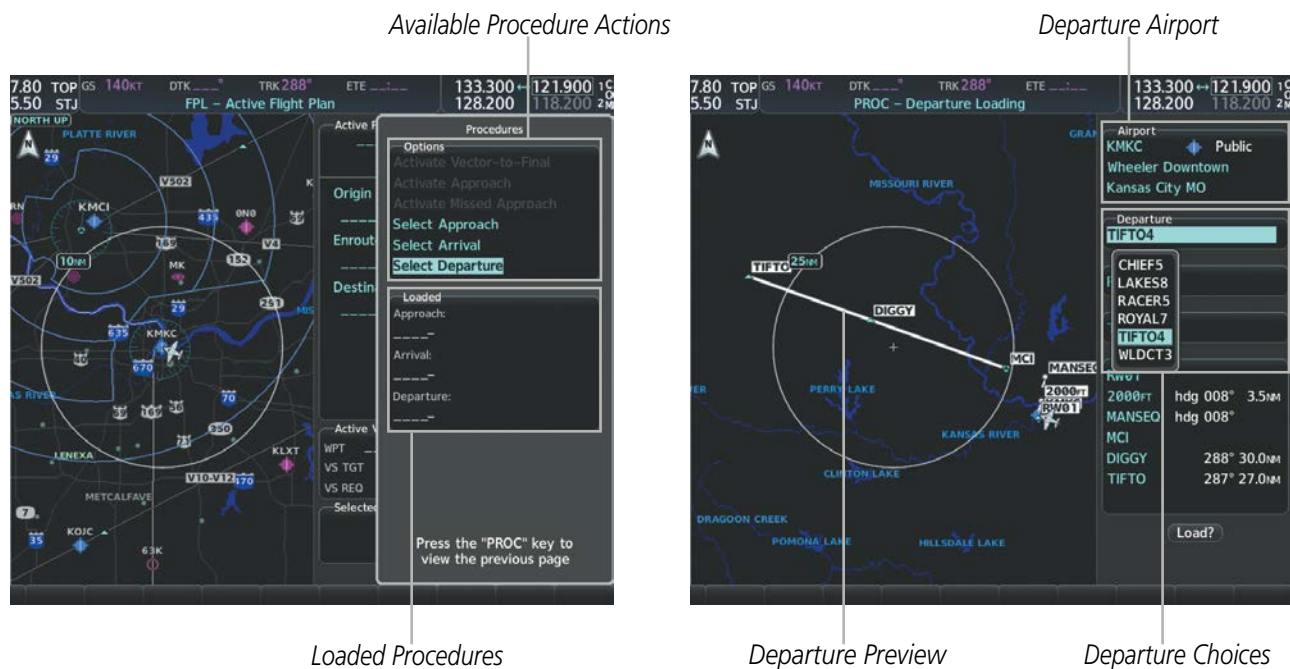
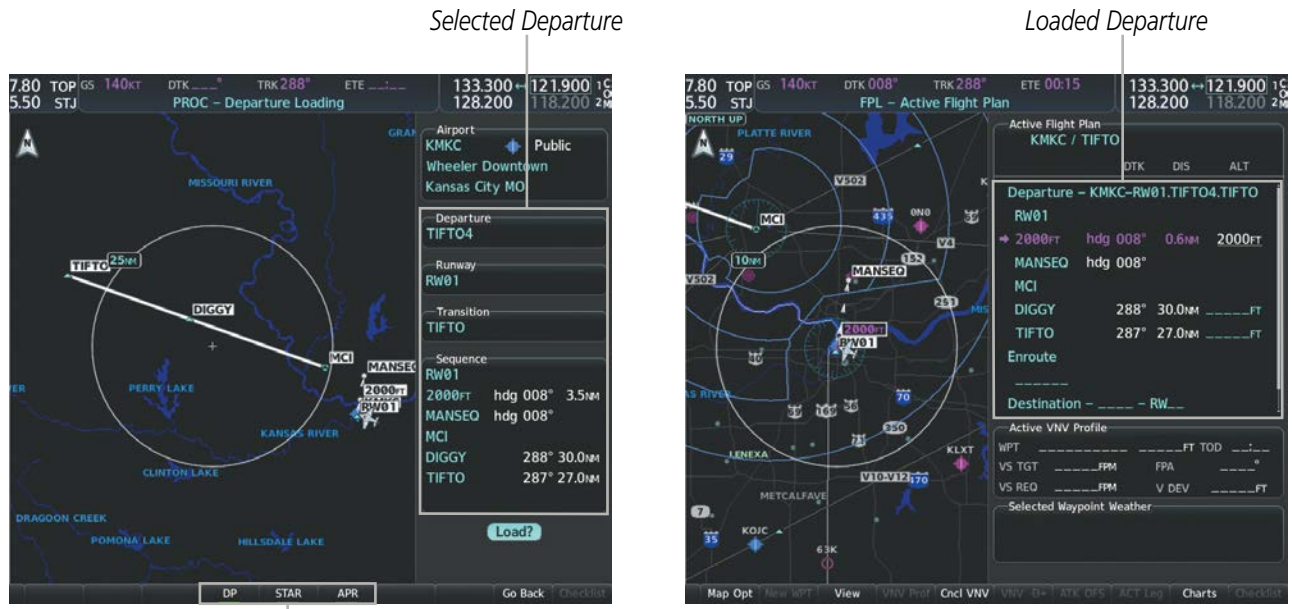


Figure 5-74 Departure Selection



Procedure Loading Page Selection Softkeys

Figure 5-75 Departure Loading

REMOVING A DEPARTURE FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, departures can be easily removed from the Active Flight Plan.

Removing a departure procedure from the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, and highlight 'Remove Departure'.
- 3) Press the **ENT** Key. A confirmation window is displayed listing the departure procedure.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.

Or:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob, and turn to highlight the departure header in the active flight plan.
- 3) Press the **CLR** Key. A confirmation window is displayed listing the departure procedure.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

ARRIVALS

A Standard Terminal Arrival (STAR) can be loaded at any airport that has one available. Only one arrival can be loaded at a time in a flight plan. If an arrival is loaded when another arrival is already in the active flight plan, the new arrival replaces the previous arrival. The route is defined by selection of an arrival, the transition waypoints, and a runway.

LOADING AN ARRIVAL INTO THE ACTIVE FLIGHT PLAN

Loading an arrival into the active flight plan using the PROC Key:

- 1) Press the **PROC** Key. The 'Procedures' Window is displayed.
- 2) Highlight 'Select Arrival'.
- 3) Press the **ENT** Key. The Arrival Loading Page/Window is displayed.
- 4) Use the **FMS** Knob to select an airport, if necessary, and press the **ENT** Key.
- 5) Select an arrival from the list and press the **ENT** Key.
- 6) Select a transition (if required) and press the **ENT** Key.
- 7) Select a runway (if required) and press the **ENT** Key. 'Load?' is highlighted.
- 8) Press the **ENT** Key to load the arrival procedure.

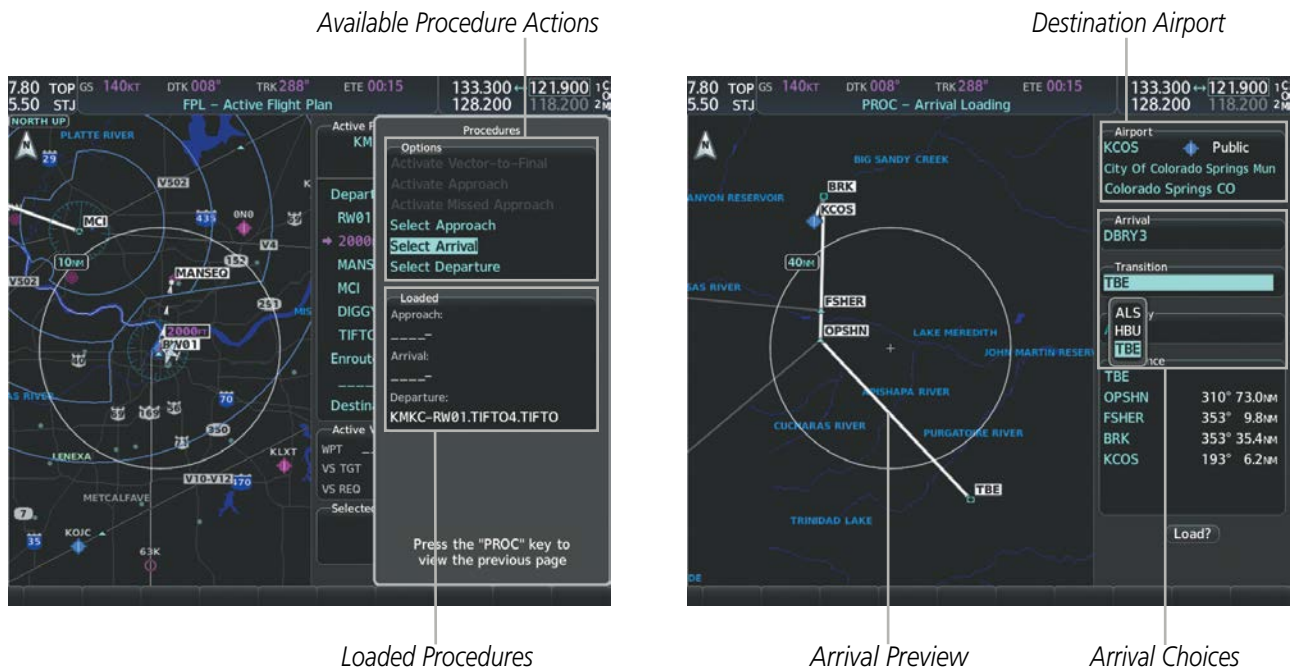
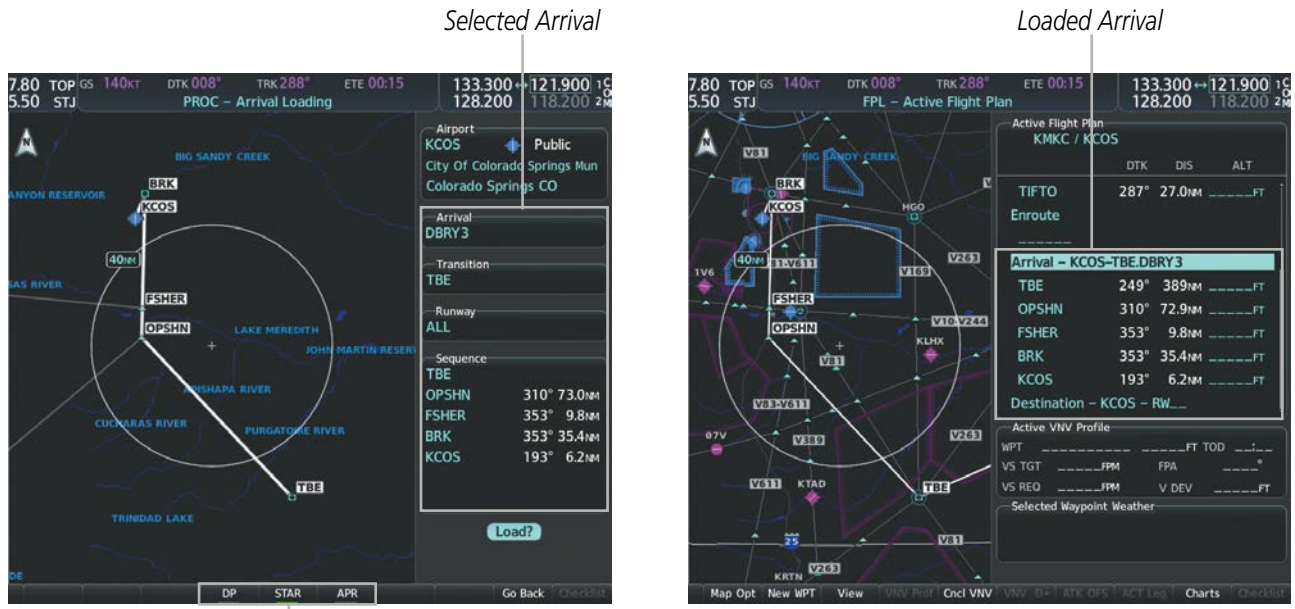


Figure 5-76 Arrival Selection



Procedure Loading Page Selection Softkeys

Figure 5-77 Arrival Loading

REMOVING AN ARRIVAL FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, arrivals can be easily removed from the Active Flight Plan.

Removing an arrival from the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, and highlight 'Remove Arrival'.
- 3) Press the **ENT** Key. A confirmation window is displayed listing the arrival procedure.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.

Or:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob, and turn to highlight the arrival header in the active flight plan.
- 3) Press the **CLR** Key. A confirmation window is displayed listing the arrival procedure.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

APPROACHES



NOTE: If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.

An Approach Procedure (APR) can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.

Whenever an approach is selected, the choice to either “Load” or “Load and Activate” is given (“Load and Activate” is only available for the active flight plan). “Loading” adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available for quick activation when needed. “Activating” also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

When selecting an approach, a “GPS” designation to the right of the procedure name indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach (e.g., VOR or ILS). The final course segment of ILS approaches, for example, must be flown by tuning the NAV receiver to the proper frequency and selecting that NAV receiver on the CDI.

The SBAS GPS allows for flying LNAV, LNAV+V, LNAV/VNAV, LP, LP+V, and LPV approach service levels according to the published chart. LNAV+V is an LNAV with advisory vertical guidance provided for assistance in maintaining a constant vertical glidepath similar to an ILS glideslope on approach. This guidance is displayed on the system PFD in the same location as the ILS glideslope using a magenta diamond. In all cases where LNAV+V is indicated by the system during an approach, LNAV minima are used. The active approach service level is annunciated on the HSI as shown in the following table:

HSI Annunciation	Description	Example on HSI
LNAV	RNAV GPS approach using published LNAV minima	
LNAV+V	RNAV GPS approach using published LNAV minima. Advisory vertical guidance is provided	
L/VNAV (available only if SBAS available)	RNAV GPS approach using published LNAV/VNAV minima (downgrades to LNAV if SBAS unavailable)	
LP (available only if SBAS available)	RNAV GPS approach using published LP minima (downgrades to LNAV if SBAS unavailable)	
LP+V (available only if SBAS available)	RNAV GPS approach using published LP minima Advisory vertical guidance is provided (downgrades to LNAV if SBAS unavailable)	
LPV (available only if SBAS available)	RNAV GPS approach using published LPV minima (downgrades to LNAV if SBAS unavailable)	

Table 5-16 Approach Service Levels

LOADING AN APPROACH INTO THE ACTIVE FLIGHT PLAN

Loading an approach into the active flight plan using the PROC Key:

- 1) Press the **PROC** Key. The 'Procedures' Window is displayed.
- 2) Highlight 'Select Approach', and press the **ENT** Key. The Approach Loading Page/Window is displayed.
- 3) Select the airport and approach:
 - a) Use the **FMS** Knob to select an airport, if necessary, and press the **ENT** Key.
 - b) Select an approach from the list and press the **ENT** Key.

Or:

 - a) If necessary, push the **FMS** Knob to exit the approach list, and use the large **FMS** Knob to move the cursor to the Approach Channel field.
 - b) Use the **FMS** Knob to enter the approach channel number, and press the **ENT** Key to accept the approach channel number. The airport and approach are selected.
- 4) Select a transition (if required) and press the **ENT** Key.
- 5) Minimums
 - a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO' or 'TEMP COMP', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.
 - b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

Or:

To skip setting minimums, press the **ENT** Key.
- 6) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate' and press the **ENT** Key to load and activate the approach procedure.



NOTE: When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the HSI must be switched to a NAV receiver to fly the final course of the approach.



NOTE: If there is no arrival procedure in the active flight plan, loading an approach after a destination airport has already been entered will result in a duplicate destination airport waypoint being added to the end of the enroute segment.

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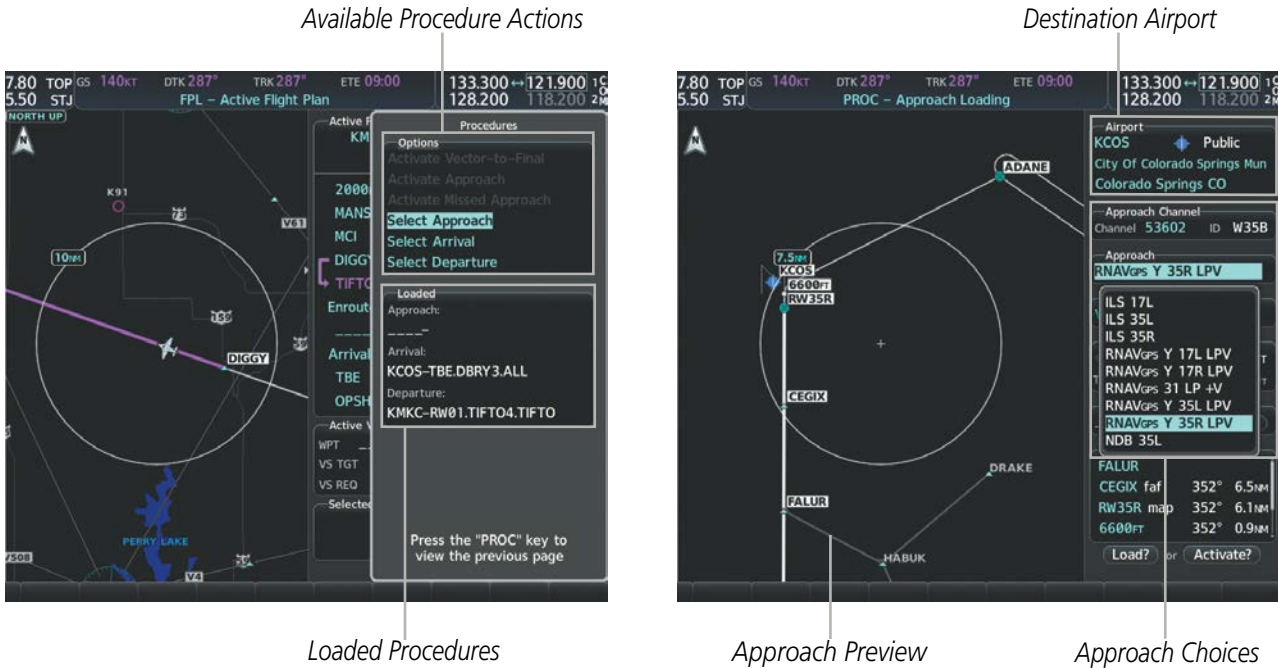


Figure 5-78 Approach Selection



Figure 5-79 Approach Loading

Loading an approach into the active flight plan from the Nearest Airport Page:

- 1) Select the 'NRST - Nearest Airports' Page.
- 2) Press the **FMS** Knob, then turn the large **FMS** Knob to highlight the desired nearest airport. The airport is previewed on the map.
- 3) Press the **APR** Softkey; or press the **MENU** Key, highlight 'Select Approach Window', and press the **ENT** Key.

- 4) Turn the **FMS** Knob to highlight the desired approach.
- 5) Press the **LD APR** Softkey; or press the **MENU** Key, highlight 'Load Approach', and press the **ENT** Key. The 'PROC - Approach Loading' Page is displayed with the transition field highlighted.
- 6) Turn the **FMS** Knob to highlight the desired transition, and press the **ENT** Key.
- 7) Minimums
 - a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO' or 'TEMP COMP', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.
 - b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

Or:

To skip setting minimums, press the **ENT** Key. 'LOAD?' is highlighted.
- 8) Press the **ENT** Key with 'LOAD?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'ACTIVATE' and press the **ENT** Key to load and activate the approach procedure. The system continues navigating the current flight plan until the approach is activated. When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the HSI must be switched to a NAV receiver to fly the final course of the approach.

ACTIVATING AN APPROACH

A previously loaded approach can be activated from the Procedures Window.

Activating a previously loaded approach:

- 1) Press the **PROC** Key. The 'Procedures' Window is displayed with 'Activate Approach' highlighted.
- 2) Press the **ENT** Key to activate the approach.

In many cases, it may be easiest to "load" the full approach while still some distance away, enroute to the destination airport. Later, if vectored to final, use the steps below to select 'Activate Vector-To-Final' — which makes the inbound course to the FAF waypoint active.

Activating a previously loaded approach with vectors to final:

- 1) Press the **PROC** Key to display the 'Procedures' Window.
- 2) Highlight 'Activate Vector-to-Final' and press the **ENT** Key.

Loading and activating an approach using the MENU Key:

- 1) From the 'PROC - Approach Loading' Page, press the **MENU** Key on the MFD. The page menu is displayed with 'Load & Activate Approach' highlighted.
- 2) Press the **ENT** Key. When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the HSI must be switched to a NAV receiver to fly the final course of the approach.

REMOVING AN APPROACH FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, approaches can be easily removed from the Active Flight Plan.

Removing an approach from the active flight plan:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **MENU** Key, and highlight 'Remove Approach'.
- 3) Press the **ENT** Key. A confirmation window is displayed listing the approach procedure.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'CANCEL' and press the **ENT** Key.

Or:

- 1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
- 2) Press the **FMS** Knob, and turn to highlight the approach header in the active flight plan.
- 3) Press the **CLR** Key. A confirmation window is displayed listing the approach procedure.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'CANCEL' and press the **ENT** Key.
- 5) Press the **FMS** Knob to remove the flashing cursor.

MISSED APPROACH

Activating a missed approach in the active flight plan:

- 1) Press the **PROC** Key.
- 2) Turn the **FMS** Knob to highlight 'Activate Missed Approach'.
- 3) Press the **ENT** Key. The aircraft automatically sequences to the MAHP.

Or:

Fly past the MAP, and press the **SUSP** Softkey on the PFD.

Or:

Press the Go-Around Button.

In this missed approach procedure, the altitude immediately following the MAP (in this case '6600FT') is not part of the published procedure. It is simply a Course to Altitude (CA) leg which guides the aircraft along the runway centerline until the altitude required to safely make the first turn toward the MAHP is exceeded. This altitude is provided by the navigation database, and may be below, equal to, or above the published minimums for this approach. In this case, if the aircraft altitude is below the specified altitude (6,600 feet) after crossing the MAP, a direct-to is established to provide a course on runway heading until an altitude of 6,600 feet is reached. After reaching 6,600 feet, a direct-to is established to the published MAHP (in this case ADANE). If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix (ADANE) to begin the missed approach procedure.

The screenshot shows the 'Active Flight Plan' for KMKC / KCOS. It lists several waypoints with their respective DTK (Direction to Leg), DIS (Distance to Leg), and ALT (Altitude). A 'Course to Altitude Leg' is highlighted at 6600FT. The destination is KCOS - RW35R.

	DTK	DIS	ALT
BRK	353°	31.3NM	_____FT
KCOS-RNAV_{GPS} Y 35R LPV			
HABUK iaf	164°	18.4NM	_____FT
FALUR	290°	6.0NM	8100FT
CEGIX faf	352°	6.5NM	8100FT
RW35R map	352°	6.1NM	
6600FT	352°	0.9NM	6600FT
ADANE mahp	055°	15.5NM	9000FT
HOLD	297°	7.0NM	
Destination - KCOS - RW35R			

Figure 5-80 Course to Altitude

In some missed approach procedures this Course to Altitude leg may be part of the published procedure. For example, a procedure may dictate a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude would appear in the list of waypoints as '5500FT'. Again, if the aircraft altitude is lower than the prescribed altitude, a direct-to is established on a Course to Altitude leg when the missed approach procedure is activated.

TEMPERATURE COMPENSATED ALTITUDE

If desired, the system can compensate the loaded approach altitudes based on a pilot-supplied temperature at the destination. For example, if the pilot enters a destination temperature of -40° C, the system increases the approach altitudes accordingly. A temperature compensated altitude is displayed in slanted text.

Activating temperature compensated altitude:

- 1) From the 'FPL - Active Flight Plan' Page, press the **MENU** Key on the MFD. The 'Page Menu' Window is displayed.
- 2) Turn the **FMS** Knob to highlight 'Temperature Compensation'.
- 3) Press the **ENT** Key. The 'Temperature Compensation' Window is displayed.
- 4) Use the small **FMS** Knob to select the temperature at the <airport>. The compensated altitude is computed as the temperature is selected.



NOTE: The temperature at the destination can be entered in the Temperature Compensation Window on the MFD, or in the References Window on the PFD. There is only one compensation temperature for the system, therefore, changing the temperature will affect both the loaded approach altitudes and the minimums. Refer to the Flight Instruments section for information about applying temperature compensation to the MDA/DH.

- 5) Press the **ENT** Key. 'Activate Compensation?' is highlighted.
- 6) Press the **ENT** Key. The compensated altitudes for the approach are shown in the flight plan.

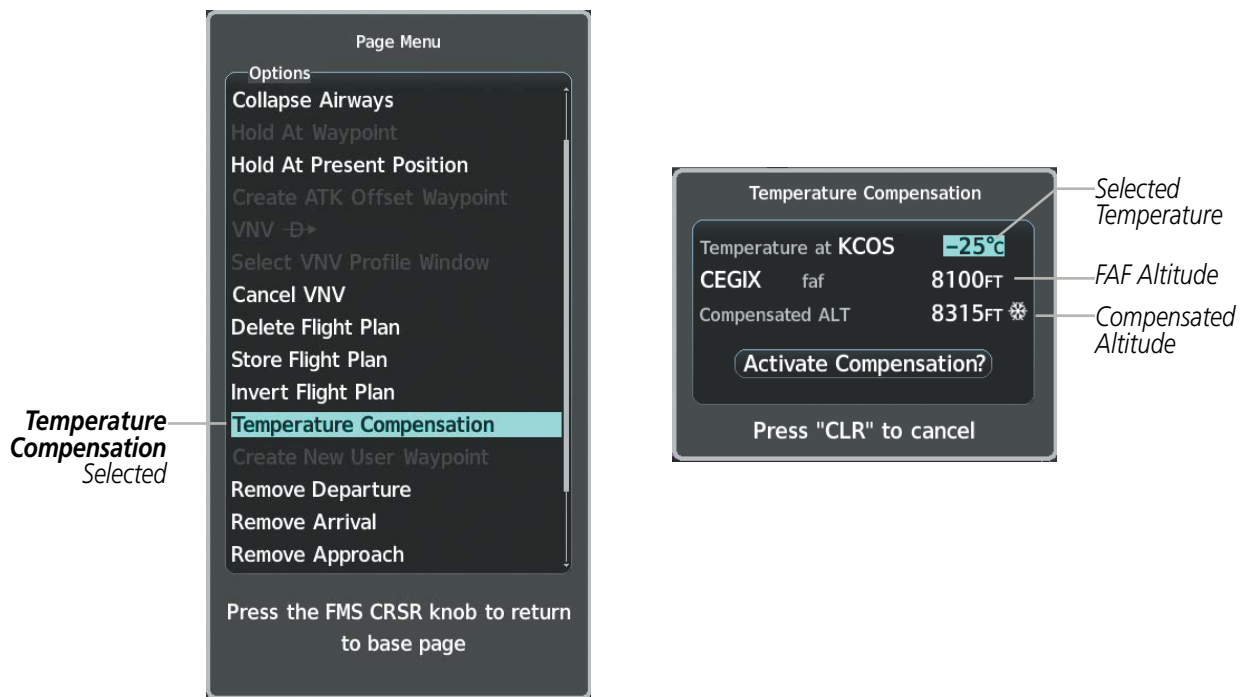


Figure 5-81 Temperature Compensation

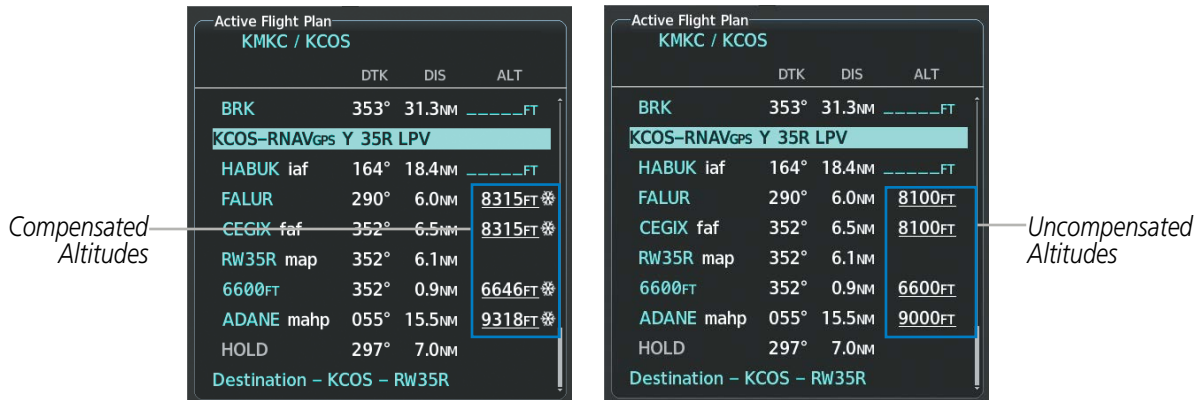


Figure 5-82 Temperature Compensation in the Active Flight Plan

Cancelling temperature compensated altitude:

- 1) From the Active Flight Plan Page, press the **MENU** Key. The 'Page Menu' Window is displayed.
- 2) Turn the **FMS** Knob to highlight 'Temperature Compensation'.
- 3) Press the **ENT** Key. The Temperature Compensation Window is displayed.
- 4) Press the **ENT** Key. 'Cancel Compensation?' is highlighted.
- 5) Press the **ENT** Key. The temperature compensated altitude at the FAF is cancelled.



NOTE: Activating/cancelling temperature compensation for the loaded approach altitudes does not select/deselect temperature compensated minimums (MDA/DH), nor does selecting/deselecting temperature compensated minimums activate/cancel temperature compensated approach altitudes.

5.9 TRIP PLANNING

The system allows the pilot to view trip planning information, fuel information, and other information for a specified flight plan or flight plan leg based on automatic data, or based on manually entered data. Weight planning is also available, based on manually entered fuel data and the active flight plan (to estimate remaining fuel).

TRIP PLANNING

All of the input of data needed for calculation and viewing of the statistics is done on the Trip Planning Page located in the Aux Page Group.

Selected Flight Plan Segment
 - FPL Number/Cumulative Legs (CUM or REM) or Leg Number (NN)
 - Waypoints Defining Selected Flight Plan/Flight Plan Leg

The screenshot shows the Trip Planning Page with the following data and callouts:

- Page Mode:** Automatic (Callout: Trip Planning Page Mode - Automatic/Manual)
- Input Data:**
 - FPL: 00, LEG: REM
 - P.POS: → KCOS
 - Departure Time: 02:38UTC
 - Ground Speed: 153KT
 - Fuel Flow: 25.0GAL/HR
 - Fuel on Board: 76GAL
- Other Stats:**
 - Calibrated Airspeed: 160KT
 - Indicated Altitude: 8768FT
 - Barometric Pressure: 29.92IN
 - Total Air Temperature: -2°C
- Trip Stats:**
 - Desired Track: ---°
 - Distance: 419NM
 - ETE: 2+44
 - ETA: 05:23UTC
 - ESA: 16300FT
 - Sunrise: 12:27UTC
 - Sunset: 21:09UTC
- Fuel Stats:**
 - Efficiency: 6.110NM/GAL
 - Total Endurance: 3+02
 - Remaining Fuel: 7GAL
 - Remaining Endurance: 0+17
 - Fuel Required: 68.6GAL
 - Total Range: 465NM
- Other Statistics:**
 - Density Altitude: ---FT
 - True Airspeed: 182KT
- Softkeys:** Map Opt, Auto, Manual, FPL, WPTs (Callout: Softkeys - Automatic/Manual Page Mode - Flight Plan/Waypoint Mode)

Callouts on the left side:

- Preview of Selected Flight Plan/Flight Plan Leg (points to the map)
- Trip Statistics
 - Desired Track
 - Distance
 - Est. Time Enroute
 - Est. Time of Arrival
 - Enroute Safe Altitude
 - Sunrise Time (local)
 - Sunset Time (local)
- Fuel Statistics
 - Efficiency
 - Total Endurance
 - Remaining Fuel
 - Remaining Endurance
 - Fuel Required
 - Total Range

Figure 5-83 Trip Planning Page

The trip planning inputs are based on sensor inputs (automatic page mode) or on pilot inputs (manual page mode). Some additional explanation of the sources for some of the inputs is as follows:

- Departure Time - This defaults to the current time in automatic page mode. The computations are from the aircraft present position, so the aircraft is always just departing.
- Calibrated Airspeed - The primary source is from the air data system, and the secondary source of information is GPS ground speed.
- Indicated Altitude - The primary source is the barometric altitude, and the secondary source of information is GPS altitude.

TRIP STATISTICS

The trip statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs.

In flight plan mode (FPL) with a stored flight plan selected (NN), and the entire flight plan (CUM) selected, the waypoints are the starting and ending waypoints of the selected flight plan.

In flight plan mode (FPL) with a stored flight plan selected (NN), and a specific leg (NN) selected, the waypoints are the endpoints of the selected leg.

In flight plan mode (FPL) with the active flight plan selected (00), and the remaining flight plan (REM) selected, the 'from' waypoint is the present position of the aircraft and the 'to' waypoint is the endpoint of the active flight plan.

In flight plan mode (FPL) with the active flight plan selected (00), and a specific leg (NN) selected, the 'from' waypoint is the current aircraft position and the 'to' waypoint is the endpoint of the selected leg.

In waypoint (WPTs) mode these are manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Desired Track - Desired Track is shown as nnn° and is the desired track between the selected waypoints. It is dashed unless only a single leg is selected.
- Distance - The distance is shown in tenths of units up to 99.9, and in whole units up to 9999.
- Estimated time enroute (ETE) - ETE is shown as hours:minutes until less than an hour, then it is shown as minutes:seconds.
- Estimated time of arrival (ETA) - ETA is shown as hours:minutes and is the local time at the destination.
 - If in waypoint mode then the ETA is the ETE added to the departure time.
 - If a flight plan other than the active flight plan is selected it shows the ETA by adding to the departure time all of the ETEs of the legs up to and including the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
 - If the active flight plan is selected the ETA reflects the current position of the aircraft and the current leg being flown. The ETA is calculated by adding to the current time the ETEs of the current leg up to and including the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
- Enroute safe altitude (ESA) - The ESA is shown as nnnnnFT
- Destination sunrise and sunset times (SUNRISE, SUNSET) - These times are shown as hours:minutes of the time at the destination.

FUEL STATISTICS

The fuel statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs. Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Fuel efficiency (Efficiency) - This value is calculated by dividing the current ground speed by the current fuel flow.
- Time of fuel endurance (Total Endurance) - This time is shown as hours:minutes. This value is obtained by dividing the amount of fuel on board by the current fuel flow.
- Fuel on board upon reaching end of selected leg (Remaining Fuel) - This value is calculated by taking the amount of fuel onboard and subtracting the fuel required to reach the end of the selected leg.
- Fuel endurance remaining at end of selected leg (Remaining Endurance) - This value is calculated by taking the time of fuel endurance and subtracting the estimated time enroute to the end of the selected leg.
- Fuel required for trip (Fuel Required) - This value is calculated by multiplying the time to go by the fuel flow.
- Total range at entered fuel flow (Total Range) - This value is calculated by multiplying the time of fuel endurance by the ground speed.

OTHER STATISTICS

These statistics are calculated based on the system sensor inputs or the manual trip planning inputs.

- Density Altitude
- True Airspeed

The pilot may select Automatic or Manual page mode, and flight plan (FPL) or waypoint (WPTs) mode. In automatic page mode, only the FPL, LEG, or waypoint IDs are editable (based on FPL/WPTs selection).



Figure 5-84 Trip Planning Page - Flight Plan Mode

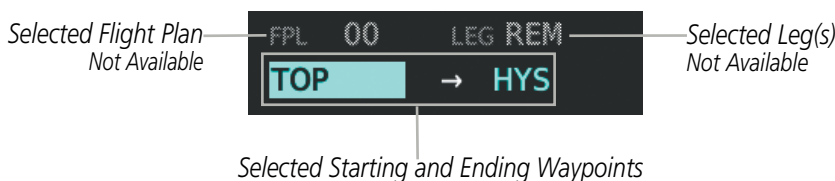


Figure 5-85 Trip Planning Page - Waypoint Mode

Selecting automatic or manual page mode:

From the 'Aux - Trip Planning' Page, press the **Auto** Softkey or the **Manual** Softkey; or press the **MENU** Key, highlight 'Auto Mode' or 'Manual Mode', and press the **ENT** Key.

Selecting flight plan or waypoint mode:

From the 'Aux - Trip Planning' Page, press the **FPL** Softkey or the **WPTs** Softkey; or press the **MENU** Key, highlight 'Flight Plan Mode' or 'Waypoints Mode', and press the **ENT** Key.

Selecting a flight plan and leg for trip statistics:

- 1) From the 'Aux - Trip Planning' Page, press the **FMS** Knob to activate the cursor in the 'FPL' Field.
- 2) Turn the small **FMS** Knob to select the desired flight plan number.
- 3) Turn the large **FMS** Knob to highlight 'CUM' or 'REM'. The statistics for each leg can be viewed by turning the small **FMS** Knob to select the desired leg. The Trip Planning Map also displays the selected data.

Selecting waypoints for waypoint mode:

- 1) From the 'Aux - Trip Planning' Page, press the **WPTs** Softkey; or press the **MENU** Key, highlight 'Waypoints Mode', and press the **ENT** Key. The cursor is positioned in the waypoint field directly below the FPL field.
- 2) Turn the **FMS** knobs to select the desired waypoint (or select from the Page Menu 'Set WPT to Present Position' if that is what is desired), and press the **ENT** Key. The cursor moves to the second waypoint field.
- 3) Turn the **FMS** knobs to select the desired waypoint, and press the **ENT** Key. The statistics for the selected leg are displayed.

In manual page mode, the other eight trip input data fields must be entered by the pilot, in addition to flight plan and leg selection.

Entering manual data for trip statistics calculations:

- 1) From the 'Aux - Trip Planning' Page, press the **Manual** Softkey or select 'Manual Mode' from the Page Menu, and press the **ENT** Key. The cursor may now be positioned in any field in the top right two boxes.
- 2) Turn the **FMS** Knobs to move the cursor onto the 'Departure Time' Field and enter the desired value. Press the **ENT** Key. The statistics are calculated using the new value and the cursor moves to the next entry field. Repeat until all desired values have been entered.

WEIGHT PLANNING



NOTE: All weight planning page data fields display data rounded to the nearest 10 pounds or 5 kilograms.

A/C Payload Calculator
Basic Empty Weight Entry -
Pilot and Stores Weight Entry -
Basic Operating Weight Calculation -
Passenger(s) Weight Entry -
Cargo Weight Entry -
Zero Fuel Weight Calculation -



Fuel Weight Calculator
- Zero Fuel Weight Calculation
- Fuel on Board Entry
- Aircraft Weight Calculation
- Estimated Landing Weight Calculation
- Estimated Landing Fuel Calculation
- Fuel Reserve Entry
- Excess Fuel Calculation

Empty Weight Softkey
(selects Basic Empty Weight)

Figure 5-86 Weight Planning Page

Entering basic empty weight:

- 1) From the 'Aux - Weight Planning' Page, press the **Empty WT** Softkey; or press the **MENU** Key, highlight 'Set Basic Empty Weight', and press the **ENT** Key to select the 'Basic Empty Weight' Field.
- 2) Turn the small **FMS** Knob to enter the basic empty weight.
- 3) Press the **ENT** Key to confirm the entry.
- 4) Press the **FMS** Knob to remove the flashing cursor.

Entering a pilot and stores weight:

- 1) From the 'Aux - Weight Planning' Page, press the **FMS** Knob to activate the cursor and highlight the 'Pilot & Stores' Field.
- 2) Turn the small **FMS** Knob to enter the pilot and stores weight.
- 3) Press the **ENT** Key to confirm the entry.
- 4) Press the **FMS** Knob to remove the flashing cursor.

The basic operating weight is calculated by adding the basic empty weight and the pilot and stores weight.

Entering the number of passengers:

- 1) From the 'Aux - Weight Planning' Page, press the **FMS** Knob to activate the cursor and highlight the 'Passengers #' Field.
- 2) Turn the small **FMS** Knob to enter the number of passengers.
- 3) Press the **ENT** Key to confirm the entry.
- 4) Press the **FMS** Knob to remove the flashing cursor.

Entering the average passenger weight:

- 1) From the 'Aux - Weight Planning' Page, press the **FMS** Knob to activate the cursor and highlight the 'at' (passenger weight) Field.
- 2) Turn the small **FMS** Knob to enter the average passenger weight.
- 3) Press the **ENT** Key to confirm the entry.
- 4) Press the **FMS** Knob to remove the flashing cursor.

The total weight of passengers is calculated by multiplying the number of passengers by the average passenger weight.

Entering the cargo weight:

- 1) From the 'Aux - Weight Planning' Page, press the **FMS** Knob to activate the cursor and highlight the 'Cargo' field.
- 2) Turn the small **FMS** Knob to enter the cargo weight.
- 3) Press the **ENT** Key to confirm the entry.
- 4) Press the **FMS** Knob to remove the flashing cursor.

The 'Zero Fuel Weight' is calculated by adding the basic empty, pilot and stores, passenger, and cargo weights.

Entering a fuel on board weight:

- 1) From the 'Aux - Weight Planning' Page, press the **FMS** Knob to activate the cursor and highlight the 'Fuel on Board' field.
- 2) Turn the small **FMS** Knob to enter the fuel on board.
- 3) Press the **ENT** Key to confirm the entry.
- 4) Press the **FMS** Knob to remove the flashing cursor.

Entering fuel reserve:

- 1) From the 'Aux - Weight Planning' Page, press the **FMS** Knob to activate the cursor and highlight the 'Fuel Reserves' field.
- 2) Turn the small **FMS** Knob to enter the fuel reserves amount.
- 3) Press the **ENT** Key to confirm the entry.
- 4) Press the **FMS** Knob to remove the flashing cursor.

When the aircraft is in the air and a destination waypoint has been entered, the fuel calculations can be completed.

- Estimated landing weight = zero fuel weight + estimated landing fuel weight.
- Estimated landing fuel weight = fuel on board weight - (fuel flow x ETE)
- Excess fuel weight = estimated landing fuel weight - fuel reserves weight

If the aircraft is on the ground or a destination waypoint has not been entered, the following fields display invalid values consisting of six dashes:

- Estimated landing weight
- Estimated landing fuel weight
- Excess fuel weight

WEIGHT CAUTION AND WARNING CONDITIONS

If the aircraft weight is greater than the maximum allowable takeoff weight, then the aircraft weight is displayed in amber.

If the estimated landing weight is greater than the maximum allowable landing weight, then the estimated landing weight is displayed in amber.

If the estimated landing fuel weight is positive, but less than or equal to the fuel reserves weight, the following values are displayed in amber:

- Estimated fuel at landing weight
- Excess fuel weight

If the estimated landing fuel weight is zero or negative, then the following values are displayed in red:

- Estimated fuel at landing weight
- Excess fuel weight

5.10 ABNORMAL OPERATION



NOTE: The Inset Map is removed from the PFD any time aircraft pitch is greater than $+30^\circ$ or less than -20° , or when a 65° bank angle is reached.

This section discusses the Dead Reckoning mode of operation and the subsequent indications.



NOTE: Dead Reckoning Mode only functions in Enroute (ENR) or Oceanic (OCN) phase of flight. In all other phases, an invalid GPS solution produces a "NO GPS POSITION" annunciation on the map and the system stops using GPS.

While in Enroute or Oceanic phase of flight, if the system detects an invalid GPS solution or is unable to calculate a GPS position, the system automatically reverts to Dead Reckoning (DR) Mode. In DR Mode, the system uses its last-known position combined with continuously updated airspeed and heading data (when available) to calculate and display the aircraft's current estimated position.

It is important to note that estimated navigation data supplied by the system in DR Mode may become increasingly unreliable and must not be used as a sole means of navigation. If while in DR Mode airspeed and/or heading data is also lost or not available, the DR function may not be capable of accurately tracking estimated position and, consequently, the system may display a path that is different than the actual movement of the aircraft. Estimated position information displayed by the system through DR while there is no heading and/or airspeed data available should not be used for navigation.

DR Mode is inherently less accurate than the standard GPS/SBAS Mode due to the lack of satellite measurements needed to determine a position. Changes in wind speed and/or wind direction compound the relative inaccuracy of DR Mode. Because of this degraded accuracy, other navigation equipment must be relied upon for position awareness until GPS-derived position data is restored.

DR Mode is indicated on the system by the appearance of the letters 'DR' superimposed in amber over the 'own aircraft' symbol as shown in Figure 5-87. In addition, 'DR' is prominently displayed in amber on the HSI slightly below and to the left of the aircraft symbol on the CDI as shown in Figure 5-87. The CDI deviation bar remains, but is removed from the display after 20 minutes in DR Mode. The autopilot will remain coupled in DR mode as long as the deviation info is available (20 min.) Lastly, but at the same time, a 'GPS NAV LOST' alert message appears on the PFD. Normal navigation using GPS/SBAS source data resumes automatically once a valid GPS solution is restored.

As a result of operating in DR Mode, all GPS-derived data is computed based upon an estimated position and is displayed as amber text on the display to denote degraded navigation source information as shown in Figure 5-87.

Also, while the system is in DR Mode, some terrain functions are not available. Additionally, the accuracy of all nearest information (airports, airspaces, and waypoints) is questionable. Finally, airspace alerts continue to function, but with degraded accuracy.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

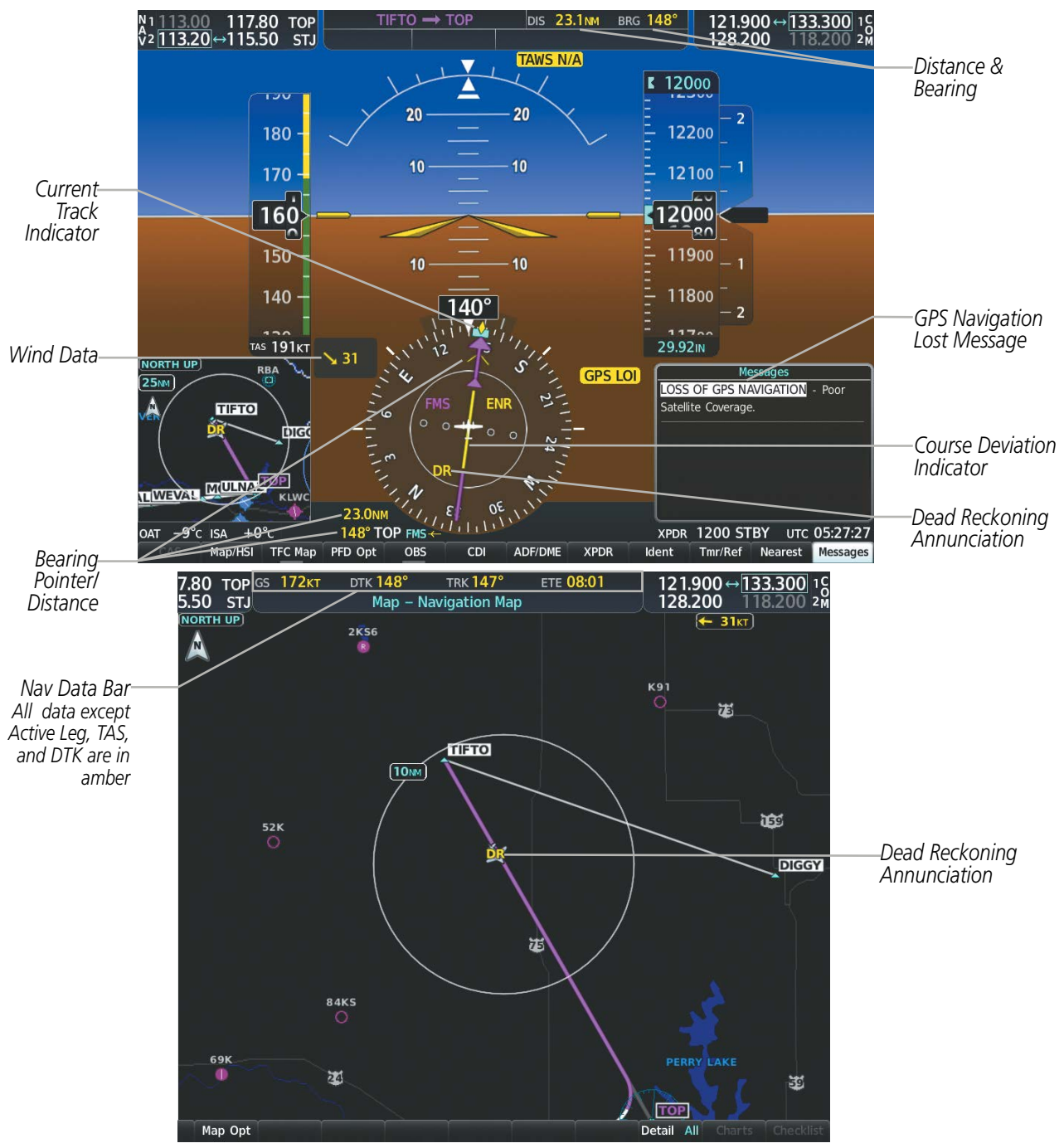


Figure 5-87 Dead Reckoning Mode - GPS Derived Data Shown in Amber

SECTION 6 HAZARD AVOIDANCE

Hazard avoidance features available for the system are designed to aid situational awareness and provide advisory information with regard to potential hazards to flight safety associated with weather, terrain, and air traffic.

Weather

- GDL 69/69A or 69/69A SXM SiriusXM Weather (Subscription Optional)
- Flight Information Services-Broadcast (Optional)

Terrain Avoidance

- Terrain Proximity
- Terrain-SVT (Standard with SVS Option)
- Terrain Awareness and Warning System Class-B (TAWS-B) (Optional)

Traffic

- Traffic Information Service (TIS)
- Garmin GTS 800 Traffic Advisory System (TAS) (Optional)
- Garmin GTX 345R Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic (Optional)

6.1 DATA LINK WEATHER



WARNING: Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information contained within data link weather products may not accurately depict current weather conditions.



WARNING: Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be older than the indicated weather product age.

The Data Link Weather feature enables the system to receive weather information from a variety of weather sources, depending on the equipment installed in the aircraft. These sources may include SiriusXM Weather and Flight Information Services-Broadcast (FIS-B). For each source, a ground-based system processes the weather information collected from a network of sensors and weather data providers.

The SiriusXM Weather service, available with the Garmin GDL 69A/GDL 69A SXM data link receiver and an active service subscription, updates its weather data periodically and automatically, and transmits this information to the aircraft's receiver via satellite on the S-Band frequency. This service provides continuous reception capabilities at any altitude throughout North America.

The FIS-B Weather service, available when equipped with a capable transponder which can receive 978 MHz Universal Access Transceiver (UAT) data, delivers subscription-free weather information periodically and automatically to the aircraft. FIS-B uses a network of FAA-operated Ground-Based Transceivers (GBTs) to transmit the information to the aircraft's receiver. Reception is limited to line-of-sight, and is available below 24,000 feet MSL in the United States. FIS-B broadcasts provide weather data in a repeating cycle which may take approximately ten minutes to transmit all available weather data. Therefore, not all weather data may be present immediately upon initial FIS-B signal acquisition. FIS-B is a component of the Automatic Dependent Surveillance (ADS-B) system, which offers both weather and traffic data; refer to the ADS-B Traffic discussion later in this section for a more detailed discussion of the ADS-B system and its capabilities.

ACTIVATING DATA LINK WEATHER SERVICES



NOTE: Service activation is not applicable to the FIS-B Weather service.

ACTIVATING THE SIRIUSXM WEATHER SERVICE

Before SiriusXM Weather can be used, the service must be activated by providing SiriusXM's customer service the coded ID(s) unique to the installed data link receiver. The Data Radio ID must be provided to activate the weather service. The Audio Radio ID enables the receiver to provide SiriusXM Radio entertainment. To view this information, refer to the following locations:

- The 'Aux - XM Information' Page on the MFD
- The SiriusXM Activation Instructions included with the Data Link Receiver
- The label on the back of the Data Link Receiver

SiriusXM uses the coded IDs to send an activation signal that allows the system to display weather data and/or provide audio entertainment programming through the data link receiver.

Establishing an account for SiriusXM services:

- 1) Select the 'Aux - XM Radio' Page Group.
- 2) If the 'Aux - XM Information' Page is not displayed, press the **Info** Softkey.
- 3) Note the Data Radio ID (for SiriusXM Weather data) and/or the Audio Radio ID (for SiriusXM Satellite Radio).
- 4) Contact SiriusXM customer service through the phone number listed on its website, www.siriusxm.com.
- 5) Provide SiriusXM customer service the Data Radio ID and/or Audio Radio ID, in addition to payment information, and the desired weather product subscription package.

After SiriusXM has been contacted, it may take approximately 15 minutes until the activation occurs.

Verifying the SiriusXM Weather service activation:

- 1) After an account has been established, select the 'Aux - XM Radio' Page Group.
- 2) If the 'Aux - XM Information' Page is not displayed, press the **Info** Softkey.
- 3) View the list of supported Weather Products. An empty box appears next to an unavailable weather product; a green filled box appears next to an available weather product. During activation, it may take several minutes for weather products in the selected subscription package to become available.



NOTE: Not all weather products offered by SiriusXM are supported for display on this system. This pilot's guide only discusses supported weather products.



Figure 6-1 'Aux - XM Information' Page

WEATHER PRODUCT AGE

Unlike real-time weather information collected directly from weather sensors on-board an aircraft, such as an airborne weather radar or a lightning detection system, data link weather by contrast relies on service providers to collect, process, and transmit weather information to the aircraft. This information can come from a variety of sources such as government agencies. Due to the time it takes to collect, process, and distribute data link weather information, it is imperative for pilots to understand that data link weather information is not real-time information and may not accurately depict the current conditions.

For each data link weather product which can be displayed as a map overlay, such as METARs, the system can also show a weather product age. This age represents the elapsed time, in minutes, since the weather service provider compiled the weather product and the current time. It does not represent the age of the information contained within the weather product itself. For example, a single mosaic of radar precipitation is comprised of data from multiple radar sites providing data at differing scan rates or intervals. The weather service provider periodically compiles this data to create a single composite image, and assigns one time to this image which becomes the basis of the product age. The service provider then makes this weather product available for data link transmission at the next scheduled update time. The actual age of the weather data contained within the mosaic is therefore older than its weather product age and should never be considered current.

SiriusXM and FIS-B weather products are broadcast automatically on a repeating cycle without pilot intervention.

Each data link weather product age has an expiration time. The weather product age is shown in white if it is less than half of this expiration time, otherwise it is shown in amber until reaching its expiration time. After a weather product has expired, the system removes the expired weather product from the displays, and shows white dashes instead of the age. If the data link receiver has not yet received a weather product 'N/A' appears instead of the age to show the product is currently not available for display. This may occur, for example, after powering on the system but before the data link receiver has received a complete weather data transmission. It could also indicate a possible outage of a weather product.

The weather product age is shown automatically for weather products displayed on MFD maps. For PFD maps, the pilot can manually enable/disable the age information.

Enabling/disabling the weather product age for PFD Maps:

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **Layout** Softkey.
- 3) Press the **WX LGND** to show/remove the weather product age information for PFD maps.
- 4) Press the **Back** Softkey twice to return to the top-level softkeys.

Tables 6-1 and 6-2 show the weather product symbols, the expiration times and the broadcast rates for SiriusXM Weather and FIS-B Weather, respectively. The broadcast rate represents the interval at which the SiriusXM Weather service transmits new signals that may or may not contain updated weather product information. It does not represent the rate at which the weather information is updated or when the Data Link Receiver receives new data. The service provider and its weather data suppliers define and control the data update intervals, which are subject to change.

SiriusXM Weather Product	Symbol	Expiration Time (Minutes)	Broadcast Rate (Minutes)
NEXRAD		30	5 (U.S.) 10 (Canada)
Cloud Top (CLD TOP)		60	30
Echo Top (ECHO TOP)		30	7.5
SiriusXM Lightning (LTNG)		30	5
Cell Movement		30	1.25
SIGMETs/AIRMETs		60	12
METARs		90	12
City Forecast		90	12
Surface Analysis		60	12
Freezing Levels		120	12
Winds Aloft		90	12
County Warnings		60	5
Cyclone Warnings		60	12
Icing Potential (CIP and SLD)		90	22
Pilot Weather Report (PIREP)		90	12
Air Report(AIREP)		90	12
Turbulence		180	12
Radar Coverage Not Available	No product symbol	30	5
Temporary Flight Restriction (TFR)		60	12
Terminal Aerodrome Forecast (TAF)	No product symbol	60	12

Table 6-1 SiriusXM Weather Product Symbols and Data Timing








FIS-B Weather Product	Symbol	Expiration Time (Minutes)	Broadcast Rate (Minutes)
NEXRAD Composite (US)		30	15
NEXRAD Composite (Regional)		30	2.5
METARs		90	5
Pilot Weather Report (PIREP)		90	10
Winds Aloft		90	10
SIGMETs/AIRMETs		60	5
No Radar Coverage	No product symbol	30	2.5
Terminal Aerodrome Forecast (TAF)	No product symbol	60	10
Temporary Flight Restriction (TFR)		60	10

Table 6-2 FIS-B Weather Product Symbols and Data Timing

DISPLAYING DATA LINK WEATHER PRODUCTS

WEATHER DATA LINK PAGE

The Map - Weather Data Link (XM/FIS-B) Page is the principal map page for viewing data link weather information. This page provides the capability for displaying the most data link weather products of any map on the system. The Weather Data Link Page also provides system-wide controls for selecting the data link weather source, if more than one source has been installed. The page title indicates the selected data link weather source (e.g., “XM”, “FIS-B”).

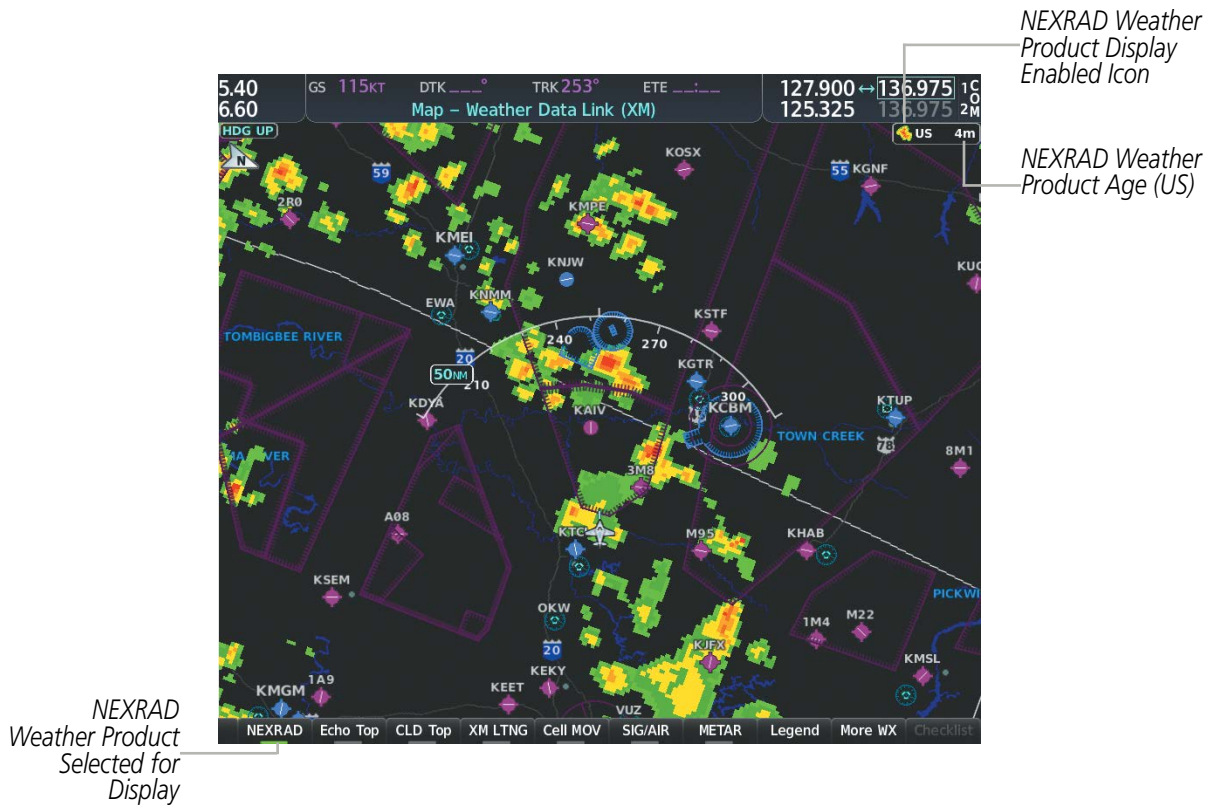


Figure 6-2 Weather Data Link (XM) Page

Viewing the Weather Data Link Page and changing the data link weather source, if applicable:

- 1) Turn the large **FMS** Knob to select the Map Page Group.
- 2) Turn the small **FMS** Knob to select the Weather Data Link (XM or FIS-B) Page. The currently selected data link weather source appears in the page title.
- 3) If the page title does not contain the desired weather source, press the **MENU** Key.
 - a) Turn the **FMS** Knob to highlight 'Display XM Weather', or 'Display FIS-B Weather' (choices may vary depending on the installed equipment).
 - b) Press the **ENT** Key.

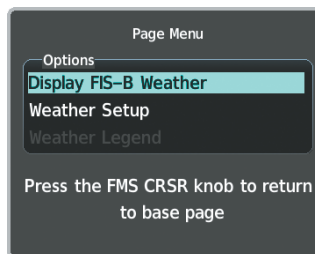


Figure 6-3 Changing the Data Link Weather Source

The system presents the softkeys for the selected source on the Weather Data Link Page, and for map overlays used throughout the system. The following figures show the softkeys for the Weather Data Link Page based on the selected source.

WEATHER DATA LINK (XM) PAGE SOFTKEYS



NOTE: Softkeys not related to data link weather are not shown in the following tables.

Level 1	Level 2	Level 3	Description
NEXRAD			Enables/disables the NEXRAD weather product overlay.
Echo Top			Enables/disables the Echo Tops weather product overlay.
CLD Top			Enables/disables the Cloud Tops weather product overlay.
XM LTNG			Enables/disables the SiriusXM Lightning weather product overlay.
Cell MOV			Enables/disables the Cell Movement weather product overlay.
SIG/AIR			Enables/disables the SIGMET/AIRMET weather product overlay.
METAR			Enables/disables the graphical METAR weather product overlay.
Legend			Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
More WX			Displays second-level SiriusXM Weather product softkeys.
	Cyclone		Enables/disables the Cyclone weather product overlay.
	SFC		Displays third level softkey for enabling/disabling the Surface Analysis and City Forecast weather product and selecting a forecast period.
		Off	Disables the Surface Analysis and City Forecast weather product overlay.
		Current	Displays the Surface Analysis for the current time period overlay.
		12 HR, 24 HR, 36 HR, 48 HR	These softkeys display a Surface Analysis and City Forecast overlay for the selected future time period.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
		Back	Returns to the second-level softkeys.
	FRZ LVL		Enables/disables the Freezing Level weather product overlay.
	Wind		Displays third level softkeys for enabling/disabling the Winds Aloft weather product and selecting a winds aloft altitude.
		PREV	Shows the previous level of winds aloft altitude softkeys.
		Off	Disables the Winds Aloft weather product overlay.
		Softkeys available for selecting winds from the Surface to 42,000 feet	Enables/disables the Winds Aloft weather product for the surface (SFC) through 15,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of winds aloft altitude softkeys.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
		Back	Returns to the second-level softkeys.

Level 1	Level 2	Level 3	Description
	ICNG		Displays altitude softkeys for the Icing weather product overlay.
		PREV	Shows the previous level of Icing altitude softkeys.
		Off	Disables the Icing weather product.
		Softkeys available for selecting winds from the Icing altitude from to 1,000 to 30,000 feet	Enables/disables the Icing weather product overlay from 1,000 feet to 30,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of Icing weather product softkeys.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
	TURB		Displays softkeys for enabling/disabling the Turbulence weather product overlay.
		PREV	Shows the previous level of Turbulence altitude softkeys.
		Off	Disables the Turbulence weather product overlay.
		Softkeys available for selecting Turbulence altitude from 21,000 feet to 45,000 feet	Enables/disables the Icing weather product overlay from 21,000 feet to 45,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of Icing weather product softkeys.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
		Back	Returns to the second-level softkeys.
	AIREPS		Enables/disables the AIREPs weather product overlay.
	PIREPS		Enables/disables the PIREPs weather product overlay.
	County		Enables/disables the County Warnings weather product overlay.
	Back		Returns to the first level softkeys.

WEATHER DATA LINK (FIS-B) PAGE SOFTKEYS

Level 1	Level 2	Level 3	Description
NEXRAD or US or RGNL or US/RGNL			Cycles through NEXRAD display modes with each press: NEXRAD (with annunciator disabled): No NEXRAD is shown. US: Displays NEXRAD data for the Continental US (CONUS). RGNL: Displays regional NEXRAD data. US/RGNL: Displays regional NEXRAD data where available, and CONUS NEXRAD data in other coverage areas.
SIG/AIR			Enables/disables the SIGMET/AIRMET weather product overlay.
METAR			Enables/disables the METAR weather product overlay.

Level 1	Level 2	Level 3	Description
Legend			Enables/disables the Connex Weather Legends Window. Softkey available for selection when at least one Connex Weather product is enabled.
More WX			Displays second-level Connex Weather product softkeys.
	Wind		Displays third level softkeys for enabling/disabling the Winds Aloft weather product and selecting a winds aloft altitude.
		PREV	Shows the previous level of winds aloft altitude softkeys.
		Off	Disables the Winds Aloft weather product overlay.
		Softkeys available for selecting winds from the Surface to 42,000 feet	Enables/disables the Winds Aloft weather product for the surface (SFC) through 15,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of winds aloft altitude softkeys.
		Legend	Enables/disables the Connex Weather Legends Window. Softkey available for selection when at least one Connex Weather product is enabled.
		Back	Returns to the second-level softkeys.
	PIREPs		Enables/disables the PIREPs weather product overlay.
	Back		Returns to the first level softkeys.

The Weather Data Link Page can display a legend for each enabled weather product.

Viewing legends for displayed weather products on the Weather Data Link Page:

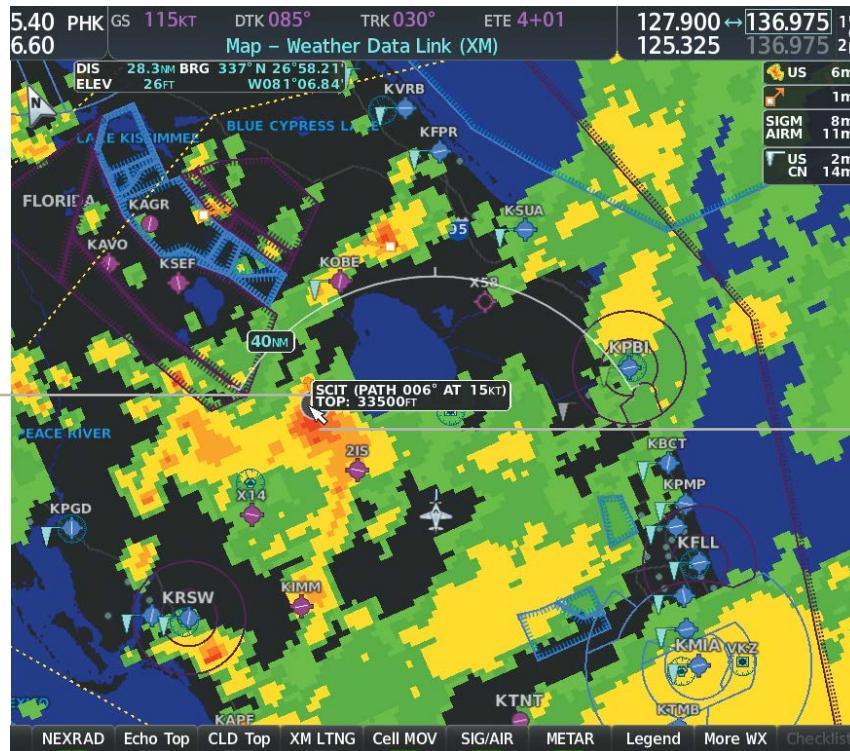
- 1) Select the Weather Data Link (XM or FIS-B) Page.
- 2) Press the **Legend** Softkey to display the legends for the displayed weather products.
Or:
 - a) Press the **MENU** Key.
 - b) Select 'Weather Legend' and press the **ENT** Key.
- 3) Turn the **FMS** Knob to scroll through the legends if more are available than fit in the window.
- 4) To remove the Weather Legends Window, press the **Legend** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Additional information about the following weather products can be displayed by panning the Map Pointer over the following products on the Weather Data Link Page:

- Echo Tops
- Cloud Tops
- Cell Movement
- SIGMETs
- AIRMETs
- METARs
- County Warnings
- TFRs
- AIREPs
- PIREPs

The map panning feature is enabled by pressing the **Joystick**. The map range is adjusted by turning the **Joystick**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.

Additional Information on Weather Feature Selected with Map Pointer



Severe Thunderstorm Selected with Map Pointer

Figure 6-4 Panning on the Weather Data Link (XM) Page

Certain weather products, such as METARs or TFRs have associated full text. When a weather product is selected with the Map Pointer, press the **ENT** Key. The system displays the full text for the selected weather product in a window. To remove the window, press the **FMS** Knob or the **CLR** Key.

The Weather Data Link Page also has a page menu that can be accessed by pressing the **MENU** Key. It has controls for enabling/disabling the weather products as an alternative to using the softkeys.

CUSTOMIZING THE WEATHER DATA LINK PAGE

The Weather Data Link Page includes controls for selecting the maximum map range to display each weather product on the page. If the pilot increases the map range beyond this selected maximum range, the system removes the weather product from the map. If more than one data link weather source has been installed, the system uses the same maximum map range for the comparable weather product of another source.

Setting up and customizing the Weather Data Link Page:

- 1) Select the Weather Data Link (XM or FIS-B) Page.
- 2) Press the **MENU** Key.
- 3) Turn the **FMS** Knob to highlight 'Weather Setup', then press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select 'Product Group 1' or 'Product Group 2', and press the **ENT** Key.



NOTE: 'Product Group 2' is not applicable to FIS-B Weather.

- 5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
- 6) Turn the small **FMS** Knob to scroll through options for each product (On/Off range settings, etc.).
- 7) Press the **ENT** Key to select an option.
- 8) Press the **FMS** Knob or **CLR** Key to return to the Weather Data Link (XM or FIS-B) Page with the changed settings.

Restoring default Weather Data Link Page settings:

- 1) Select the Weather Data Link (XM or FIS-B) Page.
- 2) Press the **MENU** Key.
- 3) Turn the **FMS** Knob to highlight 'Weather Setup', then press the **ENT** Key.
- 4) Press the **MENU** Key.
- 5) Highlight the desired default(s) to restore (all or for selection) and press **ENT** Key.
- 6) When finished, press the **FMS** Knob or press the **CLR** Key.

WEATHER PRODUCT MAP OVERLAYS

Other PFD and MFD maps and pages can display a smaller set of data link weather products. The following table shows which data link weather products can be displayed on specific maps, indicated with a '+' symbol.

Data Link Weather Product	PFD Map	Navigation Map Page	Weather Data Link Page	WPT- Weather Information Page	Other Waypoint Pages	Aux - Trip Planning Page	Nearest Page Group	Flight Plan Pages
NEXRAD†	+	+	+		+	+	+	+
Cloud Top			+					
Echo Top			+					
Data Link Lightning	+	+	+			+	+	+
Cell Movement		+	+		+	+		
SIGMETs/AIRMETs			+					
METARs	+	+	+	+	+	+	+	+
Surface Analysis & City Forecast			+					
Freezing Levels			+					
Winds Aloft		+*	+					
County Warnings			+					
Cyclone Warnings			+					
Icing Potential			+					
PIREPs			+					
AIREPs			+					
Turbulence (TURB)			+					
No Radar Coverage	+	+	+		+	+	+	+
TFRs	+	+	+	+	+	+	+°	+
TAFs				+				

† Animated SiriusXM NEXRAD available on navigation maps except the HSI Map.

* Winds Aloft data is available inside the VSD when VSD is enabled on the Navigation Map Page.

° Full TFR text not available on the Nearest VRP Page.

Table 6-3 Weather Product Display Maps

Displaying Data Link Weather Products on the Navigation Map Page:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the softkey to enable/disable the desired weather product.

The Navigation Map Page also can display legends for weather products enabled on this map with the **Legend** Softkey. This softkey is subdued if no weather products are enabled.

Showing/removing the weather legend on the Navigation Map Page:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **Legend** Softkey to show the Weather Legends window.
- 4) When finished, press the **Legend** Softkey again, or press the **FMS** Knob or the **CLR** Key to remove the window.

The Navigation Map Page also allows the pilot to select the maximum map range to display weather products. If the pilot increases the map range beyond this selected maximum range, the system removes the weather product from the map. The system uses this setting for all navigation maps, including those displayed on the PFD.

Setting up and customizing weather data for the navigation maps:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select the 'Weather' Group and press the **ENT** Key.
- 5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
- 6) Turn the small **FMS** Knob to scroll through options for each product (On/Off, range settings).
- 7) Press the **ENT** Key to select an option.
- 8) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

The system can also display data link weather information on the PFD navigation maps.

Displaying Data Link Weather products on the PFD:

- 1) On the PFD, press the **Map/HSI** Softkey.
- 2) Press the desired weather product softkey(s) to enable/disable the display of data link products on the PFD map.

On the MFD maps, the weather product icon and age appear automatically when a weather is enabled and the range is within the maximum display limits. On PFD maps, this information is available using the PFD softkeys.

Enabling/disabling the weather product icon and age display (PFD maps):

- 1) On the PFD, press the **Map/HSI** Softkey.
- 2) Press the **WX LGND** Softkey to enable/disable the weather product age, source, and icon box display on PFD Maps.

The setup menus for the Navigation Map Page and the Weather Data Link Page control the map range settings above which weather products data are decluttered from the display. If a map range larger than the weather product map range setting is selected, the weather product data is removed from the map. The page menus also provide an alternative to using the softkeys to enable/disable data link weather product overlays on maps.

WEATHER PRODUCT OVERVIEW

The following is an overview of data link weather products the system can display.

NEXRAD (SIRIUSXM)



NOTE: Data link weather radar information cannot be displayed at the same time as relative terrain, echo tops, icing, or turbulence data.

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXT-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the SiriusXM Weather service, whose satellites transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. The NEXRAD weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

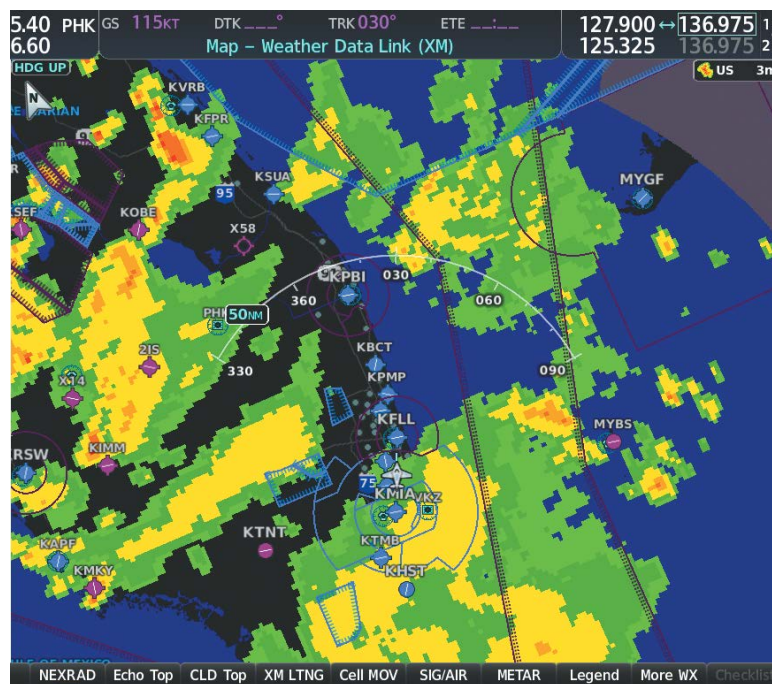


Figure 6-5 NEXRAD Weather Product on the Weather Data Link (XM) Page

For radar sites in the United States, the NEXRAD weather product shows a composite reflectivity image. This shows the *highest* radar energy received from multiple antenna tilt angles at various altitudes. For radar

sites based in Canada, the NEXRAD weather product shows radar returns from the lowest antenna tilt angle, known as base reflectivity. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation, if known.

Displaying the NEXRAD weather product on the Weather Data Link (XM) Page:

- 1) Select the 'Map - Weather Data Link (XM)' Page.
- 2) Press the **NEXRAD** Softkey.

A mosaic of data from all the available NEXRAD radar sites is shown.

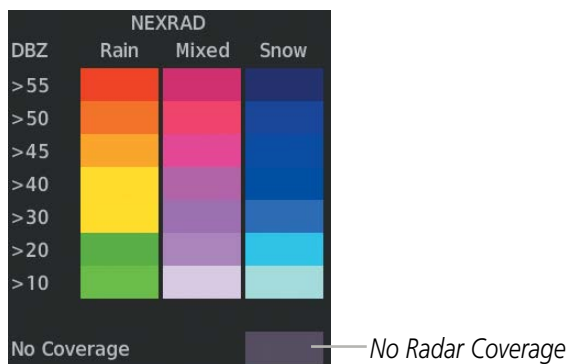


Figure 6-6 NEXRAD Weather Product Legend

Displaying the NEXRAD weather product on the Navigation Map Page:

- 1) Press the **Map Opt** Softkey.
- 2) Press the **NEXRAD** Softkey.

Displaying the NEXRAD weather product on PFD maps:

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **NEXRAD** Softkey to enable/disable the display of NEXRAD information.

The display of No Radar Coverage is always active when either NEXRAD or Echo Tops is selected. Areas where NEXRAD radar coverage and Echo Tops information is not currently available or is not being collected are indicated in gray shade of purple.

The system can animate a loop of NEXRAD information. The animated view is available on the Weather Data Link (XM) Page, and on navigation maps with the exception of the HSI Map. Animation begins after the system has received at least two recent NEXRAD images since the avionics power cycle. When NEXRAD animation is enabled, a timeline appears in the upper-right corner of the map, except for the PFD Inset Map. A pointer on the timeline indicates the relative position of the displayed frame of animation, from oldest to newest. The NEXRAD weather product age corresponds to the displayed frame. The system can show up to six frames of NEXRAD animation when the USA coverage option is selected, and up to three frames of animation when Canada is selected.

Displaying Time-Lapse NEXRAD Animation on the Weather Data Link (XM) Page:

- 1) Press the **MENU** Key.
- 2) Turn the **FMS** Knob to select 'Weather Setup' and press the **ENT** Key.
- 3) With 'Product Group 1' selected, turn the large **FMS** Knob to highlight the NEXRAD Animation On/Off field.

- 4) Turn the small **FMS** Knob to select 'On' or 'Off', then press the **ENT** Key.
- 5) To remove the menu, push the **FMS** Knob or the **CLR** Key.

The pilot enables/disables the NEXRAD animation feature for navigation maps from the Navigation Map Page.

Displaying Time-Lapse NEXRAD Animation on navigation maps:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the **FMS** Knob to select the 'Weather' Group and press the **ENT** Key.
- 5) Turn the large **FMS** Knob to highlight the NEXRAD Animation On/Off field.
- 6) Turn the small **FMS** Knob to highlight 'On' or 'Off' and press the **ENT** Key.
- 7) To remove the menu, push the **FMS** Knob or the **CLR** Key.

The pilot can select either the United States or Canada region for the desired NEXRAD coverage area. The selection for the Weather Data Link (XM) Page is independent from the selection made on the Navigation Map Page, which affects navigation maps. NEXRAD information is shown for the selected region, while a gray shade of purple is shown over the region which is not selected when the NEXRAD overlay is enabled. This is the same coloring used depict where NEXRAD coverage is not available. This indication appears over other map overlays on navigation maps, such as topographical information. The NEXRAD weather product age display indicates either 'US' or 'CN' for the selected coverage region.

Selecting the NEXRAD Coverage Region on the Weather Data Link (XM) Page:

- 1) Press the **MENU** Key.
- 2) Turn the **FMS** Knob to select 'Weather Setup' and press the **ENT** Key.
- 3) With 'Product Group 1' selected, turn the large **FMS** Knob to highlight the NEXRAD Region field.
- 4) Turn the small **FMS** Knob to select 'US' or 'CNDA' (Canada), then press the **ENT** Key.
- 5) To remove the menu, push the **FMS** Knob or the **CLR** Key.

Selecting the NEXRAD Coverage Region on navigation maps:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the large **FMS** Knob to highlight the Region US or CNDA field.
- 5) Turn the small **FMS** Knob to highlight 'US' or 'CNDA' and press the **ENT** Key.
- 6) To remove the menu, push the **FMS** Knob or the **CLR** Key.

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD LIMITATIONS

NEXRAD radar images may have certain limitations:

- Undetermined precipitation types may be displayed as mixed.
- An individual NEXRAD site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.
- Precipitation may be occurring below the lowest antenna tilt angle (0.5°), and therefore the radar beam overshoots the precipitation. For example, at a distance of 124 miles from the radar site, the radar beam is approximately 18,000 feet above the radar site. The radar cannot detect any precipitation occurring below the beam at this distance and altitude.
- At smaller map ranges, the smallest square block on the display represents an area of approximately four square kilometers. The intensity level reflected by each square represents the highest level of radar reflectivity sampled within the area.
- Unknown precipitation below 52°N is displayed as rain regardless of actual precipitation type.

Block represents approximately 4 km²

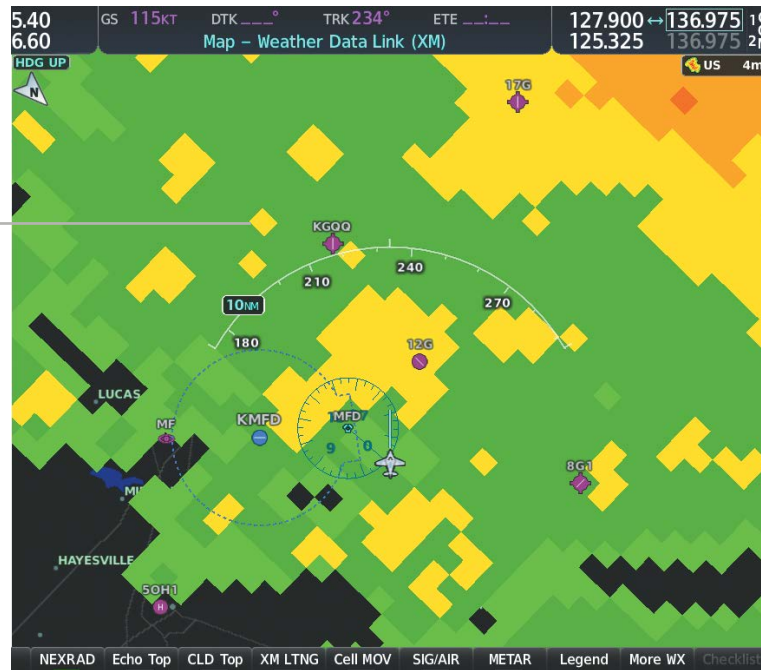


Figure 6-7 NEXRAD Weather Product with 30 NM Map Range

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strokes and spurious radar data
- Sun strokes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

NEXRAD LIMITATIONS (CANADA)

- Radar coverage extends to 55°N.
- Any precipitation displayed between 52°N and 55°N is displayed as mixed precipitation regardless of actual precipitation type.
- If the precipitation type is unknown, the system displays the precipitation as rain, regardless of actual precipitation type.



Figure 6-8 NEXRAD Weather Product - Canada

NEXRAD (FIS-B)



NOTE: The NEXRAD weather product cannot be displayed at the same time as relative terrain on the same map.

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider to FIS-B compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the FIS-B GBTs, which transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be older than the current radar synopsis and may not depict the current weather conditions. NEXRAD information should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.



Figure 6-9 Regional NEXRAD Weather Product on the Weather Data Link (FIS-B) Page

The FIS-B NEXRAD weather product may be displayed for a region around the GBT (higher resolution, updated more frequently) or for across the continental United States (lower resolution, updated less frequently). A combined version of both weather products is also available for display on the same map. When the combined NEXRAD is selected, regional NEXRAD takes display precedence where data is available, and continental US NEXRAD is displayed outside of the regional NEXRAD coverage area.

Displaying the NEXRAD weather product on the Weather Data Link (FIS-B) Page:

- 1) Select the 'Map - Weather Data Link (FIS-B)' Page.
 - 2) Press the **NEXRAD** Softkey. Each press cycles through a coverage option as the softkey name changes (**US**, **RGNL**, or **US/RGNL**).
- Or:
- 1) Press the **MENU** Key.
 - 2) Turn the **FMS** Knob to highlight 'Weather Setup' and press the **ENT** Key.
 - 3) To enable/disable the display of NEXRAD information for the continental United States, turn the small **FMS** Knob to highlight the NEXRAD On/Off field.
 - a) Turn the small **FMS** Knob to highlight 'On' to enable the display of NEXRAD for the continental United States or 'Off' to disable.
 - b) Press the **ENT** Key.

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

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- 4) To enable/disable the display of Regional NEXRAD information, turn the small **FMS** Knob to highlight the Regional On/Off field.
 - a) Turn the small **FMS** Knob to highlight 'On' to enable the display of Regional NEXRAD or 'Off' to disable.
 - b) Press the **ENT** Key.
- 5) When finished, push the **FMS** Knob.

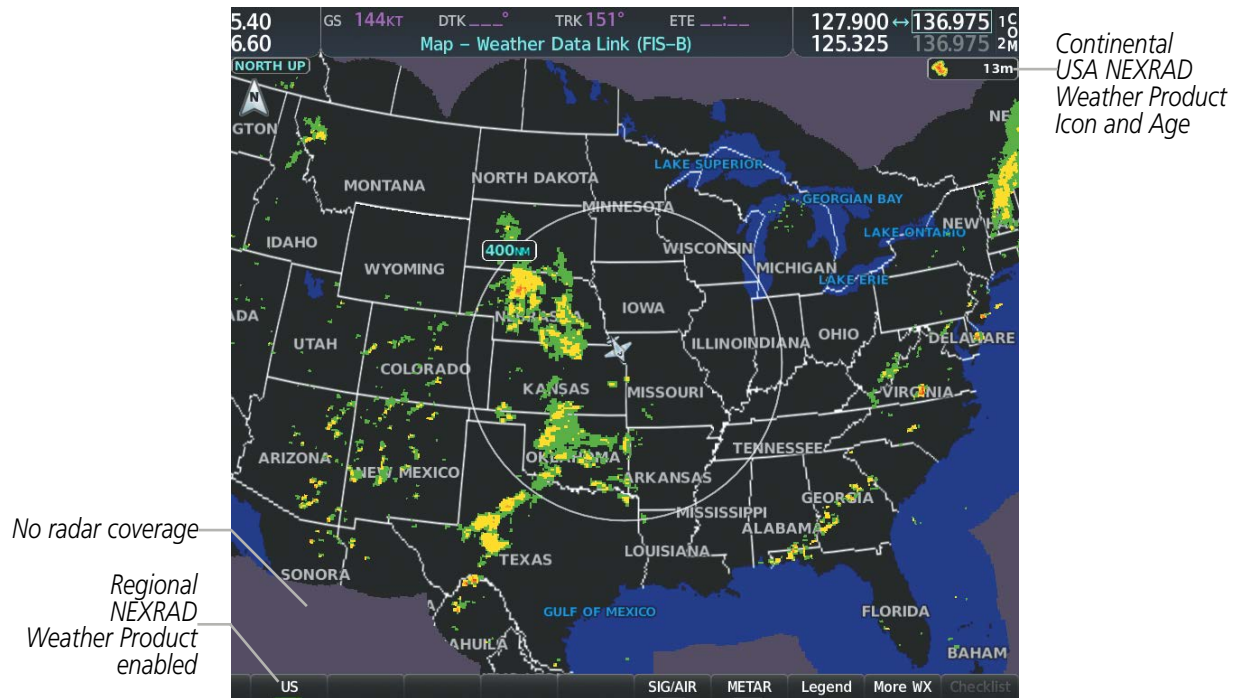


Figure 6-10 Continental US (CONUS) NEXRAD Weather Product on the Weather Data Link (FIS-B) Page



NOTE: When both NEXRAD options are enabled on the 'Map - Weather Data Link (FIS-B)' Page menu, a combined version is displayed.

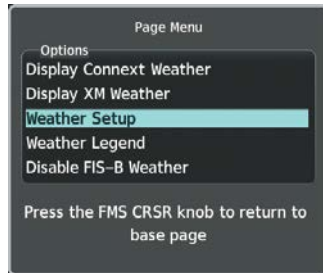


Figure 6-11 Weather Data Link (FIS-B) Page Menu

Enables/disables regional NEXRAD data display



Enables/disables NEXRAD data display for the continental United States

Figure 6-12 Weather Data Link (FIS-B) Page Setup Menu

Displaying the FIS-B NEXRAD weather product on the 'Map - Navigation Map' Page:

- 1) Press the **Map Opt** Softkey.
- 2) Press the **NEXRAD** Softkey.
- 3) To change the type of NEXRAD displayed, press the **MENU** Key.
- 4) With 'Map Settings' highlighted, press the **ENT** Key.
- 5) Turn the small **FMS** Knob to select the 'Weather' Group, then press the **ENT** Key.
- 6) Turn the large **FMS** Knob to highlight the NEXRAD Data On/Off Field.
- 7) Turn the small **FMS** Knob to highlight 'On' or 'Off'.
- 8) Turn the large **FMS** Knob to highlight the NEXRAD Data Region field.
- 9) Turn the small **FMS** Knob to highlight 'CONUS' (continental United States), 'RGNL' (regional), or 'Combined', then press the **ENT** Key. This selection also affects display of NEXRAD on the PFD Maps.
- 10) When finished, press the **FMS** Knob or press the **CLR** Key.

Displaying the FIS-B NEXRAD weather product on PFD maps:

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **NEXRAD** Softkey to enable/disable the display of NEXRAD information.

The regional NEXRAD weather product coverage area varies, as it is determined by the data received from ground-based sources. When the regional NEXRAD weather product is enabled, a white spiked boundary encloses this area to indicate the geographic limits of the regional NEXRAD coverage being displayed. The system shows composite radar data from all available NEXRAD sites inside of this boundary area.

If the continental United States version of the NEXRAD weather product is shown (**US** Softkey enabled), the coverage boundary is not shown on the map.

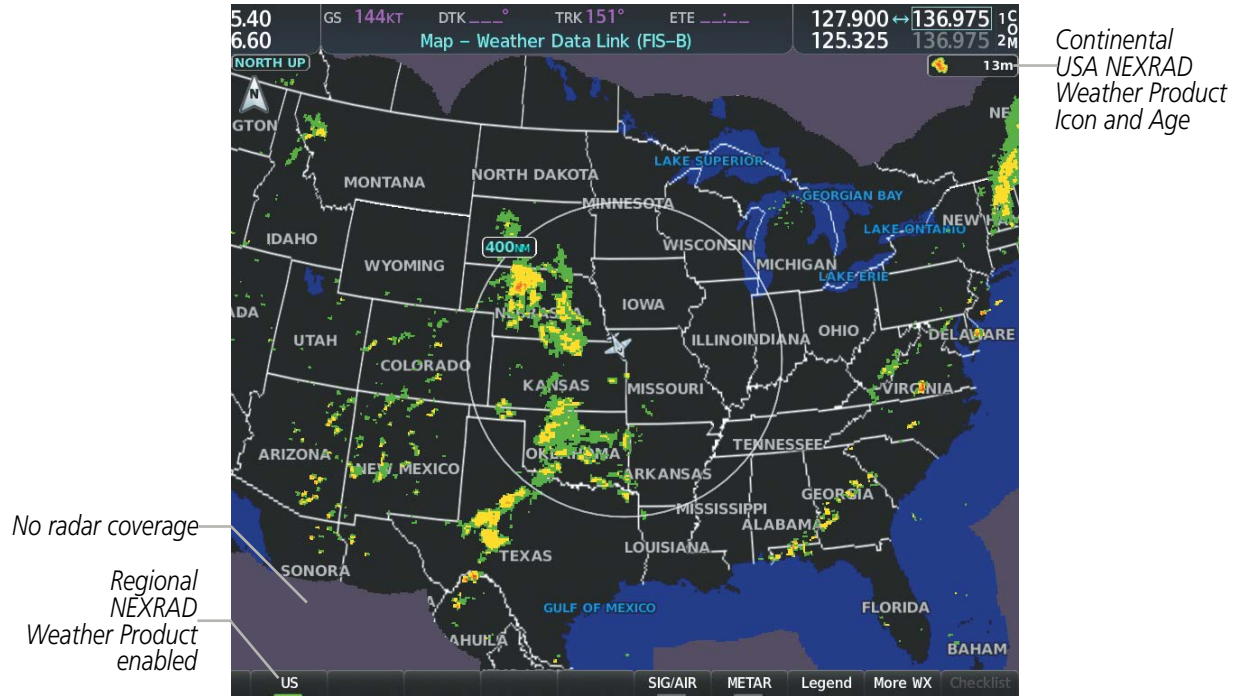


Figure 6-13 Continental US (CONUS) NEXRAD Weather Product on the Weather Data Link (FIS-B) Page

This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the 'Map - Weather Data Link (FIS-B)' Page. For the NEXRAD legend, press the **Legend** Softkey when the NEXRAD weather product is enabled.

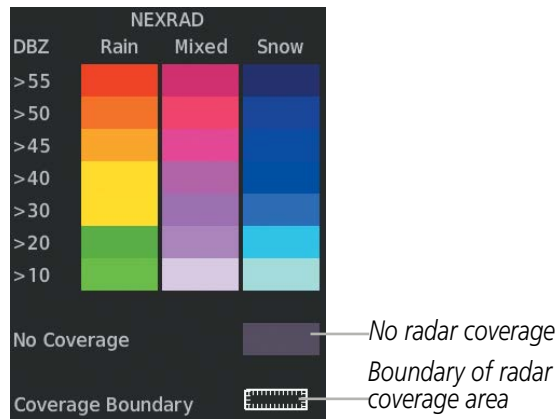


Figure 6-14 NEXRAD Weather Product Legend

The display of no radar coverage is enabled when NEXRAD is selected for display. Areas where radar data is not currently available, has not yet been received, or is not being collected are indicated in gray shade of purple.



NOTE: *If the system has not received all available NEXRAD weather data (such as during initial FIS-B signal acquisition or in areas of marginal or poor signal reception), the system may display areas of no radar coverage which are subsequently removed as radar data is received. It may take up to approximately ten minutes to receive all FIS-B data, when adequate reception is available.*

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD LIMITATIONS

NEXRAD radar images may have certain limitations:

- At smaller map ranges, individual blocks of NEXRAD weather data are viewable. For the regional version of the NEXRAD weather product, the smallest block represents 1.5 nm wide by 1 nm tall. For the continental United States version of the NEXRAD weather product, each block is 7.5 nm wide by 5 nm wide. The color of each block represents the *highest* radar reflectivity detected within that area.
- The continental US version of the NEXRAD weather product is not available above 60° of latitude.

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strokes and spurious radar data
- Sun strokes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

ECHO TOPS (SIRISUXM)



NOTE: Echo Tops cannot be displayed at the same time as Cloud Tops or NEXRAD data is displayed.

The Echo Tops weather product shows the location, elevation, and direction of the highest radar echo. The highest radar echo does not indicate the top of a storm or clouds; rather it indicates the highest altitude at which precipitation is detected. Information is derived from NEXRAD data.



Figure 6-15 Echo Tops Weather Product

Displaying Echo Tops information:

- 1) Select the 'Map - Weather Data Link (XM)' Page.
- 2) Press the **Echo Top** Softkey.

Since Echo Tops and Cloud Tops use the same color scaling to represent altitude, display of these weather products is mutually exclusive. When Echo Tops is activated, NEXRAD and Cloud Tops data are removed.

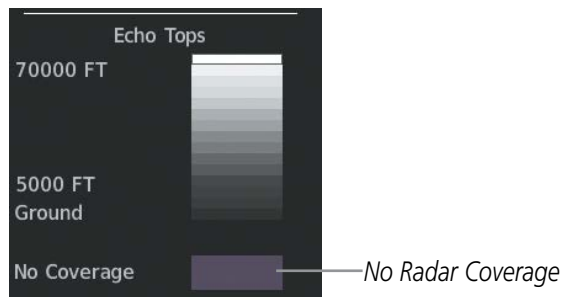


Figure 6-16 Echo Tops Legend

CLOUD TOPS (SIRIUSXM)



NOTE: Cloud Tops and Echo Tops cannot be displayed at the same time.



NOTE: The broadcast rate for Cloud Tops is 30 minutes. As with all SiriusXM Weather products, the product age becomes amber when it reaches half of the expiration time, which is 60 minutes for Cloud Tops. Therefore, this weather product age may be amber during routine operation.

The Cloud Tops weather product depicts cloud top altitudes as determined from satellite imagery.

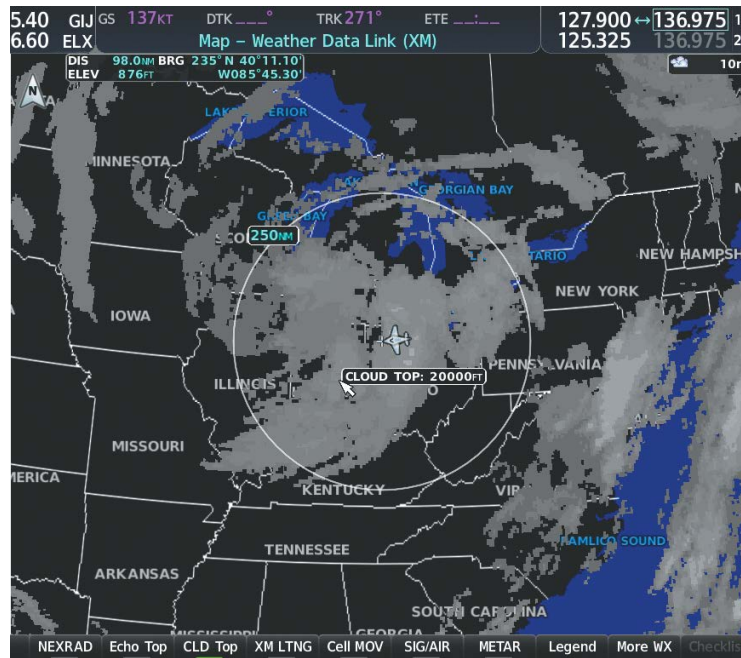


Figure 6-17 Cloud Tops Weather Product

Displaying Cloud Tops information:

- 1) Select the 'Map - Weather Data Link (XM)' Page with the **FMS** Knob.
- 2) Press the **CLD Top** Softkey.

Since Cloud Tops and Echo Tops use the same color scaling to represent altitude, display of these weather products is mutually exclusive. When Cloud Tops is activated, Echo Tops data is removed.

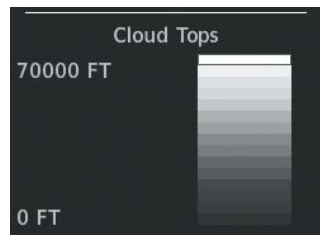


Figure 6-18 Cloud Tops Legend

DATA LINK LIGHTNING (SIRIUSXM)

The Data Link Light weather product shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike that has occurred within a two-kilometer region. The exact location of the lightning strike is not displayed.



Figure 6-19 SiriusXM Lightning Weather Product

Displaying Data Link Lightning information on Weather Data Link (XM) Page:

- 1) Select the Weather Data Link (XM) Page.
- 2) Press the **XM LTNG** Softkey.

To display the Lightning legend on the 'Map - Weather Data Link XM' Page, press the **Legend** Softkey when Data Link Lightning is selected for display.

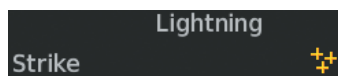


Figure 6-20 Data Link Lightning Legend

Displaying Data Link Lightning information on the Navigation Map Page:

- 1) Turn the **FMS** Knob to select the 'Map - Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **XM LTNG** Softkey.

Enabling/disabling Data Link Lightning information on PFD maps:

- 1) On the PFD, press the **Map/HSI** Softkey.
- 2) Press the **Lightning** Softkey.

- 3) Press the **Datalink** Softkey to enable data link lightning from SiriusXM, or press the **LTNG Off** Softkey to disable data link lightning.
- 4) When finished, press the **Back** Softkey.

CELL MOVEMENT (SIRIUSXM)

The Cell Movement weather product shows the location and movement of storm cells as identified by the ground-based system. Cells are represented by yellow squares, with direction of movement indicated with short, orange arrows.

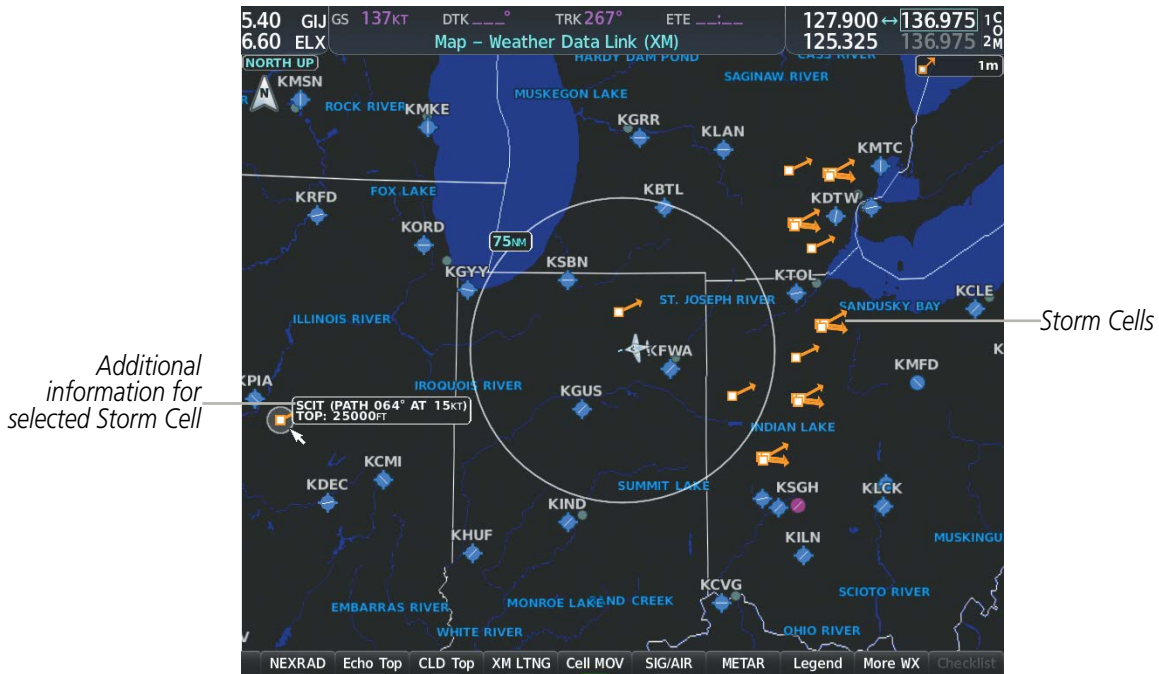


Figure 6-21 Cell Movement Weather Product

On the 'Map - Weather Data Link (XM)' Page, the Cell Movement weather product has a dedicated **CEL MOV** softkey for enabling/disabling this weather product on this page.

NOTE: The Storm Cell base height is not available with this weather product. In this case, the Storm Cell base height is displayed as 0 feet when the map pointer selects a storm cell.

Displaying Cell Movement information on the 'Map - Weather Data Link (XM)' Page:

- 1) Select the 'Weather Data Link (XM)' Page using the **FMS** Knob.
- 2) Press the **Cell MOV** Softkey.

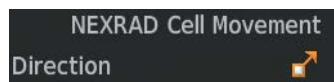


Figure 6-22 Cell Movement Legend

For navigation maps, the pilot can enable/disable the Cell Movement weather product using the **NEXRAD** Softkey. For this to occur, the pilot must first enable the 'Cell Movement' option in the Map Settings menu of the Navigation Map Page.

Setting up the system to display Cell Movement with NEXRAD on navigation maps:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to highlight 'Weather' and press the **ENT** Key.
- 5) Turn the large **FMS** Knob to 'On' or 'Off' for the Cell Movement menu option. When set to 'On', Cell Movement is enabled/disabled with the NEXRAD weather product on navigation maps. When set to 'Off', Cell Movement is not displayed on navigation maps.
- 6) When finished, push the **FMS** Knob or **CLR** Key to remove the menu.

After the 'Cell Movement' option is set to 'On', refer to the previous procedures for enabling/disabling the NEXRAD weather product to control both products simultaneously on navigation maps using the **NEXRAD** Softkey.

SIGMETS AND AIRMETS

SIGMET (SIGnificant METeorological Information) and AIRMET (AIRmen's METeorological Information) are issued for potentially hazardous weather. A Convective SIGMET is issued for hazardous convective weather such as severe or widespread thunderstorms. A localized SIGMET is a significant weather condition occurring at a localized geographical position.



NOTE: *The SIGMET and AIRMET weather products are not available unless at least one SIGMET or AIRMET has been received. The weather product age indicates 'N/A' when no SIGMET or AIRMET is available.*

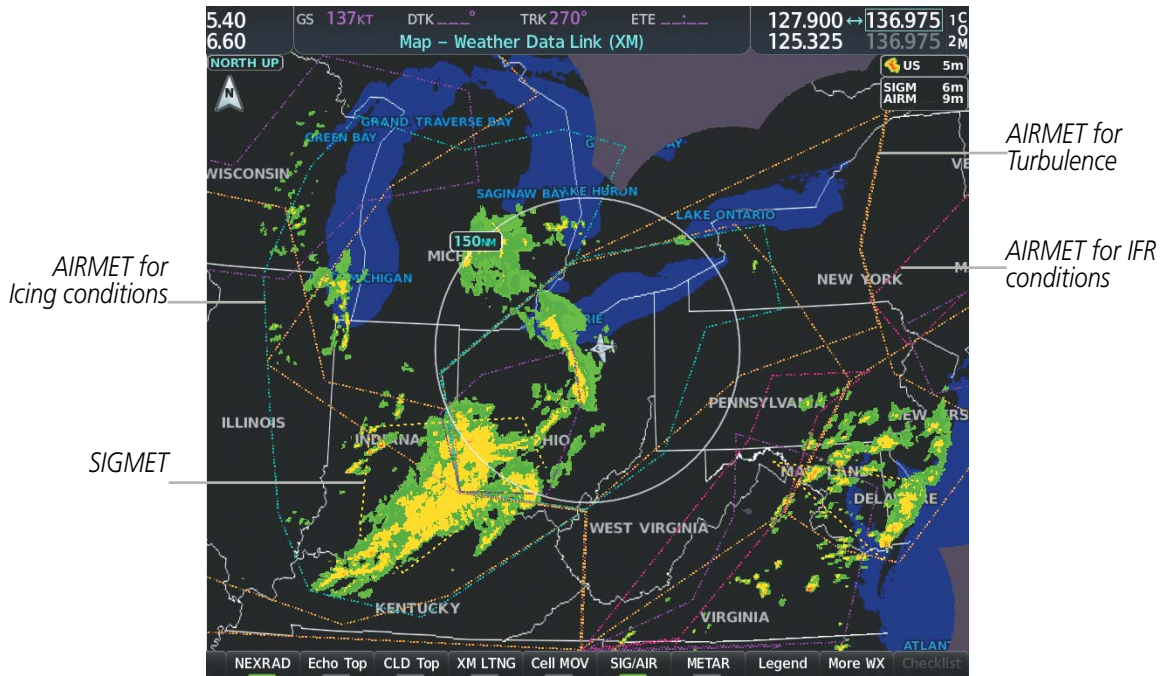
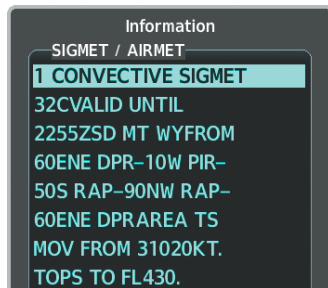


Figure 6-23 SIGMET/AIRMET Data

Displaying SIGMETs and AIRMETs:

- 1) Select the Weather Data Link (XM/FIS-B) Page.
- 2) Press the **SIG/AIR** Softkey.
- 3) To view the text of the SIGMET or AIRMET, press the **Joystick** and move the Map Pointer over the icon.
- 4) Press the **ENT** key. The following figure shows sample SIGMET text.



Sample SIGMET Text



SIGMET/AIRMET Legend

Figure 6-24 SIGMET/AIRMET Text and Legend

METARS AND TAFS



NOTE: Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except for in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.



NOTE: METAR information is only displayed within the installed navigation database service area.

METARs (METeorological Aerodrome Reports) typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure at an airport or observation station. They can also contain information on precipitation amounts, lightning, and other critical data. METARs reflect hourly observations; non-routine updates include the code “SPECI” in the report. METARs are shown as colored flags at airports that provide them.

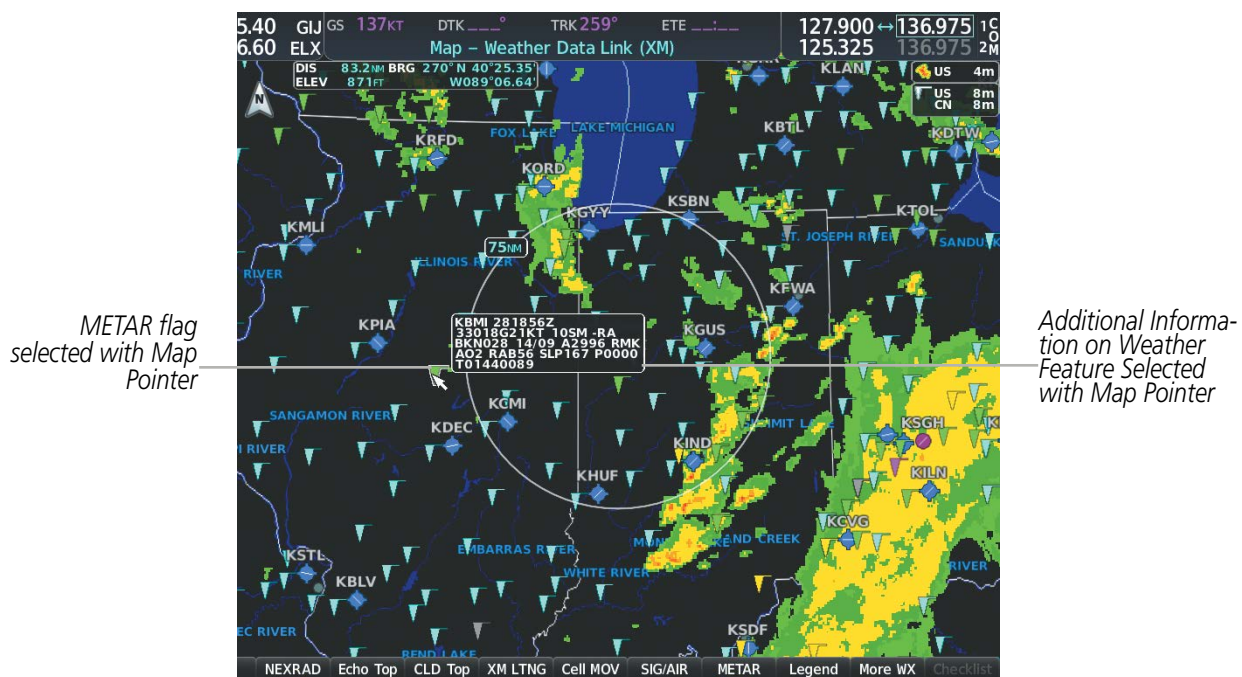


Figure 6-25 METAR Flags on the Weather Data Link Page

TAFs (Terminal Aerodrome Forecasts) are weather predictions for specific airports within a 24- hour period, and may span up to 36 hours. TAFs typically include forecast wind, visibility, weather phenomena, and sky conditions using METAR codes.

METAR and TAF text are displayed on the Weather Information Page. METAR data is displayed first in a decoded fashion, followed by the original text. Note the original text may contain additional information not found in the decoded version. TAF information is displayed only in its original form when TAFs are available.

Displaying METAR and TAF text on the MFD:

- 1) On the Weather Data Link (XM/FIS-B) Page, press the **METAR** Softkey.
- 2) Press the **Joystick** and pan to the desired airport.

- 3) Press the **ENT** Key. The Weather Information Page is shown with METAR and TAF text.
 - 4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. METAR text must be completely scrolled through before scrolling through the TAF text.
 - 5) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link (XM/FIS-B) Page.
- Or:**
- 1) Select the 'WPT - Weather Information' Page.
 - a) Turn the large **FMS** Knob to select the Waypoint Page Group.
 - b) Press the **WX** Softkey to select the 'WPT - Weather Information' Page.
 - 2) Press the **FMS** Knob to display the cursor.
 - 3) Use the **FMS** Knob to enter the desired airport and press the **ENT** Key.
 - 4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note that the METAR text must be completely scrolled through before scrolling through the TAF text.



METAR Text for the Selected Airport

TAF Text for the Selected Airport

Figure 6-26 METAR and TAF Text on the 'WPT - Weather Information Page'

To display the METAR legend on the Weather Data Link (XM) Page, press the Legend Softkey when METARs are enabled for display.

The METAR flag color is determined by the information in the METAR text. The system displays a gray METAR flag when the system cannot determine the METAR category based on the information available.

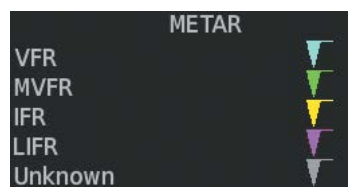


Figure 6-27 METAR Legend

The system also shows METAR flags and their associated text on the Active Flight Plan Page on the MFD. The system shows a METAR flag next to waypoints in the flight plan with an available METAR.

Displaying original METAR text on the Active Flight Plan Page:

- 1) Select the Active Flight Plan Page on the MFD.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight a waypoint with an available METAR (indicated with a METAR flag next to it). The METAR text will appear in the 'Selected Waypoint Weather' Window below.
- 4) When finished, press the **FMS** Knob to remove the cursor or press the **FPL** Key to exit the Active Flight Plan Page.

Original METAR text is also accessible on navigation maps displaying METAR flags. When the map pointer is panned over a METAR flag, the METAR text is shown in a box near the flag.

Displaying original METAR text information on the PFD Inset Map:

- 1) On the PFD, press the **Map/HSI** Softkey.
- 2) Press the **METAR** Softkey.
- 3) Press the **Joystick** and pan to the desired METAR flag. Original METAR text appears on the map.
- 4) When finished, press the **Joystick** to remove the Map Pointer.

SURFACE ANALYSIS AND CITY FORECAST (SIRIUSXM)

Surface Analysis and City Forecast information is available for current and forecast weather conditions. Forecasts are available for intervals of 12, 24, 36, and 48 hours.

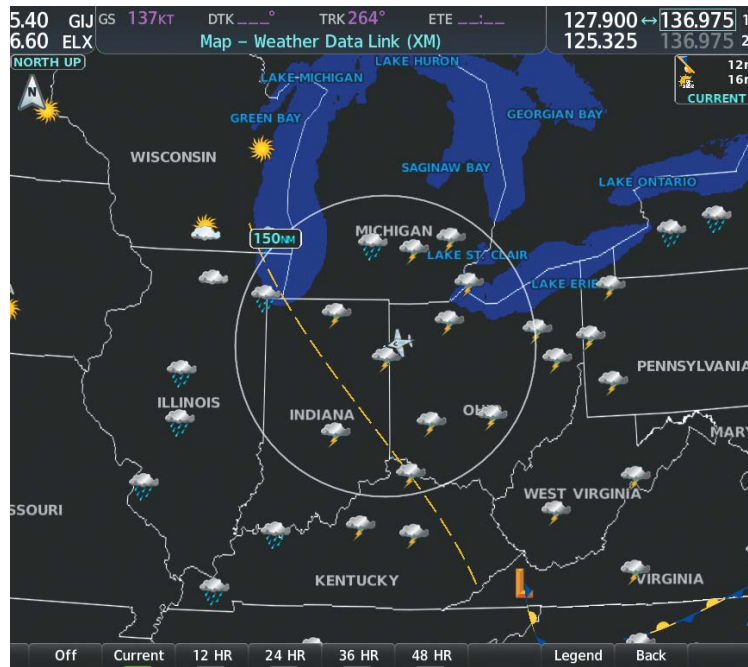


Figure 6-28 Current Surface Analysis Data

Displaying Surface Analysis and City Forecast information:

- 1) Select the 'Map - Weather Data Link (XM)' Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **SFC** Softkey.
- 4) Press the softkey for the desired forecast time: **Current**, **12 HR**, **24 HR**, **36 HR**, or **48 HR**. The **SFC** Softkey label changes to show the forecast time selected.

Or:

Press the **Off** Softkey to disable the display of the weather product.



Figure 6-29 Surface Analysis Legend

FREEZING LEVEL (SIRIUSXM)

The Freezing Level weather product shows the color-coded contour lines for the altitude and location at which the first isotherm is found. When no data is displayed for a given altitude, the data for that altitude has not been received, or is out of date and has been removed from the display. New data appears when it becomes available.

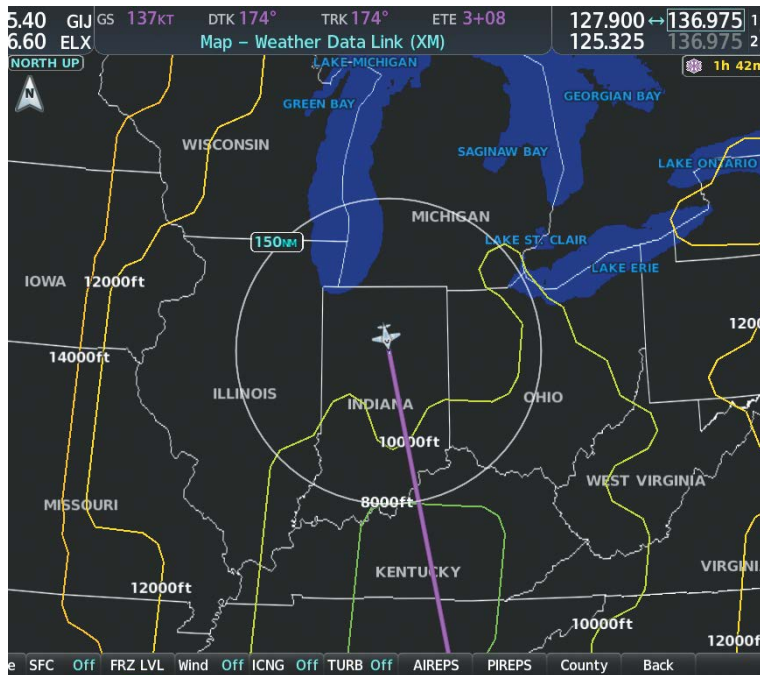


Figure 6-30 Freezing Level Data

Displaying Freezing Level information:

- 1) Select the 'Map - Weather Data Link (XM)' Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **FRZ LVL** Softkey.



Figure 6-31 Freezing Levels Legend

WINDS ALOFT

The Winds Aloft weather product shows the forecast wind speed and direction at the surface and at selected altitudes. Altitude can be displayed in 3000-foot increments beginning at the surface up to 42,000 feet MSL.

If the FIS-B option is installed and FIS-B is the active data link weather source, the Winds Aloft weather product also displays temperatures aloft next to the winds aloft arrows on the Weather Data Link (FIS-B) Page.

Displaying the Winds Aloft weather product:

- 1) Select the Weather Data Link (XM/FIS-B) Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **Wind** Softkey.
- 4) Press a softkey for the desired altitude level: **SFC** (surface) up to 42,000 feet. Press the **Next** or **Prev** Softkey to cycle through the altitude softkeys. The **Wind** Softkey label changes to reflect the altitude selected.

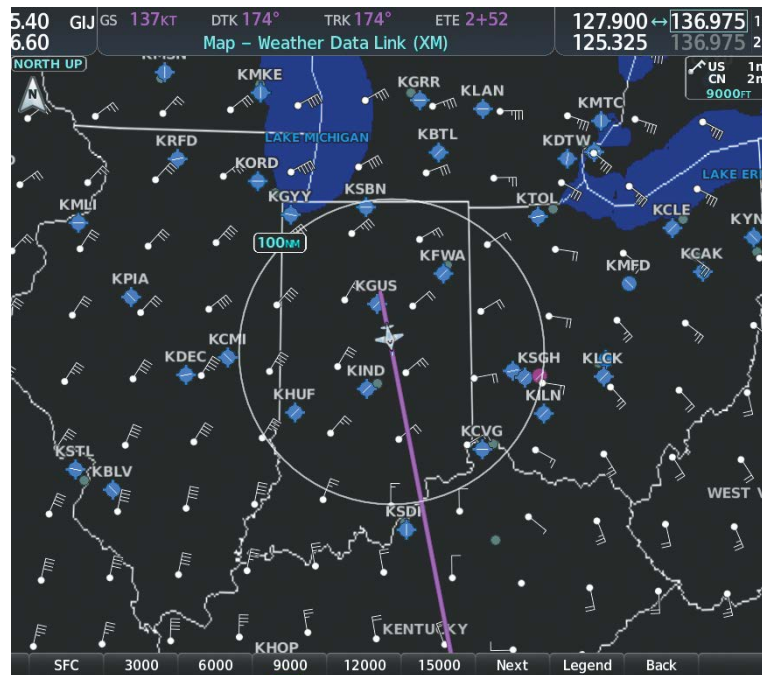


Figure 6-32 Winds Aloft Data at 12,000 Feet



Figure 6-33 Winds Aloft Data with Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) on the Navigation Map Page. The displayed components are relative to current aircraft altitude and track, but not to aircraft speed.

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Figure 6-34 Navigation Map Page with Winds Aloft Data on Profile View

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-4.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-4 VSD Headwind/Tailwind Component Symbols

Enabling/disabling the Vertical Situation Display (containing winds aloft data):

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **Inset** Softkey.
- 4) Press the **VSD** Softkey to enable/disable the Vertical Situation Display.

Or:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) Turn the **FMS** Knob to highlight 'Show VSD' or 'Hide VSD' and press the **ENT** Key.

Settings on the Navigation Map Page control the display of Winds Aloft information shown on the VSD.

Enabling/disabling winds aloft data display for the VSD:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select 'VSD' and press the **ENT** Key.
- 5) Turn the large **FMS** Knob to highlight the Winds on/off field.
- 6) Turn the small **FMS** Knob to select 'On' or 'Off'.
- 7) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

COUNTY WARNINGS (SIRIUSXM)

The County warning weather product provides specific public awareness and protection weather warnings from the National Weather Service (NWS). This can include information on tornadoes, severe thunderstorms, and flood conditions.



Figure 6-35 County Flood Warning

Displaying County Warning information:

- 1) Select the 'Map - Weather Data Link (XM)' Page with the **FMS** Knob.
- 2) Press the **More WX** Softkey.
- 3) Press the **County** Softkey.

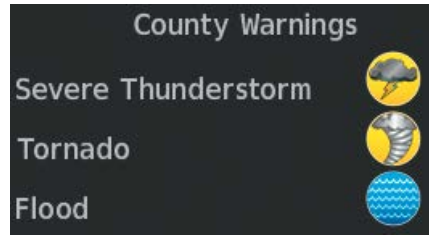


Figure 6-36 County Warnings Legend

CYCLONE (SIRIUSXM)

The Cyclone weather product shows the current location of cyclones (hurricanes), tropical storms, and their projected tracks. The system displays the projected track information in the form of DD/HH:MM.

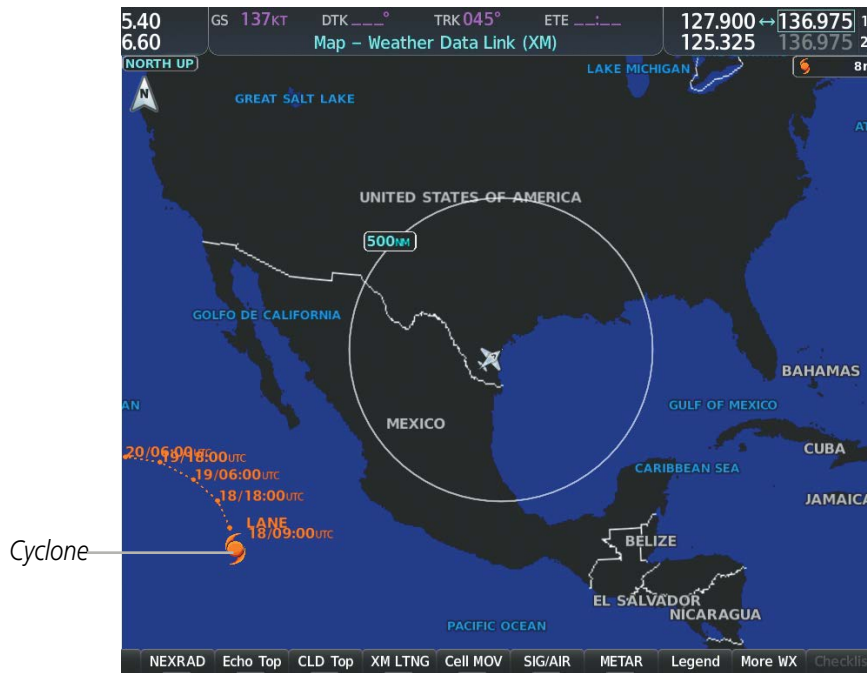


Figure 6-37 Cyclone Weather Product on the Weather Data Link (XM) Page

Displaying cyclone (hurricane) track information:

- 1) Select the 'Map Weather Data Link (XM)' Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **Cyclone** Softkey.

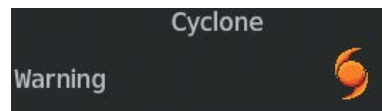


Figure 6-38 Cyclone Legend



NOTE: The Cyclone weather product is not available unless at least one cyclone or tropical storm has been received. The weather product age indicates 'N/A' when no cyclone or tropical storm has been received.

ICING (CIP & SLD) (SIRIUSXM)



NOTE: Icing information cannot be displayed simultaneously on the same map with NEXRAD.

The Current Icing Product (CIP) weather product shows a graphical view of the current icing environment. Icing severity is displayed in four categories: light, moderate, severe, and extreme (not specific to aircraft type). The CIP product is not a forecast, but a presentation of the current conditions at the time of the analysis.

Supercooled Large Droplet (SLD) icing conditions are characterized by the presence of relatively large, super cooled water droplets indicative of freezing drizzle and freezing rain aloft. SLD threat areas are depicted as magenta dots over the CIP colors.

Displaying Icing data:

- 1) Select the 'Map - Weather Data Link (XM)' Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **ICNG** Softkey.
- 4) Press a softkey for the desired altitude level: 1,000 feet up to 30,000 feet. Press the **Next** or **PREV** Softkey to cycle through the altitude softkeys. The **ICNG** Softkey label changes to indicate the altitude selected.

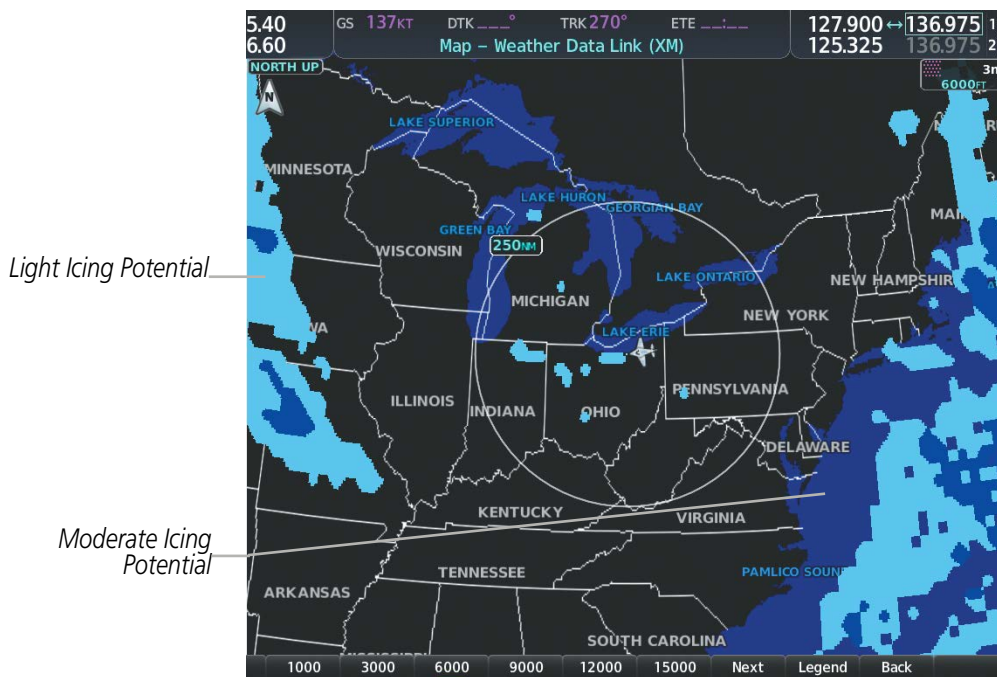


Figure 6-39 Icing Data at 18,000 Feet

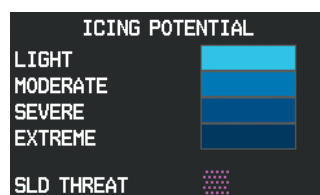


Figure 6-40 Icing Potential Legend

TURBULENCE (SIRIUSXM)



NOTE: Turbulence information cannot be displayed simultaneously on the same map with NEXRAD.

The Turbulence weather product identifies the potential for erratic movement of high-altitude air mass associated winds. Turbulence is classified as light, moderate, severe or extreme, at altitudes between 21,000 and 45,000 feet. Turbulence information is intended to supplement AIRMETs, SIGMETs, and PIREPs.

Displaying Turbulence data:

- 1) Select the 'Map - Weather Data Link (XM)' Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **TURB** Softkey.
- 4) Press a softkey for the desired altitude: 21,000 feet up to 45,000 feet. Press the **Next** or **PREV** Softkey to cycle through the altitude softkeys. The **TURB** Softkey label changes to indicate the altitude selection.

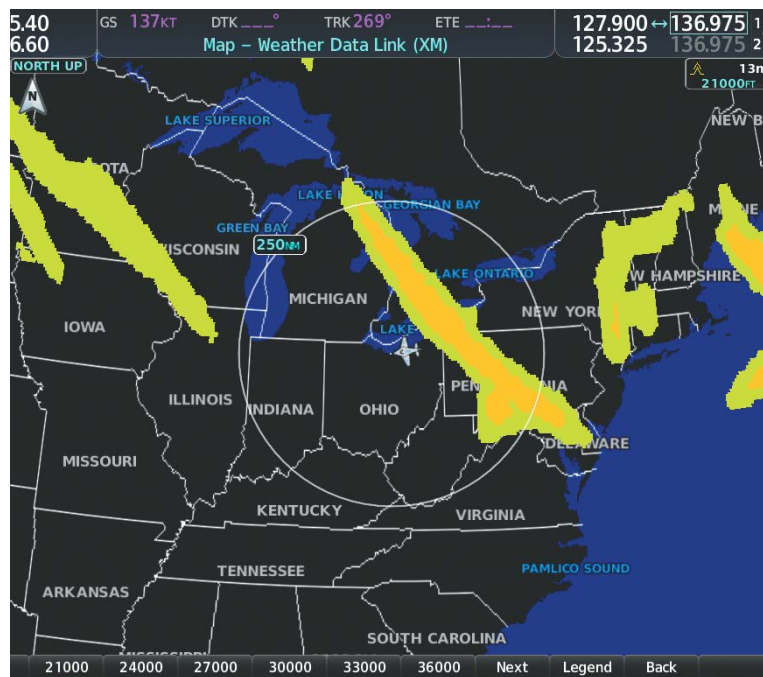


Figure 6-41 Turbulence Weather Product at 21,000 Feet

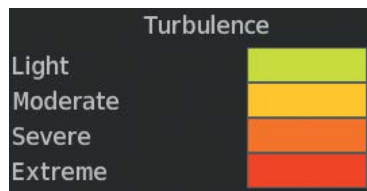


Figure 6-42 Turbulence Legend

PIREPS AND AIREPS



NOTE: AIREPs are only available with the SiriusXM Weather service.

Pilot Weather Reports (PIREPs) are in-flight weather observations collected from pilots. When significant weather conditions are reported or forecast, Air Traffic Control (ATC) facilities are required to solicit PIREPs. A PIREP may contain adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, and turbulence. PIREPs are issued as either Routine (UA) or Urgent (UUA).

Another type of PIREP is an Air Report (AIREP). Commercial airlines typically generate AIREPs.

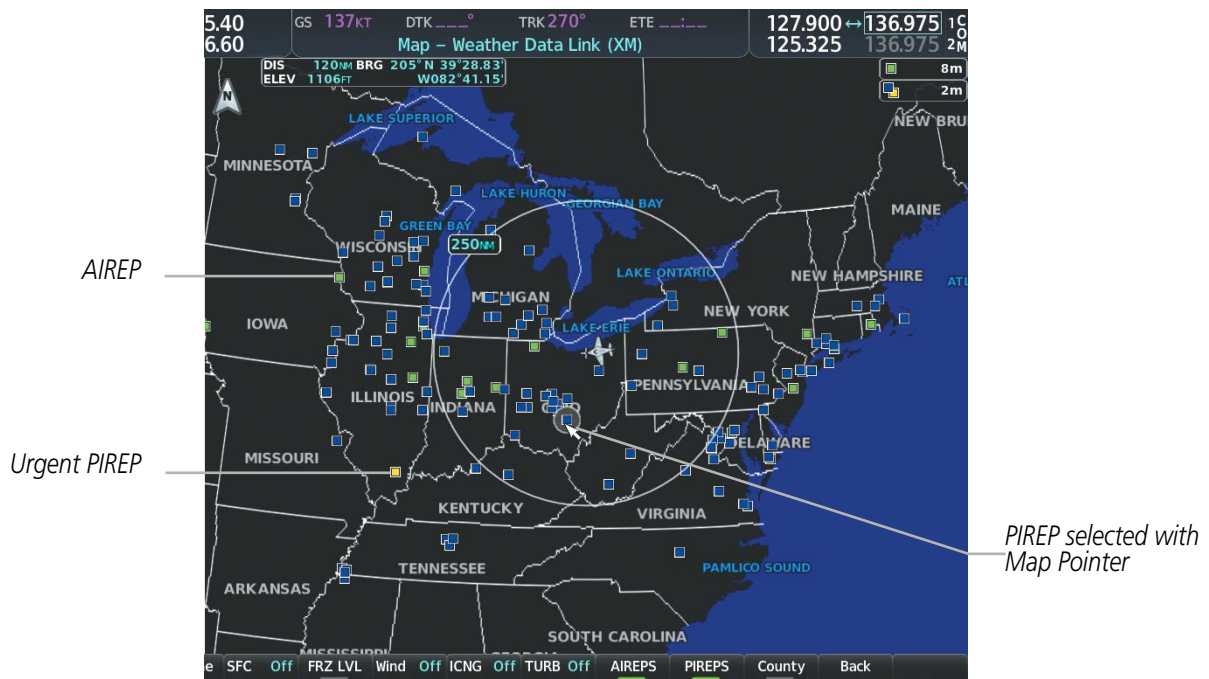


Figure 6-43 PIREPs and AIREPS on the Weather Data Link (XM) Page

Displaying PIREP and AIREP text:

- 1) Select the Map - Weather Data Link (XM/FIS-B) Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **PIREPS** or **AIREPS** Softkey. (Note the **AIREPS** Softkey is only available with the SiriusXM Weather service.)
- 4) Press the **Joystick** and pan to the desired weather report. A gray circle will appear around the weather report when it is selected.
- 5) Press the **ENT** Key. The Weather Information Page is shown with PIREP or AIREP text. The data is first displayed in a decoded fashion, followed by the original text. Note the original text may contain additional information not present in the decoded version.
- 6) Use the **FMS** Knob or the **ENT** Key to scroll through the PIREP or AIREP text.
- 7) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link (XM) Page.

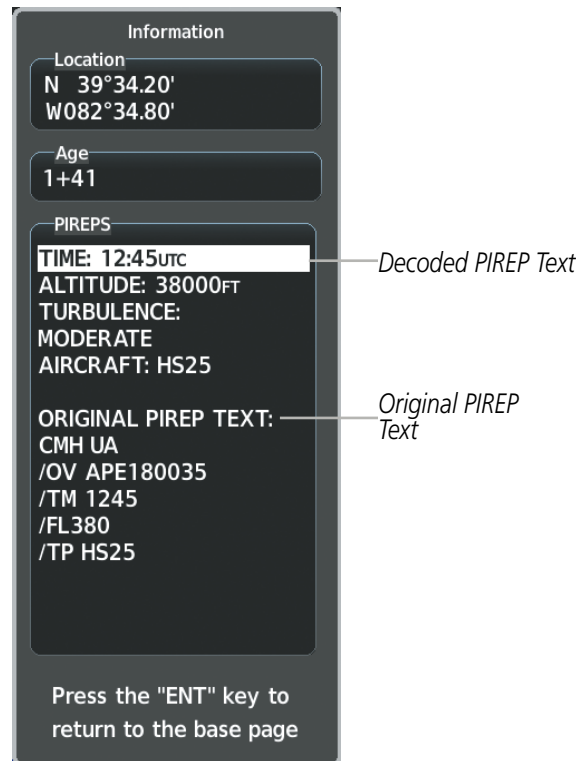


Figure 6-44 PIREP Text on the Weather Data Link (XM) Page

The PIREP color is determined by the type (routine or urgent).

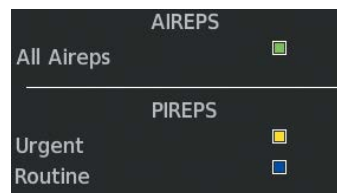


Figure 6-45 AIREPs & PIREPs Legend

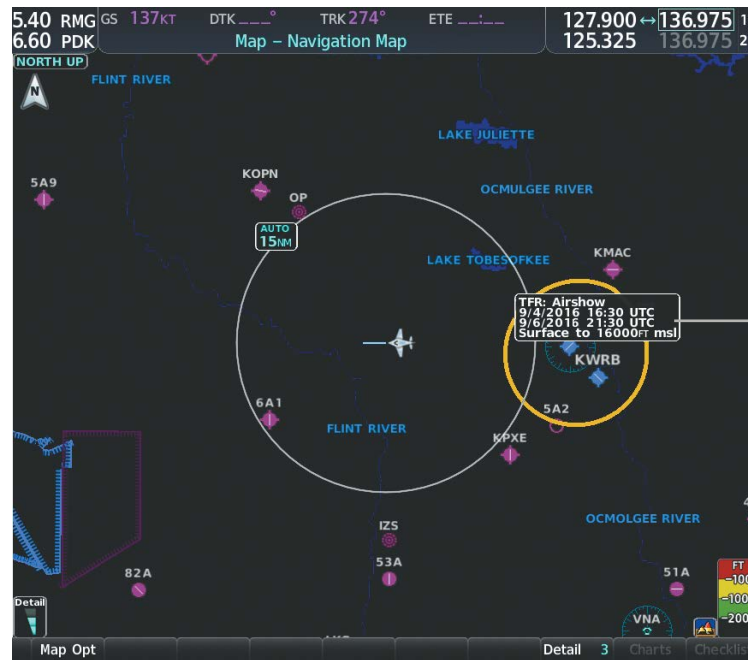
TFRS



NOTE: Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) information. Always confirm TFR information through official sources such as Flight Service Stations or Air Traffic Control.

In the United States, the FAA issues Temporary Flight Restrictions (TFRs) to designate areas where flight is restricted. TFRs are issued to restrict flight for a variety of reasons including national security, law enforcement, natural disasters, and large sporting events. TFRs may be issued at any time, and TFR data displayed on the system is only intended to supplement official TFR information obtained from Flight Service Stations (FSS), and air traffic control.

The age of TFR data is not shown; however, if TFR data is not available or has expired, the system displays 'TFR N/A' on maps on which the display of TFRs is enabled.



Information for selected TFR

Figure 6-46 TFR Data on the Weather Data Link (XM) Page

Displaying TFR Data:

- 1) Select the 'Map - Weather Data Link (XM/FIS-B)' Page or 'Map - Navigation Map' Page.
- 2) Press the **Joystick** and pan the map pointer over a TFR to highlight it. The system displays TFR summary information above the map.
- 3) Press the **ENT** Key. The system displays a pop-up menu.
- 4) If necessary, turn the **FMS** Knob to select 'Review Airspaces' and press the **ENT** Key. The system displays the TFR Information window.
- 5) Press the **FMS** Knob or the **CLR** Key to remove the TFR 'Information' window.

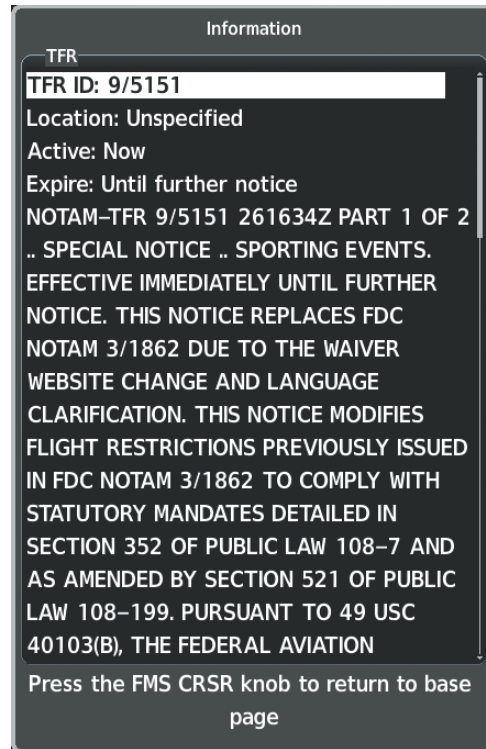


Figure 6-47 Full Text for Selected TFR

The setup menus for the Navigation Map Page control the map range settings above which TFR data is decluttered from the display. If a map range larger than the TFR product map range setting is selected, the TFR product data is removed from the map.

Maps other than the Navigation Map Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing TFR data for maps on which TFR data can be displayed:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select the 'Aviation' Group and press the **ENT** Key.
- 5) Turn the large **FMS** Knob to scroll to the TFR product range setting.
- 6) Turn the small **FMS** Knob to scroll through options (Off, range settings).
- 7) Press the **ENT** Key to select an option.
- 8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

FIS-B WEATHER STATUS

Additional information about the status of FIS-B weather products is available on the Aux - ADS-B Status Page.

Viewing FIS-B status:

- 1) Turn the large **FMS** Knob to select the Aux Page Group.
- 2) Turn the small **FMS** Knob to select the 'Aux - ADS-B Status' Page.

On the 'Weather Data Link (FIS-B)' Page, the pilot can enable/disable the FIS-B weather feature, which includes all FIS-B weather products and related softkeys on various maps.

Enabling/disabling the FIS-B weather feature:

- 1) Select the Weather Data Link (FIS-B) Page.
- 2) Press the **MENU** Key.
- 3) Turn the small **FMS** Knob to highlight 'Enable FIS-B Weather' or 'Disable FIS-B Weather', and press the **ENT** Key.



Figure 6-48 Viewing FIS-B Weather Status on the ADS-B Status Page

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

ADS-B Status Page Item	Status Message	Description
FIS-B Weather Status: FIS-B Processing	ENABLED	The FIS-B weather feature is enabled to process and display FIS-B weather products.
	DISABLED	The FIS-B weather feature is disabled.
	-----	No FIS-B weather data received from the transponder.
Weather Products: AIRMET CONUS NEXRAD METAR METAR GRAPHICAL NOTAM/TFR PIREP REGIONAL NEXRAD SIGMET TAF WINDS/TEMPS ALOFT	AVAILABLE	FIS-B weather data is available for display for the weather product.
	NOT AVAILABLE	FIS-B weather data is not available for the weather product, and/or the system is not receiving the FIS-B weather service.
	AWAITING DATA	The system is receiving the FIS-B weather service, and is waiting to receive the weather product from the FIS-B data broadcast.

Table 6-4 'Aux - ADS-B Status' Page Messages for FIS-B Weather

6.2 TERRAIN DISPLAYS



WARNING: Do not use terrain avoidance displays as the sole source of information for maintaining separation from terrain and obstacles. Garmin obtains terrain and obstacle data from third party sources and cannot independently verify the accuracy of the information.



NOTE: Terrain data is not displayed when the aircraft is outside of the installed terrain database coverage area.



NOTE: Terrain and obstacle alerting is not available north of 89° North latitude and south of 89° South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.



NOTE: Terrain and obstacle alerting requires the Terrain-SVT or TAWS-B option. No terrain or obstacle alerting occurs for the Terrain Proximity feature.

The terrain system increases situational awareness and aids in reducing controlled flight into terrain (CFIT) and obstacles.

One of the following terrain systems is installed on this aircraft:

- Terrain Proximity
- Terrain-SVT (included with the Garmin SVT option when the Terrain Awareness and Warning System Class-B (TAWS-B) is not installed; refer to the Flight Instruments section for more information about Garmin SVT.)
- TAWS-B (optional)

The installed terrain system provides color indications on map displays when terrain or obstacles are within a certain altitude threshold from the aircraft. Terrain-SVT and TAWS-B furthermore provide advisory visual annunciations and voice alerts to indicate the presence of threatening terrain or obstacles relevant to the projected flight path. This alerting capability is **not** present in the Terrain Proximity feature. Compared to Terrain-SVT alerting, TAWS-B uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles. The TAWS-B system includes more alerting capabilities than the Terrain-SVT system.

The terrain system requires the following for proper operation:

- Valid 3-D GPS position
- Valid terrain and obstacle databases

The terrain system uses terrain and obstacle information supplied by government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. Garmin verifies the data to confirm accuracy of the content. However, the displayed information should never be understood as being all-inclusive and data may still contain inaccuracies.

The terrain system uses information provided from the GPS receiver to provide a horizontal position and altitude. GPS altitude is derived from satellite measurements. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level (MSL) calculated geometrically. The system uses GSL altitude to determine alerts for the Terrain-SVT and TAWS-B systems. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source. Therefore, GSL altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

The terrain and obstacle databases used by the terrain system are referenced to MSL. Using the GPS position and GSL altitude, terrain system displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, for the Terrain-SVT or TAWS-B systems, the system uses the GPS position and GSL altitude to calculate and “predict” the aircraft’s flight path in relation to the surrounding terrain and obstacles. In this manner, the Terrain-SVT or TAWS-B systems can provide advanced alerts of predicted dangerous terrain conditions.

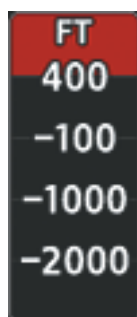
Baro-corrected altitude (or indicated altitude) is derived by adjusting the altimeter setting for local atmospheric conditions. The most accurate baro-corrected altitude can be achieved by frequently updating the altimeter setting to the nearest reporting station along the flight path. However, because actual atmospheric conditions seldom match the standard conditions defined by the International Standard Atmosphere (ISA) model (where pressure, temperature, and lapse rates have fixed values), it is common for the baro-corrected altitude (as read from the altimeter) to differ from the GSL altitude. This variation results in the aircraft’s GSL altitude differing from the baro-corrected altitude.

RELATIVE TERRAIN SYMBOLOGY

The terrain system uses colors and symbols to represent terrain and obstacles (with heights greater than 200 feet above ground level, AGL) present in the databases relative to aircraft altitude. The system dynamically adjusts these colors as the aircraft altitude changes, and after takeoff and landing.

While the aircraft is on the ground, the system displays relative terrain 400 feet or more above the aircraft altitude using red, and terrain at less than 400 feet above aircraft altitude using black, as shown on the On-Ground Legend. When the aircraft is in the air, the system displays relative terrain information using red, yellow, green, and black, as shown on the In-Air Legend. As the aircraft transitions from on-ground to in-air, or from in-air to on-ground, the display of relative terrain momentarily fades into the corresponding colors. For Terrain-SVT or TAWS-B systems, if an alert occurs, the relative terrain colors transition to the In-Air Legend if the On-Ground Legend was shown in order to provide the pilot with the most information possible.

On-Ground Legend



In-Air Legend

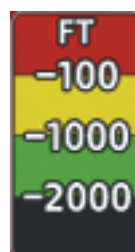


Figure 6-49 Relative Terrain Legend

The following figure shows the relative terrain coloring for the Terrain Proximity system.

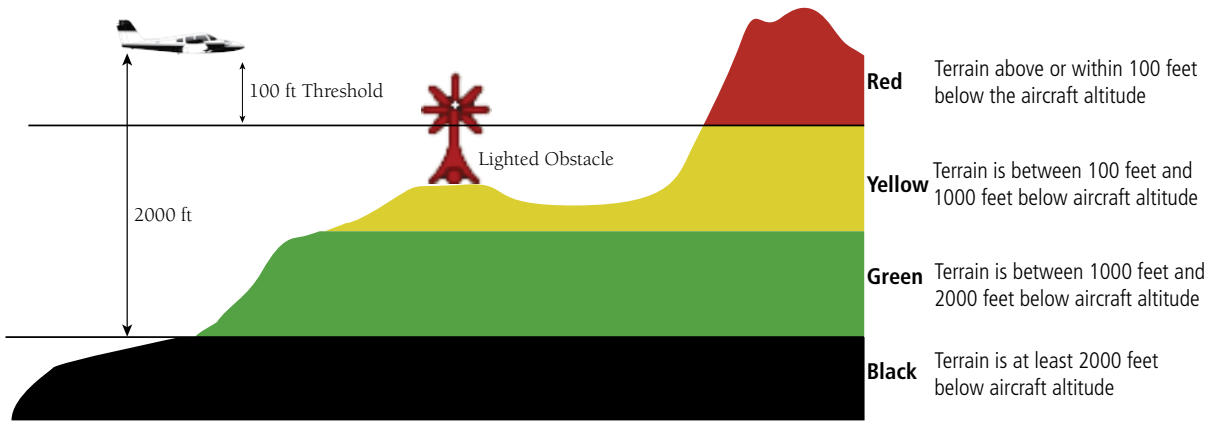


Figure 6-50 Terrain Altitude/Color Correlation for Terrain Proximity

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

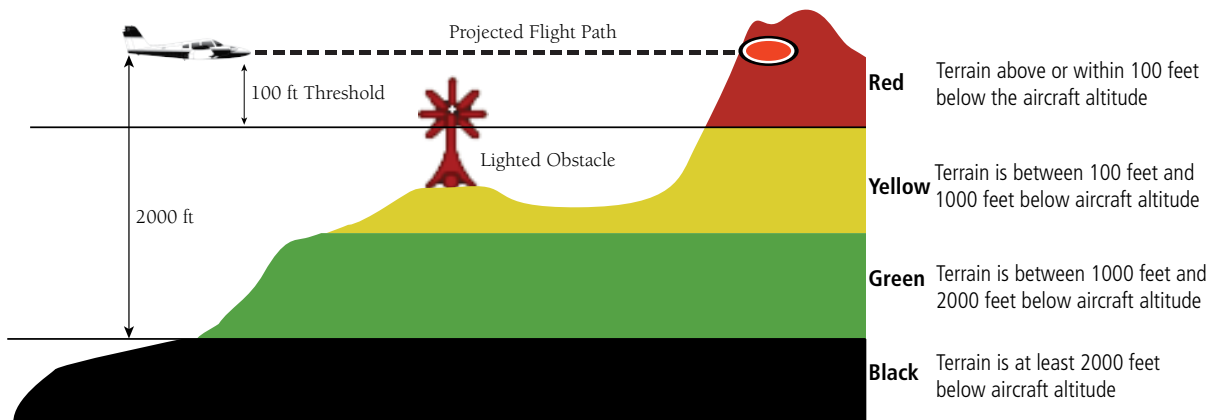


Figure 6-51 Terrain Altitude/Color Correlation for Terrain-SVT or TAWS-B Systems



NOTE: The Vertical Situation Display (VSD) Inset Window shows terrain at least 2000 feet below the aircraft altitude as gray.

The following tables show the relative obstacle coloring used by the terrain systems.

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
				White obstacle is more than 1000 ft below aircraft altitude

Table 6-5 Relative Obstacle Symbols and Colors

Unlighted Wind Turbine Obstacle	Lighted Wind Turbine Obstacle	Wind Turbine Obstacle Location
		Red obstacle is above or within 100 ft below the aircraft altitude
		Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
		White obstacle is more than 1000 ft below aircraft altitude

Table 6-6 Wind Turbine Obstacles and Colors

The Terrain-SVT and TAWS-B systems show potential impacts areas for terrain and obstacles using yellow and red as shown in the following table.

Potential Impact Area Examples	Alert Type	Example Annunciation
or	Warning	TAWS-B Warning PULL UP Terrain-SVT Warning TERRAIN
or	Caution	TERRAIN

Table 6-7 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

The 'Map - Terrain Proximity' or 'Map - Terrain-SVT' or 'Map - TAWS-B' Page is the principal map page for viewing terrain information. Terrain and obstacle information can be displayed on the following maps and pages:

- PFD Maps
- 'Map - Navigation Map Page'
- Terrain Proximity/Terrain-SVT/TAWS-B Page
- Trip Planning Page
- Flight Plan Page

Displaying terrain and obstacle information (MFD maps other than the terrain page):

- 1) Press the **Map Opt** Softkey (for the PFD Inset Map, press the **Map/HSI** Softkey).
- 2) Press the **TER** Softkey until **REL** is shown to display terrain and obstacle data.

When relative terrain is selected on maps other than the terrain page, an icon to indicate the feature is enabled for display and a legend for the relative terrain colors are shown.

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of terrain and obstacles. The setup menu also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map.

Terrain information can be selected for display independently of obstacle data; however, obstacles recognized by Terrain Proximity as yellow or red are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the Terrain Page use settings based on those selected for the Navigation Map Page. The maximum display ranges for obstacles on each map are dependent on the range setting made for the Navigation Map. If the maximum range for obstacle display on the Navigation Map is adjusted to below 20 nm, the highest obstacle display range settings on the other applicable maps are also adjusted proportionally.

Customizing terrain and obstacle display on the Navigation Map Page:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key.
- 5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
 - Terrain Display – Turns the display of relative ('REL') terrain data on or off and sets maximum range at which terrain is shown
 - Obstacle Data – Turns the display of obstacle data on or off and sets maximum range at which obstacles are shown
- 6) Turn the small **FMS** Knob to scroll through options for each product (On/Off, range settings, etc.).
- 7) Press the **ENT** Key to select an option.
- 8) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

Additional information about obstacles can be displayed by panning over the display on the map. The map panning feature is enabled by pressing the **Joystick**. The map range is adjusted by turning the **Joystick**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.



Figure 6-52 Terrain Information on the Navigation Map Page

TERRAIN PAGE

The 'Map - Terrain Proximity', or 'Map - Terrain-SVT', or 'Map - TAWS-B' Page is specialized to show terrain, and obstacle in relation to the aircraft's current altitude, without clutter from the basemap. This page is the principal page for viewing terrain information. Aviation data (airports, VORs, and other NAVAIDs) can be enabled for reference.

For Terrain-SVT and TAWS-B systems only, this page also shows potential impact areas. If an obstacle and the projected flight path of the aircraft intersect, the display automatically adjusts to a map range if necessary to emphasize the display of the potential impact area.

Aircraft orientation on this map is always heading up unless there is no valid heading, in which case the orientation is track up. Map range is adjustable with the **Joystick** from 250 feet to 1000 nm, which is indicated on the map range arc.

Displaying the terrain page:

- 1) Turn the large **FMS** Knob to select the Map Page Group.
- 2) Turn the small **FMS** Knob to select the Terrain Proximity Page/Terrain-SVT/TAWS-B Page.

Showing/hiding aviation information on the terrain page:

- 1) Press the **MENU** Key.
- 2) Select 'Show Aviation Data' or 'Hide Aviation Data' (choice dependent on current state) and press the ENT Key.

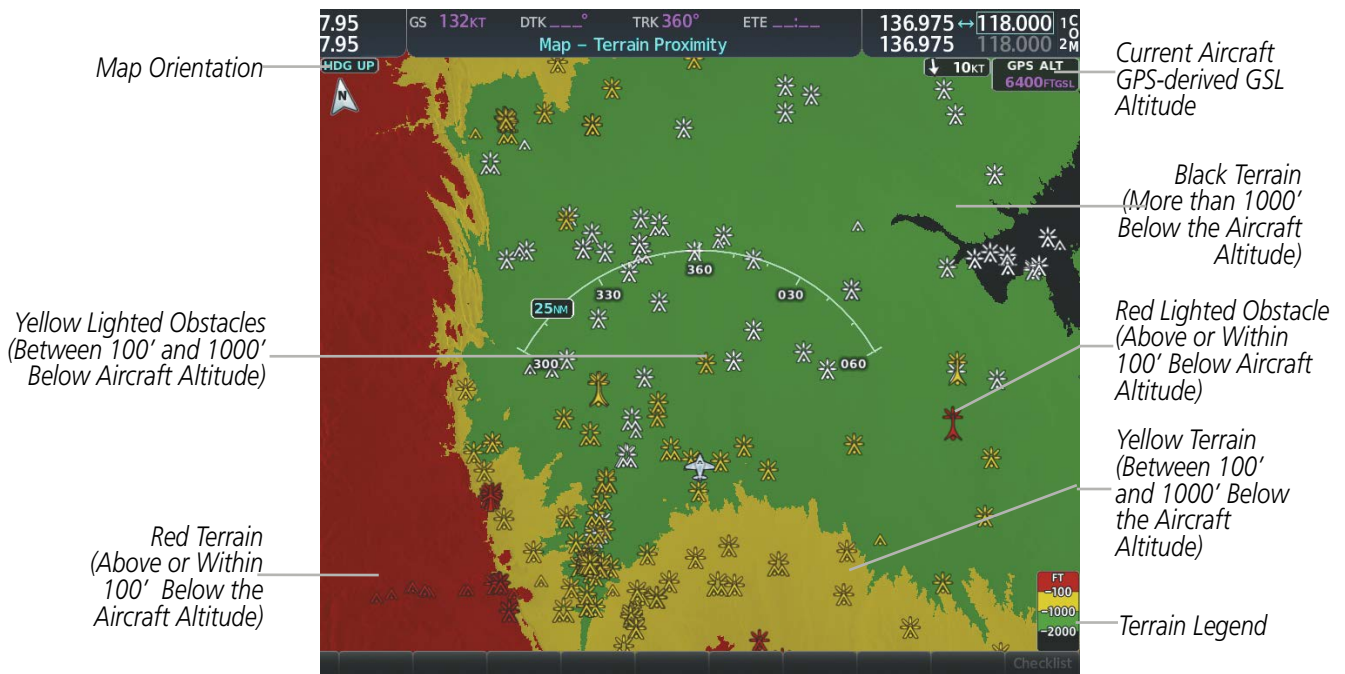


Figure 6-53 Terrain Proximity Page

VERTICAL SITUATION DISPLAY (VSD) TERRAIN

The system offers a Vertical Situation Display (VSD), which includes a profile of terrain and obstacles in an inset window on the bottom of the Navigation Map Page. Although the VSD does not display Terrain-SVT or TAWS-B alerts and potential impact areas, the VSD does use many of the same colors and symbols as these systems to depict relative terrain and obstacles within the VSD.

Enabling/Disabling the Vertical Situation Display (VSD):

- 1) Select the Navigation Map Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **Inset** Softkey.
- 4) Press the **VSD** Softkey to enable or disable the VSD.

Or:

- 1) Select the Navigation Map Page.
- 2) Press the **MENU** Key.
- 3) Select 'Show VSD' or 'Hide VSD' (choice dependent on current state) and press the **ENT** Key.

The same controls which enable/disable the display of relative terrain and obstacles on the Navigation Map Page also control the display of this information in the VSD.

VSD DISPLAY

When the VSD is enabled, terrain and obstacles in the VSD will be shown if the aircraft altitude is low enough or the VSD altitude range is high enough for the terrain to be in view (absolute terrain will be shown in gray if the **TER** Softkey is selected off on the Navigation Map Page).

The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the aircraft track between the aircraft present position and the end of the map range. The predefined width is determined by the flight phase, as announced on the HSI, and is widest during enroute or oceanic phases.

Flight Phase	Total VSD Width
Approach	0.6 nm
Departure	0.6 nm
Terminal	2.0 nm
Enroute	4.0 nm
Oceanic	4.0 nm

Table 6-8 VSD Terrain Width Varies with Phase of Flight

The forward looking swath of terrain is based on the selected VSD Mode, announced in the top-left corner of the VSD Inset Window. In Flight Plan Mode, the contour follows the active flight plan, and if no active flight plan is present, the VSD Inset Window displays 'Flight Plan Not Available'. In Track Mode, the contour is based on the aircraft ground track. In Auto Mode, the contour is based on the active flight plan, when available, otherwise, it is based on the ground track.

Selecting a VSD Mode:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **Inset** Softkey.
- 3) Press the **VSD** Softkey displaying the VSD mode in cyan. Each press of the softkey cycles through a mode selection: FPL (flight plan), TRK (track), or Auto.

When the Navigation Map range is adjusted with the **Joystick**, the horizontal distance of the VSD is adjusted to match the distance shown on the map range arc, down to one nautical mile. If the Navigation Map range is adjusted below one nautical mile, the VSD range remains at one nautical mile. When Navigation Map range is adjusted to remove altitude-correlated colored terrain data (as shown in the Terrain Legend) or obstacles from the Navigation Map, these items are also removed from the VSD; only an outline of the terrain will be displayed in black in the VSD Inset Window.

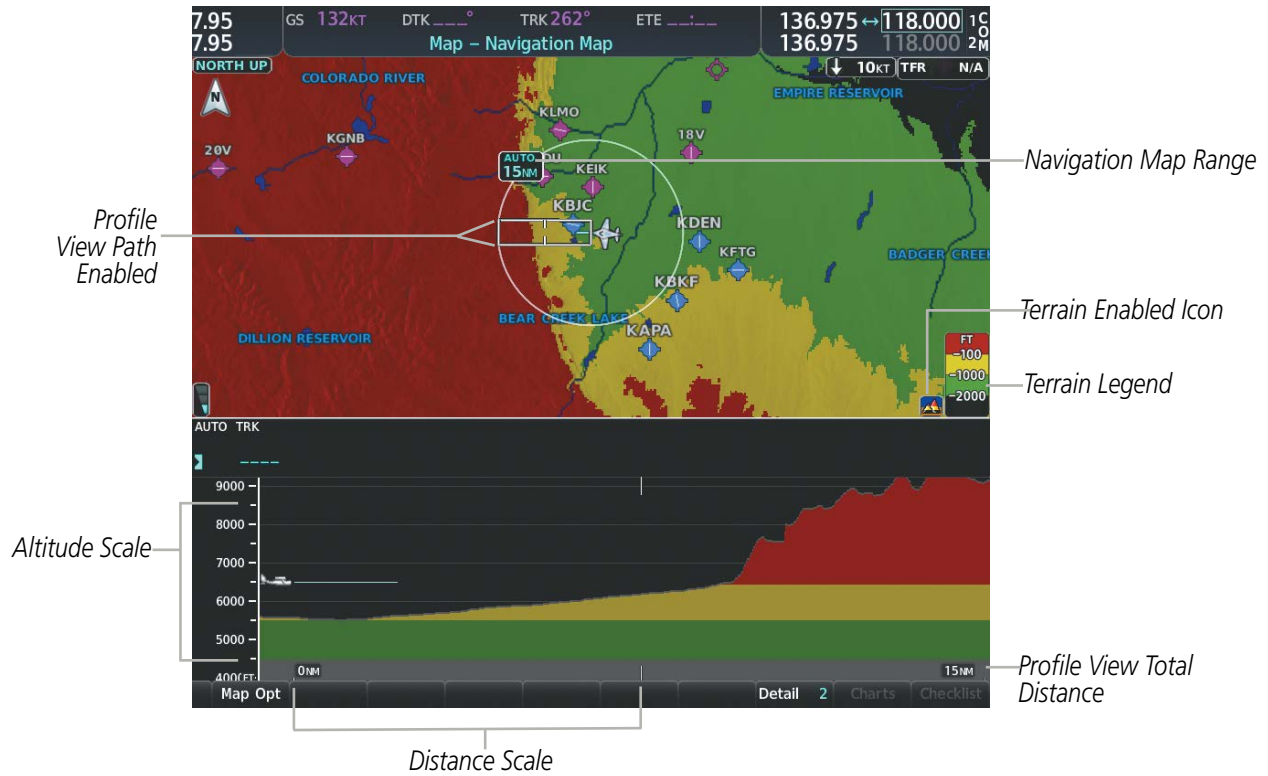


Figure 6-54 VSD on the Navigation Map Page with Relative Terrain Information

Obstacles with heights greater than 200 feet AGL appear relative to aircraft altitude along the altitude scale. The top of the obstacle symbol on the scale represents the obstacle's height AGL. If the obstacle's height AGL is higher than can be represented by the obstacle symbol itself (e.g. for especially tall obstacles), a vertical line appears below the obstacle symbol in order to depict the top of the obstacle symbol at its height AGL, as shown in the following figure.

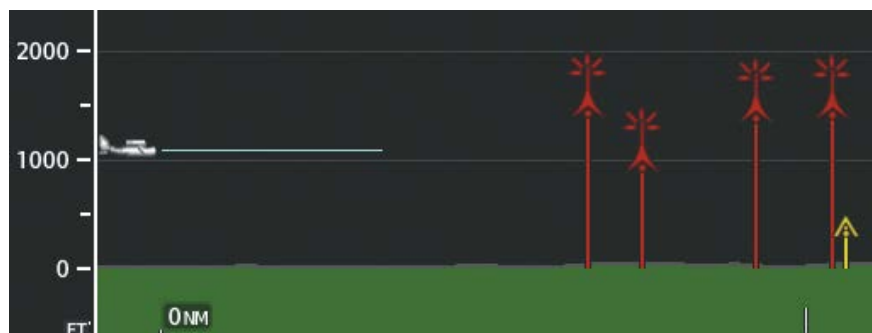


Figure 6-55 VSD with Tall Obstacles

TRACK MODE BOUNDARY

The Track Mode Boundary represents the horizontal and lateral boundaries of the VSD. The boundary is shown as a white rectangle on the 'Map - Navigation Map' Page and is only available when the VSD is enabled in Track Mode. White range markers on both edges of the Track Mode Boundary rectangle match the range

markers along the distance scale inside the VSD Inset Window whenever the profile range is at least four nautical miles (or 7.5 km if configured for metric units).

The Track Mode Boundary may be enabled/disabled, and the Navigation Map range at which the Profile Path is removed from map display can be changed.

Customizing the Track Mode Boundary display on the 'Map - Navigation Map' Page:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select the 'VSD' Group and press the **ENT** Key.
- 5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
 - TRK Mode BNDRY – Enables/disables the display of the Track Mode Boundary and sets maximum range at which Track Mode Boundary is shown.
- 6) Turn the small **FMS** Knob to scroll through options (On/Off range settings).
- 7) Press the **ENT** Key to select an option.
- 8) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

TERRAIN-SVT AND TAWS-B ALERTING DISPLAYS

Alerts are issued when flight conditions meet parameters that are set within Terrain-SVT or TAWS-B software algorithms. Terrain alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, visual annunciations are displayed and voice alerts are simultaneously issued.

When an alert is issued, annunciations appear on the PFD and MFD. The terrain alert annunciation appears to the left of the Selected Altitude box on the PFD, and bottom left on the MFD. If the terrain page is not displayed at the time, a pop-up alert appears on the MFD. To acknowledge the pop-up alert:

- Press the **CLR** Key (returns to the currently viewed page), or
- Press the **ENT** Key (accesses the 'Map - Terrain-SVT' or 'Map - TAWS-B' Page)

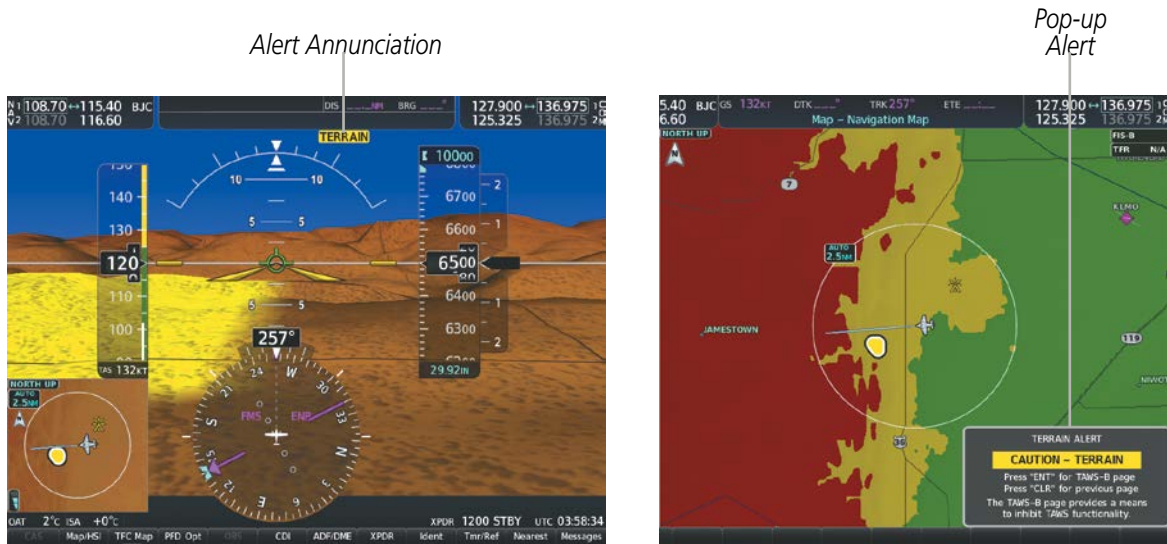


Figure 6-56 TAWS-B Alert Annunciations



Figure 6-57 Navigation Map Page (After TAWS-B Pop-up Alert Acknowledgment)

The following table lists the possible Terrain-SVT alerts.

Alert Type	PFD/MFD* Alert Annunciation	MFD Pop-Up Alert (except Terrain-SVT Page)	Voice Alert
Reduced Required Terrain Clearance Warning (RTC)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Imminent Terrain Impact Warning (ITI)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Obstacle Clearance Warning (ROC)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Obstacle Impact Warning (IOI)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN	"Caution; Terrain, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION - TERRAIN	"Caution; Terrain, Terrain"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"

* Annunciation is displayed on the MFD when terrain display is enabled.

Table 6-9 Terrain-SVT Alerts Summary

The following table lists the TAWS-B alerts.

Alert Type	PFD/MFD* Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Voice Alert
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN - PULL-UP	"Terrain, Terrain; Pull Up, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN - PULL-UP	"Terrain, Terrain; Pull Up, Pull Up"
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE - PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE - PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN	"Caution, Terrain; Caution, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION - TERRAIN	"Caution, Terrain; Caution, Terrain"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE	"Caution, Obstacle; Caution, Obstacle"

Alert Type	PFD/MFD* Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Voice Alert
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION - OBSTACLE	"Caution, Obstacle; Caution, Obstacle"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW - TERRAIN	"Too Low, Terrain"
Altitude Voice Callout (VCO) "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DON'T SINK	"Don't Sink"

* Annunciation is displayed on the MFD when terrain display is enabled.

Table 6-10 TAWS-B Alerts Summary

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVT or TAWS-B compares the projected flight path as derived from GPS data with terrain features and obstacles from the terrain and obstacle databases. The system issues FLTA alerts when the projected flight path conflicts with terrain or obstacles.

The projected flight path is a calculated area ahead of, to the sides, and below the aircraft. The size of the projected flight path varies based on factors including ground speed (the path ahead is larger when the ground speed is higher), whether the aircraft is level, turning, or descending, and the proximity to the nearest runway along the current track. As the aircraft approaches the runway, the projected flight path becomes narrower until the system automatically disables FLTA alerts or the pilot manually inhibits them.

There are two types of FLTA alerts, Reduced Required Terrain/Obstacle Clearance (RTC or ROC respectively) and Imminent Terrain/Obstacle Impact (ITI or IOI respectively).

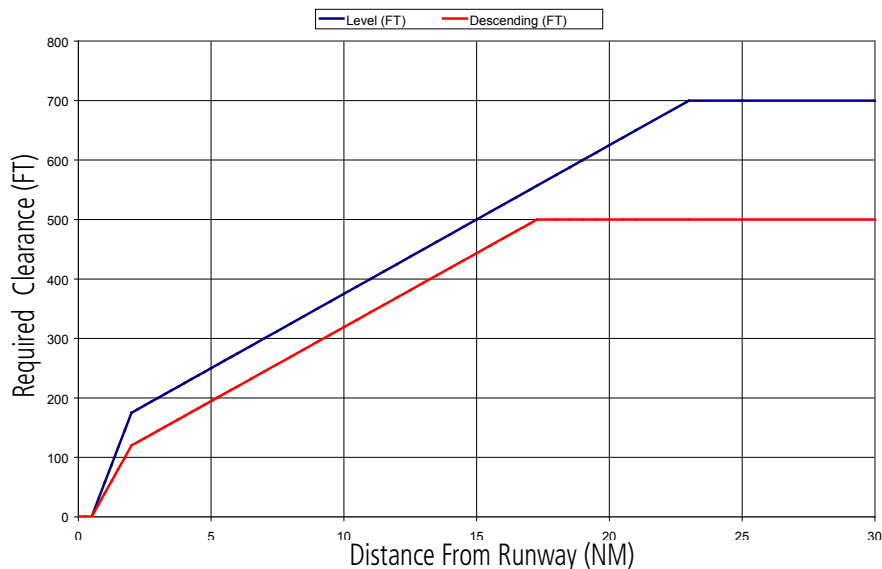


Figure 6-58 FLTA Alert Minimum Terrain and Obstacle Clearance Values

The system automatically disables FLTA alerts when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway or the aircraft is between runway ends.

ADDITIONAL TAWS-B ALERTING

In addition to the FLTA alerting discussed previously, TAWS-B provides the following additional types of alerts.

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide notification when the aircraft is determined to be closing (descending) upon terrain a rate that is calculated to be excessive relative to height above terrain. Figure 6-59 shows the parameters for the alert.

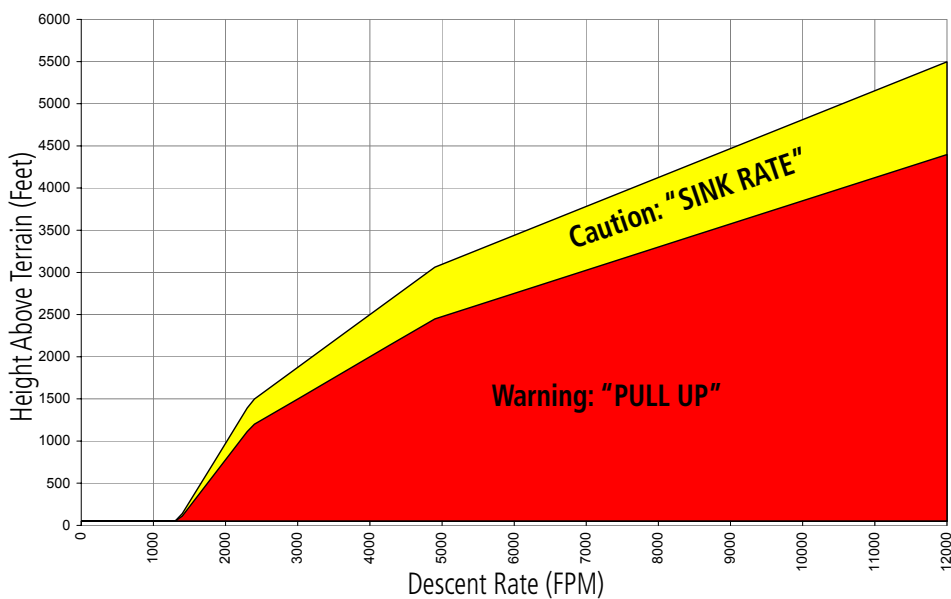


Figure 6-59 Excessive Descent Rate Alert Criteria

PREMATURE DESCENT ALERTING

A **Premature Descent Alert (PDA)** is issued when the system detects that the aircraft is significantly below the normal approach path to a runway.

PDA alerting begins when the aircraft is below 700 feet AGL within 15 nm of the destination airport and ends when the aircraft is 0.5 nm from the runway threshold.

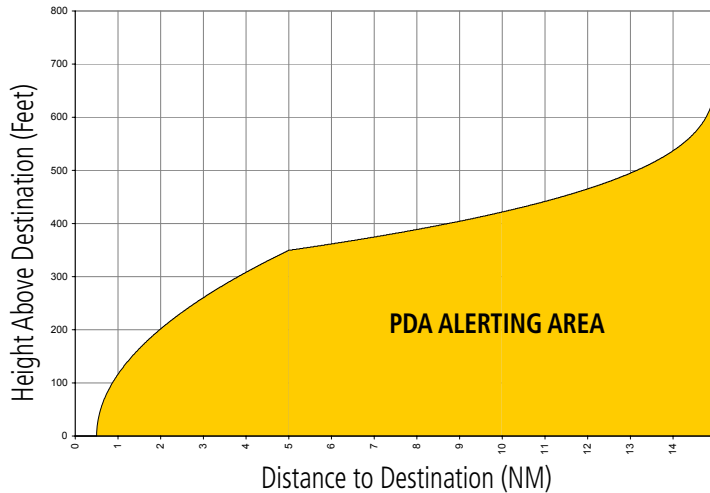


Figure 6-60 PDA Alerting Threshold

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT (NCR)

The **Negative Climb Rate (NCR) After Takeoff** alert (also referred to as “Altitude Loss After Takeoff”) provides alerts when the system determines the aircraft is losing altitude (closing upon terrain) after takeoff. The voice alert **“Don’t Sink”** is given for NCR alerts, accompanied by visual annunciations. NCR alerting is only active when departing from an airport and when the following conditions are met:

- Height above the terrain is less than 700 feet
- Distance from the departure airport is 5 nm or less
- Heading change from the departure heading is less than 110 degrees

NCR alerts can be triggered by either altitude loss or sink rate.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
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- AUDIO PANEL & CNS
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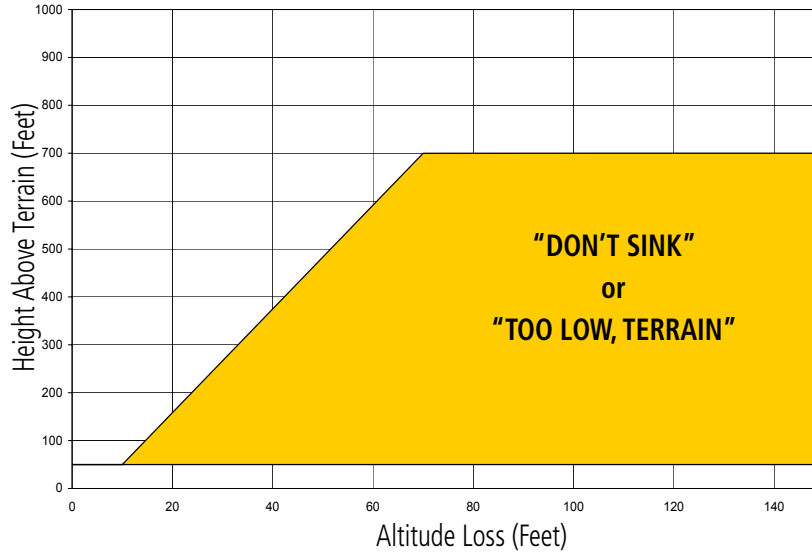


Figure 6-61 Negative Climb Rate (NCR) Altitude Loss

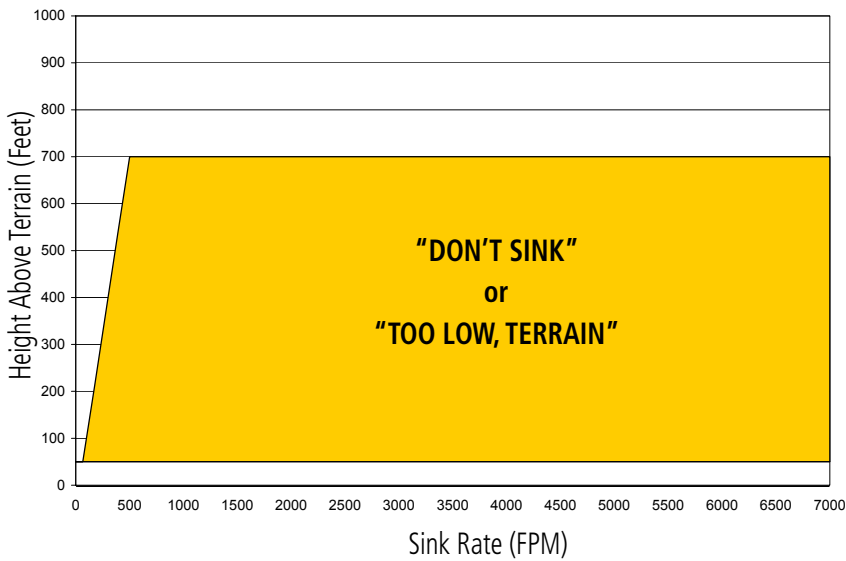


Figure 6-62 Negative Climb Rate (NCR) Sink Rate

FIVE-HUNDRED VOICE ALERT

The purpose of the TAWS-B **“Five-hundred”** voice alert is to provide an advisory alert of when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within 5 nm of an airport, the **“Five Hundred”** voice alert is based on the nearest runway threshold elevation. When the aircraft is more than 5 nm of the nearest airport, the **“Five Hundred”** voice alert is based on the height above terrain (as determined by the GPS altitude and Terrain Database).

There are no display annunciations or pop-up alerts that accompany the voice alert.

INHIBITING ALERTING

The pilot can manually inhibit FLTA alerts. If TAWS-B is installed, PDA alerts are also inhibited with FLTA alerts.



Figure 6-63 Alerting is Inhibited when Annunciation is displayed

Inhibiting/enabling TAWS-B or Terrain-SVT Alerting:

- 1) Select the terrain page.
- 2) Press the **Inhibit** Softkey. Alerting is inhibited when softkey annunciator is green.
 - Or:
 - a) Press the **MENU** Key.
 - b) Turn the **FMS** Knob to highlight the desired inhibit or enable option and press the **ENT** Key.

SYSTEM STATUS

TERRAIN-SVT

During power-up, Terrain-SVT conducts a self-test of its visual annunciations and voice alerts. An voice alert is issued at test completion.

Terrain-SVT continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the system issues the voice alert **“Terrain System Failure”** along with the ‘TER FAIL’ alert annunciation.

Terrain-SVT requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation ‘TER N/A’ is generated in the annunciation window and on the ‘Map - Terrain-SVT’ Page. The voice alert **“Terrain System Not Available”** is generated. When sufficient GPS signal is returns and the aircraft is within the database coverage area, the voice alert **“Terrain System Available”** is generated.

Alert Type	PFD/MFD† Alert Annunciation	Terrain-SVT Page Center Banner Annunciation	Voice Alert
System Test in Progress	TER TEST	TERRAIN TEST	None
System Test Pass	None	None	"Terrain System Test OK"
Terrain Alerting Inhibited	TER INH	None	None
No GPS position	TER N/A	NO GPS POSITION	"Terrain System Not Available" *
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available" *
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TER FAIL	TERRAIN FAIL	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain-SVT operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

† Annunciation is shown on Terrain-SVT Page and the Navigation Map Page when Terrain is enabled.

* "Terrain System Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

Table 6-11 Terrain-SVT System Status Annunciations

TAWS-B

During power-up, TAWS-B conducts a self-test of its visual annunciations and voice alerts. An voice alert is issued at test completion. The pilot can also manually select a TAWS-B system test. The system test option is unavailable when the ground speed exceeds 30 knots.

Manually testing the TAWS-B System:

- 1) Select the 'Map - TAWS-B' Page.
- 2) Press the **MENU** Key.
- 3) Select 'Test TAWS System' and press the **ENT** Key to confirm the selection.

TAWS-B continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the voice alert "**TAWS System Failure**" is generated along with the 'TAWS FAIL' alert annunciation.

TAWS-B requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the system displays the 'TAWS N/A' annunciation, and issues the "**TAWS Not Available**" voice alert. When the GPS signal integrity returns and the aircraft is within the database coverage area, the system issues the voice alert, "**TAWS Available**".

Alert Type	PFD/MFD* Alert Annunciation	TAWS-B Page Center Banner Annunciation	Voice Alert
System Test in progress	TAWS TEST	TAWS TEST	None
System Test pass	None	None	"TAWS System Test Test OK"
TAWS-B FLTA Alerting Inhibited	TAWS INH	None	None
No GPS position	TAWS N/A	NO GPS POSITION	"TAWS Not Available"
Excessively degraded GPS signal; or Out of database coverage area	TAWS N/A	None	"TAWS Not Available"
TAWS-B System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TAWS FAIL	TAWS FAIL	"TAWS System Failure"
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

† Annunciation is shown on TAWS-B Page and the Navigation Map Page when Terrain is enabled.

* "TAWS Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

Table 6-12 TAWS-B System Status Annunciations

6.3 TRAFFIC INFORMATION SERVICE (TIS)



WARNING: Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.



NOTE: TIS is available only when the aircraft is within the service volume of a TIS-capable terminal radar site. Aircraft without an operating transponder are invisible to both Traffic Advisory Systems (TAS) and TIS. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication.



NOTE: Mode-S TIS is disabled if a Traffic Advisory System (TAS) or Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic is installed.

Traffic Information Service (TIS) is designed to help in detection and avoidance of other aircraft. TIS uses the Mode S transponder for the traffic data link. TIS receives traffic information from ground stations, and is updated every 5 seconds. The system displays up to eight traffic targets within a 7.5-nm radius, from 3000 feet below to 3500 feet above the requesting aircraft. The system displays TIS traffic with the symbology shown in the following table.




TIS Symbol	Description
	Non-Threat Traffic
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-13 TIS Traffic Symbols

Traffic Advisories (TA) alert the crew to intruding aircraft. When traffic meets the advisory criteria for the TA, a solid yellow circle symbol appears. A TA which is detected but is outside the range of the map on which traffic is displayed are indicated with a message in the lower left corner of the map.

TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°. Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the 'Map - Traffic Map' Page (Figure 6-65) or in a banner at the lower left corner of maps other than the 'Map - Traffic Map' Page on which traffic can be displayed (Figure 6-64).

The altitude difference between the requesting aircraft and other intruder aircraft is displayed above/below the traffic symbol in hundreds of feet. If the other aircraft is above the requesting aircraft, the altitude separation appears above the traffic symbol; if below, the altitude separation appears below. Altitude trend is displayed as an up/down arrow (for speeds greater than 500 fpm in either direction) to the right of the target symbol. Traffic symbols for aircraft without altitude reporting capability appear without altitude separation or climb/descent information.

DISPLAYING TRAFFIC DATA

The 'Map - Traffic Map' Page is the principal map page for viewing traffic information. Traffic information can also be displayed on the following other maps for additional reference on the MFD when the traffic TIS is operating:

- PFD Inset Map
- 'Map - Navigation Map' Page
- 'Map - IFR/VFR Charts' Page
- 'Map - Traffic Map' Page
- 'Aux - Trip Planning' Page
- Nearest Pages
- Flight Plan Pages

Traffic information can also be displayed on the PFD when the Terrain-SVT option is installed and enabled. See the Additional Features Section for details.

Enabling/disabling traffic information (MFD maps other than the Traffic Map Page):

- 1) Press the **Map Opt** Softkey.
- 2) Select the **Traffic** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, an icon is shown to indicate the feature is enabled for display.



Figure 6-64 TIS Traffic on Navigation Map Page

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of traffic. The setup menu also controls the map range settings above which traffic data (symbols and labels) are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

Enabling/disabling traffic information on the PFD Inset Map or HSI Map:

- 1) On the PFD, press the **Map/HSI** Softkey.
- 2) Press the **Traffic** Softkey to enable/disable the display traffic information on the Inset Map or HSI Map.

Customizing traffic display on the Navigation Map Page:

- 1) Select the 'Map - Navigation Map' Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Setup' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select the 'Traffic' Group and press the **ENT** Key.
- 5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
 - Traffic – Turns the display of traffic data on or off
 - Traffic Mode – Selects the traffic mode for display; select from:
 - All Traffic - Displays all traffic
 - TA Only - Displays Traffic Alerts only
 - Traffic Symbols – Selects the maximum range at which traffic symbols are shown
 - Traffic Labels – Selects the maximum range at which traffic labels are shown (with the option to turn off)
- 6) Turn the small **FMS** Knob to scroll through options for each product (On/Off, range settings, etc.).
- 7) Press the **ENT** Key to select an option.
- 8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

TRAFFIC MAP PAGE

The Traffic Map Page is specialized to show surrounding TIS traffic data in relation to the aircraft's current position and altitude, without clutter from the basemap. Aircraft orientation on this map is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick** from 2 to 12 nm, as indicated by the map range rings.

The traffic mode is annunciated in the upper left corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. Once the aircraft is airborne, TIS switches from Standby to Operating Mode and the system begins to display traffic information. Refer to the System Status discussion for more information.

Displaying traffic on the Traffic Map Page:

- 1) Turn the large **FMS** Knob to select the Map Page Group.
- 2) Turn the small **FMS** Knob to select the 'Map - Traffic Map' Page.
- 3) Confirm TIS is in Operating Mode:
 - Press the **TIS OPER** Softkey to begin displaying traffic.
 - Or:**
 - a) Press the **MENU** Key.
 - b) Select 'Operate Mode' (shown if TIS is in Standby Mode) and press the **ENT** Key.

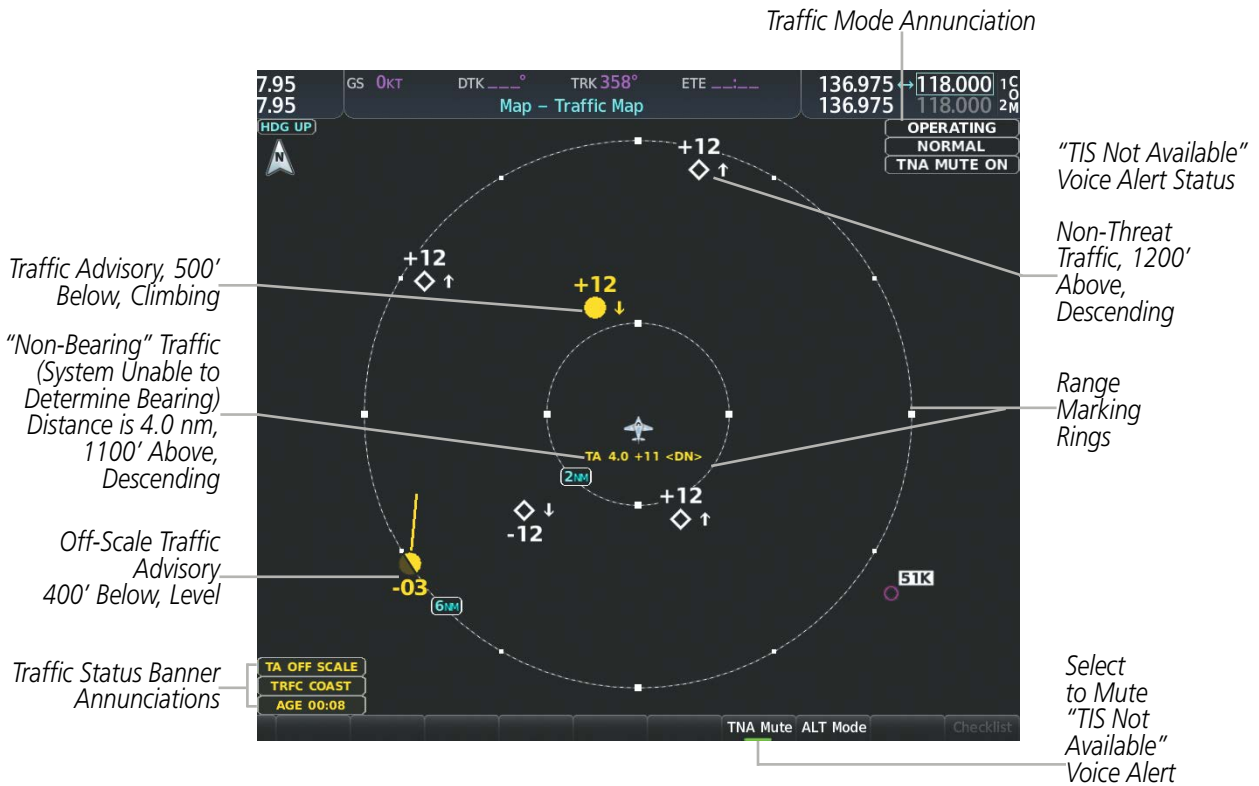


Figure 6-65 Traffic Map Page

TIS ALERTS

When the number of TAs on the Traffic Map Page increases from one scan to the next, the following occur:

- A single **"Traffic"** voice alert is generated.
- A 'TRAFFIC' Annunciation appears to the top left of the Attitude Indicator on the PFD, flashing for 5 seconds and remaining displayed until no TAs are detected in the area.
- The PFD Inset Map is automatically displayed with traffic.

To reduce the number of nuisance alerts due to proximate aircraft, the **"Traffic"** voice alert is generated only when the number of TAs increases. For example, when the first TA is displayed, a voice and visual annunciation are generated. As long as a single TA remains on the display, no additional voice alerts are generated. If a second TA appears on the display or if the number of TAs initially decreases and then subsequently increases, another voice alert is generated.

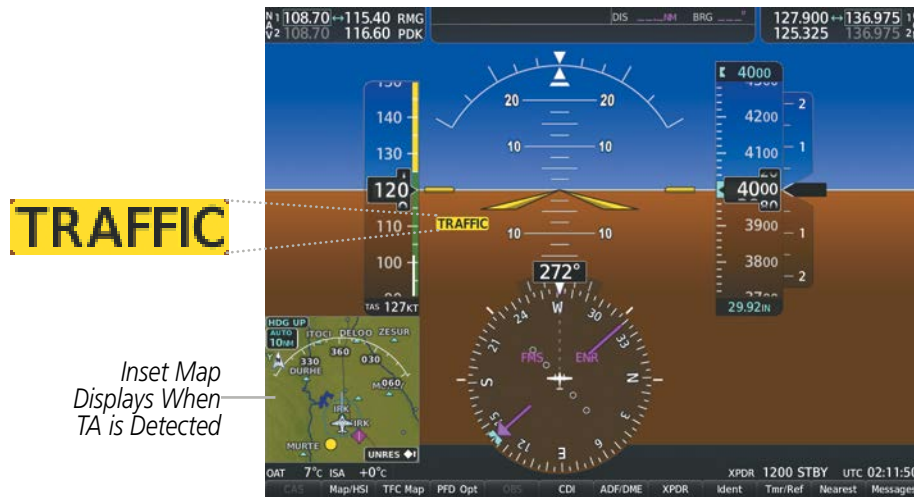


Figure 6-66 Traffic Annunciation (PFD)

A “**TIS Not Available**” (TNA) voice alert is generated when the TIS service becomes unavailable or is out of range. TIS may be unavailable in the radar coverage area due to the following:

- Radar site TIS Mode S sensor is not operational or is out of service
- Traffic or requesting aircraft is beyond the maximum range of the TIS-capable Mode S radar site.
- Traffic or requesting aircraft is above the radar site in the cone of silence and out of range of an adjacent site.
- Traffic or requesting aircraft is below radar coverage. In flat terrain, the coverage extends from about 3000 feet upward at 55 miles. Terrain and obstacles around the radar site can further decrease radar coverage in all directions.
- Traffic does not have an operating transponder.

The “**TIS Not Available**” (TNA) voice alert can be manually muted to reduce nuisance alerting. TNA muting status is shown in the upper left corner of the Traffic Map Page.

Muting the “TIS Not Available” voice alert:

- 1) Select the ‘Map - Traffic Map’ Page.
 - 2) Press the **TNA Mute** Softkey. The status is displayed in the upper left corner of the Traffic Map Page.
- Or:
- a) Press the **MENU** Key.
 - b) Select “Not Available” Mute On’ (shown if TNA muting is currently off) and press the **ENT** Key.

SYSTEM STATUS




The system performs an automatic test of TIS during power-up. If TIS passes the test, TIS enters Standby Mode (on the ground) or Operating Mode (in the air). If TIS fails the power up test, an annunciation is shown in the center of the Traffic Map Page.

Traffic Map Page Center Banner Annunciation	Description
NO DATA	Data is not being received from the transponder*
DATA FAILED	Data is being received from the transponder, but a failure is detected in the data stream*
FAILED	The transponder has failed*
UNAVAILABLE	TIS is unavailable or out of range

* Contact a service center or Garmin dealer for corrective action

Table 6-14 TIS Failure Annunciations

The traffic mode is annunciated in the upper right corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. If traffic is selected for display on another map while Standby Mode is selected, the traffic display enabled icon is crossed out (also the case whenever TIS has failed). Once the aircraft is airborne, TIS switches to Operating Mode and traffic information is displayed. The mode can be changed manually using softkeys or the page menu.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Status Icon (Other Maps)
TIS Operating	OPERATING	
TIS Standby	STANDBY (also shown in white in center of page)	
TIS Failed*	FAIL	

* See Table 6-16 for additional failure annunciations

Table 6-15 TIS Modes

Switching between TIS modes:

- 1) Select the 'Map - Traffic Map' Page.
- 2) Press the **Standby** or **Operate** Softkey to switch between modes. The mode is displayed in the upper left corner of the Traffic Map Page.

Or:

- a) Press the **MENU** Key.
- b) Select 'Operate Mode' or 'Standby Mode' (choice dependent on current state) and press the **ENT** Key.

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed (Table 6-16).

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range* Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↓	System cannot determine bearing of Traffic Advisory** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending)
AGE MM:SS	Appears if traffic data is not refreshed within 6 seconds If after another 6 seconds data is not received, traffic is removed from the display The quality of displayed traffic information is reduced as the age increases
TRFC COAST	The displayed data is not current (6 to 12 seconds since last message) The quality of displayed traffic information is reduced when this message is displayed
TRFC RMVD	Traffic is removed because it is too old for coasting (12 to 60 seconds since last message) Traffic may exist within the selected display range, but it is not displayed
TRFC FAIL	Traffic data has failed
NO TRFC DATA	Traffic has not been detected
TRFC UNAVAIL	The traffic service is unavailable or out of range

*Shown as symbol on Traffic Map Page

**Shown in center of Traffic Map Page

Table 6-16 TIS Traffic Status Annunciations

6.4 GTS 800 TRAFFIC



WARNING: Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.



WARNING: Do not rely solely upon the display of traffic information to accurately depict all of the traffic information within range of the aircraft. Due to lack of equipment, poor signal reception, and/or inaccurate information from other aircraft, traffic may be present but not represented on the display.



NOTE: Pilots should be aware of TAS system limitations. TAS systems require transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due to phenomena such as antenna shading or marginal transponder performance, traffic may be displayed intermittently, or not at all. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication. Pilots should remain vigilant for traffic at all times.



NOTE: Mode-S TIS is disabled when TAS installed.



NOTE: If a Garmin GTX 345R transponder is installed with this traffic system, refer to the ADS-B traffic discussion for more information about ADS-B traffic displays.

The optional Garmin GTS 800 is a Traffic Advisory System (TAS). It enhances flight crew situational awareness by displaying traffic information for transponder-equipped aircraft. The system also provides visual annunciations and voice traffic alerts to assist in visually acquiring traffic.

The GTS 800 is capable of tracking up to 45 intruding aircraft equipped with Mode A or C transponders, and up to 30 intruding aircraft equipped with Mode S transponders. A maximum of 30 aircraft with the highest threat potential can be displayed simultaneously. No TAS surveillance is provided for aircraft without operating transponders.

THEORY OF OPERATION

When the traffic system is in Operating Mode, the system interrogates the transponders of intruding aircraft while monitoring for transponder replies. The system uses this information to derive the distance, relative bearing, and if reported, the altitude and vertical trend for each aircraft within its surveillance range. The traffic system then calculates a closure rate to each intruder based on the projected Closest Point of Approach (CPA). If the closure rate meets the threat criteria for a Traffic Advisory (TA), the traffic system provides visual annunciations and voice alerts.

TAS SURVEILLANCE VOLUME AND SYMBOLOGY

The GTS 800 TAS surveillance system monitors the airspace within $\pm 10,000$ feet of own altitude. Under ideal conditions, the system scans transponder traffic up to 22 nm in the forward direction. The range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. In areas of greater transponder traffic density or when TCAS II (Traffic Alert and Collision Avoidance System II) systems are detected, the GTS 800 automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.



NOTE: The TAS traffic system does not display traffic determined to be on the ground, including Mode C transponder equipped aircraft operating below 300' AGL that is not climbing. However, if own aircraft has ADS-B In capability, and is receiving traffic information from an ADS-B source (including ADS-R, ADS-B, TIS-B), the system does display this traffic while operating in SURF Mode. Refer to the ADS-B Traffic Section for more information.

In addition, if a 1090 MHz extended squitter transponder is installed, and the traffic system detects airborne traffic providing 1090 MHz Automatic Dependent Surveillance - Broadcast (ADS-B) information, the system will display the TAS traffic using the ADS-B symbology. Refer to the ADS-B Traffic discussion later in this section for more information.





TAS Symbol	Description
	Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-17 TAS Symbol Description















Traffic Symbol	Description
	Traffic Advisory with ADS-B directional information. Points in the direction of the intruder aircraft track.
	Proximity Advisory with ADS-B directional information. Points in the direction of the aircraft track.
	Other Non-threat traffic with ADS-B directional information. Points in the direction of the intruder aircraft track.

Table 6-18 Traffic with ADS-B Symbology (GTX 335 Transponder)

Symbol	Description
	Traffic Advisory with directional information. Points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory out of the selected display range with directional information. Displayed at outer range ring at proper bearing.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with directional information. Points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with directional information. Points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with directional information. Points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
Table 6-19 ADS-B Traffic Symbology with GTX 345R Transponder	

A Traffic Advisory (TA), displayed as a yellow circle or triangle, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range (off scale) is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

A Proximity Advisory (PA), displayed as a solid white diamond or triangle, indicates the intruding aircraft is within ±1200 feet and is within a 6 nm range, but is still not considered a TA threat.

A Non-threat Advisory, shown as an open white diamond or triangle, is displayed for traffic beyond 6 nm that is neither a TA or PA.

A solid white rounded arrow indicates either a PA or Non-Threat traffic with ADS-B directional information, but the position of the traffic is shown with degraded accuracy.

Relative altitude, when available, is displayed above or below the corresponding intruder symbol in hundreds of feet. When this altitude is above own aircraft, it is preceded by a '+' symbol; a minus sign '-' indicates traffic is below own aircraft.

The system displays the altitude vertical trend as an up/down arrow (for speeds greater than 500 fpm in either direction) to the right of the intruder symbol.

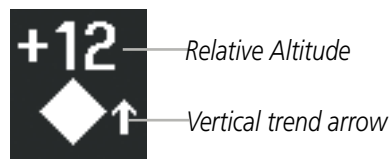


Figure 6-67 Intruder Altitude and Vertical Trend Arrow

If the intruding aircraft is providing ADS-B track information, a motion vector line extending beyond the traffic symbol in the direction of the track may also be displayed when either absolute or relative motion vectors are enabled.

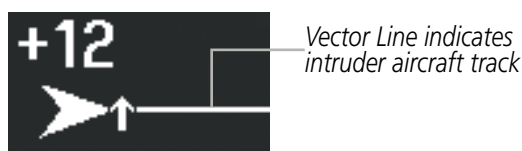


Figure 6-68 Intruder Traffic with ADS-B Directional Information and Track

TA ALERTING CONDITIONS

The traffic system automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting during flight phases likely to be near airports. The system applies Level A TA sensitivity when the groundspeed is less than 120 knots; Level B TA sensitivity applies in all other conditions.

Sensitivity Level	Intruder Altitude Available	TA Alerting Conditions
A	Yes	Intruder closing rate provides less than 20 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 20 seconds of horizontal separation and vertical separation is within 600 feet. Or: Intruder range is within 0.2 nm and vertical separation is within 600 feet.
A	No	Intruder closing rate provides less than 15 seconds of separation.
B	Yes	Intruder closing rate provides less than 30 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 30 seconds of horizontal separation and vertical separation is within 800 feet. Or: Intruder range is within 0.55 nm and vertical separation is within 800 feet.
B	No	Intruder range is less than 20 seconds.

Table 6-20 TA Sensitivity Level and TA Alerting Criteria

TAS ALERTS

When the GTS 800 detects a new TA, the following occur:

- The system issues a single **“Traffic!”** voice alert, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA (Table 6-21). For example, the announcement **“Traffic! 12 o’clock, high, four miles,”** would indicate the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.
- A ‘TRAFFIC’ Annunciation appears at the right of the airspeed on the PFD, flashes for five seconds, and remains displayed until no TAs are detected in the area (Figure 6-69).
- The PFD Inset Map is automatically displayed with TA traffic.

If the bearing of TA traffic cannot be determined, a yellow text banner will be displayed in the center of the Traffic Map Page and in the lower-left of the PFD inset map instead of a TA symbol. The text will indicate “TA” followed by the distance, relative altitude, and vertical trend arrow for the TA traffic, if known.

A TA will be displayed for at least eight seconds, even if the condition(s) that initially triggered the TA are no longer present.

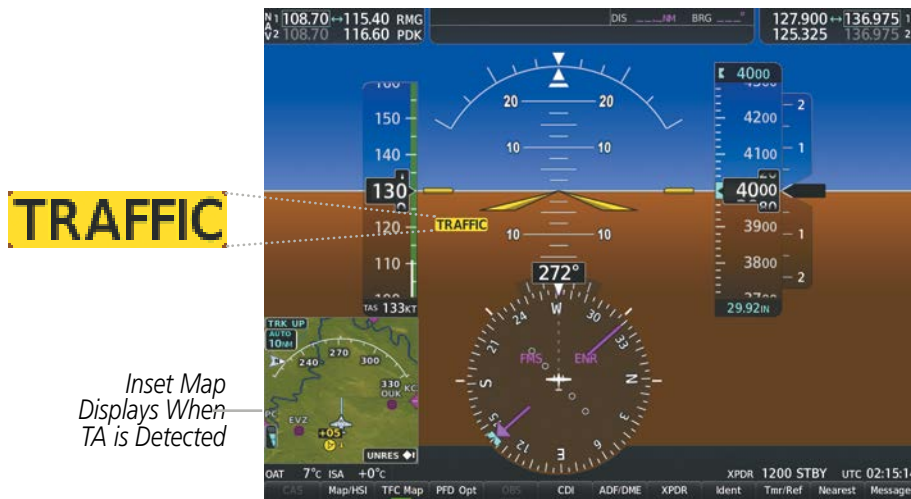


Figure 6-69 Traffic Annunciation (PFD)

Bearing	Relative Altitude	Approximate Distance (nm)
“One o’clock” through “Twelve o’clock” or “No Bearing”	“High”, “Low”, “Same Altitude” (if within 200 feet of own altitude), or “Altitude not available”	“Less than one mile”, “One Mile” through “Ten Miles”, or “More than ten miles”

Table 6-21 TA Descriptive Voice Announcements

SYSTEM TEST



NOTE: Traffic surveillance is not available during the system test. Use caution when performing a system test during flight.

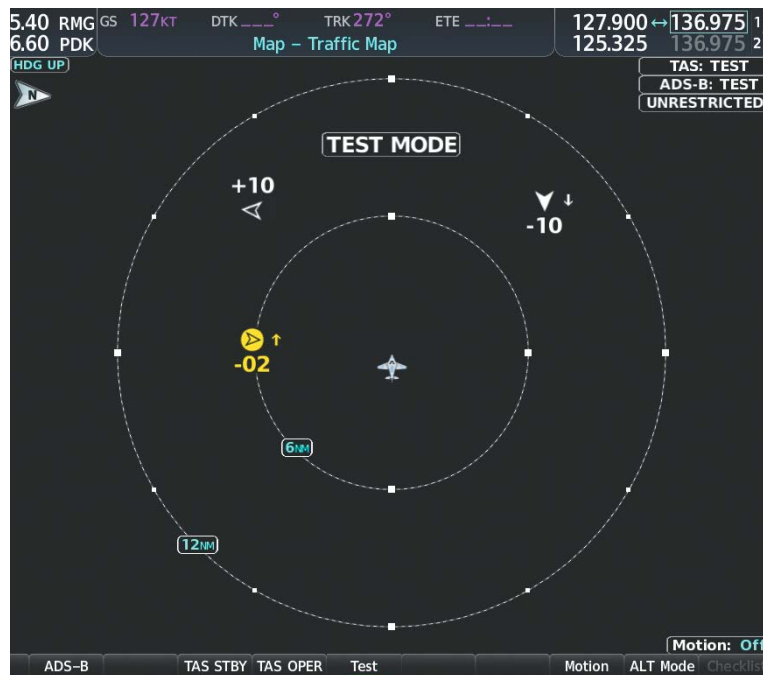
The GTS 800 provides a system test mode to verify the TAS system is operating normally. The test takes ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols appears on the Traffic Map Page. If the system test passes, the system announces, “**TAS System Test Passed**” Otherwise the system announces, “**TAS System Test Failed.**” When the system test is complete, the traffic system enters Standby Mode.

Testing the traffic system:

- 1) Turn the large **FMS** Knob to select the Map Page Group.
- 2) Turn the small **FMS** Knob to select the Traffic Map Page.
- 3) Turn the **Joystick** to set the range to 2/6 nm to allow for full test pattern to be displayed during test.
- 4) Press the **Test** Softkey.

Or:

- 1) Press the **MENU** Key and turn the small **FMS** knob to select ‘Test Mode’.
- 2) Press the **ENT** Key.



TAS Test Mode

Figure 6-70 System Test in Progress with Test Pattern

OPERATION



NOTE: The traffic system automatically transitions from **Standby** to **Operating** mode eight seconds after takeoff. The system also automatically transitions from **Operating** to **Standby** mode 24 seconds after landing.

When the avionics system initially receives power on the ground, the traffic system is in Standby Mode. The system must be in Operating Mode for traffic to be displayed and for TAs to be issued.

Changing traffic system modes on the Traffic Map Page:

- 1) Turn the large **FMS** Knob to select the Map Page Group.
- 2) Turn the small **FMS** Knob to select the 'Map - Traffic Map' Page.
- 3) Press the **Operate** or **TAS OPER** Softkey to begin displaying traffic. 'OPERATING' is displayed in the TAS Mode window.
- 4) Press the **Standby** or **TAS STBY** Softkey to place the system in the Standby mode. 'STANDBY' is displayed in the TAS Mode window.

Or:

- 1) With the 'Map - Traffic Map' Page displayed, press the **MENU** Key.
- 2) Turn the small **FMS** knob to highlight the desired mode.
- 3) Press the **ENT** Key.

TRAFFIC MAP PAGE

The Map - Traffic Map Page shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. It is the principal map page for viewing traffic information. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick** (up to 40 nm) as indicated by the map range rings.

The system annunciates the traffic mode and altitude display mode in the upper right corner of the Traffic Map Page.



Figure 6-71 Traffic Map Page

ALTITUDE DISPLAY MODE

The pilot can select the volume of airspace in which Other Non-Threat and Proximity Advisory traffic is displayed. If traffic meets the criteria for a TA, it is also displayed even if it is outside of the selected volume of airspace.

Changing the altitude range:

- 1) On the Traffic Map Page, press the **ALT Mode** Softkey.
 - 2) Select one of the following Softkeys:
 - **Above:** Displays Other Non-Threat and Proximity Advisory traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
 - **Normal:** Displays Other Non-Threat and Proximity Advisory traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.
 - **Below:** Displays Other Non-Threat and Proximity Advisory traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.
 - **UNREST (unrestricted):** All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.
 - 3) To return to the Traffic Page, press the **Back** Softkey.
- Or:**
- 1) Press the **MENU** Key.
 - 2) Turn the small **FMS** Knob to select one of the following (see softkey description in the previous step 2):

- Above
- Normal
- Below
- Unrestricted

3) Press the **ENT** Key.

TRAFFIC MAP PAGE DISPLAY RANGE

The pilot can adjust the range of traffic displayed on the ‘Map - Traffic Map’ Page. Range indications appear on rings shown on the page. A maximum map range of 40 nautical miles is available.

Selecting the Traffic Map Display Range:

- 1) Select the Map - Traffic Map Page.
- 2) Turn the **Joystick** as needed to select the desired map range.

ADDITIONAL TRAFFIC DISPLAYS

The Map - Traffic Map Page is the principal map page for viewing traffic information. Traffic information can also be displayed on the following other maps for additional reference on the MFD when the traffic unit is operating:

- PFD Inset Map
- ‘Map - Navigation Map’ Page
- ‘Map - IFR/VFR Charts’ Page
- ‘Map - Traffic Map’ Page
- ‘Aux - Trip Planning’ Page
- Nearest Pages
- Flight Plan Pages

Traffic information can also be displayed on the PFD when the Synthetic Vision Technology (SVT) option is installed and enabled. See the Additional Features Section for details.

Enabling/disabling traffic information (MFD maps other than the Traffic Map Page):

- 1) Select the **Map Opt** Softkey.
- 2) Select the **Traffic** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, the system shows a traffic status icon to indicate traffic is enabled for display (Figure 6-72).

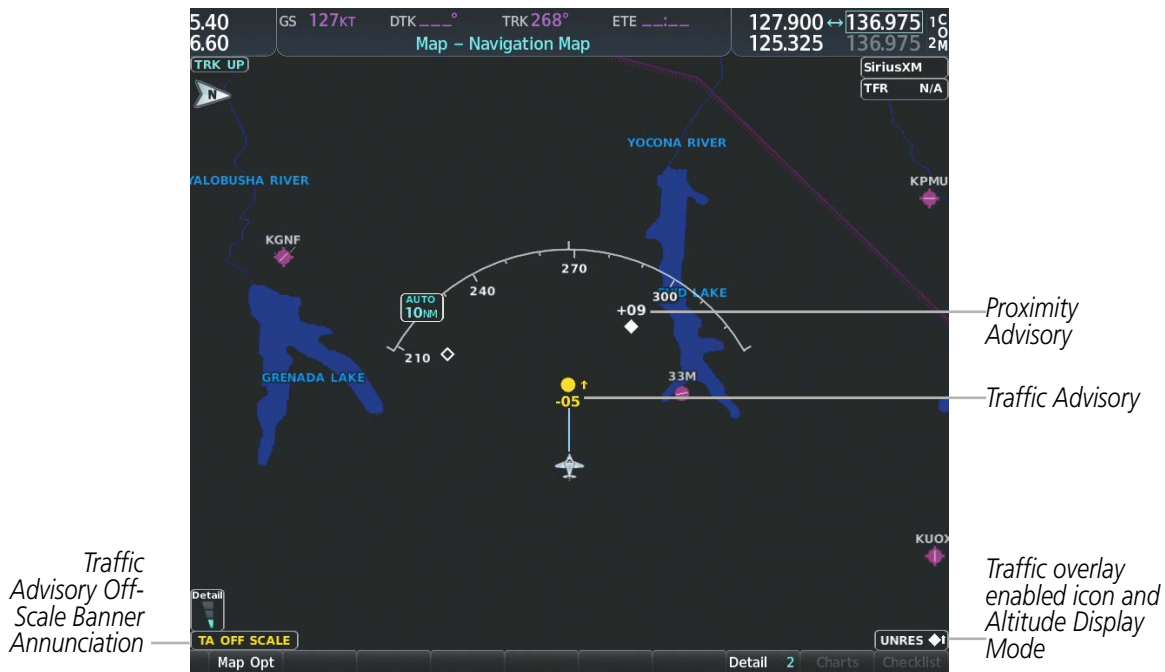


Figure 6-72 TAS Traffic on Navigation Map

Customizing the traffic display on the Navigation Map Page:

- 1) Select the Navigation Map Page.
- 2) Press the **MENU** Key.
- 3) With 'Map Settings' highlighted, press the **ENT** Key.
- 4) Turn the small **FMS** Knob to select the Traffic Group and press the **ENT** Key.
- 5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through the selections.
 - Traffic – Turns the display of traffic data on or off
 - Traffic Mode – Selects the traffic mode for display; select from:
 - All Traffic - Displays all traffic
 - TA/PA - Displays Traffic Advisories and Proximity Advisories
 - TA Only - Displays Traffic Advisories only
 - Traffic Symbols – Selects the maximum range at which traffic symbols are shown
 - Traffic Labels – Selects the maximum range at which traffic labels are shown with the option to turn off
- 6) Turn the small **FMS** Knob to scroll through options (On/Off, range settings, etc.).
- 7) Press the **ENT** Key to select an option.
- 8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page.

The Navigation Map Page Setup Menu also controls the display of traffic. The setup menu controls the map range settings. Traffic data symbols and labels can be decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

A Traffic Map is available on the PFD by pressing the **TFC Map** Softkey. A traffic map will appear in heading up orientation. Traffic information can also be overlaid with navigation, topographic and optional datalink weather information on navigation maps.

Enabling/disabling traffic information on the PFD Inset Map:

- 1) On the PFD, press the **Map/HSI** Softkey.
- 2) Press the **Traffic** Softkey to enable/disable the display traffic information on the Inset Map or HSI Map.

SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the Traffic Map Page.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Status Icon (Other Maps)
Traffic System Test Initiated	TEST (‘TEST MODE’ shown in center of page)	
Operating	OPERATING	
Standby	STANDBY (also shown in white in center of page)	
Traffic System Failed*	FAIL	

* See Table 6-23 for additional failure annunciations

Table 6-22 Traffic Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page. During a failure condition, the Operating Mode cannot be selected.

Traffic Map Page Center Annunciation	Description
NO DATA	Data is not being received from the TAS unit
DATA FAILED	Data is being received from the TAS unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the TAS unit

Table 6-23 TAS Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↓	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	TAS unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the TAS unit

*Shown as symbol on Traffic Map Page

**Shown in center of Traffic Map Page

Table 6-24 TAS Traffic Status Annunciations

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

6.5 ADS-B TRAFFIC



WARNING: Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.



WARNING: Do not rely solely upon the display of traffic information to accurately depict all of the traffic information within range of the aircraft. Due to lack of equipment, poor signal reception, and/or inaccurate information from other aircraft, traffic may be present but not represented on the display.

The optional Garmin GTX 345R transponder sends and receives Automatic Dependent Surveillance-Broadcast (ADS-B) traffic information on the 1090 MHz Extended Squitter (1090 ES) frequency. It receives ADS-B traffic and data link weather information on the 978 MHz Universal Access Transceiver (UAT) frequency. The system provides visual annunciations and voice traffic alerts to help the pilot visually acquire potentially conflicting traffic. This discussion covers the traffic features of the GTX transponder; refer to the Flight Information Service-Broadcast (FIS-B) Weather section for more information about the UAT data link weather features of the GTX 345.

ADS-B SYSTEM OVERVIEW

ADS-B is a core technology in the FAA NextGen air traffic control system and is comprised of three segments: ADS-B (Broadcast), ADS-R (Rebroadcast), and Traffic Information Service-Broadcast (TIS-B).

ADS-B is the automatic broadcast of position reports by aircraft, surface vehicles, and transmitters on fixed objects. These broadcasts contain information such as GPS position, identity (Flight ID, Call Sign, Tail Number, ICAO registration number, etc), ground track, ground speed, pressure altitude, and emergency status.

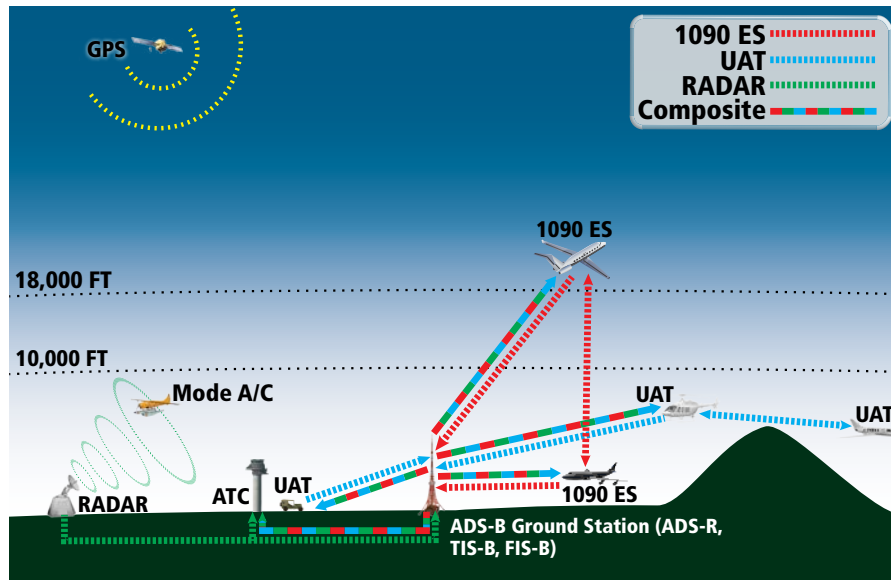


Figure 6-73 ADS-B System

For the purpose of distinguishing between levels of ADS-B service, there are three classifications of aircraft or system capability: ADS-B In, ADS-B Out, and ADS-B participating. ADS-B In refers to the capability to receive ADS-B information. ADS-B Out refers to the capability to transmit ADS-B information. ADS-B participating refers to the capability to both send and receive ADS-B information. Aircraft lacking either ADS-In, ADS-B Out, or both ADS-B capabilities may also be referred to as ADS-B nonparticipating aircraft.

AUTOMATIC DEPENDENT SURVEILLANCE-REBROADCAST (ADS-R)

Because it is not required that ADS-B In capable aircraft be able to receive ADS-B data on both the 1090 MHz and 978 MHz data links, a method exists to get data from one data link to the other. ADS-R is the rebroadcast of ADS-B data by FAA ground stations, which provide this service by taking data from one link and rebroadcasting it on the other. For example, two aircraft are in the service volume for a ground station, and one is transmitting on 1090 MHz and the other on 978 MHz, the ground station retransmits the data from each aircraft on the other link to ensure the two aircraft can “see” each other.

Because the GTX 345R transponder sends and receives ADS-B traffic reports on the 1090 ES frequency, but only receives traffic reports on the 978 MHz UAT frequency, the presence of an ADS-R ground station is necessary for an aircraft with only UAT capabilities to “see” the aircraft with the GTX 345R transponder.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

TIS-B provides the bridge between the radar-based ATC system and the ADS-B-based system. When an ADS-B In or Out capable aircraft is within the service volume of an FAA ADS-B ground station, the ground station broadcasts a portion of the ATC radar data to the aircraft. This aircraft is then included in the list of aircraft being provided TIS-B service and is then considered a “TIS-B participant.”

TIS-B coverage is available when the aircraft is within ground station coverage, in Secondary Surveillance Radar coverage, and the other aircraft is also in Secondary Surveillance Radar coverage, and is transmitting its altitude.

The ground station provides ATC radar information for other aircraft within $\pm 3,500$ feet and 15 NM of the participant, to include altitude, position, ground speed, and ground track. TIS-B broadcasts occur once every three to thirteen seconds, depending on the characteristics of the ground station providing the TIS-B service.

The following table describes the aircraft that are observed by a GTX 345R-equipped aircraft according to the level of equipment installed in the other aircraft.

Other Aircraft Equipment	Viewable by GTX 345R Equipped Aircraft
1090ES Out Equipped	Yes
UAT Receive Only Capable	No
UAT Transmit Equipped	Yes
No Transponder, No ADS-B	No
Non ADS-B Equipped, but with Mode C or S Transponder	Yes*

* Only when in ADS-B ground station coverage and when the other aircraft is in ATC radar coverage, or own aircraft is equipped with a TAS system and traffic is within the TAS surveillance range.

Table 6-25 Aircraft Available for Viewing by an ADS-B Equipped Own Aircraft

ADS-B WITH TAS

When an optional active traffic system, such as a Traffic Advisory System (TAS) is installed and operating with an optional GTX 345R transponder, the transponder receives traffic from the active traffic system and attempts to match (or “correlate”) this traffic with ADS-B traffic the transponder is tracking. When a correlation is made, the only the traffic with the most accurate information is displayed to the flight crew. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This correlation of traffic by the transponder improves the accuracy of the traffic displayed, while reducing the occurrence of the same aircraft being displayed twice.



NOTE: *When operating on the edges of ATC radar coverage or when using an optional active traffic system providing intermittent traffic data, a single aircraft may be briefly or periodically depicted as two aircraft on the display.*



NOTE: *The optional TAS system issues alerts for traffic it is tracking using TAS alerting criteria. The ADS-B system issues alerts for traffic it is tracking using the Conflict Situational Awareness & Alerting (CSA) criteria.*

CONFLICT SITUATIONAL AWARENESS & ALERTING

Conflict Situational Awareness (CSA) is an alerting algorithm which provides ADS-B traffic alerting similar to the TAS system discussed previously.

When a TA occurs with is equipment, the displays a ‘TRAFFIC’ annunciation and provides a voice alert. This annunciation and voice alert is the same as the alerts issued by the Garmin GTS 800 TAS discussed previously.



NOTE: *ADS-B traffic voice alerts are suppressed when below 500 feet.*

The own aircraft altitude above terrain determines the sensitivity of the CSA algorithm to minimize nuisance alerts. Radar Altitude (if available), Height Above Terrain, and Geodetic Sea Level (GSL) altitude are used to adjust the sensitivity of the CSA algorithm in accordance with the following table:

Sensitivity Level	Height Above Terrain (HAT)	GPS Phase of Flight	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (feet)	Protected Volume (NM)
4	Any	Any	Any	20	850	0.20
4	Any	Any	Any	20	850	0.20
4	Unavailable	Approach	Any	20	850	0.20
5	Any	Any	Any	25	850	0.20
5	>1000 <=2350	Any	Any	25	850	0.20
5	Unavailable	Terminal	Any	25	850	0.20
6	Unavailable or >2350	Not approach and not Terminal (including unavailable)	<=5000	30	850	0.35
7	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>5000 <=10,000	40	850	0.55
8	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>10,000 <=20,000	45	850	0.80
9	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>20,000 <=42,000	48	850	1.10
10	Unavailable or >2350	Not approach and not Terminal (including unavailable)	> 42,000	48	1200	1.10

Table 6-26 CSA Alerting Thresholds for ADS-B Traffic

AIRBORNE AND SURFACE APPLICATIONS

The optional GTX 345R can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five nautical miles and 1,500 feet above the nearest airport. When the AIRB application is active, the system only displays traffic which is airborne.

The SURF application is on when the aircraft is within five NM and less than 1,500 feet above field elevation. When the SURF applications is on, the system displays airborne and on the ground traffic. At a Traffic Map Page range of one nm or less, the airport environment (including taxiways and runways) appears in addition to traffic. The airport displays are derived from the SafeTaxi database. Refer to the Additional Features section for more information about SafeTaxi displays.



NOTE: Do not rely on the solely on the traffic display to determine the runway alignment of traffic, especially when runways are in close proximity to each other.

Due to the varying precision of the data received via ADS-B, ADS-R, and TIS-B services, not all traffic symbols may not be depicted on the traffic display. Because higher data precision is required for traffic to be displayed in the SURF environment, some traffic eligible for AIRB will not be displayed while SURF is on. Availability for AIRB and SURF is depicted on the 'Aux-ADS-B Status' Page, discussed later in this section.



Figure 6-74 Traffic Map Page with SURF Mode On

TRAFFIC DESCRIPTION

The symbols used to display ADS-B traffic are shown in the following table. Above or below the traffic symbol is the traffic identifier, and altitude. A small up or down arrow next to the traffic symbol indicates that the traffic is climbing or descending at a rate of at least 500 feet per minute.













Symbol	Description
	Traffic Advisory with directional information. Points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory out of the selected display range with directional information. Displayed at outer range ring at proper bearing.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with directional information. Points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with directional information. Points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with directional information. Points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic with ADS-B directional information. Pointed end indicates direction of travel. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-27 ADS-B Traffic Symbology

OPERATION

TRAFFIC MAP PAGE

The Traffic Map Page shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick**, as indicated by the map range rings.

The traffic mode and altitude display mode are annunciated in the upper left corner of the page.



Figure 6-75 Traffic Map Page

Enabling/disabling the display of ADS-B traffic.

- 1) Select the Traffic Map Page.
- 2) Select the **ADS-B** Softkey.

Or:

- a) Press the **MENU** Key and turn the small **FMS** Knob to highlight 'ADS-B On' or 'ADS-B Off'.
- b) Press the **ENT** Key.

Testing the display of ADS-B traffic:

- 1) Select the Traffic Map Page.
- 2) If necessary, turn the Joystick to select a map range of 2 and 6 nm to ensure full test pattern display.
- 3) Ensure the **ADS-B** Softkey is disabled. Otherwise the test mode is not available.
- 4) If the optional TAS is installed, ensure the **TAS STBY** Softkey is enabled.
- 5) Press the **Test** Softkey.

Or:

- a) Press the **MENU** Key.
- b) Turn the small **FMS** Knob to highlight 'Test Mode'.
- c) Press the **ENT** Key.

The traffic system provides a system test mode to verify normal operation. The test takes about ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols appears on any displayed traffic

maps. The test pattern corresponds to the current aircraft heading. A climbing TA is shown to the west, level Other Non-Threat traffic is shown to the northwest, and a descending Proximity Advisory is in the northeast, relative to own aircraft.

The system announces, **“Traffic System Test”**. When the system test is complete, the traffic system enters Standby Mode.

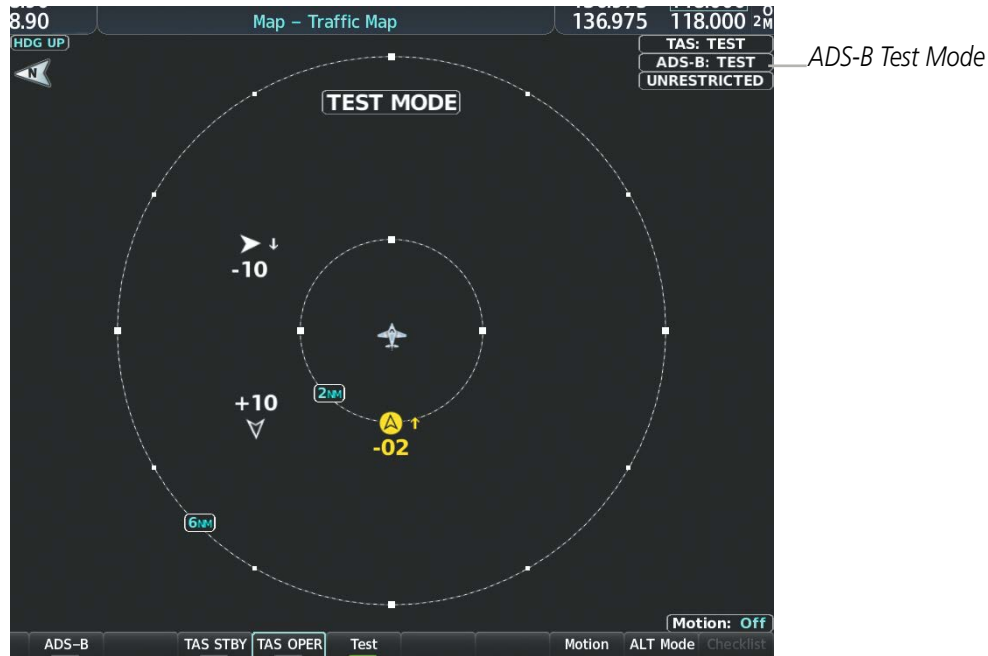


Figure 6-76 System Test in Progress with Test Pattern

The pilot can select the volume of airspace in which Other Non-Threat and Proximity traffic is displayed. TAs occurring outside of these limits will always be shown.

Changing the altitude range:

- 1) On the Traffic Map Page, select the **ALT Mode** Softkey.
- 2) Select one of the following softkeys:
 - **Above:** Displays Other Non-Threat and proximity traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
 - **Normal:** Displays Other Non-Threat and proximity traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.
 - **Below:** Displays Other Non-Threat and proximity traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.
 - **UNREST** (unrestricted): All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.
- 3) To return to the Traffic Map Page, select the **Back** Softkey.

Or:

- 1) Press the **MENU** Key.
- 2) Turn the small **FMS** Knob to highlight one of the following options:
 - Above
 - Normal
 - Below
 - Unrestricted
- 3) Press the **ENT** Key.

DISPLAYING MOTION VECTORS

When Absolute Motion Vectors are selected, the vectors extending from the traffic symbols depict the traffic's reported track and speed over the ground. When Relative Motion Vectors are selected, the vectors extending from the traffic symbols display how the traffic is moving relative to own aircraft. These vectors are calculated using the traffic's track and ground speed and own aircraft's track and ground speed. These two values are combined to depict where the traffic is moving purely with respect to own aircraft, and provide a forecast of where the traffic will be, relative to own aircraft, in the near future. If the system does not have sufficient information to calculate motion vectors, they are not shown.



Figure 6-77 Traffic Map Page with Absolute Motion Vectors Enabled



Figure 6-78 Traffic Map Page with Relative Motion Vectors Enabled

Enabling/disabling the Motion Vector display:

- 1) Select the Traffic Map Page.
- 2) Select the **Motion** Softkey.
- 3) Press one of the following softkeys:
 - **Absolute:** Displays the motion vector pointing in the absolute direction.
 - **Relative:** Displays the motion vector relative to own aircraft
 - **Off:** Disables the display of the motion vector.

Or:

- 1) Select the Traffic Map Page.
- 2) Press the **MENU** Key.
- 3) Turn the small **FMS** Knob to highlight 'Relative Motion', 'Absolute Motion' or 'Motion Vector Off'.
- 4) Press the **ENT** Key.

Adjusting the duration for the Motion Vector projected time:

- 1) Select the Traffic Map Page.
- 2) Press the **Motion** Softkey.
- 3) Press the **Duration** Softkey.
- 4) Press a softkey for the desired duration (**30 SEC, 1 MIN, 2 MIN, 5 MIN**).
- 5) When finished, select the **Back** Softkey to return to the Traffic Map Page.

DISPLAYING ADDITIONAL TRAFFIC INFORMATION

The Traffic Map Page can display additional information for a selected aircraft symbol. This may include the aircraft tail number/Flight ID, type of aircraft (e.g., glider, small/medium/large aircraft, service vehicle, unmanned airborne vehicle (UAV)), course, track, groundspeed), and other information.

Showing additional traffic information:

- 1) Select the Traffic Map Page.
- 2) Press the **FMS** Knob. The first selected traffic symbol is highlighted in cyan. Additional information appears in a window in the upper-right corner of the Traffic Map Page.
- 3) To select a different aircraft symbol, turn the **FMS** Knob to move the cyan bracket until the selected aircraft traffic symbol is highlighted.
- 4) When finished, press the **FMS** Knob again to disable the traffic selection.

TRAFFIC MAP PAGE DISPLAY RANGE

The pilot can adjust the range of traffic displayed on the 'Map - Traffic Map' Page. Range indications appear on rings shown on the page. The minimum map range is 750 feet. A maximum map range of 40 nautical miles is available.

Selecting the Traffic Map Display Range:

- 1) Select the Map - Traffic Map Page.
- 2) Turn the **Joystick** as needed to select the desired map range.



NOTE: ADS-B traffic can be displayed as an overlay to navigation maps. Refer to the previous TAS discussion for information about these additional traffic displays.

ADS-B SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the Traffic Map Page.

ADS-B Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Map Page Center Banner Annunciation	Traffic Display Status Icon (Other Maps)
ADS-B System Test Initiated	ADS-B: TEST	TEST MODE	
ADS-B Operating in Airborne Mode	ADS-B: AIRB	None	
ADS-B Operating in Surface Mode	ADS-B: SURF	None	
ADS-B Traffic Off	ADS-B: OFF	ADS-B TRFC OFF	
ADS-B Traffic Not Available	ADS-B: N/A	ADS-B TRFC N/A	
ADS-B Failed*	ADS-B: FAIL	ADS-B TRFC FAIL	

* See Table 6-29 for additional failure annunciations

Table 6-28 ADS-B Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page. During a failure condition, the Operating Mode cannot be selected.

Traffic Map Page Center Annunciation	Description
NO DATA	Data is not being received from the traffic unit
DATA FAILED	Data is being received from the traffic unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the traffic unit

Table 6-29 Traffic Failure Annunciations



NOTE: If the GTX 345R transponder has failed, the GTS 800 TAS enters failure mode, and the system will not display traffic information.

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↓	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the traffic unit

*Shown as symbol on Traffic Map Page

**Shown in center of Traffic Map Page

Table 6-30 Traffic Status Annunciations

Additional information about the status of ADS-B traffic products is available on the 'Aux - ADS-B Status' Page.

Viewing ADS-B Traffic Status:

- 1) Turn the large **FMS** Knob to select the Aux Page Group.
- 2) Turn the small **FMS** Knob to select the 'Aux - ADS-B' Status Page.



Figure 6-79 Viewing ADS-B Traffic Status on ADS-B Status Page

ADS-B Status Page Item	Status Message	Description
Traffic Application Status: Airborne (AIRB), Surface (SURF), Airborne Alerts (CSA)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) determine the application should be active. Required input data is available, and it meets performance requirements.
	Not Available	Traffic application is not available. Required input data is available, but it does not meet performance requirements.
	Fault	Traffic application is not available. Required input data is not available or the application has failed.
	Not Configured	Traffic application is not available, because it has not been configured. If this annunciation persists, the system should be serviced.
	-----	Traffic application status is invalid or unknown.
TIS-B/ADS-R Coverage	Available	The system is receiving the ADS-R coverage from an FAA ground station.
	Not Available	The system is not receiving the ADS-R coverage from an FAA ground station.
	-----	ADS-R coverage is invalid or unknown.
GPS Status: GPS Source	External #1	The GTX 345R is using the #1 GPS receiver for the GPS position source.
	External #2	The GTX 345R is using the #2 GPS receiver for the GPS position source.
	-----	The GPS source is invalid or unknown.
Ground Uplink Status: Last Uplink	Number of minutes, or '-----'	Displays the number of minutes since the last uplink from a ground station occurred. If no uplink has been received, or the status is invalid, dashes appear instead of a number of minutes.

Table 6-31 'Aux - ADS-B Status' Page Messages for ADS-B Traffic

SYSTEM
OVERVIEW

FLIGHT
INSTRUMENTS

EIS

AUDIO PANEL
& CNS

FLIGHT
MANAGEMENT

**HAZARD
AVOIDANCE**

AFCS

ADDITIONAL
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SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS OVERVIEW



NOTE: The approved Pilot's Operating Handbook (POH) always supersedes this Pilot's Guide.

The digital Garmin Automatic Flight Control System (AFCS) is fully integrated within the system's avionics architecture. The System Overview section provides a block diagram to support this system description.

The Garmin AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — The Piper PA-44-180 Seminole flight director commands are displayed on the PFD. The flight director provides:
 - Command Bars showing pitch/roll guidance
 - Vertical/lateral mode selection and processing
 - Autopilot communication
- **Autopilot (AP)** — Autopilot operation occurs within the pitch, roll, and pitch trim servos adapter. It also provides servo monitoring and automatic flight control in response to flight director steering commands, Attitude and Heading Reference System (AHRS) attitude and rate information, and airspeed.
- **Manual Electric Pitch Trim (MEPT)** — The pitch trim servo provides manual electric pitch trim capability when the autopilot is not engaged.

BASIC AUTOPILOT OPERATION

This section provides an overview for autopilot engagement and disengagement. A more detailed description follows in the Autopilot Operation section.

- **Autopilot Engagement** — The autopilot may be engaged by pushing the **AP Key** on the AFCS Control Unit. Annunciations regarding the engagement are indicated on the PFD.
- **Autopilot Engagement with Flight Director Off** — Upon engagement, the autopilot will be set to hold the current attitude of the airplane, if the flight director was not previously on. In this case, 'PIT' and 'ROL' will be annunciated.
- **Autopilot Engagement with Flight Director On** — If the flight director is on, the autopilot will smoothly pitch and roll the airplane to capture the FD command bars. The prior flight director modes remain unchanged.
- **Autopilot Disengagement** — The most common way to disconnect the autopilot is to press and release the **AP DISC Switch**, which is located on each control wheel. An autopilot disconnect tone will be heard and annunciated on the PFD. Other ways to disconnect the autopilot include:
 - Pressing the **AP Key** on the AFCS Control Unit
 - Operating the **MEPT Switch** (located on the each control wheel)
 - Pulling the autopilot circuit breaker

In the event of unexpected autopilot behavior, pressing and holding the **AP DISC Switch** will disconnect the autopilot and remove all power to the servos.

AFCS CONTROLS

The following dedicated AFCS keys are located on the bezels of the MFD:

- ① **AP Key** Engages/disengages the autopilot
- ② **FD Key** Activates/deactivates the flight director only
Pressing once turns on the flight director in the default pitch and roll modes. Pressing again deactivates the flight director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
- ③ **NAV Key** Selects/deselects Navigation Mode
- ④ **ALT Key** Selects/deselects Altitude Hold Mode
- ⑤ **VS Key** Selects/deselects Vertical Speed Mode
- ⑥ **FLC Key** Selects/deselects Flight Level Change Mode
- ⑦ **HDG Key** Selects/deselects Heading Select Mode
- ⑧ **APR Key** Selects/deselects Approach Mode
- ⑨ **VNV Key** Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
- ⑩ **NOSE UP/NOSE DN Keys** Control the mode reference in Pitch Hold, Vertical Speed, and Flight Level Change modes

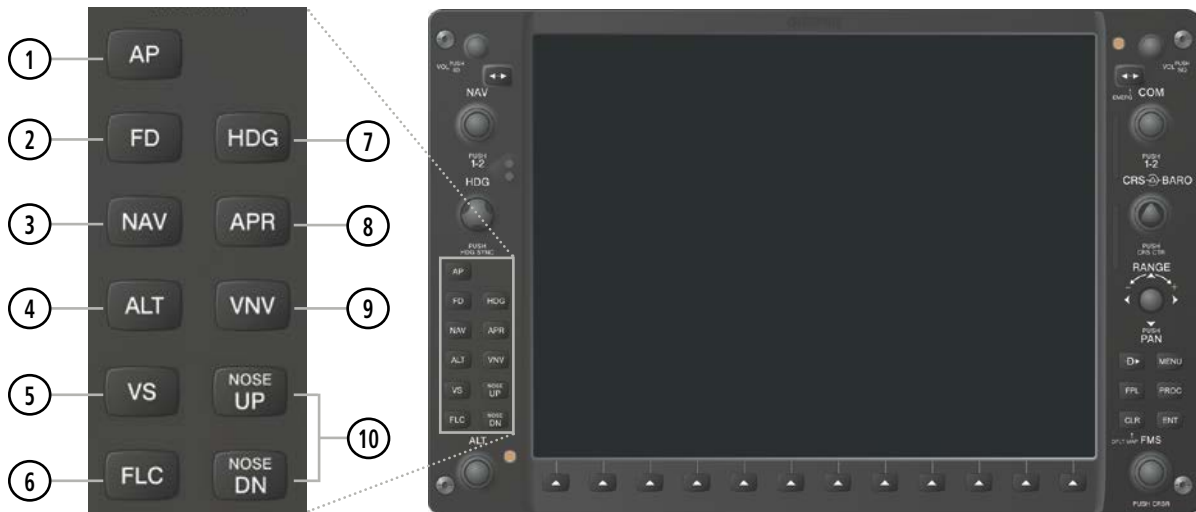


Figure 7-1 Dedicated AFCS Controls

The following AFCS controls are located separately from the AFCS Control Unit:

- AP DISC Switch (Autopilot Disconnect)** Disengages the autopilot and flight director and interrupts pitch trim operation. An **AP DISC** Switch is located on each control wheel. This switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.
- CWS Button (Control Wheel Steering)** While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in a Vertical Navigation, Glideslope, or Glidepath Mode) and roll (if in Roll Hold Mode). A **CWS** Button is located on each control wheel. Upon release of the **CWS** Button, the flight director may establish new pitch and roll references, depending on the current vertical and lateral modes. CWS operation details are discussed in the respective mode sections of this manual.
- TO/GA Switch (Go Around)** Selects flight director Takeoff (on ground) or Go Around (in air) Mode. If an approach procedure is loaded this switch also activates the missed approach when the selected navigation source is FMS or when the navigation source is VOR/LOC and a valid frequency has been tuned. The **TO/GA** Switch is located on the throttle.
- MEPT Switch (Manual Electric Pitch Trim)** Used to command manual electric pitch trim. An **MEPT** Switch is located on each control wheel. This composite switch is split into left and right sides. The left switch is the ARM contact and the right switch controls the DN (forward) and UP (rearward) contacts. Pushing the **MEPT** ARM Switch disengages the autopilot, if currently engaged. The **MEPT** ARM Switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone. Manual trim commands are generated only when both sides of the switch are operated simultaneously. If either side of the switch is active separately for more than three seconds, MEPT function is disabled and 'PTRM' is displayed as the AFCS Status Annunciation on the PFDs. The function remains disabled until both sides of the switch are inactivated.
- LVL Button Level Mode** The **LVL** Button engages the autopilot in Level Mode for pitch and roll.

7.2 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFDs. With the flight director active, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (-15°, +20°) and roll (25°) angles, vertical acceleration, and roll rate are limited to values established during AFCS certification. The flight director also provides commands to the autopilot.

ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in Table 7-1 (when the flight director is not active) activates the pilot-side flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the displays by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
TO/GA Switch	Takeoff (on ground)	TO	Takeoff (on ground)	TO
	Go Around (in air)	GA	Go Around (in air)	GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key	Roll Hold (default)	ROL	Vertical Path Tracking*	VPTH
NAV Key	Navigation**	FMS VOR LOC BC	Pitch Hold (default)	PIT
APR Key	Approach**	FMS VOR LOC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT

*Valid VNV flight plan must be entered before **VNV** Key press activates flight director.

The selected navigation receiver must have a valid VOR or LOC signal or active FMS course before **NAV or **APR** Key press activates flight director.

Table 7-1 Flight Director Activation

AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFDs when the flight director is active. Flight director selection and autopilot statuses are shown in the center of the AFCS Status Box. Lateral flight director modes are displayed on the left and vertical on the right. Armed modes are displayed in white and active in green.



Figure 7-2 PFD AFCS Display

FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the flight director reverts to the default pitch and/or roll mode.

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation, when the control for the active flight director mode is pressed, the flight director reverts to the default mode for the axis. Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green active mode field and flashing for 10 seconds.

If the information required to compute a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis. A flashing yellow mode annunciation and annunciator light indicate loss of sensor (ADC) or navigation data (VOR, LOC, FMS, VNV, SBAS) required to compute commands. When such a loss occurs, the system automatically begins to roll the wings level (enters Roll Hold Mode) or maintain the pitch angle (enters Pitch Hold Mode), depending on the affected axis. The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.



Figure 7-3 Loss of VOR Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

COMMAND BARS

Upon activation of the flight director, Command Bars are displayed in magenta on the PFDs as a single cue or cross pointers. The Aircraft Symbol (in yellow) changes to accommodate the Command Bar format; the Command Bars do not override the Aircraft Symbol. The single-cue Command Bars (Figure 7-4) move together vertically to indicate pitch commands and bank left or right to indicate roll commands. Command Bars displayed as a cross pointer (Figure 7-5) move independently to indicate pitch (horizontal bar) and roll (vertical bar) commands. Both PFDs show the same Command Bar format. If a compatible lift computer is installed, the cross-pointer option will be unavailable.

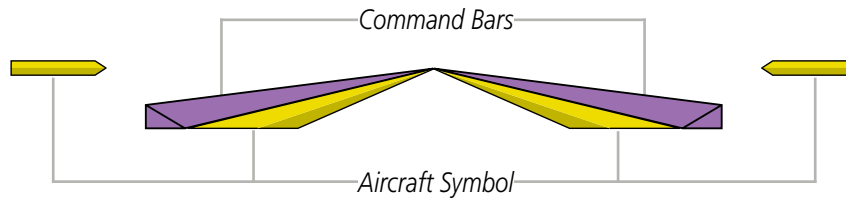


Figure 7-4 Single-cue Command Bars

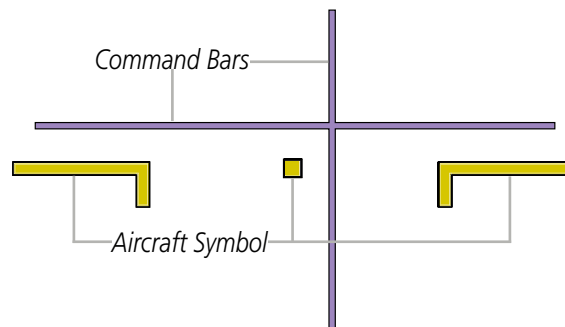


Figure 7-5 Cross-pointer Command Bars

Changing Command Bar format:

- 1) Use the **FMS** Knob to select the AUX - System Setup Page on the MFD.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight 'Format Active' in the 'Flight Director' box.
- 4) Turn the small **FMS** Knob to highlight the desired format.

'SNGL CUE' to display Command Bars as a single cue (Aircraft Symbol in Figure 7-5).

Or:

'X-POINTER' to display Command Bars as a cross-pointer (Aircraft Symbol in Figure 7-6).

If the attitude information being sent to the flight director becomes invalid or unavailable, the Command Bars are removed from the display. The flight director Command Bars also disappear if the pitch exceeds $+30^{\circ}/-20^{\circ}$ or bank exceeds 65° .

7.3 AFCS MODES

The AFCS is capable of operating in a variety of independent Lateral Modes, Vertical Modes and Combination of both the Lateral and Vertical Modes.

VERTICAL MODES

The following table lists the vertical modes with their corresponding controls and annunciations. The mode reference is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **NOSE UP** and **NOSE DN** Keys can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the **NOSE UP** and **NOSE DN** Keys are also listed in the table.

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	-15° to +20°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS		
Altitude Hold	Holds the current Altitude Reference	ALT Key	ALT nnnn FT		
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	VS Key	VS nnnn FPM	-3000 to +1500 fpm	100 fpm
Flight Level Change, IAS Hold	Maintains the current aircraft airspeed while the aircraft is climbing/descending to the Selected Altitude	FLC Key	FLC nnn KT	80 to 204 kts	1 kt

* *ALTS armed automatically when PIT, VS, FLC, TO, or GA active, and under VPTH when Selected Altitude is to be captured instead of VNV Target Altitude*

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the flight director is activated (the **FD** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the ‘PIT’ annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

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CHANGING THE PITCH REFERENCE

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the **NOSE UP** and **NOSE DN** Keys
- Pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button

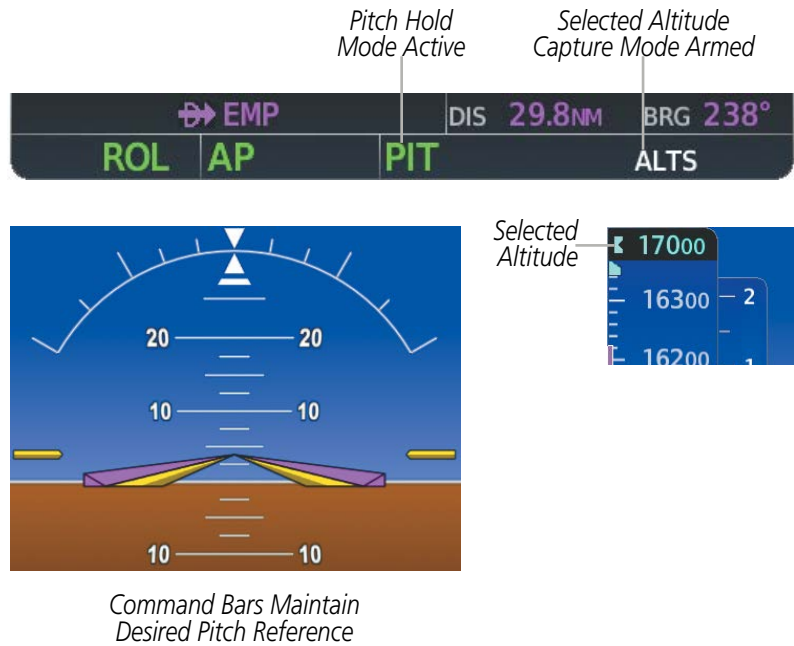


Figure 7-6 Pitch Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change
- Go Around
- Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed. The **ALT** Knob on the MFD is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude (shown as the Altitude Reference). As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.

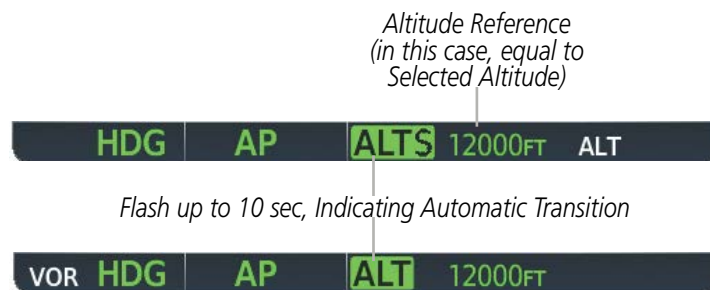


Figure 7-7 Automatic Mode Transitions During Altitude Capture

CHANGING THE SELECTED ALTITUDE



NOTE: Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.

Use of the **ALT** Knob on the MFD to change the Selected Altitude while Selected Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in Selected Altitude Capture Mode. Selected Altitude Capture Mode automatically transitions to Altitude Hold Mode when the altitude error is less than 50 feet. In this case, the Selected Altitude becomes the flight director's Altitude Reference.

CHANGING THE ALTITUDE REFERENCE



NOTE: Turning the **ALT** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.

The Altitude Reference (shown in the AFCS Status Box) may be changed by:

- Using the **NOSE UP/NOSE DN** Keys
- Pressing the **CWS** Switch, hand-flying the aircraft to attain a new Altitude Reference, then releasing the **CWS** Switch at the desired altitude (the new altitude is now the Altitude Reference)

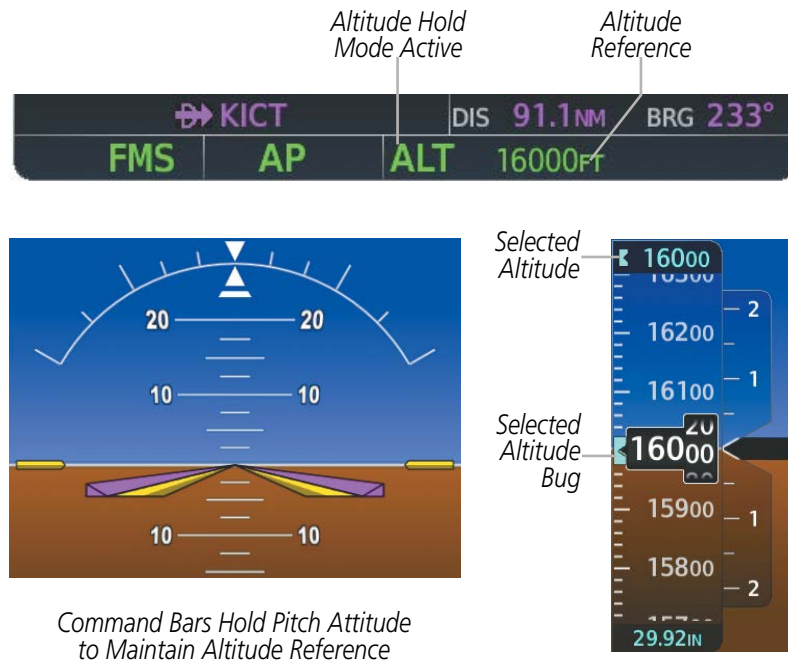


Figure 7-8 Altitude Hold Mode

VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference. Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key, 'VS' is annunciated in green in the AFCS Status Box along with the Vertical Speed Reference. The Vertical Speed Reference is also displayed above the Vertical Speed Indicator. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

The Vertical Speed Reference (shown both in the AFCS Status Box and above the Vertical Speed Indicator) may be changed by:

- Using the **NOSE UP** and **NOSE DN** Keys
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button



NOTE: If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the **CWS** Button must be pressed again after the Selected Altitude is reached.

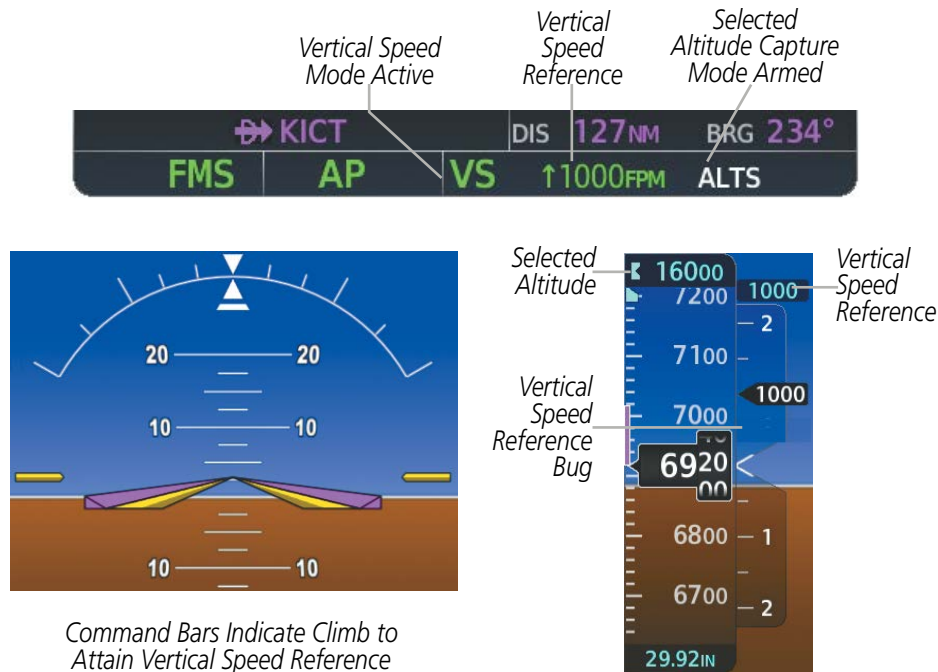


Figure 7-9 Vertical Speed Hold Mode

FLIGHT LEVEL CHANGE MODE (FLC)



NOTE: *The Selected Altitude should be set before selecting Flight Level Change Mode.*

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the flight director continuously monitors Selected Altitude, airspeed, and altitude.

The Airspeed Reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by a green ‘FLC’ annunciation beside the Airspeed Reference in the AFCS Status Box. The Airspeed Reference is also displayed directly above the Airspeed Indicator, along with a bug corresponding to the Airspeed Reference along the tape.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The flight director maintains the current altitude until either engine power or the Airspeed Reference are adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

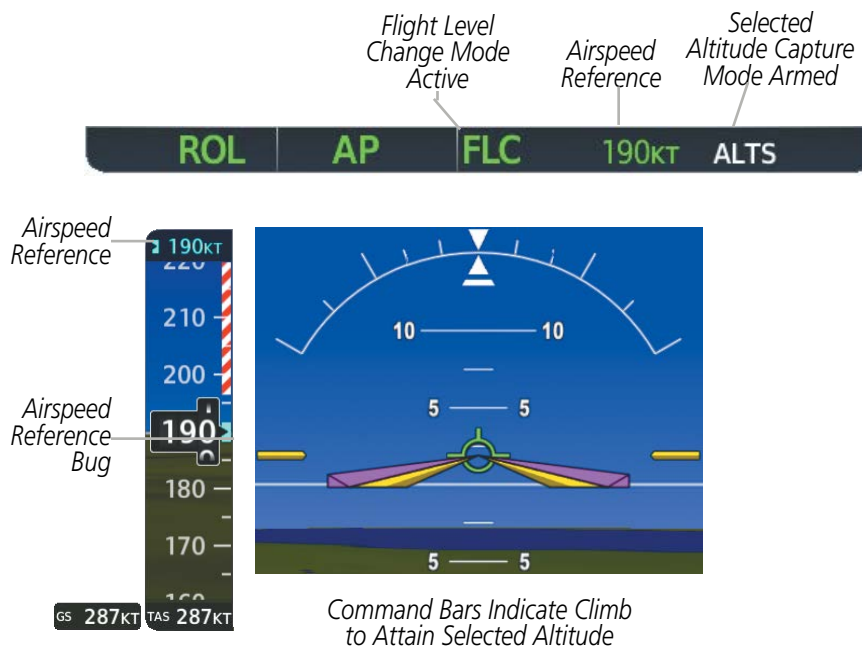


Figure 7-10 Flight Level Change Mode (IAS)

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the **NOSE UP** and **NOSE DN** Keys
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the **CWS** Button



NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the **CWS** Button must be pressed again after the Selected Altitude is reached.*

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LATERAL MODES

The following table relates each Garmin AFCS lateral mode to its respective control and annunciation. Refer to the combination modes section for information regarding Go Around and Takeoff modes.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	25°
Heading Select	Captures and tracks the Selected Heading	HDG Key	HDG	25°
Navigation, FMS Arm/Capture/Track	Captures and tracks the selected navigation source (FMS, VOR, LOC)	NAV Key	FMS	25° Capture 10° Track
Navigation, VOR Enroute Arm/Capture/Track			VOR	25° Capture 10° Track
Navigation, LOC Arm/Capture/Track (No Glideslope)			LOC	25° Capture 10° Track

Table 7-3 Flight Director Lateral Modes

The **CWS** Button does not change lateral references for Heading Select, Navigation, Backcourse, or Approach Mode. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Button.

ROLL HOLD MODE (ROL)



NOTE: If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls wings level.

When the flight director is activated or switched, Roll Hold Mode is selected by default. This mode is annunciated as ‘ROL’ in the AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle condition.



Figure 7-11 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 25°	Maintains current aircraft roll attitude
> 25°	Limits bank to 25°

Table 7-4 Roll Hold Mode Responses

CHANGING THE ROLL REFERENCE

The roll reference can be changed by pressing the **CWS** Button, establishing the desired bank angle, then releasing the **CWS** Button.

HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a cyan bug on the HSI and in the box to the upper left of the HSI.

CHANGING THE SELECTED HEADING



NOTE: Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading.

The Selected Heading is adjusted using the **HDG** Knob. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

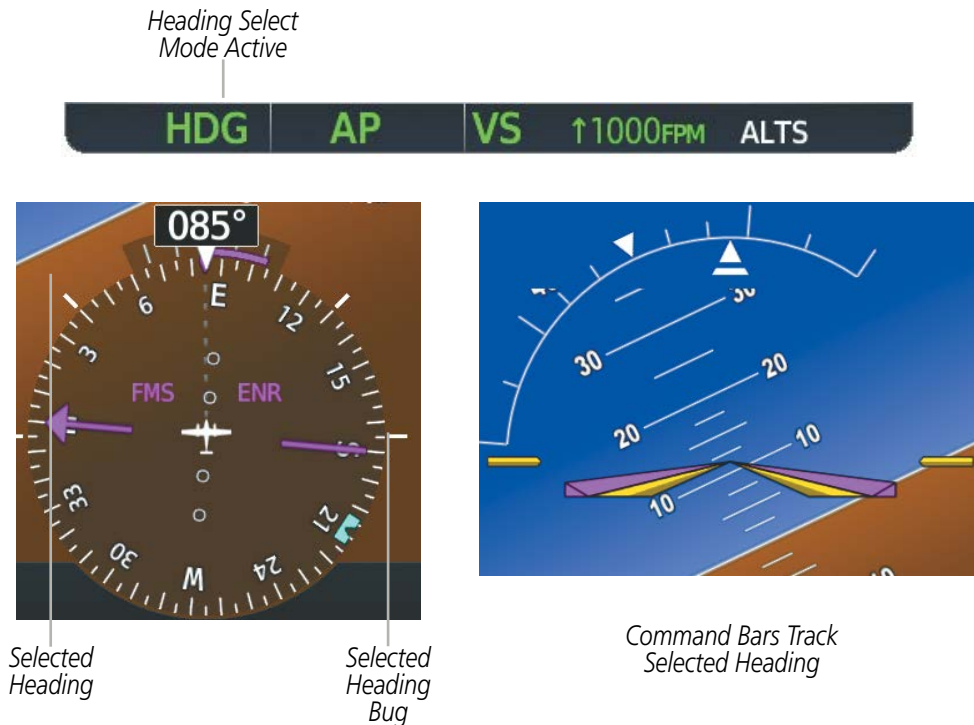


Figure 7-12 Heading Select Mode

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NAVIGATION MODES (FMS, VOR, LOC, BC)

NOTE: The selected navigation receiver must have a valid VOR or LOC signal or active FMS course for the flight director to enter Navigation Mode.

NOTE: When intercepting a flight plan leg, the flight director gives commands to capture the active leg at approximately a 45° angle to the track between the waypoints defining the active leg. The flight director does not give commands fly to the starting waypoint of the active leg.

NOTE: When making a backcourse approach, set the Selected Course to the localizer front course.

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (FMS, VOR, LOC). The flight director follows FMS roll steering commands when FMS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision SBAS and LOC approaches where vertical guidance is not required.

Backcourse Navigation Mode is selected when the localizer front course is greater than 105° from the aircraft heading. Backcourse Navigation Mode captures and tracks a localizer signal in the backcourse direction. The annunciation 'BC' in the AFCS Status Box indicates Backcourse Navigation Mode.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI is less than one dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active roll mode.



Figure 7-13 FMS Navigation Mode Armed

When the CDI has automatically switched from FMS to LOC during a LOC/ILS approach, FMS Navigation Mode remains active, providing FMS steering guidance until the localizer signal is captured. LOC Navigation Mode is armed automatically when the navigation source switch takes place if the **APR** Key is not pressed prior to the automatic source switch.

If Navigation Mode is active and either of the following occur, the flight director reverts to Roll Hold Mode (wings rolled level):

- Different VOR tuned while in VOR Navigation Mode (VOR Navigation Mode reverts to armed)
- Navigation source manually switched (with the **CDI** Softkey)
- During a LOC/ILS approach, the FAF is crossed while in FMS Navigation Mode after the automatic navigation source switch from FMS to LOC

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer, or OBS Mode has been enabled when using FMS, the Selected Course is controlled using the **CRS** Knob.

Pressing the **CWS** Switch and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or FMS flight plan) when the **CWS** Switch is released.

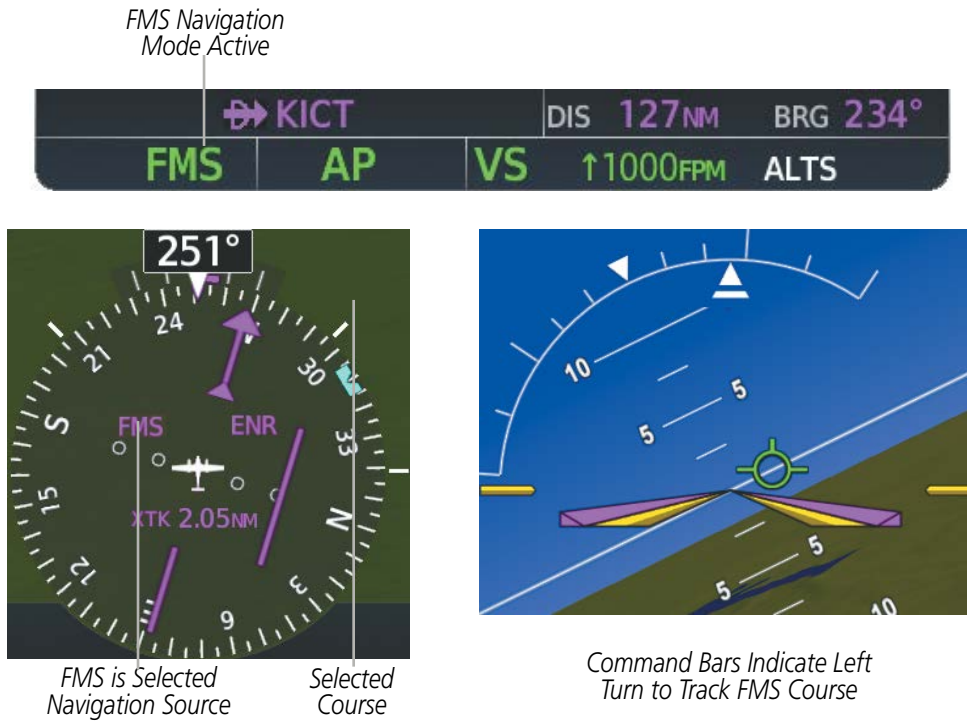


Figure 7-14 Navigation Mode

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COMBINATION MODES (VNV, APR, NAV, BC, GA)

The following table lists the modes that operating by using both Vertical and Lateral Modes with their corresponding controls and annunciations.

Mode	Description	Control	Annunciation	Maximum Roll Command Limit	Reference Range
Vertical Path Tracking	Captures and tracks descent legs of an active vertical profile	VNV Key	VPTH		
VNV Target Altitude Capture	Captures the Vertical Navigation (VNV) Target Altitude	*	ALTV		
Glidepath	Captures and tracks the SBAS glidepath on approach	APR Key	GP		
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Backcourse Arm/Capture/Track	Captures and tracks a localizer signal for backcourse approaches	NAV Key	BC	25° Capture 10° Track	
Approach, FMS Arm/Capture/Track	Captures and tracks the selected navigation source (FMS, VOR, LOC)	APR Key	FMS	25° Capture 10° Track	
Approach, VOR Arm/Capture/Track			VAPP	25° Capture 10° Track	
Approach, ILS Arm/Capture/Track (Glideslope Mode automatically armed)			LOC	25° Capture 10° Track	
Takeoff	Commands a constant pitch angle and wings level on the ground in preparation for takeoff	TO/GA Switch	TO		10°
Go Around**	Commands a constant pitch angle and wings level in the air		GA		7°

* ALTV is armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude.

**Go Around mode disengages the autopilot unless a compatible lift computer is installed.

Table 7-5 Flight Director Combination Modes

VERTICAL NAVIGATION MODES (VPTH, ALTV)

NOTE: VNV is disabled when parallel track or Dead Reckoning Mode is active. Refer to the Flight Management Section for more information on VNV flight plans.

NOTE: The Selected Altitude takes precedence over any other vertical constraints.

Vertical Navigation (VNV) flight control is available for enroute/terminal cruise and descent operations when VNV flight planning is available. Conditions for availability include, but are not limited to:

- The selected navigation source is FMS.
- A VNV flight plan (with at least one altitude-constrained waypoint) or vertical direct-to is active.
- VNV is enabled (**VNV ENBL** Softkey pressed on the MFD).
- Crosstrack error is valid and within certain limits.
- Desired/actual track are valid or track angle error is within certain limits.
- The VNV Target Altitude of the active waypoint is no more than 250 ft above the current aircraft altitude.

The flight director may be armed for VNV at any time, but no target altitudes are captured during a climb. The Command Bars provide vertical profile guidance based on specified altitudes (entered manually or loaded from the database) at waypoints in the active flight plan or vertical direct-to. The appropriate VNV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNV modes.

VERTICAL PATH TRACKING MODE (VPTH)

NOTE: If another vertical mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.

NOTE: Pressing the **CWS** Button while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Button.

When a vertical profile (VNV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' (or 'V' when Glidepath or Glideslope Mode is concurrently armed) is annunciated in white in addition to previously armed modes. If applicable, the appropriate altitude capture mode is armed for capture of the next VNV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.

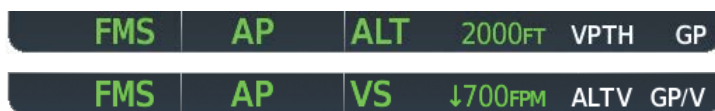


Figure 7-15 Vertical Path Tracking Armed Annunciations

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Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within five minutes of descent path interception by:

- Pressing the **VNV** Key
- Adjusting the Selected Altitude

If acknowledgment is not received within 1 minute of descent path interception, the white 'VPTH' annunciation starts to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the PFD Navigation Status Box and the "Vertical track" voice message, VNV indications (VNV Target Altitude, vertical deviation, and vertical speed required) appear on the PFDs in magenta.

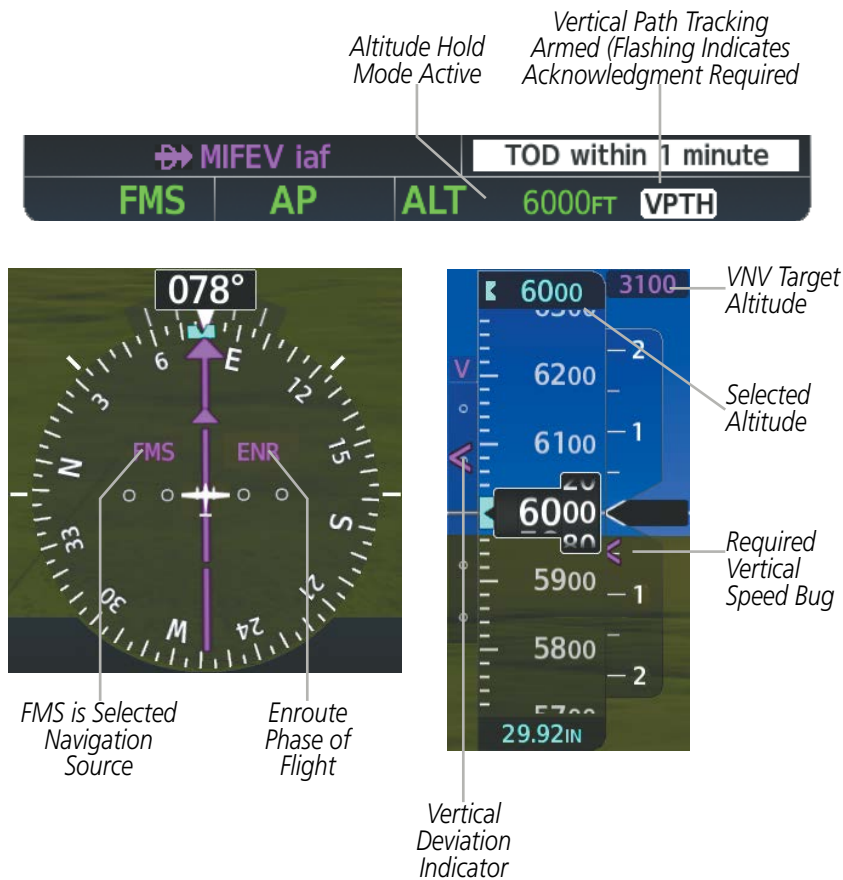


Figure 7-16 Vertical Path Capture

When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile. An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.

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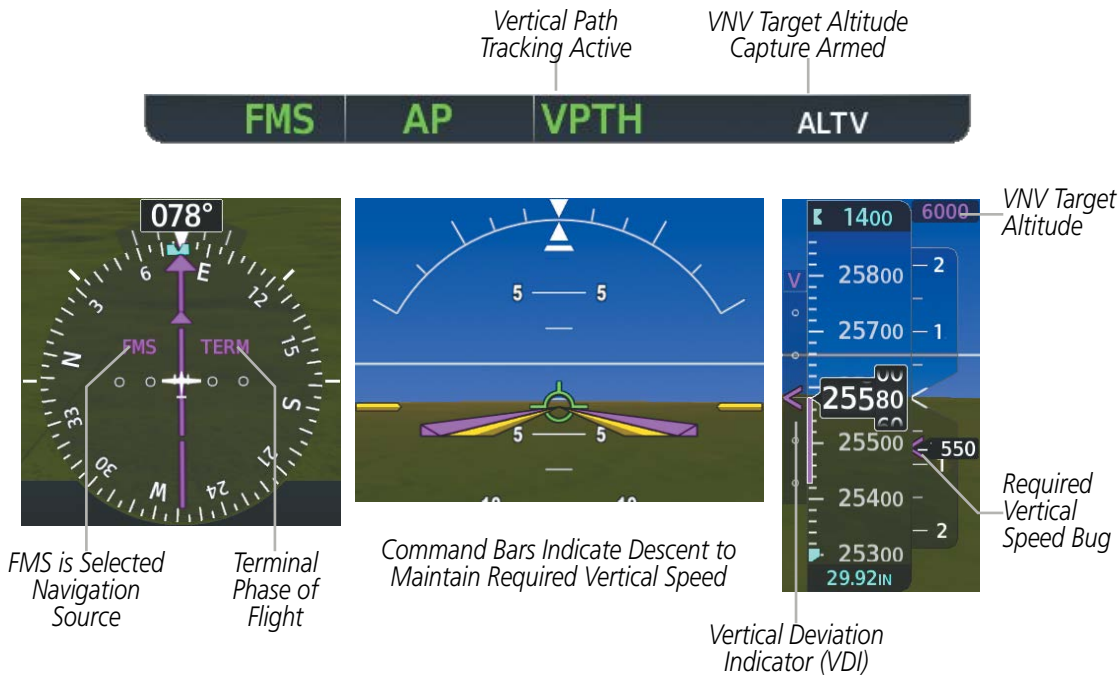


Figure 7-17 Vertical Path Tracking Mode

If the altimeter barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

AUTOMATIC REVERSION TO PITCH HOLD MODE

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode:

- Vertical deviation exceeds 200 feet during an overspeed condition.
- Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.
- Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).
- A display enters Reversionary Mode (this does not apply to an active vertical direct-to).

Unless VNV is disabled, Vertical Path Tracking Mode and the appropriate altitude capture mode become armed following the reversion to Pitch Hold Mode to allow for possible profile recapture.

NON-PATH DESCENTS

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while VNV flight control is selected. If the **VS** or **FLC** Key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed along with the appropriate altitude capture mode to allow profile re-capture.



Figure 7-18 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied:

- At least 10 seconds have passed since the non-path transition was initiated
- Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

VNV TARGET ALTITUDE CAPTURE MODE (ALTV)

NOTE: Armed VNV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNV Target Altitude Capture Mode is armed.

VNV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNV Target Altitude is to be intercepted before the Selected Altitude. The annunciation ‘ALTV’ indicates that the VNV Target Altitude is to be captured. VNV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the Flight Management Section for details). At the same time as “TOD within 1 minute” is annunciated in the Navigation Status Box, the active VNV Target Altitude is displayed above the Vertical Speed Indicator.

NOTE: When the Selected Altitude is set to the VNV Target Altitude, Selected Altitude Capture Mode (ALTS) will be armed even though the altitude value is part of the active VNAV flight plan.

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green ‘ALTV’ annunciation flashing for up to 10 seconds and the appearance of the white ‘ALT’ annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the ‘ALTV’ annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RVSI) is removed once VNV Target Altitude Capture Mode becomes active.

At 50 feet from the VNV Target Altitude, the flight director automatically transitions from VNV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white ‘ALT’ annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.

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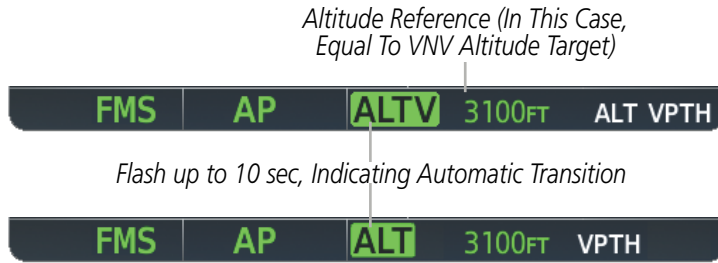


Figure 7-19 Automatic Mode Transitions During Altitude Capture



NOTE: Pressing the **CWS** Button while in VNV Target Altitude Capture Mode does not cancel the mode.

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the Flight Management Section for details).

APPROACH MODES (FMS, VAPP, LOC)



NOTE: The selected navigation receiver must have a valid VOR or LOC signal or active FMS course for the flight director to enter Approach Mode.

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (FMS, VOR, or LOC), depending on loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white to the left of the active lateral mode). If the CDI is less than one dot, the LOC is automatically captured when the **APR** Key is pressed.

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode.

Selecting VOR Approach Mode:

- 1) Ensure a valid VOR frequency is tuned
- 2) Ensure that VOR is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
- 3) Press the **APR** Key.

When FMS Approach Mode is armed, Glidepath Mode is also armed.

Selecting FMS Approach Mode without a Glidepath:

- 1) Ensure a SBAS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
- 2) Ensure that FMS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
- 3) Press the **NAV** Key.



Figure 7-20 FMS Approach Mode Armed

GLIDEPATH MODE (GP)



NOTE: Pressing the **CWS** Button while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Button.

Glidepath Mode is used to track the WAAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting FMS Approach Mode with a Glidepath:

- 1) Ensure a SBAS approach with vertical guidance (LPV, LNAV/VNAV, LP+V, LNAV+V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
- 2) Ensure that FMS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
- 3) Press the **APR** Key.



NOTE: Some RNAV (SBAS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV or LNAV+V are considered Nonprecision Approaches (NPA) and are flown to an MDA even though vertical glidepath (GP) information may be provided.



WARNING: When flying an LNAV approach (with vertical descent angle) with the autopilot coupled, the aircraft will not level off at the MDA even if the MDA is set in the altitude preselect.

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath.



Figure 7-21 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

- The active waypoint is at or after the final approach fix (FAF).
- Vertical deviation is valid.
- The CDI is at less than full scale deviation
- Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

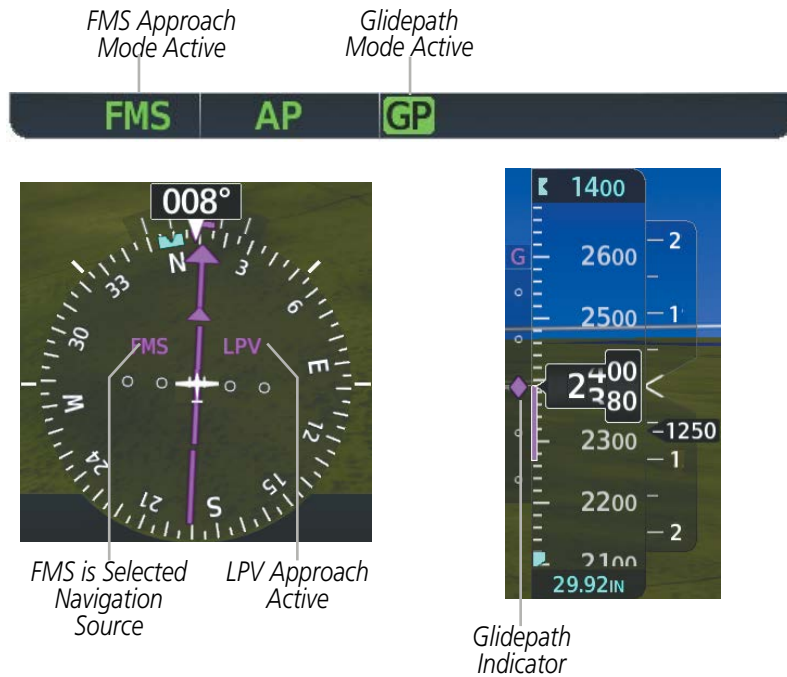


Figure 7-22 Glidepath Mode

GLIDESLOPE MODE (GS)

LOC Approach Mode allows the autopilot to fly a LOC/ILS approach with a glideslope. When LOC Approach Mode is armed, Glideslope Mode is also armed automatically. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode without a Glideslope:

- 1) Ensure a valid localizer frequency is tuned.
- 2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
- 3) Press the **NAV** Key.

Or:

- 1) Ensure that FMS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
- 2) Ensure a LOC/ILS approach is loaded into the active flight plan.
- 3) Ensure the corresponding LOC frequency is tuned.
- 4) Press the **APR** Key.



NOTE: Pressing the **CWS** Button while Glideslope Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glideslope upon release of the **CWS** Button.

Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as 'GS' in white), LOC Approach Mode is armed as the lateral flight director mode.

Selecting LOC Approach Mode with a Glideslope:

- 1) Ensure a valid localizer frequency is tuned.
- 2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
- 3) Press the **APR** Key.
 - Or:**
 - 1) Ensure that FMS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
 - 2) Ensure a LOC/ILS approach is loaded into the active flight plan.
 - 3) Ensure the corresponding LOC frequency is tuned.
 - 4) Press the **APR** Key.



Figure 7-23 Glideslope Mode Armed

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope.

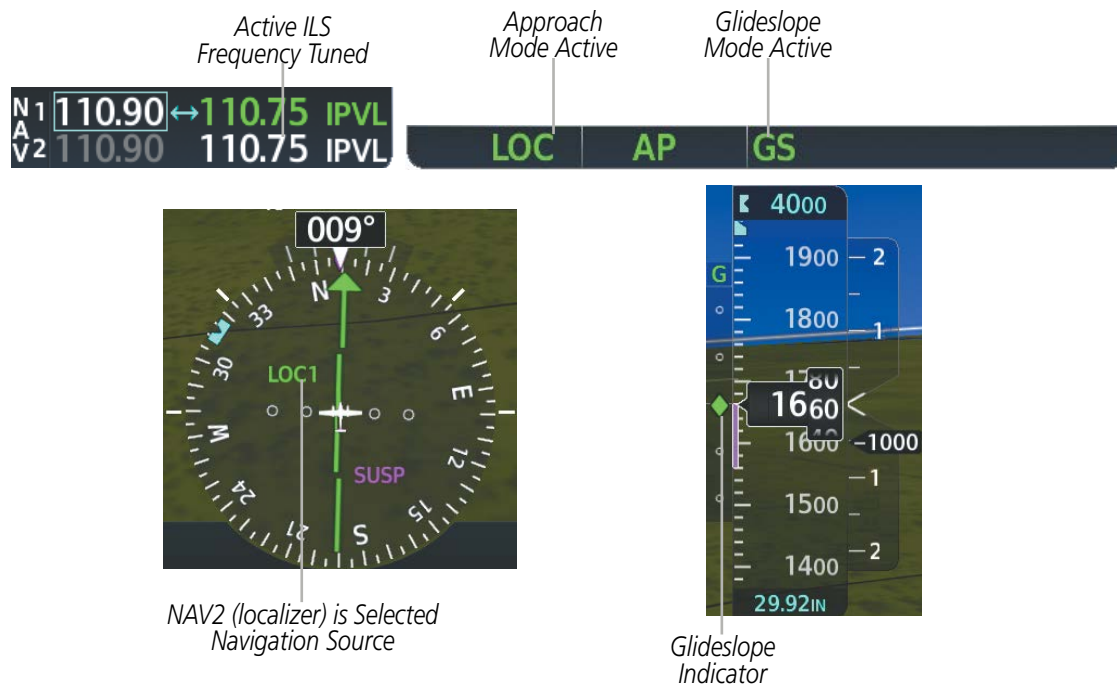


Figure 7-24 Glideslope Mode

Once the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

- Approach Mode is active and a Vectors-To-Final is activated
- Approach Mode is active and Navigation source is manually switched
- During a LOC/ILS approach FMS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from FMS to LOC

If the navigation source is VOR or localizer or OBS Mode has been enabled when using FMS, the Selected Course is controlled using the **CRS** Knob.

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach or Backcourse Mode. The autopilot guides the aircraft back to the Selected Course (or FMS flight plan) when the **CWS** Button is released.

INTERCEPTING AND FLYING A DME ARC

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that FMS Navigation Mode is engaged, FMS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on FMS. Thus, even if the APR key is pressed and LOC or VOR Approach Mode is armed prior to reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

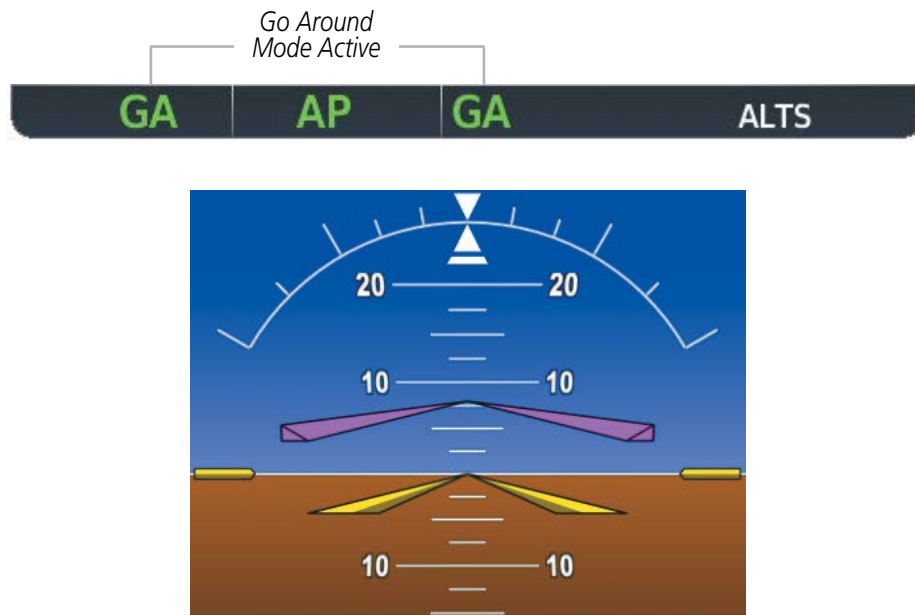
If the pilot decides to intercept the arc at a location other than the published IAF (i.e. ATC provides vectors to intercept the arc) and subsequently selects Heading Mode or Roll Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms FMS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects FMS Navigation Mode, the AFCS will no longer track the arc.

TAKEOFF (TO) AND GO AROUND (GA) MODES

In Takeoff and Go Around modes, the flight director commands a constant set pitch attitude. The **TO/GA** Switch is used to select both modes. The mode entered by the flight director depends on whether the aircraft is on the ground. Selected Altitude Capture Mode is automatically armed when the aircraft is at least 400 feet below the Selected altitude at the time Takeoff or Go Around Mode is selected.

Takeoff Mode provides an attitude reference during rotation and takeoff. This mode can be selected only while on the ground by pushing the **TO/GA** Switch. The flight director Command Bars assume a wings-level, pitch-up attitude. Autopilot engagement while Takeoff Mode is active is inhibited while the aircraft is on the ground.

Pressing the **TO/GA** Switch while in the air activates the flight director in a wings-level, pitch-up attitude, allowing the execution of a missed approach or a go around. Attempts to modify the aircraft attitude (i.e., with the **NOSE UP** and **NOSE DN** Keys or **CWS** Button) result in reversion to Pitch Hold Mode.



Command Bars Indicate Climb

Figure 7-25 Go Around Modes

7.4 AUTOPILOT OPERATION



NOTE: Refer to the POH for specific instructions regarding emergency procedures.

The Piper PA-44-180 Seminole autopilot operates the flight control surface servos to provide automatic flight control. The autopilot controls the aircraft pitch and roll attitudes following commands received from the flight director. Pitch autotrim provides trim commands to the pitch trim servo to relieve any sustained effort required by the pitch servo.

FLIGHT CONTROL

Pitch and roll commands are provided to the servos based on the active flight director modes. Servo motor control limits the maximum servo speed and torque. The servo gearboxes are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

PITCH AXIS AND TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during flight director maneuvers. Flight director pitch commands are rate- and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim servo. The pitch trim servo commands the motor to reduce the average pitch servo effort.

When the autopilot is not engaged, the pitch trim servo may be used to provide manual electric pitch trim (MEPT). This allows the aircraft to be trimmed using a control wheel switch rather than the trim wheel. Manual trim commands are generated only when both halves of the **MEPT** Switch are operated simultaneously. Trim speeds are scheduled with airspeed to provide more consistent response.

ROLL AXIS

The autopilot roll axis uses roll rate to stabilize aircraft roll attitude during flight director maneuvers. The flight director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

ENGAGEMENT

NOTE: Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the **CWS** Button to disengage the pitch and roll servos while the autopilot remains active.

When the **AP** Key is pressed, the autopilot and flight director (if not already active) are activated and the annunciator lights on the AFCS controller for the autopilot and flight director are illuminated. The flight director engages in Pitch and Roll Hold Modes when initially activated.



Figure 7-26 Autopilot Engaged

Autopilot status is displayed in the center of the AFCS Status Box. Engagement is indicated by green 'AP'.

CONTROL WHEEL STEERING

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** Button disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-flown. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.



Figure 7-27 CWS Annunciation

In most scenarios, releasing the **CWS** Button reengages the autopilot with a new reference. Refer to flight director mode descriptions for specific CWS behavior in each mode.

DISENGAGEMENT

The autopilot may be manually disengaged by pushing the **AP DISC**, **GA**, **MEPT** Switch, or the **AP** Key on the AFCS Control Unit. Manual disengagement is indicated by a five-second flashing yellow ‘AP’ annunciation and a three-second autopilot disconnect aural alert. The **AP DISC** or **MEPT** Switch may be used to cancel the aural alert.

Automatic autopilot disengagement is indicated by a flashing red and white ‘AP’ annunciation and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the **AP DISC** or **MEPT** Switch. Automatic autopilot disengagement occurs due to:

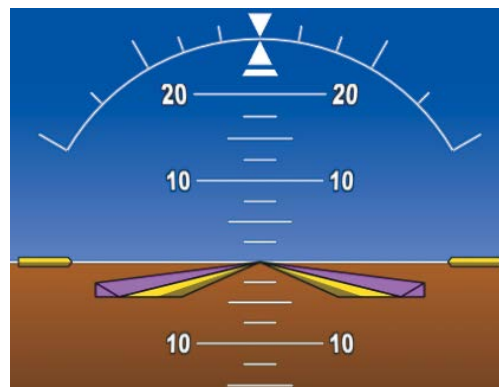
- System failure
- Invalid sensor data
- Roll Trim input
- Stall warning
- Inability to compute default flight director modes (FD also disengages automatically)



Figure 7-28 Automatic Autopilot Disengagement

LEVEL MODE

Level Mode is a coupled pitch and roll mode and is annunciated as both the vertical and lateral modes when active. Pressing the **LVL** Button (located on the instrument panel) engages the autopilot (if the autopilot is disengaged and the aircraft is within the autopilot engagement limitations) in level vertical and lateral modes. While Level Mode does not track altitude or heading, it will adjust the pitch angle to maintain zero vertical speed. When the **LVL** Button is pressed, all armed and active modes are cancelled and the autopilot and flight director revert to LVL mode for pitch and roll. While in level mode, all other modes are available by pressing the corresponding button.



Command Bars Indicate Level with the Horizon

Figure 7-29 Level Mode Annunciation

UNDERSPEED PROTECTION

Underspeed Protection is available when the optional Electronic Stability and Protection (ESP) system is installed and the autopilot is on. It is designed to discourage aircraft operation below minimum established airspeeds.

When aircraft airspeed decreases to 80 kts, a flashing yellow ‘MINSPD’ annunciation will appear above the airspeed indicator.

When the airspeed trend vector reaches a predetermined airspeed (specific to each flap setting), a single aural “AIRSPEED” will sound, alerting the pilot to the impending underspeed condition.

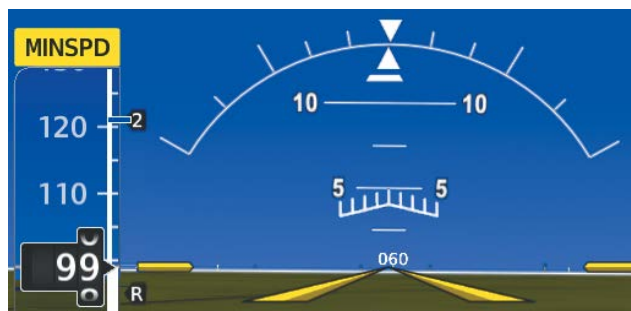


Figure 7-30 MINSPD Annunciation

If the aircraft continues to decelerate, Underspeed Protection becomes active. How Underspeed Protection functions depends on which vertical flight director mode is selected. For the purpose of this discussion, the vertical flight director modes can be divided into two categories: Those in which it is important to maintain altitude for as long as possible (altitude-critical modes), and those in which maintaining altitude is less crucial (non-altitude critical modes).

ALTITUDE-CRITICAL MODES (ALT, GS, GP, TO, GA, FLC)

When the aircraft decelerates to stall warning, the lateral and vertical flight director modes will change from active to armed, and the autopilot will provide input causing the aircraft to pitch down and the wings to level.



Figure 7-31 Lateral and Vertical Flight Director Modes Armed

An aural “AIRSPEED” alert will sound every five seconds and a red “USP ACTIVE” annunciation will appear to the right of the Vertical Speed Indicator. The pitch down force will continue until the aircraft reaches a pitch attitude at which IAS equals the IAS at which stall warning turns off, plus two knots.



Figure 7-32 Underspeed Protect Active Annunciation

When airspeed increases (as a result of adding power/thrust) to above the IAS at which stall warning turns off, plus two knots, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference and the vertical and lateral flight director modes will change from armed to active.

NON-ALTITUDE CRITICAL MODES (PIT, VS, VNAV, IAS)

When the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed, a red “USP ACTIVE” annunciation will appear to the right of the Vertical Speed Indicator. The vertical flight director mode will change from active to armed, and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed.



Figure 7-33 Vertical Flight Director Mode Armed

When airspeed increases (as a result of adding power/thrust) to an IAS above the minimum commandable autopilot airspeed, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference and the vertical flight director mode will change from armed to active.

7.5 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The annunciations in the following table (listed in order of increasing priority) can appear on the PFDs above the Airspeed and Attitude indicators. Only one annunciation may occur at a time, and messages are prioritized by criticality.

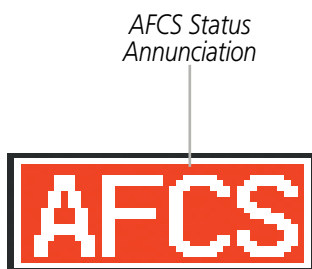


Figure 7-34 AFCS Status Annunciation

Alert Condition	Annunciation	Description
Elevator Mistrim Down		Pitch servo providing sustained force in the indicated direction
Elevator Mistrim Up		
Pitch Trim Failure (or stuck MEPT Switch)		If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move MEPT switches separately to unstick
Roll Failure		Roll axis control failure; AP inoperative
Pitch Failure		Pitch axis control failure; AP inoperative
System Failure		AP and MEPT are unavailable; FD may still be available
Preflight Test		Performing preflight system test; aural alert sounds at completion Do not press the AP DISC Switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.
		Preflight system test failed; aural alert sounds at failure

Table 7-6 AFCS Status Alerts

OVERSPEED PROTECTION

NOTE: Overspeed protection is not active in Altitude Hold, Glideslope or Glidepath modes.

While Pitch Hold, Vertical Speed, Flight Level Change, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Pitch commands are not changed until overspeed protection becomes active. Overspeed protection is provided in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding Vne.

When an autopilot overspeed condition occurs, the Airspeed Reference appears in a box above the Airspeed Indicator, flashing a yellow 'MAXSPD' annunciation. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.

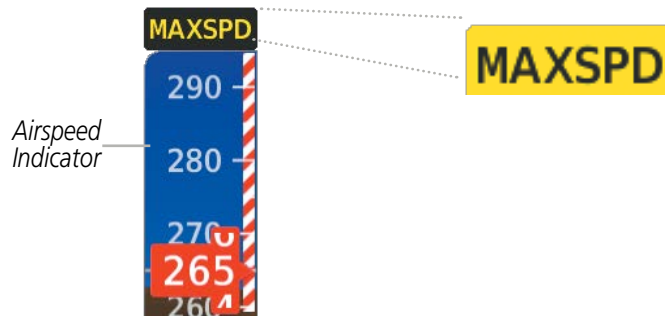


Figure 7-35 Overspeed Annunciation

7.6 ABNORMAL OPERATION

SUSPECTED AUTOPILOT MALFUNCTION



NOTE: Consult the aircraft documentation for the location of circuit breakers as well as specifics that may supplement or amplify this procedure.

If an autopilot failure or trim failure is suspected to have occurred, perform the following steps:

- 1) Firmly grasp the control wheel.
- 2) Press and hold the **AP DISC** Switch. The autopilot will disconnect and power is removed from the trim motor. Power is also removed from all primary servo motors and engaged solenoids. Note the visual and aural alerting indicating autopilot disconnect.
- 3) Retrim the aircraft as needed. Substantial trim adjustment may be needed.
- 4) Pull the appropriate circuit breaker(s) to electrically isolate the servo and solenoid components.
- 5) Release the **AP DISC** Switch.

OVERPOWERING AUTOPILOT SERVOS

In the context of this discussion, “overpowering” refers to any pressure or force applied to the pitch controls when the autopilot is engaged. A small amount of pressure or force on the pitch controls can cause the autopilot automatic trim to run to an out-of-trim condition. Therefore, any application of pressure or force to the controls should be avoided when the autopilot is engaged.

Overpowering the autopilot during flight will cause the autopilot’s automatic trim to run, resulting in an out-of-trim condition or cause the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the autopilot is disengaged.

The following steps should be added to the preflight check:

- 1) Check for proper autopilot operation and ensure the autopilot can be overpowered.
- 2) Note the forces required to overpower the autopilot servo clutches.

SECTION 8 ADDITIONAL FEATURES



NOTE: *With the availability of SafeTaxi®, ChartView, or FliteCharts®, it may be necessary to carry another source of charts on-board the aircraft.*

Additional features of the system include the following:

- SafeTaxi® diagrams
- FliteCharts® /Chartview electronic charts
- AOPA or AC-U-KWIK Airport Directory
- Wi-Fi connections
- SiriusXM Satellite Radio entertainment
- Scheduler
- Flight Data Logging
- Electronic Stability and Protection (ESP™)
- Connex®

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 700 airports in the United States. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

The optional ChartView and FliteCharts provide on-board electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information.

The AOPA and AC-U-KWIK Airport Directories offer detailed information for a selected airport, such as available services, hours of operation, and lodging options.

Wi-Fi setup allows for the transmission of data recorded by the Maintenance Logs feature as well as weather information while aircraft is on ground. The recording of this data is not visible to the pilot and requires no pilot interaction, other than setting up Wi-Fi connections where applicable.

The optional SiriusXM Satellite Radio entertainment audio feature of the GDL 69A Data Link Receiver handles more than 170 channels of music, news, and sports. SiriusXM Satellite Radio offers more entertainment choices and longer range coverage than commercial broadcast stations.

The Scheduler feature can be used to enter and display short term or long term reminder messages such as Switch fuel tanks, Change oil, or Altimeter-Transponder Check in the Messages Window on the PFD.

The Flight Data Logging feature automatically stores critical flight and engine data on an SD data card. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

The Electronic Stability and Protection (ESP™) system discourages aircraft operation outside the normal flight envelope..

Connex allows for setting up the installed optional Flight Stream device for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application.

8.1 SAFETAXI

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range. The maximum map ranges for enhanced detail are pilot configurable. When viewing at ranges close enough to show the airport detail, the map reveals taxiways with identifying letters/numbers, airport Hot Spots, and airport landmarks including ramps, buildings, control towers, and other prominent features. Resolution is greater at lower map ranges. When the MFD display is within the SafeTaxi ranges, the airplane symbol on the airport provides enhanced position awareness.

Designated Hot Spots are recognized at airports with many intersecting taxiways and runways, and/or complex ramp areas. Airport Hot Spots are outlined to caution pilots of areas on an airport surface where positional awareness confusion or runway incursions happen most often. Hot Spots are defined with a magenta circle or outline around the region of possible confusion.

Any map page that displays the navigation view can also show the SafeTaxi airport layout within the maximum configured range. The following is a list of pages where the SafeTaxi feature can be seen:

- Navigation Map Page
- Inset Map (PFD)
- Weather Datalink Page
- Airport Information Page
- Intersection Information Page
- NDB Information Page
- VOR Information Page
- User Waypoint Information Page
- Trip Planning Page
- Nearest Pages
- Active and Stored Flight Plan Pages

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the example shown, the aircraft is on taxiway Bravo inside the High Alert Intersection boundary on KSFO airport. Airport Hot Spots are outlined in magenta. When panning over the airport, features such as runway holding lines and taxiways are shown at the cursor.

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Figure 8-1 SafeTaxi Depiction on the Navigation Map Page

The **Detail** Softkey (declutter) label advances to Detail All, Detail 3, Detail 2 and Detail 1 each time the softkey is selected for easy recognition of decluttering level. Selecting the **Detail All** Softkey removes the taxiway markings and airport feature labels. Selecting the **Detail 3** Softkey removes VOR station ID, the VOR symbol, and intersection names if within the airport plan view. Selecting the **Detail 2** Softkey removes the airport runway layout, unless the airport in view is part of an active route structure. Selecting the **Detail 1** Softkey cycles back to the original map detail. Refer to Map Declutter Levels in the Flight Management Section.

8.2 CHARTS

Electronic charts that resemble the paper versions of AeroNav Services terminal procedures charts (FliteCharts) and Jeppesen terminal procedures charts (ChartView) can be displayed on the MFD.

When the databases for both chart types are purchased and loaded in the system, the desired charts brand, or source, can be selected for viewing. The active chart source for a particular procedure is shown on the information pane under Source.

Selecting Preferred Charts Source:

- 1) While viewing a chart press the **MENU** Softkey to display the 'Page Menu' options.
- 2) Turn the large **FMS** Knob to highlight the 'Chart Setup' menu option and press the **ENT** Key.
- 3) Turn the large **FMS** Knob to move to the 'Preferred Charts Source' option.
- 4) Turn the small **FMS** Knob to choose between the available options (FliteCharts, ChartView).

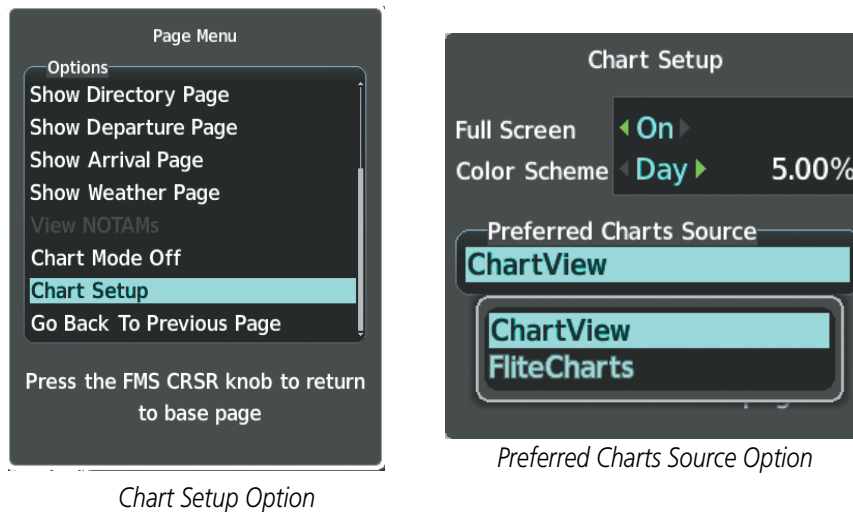


Figure 8-2 Preferred Charts Source

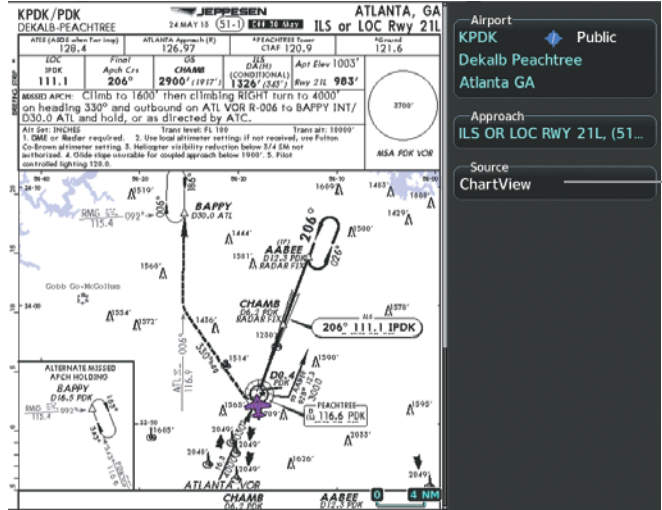


Figure 8-3 Chart Source

CHARTVIEW

ChartView resembles the paper version of Jeppesen terminal procedures charts. The charts are displayed in full color with high-resolution. The MFD depiction shows the aircraft position on the moving map in the planview of approach charts and on airport diagrams. Airport Hot Spots are outlined in magenta.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, the grey shading is for illustrative purposes only and will not appear on the published chart or MFD display. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart planview, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart planview, not to the off-scale area.

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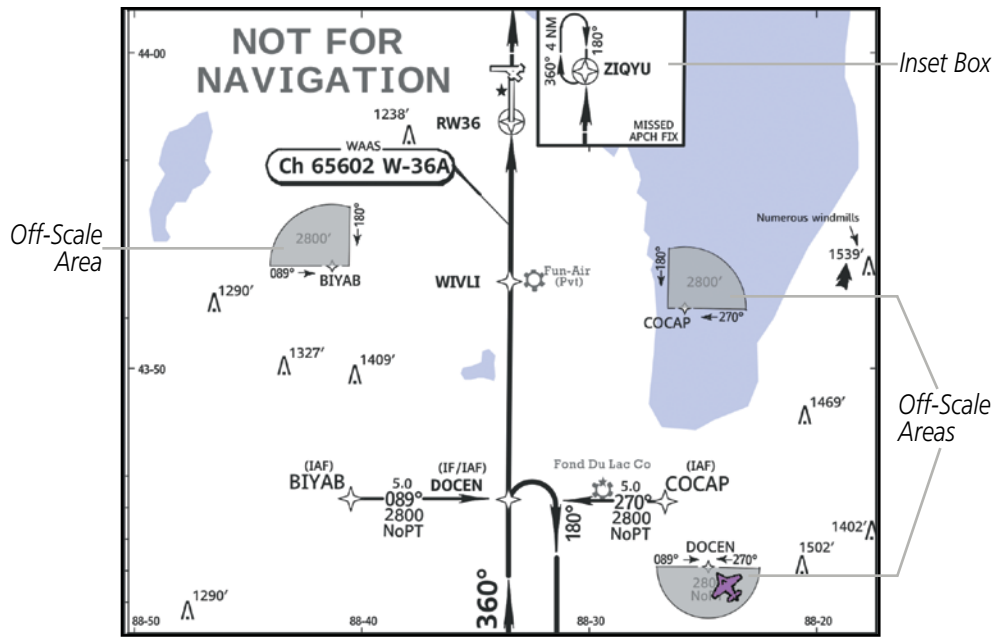


Figure 8-4 Sample Chart Indicating Off-Scale Areas



NOTE: Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.

The ChartView database subscription is available from Jeppesen, Inc. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams
- NOTAMs

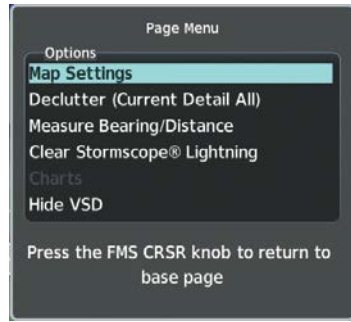
TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

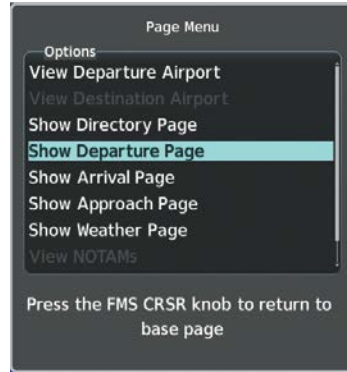
While viewing the 'Map-Navigation Map' Page, 'NRST-Nearest Airport' Page, or 'FPL-Active Flight Plan' Page, press the **Charts** Softkey.

Or:

- 1) Press the **MENU** Key to display the 'Page Menu.'
- 2) Turn the large **FMS** Knob to scroll through the 'Options' Menu to Charts.
- 3) Press the **ENT** Key to display the chart.



Navigation Map Page Options Menu



Waypoint Airport Information Page Options Menu

Figure 8-5 Option Menus

On the Waypoint Airport Information Page Options Menu, select the desired chart and press the **ENT** Key to display the chart.

When no terminal procedure chart is available, the banner Chart Not Available appears on the screen. The Chart Not Available banner does not refer to the FliteCharts subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.



Figure 8-6 Chart Not Available Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner Unable To Display Chart is then displayed.



Figure 8-7 Unable To Display Chart Banner

When a chart is not available by pressing the **Charts** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **Charts** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the 'WPT – Airport Information' page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

- 1) While viewing the 'Map-Navigation Map' Page, 'FPL-Active Flight Plan' Page, or 'NRST-Nearest Airports' Page, press the **Charts** Softkey. The airport diagram or approach chart is displayed on the 'WPT-Airport Information' Page.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the 'Approach' Box. (Press the **APR** Softkey if the 'Approach' Box is not currently shown).
- 4) Turn the small and large **FMS** Knob to enter the desired airport identifier.
- 5) Press the **ENT** Key to complete the airport selection.
- 6) Turn the large **FMS** Knob to select the 'Approach' Box.
- 7) Turn the small **FMS** Knob to show the approach chart selection choices.
- 8) Turn either **FMS** Knob to scroll through the available charts.
- 9) Press the **ENT** Key to complete the chart selection.

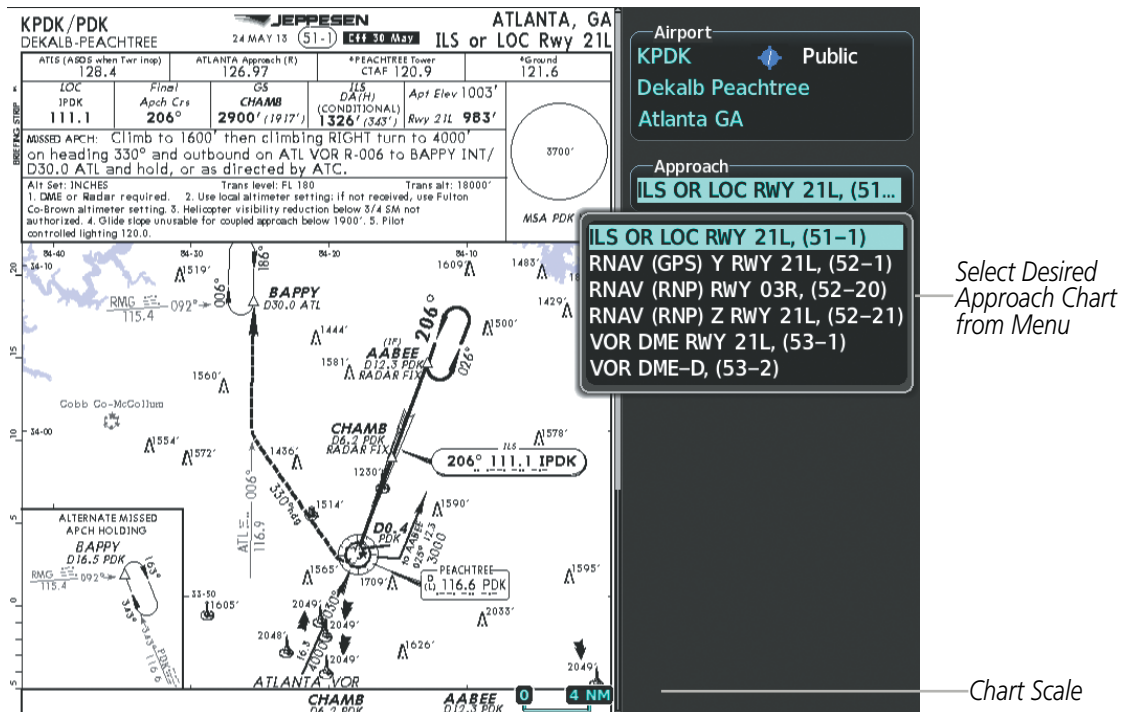


Figure 8-8 Approach Information Page, Chart Selection

While the Approaches Box is selected using the **FMS** Knob, the softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart page can be scrolled using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is shown on the chart only if the chart is to scale and the aircraft position is within the boundaries of the chart. The aircraft symbol is not displayed when the Aircraft Not Shown Icon appears. If the Chart Scale Box displays a banner NOT TO SCALE, the aircraft symbol is not shown. The Aircraft Not Shown Icon may appear at certain times, even if the chart is displayed to scale.

Pressing the **Chart** Softkey switches between the ChartView diagram and the associated map in the WPT page group. In the example shown, the **Chart** Softkey switches between the Gainesville, FL (KGNV) Airport Diagram and the navigation map on the 'WPT – Airport Information' page.

Pressing the **Info 1** or **Info 2** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **Info 1** or **Info 2** Softkey has no effect. The aircraft position is shown in magenta on the ChartView diagrams when the location of the aircraft is within the chart boundaries.

Another source for additional airport information is from the Info Box above the chart for certain airports. This information source is not related to the **Info 1** or **Info 2** Softkey. When the Info Box is selected using the **FMS** Knob, the softkeys are blank. The Charlotte, NC airport has five additional charts offering information; the Airport Diagram, Take-off Minimums, Class B Airspace, Airline Parking Gate Coordinates, and Airline Parking Gate Location. (The numbers in parentheses after the chart name are Jeppesen designators.)

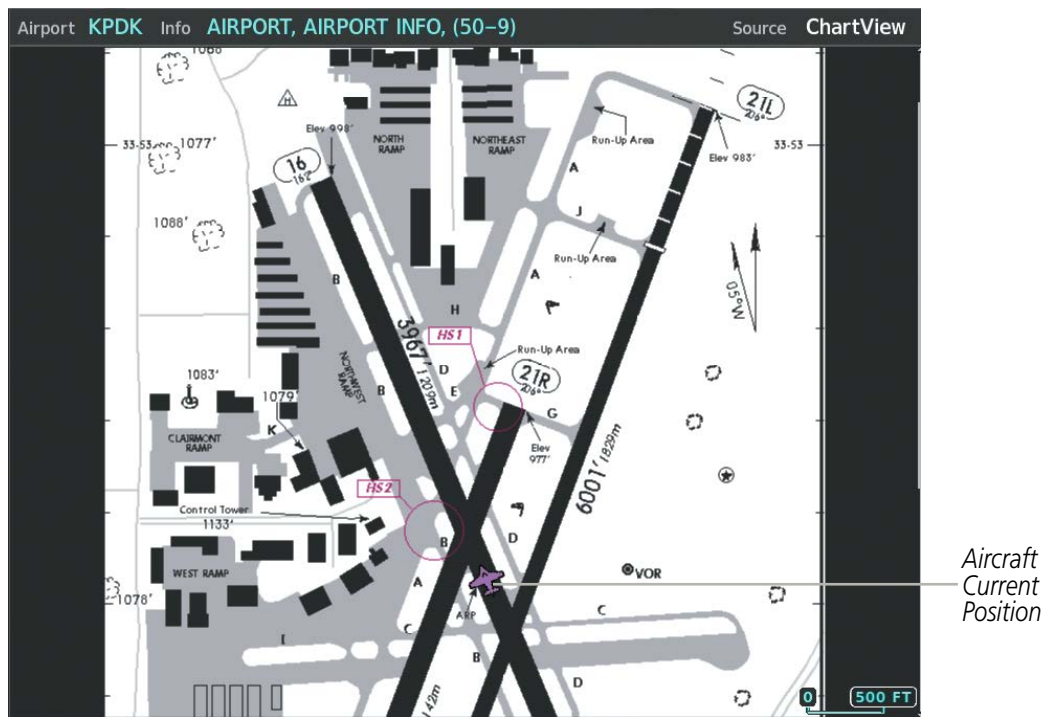


Figure 8-9 Airport Information Page, Info View, Full Screen Width

In the example shown in following figure, the Class B Chart is selected. Pressing the **ENT** Key displays the Charlotte Class B Airspace Chart.

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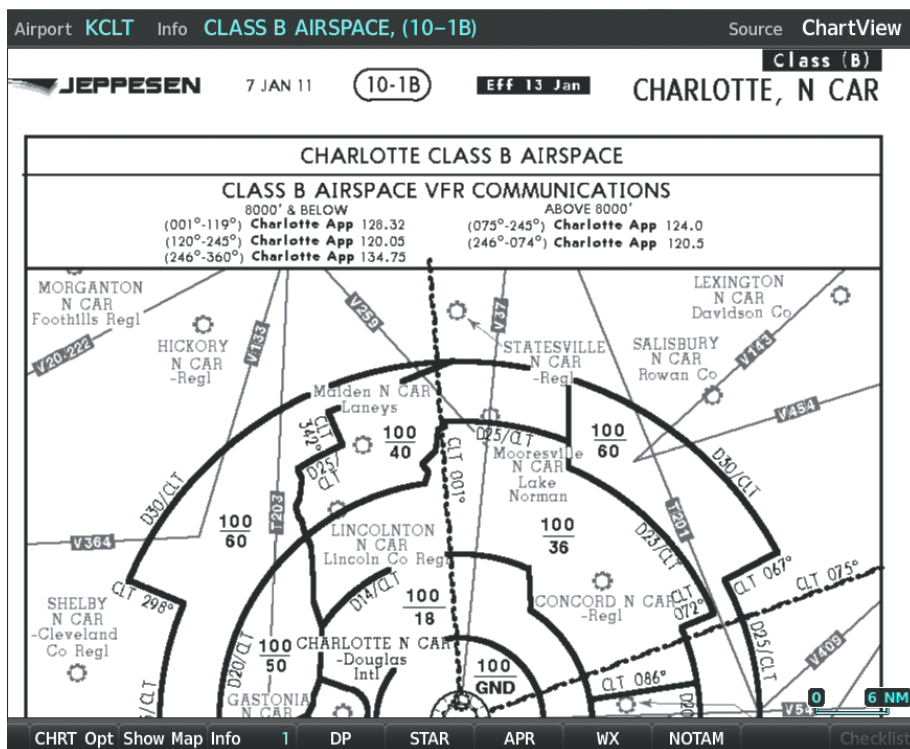


Figure 8-10 Airport Information Page, Class B Chart Selected from Info View

- Pressing the **DP** Softkey displays the Departure Procedure Chart if available.
- Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.
- Pressing the **APR** Softkey displays the approach chart for the airport if available.
- Pressing the **WX** Softkey shows the airport weather frequency information, and includes weather data such as METAR and TAF from the SiriusXM Data Link Receiver, when available. Weather information is available only when a SiriusXM Data Link Receiver is installed and the SiriusXM Weather subscription is current.
- Recent NOTAMS applicable to the current ChartView cycle are included in the ChartView database. Pressing the **NOTAM** Softkey shows the local NOTAM information for selected airports, when available. When NOTAMS are not available, the **NOTAM** Softkey label appears subdued and is disabled. The **NOTAM** Softkey may appear on the Airport Information Page and all of the chart page selections. Pressing the **NOTAM** Softkey again removes the NOTAMS information.



NOTE: A subdued softkey label indicates the function is disabled.



NOTE: Only NOTAMS applicable to specific information conveyed on the displayed Jeppesen chart are available when the NOTAM Softkey is pressed. There may be other NOTAMS available pertaining to the flight that may not be displayed. Contact Jeppesen for more information regarding Jeppesen database published NOTAMS.

CHART OPTIONS

Pressing the **CHRT Opt** Softkey displays the next level of softkeys, the chart options level.
 Pressing the **All** Softkey shows the complete approach chart on the screen.

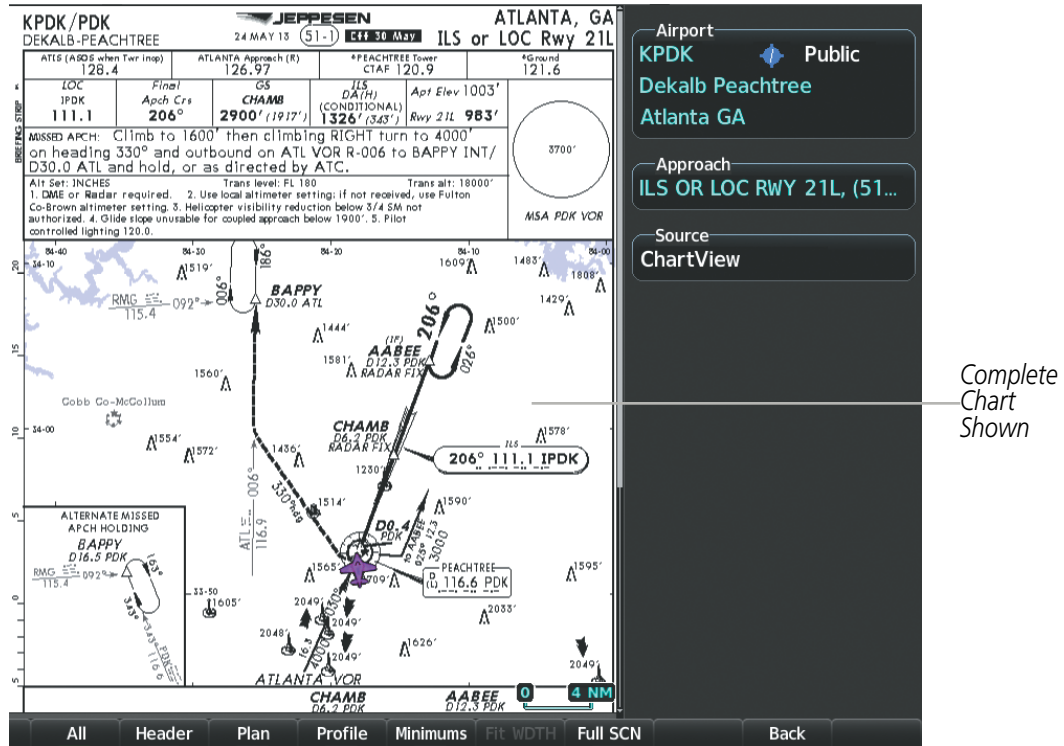


Figure 8-11 Approach Information Page, All View

- Pressing the **Header** Softkey shows the header view (approach chart briefing strip) on the screen.
- Pressing the **Plan** Softkey shows the approach chart two dimensional plan view.
- Pressing the **Profile** Softkey displays the approach chart descent profile strip.
- Pressing the **Minimums** Softkey displays the minimum descent altitude/visibility strip at the bottom of the approach chart.
- If the chart scale has been adjusted to view a small area of the chart, pressing the **Fit WDTN** Softkey changes the chart size to fit the available screen width.
- Pressing the **Full SCN** Softkey alternates between removing and replacing the data window to the right.

Selecting Additional Information:

- 1) While viewing the Airport Taxi Diagram, press the **Full SCN** Softkey to display the information windows (Airport, Info).
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the Airport, Info, Runways, or Frequencies Box.
- 4) Turn the small **FMS** Knob to select the Info Box choices. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.
- 5) Press the **FMS** Knob again to deactivate the cursor.

Pressing the **Back** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys. The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

- 1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.
- 2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.
- 3) Turn the large **FMS** Knob to move between the 'Full Screen' and 'Color Scheme' Options.
- 4) Turn the small **FMS** Knob to choose between the 'On' and 'Off' 'Full Screen' Options.

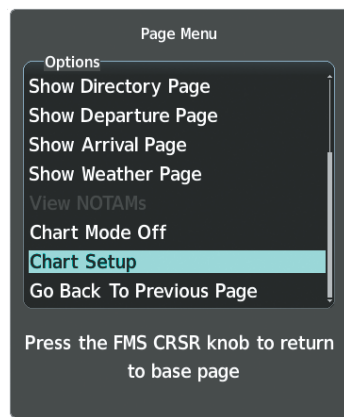
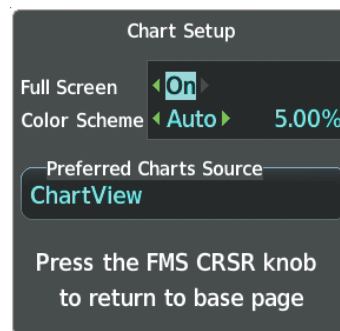


Chart Setup Option



Full Screen On/Off Selection

Figure 8-12 Page Menus

DAY/NIGHT VIEW

ChartView can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the Chart Setup Box is selected the MFD softkeys are blank.

Selecting Day, Night, or Automatic View:

- 1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.
- 2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.

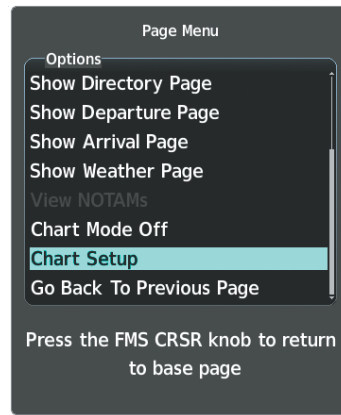


Figure 8-13 Page Menu Chart Setup

- 3) Turn the large **FMS** Knob to move to the 'Color Scheme' Option.
- 4) Turn the small **FMS** Knob to choose between 'Day', 'Auto', and 'Night' Options.
- 5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

- 6) Press the **FMS** Knob when finished to remove the 'Chart Setup' Menu.

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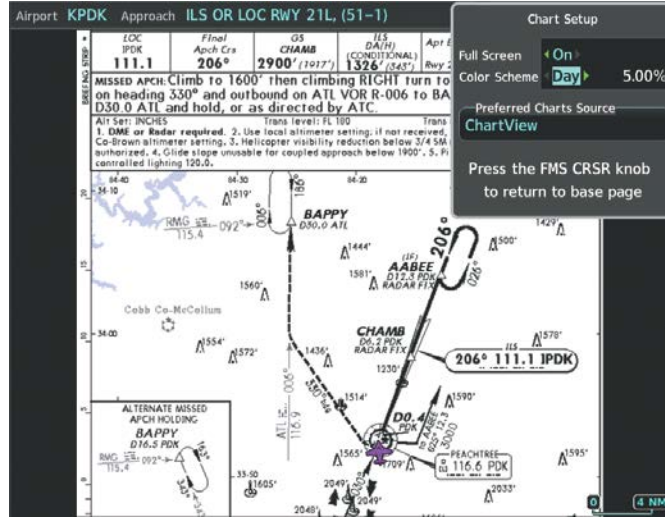


Figure 8-14 Arrival Information Page, Day View



Figure 8-15 Arrival Information Page, Night View

FLITECHARTS

FliteCharts resemble the paper version of AeroNav Services terminal procedures charts. The charts are displayed with high-resolution and in color for applicable charts.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Not all charts are geo-referenced. These charts will display an Aircraft Not Shown Icon in the lower right corner of the MFD.



Figure 8-16 Aircraft Not Shown Icon

An aircraft symbol may be displayed within an off-scale area depicted on some charts. Off-scale areas are indicated by the grey shading. Note, these areas are not shaded on the published chart. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart planview, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart planview, not to the off-scale area.

The FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams

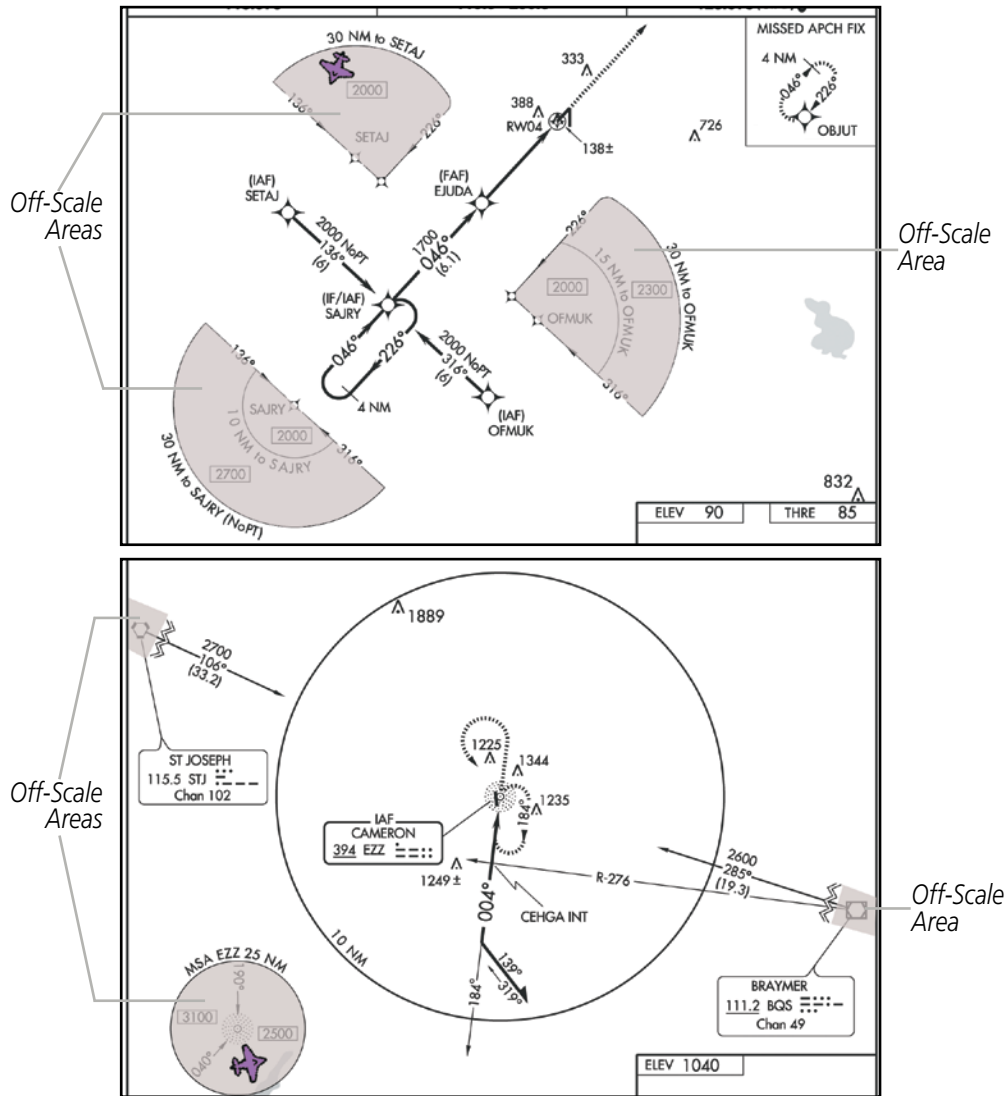


Figure 8-17 Sample Chart Indicating Off-Scale Areas



NOTE: Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.

FLITECHARTS SOFTKEYS

FliteCharts functions are displayed on three levels of softkeys. While on the Navigation Map Page, Nearest Airports Page, or Flight Plan Page, pressing the **Charts** Softkey displays the available terminal chart and advances to the chart selection level of softkeys: **CHRT Opt**, **Chart**, **Info**, **DP**, **STAR**, **APR**, **WX**, and **Go Back**. The chart selection softkeys appear on the Airport Information Page.

Pressing the **Go Back** Softkey reverts to the top level softkeys and previous page.

Pressing the **CHRT Opt** Softkey displays the available terminal chart and advances to the next level of softkeys: **All**, **Fit WDTN**, **Full SCN**, and **Back**.

While viewing the **CHRT Opt** Softkeys, after 45 seconds of softkey inactivity, the system reverts to the chart selection softkeys.

NOTAMs are not available with FliteCharts. The NOTAM Softkey label appears subdued and is disabled.

TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

While viewing the 'Map-Navigation Map' Page, 'NRST-Nearest Airport' Page, or 'FPL-Active Flight Plan' Page, press the **Charts** Softkey.

Or:

- 1) Press the **MENU** Key to display the 'Page Menu.'
- 2) Turn the large **FMS** Knob to scroll through the 'Options' Menu to 'Charts.'
- 3) Press the **ENT** Key to display the chart.

On the Waypoint Airport Information Page Options Menu, select the desired chart and press the **ENT** Key to display the chart.

When no terminal procedure chart is available, the banner No Available Charts appears on the screen. The No Available Charts banner does not refer to the FliteCharts subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.



Figure 8-18 No Available Charts Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner Unable To Display Chart is then displayed.



Figure 8-19 Unable To Display Chart Banner

When a chart is not available by pressing the **Charts** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Flight Plan Pages.

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If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **Charts** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the 'WPT – Airport Information' page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

- 1) While viewing the 'Map-Navigation Map' Page, 'FPL-Active Flight Plan' Page, or 'NRST-Nearest Airports' Page, press the **Charts** Softkey. The airport diagram or approach chart is displayed on the 'WPT-Airport Information' Page.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the 'Approach' Box. (Press the **APR** Softkey if the Approach Box is not currently shown).
- 4) Turn the small and large **FMS** Knob to enter the desired airport identifier.
- 5) Press the **ENT** Key to complete the airport selection.
- 6) Turn the large **FMS** Knob to select the 'Approach' Box.
- 7) Turn the small **FMS** Knob to show the approach chart selection choices.
- 8) Turn either **FMS** Knob to scroll through the available charts.
- 9) Press the **ENT** Key to complete the chart selection.

While the Approach Box is selected using the **FMS** Knob, the softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart can be panned using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is not shown on FliteCharts. The Chart Scale Box displays a banner NOT TO SCALE, and the Aircraft Not Shown Icon is displayed in the lower right corner of the screen.

Pressing the **Chart** Softkey switches between the FliteCharts diagram and the associated map in the WPT page group. In the example shown, the **Chart** Softkey switches between the Gainesville, FL (KGNV) Airport Diagram and the navigation map on the 'WPT – Airport Information' page.

Pressing the **Info 1** or **Info 2** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **Info 1** or **Info 2** Softkey has no effect.

Another source for additional airport information is from the Info Box above the chart or to the right of the chart for certain airports. This information source is not related to the **Info 1** or **Info 2** Softkey. When the Info Box is selected using the **FMS** Knob, the softkeys are blank.

Pressing the **ENT** Key displays the IFR Alternate Minimums Chart.

Pressing the **DP** Softkey displays the Departure Procedure Chart if available.

Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.

Pressing the **APR** Softkey displays the approach chart for the airport if available.

Pressing the **WX** Softkey shows the airport weather frequency information, when available, and includes weather data if a data link weather receiver is installed.

Selecting Additional Information:

- 1) While viewing the Airport Taxi Diagram, press the **WX** Softkey to display the information windows.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Info' Box.
- 4) Turn the small **FMS** Knob to select the 'Info' Box choices. When the 'Info' Box is selected the softkeys are blank. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.
- 5) Press the **FMS** Knob again to deactivate the cursor.

Pressing the **Go Back** Softkey reverts to the previous page (Navigation Map Page or Flight Plan Page).

CHART OPTIONS

Pressing the **CHRT Opt** Softkey displays the next level of softkeys, the chart options level.

Pressing the **All** Softkey shows the complete chart on the screen.

Pressing the **Fit WIDTH** Softkey fits the width of the chart in the display viewing area. In the example shown, the chart at close range is replaced with the full width chart.

Pressing the **Full SCN** Softkey alternates between removing and replacing the data window to the right.

Pressing the **Back** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys.

The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

- 1) While viewing a terminal chart press the **MENU** Key to display the Page Menu Options.
- 2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.
- 3) Turn the large **FMS** Knob to move between the 'Full Screen' and 'Color Scheme' Options.
- 4) Turn the small **FMS** Knob to choose between the 'On' and 'Off' Full Screen Options.

DAY/NIGHT VIEW

FliteCharts can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the Chart Setup Box is selected the MFD softkeys are blank.

Selecting Day, Night, or Automatic View:

- 1) While viewing a terminal chart press the **MENU** Key to display the Page Menu 'Options.'
- 2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.
- 3) Turn the large **FMS** Knob to move to the 'Color Scheme' Option.
- 4) Turn the small **FMS** Knob to choose between 'Day', 'Auto', and 'Night' Options.
- 5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

- 6) Press the **FMS** Knob when finished to remove the 'Chart Setup' Menu.

IFR/VFR CHARTS

IFR/VFR charts resemble the paper version and are displayed with high-resolution and in color for applicable charts.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Not all charts are geo-referenced. IFR/VFR charts may be viewed by selecting the 'Map - IFR/VFR Charts' Page.

Selecting IFR Low, IFR High, VFR Charts:

Select the 'Map - IFR/VFR Charts' Page.

- 1) Press the **VFR**, **IFR Low**, or **IFR High** Softkey to display the desired chart.

Or:

- 1) Press the **MENU** Key to display the 'Page Menu.'
- 2) Select 'Display VFR', 'Display IFR Low' or 'Display IFR High' to display the desired chart.
- 3) Press the **ENT** Key.

8.3 AIRPORT DIRECTORY

The Aircraft Owners and Pilots Association (AOPA) and optional AC-U-KWIK Airport Directory databases offer detailed information regarding services, hours of operation, lodging options, and more. This information is viewed on the Airport Information Page by selecting the **Info** Softkey until **Info 2** is displayed.

Both Airport Directories are available for downloading at flygarmin.com. However, copy only one of the databases to the Supplemental Data Card. The system cannot recognize both databases simultaneously.

Selecting the Airport Directory Page:

- 1) Turn the large **FMS** Knob to select the 'WPT' page group.
- 2) Turn the small **FMS** Knob to select the Airport Information Page. Initially, information for the airport closest to the aircraft's present position is displayed.
- 3) If necessary, select the Info softkey until **Info 2** is displayed.



Figure 8-20 AOPA Information on the Airport Information Page

Airport Directory information appears in blue and yellow text. The Effective date appears in blue when data is current and in yellow when the current date is before the effective date. The Expires date appears in blue when data is current and in yellow when expired. Not Available appears in blue in the Region field if Airport Directory data is not available on the database card. An expired Airport Directory database is not disabled and will continue to function indefinitely.

8.4 DATABASE CYCLE NUMBER AND REVISIONS

CYCLE NUMBER AND REVISION

Databases that may be available include FliteCharts, Obstacle, Terrain, IFR/VFR, Navigation, ChartView, SafeTaxi, Airport Directory. Data is revised and expiration dates vary. Data is still viewable during a period that extends from the cycle expiration date to the disables date. When turning on the system, the Power-up Page displays the current status of the databases. As an example, see the table below for the various FliteCharts Power-up Page displays and the definition of each. The expiration date and disables date varies for each database.





Example Power-up Page Display Text	
	FliteCharts Data: N/A
	FliteCharts Data: Expires DD-MMM-YYYY
	FliteCharts Data: Disables DD-MMM-YYYY
	FliteCharts Data: Disabled

Table 8-1 Database Power-up Page Annunciations

White text, such as ‘FliteCharts Data Expires’ plus a date, indicates the chart database is current. Yellow text, such as ‘Chart data is out of date!’ or ‘FliteCharts Data: Disabled’”, indicates charts are no longer viewable and have expired.

Database time critical information can also be found on the ‘Aux - System Status’ page. The database Region, Cycle number, Effective, Expires, and Disables dates of the subscription appear in either blue or yellow text. Dates shown in blue are current data. Dates shown in yellow indicate the data is not within the current subscription period.



NOTE: A subdued softkey label indicates the function is disabled.

Select the **MFD1 DB** Softkey to place the cursor in the Database window. Scroll through the listed information by turning the **FMS** Knob or pressing the **ENT** Key until the applicable database information is shown.

Database cycle numbers are in a format such as YYTI or YYII, which are deciphered as follows:

YYTI

YY – Indicates the last two digits of the year (ex. 18 represents 2018)

T – Indicates the database type (ex. S is for SafeTaxi, D is for Airport Directory)

I – Indicates the numerical issue of the database for the year (ex. 5 is the fifth issue of the year)

YYII

YY – Indicates the last two digits of the year (ex. 18 represents 2018)

II – Indicates the numerical issue of the database for the year (ex. 05 is the fifth issue of the year)

Refer to Updating Garmin Databases in Appendix for instructions on revising databases.

Example Power-up Page Display Text	Database Cycle Number Format	Revision Cycle
Navigation	YYII	28 days
Basemap Land	YYMI	Not Applicable
Terrain	YYTI	Not Applicable
Obstacle	YYBI	56 days
SafeTaxi	YYSI	56 days
Airport Directory	YYDI	56 days
FliteCharts	YYII	28 days
ChartView	YYII	14 days
IFR/VFR Charts	YYII	28 days

Table 8-2 Database Cycle Number and Revision

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- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
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8.5 WIFI CONNECTIONS

The optional GDL 59 Data Link provides a high speed IEEE 802.11g WiFi data link between the aircraft and a ground computer network while the aircraft is on the ground and located within range of the network.

The system is capable of WEP64, WEP128, WPA-PSK, and WPA2-PSK encryption formats. WPA-Enterprise and WPA2-Enterprise are not supported. Connections that require web proxies, captive portals, or other elements that require user credentials, including a user name and password or a redemption or access code; or require action such as accepting a user agreement, are not supported.

Control and monitoring of Wi-Fi functions are accomplished through the 'Aux-Maintenance Wi-Fi Setup' Page.

Viewing the WiFi Setup Page:

- 1) Turn the large **FMS** Knob on the MFD to select the Aux page group.
- 2) Turn the small **FMS** Knob to select the 'Aux-Maintenance WiFi Setup' Page.

Setting up a new WiFi connection:

- 1) Select the **Avail** Softkey on the MFD. A list of available networks will be displayed in the Available Networks window. Signal strength is shown for each network, as well as security requirements and whether the network has been saved in the system's memory.



Figure 8-21 Available Wi-Fi Networks

- 2) If necessary, select the **Rescan** Softkey to have the system scan again for available networks.
- Or:
- a) Press the **MENU** Key to display the Page Menu.
 - b) Turn either **FMS** Knob to place the cursor on 'Rescan Available Networks'.
 - c) Press the **ENT** Key.

- 3) Press the **FMS** Knob to place the cursor in the list of networks.
- 4) Turn either **FMS** Knob to select the desired network.
- 5) Select the **Connect** Softkey.
 - Or:**
 - a) Press the **MENU** Key to display the Page Menu.
 - b) Turn either **FMS** Knob to place the cursor on 'Connect to Selected Network'.
 - c) Press the **ENT** Key.
- 6) If the network is secured, a window will be displayed in order to enter the necessary passcode. Use the **FMS** Knobs to enter the desired alpha numeric characters. Select the **CapsLock** Softkey to enter upper case letters. If there is no security associated with the network, proceed to step 9.
- 7) Press the **ENT** Key. 'OK' will be highlighted.
- 8) Press the **ENT** Key again.
- 9) The Save Settings window is now displayed with the cursor highlighting 'Save Connection'.
- 10) The selected network can be saved to system memory to make re-connection easier at a later time.

Connecting the selected network without saving:

- a) Turn the large FMS Knob to move the cursor to highlight 'Connect'.
- b) Press the **ENT** Key.

Saving and connect the selected network:

- a) Press the **ENT** Key. A checkmark is placed in the checkbox and the cursor moves to the airport field.
- b) Using the **FMS** Knobs, enter an airport identifier to be associated with the saved network. This aids in identifying the network later in the event of duplicate network names.
- c) Press the **ENT** Key. The cursor moves to 'Connect'.
- d) Press the **ENT** Key again to connect to the selected network.

Editing a saved network:

- 1) While viewing list of saved networks, press the **FMS** Knob to activate the cursor.
- 2) Turn either **FMS** Knob to highlight the network to be edited.
- 3) Pressing the **ENT** Key at this point will check or uncheck the Auto Connect checkbox. When a checkmark is present, the system will automatically connect to the network when within range.
- 4) Select the **Edit** Softkey. The cursor now appears in the Connection Settings window.
- 5) Turn the large **FMS** Knob to select the network attribute to be edited.
- 6) Turn the small **FMS** Knob to begin editing the field.
- 7) When the entry is complete, press the **ENT** Key.
- 8) Turn the large **FMS** Knob or press the **ENT** Key until 'Save' is highlighted.
- 9) Press the **ENT** Key.

Disconnecting a Wi-Fi network:

Select the **DISCNCT** Softkey.

Or:

- 1) Press the **MENU** Key to display the Page Menu.
- 2) Turn either **FMS** Knob to place the cursor on 'Disconnect From Network'.
- 3) Press the **ENT** Key.

Deleting a saved Wi-Fi network:

- 1) While viewing the list of saved networks, press the **FMS** Knob to activate the cursor.
- 2) Turn either **FMS** Knob to highlight the network to be deleted.
- 3) Select the **Delete** Softkey. The selected network is removed from the list.

8.6 SIRIUSXM RADIO ENTERTAINMENT



NOTE: Refer to the Hazard Avoidance Section for information about SiriusXM Weather products.

The optional SiriusXM Satellite Radio entertainment feature of the GDL 69A Data Link Receiver is available for the pilot's and passengers' enjoyment. The GDL 69A can receive SiriusXM Satellite Radio entertainment services at any altitude throughout the Continental U.S. Entertainment audio is available only on the GDL 69A Data Link Receiver, not the GDL 69.

SiriusXM Satellite Radio offers a variety of radio programming over long distances without having to constantly search for new stations. Based on signals from satellites, coverage far exceeds land-based transmissions. SiriusXM Satellite Radio services are subscription-based. For more information on specific service packages, visit www.siriusxm.com.

ACTIVATING SIRIUSXM SATELLITE RADIO SERVICES

The service is activated by providing SiriusXM Satellite Radio with either one or two coded IDs, depending on the equipment. Either the Audio Radio ID or the Data Radio ID, or both, must be provided to SiriusXM Satellite Radio to activate the entertainment subscription.

It is not required to activate both the entertainment and weather service subscriptions with the GDL 69A. Either or both services can be activated. SiriusXM Satellite Radio uses one or both of the coded IDs to send an activation signal that, when received by the GDL 69A, allows it to play entertainment programming.

These IDs are located:

- On the label on the back of the Data Link Receiver
- On the XM Information Page on the MFD
- On the XM Satellite Radio Activation Instructions included with the unit (available at www.garmin.com, P/N 190-00355-04)

Contact the installer if the Data Radio ID and the Audio Radio ID cannot be located.

Activating the SiriusXM Satellite Radio services:

- 1) Contact SiriusXM Satellite Radio. Follow the instructions provided by SiriusXM Satellite Radio services.
- 2) Select the Auxiliary Page Group.
- 3) Select the Aux - XM Radio page.
- 4) Select the **INFO** Softkey to display the XM Information Page.
- 5) Verify that the desired services are activated.
- 6) Select the **Lock** Softkey.
- 7) Turn the large **FMS** Knob to highlight YES.
- 8) To complete activation, press the **ENT** Key.



Figure 8-22 XM Information Page

If SiriusXM Weather services have not been activated, all the weather product boxes are blank on the XM Information Page and a yellow Activation Required message is displayed in the center of the Weather Data Link Page (Map Page Group). The Service Class refers to the groupings of weather products available for subscription.

USING SIRIUSXM RADIO

The XM Radio Page provides information and control of the audio entertainment features of the SiriusXM Satellite Radio.

Selecting the XM Radio Page:

- 1) Turn the large **FMS** Knob to select the Auxiliary Page Group.
- 2) Turn the small **FMS** Knob to select the displayed 'Aux - XM Information' Page.
- 3) Select the **Radio** Softkey to show the XM Radio Page where audio entertainment is controlled.

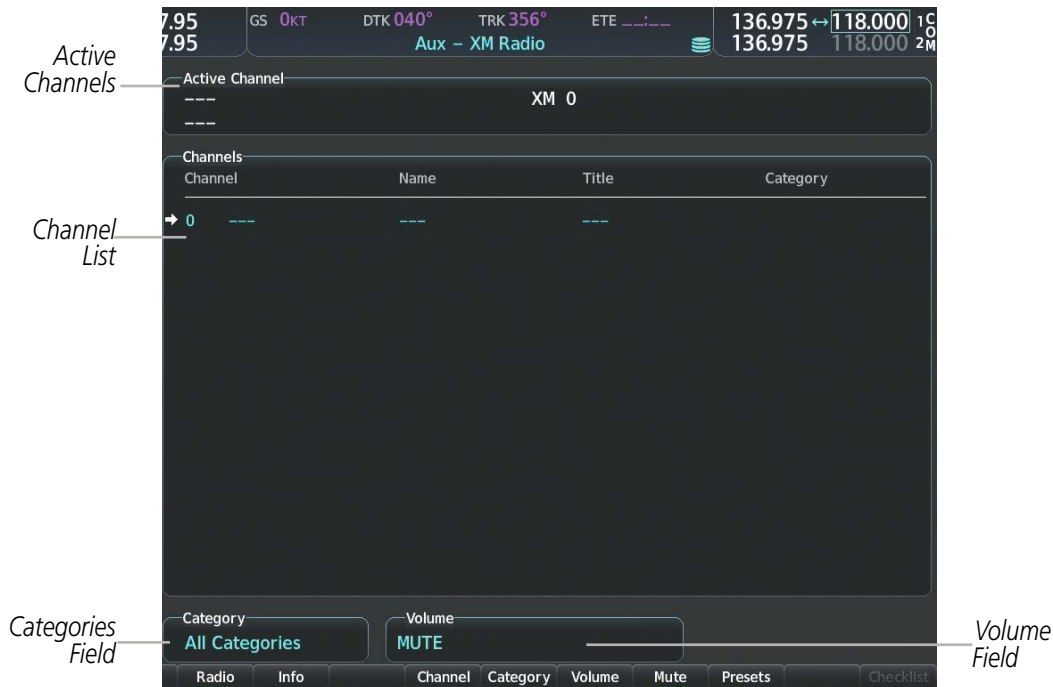


Figure 8-23 XM Radio Page

ACTIVE CHANNEL AND CHANNEL LIST

The Active Channel Box on the XM Radio Page displays the currently selected channel that the SiriusXM Radio is using.

The Channels List Box of the XM Radio Page shows a list of the available channels for the selected category. Channels can be stepped through one at a time or may be selected directly by channel number.

Selecting a channel from the channel list:

- 1) While on the XM Radio Page, select the **Channel** Softkey.
- 2) Select the **CH +** Softkey to go up through the list in the Channel Box, or move down the list with the **CH –** Softkey.

Or:

- 1) Press the **FMS** Knob to highlight the channel list and turn the large **FMS** Knob to scroll through the channels.
- 2) Press the **ENT** Key to activate the selected channel.

Selecting a channel directly:

- 1) While on the XM Radio Page, select the **Channel** Softkey.
- 2) Select the **Direct CH** Softkey. The channel number in the Active Channel Box is highlighted.
- 3) Select the numbered softkeys located on the bottom of the display to directly select the desired channel number.
- 4) Press the **ENT** Key to activate the selected channel.

CATEGORY

The Category Box of the XM Radio Page displays the currently selected category of audio. Categories of channels such as jazz, rock, or news can be selected to list the available channels for a type of music or other contents. One of the optional categories is Presets to view channels that have been programmed.

Selecting a category:

- 1) Select the **Category** Softkey on the XM Radio Page.
- 2) Select the **CAT +** and **CAT -** Softkeys to cycle through the categories.

Or:

Turn the small **FMS** Knob to display the Categories list. Highlight the desired category with the small **FMS** Knob and press the **ENT** Key. Selecting All Categories places all channels in the list.



Figure 8-24 Categories List

PRESETS

Up to 15 channels from any category can be assigned a preset number. The preset channels are selected by selecting the **Presets** and **More** Softkeys. Then the preset channel can be selected directly and added to the channel list for the Presets category.

Setting a preset channel number:

- 1) On the XM Radio Page, while listening to an Active Channel that is wanted for a preset, select the **Presets** Softkey to access the first five preset channels (**Preset 1 - Preset 5**).
- 2) Select the **More** Softkey to access the next five channels (**Preset 6 – Preset 10**), and again to access the last five channels (**Preset 11 – Preset 15**). Selecting the **More** Softkey repeatedly cycles through the preset channels.
- 3) Select any one of the (**Preset 1 - Preset 15**) softkeys to assign a number to the active channel.
- 4) Select the **Set** Softkey on the desired channel number to save the channel as a preset.



Figure 8-25 Accessing and Selecting SiriusXM Preset Channels

Selecting the **Back** Softkey, or 45 seconds of softkey inactivity, returns the system to the top level softkeys.

VOLUME

Radio volume is shown as a percentage. Volume level is controlled by selecting the **Volume** Softkey, which brings up the **Mute** Softkey and the volume increase and decrease softkeys.

Adjusting the volume:

- 1) With the XM Radio Page displayed, select the **Volume** Softkey.
- 2) Select the **VOL –** Softkey to reduce volume or select the **VOL +** Softkey to increase volume. (Once the **VOL** Softkey is selected, the volume can also be adjusted using the small **FMS** Knob.)

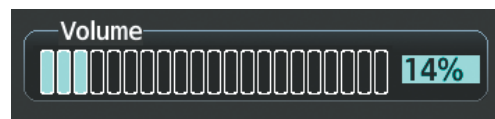


Figure 8-26 Volume Control

SiriusXM Radio volume may also be adjusted on each passenger headset.

Mute SiriusXM audio:

- 1) Select the XM Radio Page or XM Information Page.
- 2) Select the **Mute** Softkey to mute the audio. Select the **Mute** Softkey again to unmute the audio.

8.7 SCHEDULER

The Scheduler feature can be used to enter and display reminder messages (e.g., Change oil, Switch fuel tanks, or Altimeter-Transponder Check) in the Alerts Window on the PFD. Messages can be set to display based on a specific date and time (event), once the message timer reaches zero (one-time; default setting), or recurrently whenever the message timer reaches zero (periodic). Message timers set to periodic alerting automatically reset to the original timer value once the message is displayed. When power is cycled, all messages are retained until deleted, and message timer countdown is resumed.

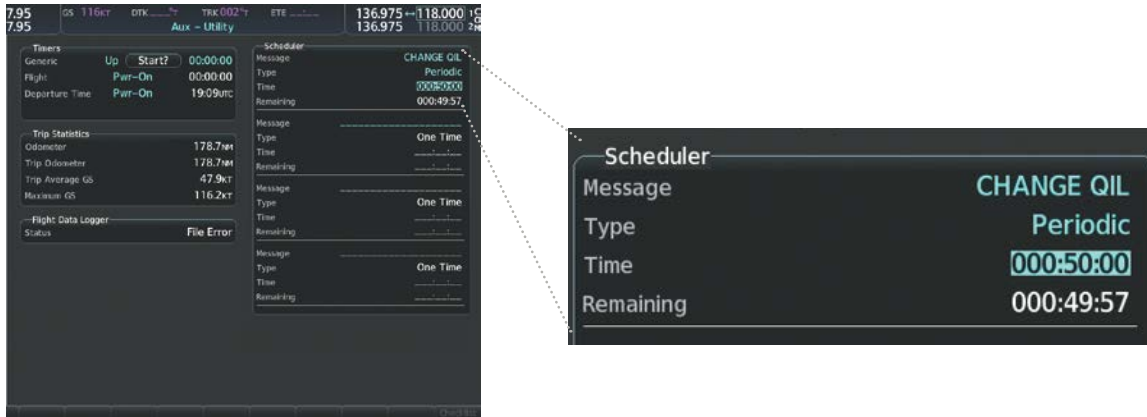


Figure 8-27 Scheduler (Utility Page)

Entering a scheduler message:

- 1) Select the 'Aux - Utility' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the first empty scheduler message naming field.
- 4) Use the **FMS** Knob to enter the message text to be displayed in the Messages Window and press the **ENT** Key.
- 5) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the field next to Type.
- 6) Turn the small **FMS** Knob to select the message type:
 - Event—Message issued at the specified date/time
 - One time—Message issued when the message timer reaches zero (default setting)
 - Periodic—Message issued each time the message timer reaches zero
- 7) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.
- 8) For periodic and one-time messages, use the **FMS** Knob to enter the timer value (HHH:MM:SS) from which to countdown and press the **ENT** Key.
- 9) For event-based messages:
 - a) Use the **FMS** Knob to enter the desired date (DD-MM-YY) and press the **ENT** Key.
 - b) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.
 - c) Use the **FMS** Knob to enter the desired time (HH:MM) and press the **ENT** Key.
- 10) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to enter the next message.

Deleting a scheduler message:

- 1) Select the 'Aux - Utility' Page.
- 2) Press the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the name field of the scheduler message to be deleted.
- 4) Press the **CLR** Key to clear the message text. If the **CLR** Key is pressed again, the message is restored.
- 5) Press the **ENT** Key while the message line is cleared to clear the message time.

Scheduler messages appear in the Messages Window on the PFD. When a scheduler message is waiting, the **Messages** Softkey label changes to Advisory. Pressing the **Messages** Softkey opens the Messages Window and acknowledges the scheduler message. The softkey label reverts to Messages when pressed. Pressing the **Messages** Softkey again removes the Messages Window from the display, and the scheduler message is deleted from the message queue.

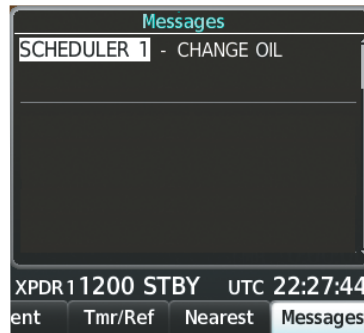


Figure 8-28 PFD Messages Window

8.8 FLIGHT DATA LOGGING



NOTE: *Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.*

The Flight Data Logging feature will automatically store critical flight and engine data on an SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

Data is written to the SD card once each second while the MFD is powered on. All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the system is powered on, provided an SD card has been inserted.

The status of the Flight Data Logging feature can be viewed on the ‘Aux-Utility’ Page. If no SD card has been inserted, “NO CARD” is displayed. When data is being written to the SD card, “LOGGING DATA” is displayed.

The .csv file may be viewed with Microsoft Excel® or other spreadsheet applications.

The following is a list of data parameters the system is capable of logging.

- Date
- Time
- GPS altitude (MSL)
- GPS altitude (WGS84 datum)
- Baro-Corrected altitude (feet)
- Baro Correction (in/Hg)
- Indicated airspeed (kts)
- Vertical speed (fpm)
- GPS vertical speed (fpm)
- OAT (degrees C)
- True airspeed (knots)
- Pitch Attitude Angle (degrees)
- Roll Attitude Angle (degrees)
- Lateral and Vertical G Force (g)
- Ground Speed (kts)
- Ground Track (degrees magnetic)
- Latitude (degrees; geodetic; +North)
- Longitude (degrees; geodetic; +East)
- Magnetic Heading (degrees)
- HSI source
- Selected course
- Com1/Com2 frequency
- Nav1/Nav2 frequency
- CDI deflection
- VDI/GP/GS deflection
- Wind Direction (degrees)
- Wind Speed (knots)
- Active Waypoint Identifier
- Distance to next waypoint (nm)
- Bearing to next waypoint (degrees)
- Magnetic variation (degrees)
- Autopilot On/Off
- AFCS roll/pitch modes
- AFCS roll/pitch commands
- GPS fix
- GPS horizontal alert limit
- GPS vertical alert limit
- SBAS GPS horizontal protection level
- SBAS GPS vertical protection level
- Fuel Qty (right & left)(gals)
- Fuel Flow (gph)
- Turbine RPM
- Oil Pressure (psi)
- Oil Temperature (deg. F)
- Torque

The file containing the recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.

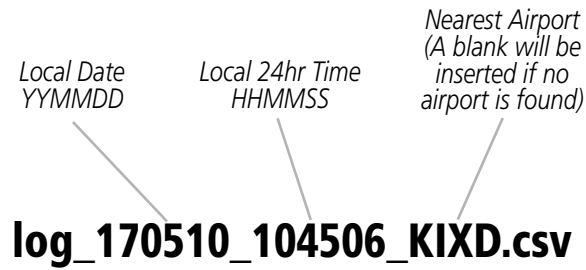


Figure 8-29 Log File Format

Data logging status can be monitored on the 'Aux-Utility' Page.

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8.9 ELECTRONIC STABILITY & PROTECTION (ESP™)

Electronic Stability and Protection (ESP™) is an optional feature that is intended to discourage the exceedance of attitude and established airspeed parameters. This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, Vmo, and/or Mmo) beyond the normal flight parameters. Enhanced stability for each condition is provided by applying a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude or high airspeed.

As the aircraft deviates further from the normal attitude and/or airspeed, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range. Except in the case of high airspeed, when maximum force is reached, force remains constant up to the maximum engagement limit. Above the maximum engagement limit, forces are no longer applied. There is no maximum engagement related to a high airspeed condition.

When ESP has been engaged for more than ten seconds (cumulative; not necessarily consecutive seconds) of a 20-second interval, the autopilot is automatically engaged with the flight director in Level Mode, bringing the aircraft into level flight. An aural “Engaging Autopilot” alert is played and the flight director mode annunciation will indicate ‘LVL’ for vertical and lateral modes.

The pilot can interrupt ESP by pressing and holding either the Control Wheel Steering (**CWS**) or Autopilot Disconnect (**AP DISC**) switch. Upon releasing the **CWS** or **AP DISC** switch, ESP force will again be applied, provided aircraft attitude and/or airspeed are within their respective engagement limits. ESP can also be overridden by overpowering the servo’s mechanical torque limit.

ESP can be enabled or disabled on the ‘Aux-System Setup 2’ Page on the MFD.

Enabling/Disabling ESP:

- 1) Turn the large **FMS** Knob to select the Aux Page Group.
- 2) Turn the small **FMS** Knob to select the System Setup Page.
- 3) If necessary, press the **SETUP 2** Softkey to display the ‘Aux-System Setup 2’ Page. If the ‘Aux-System Setup 2’ is already displayed, proceed to step 4.
- 4) Press the **FMS** Knob to activate the cursor.
- 5) Turn the large **FMS** Knob to place the cursor in the Stability & Protection field.
- 6) Turn the small **FMS** Knob to select ‘Enabled’ or ‘Disabled’.
- 7) Press the **FMS** Knob to remove the cursor.

ESP is automatically enabled on system power up.

ROLL ENGAGEMENT

Roll Limit Indicators are displayed on the roll scale at 45° right and left, indicating where ESP will engage (see following figure). As roll attitude exceeds 45°, ESP will engage and the on-side Roll Limit Indicator will move to 30°, as shown in the following figure. The Roll Limit Indicator is now showing where ESP will disengage as roll attitude decreases.

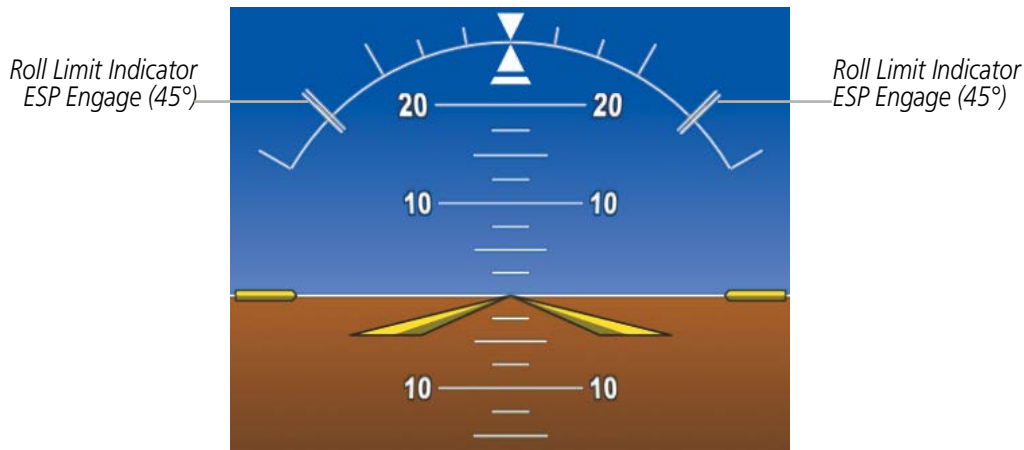


Figure 8-30 ESP Roll Engagement Indication (ESP NOT Engaged)

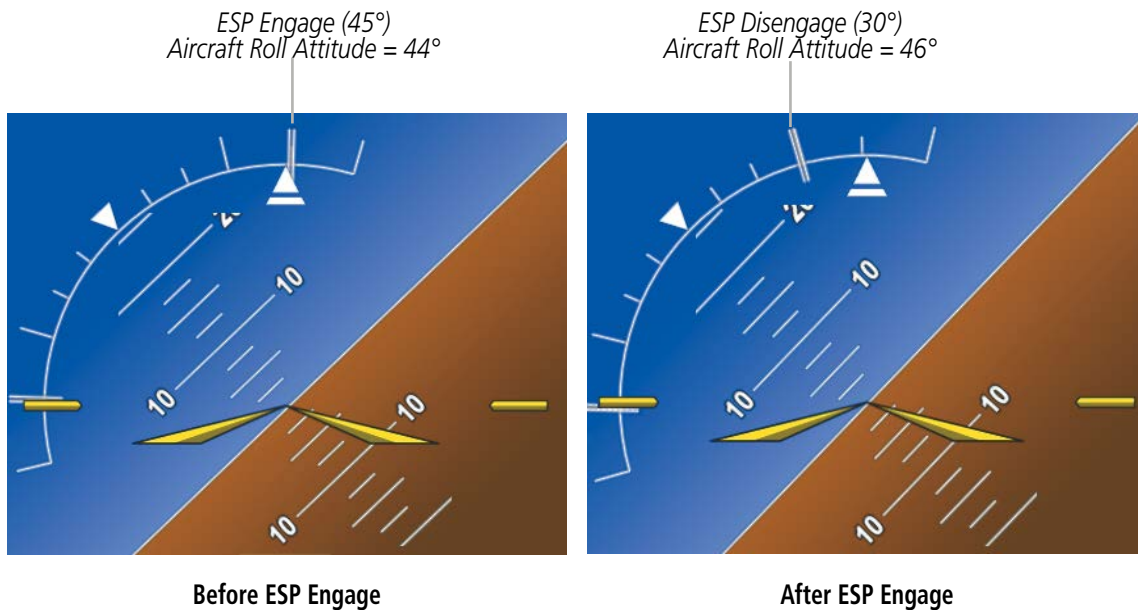


Figure 8-31 Roll Increasing to ESP Engagement

Once engaged, ESP force will be applied between 30° and 75°, as illustrated in the following figure. The force increases as roll attitude increases and decreases as roll attitude decreases. The applied force is intended to encourage pilot input that returns the airplane to a more normal roll attitude. As roll attitude decreases, ESP will disengage at 30°.

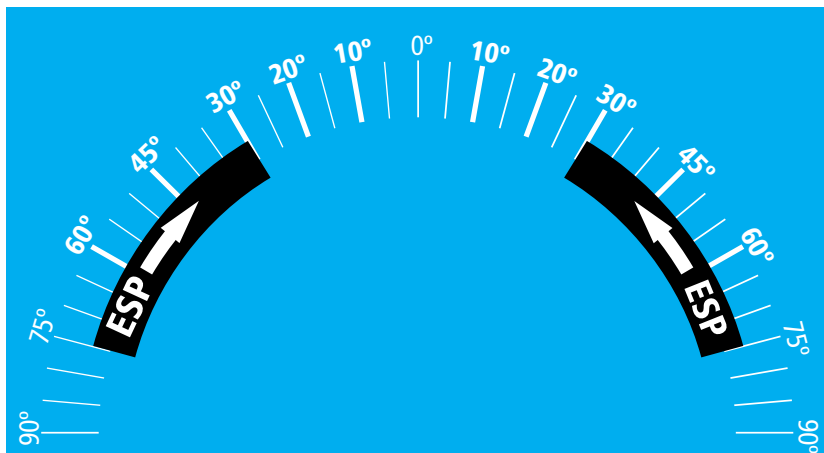


Figure 8-32 ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)

ESP is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75° (following figure).

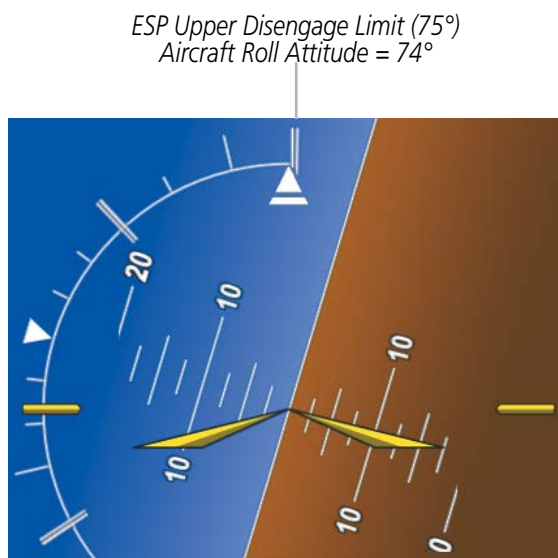


Figure 8-33 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP engages at 18° nose-up and 17° nose-down. Once ESP is engaged, it will apply opposing force between 15° and 50° nose-up and between 12° and 50° nose-down, as indicated in the following figure. Maximum opposing force is applied between 25° and 50° nose-up and between 22° and 50° nose-down.

The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft.

There are no indications marking the pitch ESP engage and disengage limits in these nose-up/nose-down conditions.

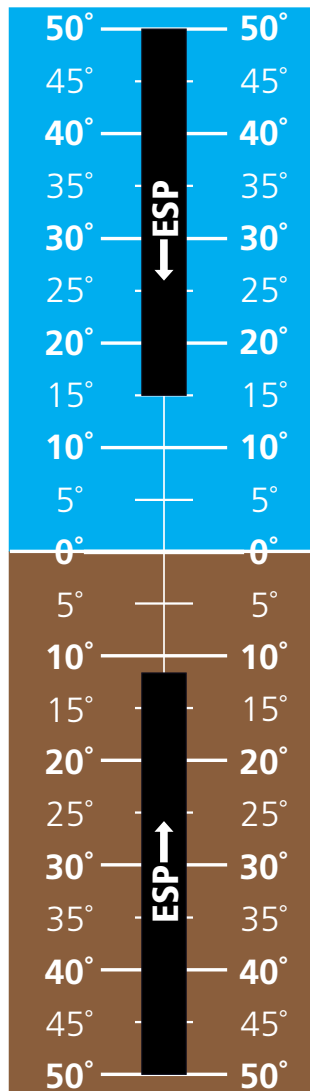


Figure 8-34 ESP Pitch Operating Range When Engaged
(Force Increases as Pitch Increases & Decreases as Pitch Decreases)

HIGH AIRSPEED PROTECTION

Exceeding V_{mo} or M_{mo} will result in ESP applying force to raise the nose of the aircraft. When the high airspeed condition is remedied, ESP force is no longer applied.

8.10 CONNEXT SETUP

The Connex Setup Page allows for setting up the installed optional Flight Stream device, or an optional GTX 345R transponder, for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application.

The mobile device must be ‘paired’ with the system in order to use the various functions. Pairing is accomplished by first placing the system in pairing mode by displaying the Connex Setup Page. The system is ‘discoverable’ whenever this page is displayed. The pairing operation is completed from the mobile device and the Garmin Pilot application. See the device Bluetooth pairing instructions and the connection instructions in the Garmin Pilot application.

Viewing the Connex Setup Page

- 1) Turn the large **FMS** Knob on the MFD to select the Aux page group.
- 2) Turn the small **FMS** Knob to select the Connex Setup page.

Changing the Bluetooth Name

- 1) While viewing the ‘Aux - Connex Setup’ Page, press the **FMS** Knob to activate the cursor.
- 2) Turn the large **FMS** Knob to place the cursor in the ‘Bluetooth Name’ field.
- 3) Enter the desired name by using the large **FMS** Knob to select the character field, and the small **FMS** Knob select the desired alphanumeric character for that field.
- 4) Press the **ENT** Key. The cursor is removed and the new name is displayed.

Enabling/Disabling Flight Plan Importing from Garmin Pilot

- 1) While viewing the ‘Aux - Connex Setup’ Page, press the **FMS** Knob to activate the cursor.
- 2) Turn the large **FMS** Knob to place the cursor in the ‘Flight Plan Import’ field.
- 3) Turn the small **FMS** Knob to select ‘Enabled’ or ‘Disabled’.
- 4) Press the **FMS** Knob to remove the cursor.

Enabling/Disabling WiFi Database Importing from Garmin Pilot

- 1) While viewing the ‘Aux - Connex Setup’ Page, press the **FMS** Knob to activate the cursor.
- 2) Turn the large **FMS** Knob to place the cursor in the ‘WiFi Database Import’ field.
- 3) Turn the small **FMS** Knob to select ‘Enabled’ or ‘Disabled’.
- 4) Press the **FMS** Knob to remove the cursor.

Enabling/Disabling Automatic Reconnection of a Specific Paired Device

- 1) While viewing the 'Aux - Connex Setup' Page, press the **FMS** Knob to activate the cursor.
- 2) Turn the large **FMS** Knob to highlight the desired paired device.
- 3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled'. Selecting 'Enabled' allows the system to automatically connect to a previously paired device when detected.
- 4) Press the **FMS** Knob to remove the cursor.

Remove a Specific Paired Device from the List of Paired Devices:

- 1) While viewing the 'Aux - Connex Setup' Page, press the **FMS** Knob to activate the cursor.
- 2) Turn the large **FMS** Knob to highlight the desired paired device.
- 3) Press the **Remove** Softkey. A confirmation screen is displayed.
- 4) If necessary, turn the large **FMS** Knob to select 'Yes'.
- 5) Press the **ENT** Key to remove the device from the list of paired devices.

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8.11 ABNORMAL OPERATION

GDL 59/69/69A SXM TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the 'Aux - System Status' Page for GDL 59, or GDL 69/69A SXM status, serial number, and software version number. If a failure has been detected in the GDL 69/69A SXM the status is marked with a red X.

Selecting the 'Aux - System Status' Page:

- 1) Turn the large **FMS** Knob to select the Aux Page Group.
- 2) Turn the small **FMS** Knob to select the 'Aux - System Status' Page.

LRU Information	Status	Serial Number	Version
COM1	X	-----	----
COM2	X	-----	----
GDC1	X	-----	----
GDC2	X	-----	----
GDL 59	✓	-----	----
GDL 59 RTR	X	-----	----
GDL 69	✓	0000001	0.00
GEA 1	X	-----	----
GEA 2	X	-----	----
GIA 1	✓	0000001	0.50
GIA 2	X	0000002	0.50
GMA 1	X	-----	----
GMA 2	X	-----	----
GMU 1	X	-----	----
GMU 2	X	-----	----
GPS 1	✓	0000001	3.0

Figure 8-35 LRU Information Window on System Status Page

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

- Ensure the installed Data Link Receiver or Iridium Transceiver has an active subscription or account
- Perform a quick check of the circuit breakers to ensure that power is applied to the Data Link Receiver or Iridium Transceiver

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Ensure that nothing is plugged into the MUSIC 1 or MUSIC 2 jacks because that would prevent SiriusXM radio from being heard

If a failure still exists, the following messages may provide insight as to the possible problem:

Message	Message Location	Description
CHECK ANTENNA	XM Information Page (MFD)	Data Link Receiver antenna error; service required
UPDATING	XM Information Page (MFD)	Data Link Receiver updating encryption code
NO SIGNAL	XM Information Page Weather Datalink Page (MFD)	Loss of signal; signal strength too low for receiver
LOADING	XM Radio Page (MFD)	Acquiring channel audio or information
OFF AIR	XM Radio Page (MFD)	Channel not in service
-----	XM Radio Page (MFD)	Missing channel information
WEATHER DATA LINK FAILED	Weather Datalink Page (MFD)	No communication from Data Link Receiver within last 5 minutes
ACTIVATION REQUIRED	XM Information Page (MFD)	SiriusXM subscription is not activated
DETECTING ACTIVATION	Weather Datalink Page (MFD)	SiriusXM subscription is activating
WAITING FOR DATA...	Weather Datalink Page (MFD)	SiriusXM subscription confirmed downloading weather data

Table 8-3 GDL 69/69A SXM Data Link Receiver Messages

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ANNUNCIATIONS AND ALERTS

NOTE: The Pilot's Operating Handbook and FAA Approved Airplane Flight Manual (AFM/POH) supersedes information found in this document.

The Alerting System conveys alerts using the following:

- **CAS Window:** The Annunciation Window displays abbreviated annunciation text. Text color is based on alert levels described in the following section. The CAS Window is located to the right of the Altimeter and Vertical Speed Indicator. All Crew Alerting System (CAS) annunciations can be displayed simultaneously in the CAS Window. A white horizontal line separates annunciations that are acknowledged from annunciations that are not yet acknowledged. Higher priority annunciations are displayed towards the top of the window.
- **Messages Window:** The Messages Window displays text messages for up to 64 prioritized alert messages. Pressing the **Messages** Softkey displays the Messages Window. Pressing the **Messages** Softkey a second time removes the Messages Window from the display. When the Messages Window is displayed, the **FMS** Knob can be used to scroll through the alert message list.
- **Softkey Annunciation:** During certain alerts, the **Messages** Softkey may appear as a flashing annunciation to accompany an alert. The **Messages** Softkey assumes a new label consistent with the alert level (Warning, Caution, or Advisory). By pressing the softkey when flashing an annunciation, the alert is acknowledged. The softkey label then returns to **Messages**. If alerts are still present, the **Messages** label is displayed in white with black text. Pressing the **Messages** Softkey a second time views the alert text messages.
- **System Annunciations:** Typically, a large red or amber 'X' appears over instruments whose information is supplied by a failed Line Replaceable Unit (LRU). See the System Annunciations Section for more information.

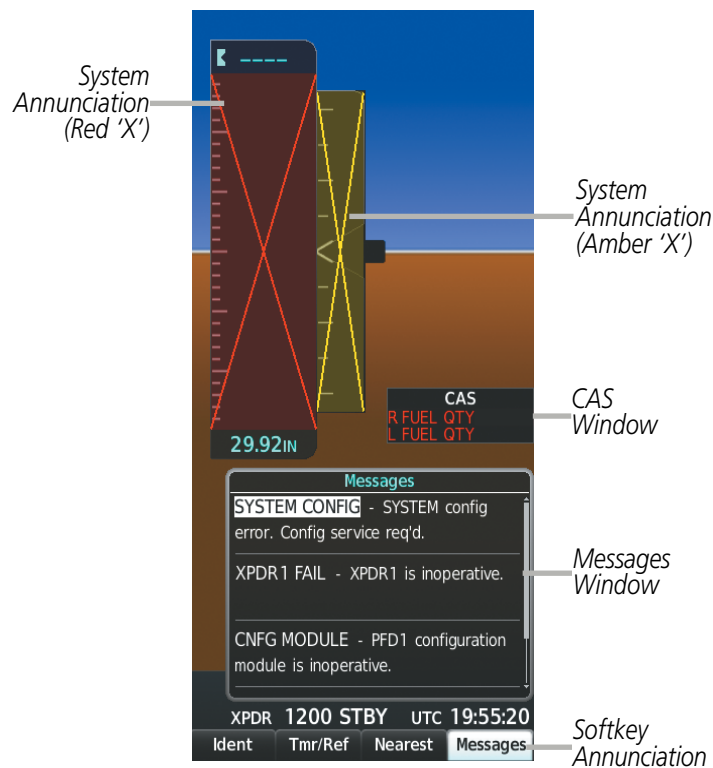


Figure A-1 Alerting System

- **Audio Alerting System:** The System issues audio alert tones when specific system conditions are met. See the Alert Level Definitions Section for more information. Should the #1 GIA 63W fail, audio and voice alerts are not generated. The annunciation tone may be tested from the AUX - System Status Page.

Testing the system annunciation tone:

- 1) Use the **FMS** Knob to select the AUX - System Status Page.
- 2) Press the **ANN TEST** Softkey.
 - a) Press the **MENU** Key.
 - b) Highlight 'Enable Annunciator Test Mode' and press the **ENT** Key.



Press to Test
Annunciation Tone

Figure A-2 System Status Page, Annunciation Tone Testing

CAS MESSAGE PRIORITIZATION



NOTE: Refer to the Pilot's Operating Handbook (POH) for corrective pilot actions.



NOTE: Any CAS messages that are generated when the system is first powered on are considered already acknowledged. They do not flash or trigger the Master Warning or Master Caution.

The Alerting System uses three alert levels. Messages are grouped by criticality (warning, caution, advisory) and sorted by order of appearance (most recent messages on top). The color of the message is based on its urgency and on required action:

The Crew Alerting System (CAS) Window is located on the right side of the PFD. Warning messages cannot be scrolled through and remain at the top of the CAS display. The scroll bar appears if more caution and advisory messages exist than can be displayed at once or if messages have been scrolled off the display. The CAS softkeys also become available.



NOTE: Aural alerts associated with abnormal conditions and advisories are managed through the audio panels. Refer to the Audio Panel and CNS Section for more information.

Warning: This level of alert requires immediate attention. When a new warning CAS message appears in the CAS Window, it flashes (inversely red on white) in conjunction with the **Warning** Softkey (see Figure A-3) and is accompanied by a repeating triple chime. Pressing the **Warning** Softkey acknowledges all flashing warning messages and extinguishes the softkey. Once acknowledged, warning messages are shown in red text and are displayed until the issue is corrected. Warning voice alerts repeat continuously until acknowledged by pressing the **Warning** Softkey.

Caution: This level of alert indicates the existence of abnormal conditions on the aircraft that may require intervention. When a new caution message appears in the CAS Window, it is shown in black on amber inverse video in conjunction with the **Caution** Softkey (see Figure A-3) and is accompanied by a double chime. Pressing the **Caution** Softkey Indicator acknowledges all amber messages and extinguishes the softkey. Once acknowledged, caution messages are displayed until the issue is corrected.

Advisory: This level of alert provides general information. When a new white advisory appears on the CAS display, it is shown in black on white inverse video in conjunction with the **Advisory** Softkey (see Figure A-3) and may be accompanied by a single chime.

Some CAS messages can be display in more than one alert level group. For example, a message might display as both a warning and a caution, but cannot appear more than once at any given time (unless the CAS is being tested). If the received signals justify multiple priorities for a certain message, the message is displayed for the higher priority condition. When graduating to a higher priority, the message flashes and requires new acknowledgment. When degrading to a lower priority condition, the message moves to the top of the appropriate grouping, but does not require new acknowledgment.

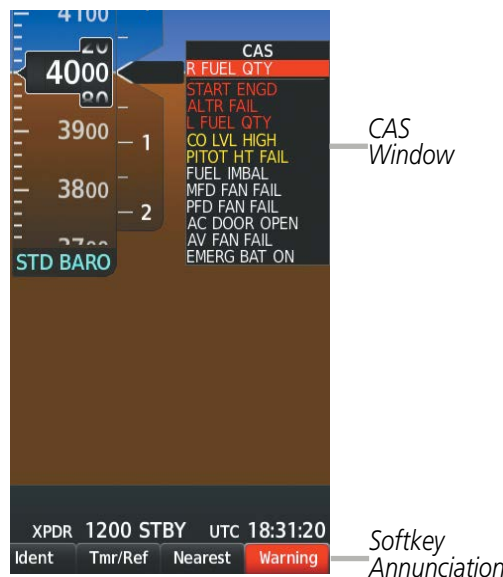


Figure A-3 CAS Message Prioritization



Figure A-4 Softkey Annunciation (Message Softkey Labels)

CAS ANNUNCIATIONS

The following annunciations are configured specifically for the Piper Seminole. Red annunciation window text signifies warnings, amber signifies cautions, and white signifies advisories. See the POH for recommended pilot actions.

DISPLAY INHIBITS

Inhibits prevent certain CAS messages from being displayed during the following conditions:

If two alert levels of the same message are active simultaneously (e.g., L FUEL QTY warning and L FUEL QTY caution) only the higher alert level is displayed.

If a GEA or GIA fails, all CAS messages depending on sensors associated with that LRU are automatically inhibited. Inhibits cannot be activated by invalid sensor data.

WARNING ANNUNCIATIONS

Annunciation Window Text	Description	Audio Alert
CHECK GEAR	Landing gear are not down and locked or Landing gear is selected UP on the ground	Triple Chime
CO LVL HIGH	The CO Guardian has detected high levels of carbon monoxide	
GEAR SYS	A failure of a gear system component has been detected	
HTR OVERHEAT	Heater unit has sensed an overheat condition	
L ALTR FAIL	Left Alternator failure	
L ENG CHT	Left engine CHT in warning range	
L FUEL QTY	Left fuel quantity in warning range	
L START ENGD	Left starter motor energized when engine is running	
R ALTR FAIL	Right Alternator failure	
R ENG CHT	Right engine CHT in warning range	
R FUEL QTY	Right fuel quantity in warning range	
R START ENGD	Right starter motor energized when engine is running	
USP ACTIVE	Underspeed protection is currently engaged	

CAUTION ANNUNCIATIONS

Annunciation Window Text	Description	Audio Alert
AC DOOR OPEN*	Air conditioning condenser door is open during in-flight engine failure condition	Double Chime
CHECK GEAR	Landing gear are not down and locked	
CO LVL HIGH*	The CO Guardian has detected high levels of carbon monoxide	
GEAR SYS	A failure of a gear system component has been detected	
HYDR PUMP ON	Hydraulic pump is running when it should not be running	
L FUEL QTY	Left fuel quantity in caution range	
PITOT HEAT FAIL	Pitot heat failure	
PITOT HEAT OFF	Pitot heat selected OFF	
R FUEL QTY	Right fuel quantity in caution range	

* Optional

ADVISORY ANNUNCIATIONS

Advisory Messages	Description	Audio Alert
AC DOOR OPEN*	Air conditioning condenser door is open	Single Chime
AV FAN FAIL	Avionics fan fail	
EMERG BATT ON	Emergency power in use	
FUEL IMBAL	Fuel imbalance (left vs. right tank quantity)	
MAINT MODE ON	Maintenance Mode ON	
MFD FAN FAIL	MFD display fan is inoperative	
PFD FAN FAIL	PFD display fan is inoperative	

* Optional

MESSAGE ADVISORIES

Alerts Window Text	Description
WOW MISCOMPARE	Left and right squat switches do not agree
CO DET SRVC*	The carbon monoxide detector needs service

* Optional

SYSTEM MESSAGE ADVISORIES

This section describes various system message advisories. Certain messages are issued due to an LRU or an LRU function failure. Such messages are normally accompanied by a corresponding red ‘X’ annunciation as shown previously in the System Annunciation section.



NOTE: This section provides information regarding system message advisories that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The Pilot’s Operating Handbook (POH) takes precedence over any conflicting guidance found in this section.

VOICE ALERTS

Message	Priority	Description
“Stall”	Warning	Imminent stall is sensed by stall vane
“Airspeed”		Airspeed exceeds VNE
“Minimums, minimums”		Aircraft has descended below the preset barometric minimum descent altitude
“Traffic”	Caution	TIS Traffic Alert
“Traffic, (distance, bearing, altitude)”		TAS Traffic Alert
“TAS System Test Passed”	Advisory	TAS system initiated test passed
“TAS System Test Failed”		TAS system initiated test failed
“Vertical track”		Aircraft is one minute from Top of Descent. Issued only when vertical navigation is enabled.
“TIS Not Available”		Aircraft is outside TIS coverage area
“Timer Expired”		Countdown timer on the PFD has reached zero

SYSTEM MESSAGE ADVISORIES

Message	Comments
ABORT APR – Loss of GPS navigation. Abort approach.	Abort approach due to loss of GPS navigation.
ADC1 ALT EC – ADC1 altitude error correction is unavailable.	GDC 1 is reporting that the altitude error correction is unavailable.
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	The AHRS is reporting that the airspeed error correction is unavailable.
AHRS1 CAL – AHRS1 calibration version error. Svc req’d.	The AHRS calibration version error. The system should be serviced.
AHRS1 CONFIG – AHRS1 config error. Config service req’d.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS1 GPS – AHRS1 using backup GPS source.	The AHRS is using the backup GPS path. Primary GPS path has failed. The system should be serviced when possible.
AHRS1 GPS – AHRS1 not receiving any GPS information.	The AHRS is not receiving any or any useful GPS information. Check POH limitations. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	The AHRS is not receiving backup GPS information. The system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	The AHRS is operating exclusively in no-GPS mode. The system should be serviced.

Message	Comments
AHRS1 SERVICE – AHRS1 Magnetic-field model needs update.	The AHRS earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS1 TAS – AHRS1 not receiving airspeed.	The AHRS is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
APR DWNGRADE – Approach downgraded.	Use LNAV minima when approach is downgraded.
ARSPC AHEAD – Airspace ahead less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft will penetrate the airspace within 10 minutes.
ARSPC NEAR – Airspace near – less than 2 nm.	Special use airspace is within 2 nm of the aircraft position.
ARSPC NEAR – Airspace near and ahead.	Special use airspace is near and ahead of the aircraft position.
APR INACTV – Approach is not active.	The system notifies the pilot that the loaded approach is not active. Activate approach when required.
CHECK CRS – Database course for LOC2 / [LOC ID] is [CRS]°.	Selected course for LOC2 differs from published localizer course by more than 10 degrees.
CNFG MODULE – PFD1 configuration module is inoperative.	The PFD1 configuration module backup memory has failed. The system should be serviced.
CO DET FAIL – The carbon monoxide detector is inoperative.	A failure in the carbon monoxide detector has been detected. The system should be serviced.
COM1 CONFIG – COM1 config error. Config service req'd.	The COM1 configuration settings do not match backup configuration memory. The system should be serviced
COM1 MANIFEST – COM1 software mismatch, communication halted.	COM1 software mismatch. The system should be serviced.
COM1 PTT – COM1 push-to-talk key is stuck.	The COM1 external push-to-talk switch is stuck in the enable (or “pressed”) position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM1 RMT XFR – COM1 remote transfer key is stuck.	The COM1 transfer switch is stuck in the enabled (or “pressed”) position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM1 SERVICE – COM1 needs service. Return unit for repair.	The system has detected a failure in COM1. COM1 may still be usable. The system should be serviced when possible.
COM1 TEMP – COM1 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
COM2 CONFIG – COM2 config error. Config service req'd.	The COM2 configuration settings do not match backup configuration memory. The system should be serviced
COM1 MANIFEST – COM1 software mismatch, communication halted.	COM1 software mismatch. The system should be serviced.
COM2 PTT – COM2 push-to-talk key is stuck.	The COM2 external push-to-talk switch is stuck in the enable (or “pressed”) position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.

Message	Comments
COM2 RMT XFR – COM2 remote transfer key is stuck.	The COM2 transfer switch is stuck in the enabled (or “pressed”) position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 SERVICE – COM2 needs service. Return unit for repair.	The system has detected a failure in COM2. COM2 may still be usable. The system should be serviced when possible.
COM2 TEMP – COM2 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
COPILOT RADIOS MUTED – Copilot radios are muted.	The copilot radios are set on mute.
DATA LOST – Pilot stored data was lost. Recheck settings.	The pilot profile data was lost. System reverts to default pilot profile and settings. The pilot may reconfigure the MFD & PFD with preferred settings, if desired.
DB CHANGE – Database changed. Verify user modified procedures.	This occurs when a stored flight plan contains procedures that have been manually edited. This alert is issued only after an navigation database update. Verify that the user-modified procedures in stored flight plans are correct and up to date.
DB CHANGE – Database changed. Verify stored airways.	This occurs when a stored flight plan contains an airway that is no longer consistent with the navigation database. This alert is issued only after an navigation database update. Verify use of airways in stored flight plans and reload airways as needed.
DB MISMATCH – Navigation database mismatch. Xtalk is off.	The PFD and MFD have different navigation database versions or types installed. Crossfill is off. Check the AUX-System Status Page to determine versions or regions. Also, check the AUX-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Obstacle database mismatch.	The PFD and MFD have different obstacle database versions or types installed. Check the AUX-System Status Page to determine versions or regions. Also, check the AUX-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Standby Navigation database mismatch.	The PFD and MFD have different standby navigation database versions or types installed. Check the AUX-System Status Page to determine versions or regions. Also, check the AUX-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Terrain database mismatch.	The PFD and MFD have different terrain database versions or types installed. Check the AUX-System Status Page to determine versions or regions. Also, check the AUX-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DIG GMA1 MANIFEST – DIG GMA 1 software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
DME CHECK RANGE – DME range disagreement. Check position sensors.	A failure or disagreement has been detected in a DME receiver. Check position sensors.
FAILED PATH – A data path has failed.	A data path connected to the GDU or the GIA 63W has failed.
FPL TRUNC – Flight plan has been truncated.	This occurs when a newly installed navigation database eliminates an obsolete approach or arrival used by a stored flight plan. The obsolete procedure is removed from the flight plan. Update flight plan with current arrival or approach.

Message	Comments
FPL WPT LOCK – Flight plan waypoint is locked.	Upon power-up, the system detects that a stored flight plan waypoint is locked. This occurs when a navigation database update eliminates an obsolete waypoint. The flight plan cannot find the specified waypoint and flags this message. This can also occur with user waypoints in a flight plan that is deleted. Remove the waypoint from the flight plan if it no longer exists in any database, OR update the waypoint name/identifier to reflect the new information.
G/S1 FAIL – G/S1 is inoperative.	A failure has been detected in glideslope receiver 1. The system should be serviced.
G/S1 SERVICE – G/S1 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 1. The receiver may still be available. The system should be serviced when possible.
G/S2 FAIL – G/S2 is inoperative.	A failure has been detected in glideslope receiver 2. The system should be serviced.
G/S2 SERVICE – G/S2 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 2. The receiver may still be available. The system should be serviced when possible.
GDC1 MANIFEST – GDC1 software mismatch, communication halted.	GDC 1 has incorrect software installed. The system should be serviced.
GDL59 CONFIG – GDL 59 config error. Config service req'd.	GDL 59 configuration settings do not match those of backup configuration memory. The system should be serviced.
GDL59 FAIL – GDL 59 has failed.	A fault has been detected in the GDL 59. The receiver is unavailable. The system should be serviced.
GDL59 RTR FAIL – The GDL 59 router has failed.	A fault has been detected in the GDL 59 router. The system should be serviced.
GDL59 SERVICE – GDL 59 needs service. Return unit for repair.	A fault has been detected in the GDL 59. The system should be serviced.
GDL69 CONFIG – GDL 69 config error. Config service req'd.	GDL 69/69A SXM configuration settings do not match those of backup configuration memory. The system should be serviced.
GDL69 FAIL – GDL 69 has failed.	A failure has been detected in the GDL 69/69A or GDL 69/69A SXM. The receiver is unavailable. The system should be serviced.
GDL69 MANIFEST – GDL software mismatch, communication halted.	The GDL 69/69A SXM has incorrect software installed. The system should be serviced.
GEA1 CONFIG – GEA1 config error. Config service req'd.	The #1 GEA 71 configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA1 MANIFEST – GEA1 software mismatch, communication halted.	The #1 GEA 71 has incorrect software installed. The system should be serviced.
GEO LIMITS – AHRS1 too far North/South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.
GFC MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
GIA1 CONFIG – GIA1 audio config error. Config service req'd.	The GIA1 have an error in the audio configuration. The system should be serviced.
GIA1 CONFIG – GIA1 config error. Config service req'd.	The GIA1 configuration settings do not match backup configuration memory. The system should be serviced.

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GIA1 COOLING – GIA1 temperature too low.	The GIA1 and/or GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
GIA1 COOLING – GIA1 over temperature.	The GIA1 temperature is too high. If problem persists, the system should be serviced.
GIA1 MANIFEST – GIA1 software mismatch, communication halted.	The GIA1 1 has incorrect software installed. The system should be serviced.
GIA1 SERVICE – GIA1 needs service. Return the unit for repair.	The GIA1 self-test has detected a problem in the unit. The system should be serviced.
GIA2 CONFIG – GIA2 audio config error. Config service req'd.	The GIA2 have an error in the audio configuration. The system should be serviced.
GIA2 CONFIG – GIA2 config error. Config service req'd.	The GIA2 configuration settings do not match backup configuration memory. The system should be serviced.
GIA2 COOLING – GIA2 over temperature.	The GIA2 temperature is too high. If problem persists, the system should be serviced.
GIA2 COOLING – GIA2 temperature too low.	The GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
GIA2 MANIFEST – GIA2 software mismatch, communication halted.	The GIA 2 has incorrect software installed. The system should be serviced.
GIA2 SERVICE – GIA2 needs service. Return the unit for repair.	The GIA2 self-test has detected a problem in the unit. The system should be serviced.
GMA1 AUX MANIFEST – GMA 1 AUX software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
GMA1 CONFIG – GMA1 config error. Config service req'd.	The audio panel configuration settings do not match backup configuration memory. The system should be serviced.
GMA1 FAIL – GMA1 is inoperative.	The audio panel self-test has detected a failure. The audio panel is unavailable. The system should be serviced.
GMA1 MANIFEST – GMA1 software mismatch, communication halted.	The audio panel has incorrect software installed. The system should be serviced.
GMA1 SERVICE – GMA1 needs service. Return unit for repair.	The audio panel self-test has detected a problem in the unit. Certain audio functions may still be available, and the audio panel may still be usable. The system should be serviced when possible.
GMU1 MANIFEST – GMU1 software mismatch, communication halted.	The GMU 44 has incorrect software installed. The system should be serviced.
GPS NAV LOST – Loss of GPS navigation. Insufficient satellites.	Loss of GPS navigation due to insufficient satellites.
GPS NAV LOST – Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.
GPS NAV LOST – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.

Message	Comments
GPS1 SERVICE – GPS1 needs service. Return unit for repair.	A failure has been detected in the GPS1 and/or GPS2 receiver. The receiver may still be available. The system should be serviced.
GPS2 SERVICE – GPS2 needs service. Return unit for repair.	
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	The AHRS has incorrect software installed. The system should be serviced.
GTS CONFIG – GTS config error. Config service req'd.	GTS 800 configuration settings do not match those of the GDU configuration. The system should be serviced.
GTS MANIFEST – GTS software mismatch, communication halted.	The GTS has incorrect software installed. The system should be serviced.
GTX1 MANIFEST – GTX1 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
HDG FAULT – AHRS1 magnetometer fault has occurred.	A fault has occurred in the #1 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
HW MISMATCH – GIA hardware mismatch. GIA1 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
HW MISMATCH – GIA hardware mismatch. GIA2 communication halted.	
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
INVALID ADM – Invalid ADM: ATN communication halted.	Data link avionics were not configured correctly and therefore will not be able to communicate with the ground network.
LOCKED FPL – Cannot navigate locked flight plan.	This occurs when the pilot attempts to activate a stored flight plan that contains locked waypoint. Remove locked waypoint from flight plan. Update flight plan with current waypoint.
LOI – GPS integrity lost. Crosscheck with other NAVS.	GPS integrity is insufficient for the current phase of flight.
LRG MAG VAR – Verify all course angles.	The GDU's internal model cannot determine the exact magnetic variance for geographic locations near the magnetic poles. Displayed magnetic course angles may differ from the actual magnetic heading by more than 2°.
MANIFEST – MFD1 software mismatch, communication halted.	The PFD and/or MFD has incorrect software installed. The system should be serviced.
MANIFEST – PFD1 software mismatch, communication halted.	
MFD SOFTWARE – MFD mismatch, communication halted.	The specified GDU has different software versions installed. The system should be serviced.
MFD TERRAIN DSP – MFD Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in the specified GDU is missing or invalid.
MFD1 BACKLIGHT CALIBRATION – MFD1 calibration. Return for repair.	The specified GDU's backlight calibration cannot be found or is invalid. The system should be serviced.

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MFD1 COOLING – MFD1 has poor cooling. Reducing power usage.	The MFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 Airport Directory database error exists.	The MFD detected a failure in the Airport Directory database. Ensure that the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 basemap database error exists.	The MFD detected a failure in the basemap database.
MFD1 DB ERR – MFD1 Chartview database error exists.	The MFD detected a failure in the ChartView database (optional feature). Ensure that the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 FliteCharts database error exists.	The MFD detected a failure in the FliteCharts database (optional feature). Ensure that the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 multiple database errors exists.	The MFD detected a failure in more than one database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 navigation database error exists.	The MFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 obstacle database error exists.	The MFD detected a failure in the obstacle database. Ensure that the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
MFD1 DB ERR – MFD1 Safe Taxi database error exists.	The MFD detected a failure in the Safe Taxi database. Ensure that the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. Replace terrain card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. Replace terrain card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
MFD1 SERVICE – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
MFD1 KEYSTK – MFD1 [key name] is stuck.	A key is stuck on the MFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
MFD1 VOLTAGE – MFD1 has low voltage. Reducing power usage	The MFD voltage is low. The system should be serviced.
NAV1 MANIFEST – NAV1 software mismatch, communication halted.	NAV1 software mismatch. The system should be serviced.

Message	Comments
NAV1 RMT XFR – NAV1 remote transfer key is stuck.	The remote NAV1 transfer switch is stuck in the enabled (or “pressed”) state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV1 SERVICE – NAV1 needs service. Return unit for repair.	A failure has been detected in the NAV1 receiver. The receiver may still be available. The system should be serviced.
NAV2 MANIFEST – NAV2 software mismatch, communication halted.	NAV2 software mismatch. The system should be serviced.
NAV2 RMT XFR – NAV2 remote transfer key is stuck.	The remote NAV2 transfer switch is stuck in the enabled (or “pressed”) state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV2 SERVICE – NAV2 needs service. Return unit for repair.	A failure has been detected in the NAV2 receiver. The receiver may still be available. The system should be serviced.
NON-MAGNETIC UNITS – Non-magnetic NAV ANGLE display units are active.	Navigation angle is not set to MAGNETIC at power-up.
NON WGS84 WPT – Do not use GPS for navigation to [xxxx]	The position of the selected waypoint [xxxx] is not calculated based on the WGS84 map reference datum and may be positioned in error as displayed. Do not use GPS to navigate to the selected non-WGS84 waypoint.
PFD1 BACKLIGHT CALIBRATION – PFD1 backlight calibration lost. Return for repair.	The PFD1 backlight calibration cannot be found or is invalid. The system should be serviced.
PFD1 CONFIG – PFD1 config error. Config service req'd.	The PFD configuration settings do not match backup configuration memory. The system should be serviced.
PFD1 COOLING – PFD1 has poor cooling. Reducing power usage.	The PFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 basemap database error exists.	The PFD detected a failure in the basemap database.
PFD1 DB ERR – PFD1 multiple database errors exists.	The PFD detected a failure in more than one database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 navigation database error exists.	The PFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
PFD1 DB ERR – PFD1 Safe Taxi database error exists.	The PFD detected a failure in the Safe Taxi database. Ensure that the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database error exists.	The PFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. Replace terrain card. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
PFD1 KEYSTK – PFD1 [key name] is stuck.	A key is stuck on the PFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.

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Message	Comments
[PFD1 or MFD1] CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD or MFD. The SD card needs to be reinserted.
[PFD1 or MFD1] CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD or MFD. The SD card needs to be reinserted.
[PFD1 or MFD1] CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified PFD or MFD contains invalid data.
[PFD1 or MFD1] CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD or MFD contains invalid data.
PFD1 VOLTAGE – PFD1 has low voltage. Reducing power usage	The PFD1 voltage is low. The system should be serviced.
PFD1 KEYSTK – PFD2 [key name] is stuck.	A key is stuck on the PFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
PFD1 SERVICE – PFD2 needs service. Return unit for repair.	The PFD self-test has detected a problem. The system should be serviced.
PFD1 TERRAIN DSP – PFD1 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in PFD1 is missing or invalid.
PFD1 VOLTAGE – PFD2 has low voltage. Reducing power usage	The PFD1 voltage is low. The system should be serviced.
PILOT RADIOS MUTED – Pilot radios are muted.	The pilot radios are set on mute.
PTK FAIL – Parallel track unavailable: invalid leg type.	Invalid leg type for parallel offset.
PTK FAIL – Parallel track unavailable: past IAF.	IAF waypoint for parallel offset has been passed.
PTK FAIL – Parallel track unavailable: bad geometry.	Bad parallel track geometry.
SCHEDULER [#] – <message>.	Message criteria entered by the user.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT MAG – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avionics Settings Screen to Magnetic.
SLCT NAV – Select NAV on CDI for approach.	The system notifies the pilot to set the CDI to the correct NAV receiver. Set the CDI to the correct NAV receiver.
SLCT NON-MAG – Select alternate NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avionics Settings Screen to True.
STEEP TURN – Steep turn ahead.	A steep turn is 15 seconds ahead. Prepare to turn.
STRMSCP FAIL – Stormscope has failed.	Stormscope has failed. The system should be serviced.
SVT DISABLED – Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.

Message	Comments
SVT DISABLED – Terrain DB resolution too low.	Synthetic Vision is disabled because a terrain database of sufficient resolution (4.9 arc-second or better) is not currently installed.
SW MISMATCH – GDU software version mismatch. Xtalk is off.	The MFD and PFD have different software versions installed. The system should be serviced.
TERRAIN AUD CFG – Trn Awareness audio config error. Service req'd.	TAWS is disabled because the audio configuration is invalid. The system should be serviced.
TERRAIN DISABLED – Terrain Awareness DB resolution too low.	TAWS is disabled because a terrain database of sufficient resolution (4.9 arc-second or better) is not currently installed.
TIMER EXPIRD – Timer has expired.	The system notifies the pilot that the timer has expired.
TRAFFIC FAIL – Traffic device has failed.	The system is no longer receiving data from the traffic system. The traffic device should be serviced.
TRN AUD FAIL – Trn Awareness audio source unavailable	Terrain Awareness audio is unavailable. The system should be serviced.
UNABLE V WPT – Can't reach current vertical waypoint.	The current vertical waypoint can not be reached within the maximum flight path angle and vertical speed constraints. The system automatically transitions to the next vertical waypoint.
VNV – Unavailable. Excessive crosstrack error.	The current crosstrack exceeds the limit, causing vertical deviation to go invalid.
VNV – Unavailable. Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.
VNV – Unavailable. Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
VNV – Unavailable. Unsupported leg type in flight plan.	The lateral flight plan contains a procedure turn, vector, or other unsupported leg type prior to the active vertical waypoint. This prevents vertical guidance to the active vertical waypoint.
WPT ARRIVAL – Arriving at waypoint -[xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
XPDR1 ADS-B 1090 – Datalink: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
XPDR1 ADS-B FAIL – Transponder: XPDR1 is unable to transmit ADS-B messages.	ADS-B is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR1 ADS-B NO POS – Transponder: ADS-B is not transmitting position.	The transponder is not able to receive position information.
XPDR1 ADS-B TRFC – Transponder: ADS-B traffic has failed	The Transponder is incapable of processing traffic information.
XPDR1 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
XPDR1 CONFIG – XPDR1 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.

Message	Comments
XPDR1 CSA FAIL - Traffic: ADS-B In traffic alerting has failed.	ADS-B Conflict Situational Awareness (CSA) is unavailable.
XPDR1 FAIL – XPDR1 is inoperative.	There is no communication with the #1 or #2 transponder.
XPDR1 FAULT – Datalink: ADSB-B in has failed.	The transponder is unable to receive ADS-B information.
XPDR1 FIS-B WX – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
XPDR1 OVER TEMP - Transponder: Transponder over temp.	The system has detected an over temperature condition in XPDR1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XPDR1 PRES ALT –Transponder: ADS-B no pressure altitude.	Unable to provide pressure altitude information.
XPDR1 SRVC – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when possible.
XPDR1 UNDER TEMP - Transponder: Transponder under temp.	The system has detected an under temperature condition in XPDR1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XTALK ERROR – A flight display crosstalk error has occurred.	The MFD and PFD are not communicating with each other. The system should be serviced.

FLIGHT PLAN IMPORT/EXPORT MESSAGES

In some circumstances, some messages may appear in conjunction with others.

Flight Plan Import/Export Results	Description
'Flight plan successfully imported.'	A flight plan file stored on the SD card was successfully imported as a stored flight plan.
'File contained user waypoints only. User waypoints imported successfully. No stored flight plan data was modified.'	The file stored on the SD card did not contain a flight plan, only user waypoints. These waypoints have been saved to the system user waypoints. No flight plans stored in the system have been modified.
'No flight plan files found to import.'	The SD card contains no flight plan data.
'Flight plan import failed.'	Flight plan data was not successfully imported from the SD card.
'File contained user waypoints only.'	The file stored on the SD card did not contain a flight plan, only user waypoints. One or more of these waypoints did not import successfully.
'Flight plan partially imported.'	Some flight plan waypoints were successfully imported from the SD card, however others had errors and were not imported. A partial stored flight plan now exists in the system.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints that the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.

Flight Plan Import/Export Results	Description
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

PILOT PROFILE IMPORT/EXPORT MESSAGES

Pilot Profile Import/Export Results	Description
'No pilot profile plan files found to import.'	Displayed if the SD card does not have one or more valid pilot profile filenames.
'Overwrite existing profile?'	Displayed if the profile name matches the name of existing profile.
'Profile name invalid. Enter a different profile name.'	Displayed if the profile name is invalid.
'All available pilot profiles in use. Delete a profile before importing another.'	Displayed if the maximum number for pilot profiles has been reached.
'Pilot profile import failed.'	Displayed if the importing operation fails for any other reason.
'Pilot profile import succeeded.'	Displayed if the importing operation succeeds.
'Overwrite existing file?'	Displayed if the filename matches the name of an existing file on the SD card.
'Pilot profile export failed.'	Displayed if the export operation fails.
'Pilot profile export succeeded.'	Displayed if the export operation succeeds.

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DATABASE MANAGEMENT

Database information is obtained from third party sources. Inaccuracies in the data may be discovered from time to time. Garmin communicates this information by issuing a Database Alert. These notifications are available on <http://fly.garmin.com>.

Garmin requests the flight crew report any observed discrepancies related to database information. These discrepancies could come in the form of an incorrect procedure; incorrectly identified terrain, obstacles and fixes; or any other displayed item used for navigation or communication in the air or on the ground. Go to <http://fly.garmin.com> and select Aviation Data Error Report.



CAUTION: *Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.*

The system uses Secure Digital (SD) cards to load and store various types of data. For basic flight operations, SD cards are required for database storage as well as database updates. Not all SD cards are compatible with the system.



NOTE: *When loading database updates, the 'DB Mismatch' message will be displayed until database synchronization is complete, followed by turning system power off, then on. Synchronization can be monitored on the Aux – Databases Page.*



NOTE: *Loading a database in the system prior to its effective date will result in the expiration date on the power-up screen and the effective date on the Aux – Databases Page being displayed in amber.*

LOADING UPDATED DATABASES



CAUTION: *Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.*



NOTE: *When loading database updates, the 'DB Mismatch' system messages will be displayed until database synchronization is complete, followed by turning system power off, then on. Synchronization can be monitored on the Aux-Database Page.*

All databases are updated through a single SD card in the bottom slot of the MFD. When the card is inserted, the databases on the card will be copied to standby and synchronized across all powered, configured units. When in standby, databases are not immediately available for use, but stored to be activated at a later time.

Databases may be loaded through Garmin Pilot and Flight Stream 510. When loading databases through Garmin Pilot and the Flight Stream 510, the Flight Stream 510 must be enabled on the system and the multimedia card inserted in the bottom SD slot of the MFD.

The cycles and dates for both standby and active databases are displayed on the “Aux – Databases” page on the MFD. Any active databases with expiration dates in the past will be highlighted with amber text. When an expired active database has a standby database that is ready to become effective, a cyan double-sided arrow

will be displayed between the database cycles. When this arrow is visible, it indicates that the standby and active databases in that row will be switched on the next power cycle, activating the current standby database. Databases can also be manually selected (or deselected) by highlighting a list item and pressing the ENT key, provided a valid, verified standby database is present.

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

The basemap database contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date.

The terrain database contains the terrain mapping data. These databases are updated periodically and have no expiration date.

The obstacle database contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. This database is updated on a 56-day cycle.



NOTE: *The data contained in the terrain and obstacle databases comes from government agencies. Garmin accurately processes and cross-validates the data, but cannot guarantee the accuracy and completeness of the data.*

The AOPA or AC-U-KWIK Airport Directory provides data on airports and heliports throughout the U.S. or worldwide, respectively. The AOPA Directory offers detailed information for over 5,300 U. S. airports, along with the names and phone numbers of thousands of FBOs. These databases are updated every 56 days. The AC-U-KWIK Directory offers detailed information for more than 8,000 airports with runways longer than 3,000 feet worldwide.

The SafeTaxi database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle.

The FliteCharts database contains procedure charts for the United States only. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function.

The ChartView database is updated on a 14-day cycle. If the ChartView database is not updated within 70 days of the expiration date, ChartView will no longer function. The ChartView database must be purchased directly from Jeppesen, but can be updated at www.jeppesen.com or www.flygarmin.com.

UPDATING DATABASES

The Garmin database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (fly.garmin.com). Once the updated files have been downloaded from the website, a PC equipped with an appropriate SD card reader is used to unpack and program the new databases onto an existing Supplemental Data Card. Equipment required to perform the update is as follows:

- Windows-compatible PC computer
- SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent
- Updated database obtained from the Garmin website
- Supplemental SD Cards

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

In order to load databases through Garmin Pilot and the Flight Stream 510, the Flight Stream 510 must be enabled on the system and inserted in the bottom SD slot of the MFD. A mobile device with Garmin Pilot must be paired with the Flight Stream 510 over Bluetooth (refer to the Additional Features section). When there is at least one paired device available to connect, the Flight Stream 510 will automatically connect to the system's preferred mobile device. The preferred device can be selected on the Aux – Databases page from a menu list of paired devices.

Once a connection to the paired mobile device is made, Garmin Pilot makes available databases that can be transferred to the Flight Stream 510. If any of these databases is more recent than the respective standby database on the system, (or if there is no standby database on the system) those databases will be automatically selected to load. The database updates may be initiated from the Aux - Databases page, or from other pages on the MFD.

Updating Databases:

- 1) With the system OFF, remove an SD Card from the bottom SD card slot of the MFD.
- 2) Download and install the databases on an SD card.
- 3) Put the SD Card in the bottom SD card slot of the MFD.
- 4) Turn the system ON.
- 5) Press the **ENT** Key or the right most softkey on MFD display to acknowledge the startup screen.
- 6) Turn the large **FMS** Knob to select the Aux page group on the MFD.
- 7) Turn the small **FMS** Knob to select the Database page group on the MFD.
- 8) Monitor the Sync Status on the Database page. Wait for all databases to complete syncing, indicated by 'Sync Complete' being displayed. A cyan double arrow will appear between the Standby and Active columns to show which Standby databases will be transferred to Active at the next power cycle.

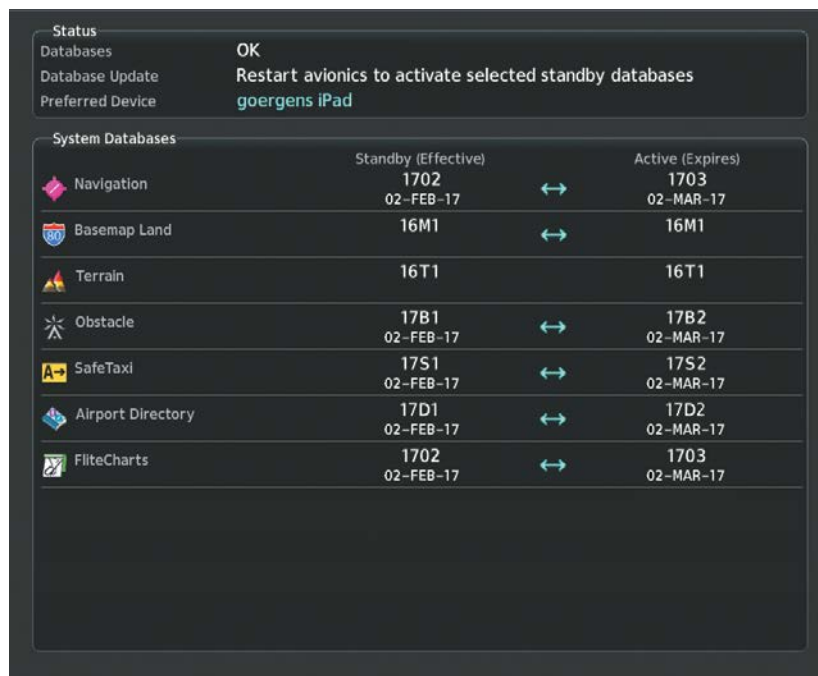


Figure B-1 Database Page before Activation of Standby Databases

- 9) Verify the correct database cycle information is shown in the Standby Database column.



NOTE: The **Restart** Softkey is enabled only when the aircraft is on the ground.

- 10) Press the **Restart** Softkey. A 10 second restart countdown will appear.
- 11) Press the **Restart** Button in the display window to continue with the restart of the system, or remove power from the system if the **Restart** Softkey is diminished.

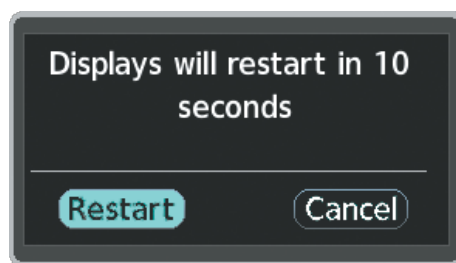


Figure B-2 Database Restart

- 12) Remove the SD card from the bottom slot of the MFD.
- 13) After restarting the system, turn the large **FMS** Knob and select the Aux page group on the MFD.
- 14) Turn the small **FMS** Knob and select the Databases page.
- 15) Verify that the standby databases transferred and are now in the active database column.

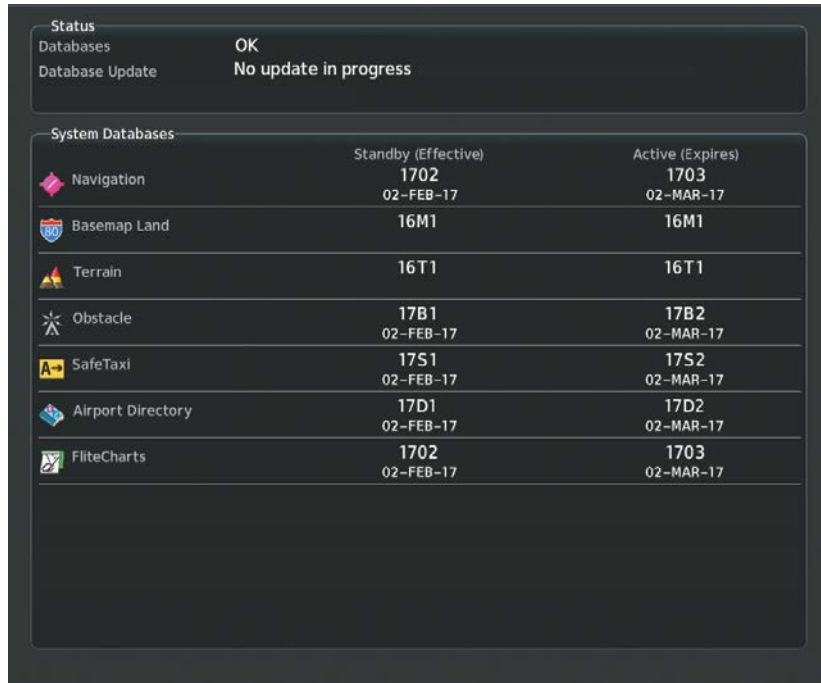


Figure B-3 Aux - Database Page - Updated Databases

- 16) To view database information for an individual display, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.



Figure B-4 Database Page Details

- 17) To manually activate any databases that did not transfer to the active column:
 - a) Press the **FMS** Knob. The first database title on the screen will be selected.
 - b) Turn the small **FMS** Knob as necessary to select the database title.
 - c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.
 - d) Remove and reapply power to the system.
 - e) Verify that the standby databases transferred and are now in the active database column.
- 18) Remove power from the system.

UPDATING DATABASES USING FLIGHT STREAM 510

Updating Databases from any MFD page (except the Aux - Databases page):

- 1) Insert the Flight Stream Multimedia Card in the bottom slot of the MFD.

- 2) Press the **Update** softkey when the Database Update screen appears.

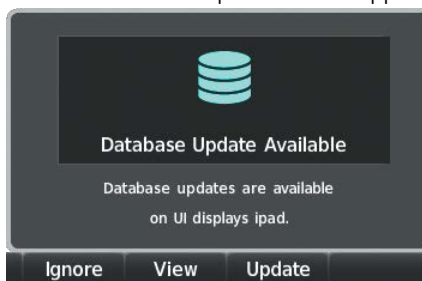


Figure B-5 Database Update Available

- 3) The Flight Stream 510 will enter WI-FI mode. The following screen will appear.



Figure B-6 Starting Database Transfer

- 4) Put the mobile device in WI-FI mode (refer to the Additional Features section).
- 5) Connect the mobile device to the Flight Stream 510 WI-FI (refer to the Additional Features section). The 'WI-FI Not Connected' screen will close when the WI-FI connection is established.
- 6) When the transfer is complete, the following screen will appear.

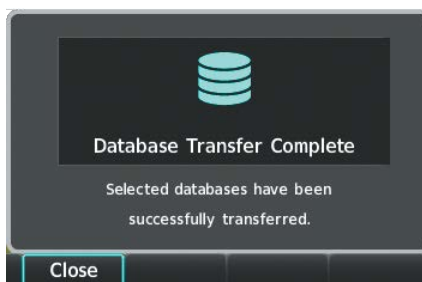


Figure B-7 Database Transfer Complete

- 7) Press the **Close** softkey.
- 8) When an existing database is expired and a new one is ready to become active, a 'Database Expired' window will appear. Continue to the next step to restart the system.

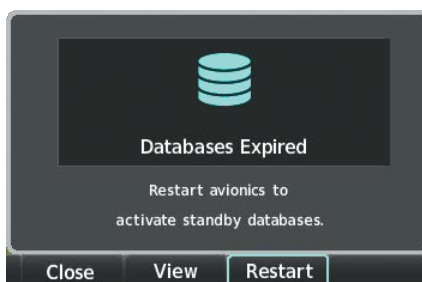


Figure B-8 Database Expired



NOTE: The **Restart** Softkey is enabled only when the aircraft is on the ground.

- 9) Select the **Restart** softkey to restart the system and load the updated database(s), or remove power from the system if the **Restart** Softkey is diminished .
- 10) After restarting the system, turn the large **FMS** Knob and select the Aux page group on the MFD.
- 11) Turn the small **FMS** Knob and select the Databases page.
- 12) Verify that the standby databases transferred and are now in the active database column.

System Databases	Standby (Effective)	Active (Expires)
Navigation	1702 02-FEB-17	1703 02-MAR-17
Basemap Land	16M1	16M1
Terrain	16T1	16T1
Obstacle	17B1 02-FEB-17	17B2 02-MAR-17
SafeTaxi	17S1 02-FEB-17	17S2 02-MAR-17
Airport Directory	17D1 02-FEB-17	17D2 02-MAR-17
FliteCharts	1702 02-FEB-17	1703 02-MAR-17

Figure B-9 Database Page with Updated Databases

- 13) To view database information for an individual display, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.

Standby	Active
US 1608	US 1603
Expires: 18-Aug-2016	Expires: 31-Mar-2016
Effective: 21-Jul-2016	Effective: 03-Mar-2016
Disables: 14-Feb-2017	Disables: 27-Sep-2016
Copyright 2016. Garmin Ltd. or its subsidiaries	
OK	

Figure B-10 Database Page Details

- 14) To manually activate any databases that did not transfer to the active column:
 - a) Press the **FMS** Knob. The first database title on the screen will be selected.
 - b) Turn the small **FMS** Knob as necessary to select the database title.

- c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.
 - d) Remove and reapply power to the system.
 - e) Verify that the standby databases transferred and are now in the active database column.
- 15) Remove power from the system.

Updating Databases from the Aux - Databases page:

- 1) With the system OFF, insert the Flight Stream Multimedia Card in the bottom slot of the MFD.
- 2) Turn the large **FMS** Knob to select the Aux page group on the MFD.
- 3) Turn the small **FMS** Knob to select the Database page group on the MFD.
- 4) Press the **Device** Softkey.
- 5) The Aux - Databases page will show the databases connected to the mobile device in place of the active databases on the system. Databases selected to load will be indicated by a cyan arrow.
- 6) Press the **Update** softkey. The Flight Stream 510 will enter WI-FI mode.
- 7) Put the mobile device in WI-FI mode (refer to the Additional Features section).
- 8) Connect the mobile device to the Flight Stream 510 WI-FI (refer to the Additional Features section).
- 9) The Database Update status will appear in the Status window at the top of the page.



NOTE: The **Restart** Softkey is enabled only when the aircraft is on the ground.

- 10) Select the **Restart** softkey to restart the system and load the updated database(s), or remove power from the system if the **Restart** Softkey is diminished .
- 11) After restarting the system, turn the large **FMS** Knob and select the Aux page group on the MFD.
- 12) Turn the small **FMS** Knob and select the Databases page.
- 13) Verify that the standby databases transferred and are now in the active database column.

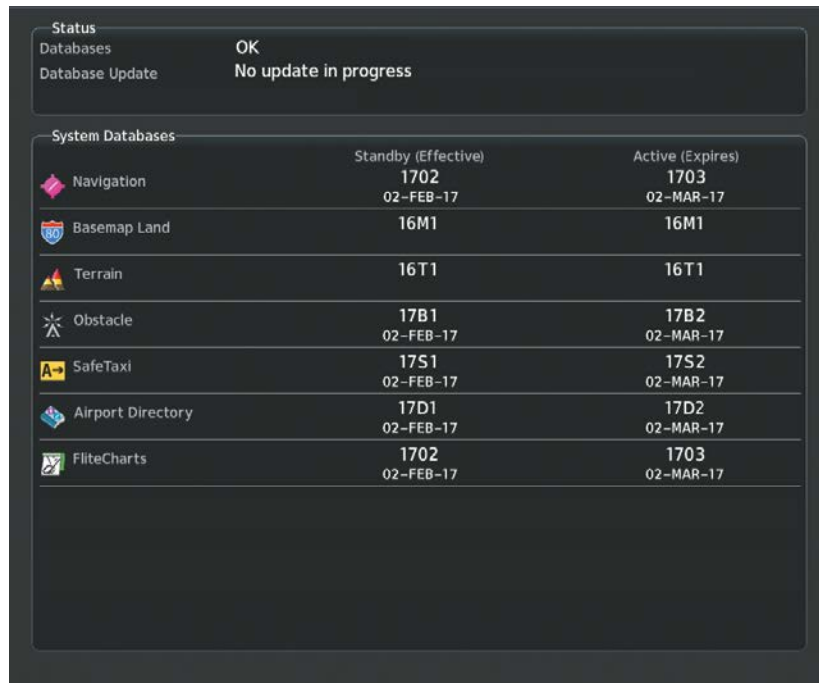


Figure B-11 Database Page with Updated Databases

- 14) To view database information for an individual display, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.



Figure B-12 Database Page Details

- 15) To manually activate any databases that did not transfer to the active column:
 - a) Press the **FMS** Knob. The first database title on the screen will be selected.
 - b) Turn the small **FMS** Knob as necessary to select the database title.
 - c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.
 - d) Remove and reapply power to the system.
 - e) Verify that the standby databases transferred and are now in the active database column.
- 16) Remove power from the system.

MAGNETIC FIELD VARIATION DATABASE UPDATE

A copy of the current magnetic field variation database (MV DB) is included with the navigation database. At startup, the system compares this version of the MV DB with that presently being used by the ADAHRS. If the system determines the MV DB needs to be updated, a prompt is displayed on the Navigation Map Page.

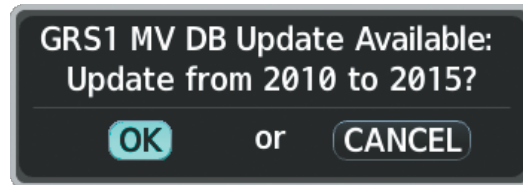


Figure B-13 Magnetic Field Variation Database Update Prompt

Loading the magnetic field variation database update:

With 'OK' highlighted, as seen in Figure B-13, press the **ENT** Key on the MFD. A progress monitor is displayed as shown in Figure B-14. When the upload is complete, the system is ready for use.

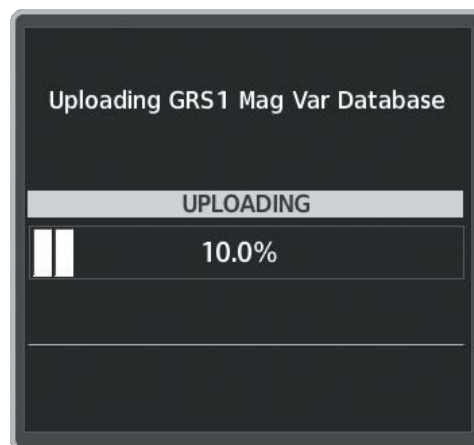


Figure B-14 Uploading Database

GARMIN AVIATION GLOSSARY

ACARS	Airborne Communications Addressing and Reporting System	AP DISC	Autopilot Disconnect
ACC	Accuracy	APPR, APR	Approach
ACT, ACTV	Active, Activate, Altitude Compensated Tilt	APT	Airport, Aerodrome
ADAHRS	Air Data, Attitude and Heading Reference System	APTSIGNS	Airport Signs
ADC	Air Data Computer	ARINC	Aeronautical Radio Incorporated
ADF	Automatic Direction Finder	ARSPC	Airspace
ADI	Attitude Direction Indicator	ARTCC	Air Route Traffic Control Center
ADIZ	Air Defense Identification Zone	ARV	Arrival
ADS-B	Automatic Dependent Surveillance-Broadcast	AS	Airspeed
ADS-R	Automatic Dependent Surveillance-Rebroadcast	ASB	Aviation Support Branch
AF	Arc to Fix Leg	ASOS	Automated Surface Observing System
AFCS	Automatic Flight Control System	AT	Auto Throttle
AFM	Airplane Flight Manual	ATC	Air Traffic Control
AFMS	Airplane Flight Manual Supplement	ATCRBS	ATC Radar Beacon System
AFRM	Airframe	ATIS	Automatic Terminal Information Service
AGL	Above Ground Level	ATK	Along Track
AHRS	Attitude and Heading Reference System	AUTOSEQ	Automatic Sequence
AIM	Aeronautical Information Manual	AUX	Auxiliary
AIRB	Airborne	AVG	Average
AIRMET	Airman's Meteorological Information	AVLC	Aviation VHF Link Control
AIRREP	Air Reports	AWOS	Automated Weather Observing System
ALRT	Alert	B	Both Runways
ALT	Altitude	B ALT	Barometric Altitude
ALT, ALTN	Alternator	BARO	Barometer, Barometric
ALTS	Selected Altitude Capture Mode	BATT	Battery
ALTV	VNAV Altitude Capture Mode	BC	Backcourse
AMPS	Amperes	Bearing	The compass direction from the present position to a destination waypoint.
ANNUNC/ANN	Annunciation/Annunciator	BFO	Beat Frequency Oscillator
ANT	Antenna	BKSP	Backspace
AOA	Angle of Attack, ACARS Over AVLC	Bluetooth	Wireless standard for data exchange over short distances
AOC	Aeronautical Operational Control	BOC	Bottom of Climb
AOG	Aircraft On Ground	BOD	Bottom of Descent
AOPA	Aircraft Owners and Pilots Association	BRG	see also Bearing
AP	Autopilot	°C	Degrees Celsius

C	Center Runway	Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.
CA	Course to Altitude Leg	CRS	see also Course, Course to Steer
CAL	Calibrated	CRSR	Cursor
CALC	Calculator	CSA	Conflict Situational Awareness
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.	CSC	Current Speed Control
CAS	Crew Alerting System	CTA	Control Area
CD	Course to DME Distance Leg	CTR	Center
CDI	Course Deviation Indicator	CTRL	Control
CDU	Control Display Unit	Cumulative, CUM	The total of all legs in a flight plan.
CF	Course to Fix Leg	CVDR	Cockpit Voice Data Recorder
CG	Center of Gravity	CVR	Cockpit Voice Recorder
CH, CHNL	Channel	CVRG	Coverage
CHT	Cylinder Head Temperature	CWS	Control Wheel Steering
CHKLIST	Checklist	CYL	Cylinder
CI	Course to Intercept Leg	D ALT	Density Altitude
CLD	Cloud	D-ATIS	Digital Automatic Terminal Info Service
CLR	Clear	DB, DBASE	Database
CM	Centimeter	dBZ	Decibels 'Z' (Radar Return)
CMC	Central Maintenance Computer	DCL	Departure Clearance
CN	Canada	DCLTR, DECLTR	Declutter
CNS	Communication, Navigation, & Surveillance	DEC FUEL	Decrease Fuel
CO	Carbon Monoxide	DEG	Degree
COM	Communication Radio	DEIC, DEICE	De-icing
CONFIG	Configuration	DEP	Departure
COOL	Coolant	Desired Track	The desired course between the active "from" and "to" waypoints.
COPLT	Copilot	DES, DEST	Destination
Course	The line between two points to be followed by the aircraft.	DEV	Deviation
Course to Steer	The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.	DF	Direct to Fix Leg
CPDLC	Controller Pilot Datalink Communications	DFLT	Default
CPL	Couple	DG	Directional Gyro
CR	Course to Radial Leg	DGRD	Degrade
CRG	Cockpit Reference Guide	DH	Decision Height
CRNT	Current	Dilution of Precision	A measure of GPS satellite geometry quality on a scale of one to ten (lower numbers equal better geometry, where higher numbers equal poorer geometry).

DIR	Direction	ENGD	Engaged
DIS	Distance	ENR	Enroute; ETE to Final Destination
Distance	The 'great circle' distance from the present position to a destination waypoint.	Enroute Safe Altitude (ESA)	Uses Grid MORAs to determine a safe altitude within ten miles left or right of the desired course on an active flight plan or direct-to.
DL LTNG	Datalink Lightning	ENT	Enter
DLS	Data Link System	EPE	see also Estimated Position Error
DME	Distance Measuring Equipment	EPU	Estimated Position Uncertainty
DN	Down	ERR	Error
DOP	see also Dilution of Precision	ES	Extended Squitter
DP	Departure Procedure	ESA	see also Enroute Safe Altitude
DPRT	Departure	ESP	Electronic Stability and Protection
DR	Dead Reckoning	Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
DSBL	Disabled	Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
DTG	Distance To Go, Remaining distance to last active FPL waypoint	Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.
DTK	see also Desired Track	ETA	see also Estimated Time of Arrival
DQR	Data Quality Requirements	ETE	see also Estimated Time Enroute
E	Empty, East	EVS	Enhanced Vision System
EAS	Engine and Airframe Systems	EXPIRD	Expired
ECU	Engine Control Unit	°F	Degrees Fahrenheit
EDM	Emergency Descent Mode	FA	Course From Fix to Altitude Leg
EFC	Expected Further Clearance	FAA	Federal Aviation Administration
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.	FADEC	Full Authority Digital Engine Control
EGNOS	European Geostationary Navigation Overlay Service	FAF	Final Approach Fix
EGT	Exhaust Gas Temperature	FAIL	Failure
EICAS	Engine Indication and Crew Alerting System	FANS	Future Air Navigation System
EIS	Engine Indication System	FBO	Fixed Base Operator
ELEV	Elevation, Elevator	FC	Course From Fix to Distance Leg
ELT	Emergency Locator Transmitter	FCC	Federal Communication Commission
EMER, EMERG, EMERGCY	Emergency	FCST	Forecast
EMI	Electromagnetic Interference	FD	Flight Director, Course From Fix to DME Distance Leg
END, ENDUR	Endurance	FDE	Fault Detection and Exclusion
Endurance	Flight endurance, or total possible flight time based on available fuel on board.		
ENG	Engine		

SYSTEM OVERVIEW	FF, FFLOW	see also Fuel Flow	GDU	Garmin Display Unit
	FIS-B	Flight Information Services-Broadcast	GEA	Garmin Engine/Airframe Unit
	FISDL	Flight Information Service Data Link	GEO	Geographic
	FL	Flight Level	GFC	Garmin Flight Control
	FLC	Flight Level Change	GIA	Garmin Integrated Avionics Unit
	FLT	Flight Timer	GLONASS	Global Orbiting Navigation Satellite Landing System
	FLTA	Forward Looking Terrain Avoidance	GLS	Global Navigation Satellite Landing System
	FM	Course From Fix to Manual Termination Leg	GMA	Garmin Audio Panel System
	FMS	Flight Management System	GMC	Garmin Mode Controller
	FOB	see also Fuel On Board	GMT	Greenwich Mean Time
FLIGHT INSTRUMENTS	FOD	see also Fuel Over Destination	GMU	Garmin Magnetometer Unit
	FPA	Flight Path Angle	GND	Ground
	FPL	Flight Plan	GPH	Gallons per Hour
	FPM	Feet Per Minute, Flight Path Marker	GPN	Garmin Part Number
	FREQ	Frequency	GPS	Global Positioning System
	FRMT	Format	GPWS	Ground Proximity Warning System
	FRZ	Freezing	Grid MORA (Minimum Off—Route Altitude)	One degree latitude by one degree longitude in size and clears the highest elevation reference point in the grid by: a) 1,000 feet where the highest elevation is <5001MSL or b) 2,000 feet where the highest elevation is >5000MSL
	FSM	Flight System Messages	Groundspeed	The velocity that the aircraft is travelling relative to a ground position.
	FSS	Flight Service Station	Ground Track	See Track
	FT	foot/feet	GRS	Garmin Reference System
EIS	Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.	GS	Ground Speed, Glideslope
	Fuel On Board	The total amount of usable fuel on board the aircraft.	GSA	Garmin Servo Adapter
	Fuel Over Destination	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.	GSD	Garmin Data Concentrator
	FWD	Forward	GSL	Geodetic Sea Level
	G/S	Glideslope	GSR	Garmin Satellite Radio
	GA	Go-Around	GSU	Garmin Sensor Unit
	GAL, GL	Gallon(s)	GTC	Garmin Touchscreen Controller
	GBOX	Gearbox	GTS	Garmin Traffic System
	GBT	Ground Based Transceiver	GTX	Garmin Transponder
	GCU	Garmin Control Unit	GWX	Garmin Weather Radar
AUDIO PANEL & CNS	GCS	Ground Clutter Suppression	HA	Hold Terminating at Altitude Leg
	GDC	Garmin Air Data Computer	HDG	see also Heading
	GDL	Garmin Satellite Data Link		
	GDR	Garmin Data Radio		
FLIGHT MANAGEMENT				
HAZARD AVOIDANCE				
AFCS				
ADDITIONAL FEATURES				
APPENDICES				
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HDOP	Horizontal Dilution of Precision	IN	Inch
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.	INACTV	Inactive
HF	High Frequency, Hold Terminating at Fix Leg	INC FUEL	Increase Fuel
HFOM	see also Horizontal Figure of Merit	IND	Indicator, Indicated
Hg	Mercury	Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
HI	High	INFO	Information
HI SENS	High Sensitivity	IN Hg	Inches of Mercury
HM	Hold with Manual Termination Leg	INS	Inertial Navigation System
HNS	Hybrid Navigation System	INT	Intersection(s)
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.	INTEG	Integrity (RAIM unavailable)
hPa	Hectopascal	IrDA, IRDA	Infrared Data Association
HPL	Horizontal Protection Level	ISA	International Standard Atmosphere; ISA Relative Temperature
HR	Hour	ITT	Inter-Turbine Temperature, Interstage Turbine Temperature
HRZN HDG	Horizon Heading	KEYSTK	Key Stuck
HSDB	High-Speed Data Bus	KG	Kilogram
HSI	Horizontal Situation Indicator	kHz	Kilohertz
HT	Heat	KM	Kilometer
HUL	Horizontal Uncertainty Level	KT	Knot
Hz	Hertz (cycles per second)	L	Left, Left Runway
I	Inner Marker	LAT	Latitude
IAF	Initial Approach Fix	LBL	Label
IAS	Indicated Air Speed	LB	Pound
IAT	Indicated Air Temperature	LCD	Liquid Crystal Display
IAU	Integrated Avionics Unit	LCL	Local
ICAO	International Civil Aviation Organization	LDA	Landing Distance Available
ICS	Intercom System	LDG	ETA at Final Destination
ID	Identification/Morse Code Identifier	LED	Light Emitting Diode
IDENT, IDNT	Identification	Left Over Fuel On Board	The amount of fuel remaining on board after the completion of one or more legs of a flight plan or direct-to.
IEEE	Institute of Electrical & Electronics Engineers	Left Over Fuel Reserve	The amount of flight time remaining, based on the amount of fuel on board after the completion of one or more legs of a flight plan or direct-to, and a known consumption rate.
IF	Initial Fix		
IFR	Instrument Flight Rules		
IG	Imperial Gallon		
ILS	Instrument Landing System		
IMC	Instrument Meteorological Conditions		

Leg	The portion of a flight plan between two waypoints.	MFD	Multi Function Display
LGND	Legend	MFW	Multi Function Window
LIFR	Low Instrument Flight Rules	MGRS	Military Grid Reference System
LMM	Location Middle Marker	MHz	Megahertz
LNAV	Lateral Navigation	MIC	Microphone
LO	Low	MIN	Minimum
LOA	Letter of Authorization	Minimum Safe Altitude (MSA)	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.
LOC	Localizer	MKR	Marker Beacon
LOI	Loss of Integrity (GPS)	MOA	Military Operations Area
LOM	Location Outer Marker	MON	Monitor
LON	Longitude	MOV	Movement
LP	Localizer Performance	MORA	Minimum Off-Route Altitude
LPV	Localizer Performance with Vertical Guidance	MPEL	Maximum Permissible Exposure Level
LRU	Line Replaceable Unit	MPM	Meters per Minute
LT	Left	MSA	see also Minimum Safe Altitude
LTNG	Lightning	MSAS	Multi-functional Satellite Augmentation System
LVL	Level	MSG	Message
M	Meter, Middle Marker, Mach	MSL	Mean Sea Level
M_{MO} (V_{MO})	Maximum Speed	MT, M	Meter
Mach Number	Mach number is the ratio of the true airspeed to the speed of sound.	mV	Millivolt(s)
MAG	Magnetic	MVFR	Marginal Visual Flight Rules
MAG VAR	Magnetic Variation	N	North
MAHP	Missed Approach Hold Point	NAV	Navigation
MAN IN	Manifold Pressure (inches Hg)	NAVAID	Navigation Aid
MAN SQ	Manual Squelch	NDB	Non-Directional Beacon
MANSEQ	Manual Sequence	NEXRAD	Next Generation Radar
MAP	Missed Approach Point	NM	Nautical Mile(s)
MASQ	Master Avionics Squelch	NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
MAX	Maximum	NOTAM	Notice To Airman
MAXSPD	Maximum Speed (overspeed)	NRST	Nearest
MB	Marker Beacon	O	Outer Marker
MDA	Barometric Minimum Descent Altitude	OAT	Outside Air Temperature
MEPT	Manual Electric Pitch Trim	OBS	Omni Bearing Selector
MET	Manual Electric Trim		
METAR	Aviation Routine Weather Report		

OFST	Offset	RAD ALT	Radio Altimeter
OOOI	Out of the gate, Off the ground, On the ground, and In the gate	RAIM	Receiver Autonomous Integrity Monitoring
OXY	Oxygen	RAM	Random Access Memory
P ALT	Pressure Altitude	RAT	Ram Air Temperature
PA	Passenger Address, Proximity Advisory	RCVR	Receiver
PASS	Passenger(s)	REF	Reference
PC	Personal Computer	REM	Remaining (fuel remaining), Reminder
PDC	Pre-Departure Clearance	REQ	Required
PFD	Primary Flight Display	RES	Reserve (fuel reserve entered by pilot)
PG	Pilot's Guide	REV	Reverse, Revision, Revise
PI	Procedure Turn to Course Intercept Leg	RF	Radio Frequency, Constant Radius Turn to Fix Leg
PIREP	Pilot Report	RMI	Radio Magnetic Indicator
PIT, PTCH	Pitch	RMT	Remote
POA	Plain Old ACARS	RNAV	Area Navigation
POH	Pilot's Operating Handbook	RNG	Range
POHS	Pilot's Operating Handbook Supplement	RNP	Required Navigation Performance
POS, POSN	Position	RNWX, RWY	Runway
PPH	Pounds per Hour	ROL	Roll
PPM	Parts per Million	ROM	Read Only Memory
P. POS	Present Position	RPM	Revolutions Per Minute
PRES, PRESS	Pressure	RST FUEL	Reset Fuel
PROC	Procedure(s), Procedure Turn	RSV	Reserve (fuel reserve entered by pilot)
PROP	Propeller	RT	Right
PROX	Proximity	RVRSNRY	Reversionary
PSI	Pounds per Square Inch	RVSM	Reduced Vertical Separation Minimums
PT	Procedure Turn	RX	Receive
PTK	Parallel Track	S	South
PTT	Push-to-Talk	SA	Selective Availability
PWR	Power	SAR	Search and Rescue
QFE	Field Elevation Pressure	SAT	Static Air Temperature
QNH	Sea Level Pressure	SBAS	Satellite-Based Augmentation System
QTY	Quantity	SCIT	Storm Cell Identification and Tracking
R	Right, Right Runway	SD	Secure Digital
RA	Resolution Advisory, Radio Altimeter	SEC	Second(s)
RAD	Radial	SEL, SLCT	Select
		SELCAL	Selective Calling

SYSTEM OVERVIEW	SENS	Sense	TACAN	Tactical Air Navigation System
	SFC	Surface	TAF	Terminal Aerodrome Forecast
	SIAP	Standard Instrument Approach Procedures	TAS	True Airspeed, Traffic Advisory System
FLIGHT INSTRUMENTS	SID	Standard Instrument Departure	TAT	Total Air Temperature
	SIG/AIR	SIGMET/AIRMET	TAWS	Terrain Awareness and Warning System
	SIGMET	Significant Meteorological Information	TCA	Terminal Control Area
	SIM	Simulator	TCAS	Traffic Alert Collision Avoidance System
	SLD	Supercooled Large Droplet	TEL	Telephone
	SLP/SKD	Slip/Skid	TEMP	Temperature
	SMBL	Symbol	TERM	Terminal
	SMS	Short Message System	TF	Track Between Two Fixes Leg
	SNGL	Single	TFR	Temporary Flight Restriction
	SPC	Space	TGT	Target
	SPD	Speed	T HDG	True Heading
	SPI	Special Position Identification	TIS	Traffic Information Service
	SPKR	Speaker	TIS-B	Traffic Information Service-Broadcast
	SQ	Squelch	TIT	Turbine Inlet Temperature
	SRVC, SVC	Service	TKE	see also Track Angle Error
	SSID	Wireless Service Set Identifier	TMA	Terminal Maneuvering Area
	STAB	Stabilization	TMR/REF	Timer/Reference
STAL	Stall	TOC	Top of Climb	
STAR	Standard Terminal Arrival Route	TOD	Top of Descent	
STATS	Statistics	TOGA, TO/GA	Take-Off, Go-Around	
STBY	Standby	TOLD	Takeoff and Landing Data	
STD	Standard	TOPO	Topographic	
STRMSCP	Stormscope	TORA	Takeoff Run Available	
SUA	Special Use Airspace	TOT	Total	
SURF	Surface	TPA	Traffic Pattern Altitude	
SUSP	Suspend	Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'.	
SVT	Synthetic Vision Technology	Track Angle Error	The angle difference between the desired track and the current track.	
SW	Software	TRK	see also Track	
SYNC	Synchronize	TRSA	Terminal Radar Service Area	
SYN TERR	Synthetic Terrain	TRUNC	Truncated	
SYN VIS	Synthetic Vision	TTL	Total	
SYS	System	TURB	Turbulence	
T	True	TURN	Procedure Turn	
TA	Traffic Advisory	TWIP	Terminal Weather Information for Pilots	

TX	Transmit	VD	Heading Vector to DME Distance Leg
UAT	Universal Access Transceiver	VDC	Volts Direct Current
UHF	Ultra-High Frequency	VDL	VHF Datalink
UNAVAIL	Unavailable	VERT	Vertical
US	United States	Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.
USR	User	Vertical Speed Required	The vertical speed necessary to descend/ climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.
UTC	Coordinated Universal Time	VFOM	see also Vertical Figure of Merit
UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid	VFR	Visual Flight Rules
V	Volts	VHF	Very High Frequency
V, Vspeed	Velocity (airspeed)	VI	Heading Vector to Intercept Leg
V₁	Takeoff Decision Speed	VLOC	VOR/Localizer Receiver
V₂	Takeoff Safety Speed	VM	Heading Vector to Manual Termination Leg
V_A	Maneuvering Speed	VMC	Visual Meteorological Conditions
V_{APP}, V_{AC}	Approach Climb Speed	VNAV, VNV	Vertical Navigation
V_{FE}	Maximum Flap Extended Speed	VOL	Volume
V_{LE}	Maximum Landing Gear Extended Speed	VOR	VHF Omnidirectional Range
V_{LNDx}	Approach Speed (Flaps at x°)	VORTAC	VHF Omnidirectional Range Station and Tactical Air Navigation
V_{LO}	Maximum Landing Gear Operating Speed	VPATH, VPTH	Vertical Path
V_{MC}	Minimum Control Speed	VPL	Vertical Protection Level
V_{MO} (M_{MO})	Maximum Operating Speed	VPROF	VNAV Profile, Vertical Profile
V_{NE}	Never-Exceed Speed	VR	Heading Vector to Radial Leg
V_R	Takeoff Rotate Speed	VRP	Visual Reporting Point
V_{REF}	Landing Approach Speed, Reference Landing Speed	VS	Vertical Speed
V_{SB}	Maximum Speedbrake Speed	VSD	Vertical Situation Display
V_{SR}	Stall Speed	VSI	Vertical Speed Indicator
V_T	Takeoff Flap Retraction Speed	VSR, VS REQ	see also Vertical Speed Required
V_{TIRE}	Maximum Tire Speed	VTF	Vector to Final
V_X	Best Angle of Climb Speed	W	Watt(s), West
V_Y	Best Rate of Climb Speed	WAAS	Wide Area Augmentation System
V_{YSE}	Best Single-Engine Rate of Climb Speed	WARN	Warning
V DEV	Vertical Deviation	WATCH	Weather Attenuated Color Highlight
VA	Heading Vector to Altitude Leg	WGS-84	World Geodetic System - 1984
VAC	Volts Alternating Current		
VAPP	VOR Approach		
VAR	Variation		

WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
WOG	Weight on Gear
WOW	Weight on Wheels
WPT	Waypoint(s)
WT	Weight
WW	World Wide
WX	Weather
XFER, XFR	Transfer
XM LTNG	SiriusXM Lightning
XPDR	Transponder
XTALK	Cross-Talk
XTK	Cross-Track, Crosstrack Error
YD	Yaw Damper

FREQUENTLY ASKED QUESTIONS

If a particular aspect of system operational capability is not addressed by these commonly asked questions or in the index, contact Garmin (see the copyright page or back cover for contact information) or a Garmin-authorized dealer. Garmin is dedicated to supporting its products and customers.

WHAT IS SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan and parts of northern Australia.

HOW DOES SBAS AFFECT APPROACH OPERATIONS?

Both LNAV/VNAV and LPV approaches use the accuracy of SBAS to include vertical (glide path) guidance capability. The additional accuracy and vertical guidance capability allows improved instrument approaches to an expanded number of airports throughout the U.S.

The implementation of LPV approaches further improves precision approach capabilities. LPV approaches are designed to make full use of the improved GPS signal from the SBAS. This approach combines the LNAV/VNAV vertical accuracy with lateral guidance similar to the typical Instrument Landing System (ILS). LPV approaches allow lower approach minimums.

WHAT IS RAIM AND HOW DOES IT AFFECT APPROACH OPERATIONS?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:

- Monitors and verifies integrity and geometry of tracked GPS satellites
- Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight
- Predicts satellite coverage of a destination area to determine whether the number of available satellites is sufficient to satisfy requirements



NOTE: *If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the "RAIM not available from FAF to MAP" message and the LOI annunciation flagging on the HSI.*

For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 nm for oceanic and en route, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). The system monitors RAIM and issues an alert message when RAIM is not available (see Appendix A). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

WHAT IS GSL ALTITUDE?

GSL (Geodetic Sea Level) altitude is the height above Mean Sea Level (MSL), as calculated geometrically, generally using a global positioning system (GPS) as the primary data source. The calculated result may or may not include a barometric component, but the primary source is geometric.

WHY ARE THERE NOT ANY APPROACHES AVAILABLE FOR A FLIGHT PLAN?

Approaches are available for the final destination airport in a flight plan or as a direct-to (keep in mind that some VOR/VORTAC identifiers are similar to airport identifiers). If a destination airport does not have a published approach, the system indicates “NONE” for the available procedures.

WHAT HAPPENS WHEN AN APPROACH IS SELECTED? CAN A FLIGHT PLAN WITH AN APPROACH, A DEPARTURE, OR AN ARRIVAL BE STORED?

When an approach, departure, or arrival is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan, along with a header line showing the title of the selected instrument procedure. The original en route portion of the flight plan remains active, unless the instrument procedure is activated. This may be done either when the procedure is loaded or at a later time.

Flight plans can also be stored with an approach, a departure, or an arrival. Note that the active flight plan is erased when the system is turned off. Also, the active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, a departure, or an arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information, provided the procedure has not been modified. Should an approach, departure, or arrival procedure no longer be available, the flight plan becomes locked until the procedure is deleted from the flight plan.

CAN “SLANT GOLF” (“/G”) BE FILED?

“/G” may be filed for a flight plan. The system meets the requirements of TSO-C145a Class 3 and ETSO C145 Class 3 installations. GPS approaches are not to be flown with an expired database. See the approved Pilot’s Operating Handbook (POH) as well as the Aeronautical Information Manual (AIM) for more information.

WHAT DOES THE OBS SOFTKEY DO?

The **OBS** Softkey is used to select manual sequencing of waypoints. Activating OBS mode sets the current active-to waypoint as the primary navigation reference and prevents the system from sequencing to the next waypoint in a flight plan. When OBS mode is cancelled, automatic waypoint sequencing is continued, and the system automatically activates the next waypoint in the flight plan once the aircraft has crossed the present active waypoint.

Normal (OBS not activated)	OBS
<ul style="list-style-type: none"> • Automatic sequencing of waypoints 	<ul style="list-style-type: none"> • Manual sequencing - 'holds' on selected waypoint
<ul style="list-style-type: none"> • Manual course change on HSI not possible 	<ul style="list-style-type: none"> • Manually select course to waypoint from HSI
<ul style="list-style-type: none"> • Always navigates 'TO' the active waypoint 	<ul style="list-style-type: none"> • Indicates 'TO' or 'FROM' waypoint
<ul style="list-style-type: none"> • Must be in this mode for final approach course 	<ul style="list-style-type: none"> • Cannot be set for final approach course or published holding patterns

When OBS mode is active, the system allows the pilot to set a desired course to/from a waypoint using the **CRS/BARO** Knob and HSI (much like a VOR).

The most common application for using the **OBS** Softkey is the missed approach. The system suspends automatic waypoint sequencing (indicated by a 'SUSP' annunciation placed on the HSI) when the missed approach point (MAP) is crossed. This prevents the system from automatically sequencing to the missed approach holding point (MAHP). During this time, the **OBS** Softkey designation changes to **SUSP**. Pressing the **SUSP** Softkey reactivates automatic waypoint sequencing. The **OBS** Softkey then resumes its normal functionality.

WHY MIGHT THE SYSTEM NOT AUTOMATICALLY SEQUENCE TO THE NEXT WAYPOINT?

The system only sequences flight plan waypoints when automatic sequencing is enabled (i.e., no 'OBS' or 'SUSP' annunciation on the HSI). For automatic sequencing to occur, the aircraft must also cross the *bisector* of the turn being navigated. The bisector is a line passing through the waypoint common to two flight plan legs at an equal angle from each leg.

HOW CAN A WAYPOINT BE SKIPPED IN AN APPROACH, A DEPARTURE, OR AN ARRIVAL?

The system allows the pilot to manually select any approach, departure, or arrival leg as the active leg of the flight plan. This procedure is performed on the MFD from the Active Flight Plan Page by highlighting the desired waypoint and pressing the **ACT Leg** Softkey then the **ENT** Key to approve the selection. The GPS then provides navigation along the selected flight plan leg.

WHEN DOES TURN ANTICIPATION BEGIN?

The system smooths adjacent leg transitions based on a normal 15° bank angle (with the ability to roll up to 30°) and provides three pilot cues for turn anticipation:

- A waypoint alert ('Next DTK ###° in # seconds' or 'Next HDG ###° in # seconds') appears on the PFD 10 seconds before the turn point and flashes as it counts down to zero.
- A flashing turn advisory ('Turn [right/left] to ###° in # seconds') appears on the PFD 10 seconds before the turn and flashes as it counts down to zero. 'Turn [right/left] to ###° now' or 'Next [DTK/HDG] to ###° now' is displayed when the pilot is to begin the turn and the HSI (GPS mode) automatically sequences to the next DTK or HDG value.
- The To/From indicator on the HSI flips momentarily to indicate that the midpoint of the turn has been crossed.

WHEN DOES THE CDI SCALE CHANGE?

Once a departure is activated, the Course Deviation Indicator (CDI) full scale deflection is set to 0.3 nm. The CDI scale changes to 1.0 nm (terminal mode) then ramps up to 2.0 nm (enroute mode) at 30 nm from the departure airport. When 31 nm from the destination, the CDI scale smoothly transition from 2.0 nm back to 1.0 nm (terminal mode). At 2.0 nm before the FAF during an active approach, the CDI scale transitions down further based on the type of approach activated (LNAV, LNAV/VNAV, LPV). When a missed approach is activated, the CDI is set to 0.3 nm. See the Flight Instruments Section for more details on CDI scaling.

WHY DOES THE HSI NOT RESPOND LIKE A VOR WHEN OBS MODE IS ACTIVE?

Unlike a VOR, the CDI scale used on GPS equipment is based on the crosstrack distance to the desired course, not on the angular relationship to the destination. Therefore, the CDI deflection on the GPS is constant regardless of the distance to the destination and does not become less sensitive when further away from the destination.

WHAT IS THE CORRECT MISSED APPROACH PROCEDURE? HOW IS THE MISSED APPROACH HOLDING POINT SELECTED?

To comply with TSO specifications, the system does not automatically sequence past the MAP. The first waypoint in the missed approach procedure becomes the active waypoint when the **SUSP** Softkey is selected *after* crossing the MAP. All published missed approach procedures must be followed, as indicated on the approach plate.

To execute the missed approach procedure prior to the MAP (not recommended), select the Active Flight Plan Page and use the **ACT Leg** Softkey to activate the missed approach portion of the procedure.

AFTER A MISSED APPROACH, HOW CAN THE SAME APPROACH BE RE-SELECTED? HOW CAN A NEW APPROACH BE ACTIVATED?

















NOTE: Do not attempt to reactivate the current approach prior to crossing the missed approach point (MAP). If an attempt to do so is made, an alert message "Are you sure you want to discontinue the current approach?" appears. The system directs the pilot back to the transition waypoint and does not take into consideration any missed approach procedures, if the current approach is reactivated.

After flying the missed approach procedure, the pilot may reactivate the same approach for another attempt by pressing the **PROC** Key. Once the clearance is given for another attempt, activate the approach by highlighting 'Activate Approach' using the large **FMS** Knob and pressing the **ENT** Key. The system provides navigation along the desired course to the waypoint and rejoins the approach in sequence from that point.

To activate a new approach for the same airport, select the new procedure by pressing the **PROC** Key. Choose 'Select Approach', select the desired approach from the list shown, and press the **ENT** Key. Select the desired transition, then activate the approach using the **ENT** Key.

To activate a new approach to a different airport, press the **Direct-to** Key and select the desired airport using the **FMS** Knobs. Press the **ENT** Key to accept the selected airport, then follow the steps in the preceding paragraph to select an approach for the new airport.

MISCELLANEOUS MAP SYMBOLS

Item	Symbol
ARTCC Frequency or FSS Frequency	
Map Pointer (when panning)	
Elevation Pointer (on Topography Scale when panning)	
Measuring Pointer	
Wind Vector	
Overzoom Indicator	
User Waypoint	
Vertical Navigation Along Track Waypoint	
Parallel Track Waypoint	
Unanchored Flight Path Waypoint	
Displayed when aircraft GPS location is valid, but heading is invalid.	
Top of Descent (TOD)	
Bottom of Descent (BOD)	
Navigating using Dead Reckoning	

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Garmin International, Inc.
1200 East 151st Street
Olathe, Kansas 66062, U.S.A.
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Fax: 913.397.8282
Aircraft On Ground (AOG)
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Garmin AT, Inc.
2345 Turner Road SE
Salem, OR 97302, U.S.A.
Tel: 503.581.8101
Fax 503.364.2138

Garmin (Europe) Ltd.
Liberty House, Hounslow Business Park
Southampton, Hampshire SO40 9LR U.K.
Tel: +44 (0) 238 052 4000
Fax: +44 (0) 238 052 4004
Aviation Support: +44 (0) 370 850 1243

Garmin Corporation
No. 68, Zhangshu 2nd Road
Xizhi District,
New Taipei City, Taiwan
Tel: 34-93-357-2608
Fax: 34-93-429-4484

www.garmin.com