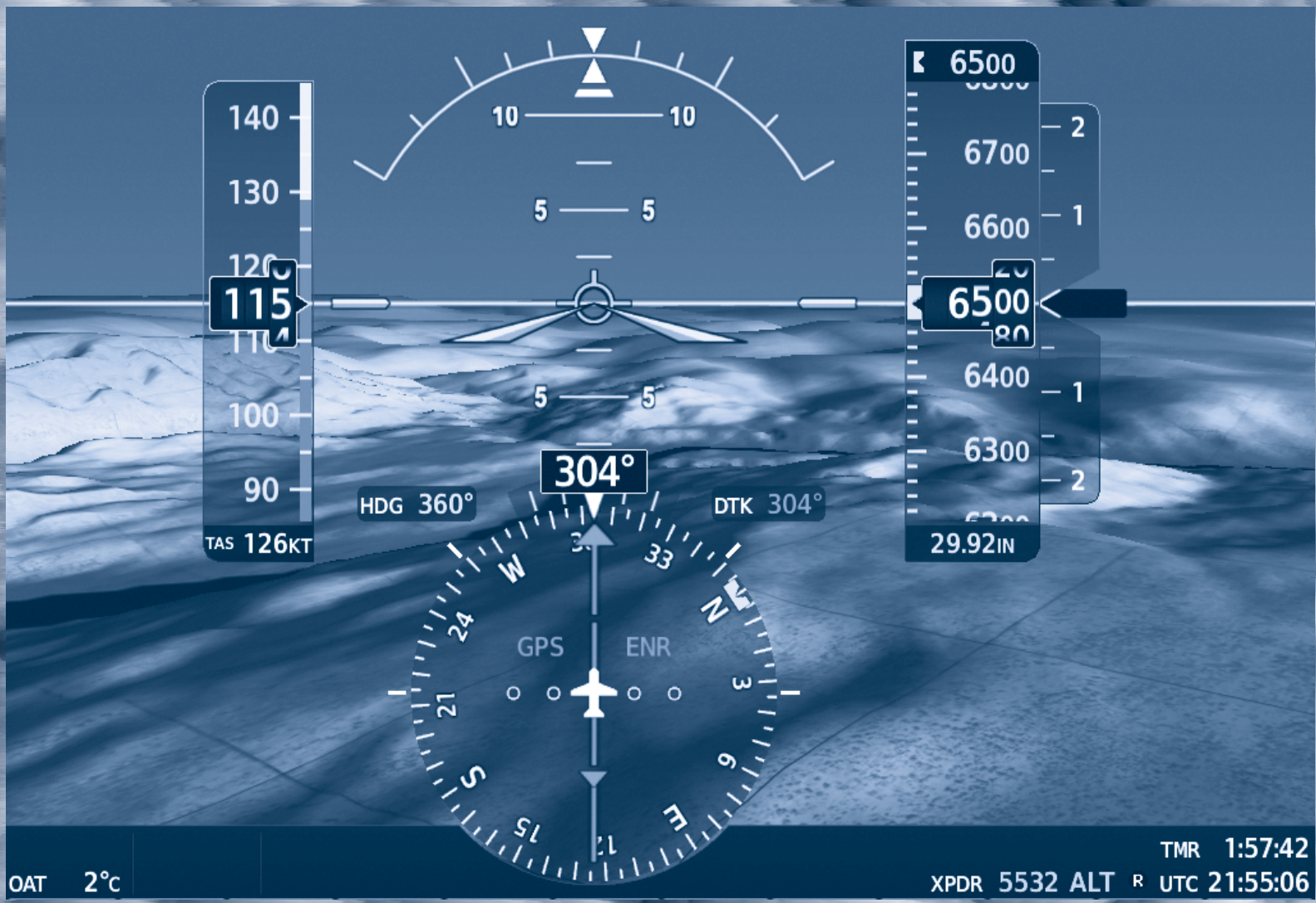
GARMIN®

G1000® NXi

Pilot's Guide



Cessna NAV III

System Software Version 4013.00 or later

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 4013.00 or later for the G1000 NXi Cessna NAV III. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

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WARNING: *Do not operate this equipment without first obtaining qualified instruction.*

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: *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: *Do not rely on the displayed minimum safe altitude (MSAs) as the sole source of obstacle and terrain avoidance information. Always refer to current aeronautical charts for appropriate minimum clearance altitudes.*

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: *Do not rely on the autopilot to level the aircraft at the MDA/DH when flying 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. (If Equipped with Garmin AFCS)*

WARNING: *Do not rely on the accuracy of attitude and heading indications in the following geographic areas (due to variations in the earth's magnetic field): North of 72° North latitude at all longitudes; South of 70° South latitude at all longitudes; North of 65° North latitude between longitude 75° W and 120° W. (Northern Canada); North of 70° North latitude between longitude 70° W and 128° W. (Northern Canada); North of 70° North latitude between longitude 85° E and 114° E. (Northern Russia); South of 55° South latitude between longitude 120° E and 165° E. (Region south of Australia and New Zealand).*

WARNING: *Use appropriate primary systems for navigation, and for terrain, obstacle, and traffic avoidance. Garmin 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.*

WARNING: *Do not use the Garmin 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.*

WARNING: *Do not use TAWS information for primary terrain or obstacle avoidance. TAWS is intended only to enhance situational awareness.*

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 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 SurfaceWatch™ information as the primary method of flight guidance during airborne or ground operations. SurfaceWatch does not have NOTAM or ATIS information regarding the current active runway, condition, or information about the position of hold lines.*

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

CAUTION: *Do not allow repairs to be made by anyone other than an authorized Garmin service center. Unauthorized repairs or modifications could void both the warranty and affect the airworthiness of the aircraft.*

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 *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: *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: *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: *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 flygarmin.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 pertinent aircraft documents 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 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 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: *Electronic aeronautical charts displayed on this system have been shown to meet the guidance in AC 120-76D as a Type B Electronic Flight Bag (EFB) for FliteCharts and ChartView. The accuracy of the charts is subject to the chart data provider. Own-ship position on airport surface charts cannot be guaranteed to meet the accuracy specified in AC 120-76D. Possible additional requirements may make a secondary source of aeronautical charts, such as traditional paper charts or an additional electronic display, necessary on the aircraft and available to the pilot. If the secondary source of aeronautical charts is a Portable Electronic Device (PED), its use must be consistent with the guidance in AC 120-76D.*

NOTE: *The navigation databases used in Garmin navigation systems contain Special Procedures. Prior to flying these procedures, pilots must have specific FAA authorization, training, and possession of the corresponding current, and legitimately-sourced chart (approach plate, etc.). Inclusion of the Special Procedure in the navigation database DOES NOT imply specific FAA authorization to fly the procedure.*

NOTE: *Terrain and obstacle alerting is not available north of 89º North latitude and south of 89º 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: *The nose of the 'own ship' symbol represents the location of the aircraft. The center of any traffic symbol represents the location of that traffic. The traffic and own ship symbols are an abstract representation and do not reflect the physical extent of the aircraft/traffic, and should not replace other methods for identifying traffic.*

NOTE: *When using Stormscope, there are several atmospheric phenomena in addition to nearby thunderstorms that can cause isolated discharge points in the strike display mode. However, clusters of two or more discharge points in the strike display mode do indicate thunderstorm activity if these points reappear after the screen has been cleared.*

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

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: *Operate G1000 NXi system power through at least one cycle in a period of four days of continuous operation to avoid an autonomous system reboot.*

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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 Cessna NAV III. The system is an integrated avionics system that presents flight instrumentation, position, navigation, communication, and identification information to the pilot through large-format displays. The system consists of the following Line Replaceable Units (LRUs):

- **GDU 1054B/1050** (2) – The Display Unit features a 10 inch high resolution LCD display. The unit installed on the left side is designated as the Primary Flight Display (PFD). The unit installed on the right side is designated as the Multi-Function Display (MFD). In normal operations, the PFD will show a flight display and may also show a display pane. In normal operations, the MFD will show the Engine Indication System (EIS) display, in addition to one or two display panes. The PFD and MFD communicate with each other and the on-side Integrated Avionics Unit (IAU). Systems configured with Garmin Automatic Flight Control System (AFCS) use GDU 1054B. Model 172 aircraft not equipped with Garmin AFCS use GDU 1050.
- **GIA 63W** (2) – The Integrated Avionics Unit (IAU) functions as the main communication hub, linking all LRUs with the PFD and MFD. Each IAU contains a GPS SBAS receiver, VHF COM/NAV/GS receivers, a flight director (FD) and system integration microprocessors. Each IAU is paired with the on-side Display Unit. The IAUs are not paired together and do not communicate with each other directly.
- **GDC 74A** (1) – The Air Data Computer (ADC) processes data from the pitot/static system as well as the OAT probe. This unit provides pressure altitude, airspeed, vertical speed and OAT information to the system, and it communicates with the IAUs, the PFD, and the MFD (it also interfaces directly with the OAT probe). The unit is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.
- **GRS 77** (1) – The Attitude and Heading Reference System (AHRS) provides aircraft attitude and heading information to the PFD, MFD, and both IAUs. The unit contains advanced sensors (including accelerometers and rate sensors) and interfaces with the Magnetometer to obtain magnetic field information and with both IAUs to obtain GPS information.
- **GEA 71** (1) – The Engine Airframe Unit receives and processes signals from the engine and airframe sensors. This unit communicates with both IAUs.
- **GMU 44** (1) – The Magnetometer measures local magnetic field. Data is sent to the AHRS for processing to determine aircraft magnetic heading. The unit receives power directly from the AHRS and communicates with the AHRS.
- **GMA 1347** (1) – The Audio Panel integrates NAV/COM digital audio, intercom system and marker beacon controls. Pressing the red **DISPLAY BACKUP** Button on this unit, enables the manual control of the display Reversionary Mode. It communicates with the PFD and MFD.
- **GTX 33ES** (1 standard) / **GTX 335R/345R** (1 alternate) – Each Transponder is a solid-state Transponder that provides modes A, C, and S capabilities. The standard GTX 33ES provides Diversity, Extended Squitter, and ADS-B Out functionality. The alternate GTX 335R also provides ADS-B Out. The alternate GTX 345R provides ADS-B In/Out and Bluetooth® functionality. The Transponder is controlled from the PFD and communicates with the both IAUs and the MFD.
- **GSA 81** (3) – The Servo Actuator is used for the automatic control of roll, pitch, and pitch trim. These units interface with each IAU.

- **GSM 85** (3) – The Servo Gearbox is responsible for transferring output torque of Servo Actuator to the mechanical flight-control surface linkage.
- **GDL 69A/69A SXM** (1 optional) – The SiriusXM Datalink Receiver provides weather information, as well as digital audio entertainment. The receiver communicates with the MFD. A subscription to SiriusXM Weather and/or SiriusXM Satellite Radio service is required to enable services.
- **GTS 800** (1 optional) – The 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. The TAS unit is connected to the PFD.
- **Flight Stream 510** (1 optional) – The Flight Stream Wireless Transceiver provides wireless Bluetooth® connectivity between a compatible tablet/mobile device and the avionics system. GPS, AHRS, ADC, ADS-B, traffic, SiriusXM audio, and 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 be performed using the Flight Stream 510 WiFi link.

The system is capable of interfacing with the following non-Garmin optional equipment:

- **WX-500** L3 Stormscope Lightning Detection
- **KN 63** DME Receiver
- **KR 87** ADF Receiver
- CO Guardian Carbon Monoxide Detection
- BP 2007 Comant CI 2480-4000 Antenna Config (VHF/GPS/XM)
- Pre BP 2007 Comant CI 2480-4000 Antenna Config (VHF/GPS/XM)

NOTE: *Refer to the AFCS (Automatic Flight Control System) Section for details on the Garmin AFCS, if equipped.*

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

A top-level system block diagram is shown in the following figure.

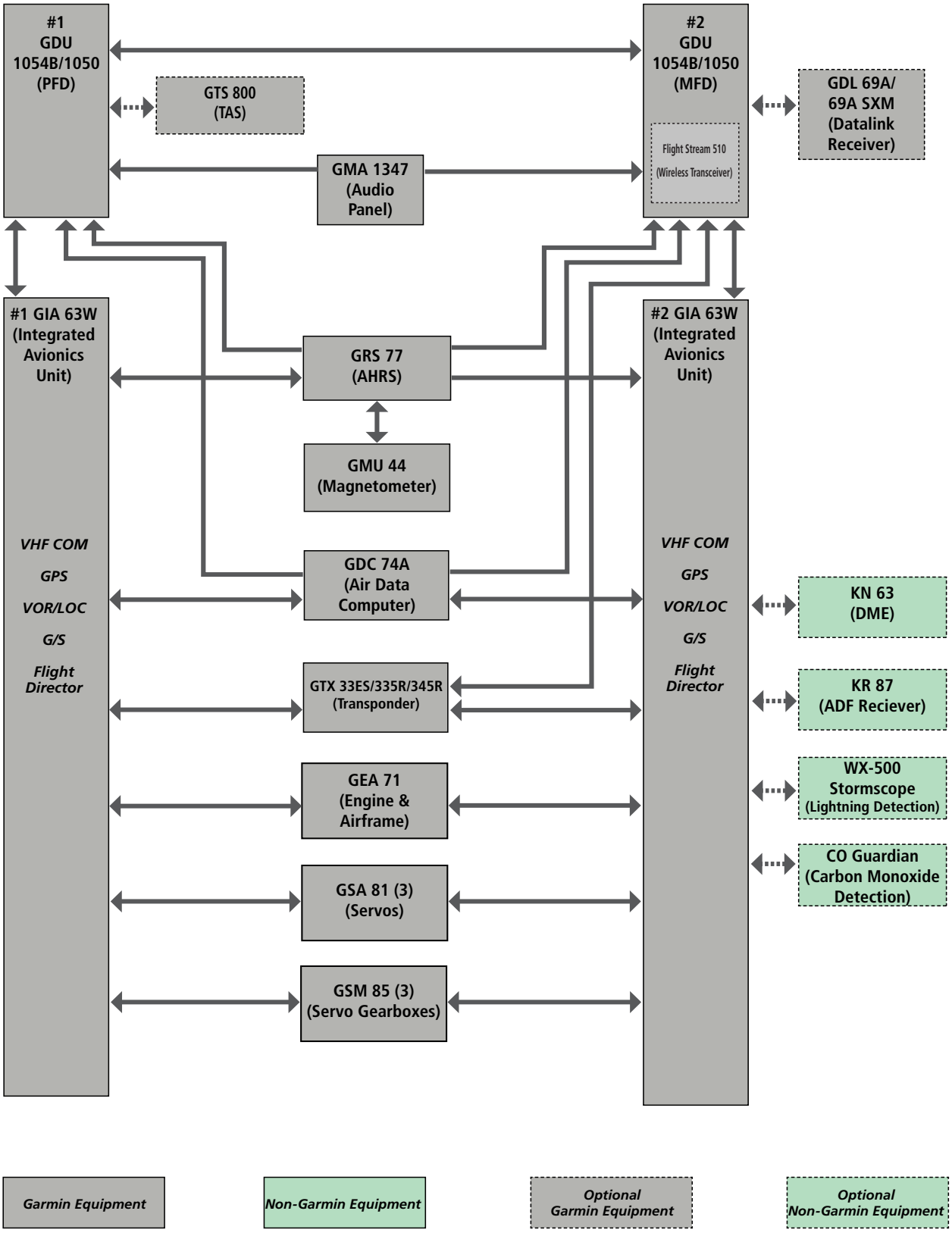


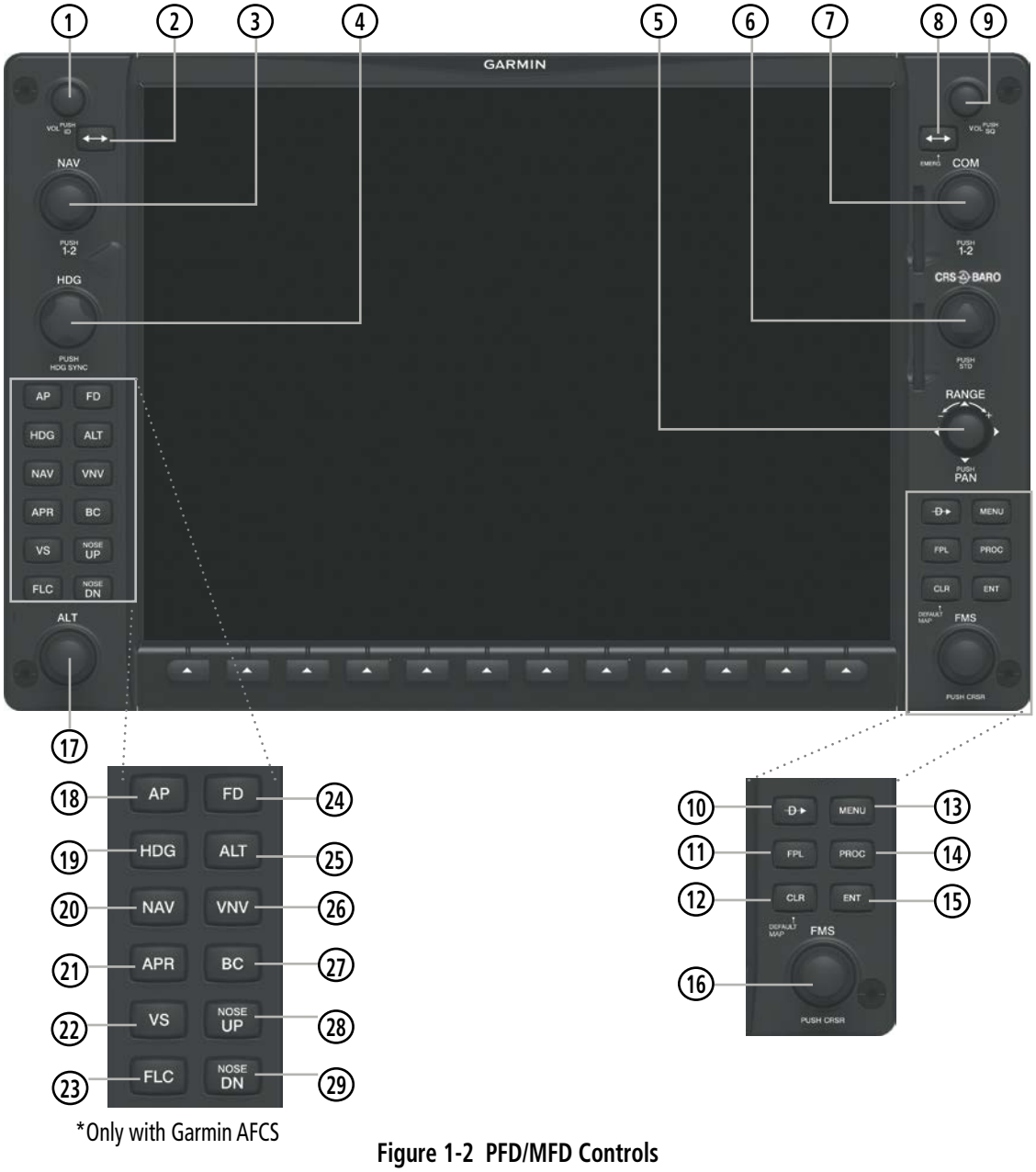
Figure 1-1 System Block Diagram

1.2 SYSTEM CONTROLS

The system controls have been designed to simplify operation of the system and minimize workload and the time required to access sophisticated functionality. These controls are located on the PFD and MFD bezels and Audio Panel. The controls for the PFD and MFD are discussed within this section.

NOTE: *The Audio Panel controls are described in the Audio Panel & CNS Section.*

PFD/MFD CONTROLS



*Only with Garmin AFCS

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). Push 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). Push to toggle cyan 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. Push to display a digital heading momentarily to the left of the HSI and synchronize the Selected Heading to the current heading.
(5) **Range Knob/Joystick**	Turn to change map range. Push to activate map pointer for map panning.
(6) **CRS/BARO Knob**	Turn large knob for altimeter barometric pressure setting. Turn small knob to set the pilot-selected course on the HSI when the VOR1, VOR2, or OBS/SUSP mode is selected. Pushing this knob centers the CDI on the currently selected VOR. The pilot-selected course provides course reference to the flight director when operating in navigation and approach modes. Push 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). Push to toggle cyan 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). Push to turn the COM automatic squelch ON/OFF.
(10) **Direct-to Key (D▸)**	Activates the direct-to function and allows the user to enter a destination waypoint and establish a direct course to the selected destination (the destination is either specified by the identifier, chosen from the active route, or taken from the map pointer position).
(11) **FPL Key**	Accesses flight plan information and allows for creating and editing the active flight plan.
(12) **CLR Key (DFLT MAP)**	Erases information, cancels entries, or removes menus. Press and hold to display the 'Map – 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)**	Push 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 (large knob selects the thousands; 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) **HDG Key***	Selects/deselects the Heading Select mode.
(20) **NAV Key***	Selects/deselects the Navigation mode.
(21) **APR Key***	Selects/deselects the Approach mode.
(22) **VS Key***	Selects/deselects the Vertical Speed mode.
(23) **FLC Key***	Selects/deselects the Flight Level Change mode.
(24) **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.
(25) **ALT Key***	Selects/deselects the Altitude Hold mode.
(26) **VNV Key* (if equipped)**	Selects/deselects Vertical Navigation mode.
(27) **BC Key***	Selects/deselects Back Course mode.
(28) **NOSE UP Key***	Controls the active pitch reference for the Pitch Hold, Vertical Speed, and Flight Level Change modes.
(29) **NOSE DN Key***	Controls the active pitch reference for the Pitch Hold, Vertical Speed, and Flight Level Change modes.

**Key only available when equipped with Garmin AFCS.*

The **NAV**, **CRS/BARO**, **COM**, **FMS**, and **ALT** knobs are concentric dual knobs, each having a small (inner) and large (outer) control portion. When a portion of the knob is not specified in the text, either may be used.

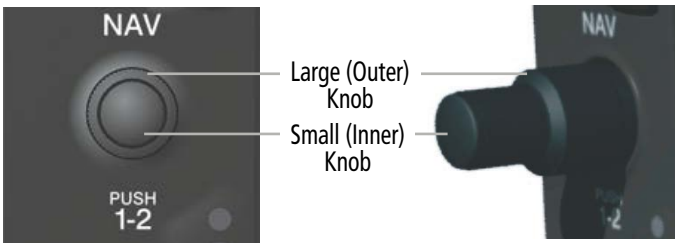


Figure 1-3 Dual Concentric Knob

SECURE DIGITAL (SD) CARDS

NOTE: *DO NOT use the database SD cards for any purpose other than database storage.*

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

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

The data card slots on the PFD and MFD 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. SD cards are used for various databases, system software updates, recording flight data, and storing electronic documents. Also, flight plans may be imported or exported from an SD card in the MFD. Not all SD cards are compatible with the system. Use only SD cards supplied by Garmin or the aircraft manufacturer.

Inserting 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.

Removing an SD card

Gently press on the SD card to release the spring latch and eject the card.

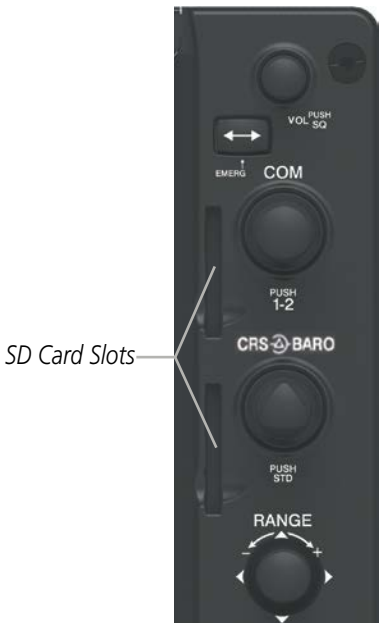


Figure 1-4 PFD/MFD Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

This section discusses applying power to the system, normal and reversionary display operation, system status, AHRS modes of operation, and GPS receiver operation.

APPLYING POWER TO THE SYSTEM

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

NOTE: *See the current version of the pertinent flight manual 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 processors, memory, external inputs, and outputs to provide safe operation.

The system momentarily displays test annunciations and illuminates annunciator lights on the audio panel and the display bezels when power is applied. All annunciations and annunciator lights should be extinguished typically within the first minute of applying power.

On the PFD the AHRS begins to initialize and displays 'AHRS ALIGN: Keep Wings Level'. The AHRS should display valid attitude and heading fields typically within the first minute of applying power. The AHRS can align itself both while taxiing in a straight line and during level flight.

When the MFD is powered on, the initial screen displays the following information:

- Copyright
- System Version
- Land Database Name and Version
- Terrain Database Name and Version
- Obstacle Database Name and Expiration Date
- Navigation Database Name and Expiration Date
- Airport Directory Name and Expiration Date
- ChartView Database Information
- FliteCharts Database Information

Current database information includes database type, cycle number, or valid operating dates. Review the listed information for currency (to ensure no databases have expired). Then, press the **ENT** Key or the right-most softkey on the MFD to acknowledge the information and continue.

NORMAL OPERATION

NOTE: *In normal operating mode, backlighting can only be adjusted from the PFD. In Reversionary Mode, it can be adjusted from the remaining display(s).*

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

Figure 1-5 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 a display failure, the system automatically switches to Reversionary (backup) Mode. In Reversionary Mode, all important flight information is presented on the remaining display.

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

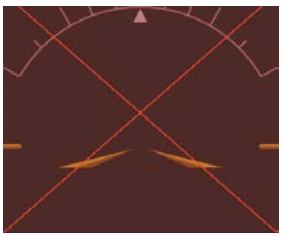
Reversionary Mode may be manually activated at any time by pressing the Audio Panel's red **DISPLAY BACKUP** Button. Pressing this button again deactivates Reversionary Mode.

Figure 1-6 Reversionary Mode (Failed PFD)

SYSTEM ANNUNCIATIONS

When an LRU or an LRU function fails, a large 'X' is typically displayed on window(s) associated with the failed data. Depending on the LRU, the 'X' may be amber or red. Upon applying power to the system, certain instruments remain invalid as equipment begins to initialize. All windows should be operational within one minute of applying power. If any window remains flagged, the system should be serviced by a Garmin-authorized repair facility.

NOTE: *For a detailed description of all annunciations and alerts, refer to the Appendices. Refer to the current version of the pertinent flight manual for additional information regarding pilot responses to these annunciations.*

System Annunciation	Comment
	AHRS 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 pertinent flight manual).
	Display system is not receiving airspeed input from the AHRS.
	Display system is not receiving valid heading input from the AHRS or Magnetometer.

System Annunciation	Comment
	Display system is not receiving vertical speed input from the AHRS.
	Display system is not receiving altitude input from the AHRS.
	Display system is not receiving valid temperature information.
	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 the field is not receiving valid data.

Table 1-1 System Failure Annunciations

SYSTEM STATUS

The status, serial number and software version numbers of detected LRUs can be checked on the 'Aux – System Status' Page. Pertinent information on all system databases is also displayed. 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 Information' 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.

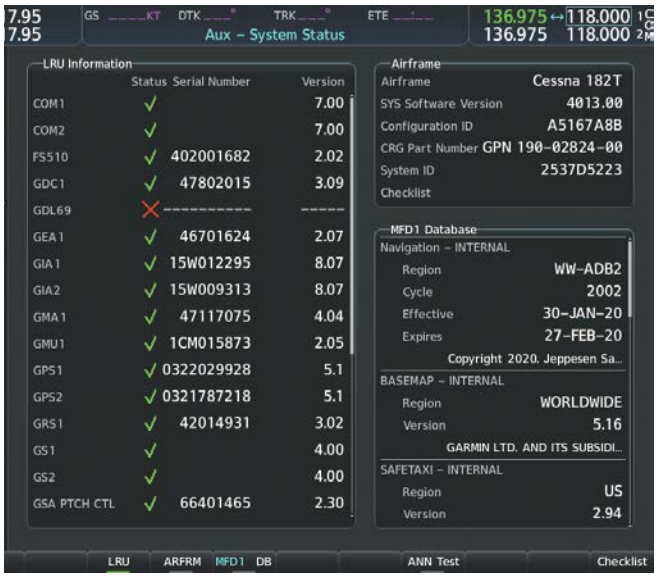


Figure 1-7 Example 'Aux – System Status' Page

The **LRU** and **ARFRM** softkeys on the 'Aux – System Status' Page select the applicable box ('LRU Information' or 'Airframe') through which the **FMS** Knob can be used to scroll information.

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

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

AHRS OPERATION

WARNING: *Do not rely on the accuracy of attitude and heading indications in the following geographic areas (due to variations in the earth's magnetic field): North of 72° North latitude at all longitudes; South of 70° South latitude at all longitudes; North of 65° North latitude between longitude 75° W and 120° W (Northern Canada); North of 70° North latitude between longitude 70° W and 128° W (Northern Canada); North of 70° North latitude between longitude 85° E and 114° E (Northern Russia); South of 55° South latitude between longitude 120° E and 165° E (Region south of Australia and New Zealand).*

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. During normal operations, 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.

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.*

Two GPS inputs are provided to the AHRS. If GPS information from one of the inputs fails, the AHRS uses the operating GPS input and a System Message is issued to inform the crew. If both GPS inputs fail, the AHRS can continue to provide attitude and heading information to the PFDs as long as magnetometer and airspeed data are available and valid.

MAGNETOMETER FAILURE

If the magnetometer input fails, the AHRS transitions to one of the reversionary 'heading invalid' 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').

AIR DATA INPUT FAILURE

Failure of the air data input has no affect on the AHRS output while AHRS is receiving valid GPS information. Invalid/unavailable airspeed data in addition to GPS failure results in loss of all attitude and heading information on the PFD.

MAGNETIC FIELD VARIATION DATABASE

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 five years. See the Appendices for information on updating the Magnetic Field Variation Database. The system will prompt the crew on startup when an update is available. Failure to update this database could lead to erroneous heading information being displayed to the crew.

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 **GPS1** or **GPS2** Softkey.

   Or:

   a) Press the **MENU** Key.
   b) Use the **FMS** Knob to highlight the receiver which is not selected ('GPS1' or 'GPS2') and press the **ENT** Key.

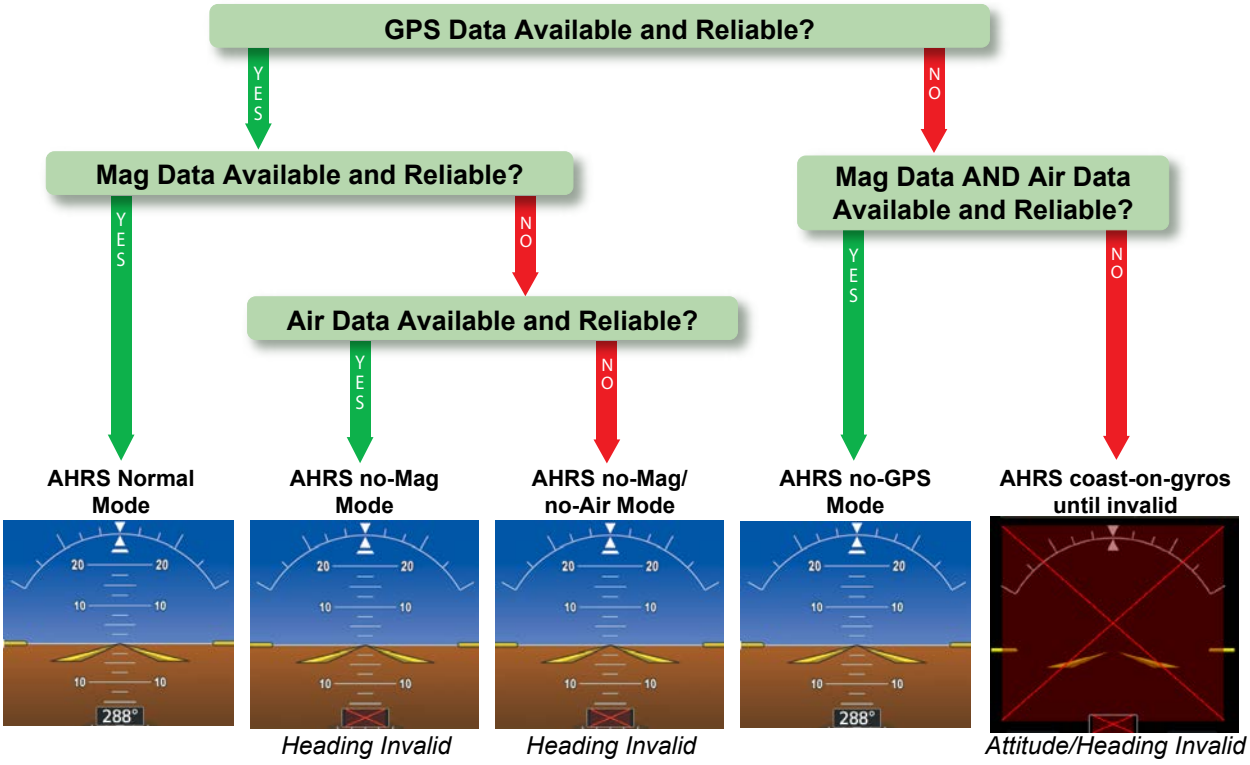


Figure 1-8 AHRS Operation

GPS RECEIVER OPERATION

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

Internal system checking is performed to ensure both GPS receivers are providing accurate data to the system. In some circumstances, both GPS receivers may be providing accurate data, but one receiver may be providing a better GPS solution than the other. In this case, the GPS receiver producing the better solution is automatically coupled to the PFD.

GPS sensor annunciations are most often seen after system power-on when one GPS receiver has acquired satellites before the other, or one of the GPS receivers has not yet acquired an 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 'Alerts' Window on the PFD. If no failure message exists, check the 'Aux – GPS Status' Page and compare the information for GPS1 and GPS2. Discrepancies may indicate a problem.

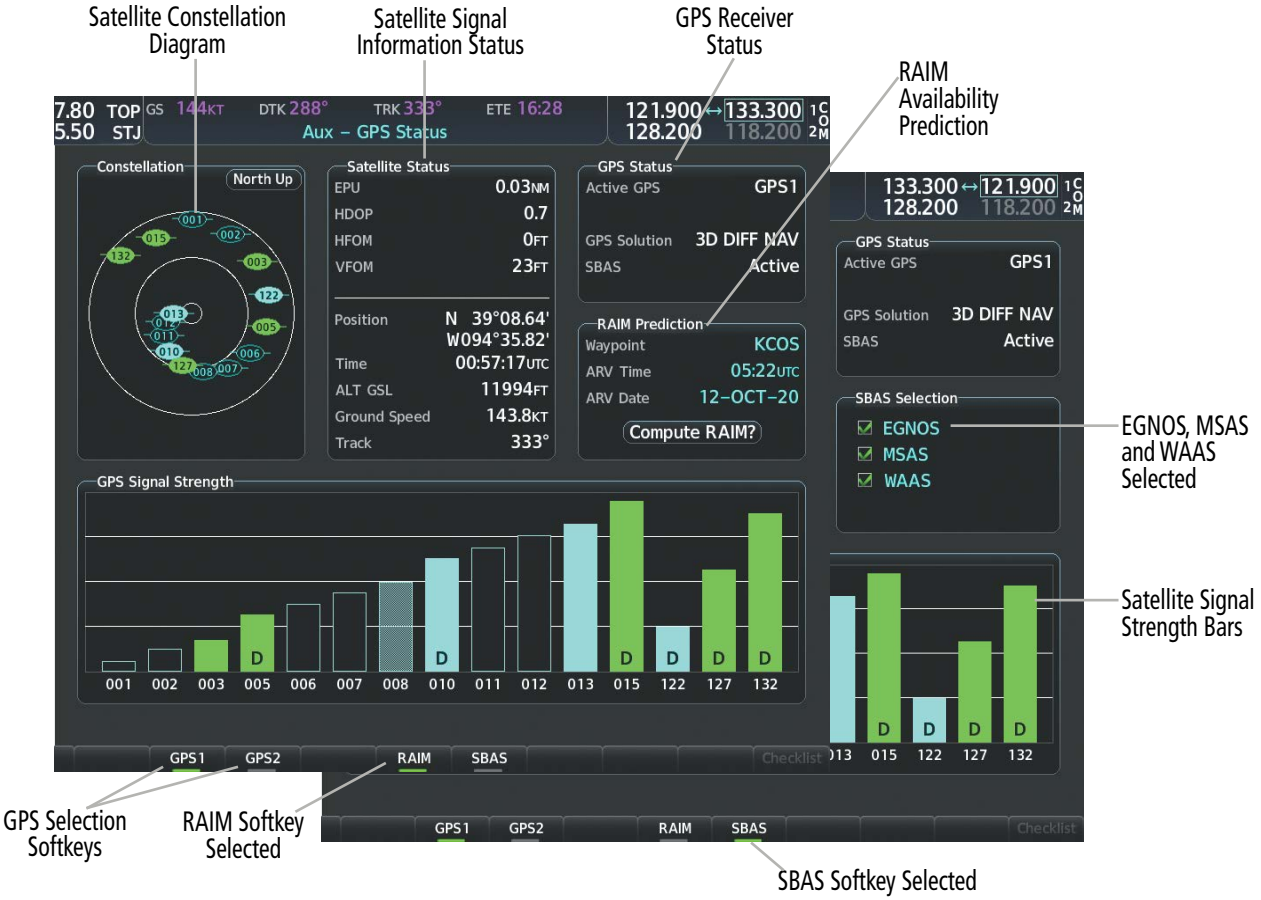


Figure 1-9 'Aux – GPS Status' Page (RAIM or SBAS Selected)

SATELLITE CONSTELLATION DIAGRAM

The 'Aux – GPS Status' Page displays satellites currently in view 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 Pseudorandom Noise (PRN) number (i.e., satellite identification number). Satellites whose signals are currently being used are represented by solid ovals.

SATELLITE SIGNAL INFORMATION 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 RECEIVER 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 on the upper right of the 'Aux – 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. Satellite-Based Augmentation System (SBAS) indicates 'INACTIVE'. When acquisition is complete, the solution status indicates '3D DIFF NAV' and SBAS indicates 'ACTIVE'.

RECEIVER AUTONOMOUS INTEGRITY MONITORING (RAIM) PREDICTION

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 the available satellite geometry allows the receiver to calculate a position within a specified RAIM protection limit (2.0 nm 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.

NOTE: *The system RAIM prediction capability does not meet all RAIM prediction requirements. Reference the RAIM/Fault Detection and Exclusion (FDE) Prediction Tool at flygarmin.com, as required.*

Predicting RAIM availability at a selected waypoint:

1) Use the **FMS** Knob to select the 'Aux – GPS Status' Page.
2) If necessary, press the **RAIM** Softkey.
3) Push the **FMS** Knob. The 'Waypoint' Field is highlighted.
4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window.

5) 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 flight plan list is populated only when navigating a flight plan).

   b) Turn the small **FMS** Knob clockwise to display the Nearest, Recent, or User waypoints, if required.

   c) Turn the large **FMS** Knob clockwise to select the desired waypoint. Press the **ENT** Key. The system automatically fills in the identifier, facility, and city fields with the information for the selected waypoint.

   d) Press the **ENT** Key again 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) Use the **FMS** Knob to select the 'Aux – GPS Status' Page.

2) If necessary, press the **RAIM** Softkey.

3) Push the **FMS** Knob. 'P.POS' in the 'Waypoint' Field is highlighted.

4) Press the **ENT** Key to accept the present position waypoint entry.

5) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.

6) Use the **FMS** Knob to enter an arrival date and press the **ENT** Key.

7) 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 EGNOS, WAAS and MSAS enabling/disabling.

Disabling SBAS:

1) Use the **FMS** Knob to select the 'Aux – GPS Status' Page.
2) If necessary, press the **SBAS** Softkey.
3) Push 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) Push the **FMS** Knob to remove the cursor.

GPS SATELLITE SIGNAL STRENGTHS

The 'Aux – 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 — 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 FUNCTIONS

Selection softkeys are located along the bottom of the displays. The bezel keys below the softkey labels can be used to press 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 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).

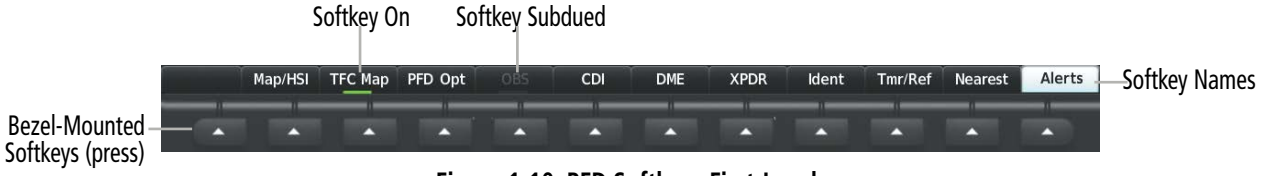


Figure 1-10 PFD Softkeys First-Level

PFD SOFTKEYS

The PFD softkeys provide control over the PFD display and some flight management functions, including GPS, NAV, terrain, traffic, and weather. Each softkey sublevel has a **Back** Softkey which can be pressed to return to the previous level. If messages remain after acknowledgement, the **Alerts** Softkey is black on white. The **Alerts** 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 in Level 2 provides yet another set of softkey functions, those new available softkeys are then explained in the Level 3 column, etc.

Softkeys are listed in order by row for each level as they appear on the screen left to right.

Level 1	Level 2	Level 3	Description
Map/HSI			Displays the PFD map settings softkeys.
	Layout		Displays the PFD map selection softkeys.
		Map Off	Removes the PFD map from display (Inset, HSI, 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.
		WX LGND	Displays/removes the name of the selected weather data provider and the weather product icon and age box (for enabled weather products).
	Detail		Selects desired amount of map detail: - **All** (no declutter): All map features visible. - **Detail 3**: Declutters land data. - **Detail 2**: Declutters land and SUA data. - **Detail 1**: Removes everything except for the active flight plan.

Level 1	Level 2	Level 3	Description
	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 NEXRAD weather and coverage on PFD map (optional).
	METAR		Displays METAR information on Inset Map (optional).
	Lightning		Adds/removes the display of lightning information on PFD map.
		LTNG Off	Disables lightning function on PFD map. The softkey annunciator is green when the lightning function is off.
		Datalink	Selects the datalink lightning source for the PFD map.
		STRMSCP	Adds or removes the display of Stormscope information on 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 Pathways 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.
		Off	Wind information not displayed.
		Option 1	Wind displayed as headwind/tailwind and crosswind arrows with numeric components.
		Option 2	Wind displayed as total wind direction arrow and numeric speed.
		Option 3	Wind displayed as total wind direction arrow with digital numeric direction and speed.
	DME		Displays DME Information Window (optional).
	Bearing 1		Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	Bearing 2		Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	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 or SUSP			Selects OBS mode on the CDI when navigating by GPS (only available with active leg). When OBS is on, the softkey annunciator is green. 'SUSP' will replace 'OBS' when waypoint sequencing is suspended.

Level 1	Level 2	Level 3	Description
CDI			Cycles through FMS, NAV1, and NAV2 navigation modes on the CDI.
DME			Displays the 'DME Tuning' Window, allowing tuning and selection of the DME (optional).
XPDR			Displays the transponder selection softkeys.
	Standby		Selects standby mode (transponder does not reply to any interrogations).
	On		Activates transponder (transponder replies to identification interrogations).
	ALT		Selects 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 'References' Window.
Nearest			Displays 'Nearest Airports' Window.
Alerts or Message			Displays 'Alerts' Window. System generated messages cause the **Alerts** Softkey to change to a flashing **Message** Softkey. Pressing the **Message** Softkey opens the 'Alerts' Window, acknowledges the message, and the softkey reverts to **Alerts**.

Table 1-2 PFD Softkeys

MFD SOFTKEYS

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

The following table provides an example of the MFD softkey functions accessed from the 'MAP – Navigation Map' Page. 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	Level 4	Description
Engine				Displays second-level engine softkeys for EIS configuration.
	Engine			Displays default EIS display.
	Lean			Displays EIS lean display and lean softkeys.
		CYL SLCT		Allows selection of engine cylinder to view additional information.

Level 1	Level 2	Level 3	Level 4	Description
		Assist		Enables/disables leaning assist mode.
	System			Displays system oil pressure and temperature, fuel calculations, electrical system information and system softkeys.
		RST Fuel		Resets calculated fuel remaining to default and resets fuel used to zero.
		GAL REM		Press to display the fuel totalizer softkeys
			-10 GAL	Press to decrease remaining fuel quantity in 10-gallon increments.
			-1 GAL	Press to decrease remaining fuel quantity in 1-gallon increments.
			+1 GAL	Press to increase remaining fuel quantity in 1-gallon increments.
			+10 GAL	Press to increase remaining fuel quantity in 10-gallon increments.
			35 GAL	Sets remaining fuel to 35 gallons.
			53 GAL	Sets remaining fuel to 53 gallons.
Map Opt				Displays the different map softkey selectable features.
	Traffic			Displays traffic information on the 'Map – Navigation Map' Page.
	Inset			Displays second level softkeys for the VSD Inset.
		Off		Removes VSD Inset from 'Map – Navigation Map' Page.
		VSD		Displays VSD Inset on 'Map – Navigation Map' Page.
		VSD		Displays VSD Inset 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.
	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.
	STRMSCP			Displays Stormscope information on Navigation Map (optional).
	NEXRAD			Displays XM NEXRAD weather and coverage on 'Map – Navigation Map' Page (optional).
	XM LTNG			Displays XM lightning information on the 'Map – Navigation Map' Page (optional).

Level 1	Level 2	Level 3	Level 4	Description
	METAR			Displays METAR information on Inset Map (optional).
	Legend			Displays legends for enabled weather products (optional).
Detail				Selects desired amount of map detail; cycles through the following levels: - **Detail All**: All map features visible. - **Detail-3**: Declutters land data. - **Detail-2**: Declutters land and SUA data. - **Detail-1**: Removes everything except for the active flight plan.
Charts				When available, displays optional airport and terminal procedure charts.
	CHRT Opt			Displays chart settings softkeys (if available).
		Fit WDTH		Adjusts chart size to fit available screen width.
		Full SCN		Toggles display of data window to the right of chart.
	Show Map			Displays the 'WPT – Airport Information' Page.
	Info			Pressing the **Info 1** or **Info 2** Softkey returns to the airport diagram when the view is on a different chart.
	DP			Displays departure procedure chart.
	STAR			Displays standard terminal arrival procedure chart.
	APR			Displays approach procedure chart.
	WX			Displays weather information.
Checklist				When available, displays optional checklists

Table 1-3 MFD 'Map – 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 this section. Softkey selection does not display menus or submenus.

Navigating the 'Page Menu' Window:

1) Press the **MENU** Key to display the 'Page Menu' Window.
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. Pushing the **FMS** Knob also removes the displayed menu.

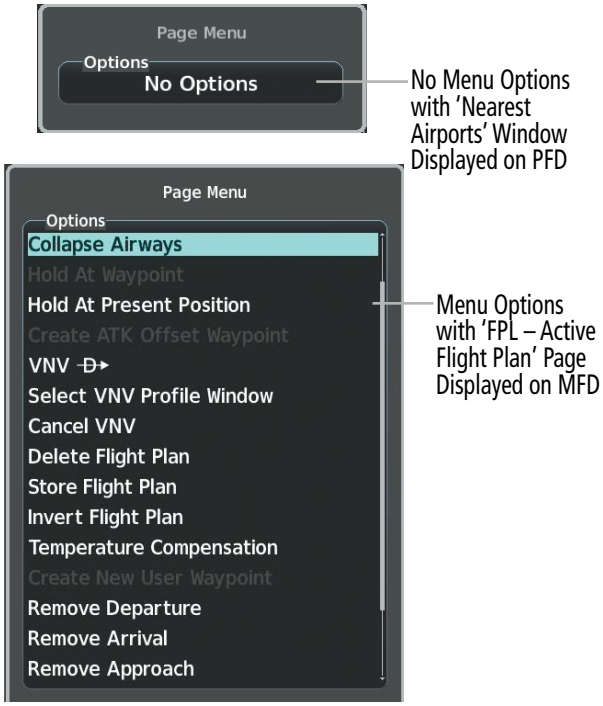


Figure 1-11 Page Menu Examples

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 Status Box. 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, the active title of the page changes while the page name in the list remains the same.

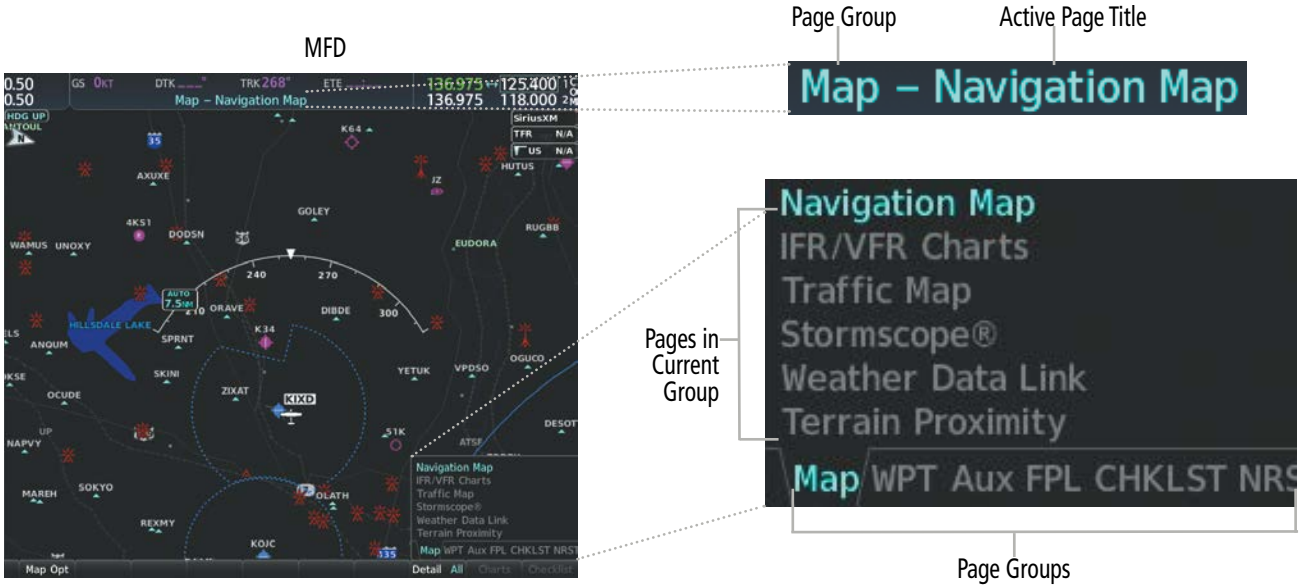


Figure 1-12 Page Title and Page Groups

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 pressing 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' respectively) within the same page, 'XM Radio'.

Page Group	Pages within Page Group
Map (Map Page Group)	Navigation Map IFR/VFR Charts Traffic Map Stormscope® (optional) Weather Data Link (optional) Terrain Proximity

Page Group	Pages within Page Group
WPT (Waypoint Page Group)	Airport/Procedures/Weather Information Pages - 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 (**WX** Softkey) - NOTAM information (**NOTAM** Softkey) - Electronic checklists (**Checklist** Softkey) Intersection Information NDB Information VOR Information VRP Information User WPT Information
Aux (Auxiliary Page Group)	Trip Planning Utility GPS Status System Setup 1 and 2 XM Radio (service optional) - XM Radio (**Radio** Softkey) - XM Information (**Info** Softkey) System Status ADS-B Status Connext Setup (optional) Databases
FPL (Flight Plan Page Group)	Active Flight Plan - Wide View, Narrow View (**View** Softkey) Flight Plan Catalog - Stored Flight Plan (**New** Softkey) SurfaceWatch Setup (optional)
CHKLST (Checklist Page Group)	N/A
NRST (Nearest Page Group)	Nearest Airports Nearest Intersections Nearest NDB Nearest VOR Nearest VRP Nearest User WPTS Nearest Frequencies Nearest Airspaces

Table 1-4 Page Groups 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 are managed from the 'Aux – System Setup (1 or 2)' pages. Fields shown in cyan text may be edited. Managing system time format, display units, page navigation, 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.

- Time Format (local or UTC)
- Display (measurement) Units
- BARO (barometric) Transition Alert (see the Flight Instruments Section)
- Airspace Alerts (see the Flight Management Section)
- Arrival Alerts (see the Flight Management Section)
- SurfaceWatch Alerts (optional; see the Additional Features Section)
- Flight Director Format (not configurable; see the AFCS Section)
- MFD Data Bar (i.e., Navigation Status Box) Fields (see the Flight Management Section)
- GPS CDI Format (see the Flight Instruments Section)
- COM Configuration (see the Audio Panel & CNS Section)
- Nearest Airport (see the Flight Management Section)
- Page Navigation
- Audio

Restoring system setup defaults:

1) Use the **FMS** Knob to select the 'Aux – System Setup (1 or 2)' Page.
2) Press the **Defaults** Softkey; or press the **MENU** Key, highlight 'Restore Page Defaults', and press the **ENT** Key. The message 'Restore Setup (1 or 2) Page Defaults?' is displayed.
3) With 'OK' highlighted, press the **ENT** Key.

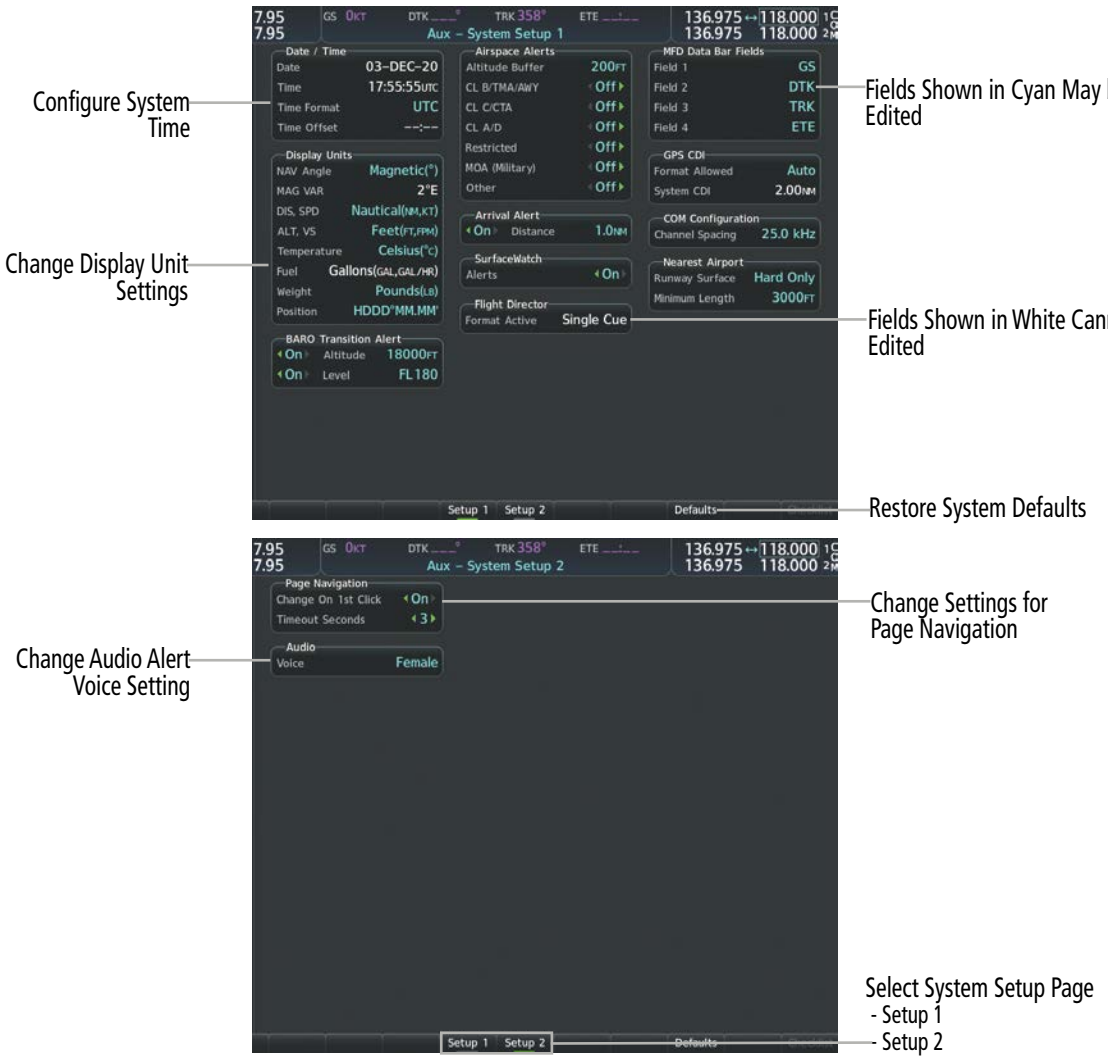


Figure 1-13 'Aux – System Setup 1/2' Pages (Fields Shown In Cyan May be Edited)

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 12hr, Local 24hr, or UTC. Local time is set by adding/subtracting an offset (hours:minutes) to/from UTC.

Configuring the system time:

1) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page.
2) Push the **FMS** Knob momentarily to activate the flashing 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 (±HH:MM) and press the **ENT** Key to confirm selection.

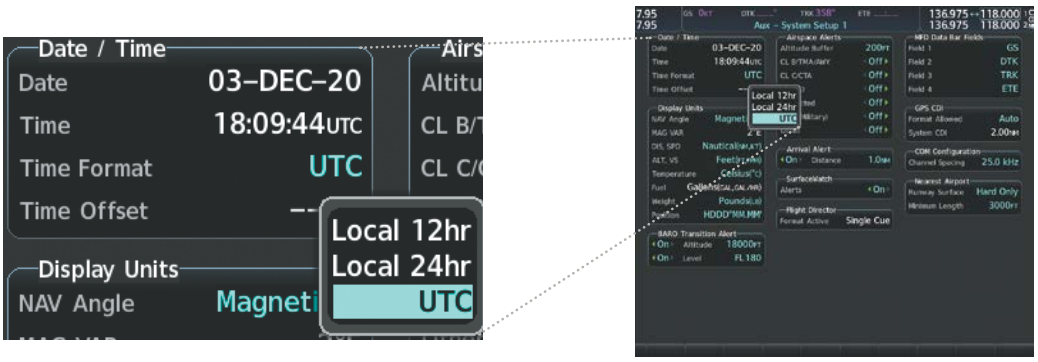


Figure 1-14 Date/Time Settings on 'Aux – System Setup 1' Page

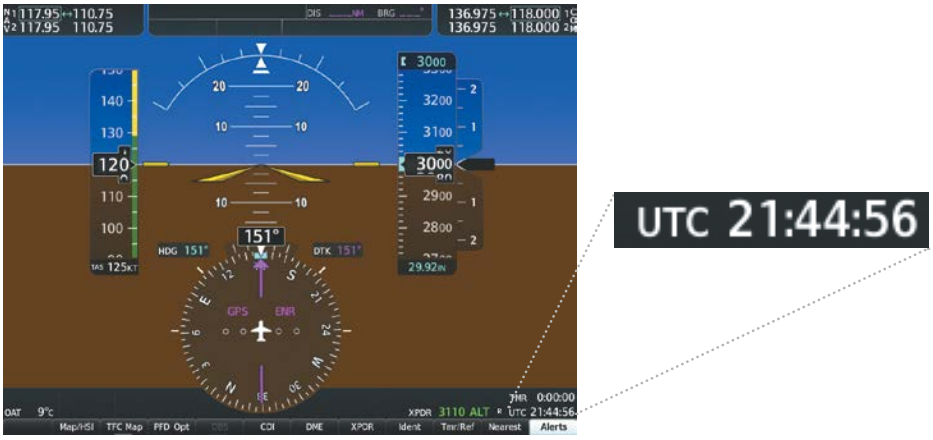


Figure 1-15 System Time (UTC Format)

DISPLAY UNITS

Units in which various quantities are displayed on the system screens are listed on the 'Aux – System Setup 1' Page. The navigation angle reference, distance, speed, temperature, weight and position units can be set from this page.

Category	Settings	Affected Quantities	Exceptions
Navigation Angle	Magnetic (North)* True (North)	Heading Course Bearing Track Desired Track Wind Direction (Trip Planning Page)	N/A

Category	Settings	Affected Quantities	Exceptions
Distance and Speed	Nautical* Metric	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 ('Map – Traffic Map' 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" MGRS 1m MGRS 10m	All Positions	N/A

* *Default setting*
** *Not configurable*

Changing a display unit setting:

1) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page.

2) Push the **FMS** Knob momentarily to activate the flashing cursor.

3) Turn the large **FMS** Knob to highlight the desired field in the 'Display Units' Box.

4) Turn the small **FMS** Knob to select the desired units.

5) Press the **ENT** Key. Press the **CLR** Key to cancel the action without changing the units.

PAGE NAVIGATION

The number of clicks it takes to display the page group tabs and change to the next tab can be controlled from the page navigation settings. The large **FMS** Knob displays the page group tabs and navigates through the tabs. The small **FMS** Knob navigates through the pages listed within a specific group. 'Off' displays the page group tabs with one click of the **FMS** Knob. 'On' displays the page group tabs and navigates to the next tab with one click of the **FMS** Knob.

The pilot can select the amount of time the page group tabs are displayed (in the lower right corner of the MFD). The timeout can range from 2 to 10 seconds.

Selecting page navigation settings:

1) Use the **FMS** Knob (and press the **Setup 2** Softkey, if necessary) to select the 'Aux – System Setup 2' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to select the 'Change On 1st Click' Field in the 'Page Navigation' Box.
4) Turn the small **FMS** Knob clockwise to turn the setting 'On' or counterclockwise to turn the setting 'Off'.
5) Turn the large **FMS** Knob to select the 'Timeout Seconds' Field in the 'Page Navigation' Box.
6) Turn the small **FMS** Knob to select the desired number of seconds.
7) Push the **FMS** Knob momentarily to remove the flashing cursor.

AUDIO ALERTS

The 'Audio' Box on the 'Aux – System Setup 2' Page controls the audio alert voice setting (male or female).

Changing the audio alert voice:

1) Use the **FMS** Knob (and press the **Setup 2** Softkey, if necessary) to select the 'Aux – System Setup 2' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the 'Voice' Field in the 'Audio' Box.
4) Use the **FMS** Knob to select the desired voice setting and press the **ENT** Key.

SYSTEM UTILITIES

For flight planning purposes, timers, trip statistics, and a scheduler feature are provided on the 'Aux – Utility' Page. Trip statistics—odometer, trip odometer, and average trip and maximum groundspeeds—are displayed from the time of the last reset.

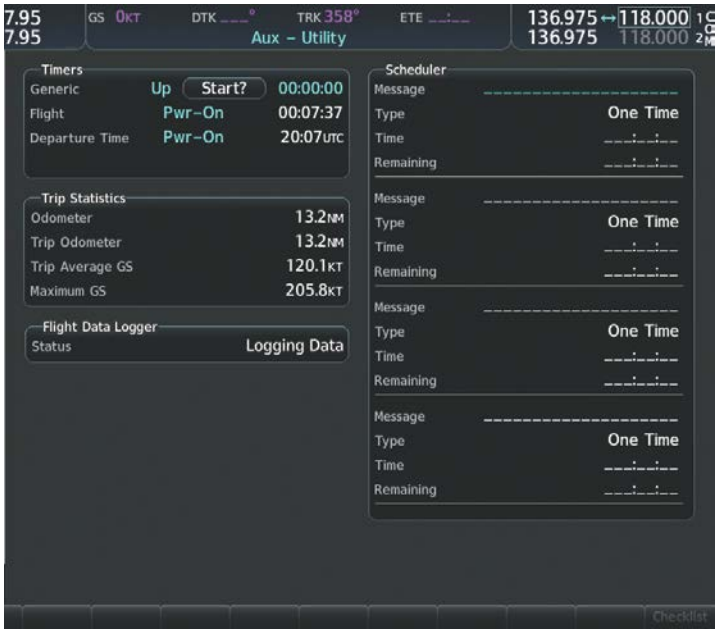


Figure 1-16 'Aux – Utility' Page

TIMERS

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

» Stopwatch-like Generic Timer

» 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 (MFD):

1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
2) Push 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 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 generic timer may also be accessed via the **Tmr/Ref** Softkey on the PFD.

Setting the generic timer (PFD):

1) Press the **Tmr/Ref** Softkey. This opens the 'References' Window.
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.

The flight timer can be set to count up from zero starting at system power application or from the time 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) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the 'Flight' Field in the 'Timers' Box.
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 application 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 'Aux – System Setup 1' Page.

Setting the departure timer starting criterion:

1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the 'Departure Time' Field in the 'Timers' Box.
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 trip average groundspeed. Maximum groundspeed for the period of time since the last reset is also displayed.

Resetting trip statistics displays:

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 display and odometer.
   - 'Reset Odometer' — Resets odometer display only.
   - 'Reset Maximum Speed' — Resets maximum speed display only.
   - 'Reset All' — Resets flight timer, departure timer, odometers, and groundspeed displays.
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., "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.

Scheduler messages cause the **Alerts** Softkey to change to a flashing **Message** Softkey. Pressing the **Message** Softkey opens the 'Alerts' Window and acknowledges the scheduler message. The softkey reverts to the **Alerts** Softkey. Pressing the **Alerts** Softkey again removes the 'Alerts' Window from the display and the scheduler message is deleted from the message queue.

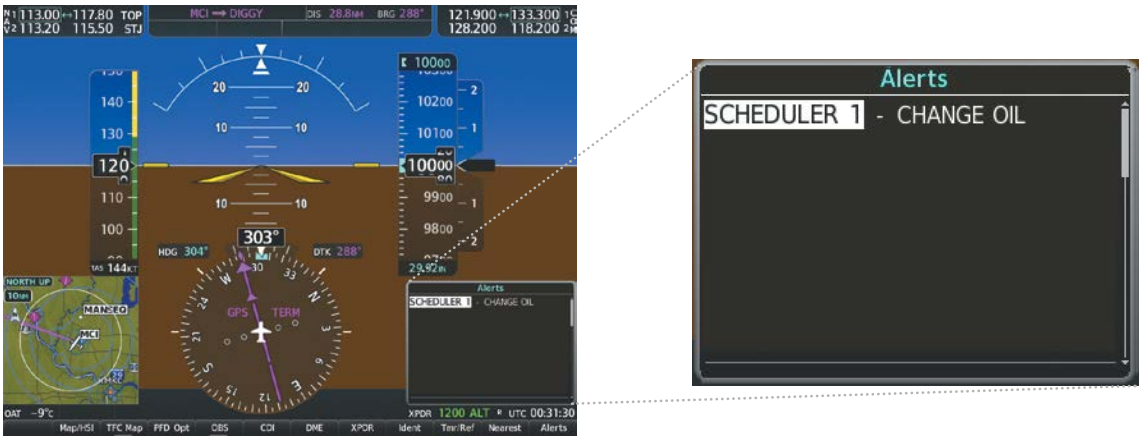


Figure 1-17 PFD 'Alerts' Window

Entering a scheduler message:

1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the first empty field within the 'Scheduler' Box.
4) Use the **FMS** Knob to enter text within the 'Message' Field to be displayed in the 'Alerts' Window and press the **ENT** Key.
5) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the 'Type' Field.
6) Turn the small **FMS** Knob to select 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 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-MMM-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) Push the **FMS** Knob to remove the cursor, or use the large **FMS** Knob to move the cursor to enter the next message.

Deleting a scheduler message:

1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the 'Message' 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.

1.5 DISPLAY BACKLIGHTING

The PFD and MFD display backlighting, the PFD and MFD bezels, 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 display(s).

Adjusting display backlighting:

1) Press the PFD **MENU** Key to display the 'PFD Setup Menu' Window. 'Auto' is now highlighted next to 'PFD 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 setting, then press the **ENT** Key.
4) If desired, use the large **FMS** Knob to select 'Auto' next to 'MFD Display'. Repeat steps 2 and 3 to adjust the MFD display backlighting.
5) 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' Window. '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 1-18 'PFD Setup Menu' Window

SECTION 2 FLIGHT INSTRUMENTS

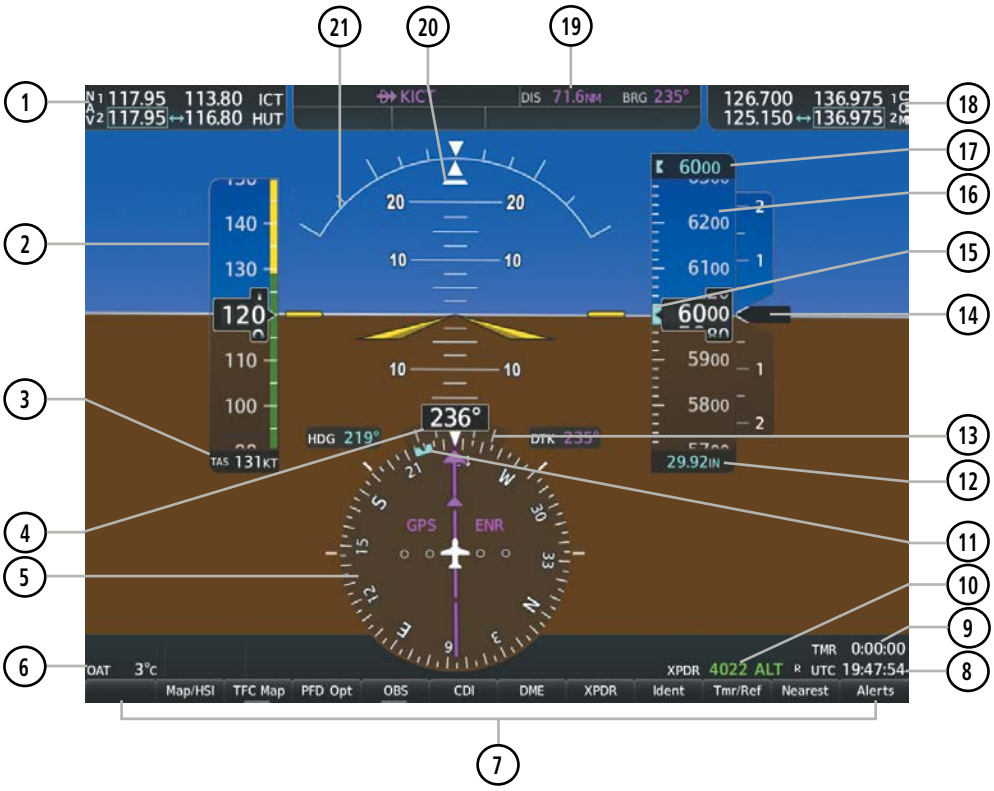
NOTE: *If equipped, the Automatic Flight Control System (AFCS) provides additional indications such as bugs and annunciations on selected flight instruments during certain AFCS flight director modes. Refer to the AFCS Section for more information about these indications.*

The system increases pilot situational awareness by providing an easy-to-scan Primary Flight Display (PFD) featuring a large horizon, airspeed, attitude, vertical speed, and course deviation information. In addition to the flight instruments, navigation, communication, terrain, traffic, and weather information are also presented on the PFDs and are 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
  - True Airspeed
  - Airspeed Awareness Ranges
  - Vspeed Reference Bugs
  - Trend Vector
- Attitude Indicator with Slip/Skid Indication
- Altimeter, showing
  - Barometric Setting
  - Selected Altitude
  - Trend Vector
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Outside Air Temperature (OAT)
- Horizontal Situation Indicator, showing
  - Turn Rate Indicator
  - Bearing Pointers and Information Windows
  - Course Deviation Indicator (CDI)
  - Navigation Source
- System Time
- Wind Data
- Vertical Navigation Indications
- Transponder Mode, Code, and Ident/Reply
- 'References' Window, showing
  - Generic Timer
  - Vspeed Values
  - Minimum Altitude Alerts

The PFD also displays various alerts and annunciations.



1. NAV Frequency Box
2. Airspeed Indicator
3. True Airspeed
4. Current Heading
5. Horizontal Situation Indicator (HSI)
6. Outside Air Temperature (OAT)
7. Softkeys
8. System Time
9. Generic Timer
10. Transponder Data Box
11. Selected Heading Bug
12. Barometric Altimeter Setting
13. Turn Rate Indicator
14. Vertical Speed Indicator (VSI)
15. Selected Altitude Bug
16. Altimeter
17. Selected Altitude
18. COM Frequency Box
19. Navigation Status Box
20. Slip/Skid Indicator
21. Attitude Indicator

Figure 2-1 Primary Flight Display (Default)

1. Selected Heading
2. Wind Data Box
3. Inset Map
4. Bearing Information Windows
5. Minimum Altitude Alert Setting
6. 'Flight Plan' Window
7. Desired Track
8. Required Vertical Speed Indicator
9. Vertical Deviation Indication
10. VNV Target Altitude

Figure 2-2 Additional PFD Information

2.1 FLIGHT INSTRUMENTS

AIRSPEED INDICATOR

NOTE: *Refer to the current pertinent flight manual 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 the never exceed speed (V_{NE}), then it becomes red.

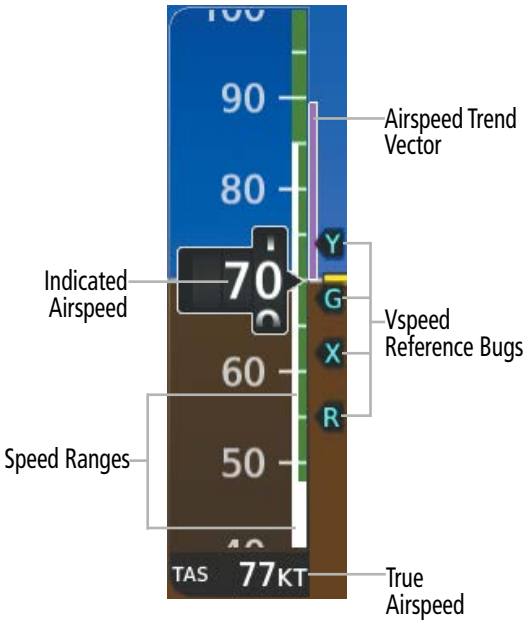


Figure 2-3 Airspeed Indicator

Figure 2-4 Red Pointer Showing Airspeed Above V_{NE}

Color coded stripes appear on the Airspeed Indicator to show the operating ranges. The low speed range stripe is red. Normal operating range is green. The caution range is amber. Never exceed speed (V_{NE}) begins with a red and white barber pole. The flaps operating range is indicated by a white stripe.

The Airspeed Trend Vector is a vertical magenta line that appears to the right of the color-coded speed range stripe 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 6 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 Glide. 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.

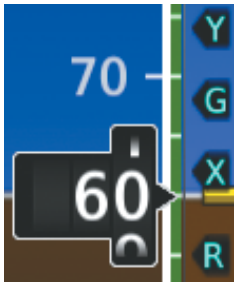


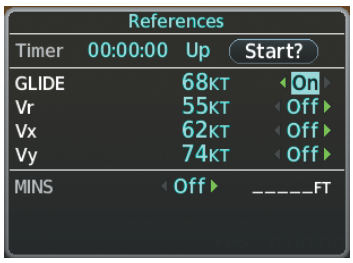
Figure 2-5 Vspeed References

Vspeed	Bug Label
GLIDE	G
V_r	R
V_x	X
V_y	Y

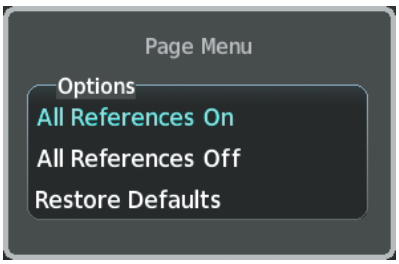
Table 2-1 Vspeed Bug Labels

Changing Vspeeds and turning Vspeed bugs on/off:

1) Press the **Tmr/Ref** Softkey.
2) Turn the large **FMS** Knob to highlight the desired Vspeed.
3) Use the small **FMS** Knob to change the Vspeed in 1 knot increments (when a speed has been changed from a default value, an asterisk appears next to the speed).
4) Press the **ENT** Key or turn the large **FMS** Knob to highlight the 'On/Off' Field
5) Turn the small **FMS** Knob clockwise to 'On' or counterclockwise to 'Off'.
6) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.



'References' Window



'References' Window Menu

Figure 2-6 'References' Window and Menu

Vspeed bugs can be enabled/disabled individually, or collectively.

Enabling/disabling or restoring all Vspeed bugs as a group:

1) Press the **Tmr/Ref** Softkey.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'All References On', 'All References Off', or 'Restore Defaults', as desired.
4) Press the **ENT** Key.
5) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.

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.

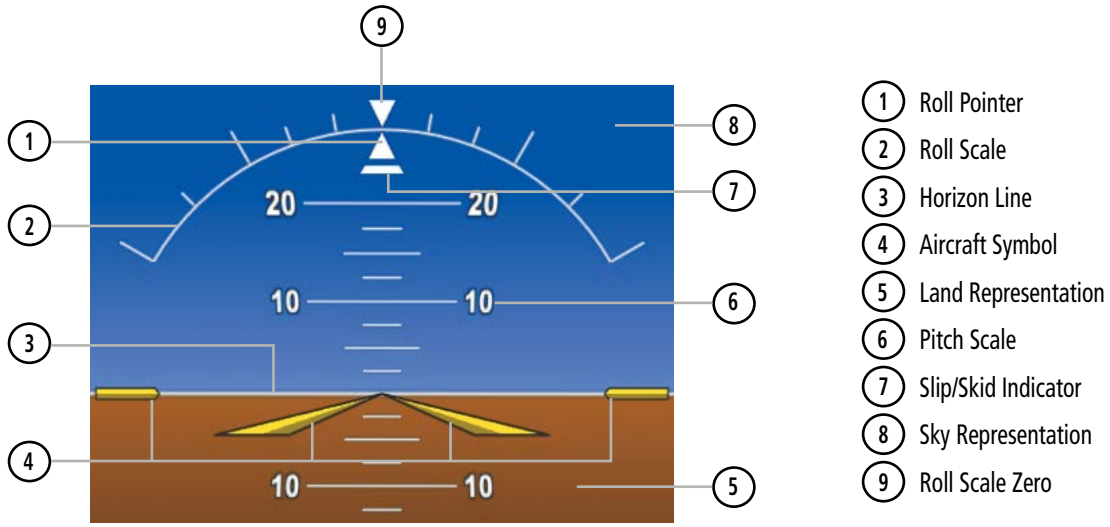


Figure 2-7 Attitude Indicator

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 90˚. 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˚. When the optional Garmin Synthetic Vision Technology (SVT) is activated, the pitch scale is reduced to 10˚ up and 7.5˚ down (refer to the Flight Instruments Section for information about Garmin SVT).

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.

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 2-8 Slip/Skid Indication

ALTIMETER

INTRODUCTION

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.

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 6 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.

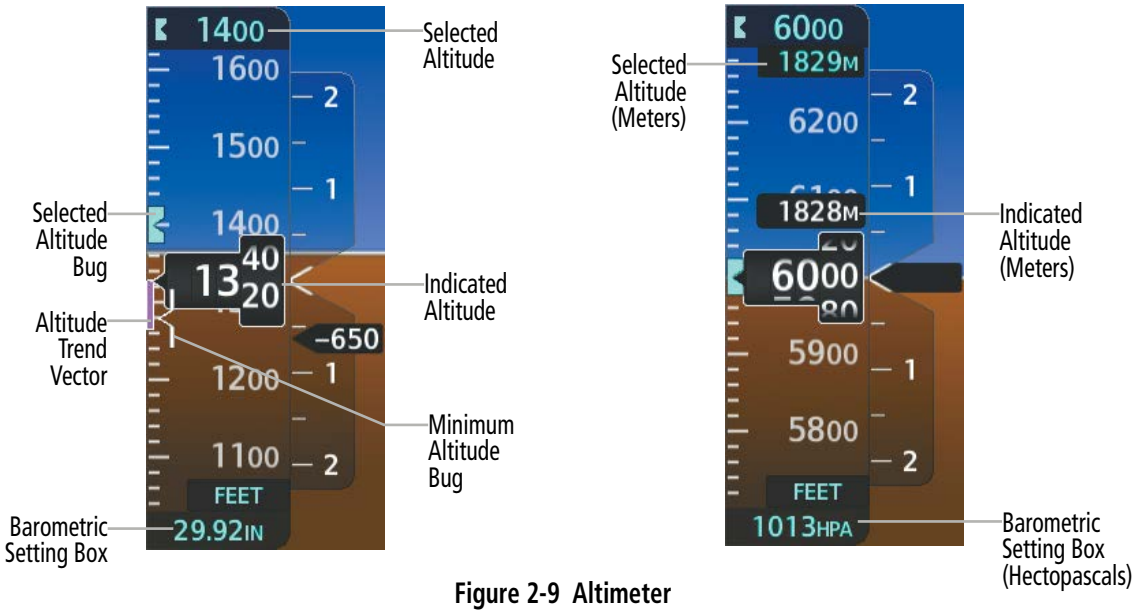


Figure 2-9 Altimeter

BAROMETRIC SETTING

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 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.

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.

Figure 2-10 Standard Barometric Altimeter 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.

SELECTED ALTITUDE

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 below the Selected Altitude See the AFCS Section for more information about the Selected Altitude.

Setting the Selected Altitude:

Turn the **ALT** Knob to set the Selected Altitude. Turn the large knob for 1000-ft increments or the small knob for 100-ft increments. If set to metric units, the large knob adjusts the Selected Altitude in 500-meter increments and the small knob in 50-meter increments.

If a Minimum Altitude value has been set, this altitude is also available for the Selected Altitude while turning the **ALT** Knob.

UNITS OVERLAY

The system is set to display feet by default. However, the pilot can choose to display a meters overlay for the indicated altitude and Selected Altitude.

Enabling altitude units overlay:

1) Press the **PFD Opt** Softkey to display the second-level softkeys.
2) Press the **ALT Units** Softkey.
3) Press the **Meters** Softkey to enable/disable the meters overlay.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

BARO TRANSITION ALERTS

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 Alerts:

1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight 'On' or 'Off' associated with the 'Altitude' Field in the 'BARO Transition Alert' Box.
4) Turn the small **FMS** Knob to set the BARO Transition Alert Altitude to 'On' or 'Off'.
5) Turn the large **FMS** Knob to highlight the 'Altitude' Field in the 'BARO Transition Alert' Box.
6) Use the **FMS** Knob 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 'On' or 'Off' associated with the 'Level' Field in the 'BARO Transition Alert' Box.
8) Turn the small **FMS** Knob to set the BARO Transition Alert Flight Level to 'On' or 'Off'.
9) Turn the large **FMS** Knob to highlight the 'Level' Field in the 'BARO Transition Alert' Box.
10) Use the **FMS** Knob 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)

The Vertical Speed Indicator (VSI) 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. See the Flight Management Section for details on VNV features and refer to this section for more information about VNV indications on the PFD.

VERTICAL DEVIATION INDICATOR (VDI)

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

When vertical navigation is being used, 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 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 this section for more information on VNV indications.

The Glideslope Indicator appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV field. A green diamond acts as the Glideslope Indicator, like a glideslope needle on a conventional indicator. When the system auto-switches the active navigation source to the localizer frequency, the Glideslope Indicator is displayed. If a localizer frequency is tuned and there is no glideslope, 'NO GS' is displayed in place of the diamond.

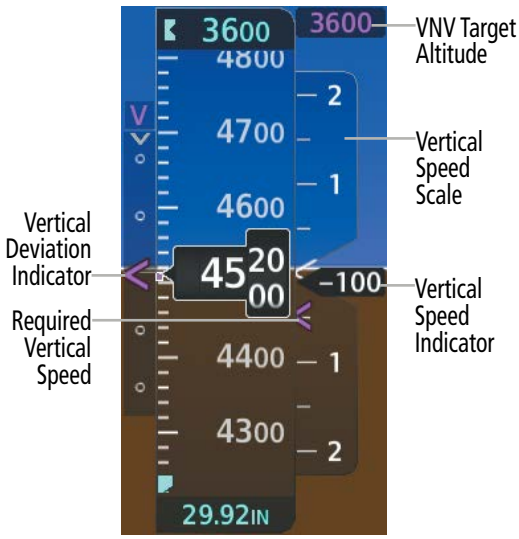


Figure 2-11 Vertical Speed and Deviation Indicators (VSI and VDI)

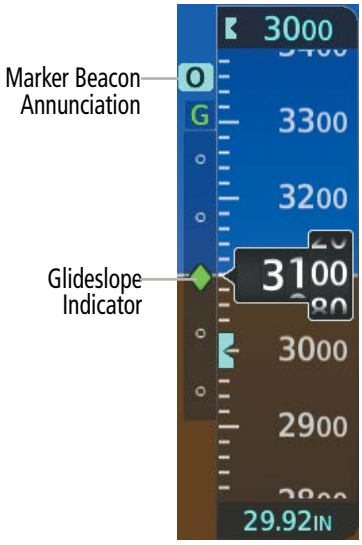


Figure 2-12 Glideslope Indicator

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.*

NOTE: *When the temperature is warmer than a standard day, the system-generated glidepath guidance for a non-precision approach may cross below the FAF minimum altitude restriction.*

The Glidepath Indicator is a vertical deviation scale for GPS approaches supporting SBAS vertical guidance or advisory vertical guidance. The Glidepath Indicator, a magenta diamond, appears on the PFD as soon as the Final Approach Fix (FAF) becomes the active waypoint and GPS 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).

A hollow gray diamond represents a preview of the Glidepath Indicator. This is displayed while inbound to the FAF waypoint, but before the FAF waypoint is the next active waypoint. The preview is also displayed when the AFCS is coupled to the Vertical Path Tracking mode (VPTH) while inbound to the FAF waypoint, until the AFCS captures the glidepath (refer to the AFCS Section for more information about Vertical Path Tracking mode). The hollow gray preview diamond changes to a solid magenta diamond to indicate the Glidepath Indicator is active. If the approach type downgrades past the FAF, 'NO GP' is displayed in place of the diamond.

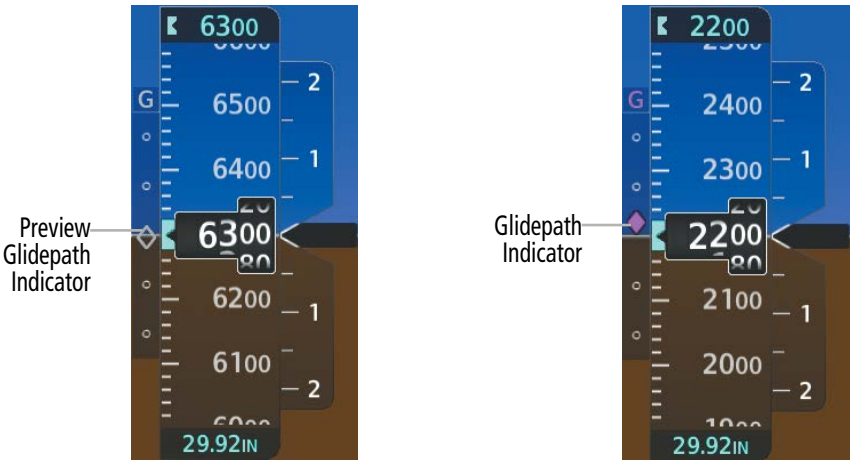


Figure 2-13 Glidepath Indicator

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)

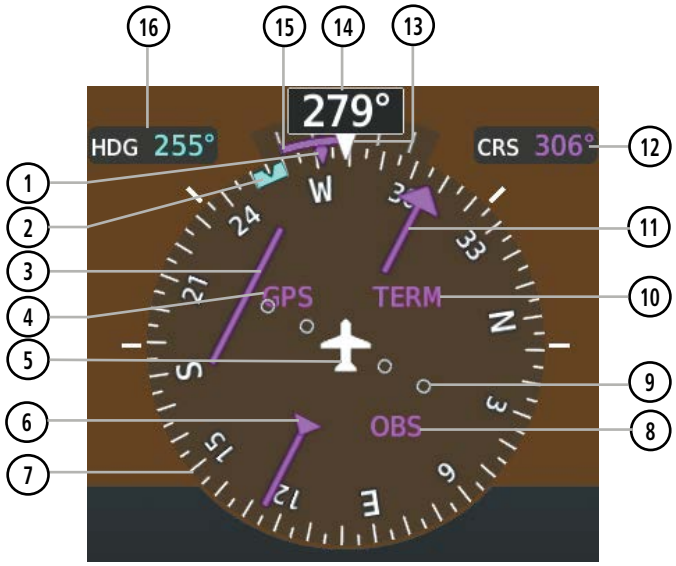
Criteria	VNV Indication Removed		
	Required Vertical Speed (RVSI)	Vertical Deviation (VDI)	VNV Target Altitude
Aircraft > 1 min before the next TOD due to flight plan change	X	X	X
VNV cancelled (**Cncl VNV** Softkey pressed on MFD)	X	X	X
Distance to active waypoint cannot be computed due to unsupported 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 cannot be reached within maximum allowed flight path angle and vertical speed	X	X	
Last altitude-constrained waypoint in active flight plan reached	X	X (30 sec before)	X

Table 2-2 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, and the current track is represented on the HSI by a magenta diamond. The HSI also presents turn rate, course deviation, bearing, and navigation source information. The HSI is available as a traditional 360° compass rose and a 210° HSI Map. The HSI Map offers two pilot-selectable map formats: a navigation map or traffic map. The HSI Map and Inset Map cannot be displayed simultaneously.

The traditional (360°) HSI contains a Course Deviation Indicator (CDI) with a Course Pointer, To/From Indicator, sliding Deviation Bar and scale. The Course Pointer is a single line arrow (GPS, VOR1, and LOC1) 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 valid NAVAID data.



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

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

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 Map is a 210 ° expanded compass rose which also includes a navigation map with overlay capabilities such as topographical and weather information. The HSI Map contains a Course Pointer, a combined To/From Indicator with a sliding deviation indicator (bar), and a lateral deviation scale. To the upper left of the HSI, the Selected Heading is shown in cyan, which corresponds to the cyan heading bug on the compass rose. If the Selected Heading Bug is adjusted to a heading not included on the HSI Map, the Selected Heading Bug will appear at the corresponding edge of the HSI Map compass rose. A digital reading of the current heading appears above the rotating compass card. A magenta diamond on the HSI represents the current track over the ground the aircraft is flying. The Desired Track (DTK) is shown in magenta to the upper right of the HSI when the selected navigation source is GPS and OBS mode is not active. The Selected Course (CRS) is shown to the upper right of the HSI in green when the selected navigation source is VOR or LOC, and in magenta when the selected navigation source is GPS with OBS mode active. Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the can appear in two different ways: an arrowhead (GPS, VOR, OBS) or a diamond (LOC). Refer to the Flight Management Section for information about using HSI Map overlays.

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

- Sliding Course Deviation Indicator (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)

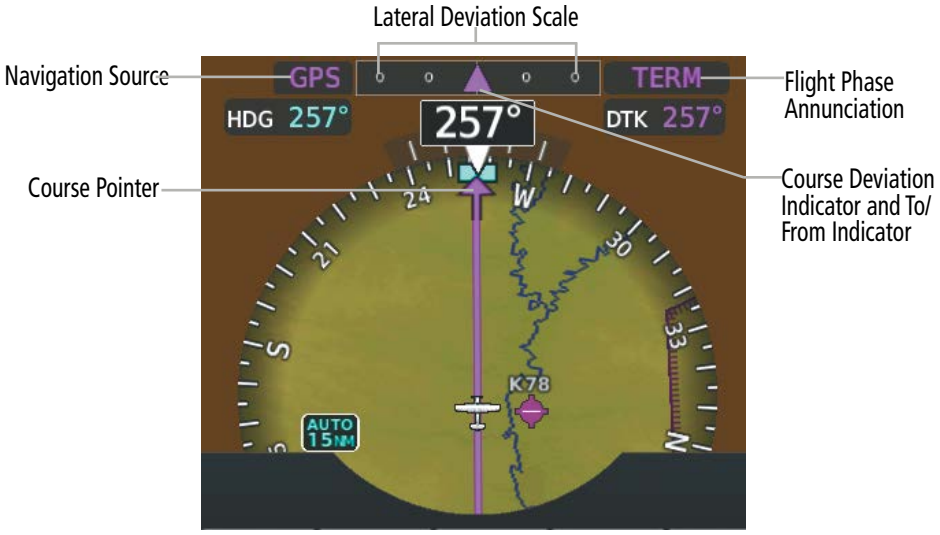


Figure 2-16 HSI Map

Adjusting the Selected Heading:

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

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

Adjusting the Selected Course:

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

Push 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 a message 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 (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the 'NAV Angle' Field in the 'Display Units' Box.
4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key:
   - 'True(°T)' – References angles to true north.
   - 'Magnetic(**°**)' – Angles corrected to the computed magnetic variation (Mag Var).
5) Push the **FMS** Knob to remove the cursor.

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 2-19 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 GPS 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 (Bearing 1) or double-line (Bearing 2). 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. The white ring is not shown when the HSI Map is enabled. Bearing pointers may be selected but not necessarily visible due to data unavailability.

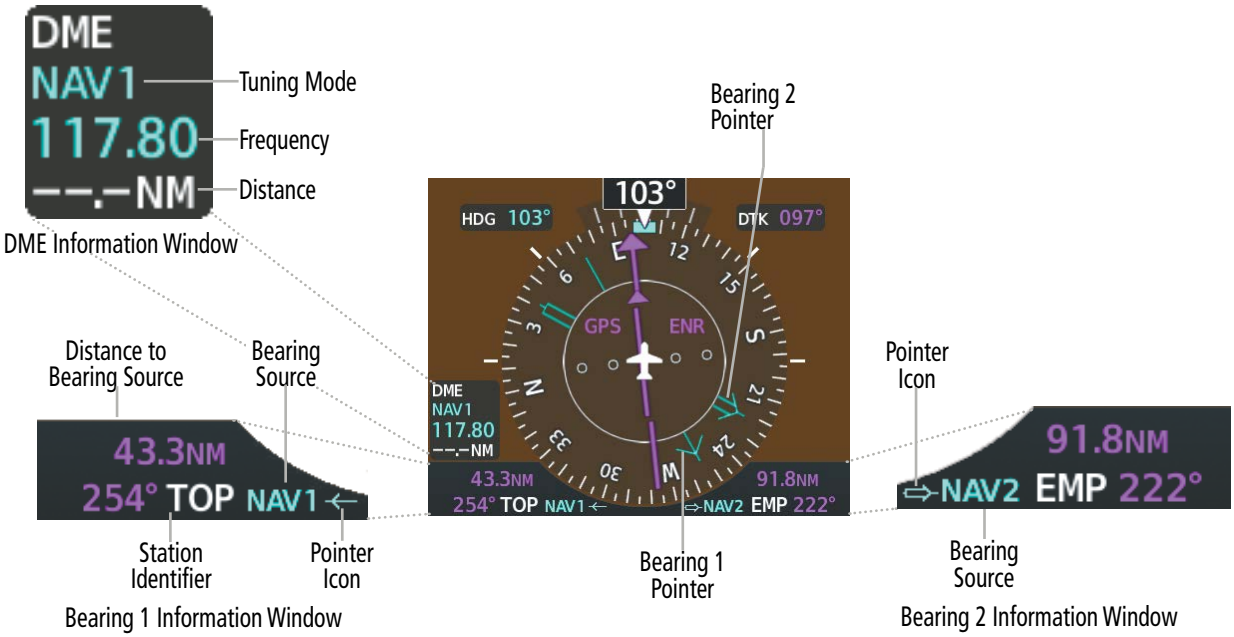


Figure 2-20 HSI with Bearing and DME Information Windows

When a bearing pointer is displayed, the associated information window is also displayed. The bearing information windows are displayed at the lower sides of the HSI and give the following information:

- Bearing Source (NAV, GPS, ADF)
- Pointer Icon (BRG1 = Single Line, BRG2 = Double Line)
- Frequency (NAV)
- Station/Waypoint Identifier (NAV, GPS)
- GPS-Derived Great Circle Distance to Bearing Source

When the NAV radio is tuned to an ILS frequency, the bearing source and the bearing pointer are removed from the HSI and replaced with 'ILS'. When NAV1 or NAV2 is the selected bearing source, the frequency is replaced by the station identifier when the station is within range. If GPS 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 GPS 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 the **Bearing 1** or **Bearing 2** Softkey to display the desired bearing pointer and information window using the NAV1 source.
3) Press either the **Bearing 1** or **Bearing 2** Softkey again to change the bearing source to NAV2.
4) Press either the **Bearing 1** or **Bearing 2** Softkey a third time to change the bearing source to GPS.
5) Press either the **Bearing 1** or **Bearing 2** Softkey a fourth time to change the bearing source to ADF.
6) To remove the bearing pointer and information window, press either the **Bearing 1** or **Bearing 2** Softkey again.

DME INFORMATION WINDOW

NOTE: *DME radio installation is optional.*

The DME Information Window is displayed above the Bearing 1 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 & 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 Bearing 1 Information Window.
3) To remove the DME Information Window, press the **DME** Softkey again.

COURSE DEVIATION INDICATOR (CDI)

The course Deviation Bar 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.

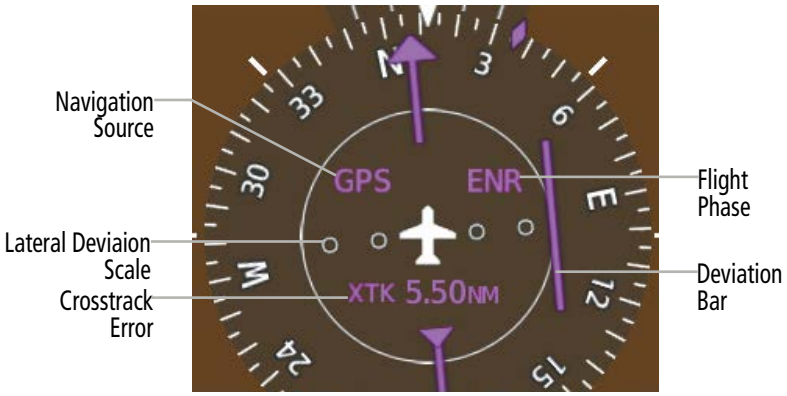


Figure 2-21 Course Deviation Indicator (CDI)

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

Figure 2-22 Navigation Sources

Changing navigation sources:

1) Press the **CDI** Softkey to change from GPS 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 GPS.

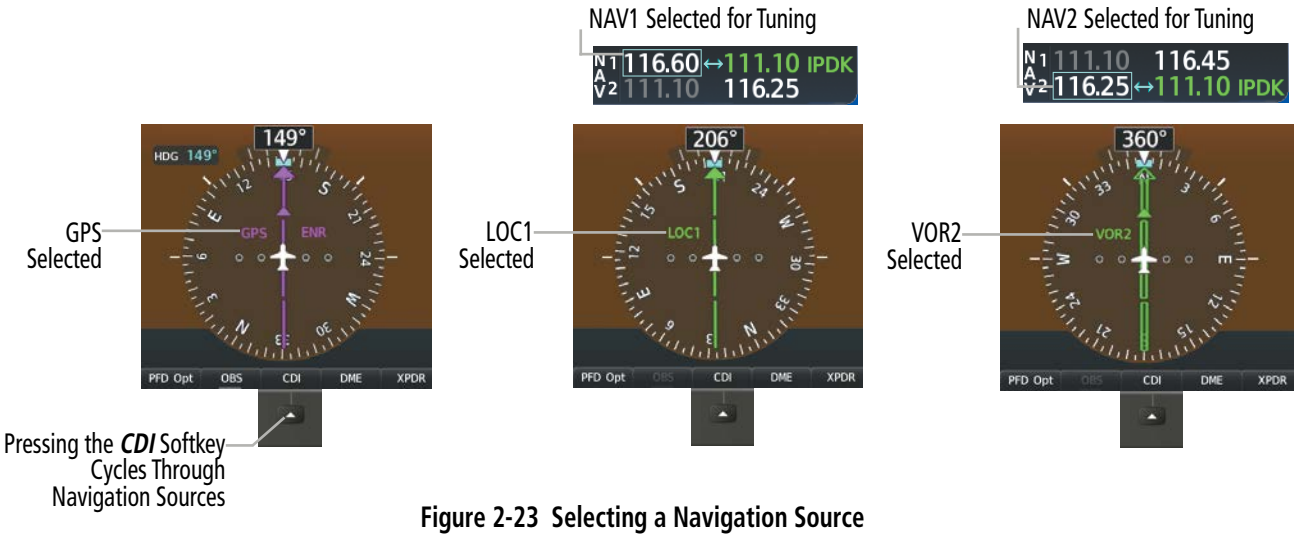


Figure 2-23 Selecting a Navigation Source

The system automatically changes from GPS 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 GPS CDI deviation is less than 1.2 times full-scale deflection.

GPS 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 GPS information becomes invalid. Activating a Vector-to-Final (VTF) also causes the CDI to switch to LOC navigation source. GPS 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, it is possible to be above the glideslope when the navigation source automatically changes from GPS to LOC. The probability of this occurring varies based on air temperature.

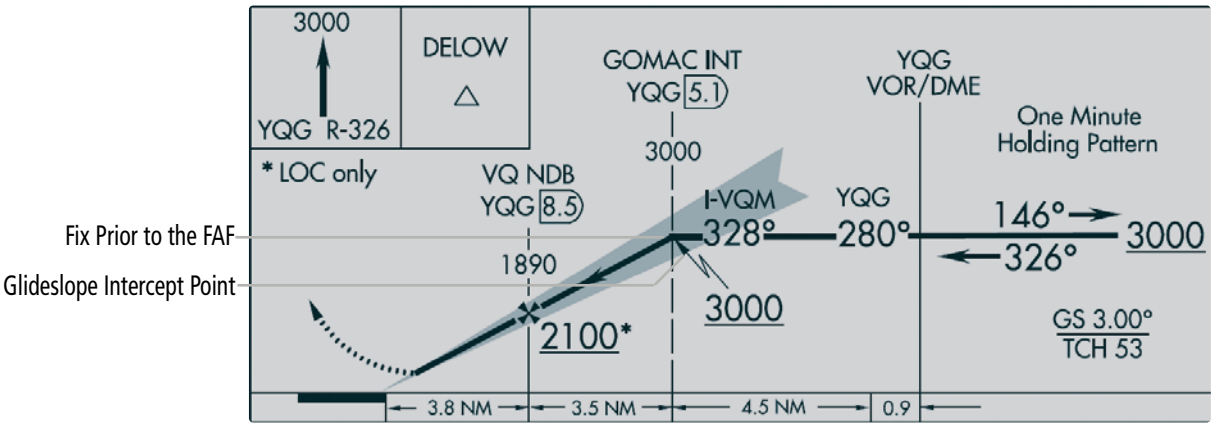


Figure 2-24 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

GPS CDI SCALING

When GPS 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 in the 'System CDI' Field of the 'GPS CDI' Box on the 'Aux – System Setup 1' Page. The full-scale deflection setting may also be changed (2.00NM, 1.00NM, 0.30NM, 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 GPS CDI setting:

1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the 'Format Allowed' Field 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 **CLR** Key, or push the **FMS** Knob to deactivate the cursor.

When set to 'Auto' (default), the GPS CDI scale automatically adjusts to the desired limits based upon the current phase of flight, as follows:

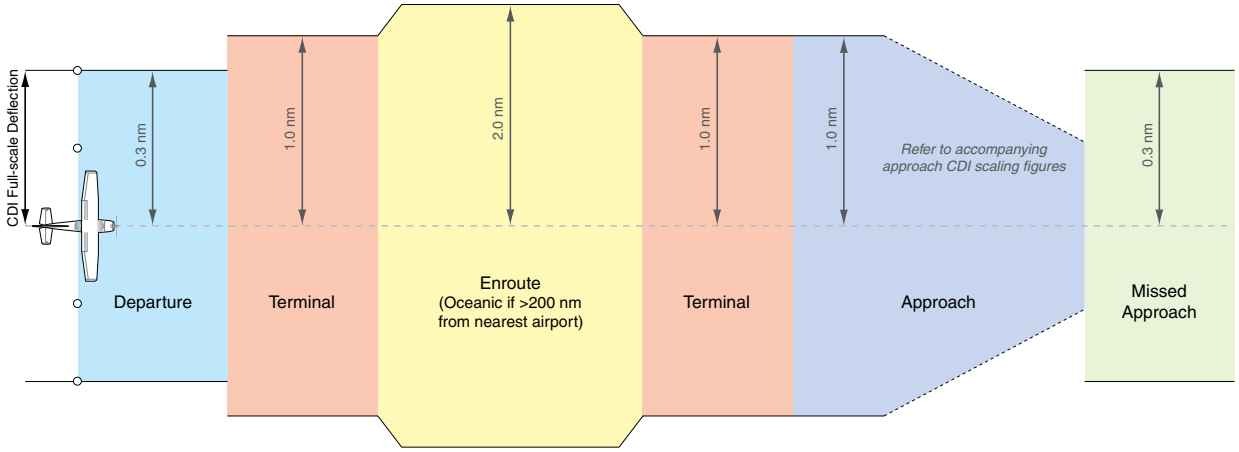


Figure 2-25 Automatic CDI Scaling

» 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 (refer to the Appendices Section 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 (4.0 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 (see following figures). 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.

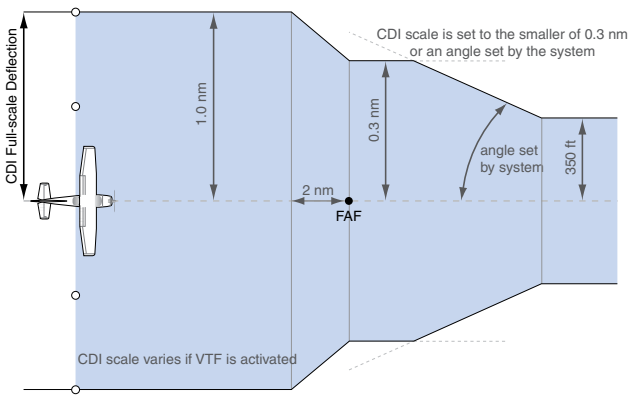


Figure 2-26 Typical LNAV, LNAV+V, and Visual Approach Service Level CDI Scaling

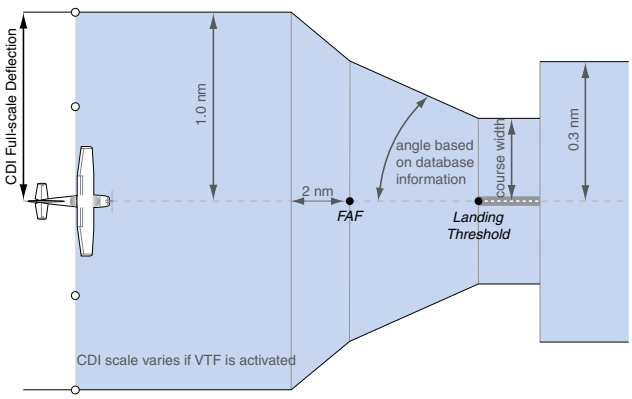


Figure 2-27 Typical LNAV/VNAV, LP, LP+V and LPV Approach Service Level CDI Scaling

» 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.

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.
Approach (Non-precision with Advisory Vertical Guidance)	LNAV + V	
Approach (Non-precision with Advisory Vertical Guidance)	VISUAL	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables.
Approach (LP)	LP	
Approach (LP+V)	LP+V	
Approach (LPV)	LPV	
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 2-3 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 on the HSI, or to the upper right of the HSI Map.

While OBS mode 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 flight plan returns to normal operation with automatic sequencing of waypoints, following the course set in OBS mode. The flight path on the moving map retains the modified course line.

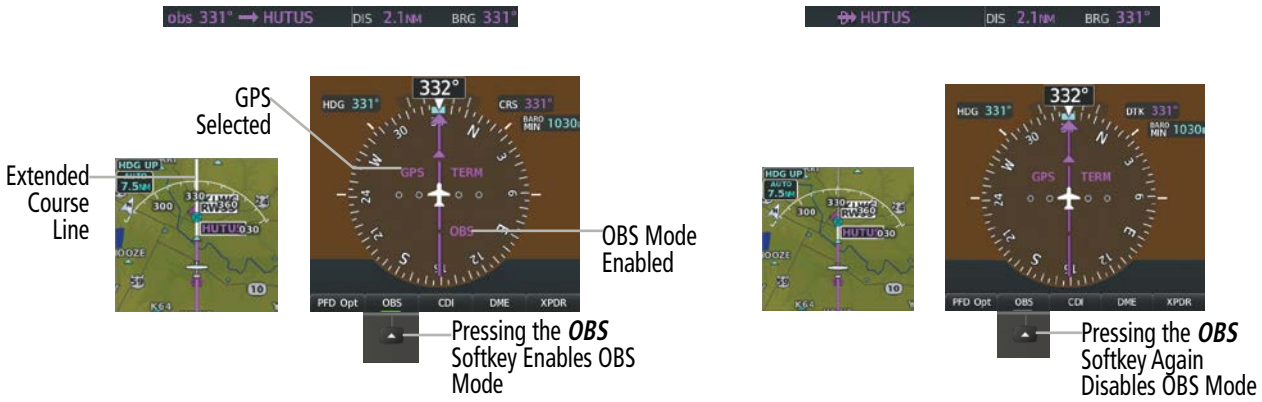


Figure 2-28 Omni-bearing Selector (OBS) Mode

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. Push 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 a **SUSP** Softkey label to indicate the suspension is active. Pressing the **SUSP** Softkey deactivates the suspension and resumes automatic sequencing of approach waypoints.

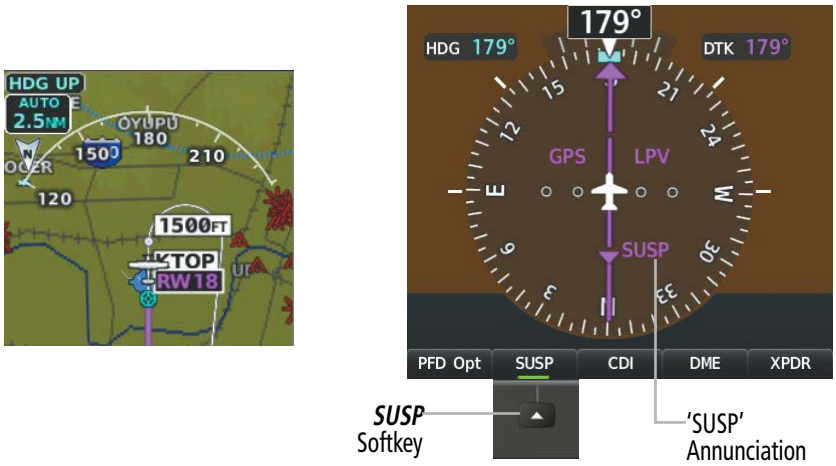


Figure 2-29 Suspending Automatic Waypoint Sequencing

2.2 SUPPLEMENTAL FLIGHT DATA

In addition to the flight instruments, the PFD also displays various supplemental information, including temperature and wind data.

TEMPERATURE DISPLAY

The Outside Air Temperature (OAT) is displayed in the lower left corner of the PFD under normal conditions. It is displayed in either degrees Celsius (°C) or Fahrenheit (°F), depending on the temperature units selected on the 'Aux – System Setup 1' Page.

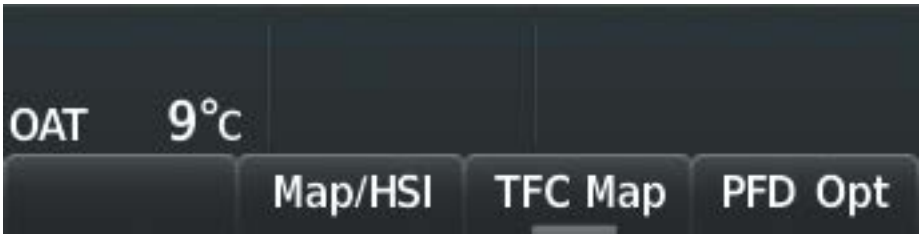


Figure 2-30 Outside Air Temperature (Displayed on PFD)

Changing temperature display units:

1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the 'Temperature' Field in the 'Display Units' Box.
4) Turn the small **FMS** Knob to highlight either 'Celsius(°C)' or 'Fahrenheit(°F)' and press the **ENT** Key to confirm the selection.
5) To cancel the selection press the **CLR** Key, or push the **FMS** Knob to deactivate the cursor.

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.

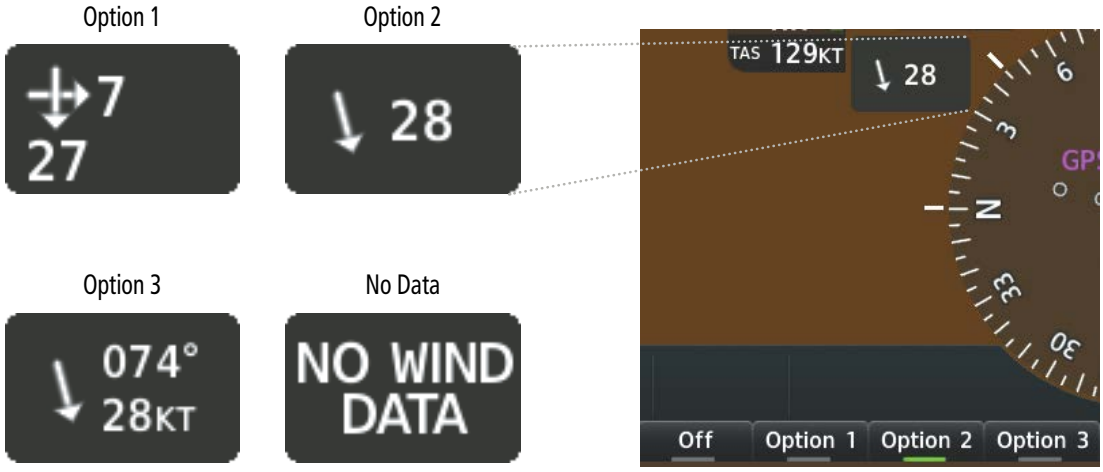


Figure 2-31 Wind Data

Displaying wind data:

1) Press the **PFD Opt** Softkey.
2) Press the **Wind** Softkey to display wind data option softkeys.
3) Press one of the option softkeys to change how wind data is displayed to the left of the HSI:
   - **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/tailwind and crosswind components
4) To remove the window, press the **Off** Softkey.

2.3 GARMIN SYNTHETIC VISION TECHNOLOGY (SVT) (OPTIONAL)

WARNING: *Use appropriate primary systems for navigation, and for terrain, obstacle, and traffic avoidance. Garmin 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: *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 89º North latitude and south of 89º 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 a 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 30 degrees to the left and 35 degrees to the right. During Reversionary Mode, the Field of View is reduced. 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 the terrain elevation contours are stored in squares measuring 4.9 arc-seconds on each side. 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, and other obstacles over 200' AGL that are included in the obstacle database. Wire obstacles, such as high voltage transmission lines, may also be shown when present in the 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 navigation maps. The terrain display also includes a north–south east–west grid with lines oriented to true north and spaced at one arc-minute intervals to assist in orientation relative to the terrain.

Forward-looking terrain and obstacle alerting is integrated within SVT to provide visual and auditory alerts to indicate the presence of terrain and obstacle threats relevant to the projected flight path. Terrain and obstacle alerts are displayed in red and yellow shading on the PFD.

SVT can be displayed on the Multifunction Display (MFD) in Reversionary Mode. If SVT is enabled when switching to Reversionary Mode, it may 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 reliability on which to base decisions and plan maneuvers to avoid terrain or obstacles. Navigation must not be predicated solely upon the use of the terrain or obstacle data indicated by the SVT display.

The following SVT enhancements appear on the PFD:

- Flight Path Marker
- Horizon Heading Marks
- Airport Signs
- Runway Display
- Terrain Alerting
- Obstacle Alerting
- Pathways

Figure 2-32 Synthetic Vision Imagery

SVT OPERATION

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 (annunciator turns green). After activating the **Terrain** Softkey, the **Pathways**, **HDG LBL**, and **APT Sign** softkeys may be activated in any combination to display desired features. When system power is cycled, 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 the display of heading marks and digits on the Zero Pitch Line.
- **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.

SVT FEATURES

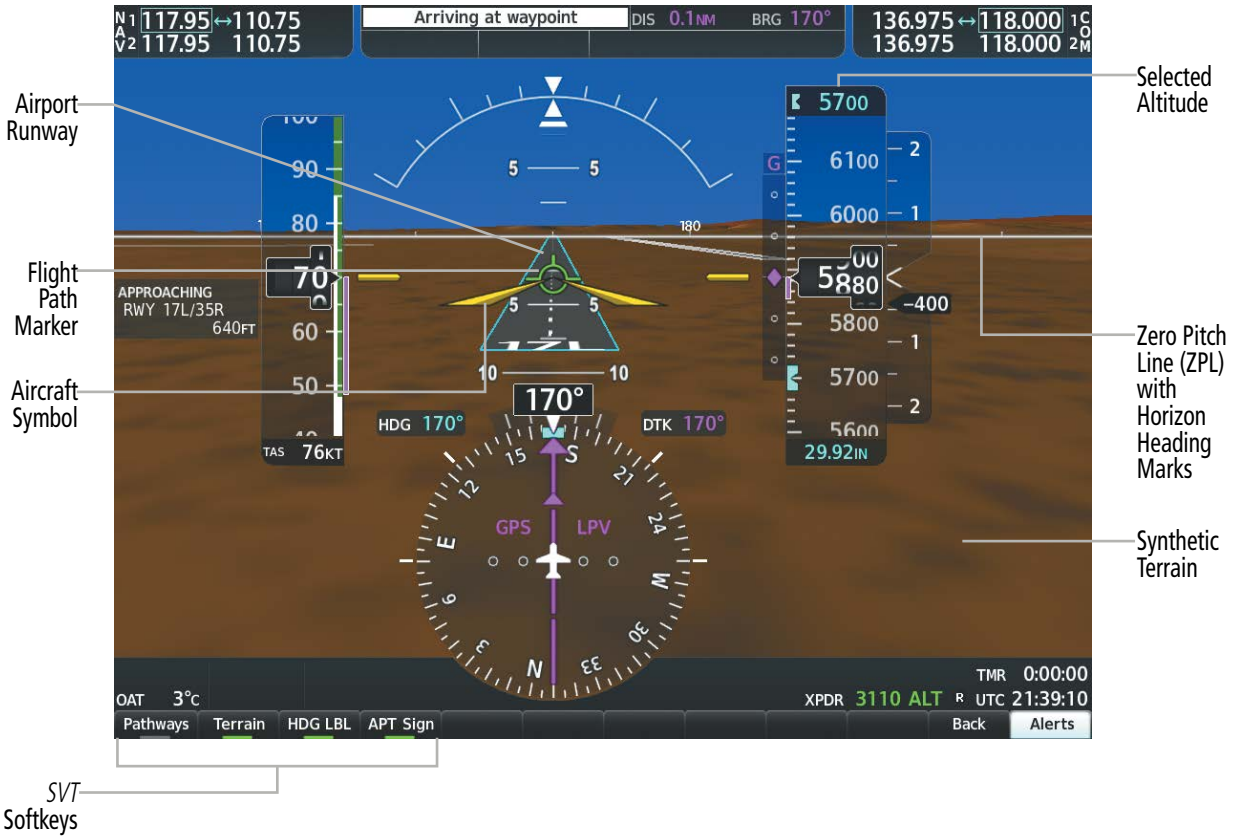


Figure 2-33 SVT on the Primary Flight Display

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

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.

FLIGHT PATH MARKER

NOTE: *Do not use the Flight Path Marker as a flight director.*

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 displayed 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 altitude and direction when navigating a flight plan. When on course and altitude, the FPM is aligned inside the Pathways boxes.

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 TAWS. However, decisions regarding terrain and/or obstacle avoidance should not be made using only the FPM.

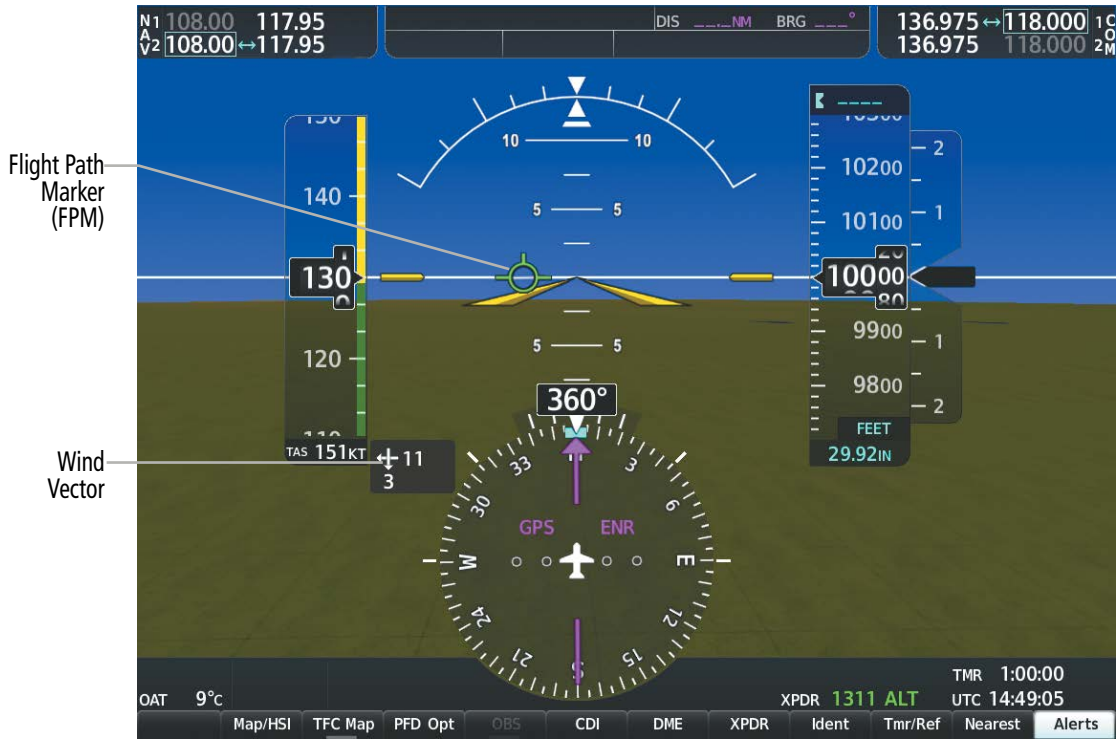


Figure 2-34 Flight Path Marker Affected by Wind

TRAFFIC

NOTE: *Intruder aircraft at or below 500 ft. AGL may not appear on the Garmin 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. Traffic symbols and coloring are consistent with that used for traffic displayed on the Inset Map or MFD traffic page. 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.

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 Pathways boxes are displayed is determined by the higher of either the Selected Altitude or the VNAV altitude programmed for the active leg in the flight plan.

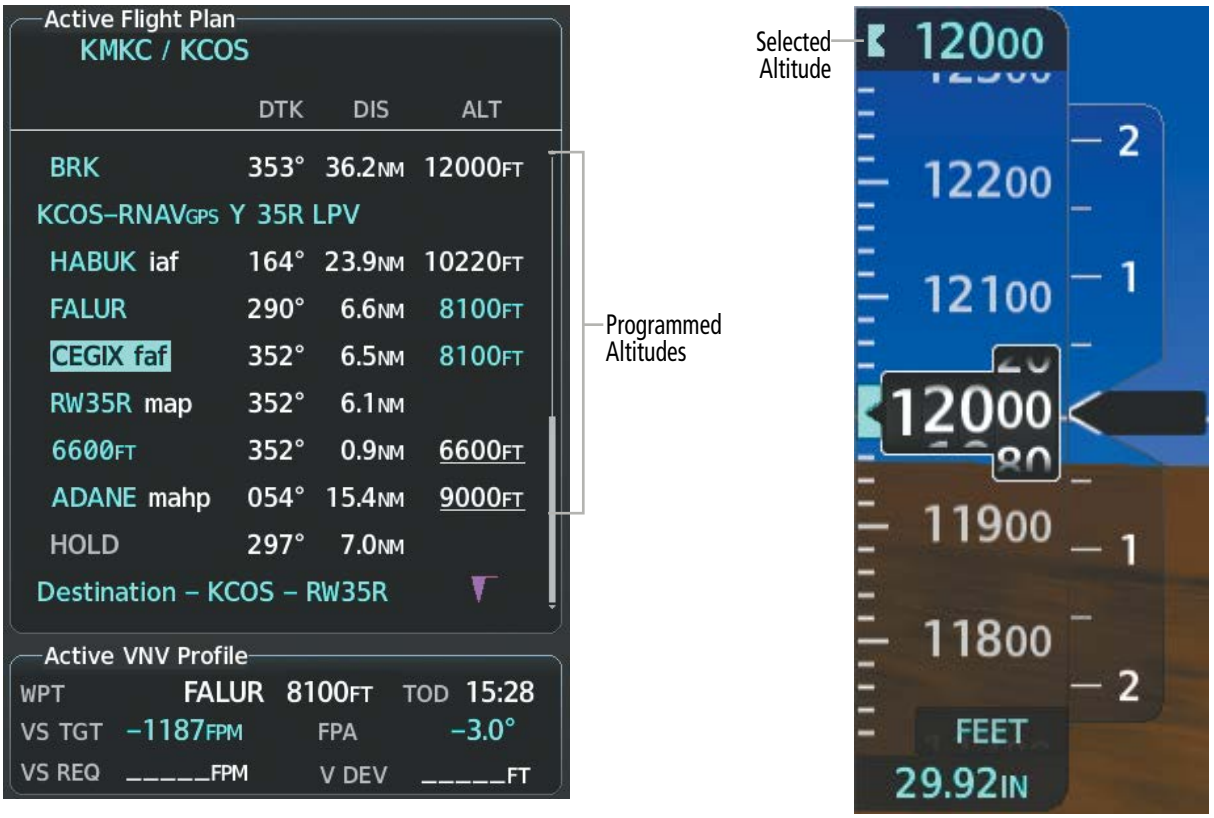


Figure 2-35 Programmed and Selected Altitudes

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 white boxes, corresponding to a white line drawn on the navigation map indicating an inactive leg.

Pathways provide supplemental glidepath/glideslope information on an active ILS, LPV, LNAV/VNAV, Visual, and some LNAV approaches. Pathways are intended as an aid to situational awareness and should not be used independent of the CDI, VDI, Glidepath Indicator, and Glideslope 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.

Figure 2-36 SVT Pathways

Activating and deactivating Pathways:

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

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 Pathways boxes decreases to a minimum of 4.

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 be can 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.

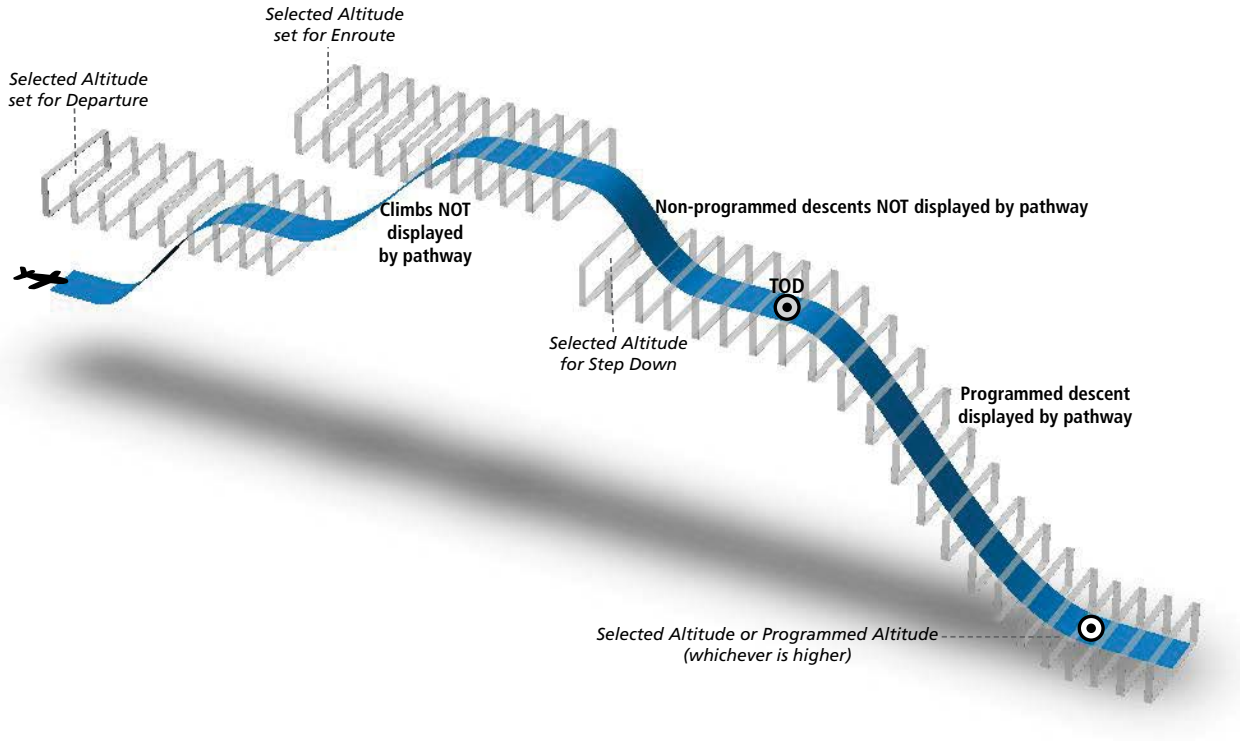


Figure 2-37 SVT Pathways, Enroute and Descent

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.

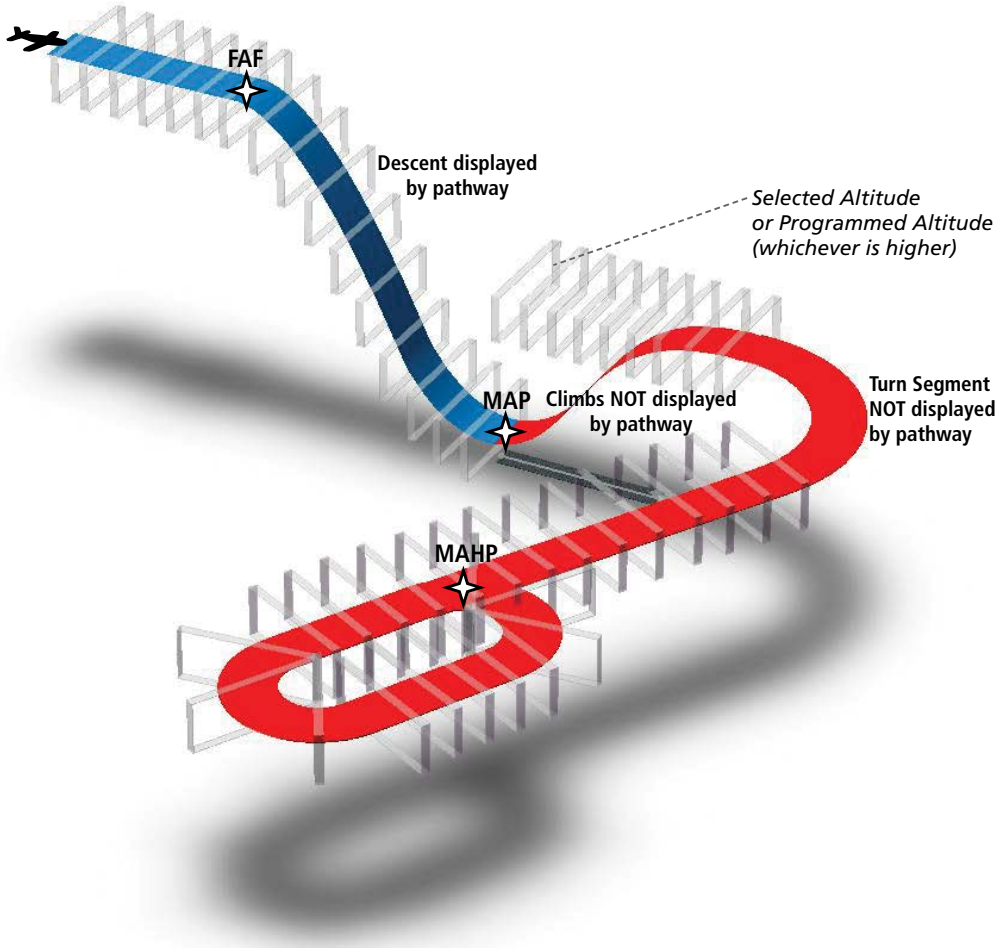


Figure 2-38 SVT Pathways, Approach, Missed Approach, and Holding

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.

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.

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 8 nm 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.

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.

Figure 2-39 Airport Signs

RUNWAYS

WARNING: *Do not use Garmin 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. When a specific runway is associated with an approach in the flight plan or when the origin/destination runway with defined dimensions is entered into the system, the runway perimeter will be outlined with a cyan box. The cyan box may include chevrons to indicate runway direction, depending on the need for decluttering. As the aircraft nears the runway, the cyan runway border will overlay the white runway border.

Figure 2-40 Airport Runways

TERRAIN AND OBSTACLE 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 map displays. For more detailed information regarding Terrain-SVT, 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.

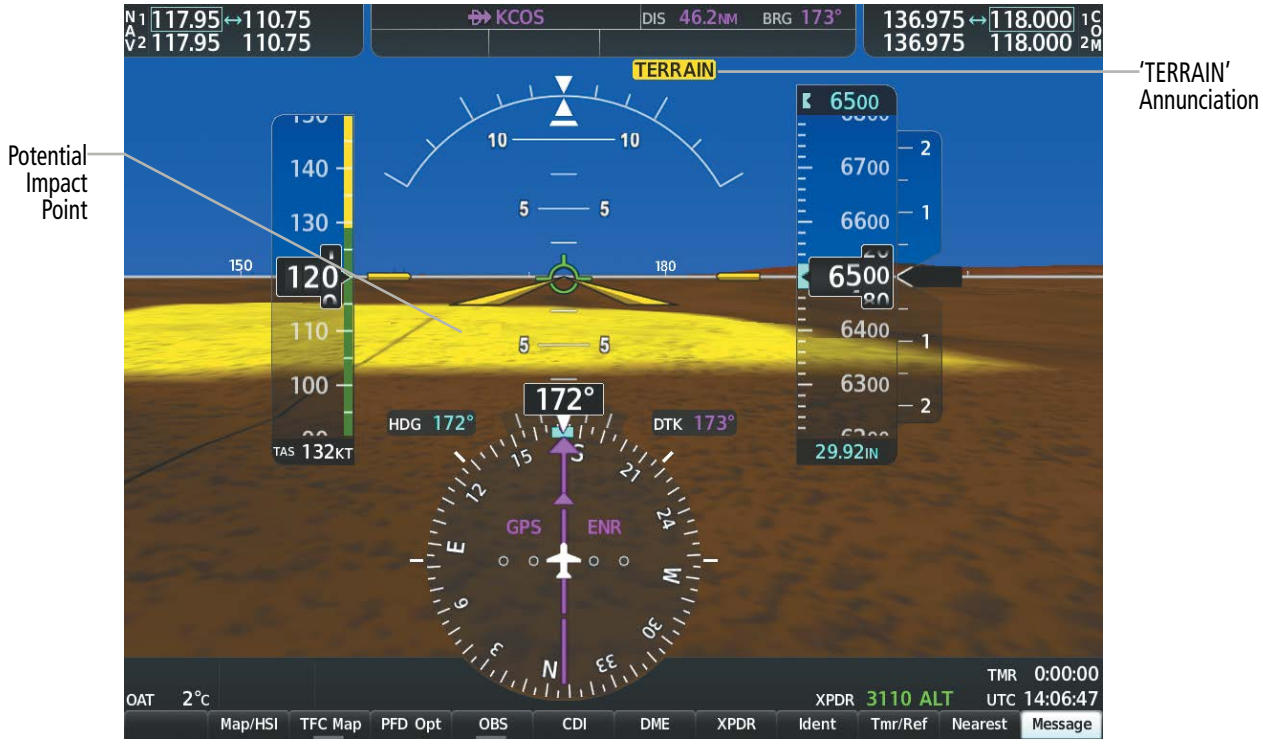


Figure 2-41 SVT Terrain Caution Alert

Obstacles are represented on the synthetic terrain display by standard two-dimensional tower symbols found on the Inset Map and MFD maps and charts. To depict obstacles from the pilot's perspective, the synthetic terrain display determines the size of each obstacle symbol using the obstacle's relative height above terrain and distance from the aircraft. Obstacles greater than 1000 feet below the aircraft altitude are not shown. Obstacles are shown behind the airspeed and altitude displays.

During a terrain obstacle alert, the obstacle symbol on the synthetic terrain display is yellow for an obstacle caution or red for an obstacle warning.

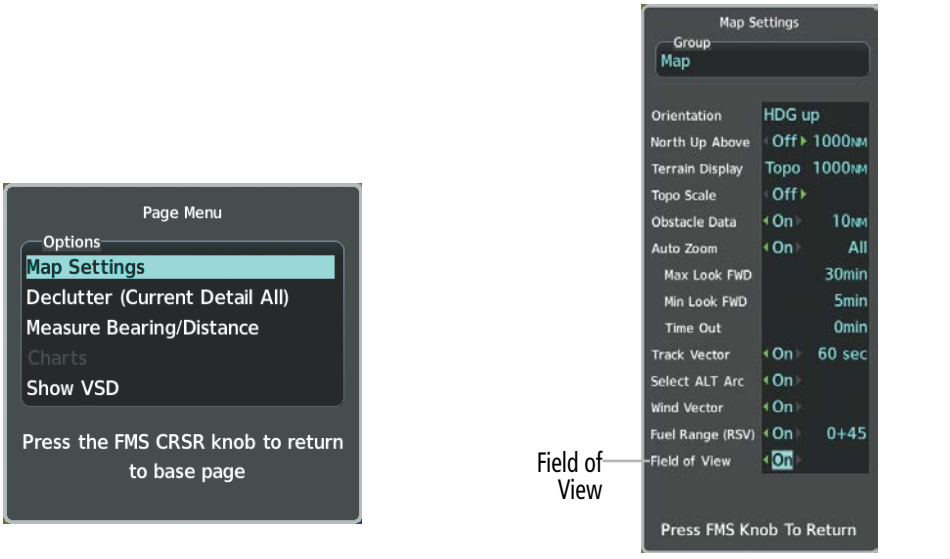
Figure 2-42 SVT Obstacle Warning Alert

FIELD OF VIEW

The PFD Field of View can be represented on the '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 small **FMS** Knob to highlight 'Map' in the 'Group' Box 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) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.



'Map – Navigation Map' Page Menu

'Map Settings' Menu, 'Map' Group, 'Field of View' Field

Figure 2-43 Field of View Option Menus

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

SVT View on the PFD

Field of View on the MFD

Figure 2-44 PFD and MFD Field of View Comparison

2.4 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

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

MARKER BEACON ANNUNCIATIONS

Marker Beacon Annunciations are displayed on the PFD to the left of the Altimeter. The outer marker (O) reception is indicated in cyan, middle (M) in amber, and inner (I) in white. Refer to the Audio Panel & CNS Section for more information on Marker Beacon Annunciations.

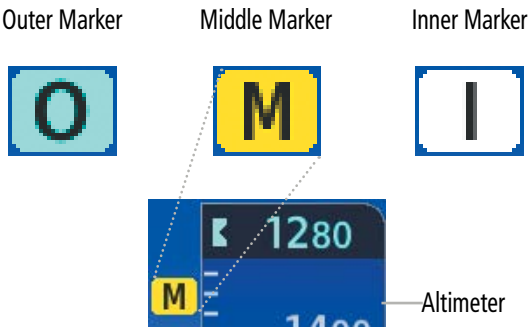


Figure 2-45 Marker Beacon Annunciations

ALTITUDE ALERTING

Altitude alerting provides the pilot with visual and aural alerts 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, the annunciation changes to cyan text on a black background, flashes for five seconds, and an aural tone is heard.
- 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 2-46 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 terrain alerting has been inhibited, is not available, or has failed.*

When the Final Approach Fix (FAF) is the active waypoint in an 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 2-47 Low Altitude Annunciation on PFD

MINIMUM ALTITUDE ALERTING

For altitude awareness, a barometric or temperature compensated Minimum Altitude Alert 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 cycled. For example, while enroute, the pilot may choose to set the MEA. When the pilot loads an approach, the set Minimum Altitude Alert is removed, and the pilot may enter approach minimums. When active, the altitude setting is displayed to the bottom left of the Altimeter. The function serves only as an alert and does not couple to the autopilot. 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 Minimum Altitude Alert:

- When the aircraft altitude is over 100 feet above the Minimum Altitude Alert 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 altitude alert, the bug and text turn white.
- Once the aircraft reaches the alert value, the bug and text become amber and a "Minimums, Minimums" voice alert occurs.

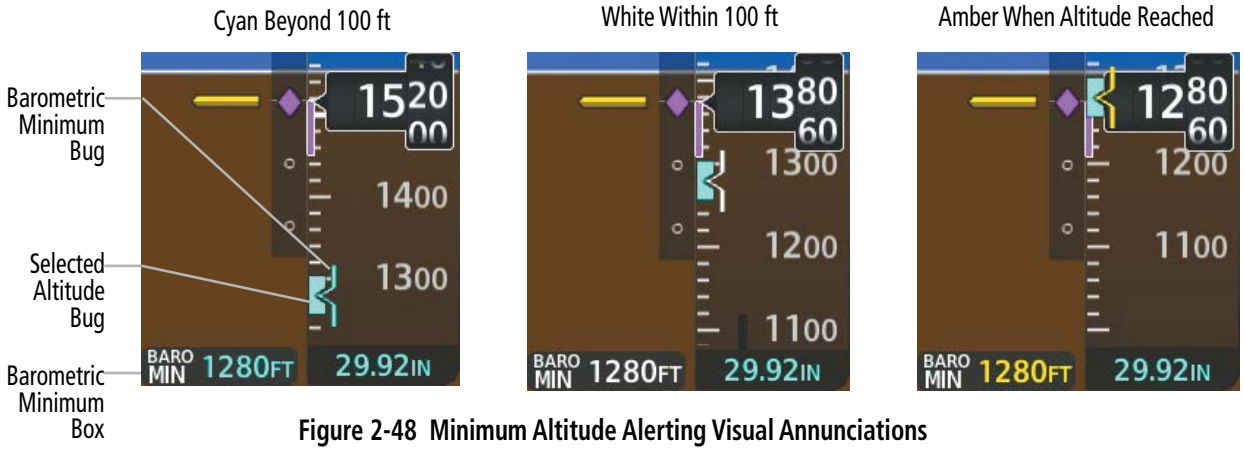


Figure 2-48 Minimum Altitude Alerting Visual Annunciations

Alerting is inhibited while the aircraft is on the ground and until the aircraft reaches 150 feet above the set value. If the aircraft proceeds to climb after having reached the alerting altitude, once it reaches 50 feet above the value, alerting is disabled.

Setting the Minimum Altitude Alert and Bug:

1) Press the **Tmr/Ref** Softkey.
2) Turn the large **FMS** Knob to highlight the Minimums ('MINS') 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 (from zero to 16,000 feet).
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.

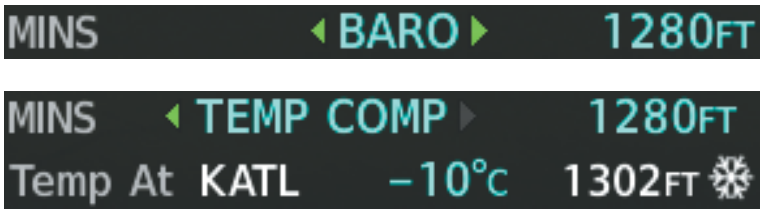


Figure 2-49 BARO and TEMP COMP Minimum Altitude Alerting

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in the following table can appear on the HSI when abnormal GPS conditions occur. GPS navigation will resume automatically once a valid GPS solution is restored (and GPS sensors have not been inhibited). Refer to the Flight Management Section for more information on abnormal GPS conditions.

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	Dead Reckoning–System is using projected position rather than GPS position to compute navigation data and sequence active flight plan waypoints.

Table 2-4 Abnormal GPS Conditions Annunciated on HSI

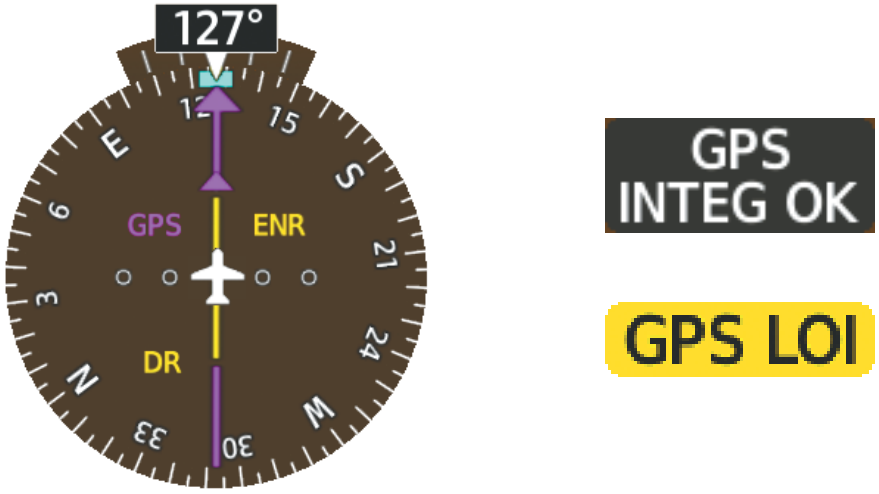


Figure 2-50 Example HSI Annunciations

In Dead Reckoning (DR) mode, when GPS is the selected navigation source, the CDI Deviation Bar turns amber and is subsequently removed after 20 minutes. The following items on the PFD are also shown in amber:

- Current Track Indicator
- Wind Data (calculated based on GPS information)
- Distances in the Bearing Information Windows
- GPS Bearing Pointers
- Desired Track (DTK)
- Active Flight Plan Distances, Bearings, and ETE Values

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. See the Flight Management Section for more information about DR mode.

GARMIN SVT TROUBLESHOOTING

Garmin 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
- 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

GARMIN SVT IN REVERSIONARY MODE

SVT can be displayed on the 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.

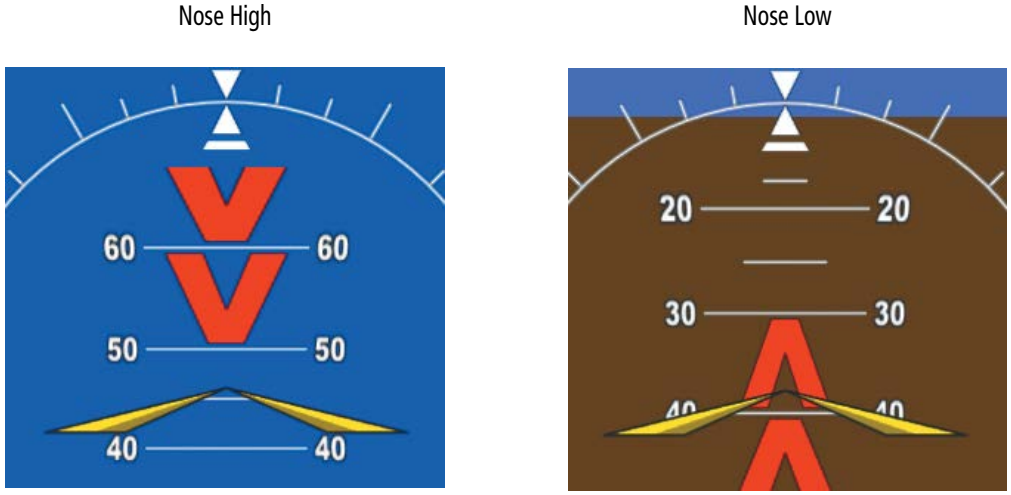


Figure 2-51 Pitch Attitude Warnings

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 the PFD and the associated softkeys are disabled when the aircraft experiences unusual attitudes:

- Traffic Annunciations
- AFCS Annunciations
- True Airspeed
- Inset Map
- Outside Air Temperature (OAT)
- Wind Data
- Selected Heading Indication
- Selected Course Indication
- System Time
- Transponder Status Box
- Windows Displayed on the PFD
- Altimeter Barometric Setting
- Minimum Altitude Alert Setting
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Selected Altitude
- VNV Target Altitude

GARMIN SVT UNUSUAL ATTITUDES

During extreme pitch attitudes, the display shows either a brown or blue colored bar at the top or bottom of the screen to represent earth or sky. The blue colored bar is also displayed when terrain gradient is great enough to completely fill the display. This is intended to prevent losing sight of the horizon during extreme pitch attitudes.

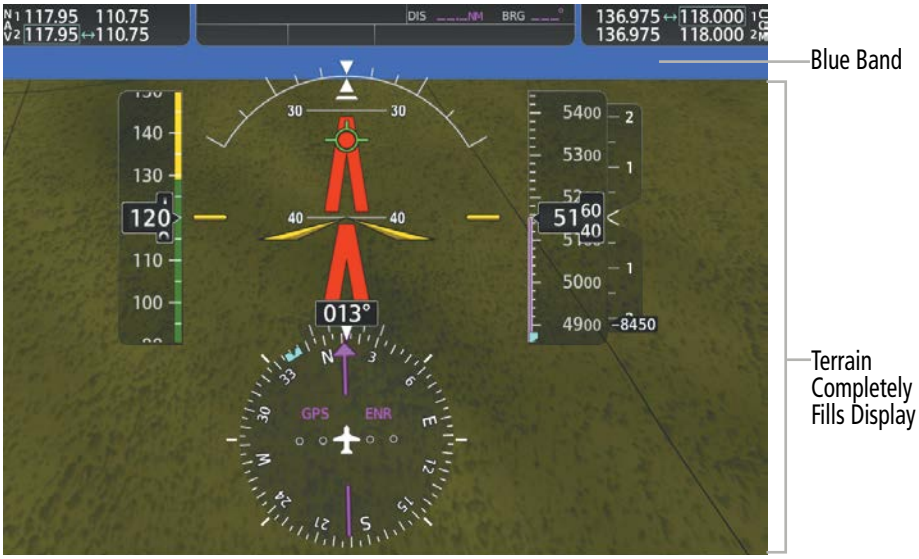


Figure 2-52 Blue Sky Bar with Full Display Terrain

SECTION 3 ENGINE INDICATION SYSTEM

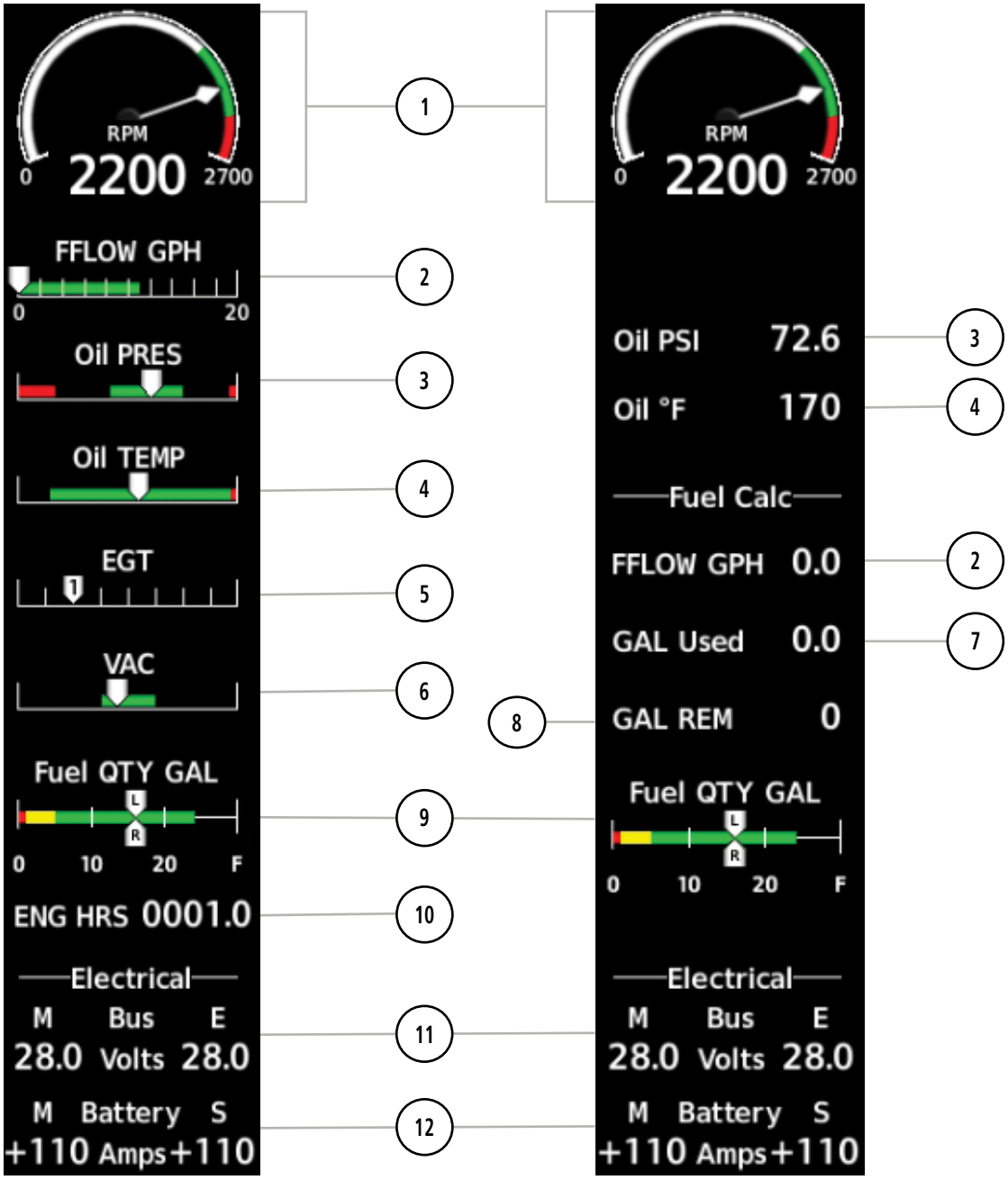
NOTE: *Refer to the current version of the pertinent flight manual for limitations.*

The system offers improved flight operations and reduces crew workload by automatically monitoring critical system parameters and providing system alerts during all phases of flight. The Engine Indication System (EIS) displays electrical, fuel, and engine information on the left side of the Multi Function Display (MFD). Pressing the **Engine** Softkey EIS, provides additional EIS features.

Figure 3-1 MFD with EIS display

Green bands on the instruments indicate normal ranges of operation; amber 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 displays flash to indicate cautions and warnings. If sensory data to an instrument becomes invalid or unavailable, a red or amber "X" is displayed across the instrument.

3.1 ENGINE DISPLAY

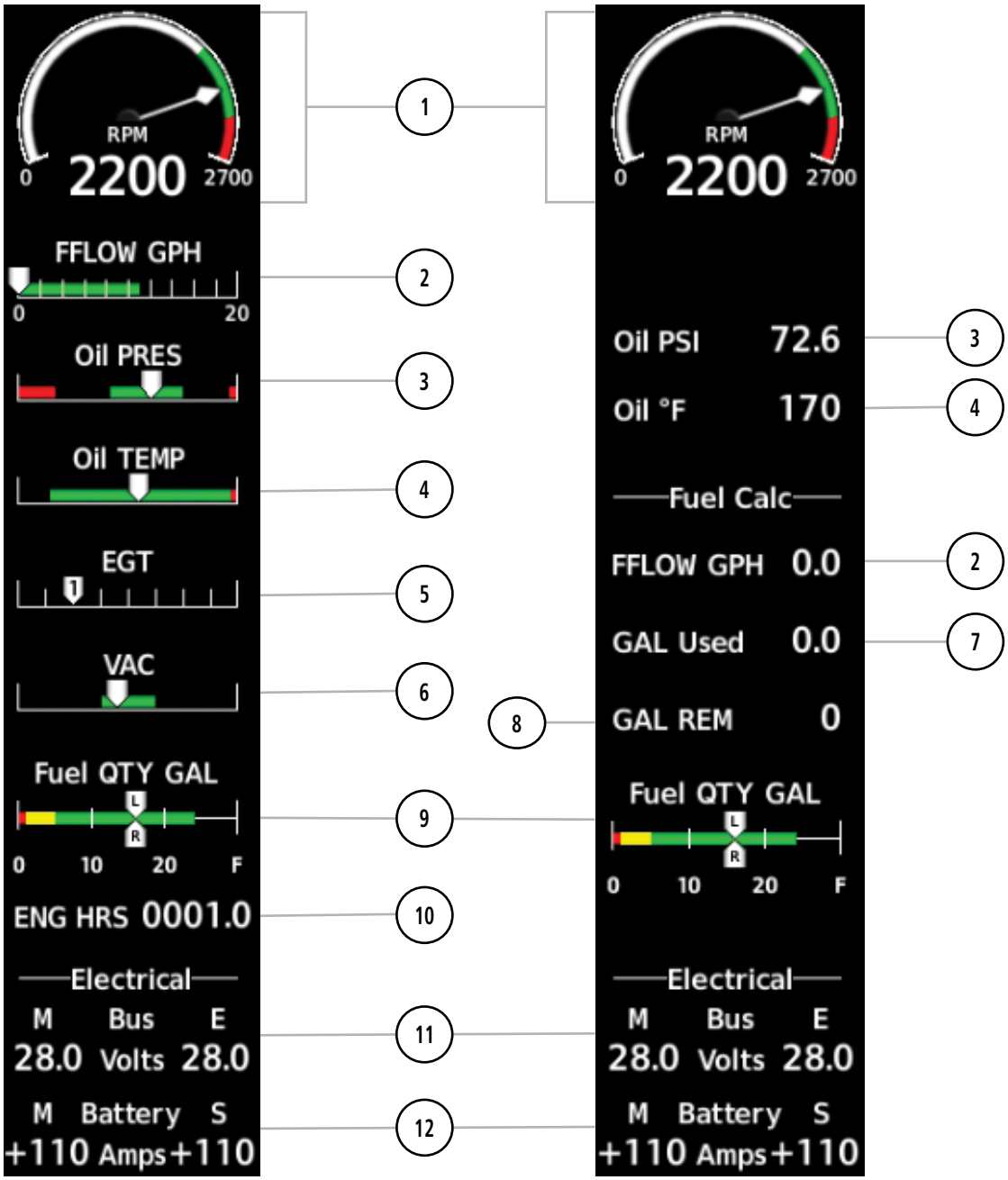


Engine Display

Engine System Display

Figure 3-2 Model 172R

(1) **Tachometer Indicator (RPM)**	Displays engine tachometer in revolutions per minute (RPM)
(2) **Fuel Flow Indicator (FFLOW GPH)**	Displays fuel flow in gallons per hour (gph)
(3) **Oil Pressure Indicator (OIL PSI)**	Displays oil pressure in pounds per square inch (psi)
(4) **Oil Temperature Indicator (OIL °F)**	Displays oil temperature in degrees Fahrenheit (°F)
(5) **Exhaust Gas Temperature Indicator (EGT)**	Displays exhaust gas temperature in degrees Fahrenheit (°F)
(6) **Vacuum Pressure Indicator (VAC)**	Displays standby vacuum pump pressure)
(7) **Calculated Fuel Used (GAL Used)**	Displays fuel used in gallons, based on fuel flow
(8) **Calculated Fuel Remaining (GAL REM)**	Displays the totalizer-based fuel remaining in gallons
(9) **Fuel Quantity Indicator (Fuel QTY GAL)**	Displays the amount of fuel in gallons (gal) for each side of a standard fuel tank
(10) **Engine Hour Indicator (ENG HRS)**	Displays a numeric digits for the time in hours (hrs) the engine has been in service
(11) **Voltmeter (M, S Bus Volts)**	Displays the main and essential bus voltages
(12) **Ammeter (M, S Battery Amps)**	Displays the main and standby battery load in amperes

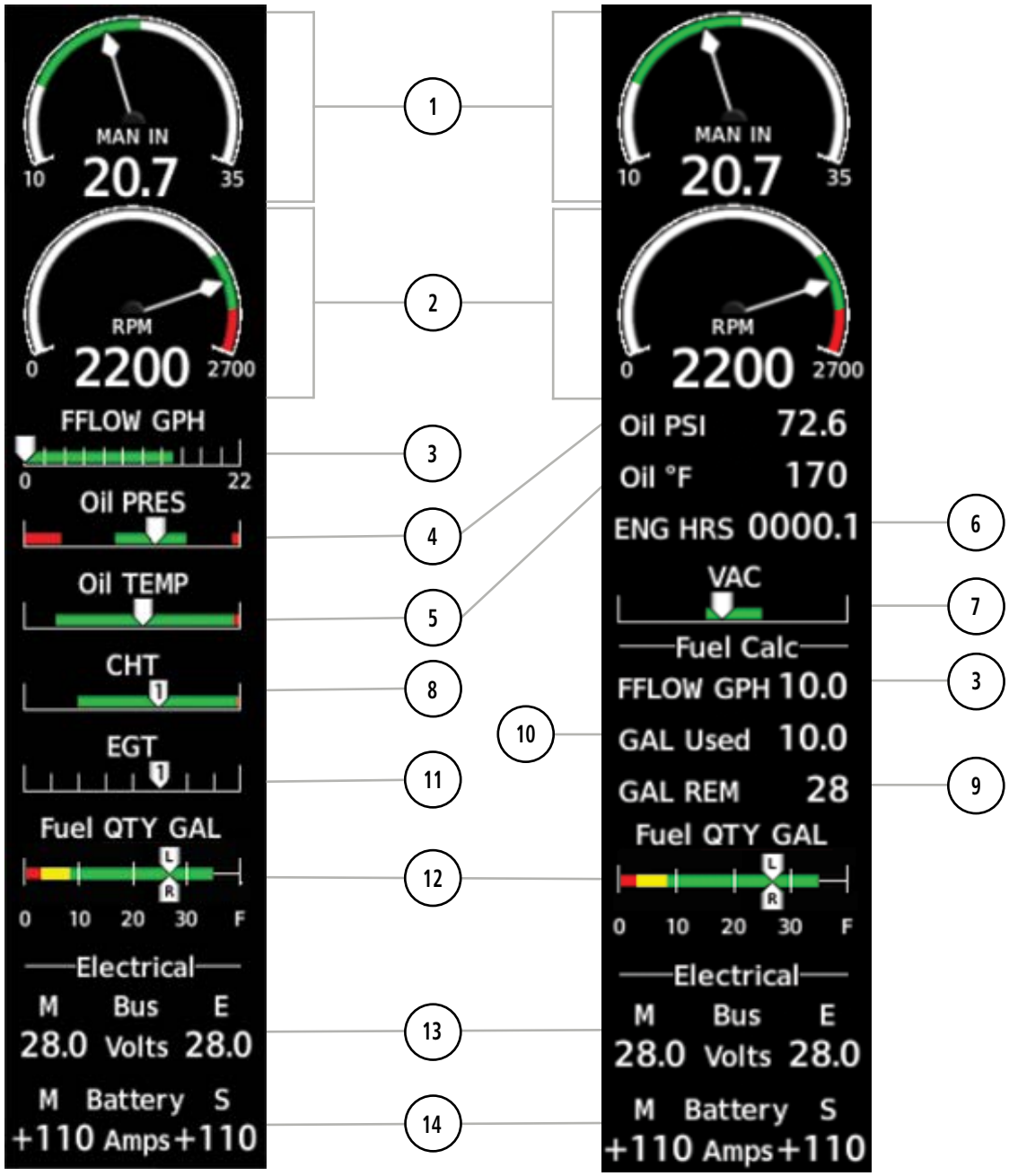


Engine Display

Engine System Display

Figure 3-3 Model 172S

(1) **Tachometer Indicator (RPM)**	Displays engine tachometer in revolutions per minute (RPM)
(2) **Fuel Flow Indicator (FFLOW GPH)**	Displays fuel flow in gallons per hour (gph)
(3) **Oil Pressure Indicator (OIL PSI)**	Displays oil pressure in pounds per square inch (psi)
(4) **Oil Temperature Indicator (OIL °F)**	Displays oil temperature in degrees Fahrenheit (°F)
(5) **Exhaust Gas Temperature Indicator (EGT)**	Displays exhaust gas temperature in degrees Fahrenheit (°F)
(6) **Vacuum Pressure Indicator (VAC)**	Displays standby vacuum pump pressure)
(7) **Calculated Fuel Used (GAL Used)**	Displays fuel used in gallons, based on fuel flow
(8) **Calculated Fuel Remaining (GAL REM)**	Displays the totalizer-based fuel remaining in gallons
(9) **Fuel Quantity Indicator (Fuel QTY GAL)**	Displays the amount of fuel in gallons (gal) for each side of a standard fuel tank
(10) **Engine Hour Indicator (ENG HRS)**	Displays a numeric digits for the time in hours (hrs) the engine has been in service
(11) **Voltmeter (M, S Bus Volts)**	Displays the main and essential bus voltages
(12) **Ammeter (M, S Battery Amps)**	Displays the main and standby battery load in amperes

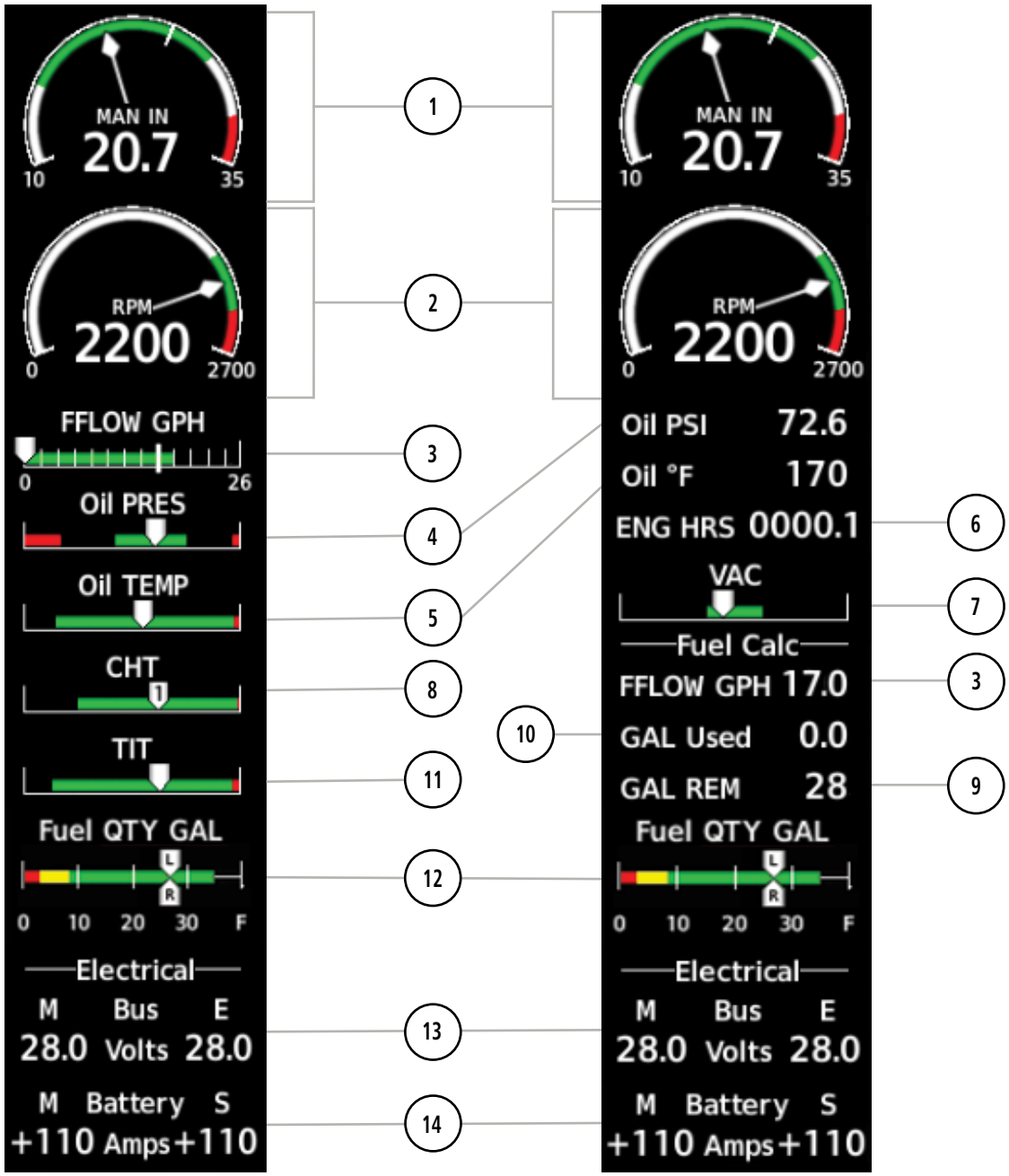


Engine Display

Engine System Display

Figure 3-4 Model 182T

(1) **Manifold Pressure Indicator (IN HG)**	Displays engine manifold pressure inches of mercury (IN HG)
(2) **Tachometer Indicator (RPM)**	Displays engine tachometer in revolutions per minute (RPM)
(3) **Fuel Flow Indicator (FFLOW GPH)**	Displays fuel flow in gallons per hour (gph)
(4) **Oil Pressure Indicator (OIL PSI)**	Displays oil pressure in pounds per square inch (psi)
(5) **Oil Temperature Indicator (OIL °C)**	Displays oil temperature in degrees Celsius (°C)
(6) **Engine Hour Indicator (ENG HRS)**	Displays a numeric digits for the time in hours (hrs) the engine has been in service
(7) **Vacuum Pressure Indicator (VAC)**	Displays standby vacuum pump pressure)
(8) **Cylinder Head Temperature Indicator (CHT)**	Displays cylinder head temperature in degrees Celsius (°C)
(9) **Calculated Fuel Remaining (GAL REM)**	Displays the totalizer-based fuel remaining in gallons
(10) **Calculated Fuel Used (GAL Used)**	Displays fuel used in gallons, based on fuel flow
(11) **Exhaust Gas Temperature Indicator (EGT)**	Displays exhaust gas temperature in degrees Fahrenheit (°F)
(12) **Fuel Quantity Indicator (Fuel QTY GAL)**	Displays the amount of fuel in gallons (gal) for each side of a standard fuel tank.
(13) **Voltmeter (M, S Bus Volts)**	Displays the main and essential bus voltages
(14) **Ammeter (M, S Battery Amps)**	Displays the main and standby battery load in amperes

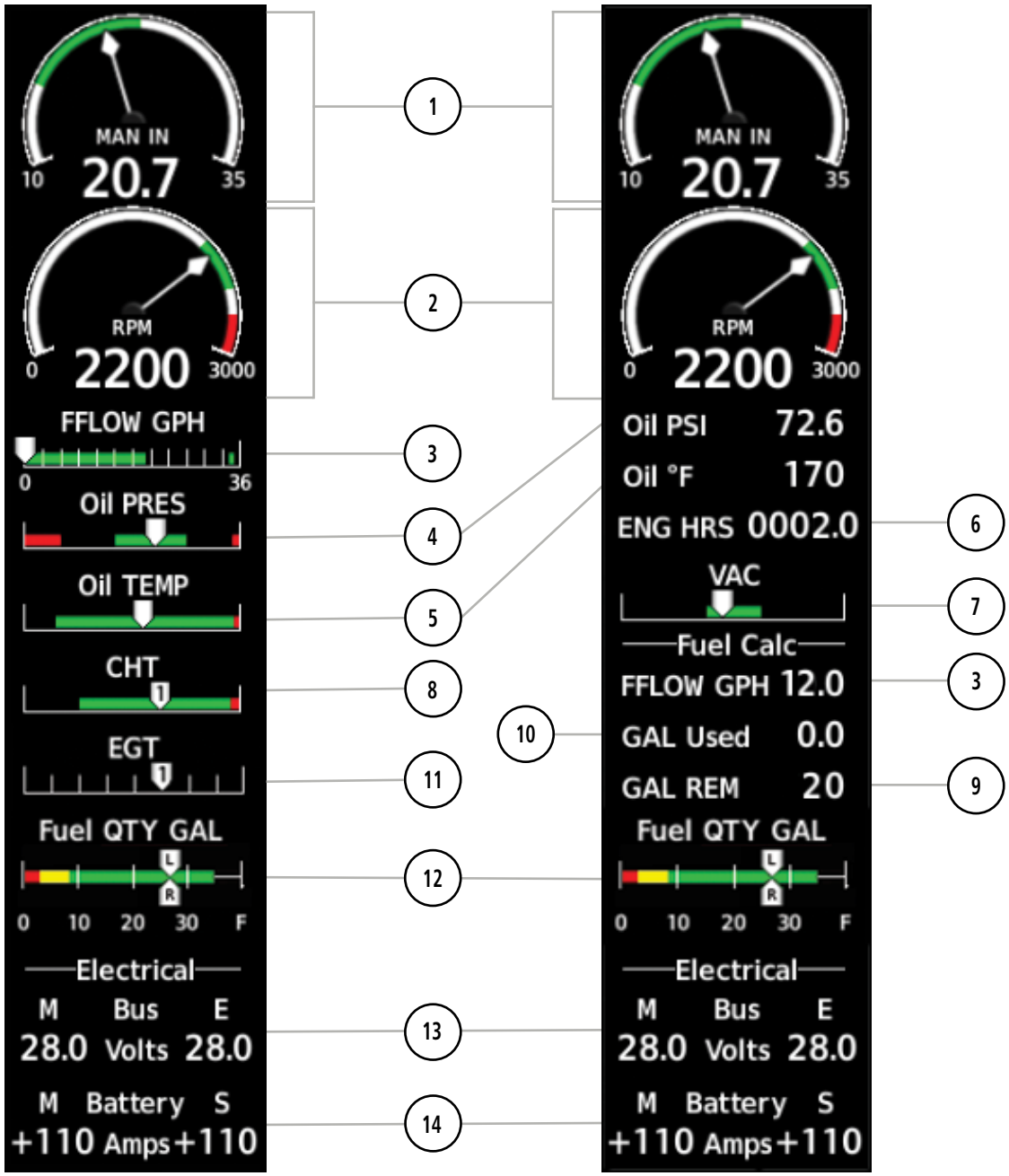


Engine Display

Engine System Display

Figure 3-5 Model T182T

(1) **Manifold Pressure Indicator (IN HG)**	Displays engine manifold pressure inches of mercury (IN HG)
(2) **Tachometer Indicator (RPM)**	Displays engine tachometer in revolutions per minute (RPM)
(3) **Fuel Flow Indicator (FFLOW GPH)**	Displays fuel flow in gallons per hour (gph)
(4) **Oil Pressure Indicator (OIL PSI)**	Displays oil pressure in pounds per square inch (psi)
(5) **Oil Temperature Indicator (OIL °C)**	Displays oil temperature in degrees Celsius (°C)
(6) **Engine Hour Indicator (ENG HRS)**	Displays a numeric digits for the time in hours (hrs) the engine has been in service
(7) **Vacuum Pressure Indicator (VAC)**	Displays standby vacuum pump pressure)
(8) **Cylinder Head Temperature Indicator (CHT)**	Displays cylinder head temperature in degrees Celsius (°C)
(9) **Calculated Fuel Remaining (GAL REM)**	Displays the totalizer-based fuel remaining in gallons
(10) **Calculated Fuel Used (GAL Used)**	Displays fuel used in gallons, based on fuel flow
(11) **Turbine Inlet Temperature Indicator (TIT)**	Displays turbine inlet temperature in degrees Fahrenheit (°F)
(12) **Fuel Quantity Indicator (Fuel QTY GAL)**	Displays the amount of fuel in gallons (gal) for each side of a standard fuel tank.
(13) **Voltmeter (M, S Bus Volts)**	Displays the main and essential bus voltages
(14) **Ammeter (M, S Battery Amps)**	Displays the main and standby battery load in amperes

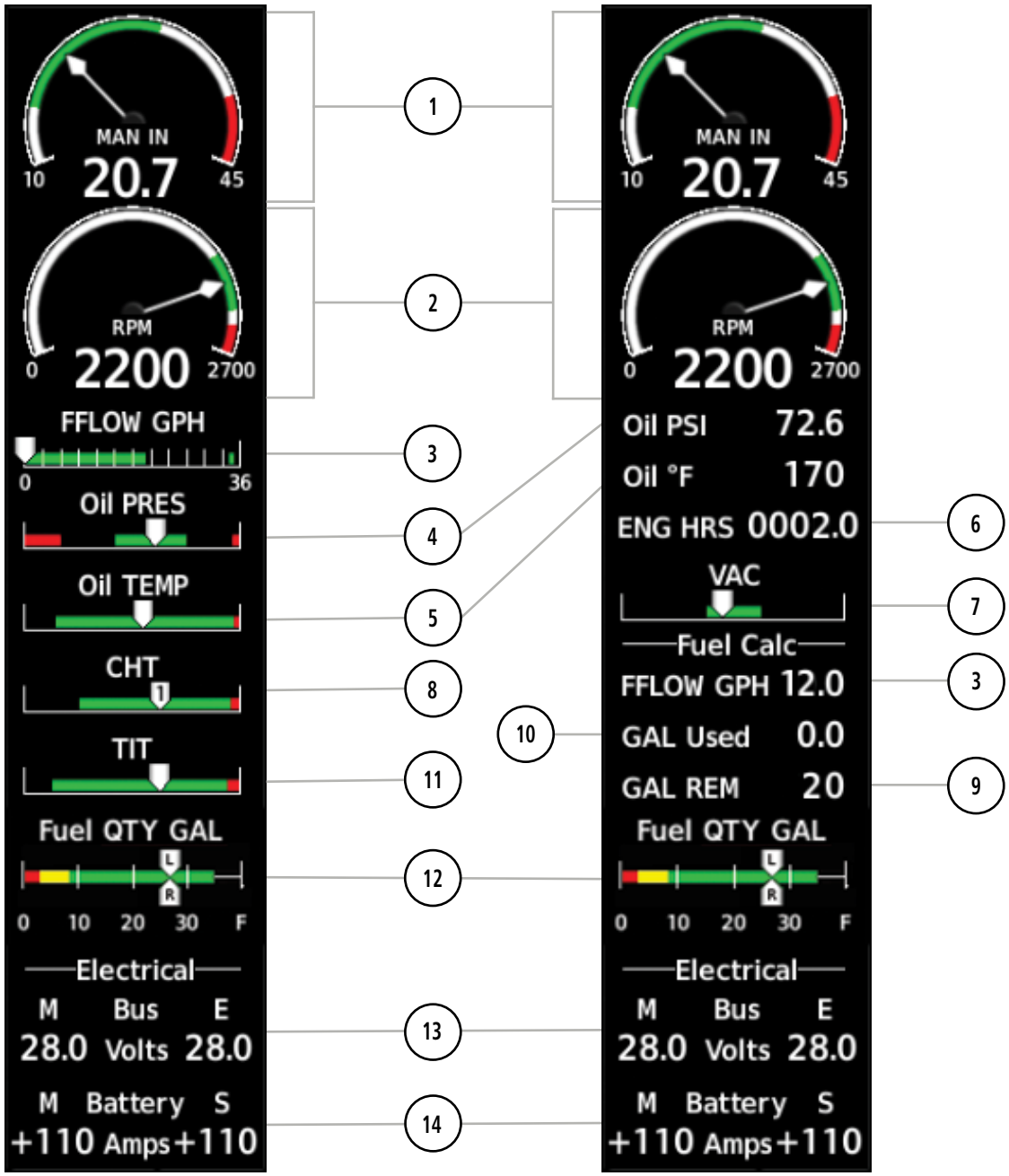


Engine Display

Engine System Display

Figure 3-6 Model 206H

(1) **Manifold Pressure Indicator (IN HG)**	Displays engine manifold pressure inches of mercury (IN HG)
(2) **Tachometer Indicator (RPM)**	Displays engine tachometer in revolutions per minute (RPM)
(3) **Fuel Flow Indicator (FFLOW GPH)**	Displays fuel flow in gallons per hour (gph)
(4) **Oil Pressure Indicator (OIL PSI)**	Displays oil pressure in pounds per square inch (psi)
(5) **Oil Temperature Indicator (OIL °C)**	Displays oil temperature in degrees Celsius (°C)
(6) **Engine Hour Indicator (ENG HRS)**	Displays a numeric digits for the time in hours (hrs) the engine has been in service
(7) **Vacuum Pressure Indicator (VAC)**	Displays standby vacuum pump pressure)
(8) **Cylinder Head Temperature Indicator (CHT)**	Displays cylinder head temperature in degrees Celsius (°C)
(9) **Calculated Fuel Remaining (GAL REM)**	Displays the totalizer-based fuel remaining in gallons
(10) **Calculated Fuel Used (GAL Used)**	Displays fuel used in gallons, based on fuel flow
(11) **Exhaust Gas Temperature Indicator (EGT)**	Displays exhaust gas temperature in degrees Fahrenheit (°F)
(12) **Fuel Quantity Indicator (Fuel QTY GAL)**	Displays the amount of fuel in gallons (gal) for each side of a standard fuel tank.
(13) **Voltmeter (M, S Bus Volts)**	Displays the main and essential bus voltages
(14) **Ammeter (M, S Battery Amps)**	Displays the main and standby battery load in amperes



Engine Display

Engine System Display

Figure 3-7 Model T206H

(1) **Manifold Pressure Indicator (IN HG)**	Displays engine manifold pressure inches of mercury (IN HG)
(2) **Tachometer Indicator (RPM)**	Displays engine tachometer in revolutions per minute (RPM)
(3) **Fuel Flow Indicator (FFLOW GPH)**	Displays fuel flow in gallons per hour (gph)
(4) **Oil Pressure Indicator (OIL PSI)**	Displays oil pressure in pounds per square inch (psi)
(5) **Oil Temperature Indicator (OIL °C)**	Displays oil temperature in degrees Celsius (°C)
(6) **Engine Hour Indicator (ENG HRS)**	Displays a numeric digits for the time in hours (hrs) the engine has been in service
(7) **Vacuum Pressure Indicator (VAC)**	Displays standby vacuum pump pressure)
(8) **Cylinder Head Temperature Indicator (CHT)**	Displays cylinder head temperature in degrees Celsius (°C)
(9) **Calculated Fuel Remaining (GAL REM)**	Displays the totalizer-based fuel remaining in gallons
(10) **Calculated Fuel Used (GAL Used)**	Displays fuel used in gallons, based on fuel flow
(11) **Turbine Inlet Temperature Indicator (TIT)**	Displays turbine inlet temperature in degrees Fahrenheit (°F)
(12) **Fuel Quantity Indicator (Fuel QTY GAL)**	Displays the amount of fuel in gallons (gal) for each side of a standard fuel tank.
(13) **Voltmeter (M, S Bus Volts)**	Displays the main and essential bus voltages
(14) **Ammeter (M, S Battery Amps)**	Displays the main and standby battery load in amperes

ENGINE PAGE

The EIS - Engine Page displays all engine, fuel, electrical, and fuel calculation information. To access this page, press the **Engine** Softkey. Refer to Table 3-1 for Engine Page softkey functions.

Level 1	Level 2	Level 3	Description
Engine			Displays second-level engine softkeys.
	Lean		Displays lean softkeys.
		CYL SLCT	Selects the engine cylinder to monitor during leaning operations.
		Assist	Displays peak temperature marker above cylinder .
	System		Displays system softkeys.
		RST Fuel	Resets gallons of fuel remaining to zero (0).
		GAL REM	Sets gallons of fuel remaining.
	Back		Returns to main MFD softkey options.

Table 3-1 Engine Page Softkey

Figure 3-8 Engine Page (Models 172R/S Shown)

ELECTRICAL

Current for the battery (Battery Amps) and bus voltage (Bus Volts) are displayed in numerical digits.

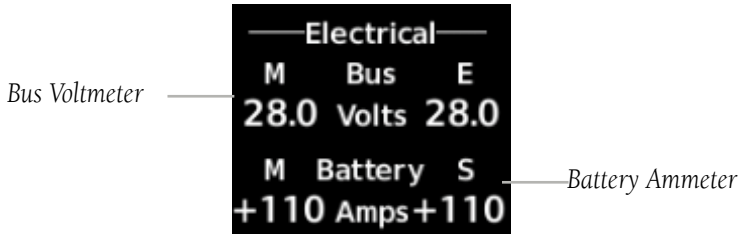


Figure 3-9 Electrical Group

TURBINE INLET TEMPERATURE

The Turbine Inlet Temperature (TIT) horizontal bar indicator, is on the main Engine Display and on the Engine Lean Display. The Engine Lean Display also shows the numerical temperature in degrees of Fahrenheit (°F). If the TIT enters the amber band, a caution is issued. If the TIT enters the red band, a warning is issued.

Figure 3-10 Turbine Inlet Temperature

EXHAUST GAS TEMPERATURE

The Exhaust Gas Temperature (EGT) digits for the selected cylinder is shown on the Engine Lean Display. The temperature digits are displayed in degrees of Fahrenheit (°F).

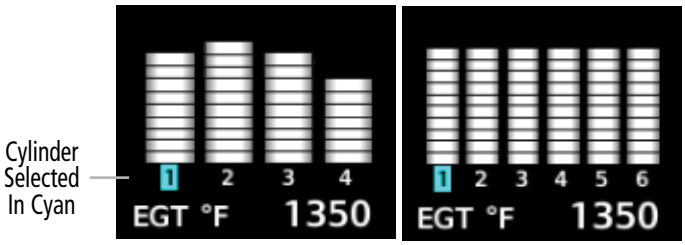


Figure 3-11 Exhaust Gas Temperatures (Normal)

CYLINDER HEAD TEMPERATURE

The Cylinder Head Temperature (CHT) is shown near the bottom of the Engine Lean Display.

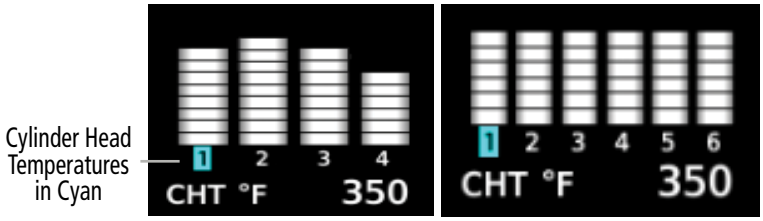


Figure 3-12 Cylinder Head Temperatures (CHT)

LEAN ENGINE DISPLAY

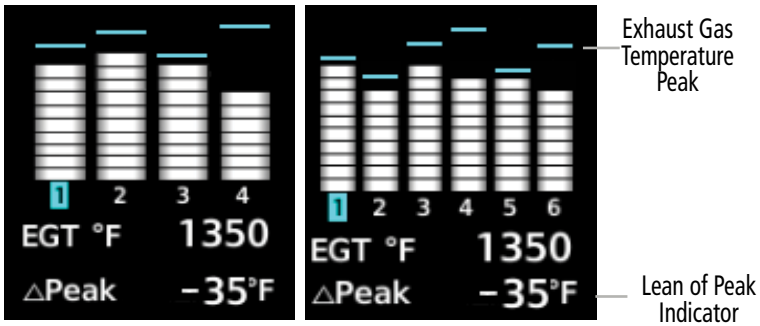


Figure 3-13 Exhaust Gas Temperatures (Lean Assist)

Accessing the EIS Lean Display:

1) On the MFD, press the **Engine** Softkey.
2) Press the **Lean** softkey.

From the Lean Display, the **CYL SLCT** and **Assist** Softkeys can be utilized to obtain information about specific cylinders on both the EGT and CHT graphs. Pressing the **CYL SLCT** Softkey cycles through the cylinders; the selected cylinder number is displayed in cyan. The **CYL SLCT** Softkey is disabled during warning or caution conditions or when the **Assist** Softkey is pressed.

Monitoring the desired cylinder's EGT and CHT:

From the Lean Page, press the **CYL SLCT** Softkey to cycle through each cylinder and view its EGT and CHT. The selected cylinder is shown in cyan.

When the **Assist** Softkey is selected, the system initially highlights and selects the cylinder number with the hottest EGT and displays its temperature below the EGT bar graph. The digits showing the difference between peak (ΔPEAK) and the current EGT temperature for the selected cylinder is displayed, below the EGT temperature.

As the mixture is leaned, a cyan line will appear above each cylinder to indicate EGT peak. Refer to the current version of the pertinent flight manual for the recommended mixture adjustment procedures.

Monitoring of the cylinder continues until the **Assist** Softkey is pressed again which disables lean assist and removes the peak lines from the bar graph and the temperature deviation from peak (ΔPEAK). The system then returns to seeking the hottest cylinder.

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) and range (in nautical miles) 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:

1) On the MFD, press the **Engine** Softkey.
2) Press the **System** softkey.
3) Press the **GAL REM** softkey.

   Select the softkey that best describes the current fuel load desired Once selected, press the **BACK** softkey.

Resetting the fuel totalizer:

On the Engine System Page, press the **RST Fuel** Softkey; this resets displayed fuel remaining (GAL REM) to zero and fuel used to zero.

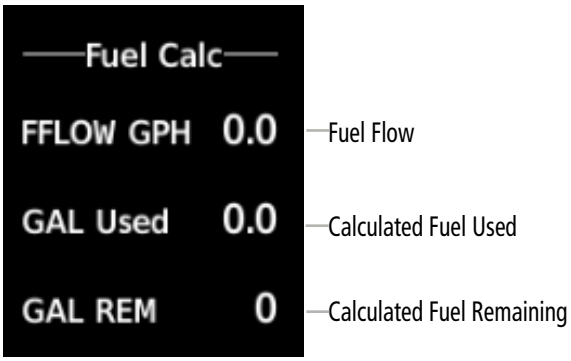


Figure 3-14 Fuel Calculations Group

A map feature related to the EIS Fuel Calculations is the Fuel Range Ring, which graphically illustrates the aircraft's remaining range based on 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.

Enabling/disabling the Fuel Range Ring and selecting a reserve fuel time:

1) Display the Navigation Map Page (press and hold the **CLR** Key for 2 seconds to quickly select this map).
2) Press the **MENU** Key.
3) Highlight 'Map Settings' and press the **ENT** Key. The Map Settings Menu is displayed.
4) Use the small **FMS** Knob to select the 'Map' group and press the **ENT** Key.
5) Highlight the 'Fuel Range (RSV)' field.
6) Turn the small **FMS** Knob to select 'On' or 'Off'.
7) Turn the large **FMS** Knob to highlight the reserve fuel time, how long the aircraft can fly after reaching the reserve fuel.

8) Enter the desired reserve fuel time (00:00 to 23:59; hours:minutes) and press the **ENT** Key.

9) Press the **FMS** Knob to return to the Navigation Map Page.

OIL PRESSURE AND TEMPERATURE GAUGES

Engine oil pressure and temperature are shown along horizontal bar indicators on the MFD, and are shown in numerical digits when Engine System is displayed. Oil pressure is shown in pounds per square inch (psi) and temperature in degrees of Fahrenheit (°F).. If the oil pressure pointer enters the amber band, a caution is issued. If the oil pressure or oil temperature pointers enter the red band, a warning is issued.

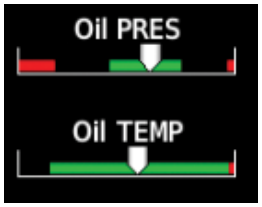


Figure 3-15 Engine Displayed Oil Pressure and Temperature Gauges Displayed on MFD

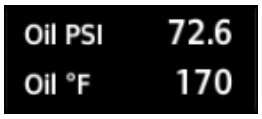


Figure 3-16 Engine System Displayed Oil Pressure and Temperature Gauges

FUEL QUANTITY

The fuel display shows the fuel quantity in each tank in gallons (gal). Fuel quantity for each tank is normally shown along a horizontal bar indicator. A caution or warning is issued for low fuel quantity.

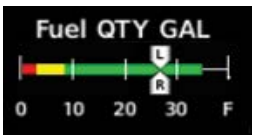


Figure 3-17 Fuel Display

3.2 EIS DISPLAY (REVERSIONARY MODE)

In the event of a PFD or MFD display failure, the display(s) operating in Reversionary Mode are configured to present PFD symbology together with the EIS Display (refer to the System Overview for information about display reversionary mode).

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

Figure 3-18 Reversionary Mode - EIS Shown (Models 172R/Shown

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SECTION 4 AUDIO PANEL AND CNS

4.1 OVERVIEW

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

CNS operation in the Cessna Nav III is performed by the following Line Replaceable Units (LRUs):

- Primary Flight Display (PFD)
- Multi Function 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 receiver, 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 reply status.

PFD CONTROLS AND FREQUENCY DISPLAY

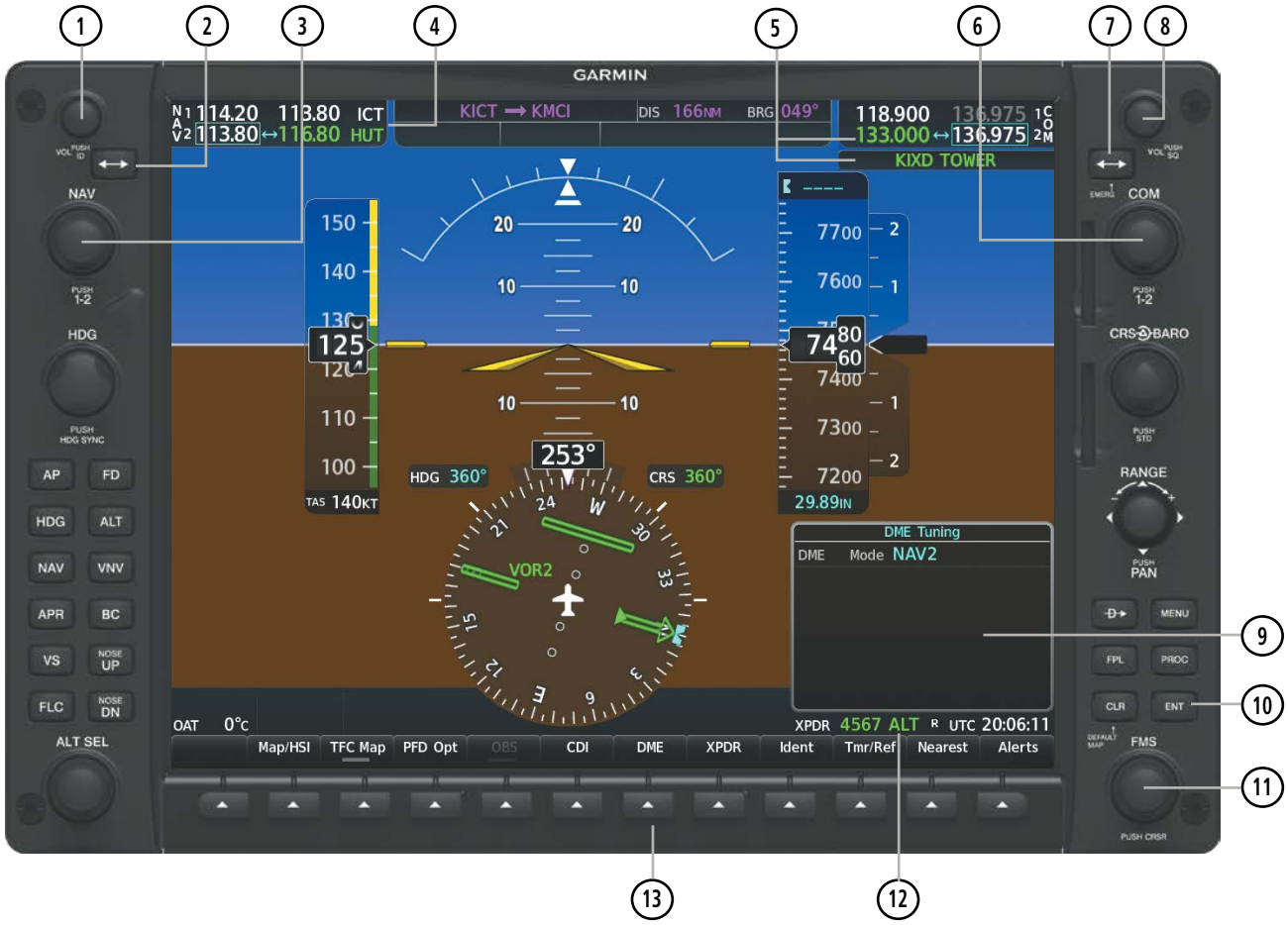


Figure 4-1 PFD Controls, NAV/COM Frequency Tuning Boxes, and DME Tuning Window

(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 frequency selected for tuning (light blue numbers) and the 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 underneath the COM Frequency Box.
(6) **COM Knob**	Tunes the standby frequencies for the COM transceiver (large knob for MHz; small knob for kHz). Press to move the frequency selected for tuning (light blue numbers) and the 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) **DME Tuning Window**	Displays DME frequency pairing mode. Display by selecting the **DME** Softkey.
(10) **ENT Key**	Validates or confirms DME pairing mode and Auto-tune selection.
(11) **FMS Knob**	Flight Management System Knob, used to enter transponder codes, select DME modes, and Auto-tune entries when DME Tuning Window or 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.
(13) **DME Softkey**	Displays the DME Tuning Window.

AUDIO PANEL CONTROLS

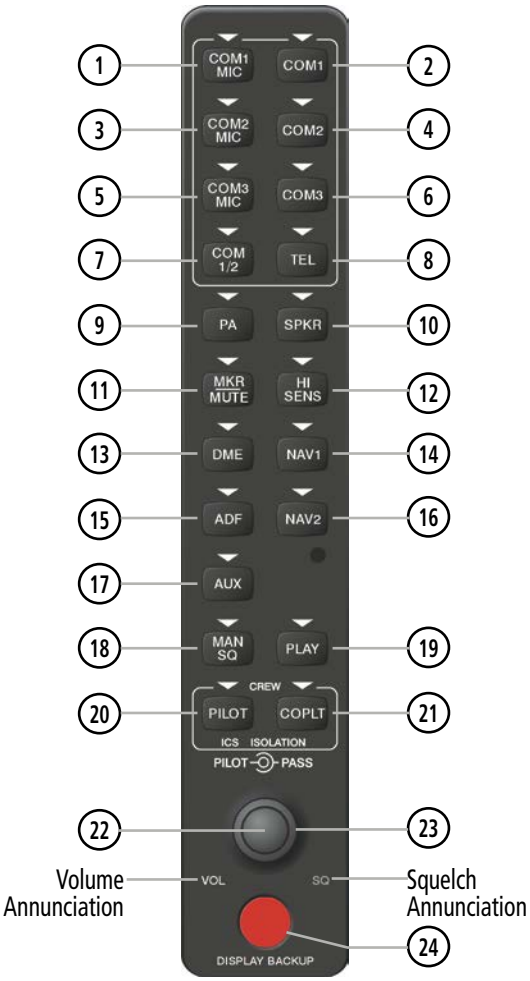


Figure 4-2 Audio Panel Controls

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**	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.

(5) **COM3 MIC**	Not used in Cessna Nav III aircraft.
(6) **COM3**	Not used in Cessna Nav III aircraft.
(7) **COM1/2**	Not used in Cessna Nav III aircraft.
(8) **TEL**	Not used in Cessna Nav III aircraft.
(9) **PA**	Selects the passenger address system. The selected COM transmitter is deselected when the PA Key is pressed. [182T, (T)182T, 206H, and (T)206H only.]
(10) **SPKR**	Selects and deselects the cabin speaker. 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 Cessna Nav III aircraft.
(18) **MAN SQ**	Enables manual squelch for the intercom. When the intercom is active, press the **PILOT** Knob to illuminate the squelch annunciation. 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 is 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 TUNING BOXES

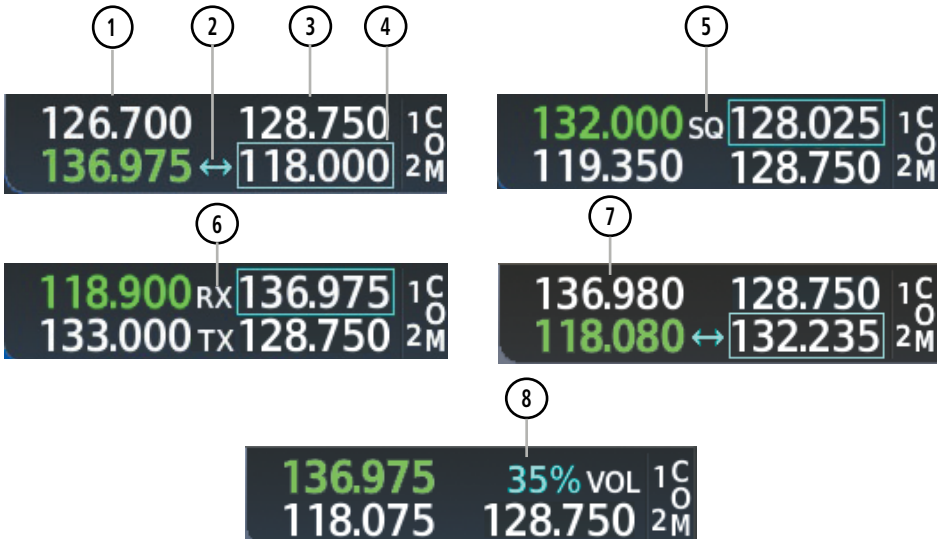


Figure 4-3 COM Tuning Box Indications

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

1. **Active Field** – The COM Frequency Box is composed of four fields; the two active frequencies are on the left. An active COM frequency is displayed in green and indicates 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 or the **PA** Key is selected on the Audio Panel.
2. **Frequency Transfer Arrow** – Indicates which COM transceiver is selected for frequency transfer between the Standby and Active fields. Moves between the upper and lower radio frequency fields with the Frequency Tuning Box.
3. **Standby Field** – The COM Frequency Box is composed of four fields; the two standby frequencies are on the right. 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.
4. **Frequency Tuning Box** – Indicates which COM transceiver is to be tuned in the Standby Field. Moves between the upper and lower radio frequency fields with the Frequency Transfer Arrow.
5. **Automatic Squelch Indication** – Indicates that Automatic Squelch is disabled. Automatic Squelch quiets unwanted static noise when no audio signal is received, while still providing good sensitivity to weak COM signals. When Automatic Squelch is disabled, COM audio reception is always on. Continuous static noise is heard over the headsets and speaker, if selected.
6. **Transmit and Receive Indications** – During COM transmission, a white TX appears by the active COM frequency replacing the Frequency Transfer Arrow. During COM signal reception, a white RX appears by the active COM frequency replacing the Frequency Transfer Arrow.

(7) **Frequency Spacing** – The 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.

(8) **COM 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.

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 (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.

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) Select the **Nearest** 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 Frequency Field.
4) Press the Frequency Transfer Key to transfer the frequency to the COM Active Frequency Field.

Figure 4-4 Nearest Airports Window (PFD)

AUTO-TUNING FROM THE MFD

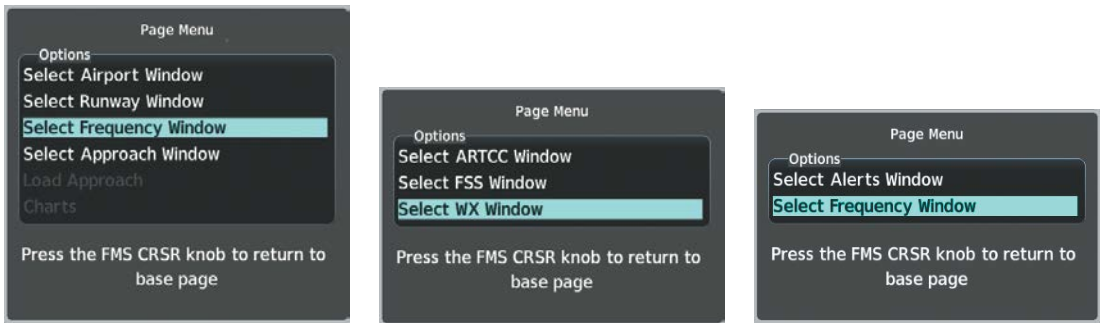
Frequencies can be automatically loaded into the COM Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key.

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.
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 on either PFD to transfer the frequency to the COM Active Frequency Field.

Or:

1) 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 or the **ENT** Key.
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.



Nearest Airports Menu | Nearest Frequencies Menu | Nearest Airspaces Menu

Figure 4-5 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.

Figure 4-6 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.

FREQUENCY SPACING

The 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 1 Page of the Aux Page Group.

Changing COM frequency channel spacing:

1) Select the Aux – System Setup 1 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 softkeys are blank.

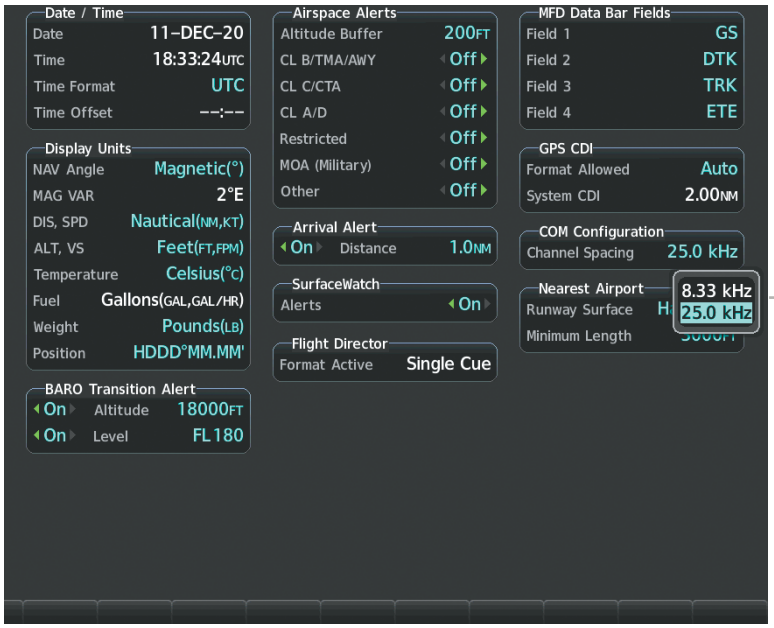


Figure 4-7 Aux – System Setup 1 Page

4.3 NAV OPERATION

NAV TUNING BOXES

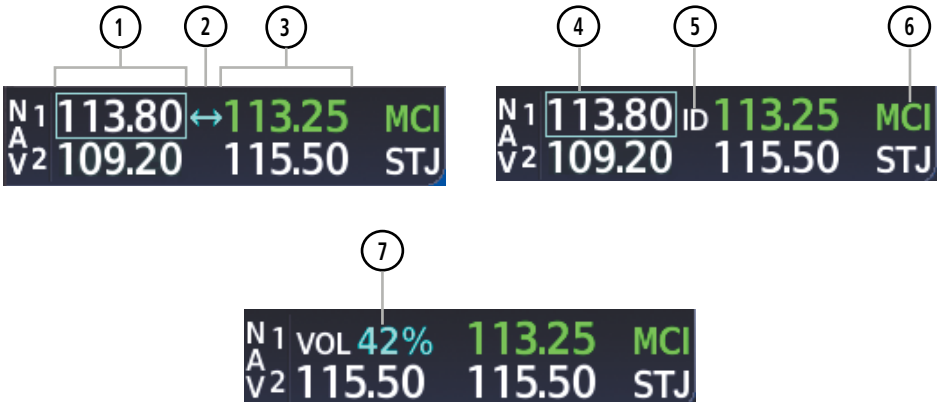


Figure 4-8 NAV Tuning Box Indications

1. **Standby Fields** – The NAV Frequency Box is composed of four fields; the two standby frequencies are on the left. 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.
2. **Frequency Transfer Arrow** – Moves between the upper and lower radio frequency fields with the Frequency Tuning Box. Indicates which NAV transceiver is selected for frequency transfer between the Standby and Active fields.
3. **Active Fields** – The NAV Frequency Box is composed of four fields; the two active frequencies are on the right. An active NAV frequency is displayed in green. The active NAV radio is selected by pressing the **CDI** softkey on the PFD. Both active NAV frequencies appearing in white indicate that no NAV radio is selected.
4. **NAV Tuning Box** – Moves between the upper and lower radio standby frequency fields with the Frequency Transfer Arrow. Indicates which NAV transceiver is to be tuned in the Standby Field. Moving the Frequency Tuning Box is accomplished by pressing the **NAV** knob on the PFD.
5. **VOR/LOC Morse Code Audio Indication** – When the Morse code Identifier audio is on for a NAV radio, a white ID replaces the **Frequency Transfer Arrow** to the left of the active NAV frequency. In order to listen to either station identifier, press the **NAV1** or **NAV2** Key on the Audio Panel. Pressing the **VOL/ID** Knob turns on/off the Morse code audio only in the radio with the NAV Tuning Box. To turn on/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.
6. **Decoded Morse Code Station Identifier** – The NAV Frequency Box displays the decoded Morse Code station identifier that is received from the navigation source. Audio verification of the selected station identifier is still required, and can be accomplished by selecting the corresponding NAV radio on the audio panel and pressing the **NAV VOL/ID** Knob.
7. **NAV VOLUME** – NAV 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.

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

While cycling through the **CDI** Softkey selections, the selected NAV standby frequency is selected for tuning, the Frequency Transfer Arrow is placed in the selected 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 and the previously selected NAV standby frequency remains selected for tuning.

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

The NAV Frequency Box displays the decoded Morse Code station identifier that is received from the navigation source. Audio verification of the selected station identifier is still required, and can be accomplished by selecting the corresponding NAV radio on the audio panel and pressing the **NAV VOL/ID** Knob.

NAV radios are selected for listening by pressing the corresponding keys on the Audio Panel. Pressing the **NAV1**, **NAV2**, **ADF**, or **DME** 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.

NAV RECEIVER MANUAL TUNING

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

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.

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 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 and Nearest Airports pages, press the **FREQ** Softkey to place the cursor on the NAV frequency.
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.

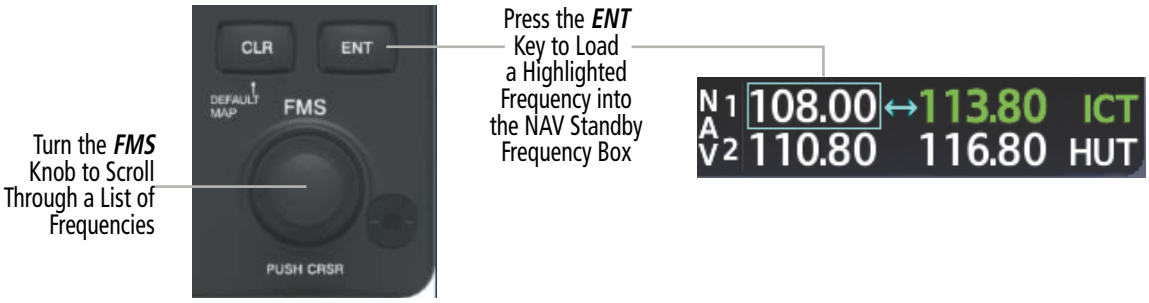
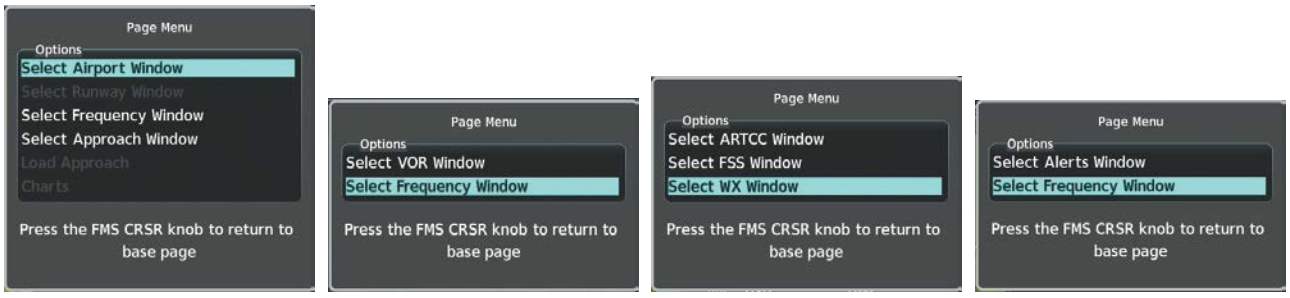


Figure 4-9 NAV Frequency Auto-Tuning from the MFD

Or:

1) When on the NRST pages, press the **MENU** Key on the MFD control unit 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 or the **ENT** Key.
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.



Nearest Airports Menu | Nearest VOR Menu | Nearest Frequencies Menu | Nearest Airspaces Menu

Figure 4-10 Nearest Pages Menus

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.

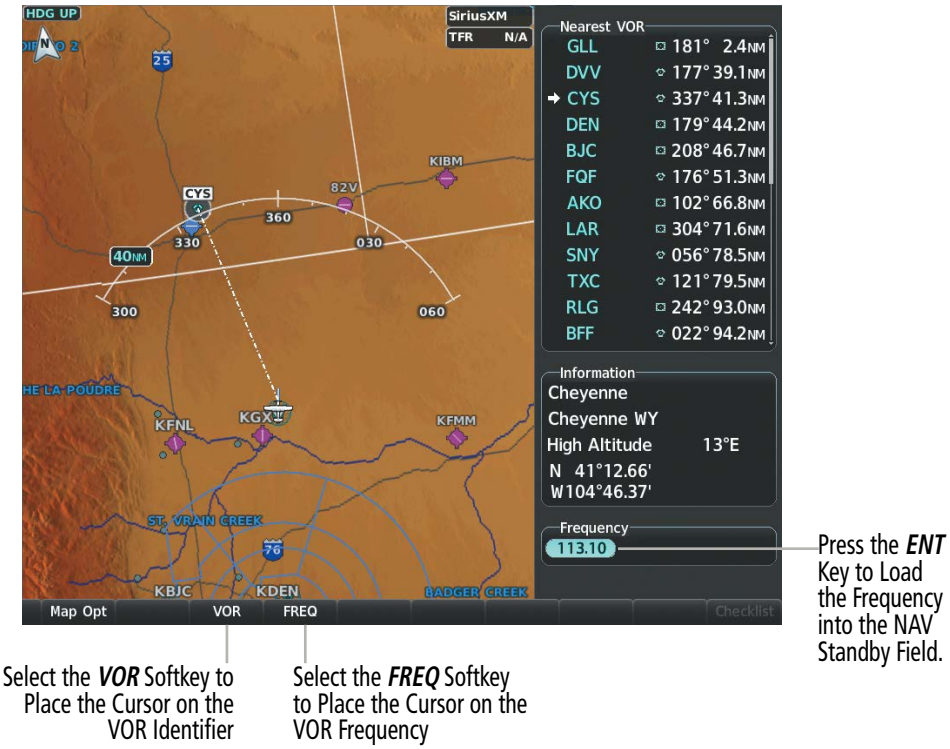


Figure 4-11 Loading the NAV Frequency from the NRST – Nearest VOR Page

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.

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 field on approach activation on the PFD.

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 an 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 4-12 Marker Beacon Keys

The Audio Panels provide three different states of marker beacon operation; On, Muted, and Deselected. Pressing the **MKR/MUTE** Key selects and deselects 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.

DME TUNING

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

The G1000 NXi System tunes the optional DME transceiver. 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 DME Tuning Window is located to the right of the HSI in the lower right corner of the PFD. The DME transceiver is tuned by selecting NAV1, NAV2, or HOLD in the DME Tuning Window. Pressing the **DME** Softkey switches the DME Tuning Window on and off.

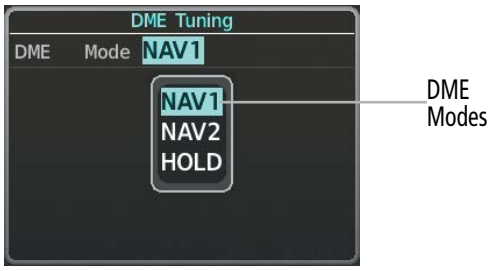


Figure 4-13 DME Tuning Window

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 **DME** Softkey to display the 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 tuning entry and reverts back to the previously selected DME tuning state. Pressing the **FMS** Knob activates/deactivates the cursor in the DME Tuning Window.

See the Flight Instruments Section for displaying the DME information window.

4.4 MODE S TRANSPONDER

The Mode S Transponder provides 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. (EHS requirements only available with GTX 33ES.)
- 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: **Standby**, **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.

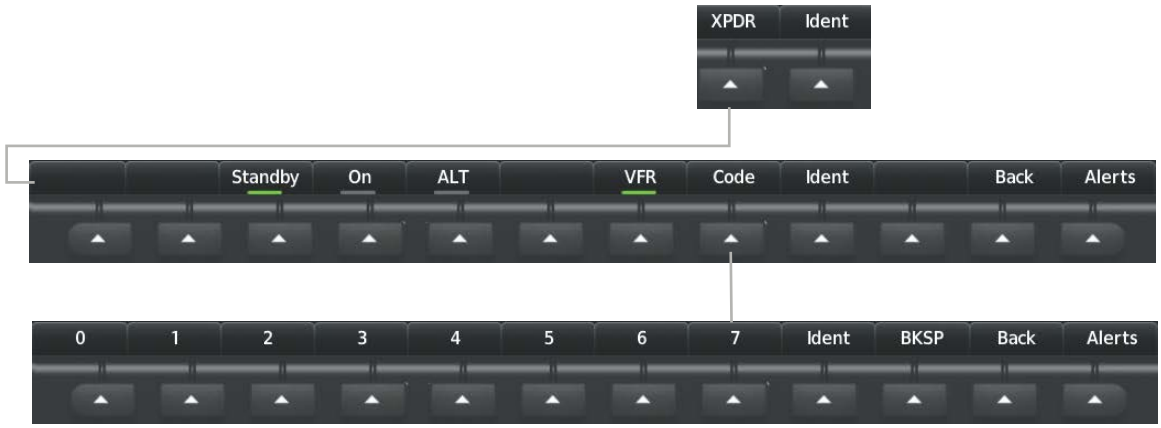


Figure 4-14 XPDR Softkeys (PFD)

TRANSPONDER MODE SELECTION

Mode selection can be automatic (Altitude Mode) or manual (Standby, ON, and Altitude Modes). The **Standby**, **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 **Standby** 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.

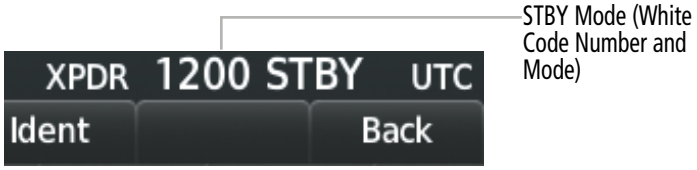


Figure 4-15 Standby Mode

MANUAL ON MODE

On Mode can be selected at any time by pressing the **On** Softkey. An On indication will appear in the mode field of the Transponder Data Box. Selecting On mode enables transmission of transponder replies and squitters, but transmissions will not include altitude information. The On indication and transponder code in the Transponder Data Box will appear green while airborne and white while on the ground. When the transponder is operating with an air state of on-ground it will disable replies to Mode A, Mode C, and Mode S all-call interrogations so the aircraft will not show up on the traffic systems of other aircraft.

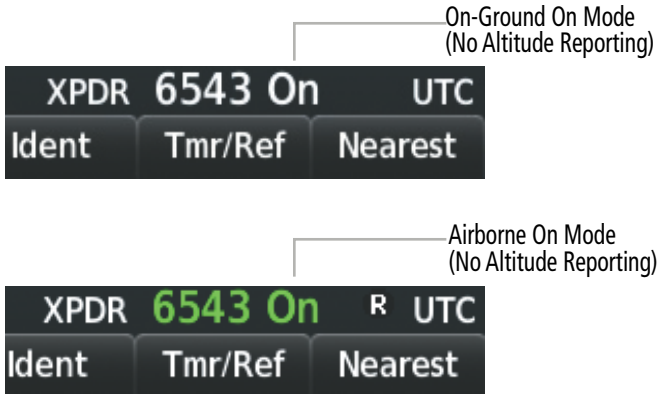


Figure 4-16 On Mode

ALTITUDE MODE

ALT Mode can be selected at any time by pressing the **ALT** Softkey. When ALT mode is selected, an ALT indication will appear in the mode field of the Transponder Data Box. Selecting ALT mode enables transmission of transponder replies and squitters. Transmissions will include pressure altitude information. The ALT indication and transponder code in the Transponder Data Box will appear green while airborne and white while on the ground. When the transponder is operating with an air state of on-ground it will disable replies to Mode A, Mode C, and Mode S all-call interrogations so the aircraft will not show up on the traffic systems of other aircraft.

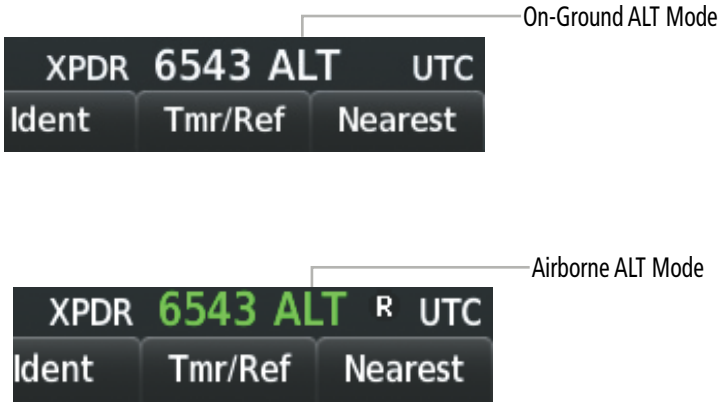


Figure 4-17 Altitude Mode

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.

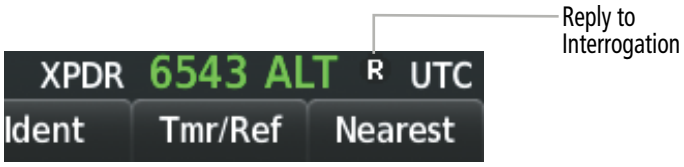


Figure 4-18 Reply Indication

VFR CODE

The VFR code can be entered either manually or by selecting the **XPDR** Softkey, then the **VFR** Softkey. When the **VFR** Softkey is selected, the pre-programmed VFR code is automatically displayed in the code field of the Transponder Data Box. Selecting 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.

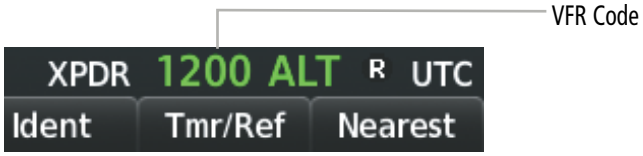


Figure 4-19 VFR Code

ENTERING A TRANSPONDER CODE

Entering a transponder code with softkeys:

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

Entering a transponder code with the PFD FMS Knob:

1) Press the **XPDR** and the **Code** Softkeys as in the previous procedure to enable code entry.
2) Turn the small **FMS** Knob on the PFD 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.

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 identing 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 Ident 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.

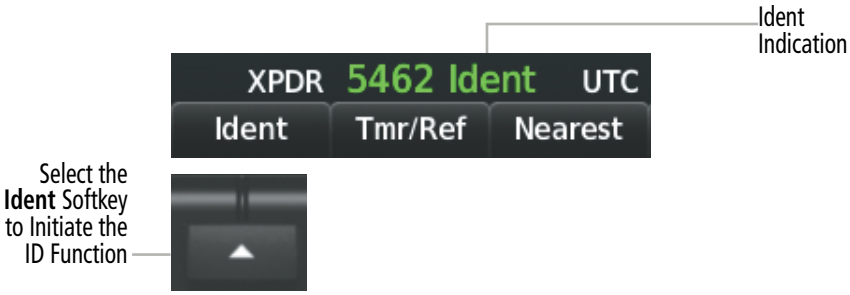


Figure 4-20 Ident Softkey and Indication

4.5 ADDITIONAL AUDIO PANEL FUNCTIONS

POWER-UP

The Audio Panels perform 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. The exceptions are the speaker and intercom, which are always selected during power up.

MONO/STEREO HEADSETS

Stereo headsets are recommended for use in this aircraft.

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. 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. Contact a Garmin-authorized service center for volume adjustment.

INTERCOM

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

PILOT KEY Annunciator	COPLT KEY Annunciator	Pilot Hears	Copilot Hears	Passenger Hears
OFF	OFF	Selected radios, aural alerts, pilot, copilot, passengers, MUSIC INPUT #1	Selected radios, aural alerts, pilot, copilot, passengers, MUSIC INPUT #1	Selected radios, aural alerts, pilot, copilot, passengers, MUSIC INPUT #2
ON	OFF	Selected radios, aural alerts, pilot	Copilot, passengers, MUSIC INPUT #1	Copilot, passengers, MUSIC INPUT #2
OFF	ON	Selected radios, aural alerts, pilot; passengers, MUSIC INPUT #1	Copilot	Selected radios, aural alerts, pilot, passengers, MUSIC INPUT #2
ON	ON	Selected radios, aural alerts, pilot, copilot	Selected radios, aural alerts, pilot, copilot	Passengers; MUSIC INPUT #2

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 annunciations 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).

CLEARANCE RECORDER AND PLAYER

NOTE: *Pressing the play key on the pilot's Audio Panel plays recorded audio to the Pilot. Pressing the play key on the Copilot's Audio Panel plays recorded audio to the Copilot.*

The Audio Panel contains a digital clearance recorder that continually 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. The PLAY annunciator remains lit to indicate when play is in progress. The PLAY annunciator turns off after playback is finished.

Pressing the **PLAY** Key once plays the latest recorded memory block and then returns to normal operation. Pressing the **PLAY** Key again 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 twice within one-half second while audio is playing plays the previous block of recorded audio. Each subsequent two presses of the **PLAY** Key within one-half second backtracks through the recorded memory blocks to reach and play any recorded block.

Powering off the unit automatically clears all recorded blocks.

ENTERTAINMENT INPUTS

NOTE: *MUSIC INPUT #1 and MUSIC INPUT #2 cannot be completely turned off. Audio level for MUSIC INPUT #1 and MUSIC INPUT #2 can be adjusted by a Garmin-authorized service center.*

The Audio Panel provides two stereo auxiliary entertainment inputs: MUSIC INPUT #1 and MUSIC INPUT #2. These inputs are compatible with popular portable entertainment devices such as MP3 players, cell phones, and tablets. Two 3.5-mm stereo phone jacks are installed in convenient locations for audio connection. The headphone outputs of the entertainment devices are plugged into the MUSIC INPUT #1 or MUSIC INPUT #2 jacks.

The current ICS state of isolation affects the distribution of the entertainment input MUSIC INPUT #1.

MUSIC INPUT #1

MUSIC INPUT #1 can be heard by the pilot and copilot when both the PILOT and the COPLT Annunciators are extinguished. MUSIC INPUT #1 can also be heard by the pilot when the COPLT Annunciator is illuminated and by the copilot when the PILOT Annunciator is illuminated.

MUSIC INPUT #1 MUTING

MUSIC INPUT #1 muting occurs when aircraft radio or marker beacon activity is heard. MUSIC INPUT #1 is always soft muted when an interruption occurs from these sources. Soft muting is the gradual return of MUSIC INPUT #1 to its original volume level. The time required for MUSIC INPUT #1 volume to return to normal is between one-half and four seconds.

MUSIC INPUT #1 MUTING ENABLE/DISABLE

Pressing and holding the **MKR/MUTE** Key for three seconds switches MUSIC INPUT #1 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. MUSIC INPUT #1 muting is reset (enabled) during power up.

MUSIC INPUT #2

MUSIC INPUT #2 can be heard only by the passengers and is never muted.

SIRIUSXM RADIO ENTERTAINMENT

SiriusXM Radio audio from the Data Link Receiver may be heard by the pilot and passengers simultaneously (optional: requires subscription to SiriusXM Radio Service). Refer to the Additional Features Section for more details on the Data Link Receiver.

Connecting a stereo input to either MUSIC INPUT #1 or MUSIC INPUT #2 jacks removes the SiriusXM Radio Audio from that input. For example, if passengers prefer their own music while the pilot listens to the SiriusXM Radio, the entertainment audio should be connected to the MUSIC INPUT #2 jack.

4.6 AUDIO PANELS 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** Key is pressed, 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 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 ensure awareness of all audio levels in the Audio Panel and radios.

Setting the Audio Panel during preflight:

1) Verify that the PILOT and COPLT Annunciators are extinguished.
2) Verify manual squelch is set to full open.
3) Turn the **PILOT/PASS** Knobs clockwise two full turns. This sets the intercom level to max volume (least amount of attenuation).
4) Adjust radio volume levels (COM, NAV) to a suitable level.
5) Adjust the **PILOT/PASS** 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 system includes equipment failures of the system 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 in the Alerts Window 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.

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.

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 is not available on the speaker during Fail-safe operation.

REVERSIONARY MODE

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

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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 full color displays. 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 and MFD 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), Visual Approach (VISUAL) or Missed Approach (MAPR)).

The Inset Map and HSI Map are small versions of the MFD 'Map – Navigation Map' Page. The Inset Map is displayed in the lower left corner of the PFD (lower right during reversionary mode), and the HSI Map is displayed in the center of the HSI. The Inset Map and the HSI Map may each be referred to as the PFD Map. A PFD Map is displayed by pressing the **Map/HSI** Softkey, pressing the **Layout** Softkey, then pressing either the **Inset Map** or **HSI Map** Softkey. Pressing the **Map Off** Softkey removes the PFD Map.

The 'Map – Navigation Map' Page displays aviation data (e.g., airports, VORs, airways, airspaces), geographic data (e.g., cities, lakes, highways, borders), absolute terrain 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 MFD map displays can be reduced by pressing the **Detail** Softkey on the MFD. The map can be oriented three different ways: North Up (NORTH UP), Track Up (TRK UP), or Heading Up (HDG UP).

Aviation data and flight plan data may also be viewed on other display pages, such the waypoint pages. Hereafter, references to "map displays" implies the 'Map – Navigation Map' Page and all other pages capable of displaying a map with aviation or flight plan data. An aircraft icon is placed on the map display 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 map display. The other legs are shown in white.

There are 28 different map ranges available, from 250 feet to 1000 nm. Range is indicated in the upper left quadrant of the range ring shown around the aircraft icon. This indicated range is the range from the aircraft icon to the range ring and roughly half the range to the top edge of the displayed 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.

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

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

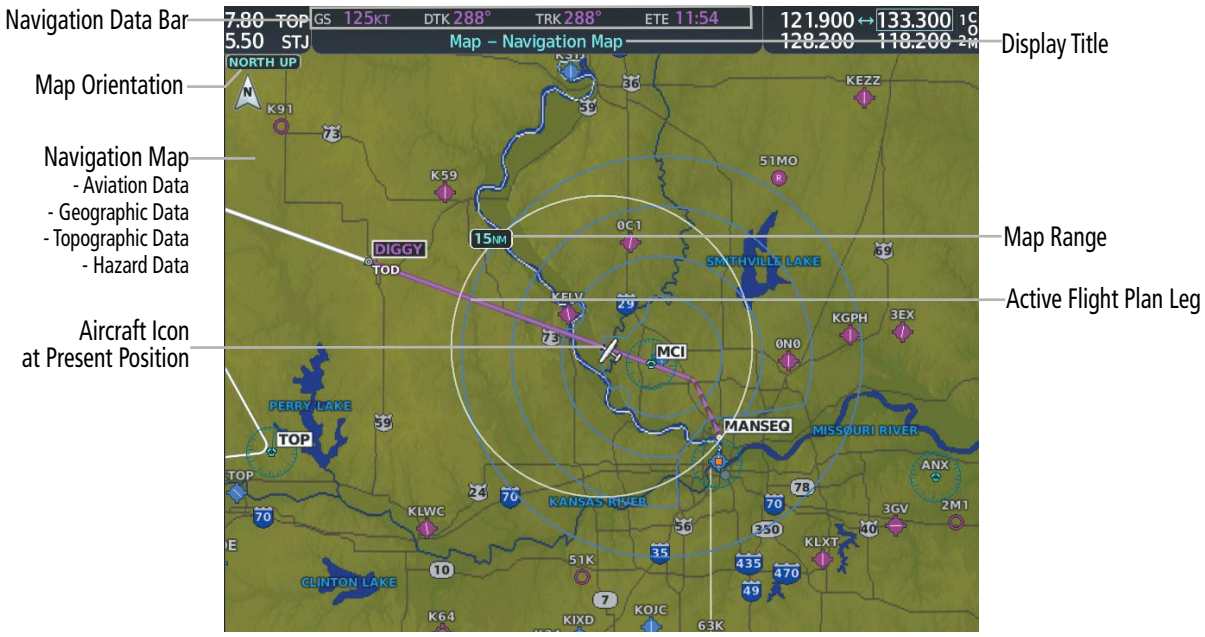


Figure 5-3 GPS Navigation Information on the MFD 'Map - Navigation Map' Page

PFD NAVIGATION STATUS BOX AND MFD 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., '⊕→ 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	vtf	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 Navigation 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)
- **DEST** (Destination airport identifier)
- **DIS** (Distance)
- **DTG** (Distance to go to destination)
- **DTK** (Desired tack)
- **END** (Endurance)
- **ENR** (ETE to final destination)
- **ESA** (Enroute safe altitude)
- **ETA** (Estimated time of arrival)
- **ETE** (Estimated time enroute)
- **FLT** (Flight timer)
- **FOB** (Fuel on Board)
- **FOD** (Fuel over destination)
- **GS** (Groundspeed)
- **MSA** (Minimum safe altitude)
- **TAS** (True airspeed)
- **TKE** (Track angle error)
- **TRK** (Track)
- **VSR** (Vertical speed required)
- **XTK** (Cross-track error)

Figure 5-5 MFD Navigation Data Bar

NOTE: *The MSA altitude displayed will equal the highest grid MORA (Minimum Off Route Altitude) within a 10 mile square, surrounding the aircraft. The square is aligned to the cardinal directions and provides 1,000 feet separation (2,000 feet in designated mountainous terrain within the U.S.). Grid MORA data (or its equivalent) must be present in the database to provide an MSA value.*

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) Push 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, user waypoints, 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)
- Obstacles
- Map Pointer information (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Fuel range ring
- Flight plan legs
- Track vector
- Terrain
- Topography scale and data

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

- All Map Group Pages ('Map')
- All Waypoint Group Pages ('WPT')
- 'Aux – Trip Planning' Page ('Aux')
- Flight Plan Pages ('FPL')
- All Nearest Group Pages ('NRST')
- 'Direct To' Window
- PFD Maps
- 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.

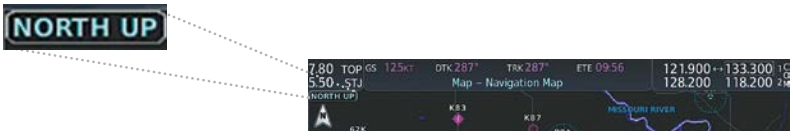


Figure 5-6 Map Orientation

- 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.

The North Up Above setting configures the map to switch automatically to a north up orientation when the map range reaches a minimum range.

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.*

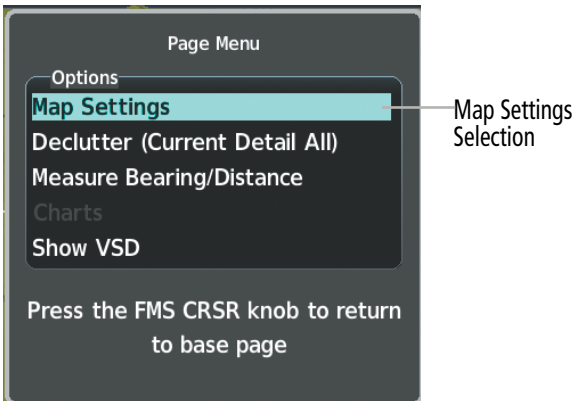


Figure 5-7 'Map - Navigation Map' Page Menu

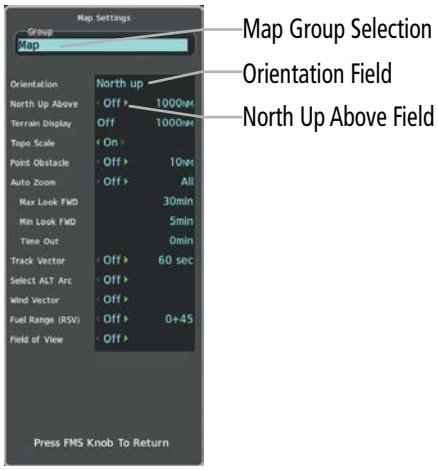


Figure 5-8 'Map Settings' Window - 'Map' Group

Changing the orientation for map displays:

1) With the 'Map – Navigation Map' Page displayed, press the **MENU** Key. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key to display the 'Map Settings' Window.
3) Select the 'Map' Group.
4) Press the **ENT** Key.
5) Turn the small **FMS** Knob to select the desired orientation.
6) Press the **ENT** Key to select the new orientation.
7) Push the **FMS** Knob to return to the base page.

Enabling/disabling North Up Above 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) Push 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. 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 map displays automatically adjust to the smallest map range clearly showing the potential impact areas. If a new traffic advisory alert occurs, any map display showing 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' Field (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' Field to zero causes the manual override to never time out.

» When the 'Max Look FWD' Field is set to zero, the upper limit becomes the maximum range available (1000 nm).

» When the 'Min Look FWD' Field 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) Turn the small **FMS** Knob to select the 'Map' Group.
4) Press the **ENT** Key.
5) Turn the large **FMS** Knob to 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) Push 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
- Graphically create user waypoints
- Measure the bearing distance from the aircraft present position to any location on the map display, or between any two points on the map display
- View obstacle, 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.

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.*

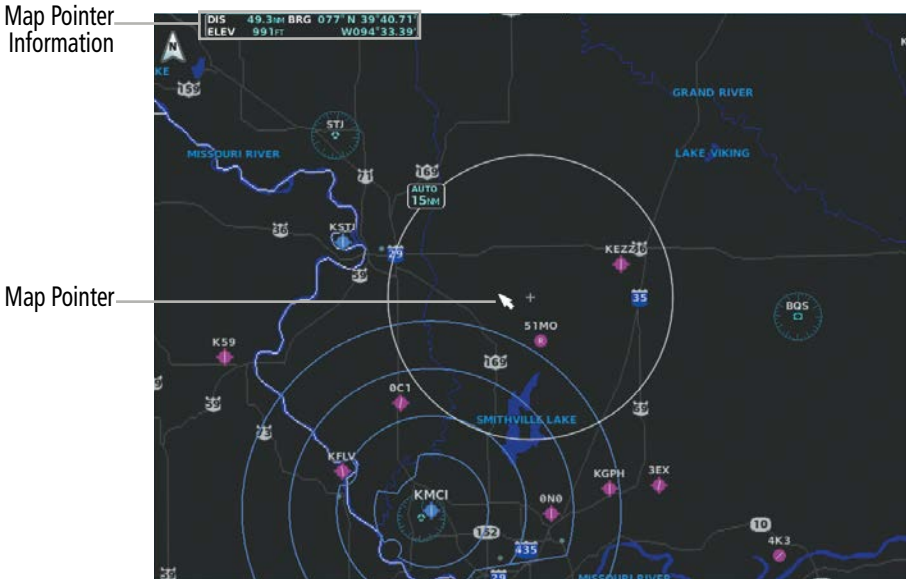


Figure 5-10 Map Pointer Activated

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.

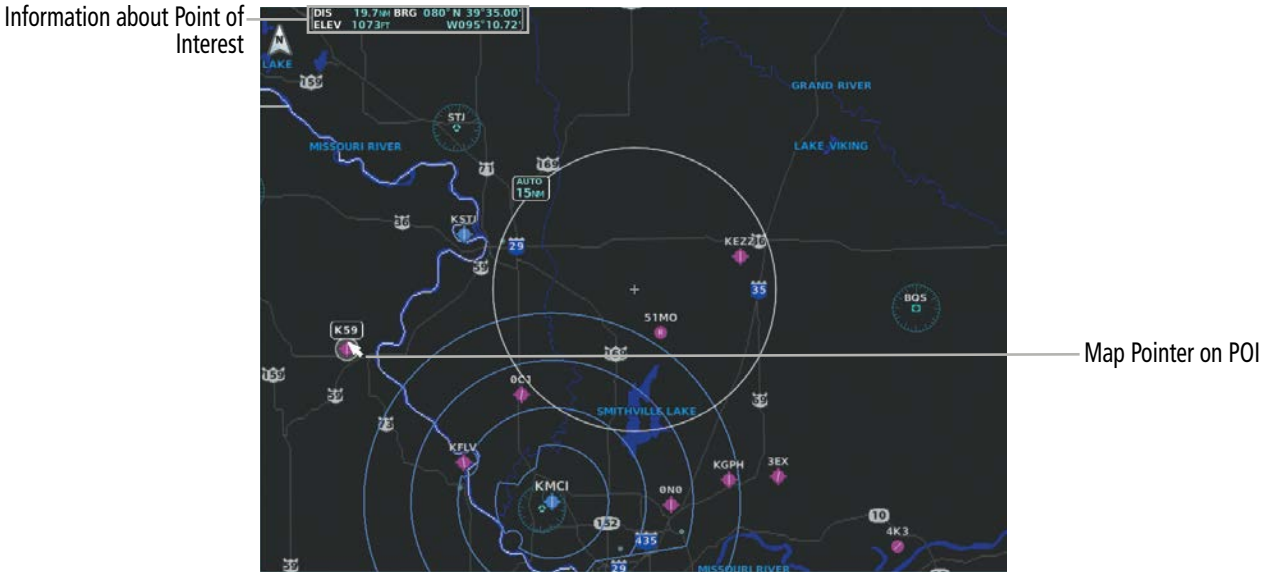


Figure 5-11 Map Pointer on Point of Interest

Panning the map:

1) With the desired map display shown on the MFD, 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.

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

1) With the desired map display shown on the MFD, push the **Joystick** to display the Map Pointer and place the Map Pointer on a waypoint.
2) Press the **ENT** Key to display the information page for the selected waypoint.
3) Press the **Go Back** Softkey, the **CLR** Key, or the **ENT** Key to exit the information page and return to the 'Map – Navigation Map' Page.

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 display shown on the MFD, push the **Joystick** to display the Map Pointer. Place the Map Pointer on the boundary of an airspace. Information about the airspace is displayed on the map next to the map pointer.
2) Push the **Joystick** to remove the Map Pointer and center the map on the aircraft.

Or:

1) With the desired map display shown on the MFD, push the **Joystick** to display the Map Pointer and place the Map Pointer on an open area within the boundaries of an airspace.
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) Push the **FMS** Knob, or press the **CLR** or **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 map display may be calculated using the 'Measure Bearing and Distance' selection from page menu. This function is only available on the 'Map – Navigation Map' Page and the VFR/IFR map pages. 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 map display.

Figure 5-12 Measuring Bearing and Distance

Measuring bearing and distance between any two points:

1) Press the **MENU** Key (with the 'Map – Navigation Map' Page or one of the VFR/IFR pages displayed).
2) Use the **FMS** Knob to 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' Window and press the **ENT** Key.

TOPOGRAPHY

All map displays can show various shades of topography colors representing land elevation, similar to aviation sectional charts. 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 'Map – Navigation Map' Page, items are removed on the PFD Map two range levels smaller than the range selected in the 'Map Settings' Page (e.g, a setting of 100 nm removes the item at ranges above 100 nm on MFD 'Map – Navigation Map' Page, while the PFD Map removes the same item at 50 nm).*

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 'Map – Navigation Map' Page. In addition, the 'Map – Navigation Map' Page 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.

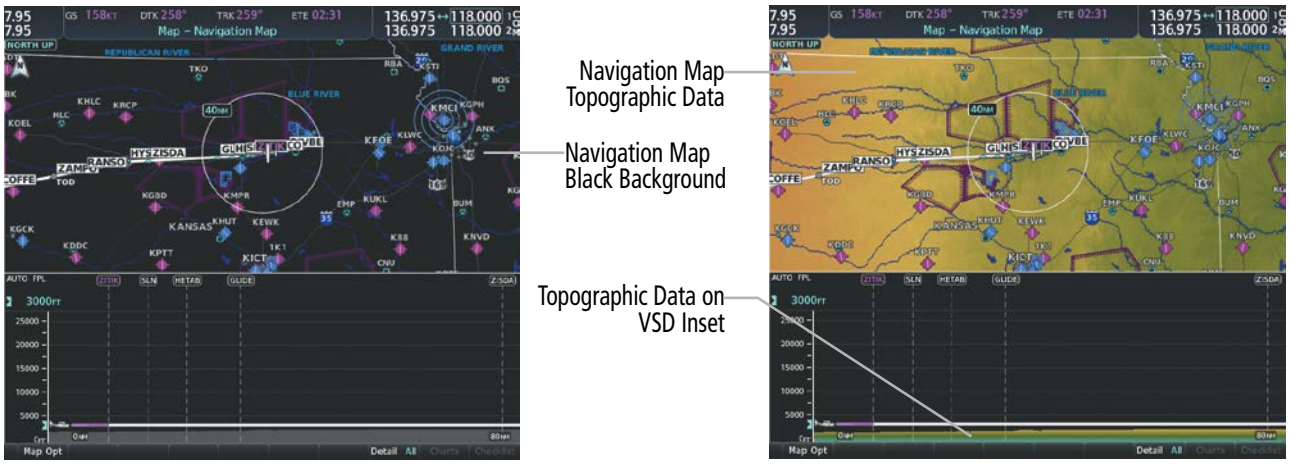


Figure 5-13 'Map - Navigation Map' Page Topographic Data

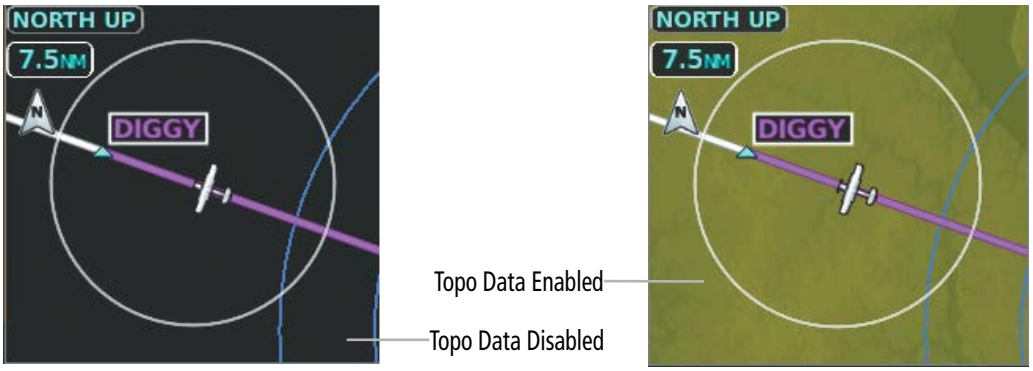


Figure 5-14 PFD Inset Map - Topographic Data

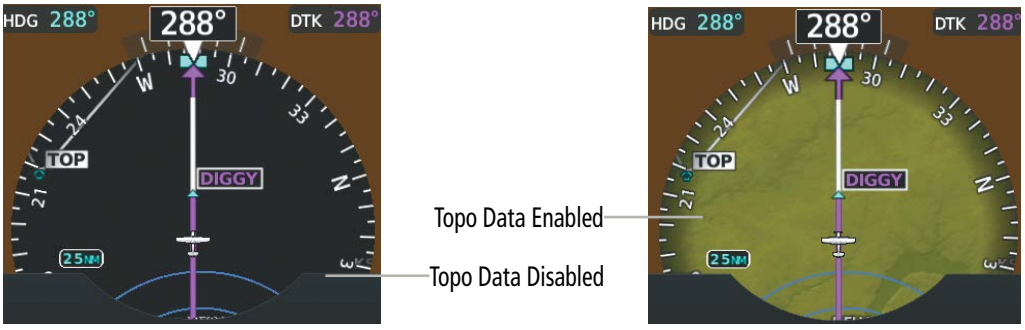


Figure 5-15 PFD HSI Map - Topographic Data

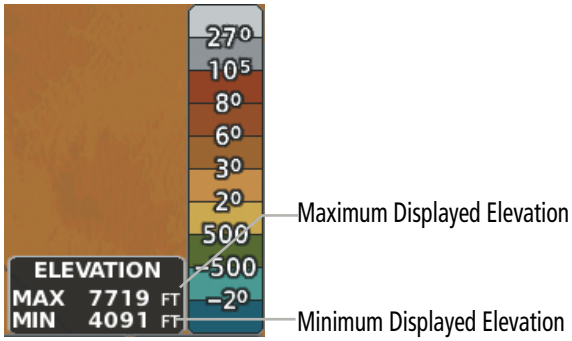


Figure 5-16 Navigation Map - Topo Scale

Displaying/removing topographic data on MFD map displays:

1) Press the **Map Opt** Softkey on the 'Map – Navigation Map' Page.
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 map. When topographic data is removed from the page, all navigation data is presented on a black background.

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 'Map' Group.

4) Press the **ENT** Key.
5) Turn the large **FMS** Knob to highlight the 'Terrain Display' Field.
6) Turn the small **FMS** Knob to select 'Topo' or 'Off'. Press the **ENT** Key.
7) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

Displaying/removing topographic data on the PFD Map:

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

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) Turn the small **FMS** Knob to select the 'Map' Group.
4) Press the **ENT** Key.
5) Use the large **FMS** Knob to 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) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

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) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the 'Topo Scale' Field.
5) Turn the small **FMS** Knob to select 'On' or 'Off'. Press the **ENT** Key.
6) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

MAP DISPLAY SYMBOLS

This section discusses the types of land, aviation, airspace, airway, and map 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 maximum range is based upon the range ring setting, not distance from the aircraft. The decluttering of the symbols from the map using the **Detail** Softkey is also discussed. For more information on VSD inset settings, reference the Flight Planning discussion later in this section.

LAND SYMBOLS

The following items are configured on the land menu:

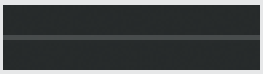
Land Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
User Waypoint		25	40
Highways and Roads		(see below)	
- Interstate Highway (Freeway)		50	400
- International Highway (Freeway)		50	400
- US Highway (National Highway)		15	150
- State Highway (Local Highway)		2.5	100
- Local Road (Local Road)	N/A	4	25
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 5-2 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the aviation menu:

Aviation Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
Large Airport (Longest Runway ≥ 8100 ft)		100	1000
Medium Airport (8100 ft > Longest Runway ≥ 5000 ft, or Longest Runway < 5000 ft with control tower)		50	400
Small Airport (Longest Runway < 5000 ft without a control tower)		25	150
Taxiways (SafeTaxi)	See Additional Features	1.5	5
Runway Extension		7.5	150

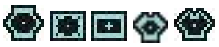
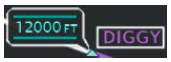
Aviation Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
Intersection (INT)		25	40
Non-directional Beacon (NDB)		25	50
VOR (VOR, VOR/DME, DME, VORTAC, TACAN)		50	250
- VOR Compass Rose On/Off		N/A	N/A
Visual Reporting Point (VRP)		25	1000
Temporary Flight Restriction (TFR)		250	1000
VNAV Constraints (manually modified)('Show All' also displays auto-designated and published constraints)		1000	1000

Table 5-3 Aviation Symbol Information

AIRSPACE SYMBOLS

The following items are configured on the airspace menu:

Airspace Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
Class B Airspace Altitude Label (ceiling/floor)		*	*
Class C Airspace Altitude Label (ceiling/floor)		*	*
Class D Airspace Altitude Label (ceiling)		*	*
CL B/TMA/AWY	(see below)		
- Class B (CL B) and Terminal Manoeuvring Area (TMA)**		50	150
- Airway (AWY)**			
CL C/CTA	(see below)		
- Class C Airspace (CL C)		50	100
- Control Area (CTA)**			

Airspace Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
CL A/D	(see below)		
- Terminal Radar Service Area (TRSA), Controlled Traffic Region (CTR)**, and Class A (CL A)**		10	100
- Class D			
- Aerodrome Traffic Zone (ATZ)**			
- Traffic Information Zone (TIZ)**			
Restricted and Prohibited Areas (Restricted)		50	100
Military Operations Areas (MOA (Military))		50	250
Other	(see below)		
- ADIZ		50	250
- Alert			
- Class E**			
- Class G**			
- Temporary**			
- Danger, Warning, Unknown, Special Rules**, and Training**			

**Label placement and range is determined by the system for best display and minimal clutter*
***Not located in the United States*

Table 5-4 Airspace Symbol Information

AIRWAY SYMBOLS

This airways discussion is based upon the North American airway structure. The airway structure in places other than North America vary by location, etc. and are not discussed in this book.

Low Altitude Airways are drawn in gray (the same shade used for roads). High Altitude Airways are drawn in green. When both types of airways are displayed, High Altitude Airways are drawn on top of Low Altitude Airways. When airways are selected for display on the map, the airway waypoints (VORs, NDBs and Intersections) are also displayed.

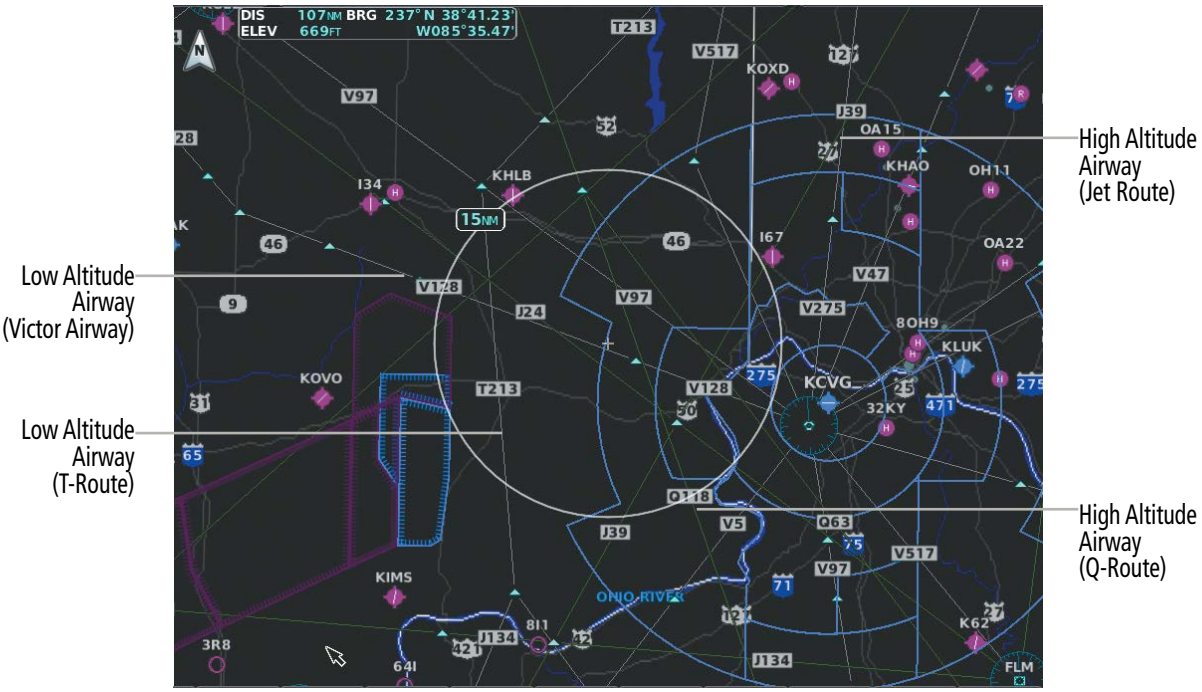


Figure 5-17 Airways on 'Map - Navigation Map' Page

The following items are configured on the airways menu:

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

Table 5-5 Airways Symbol Information

SYMBOL SETUP

All map displays can show land, aviation, airspace and airway 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.

NOTE: *The HSI Map does not display Intersections, Cities, Roads, or Lat/Lon lines.*

Setting up the 'Land', 'Aviation', 'Airspace', or 'Airways' 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 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 through 7, as necessary.
9) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

The preceding procedure can be used for selecting which Airspaces should be shown on the map display. Additionally, airspace altitude labels may also be shown, as explained in the following procedure.

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) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

Airways may be displayed on the map at the pilot's discretion using either a combination of **AWY** Softkey selections, or menu selections using the **MENU** Key from the 'Map – Navigation Map' Page. The Airway range can also be programmed to only display Airways on the MFD when the map range is at or below a specific number.

Displaying/removing airways:

1) Press the **Map Opt** Softkey with the 'Map – Navigation Map' Page displayed.
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' or the 'High ALT Airways' On/Off Field.
5) Turn the small **FMS** Knob to select 'Off' or 'On'. Press the **ENT** Key.
6) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

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) Turn the large **FMS** Knob to highlight the Low ALT Airways Range Field 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) Push the **FMS** Knob to return to the 'Map – 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.

The following table 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
Latitude/Longitude Grid		X	X
User Waypoints and VRPs		X	X
NAVAIDs and Intersections (does not declutter if used to define airway)		X	X
Class B Airspaces/TMA/AWY		X	X
Class C Airspaces/CTA		X	X
Class A/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 Map Items Decluttered for each Detail Level

Decluttering the MFD map display:

Press the **Detail** Softkey with the 'Map – 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 'Map – Navigation Map' Page displayed.
2) Turn the **FMS** Knob to highlight 'Declutter'. The current declutter level is shown.
3) Press the **ENT** Key to apply the next declutter level and return to the 'Map – Navigation Map' Page.

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.

ADDITIONAL MAP DISPLAY ITEMS

Map displays can show some additional items. Some items can be displayed through the use of the nearest frequency, map panning, and map measuring functions. Other items (e.g. optional SVT Field of View, track vector, selected altitude intercept arc, wind vector, and fuel range ring) can be displayed/removed individually through the 'Map Settings' Window option. Refer to the Hazard Avoidance Section for information on displaying obstacles (Point Obstacle) on the map.

The icons in the following table will be displayed when specific map functions are conducted or the heading or GPS solution is invalid:

Symbol Name	Description	Symbol
ARTCC Frequency or FSS Frequency	Displayed when using the Nearest Frequencies function	
Map Pointer	Displayed when panning (see Using Map Displays in Flight Management)	
Measuring Pointer	Displayed when measuring bearing and distance (see Using Map Displays in Flight Management)	
No heading aircraft icon	Replaces the normal aircraft icon when aircraft GPS location is valid, but the heading is invalid.	
Dead reckoning aircraft icon	'DR' text displayed over the aircraft icon when the GPS solution is invalid (see Abnormal Operations in Flight Management)	

Table 5-7 Miscellaneous Map Display Symbols

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 through 7, as necessary.
9) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

Track Vector

Map displays can show 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.

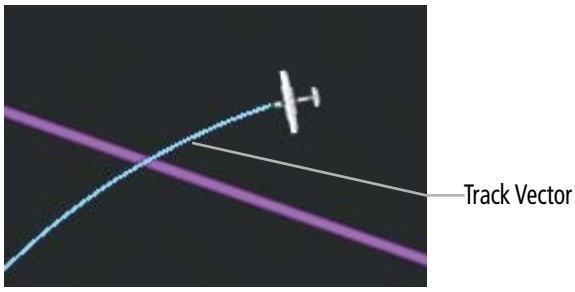


Figure 5-18 Track Vector

Selected Altitude Intercept Arc

Map displays can show 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 5-19 Selected Altitude Arc

Wind Vector on MFD

The map displays a wind vector arrow in the upper right-hand portion of the display. 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 5-20 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. Fuel reserve time can be input into the Fuel Range (RSV) time field within the 'Map Settings' Window.

Figure 5-21 Fuel Range Ring

Field of View (SVT)

Map displays can show the boundaries of the optional 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.

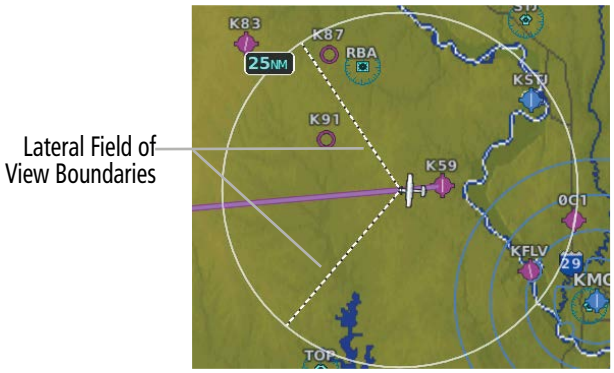


Figure 5-22 Field of View

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 system 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 D→ Key on any of the waypoint pages.

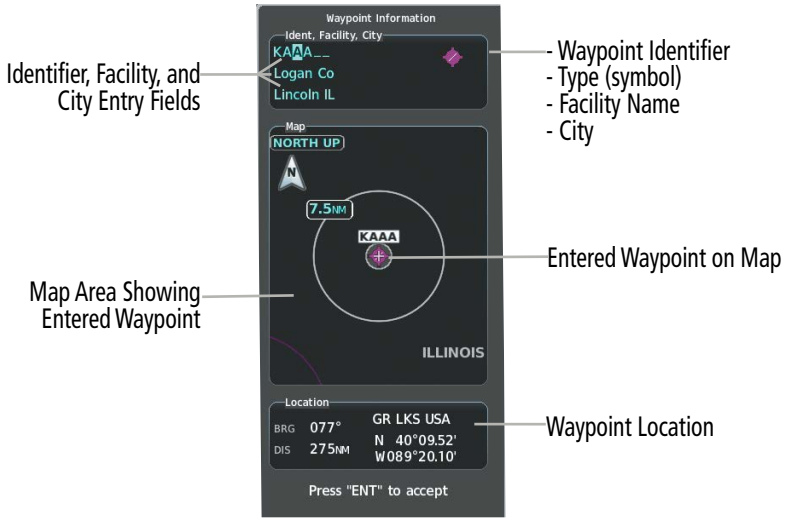


Figure 5-23 Waypoint Information

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.

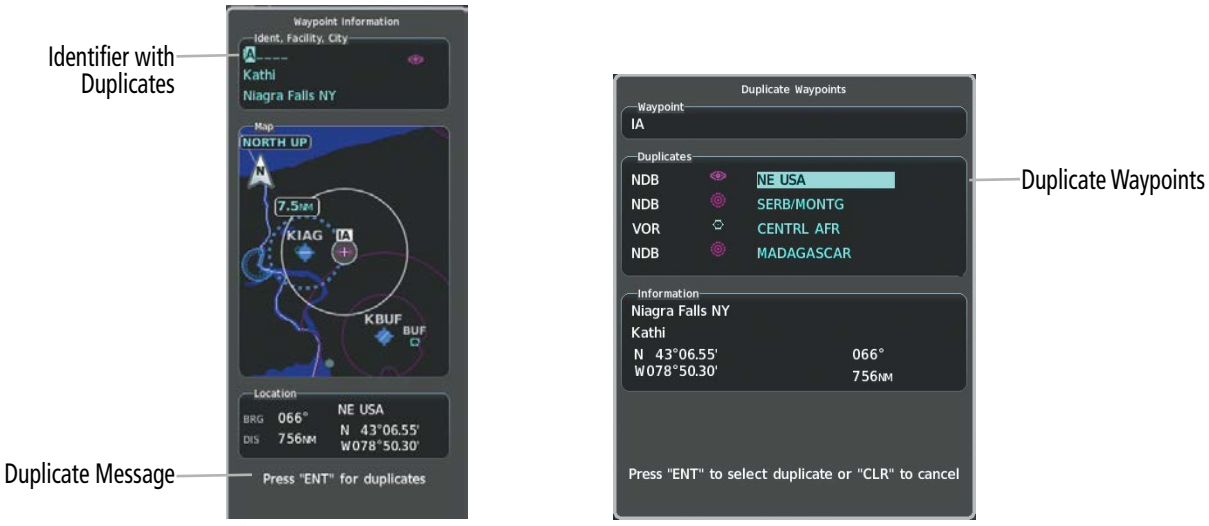


Figure 5-24 Waypoint Information - Duplicate Identifier

AIRPORTS

AIRPORT INFORMATION

NOTE: *'North Up' orientation on the 'WPT – Airport Information' Page cannot be changed; the pilot needs to be aware of proper orientation if the other map display orientation is different from the 'WPT – Airport Information' Page Map.*

The 'WPT – Airport Information' Page is the first page in 'WPT' 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 'WPT – 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 'WPT – 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 'WPT – Airport Information' Page by pressing the **Info** Softkey until 'Info 1' is displayed.

Figure 5-25 'WPT - Airport Information' Page

The following descriptions and abbreviations are used on the 'WPT – 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 (pilot-controlled lighting)

» COM Availability: TX (transmit only), RX (receive only), PT (part time), i (additional information available)

The '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	FSS	Terminal *	
AWOS	Gate	TMA *	
Center	Ground	Tower	
Class B *	Helicopter	TRSA *	
Class C *	Multicom	Unicom	
Clearance	Other		

** May include Additional Information*

Table 5-8 Airport Frequency Abbreviations

A departure, arrival, or approach can be loaded using the softkeys on the 'WPT – 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).

Figure 5-26 'WPT - Airport Directory' Page Example

The airport directory information is viewed on the 'WPT – Airport Directory' Page by pressing the **Info** Softkey until '2' is displayed. The Aircraft Owners and Pilots Association (AOPA) and AC-U-KWIK Airport Directory databases provide detailed information. Both directories are available for downloading at flygarmin.com, however copy only one of the databases to the Supplemental Data Card since the system cannot recognize both databases simultaneously:

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

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

Selecting a runway:

1) With the 'WPT – Airport Information' Page (**Info 1** Softkey) displayed, push 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, push 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.

NEAREST AIRPORT

The system can display the nearest airports on both the PFD and the MFD. This gives the pilot quick access to nearest airport information (very useful if an immediate landing is required).

The **Nearest** Softkey on the PFD, displays the 'Nearest Airports' Window containing 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.

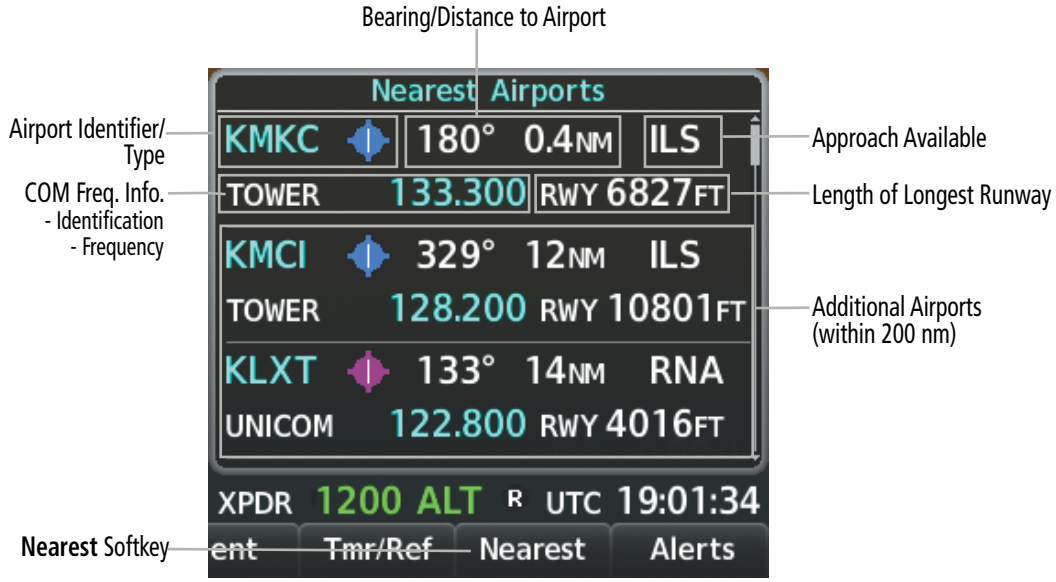


Figure 5-27 Nearest Airports on PFD

Pressing the **ENT** Key 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 5-28 Airport Information 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 'NRST – 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. The selected airport is indicated by a white arrow, and a dashed white line is drawn on the map from the aircraft position to the nearest airport. The currently selected airport remains in the list until it is unselected.

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'. If there are more than can be shown in the given box, each list can be scrolled. If there are no items for display in a boxed area, text indicating that fact is displayed.

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

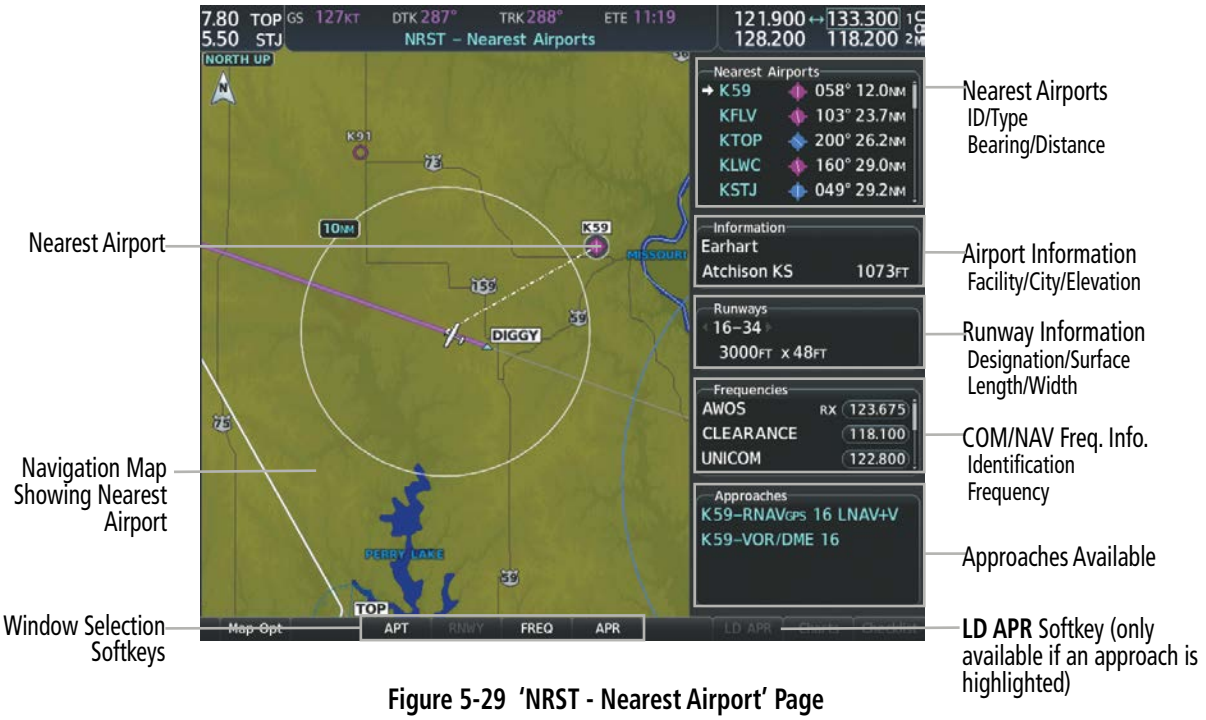


Figure 5-29 'NRST - Nearest Airport' Page

Viewing information for a nearest airport on the MFD:

1) Turn the **FMS** Knobs to select the 'NRST – 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.
2) Press the **APT** Softkey; or push 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.
3) Turn the **FMS** Knob to highlight the desired airport. (Pressing the **ENT** Key also moves to the next airport.)
4) Push 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 **RNWY** 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) Push the **FMS** Knob to remove the flashing cursor.

The 'Nearest Airports' Box on the 'Aux – System Setup 1' Page defines the minimum runway length and surface type used when determining the 25 nearest airports to display on the MFD 'NRST – 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) Push 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, Water).
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) Push the **FMS** Knob to remove the flashing cursor.

NON-AIRPORT AND USER CREATED WAYPOINTS

WAYPOINT INFORMATION

Information pages for Intersections, VORs, NDBs, VRPs, and User Waypoints will show a map of the currently selected waypoint, the waypoint identifier, and location. Additionally, intersections will show the nearest VOR while both the VOR and NDB waypoints will show their frequency and the nearest airport. User Waypoint information also provides the reference Type (radial/radial, radial/DME, or latitude/longitude), temporary status, comments, and a User Waypoint list.

The 'VOR Information' Page can be used to view information about VOR and ILS signals (since ILS signals can be received on a NAV receiver), or to quickly tune a VOR or ILS frequency. If a VOR station is combined with a TACAN station it is listed as a VOR-TACAN on the 'VOR Information' Page and if it includes only DME, it is displayed as VOR-DME. Also, the VOR class (Low Altitude, High Altitude, and Terminal) will be shown in the VOR 'Information' Box.

The system can create and store up to 1,000 user-defined waypoints. User waypoints can be created from any map display (except PFD Inset Map, 'Aux – Trip Planning' Page, or Procedure Pages) by selecting a position on the map using the **Joystick**, or from the 'WPT – User WPT 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, removed, or moved. Temporary user waypoints are erased upon system power down.

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

Figure 5-30 Non-Airport Waypoint Information Page (Intersection Example)

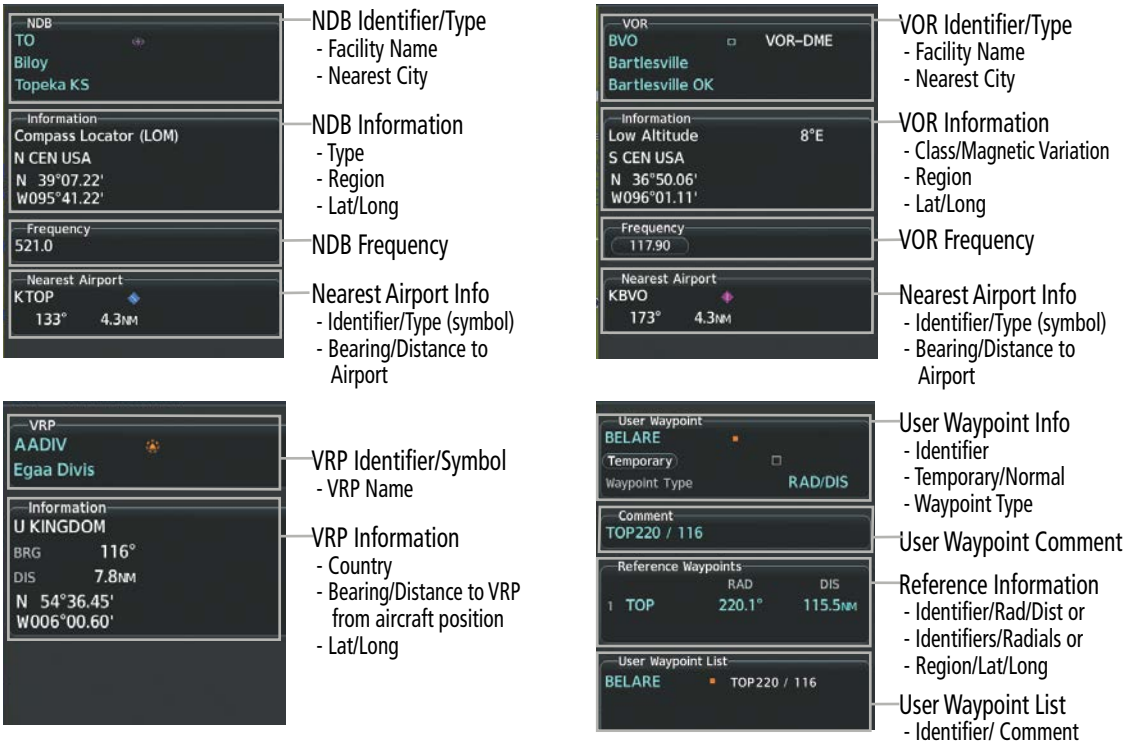


Figure 5-31 Non-Airport Waypoint Information Pages (NDB, VOR, VRP, and User Waypoint)

Viewing Waypoint Information:

1) Turn the **FMS** Knobs to select the 'WPT – (Intersection, NDB, VOR, VRP, or User WPT) Information' Page.

2) Push the **FMS** Knob to display the flashing cursor in the Intersection, NDB, VOR, VRP, or User Waypoint Box.

3) Use the **FMS** Knobs and enter an identifier, facility name, or location.

4) Press the **ENT** Key, if needed.

5) Push the **FMS** Knob to remove the flashing cursor.

NEAREST WAYPOINTS

The Nearest pages can be used to quickly find waypoints close to the aircraft. The system will display a scrollable list up to 25 nearest waypoints with bearing and distance from the aircraft, a map of the surrounding area, and additional information particular to the type of waypoint chosen. A white arrow before the waypoint identifier/name indicates the currently selected waypoint shown on the map, with its associated information in the lower box or boxes:

» The 'NRST – Nearest Intersection' Page will show three boxes labeled 'Nearest INT', 'Information', and a 'Reference VOR'.

» The 'NRST – Nearest NDB' Page will show three boxes labeled 'Nearest NDB', 'Information', and 'Frequency'. The NDB 'Information' Box will show a Compass Locator if the NDB is associated with either a Locator Outer Marker (LOM) or Locator Middle Marker (LMM).

» The 'NRST – Nearest VOR' Page will show three boxes labeled 'Nearest VOR', 'Information', and 'Frequency'. The NAV frequency from a selected VOR station can be loaded from the 'NRST – Nearest VOR' Page via the **FREQ** Softkey. See the Audio & CNS Section for more information.

» The 'NRST – Nearest VRP' Page will show two boxes labeled 'Nearest VRP' and 'Information'. Information will contain the VRP Name, Country and latitude/longitude.

» The 'NRST – Nearest User WPTS' Page will show three boxes labeled 'Nearest User', 'Information', and 'Reference Waypoints'. Information will include any Comments and the latitude/longitude. The 'Reference Waypoints' Box will provide a reference NAVAID with a radial/DME that coincides with the User Waypoint.

The nearest waypoint list will only include waypoints within 200nm. If there are no waypoints in the list, text indicating that there are no nearest waypoints will be displayed, and the information and frequency fields (if applicable) will be dashed.

Figure 5-32 'NRST - Nearest Intersection' Page

Figure 5-33 Nearest Non-Airport Waypoints (NDB, VOR, VRP, and User WPTS)

Viewing Nearest Non-Airport Waypoints:

1) Turn the **FMS** Knobs to select the 'NRST – Nearest (Intersections, NDB, VOR, VRP, or User WPTS)' Page.
2) Push the **FMS** Knob to display the flashing cursor in the 'Nearest INT, NDB, VOR, VRP, or User' Box,

   Or:

   If the 'NRST – Nearest VOR' Page is displayed, to display the flashing cursor:

   Press the **VOR** Softkey.

   Or:

   a) Press the **MENU** Key
   b) Highlight 'Select VOR Window', and press the **ENT** Key.
3) If needed, press the **ENT** Key or turn either **FMS** Knob as needed to select an identifier.
4) Push the **FMS** Knob to remove the flashing cursor.

USER WAYPOINTS

The system can create and store up to 1,000 user-defined waypoints. User waypoints can be created on most MFD map displays by selecting a position on the map using the **Joystick**, or through the 'WPT – User WPT Information' or flight plan pages. Waypoints created from WPT or FPL pages will default to the current aircraft position.

Temporary user waypoints, as indicated by a green check mark in the 'Temporary' Field, will be automatically deleted upon the next power cycle. The default storage setting for creating a new user waypoint can be changed from the 'Waypoint Setup' Window.

Three Types of reference are available to define the user waypoint position: radial/distance from an existing waypoint (RAD/DIS), radial intersection from two existing waypoints (RAD/RAD), or latitude and longitude (LAT/LON). By default, new waypoints will be created as a Route waypoint type using the RAD/DIS mode of reference.

A system generated comment for a user-defined waypoint incorporates the reference waypoint identifier, bearing, and distance. A new comment may be entered, limited to 25 characters.

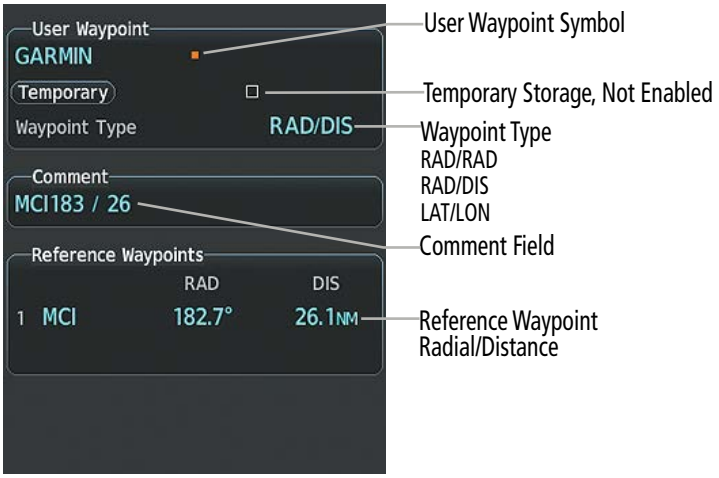


Figure 5-34 User Waypoint

Creating a user waypoint:

1) Create a new waypoint name:

a) From any page showing a map display, push the **Joystick** to activate the panning function and pan to the map location of the desired user waypoint (excluding the 'Aux – Trip Planning' and Procedure pages).

b) Press the **ENT** Key. The system provides an automated User Waypoint name. (If the map pointer is within the boundaries of an airspace, a menu pops. Use the **FMS** Knob to highlight 'Create User Waypoint' and press the **ENT** Key.) The 'WPT – User WPT Information' Page is displayed with the captured position.

c) If desired, use the large **FMS** Knob to highlight the User Waypoint name, and use the **FMS** Knobs to change the name.

Or:

a) With the 'WPT – User WPT Information' Page displayed, press the **New** Softkey, or press the **MENU** Key and select 'Create New User Waypoint' and press the **ENT** Key.

b) Use the **FMS** Knobs to enter a user waypoint name.

c) Press the **ENT** Key to accept the waypoint name.

Or:

a) With the 'WPT – User WPT Information' Page displayed, push the **FMS** Knob to activate the cursor. Use the large **FMS** Knob to highlight the waypoint name.

b) Enter a user waypoint name.

c) Press the **ENT** Key. The message 'Are you sure you want to create the new user waypoint AAAAAA?' is displayed.

d) With 'Yes' highlighted, press the **ENT** Key to accept the waypoint name.

Or:

a) With a flight plan page or window displayed, push the **FMS** Knob to activate the cursor (not required on the PFD).

b) Select the point in the flight plan before which to add the new user waypoint. The new waypoint is placed directly in front of (above) the highlighted waypoint.

c) Turn the small **FMS** Knob clockwise to display the 'Waypoint Information' Window.

d) Enter the name of the new user waypoint (a waypoint that does not match any existing waypoint in the database) and press the **ENT** Key.

e) The message 'AAAAA does not exist. Create User Waypoint?' is displayed. Press the **ENT** Key with 'Yes' highlighted to accept the waypoint name.

2) If desired, use the large **FMS** Knob to highlight the 'Temporary' Field and press the **ENT** Key to check or uncheck the box to change the storage method to temporary or normal, as desired.

3) Use the large **FMS** Knob to highlight the 'Waypoint Type' Field if necessary. If desired, change the waypoint type of reference 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.

4) If desired, use the large **FMS** Knob to highlight the field in the 'Comment' Box, then use the **FMS** Knobs to change the comment (limited to 25 characters).

5) When finished, push the **FMS** Knob to remove the flashing cursor.

   Or:

   With a flight plan page or window displayed, turn the large **FMS** Knob to highlight 'Load WPT to FPL' and press the **ENT** Key.

Editing a user waypoint comment or location:

1) With the 'WPT – User WPT Information' Page displayed, push the **FMS** Knob to activate the cursor. The cursor is placed in the 'User Waypoint' Box.
2) Use the **FMS** Knobs to enter the name of the User Waypoint; or turn the large **FMS** Knob and scroll to the desired waypoint in the 'User Waypoint List' Box.
3) Turn the large **FMS** Knob to move the cursor to the desired field.
4) Use the **FMS** Knobs to make any changes.
5) Press the **ENT** Key to accept the changes.
6) Push the **FMS** Knob to remove the flashing cursor.

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) Use the small **FMS** Knob to select 'Normal' or 'Temporary' as desired, and press the **ENT** Key.
4) Push the **FMS** Knob to remove the flashing cursor and return to the 'WPT – User WPT Information' Page.

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) Push the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'WPT – User WPT Information' Page displayed, push the **FMS** Knob to activate the cursor.
2) Use the large **FMS** Knob to highlight a User Waypoint in the 'User Waypoint List' Box, or use the **FMS** Knobs to enter a waypoint in the 'User Waypoint' Box.
3) Press the **MENU** Key. Use the **FMS** Knobs to highlight 'Delete User Waypoint'.
4) Press the **ENT** Key twice to confirm the selection.
5) Push 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) Use the **FMS** Knobs to highlight 'Delete All User Waypoints.'
4) Press the **ENT** Key twice to confirm the selection.

5.4 AIRSPACES

The system can display the following types of airspaces: Class B, TMA, and Airways surrounding TMA, Class C, CTA, Class A, Class D, Restricted (Prohibited), MOA (Military), and other airspace provided by the navigation database. Some examples of typical airspaces are depicted below. See the Map Symbols portion of this section for the maximum ranges for each type of airspace and the symbol used to define the airspace area. Temporary Flight Restrictions (TFRs) are discussed in the Hazard Avoidance Section.

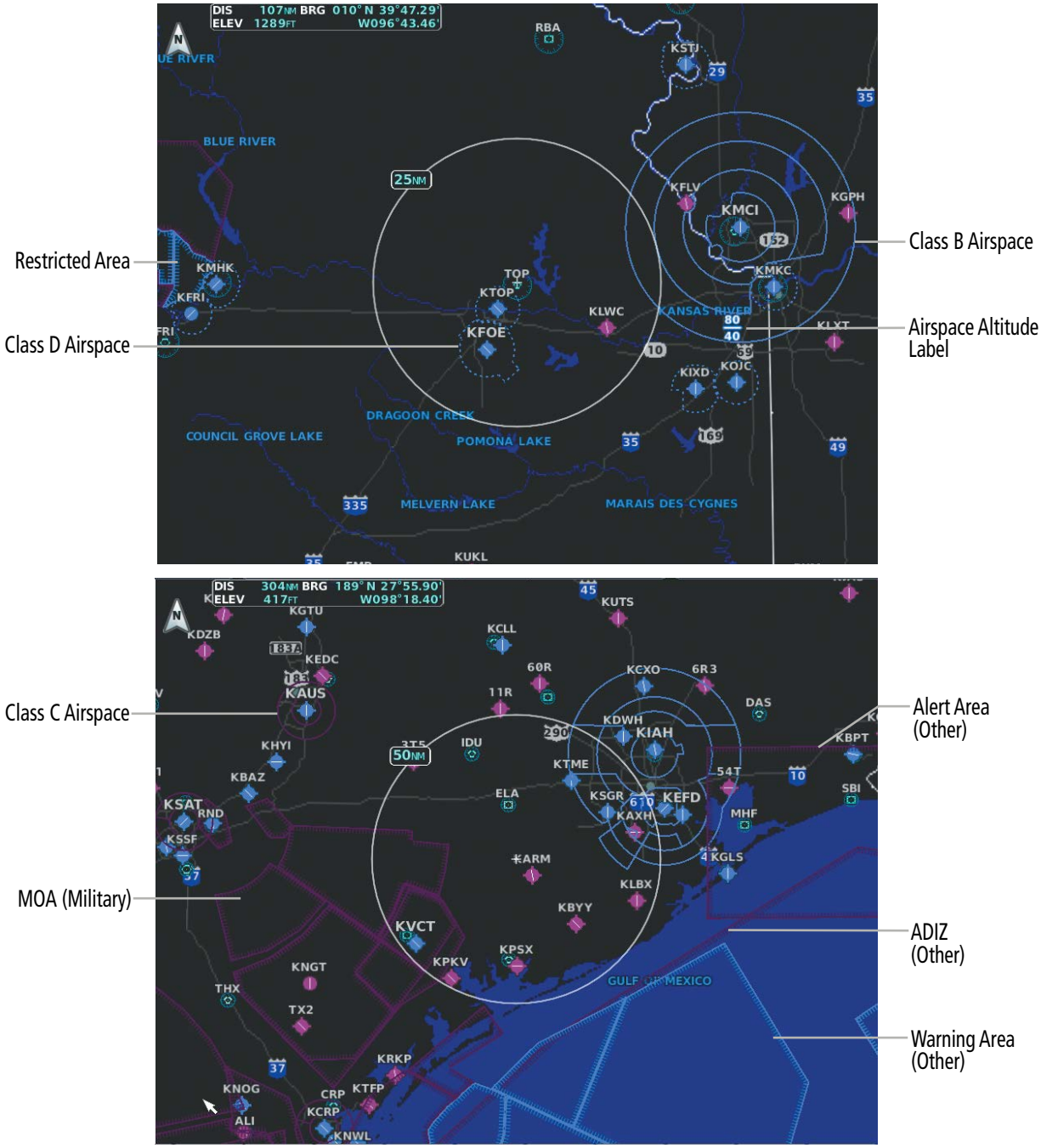


Figure 5-35 Airspaces

NEAREST AIRSPACE

SETTING AIRSPACE ALERTS

The 'Airspace Alerts' Box ('Aux – System Setup 1' Page) on the MFD allows the pilot to turn the controlled/special-use airspace message alerts on or off. This does not affect the alerts listed on the 'NRST – Nearest Airspaces ' Page or the airspace boundaries depicted on the map display. It simply turns on/off the system messages related to airspace alerts provided when the aircraft is approaching or near an airspace.

The following system messages will be generated on the PFD when airspace alerts are set to on.

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 track. The aircraft current ground track 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 Airspace Messages

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.

Enabling/disabling airspace alerts:

1) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page (**Setup 1** Softkey).
2) Push 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) Push the **FMS** Knob to remove the flashing cursor.

Changing the altitude buffer distance setting:

1) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page (**Setup 1** Softkey).
2) Push 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) Push the **FMS** Knob to remove the flashing cursor.

VIEWING NEAREST AIRSPACE INFORMATION

The 'NRST – 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 'NRST – Nearest Airspaces' Page. In addition to displaying a map of airspace boundaries and surrounding area, the 'NRST – Nearest Airspaces' Page displays airspace information in four boxes labelled 'Airspace Alerts', 'Airspace Agency', 'Vertical Limits', and 'Frequencies'.

Airspace alerts and associated frequencies are shown in scrollable lists on the 'NRST – 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.

Figure 5-36 'NRST - Nearest Airspaces' Page

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 **Alerts** Softkey on the MFD; or push 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) Use the **FMS** Knob to highlight the desired airspace.
4) Push the **FMS** Knob to remove the flashing cursor.

SMART AIRSPACE

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.

NOTE: *Smart Airspace function will not de-emphasize airspaces on the HSI Map when the MFD is in reversionary mode.*

Smart Airspace Off

Smart Airspace On

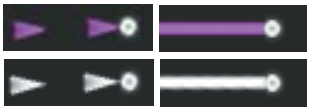
Figure 5-37 Smart Airspace

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 'Map Settings' Window is displayed.
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) Push the **FMS** Knob to remove the flashing cursor.

5.5 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. Additionally, the system provides direct-to functionality, allowing short-term navigation to a single waypoint. Activated direct-to navigation information is displayed in the 'Active Flight Plan' Box above the Active Flight Plan. 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 Symbol Name	Description	Symbol
Course Leg	Course leg currently flown	
	A future course leg in the current phase of flight	
	A course leg in either a previously flown course leg, or a future course leg not in the current phase of flight	
Heading Leg	Heading leg currently flown	
	Future heading leg	
Roll Steering Path*	Turning path currently flown	
	Turning path for the next flight plan leg	
	Turning path beyond the next flight plan leg	
Turn Anticipation Arc	Displayed when sequencing to the next flight plan leg via a fly-by waponit, a lead turn is created, adjusting for groundspeed	
Fly-Over Waypoint	Displayed as a fly-over waypoint	
Along Track Waypoint	Displayed when an along track waypoint is created	
Flight Path Fix	A fix that terminates: manually, at a specified altitude, or at a specified distance or radial when flying a heading	
Top of Descent (TOD) and Bottom of Descent (BOD)	When vertically navigating, the system will display where the aircraft will begin complete the descent	
Parallel Track Waypoint	Displayed when a parallel track is created	

**Roll Steering Path transitions between two disconnected legs (i.e. holding), some procedure turn segments, parallel track segments, or after some fly-over waypoints.*

Table 5-10 Flight Plan Symbols on Map

NOTE: *The system supports AFCS lateral guidance for all leg types (using navigation or approach mode). The system does not support course deviation for any heading leg types (VA, VD, VI, VM, or VR).*

DIRECT-TO NAVIGATION

The Direct-to method of navigation, initiated by pressing the D→ Key, allows quick selection of a destination and provides guidance to the selected point. 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 5-38 'Direct To' Window - MFD

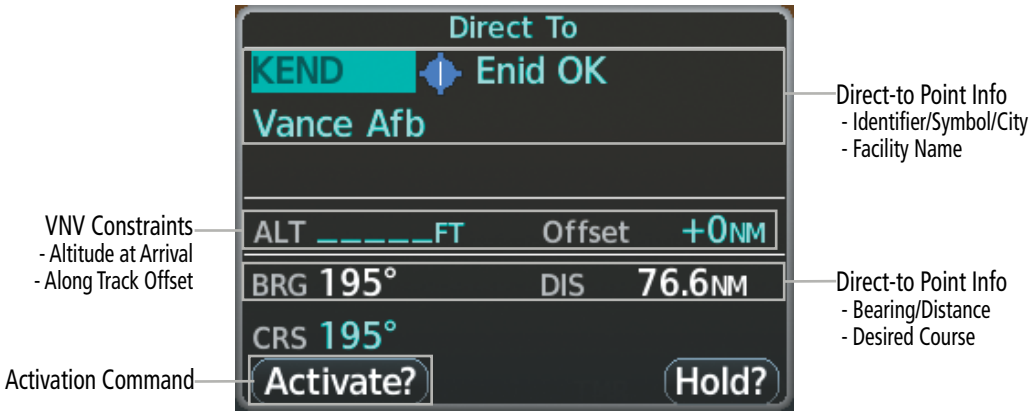


Figure 5-39 'Direct To' Window - PFD

Any waypoint can be entered as a direct-to destination from a 'Direct To' Window. Also, any waypoint contained in the active flight plan can be selected as a direct-to waypoint from a 'Direct To' Window, the 'FPL – Active Flight Plan' Page, or the active 'Flight Plan' Window.

The 'Direct To' Window can always be displayed 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.

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 'CRS' or 'Course' Field on the 'Direct To' Window.

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

1) Press the D▸ 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. The 'Activate?' Field is highlighted.
4) Press the **ENT** Key to activate the direct-to.

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

1) While navigating an active flight plan, press the D▸ 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 the waypoint submenu window with a list of flight plan waypoints.
3) Turn the large **FMS** Knob to 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) Press the **FPL** Key.
2) Push the **FMS** Knob to activate the cursor (not required on PFD), and turn the large **FMS** Knob to highlight the desired waypoint.
3) Press the D▸ Key.
4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
5) Press the **ENT** Key again to activate the direct-to.

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 the waypoint submenu window.
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.

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.

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 push the **FMS** Knob.
2) Use the **FMS** Knob to 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.

Selecting a manual direct-to course:

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 large **FMS** Knob to highlight the 'CRS' or 'Course' Field.
3) Use the small **FMS** Knob to 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.
2) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
3) Press the **ENT** Key again to activate the direct-to.

Direct-to destinations may also be selected by using the Map Pointer on any map display (Map Pointer functionality is not available for traffic or terrain 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 Map Pointer:

1) From any page showing a map display (excluding the traffic and terrain pages), push the **Joystick** to display the Map Pointer.
2) Move the **Joystick** to place the pointer at the desired destination location. If the Map Pointer is placed on a waypoint, the waypoint name is highlighted.
3) Press the D▸ Key to display the 'Direct To' Window with the selected point entered as the direct-to destination.
4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
5) Press the **ENT** Key again to activate the direct-to.

Cancelling a Direct-to:

1) Press the D▸ 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.

A direct-to with altitude constraints creates a vertical path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude constraint of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if VNV offset distance has been entered. Direct-to vertical navigation is discussed in the Flight Plan Vertical Navigation portion of Flight Management. Offset distances (Along Track Offsets) are discussed in the Flight Plan Operations portion of Flight Management.

SELECTION AND MODIFICATION METHODS

There are three methods to create or modify a flight plan:

- 'FPL – 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)
- 'FPL – Flight Plan Catalog' Page on the MFD (create/modify a stored flight plan)

To create or modify a flight plan, the cursor can be used to edit the required fields within the flight plan and the 'Active VNV Profile' Box within the 'FPL – Active Flight Plan' Page. The cursor will appear as a field consisting of a solid cyan or magenta rectangle. The cursor can be activated by pushing the **FMS** Knob. The Insertion Point Indicator is displayed as a small cyan triangle and is associated with the Cursor location. The purpose of the Insertion Point Indicator is to show where new data entry information will be placed within the flight plan.

Fields can be highlighted by turning the large **FMS** Knob, and edits can be accomplished within the field by combining small and large **FMS** Knob turns.

Figure 5-40 'Flight Plan' Window on PFD

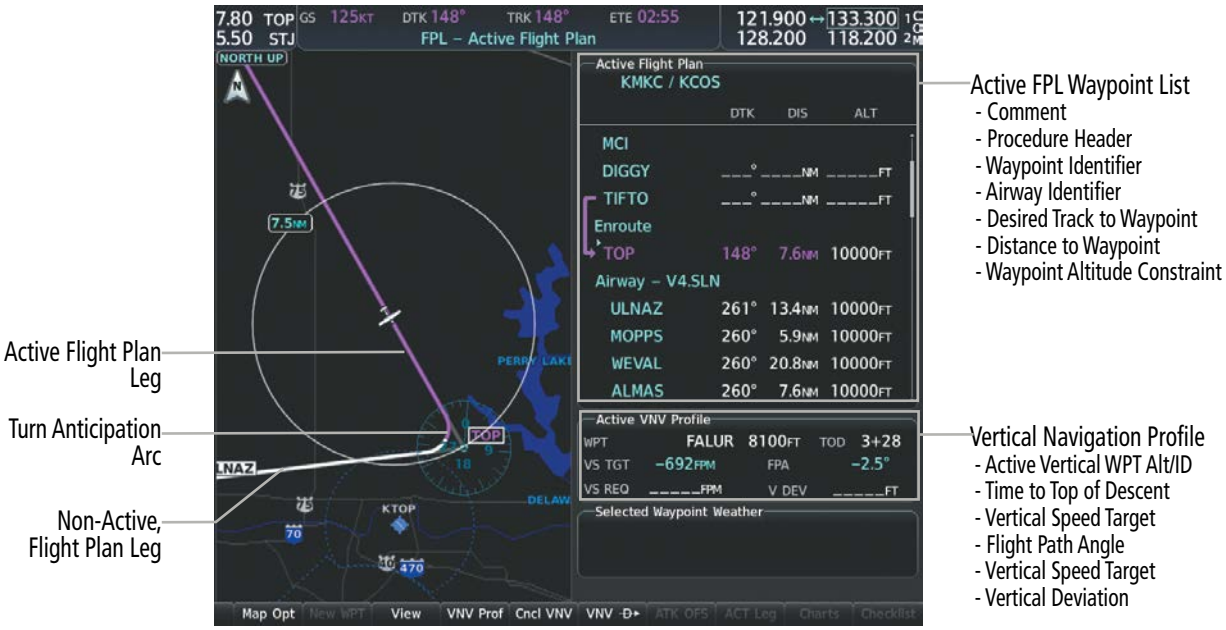


Figure 5-41 'FPL - Active Flight Plan' Page

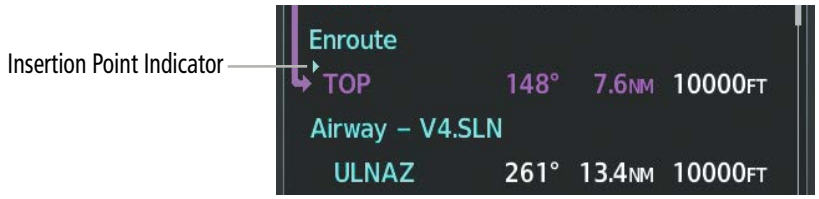


Figure 5-42 Insertion Point Indicator

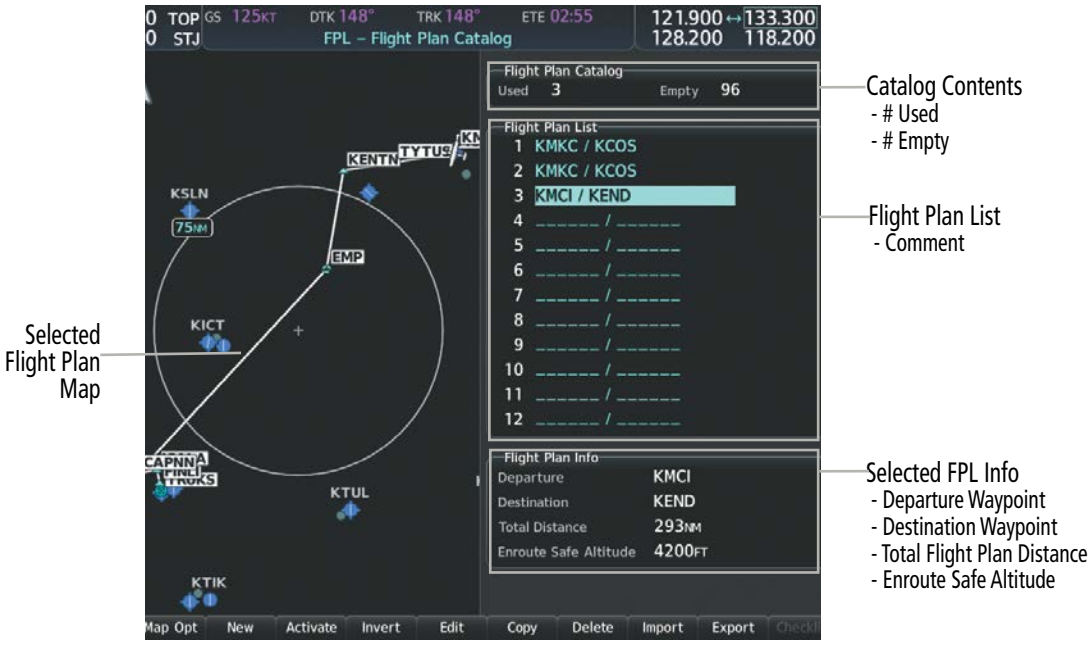


Figure 5-43 'FPL - Flight Plan Catalog' Page

FLIGHT PLAN DISPLAY

Flight plan information can be displayed in different locations and formats. Profile information for the active flight plan may also be displayed; see the Vertical Situation Display portion of Flight Management for more information. Active flight plan creation and modifications can be made on the 'FPL – Active Flight Plan' Page or on the 'Flight Plan' Window.

FLIGHT PLAN VIEWS

The 'FPL – Active Flight Plan' Page 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 it 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 for 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 press the **Narrow** Softkey to display the narrow view.
5) Press the **Back** Softkey to return to the top level active flight plan softkeys.

CREATING A BASIC FLIGHT PLAN

The active flight plan is listed on the 'FPL – 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 map displays. Stored flight plans are listed on the 'FPL – Flight Plan Catalog' Page, and are available for activation (becomes the active flight plan).

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. A flight plan can also be created and stored in the system memory. Up to 99 flight plans with up to 100 waypoints each can be created and stored in memory. If the flight plan memory is full and a flight plan is imported, it will overwrite the last flight plan in the catalog.

Upon power application, 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 within 5 nm of the airport 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.

Auto-designation will determine the most likely airport of origin and auto-populate the Active Flight Plan. Once determined, the airfield identifier automatically appears in the 'Origin' Field and the line immediately below 'Origin' while keeping the runway ('RW') Field empty. The line below the Origin line serves as the first point in the flight plan.

NOTE: *If the 'RW' Field is filled, then the first point in the flight plan is auto-populated with the runway selected, located in the line immediately below the 'RW' Field.*

Auto-designation occurs between 15 and 60 seconds after the display receives power under the following conditions:

- Aircraft position is known
- Aircraft is on the ground
- Nearest airport is within 200NM
- Flight plan is empty

If the pilot manually enters the origin, or any other leg of the flight plan before auto-designation occurs, nothing gets inserted automatically. The automatic insertion logic only runs once, so the pilot can edit the origin if the nearest airport is not the desired origin.

If the pilot enters a different airport into the first point of the flight plan, the Origin will change to this entry, and the pilot will be prompted to enter the departure runway.

Both the Origin airport/runway and the first point of the flight plan will be the same unless a departure is entered and a manual leg is inserted at the beginning of the loaded departure. Loading a departure locks in the origin information.

NOTE: *In some cases, Origin and Destination airports may not be displayed in the PFD "Flight Plan" Window, "Recent" submenu or the MFD 'WPT – Airport Information' Page until the airport waypoint is loaded into the flight plan.*

The following procedure is intended to provide an overview of basic flight plan creation. It will create a flight plan from the origin runway to the destination runway, and includes enroute waypoint selection. The following procedure does not include airways or terminal procedures. For instructions on how to add airways to a flight plan, see the Flight Plan Waypoint and Airway Modifications discussion later in this Flight Planning Section. For information on departures, arrivals, approaches, and missed approaches see the Procedures Section.

Creating a flight plan:

1) For an active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).

Or:

For a stored flight plan:

a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.

b) Press the **New** Softkey; push the **FMS** Knob and select an empty Flight Plan List Field, and press the **ENT** Key; or press the **ENT** Key; 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.

2) If the system auto-designated the Origin, proceed to Step 3.

Or:

Enter or modify the origin airport and runway as follows:

a) Select the field below the Origin header to enter the origin airport identifier.

b) Use the **FMS** Knob, or the waypoint submenu to enter the identifier, facility, or city name of the airport.

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 airport/runway to the flight plan.

3) Select the destination airport and runway by highlighting the field below the Destination header and completing steps 2b – 2e.

4) Select the enroute waypoints:

a) Select the location to insert the waypoint.

b) Use the **FMS** Knob to enter the identifier, facility, or city name of the waypoint.

c) Press the **ENT** Key. The 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, push the **FMS** Knob to remove to deactivate the cursor.

FLIGHT PLAN WAYPOINT AND AIRWAY MODIFICATIONS

All flight plans can be edited at any time. Waypoints and airways can be added, modified, or removed from any flight plan. Edits made to an active flight plan affect navigation as soon as they are entered. Modifications to flight planned departures, arrivals, approaches, and missed approaches are discussed later in the Procedures portion of Flight Management.

FLIGHT PLAN WAYPOINTS

Within flight plans, waypoints can be added and removed. 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.

Adding Waypoints

To add a waypoint, choose the flight plan, select the desired point of insertion, enter the waypoint, and the waypoint will be added prior to the selected waypoint. Either the 'Waypoint Information' Window or Waypoint Submenu can be used when entering the waypoint.

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.*

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.*

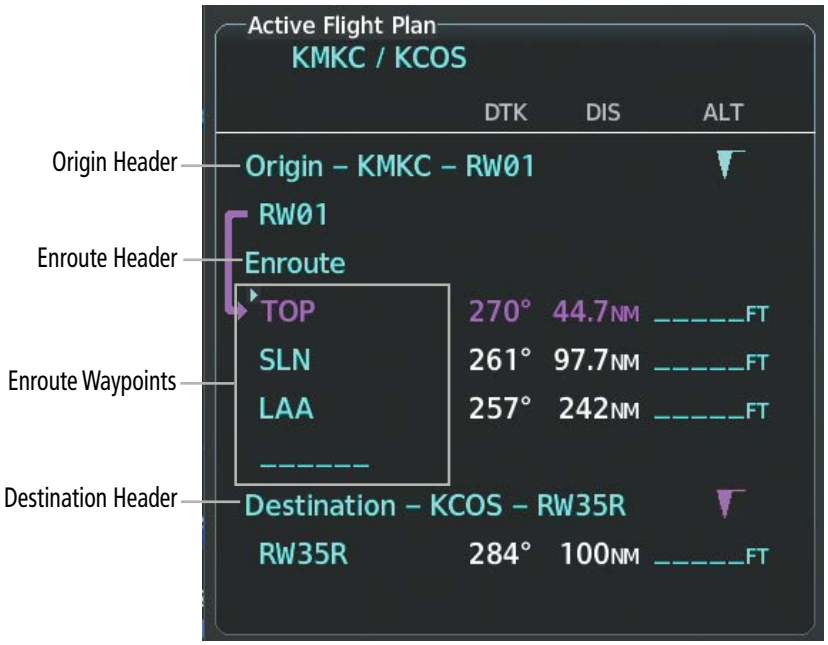


Figure 5-44 Active Flight Plan Waypoints

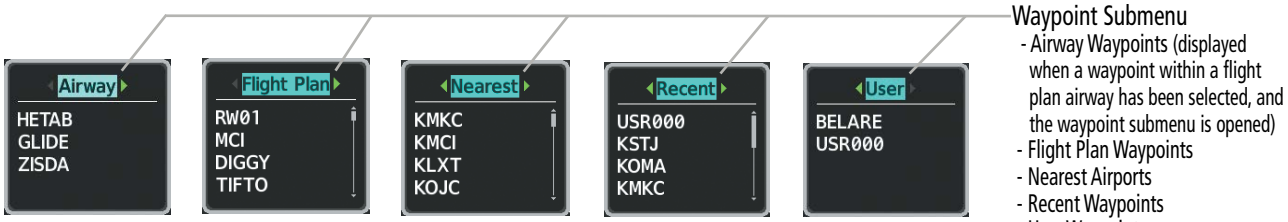


Figure 5-45 Waypoint Submenu

Adding a waypoint to a flight plan:

1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Select the point in the flight plan before which to add the new waypoint. The new waypoint is placed directly in front of the highlighted waypoint.

3) 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).

4) 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 flight plan is modified as each waypoint is entered.

Creating and adding user waypoints to a flight plan using the map pointer on the MFD:

1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Select the location to insert the waypoint.

3) Push the **Joystick** for the MFD to activate the panning function on the flight plan map and pan to the location of the desired user waypoint.

4) 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 MAPxxx (using the next available in sequence) and is added to the flight plan.

Removing Waypoints

Individual waypoints and airways can be removed from a flight plan. Some waypoints in the final approach segment (such as the FAF or MAP) can not be removed individually. Attempting to remove a waypoint that is not allowed results in a window displaying 'Invalid flight plan modification'. To remove a waypoint, choose the flight plan, select the desired point of insertion or waypoint to remove, enter/remove the waypoint, and it is added in front of the selected waypoint.

NOTE: If removal of a flight plan item (waypoint, procedure, etc.) results in the removal of the end waypoint of the active leg, an off-route direct-to to the removed waypoint is created and activated.

Removing an individual waypoint from a flight plan:

1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Turn the large **FMS** Knob to highlight the waypoint to be removed.

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) Push the **FMS** Knob to remove the flashing cursor.

Fly-Over Waypoints

Waypoints entered in the enroute segment of the flight plan may be treated as either fly-by or fly-over waypoints.

If the system determines the flight plan leg geometry cannot support fly-by navigation for a waypoint sequence in the current flight plan, it will change a fly-by waypoint to a fly-over waypoint automatically. A roll steering path or future roll steering path may be displayed after the fly-over waypoint until the roll steering path aligns with the course leg connecting the fly-over waypoint and the following waypoint in the flight plan. This system generated fly-over waypoint will not display the fly-over symbol.

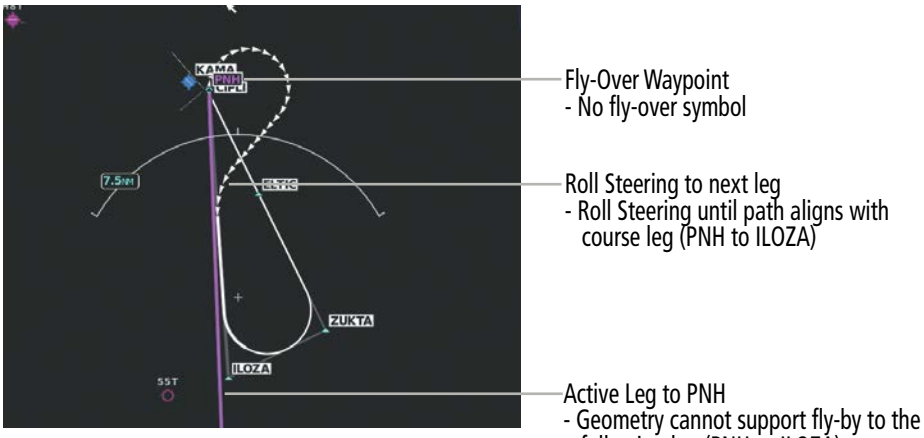


Figure 5-46 PNH Fly-Over Waypoint

FLIGHT PLAN AIRWAYS

Within flight plans, airways can be added, removed and collapsed/expanded.

Adding Airways

Airways can be added to any flight plan. An airway can only be added if there is an existing entry waypoint in the flight plan that is part of the desired airway and is not part of an arrival or approach procedure. The system anticipates the desired airway based on the selected waypoint and the flight plan.

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 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.

Figure 5-47 'FPL - Select Airway' Page - Selecting Airway

Figure 5-48 'FPL - Select Airway' Page - Selecting Exit Point

Adding an airway to a flight plan:

1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).

Or:

For a stored flight plan:

a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

b) Turn the **FMS** Knob to highlight the desired flight plan.

c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Turn the large **FMS** Knob to move the cursor below the airway entry waypoint for the insertion point. If there is no valid airway entry waypoint in the flight plan, one must be entered first.

3) Turn the small **FMS** Knob for the MFD one click clockwise and press the **LD AIRWY** Softkey, or press the **MENU** Key and select "Load Airway"(PFD or MFD). The **LD AIRWY** Softkey or the "Load Airway" menu item is available only when a valid airway entry waypoint has already been entered in the flight plan.

4) Turn the **FMS** Knob to highlight the desired airway from the list, and press the **ENT** Key. Low altitude airways are shown first in the list, followed by "all" altitude airways, and then high altitude airways.

5) Turn the **FMS** Knob to highlight the desired airway exit point from the list, and press the **ENT** Key. 'Load?' is highlighted.

6) Press the **ENT** Key. The system returns to editing the flight plan with the new airway inserted.

Some airways have directional restrictions on all or part of the route. Airway "A2" in Europe has a directional restriction requiring the route to be flown in one direction only.

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.

Removing Airways

Removing an entire airway from a flight plan:

1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Select the header of the airway to be removed.

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) Push the **FMS** Knob to remove the flashing cursor.

Collapsing Airways

The system allows airways on the active flight plan to be collapsed or expanded. 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 flight plan will always keep 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.

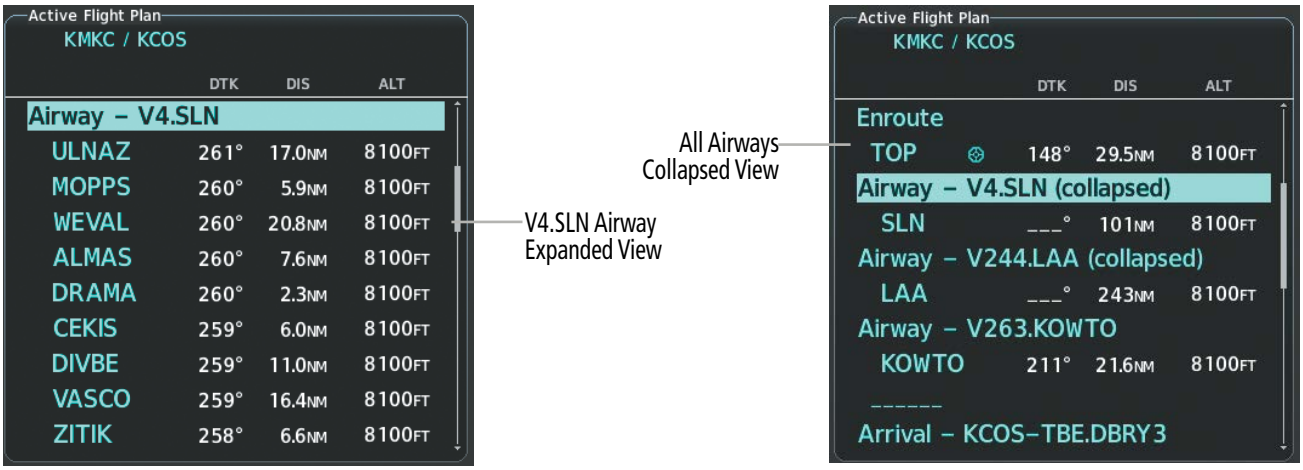


Figure 5-49 Expanded/Collapsed Airways

Collapsing/expanding the airways in a flight plan:

1) For the active flight plan, press the **FPL** Key.

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Press the **MENU** Key, highlight 'Collapse Airways' or 'Expand Airways', and press the **ENT** Key. The airways are collapsed/expanded.

FLIGHT PLAN WAYPOINT CONSTRAINTS

NOTE: *Initiating the VNV direct-to function to the FAF, manually specifying an FPA to the FAF, or manually creating an altitude constraint at the FAF will disrupt the VNV function from creating a lateral offset. Thus, the baro-VNV path may not intersect the approach descent path.*

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. See the following figure for an example of how different Altitude Constraint Types are displayed in the active flight plan. Any published BETWEEN altitude restriction derived from the database is displayed in white text as an AT-or-ABOVE constraint type; the lower altitude of the published restriction is used to define the constraint.

The system will auto-designate (automatically enter and enable) altitude constraints to be used for vertical guidance when a procedure is loaded. An altitude constraint which has been auto-designated by the system will be displayed as cyan text.

An altitude constraint may be manually designated for procedure waypoints and enroute waypoints by activating and moving the cursor to the desired altitude in the active flight plan, turning the small **FMS** Knob and pressing the **ENT** Key. An altitude constraint may be manually designated only if it is available for vertical guidance. Altitudes that are not available for vertical guidance are shown in white text and cannot be selected by the cursor.

The system is capable of providing vertical navigation for crossing AT the altitude constraint designated for use, regardless of published constraint type. For example, a published departure procedure may contain an AT-or-ABOVE 3,000 feet altitude crossing restriction. Designating this altitude constraint in the flight plan allows vertical navigation for crossing AT 3,000 feet.

NOTE: *All designated altitudes (cyan text) will be displayed in the active flight plan without restriction bars regardless of what is shown on the published procedure.*

NOTE: *If the Final Approach Fix (FAF) is available for vertical guidance, the FAF altitude constraint may be modified and set above or below the published FAF altitude.*

For all designated altitudes, the system will automatically calculate advisory altitudes prior to the designated altitude constraint. These advisory altitudes are not auto-designated and are displayed as white text.

Altitudes that have been designated for use in vertical guidance can be "un-designated". Pressing the **CLR** Key with the altitude constraint highlighted in the active flight plan removes the altitude constraint designation. The altitude will not be used for vertical guidance and the text displayed will be shown in white. The system will recalculate advisory altitudes (white text) once any altitude constraint is designated, modified, or un-designated.

An altitude constraint may be entered as a flight level (FL), height above mean sea level (MSL), or height above ground level (AGL). AGL format is only available for airport waypoints.

VNAV guidance is only provided for valid descent altitude constraints which have been designated for use. An altitude constraint that is crossed out indicates the system has determined this constraint to be invalid based on aircraft limitations or logical sequencing of the altitude constraint within the flight plan.

Altitude constraints can be modified or removed after having been added to the flight plan. If an altitude constraint is removed and the navigation database contains an altitude restriction for the lateral waypoint, the system will display that altitude restriction in white text. The system also provides a way to reinstate a published altitude constraint that has been modified.

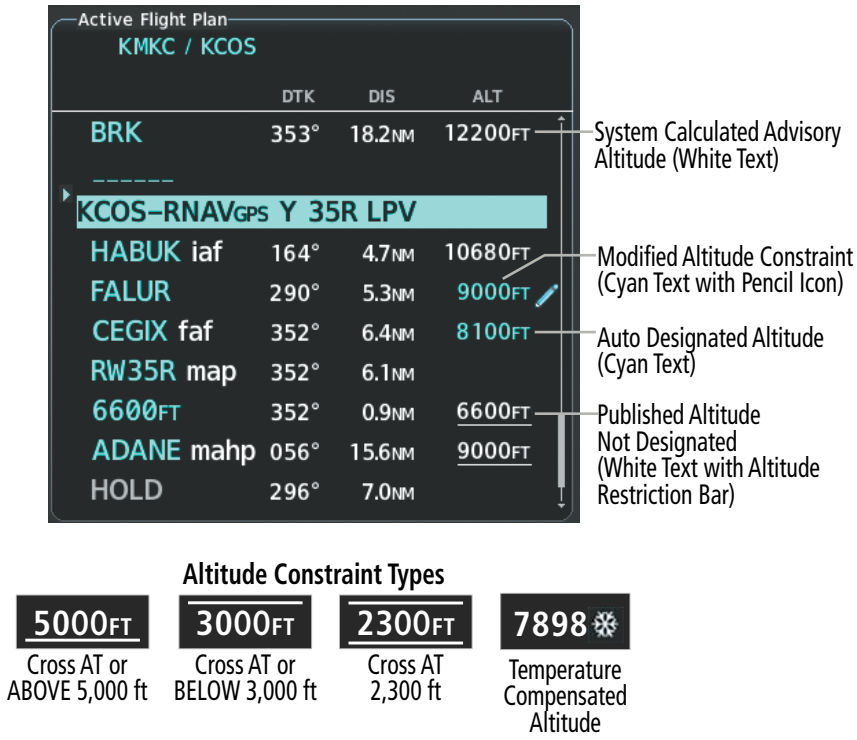


Figure 5-50 Waypoint Altitude Constraints

White Text	Cyan Text
5000FT Advisory altitude calculated by the system estimating the altitude of the aircraft as it passes the waypoint. 5000FT Altitude retrieved from the navigation database. White line(s) above and/or below indicate 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.	8600FT Altitude is designated for vertical guidance. A pencil icon indicates a manually modified altitude constraint. 8100FT The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.

Table 5-11 Altitude Constraint Legend

Entering/designating or modifying an altitude constraint:

1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the small **FMS** Knob and enter an altitude constraint value using the **FMS** Knob. 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 aerodrome without a runway selected, an additional choice is displayed. Turn the small **FMS** Knob to choose 'MSL' or 'AGL', and press the **ENT** Key to accept the altitude.

Removing/undesignating an altitude constraint:

1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
2) Push the **FMS** Knob to activate the cursor 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.

Reverting a manually entered altitude constraint back to the navigation database value:

1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
2) Push the **FMS** Knob to activate the cursor 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.

FLIGHT PLAN 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, HF, PI, RF, and TF. Altitude constraints are not retained in stored flight plans.*

The 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.

Vertical navigation is available for flight director guidance when valid VNV data is entered in flight plan and the **ENBL VNV** Softkey is pressed (softkey label changes to '**Cncl VNV**' once enabled) on the 'FPL – Active Flight Plan' Page. Refer to the AFCS Section for more information on utilizing vertical navigation for aircraft control.

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.

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

Enabling and Disabling VNV guidance:

1) Press the **FPL** Key for 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.

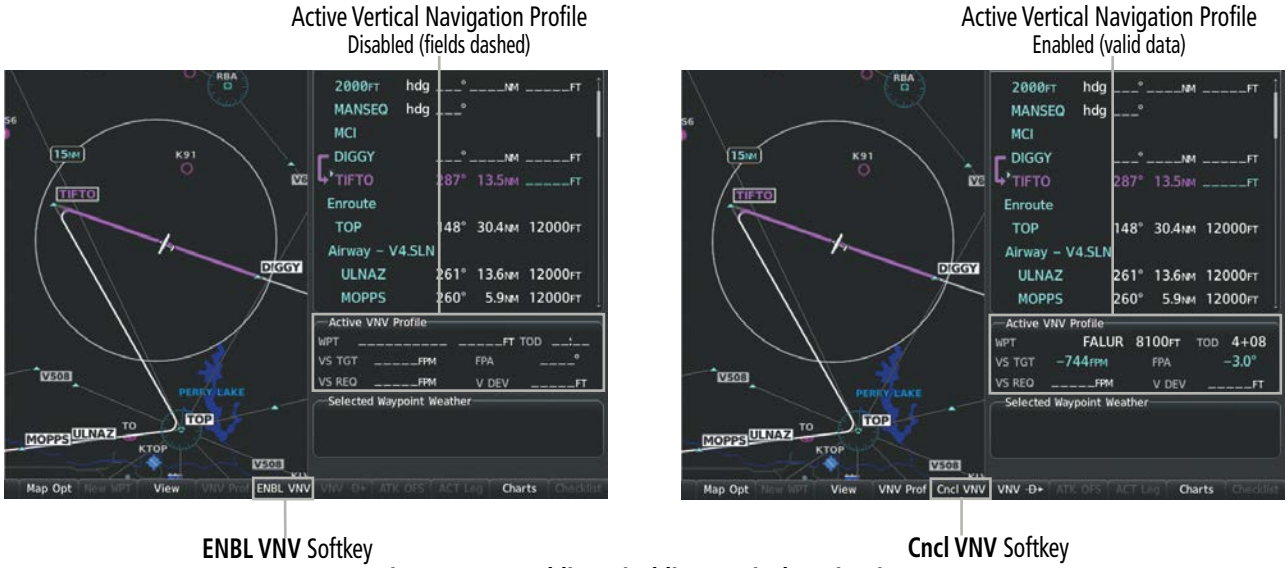


Figure 5-51 Enabling/Disabling Vertical Navigation

ACTIVE VNAV PROFILE

The active 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. The default FPA is -2.5degrees which can be modified to another default.

Modifying the VS TGT and FPA:

1) Press the **FPL** Key for 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) Push 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 'Map – 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, 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.

The VSD horizontal range is equal to the 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 map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the 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.

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). 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.

The numeric constraint values are displayed below the waypoint label, using the same color and format as on the Active Flight Plan Page. See the Altitude Constraints discussion earlier in this section for more information.

Additionally, a constraint icon is displayed on the VSD along the vertical profile path for each altitude constraint, as shown in the following figure.

NOTE: *Certain leg types (e.g. holds, heading legs) do not support VNV descents because the lateral distance of those legs in unknown. The VSD will not show a VNV profile for any legs that have no vertical path guidance.*

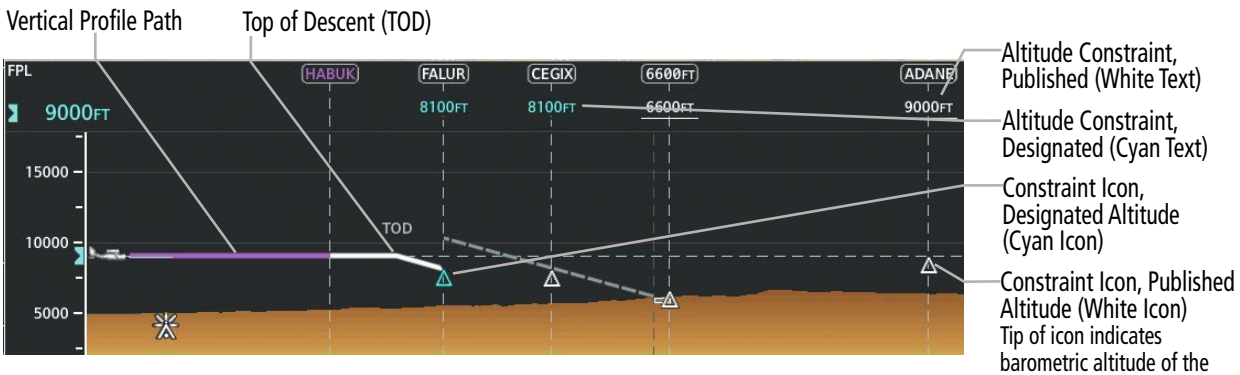


Figure 5-52 Vertical Situation Display (VSD)

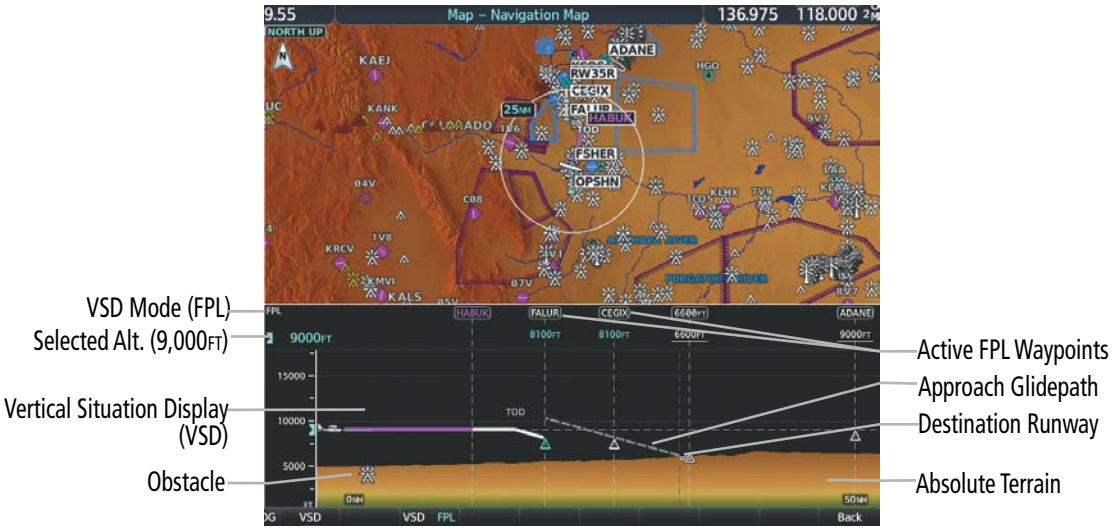


Figure 5-53 VSD Inset on 'Map - Navigation Map' Page

VSD Mode Softkey	Displayed Mode	FPL Criteria	Items available on VSD
Auto	AUTO FPL	Available active FPL & aircraft within FPL swath	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information*
	AUTO TRK	(1) Active FPL available & aircraft not within FPL swath, or (2) Active FPL not available	Terrain/obstacles along the current track, vertical track vector, and selected altitude
Flight Plan	FPL	Active FPL available	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information*
		Active FPL not available	Only shows message 'Flight Plan Not Available'
Track	TRK	N/A	Terrain/obstacles along the current track, vertical track vector, and selected altitude

**Active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, TOD/BOD, and destination runway*

Table 5-12 VSD Modes

Flight Phase	Width of Swath
Approach, Departure	0.6 nm
Terminal	2.0 nm
En Route, Oceanic	4.0 nm

Table 5-13 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.
'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 is old, disable and enable VSD'	The system has encountered a delay and VSD data has failed to update for 2 seconds or more. This message may be momentarily displayed and then removed as the delay is overcome. In the event the message persists, it is recommended to disable and enable VSD.

Table 5-14 VSD System Messages

Enabling and changing settings for 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** or **Off** Softkey to enable or disable the Vertical Situation Display.
5) If desired, 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:
   a) Turn the **FMS** Knob to highlight 'Show VSD' or 'Hide VSD' and press the **ENT** Key.
   b) Press the **Map Opt** Softkey.

c) Press the **Inset** Softkey.

d) Press the VSD Mode softkey to choose between **Auto**, **FPL**, or **TRK**.

Or:

a) Press the **ENT** Key to select Map Settings.

b) Turn the large **FMS** Knob to select 'VSD' and press the **ENT** Key.

c) Highlight the 'Mode' 'On' or 'Off' Field and turn the small FMS Knob to enable/disable VSD.

d) To change the Mode setting, highlight the 'Mode' Field.

e) Use the small FMS Knob to select 'Auto', 'FPL', or 'TRK', and press the **ENT** Key.

Disabling 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 **Off** Softkey.

Or:

1) Select the 'Map – Navigation Map' Page.
2) Press the **MENU** Key:

a) Turn the **FMS** Knob to highlight 'Show VSD'

b) Press the **ENT** Key.

Or:

a) Press the **ENT** Key to select Map Settings.

b) Turn the large **FMS** Knob to select 'VSD' and press the **ENT** Key.

c) Highlight the 'Mode' On/Off Field and turn the small FMS Knob to select 'Off'.

d) Press the **ENT** Key.

VERTICAL NAVIGATION DIRECT-TO

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** Softkey on the 'FPL – 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 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. 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.

Activating a vertical navigation direct-to:

1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
2) Push the **FMS** Knob to activate the cursor and turn 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** 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) Push the **FMS** Knob to remove the flashing cursor.

Removing a VNV altitude constraint:

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

FLIGHT PLAN OPERATIONS

This section will discuss activating a flight plan leg and conducting enroute operations such as creating an along track offset, parallel track, closest point from a reference point and user defined holding. For information on departures, arrivals, and approaches refer to the Procedures portion in the Flight Management Section.

In-flight, the system automatically sequences through the active flight plan, with the exception of manually terminated legs (such as FM, HM, or VM) that can occur within procedures (refer to the Procedures Section later in the Flight Management Section).

ACTIVATING A FLIGHT PLAN LEG

The flight plan leg which is currently being used for navigation guidance is referred to as the 'active leg'. The system automatically sequences from one active leg to the next as defined by the active flight plan. Any leg in the active flight plan successive to the leg currently being flown may be selected to become the new active leg.

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) Push the **FMS** Knob to activate the cursor (not required on 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) Push 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 the active 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 removed and a new one created with the new offset distance.

Figure 5-54 Along Track Offset

Entering an along track offset distance:

1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).
2) 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) Push the **FMS** Knob to deactivate the flashing cursor.

Removing an along track offset distance:

1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).
2) Turn the large **FMS** Knob to highlight the along track offset.
3) Press the **CLR** Key. The 'Remove VNAV along-track waypoint' 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.

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

1) Press the ⊣D▸ Key to display the 'Direct To' Window.
2) Turn the large **FMS** Knob to place the cursor in the altitude field ('VNV' or 'ALT').
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) The cursor is now flashing in the offset distance field.
6) Enter the desired along-track distance.
7) Press the **ENT** Key. 'Activate?' is highlighted.
8) Press the **ENT** Key to activate.

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 flight plan to a selected waypoint:

1) For the active flight plan, press the **FPL** Key.

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

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 and press the **ENT** Key. 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. The name for the new user waypoint is derived from the identifier of the reference waypoint.

PARALLEL TRACK

The Parallel Track 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. 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.

If the parallel track proposed by the offset direction and distance is not allowed by the system, the activation prompt is displayed, but disabled.

The following will inhibit activation of a parallel track:

» Initiating a direct-to, to the selected waypoint.

» If an approach leg is active, the status indicates 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 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 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').

If there are no legs remaining in the flight plan after the given leg, or OBS mode is active. The following will cancel the parallel track:

» Initiating a direct-to, to a waypoint.

» Initiating a hold at the present position.

» If a course change occurs greater than 120° or the parallel tracks overlap as a result of the course change.

» No legs are remaining in the flight plan after the given leg, or OBS mode is active. 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.

NOTE: *Vertical navigation is unavailable while the Parallel Track feature is active.*

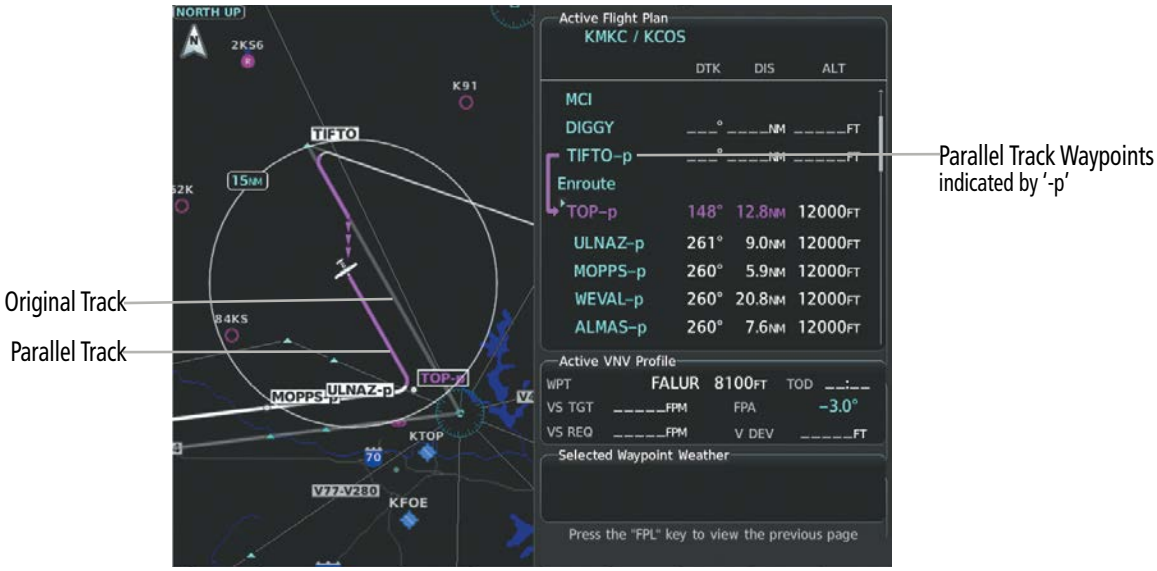


Figure 5-55 Parallel Track Active

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 1-50 nm and press the **ENT** Key. 'Activate Parallel Track?' 'Activate Parallel Track' is highlighted.
5) Press the **ENT** Key to activate parallel track. Push the **FMS** Knob or the **CLR** Key to cancel the parallel track activation.

Cancelling parallel track:

1) Press the **FPL** Key to display the 'FPL – Active Flight Plan' Page (MFD) or the Active '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?''Cancel Parallel Track' highlighted.
3) Press the **ENT** Key.

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.

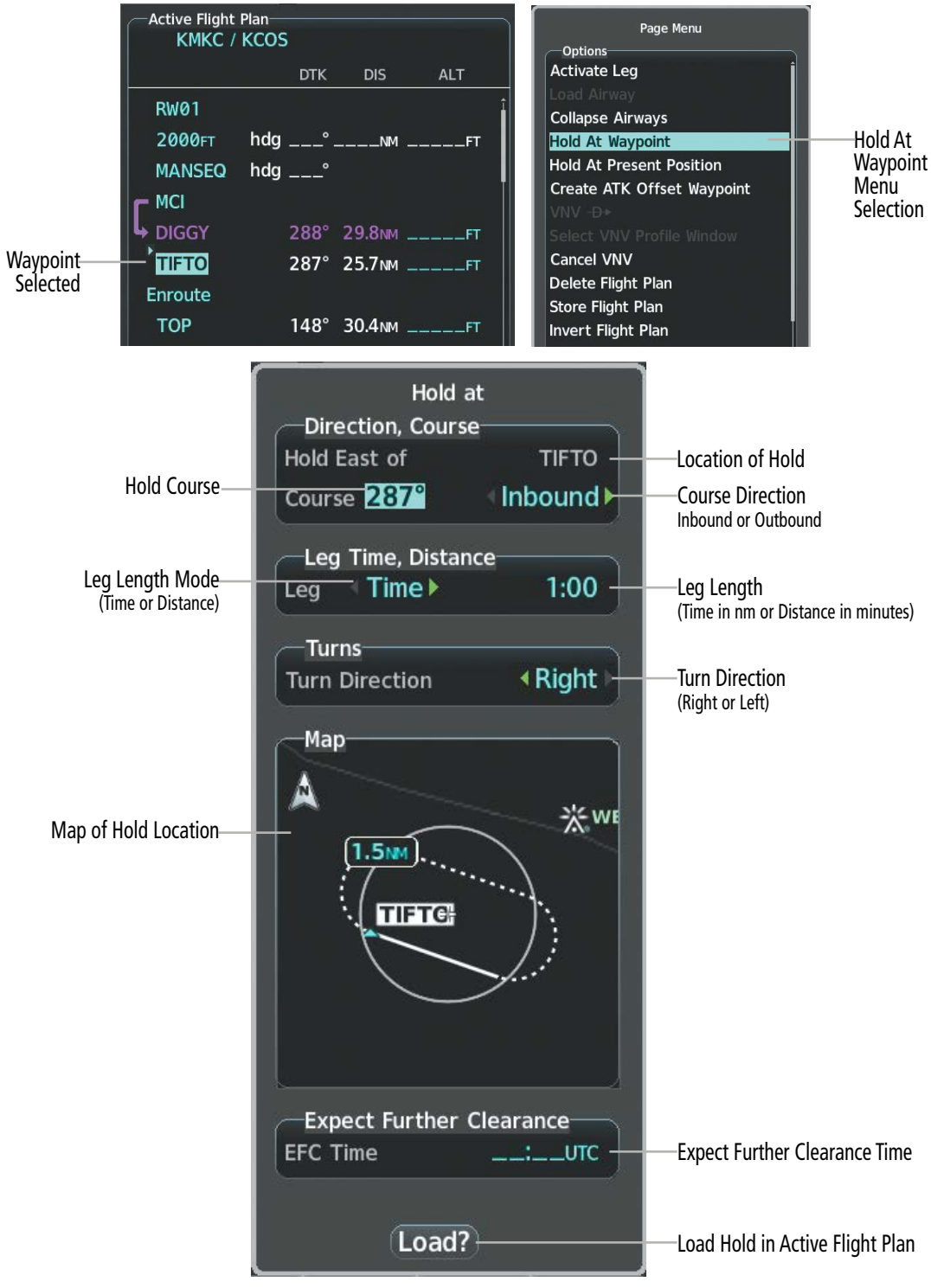


Figure 5-56 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

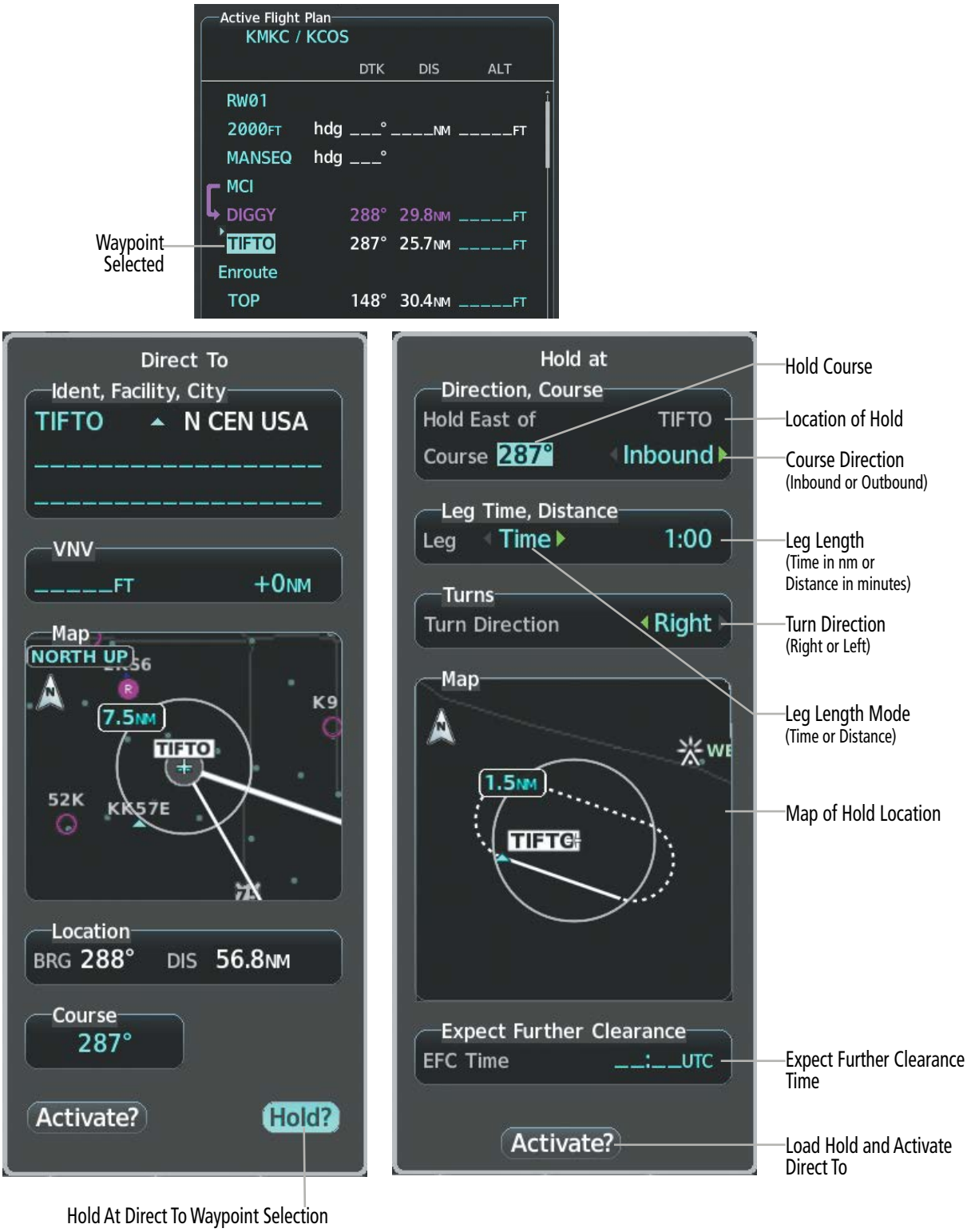


Figure 5-57 Creating a User Defined Holding Pattern at a Direct To Waypoint

Creating a user-defined hold at a flight plan waypoint:

1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) 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, then select 'Hold?' when finished.
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, '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.)

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 from a flight plan:

1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
   b) Turn the **FMS** Knob to highlight the desired flight plan.
   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
2) Turn the large **FMS** Knob to highlight the 'HOLD' in the flight plan.
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 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.
2) Press the **MENU** Key to display the 'Page Menu' Window with the cursor on the 'Cancel Direct-To NAV' selection.
3) Press the **ENT** Key. The holding pattern is removed.

ARRIVAL ALERTS

The 'Arrival Alert' Box on the 'Aux – System Setup 1' Page allows arrival alert messages to be turned On/Off and the alert trigger distance (up to 99.9 units) set for alerts provided 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 on the PFD. 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.

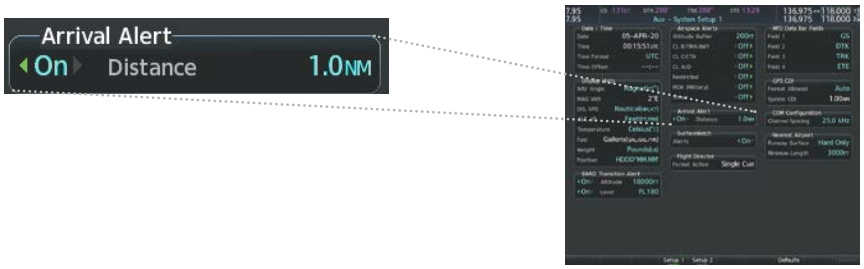


Figure 5-58 Arrival Alert Settings ('Aux - System Setup 1' Page)

Enabling/disabling the Arrival Alert:

1) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page (**Setup 1** Softkey).
2) Push 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 (**Setup 1** Softkey).
2) Push 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.

MANAGING FLIGHT PLANS

The pilot can manage flight plans by importing/exporting via SD Card or the optional Wireless Transceiver (FlightStream 510), and by storing, copying, inverting, and deleting. Also, the comment field (name) of each flight plan can be changed to something that is useful for identification and sorting.

IMPORTING AND EXPORTING FLIGHT PLANS

Flight plans can be transferred to or from a wireless connection via the optional Wireless Transceiver. Wireless transfer of a flight plan to a mobile device is controlled by the wireless device. When a wireless connection is attempting to transfer a flight plan to the system, the pending flight plan may be ignored, previewed, stored, or activated by the pilot.

Figure 5-59 Pending Flight Plan Transfer from a Mobile Device

Ignoring a flight plan transfer from a wireless connection:

1) When a flight plan transfer has been initiated from a wireless connection, a Pending Flight Plan pop-up alert appears in the lower right corner of the MFD, and a Connext annunciation 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.

Previewing a flight plan transfer from a wireless connection:

1) When a flight plan transfer has been initiated from a wireless connection, a Pending Flight Plan pop-up alert appears in the lower right corner of the MFD, and an Connext annunciation 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.

Storing a pending flight plan:

1) Press the **FPL** Key.
2) Turn the small **FMS** Knob to display the 'FPL – Flight Plan Catalog' Page.
3) Push the **FMS** Knob to activate the cursor.
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) Push 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 and turn the small **FMS** Knob to display the 'FPL – Flight Plan Catalog' Page.
2) Push 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 on the MFD.
4) Press the **Activate** Softkey. The 'Activate Flight Plan?' window is displayed.

   Or:

   a) Push 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 'FPL – 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.
2) Turn the small **FMS** Knob to display the 'FPL – Flight Plan Catalog' Page.
3) Push 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 'FPL – 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.
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.

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) Push 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) Push 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.*

Under certain conditions, some messages may appear when a flight plan is imported or exported.

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 Import/Export Results	Description
'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 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 contains invalid waypoint(s)'	One or more imported flight plan waypoints is/are invalid or locked (this may occur if waypoints in the flight plan were removed in a recent database cycle). The imported flight plan can be deleted or it can be viewed and edited to remove invalid waypoints prior to use.
'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 5-15 Flight Plan Import/Export Messages

INVERTING A FLIGHT PLAN

A flight plan may be inverted (reversed) for navigation back to the original departure point.

Inverting the active flight plan:

1) Press the **FPL** Key.
2) Press the **MENU** Key, highlight 'Invert Flight Plan', and press the **ENT** Key.
3) An 'Invert active flight plan?' confirmation window is displayed. Press the **ENT** Key to invert and activate the 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) Push 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.

DELETING THE ACTIVE FLIGHT PLAN

The active flight plan is erased when the system is turned off, overwritten when another flight plan is activated. Additionally, the system allows the pilot to delete the active flight plan. Deleting the active flight plan suspends navigation by the system.

Deleting the active flight plan:

1) Press the **FPL** Key.
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 flight plan. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

STORED FLIGHT PLAN FUNCTIONS

The system can store up to 99 flight plans, numbered 1 through 99. Details about each stored flight plan can be viewed on the 'FPL – Flight Plan Catalog' Page and on the 'FPL – Stored Flight Plan' Page.

A stored flight plan may be viewed or edited. The system also 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.

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).

Lastly, individual or all stored flight plans can be deleted from the system memory.

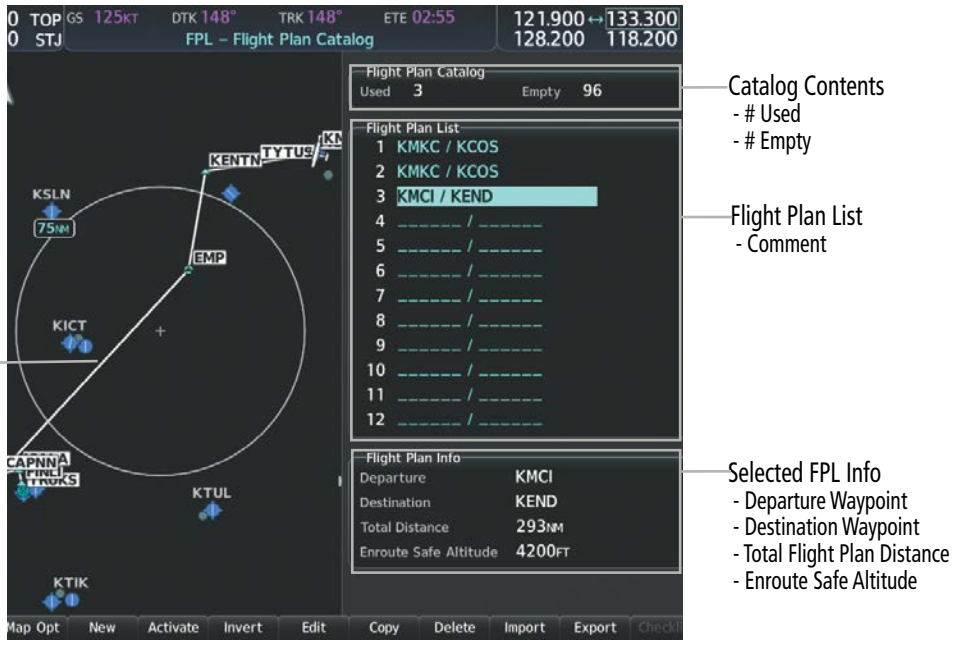


Figure 5-60 'FPL - Flight Plan Catalog' Page

Viewing information about a stored flight plan:

1) Press the **FPL** Key for 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) Push the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired flight plan.
4) The Flight Plan Information is displayed showing 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) Push the **FMS** Knob to exit the 'FPL – Stored Flight Plan' Page.

Storing a flight plan:

1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
2) Press the **Menu** Key. 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.

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) Push the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Open the 'Activate stored flight plan?' window:

   Press the **Activate** Softkey.

   Or:

   Press the **ENT** Key. An 'Activate stored flight plan?' window will appear.

   Or:

   a) Press the **MENU** Key.
   b) Highlight 'Activate Flight Plan' and press the **ENT** Key.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

Copying a stored flight plan to another flight plan memory slot, on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL – Flight Plan Catalog' Page.
2) Push the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Open the 'Copy to flight plan XX?' window:

   Press the **Copy** Softkey.

   Or:

   a) Press the **MENU** Key, highlight 'Copy Flight Plan'.
   b) 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.

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) Push the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Open the 'Delete flight plan XX?' window:

   Press the **Delete** Softkey.

   Or:

   Press the **CLR** Key.

   Or:

   a) Press the **MENU** Key.
   b) Highlight 'Delete Flight Plan', and press the **ENT** Key.
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.

Changing a Flight Plan Comment (Name):

1) Press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).

   Or:

   For a stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

   b) Turn the **FMS** Knob to highlight the desired flight plan.

   c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Select the comment field.

3) Use the **FMS** Knobs to edit the comment.

4) Press the **ENT** Key to accept the changes.

5) Push the **FMS** Knob to deactivate the flashing cursor.

5.6 PROCEDURES

The system can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARs), and non-precision and precision approaches (APPRs) are stored within the database and can be loaded using any Procedures **(PROC)** Key.

NOTE: *The charts database may contain Special Procedures. Prior to flying these procedures, pilots must have specific FAA authorization, training, and possession of the corresponding current, and legitimately-sourced chart (approach plate, etc.). Inclusion of the Special Procedure in the navigation database DOES NOT imply specific FAA authorization to fly the procedure.*

NOTE: *Some airports may have published instrument approach procedures not contained within the navigation database. These procedures may be available for preview from the charts database, but are not available for navigation guidance. See the Additional Features Section for more information on previewing Charts.*

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. Furthermore, only one procedure for each type of procedure (DP, STAR, APPR) can be loaded at a time in a flight plan.

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.

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 5-61 Procedure Leg Identifiers

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 removed 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.

Viewing available procedures at an airport:

1) From the 'WPT – Airport Information' Page (**Info 1** Softkey):

Press the **DP** Softkey. The 'WPT – Departure Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.

Or:

Press the **STAR** Softkey. The 'WPT – Arrival Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.

Or:

Press the **APR** Softkey. The 'WPT – Approach Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.

2) To select another airport, push 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) Repeat Step 5, until desired information has been viewed for the chosen procedure.

7) Press the **Info 1** Softkey to return to the 'WPT - Airport Information' Page.

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.

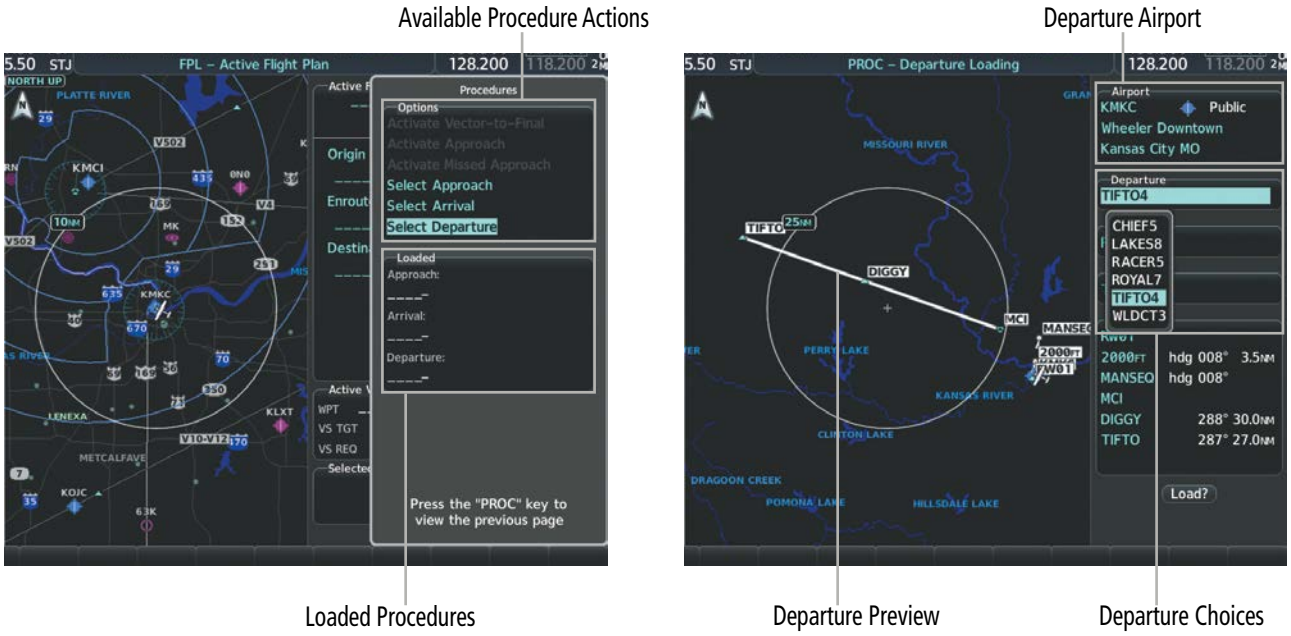


Figure 5-62 Departure Selection

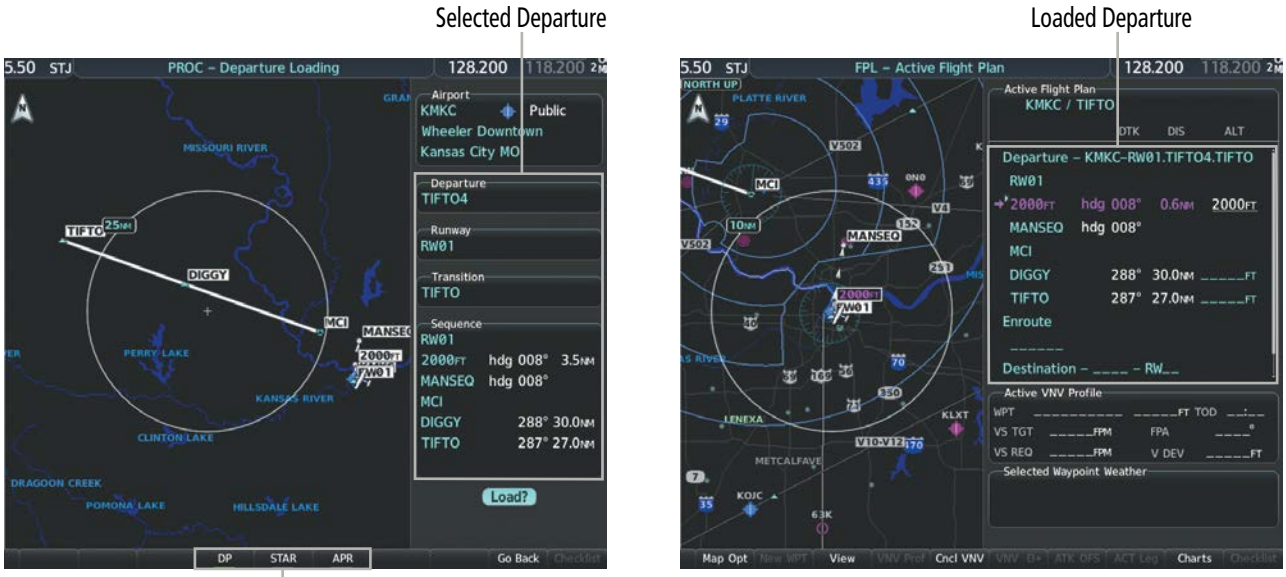


Figure 5-63 Departure Loading

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 'PROC – Departure Loading' Page is displayed.
4) Use the **FMS** Knob to select an airport 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.

Loading a departure into the active flight plan from the 'WPT – Departure Information' Page:

1) From the 'WPT – Airport Information' Page (first page in the WPT group), press the **DP** Softkey. The 'WPT – Departure Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport information' Page.
2) To select another airport, push the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
3) Select a different departure, if desired.
   a) Turn the large **FMS** Knob to place the cursor in the 'Departure' Box. The departure is previewed on the map.
   b) Turn the small **FMS** Knob to view the available departures. Press the **ENT** Key to select the departure. The cursor moves to the 'Runway' Box. The departure is previewed on the map.
   c) Turn the small **FMS** Knob to view the available runways. Press the **ENT** Key to select the runway. The cursor moves to the 'Transition' Box (only if there are available transitions). The departure 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. The departure is previewed on the map.
4) Press the **MENU** Key to display the 'Page Menu' Window.
5) Turn the **FMS** Knob to highlight 'Load Departure'.
6) Press the **ENT** Key to load the departure procedure into the active flight plan.

Loading a departure procedure into a stored flight plan:

1) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the **FMS** Knob to highlight the desired flight plan.
4) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
5) 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.
6) Select a departure. Press the **ENT** Key.
7) Select a runway served by the selected departure (if required). Press the **ENT** Key.
8) Select a transition for the selected departure (if required). Press the **ENT** Key.
9) Press the **ENT** Key to load the selected departure procedure.

Removing a departure procedure from a flight plan:

1) If removing from the active flight plan, press the **FPL** Key for the MFD.

   Or:

   If removing from the stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
   b) Push the **FMS** Knob to activate the cursor.
   c) Turn the **FMS** Knob to highlight the desired flight plan.
   d) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Select the departure for removal:

   a) Press the **MENU** Key, and highlight 'Remove Departure'.
   b) Press the **ENT** Key. A confirmation window is displayed listing the departure procedure.

   Or:

   a) Push the **FMS** Knob to activate the cursor (not required on PFD).
   b) Turn the large **FMS** Knob to highlight the departure header in the flight plan.
   c) Press the **CLR** Key. A confirmation window is displayed listing the departure procedure.

3) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.
4) Push 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.

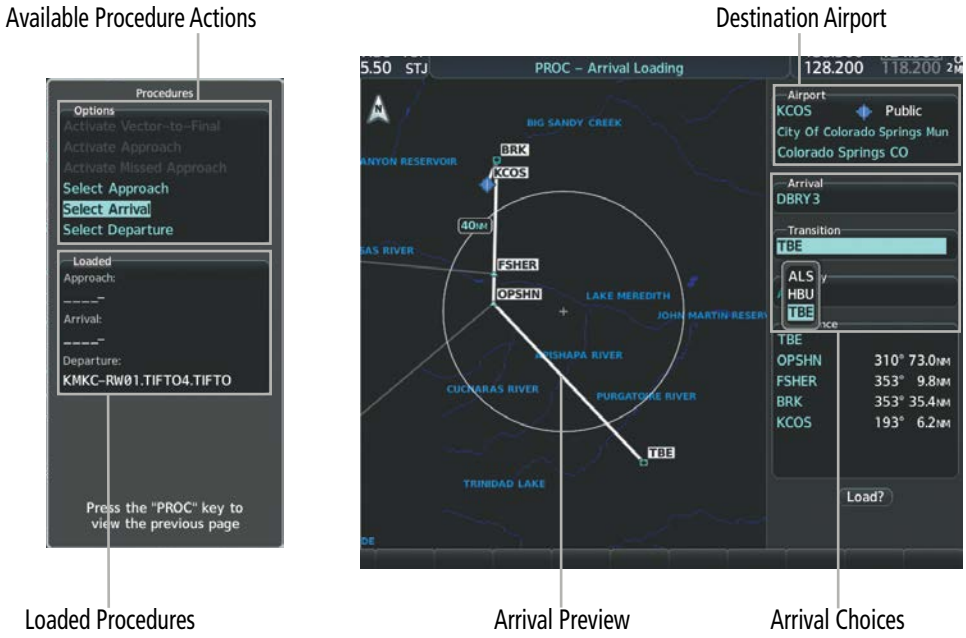


Figure 5-64 Arrival Selection

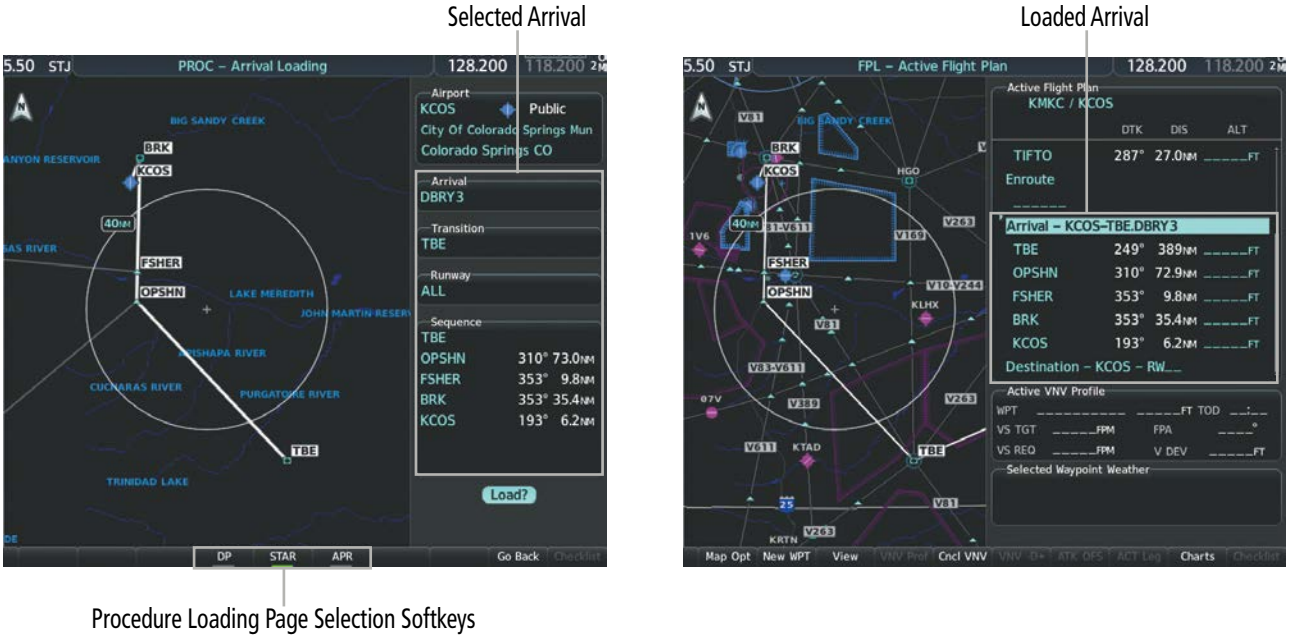


Figure 5-65 Arrival Loading

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 'PROC – Arrival Loading' Page is displayed.
4) Use the **FMS** Knob to select an airport 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

Loading an arrival into the active flight plan from the 'WPT – Arrival Information' Page:

1) From the 'WPT – Airport Information' Page (first page in the WPT group), press the **STAR** Softkey. The 'WPT – Arrival Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.
2) To select another airport, push the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
3) Select a different arrival, if desired.
   a) Turn the large **FMS** Knob to highlight the arrival. The arrival is previewed on the map.
   b) Turn the small **FMS** Knob to view the available arrivals. Press the **ENT** Key to select the arrival. The cursor moves to the 'Transition' Box (only if there are available transitions). The arrival is previewed on the map.
   c) Turn the small **FMS** Knob to view the available transitions. Press the **ENT** Key to select the transition. The cursor moves to the 'Runway' Box. The arrival is previewed on the map.
   d) Turn the small **FMS** Knob to view the available runways. Press the **ENT** Key to select the runway. The cursor moves to the 'Sequence' Box. The arrival is previewed on the map.
4) Press the **MENU** Key to display the Arrival Information 'Page Menu' Window.
5) Turn the **FMS** Knob to highlight 'Load Arrival'.
6) Press the **ENT** Key to load the arrival procedure into the active flight plan.

Loading an arrival procedure into a stored flight plan:

1) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the **FMS** Knob to highlight the desired flight plan.
4) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
5) 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.
6) Select an arrival. Press the **ENT** Key.
7) Select a transition for the selected arrival (if required). Press the **ENT** Key.
8) Select a runway served by the selected arrival (if required). Press the **ENT** Key.
9) Press the **ENT** Key to load the selected arrival procedure.

Removing an arrival procedure from a flight plan:

1) If removing from the active flight plan, press the **FPL** Key for the MFD.

   Or:

   If removing from the stored flight plan:

   a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
   b) Push the **FMS** Knob to activate the cursor.
   c) Turn the **FMS** Knob to highlight the desired flight plan.
   d) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Select the arrival for removal:

   a) Press the **MENU** Key, and highlight 'Remove Arrival'.
   b) Press the **ENT** Key. A confirmation window is displayed listing the arrival procedure.

   Or:

   a) Push the **FMS** Knob to activate the cursor (not required on PFD).
   b) Turn the large **FMS** Knob to highlight the arrival header in the flight plan.
   c) Press the **CLR** Key. A confirmation window is displayed listing the arrival procedure.

3) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.
4) Push the **FMS** Knob to remove the flashing cursor.

APPROACHES

The system can provide navigation guidance for GPS and NAVAID instrument approach procedures. Visual Approach guidance is also available. This section will discuss loading, activating, and removing approaches designated for navigation. For information on changing the navigation source of the CDI, and for information on the display of vertical guidance on the PFD, see the Flight Instruments Section. See the Audio Panel & CNS Section for information on selecting and tuning a NAV receiver.

INSTRUMENT APPROACH

The system 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.

NOTE: *When flying Direct-to the Final Approach Fix (FAF), the system will suspend (SUSP) leg sequencing if the approach intercept angel exceeds 45 degrees.*

NOTE: *When Vectors to Final is selected, the system will display an extended centerline, but guidance is not provided to the Final Approach Course.*

PUBLISHED APPROACHES USING GPS

RNAV/GPS approach procedures require GPS and can be selected for use. When the display shows 'GPS' after a NAVAID prefix (such as `VORGPS 17L'), this indicates the procedure is an Overlay Approach. The procedure may be flown either as a conventional, ground-based approach procedure or may be flown using GPS. When the display shows an approach with '+V', this indicates the system will provide advisory vertical guidance when using GPS to fly the approach.

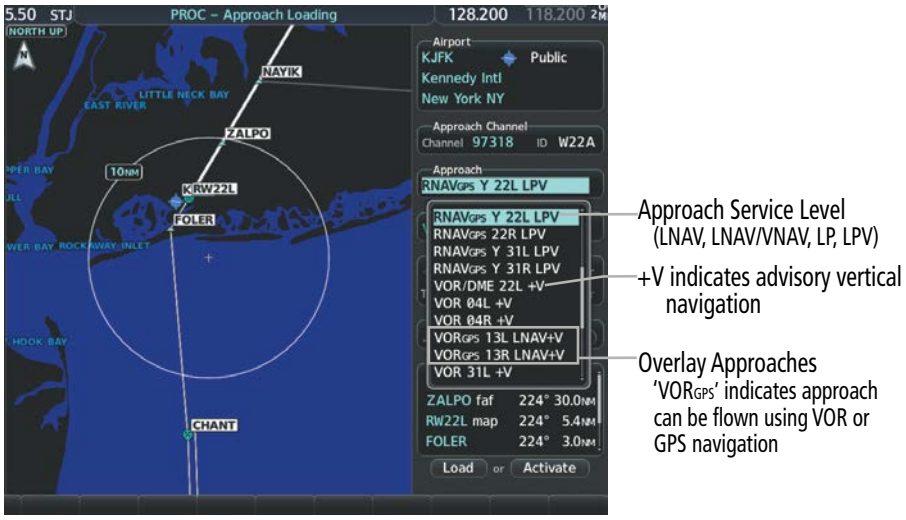


Figure 5-66 Example of Available Approaches with GPS Guidance

The system will allow the applicable level of service for the chosen approach using GPS navigation. See the following table for approach service levels allowed by the system:

HSI Annunciation	Description	Example on HSI
LNAV	Approach to the published MDA	Approach Service Level - LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV
LP		
LNAV+V	Approach with advisory vertical guidance to the published MDA	
LP+V		
L/VNAV	Approach with approved vertical guidance to the published DA	
LPV		

Table 5-16 Approach Service Levels

The system GPS receivers will use Satellite Based Augmentation (SBAS) when available. Some approaches require the use of SBAS for lateral and/or vertical GPS navigation. For information on how lateral and vertical guidance is depicted on the PFD, see the Flight Instruments Section.

Approach Service Level	Lateral Navigation Source	Vertical Navigation Source
LNAV	GPS	N/A
LNAV+V	GPS	GPS (advisory only)
LNAV/VNAV	GPS	GPS*
LP	GPS*	N/A
LP+V	GPS*	GPS* (advisory only)
LPV	GPS*	GPS*

**SBAS required*

Table 5-17 Source of Lateral and Vertical Navigation per Approach Service Level

Loss of SBAS

Due to the high level of precision required by some approach service levels, losing SBAS may require the pilot to acknowledge a downgrade of approach service level, or to abort the approach. See the following table for approach degradation behavior:

NOTE: *Refer to the current, pertinent flight manual for additional information regarding crew responses for loss of SBAS and approach downgrade procedures.*

Approach	SBAS Becomes Unavailable	Description	Action Required	Downgrade
LNAV	Approach phase not specified	SBAS not required. The approach is continued.	None	N/A
LNAV+V	Prior to the FAF	HSI displays amber 'LNAV+V'; VDI displays 'NO GP'. **	None	N/A
	At/after the FAF	HSI displays magenta 'LNAV'; VDI displays 'NO GP'.	None	LNAV*
LNAV/ VNAV	Prior to the FAF	HSI displays amber 'L/VNAV'; VDI displays 'NO GP'. **	None	N/A
	At/after the FAF	HSI displays magenta 'LNAV'; VDI displays 'NO GP'.	None	LNAV*
LP	More than 1 min prior to the FAF	HSI displays amber 'LP'	None	N/A
	Within 1 min prior to the FAF	HSI displays magenta 'LNAV'; CDI is removed. **	Acknowledge message to redisplay CDI with LNAV	LNAV*
	At/after the FAF	CDI is removed **	Abort	N/A
LP+V	More than 1 min prior to the FAF	HSI displays amber 'LP+V'; VDI displays 'NO GP'.	None	N/A
	Within 1 min prior to the FAF	HSI displays magenta 'LNAV'; CDI is removed. VDI displays 'NO GP'. **	Acknowledge message to redisplay CDI with LNAV	LNAV*
	At/after the FAF	CDI is removed; VDI displays 'NO GP'. **	Abort	N/A
LPV	More than 1 min prior to the FAF	HSI displays amber 'LPV'	None	N/A
	Within 1 min prior to the FAF	HSI displays magenta 'LNAV'; VDI displays 'NO GP'.	None	LNAV*
	At/after the FAF			

**If there are no LNAV minimums available for the approach, abort.*
***System message is generated.*

Table 5-18 Approach Degradation Behavior

Loss of GPS

When GPS sensors are no longer being utilized for position fixing while on a GPS approach, the approach must be aborted. When a loss of GPS occurs during a GPS approach, the HSI will no longer display the CDI deviation bar, the approach indication will display an amber 'LNAV', and the system message 'ABORT APR' will be displayed. Once the pilot acknowledges the message, the HSI flight phase will change and the CDI deviation bar will reappear. Reference the Abnormal Operations in later in this section for more information on loss of GPS.

VISUAL APPROACH

The system provides a visual approach feature. Unlike instrument approaches, visual approaches are not defined in the navigation database and do not follow a precise prescribed path. Instead, the system calculates the lateral and vertical path for the chosen runway and creates visual approach waypoints based on runway position and course as specified in the navigation database.

NOTE: *The charts database may contain Charted Visual Flight Procedures (CVFPs) for certain airports. CVFPs follow a precise prescribed path and are classified as Instrument Approach Procedures (IAPs). See the Additional Features Section for more information on Charts.*

Each visual approach will have two transitions, the straight in transition (STRAIGHT) and the Vectors-to-Final transition (VECTORS). The visual approach waypoints (fixes) consist of the initial fix (STRGHT), the final approach fix (FINAL), and the missed approach point (RWxx).

For visual approaches, the pilot is responsible for avoiding terrain, obstacles and traffic. Therefore, when a visual approach is selected, the message "Obstacle clearance is not provided for visual approaches" is displayed on the approach selection page and must be acknowledged before the visual approach is loaded into the flight plan.

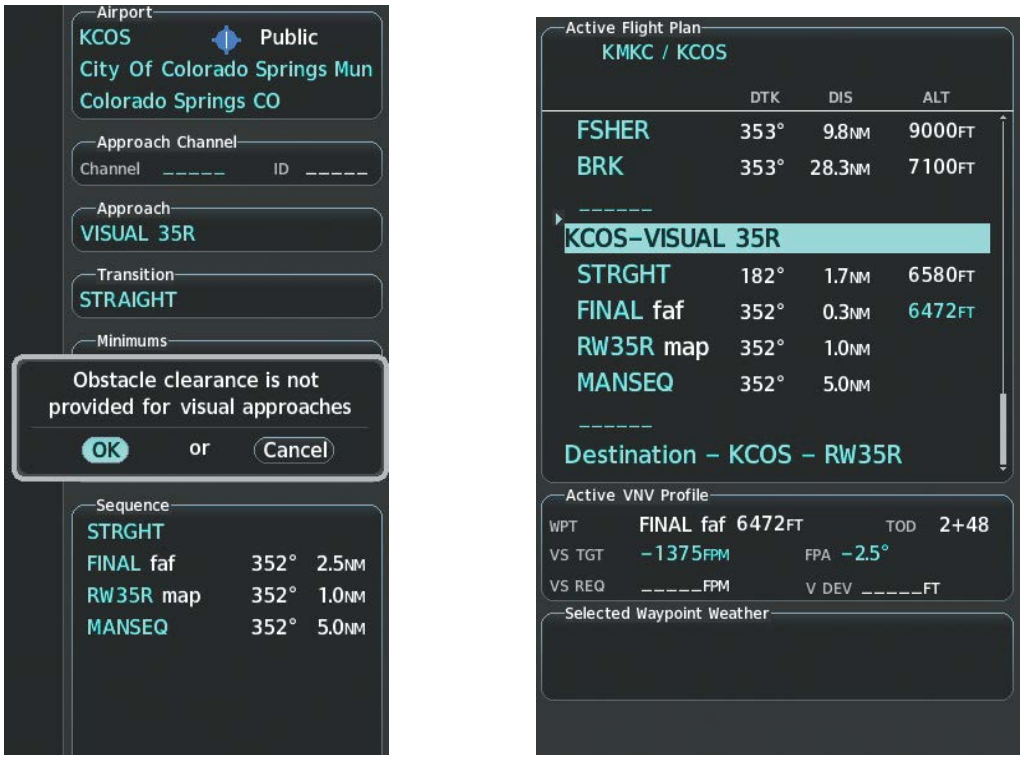


Figure 5-67 Loading Visual Approach

LOADING AND ACTIVATING AN APPROACH

Whenever an approach is selected, the choice to either 'Load?' or 'Activate?' is given. 'Load' 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. 'Activate' also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in 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.

NOTE: *The popup message, 'NOT APPROVED FOR GPS' will be generated when selecting a NAVAID exclusive approach. This message is intended for localizer-based approaches. Refer to the current flight manual and applicable regulations for information on approach navigation requirements.*

NOTE: *If there is no arrival procedure in the active flight plan, loading an approach to a flight plan in which the destination airport has already been entered, will result in the previously entered destination airport waypoint followed by the newly loaded approach.*

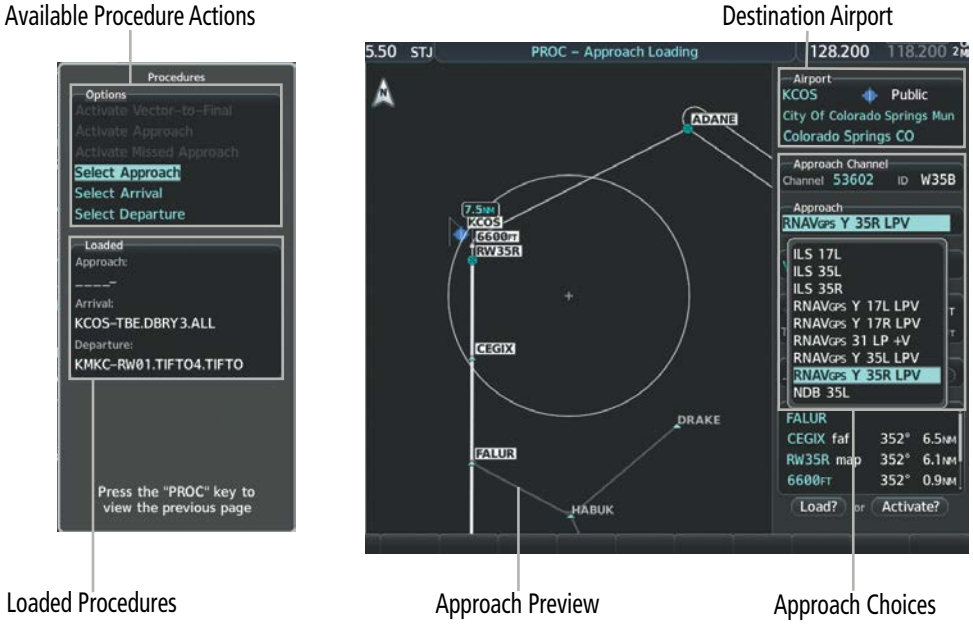


Figure 5-68 Approach Selection

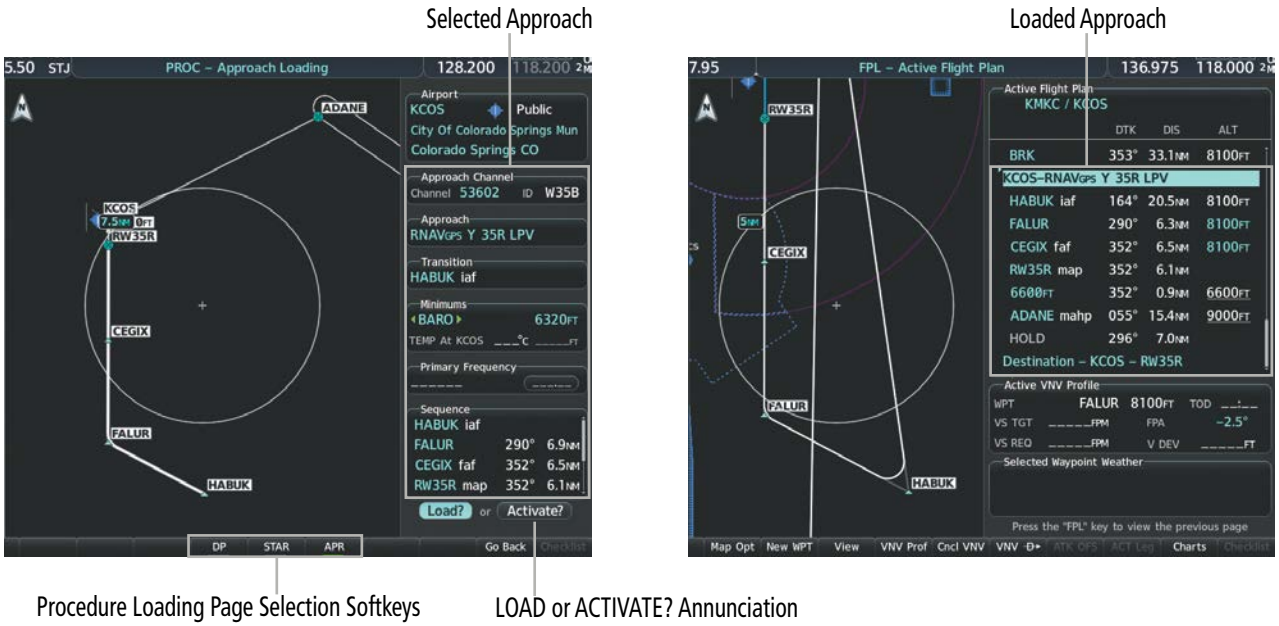


Figure 5-69 Approach Loading

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 'PROC – Approach Loading' Page is displayed.
3) 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.
4) Select a transition (if required) and press the **ENT** Key.
5) Enter minimums:

   To skip setting minimums, press the **ENT** Key.

   Or:

   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 (as reported at the destination airport), and 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.

When selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the ENT Key.

If a visual approach was selected, the message 'Obstacle clearance is not provided for visual approaches' is displayed. With 'OK' highlighted, press the **ENT** Key.

Loading an approach into the active flight plan from the 'NRST – Nearest Airport' Page:

1) Select the 'NRST – Nearest Airports' Page.
2) Push 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) Enter Minimums:

   To skip setting minimums, press the **ENT** Key. The 'Load?' Field is highlighted.

   Or:

   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.

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.

   When selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the ENT Key.

   If a visual approach was selected, the message 'Obstacle clearance is not provided for visual approaches' is displayed. With 'OK' highlighted, press the **ENT** Key.

Loading an approach procedure into a stored flight plan:

1) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
2) Turn the **FMS** Knob to 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 'FPL – Stored Flight Plan' Page is displayed.
4) 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.

5) 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.

6) Select a transition for the selected approach. Press the **ENT** Key.

7) Press the **ENT** Key to load the selected approach procedure.

   If a visual approach was selected, the message 'Obstacle clearance is not provided for visual approaches' is displayed. With 'OK' highlighted, press the **ENT** Key.

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.

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. The 'Page Menu' Window is displayed with 'Load & Activate Approach' highlighted.

2) Press the **ENT** Key.

   When selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the ENT Key.

   Or:

1) Press the **PROC** Key.

2) Use the large **FMS** Knob to highlight 'Select Approach' and press the **ENT** Key.

3) From the 'PROC – Approach Loading' Page, press the **MENU** Key for the MFD. The 'Page Menu' Window is displayed with 'Load & Activate Approach' highlighted.

4) Press the **ENT** Key.

   When selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the ENT Key.

If a visual approach was selected, the message 'Obstacle clearance is not provided for visual approaches' is displayed. With 'OK' highlighted, press the **ENT** Key.

REMOVING AN APPROACH

Removing an approach from the active or stored flight plan:

1) Open the appropriate flight plan page:

For the active flight plan, press the **FPL** Key, or turn the **FMS** Knobs to select the 'FPL – Active Flight Plan' Page.

Or:

For a stored flight plan:

a) Turn the **FMS** Knobs to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.

b) Turn the **FMS** Knob to highlight the desired flight plan.

c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

2) Remove the approach:

a) Press the **MENU** Key, and highlight 'Remove Approach'.

b) Press the **ENT** Key. A confirmation window is displayed listing the approach procedure.

c) With 'OK' highlighted, press the **ENT** Key.

Or:

a) Push the **FMS** Knob to activate the cursor if not already activated.

b) Turn the large **FMS** Knob to highlight the approach header in the active flight plan.

c) Press the **CLR** Key. A confirmation window is displayed listing the approach procedure.

d) With 'OK' highlighted, press the **ENT** Key.

e) Push the **FMS** Knob to deactivate the flashing cursor.

MISSED APPROACH

The system is capable of providing guidance for the approach as well as the missed approach. Once the missed approach is activated, MAPR will be displayed on the HSI next to the CDI. If the missed approach is activated prior to the Missed Approach Point (MAP), waypoint sequencing will continue along the approach to the missed approach. If the missed approach is not activated prior to the MAP, the system will enter SUSP Mode once the aircraft crosses the MAP until the missed approach is activated or SUSP Mode is disabled. See the Flight Instruments, Course Deviation Indicator section for more information on SUSP Mode.

See the Using Map Displays, Map Symbols discussion previously given in this section for information on displaying the missed approach preview on map displays.

In the missed approach procedure shown in the following figure, the altitude immediately following the MAP may or may not be part of the published procedure. Regardless, it represents a Course to Altitude (CA) leg along the runway centerline. The altitude shown must be achieved before turning safely toward the MAHP. If the aircraft altitude is below the specified altitude after crossing the MAP, a direct-to is established to provide a course on runway heading until the altitude is reached. After reaching the altitude, a direct-to is established to the next published waypoint. If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix to begin the missed approach procedure.

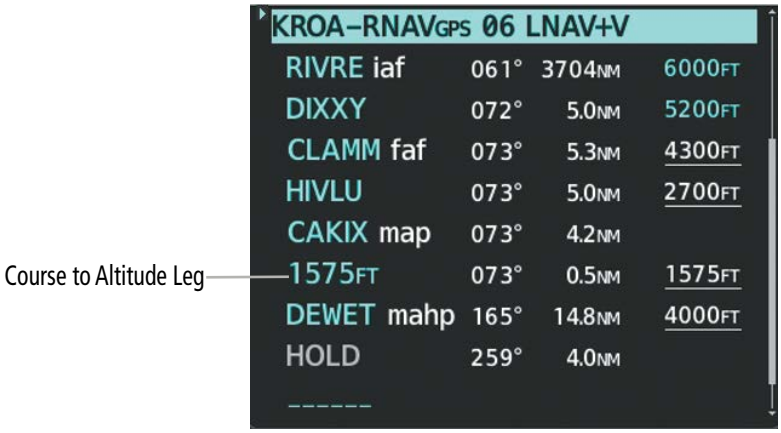


Figure 5-70 Course to Altitude

Activating a missed approach in the active flight plan:

Press the Go-Around Button.

Or:

Fly past the MAP, and press the **SUSP** Softkey on the PFD.

Or:

1) Press the **PROC** Key.
2) Turn the **FMS** Knob to highlight 'Activate Missed Approach'. (This option is selectable after the leg to the FAF becomes active and GPS is the active NAV source.)
3) Press the **ENT** Key.

TRANSITION TO APPROACH FUNCTION

When utilizing Baro-VNAV to descend to the FAF on an approach, the system utilizes the Transition to Approach (TTA) function to calculate and adjust the descent path between the FAF and the waypoint preceding the FAF so that a seamless capture of and transition to approach vertical guidance occurs. The time and location of the Bottom of Descent (BOD) may change once any TTA adjustments are made.

TEMPERATURE COMPENSATED ALTITUDE

Temperature Compensation for approach altitudes

If desired, the system can calculate temperature compensation for waypoint crossing altitudes loaded as part of an approach procedure. The pilot must manually enable temperature compensation and then enter the destination airport temperature. The system adjusts the altitudes accordingly, and the snowflake icon (❄) is displayed next to those altitudes.

NOTE: *Manually enabling temperature compensation for approach altitudes inhibits the Transition to Approach (TTA) function.*

Manually setting temperature compensation for approach waypoint altitudes:

1) From the 'FPL – 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 with the temperature highlighted.
4) Use the small **FMS** Knob to change the 'Temperature at <airport>' Field. The compensated altitude is computed as the temperature is selected.
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.

Cancelling temperature compensation setting for approach waypoint altitudes:

1) From the 'FPL – 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.

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.*

NOTE: *Regardless of when the destination temperature setting is entered (when enabling temperature compensation for approach waypoint altitudes, or when enabling temperature compensation for approach minimums), the system will use the same temperature setting for all temperature compensation calculations.*

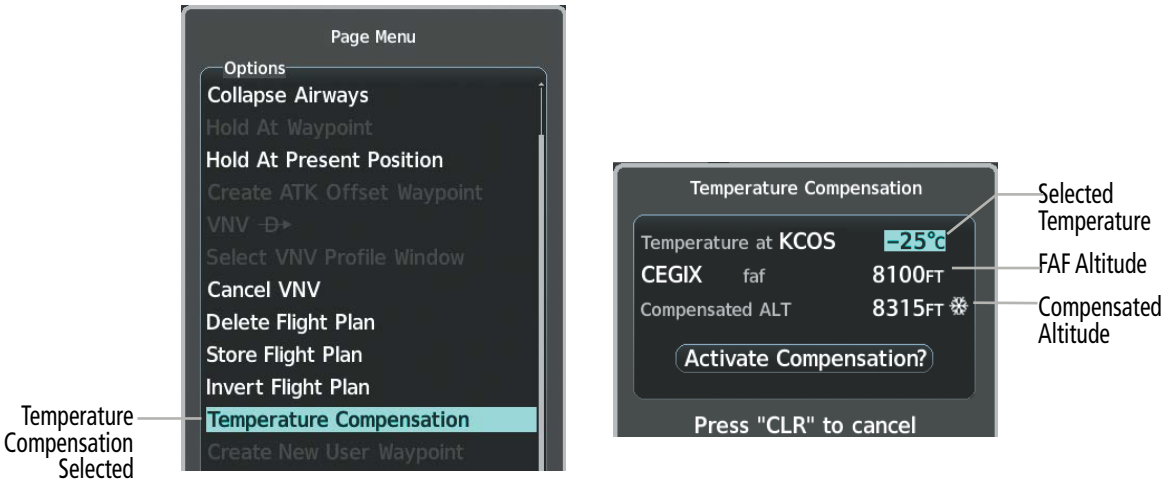


Figure 5-71 Manually Setting Temperature Compensation

Figure 5-72 Temperature Compensation set for approach loaded altitudes

Temperature Compensation for Approach Minimums

A temperature compensated minimum descent altitude can be entered for the approach. Once this is entered, the altitude is also displayed on the PFD.

Entering a temperature compensated minimum into an approach:

1) From the 'FPL – Active Flight Plan' Page, press the **PROC** Key. The 'Procedures' Window is displayed.
2) If necessary, turn the large **FMS** Knob to highlight 'Select Approach'. Press the **ENT** Key.
3) If necessary, use the **FMS** Knob and the **ENT** Key to select the desired airport, approach, and transition.
4) Use the **FMS** Knob to place the flashing cursor in the 'Minimums' Box. Turn the small **FMS** Knob to select 'TEMP COMP'. Press the **ENT** Key.
5) Turn the small **FMS** Knob to enter the minimums altitude. Press the **ENT** Key. The cursor is placed in the 'TEMP AT <destination airport>' Field.
6) Turn the small **FMS** Knob to enter the temperature at the destination. Press the **ENT** Key.
7) Press the **ENT** Key with either 'Load?' or 'Activate?' highlighted. The approach is added to the active flight plan, and the temperature compensated minimums are displayed on the PFD.

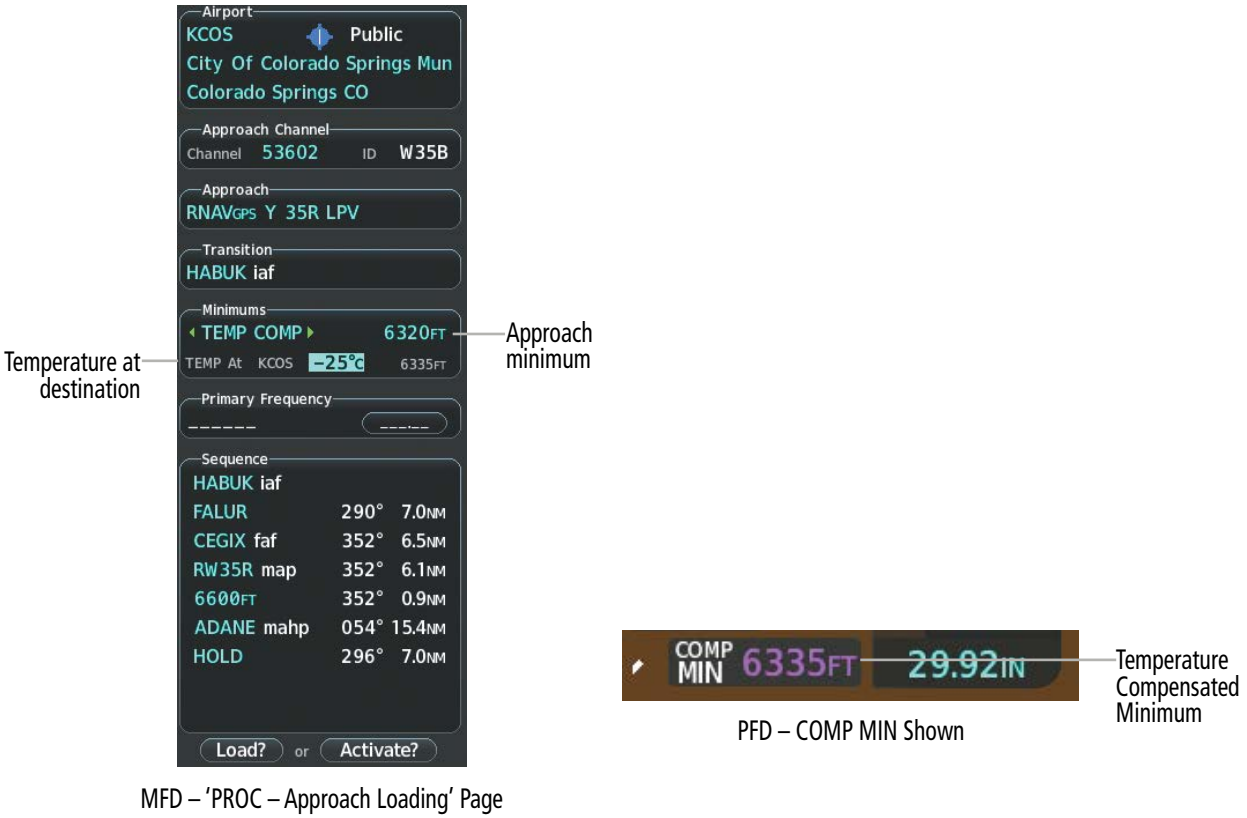


Figure 5-73 Entering Temp Comp Minimums for an Approach

5.7 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. All of the input of data needed for calculation and viewing of the statistics is displayed on the 'Aux – Trip Planning' Page.

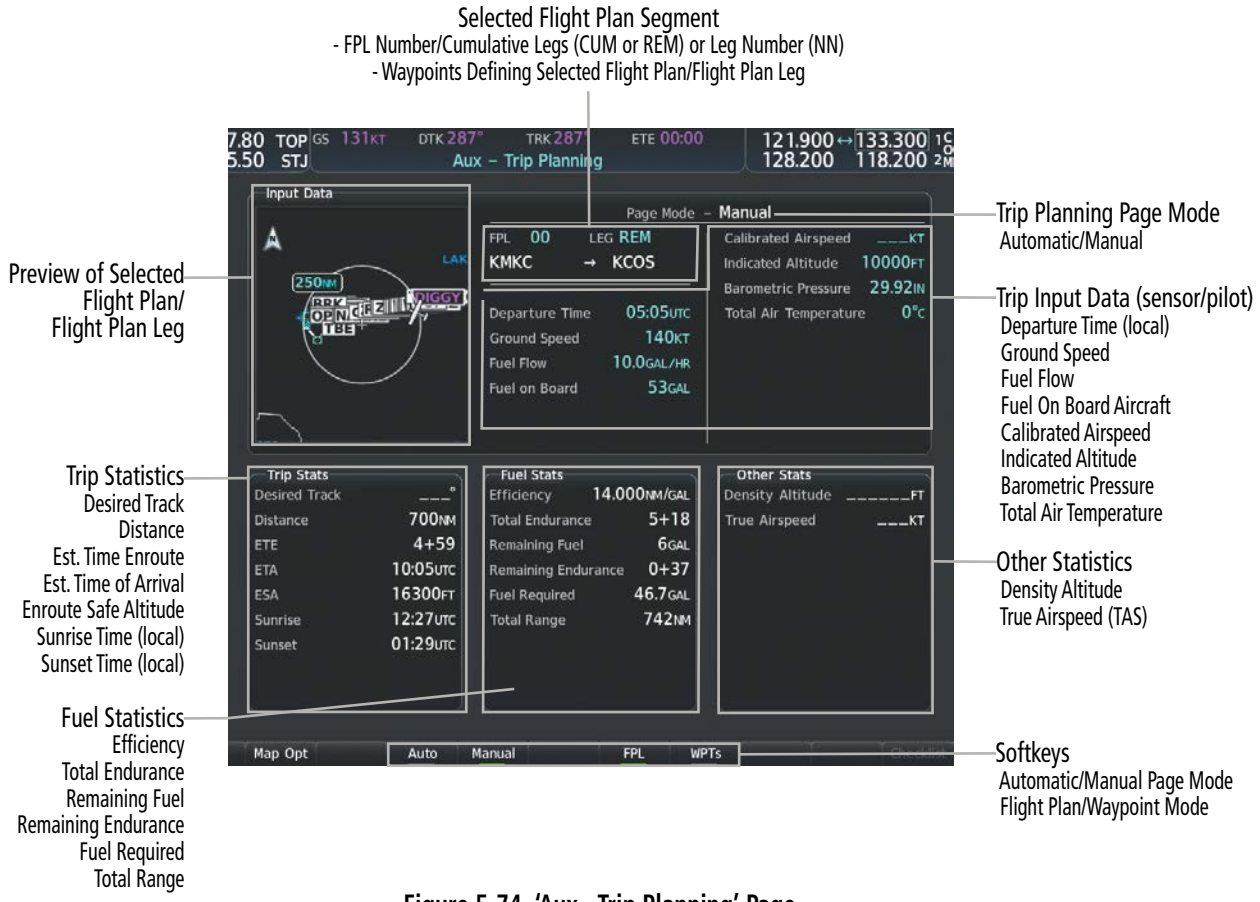


Figure 5-74 'Aux - Trip Planning' Page

The trip planning calculations for the current flight plan are based on fuel weight and sensor inputs (automatic page mode) or 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 (01-99), 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 (01-99) and a specific leg 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 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 on Board 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 Remaining Endurance and subtracting the ETE 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 Remaining 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). 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.

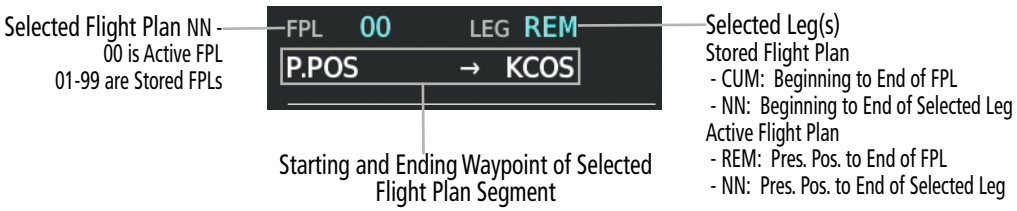


Figure 5-75 Trip Planning - Flight Plan Mode

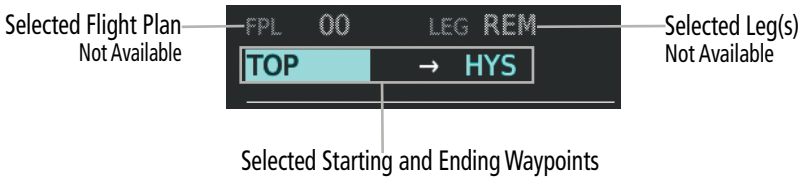


Figure 5-76 Trip Planning - Waypoint Mode

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, push 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' Window '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.

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' Window, and press the **ENT** Key. The cursor may now be positioned in any field within the input data box.
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.

5.8 ABNORMAL OPERATION

DEAD RECKONING

This section discusses the Dead Reckoning mode of operation and the subsequent indications.

NOTE: *Dead Reckoning Mode only functions in the Enroute or Oceanic 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.*

The system will revert to Dead Reckoning (DR) Mode if the system is no longer using GPS for position fixing. 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.

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" displayed in amber on the HSI below and to the left of the aircraft symbol, and on top of the aircraft symbol on map displays. The CDI deviation bar is displayed in amber, but is removed from the display after 20 minutes in DR mode. The autopilot will remain coupled in DR mode as long as the lateral deviation guidance 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 data that is dependent upon GPS is displayed as amber text to denote degraded navigation source information. The accuracy of all bearing and distance information on nearest pages (airports, airspaces, and waypoints) and waypoint information pages is questionable, and is displayed in amber. If the VSD Inset is enabled, 'VSD Not Available' will be displayed. Airspace alerts continue to function, but with degraded accuracy. Also, while the system is in DR mode, optional SVT and terrain alerting functions are disabled.

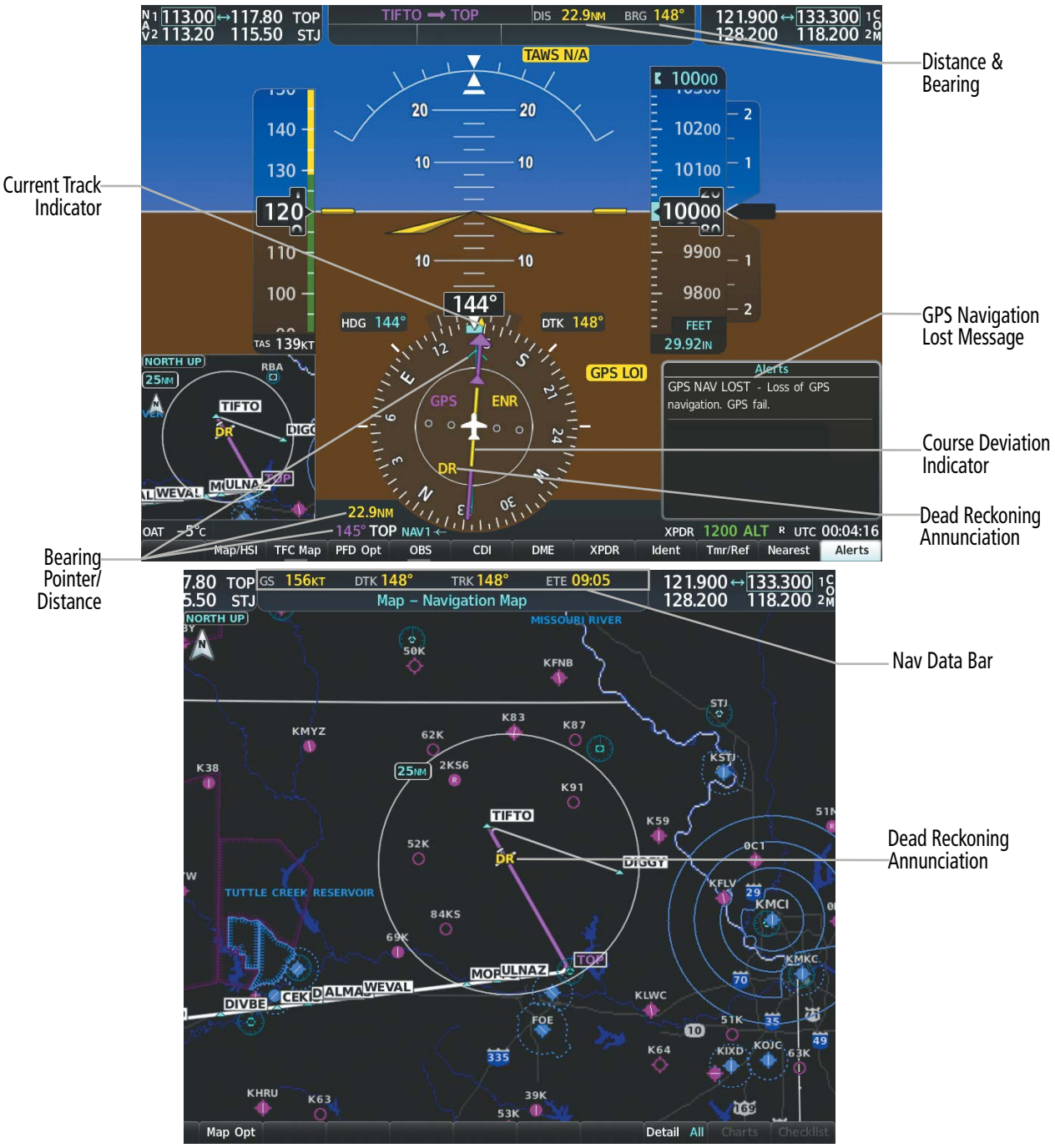


Figure 5-77 Dead Reckoning Mode - GPS Derived Data Shown in Amber

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 (FIS-B) (Optional)
  - L-3 WX-500 Stormscope® Lightning Detection System
- **Terrain Avoidance**
  - Terrain Proximity
  - Terrain-SVT (included with Garmin SVT option)
  - Terrain Awareness and Warning System Class-B (TAWS-B)
- **Traffic**
  - Traffic Information Service (TIS)
  - Traffic Advisory System (TAS) Traffic (Standard)
  - 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 and 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. Differences in performance between the GDL 69A and 69A SXM data link receiver models, where relevant, are discussed where applicable in this section.

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. A separate Audio Radio ID, if present, 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 XM Radio Page in the Auxiliary Page Group.
2) If necessary, press the **Info** Softkey to display the 'Aux - XM Information' Page.
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) Once a SiriusXM Weather account has been established, select the XM Radio Page in the Auxiliary Page Group.
2) If necessary, press the **Info** Softkey to display the 'Aux - XM Information' Page.
3) View the list of supported Weather Products. A white 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 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 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	Product Symbol	Expiration Time (Minutes)
Next-generation Radar (NEXRAD)		30
Cloud Tops		60
Echo Tops		30
SiriusXM Lightning		30
Storm Cell Movement		30
SIGMETs		60
AIRMETs		60
METARs		90
City Forecast		90
Surface Analysis		60
Freezing Levels		120
Winds Aloft		90
County Warnings		60
Cyclone (Hurricane) Warnings		60
Icing Potential (CIP and SLD)		90
Pilot Weather Report (PIREPs)		90
Air Report (AIREPs)		90
Turbulence		180
No Radar Coverage	No product symbol	30
Temporary Flight Restrictions (TFRs)		60
Terminal Aerodrome Reports (TAFs)	No product symbol	60

Table 6-1 SiriusXM Weather Product Symbols and Data Timing

FIS-B Weather Product	Product Symbol	Expiration Time (Minutes)
NEXRAD Composite (US)		30
NEXRAD Composite (Regional)		30
METARs		90
Pilot Weather Report (PIREP)		90
Winds Aloft		90
SIGMETs/AIRMETs		60
No Radar Coverage	No product symbol	30
Terminal Aerodrome Forecast (TAF)	No product symbol	60
Temporary Flight Restriction (TFR)		60

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 'Map - Weather Data Link (XM/FIS-B)' 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").

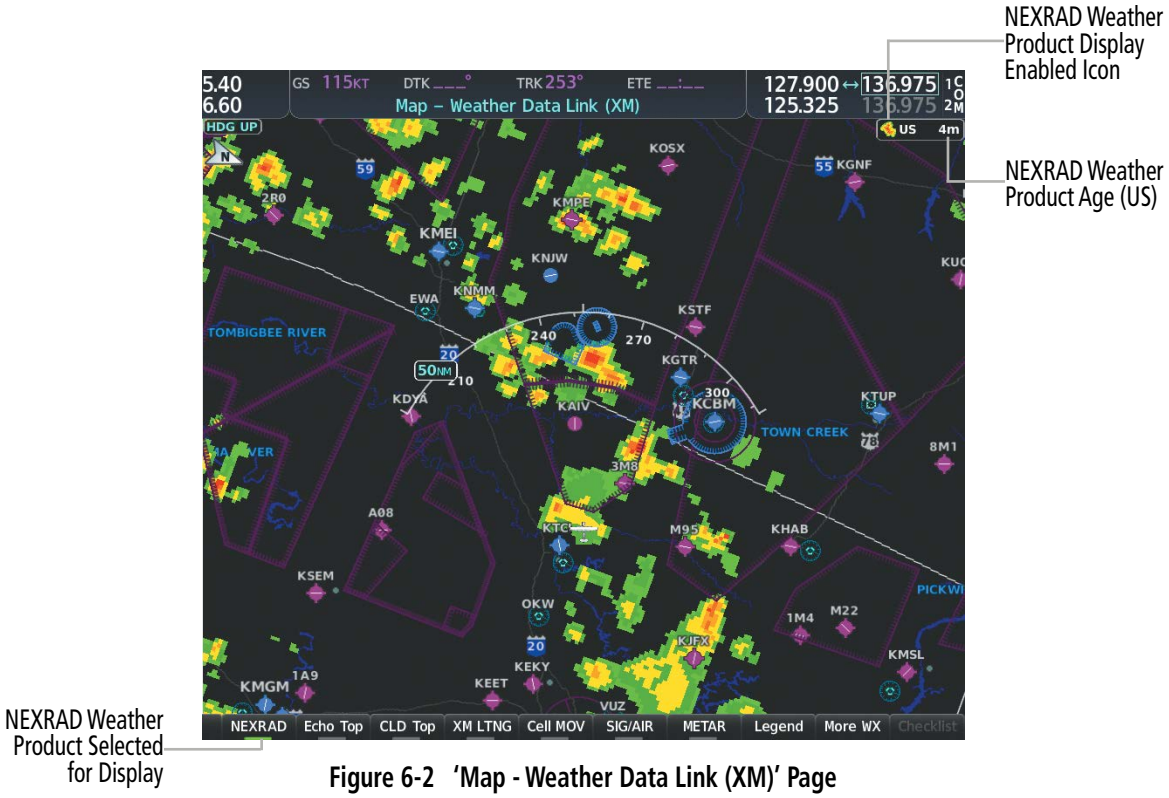


Figure 6-2 'Map - Weather Data Link (XM)' Page

Viewing the 'Map - Weather Data Link (XM)' 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 'Map - 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.

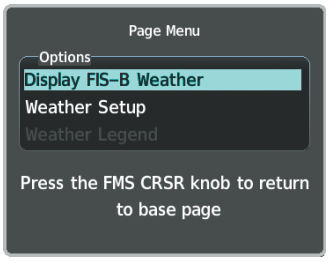


Figure 6-3 Changing the Data Link Weather Source

The system presents the softkeys for the selected source on the 'Map - Weather Data Link' Page, and for map overlays used throughout the system. The following figures show the softkeys for the 'Map - Weather Data Link' based on the selected source.

'MAP - WEATHER DATA LINK (XM)' PAGE SOFTKEYS

NOTE: Only softkeys pertaining to data link weather features are 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 42,0000 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.

Level 1	Level 2	Level 3	Description
		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.
	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.

'MAP - 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.
Legend			Enables/disables the FIS-B Weather Legends Window. Softkey available for selection when at least one FIS-B Weather product is enabled.
More WX			Displays second-level FIS-B 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 1,000 feet to 53,0000 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 FIS-B Weather Legends Window. Softkey available for selection when at least one FIS-B 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 'Map - Weather Data Link (XM)' can display a legend for each enabled weather product.

Viewing legends for displayed weather products on the 'Map - Weather Data Link (XM)':

1) Select the 'Map - Weather Data Link (XM)'.
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 'Map - Weather Data Link (XM)':

- 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.

METAR flag selected with Map Pointer

Additional Information on Weather Feature Selected with Map Pointer

Figure 6-4 Panning on the 'Map - 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 'Map - Weather Data Link (XM)' 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 'Map - Weather Data Link (XM)'

The 'Map - Weather Data Link (XM)' 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 'Map - Weather Data Link (XM)':

1) Select the 'Map - Weather Data Link (XM)'.
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.
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 'Map - Weather Data Link (XM)' Page with the changed settings.

NOTE: *'Product Group 2' is only applicable to SiriusXM.*

Restoring default 'Map - Weather Data Link (XM)' settings:

1) Select the 'Map - Weather Data Link (XM)'.
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	'Map - Navigation Map' Page	'Map - Weather Data Link (XM)'	'WPT - Weather Information' Page	'Aux - Trip Planning' Page	'Aux - Video' 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		+[1]	+					
County Warnings			+					
Cyclone Warnings			+					
Icing Potential			+					
PIREPs			+	+				
AIREPs			+	+				
Turbulence (TURB)			+					
No Radar Coverage	+	+	+		+	+	+	+
TFRs	+	+	+	+	+	+	+	+
TAFs				+				

[1] *Winds Aloft data is available inside the VSD when VSD is enabled on the 'Map - Navigation Map' Page.*

Table 6-3 Weather Product Display Maps

Displaying Data Link Weather Products on the 'Map - 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 'Map - 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 'Map - 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 'Map - 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 **Layout** Softkey.
3) 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 'Map - Navigation Map' Page and the 'Map - Weather Data Link (XM)' 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: *Datalink 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.

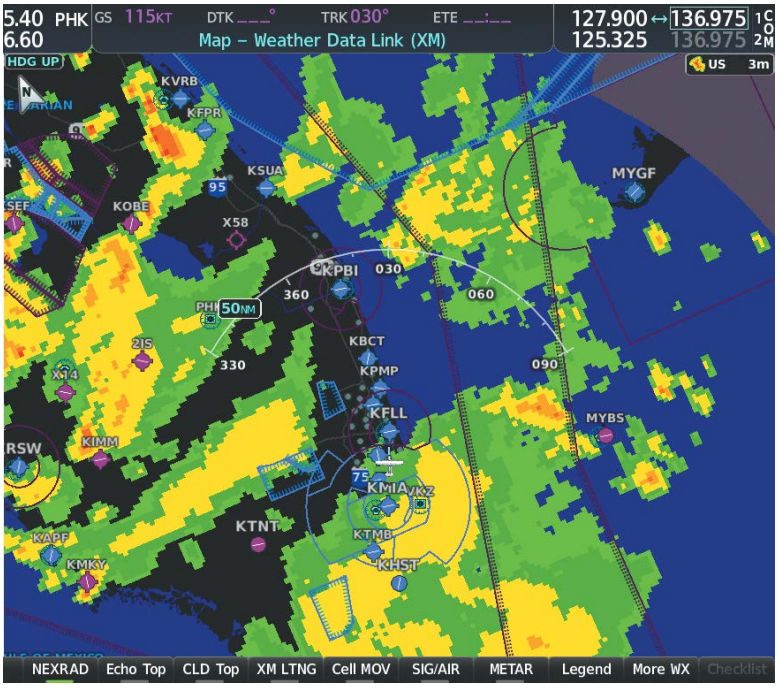


Figure 6-5 NEXRAD Weather Product on the 'Map - Weather Data Link (XM)' Page

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 'Map - 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 'Map - 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 pilot can select either the United States or Canada region for the desired NEXRAD coverage area on the 'Map - Weather Data Link (XM)' Page. NEXRAD information is shown for the selected region, while a gray shade of purple is shown for the region which is not selected.

Selecting the NEXRAD Coverage Region on the 'Map - 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', then press the **ENT** Key.
5) To remove the menu, push the **FMS** Knob or the **CLR** Key.

The NEXRAD weather product age display indicates either 'US' or 'CN' for the selected coverage region.

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.

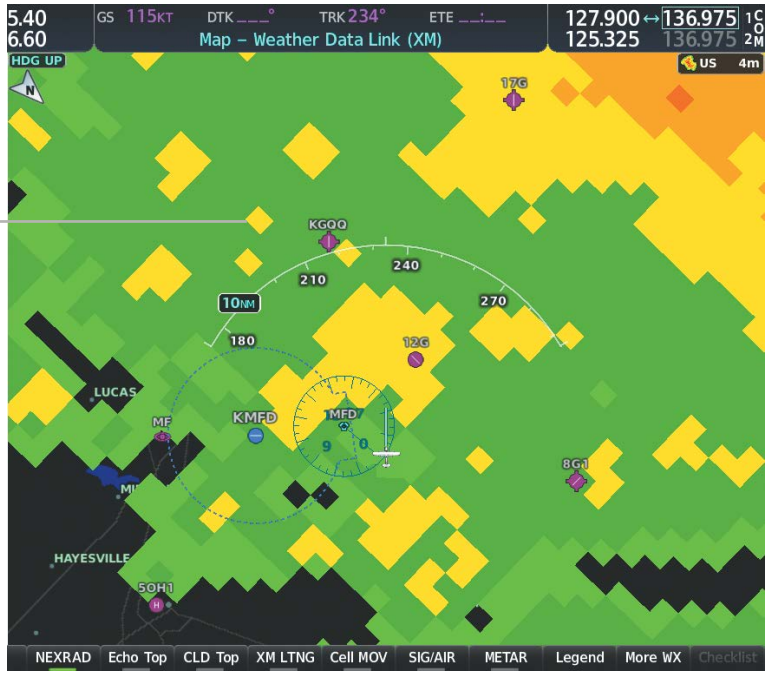


Figure 6-7 NEXRAD Weather Product with 30 NM Map Range on the 'Map - Weather Data Link (XM)' Page

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (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.

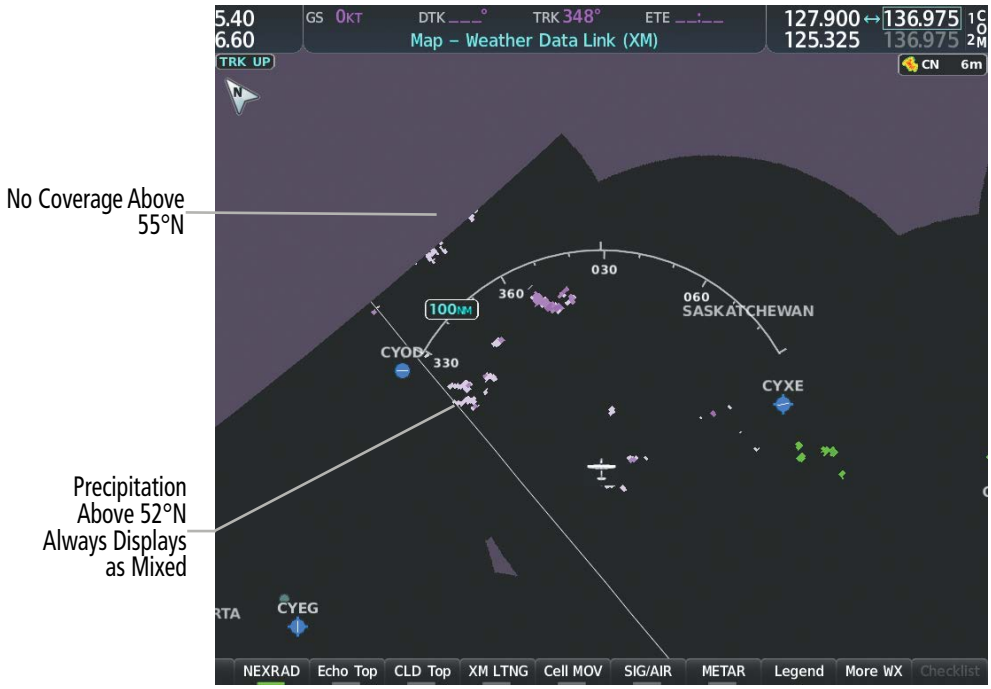


Figure 6-8 NEXRAD Weather Product - Canada on the 'Map - Weather Data Link (XM)' Page

NEXRAD (FIS-B)

NOTE: *The NEXRAD weather product cannot be displayed at the same time as relative terrain.*

NOTE: *Pilots are encouraged to check additional NOTAM sources to supplement FIS-B NOTAMs. NOTAMs older than 30 minutes will not be displayed by FIS-B. For additional information refer to InFO 18008 and AC 00-63.*

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 'Map - Weather Data Link (FIS-B)' Page:

1) Select the 'Map - Weather Data Link (FIS-B)' Page.
2) Select the **NEXRAD** Softkey. Each selection cycles though 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.
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.

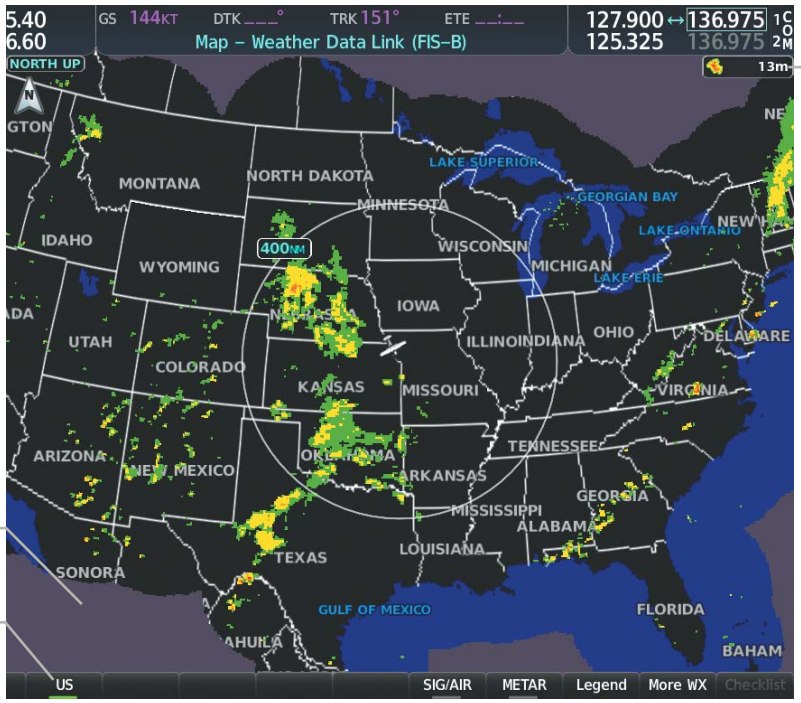


Figure 6-10 Continental US (CONUS) NEXRAD Weather Product on the 'Weather Data Link (FIS-B)' Page

NOTE: *When both NEXRAD options are enabled on the 'Map - Weather Data Link (FIS-B)' Page menu, a combined version is displayed.*

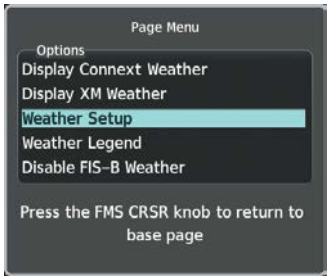


Figure 6-11 Weather Data Link (FIS-B) Page Menu

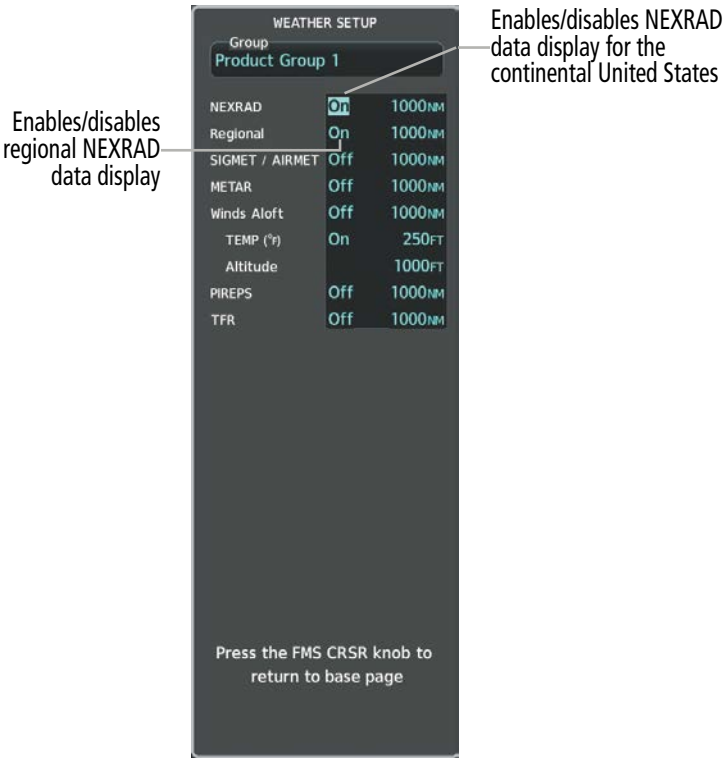


Figure 6-12 Weather Data Link (FIS-B) Page Setup Menu

Displaying the NEXRAD weather product on the 'Map - Navigation Map' Page:

1) Select the **Map Opt** Softkey.
2) Select 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 Region field.
7) 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.
8) When finished, press the **FMS** Knob or press the **CLR** Key.

Displaying the NEXRAD weather product on PFD maps:

1) Press the **Map/HSI** Softkey (in TCAS II installations, press the **Map Opt** 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.

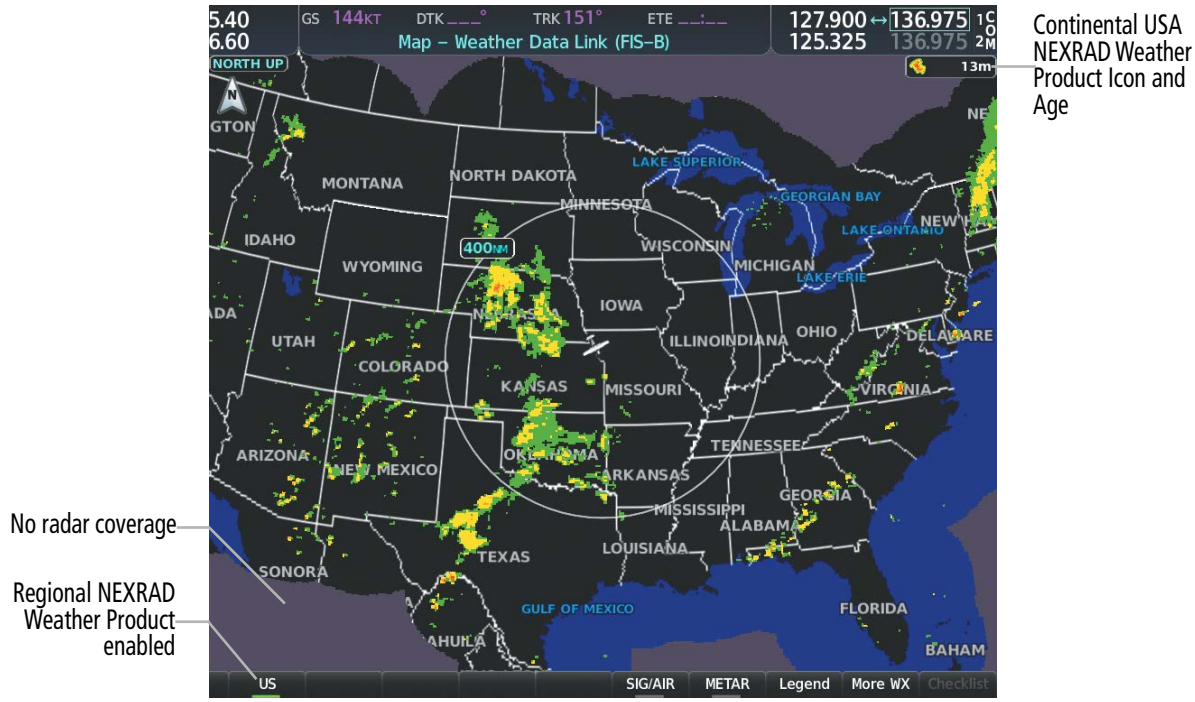


Figure 6-13 Continental US (CONUS) NEXRAD Weather Product on the 'Weather Data Link (FIS-B)' Page

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, select the **Legend** Softkey when the NEXRAD weather product is enabled.

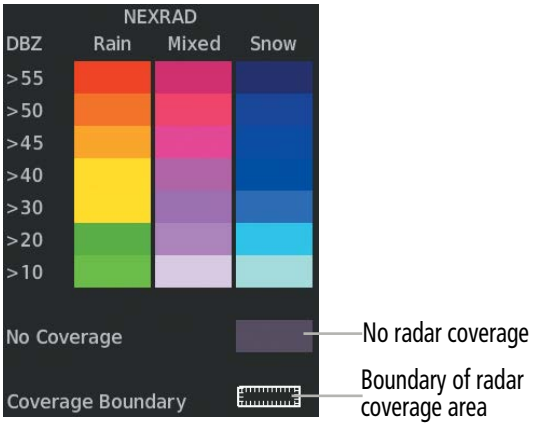


Figure 6-14 NEXRAD Weather Product Legend

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 60º of latitude.

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (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 (SIRIUSXM)

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 on the 'Map - Weather Data Link (XM)' Page

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.

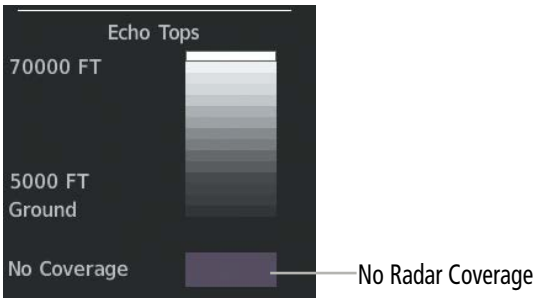


Figure 6-16 Echo Tops Legend

CLOUD TOPS (SIRIUSXM)

NOTE: *Cloud Tops and Echo Tops cannot be displayed at the same time.*

NOTE: *If a GDL 69/69A SXM receiver is installed, 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.

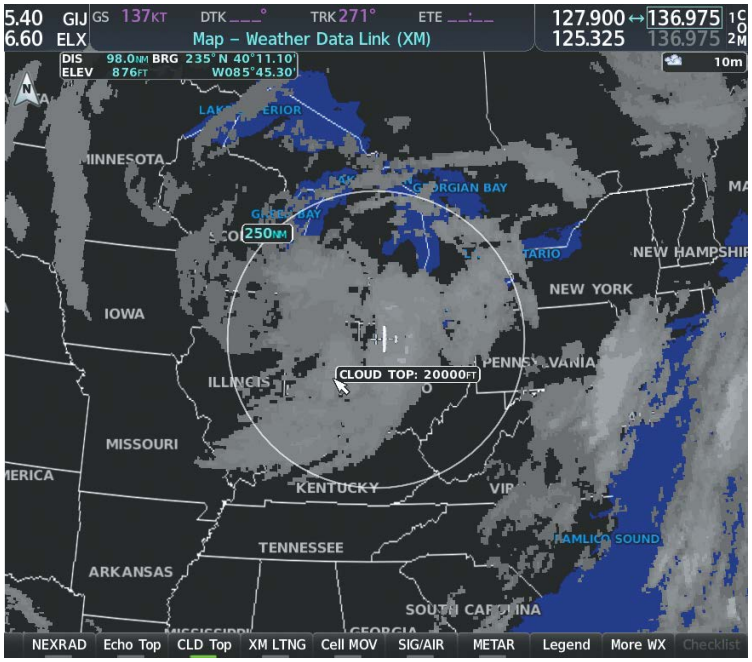


Figure 6-17 Cloud Tops Weather Product on the 'Map - Weather Data Link (XM)' Page

Displaying Cloud Tops information:

1) Select the 'Map - Weather Data Link (XM)' Page with the **FMS** Knob.
2) Select 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.

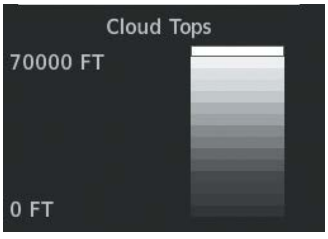


Figure 6-18 Cloud Tops Legend

DATA LINK LIGHTNING

NOTE: *Lightning from a data link source cannot be displayed simultaneously on the same map as information from an optional on-board lightning detection system.*

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 XM LTNG on the 'Map - Weather Data Link (XM)' Page

Displaying Data Link Lightning information on 'Map - Weather Data Link (XM)':

1) Turn the **FMS** Knob to select the 'Map - Weather Data Link (XM)'.
2) Press the **XM LTNG** or **DL LTNG** Softkey (softkey name depends on the selected weather source).

To display the Lightning legend on the 'Map - Weather Data Link (XM)', select the **Legend** Softkey when Data Link Lightning is selected for display.

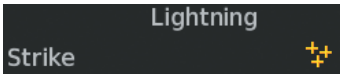


Figure 6-20 Data Link Lightning Legend

Displaying Data Link Lightning information on the 'Map - Navigation Map' Page:

1) Turn the **FMS** Knob to select the 'Map - Navigation Map' Page.
2) Select the **Map Opt** Softkey.
3) Select the **XM LTNG** or **DL 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 the selected data link weather source, 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

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 if a GDL 69 SXM or 69A SXM data link receiver is installed. 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 'Map - Weather Data Link (XM)' Page using the **FMS** Knob.
2) Select the **Cell MOV** Softkey.

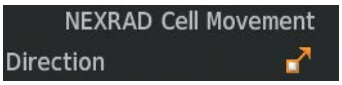


Figure 6-22 Cell Movement Legend

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 'Map - Navigation Map' Page.

Setting up the system to display Cell Movement with NEXRAD on navigation maps:

1) Use the **FMS** Knob to 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: *If SiriusXM Weather is the active data link weather source and a GDL 69/69A SXM receiver installed, 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.*

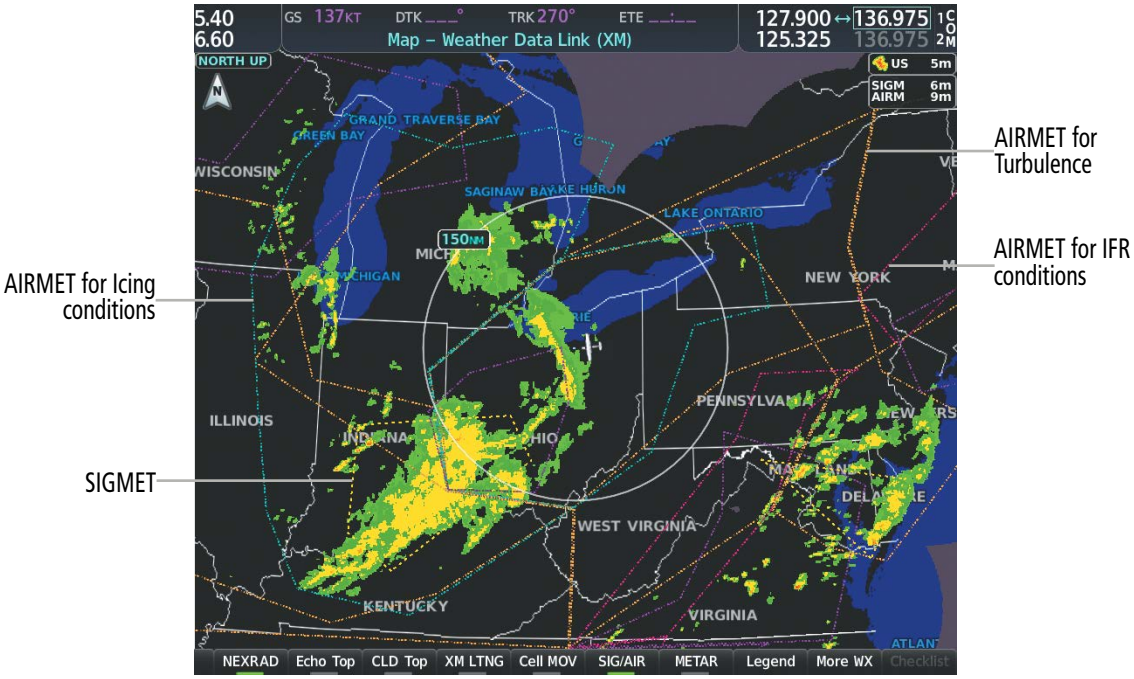


Figure 6-23 SIGMET/AIRMET Data on the 'Map - Weather Data Link (XM)' Page

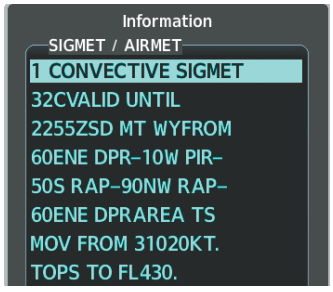
Displaying SIGMETs and AIRMETs:

1) Select the 'Map - Weather Data Link (XM)'.

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

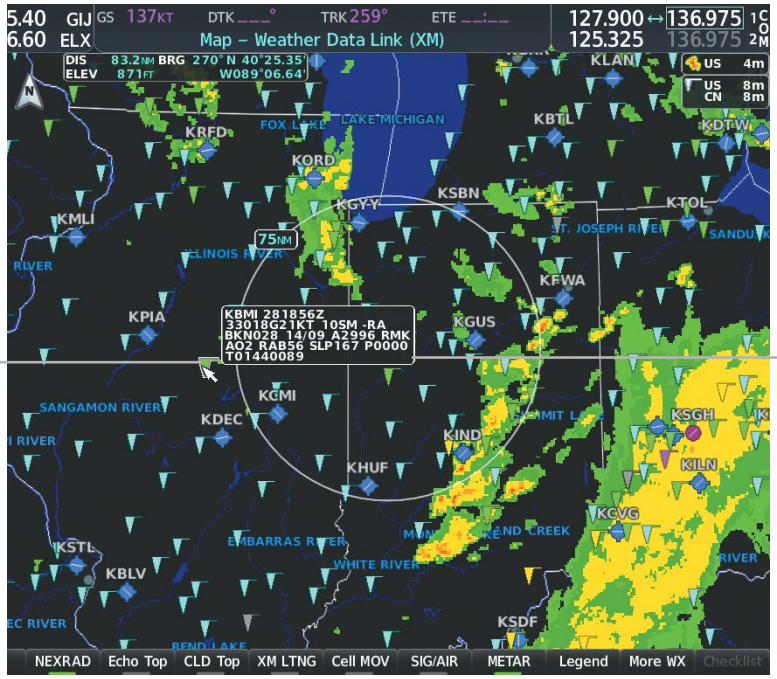
Figure 6-24 SIGMET/AIRMET Text and Legend

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.



METAR flag selected with Map Pointer

Additional Information on Weather Feature Selected with Map Pointer

Figure 6-25 METAR Flags on the 'Map - Weather Data Link (XM)' 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 'WPT - 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 'Map - Weather Data Link (XM)', press the **METAR** Softkey.
2) Press the **Joystick** and pan to the desired airport.
3) Press the **ENT** Key. The 'WPT - 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 'Map - Weather Data Link (XM)'.

Or:

1) Select the 'WPT - Weather Information' Page.
   a) Turn the large **FMS** Knob to select the Waypoint Page Group.
   b) Select 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.

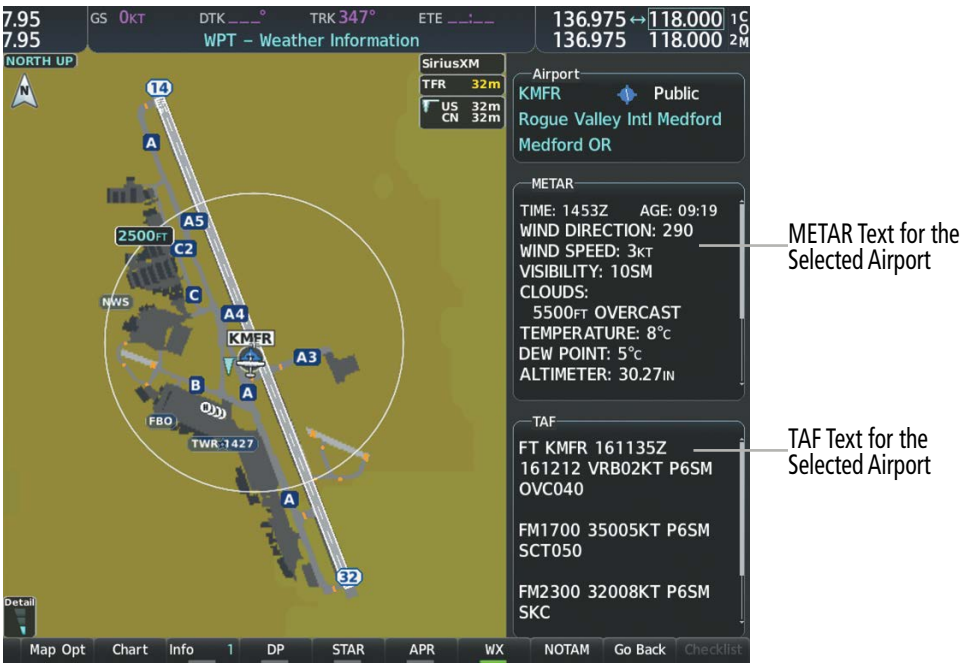


Figure 6-26 METAR and TAF Text on the 'WPT - Weather Information' Page

To display the METAR legend on the 'Map - Weather Data Link (XM)' Page, select 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.

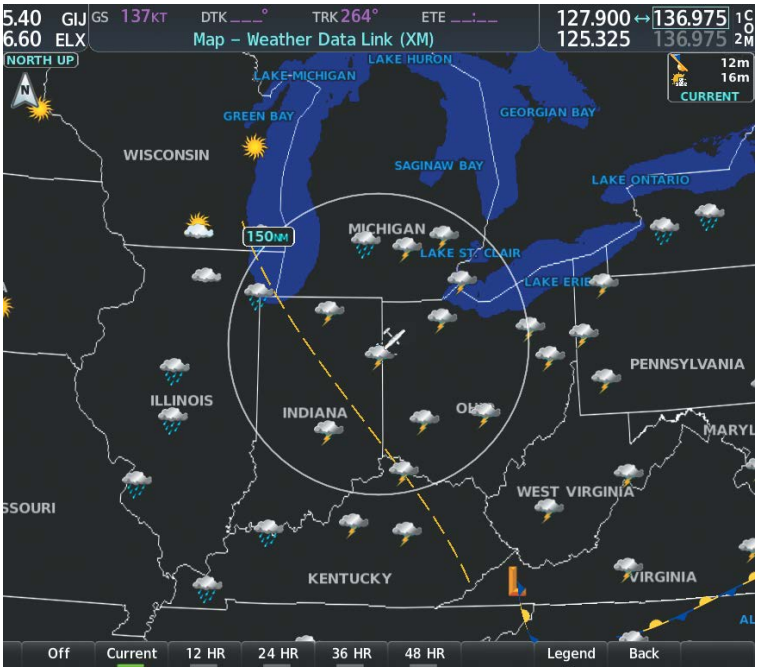


Figure 6-28 Current Surface Analysis Data on the 'Map - Weather Data Link (XM)' Page

Displaying Surface Analysis and City Forecast information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select 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.

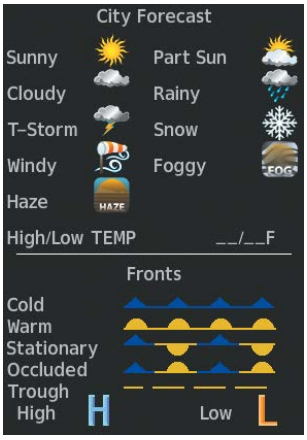


Figure 6-29 Surface Analysis Legend

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 on the 'Map - Weather Data Link (XM)' Page

Displaying Freezing Level information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select 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 'Map - Weather Data Link (FIS-B)' Page.

Displaying the Winds Aloft weather product:

1) Select the 'Map - Weather Data Link (XM)' with the **FMS** Knob.
2) Select the **More WX** Softkey.
3) Select the **Wind** Softkey.
4) Select a softkey for the desired altitude level: **SFC** (surface) up to 42,000 feet. Select the **Next** or **Prev** Softkey to cycle through the altitude softkeys. The **Wind** Softkey label changes to reflect the altitude selected.

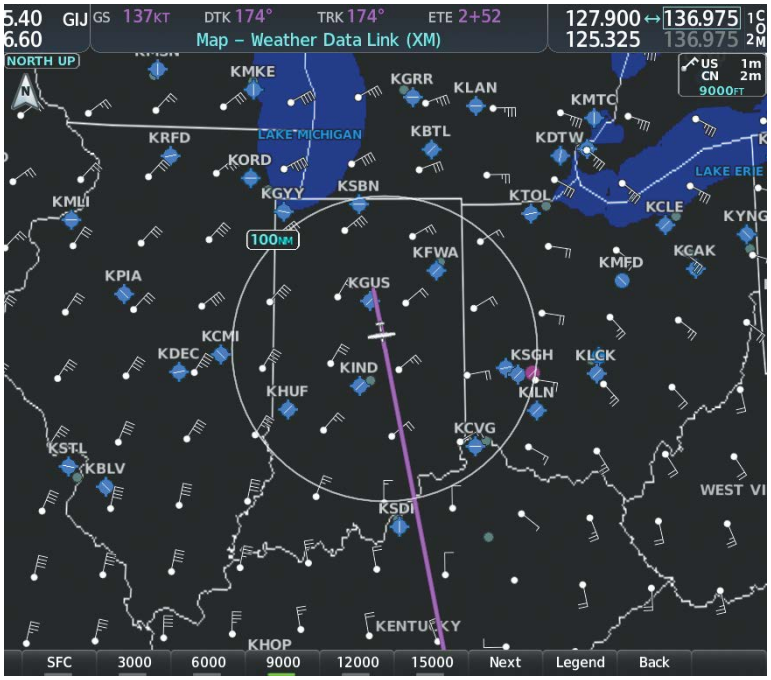


Figure 6-32 Winds Aloft Data at 12,000 Feet on the 'Map - Weather Data Link (XM)' Page

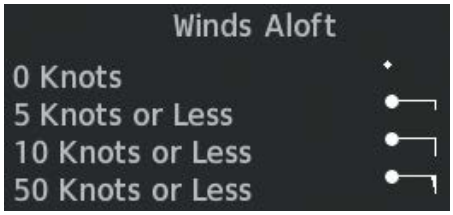


Figure 6-33 Winds Aloft Data with Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) on the 'Map - Navigation Map' Page. The displayed components are relative to current aircraft altitude and track, but not to aircraft speed.

Figure 6-34 'Map - Navigation Map' Page with Winds Aloft Data on the VSD

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.

Winds Aloft data inside the VSD is enabled by default when the VSD is displayed on the 'Map - Navigation Map' Page. This behavior can be changed on the 'Map - Navigation Map' Page.

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.

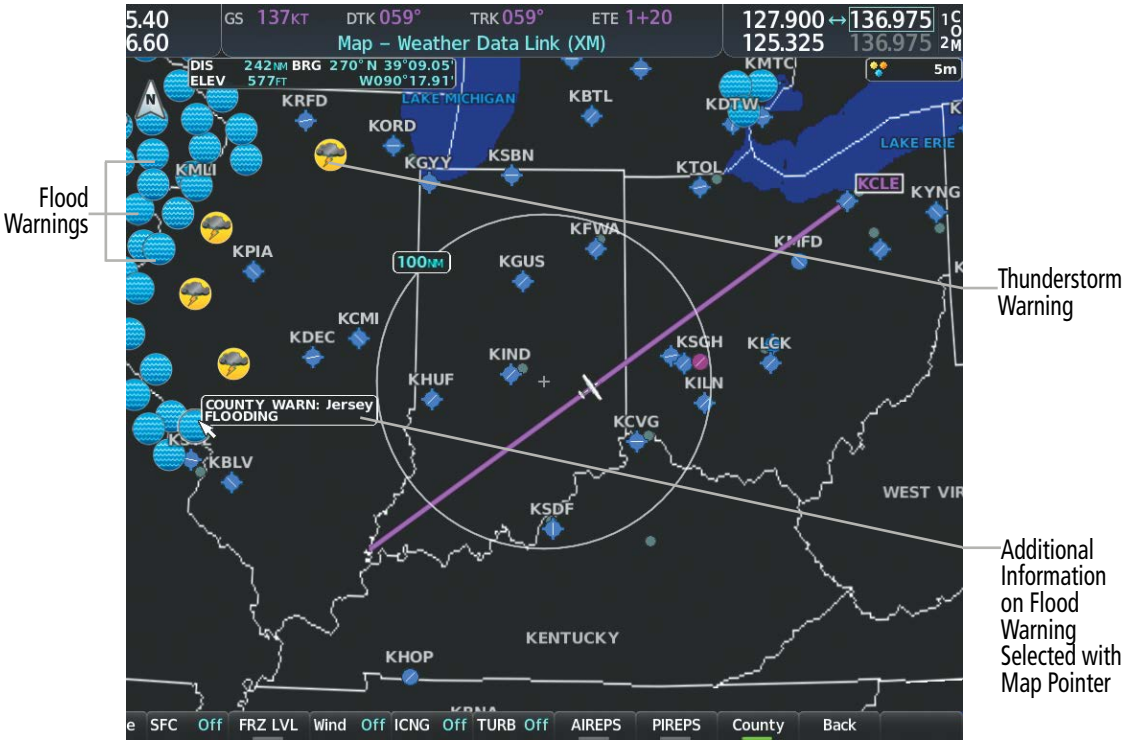


Figure 6-35 County Flood Warning on the 'Map - Weather Data Link (XM)' Page

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.

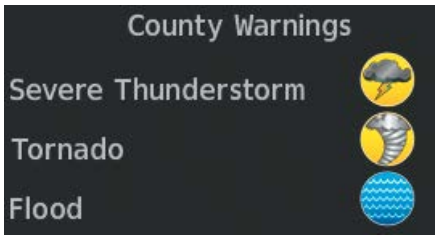


Figure 6-36 County Warnings Legend

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 with the **FMS** Knob.
2) Select the **More WX** Softkey.
3) Select the **Cyclone** Softkey.

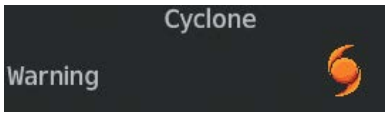


Figure 6-38 Cyclone Legend

NOTE: *If a GDL 69/69A SXM receiver is installed, 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)

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) Select the **More WX** Softkey.
3) Select the **ICNG** Softkey.
4) Select a softkey for the desired altitude level: 1,000 feet up to 30,000 feet. Select the **Next** or **PREV** Softkey to cycle through the altitude softkeys. The **ICNG** Softkey label changes to indicate the altitude selected.

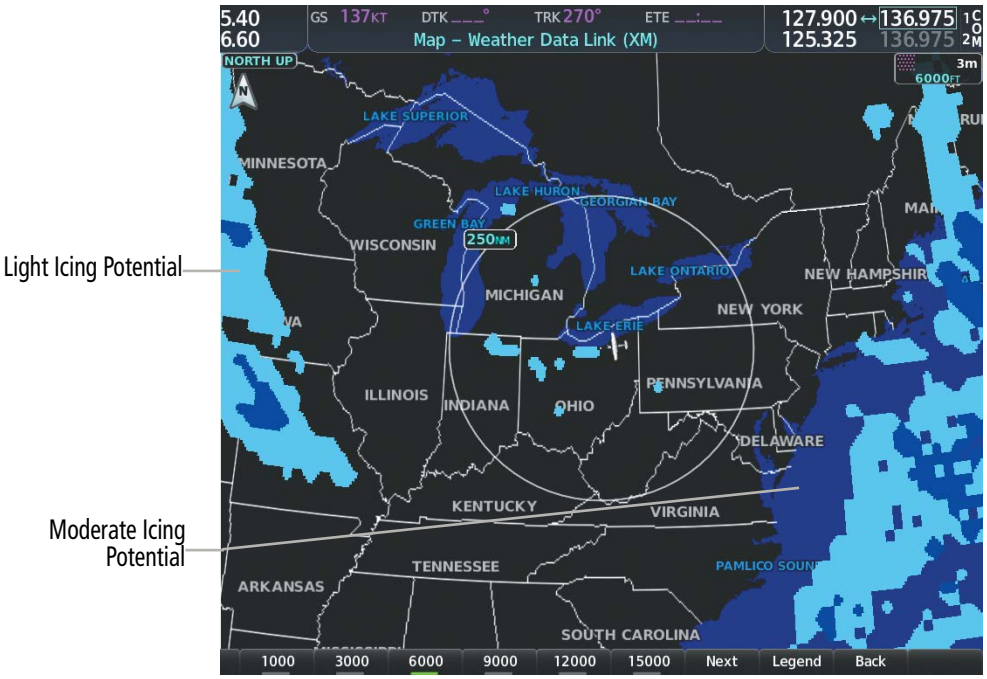


Figure 6-39 Icing Data at 18,000 Feet on the 'Map - Weather Data Link (XM)' Page

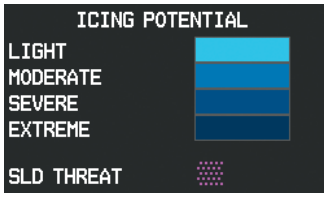


Figure 6-40 Icing Potential Legend

TURBULENCE (SIRIUSXM)

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) Select the **More WX** Softkey.
3) Select the **TURB** Softkey.
4) Select 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.

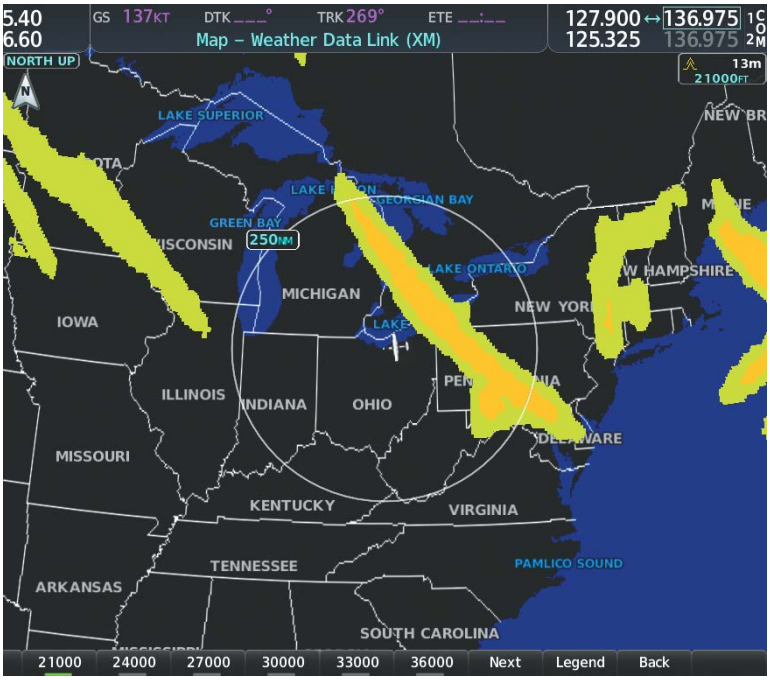


Figure 6-41 Turbulence Weather Product at 21,000 Feet on the 'Map - Weather Data Link (XM)' Page

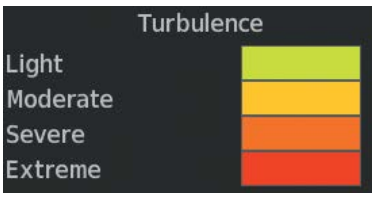


Figure 6-42 Turbulence Legend

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.

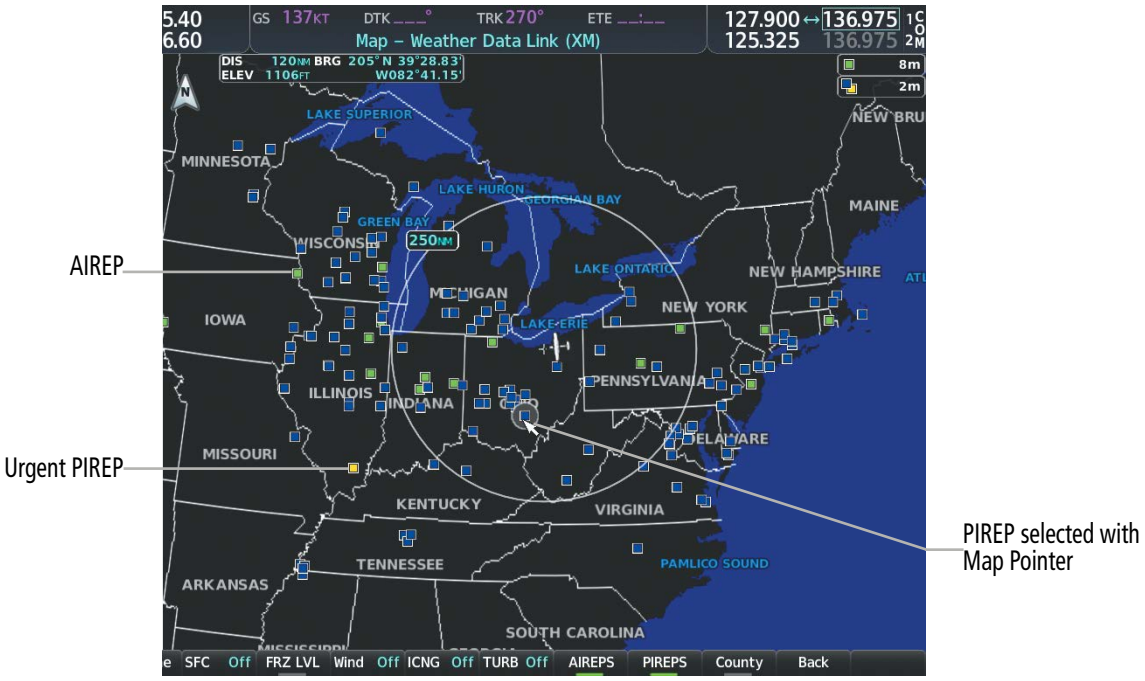


Figure 6-43 PIREPs and AIREPS on the Weather Data Link (XM) Page

Displaying PIREP and AIREP text:

1) Select the 'Map - Weather Data Link (XM)'.
2) Select the **More WX** Softkey.
3) Select 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 'WPT - 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 'Map - Weather Data Link (XM)' Page.

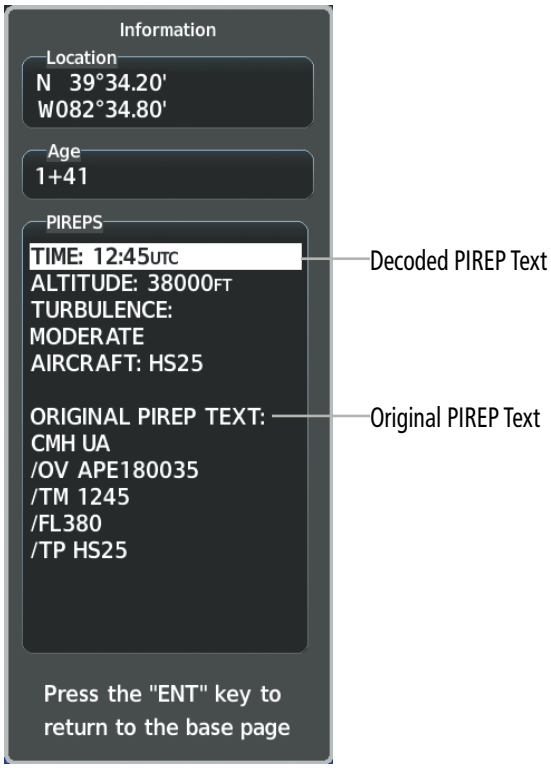


Figure 6-44 PIREP Text on the Weather Data Link (XM) Page

The PIREP color is determined by the type (routine or urgent).

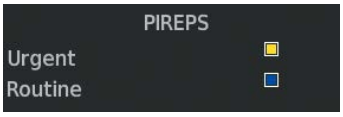


Figure 6-45 AIREPs & PIREPs Legend

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' in the upper-left corner of maps on which TFRs can be displayed.

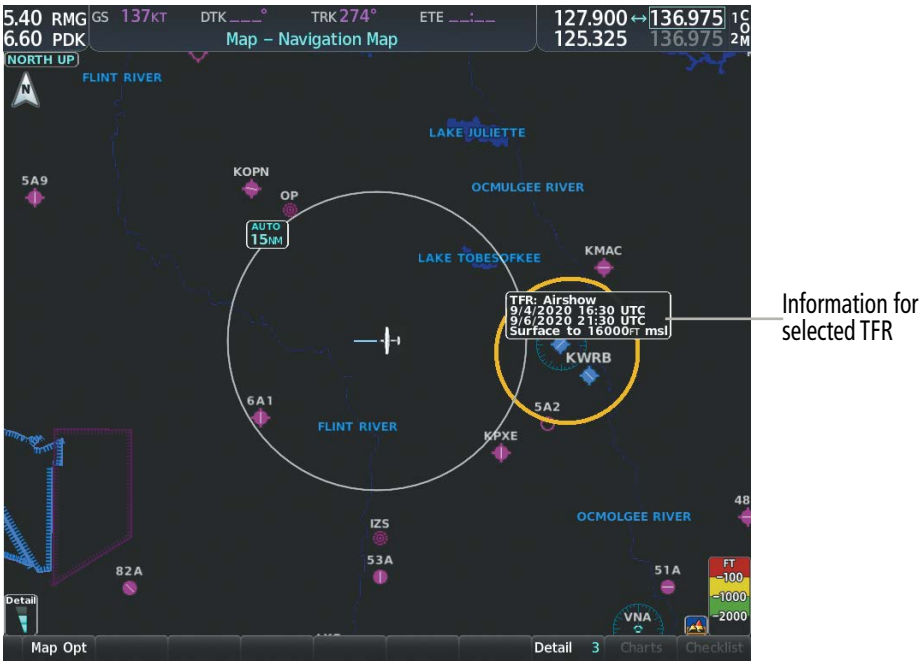


Figure 6-46 TFR Data on the Weather Data Link (XM) Page

Displaying TFR Data:

1) Select the 'Map - Weather Data Link (XM)' 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.

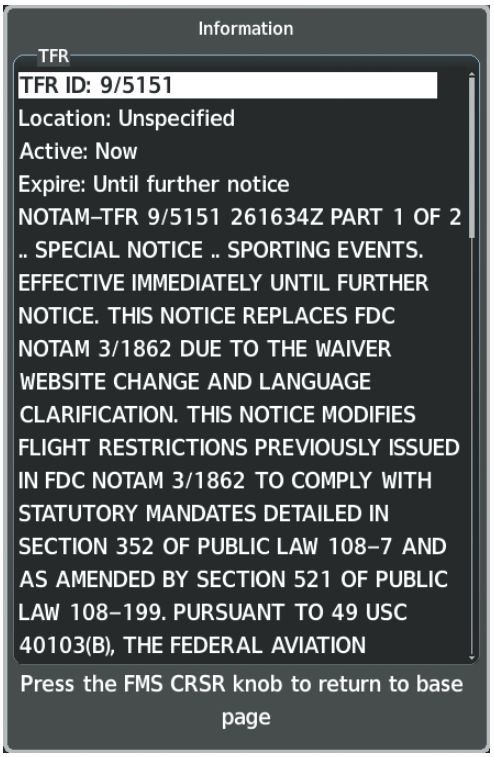


Figure 6-47 Full Text for Selected TFR

The setup menus for the 'Map - 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 'Map - Navigation Map' Page use settings based on those selected for the 'Map - 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 'Map - 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 'Map - 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 'Map - 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 'Aux - ADS-B Status' Page

FIS-B WEATHER ABNORMAL OPERATIONS

Additional information about the status of FIS-B Data Status is available on the 'FIS-B Weather Settings' Screen of the Touchscreen Controller.

FIS-B Weather Status Banner Annunciation	Description
FIS–B WEATHER UNAVAILABLE	Current aircraft position is outside the FIS-B Coverage area.
NOT RECEIVING WEATHER DATA	GTX 345R is currently offline or not receiving FIS-B Weather data from the antenna.

Table 6-5 FIS-B Weather Status Annunciation

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 6-6 'Aux - ADS-B Status' Page Messages for FIS-B Weather

6.2 STORMSCOPE LIGHTNING DETECTION SYSTEM

WARNING: *Do not rely on information from the lightning detection system display as the sole basis for hazardous weather avoidance. Range limitations and interference may cause the system to display inaccurate or incomplete information. Refer to documentation from the lightning detection system manufacturer for detailed information about the system.*

NOTE: *Stormscope® lightning information cannot be displayed simultaneously on the same map as lightning information from data link lightning sources.*

The system can display L-3 WX-500 Stormscope® lightning detection system information on the Stormscope® Page, and as an overlay on navigation maps. The system uses the symbols shown in the following table to depict lightning strikes and cells based on the age of the information.

Lightning Age	Symbol
Strike is less than 6 seconds old	
Strike is between 6 and 60 seconds old	
Strike is between 1 and 2 minutes old	
Strike is between 2 and 3 minutes old	

Table 6-7 Lightning Age and Symbols

USING THE STORMSCOPE PAGE

On the Stormscope® Page, lightning information can be displayed at the ranges of 25 nm, 50 nm, 100 nm, and 200 nm.

Adjusting the Stormscope Map Range:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the Stormscope® Page.
3) Turn the **Joystick** clockwise to increase the map range or counter-clockwise to decrease the map range.

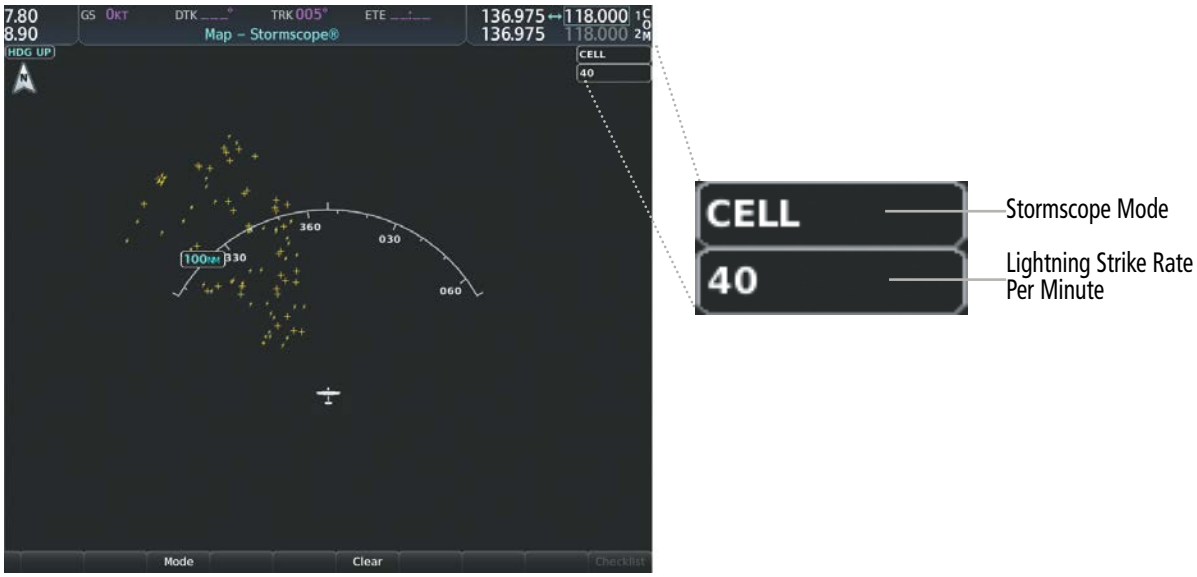


Figure 6-49 Stormscope® Page with Cell Mode Selected

Selecting 'cell' or 'strike' mode:

1) Select the Stormscope® Page.
2) Select the **Mode** Softkey. The **Cell** and **Strike** softkeys are displayed.
3) Select the **Cell** Softkey to display 'CELL' data or select the **Strike** Softkey to display 'STRIKE' data. 'CELL' or 'STRIKE' is displayed in the mode box in the upper right corner of the Stormscope® Page.
4) Press the **Back** Softkey to return to the top level softkeys for the Stormscope® Page.

Or:

1) Select the Stormscope® Page.
2) Press the **MENU** Key to display the Stormscope® Page Menu. Either 'Cell Mode' or 'Strike Mode' is highlighted in cyan to indicate the mode to be selected.
3) Press the **ENT** Key to select the highlighted mode and remove the menu. To remove the menu without changing modes, press the **MENU** Key or the **CLR** Key, or push the **FMS** Knob.

If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn . This is to ensure that the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft. Clearing Stormscope® lightning on any map clears this information from all displays on the system.

Manually clearing Stormscope cell or strike information:

1) Select the Stormscope® Page.
2) Select the **Clear** Softkey.

Or:

a) Press the **MENU** Key.

b) Turn the **FMS** Knob to highlight 'Clear Lightning Data', then press the **ENT** Key.

Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Clear Stormscope® Lightning', then press the **ENT** Key.

Displaying Stormscope information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **STRMSCP** Softkey.

Displaying Stormscope information on PFD maps:

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the **Lightning** Softkey.
3) Press the **STRMSCP** Softkey.

SETTING UP STORMSCOPE ON THE NAVIGATION MAP

To change the display range on the 'Map - Navigation Map' Page, turn the **Joystick** clockwise to increase the map range or counter-clockwise to decrease the map range.

The following options are available for displaying Stormscope® information on the 'Map - Navigation Map' Page:

- Stormscope On/Off field – Enables/disables the display of Stormscope lightning symbols.
- Stormscope maximum display range – Selects the maximum map range to display Stormscope symbols. Stormscope data is removed when a map range greater than the STRMSCP SMBL value is selected.
- Stormscope Mode – Selects the Cell or Strike mode of lightning activity. Cell mode identifies clusters or cells of electrical activity. Strike mode indicates the approximate location of lightning strikes.

Setting up Stormscope options on the Navigation Map:

1) On the 'Map - Navigation Map' Page, press the **MENU** Key.
2) With 'Map Settings' selected, press the **ENT** Key.
3) Turn the small **FMS** Knob to display the group selection window. Turn the small **FMS** Knob to select 'Weather', and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight and move between the product selections.
5) When an item is highlighted, turn the small **FMS** Knob to select the option.
6) Press the **ENT** Key.
7) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

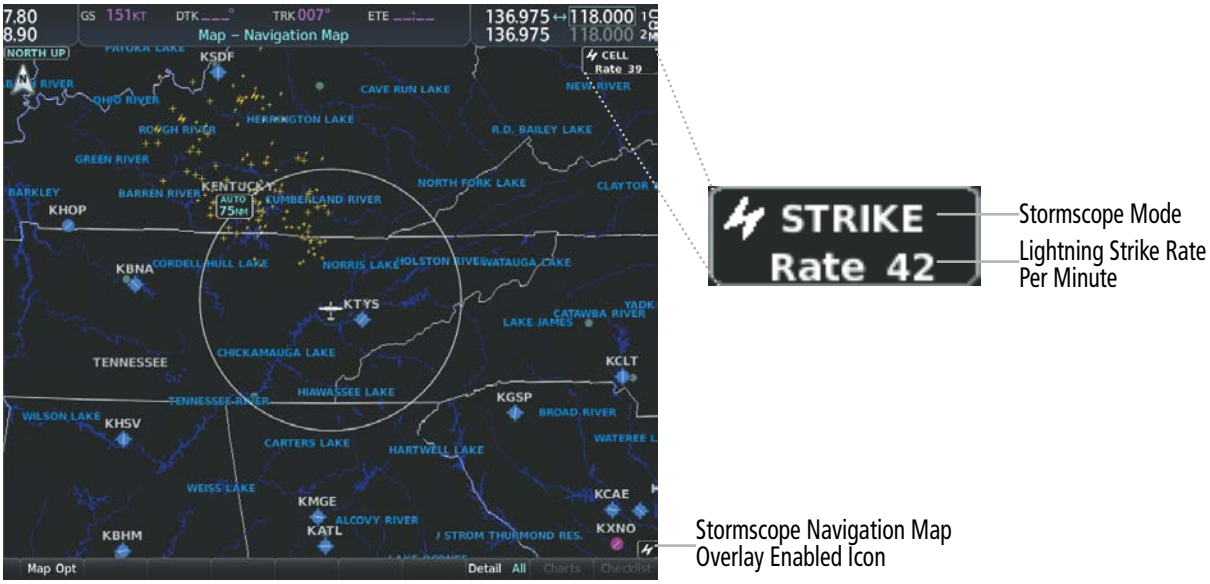


Figure 6-50 'Map - Navigation Map' Page with Stormscope® Lightning Data

6.3 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.*

WARNING: *Use appropriate primary systems for navigation, and for terrain, obstacle, and traffic avoidance. Garmin 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: *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 89º North latitude and south of 89º 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. Only the TAWS-B system complies with TSO-C15b certification standards, and includes additional 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 in the On-Ground Legend was shown in order to provide the flight crew with the most information possible.

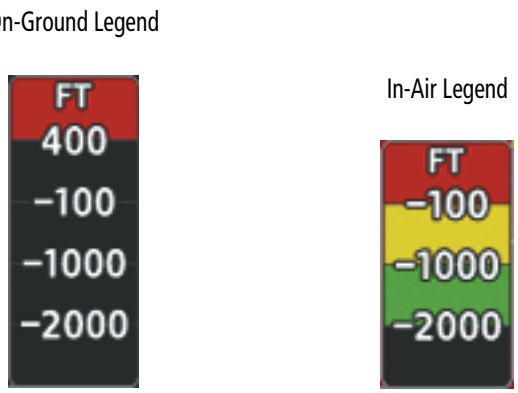


Figure 6-51 Relative Terrain Legend

The following figure shows the relative terrain coloring for the Terrain Proximity system.

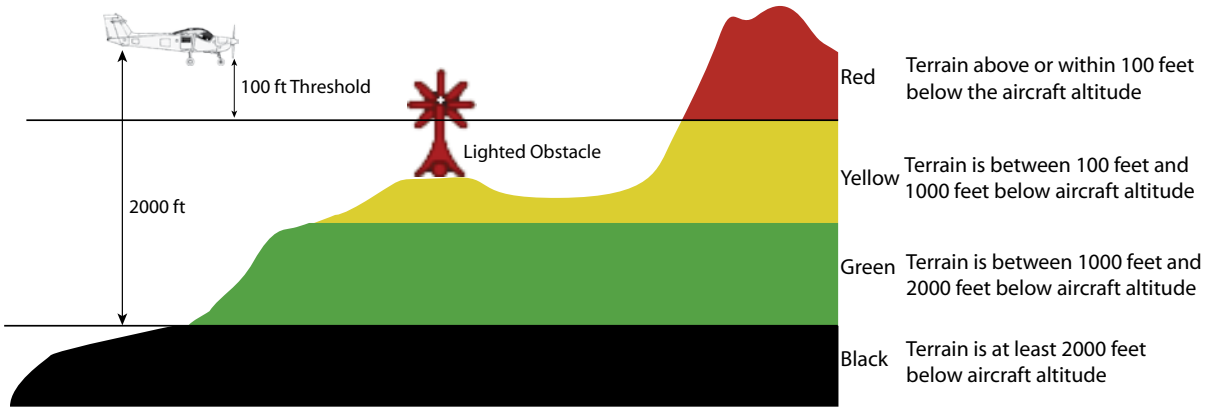


Figure 6-52 Terrain Altitude/Color Correlation for Terrain Proximity

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

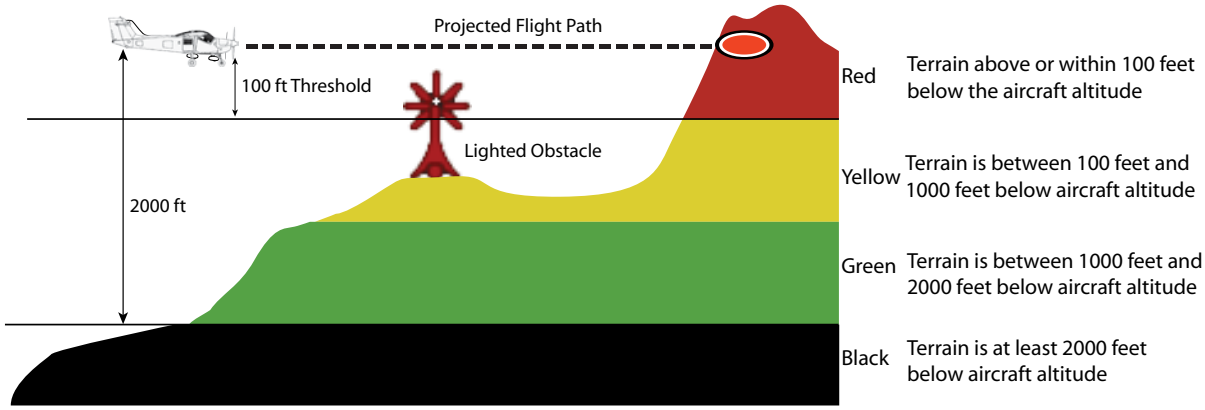


Figure 6-53 Terrain Altitude/Color Correlation for Terrain-SVT or TAWS-B Systems

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 6-8 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 6-9 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
	Warning	
	Caution	

Table 6-10 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

The Map - Terrain Proximity or Terrain-SVT or 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 'Map - 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 Proximity Page use settings based on those selected for the 'Map - 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 '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 '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.

Additional Information on Obstacle Selected with Map Pointer

Lighted Obstacle Selected with Map Pointer

Red Lighted Obstacles (Above or Within 100' Below Aircraft Altitude)

Red Terrain Area (Above or Within 100' Below Aircraft Altitude)

Yellow Terrain Area (Between 100' and 1000' Below Aircraft Altitude)

Terrain Display Enabled Icon

Terrain Legend

Figure 6-54 Terrain Information on the 'Map - 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 1 to 200 nm, as indicated by the map range rings (or arcs).

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.

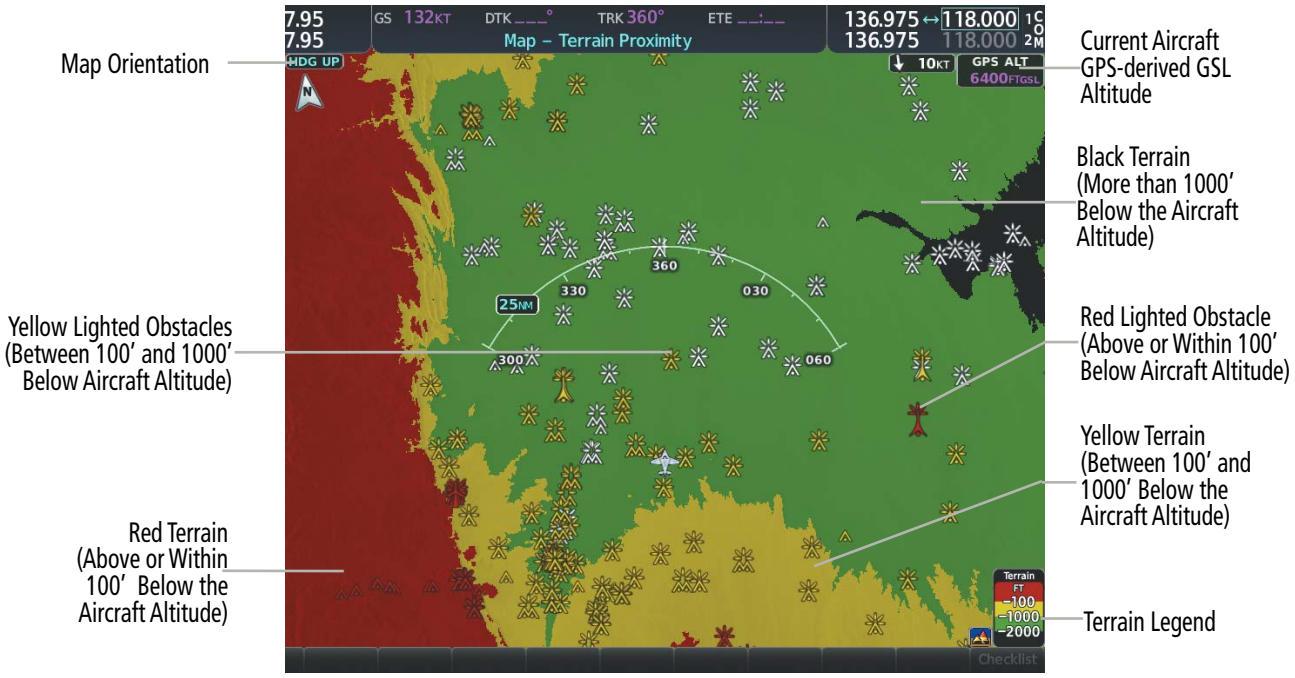


Figure 6-55 Terrain Proximity Page

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 Terrain-SVT or TAWS-B Page)

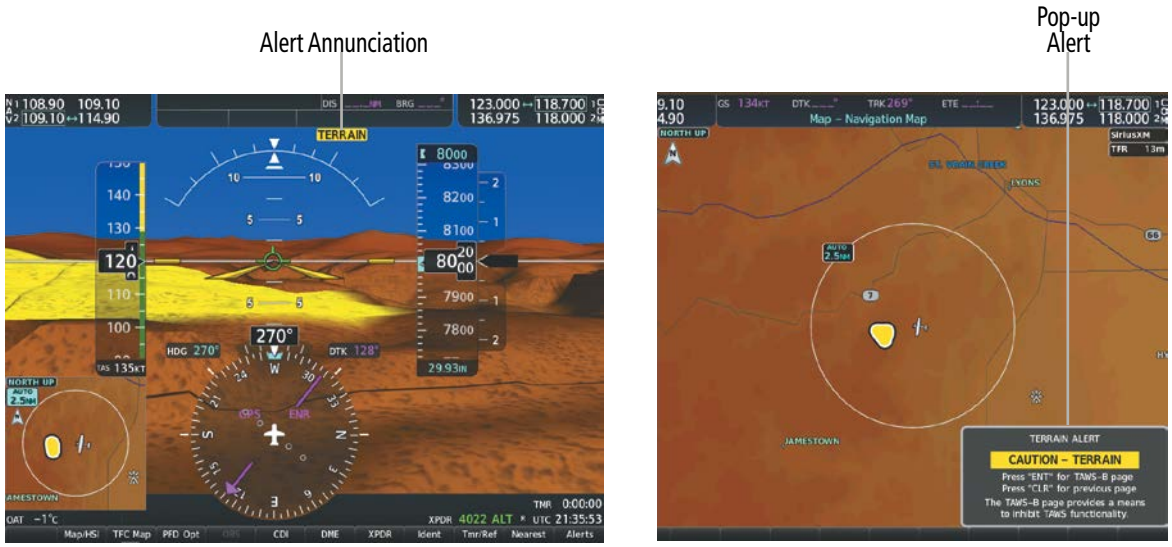


Figure 6-56 TAWS-B Alert Annunciations

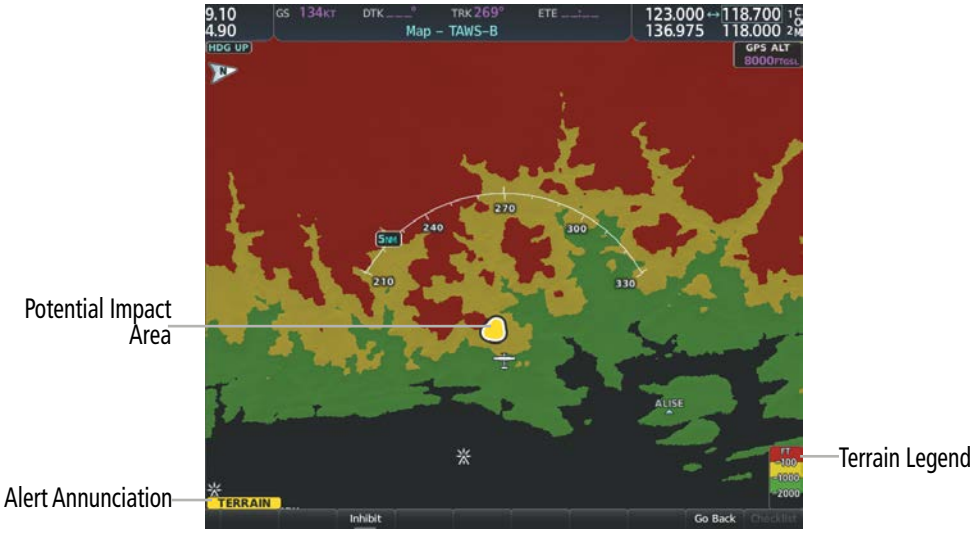


Figure 6-57 'Map - Navigation Map' Page (After TAWS-B Pop-up Alert Acknowledgment)

The following table lists the possible Terrain-SVT alerts.

Alert Type	PFD/Terrain-SVT Page 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"

Table 6-11 Terrain-SVT Alerts Summary

The following table lists the TAWS-B alerts.

Alert Type	PFD/MFD[2] 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 or TERRAIN AHEAD – PULL–UP	"Terrain, Terrain; Pull-Up, Pull-Up"[1] or "Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN – PULL–UP or TERRAIN AHEAD – PULL–UP	"Terrain, Terrain; Pull-Up, Pull-Up"[1] or "Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up"
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE – PULL–UP or OBSTACLE AHEAD – PULL–UP	"Obstacle, Obstacle; Pull-Up, Pull-Up"[1] or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up"

Alert Type	PFD/MFD[2] Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Voice Alert
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE – PULL–UP or OBSTACLE AHEAD – PULL–UP	"Obstacle, Obstacle; Pull-Up, Pull-Up"[1] or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN or TERRAIN – AHEAD	"Caution, Terrain; Caution, Terrain"[1] or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN or TERRAIN – AHEAD	"Caution, Terrain; Caution, Terrain"[1] or "Terrain Ahead; Terrain Ahead"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"[1] or "Obstacle Ahead; Obstacle Ahead"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"[1] or "Obstacle Ahead; Obstacle Ahead"
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	DONT SINK or TOO LOW – TERRAIN	"Don't Sink"[1] or "Too Low, Terrain"

[1] *Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.*

[2] *Annunciation is displayed on the MFD when terrain display is enabled.*

Table 6-12 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.

When Terrain-SVT or TAWS-B FLTA alerts are manually inhibited, the annunciation is shown on the PFD and in the MFD for maps displaying relative terrain

Figure 6-59 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.

While TAWS-B alerting is inhibited, is unavailable, or has failed, the system may show a 'LOW ALT' annunciation on the PFDs if all of these conditions are met:

- The aircraft is on a GPS SBAS approach.
- The Final Approach Fix (FAF) is the active waypoint.
- The aircraft altitude is at least 164 feet below the prescribed FAF altitude.

Refer to the Flight Instruments for more information about the 'LOW ALT' annunciation.

ADDITIONAL TAWS-B ALERTING

In addition to the FLTA alerting discussed previously, TAWS-B provides the following additional types of alerts.

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.

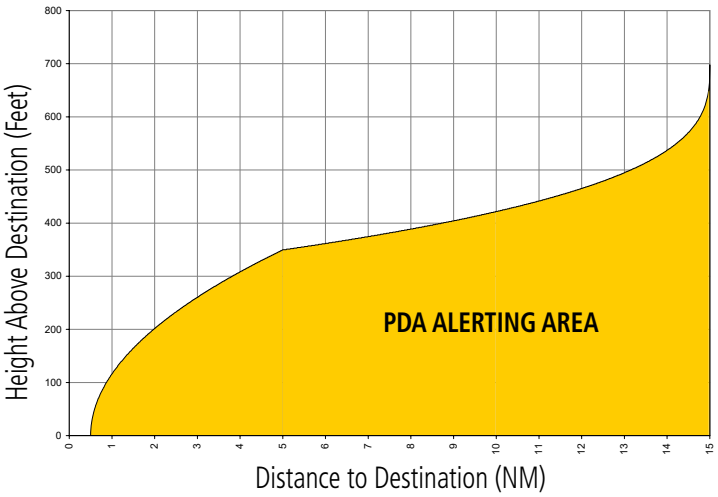


Figure 6-60 PDA Alerting Threshold

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.

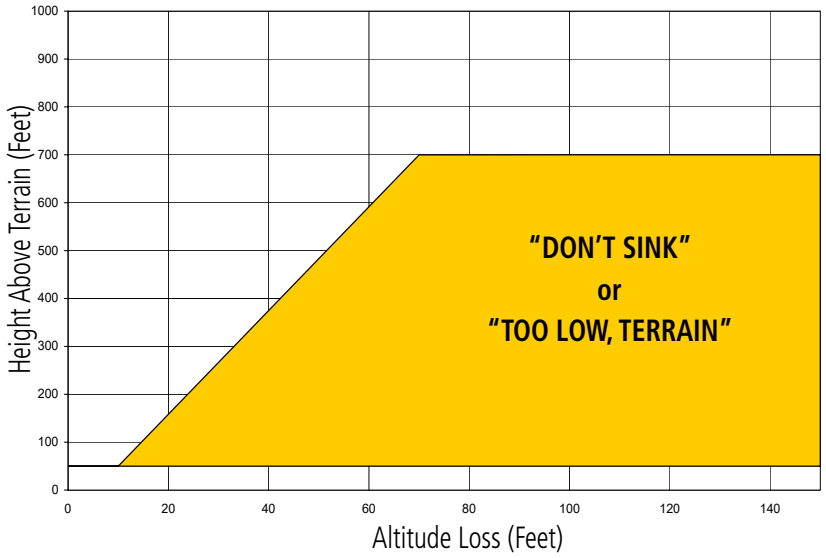


Figure 6-61 Negative Climb Rate (NCR) Altitude Loss

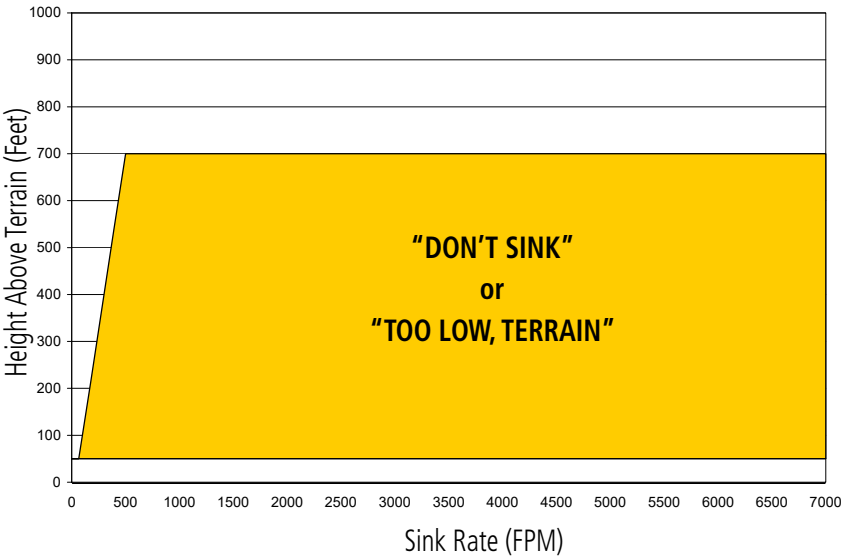


Figure 6-62 Negative Climb Rate (NCR) Sink Rate

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 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.

TERRAIN-SVT

During power application, 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[1] Alert Annunciation	'Map - 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"[2]
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available"[2]
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

[1] *Annunciation is shown on Terrain-SVT Page and the 'Map - Navigation Map' Page when Terrain is enabled.*
[2] *"Terrain System Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.*

Table 6-13 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.

Manually testing the TAWS-B System:

1) Select the 'Map - TAWS-B' Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight '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 'Map - TAWS-B' Page Alert Annunciation	'Map - 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 OK"
TAWS Alerting is inhibited	**TAWS INH**	None	None
Sufficient GPS signal reception restored	None	None	"TAWS Available"[2] (voice alert only in flight)
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 System Test Fail; Terrain, Airport Terrain or Obstacle database unavailable or invalid on all displays; software mismatch among displays; TAWS 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

[1] *Annunciation is shown on TAWS-B Page and the 'Map - Navigation Map' Page when Terrain is enabled.*
[2] *"TAWS Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.*

Table 6-14 TAWS-B System Status Annunciations

6.4 TRAFFIC INFORMATION SERVICE (TIS)

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 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 Traffic Advisory Systems (TAS), Traffic Alert and Collision Avoidance Systems (TCAS) and TIS. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication.*

NOTE: *TIS is disabled if another traffic system 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 five seconds. The system displays up to eight traffic symbols 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 6-15 TIS Traffic Symbols

Traffic Advisories (TA) alert the crew to intruding aircraft. When traffic meets the advisory criteria for the TA, a solid amber 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 or in a banner at the lower left corner of maps other than the 'Map - Traffic Map' Page on which traffic can be displayed.

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 Maps
- 'Map - Navigation Map' Page
- 'Map - Traffic Map' Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page

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 overlays (MFD navigation maps):

1) Select the **Map Opt** Softkey.
2) Select the **Traffic** Softkey. Traffic is now displayed on the navigation map.

When traffic is selected on maps other than the 'Map - Traffic Map' Page, an icon is shown to indicate the feature is enabled for display.

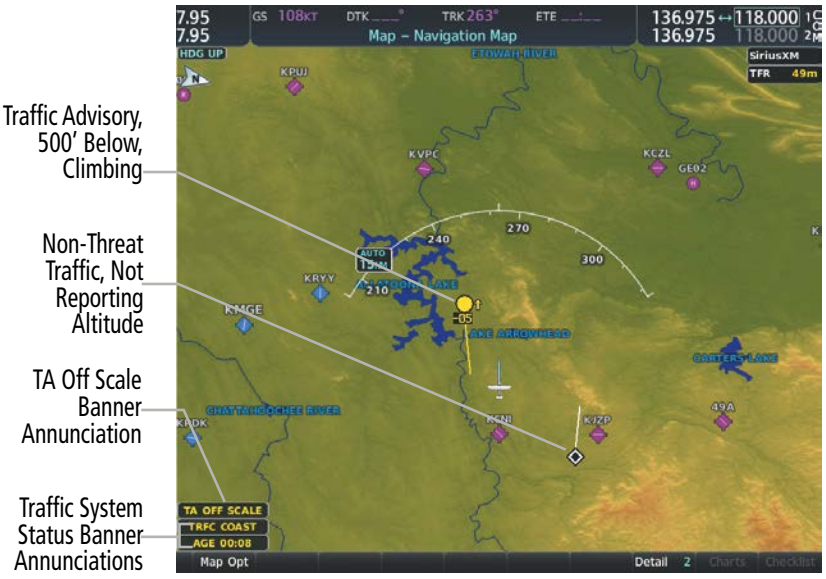


Figure 6-63 TIS Traffic on 'Map - Navigation Map' Page

The 'Map - 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 'Map - Traffic Map' Page use settings based on those selected for the 'Map - 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 'Map - 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 'Map - Navigation Map' Page with the changed settings.

'MAP - TRAFFIC MAP' PAGE

The 'Map - 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 'Map - 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 'Map - 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:
   a) 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.

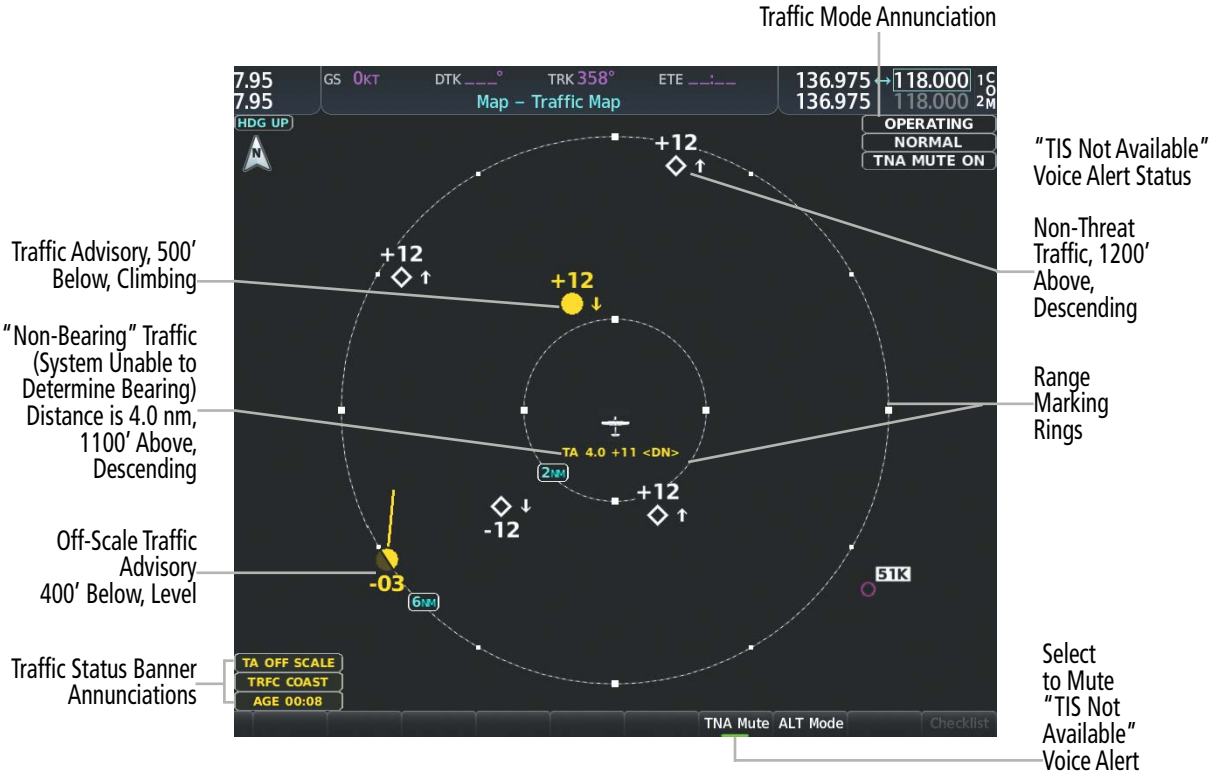


Figure 6-64 'Map - Traffic Map' Page

TIS ALERTS

When the number of TAs on the 'Map - 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 right of the airspeed tape, flashes for five seconds, and remains displayed until no TAs are detected in the area.
- The PFD Inset Map or HSI 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 6-65 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 right corner of the 'Map - 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 'Map - 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 'Map - Traffic Map' Page.

'Map - Traffic Map' Page Center Banner Annunciation	Description
NO DATA	Data is not being received from the transponder[1].
DATA FAILED	Data is being received from the transponder, but a failure is detected in the data stream[1].
FAILED	The transponder has failed[1].
UNAVAILABLE	TIS is unavailable or out of range

[1] *Contact a service center or Garmin dealer for corrective action*

Table 6-16 TIS Failure Annunciations

The traffic mode is annunciated in the upper right corner of the 'Map - 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.

Traffic Map Mode Annunciation	Traffic Map Center Banner Annunciation	Traffic Overlay Status Icon (Navigation Maps)	Description
DATA FAILED	TRFC FAIL		Data is being received from the transponder, but a failure is detected in the data stream.[1]
NO DATA	TRFC FAIL		Data is not being received from the transponder.[1]
OPERATING	None		TIS is operating and is receiving traffic data from a data link.
OPERATING	UNAVAILABLE		TIS is operating, but the traffic service is currently unavailable or is out of reception range.
STANDBY	STANDBY		TIS is in Standby Mode.
UNIT FAILED	TRFC FAIL		The transponder has failed.[1]

[1] *See Table 6-18 for additional failure annunciations.*

Table 6-17 TIS Modes and Status Annunciations

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 right corner of the 'Map - 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, as shown in the following table.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range[1] Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory[2] 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

[1] *Shown as symbol on 'Map - Traffic Map' Page*
[2] *Shown in center of 'Map - Traffic Map' Page*

Table 6-18 TIS Traffic Status Annunciations

6.5 TAS 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 traffic system limitations. Traffic 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 another traffic system is installed.*

NOTE: *If Garmin GTX 345R transponder is installed, refer to the Automatic Dependent Surveillance-Broadcast (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 alerts to help the pilot visually acquire traffic.

The Garmin 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.

TAS THEORY OF OPERATION

When the traffic system is in Operating Mode, the system directly interrogates the transponders of other aircraft in the vicinity. The traffic 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 actively scans the airspace within ±10,000 feet of its altitude. Under ideal conditions, the GTS 800 scans transponder traffic up to 22 nm in the forward direction. The range is somewhat reduced to the sides and aft of the 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 on-board traffic system automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.

NOTE: *The Garmin 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.*

When the standard Garmin GTX 33 ES, or the optional GTX 335 transponder is installed, the system uses the following symbols to represent traffic.

Traffic Symbol	Description
	Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-19 TAS Symbol Description with GTX 33 ES Transponder

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 6-20 Traffic with ADS-B Symbology (GTX 335 Transponder)

If a Garmin GTX 345 transponder is installed with the TAS, the symbols in the following table depict traffic, and include Automatic Dependent Surveillance-Broadcast (ADS-B) information. Refer to the ADS-B Traffic discussion later in this section for more information.

Symbol	Description
	Traffic Advisory with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory with ADS-B directional information is beyond the selected display range. Displayed at outer range ring at proper bearing. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with ADS-B directional information. Arrow points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with ADS-B directional information. Arrow 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 ADS-B 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 without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-21 ADS-B Traffic Symbology with GTX 345R Transponder

A Traffic Advisory (TA), displayed as a solid amber circle or circle enclosing an arrow, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A TA 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 arrow, indicates the intruding aircraft is within ±1200 feet and is within a 6 nm range, but is still not considered a TA threat.

Other, non-threat traffic, shown as an open white diamond or arrow, is displayed for traffic beyond six nautical miles that is neither a TA or PA.

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.

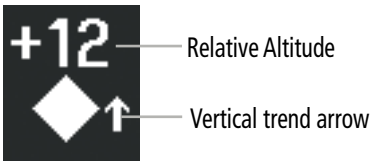


Figure 6-66 Intruder Altitude and Vertical Trend Arrow

TA ALERTING CONDITIONS (GTS 800)

The GTS 800 traffic system automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting when the aircraft is more likely to be near an airport. The system uses Level A (less) sensitivity when the height above terrain is at or below 2,000' AGL. If the height above terrain is unavailable, Level A sensitivity applies when the ground speed is less than 120 knots. In all other conditions, Level B (higher) sensitivity applies.

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 or intruder range is within 0.2 NM.
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 closing rate provides less than 20 seconds of separation or intruder range is within 0.55 NM.

Table 6-22 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. 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.

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 6-23 TA Descriptive Voice Announcements

- 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.
- A PFD 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 'Map - 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.

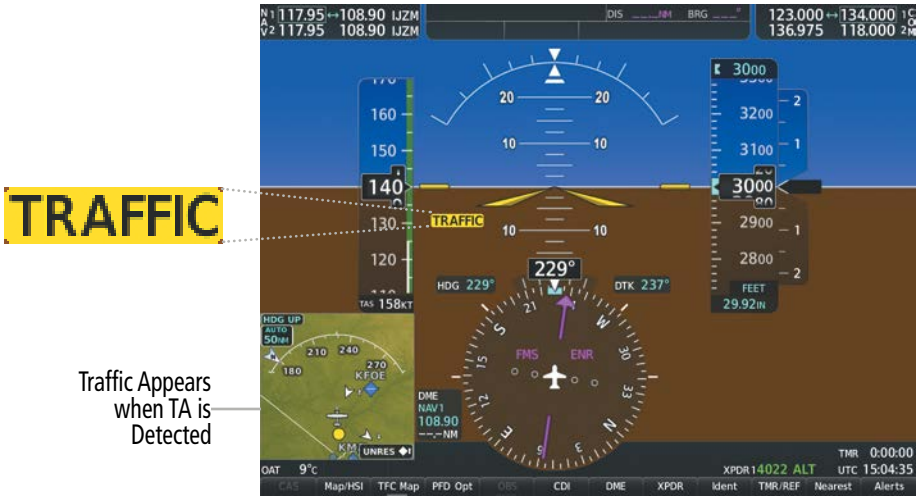


Figure 6-67 Traffic Annunciation (PFD)

SYSTEM TEST

The traffic system provides a system test mode to verify the TAS is operating normally. The test takes about ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols appears on the 'Map - Traffic Map' Page. For the GTS 800, if system test passes, the system announces, *"TAS System Test Passed"* or *"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 'Map - 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 **Standby** or **TAS STBY** Softkey.
5) Press the **Test** Softkey.

Or:

1) With the Traffic system in Standby mode, press the MENU Key.
2) Turn the small **FMS** Knob to select 'Test Mode'.
3) Press the **ENT** Key.

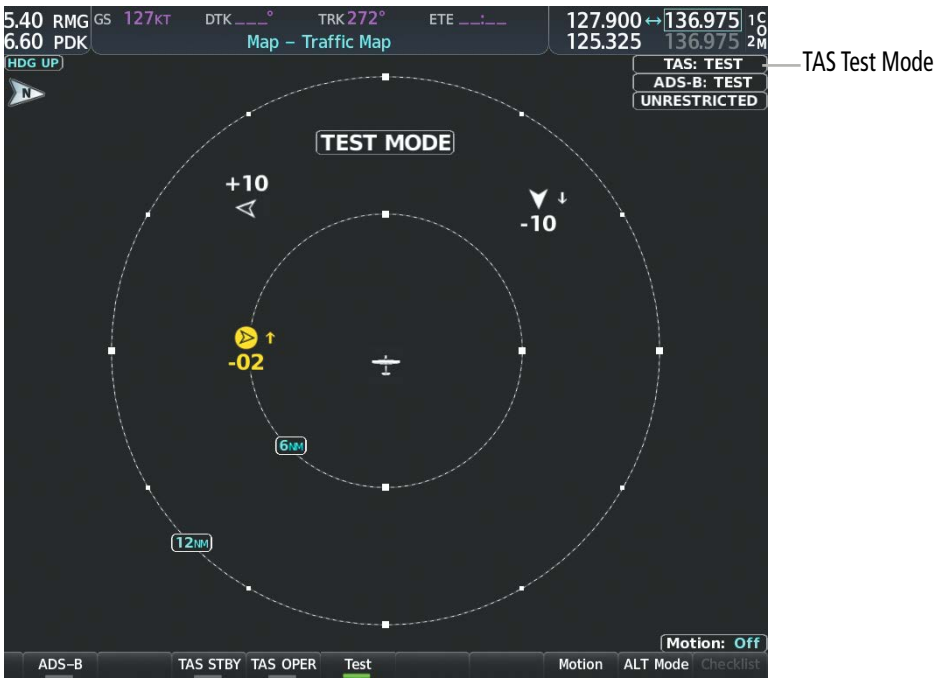


Figure 6-68 System Test in Progress with Test Pattern

OPERATION

NOTE: *The Garmin GTS 800 TAS automatically changes from* ***Standby*** *to* ***Operating*** *mode eight seconds after takeoff. The system also automatically changes 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 'Map - 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 Traffic mode field.
4) Press the **Standby** or **TAS STBY** Softkey to place the system in the Standby mode. 'STANDBY' is displayed in the Traffic mode field.

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.

'MAP - 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. The pilot can adjust the map range with the **Joystick.** A range indication appears on each range ring.

The system annunciates the traffic mode and altitude display mode in the upper right corner of the 'Map - Traffic Map' Page.

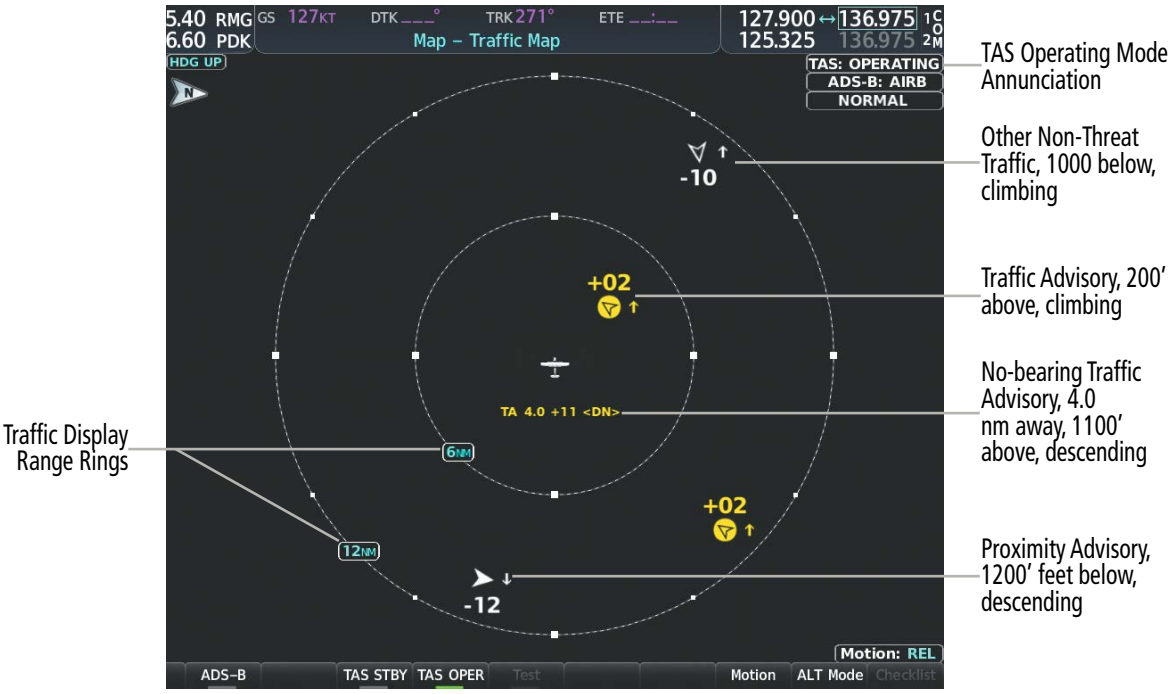


Figure 6-69 'Map - Traffic Map' Page

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 'Map - Traffic Map' Page, select 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, select 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) Select the **ENT** Softkey.

'Map - Traffic Map' Page Display Range

The display range on the 'Map - Traffic Map' Page can be changed at any time. Map range is adjustable with the **Joystick**, and rings on the map denote the ranges.

Changing the display range on the 'Map - Traffic Map' Page:

1) Turn the **Joystick**.
2) The following range options are available:
   - 750 ft (with optional ADS-B)
   - 750 ft and 1500 ft (with optional ADS-B)
   - 1500 ft and 0.5 nm (with optional ADS-B)
   - 0.5 nm and 1 nm (with optional ADS-B)
   - 1 nm and 2 nm (with optional ADS-B)
   - 2 nm
   - 2 and 6 nm
   - 6 and 12 nm
   - 12 and 24 nm
   - 24 and 40 nm (available with ADS-B)

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:

» 'Map - Navigation Map' Page
» 'Map - Traffic Map' Page
» Trip Planning Page
» Nearest Pages
» Active Flight Plan Page
» Aux Video Page

Enabling/disabling traffic information (MFD maps other than the 'Map - 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 'Map - Traffic Map' Page, the system shows a traffic status icon to indicate traffic is enabled for display as well as the altitude display mode (Above, Below, Normal, Unres).

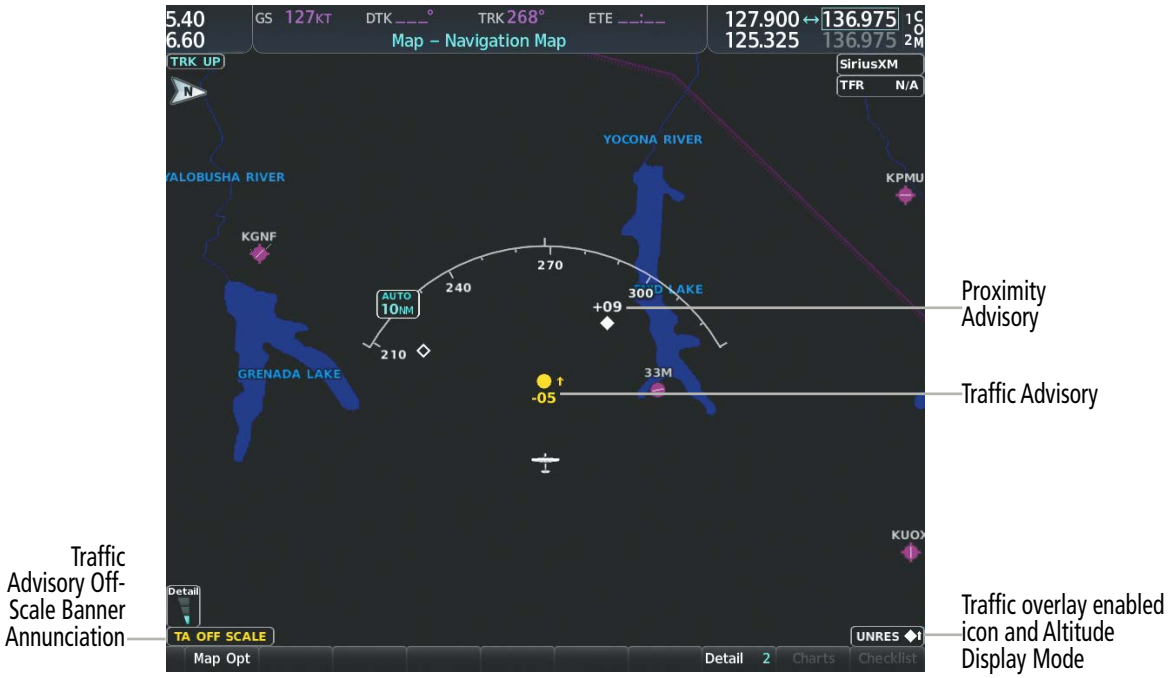


Figure 6-70 TAS Traffic on Navigation Map

Customizing the traffic 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 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) Push the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page.

The 'Map - 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 'Map - Traffic Map' Page use settings based on those selected for the 'Map - Navigation Map' Page.

A traffic-only inset map is available on the PFD by pressing the **TFC Map** Softkey. A traffic map appears on the PFD. This map resembles the 'Map - Traffic Map' Page, and presents a heading up format. Traffic information can also be overlaid on PFD navigation maps.

Enabling/disabling traffic overlay on PFD navigation maps:

1) With the Inset Map or HSI Map displayed, press the **Map/HSI** Softkey on the PFD.
2) Press the **Traffic** Softkey to enable/disable the display traffic information.

SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the 'Map - Traffic Map' Page.

Mode	Traffic Mode Annunciation ('Map - 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[1]	**FAIL**	

[1] *See Table 6-25 for additional failure annunciations*

Table 6-24 Traffic Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the 'Map - Traffic Map' Page. During a failure condition, the Operating Mode cannot be selected.

'Map - 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 6-25 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[1]. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory[2]. 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

[1] *Shown as symbol on 'Map - Traffic Map' Page*
[2] *Shown in center of 'Map - Traffic Map' Page*

Table 6-26 TAS Traffic Status Annunciations

6.6 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.*

ADS-B SYSTEM OVERVIEW

Automatic Dependent Surveillance-Broadcast (ADS-B) is a core technology in the FAA NextGen air traffic control system. It offers improved surveillance services, both air-to-air and air-to-ground, especially in areas where radar coverage is ineffective due to terrain, or where it is impractical or cost prohibitive. ADS-B is comprised of three segments for the purposes of providing traffic information: ADS-B (Broadcast), ADS-R (Rebroadcast), and Traffic Information Service-Broadcast (TIS-B).

ADS-B includes 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.

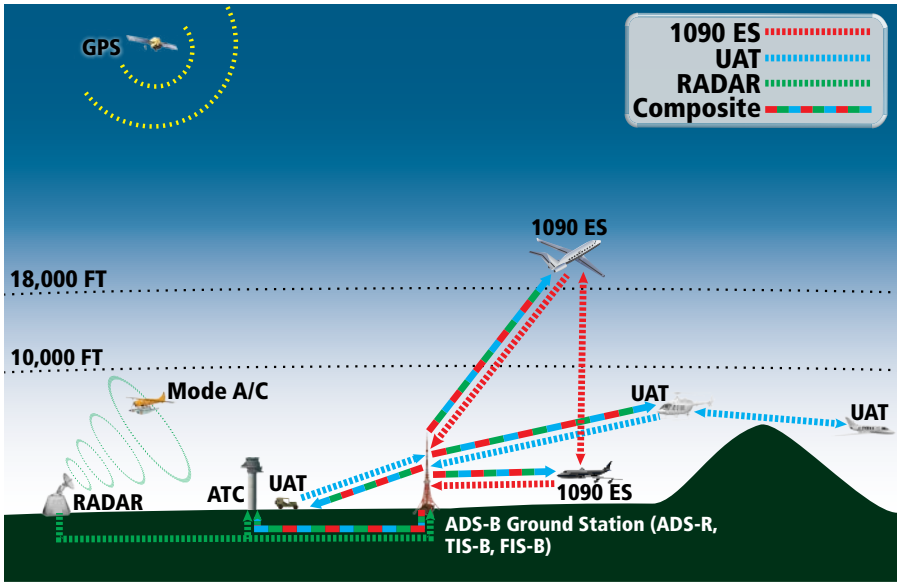


Figure 6-71 ADS-B System

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.

The ADS-B system operates on two frequencies: 1090 MHz and 978 MHz. Both frequencies provide the same traffic information. An aircraft may be ADS-B In, Out, or participating on one or both frequencies, depending on the installed equipment. The 1090 MHz frequency portion of ADS-B is known as 1090 Extended Squitter (1090 ES). The 978 MHz portion of ADS-B is known as Universal Access Transceiver (UAT).

The optional Garmin GTX 33 ES transponder provides ADS-B Out functions using the 1090 ES data link, and no ADS-B In traffic display is provided.

The optional Garmin GTX 345R transponder provides ADS-B Out functions using the 1090 ES data link. It also performs ADS-B In functions using the UAT data link. For the GTX 345, this includes the reception of Flight Information Services-Broadcast (FIS-B) data link weather service, provided when the aircraft is receiving data from a participating ground station; refer to the Data Link Weather section for more information about FIS-B Weather.

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 traffic data from one link and rebroadcasting it on the other. For example, if two aircraft are in the service volume for a ground station, and one is transmitting on 1090 MHz and the other is transmitting 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 as traffic.

For example, if another aircraft can only receive 978 MHz UAT information, it cannot directly 'see' another aircraft sending only 1090 ES information aircraft unless an ADS-R ground station in the vicinity rebroadcasts the 1090 ES data over the 978 MHz UAT frequency. This is also true for an aircraft when can only receive 1090 ES data; it would need an ADS-R ground station to 'see' another aircraft operating on the UAT frequency.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

TIS-B provides a link between the secondary surveillance radar (SSR)-based system ATC uses 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 SSR coverage, and the other aircraft is also in SSR coverage, and is transmitting its altitude.

The ground station provides ATC radar information for other aircraft within ±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.

ADS-B TRAFFIC ADVISORY SYSTEM (ATAS)

ADS-B Traffic Advisory System (ATAS) is an alerting algorithm which provides ADS-B traffic alerts to the flight crew which are similar in nature to the TAS Traffic system discussed previously.

When a TA occurs, the system displays an amber 'TRAFFIC' annunciation on the PFDs and provides a voice alert. The TA voice alert corresponds to the installed traffic system. For example, if a TAS system is installed, the voice alert is *"Traffic"*, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that caused the TA. When a TAS system is installed, the TA voice alert is *"Traffic, Traffic"* for traffic meeting conditions. The own aircraft altitude above terrain determines the sensitivity of the ATAS algorithm to minimize nuisance alerts to the flight crew.

NOTE: *The system mutes TA voice alerts from ADS-B sources when own aircraft is below 400 feet AGL.*

Sensitivity Level	Height Above Airport Reference Point (Feet)	Radar Altitude (Feet)	Height Above Terrain (HAT)	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (Feet)	Protected Volume (NM)
4	< = 1500 and within 5 NM of airport reference point	Any	Any	Any	30	400	0.20
4	Unavailable	< = 1500	Any	Any	30	400	0.20
4	Unavailable	Unavailable	< = 1500	Any	30	400	0.20
5	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	< = 5000	35	700	0.35
6	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 5000 < = 10,000	40	700	0.55
7	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 10,000 < = 20,000	45	700	0.80
8	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 20,000	48	700	1.10

Table 6-27 ATAS Alerting Thresholds for ADS-B Traffic

AIRBORNE AND SURFACE APPLICATIONS

ADS-B traffic 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 NM 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 'Map - 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.

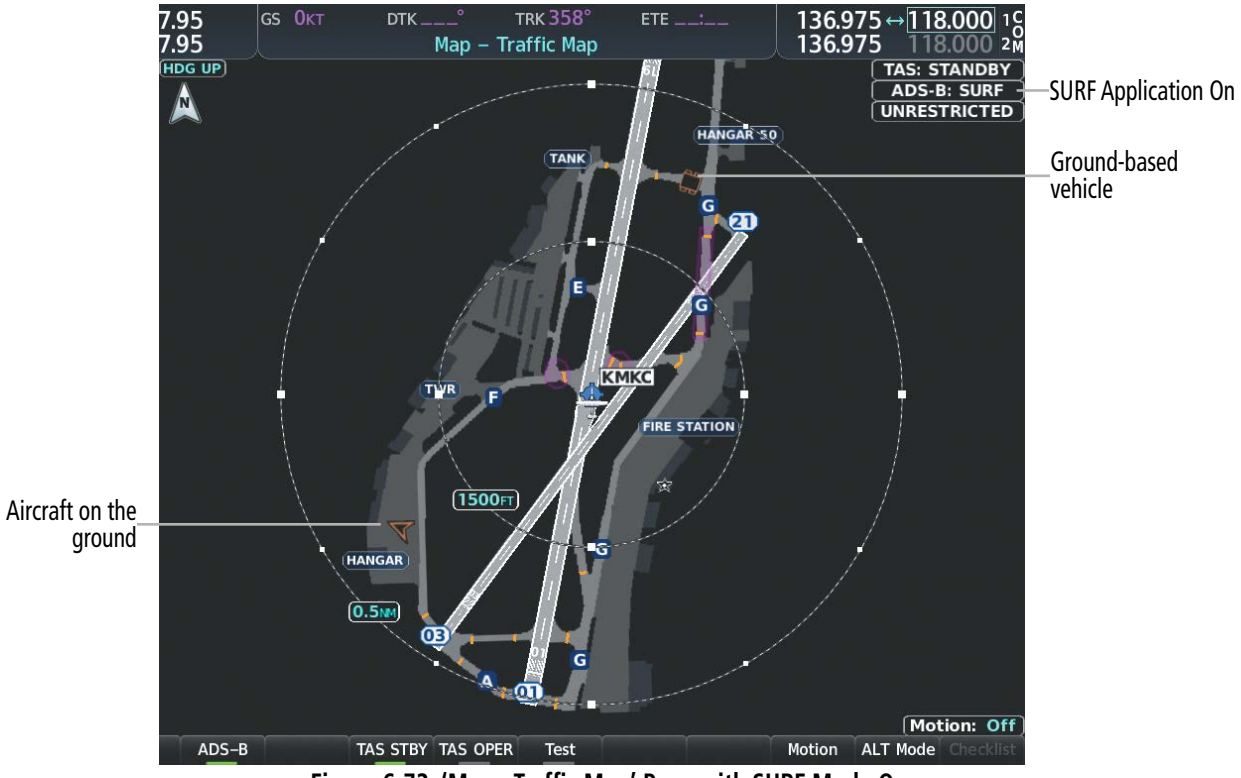


Figure 6-72 'Map - Traffic Map' Page with SURF Mode On

TRAFFIC DISPLAY SYMBOLOGY

The symbols used to display ADS-B traffic are shown in the following table.

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 without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-28 ADS-B Traffic Symbology

OPERATION

'MAP - 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. 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 right corner of the page.

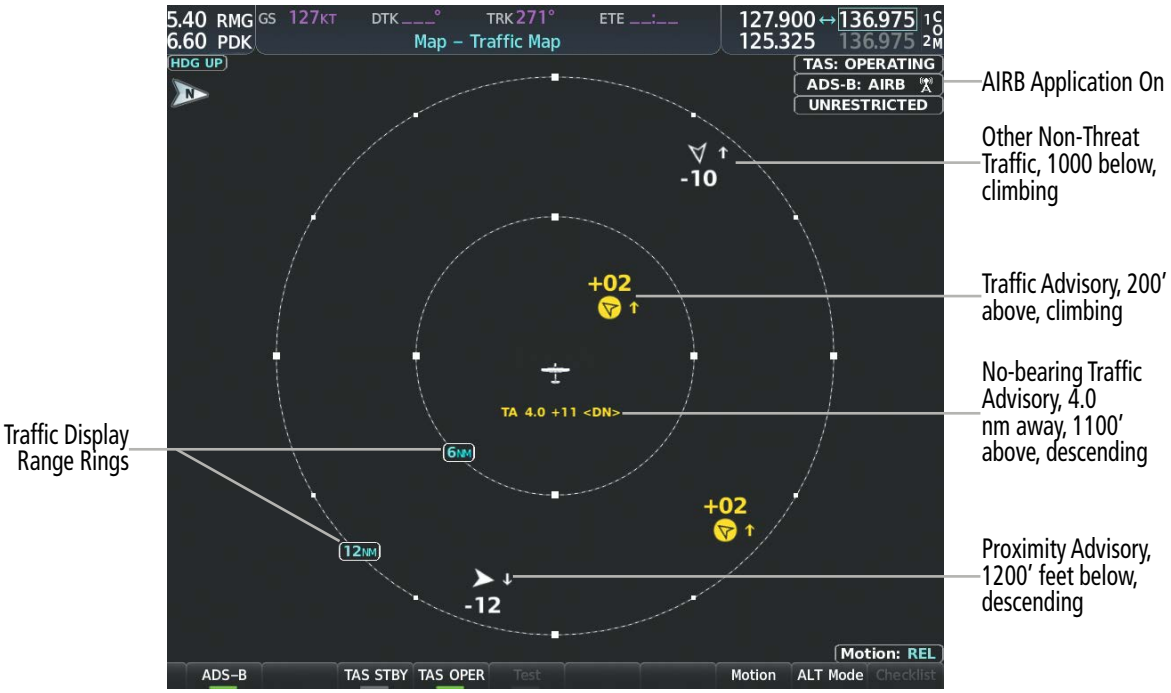


Figure 6-73 'Map - Traffic Map' Page

Enabling/disabling the display of ADS-B traffic:

1) Select the 'Map - 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 'Map - 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.
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.

A test pattern of traffic symbols appears during the test, and a 'TRAFFIC' annunciation appears on the PFD. At the conclusion of the test, the system issues the voice alert "Traffic System Test". If the test pattern is displayed and the voice alert is heard, the system has passed the test.

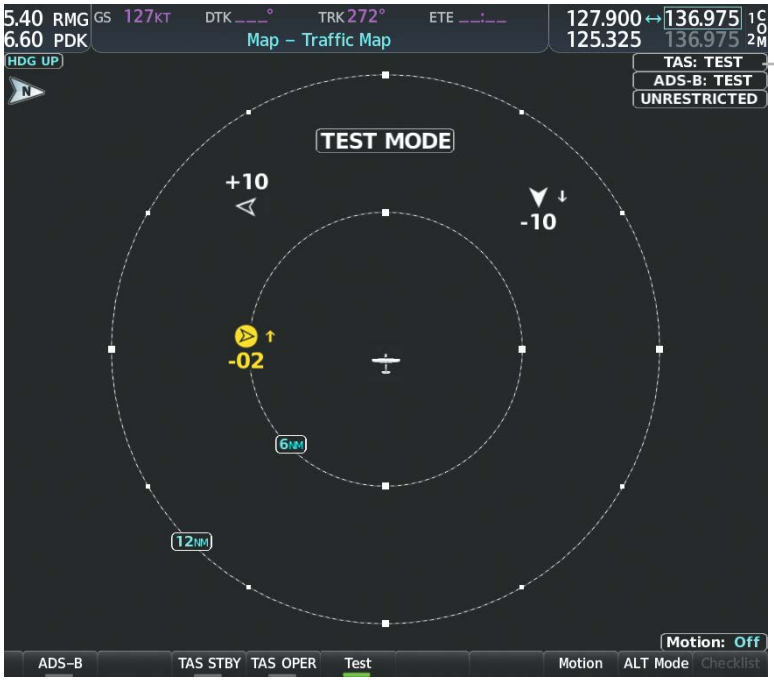


Figure 6-74 System Test in Progress with Test Pattern

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 'Map - Traffic Map' Page, select the **ALT Mode** Softkey.

2) Select one of the following softkeys:

- **Above:** Displays Other Non-Threat and proximity traffic from 9000 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 9000 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 'Map - 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 (see softkey description in the previous step 2):
   - 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.

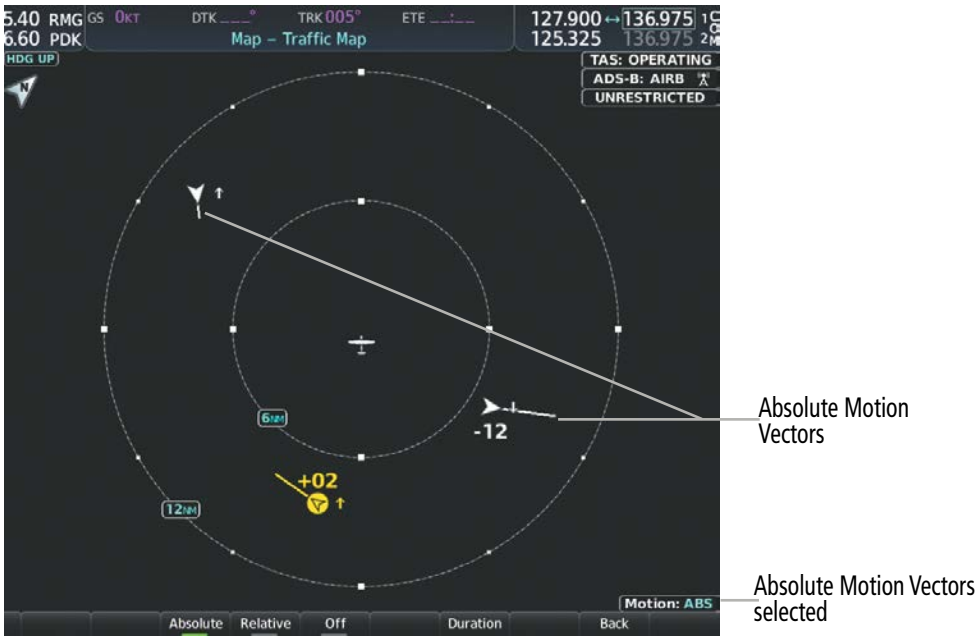


Figure 6-75 'Map - Traffic Map' Page with Absolute Motion Vectors Enabled

Figure 6-76 'Map - Traffic Map' Page with Relative Motion Vectors Enabled

Enabling/disabling the Motion Vector display:

1) Select the 'Map - Traffic Map' Page.
2) Select the **Motion** Softkey.
3) Select 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 'Map - 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 'Map - Traffic Map' Page.
2) Select the **Motion** Softkey.
3) Select the **Duration** Softkey.
4) Select 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 'Map - Traffic Map' Page.

Displaying Additional Traffic Information

The 'Map - 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 'Map - Traffic Map' Page.
2) Press the **FMS** Knob. A cyan border appears on the first selected traffic symbol. Additional information appears in a window in the lower-left corner of the 'Map - Traffic Map' Page.
3) To select a different aircraft symbol, turn the **FMS** Knob to move the cyan border until another symbol is selected.
4) When finished, press the **FMS** Knob again to disable the traffic selection.

'Map - Traffic Map' Page Display Range

The display range on the 'Map - Traffic Map' Page can be changed at any time. Map range is adjustable with the **Joystick**, as indicated by the map range rings.

Changing the display range on the 'Map - Traffic Map' Page:

1) Turn the **Joystick**.
2) The following range options are available:
   - 500 feet
   - 500 feet and 1000 feet
   - 1000 feet and 2000 feet
   - 2000 feet and 1 nm
   - 1 and 2 nm
   - 2 and 6 nm
   - 6 and 12 nm
   - 12 and 24 nm
   - 24 and 40 nm

NOTE: *ADS-B traffic can be displayed as an overlay to navigation maps and IFR/VFR Charts. Refer to the previous TAS discussions for information about these additional traffic displays.*

ADS-B SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the 'Map - Traffic Map' Page.

ADS-B Mode	Traffic Mode Annunciation ('Map - Traffic Map' Page)	'Map - 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	
ABS-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[1]	ADS-B: FAIL	ADS-B TRFC FAIL	

[1] *See Table 6-30 for additional failure annunciations*

Table 6-29 ADS-B Modes

NOTE: *If the optional TAS fails, the display of ADS-B traffic (ADS-B In) also fails, unless a GTX 345R transponder is installed. In this case, if the TAS fails, the display of ADS-B traffic continues even if the TAS has failed.*

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the 'Map - Traffic Map' Page. During a failure condition, the Operating Mode cannot be selected.

'Map - 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 6-30 Traffic 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[1]. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory[2]. 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

[1] *Shown as symbol on Traffic Map Page*
[2] *Shown in center of Traffic Map Page*

Table 6-31 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 6-77 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 (ATAS)	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 system is using the #1 GPS receiver for the GPS position source.
	External #2	The system 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 the number of minutes.

Table 6-32 Aux-ADS-B Status Page Messages for ADS-B Traffic

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS OVERVIEW

NOTE: *If the aircraft is not equipped with the Garmin AFCS, Reference the approved current pertinent flight manual for AFCS information.*

The Garmin AFCS is a digital Automatic Flight Control System (AFCS), fully integrated within the system 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)** — Flight director operation takes place within the primary (#1) GIA 63W. Flight director commands are displayed on the PFD. The flight director provides:
- 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. 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.
- **Yaw Damper (YD**) — The yaw servo is self-monitoring and provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed.
- **Manual Electric Trim (MET)** — The pitch trim adapter provides manual electric trim capability when the autopilot is not engaged.

AFCS CONTROLS ON THE MFD

The following dedicated AFCS keys are located on the bezels of the PFD and MFD:

1	**AP Key**	Engages/disengages the autopilot
2	**HDG Key**	Selects/deselects Heading Select Mode
3	**NAV Key**	Selects/deselects Navigation Mode
4	**APR Key**	Selects/deselects Approach Mode
5	**VS Key**	Selects/deselects Vertical Speed Mode
6	**FLC Key**	Selects/deselects Flight Level Change Mode
7	**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.
8	**ALT Key**	Selects/deselects Altitude Hold Mode
9	**VNV Key**	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
10	**BC Key**	Selects/deselects Backcourse Mode
11	**NOSE UP/NOSE DN Keys**	Control the mode reference in Pitch Hold, Vertical Speed, and Flight Level Change modes

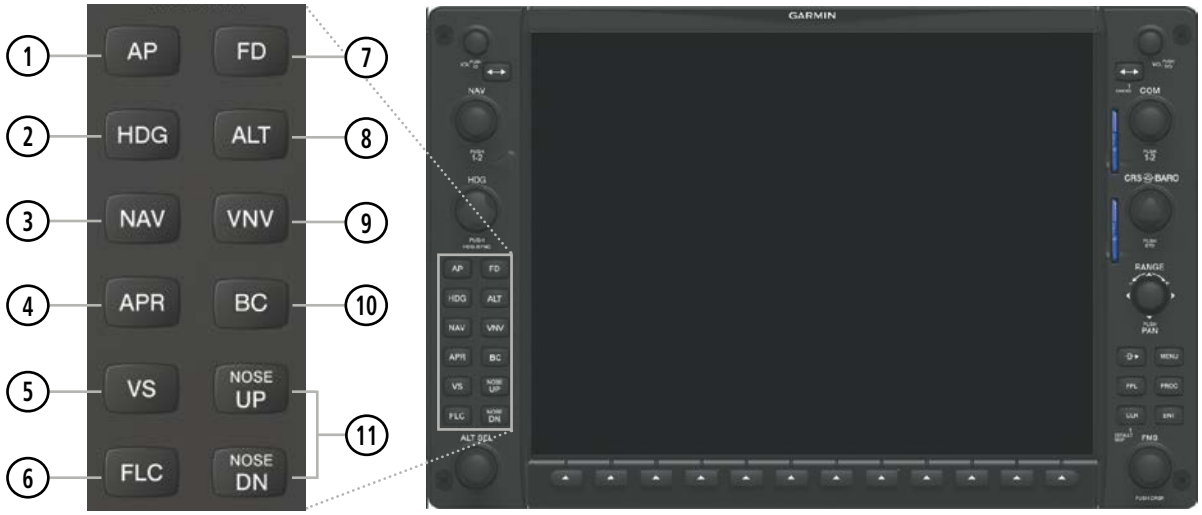


Figure 7-1 Dedicated AFCS Controls

The following AFCS controls are located in the cockpit separately from the PFD and MFD:

AP DISC Button (Autopilot Disconnect)	Disengages the autopilot and interrupts pitch trim operation The **AP DISC** Button is located on the pilot's control yoke. This switch may be used to mute the aural autopilot disconnect alert.
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 Glideslope Mode) and roll (if in Roll Hold Mode) Upon release of the **CWS** Button, the flight director may establish new reference points, depending on the current pitch and roll modes. CWS operation details are discussed in the flight director modes section. The **CWS** Button is located on the pilot's control yoke.
GA Button (Go Around)	The autopilot remains engaged and selects flight director Go Around Mode If an approach procedure is loaded this button also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned. The **GA** Button is located on the instrument panel above the throttle.
MET Switch (Manual Electric Trim)	Used to command manual electric trim. 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. The **MET** ARM Switch can be used to disengage the autopilot and 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, MET function is disabled and 'PTRM' is displayed as the AFCS Status Annunciation on the PFD. The function remains disabled until both sides of the switch are inactivated. The **MET** Switch is located on the pilot's control yoke.

BASIC AUTOPILOT OPERATION

The following describes basic autopilot functionality. A more detailed description follows in Section 7.4.

- **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 the 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
  - » Pressing the **GA Switch** (located on the instrument panel above the throttle.)
  - » Operating the **MET Switch** (located on the pilot's 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.

7.2 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFD. With the flight director activated, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (+20°/-15°) and roll (22°) 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 flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the display 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
GA Switch	Takeoff (on ground) Go Around (in air)	TO GA	Takeoff (on ground) Go Around (in air)	TO 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[1]	VPTH
NAV Key	Navigation[2]	GPS VOR LOC	Pitch Hold (default)	PIT
BC Key	Backcourse[3]	BC	Pitch Hold (default)	PIT
APR Key	Approach[2]	GPS VOR LOC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT

[1] *Valid VNV flight plan must be entered before* **VNV** *Key press activates flight director.*

[2] *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course before* ***NAV*** *or* ***APR*** *Key press activates flight director.*

[3] *The selected navigation receiver must have a valid LOC signal before* ***BC*** *Key press activates flight director.*

Table 7-1 Flight Director Activation

AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFD when the flight director is active. Flight director selection and autopilot and yaw damper 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.

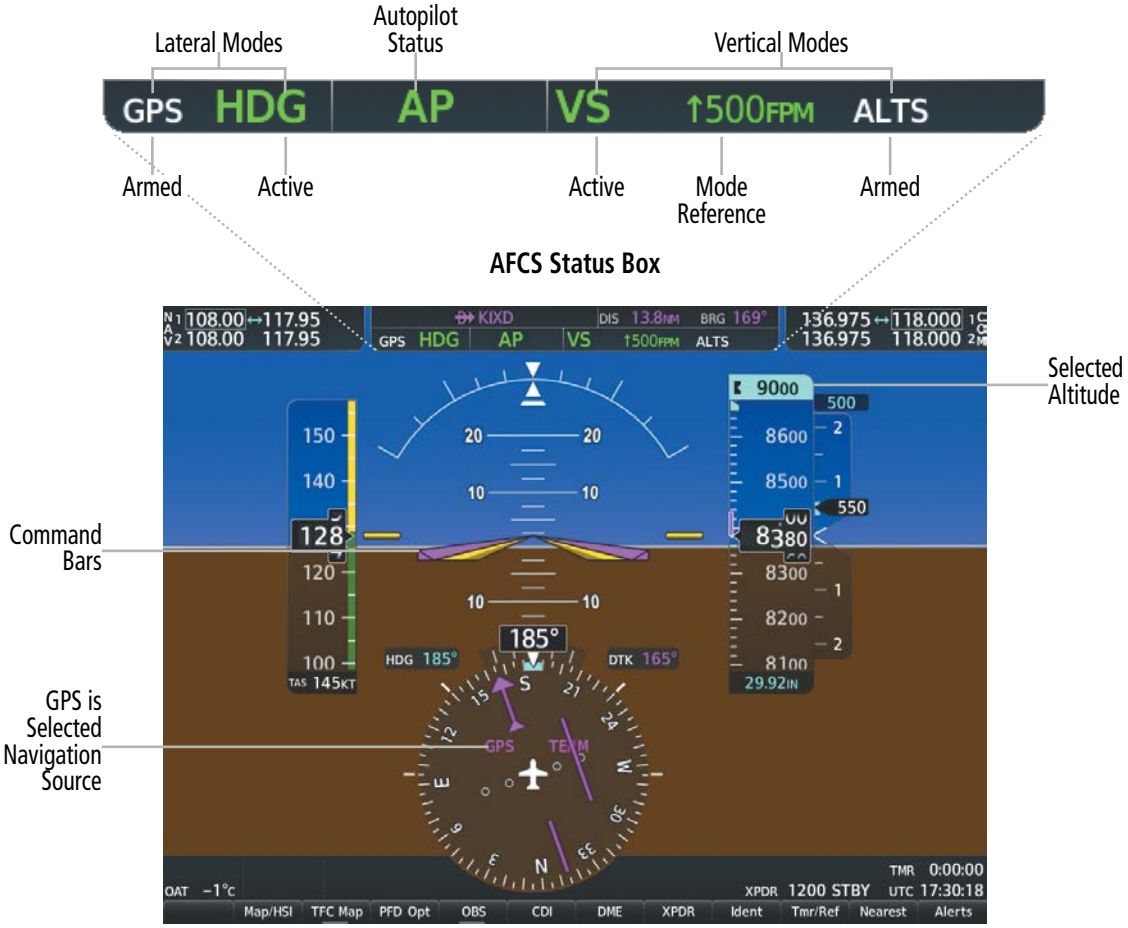


Figure 7-2 PFD AFCS Display

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 modes.

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(s) for the axis(es). 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, GPS, 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 GPS 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 PFD as a single cue. The Command Bars do not override the Aircraft Symbol. The Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.

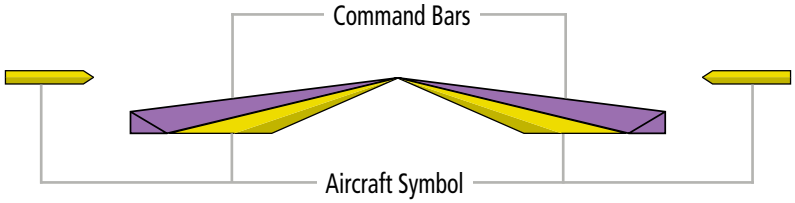


Figure 7-4 Command Bars

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°/-20° 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/DN** Wheel can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode.

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	[1]	ALTS			
Altitude Hold	Holds the current Altitude Reference	**ALT** Key	ALT	nnnnn FT		
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**VS** Key	VS	nnnn FPM	-2000 to +1500 fpm	100 fpm
Flight Level Change, IAS Hold	Maintains the current aircraft airspeed in IAS while the aircraft is climbing/descending to the Selected Altitude	**FLC** Key	FLC	nnn KT	70 to 150 kts (172) 70 to 160 kts (182) 80 to 160 kts (206)	1 kt

[1] *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 green '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.

Changing the Pitch Reference

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the **NOSE UP/NOSE DN** Keys
- Pressing the **CWS** Switch, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Switch

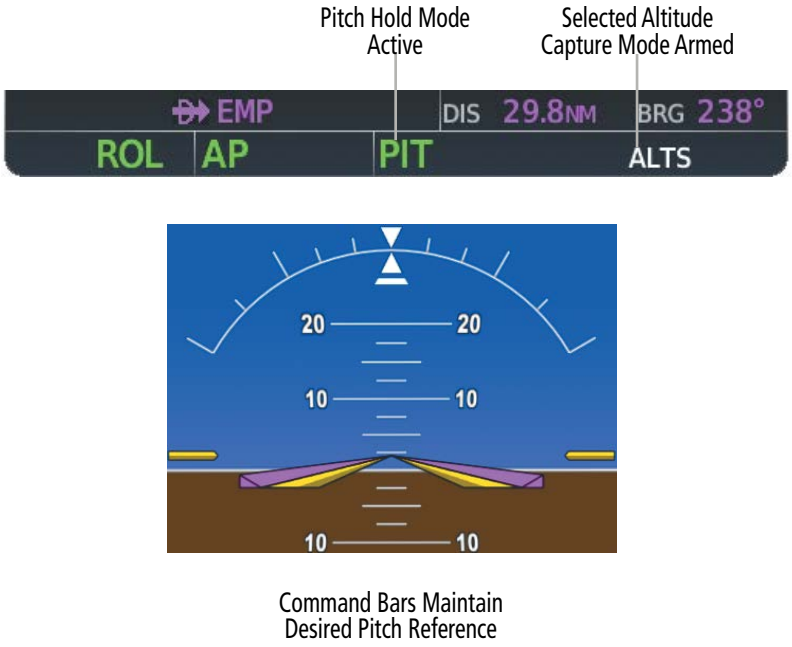


Figure 7-5 Pitch Hold Mode

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 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.

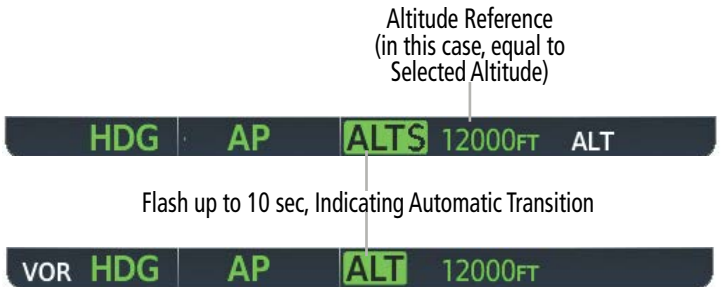


Figure 7-6 Automatic Mode Transitions During Altitude Capture

Changing the Selected Altitude

NOTE: *Pressing the **CWS** Switch while in Selected Altitude Capture Mode does not cancel the mode.*

Use of the **ALT** Knob 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)

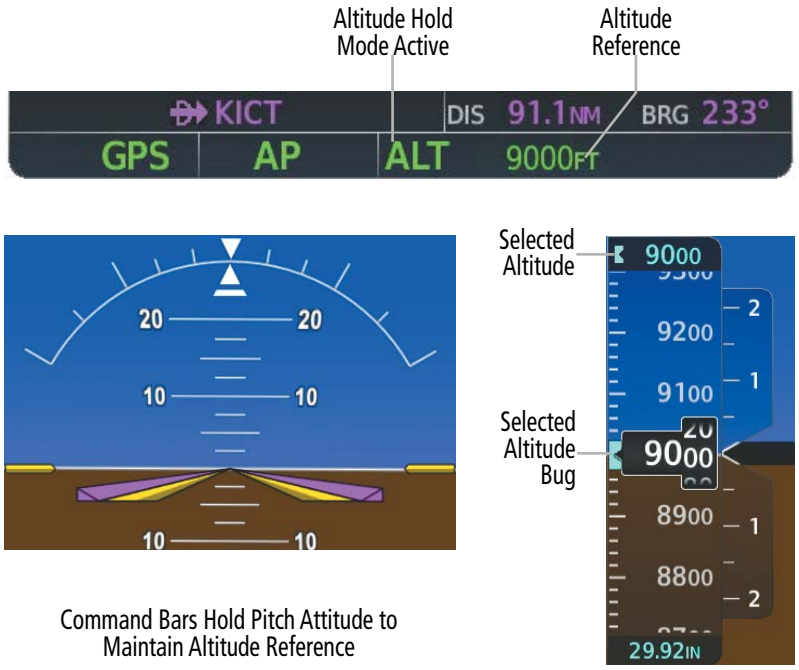


Figure 7-7 Altitude Hold Mode

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.

Changing the Vertical Speed Reference

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/NOSE DN** Keys
- Pressing the **CWS** Switch, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Switch

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*** *Switch must be pressed again after the Selected Altitude is reached.*

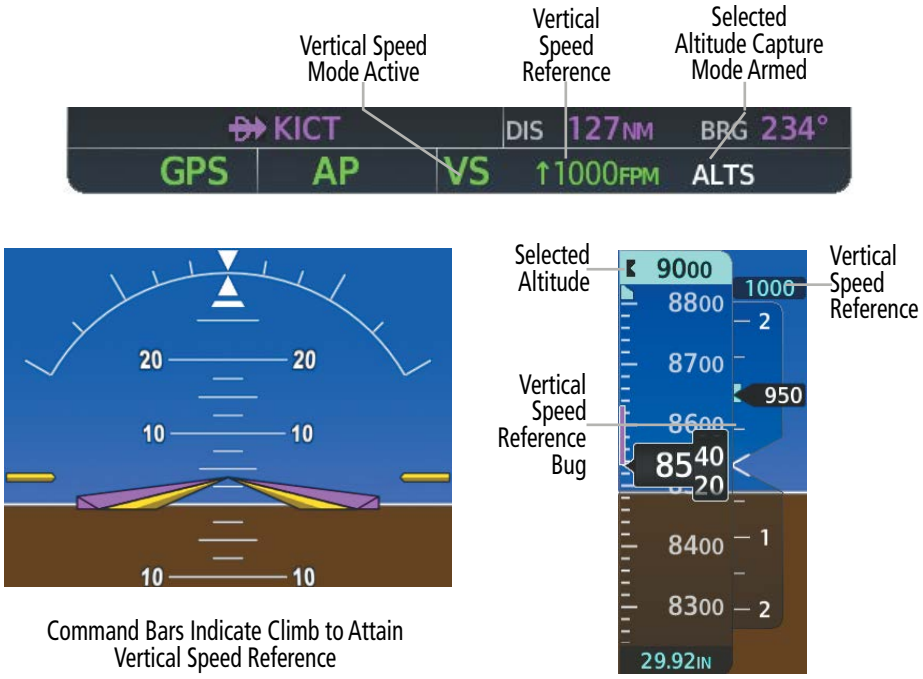


Figure 7-8 Vertical Speed Hold Mode

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 (IAS) 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.

Changing the Airspeed Reference

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the **NOSE UP/NOSE DN** Keys
- Pressing the **CWS** Switch, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the **CWS** Switch

NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Airspeed Reference is not changed. To adjust the Airspeed Reference in this case, the* ***CWS*** *Switch must be pressed again after the Selected Altitude is reached.*

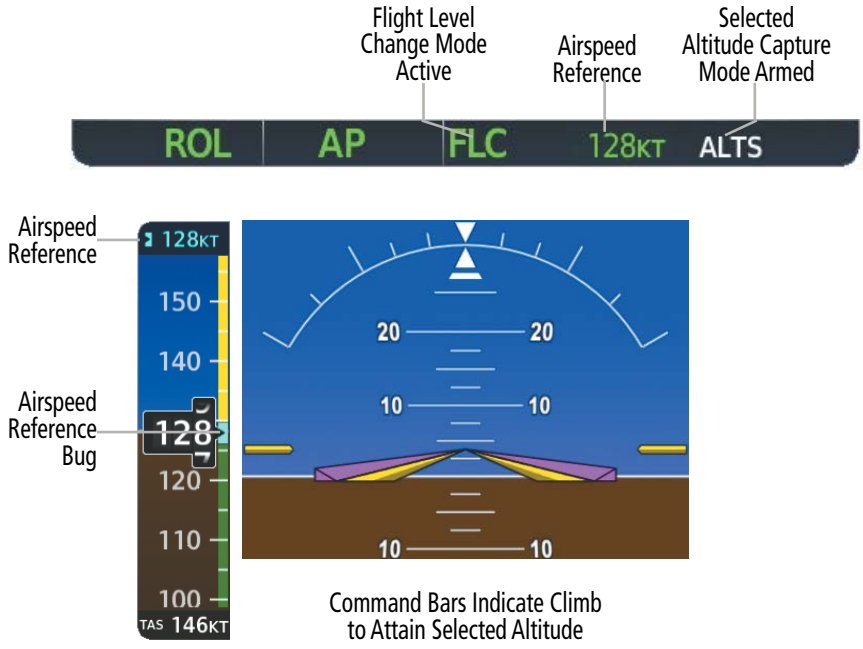


Figure 7-9 Flight Level Change Mode (IAS)

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	22°
Heading Select	Captures and tracks the Selected Heading	**HDG** Key	HDG	22°
Navigation, GPS Arm/Capture/Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	22° Capture 10° Track
Navigation, VOR Enroute Arm/Capture/Track			VOR	22° Capture 10° Track
Navigation, LOC Arm/Capture/Track (No Glideslope)			LOC	22° 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 the 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 7-10 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 22°	Maintains current aircraft roll attitude
> 22°	Limits bank to 22°

Table 7-4 Roll Hold Mode Responses

Changing the Roll Reference

The roll reference can be changed by pressing the **CWS** Switch, establishing the desired bank angle, then releasing the **CWS** Switch.

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.

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** Switch 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** Switch.

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.

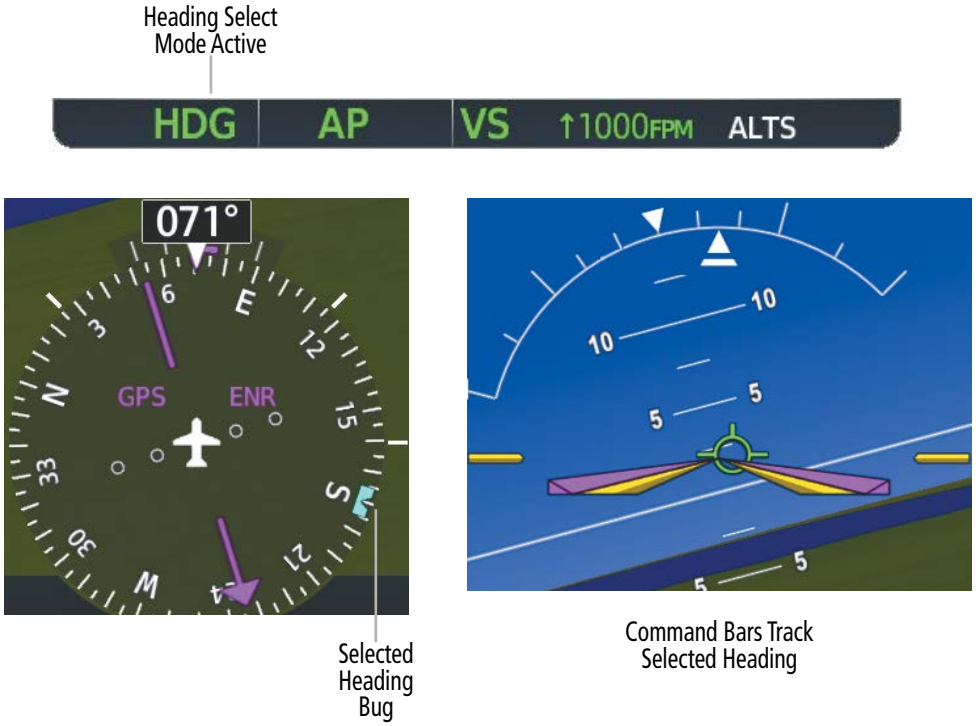


Figure 7-11 Heading Select Mode

NAVIGATION MODES (GPS, VOR, LOC)

NOTE: *The selected navigation receiver must have a valid VOR or LOC signal or active GPS 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 to 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 (GPS, VOR, LOC). The flight director follows GPS roll steering commands when GPS 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 GPS and LOC approaches where vertical guidance is not required.

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The mode may be selected by pressing the **BC** Key. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. If the CDI is less than one dot, the Backcourse Mode is automatically captured when the **BC** Key is pressed. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** or **BC** Key is pressed, the selected mode is armed. If the CDI shows less than one dot, Navigation Mode is automatically captured when the **NAV** or **BC** Key is pressed. The armed annunciation appears in white to the left of the active lateral mode.

Figure 7-12 GPS Navigation Mode Armed

When the CDI has automatically switched from GPS to LOC during a LOC/ILS approach, GPS Navigation Mode remains active, providing GPS 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 GPS Navigation Mode after the automatic navigation source switch from GPS to LOC

Changing the Selected Course

If the navigation source is VOR or localizer, or OBS Mode has been enabled when using GPS, 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 GPS flight plan) when the **CWS Switch** Switch is released

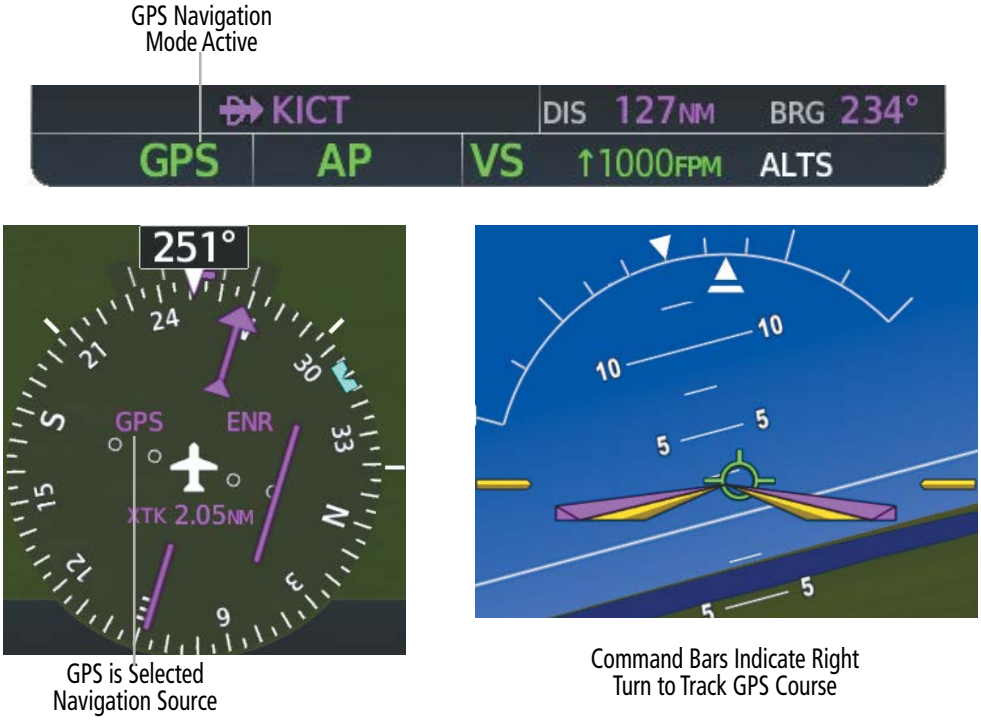


Figure 7-13 Navigation Mode

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	[1]	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	**BC** Key	BC	22° Capture 10° Track	
Approach, GPS Arm/Capture/Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**APR** Key	GPS	22° Capture 10° Track	
Approach, VOR Arm/Capture/Track			VAPP	22° Capture 10° Track	
Approach, ILS Arm/Capture/Track (Glideslope Mode automatically armed)			LOC	22° Capture 10° Track	
Go Around[2]	Commands a constant pitch angle and wings level in the air	**GA** Button	GA		7°

[1] *ALTV is armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude.*

[2] *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.*

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 any time that VNV flight planning is available. Refer to the Flight Management Section for more information on VNV flight plans. Conditions for availability include, but are not limited to:

» The selected navigation source is GPS.
» 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: *Vertical Path Tracking Mode is only applicable to aircraft equipped with a **VNV** Key.*

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** Switch 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** Switch.*

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.

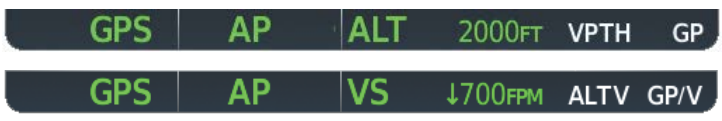


Figure 7-14 Vertical Path Tracking Armed Annunciations

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 one 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 PFD in magenta.

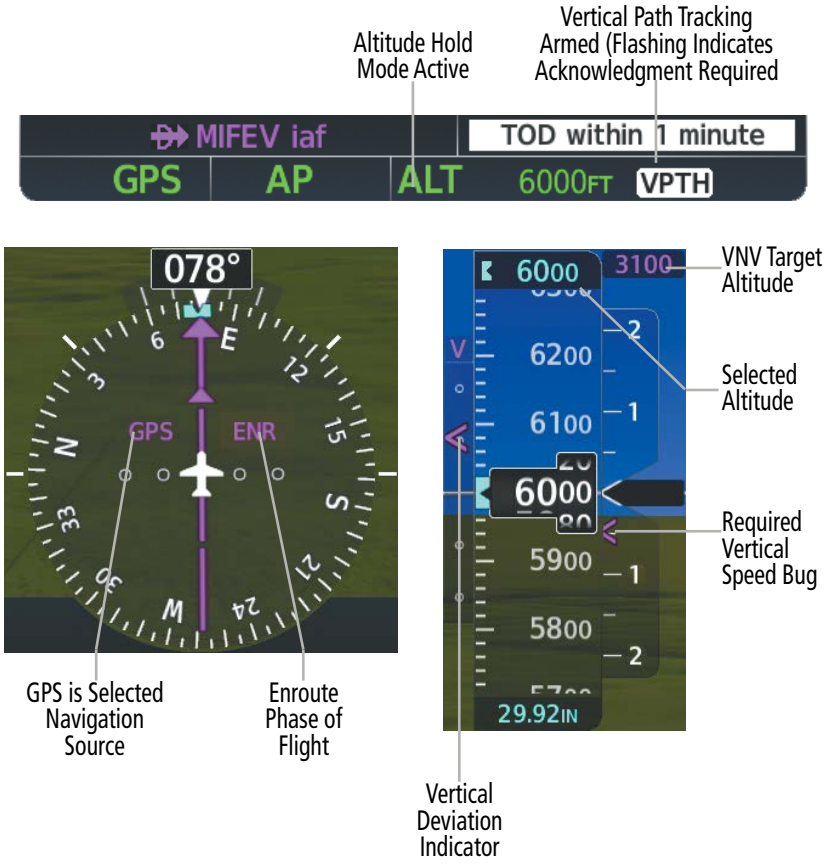


Figure 7-15 Vertical Path Capture

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.

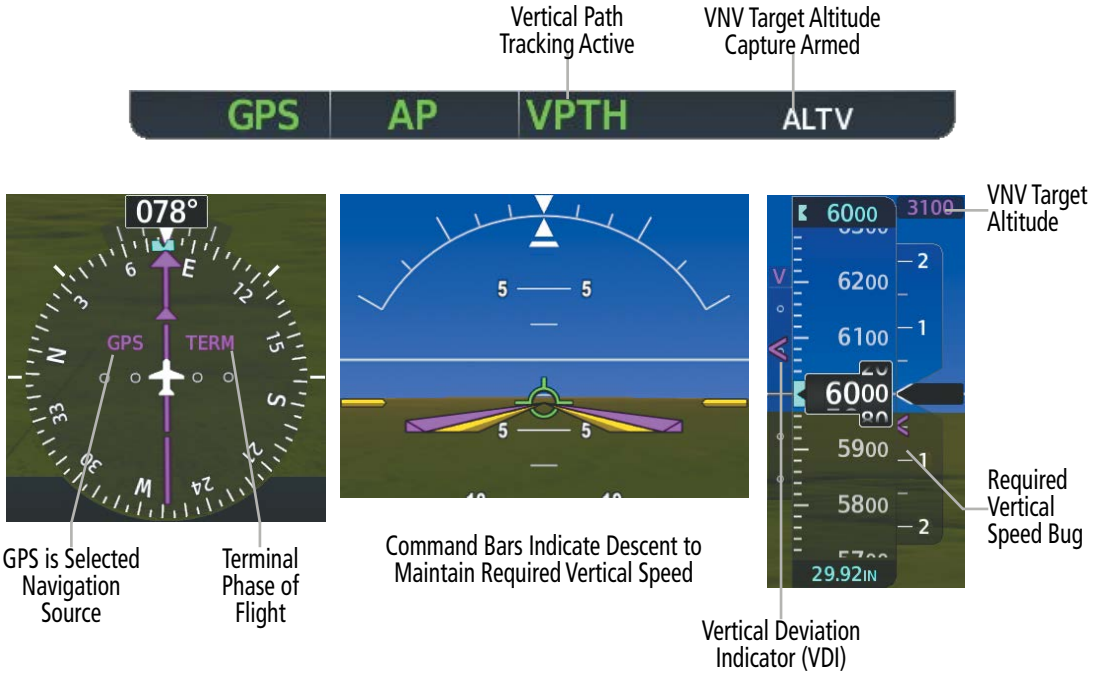


Figure 7-16 Vertical Path Tracking Mode

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 7-17 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: *VNV Target Altitude Capture Mode is only applicable to aircraft equipped with a* ***VNV*** *Key.*

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 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.

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.

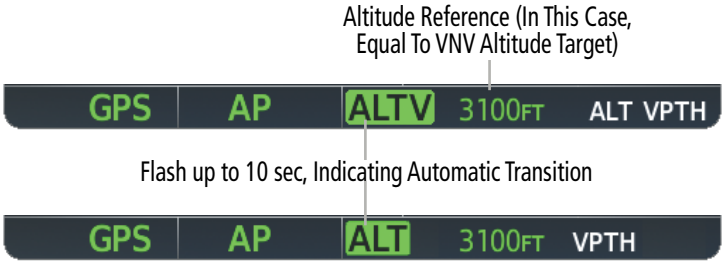


Figure 7-18 Automatic Mode Transitions During Altitude Capture

Changing the VNV Target Altitude

NOTE: *Pressing the **CWS** Switch 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 (GPS, VAPP, LOC)

NOTE: *The selected navigation receiver must have a valid VOR or LOC signal or active GPS 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 (GPS, 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 the 1 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 GPS Approach Mode is armed, Glidepath Mode is also armed.

Selecting GPS Approach Mode:

1) Ensure a GPS 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 GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

Figure 7-19 GPS Approach Mode Armed

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:

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 GPS 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.

If 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, GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

Changing the Selected Course

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

GLIDEPATH MODE (GP)

NOTE: *Pressing the **CWS** Switch while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Switch.*

Glidepath Mode is available only when SBAS is available. Glidepath Mode is used to track the SBAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting Glidepath Mode (SBAS Only):

1) Ensure a GPS approach with vertical guidance or vertical descent angle (LPV, LNAV/VNAV, 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 GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

NOTE: *Some RNAV (GPS) 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 should be flown to an MDA, until visual with the landing surface, 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 7-20 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

» A GPS approach with vertical guidance (LPV, LNAV/VNAV, LNAV+V) is loaded into the active flight plan.
» 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)

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.*

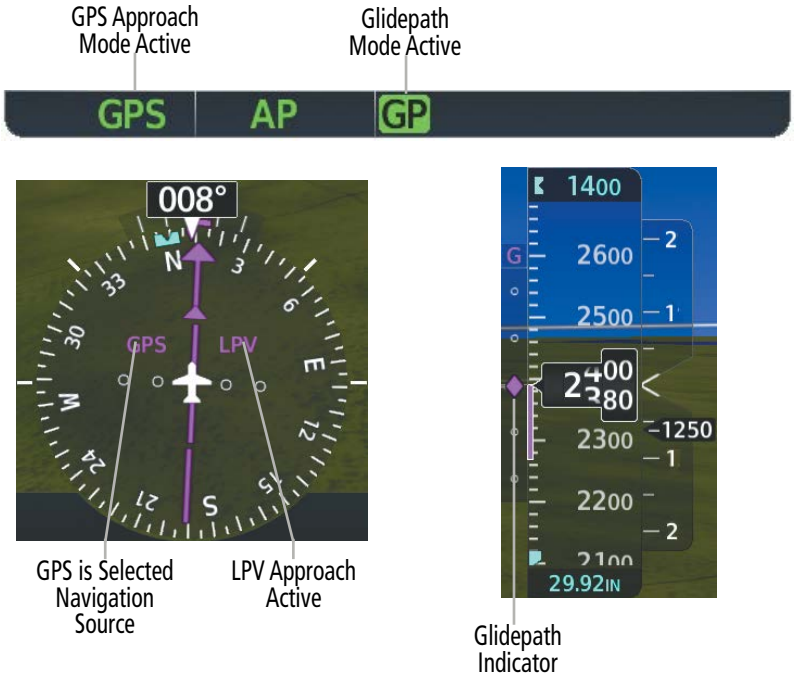


Figure 7-21 Glidepath Mode

GLIDESLOPE MODE (GS)

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 Glideslope Mode:

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 GPS 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 7-22 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.

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.*

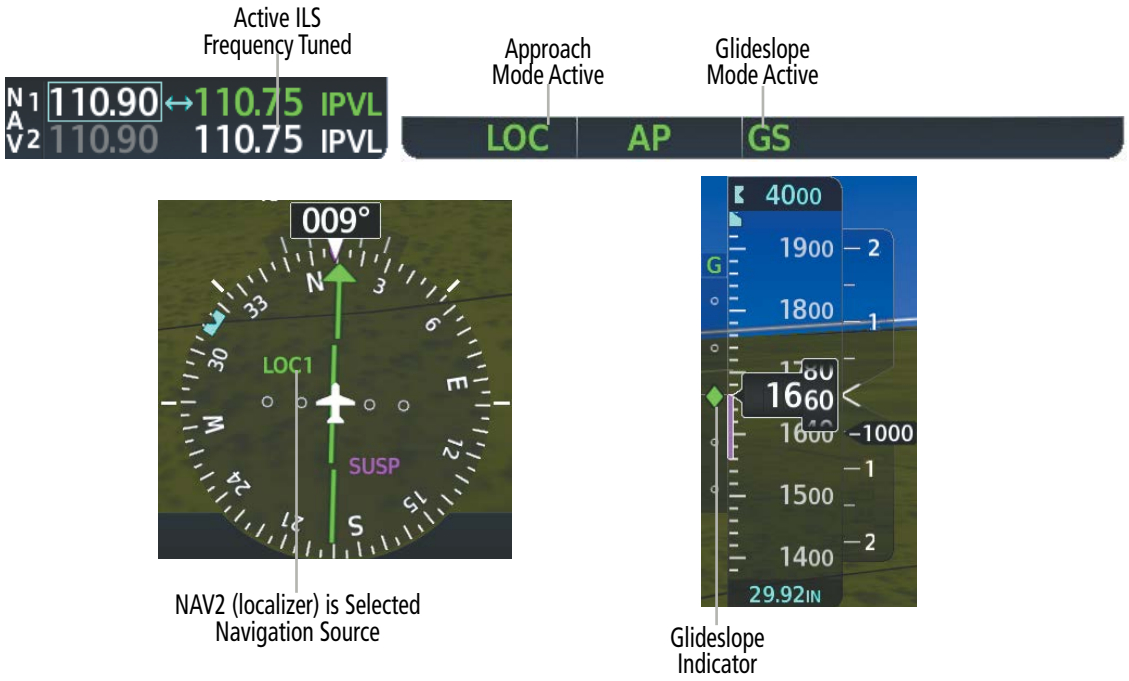


Figure 7-23 Glideslope Mode

BACKCOURSE MODE (BC)

NOTE: *When making a backcourse approach, set the Selected Course to the localizer front course.*

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The mode may be selected by pressing the **BC** Key. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. If the CDI is less than one dot, Backcourse Mode is automatically captured when the **BC** Key is pressed. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.

LOC2 is Selected Navigation Source

Figure 7-24 Backcourse Mode

Changing the Selected Course

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not reset any reference data while in Backcourse Mode. The autopilot guides the aircraft back to the Selected Course 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 GPS Navigation Mode is engaged, GPS 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 GPS. 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 GPS 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 GPS Navigation Mode, the AFCS will no longer track the arc.

GO AROUND (GA) MODES

Pressing the **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. Go Around Mode disengages the autopilot and arms Selected Altitude Capture Mode automatically. Subsequent autopilot engagement is allowed. Attempts to modify the aircraft attitude (i.e., with the **NOSE UP/NOSE DN** Keys or **CWS** Switch) result in reversion to Pitch and Roll Hold modes.

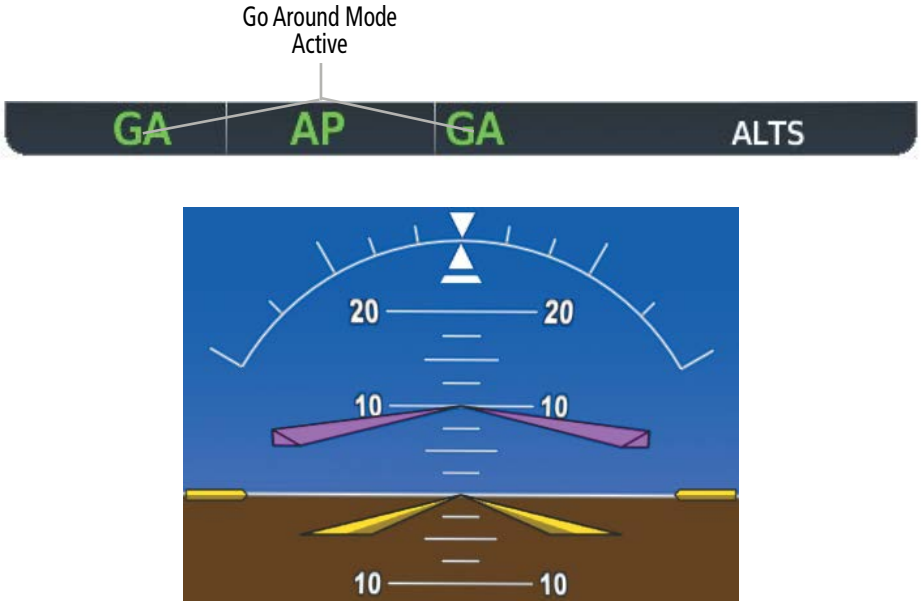


Figure 7-25 Go Around Modes

7.4 AUTOPILOT

NOTE: Refer to the current pertinent flight manual for specific instructions regarding emergency procedures.

The autopilot operates flight control surface servos to provide automatic flight control. Pitch and roll commands are provided to the servos, based on the active flight director modes. The autopilot uses pitch and roll rates to stabilize the aircraft attitude during upsets and flight director maneuvers. Flight director commands are rate- and attitude-limited, combined with pitch and roll damper control, and sent to the pitch and roll servo motors.

Pitch autotrim provides trim commands to the pitch trim servo to relieve any sustained effort required by the pitch servo. 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 trim (MET). This allows the aircraft to be trimmed using a control wheel switch rather than the trim wheel. Manual trim commands are generated with the **MET** Switch. Trim speeds are scheduled with airspeed to provide more consistent response.

Servo motor control limits the maximum servo speed and torque. The servo mounts are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

FLIGHT CONTROL

Pitch and roll commands are provided to the servos based on the active flight director modes. Yaw damping is provided by the yaw servo. Servo motor control limits the maximum servo speed and torque. The servo mounts 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 (MET). 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 **MET** 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** Switch 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 engaged) are activated. Engagement is indicated by a green 'AP' annunciation in the center of the AFCS Status Box. The flight director engages in Pitch and Roll Hold modes when initially activated.

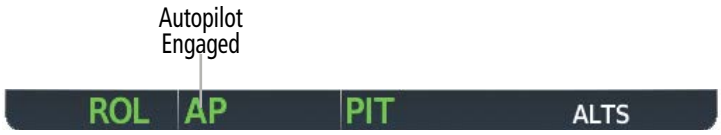


Figure 7-26 Autopilot and Yaw Damper Engaged

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.

In most scenarios, releasing the **CWS** Button reengages the autopilot with a new reference. Refer to the flight director modes section for CWS behavior in each mode.

Figure 7-27 CWS Annunciation

DISENGAGEMENT

The autopilot is manually disengaged by pushing the **AP DISC** Switch, **AP** Key on the MFD, **GA** Switch, or **MET** ARM Switch. Manual autopilot disengagement is indicated by a five-second flashing yellow 'AP' annunciation and a three-second autopilot disconnect aural alert.

Figure 7-28 Manual Autopilot Disengagement

Pushing the **AP DISC** Switch disengages the autopilot. When the autopilot is manually disengaged, the 'AP' annunciation turns yellow and flashes for 5 seconds and a three-second autopilot disconnect aural alert is generated.

Figure 7-29 Yaw Damper Disengagement

After manual disengagement, the autopilot disconnect aural alert may be cancelled by pushing the **MET** ARM or **AP DISC** Switch (**AP DISC** Switch also cancels the flashing 'AP' annunciation).

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 **MET** ARM Switch. Automatic autopilot disengagement occurs due to:

- System failure
- Invalid sensor data
- Inability to compute default flight director modes (FD also disengages automatically)

7.5 AFCS ANNUNCIATIONS AND ALERTS

AFCS CAS MESSAGES

The annunciations in Table 7-6 (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.

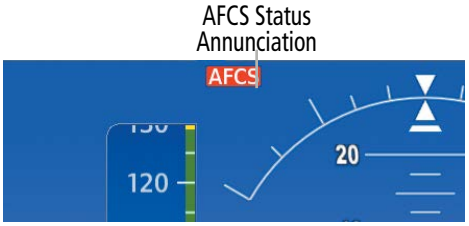


Figure 7-30 AFCS Status Annunciation

Alert Condition	Annunciation	Description
Aileron Mistrim Right	AIL→	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	←AIL	
Elevator Mistrim Down	↓ELE	Pitch servo providing sustained force in the indicated direction
Elevator Mistrim Up	↑ELE	
Pitch Trim Failure (or stuck **MET** Switch)	PTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move **MET** switches separately to unstick
Roll Failure	ROLL	Roll axis control failure; AP inoperative
Pitch Failure	PTCH	Pitch axis control failure; AP inoperative
System Failure	AFCS	AP and MET are unavailable; FD may still be available
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion Do not press the **AP DISC** Switch during servo power-on and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-on tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test failed; aural alert sounds at failure

Table 7-6 AFCS Status Alerts

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
- ChartView, FliteCharts, and IFR/VFR electronic charts
- SurfaceWatch™
- SiriusXM Satellite Radio entertainment
- Flight Data Logging
- Connext Setup
- Electronic Checklists

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, FliteCharts and IFR/VFR electronic charts provides on-board electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information.

The optional SurfaceWatch™ feature provides voice and visual annunciations to aid in maintaining situational awareness and avoid potential runway incursions during ground and air operations in the airport environment.

The optional SiriusXM Satellite Radio entertainment audio feature of the GDL 69 SXM 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 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.

Connext 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.

Electronic checklists allow a pilot to quickly find the proper procedure for a particular phase of flight.

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
- PFD Maps
- 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.

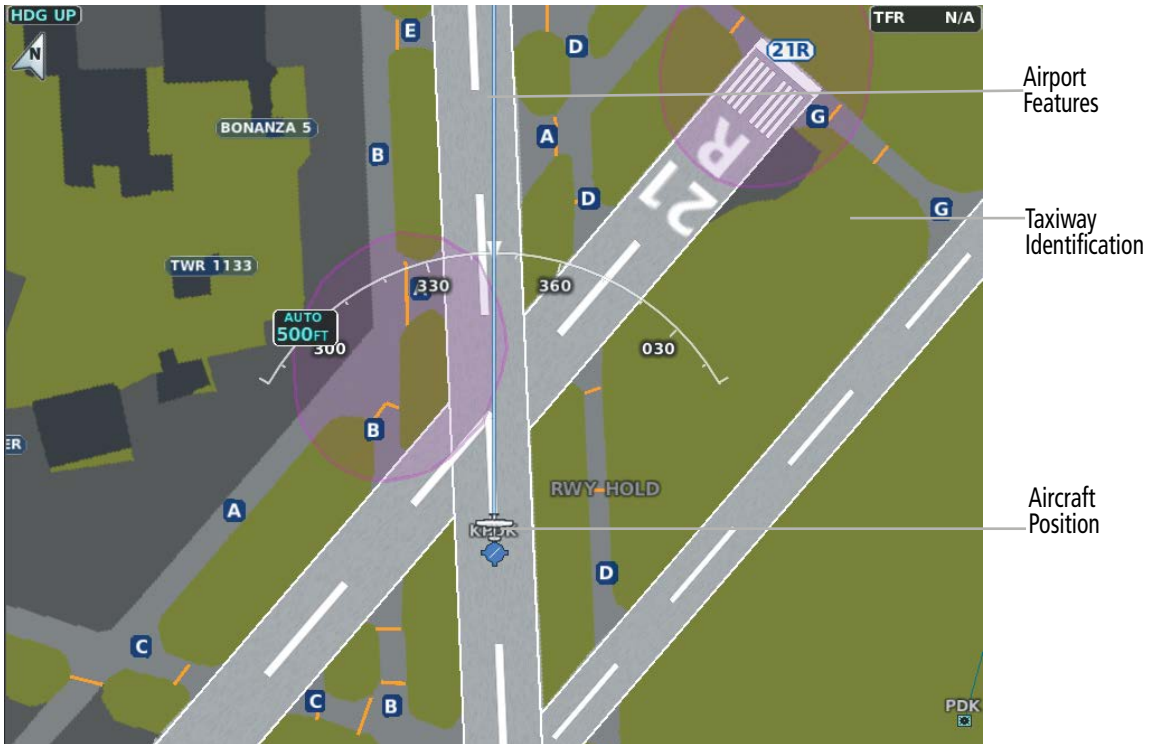


Figure 8-1 SafeTaxi Depiction on the Navigation Map Page

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.

Configuring SafeTaxi range:

1) While viewing the Navigation Map Page, press the **MENU** Key to display the Page Menu.
2) Turn the large **FMS** Knob to highlight the Map Settings Menu Option and press the **ENT** Key.
3) Turn the **FMS** Knob to select the Aviation Group and press the **ENT** Key.
4) Turn the large **FMS** Knob to scroll through the Aviation Group options to SafeTaxi.
5) Turn the small **FMS** Knob to display the range of distances.
6) Turn either **FMS** Knob to select the desired distance for maximum SafeTaxi display range.
7) Press the **ENT** Key to complete the selection.
8) Push the **FMS** Knob to return to the Navigation Map Page.

8.2 CHARTS

The preferred charts source can be selected within the system. 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).

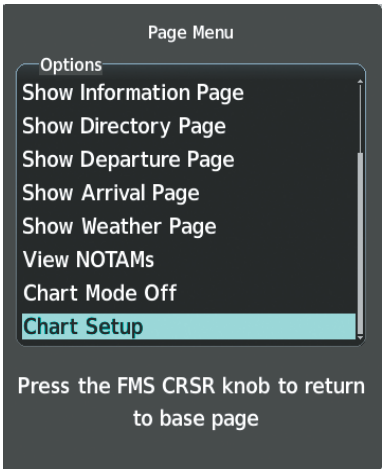
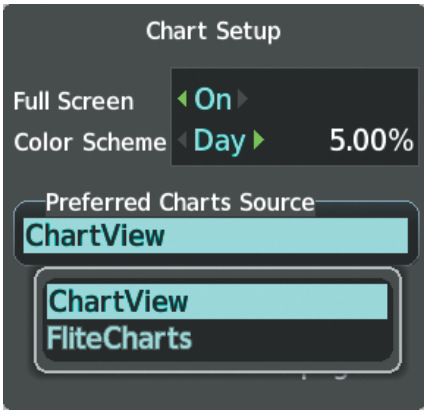


Chart Setup Option



Preferred Charts Source Option

Figure 8-2 Preferred Charts Source

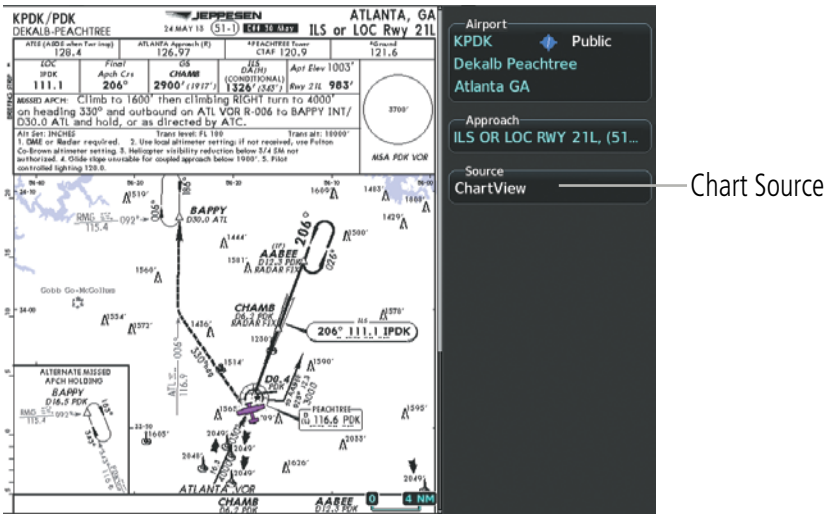


Figure 8-3 Chart Source

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.

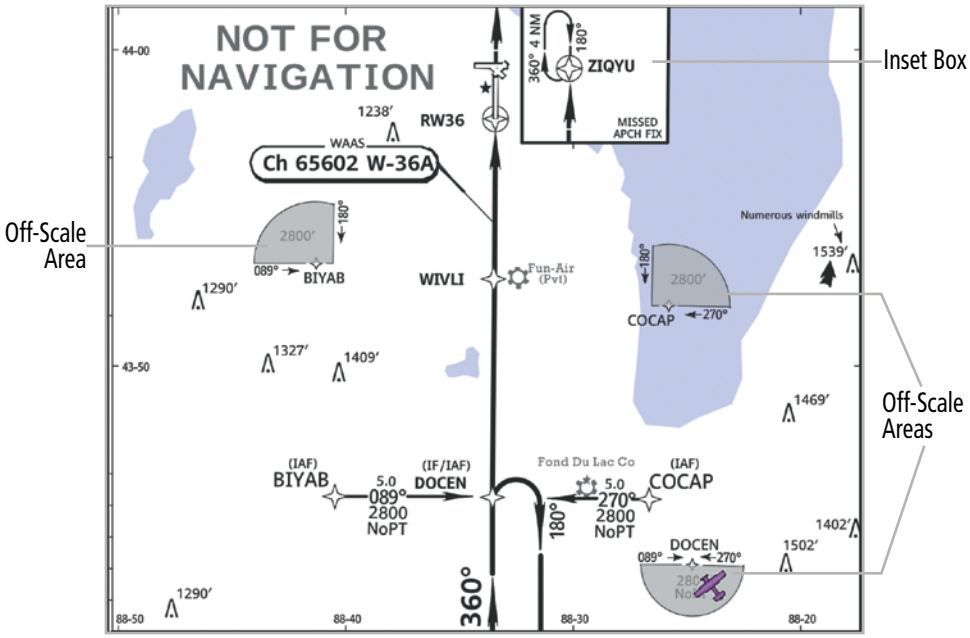


Figure 8-4 Sample Chart Indicating Off-Scale Areas

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

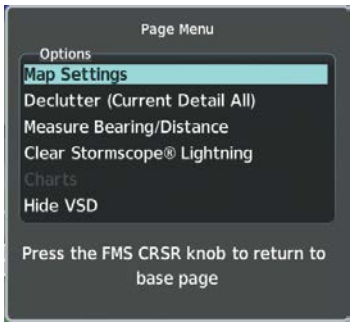
TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

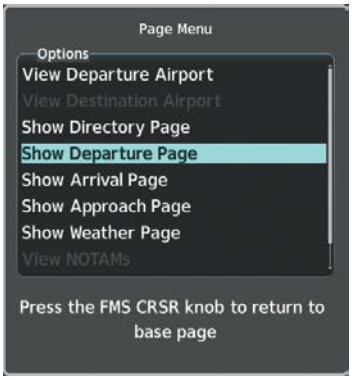
While viewing the Navigation Map Page, Nearest Airport Page, or Flight Plan Page, the **Charts** Softkey.

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 selecting 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, selecting 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 Navigation Map Page, Flight Plan Page, or Nearest Airports Page, press the **Charts** Softkey. The airport diagram or approach chart is displayed on the Airport Information Page.
2) Push 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.

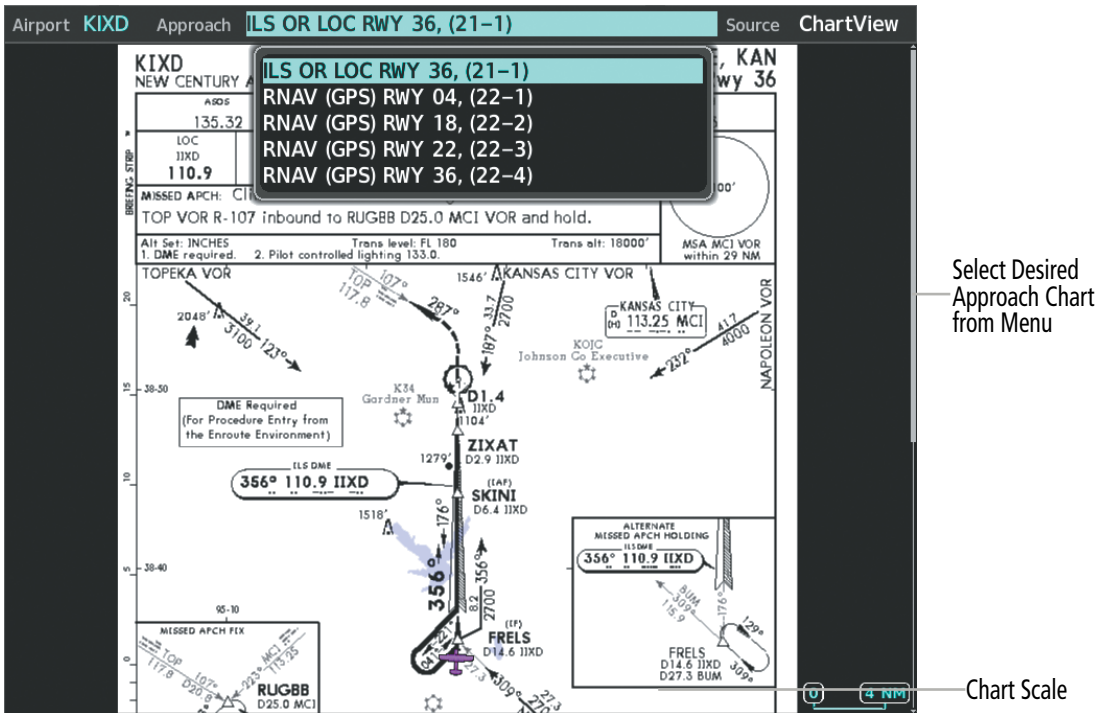


Figure 8-8 Approach Information Page, Chart Selection

While the Approaches Box is selected using the **FMS** Knob, the system 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.

Selecting 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.

Selecting 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 system softkeys are blank. The Centennial Airport has two additional charts offering information; the Airport Diagram, Take-off Minimums, Class B Airspace, (The numbers in parentheses after the chart name are Jeppesen designators.)

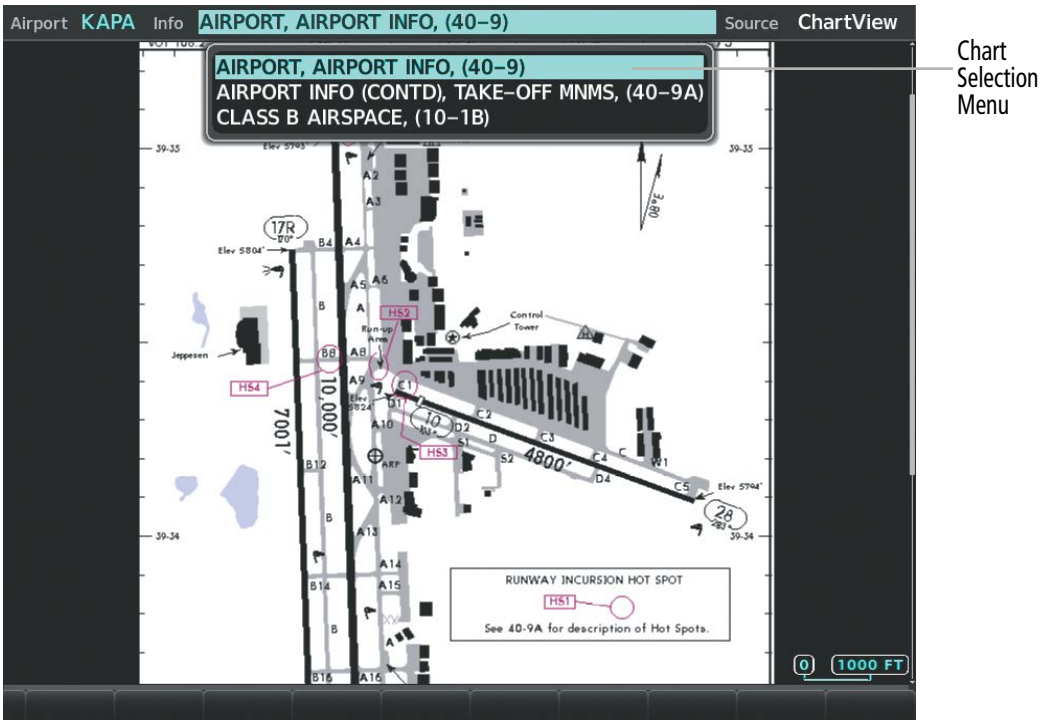


Figure 8-9 Airport Information Page, INFO View

In the example shown in following figure, the Class B Chart is selected. Pressing the **ENT** Key displays the Charlotte Class B Airspace Chart.

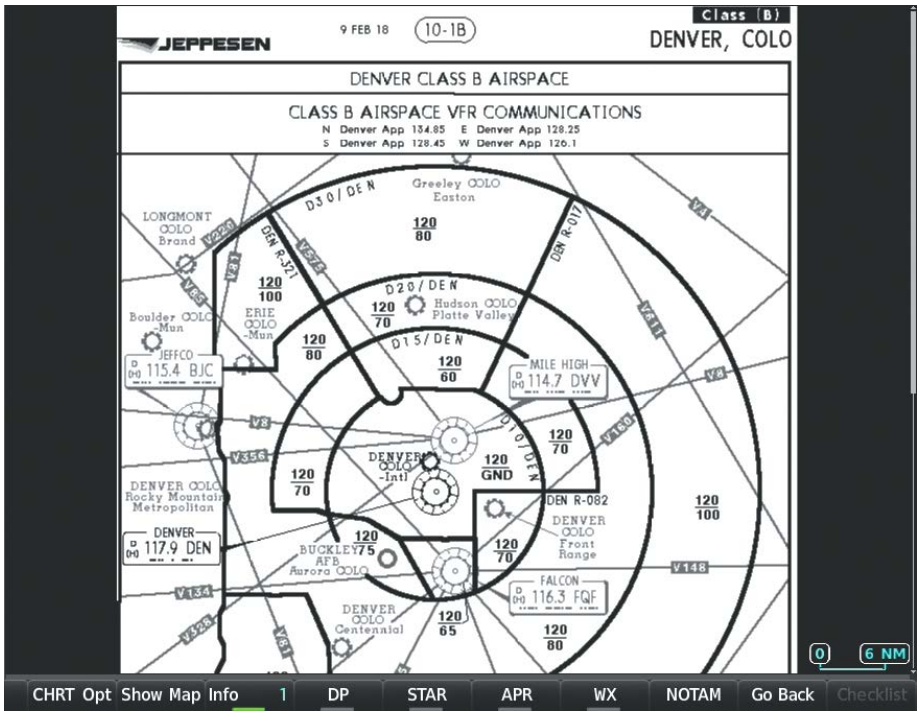


Figure 8-10 Airport Information Page, Class B Chart Selected from INFO View

» 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.*

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.

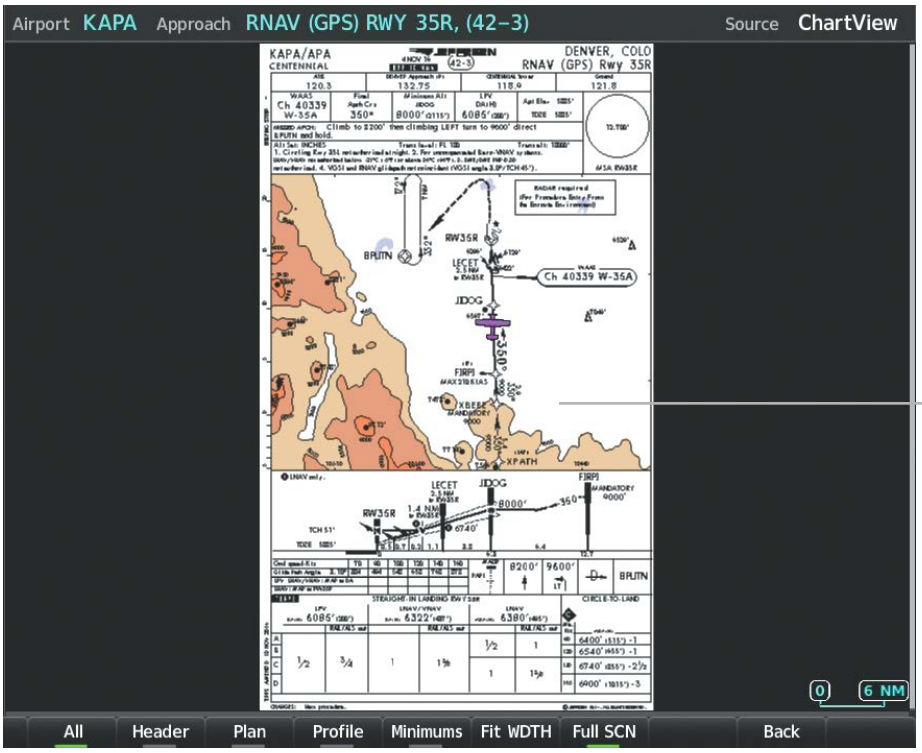


Figure 8-11 Approach Information Page, ALL View

» 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, selecting the **Fit WDTH** 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) Push 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) Push 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.

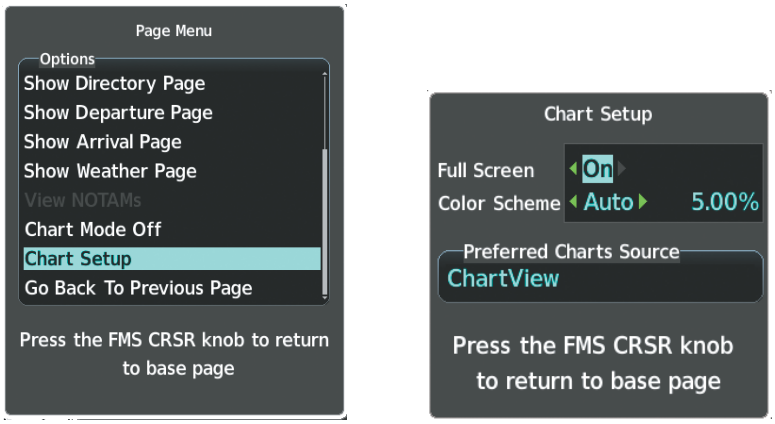


Chart Setup Option — Full Screen On/Off Selection

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.

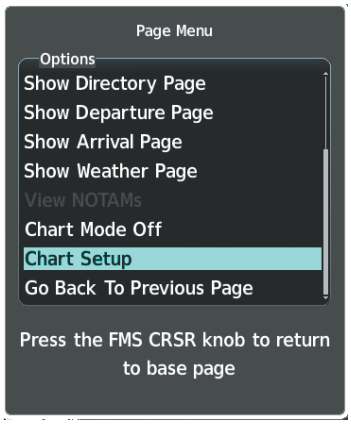


Figure 8-13 Page Menu Chart Setup

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) Push the **FMS** Knob when finished to remove the Chart Setup Menu.

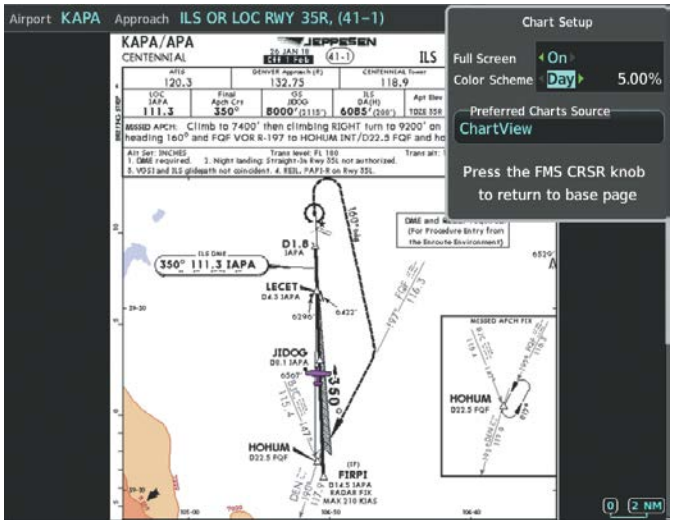


Figure 8-14 Arrival Information Page, Day View

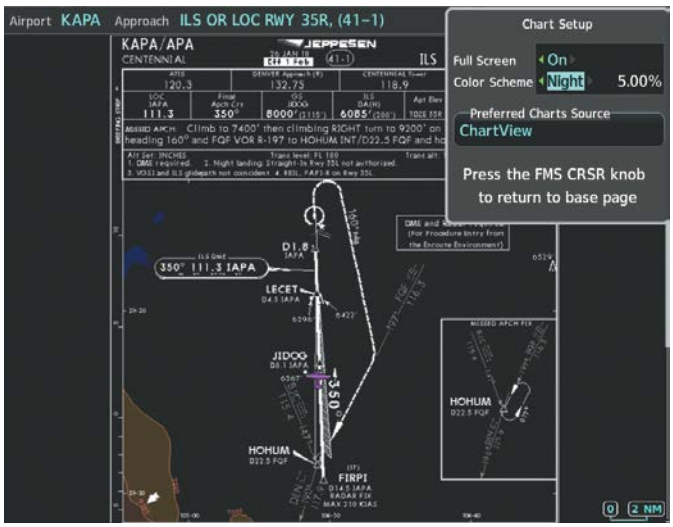


Figure 8-15 Arrival Information Page, Night View

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

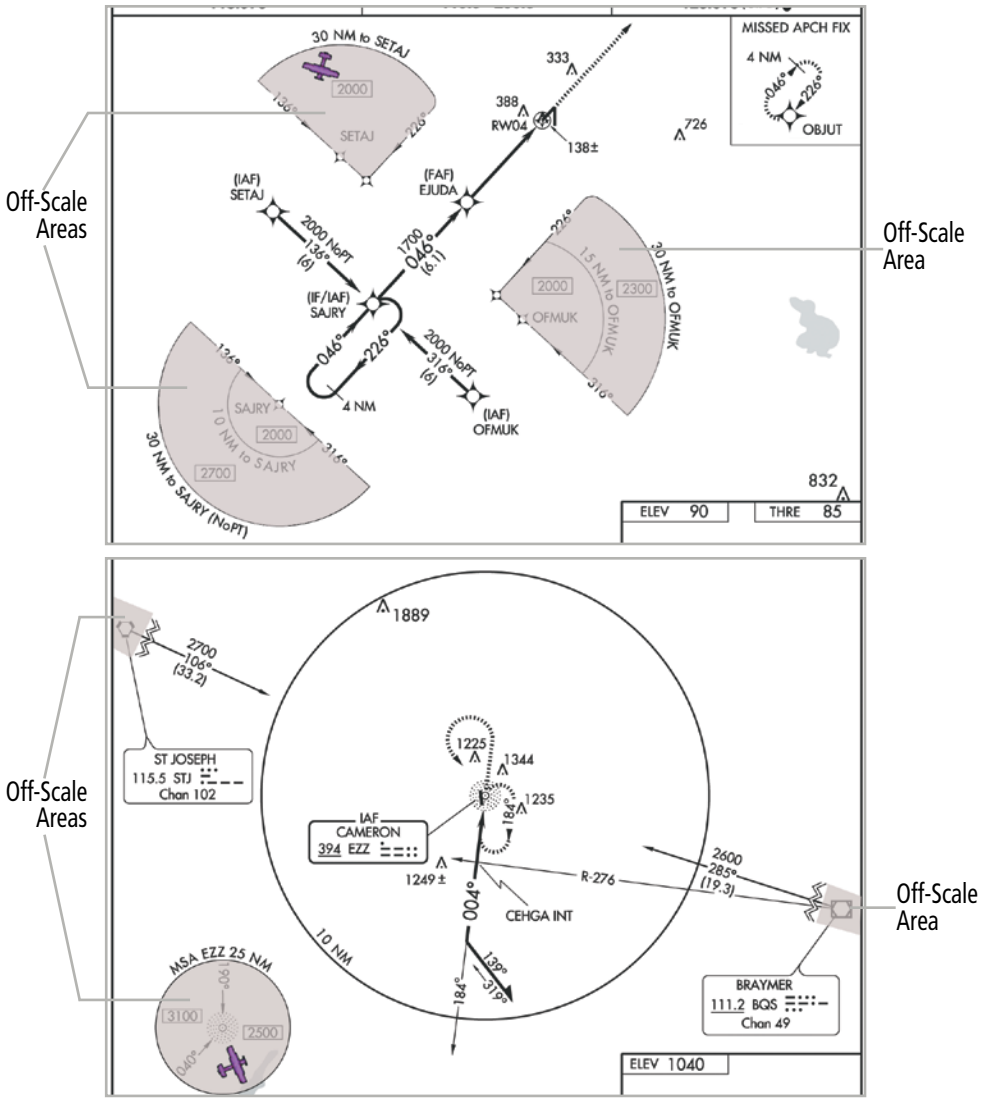


Figure 8-17 Sample Chart Indicating Off-Scale Areas

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 WDTH**, **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 Navigation Map Page, Nearest Airport Page, or 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.

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 Navigation Map Page, Flight Plan Page, or Nearest Airports Page, press the **Charts** Softkey. The airport diagram or approach chart is displayed on the Airport Information Page.
2) Push 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 system 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 system 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 (AIRPORT, INFO).
2) Push 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 system 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) Push 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) Push the **FMS** Knob when finished to remove the Chart Setup Menu.

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.

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.

Figure 8-20 GPS Navigation Information on the VFR Chart

Selecting IFR Low, IFR High, VFR Charts:

1) Select the 'Map - IFR/VFR Charts' Page.
2) 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.

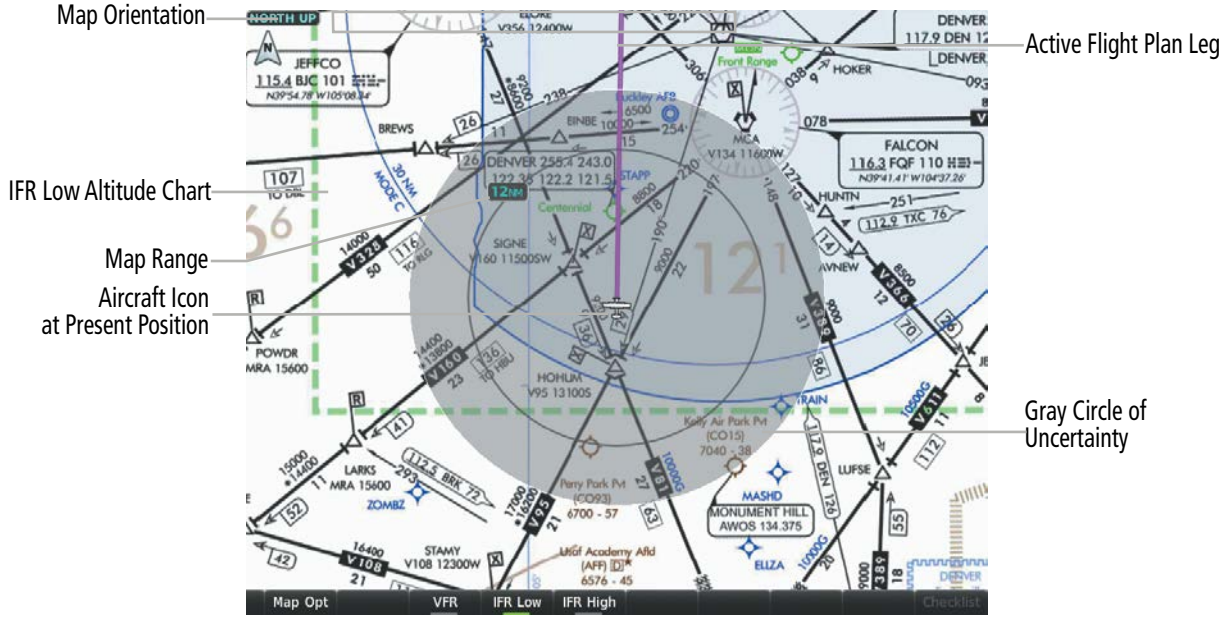


Figure 8-21 GPS Navigation Information on the IFR Low Altitude Chart

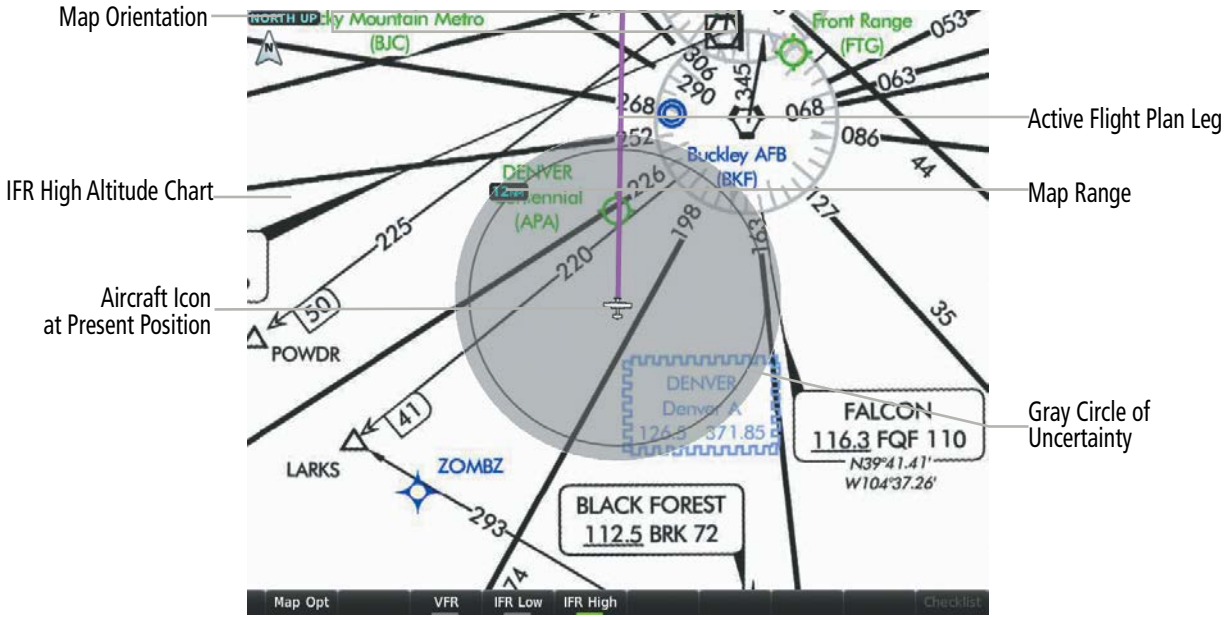


Figure 8-22 GPS Navigation Information on the IFR High Altitude Chart

8.3 SURFACEWATCH

NOTE: *The SafeTaxi database must be available to provide information regarding taxiways, aprons and other objects in the airport environment.*

The SurfaceWatch™ feature provides visual annunciations to help the flight crew maintain situational awareness and avoid potential runway incursions and excursions during ground and air operations in the airport environment. The SurfaceWatch feature is comprised of the following key components:

- Alert Annunciations
  - Taxiway Takeoff
  - Runway Too Short (during takeoff or landing)
  - Check Runway (during takeoff or landing)
  - Taxiway Landing
- Provides information on the Primary Flight Display (PFD) that contains runway and taxiway information that changes as the aircraft moves through the airport environment.

The full SurfaceWatch feature is not available in Reversionary Mode.

Inhibiting/uninhibiting SurfaceWatch:

1) Select the 'Aux - System Setup 1' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor..
3) Turn the large **FMS** Knob to highlight the SurfaceWatch field.
4) Turn the small **FMS** Knob to toggle the SurfaceWatch alerts on or off.

INFORMATION BOX

The SurfaceWatch™ Information Box is displayed on the PFD. It contains runway and taxiway information that dynamically changes as the aircraft moves through the airport environment. The information that is displayed in the Information Box is the aircraft's relative position to nearby aprons, taxiways, and runways.

There are three components to the SurfaceWatch™ Information Box. These components are Currently Occupied, Approaching, and Crossing Runways.

Figure 8-23 Information Types Displayed in the Information Box

CURRENTLY OCCUPIED

This component indicates the aircraft is 'ON' the indicated apron, taxiway, or runway. The aircraft is currently 'ON' runway 04 right (RWY 04R). The remaining runway distance is also shown when the aircraft is situated on and aligned with a runway.

If the aircraft is airborne and approaching an airport, 'AIRBORNE TO' and the destination airport identifier will be displayed.

Information regarding non-manuevering areas not labeled on the SafeTaxi diagram will not be displayed.

APPROACHING COMPONENT

This component indicates the aircraft is 'APPROACHING' the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently 'APPROACHING' taxiway H (TWY H). The distance to the taxiway is also shown.

When the aircraft is taxiing and approaching an intersection of multiple taxiways, the taxiway identifiers will be listed in order of proximity and the distance to the nearest is displayed.

When the aircraft is taxiing and crossing an intersection of multiple taxiways, 'CROSSING' will be displayed and no distance will be shown.

CROSSING RUNWAYS

This component lists the runways, from closest to furthest, that are 'CROSSING' the runway the aircraft currently occupies. The distance to each runway is also shown in order of closest distance. Runways behind the aircraft are not depicted.

The Crossing Runways component is shown in conjunction with the Currently Occupied component of the Information Box.

ALERTS

The SurfaceWatch alert annunciations are displayed in the central portion of the PFD. The alert annunciations are accompanied by a corresponding voice alert.

SurfaceWatch Alert Annunciation	Associated Voice Alert	Description
TWY TAKEOFF	"Taxiway"	Issued when the aircraft is taking off from a non-runway (e.g. a taxiway)
RWY TOO SHORT	"Runway too short"	Issued when the aircraft is taking off from, or landing on, a runway with a length less than needed as entered.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from, or landing on, a runway different than that entered in the Takeoff Data or Landing Data screen.
TWY LANDING	"Taxiway"	Issued when the aircraft is landing on a non-runway (e.g. a taxiway).

Table 8-1 SurfaceWatch Alert Annunciations

TAKEOFF ALERTS

The Takeoff phase-of-flight, as determined by the system, must be valid in order for the system to issue Takeoff Alerts.

Taxiway Takeoff

The Taxiway Takeoff alert is issued when the aircraft attempts to takeoff from a non-runway (e.g. a taxiway) or the aircraft is not aligned with a runway.

In addition to the visual and voice alerts, the Information Box contains a textual description of the currently occupied taxiway (or other maneuvering area) and potentially the next area (apron or maneuvering area) to be occupied (based on aircraft heading and the airport geometry) and the distance to that area.

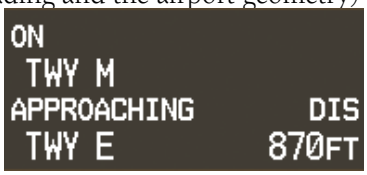


Figure 8-24 Typical Taxiway Information Displayed in the Information Box

Runway Too Short

The Runway Too Short (during takeoff) alert is issued when the aircraft attempts to takeoff from a runway and the remaining runway length is less than the required length. The insufficient runway length condition is determined based on aircraft current position during the takeoff roll and the required takeoff distance information entered on the Takeoff Data Screen.

Note that while the Runway Too Short alert may be issued for any runway from which the aircraft is taking off, the system will always calculate the runway length for the specific runway entered in the Takeoff Data.

In addition to the visual and voice alert, the Information Box will contain a textual description of the currently occupied runway and the remaining runway length.

Figure 8-25 Typical Runway Information Displayed in the Information Box

Check Runway

The Check Runway alert is issued when the aircraft attempts to takeoff from a runway that does not match the departure runway entered in the Takeoff Data Screen.

In addition to the visual and voice alert, the Information Box contains a textual description of the currently occupied runway.

LANDING ALERTS

The On-Final phase-of-flight, as determined by the system, must be valid in order for the system to issue Landing Alerts.

Taxiway Landing

The Taxiway Landing alert is issued when the aircraft attempts to land on a non-runway (e.g. a taxiway) or the aircraft is not aligned with a runway.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text "APPROACHING TWY" to indicate a non-runway landing is being attempted.

Figure 8-26 Typical Information Displayed During a Taxiway Landing Alert

Runway Too Short

The Runway Too Short alert is issued when the aircraft attempts to land on a runway where the remaining runway length is less than the required landing runway length entered in the Landing Data Screen.

Note that while the Runway Too Short alert may be issued for any runway with which aircraft is aligned, the system will always calculate the runway length for the specific runway entered in entered in the Landing Data Screen.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text "APPROACHING REMAINING" to indicate a the remaining runway length.

Figure 8-27 Typical Information Displayed During a Runway Too Short Alert

Check Runway

The Check Runway alert is issued when the aircraft attempts to land on a runway that does not match the arrival runway specified in the Landing Data.

Additionally, the Information Box will display the destination airport identifier, the runway with which the aircraft is aligned, and the distance to the runway.

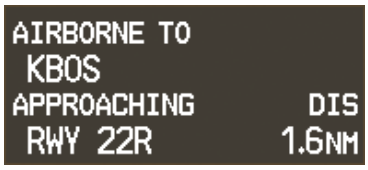


Figure 8-28 Typical Information Displayed During a Check Runway Alert

SURFACEWATCH SETUP

Origin/destination airport, runway and distance data entered integrates with SurfaceWatch technology to alert the flight crew to a runway too short for takeoff/landing, or to advise of a potential taxiway takeoff/landing. The runway selected in SurfaceWatch Setup appears on the airport diagram in cyan, and appears outlined in cyan on the synthetic vision representation of the runway on the PFD.

Entering origin/destination airport:

1) Select the 'FPL - SurfaceWatch Setup' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob if necessary to highlight the Origin or Destination Airport field.
4) Use the **FMS** Knobs to input the desired Origin or Destination Airport.

Selecting origin/destination runway:

1) Select the 'FPL - SurfaceWatch Setup' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob if necessary to highlight the Runway or Landing Runway field.
4) Turn the small **FMS** Knob to select the desired available Runway or Landing Runway. As the small **FMS** Knob is turned, the preview of the selected runway or landing runway is also displayed.

Selecting required takeoff/landing distance:

1) Select the 'FPL - SurfaceWatch Setup' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob if necessary to highlight the REQD Takeoff DIS or REQD Landing DIS field.
4) Use the **FMS** Knobs to enter the required takeoff or landing distance. Upon pressing the **FMS** Knob and committing the required takeoff or landing distance, the Runway Length field will turn amber if an insufficient runway length exists.

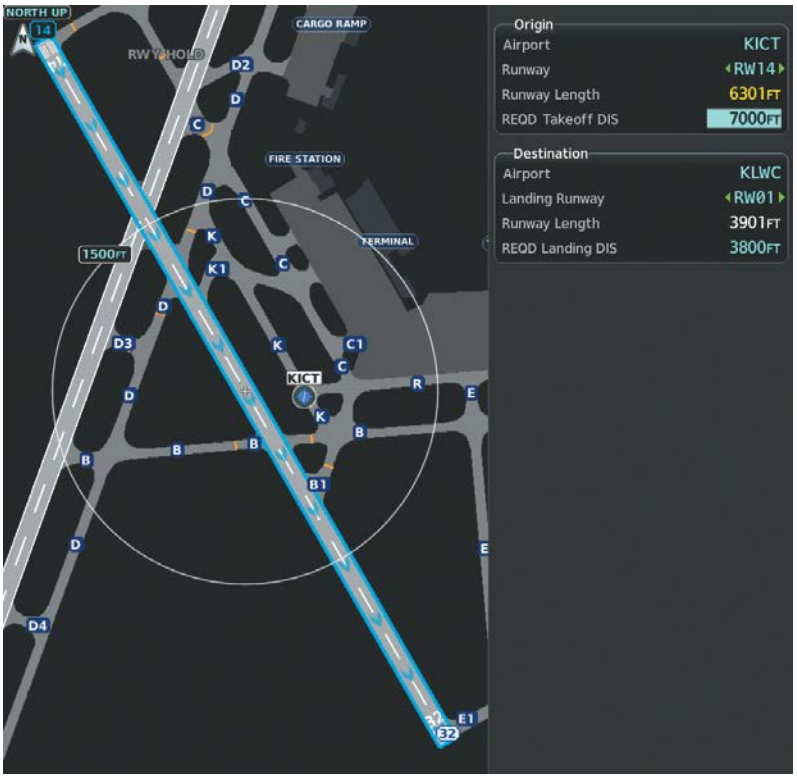


Figure 8-29 SurfaceWatch Setup Page (MFD)

Figure 8-30 SurfaceWatch Info and Cyan Runway Outline (PFD)

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-on Page displays the current status of the databases. As an example, see the table below for the various FliteCharts Power-on Page displays and the definition of each. The expiration date and disables date varies for each database.

Example Power-on Page Display Text
FliteCharts Data: └ N/A
FliteCharts Data: └ Expires DD-MMM-YYYY
FliteCharts Data: └ Disables DD-MMM-YYYY
FliteCharts Data: └ Disabled

Table 8-2 Database Power-on 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.*

Press 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-on 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

Figure 8-31 Database Startup, Format and Cycle

8.5 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 SXM Data Link Receiver is available for the pilot's and passengers' enjoyment. The SiriusXM Datalink Receiver can receive SiriusXM Satellite Radio entertainment services at any altitude throughout the Continental U.S. Entertainment audio is available only on the GDL 69A SXM 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 SXM. 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 SiriusXM Datalink Receiver, 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) Press the **Info** Softkey to display the XM Information Page.
5) Verify the desired services are activated.

Figure 8-32 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) Press the **Radio** Softkey to show the XM Radio Page where audio entertainment is controlled.

ACTIVE CHANNEL AND CHANNEL LIST

The Active Channel Box on the XM Radio Page displays the currently selected channel 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, press the **Channel** Softkey.
2) Press the **CH +** Softkey to go up through the list in the Channel Box, or move down the list with the **CH –** Softkey.

Or:

1) Push 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, press the **Channel** Softkey.
2) Press the **Direct CH** Softkey. The channel number in the Active Channel Box is highlighted.
3) Press 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) Press the **Category** Softkey on the XM Radio Page.
2) Press 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.

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, press the **Presets** Softkey to access the first five preset channels (**Preset 1 - Preset 5**).
2) Press 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**). Pressing the **More** Softkey repeatedly cycles through the preset channels.
3) Press any one of the (**Preset 1 - Preset 15**) softkeys to assign a number to the active channel.
4) Press the **Set** Softkey on the desired channel number to save the channel as a preset.

Pressing 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 pressing 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, press the **Volume** Softkey.
2) Press the **VOL –** Softkey to reduce volume or press the **VOL +** Softkey to increase volume. (Once the **VOL** Softkey is pressed, the volume can also be adjusted using the small **FMS** Knob.)

SiriusXM Radio volume may also be adjusted on each passenger headset.

Muting SiriusXM audio:

1) Select the XM Radio Page or XM Information Page.
2) Press the **Mute** Softkey to mute the audio. Press the **Mute** Softkey again to unmute the audio.

SIRIUSXM DATA LINK RECEIVER TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the 'Aux - System Status' Page for GDL 69A SXM status, serial number, and software version number. If a failure has been detected in the GDL 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.

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

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

8.6 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)
- Oil Pressure (psi)
- Oil Temperature (deg. F)

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.

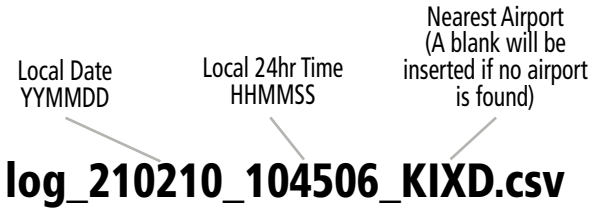


Figure 8-33 Log File Format

Data logging status can be monitored on the 'Aux-Utility' Page.

8.7 CONNEXT SETUP

The Connext Setup Page allows for setting up the installed optional wireless transceiver 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 Connext 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 Connext 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 Connext Setup page.

Figure 8-34 Select the Connext Setup Page

Changing the Bluetooth Name

1) While viewing the 'Aux - Connext Setup' Page, push 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.

Figure 8-35 Changing the Bluetooth Name

Enabling/Disabling Flight Plan Importing from Garmin Pilot

1) While viewing the 'Aux - Connext Setup' Page, push 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) Push the **FMS** Knob to remove the cursor.

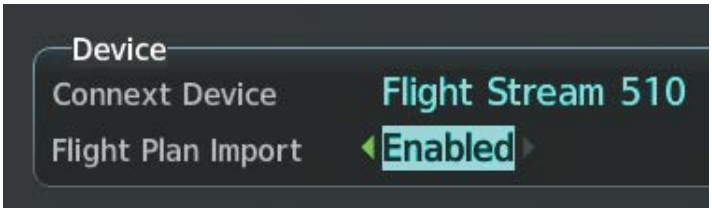


Figure 8-36 Flight Plan Import Enabled

Enabling/Disabling WiFi Database Importing from Garmin Pilot

1) While viewing the 'Aux - Connext Setup' Page, push 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) Push the **FMS** Knob to remove the cursor.

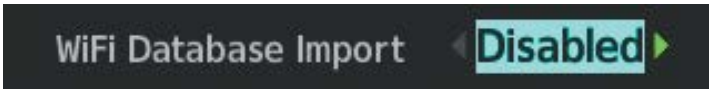


Figure 8-37 WiFi Database Disabled

Enabling/Disabling Automatic Reconnection of a Specific Paired Device

1) While viewing the 'Aux - Connext Setup' Page, push 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) Push the **FMS** Knob to remove the cursor.

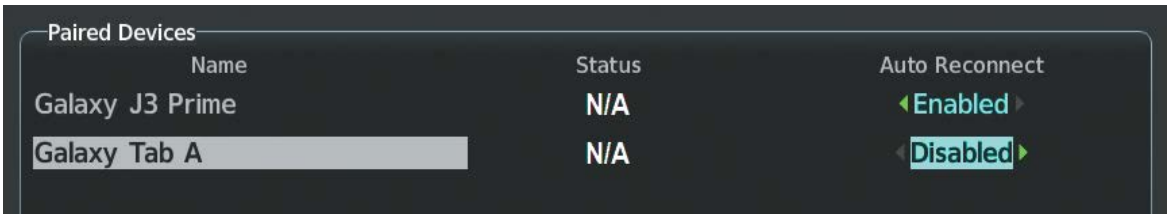


Figure 8-38 Disabled Auto Connect

Removing a Specific Paired Device from the List of Paired Devices:

1) While viewing the 'Aux - Connext Setup' Page, push 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.

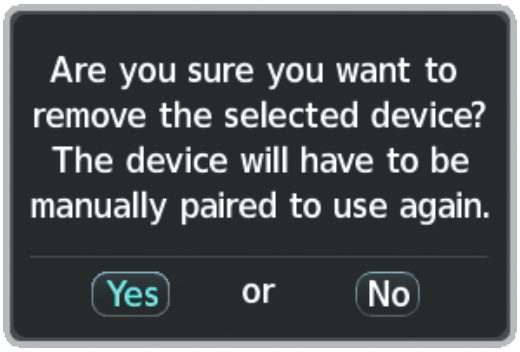


Figure 8-39 Removing Paired Device

8.8 ELECTRONIC CHECKLISTS

NOTE: *The optional checklists presented here are for example only and may differ from checklists available for the airframe. The information described in this section is not intended to replace the checklist information described in the current pertinent flight manual or the Pilot Safety and Warning Supplements document.*

NOTE: *Garmin is not responsible for the content of checklists. Checklists are created by the aircraft manufacturer. Modifications or updates to the checklists are coordinated through the aircraft manufacturer. The user cannot edit these checklists.*

The MFD is able to display optional electronic checklists which allow a pilot to quickly find the proper procedure on the ground and during each phase of flight. The system accesses the checklists from an SD card inserted into the bezel slot. If the SD card contains an invalid checklist file or no checklist, the Power-on Page messages display 'Checklist File: Invalid' or 'Checklist File: N/A' (not available) and the **Checklist** Softkey is not available.

Accessing and navigating checklists:

1) From any page on the MFD (except the EIS Pages), press the **Checklist** Softkey or turn the large **FMS** Knob to select the Checklist Page.
2) Turn the large **FMS** Knob to select the 'Group' Field.
3) Turn the small **FMS** Knob to select the desired procedure and press the **ENT** Key.
4) Turn the large **FMS** Knob to select the 'Checklist' Field.
5) Turn the **FMS** Knob to select the desired checklist and press the **ENT** Key. The selected checklist item is indicated with white text surrounded by a white box.
6) Press the **ENT** Key or **Check** Softkey to check the selected checklist item. The line item turns green and a checkmark is placed in the associated box. The next line item is automatically selected for checking.

   Either **FMS** Knob can be used to scroll through the checklist and select the desired checklist item.

   Press the **CLR** Key or **Uncheck** Softkey to remove a check mark from an item.
7) When all checklist items have been checked, '*Checklist Finished*' is displayed in green text at the bottom left of the checklist window. If all items in the checklist have not be checked, '*Checklist Not Finished*' will be displayed in yellow text.
8) Press the **ENT** Key. 'Go To Next Checklist?' will be highlighted by the cursor.
9) Press the **ENT** Key to advance to the next checklist.
10) Press the **Exit** Softkey to exit the Checklist Page and return to the page last viewed.

Accessing emergency procedures:

1) From any page on the MFD (except the EIS Pages), press the **Checklist** Softkey or turn the large **FMS** Knob to select the Checklist Page.
2) Press the **EMER** Softkey.
3) Turn the **FMS** Knob to select the desired emergency checklist and press the **ENT** Key.
4) Press the **ENT** Key or **Check** Softkey to check the selected emergency checklist item. The line item turns green and a checkmark is placed in the box next to it. The next line item is automatically highlighted for checking.

   Either **FMS** Knob can be used to scroll through the checklist and select the desired checklist item.

   Press the **CLR** Key or **Uncheck** Softkey to remove a check mark from an item.
5) When all checklist items have been checked, '*Checklist Finished*' is displayed in green text at the bottom left of the checklist window. If all items in the checklist have not be checked, '*Checklist Not Finished*' will be displayed in yellow text.
6) Press the **ENT** Key. 'Go To Next Checklist?' will be highlighted by the cursor.
7) Press the **ENT** Key to advance to the next checklist.
8) Press the **Return** Softkey to return to the previous checklist.
9) Press the **Exit** Softkey to exit the Checklist Page and return to the page last viewed.

ANNUNCIATIONS AND ALERTS

The Alerting System conveys alerts using the following items:

- **Annunciation Window:** The Annunciation Window displays abbreviated annunciation text. Text color is based on alert levels described in the following section. The Annunciation Window is located to the right of the Altimeter and Vertical Speed Indicator. All Cessna Nav III annunciations can be displayed simultaneously in the Annunciation Window. A white horizontal line separates annunciations that are acknowledged from annunciations that are not yet acknowledged. Higher priority annunciations are displayed toward the top of the window. Lower priority annunciations are displayed toward the bottom of the window.
- **Alerts Window:** The Alerts Window displays text messages for up to 64 prioritized alert messages. When an alert is activated, a flashing **Messages** Softkey is displayed. Pressing the **Messages** Softkey displays the Alerts Window. Pressing the **Alerts** Softkey a second time removes the Alerts Window from the display. When the Alerts Window is displayed, the **FMS** Knob can be used to scroll through the alert list.
- **Softkey Annunciation:** During certain alerts, a **Warning** or **Caution** Softkey may appear as a flashing annunciation to accompany an alert. The **Messages/Alerts** Softkey assumes a new label consistent with the alert level (Warning, Caution). By pressing the softkey when flashing an annunciation, the alert is acknowledged. The softkey label then returns to **Alerts**. If alerts are still present, the **Alerts** label is displayed in white with black text. Pressing the **Alerts** Softkey a second time views the alert text messages.
- **System Annunciations:** Typically, a large red 'X' appears over instruments whose information is supplied by a failed Line Replaceable Unit (LRU). See the System Annunciations Section for more information.

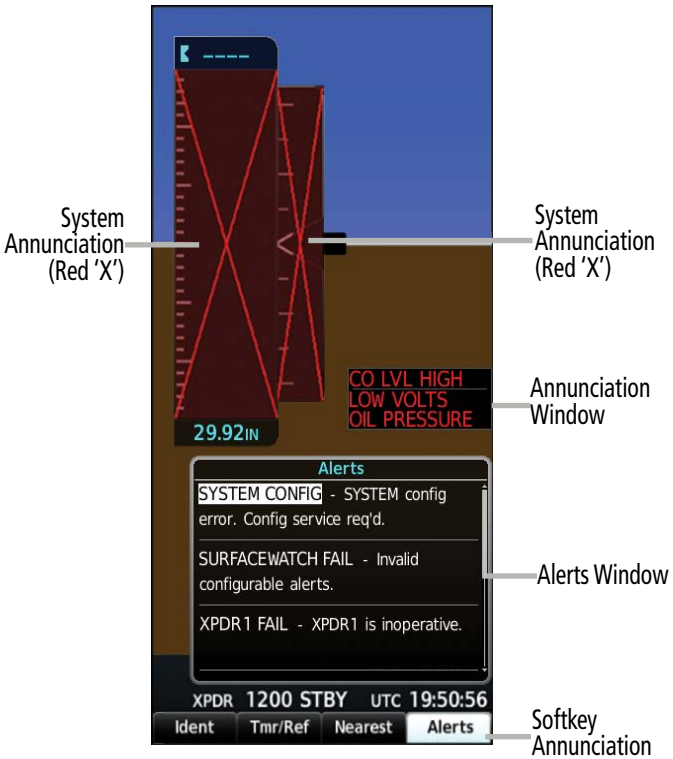


Figure A-1 Alerting System

ALERT LEVEL DEFINITIONS

NOTE: *Refer to the current version of the pertinent flight manual for corrective pilot actions.*

The Alerting System uses four alert levels, as installed in the Cessna Nav III aircraft.

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. A warning alert appears in the Annunciation Window and is accompanied by a continuous aural tone. Text appearing in the Annunciation Window is red. A warning alert is also accompanied by a flashing **Warning** Softkey annunciation. Pressing the Warning Softkey acknowledges the warning alert and stops the aural tone, if applicable.

Caution: This level of alert indicates the existence of abnormal conditions on the aircraft that may require pilot intervention. When a new caution alert appears in the Annunciation Window, it is shown in black on amber inverse video in conjunction with the **Caution** Softkey and is accompanied by an aural tone. Pressing the **Caution** Softkey acknowledges all amber messages and extinguishes the softkey. Once acknowledged, caution messages are displayed until the issue is corrected.

Safe Operating Advisory (if equipped): This level of alert indicates crew awareness is required. It is shown in green text in the Annunciation Window.

System Message Advisory: This level of alert provides general information to the pilot. Message Advisories appear in the Alerts Window and are not shown in the Annunciation Window. When a Message Advisory occurs, the system provides a white flashing **Messages** Softkey annunciation. Pressing the softkey acknowledges the message advisory alert, and displays the associated text in the Alerts Window.

Figure A-2 Annunciation Window

Figure A-3 Warning and Caution Softkey Annunciations

AUDIO ALERTING SYSTEM TEST

The system issues audio alert tones when specific system conditions are met. 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) Select the **ANN Test** Softkey.

Or:

1) From the 'Aux - System Status Page', press the **MENU** Key.
2) Highlight 'Enable Annunciator Test Mode' and press the **ENT** Key.

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 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 current version of the pertinent flight manuals, takes precedence over any conflicting guidance found in this section.*

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	GDC1 is reporting the altitude error correction is unavailable.
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	GDC1 is reporting the airspeed error correction is unavailable.
AHRS1 CAL – AHRS1 calibration version error. Srvc req'd.	The #1 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 #1 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 #1 AHRS is not receiving any or any useful GPS information. Check the current version of the pertinent flight manual for limitations. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	The #1 AHRS is not receiving backup GPS information. The system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	The #1 AHRS is operating exclusively in no-GPS mode. The system should be serviced.
AHRS1 SERVICE – AHRS1 Magnetic-field model needs update.	The #1 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.

Message	Comments
AHRS1 TAS – AHRS1 not receiving airspeed.	The #1 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 the loaded approach is not active. Activate approach when required.
AUDIO MANIFEST – Audio software mismatch, communication halted.	The GIA has incorrect software installed. The system should be serviced.
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 SRVC – The carbon monoxide detector needs service.	A failure has been detected in carbon monoxide detector has been detected. The detector may still be available. The system should be serviced when possible.
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 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
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.
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.

Message	Comments
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 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.
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.
FPL WPT LOCK – Flight plan waypoint is locked.	Upon power-on, the system detects that a stored flight plan waypoint is locked. This occurs when an 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.
FPL WPT MOVE – Flight plan waypoint moved.	The system has detected that a waypoint coordinate has changed due to a new navigation database update. Verify that stored flight plans contain correct waypoint locations.
FS 510 MANIFEST – FS 510 software mismatch.	Incorrect software version. The system should be serviced.

Message	Comments
FS510 CARD ERROR – FS510 not detected in MFD Bottom Slot.	The wireless transceiver (FS 510) multimedia card for the wireless transceiver (FS 510) was removed from the bottom card slot of the MFD. The multimedia card needs to be reinserted.
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.	The ADAHRS has incorrect software installed. 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 GEA1 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 ADAHRS 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.
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.

Message	Comments
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.
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 ADAHRS 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 ADAHRS 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.

Message	Comments
HW MISMATCH – GIA hardware mismatch. GIA2 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
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 MFD has incorrect software installed. The system should be serviced.
MANIFEST – PFD1 software mismatch, communication halted.	The PFD has incorrect software installed. The system should be serviced.
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.
MFD1 CONFIG – MFD1 config error. Config service req'd.	The MFD configuration settings do not match backup configuration memory. The system should be serviced.
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 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 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 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 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.

Message	Comments
MFD1 DB ERR – MFD1 Safe Taxi database error exists.	The MFD detected a failure in the Safe Taxi database. Ensure 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 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.
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-on
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 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.

Message	Comments
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 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 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.
[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 – PFD1 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 PFD2 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.

Message	Comments
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.
SURFACEWATCH DISABLED – Too far north/south.	The SurfaceWatch system has been disabled.
SURFACEWATCH FAIL – Invalid audio configuration.	The SurfaceWatch system has failed due to an invalid audio configuration.
SURFACEWATCH FAIL – Invalid configurable alerts.	The SurfaceWatch system has failed due to invalid configurable alerts.
SURFACEWATCH FAIL – One or more inputs invalid.	The SurfaceWatch system has failed due to one or more invalid inputs.
SURFACEWATCH INHIBITED – Surfacewatch inhibited.	The SurfaceWatch system has been inhibited.
SVT DISABLED – Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.
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 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.

Message	Comments
WPT ARRIVAL – Arriving at waypoint -[xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
XPDR1 ADS-B 1090 – Datalinik: 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.
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.

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 flygarmin.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 flygarmin.com and select Aviation Data Error Report.

A 32 GB Supplemental Data (SD) card (including FS 510 Wireless Transceiver card when used as a storage device) is required to perform database updates. Only cards provided by Garmin or the OEM should be used. In the event there is a file corruption problem with the SD card or Wireless Transceiver card, it may be necessary to reformat the card. This can cause an issue when formatting using Mac OS, where the newly formatted device will not be recognized by the avionics system. When using a Macintosh computer to format the SD card or Wireless Transceiver card, Garmin recommends using the SD Memory Card Formatter application made available by the SD Association as a download from sdcard.org. When running the application, use the Quick Format option.

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: *Use of SD cards that are not Garmin or OEM provided may cause system malfunctions when left in the MFD after the databases are loaded.*

In addition to SD card loading, databases may be loaded through Garmin Pilot™ and FS 510 Wireless Transceiver. When loading databases through Garmin Pilot™ and the Wireless Transceiver, it must be enabled on the system and the Wireless Transceiver card inserted in the bottom SD slot of the MFD.

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-on 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' message 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.*

Databases may be loaded through Garmin Pilot™ and Wireless Transceiver (also known as Flight Stream 510 or FS510). When loading databases through Garmin Pilot™ and the Wireless Transceiver, the Wireless Transceiver 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 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 navigation database contains the aeronautical data used by the system for the flight management and flight planning functions. Included is detailed data for waypoints, procedures (arrivals, departures, approaches), and airways. The navigation database is updated every 28 days.

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. 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 jeppesen.com or flygarmin.com.

The IFR/VFR charts database contains VFR and IFR raster charts. The VFR Charts are digital representations of the Sectional Aeronautical Charts and Terminal Area Charts. The IFR Charts include both IFR High (designed for navigation at or above 18,000 ft) and IFR Low (designed for navigation below 18,000 ft). IFR/VFR Charts are updated every 28 days except for Canadian IFR/VFR Charts which are updated every 56 days. The IFR/VFR charts database is available for multiple regions. Refer to flygarmin.com for a list of IFR/VFR charts databases available.

The Checklist database is a custom configured database. Refer to the Additional Features Section for details.

UPDATING DATABASES WITH SD CARD OR WIRELESS TRANSCEIVER CARD

All databases are updated through a single SD card or Wireless Transceiver 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. After update, the card is removed and the databases are stored on the system. When in standby, databases are not immediately available for use, but stored to be activated at a later time.

Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (flygarmin.com). Once the updated files have been downloaded from the website, a personal computer equipped with an appropriate SD card reader is used to unpack and program the new databases onto an existing Supplemental Data Card. When database files are loaded to the SD card, any previously loaded database files of the same type residing on the SD card will be overwritten. This includes loading a database of a different coverage area or data cycle than that currently residing on the SD card. Equipment required to perform the update is as follows:

» A personal computer with Vista or later/Mac OS X 10.9 or later.
» SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent.
» Garmin SD Card Reader for Wireless Transceiver cards.
» Updated database obtained from the Garmin website.
» Garmin or OEM provided 32 GB SD card or Wireless Transceiver card.

Updating Databases using an SD or Wireless Transceiver card:

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 or Wireless Tranceiver card.

3) Put the SD Card or the Wireless Tranceiver 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 and select Aux.

7) Turn the small **FMS** Knob and select Databases.

8) Monitor the Sync Status on the 'Aux-Databases' 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.

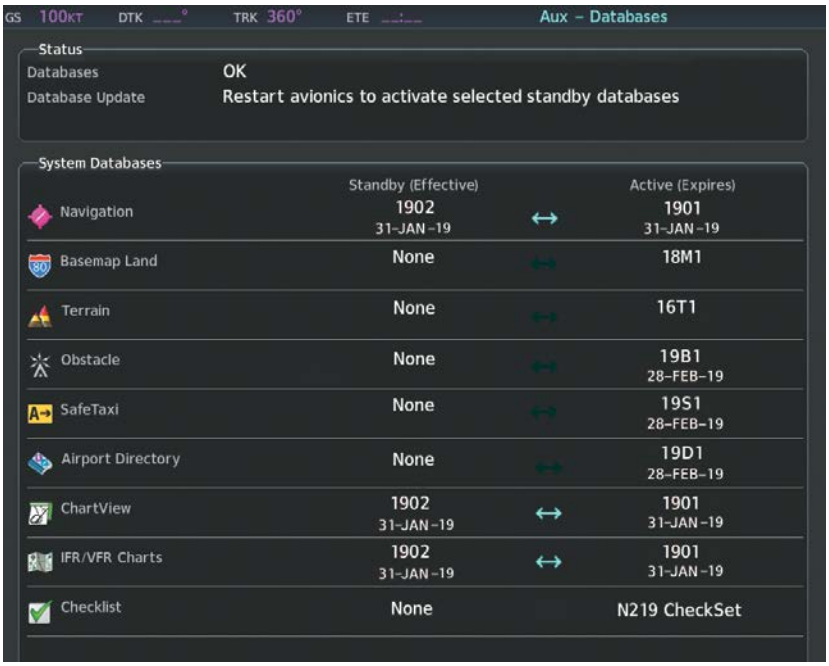


Figure B-1 'Aux - Databases' Page before Activation of Standby Databases

9) Verify the correct database cycle information is shown in the Standby 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 greyed.

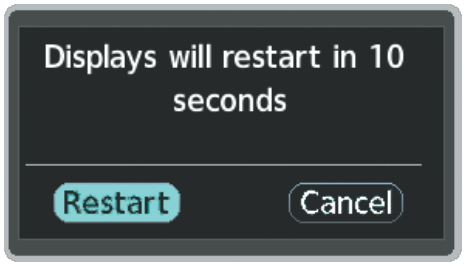


Figure B-2 Database Restart

12) Remove the standard SD card from the bottom slot of the MFD if desired. Wireless Transceiver Multimedia Cards should not be removed from the bottom slot.

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 the standby databases transferred and are now in the active database column.

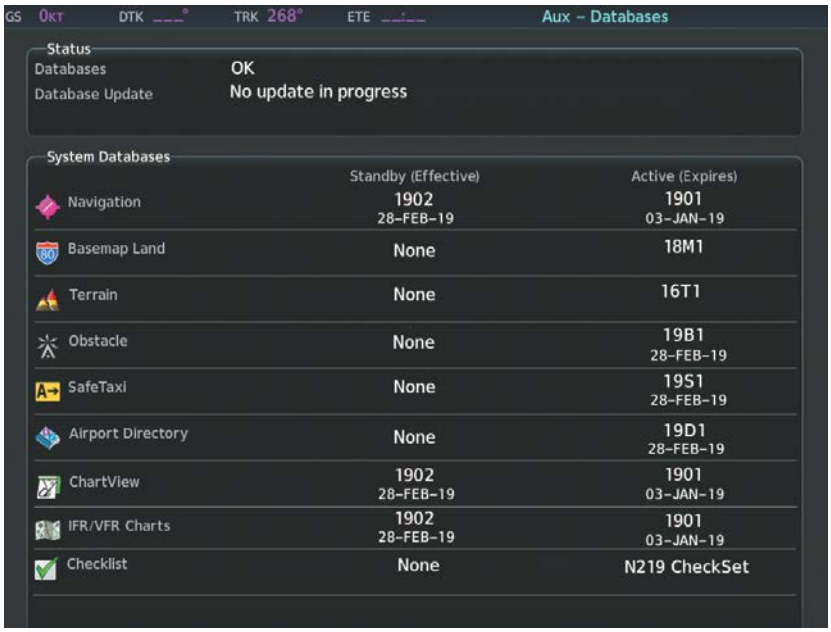


Figure B-3 'Aux - Databases' Page - Updated Databases

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 the standby database will become active.
- **d)** Remove and reapply power to the system.
- **e)** Verify the standby databases transferred and are now in the active database column.

18) Remove power from the system.

UPDATING DATABASES USING GARMIN PILOT / WIRELESS TRANSCEIVER

In order to load databases through Garmin Pilot™ and the Wireless Transceiver (also known as Flight Stream 510 or FS510), the Wireless Transceiver must be enabled on the system with the Wireless Transciever card inserted in the bottom SD slot of the MFD. A mobile device with Garmin Pilot must be paired with the Wireless Transceiver over Wireless (refer to the Additional Features section). When there is at least one paired device available to connect, the Wireless Transceiver 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 Wireless Transceiver. 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.

NOTE: *The system will only provide a WiFi connection if new databases have been detected for download on Garmin Pilot via a valid Bluetooth connection. If there are no database updates required the system will not provide a WiFi signal.*

NOTE: *If the mobile device has previously connected to the Wireless Transceiver, and is not connected to another WiFi source, the mobile device should connect automatically to the Wireless Transceiver. If the mobile device is connected to another WiFi source (i.e. hangar wifi), then the Wireless Transceiver will not connect automatically.*

Updating Databases from any MFD page (except the Aux - Databases page):

1) Insert the Wireless Transceiver SD Card in the bottom slot of the MFD if not already inserted.
2) Press the **Update** softkey when the Database Update screen appears.

Figure B-5 Database Update Available

3) The Wireless Transceiver 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 Wireless Transceiver 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. Ppress the **Close** softkey.

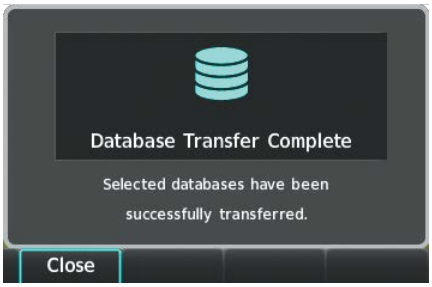


Figure B-7 Database Transfer Complete

7) 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.

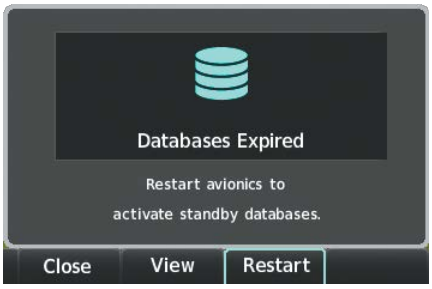


Figure B-8 Database Expired

NOTE: *The **Restart** Softkey is enabled only when the aircraft is on the ground.*

8) 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 greyed .

9) After restarting the system, turn the large **FMS** Knob and select the Aux page group on the MFD.

10) Turn the small **FMS** Knob and select the Databases page.

11) Verify the standby databases transferred and are now in the active database column.

Figure B-9 'Aux Databases' Page with Updated Databases

12) 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-10 Database Page Details

13) 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 the standby database will become active.

d) Remove and reapply power to the system.

e) Verify the standby databases transferred and are now in the active database column.

14) Remove power from the system.

Updating Databases from the Aux - Databases page:

1) With the system OFF, insert the Wireless Transceiver Mutimedia 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 Wireless Transceiver 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 Wireless Transceiver 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 greyed .
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 the standby databases transferred and are now in the active database column.

Figure B-11 'Aux - Databases' 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 the standby database will become active.
- **d)** Remove and reapply power to the system.
- **e)** Verify 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.

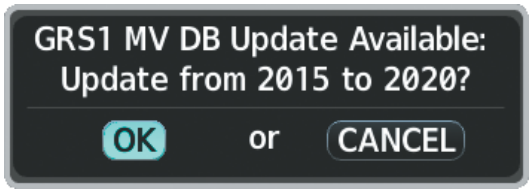


Figure B-13 Magnetic Field Variation Database Update Prompt

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

Blank Page

AVIATION TERMS AND ACRONYMS

A	Amps, Amperes
ABN	Abnormal
AC	Advisory Circular, Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
ACC	Accuracy
ACFT	Aircraft
ACK	Acknowledge
ACT, ACTV	Active, Activate, Altitude Compensated Tilt
ADAHRS	Air Data, Attitude and Heading Reference System
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Direction Indicator
ADIZ	Air Defense Identification Zone
ADM	Administrative Domain
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-R	Automatic Dependent Surveillance-Rebroadcast
AEA	Aircraft Electronic Association
AF	Arc to Fix Leg
AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AFN	ATS Facilities Notification
AFRM	Airframe
AFTN	Aeronautical Fixed Telecommunication Network
A/G	Air-to-Ground
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
AIM	Aeronautical Information Manual
AIRB	Airborne
AIRMET, AIRM	Airman's Meteorological Information
AIRREP	Air Reports
ALRT	Alert, Alerting
ALT	Altitude
ALT, ALTN	Alternator, Alternate
ALTM	Altimeter
ALTS	Altitude Select, Selected Altitude Capture Mode
ALTV	VNAV Altitude Capture Mode
AM	Amplitude Modulation
AMP	Amplifier, Ampere
AMPS	Amperes
ANN/ANNUNC	Annunciation/Annunciator
ANSP	Air Navigation Service Provider
ANT	Antenna
AOA	Angle of Attack, ACARS Over AVLC
AOC	Aeronautical Operational Control
AOG	Aircraft On Ground
AOPA	Aircraft Owners and Pilots Association
AP	Autopilot
AP DISC	Autopilot Disconnect
APPR, APR	Approach, Approach Control
APT	Airport, Aerodrome, Automatic Pitch Trim
APTSIGNS	Airport Signs
APU	Auxiliary Power Unit
APV	Approaches with Vertical Guidance
ARINC	Aeronautical Radio Incorporated
ARM	Arm, Armed
ARSPC	Airspace
ARTCC	Air Route Traffic Control Center
ARV	Arrival
AS	Airspeed
ASB	Aviation Support Branch
ASI	Airspeed Indicator
ASOS	Automated Surface Observing System
AT	Auto Throttle
ATAS	ADS-B Traffic Advisory System
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon System
ATD	Along-Track Distance
ATE	Along-Track Error, Automatic Test Equipment
ATIS	Automatic Terminal Information Service

ATK	Along Track
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
ATT	Attitude
AUD	Audio
AUTO	Automatic
AUTOSEQ	Automatic Sequence
AUX	Auxiliary
AVAIL	Available
AVG	Average
AVLC	Aviation VHF Link Control
AWOS	Automated Weather Observing System
AZ	Azimuth
B	Both Runways
B ALT	Barometric Altitude
BC, B/C	Back Course
BARO	Barometer, Barometric Setting
BATT	Battery
Bearing	The compass direction from the present position to a destination waypoint.
BFO	Beat Frequency Oscillator
BKLT	Backlight
BKSP	Backspace
BLKHD	Bulkhead
Bluetooth	Wireless standard for data exchange over short distances
BOC	Bottom of Climb
BOD	Bottom of Descent
BRG	see also Bearing
BRK	Brake
BTM	Bottom
°C	Degrees Celsius
C	Center Runway
CA	Course to Altitude Leg
CAL	Calibrated
CALC	Calculator
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
CAS	Crew Alerting System
CLB	Climb
CB	Circuit Breaker
CCG	Current Climb Gradient
CD	Course to DME Distance Leg
CDA	Current Data Authority
CDI	Course Deviation Indicator
CDU	Control Display Unit
CF	Course to Fix Leg
CFG	Configuration
CFIT	Controlled Flight into Terrain
CG	Center of Gravity
CH, CHNL	Channel
CHKLIST	Checklist
CHRG	Charge
CHT	Cylinder Head Temperature
CI	Course to Intercept Leg
CIP	Current Icing Potential
CL	Class, Centerline
CLB	Climb
CLD	Cloud
CLG	Ceiling
CLR	Clear
CLS	Close
CLTR	Clutter
CM	Centimeter
CMC	Central Maintenance Computer
CMPRTR	Comparator
CN	Canada
CNCL	Cancel
CNFM	Confirm
CNI	Communication, Navigation, & Identification
CNS	Communication, Navigation, & Surveillance
CO	Carbon Monoxide
COM	Communication Radio
COMP	Compensated, Compensation
CONFIG	Configuration
CONUS	Continental United States

COOL	Coolant
COPLT	Copilot
CORR	Correct, Corrected, Correction
Course	The line between two points to be followed by the aircraft.
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.
CP	Copilot, Control Panel
CPDLC	Controller Pilot Datalink Communications
CPL	Couple
CR	Course to Radial Leg
CRG	Cockpit Reference Guide
CRNT	Current
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.
CRS	see also Course, Course to Steer
CRSR	Cursor
CRU, CRZ	Cruise
CSA	Conflict Situational Awareness
CSC	Current Speed Control
CSTR	Constraint
CTA	Control Area
CTAF	Common Traffic Advisory Frequency
CTR	Center
CTRL	Control
Cumulative, CUM	The total of all legs in a flight plan.
CVDR	Cockpit Voice Data Recorder
CVFP	Charted Visual Flight Procedure
CVR	Cockpit Voice Recorder
CVRG	Coverage
CWS	Control Wheel Steering
CYC CTR	Cyclic Centering
CYL	Cylinder
CZ	Control Zone
D->, ~~D~~▸	Direct-To
D/A	Digital to Analog Converter
D ALT	Density Altitude
D-ATIS	Digital Automatic Terminal Info Service
DA	Decision Altitude, Drift Angle
DB, DBASE	Database
dBZ	Decibels 'Z' (Radar Return)
DCL	Departure Clearance
DCLTR, DECLTR	Declutter
DEC	Declination
DEC FUEL	Decrease Fuel
DEG	Degree
DEIC, DEICE	De-icing
DEL	Delete
DEP	Departure, Departure Control
DESC	Descent
Desired Track	The desired course between the active "from" and "to" waypoints.
DEST, DES	Destination, Destination Airport Identifier
DET	Detect, Detected, Detection, Detector
DEV	Deviation
DF	Direction Finder, Direct to Fix Leg
DFLT	Default
DG	Directional Gyro
DGPS	Differential GPS
DGRD	Degrade
DH	Decision Height
DIFF	Differential
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
DIS	Distance
DISENG	Disengage
Distance	The 'great circle' distance from the present position to a destination waypoint.
DIV	Divert, Diversion
DL LTNG	Datalink Lightning
DLS	Data Link System
DME	Distance Measuring Equipment
DN	Down

DNALT	Density Altitude
DNGR	Danger
DNLK	Downlink
DOD	Department of Defense
DOP	see also Dilution of Precision
DOPP	Doppler
DP	Departure Procedure, Differential Pressure
DPRT	Departure
DQR	Data Quality Requirements
DR	Dead Reckoning
DSBL	Disabled
DSP	Display, Datalink Service Provider, Digital Signal Processor
DTG	Distance To Go, Remaining distance to last active FPL waypoint
DTK	see also Desired Track
DWNGRADE	Downgrade
E	Empty, East
EAS	Engine and Airframe Systems
EC	Error Correction
ECC	Error Correcting Code
ECL	Eledtronic Checklist
ECR	Excessive Closure Rate
ECS	Environmental Control System
ECU	Engine Control Unit
EDM	Emergency Descent Mode
EDR	Excessive Descent Rate
EFC	Expected Further Clearance
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.
EGNOS	European Geostationary Navigation Overlay Service
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EIS	Engine Indication System
ELEC	Electrical
ELEV	Elevation, Elevator
ELT	Emergency Locator Transmitter
EMER, EMERG, EMERGCY	Emergency
EMI	Electromagnetic Interference
END, ENDUR	Endurance
Endurance	Flight endurance, or total possible flight time based on available fuel on board.
ENG	Engine
ENGA	Engage
ENGD	Engaged
ENR	Enroute; ETE to Final Destination
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.
ENT	Enter
EP	Envelope Protection
EPE	see also Estimated Position Error
EPU	Estimated Position Uncertainty
ERR	Error
ES	Extended Squitter
ESA	Emergency Safe Altitude, see also Enroute Safe Altitude
ESP	Electronic Stability and Protection
Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.
Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
ET	Elapsed Time
ETA	see also Estimated Time of Arrival
ETE	see also Estimated Time Enroute
EVS	Enhanced Vision System
EXP	Expand
EXPIRD	Expired
EXT	External
EXTD	Extend
EXTING	Extinguish, Extinguisher
EXTR	Extract, Extraction
°F	Degrees Fahrenheit
FA	Course From Fix to Altitude Leg
FAA	Federal Aviation Administration

FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAIL	Failure
FANS	Future Air Navigation System
FAP	Final Approach Point
FAPP	Final Approach
FAR	Federal Aviation Regulations
FBO	Fixed Base Operator
F/C	Flight Crew
FC	Course From Fix to Distance Leg
FCC	Federal Communication Commission
FCST	Forecast
FCTN	Function
FD	Flight Director, Course From Fix to DME Distance Leg
FDE	Fault Detection and Exclusion
FDR	Flight Data Recorder
FF, FFLOW	see also Fuel Flow
FIS-B	Flight Information Services-Broadcast
FISDL	Flight Information Service Data Link
FIT	Flight Into Terrain
FL	Flight Level
FLC, FLCH	Flight Level Change
FLT	Flight, Flight Timer
FLTA	Forward Looking Terrain Avoidance
FLW	Follow, Following
FM	Course From Fix to Manual Termination Leg
FMS	Flight Management System
FOB	see also Fuel On Board
FOD	see also Fuel Over Destination
FPA	Flight Path Angle
FPL	Flight Plan
FPM	Feet Per Minute, Flight Path Marker
FR	From
FREQ	Frequency
FRMT	Format
FRT	Front
FRZ	Freezing
FSD	Full-Scale Deflection
FSM	Flight System Messages
FSS	Flight Service Station
FT	Foot/Feet
Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.
Fuel On Board	The total amount of usable fuel on board the aircraft.
Fuel Over Destination	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.
FWD	Forward
G/A	Ground to Air
G/S	Glideslope
GA	Go-Around
GAGAN	GPS Aided GEO Augmented Navigation
GAGL	GPS AGL Altitude
GAL, GL	Gallon(s)
GBAS	Ground Based Augmentation System
GBOX	Gearbox
GBT	Ground Based Transceiver
GCS	Ground Clutter Suppression
GCSS	Garmin Connext Satellite Services
GCU	Garmin Control Unit
GDC	Garmin Air Data Computer
GDL	Garmin Satellite Data Link
GDR	Garmin Data Radio
GDU	Garmin Display Unit
GEA	Garmin Engine/Airframe Unit
GEAR	Landing Gear
GEN	Generator
GEO	Geographic
GFC	Garmin Flight Control
GHz	Gigahertz
GIA	Garmin Integrated Avionics Unit
GLONASS	Global Orbiting Navigation Satellite Landing System
GLS	Global Navigation Satellite Landing System
GMA	Garmin Audio Panel System
GMC	Garmin Mode Controller
GMT	Greenwich Mean Time
GMU	Garmin Magnetometer Unit
GND	Ground

GOLD	Global Operational Data Link
GP	Glidepath
GPH	Gallons per Hour
GPN	Garmin Part Number
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
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
Ground Track	See Track
Groundspeed	The velocity the aircraft is travelling relative to a ground position.
GRP	Geographic/Ground Reference Point
GRS	Garmin Reference System
GS	Ground Speed, Glideslope
GSA	Garmin Servo Adapter
GSD	Glideslope/Glidepath Deviation, Garmin Data Concentrator
GSL	Geometric/Geodetic Sea Level
GSR	Garmin Satellite Radio
GSU	Garmin Sensor Unit
GTC	Garmin Touchscreen Controller
GTS	Garmin Traffic System
GTX	Garmin Transponder
GW	Gross Weight
GWX	Garmin Weather Radar
H	Hours
H+MM	Hours and Minutes
HA	Hold Terminating at Altitude Leg
HAL	Horizontal Alert Limit
HAT	Height Above Threshold
HDG	see also Heading
HDOP	Horizontal Dilution of Precision
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
HF	High Frequency, Hold Terminating at Fix Leg
HFOM	see also Horizontal Figure of Merit
Hg	Mercury
HI	High
HI SENS	High Sensitivity
HLD	Hold, Holding, Holding Pattern
HM	Hold with Manual Termination Leg
HNS	Hybrid Navigation Sensor
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
HOV	Hover
HOV-P	Hover Prediction
HP	High Pressure, Horsepower
hPa	Hectopascal
HPI	Hover Power Indicator
HPL	Horizontal Protection Level
HR	Hour
HRZN HDG	Horizon Heading
HSDB	High-Speed Data Bus
HSI	Horizontal Situation Indicator
HT	Heat, Height
HTR	Heater
HUL	Horizontal Uncertainty Level
HWND	Headwind
HYD	Hydraulic
Hz	Hertz (cycles per second)
HZN	Horizon
I	Inner Marker
IAF	Initial Approach Fix
IAP	Instrument Approach Procedure
IAS	Indicated Air Speed
IAT	Indicated Air Temperature
IATA	International Air Transport Association
IAU	Integrated Avionics Unit
IBD, INBD	Inboard
ICAO	International Civil Aviation Organization
ICE	Icing
ICS	Intercom System
ID	Identification/Morse Code Identifier
IDENT, IDNT	Identification
IEEE	Institute of Electrical & Electronics Engineers
IF	Initial Fix

IFR	Instrument Flight Rules
IG	Imperial Gallon
IGE	In Ground Effect
ILI	Imminent Line Impact
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
IN	Inch
IN Hg, "HG	Inches of Mercury
INACTV	Inactive
INBD	Inboard
INBND	Inbound
INC FUEL	Increase Fuel
IND	Indicator, Indicated
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
INDX	Index
INFO	Information
INH, INHIB	Inhibit
INOP	Inoperative
INS	Inertial Navigation System
INSTR	Instrument
INT	Intersection(s)
INTEG	Integrity (RAIM unavailable)
INTERN, INTRL	Internal
INV	Invalid
IOI	Imminent Obstacle Impact
IR	Infrared
IrDA, IRDA	Infrared Data Association
IRST	Infrared Surveillance and Tracking
ISA	International Standard Atmosphere; ISA Relative Temperature
ISO	International Standards Organization
ISOL	Isolation
ITI	Imminent Terrain Impact
ITT	Inter-Turbine Temperature, Interstage Turbine Temperature
KEYSTK	Key Stuck
KG	Kilogram
kHz	Kilohertz
KM	Kilometer
KT	Knot
L	Left, Left Runway
LAT	Latitude, Lateral
LB	Pound
LBL	Label
LCD	Liquid Crystal Display
LCL	Local
LDA	Landing Distance Available
LDG	ETA at Final Destination
LED	Light Emitting Diode
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.
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.
Leg	The portion of a flight plan between two waypoints.
LEN	Length
LGND	Legend
LIFR	Low Instrument Flight Rules
LI-ION	Lithium Ion
LIM	Limit
LMM	Location Middle Marker
LNAV	Lateral Navigation
LO	Low
LOA	Letter of Authorization
LOC	Localizer
LOI	Loss of Integrity (GPS)
LOM	Location Outer Marker
LON, LONG	Longitude, Longitudinal
LP	Localizer Performance, Low Pressure
LPV	Localizer Performance with Vertical Guidance
LRU	Line Replaceable Unit
LSB V	Lower Sideband Voice
LT	Left, Light
LTNG	Lightning
LVL	Level
M	Meter, Middle Marker, Mach

Mach Number	Mach number is the ratio of the true airspeed to the speed of sound.
MAG	Magnetic
MAG VAR	Magnetic Variation
MAHP	Missed Approach Hold Point
MAINT	Maintain
MAL	Malfunction
MAN	Manual
MAN IN	Manifold Pressure (inches Hg)
MAN SQ	Manual Squelch
MANSEQ	Manual Sequence
MAP	Missed Approach Point
MAPROC	Missed Approach Procedure
MASQ	Master Avionics Squelch
MAX	Maximum
MAXSPD	Maximum Speed (overspeed)
MB	Marker Beacon, Millabar(s)
MCDU	Multifunction Control and Display Unit
MCLB	Maximum Climb Thrust
MCP	Maximum Continuous Power
MCRZ	Maximum Cruise Thrust
MDA	Barometric Minimum Descent Altitude
MEA	Minimum Enroute Altitude
MEM	Memory
MEPT	Manual Electric Pitch Trim
MET	Manual Electric Trim
METAR	Aviation Routine Weather Report
METRO	Metropolitan
MFD	Multi Function Display
MGRS	Military Grid Reference System
MGT	Measured Gas Temperature
MHz	Megahertz
MIC	Microphone
MID	Middle
MIN	Minimum, Minute
MKR	Marker Beacon
MM	Middle Marker
MMO (VMO)	Maximum Speed
MOA	Military Operations Area
MOD	Modification, Modify
MON	Monitor, Monitored, Monitoring
MORA	Minimum Off-Route Altitude
MOV	Movement
MPEL	Maximum Permissible Exposure Level
MPM	Meters per Minute
MSA	Minimum Safe Altitude
MSAS	Multi-functional Satellite Augmentation System
MSG	Message
MSL	Mean Sea Level
MT, M	Meter
MTG	Mounting
MTN	Mountain
MTOGW	Maximum Takeoff Gross Weight
MTOW	Maximum Takeoff Weight
mV	Millivolt(s)
MVFR	Marginal Visual Flight Rules
N	North
NATS	North Atlantic Tracks System
NAV	Navigation
NAVAID	Navigation Aid
NCR	Negative Climb Rate
NDA	Next Data Authority
NDB	Non-Directional Beacon
NEG	Negative
NEXRAD	Next Generation Radar
NG	Gas Producer Rotation Speed
NM	Nautical Mile(s)
NMPG	Nautical Miles per Gallon
NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
NORM	Normal
NOTAM	Notice To Airman
NP	Power Turbine Speed
NPA	Non-Precision Approach
NR	Rotor Speed
NRST	Nearest
NWHL	Nosewheel

NWS	National Weather Service, Nosewheel Steering
O	Outer Marker
OAT	Outside Air Temperature
OBD, OUTBD	Outboard
OBS	Omni Bearing Selector, Observation, Observe, Observed
OBSCR	Obscuration
OCL	Oceanic Clearance
OEM	Original Equipment Manufacturer
OFST	Offset
OGE	Out of Ground Effect
OM	Outer Marker
OOOI	Out of the gate, Off the ground, On the ground, and In the gate
OROCA	Off Route Obstacle Clearance Altitude
OUTBD	Outboard
OUTBND	Outbound
OVBD	Overboard
OVFL	Overflow
OVFLY	Overfly, Overflying
OVHD	Overhead
OVHT	Overheat
OVLIM	Overlimit
OVLD	Overload
OVPR	Overpressure
OVR, OVRD	Override
OVRN	Overrun
OVSPD	Overspeed
OVTMP	Overtemperature
OXY	Oxygen
P ALT	Pressure Altitude
P-ATT	Pitch Attitude
PA	Precision Approach, Passenger Address, Proximity Advisory
PB	Push Button
PASS, PAX	Passenger(s)
PC	Personal Computer
PDA	Premature Descent Alerting
PDC	Pre-Departure Clearance
PED	Personal Electronic Device
PERF	Performance
PFD	Primary Flight Display
PG	Pilot's Guide
PI	Procedure Turn to Course Intercept Leg
PIREP	Pilot Report
PIT, PTCH	Pitch
PLT	Pilot
PNR	Prior Notice Required
POA	Plain Old ACARS
POB	Persons (Souls) on Board
POF	Phase of Flight
POH	Pilot's Operating Handbook
POHS	Pilot's Operating Handbook Supplement
POS, POSN	Position
POSS	Possible
PPH	Pounds per Hour
PPM	Parts per Million
PPOS, P. POS	Present Position
PREFLT	Preflight
PRES, PRESS, P	Pressure
PREV	Previous
PRI	Primary
PRL	Parallel
PRN	Pseudo Random Noise
PROC	Procedure(s), Procedure Turn
PROP	Propeller
PROX	Proximity
PSI	Pounds per Square Inch, Power Situation Indicator
PT	Procedure Turn
PTK	Parallel Track
PTT	Push-to-Talk
PWR	Power
Q	Engine Torque
QFE	Field Elevation Pressure
QNE	Pressure Altitude
QNH	Sea Level Pressure
QTY	Quantity
R	Right, Right Runway

RA	Resolution Advisory, Radio Altimeter, Radar Altimeter
RAD	Radial
RAD ALT	Radio Altimeter, Radar Altimeter
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RAT	Ram Air Temperature
RCVR	Receiver
R/D	Radial/Distance
RDR	Radar
REC	Record, Recorder
RECIRC	Recirculate/Recirculating
REF	Reference
REGL	Regulator
REM	Remaining (fuel remaining), Reminder, Removed, Remote
REQ	Request
REQD	Required
RES	Reserve (fuel reserve entered by pilot)
REST	Restricted, Restriction
RET	Return
REV	Reverse, Revision, Revise
RF	Radio Frequency, Constant Radius Turn to Fix Leg
RFM	Rotorcraft Flight Manual
RLC	Required Line Clearance
RMI	Radio Magnetic Indicator
RMT	Remote
RNAV	Area Navigation
RNG	Range
RNP	Required Navigation Performance
RNWY, RWY	Runway
ROASS	Runway Overrun Awareness and Alerting System
ROC	Required Obstacle Clearance, Rate of Cllmb
ROD	Rate of Descent
ROL	Roll
ROM	Read Only Memory
ROT	Rotary
RPM	Revolutions Per Minute
RQRD	Required
RST FUEL	Reset Fuel
RSV	Reserve (fuel reserve entered by pilot)
RT	Right
RTC	Required Terrain Clearance
RTE	Route
RTR	Router
RUDICS	Router-Based Unrestricted Digital Interworking Connectivity Solution
RVRSNRY	Reversionary
RVSI	Required Vertical Speed Indicator
RVSM	Reduced Vertical Separation Minimums
RX	Receive
S	South
SA	Selective Availability
SAIB	Special Airworthiness Information Bulletin
SAR	Search and Rescue
SAT	Static Air Temperature
SATCOM	Satellite Communication
SBAS	Satellite-Based Augmentation System
S-CLB	Step Climb
SC	Short Circuit
SCIT	Storm Cell Identification and Tracking
S-DES	Step Descent
SD	Secure Digital
SEC	Second(s)
SECT	Section
SEG	Segment
SEL, SLCT	Select
SELCAL	Selective Calling
SENS	Sense, Sensitivity
SEQ	Sequence, Sequencing
SERV	Service, Servicing, Served
SET	Setup
SFC	Surface
SHT	Short
SIAP	Standard Instrument Approach Procedures
SID	Standard Instrument Departure

SIG	Signal
SIG/AIR	SIGMET/AIRMET
SIGM	SIGMET
SIGMET	Significant Meteorological Information
SIM	Simulator
SITA	Societe Internationale de Telecommunications
SLD	Supercooled Large Droplet
SLP/SKD	Slip/Skid
SLW	Slow
SM	Statute Mile
SMBL	Symbol
SMK	Smoke
SMS	Short Message System
SNGL	Single
SOB	Souls on Board
SPBK	Speed Brake
SPC	Space
SPD	Speed
SPI	Special Position Identification
SPKR	Speaker
SQ, SQL	Squelch
SRVC, SVC	Service
SSEC	Static Source Error Correction
SSID	Wireless Service Set Identifier
STAB	Stabilization
STAL	Stall
STAR	Standard Terminal Arrival Route
STAT	Status
STATS	Statistics
STBY	Standby
STC	Sensitivity Time Constant, Supplemental Type Certificate
STD	Standard
STN	Station
STR	Strip
STRMSCP	Stormscope
SUA	Special Use Airspace
SUB	Substitute
SUPPRESS	Suppression
SURF	Surface
SUSP	Suspend
SVBL	Serviceable
SVT	Synthetic Vision Technology
SW	Software
SYN TERR	Synthetic Terrain
SYN VIS	Synthetic Vision
SYNC	Synchronize
SYNTH	Synthesizer
SYS	System
T	True
T HDG	True Heading
T/R	Thrust Reverser
TA	Traffic Advisory, Transition Altitude
TAC	Tactical
TACAN, TCN	Tactical Air Navigation System
TAF	Terminal Aerodrome Forecast
TAS	True Airspeed, Traffic Advisory System
TAT	Total Air Temperature
TAWS	Terrain Awareness and Warning System
TCA	Terminal Control Area
TCAS	Traffic Alert Collision Avoidance System
TCH	Threshold Crossing Height
TD	Touchdown
TEL	Telephone
TEMP	Temperature
TERM	Terminal
TERR	Terrain
T/F	To/From
TF	Track Between Two Fixes Leg
TFR	Temporary Flight Restriction
TGT	Target
TH	True Heading
THLD	Threshold
THR	Thrust
TIS	Traffic Information Service
TIS-B	Traffic Information Service-Broadcast

TIT	Turbine Inlet Temperature
TKE	see also Track Angle Error
TL	Transition Level
TLA	Throttle Lever Angle, Thrust Lever Angle
TMA	Terminal Maneuvering Area
TMR/REF	Timer/Reference
TNK	Tank
TO	To, Takeoff
TOC	Top of Climb
TOD	Top of Descent, Time to TOD
TOGA, TO/GA	Take-Off, Go-Around
TOLD	Takeoff and Landing Data
TOPO	Topographic
TORA	Takeoff Run Available
TOT	Total
TPA	Traffic Pattern Altitude
Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'.
Track Angle Error	The angle difference between the desired track and the current track.
TRFC	Traffic
TRK	see also Track
TRN	Terrain
TRSA	Terminal Radar Service Area
TRUNC	Truncated
TSO	Technical Standard Order
TST	Test
TTA	Time-to-Alert
TTK	True Track
TTL	Total
TTS	Text to Speech
TUR	Turbine
TURB	Turbulence
TURN	Procedure Turn
TWND	Tailwind
TWIP	Terminal Weather Information for Pilots
TWR	Tower
TWY	Taxiway
TX	Transmit
UA	Routine PIREP
UAT	Universal Access Transceiver
UHF	Ultra-High Frequency
UNABL	Unable
UNAVAIL	Unavailable
UNLIM	Unlimited
UPLK	Uplink
US	United States
USB V	Upper Sideband Voice
USR	User
UTC	Coordinated Universal Time
UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid
UUA	Urgent PIREP
V	Volts, Vertical
V DEV	Vertical Deviation
V, Vspeed	Velocity (airspeed)
V_1	Takeoff Decision Speed
V_2	Takeoff Safety Speed
V_A	Maneuvering Speed
VA	Heading Vector to Altitude Leg
VAC	Volts Alternating Current
VAL	Vertical Alert Limit
VAPP	VOR Approach Mode
V_{APP} , V_{AC}	Approach Climb Speed
VAR	Variable, Variation
VCO	Voice Call Out
VD	Heading Vector to DME Distance Leg
VDC	Volts Direct Current
VDI	Vertical Deviation Indicator
VDL	VHF Datalink
VECT	Vector
VERT	Vertical
Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.
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.
V_{FE}	Maximum Flap Extended Speed
VFOM	see also Vertical Figure of Merit
VFR	Visual Flight Rules

VHF	Very High Frequency
VI	Heading Vector to Intercept Leg
VIB	Vibration
V_{LE}	Maximum Landing Gear Extended Speed
V_{LNDx}	Approach Speed (Flaps at x°)
V_{LO}	Maximum Landing Gear Operating Speed
VLD	Valid
VLOC, VOR/L	VOR/Localizer Receiver
VM	Heading Vector to Manual Termination Leg
V_{MC}	Minimum Control Speed
VMC	Visual Meteorological Conditions
V_{MO} (M_{MO})	Maximum Operating Speed
VNAV, VNV	Vertical Navigation
V_{NE}	Never-Exceed Speed
VOL	Volume
VOR	VHF Omnidirectional Range
VOR/D	VOR/DME
VOR/I	VOR/ILS
VORTAC	VHF Omnidirectional Range Station and Tactical Air Navigation
VPATH, VPTH	Vertical Path
VPL	Vertical Protection Level
VPROF	VNAV Profile, Vertical Profile
V_R	Takeoff Rotate Speed
VR	Heading Vector to Radial Leg
V_{REF}	Landing Approach Speed, Reference Landing Speed
VRP	Visual Reporting Point
VS	Vertical Speed
V_{SB}	Maximum Speedbrake Speed
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
V_{SR}	Stall Speed
VSR, VS REQ	see also Vertical Speed Required
V_T	Takeoff Flap Retraction Speed
VTE	Vertical Track Error
VTF	Vector to Final
VTK	Vertical Track
V_{TIRE}	Maximum Tire Speed
V_X	Best Angle of Climb Speed
V_Y	Best Rate of Climb Speed
V_{YSE}	Best Single-Engine Rate of Climb Speed
W	Watt(s), West
WAAS	Wide Area Augmentation System
WARN	Warning
WATCH	Weather Attenuated Color Highlight
WDIR	Wind Direction
WSPD	Wind Speed
WGS-84	World Geodetic System - 1984
WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
WILCO	Will Comply
WNDSHR, WSHEAR	Windshear
WL	Wings Level
WOG	Weight on Gear
WOW	Weight on Wheels
WPT	Waypoint(s)
WT	Weight
W/V	Wind Velocity
WW	World Wide
WX	Weather
WXR	Weather Radar
XFD	Crossfeed
XFER, XFR	Transfer
XFLOW	Crossflow
XM LTNG	SiriusXM Lightning
XMIT	Transmit
XMSN	Transmission
XPDR	Transponder
XTALK	Cross-Talk
XTE	Crosstrack Error
XTK	Cross-Track, Crosstrack Error
YD	Yaw Damper
Z	Reflectivity Factor

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FREQUENTLY ASKED QUESTIONS

If a particular aspect of G1000 NXi 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?

LP and LPV approaches use the accuracy of SBAS to provide additional precision for lateral (LP, LPV) and vertical (LPV) guidance capability. LPV approaches also allow lower approach minimums. When SBAS is not available, LP and LPV approaches cannot be added to the active flight plan. An LP or LPV approach already loaded will be downgraded to an LNAV or LNAV/VNAV approach, using LNAV or LNAV/VNAV minima.

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.

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
• Automatic sequencing of waypoints	• Manual sequencing - 'holds' on selected waypoint
• Manual course change on HSI not possible	• Manually select course to waypoint from HSI
• Always navigates 'TO' the active waypoint	• Indicates 'TO' or 'FROM' waypoint
• Must be in this mode for final approach course	• 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 does 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). 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 selecting 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 G1000 NXi 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, LP, 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.

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