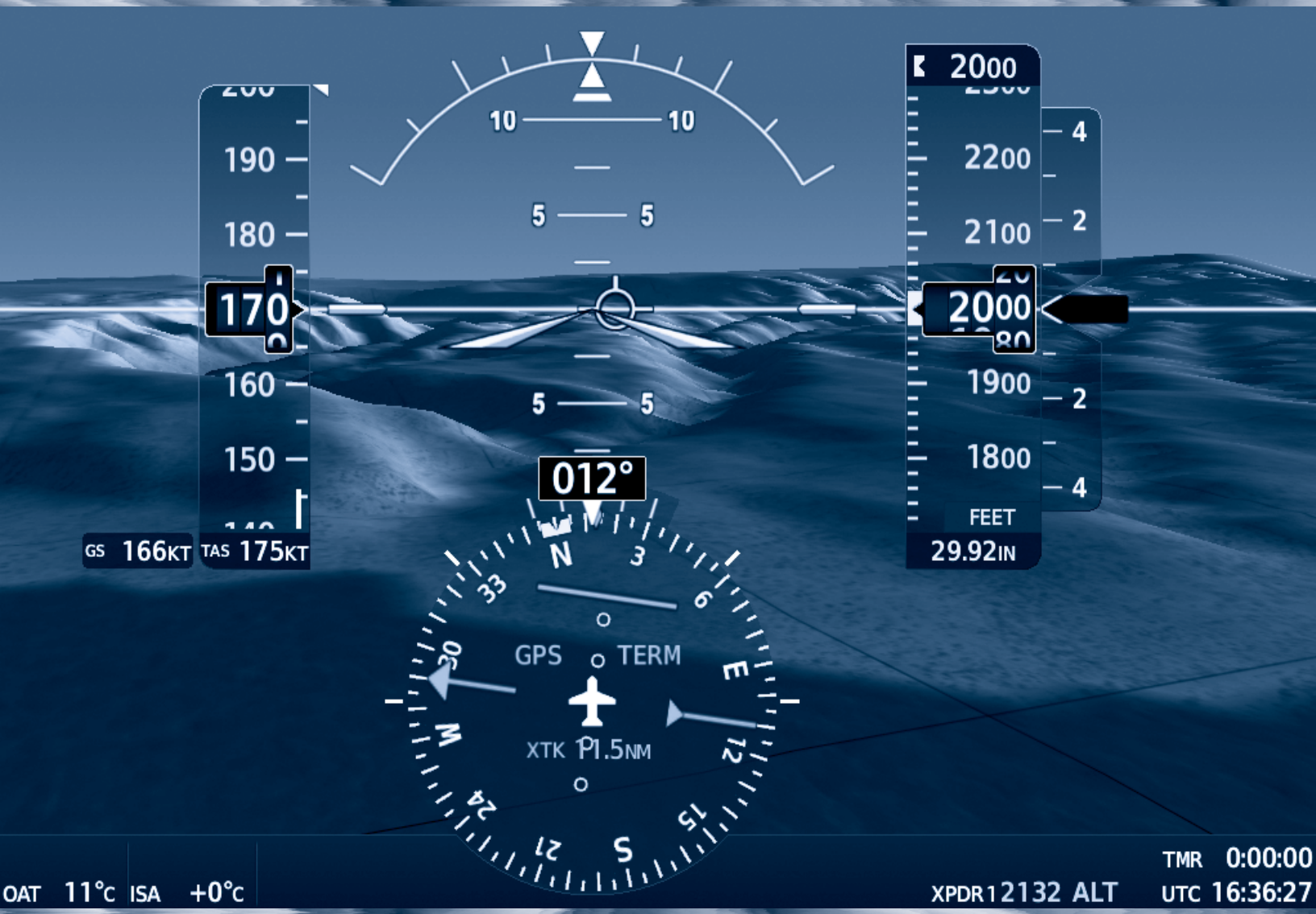
GARMIN®

G1000® NXi

Pilot's Guide



Beechcraft 200/B200 Series

System Software Version 2286.07 or later

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This manual reflects the operation of System Software version 2286.07 or later for the G1000 NXi Beechcraft 200/B200 Series. 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 use terrain avoidance displays as the sole source of information for maintaining separation from terrain and obstacles. Garmin obtains terrain and obstacle data from third party sources and cannot independently verify the accuracy of the information.*

WARNING: *Always refer to current aeronautical charts and NOTAMs for verification of displayed aeronautical information. Displayed aeronautical data may not incorporate the latest NOTAM information.*

WARNING: *Do not use geometric altitude for compliance with air traffic control altitude requirements. The primary barometric altimeter must be used for compliance with all air traffic control altitude regulations, requirements, instructions, and clearances.*

WARNING: *Do not use basemap information (land and water data) as the sole means of navigation. Basemap data is intended only to supplement other approved navigation data sources and should be considered only an aid to enhance situational awareness.*

WARNING: *Do not rely solely upon the display of traffic information to accurately depict all of the traffic within range of the aircraft. Due to lack of equipment, poor signal reception, and/or inaccurate information from aircraft or ground stations, traffic may be present that is not represented on the display.*

WARNING: *Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information contained within data link weather products may not accurately depict current weather conditions.*

WARNING: *Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be older than the indicated weather product age.*

WARNING: *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 operate this equipment without first obtaining qualified instruction.*

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.*

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: *Always use traffic information shown on system displays only as an aid to visually acquiring traffic. Traffic avoidance maneuvers are based upon TCAS II Resolution Advisories , ATC guidance, or positive visual acquisition of conflicting traffic.*

WARNING: *Do not rely on information from a 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.*

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 operate the weather radar in a transmitting mode when personnel or objects are within the MPEL boundary.*

WARNING: *Always position the weather radar gain setting to Calibrated for viewing the actual intensity of precipitation. Changing the gain in weather mode causes precipitation intensity to be displayed as a color not representative of the true intensity.*

WARNING: *Do not assume weather radar transmission is disabled unless all display panes displaying weather radar are set to Standby Mode, and are displaying 'STANDBY' in the center of each weather radar display. Transmission is also disabled by touching the Radar On Button or pressing the Radar On Softkey to set the weather radar system to Off Mode, as indicated by a gray annunciator.*

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

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.*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NOTE: *Garmin requests the flight crew report any observed discrepancies related to database information. These discrepancies could come in the form of an incorrect procedure; incorrectly identified terrain, obstacles and fixes; or any other displayed item used for navigation or communication in the air or on the ground. Go to www.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 FlightCharts 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 89° North latitude and south 89° South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.*

***NOTE:** When operating the system with the magnetic sensor uncoupled from the AHRS, the displayed heading and heading information used by some system components (e.g. traffic system, AFCS, and weather radar) will be different from the heading calculated by the AHRS. The difference is an amount equal to the difference between the current Magnetic Field Variation Database (MV DB) value, and the MV DB value when the magnetic sensor was uncoupled. Due to the convergence of isogonic lines, this condition is most noticeable at or near the north and south magnetic poles.*

***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:** 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.*

***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.*

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SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the integrated avionics system as installed in the Beechcraft 200/B200 Series. The system presents flight instrumentation, position, navigation, communication, and identification information to the pilot through large-format displays.

LINE REPLACEABLE UNITS

The system consists of the following Line Replaceable Units (LRUs):

- **GDU 1050A** (2) – Each unit is configured as a PFD that features a 10-inch high resolution LED backlit display. The unit installed on the left/pilot side is designated as PFD1, and the one installed on the right/copilot side is designated as PFD2. These units communicate with each other, the MFD, and with the on-side GIA Integrated Avionics Unit through a High-Speed Data Bus (HSDB) connection.
- **GDU 1550** (1) – Features a 15-inch, high resolution LED backlit display configured as an MFD. This unit is linked to both PFDs via HSDB connection.
- **GIA 64E** (2) or **GIA 63W** (2) (Alternate) – Integrated Avionics Units (IAUs) function as the main communication hub, linking all LRUs with the on-side PFD and MFD. Each GIA contains a GPS SBAS receiver, VHF COM/NAV/GS receivers, a flight director (FD) and system integration microprocessors. Each GIA is paired with the on-side PFD via HSDB connection. The GIAs are not paired together and do not communicate with each other directly.
- **GSU 75B** (2) (Alternate to GDC and GRS) – Processes data from the pitot/static system as well as the OAT probe to provide pressure altitude, airspeed, vertical speed and OAT information to the system. This unit also provides aircraft attitude and heading information via ARINC 429 to the onside PFD and both GIA units. The GSU contains advanced sensors (including accelerometers and rate sensors) and interfaces with the GMU 44 to obtain magnetic field information, and with the GIA to obtain GPS information. ADAHRS modes of operation are discussed later in this document.
- **GEA 71B** (2) or **GEA 71** (2) (Alternate) – Receives and processes signals from the engine and airframe sensors. This unit communicates with both GIAs using an RS-485 digital interface.
- **GDC 7400** (2) or **GDC 74B** (Alternate to GSU) – 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 communicates with the on-side GIA, PFD, GRS, and GTP. The #1 GDC communicates with the MFD. It is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.
- **GRS 7800** (2) or **GRS 77** (2) (Alternate to GSU) – Provides aircraft attitude and heading information to the on-side PFD, GIA, and GMU. The GRS contains advanced sensors (including accelerometers and rate sensors) and interfaces with the on-side GMU to obtain magnetic field information, the GDC to obtain air data, and both GIAs to obtain GPS information. AHRS modes of operation are discussed later in this document.
- **GMU 44** (2) – Measures and sends local magnetic field data to the GRS for processing to determine aircraft magnetic heading. This unit receives power directly from the GRS and communicates with the GRS using an RS-485 digital interface.
- **GMA 1360D** (2) or **GMA 1347D** (2) (Alternate) – Integrates NAV/COM digital audio, intercom system and marker beacon controls, and is installed in dual configuration on the outboard side of PFD1 and PFD2. This unit also enables the manual control of the display reversionary mode (red **DISPLAY BACKUP** Button) and communicates with the on-side GIA.

- **GTX 335R / 345R / 3000 / 33** (2) (Optional) – Solid-state transponders that provide Modes A, C, S and ADS-B "In" capability for the 335R and 3000, and "In/Out" capability for the 345R. Both transponders can be controlled from either PFD, and only one transponder can be active at a time. Each transponder communicates with the on-side GIA through an RS-232 digital interface. If a GTX 345R is installed, the second transponder will not be another GTX 345R. If the GTX 3000 is installed, both transponders will be the GTX 3000 model.
- **Flight Stream 510** (1) (Optional) – Bluetooth® transceiver that provides wireless connectivity between a compatible tablet/mobile device and the avionics system.
- **GDL 69A SXM** (1) (Optional) – A satellite radio receiver that provides datalink weather information to the MFD (and, indirectly, to the inset map of the PFD) as well as digital audio entertainment. The GDL 69A SXM communicates with the MFD via HSDB connection. Subscriptions to the SiriusXM Weather or SiriusXM Satellite Radio services are required to enable the GDL 69A SXM capability.
- **GDL 59** (1) (Optional) – GDL 59 datalink operations are performed through the GDL 69A via an HSDB connection. If the GDL 69A is not installed, operations go through the MFD. Connectivity with the GSR 56 for the Iridium telephone feature is through the RS-232 bus.
- **GSR 56** (1) (Optional) – The Iridium Transceiver operation for voice communication is by means of a telephone handset in the cabin and pilot and copilot headsets in the cockpit. The transceiver can also send and receive data provided by the GDL 59 through the RS-232 bus, and provide Garmin Connext Weather and SMS functions.
- **GWX 75 / 68 / 70** (1) – Provides airborne weather and ground mapped radar data to the MFD, through the XM datalink, via HSDB connection. If the GDL 69A is not installed, operations go through the MFD.
- **GCU 477** (1) – Provides the Flight Management System (FMS) controls for the PFD1 and MFD through an RS-232 digital interface.
- **GMC 710** (1) – Provides the controls for the Garmin AFCS through an RS-232 digital interface allowing communication with both PFDs.
- **GTP 59** (2) – Provides Outside Air Temperature (OAT) data to the on-side GSU or GDC.
- **GTS 825 / 855 / 8000** (1) (Optional) – The GTS 825 Traffic Advisory System (TAS), GTS 855 Traffic Alert and Collision Avoidance System I (TCAS I) and GTS 8000 (TCAS II) use active interrogations of Mode S and Mode C transponders to provide traffic information to the pilot independent of the ATC system.
- **GRA 5500** (1) (Optional) – Provides altitude above the ground (AGL) to the MFD, through the GIA.
- **GSA 80** (4) and **GSM 85A / GSM 86** (4) – The GSA 80 servos are used for the automatic control of roll, pitch, and yaw, and pitch trim. These units interface with each GIA. The GSM servo gearboxes are responsible for transferring the output torque of the servo actuator to the mechanical flight-control surface linkage.

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

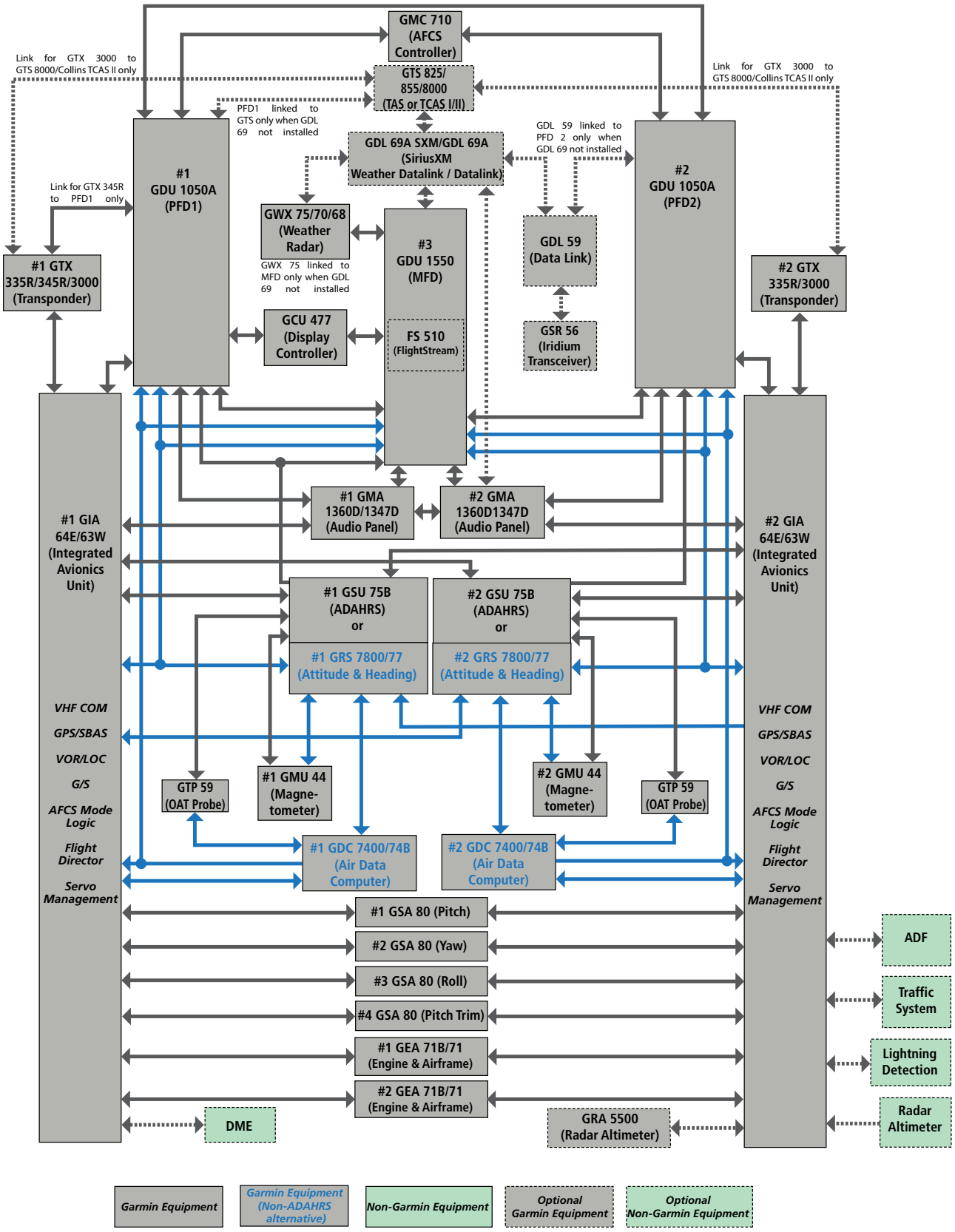


Figure 1-1 System (LRU Configuration)

1.2 SYSTEM CONTROLS

NOTE: *The Audio Panel and AFCS controls are described in the Audio and CNS and AFCS Sections respectively.*

The system controls are located on the PFD and MFD bezels, PFD/MFD Controller, AFCS Controller and the audio panel. The controls for the PFD and MFD bezels and PFD/MFD Controllers are discussed in this section.

PFD CONTROLS

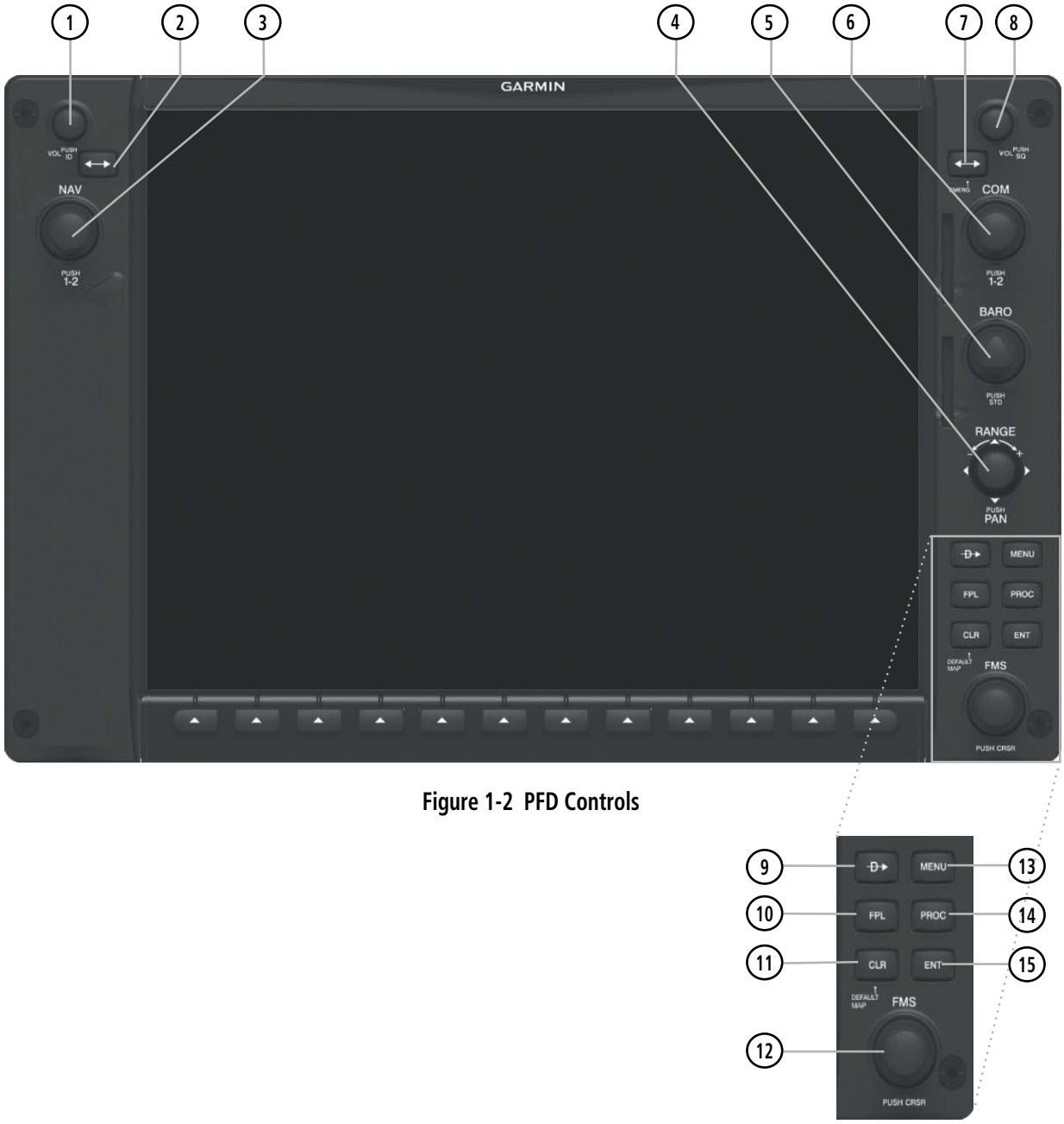


Figure 1-2 PFD Controls

The following list provides an overview of the controls located on the PFD bezel (see Figure 1-2).

(1) **NAV VOL/ID Knob** – Controls NAV audio volume level. Press to toggle 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** – Toggles the standby and active NAV frequencies.

(3) **Dual NAV Knob** – Tunes the standby frequencies for the NAV receiver (large knob for MHz; small knob for kHz). Push to switch the tuning box (cyan box) between NAV1 and NAV2.

(4) **Joystick** – Changes the map range when rotated. Activates the map pointer when pressed.

(5) **BARO Knob** – Sets the altimeter barometric pressure. Push to enter standard pressure (29.92).

(6) **Dual COM Knob** – Tunes the standby frequencies for the COM transceiver (large knob for MHz; small knob for kHz). Push to switch the tuning box (cyan box) between COM1 and COM2.

(7) **COM Frequency Transfer Key** – Toggles the standby and active COM frequencies. Press and hold this key for two seconds to tune the emergency frequency (121.5 MHz) automatically into the active frequency field.

(8) **COM VOL/SQ Knob** – Controls COM audio volume level. Volume level is shown in the COM frequency field as a percentage. Push to turn the COM automatic squelch ON and OFF.

(9) **Direct-to Key (D▸)** – 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).

(10) **FPL Key** – Displays the active 'FPL - Active Flight Plan' Page for creating and editing the active flight plan.

(11) **CLR Key** – Erases information, cancels entries, or removes page menus.

(12) **Dual FMS Knob** – Flight Management System Knob. Push the **FMS** Knob to turn the selection cursor ON and OFF. When the cursor is ON, data may be entered in the applicable window by turning the small and large knobs. The large knob moves the cursor on the page, while the small knob selects individual characters for the highlighted cursor location.

(13) **MENU Key** – Displays a context-sensitive list of options. This list allows the user to access additional features or make setting changes that relate to particular pages.

(14) **PROC Key** – Gives access to IFR departure procedures (DPs), arrival procedures (STARs) and approach procedures (IAPs) for a flight plan. If a flight plan is used, available procedures for the departure and/or arrival airport are automatically suggested. These procedures can then be loaded into the active flight plan. If a flight plan is not used, both the desired airport and the desired procedure may be selected.

(15) **ENT Key** – Validates or confirms a menu selection or data entry.

PFD/MFD CONTROLLER

The controls for the MFD are located on both the MFD bezel and the PFD/MFD Controller. The bottom portion of the MFD bezel features 12 softkeys that are designed to perform various functions depending upon the specific page being displayed. These softkeys are discussed throughout the Pilot's Guide documentation.

The following list provides an overview of the controls located on the Controller (see figure below):

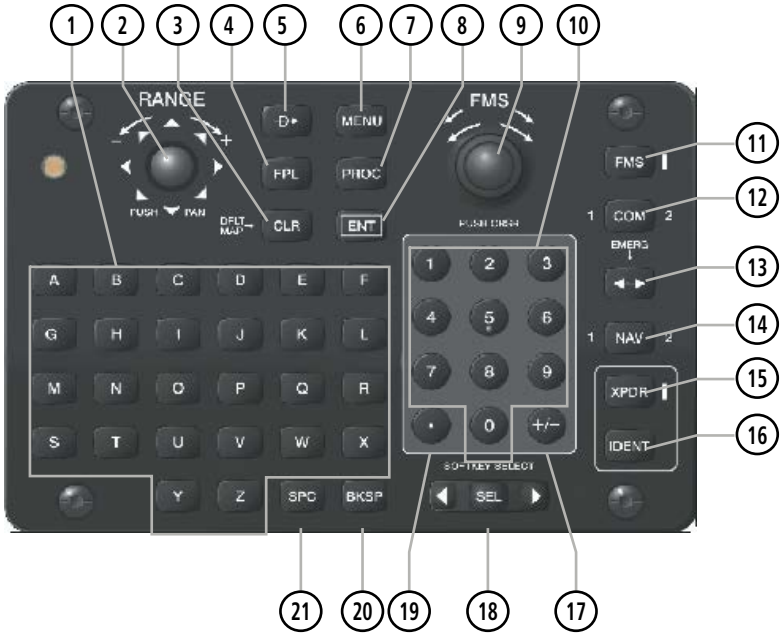


Figure 1-3 PFD/MFD Controller (GCU 477)

(1) **Alphabetic Keys** – Allow the user to enter letters quickly, without having to select individual characters with the **FMS** Knob.

(2) **Range Knob/Joystick** – Turn to change map range. Push to activate the map pointer for map panning.

(3) **CLR Key** – Erases information, cancels entries, or removes page menus. Pressing and holding this key displays the 'Navigation Map' Page automatically.

(4) **FPL Key** – Displays the active 'FPL - Active Flight Plan' Page for creating and editing the active flight plan, or for accessing stored flight plans.

(5) **Direct-to Key (D▸)** – 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).

(6) **MENU Key** – Displays a context-sensitive list of options. This list allows the user to access additional features or make setting changes that relate to particular pages.

(7) **PROC Key** – Gives access to IFR departure procedures (DPs), arrival procedures (STARs) and approach procedures (IAPs) for a flight plan. If a flight plan is used, available procedures for the departure and/or arrival airport are automatically suggested. Theses procedures can then be loaded into the active flight plan. If a flight plan is not used, both the desired airport and the desired procedure may be selected.

(8) **ENT Key** – Validates or confirms a menu selection or data entry.

(9) **Dual FMS Knob** – Flight Management System Knob. When the **FMS** Key is pressed, this knob selects the MFD page to be viewed. The large knob selects a page group (Map, WPT, Aux, NRST), while the small knob selects a specific page within the page group. Pushing the **FMS** Knob turns the selection cursor ON and OFF. When the cursor is ON, data may be entered in the applicable window by turning the small and large knobs. In this case, the large knob moves the cursor on the page, while the small knob selects individual characters for the highlighted cursor location. This knob also has tuning capability for the COM and NAV radios when the appropriate COM or NAV key is pressed. When the **XPDR** Key is pressed, the transponder code may be entered using the **FMS** Knob.

(10) **Numeric Keys** – Allow the user to enter numbers quickly, without having to select individual characters with the **FMS** Knob.

(11) **FMS Key** – Sets the **FMS** Knob to control FMS functions on the MFD. When pressed, an annunciator next to the key illuminates indicating adjustment of the **FMS** Knob will now affect FMS functions.

(12) **COM Key** – Sets the **FMS** Knob to control tuning of the COM radios. The first press will select COM1, as indicated by an illuminated "1" to the left of the key. Press again to select COM2. This is annunciated with a "2" to the right of the key. Each subsequent press of the **COM** Key will switch between COM1 and COM2. Use the **FMS** Knob to tune the selected COM.

(13) **Frequency Transfer Key (EMERG)** – Switches the standby and active COM or NAV frequencies. Press and hold this key for two seconds to tune the emergency frequency (121.5 MHz) automatically into the active frequency field.

(14) **NAV Key** – Sets the **FMS** Knob to control tuning of the NAV radios. The first press will select NAV1, as indicated by an illuminated "1" to the left of the key. Press again to select NAV2. This is annunciated with a "2" to the right of the key. Each subsequent press of the **NAV** Key will switch between NAV1 and NAV2. Use the **FMS** Knob to tune the selected NAV.

(15) **XPDR Key** – Sets the **FMS** Knob to enter transponders codes. When pressed, an annunciator next to the key illuminates indicating the **FMS** Knob can now be used for transponder code entry.

(16) **IDENT Key** – Activates transponder IDENT function.

(17) **Plus (+) Minus (-) Key** – Toggles a (+) or (-) character.

(18) **SEL Key** – The center of this key activates the selected MFD softkey, while the right and left arrows move the softkey selection box to the right and left, respectively.

(19) **Decimal Key** – Enters a decimal point.

(20) **BKSP Key** – Moves the cursor back one character space.

(21) **SPC Key** – Adds a space character.

SECURE DIGITAL CARDS

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

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

The PFD or MFD data card slots use Secure Digital (SD) cards and are located on the top right portion of the display bezels. Each display bezel is equipped with two SD card slots. SD cards are used system software updates. Also, flight plans may be imported or exported from an SD card in the MFD.

Inserting and Removing an SD card:

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

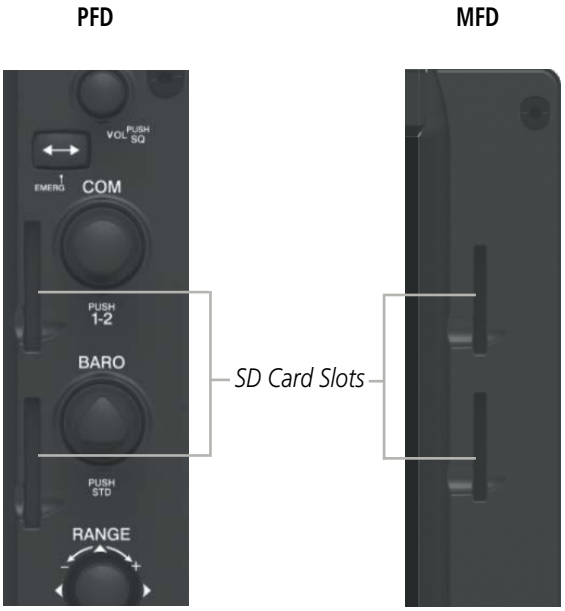


Figure 1-4 Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

This section discusses powering up the system, normal and reversionary display operation, annunciations, system status, air data and attitude heading reference system (ADAHRS) modes of operation, and GPS receiver operation.

SYSTEM POWER-UP

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

NOTE: *See the 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 PFDs, MFD and supporting sub-systems include both power-on and continuous built-in test features that exercise the processor, RAM, ROM, external inputs and outputs to provide safe operation.

When powering up the system, test annunciations are displayed and key annunciator lights also become momentarily illuminated on the audio panel and the display bezels. On the PFD, the ADAHRS begins to initialize and an alignment message is displayed. All system annunciations should disappear typically within one minute of power-up.

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

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

Current database information includes the valid operating dates, cycle number and database type. When this information has been reviewed for currency (to ensure that no databases have expired), the pilot is prompted to continue.

The displays are connected together via multiple data busses, thus allowing for high-speed communication. As shown in Figure 1-1, each IAU is connected to the on-side PFD. This section discusses the normal and reversionary modes of operation as well as the various AHRS modes of the system.

NORMAL OPERATION

NOTE: *In normal operating mode, backlighting can only be adjusted from the PFD (see later in this section). In reversionary mode, it can be adjusted from the remaining display.*

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

PFD1 MFD PFD2

Figure 1-5 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 can be manually switched to reversionary (backup) mode (all remaining displays enter reversionary mode). In reversionary mode, all important flight information is presented on the remaining display(s) in the same format as in normal operating mode.

If a display fails, the appropriate IAU-display Ethernet interface is cut off. Thus, the IAU can no longer communicate with the remaining display (refer to the figure below), 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 ADAHRS, Engine/Airframe Unit, and Transponder, as required. The change to backup paths is completely automated for all LRUs and no pilot action is required.

When a display fails, the system automatically switches to reversionary (backup) mode as follows:

- **PFD1 failure –** MFD and PFD2 remain in normal mode.
- **MFD failure –** PFD1 automatically switches to reversionary mode.
- **PFD2 failure –** MFD and PFD1 remain in normal mode.

Figure 1-6 Reversionary Mode

Reversionary mode can be activated manually by pressing the dedicated **DISPLAY BACKUP** Button at the bottom of the audio panel (see the following figure). Pressing this button again deactivates reversionary mode.

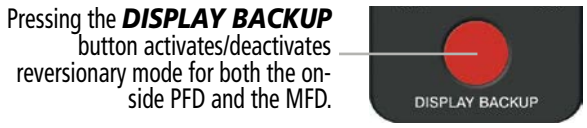


Figure 1-7 GMA DISPLAY BACKUP Button

Each display can be configured to operate in reversionary mode, as follows:

- **PFD1 –** By pressing the **DISPLAY BACKUP** Button on the left audio panel.
- **MFD –** By pressing the **DISPLAY BACKUP** Button on the left or the right audio panel.
- **PFD2 –** By pressing the **DISPLAY BACKUP** Button on the right audio panel.

Should the connection between a PFD and the on-side IAU become inoperative, the on-side IAU can no longer communicate with the remaining PFD. As a result, the NAV and COM functions provided to the failed PFD by the on-side IAU are flagged as invalid (red "X") on the remaining PFD (see in the following table).

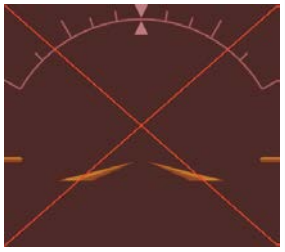
SYSTEM ANNUNCIATIONS

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

When an LRU or an LRU function fails, a large red or amber "X" is typically displayed on windows associated with the failed data. Refer to the aircraft flight manual for additional information regarding pilot responses to these annunciations.

The status of detected LRUs can be checked on the 'Aux - System Status' Page. Active LRUs are indicated by green check marks; failed

NOTE: *Refer to the current version of the pertinent flight manual for additional information regarding pilot responses to these annunciations.*

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

System Annunciation	Comment
	Display system is not receiving vertical speed input.
	Display system is not receiving valid heading input from the AHRS/ADAHRS or magnetometer.
	Display system is not receiving altitude input.
	Display system is not receiving valid ISA information.
	Display system is not receiving valid Ground Speed information from the GPS.
	Display system is not receiving valid OAT 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 that the field is not receiving valid data.

Table 1-1 System Annunciations

Viewing **LRU Information:**

1) Use the **FMS** Knob to select the 'Aux - System Status' Page.

2) To place the cursor in the 'LRU Info' Box,

Press the **LRU** Softkey

Or:

a) Press the **MENU** Key

b) With the 'Select LRU' Window highlighted, press the **ENT** Key.

3) Use the **FMS** Knob to scroll through the box to view LRU status information.

SYSTEM STATUS PAGE

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

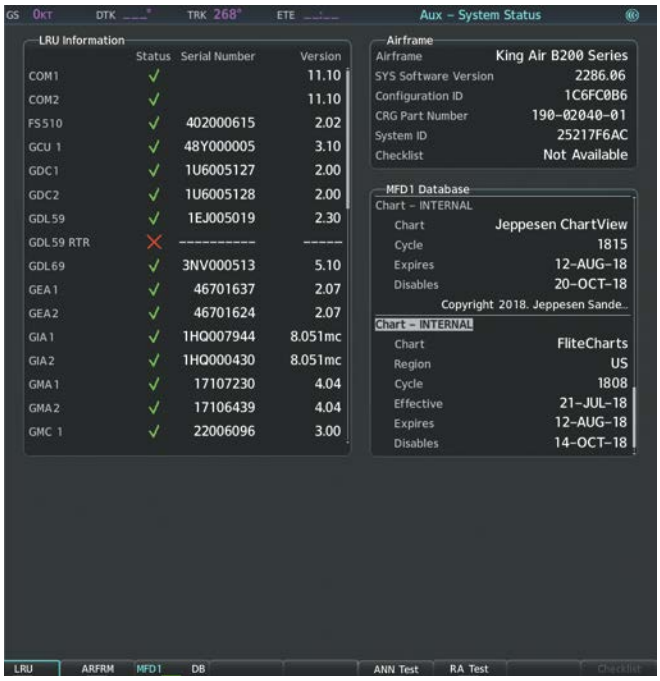


Figure 1-8 Example 'Aux - System Status' Page

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

Pressing the **MFD1 DB** Softkey (label annunciator turns green indicting the softkey is selected) places the cursor in the database window. Use the **FMS** Knob to scroll through database information for the MFD. Pressing the softkey again will change the softkey label to **PFD1 DB**. PFD 1 database information is now displayed in the database window. Pressing the softkey a third time will change the softkey label to **PFD2 DB**. PFD 2 database information is now displayed in the database window.

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

The **RA Test** Softkey, when selected, initiates the Radar Altimeter test mode. For more information, see the Flight Instruments section.

ADAHRS OPERATION

In addition to using internal sensors, the ADAHRS uses GPS information, magnetic field data and air data to assist in attitude/heading calculations. In normal mode, the ADAHRS relies upon GPS and magnetic field measurements. In Heading Preset Mode, the magnetometer data is replaced by a heading value set by the pilot. If either of these external measurements is unavailable or invalid, the ADAHRS uses air data information for attitude determination. Six ADAHRS modes of operation are available (see table below) 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.

ADAHRS Mode	GPS Data Available	Magnetometer Data Available	Air Data Available	Attitude Indicator	Condition
ADAHRS Normal	Yes	Yes	Yes		Valid Pitch/Roll/Heading.
ADAHRS no-GPS	No	Yes	Yes		Valid Pitch/Roll/Heading.
ADAHRS no-GPS/ no-Mag	No	No	Yes		Valid Pitch/Roll. Heading will coast-on-gyros until it becomes invalid.
ADAHRS coast-on-gyros until invalid	No	No	No		Invalid Pitch/Roll/Heading.
ADAHRS no-Mag Data	Yes	No	Yes		Valid Pitch/Roll. Heading Invalid.
ADAHRS no-Mag/ no-Air Data	Yes	No	No		Invalid Heading.
ADAHRS coast-on-gyros until invalid	No	Yes	No		Invalid Pitch/Roll/Heading.
ADAHRS no-Air Data	Yes	Yes	No		Valid Pitch/Roll/Heading.

Table 1-2 ADAHRS Operation

NOTE: *Refer to the Appendices for specific ADAHRS alert information.*

NOTE: *Aggressive maneuvering while the ADAHRS is not operating normally can degrade ADAHRS accuracy.*

NOTE: *In-flight initialization of ADAHRS, 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 ADAHRS initialization to take an indefinite amount of time which would result in an extended period of time where valid ADAHRS outputs are unavailable.*

AHRS OPERATION

The Attitude and Heading Reference System (AHRS) (optional) performs attitude, heading, and vertical acceleration calculations for the system, using GPS, magnetometer, air data, and internal inertial sensors. Attitude and heading information are updated on the PFD(s) while the AHRS receives appropriate combinations of information from the external sensor inputs.

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 you on startup when an update is available. Failure to update this database could lead to erroneous heading information being displayed to the pilot.

GRS 7800 Operation

In primary mode, the GRS 7800 AHRS relies upon GPS and magnetic field measurements (air data is not used). If either GPS or magnetometer data is unavailable or unreliable, the AHRS uses the remaining inputs for attitude/heading determination. In DG Free Mode, the magnetometer data is replaced by a heading value set by the flight crew. Four AHRS modes of operation are available (see figure below) and depend upon the combination of available sensor inputs. Loss of GPS or magnetometer sensor inputs is communicated to the pilot by message advisory alerts. Refer to the Flight Instruments section for further discussion of DG Free Mode.

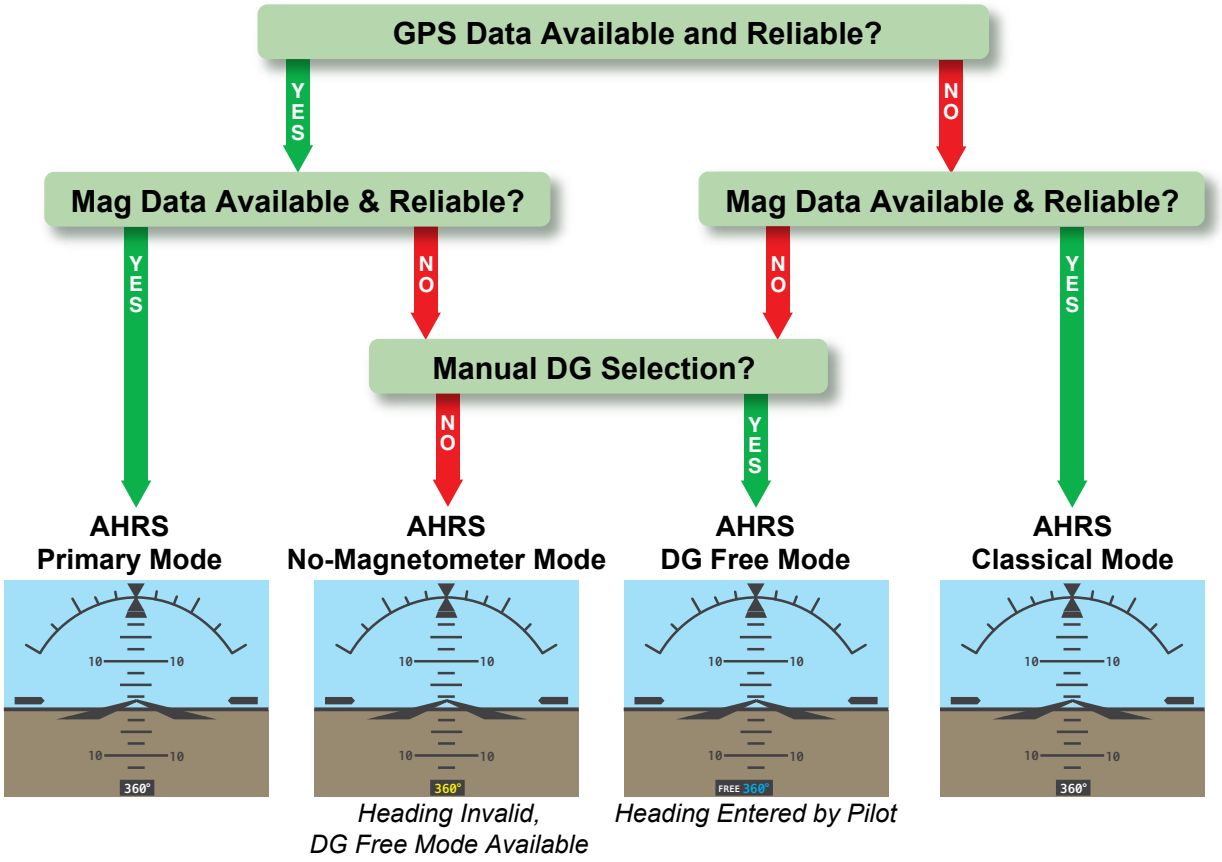


Figure 1-9 AHRS Modes (GRS 7800)

GPS Input Failure

Two GPS inputs are provided to the AHRS. If GPS information from one of the inputs fails, the AHRS uses the remaining GPS input and an alert message is issued to inform the pilot. If both GPS inputs fail, the AHRS can continue to provide AHRS information to the PFD(s) as long as magnetometer data is available and reliable (air data will be used to aid calculations during speed changes and extended turns).

Magnetometer Failure

If the magnetometer input fails, the AHRS continues to output valid attitude information; however, the heading output on the PFD(s) is shown in amber. The pilot can select DG Free mode to provide heading inputs.

Air Data Input Failure

Failure of the air data input has no effect on the AHRS output.

GPS RECEIVER OPERATION

Each IAU 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.

GPS1 provides information to the pilot-side PFD and GPS2 provides data to the copilot-side PFD. Internal system checking is performed to ensure both GPS receivers are providing accurate data to the PFDs. In some circumstances, both GPS receivers may be providing accurate data, but one receiver may be providing a better GPS solution than the other receiver. In this case the GPS receiver producing the better solution is automatically coupled to both PFDs. "BOTH ON GPS 1" or "BOTH ON GPS 2" is displayed in the 'Reversionary Sensor' Window (see Appendix A) indicating which GPS receiver is being used. Both GPS receivers are still functioning properly, but one receiver is performing better than the other at that particular time.

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

If the sensor annunciation persists, check for a system failure message in the '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.

Viewing GPS receiver status information:

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

Selecting the GPS receiver for which data may be reviewed:

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

   Press the desired **GPS** Softkey.

   Or:

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

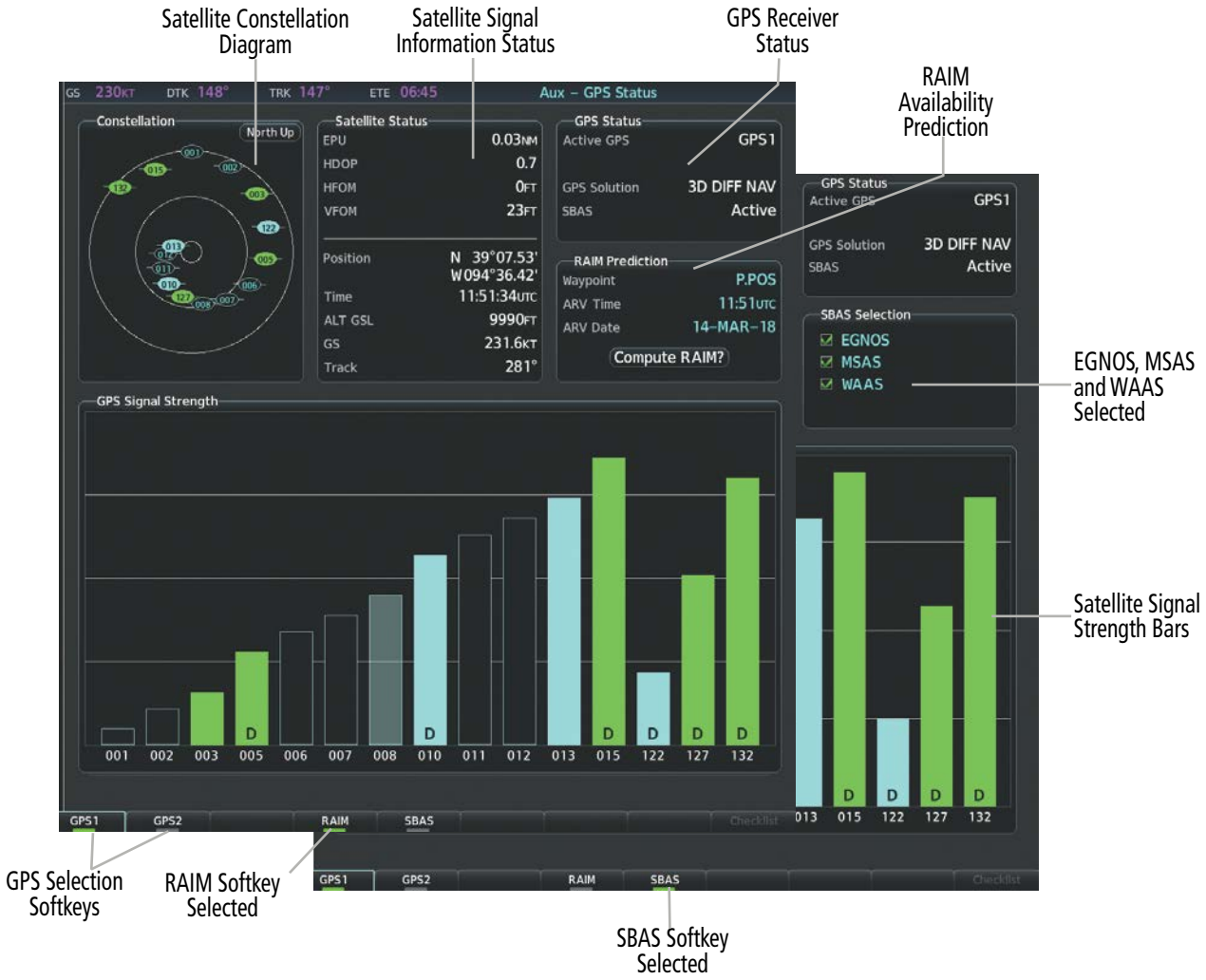


Figure 1-10 'Aux - GPS Status' Page (RAIM or SBAS Selected)

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

SATELLITE STATUS

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

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

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

GPS 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 in 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.

The system will determine if messages are being received from the WAAS engine. If so, the SBAS will read 'Active'. If no messages have been received for 4 seconds and SBAS providers are enabled, the SBAS status will read 'Inactive'. If SBAS providers are disabled, SBAS status will read 'Disabled'. Note, that a fix is not required, but rather the status is determined by communication with the WAAS engine.

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 that the available satellite geometry allows the receiver to calculate a position within a specified RAIM protection limit (2.0 nautical miles for oceanic and enroute, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). During oceanic, enroute, and terminal phases of flight, RAIM is available nearly 100% of the time.

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

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

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

Predicting RAIM availability at a selected waypoint:

1) 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) Enter the desired waypoint:

   Use the **FMS** Knob to enter the desired waypoint by identifier, facility, or city name and press the **ENT** Key. Refer to Section 1.7 for instructions on entering alphanumeric data into the system.

   Or:

   a) Turn the small **FMS** Knob counter-clockwise to display a list of flight plan waypoints (the FPL list is populated only when navigating a flight plan).

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

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

   d) Press the **ENT** Key to accept the waypoint entry.
6) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.
7) Use the **FMS** Knob to enter an arrival date and press the **ENT** Key.
8) With the cursor highlighting 'Compute RAIM?', press the **ENT** Key. Once RAIM availability is computed, one of the following is displayed:
   - 'Compute RAIM?'—RAIM has not been computed for the current waypoint, time, and date combination
   - 'Computing Availability'—RAIM calculation in progress
   - 'RAIM Available'—RAIM is predicted to be available for the specified waypoint, time, and date
   - 'RAIM not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date

Predicting RAIM availability at present position:

1) Select the 'Aux - GPS Status' Page.
2) If necessary, press the **RAIM** Softkey.
3) Push the **FMS** Knob. The 'Waypoint' Field is highlighted.
4) Press the **MENU** Key.
5) With 'Set WPT to Present Position' highlighted, press the **ENT** Key.
6) Press the **ENT** Key to accept the waypoint entry.
7) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.

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

9) With the cursor highlighting 'Compute RAIM?', press the **ENT** Key. Once RAIM availability is computed, one of the following is displayed:

- 'Compute RAIM?'—RAIM has not been computed for the current waypoint, time, and date combination
- 'Computing Availability'—RAIM calculation in progress
- 'RAIM Available'—RAIM is predicted to be available for the specified waypoint, time, and date
- 'RAIM not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date

SBAS SELECTION (SBAS SOFTKEY IS SELECTED)

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

Disabling SBAS:

1) Select the 'Aux - GPS Status' Page.

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

3) 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—Denotes the satellite is being used as part of the differential computations

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

1.4 ACCESSING SYSTEM FUNCTIONALITY

SOFTKEY FUNCTION

Selection softkeys are located along the bottom of the displays. The softkeys shown depend on the softkey level previously selected. The bezel keys below the softkey labels can be used to 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 (with the exception of the Map Range keys) to reflect the name of the chosen option. The last type of softkey, when pressed displays another set of softkeys available for the selected function. Also, these softkeys revert to the previous level after 45 seconds of inactivity. When a softkey function is disabled, the softkey label is subdued (dimmed)

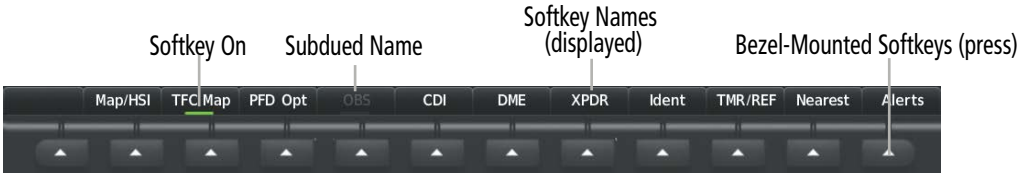


Figure 1-11 Softkeys (First-Level PFD Configuration)

Another means of selecting softkeys on the MFD is by using the Controller:

Selecting a softkey using the PFD/MFD Controller:

1) Move the softkey selection box to the desired softkey using the arrows of the **SEL** Key.
2) Press the center of the **SEL** Key to press the desired softkey.

PFD SOFTKEYS

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

Level 1	Level 2	Level 3	Level 4	Description
Map/HSI				Displays the PFD Map display settings softkeys.
	Layout			Displays the PFD Map selection softkeys.
		Map Off		Removes the PFD map from display (Inset, HSI, or Traffic)
		Inset Map		Displays the Inset Map
		HSI Map		Displays the HSI Map
		Inset Trfc		Replaces the Inset Map with a dedicated traffic display.
		HSI Trfc		Replaces the HSI Map with a dedicated traffic display.
	Detail			Selects desired amount of map detail: - **All** (No Declutter): All map features visible - **Detail 1**: Declutters land data - **Detail 2**: Declutters land and SUA data - **Detail 3**: Removes everything except for the active flight plan
	Traffic			Displays traffic information on PFD Map.
	TER			- **Topo**: Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on PFD Map. - **REL**: Displays relative terrain information on the PFD Map. - **Off**: Removes terrain
	WX LGND			Displays/removes the name of the selected weather data provider (SiriusXM) and the weather product icon and age box (for enabled weather products).
	NEXRAD			Displays XM NEXRAD weather and coverage on PFD Map (subscription optional)
	METAR			Displays METAR information on Inset Map (subscription optional)
	Lightning			Adds/removes the display of SiriusXM or Connext lightning information (based on weather data source selection) on the 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 weather source for the PFD Map
		STRMSCP		Adds or removes the display of Stormscope information on the PFD Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray.
	Wx Radar			When enabled, displays the airborne weather radar overlay on HSI Map (WX 70/75 only).
	RDR Opt			Displays softkeys for airborne weather radar options (WX 70/75 only).
		Mode SEL		Displays softkeys for weather radar mode selection (WX 70/75 only).
			Off	Disables weather radar mode (WX 70/75 only).
			Standby	Selects Standby weather radar mode (WX 70/75 only).
			Weather	Activates Weather radar mode (WX 70/75 only).
			Ground	Activates Ground Map weather radar mode (WX 70/75 only).

Level 1	Level 2	Level 3	Level 4	Description
		Gain -		Decreases weather radar gain setting (WX 70/75 only).
		Gain +		Increases weather radar gain setting (WX 70/75 only).
		WX ALRT		When enabled, displays weather alerts as system messages (WX 70/75 only).
		Stab		Activates antenna stabilization feature (WX 70/75 only).
		ACT		Activates Altitude Compensated Tilt feature (WX 70/75 only).
TFC Map				Replaces the PFD Map with a dedicated traffic display.
PFD Opt				Displays second-level softkeys for additional PFD options.
	SVT			Displays additional SVT overlay softkeys
		Pathways		Displays Pathway Boxes on the Synthetic Vision Display.
		Terrain		Enables synthetic terrain depiction.
		HDG LBL		Displays compass heading along the Zero-Pitch line.
		APT Sign		Displays position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are displayed when the airport is within approximately 9 nm.
	Wind			Displays the wind option softkeys
		Option 1		Headwind/Tailwind and crosswind components.
		Option 2		Wind direction arrow and speed.
		Option 3		Wind direction arrow with direction and speed.
		Off		Wind information not displayed.
	DME			Displays 'DME Information' Window
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	Sensors			Displays the sensor selection softkeys.
		ADC		Displays ADC selection softkeys.
			ADC 1	Selects the #1 ADC.
			ADC 2	Selects the #2 ADC.
		AHRS		Displays the AHRS selection softkeys.
			AHRS 1	Selects the #1 AHRS.
			AHRS 2	Selects the #2 AHRS.
		HDG		Displays the softkeys for selecting one of the two DG modes (GRS 7800 only).
			DG	Selects desired DG Mode: (GRS 7800 only). - **Slave**: Slaves the DG to the AHRS. - **Free:** Allows the DG to enter FREE mode.
			HDG -	Slews heading counterclockwise (GRS 7800 only).
			HDG +	Slews heading clockwise (GRS 7800 only).

Level 1	Level 2	Level 3	Level 4	Description
			HDG Sync	Synchronizes heading to the selected heading (GRS 7800 only).
			TRK Sync	Synchronizes heading to the current track (GRS 7800 only).
	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				Selects OBS mode on the CDI when navigating by GPS (only available with active leg). When OBS is on, the softkey annunciator is green.
CDI				Cycles through FMS, NAV1, and NAV2 navigation modes on the CDI.
DME				Displays the 'DME Tuning' Window, allowing tuning and selection of the DME (optional).
Transponder Softkeys without TCAS II				
XPDR				Displays the transponder selection softkeys.
	XPDR 1			Selects the #1 transponder as active.
	XPDR 2			Selects the #2 transponder as active.
	Standby			Selects transponder Standby Mode (transponder does not reply to any interrogations).
	On			Activates transponder (transponder replies to identification interrogations).
	ALT			Altitude Reporting Mode (transponder replies to identification and altitude interrogations).
	VFR			Automatically enters the VFR code (1200 in the U.S.A. only)
	Code			Displays transponder code selection softkeys 0-7.
		0 - 7		Use numbers to enter code.
		Ident		Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
		BKSP		Removes numbers entered, one at a time.
	Ident			Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
Transponder Softkeys with TCAS II				
XPDR/TFC				Displays the transponder selection softkeys.
	XPDR1			Selects the #1 transponder as active
	XPDR2			Selects the #2 transponder as active

Level 1	Level 2	Level 3	Level 4	Description
	Mode			Displays transponder mode selection softkeys
		Standby		Selects transponder Standby Mode (transponder does not reply to any interrogations). When the transponder is set to standby, the TCAS II system is also set to standby.
		On		Activates transponder (transponder replies to identification interrogations). When the transponder is set to ON, the TCAS II system is set to standby.
		ALT		Altitude Reporting Mode (transponder replies to identification and altitude interrogations). When the transponder is set to ALT, the TCAS II system is set to standby.
		TA Only		Activates the TCAS II system in TA Only Mode and sets the transponder to ALT.
		TA/RA		Activates the TCAS II system in TA/RA Mode and sets the transponder to ALT.
	TCAS			Displays the TCAS control softkeys.
		Relative		Displays intruder altitude as altitude relative to own aircraft altitude.
		Absolute		Displays intruder MSL altitude.
		ALT RNG		Displays the altitude display range softkeys.
			Above	Displays non-threat traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
			Normal	Displays non-threat traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.
			Below	Displays non-threat traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.
			UNREST	All traffic is displayed.
		Test		Activates Test Mode and displays test intruder symbols.
	Code			Displays transponder code selection softkeys 0-7.
		0 - 7		Use numbers to enter code.
		Ident		Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
		BKSP		Removes numbers entered, one at a time.
	Ident			Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
Ident				Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
TMR/REF				Displays Timer 'References' Window.
Nearest				Displays 'Nearest Airports' Window.
Alerts or Messages				Displays the Alerts window when pressed. System generated messages cause the Alerts Softkey label to change to a flashing 'Message' label. Pressing the Message softkey opens the 'Alerts' Window, acknowledges the message, and the softkey reverts to the 'Alerts' label

Table 1-3 PFD Softkeys

MFD SOFTKEYS

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

The following table provides an example of the MFD Softkey functions accessed from the '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	Description
Map Opt			Displays second level Map Options softkeys
	Traffic		Displays traffic information on 'Navigation Map' Page.
	Inset		Displays inset window second level softkeys.
		Off	Removes VSD inset from 'Navigation Map' Page.
		FPL PROG	Displays the Flight Plan Progress inset on the 'Navigation Map' Page.
		VSD	Displays VSD profile information of terrain/obstacles along the current track, vertical track vector, and selected altitude. - **Auto**: Automatically displays either VSD profile information for active flight plan information or along current track with no active flight plan. - **FPL**: Displays VSD profile information for active flight plan. - **TRK**: Displays VSD profile information along current track.
	TER		Displays terrain on the map; cycles through the following: - **Off**: No terrain information shown on MFD Map. - **Topo**: Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on MFD Map. - **REL**: Displays relative terrain information on the MFD Map.
	AWY		Displays airways on the map; cycles through the following: - **Off**: No airways are displayed. - **On**: All airways are displayed. - **Low**: Only low altitude airways are displayed. - **High**: Only high altitude airways are displayed.
	STRMSCP		Displays Stormscope information on 'Navigation Map' Page (optional).
	NEXRAD		Displays XM NEXRAD weather and coverage on 'Navigation Map' Page (optional).
	XM LTNG		Displays XM lightning information on 'Navigation Map' Page (optional).
	METAR		Displays METAR information on Inset Map (subscription optional).
	Legend		Displays legends for the displayed XM Weather products (optional).
	WX Radar		Displays XM weather radar information on 'Navigation Map' Page (optional).

Level 1	Level 2	Level 3	Description
Detail			Selects desired amount of map detail; cycles through the following levels: - **Detail All**: All map features visible. - **Detail-1**: Declutters land data. - **Detail-2**: Declutters land and SUA data. - **Detail-3**: Removes everything except for the active flight plan.
Charts			When available, displays optional airport and terminal procedure charts.
	CHRT Opt		Displays chart display settings softkeys.
		All	Displays the entire chart on the screen.
		Header	Displays the header view (approach chart briefing strip) on the screen.
		Plan	Displays the approach chart two dimensional plan view.
		Profile	Displays the approach chart descent profile strip.
		Minimums	Displays the minimum descent altitude/visibility strip at the bottom of the approach chart.
		Fit WDTH	Changes the chart size to fit the available screen width.
		Full SCN	Removes data window to display chart on screen.
	AUTO		Displays the most pertinent chart based on the phase of flight and loaded procedures in the active flight plan.
	Info		Displays airport information: - **Info 1:** Airport Information - **Info 2:** Airport Directory
	DP		Displays departure procedure chart.
	STAR		Displays standard terminal arrival procedure chart.
	APR		Displays approach procedure chart.
	WX		Displays weather information.
	NOTAM		Displays NOTAM information for selected airport, when available.

Table 1-4 MFD Softkeys

MENUS

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

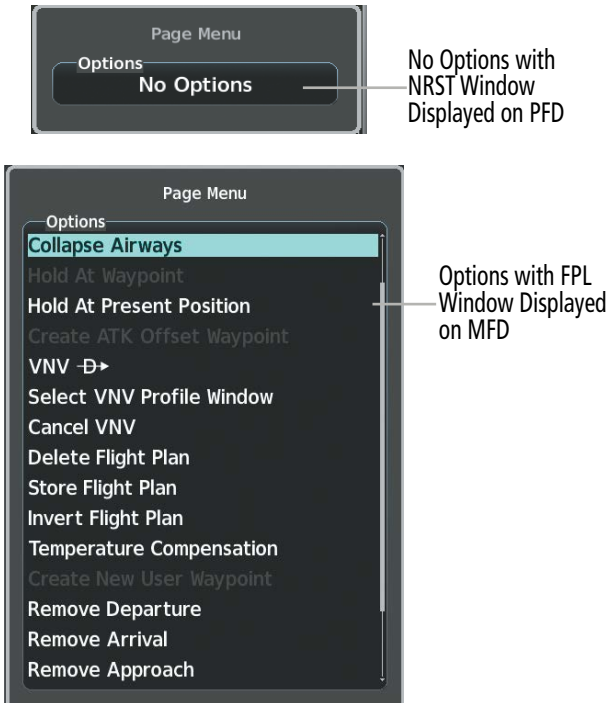


Figure 1-12 Page Menu Examples

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. Pressing the **FMS** Knob also removes the displayed menu.

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 Display Title is comprised of the page group and active page title and is displayed in the upper center of the screen below the Navigation Data Bar. In the bottom right corner of the screen, a page group window is displayed by turning either FMS Knob. The page group tabs are displayed along the bottom of the window. The page titles are displayed in a list above the page group tabs.

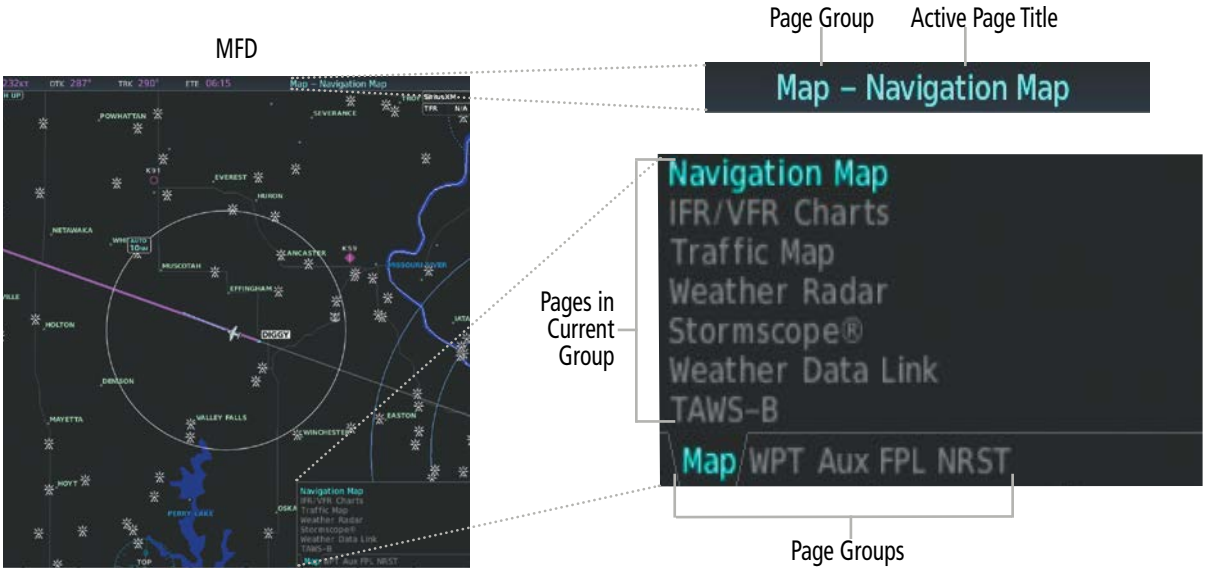


Figure 1-13 Page Title and Page Groups

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

Selecting a page using the FMS Knob:

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

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

• Map (Map Page Group)	- Navigation Map - IFR/VFR Chart pages » VFR chart (**VFR** Softkey) » Low IFR chart (**IFR Low** Softkey) » High IFR chart (**IFR High** Softkey) - Traffic Map - Weather Radar - Stormscope® (optional) - Weather Datalink (service optional) - TAWS
• 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 (optional) (**WX** Softkey) - Intersection Information - NDB Information - VOR Information - VRP Information - User Waypoint Information
• Aux (Auxiliary Page Group)	- Weight Planning - Trip Planning - Utility - GPS Status - System Setup 1/2 - XM Radio Pages » XM Information (**Info** Softkey) » XM Radio (**Radio** Softkey) - Satellite Phone » Telephone (**Phone** Softkey) » Text Messaging (**SMS** Softkey) - Maintenance WiFi Setup - System Status - ADS-B Status - Connext Setup - Databases

• FPL ('FPL - Active Flight Plan' Page Group)	- Active Flight Plan » Wide View, Narrow View (**View** Softkey) - Flight Plan Catalog » Stored Flight Plan (via **New** Softkey) - SurfaceWatch Setup (optional)
• NRST (Nearest Page Group)	- Nearest Airports - Nearest Intersections - Nearest NDB - Nearest VOR - Nearest VRP - Nearest User WPTS - Nearest Frequencies - Nearest Airspaces

Table 1-5 Page Group and Pages

PROCEDURE PAGES (PROC)

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

» Approach Loading

» Arrival Loading

» Departure Loading

SPLIT SCREEN FUNCTIONALITY

Chart pages may be viewed in split screen mode with either the 'Map - Navigation Map' or 'FPL - Active Flight Plan' Page open. To activate the split screen functionality, press the **Charts** Softkey. Two display panes are displayed on the MFD. If split screen is activated from the 'Map - Navigation Map' Page, the page title will show 'Map - Chart + Navigation Map'. If split screen is activated from the 'FPL - Active Flight Plan' Page, the page title will change to show 'FPL - Chart + Active Flight Plan'.

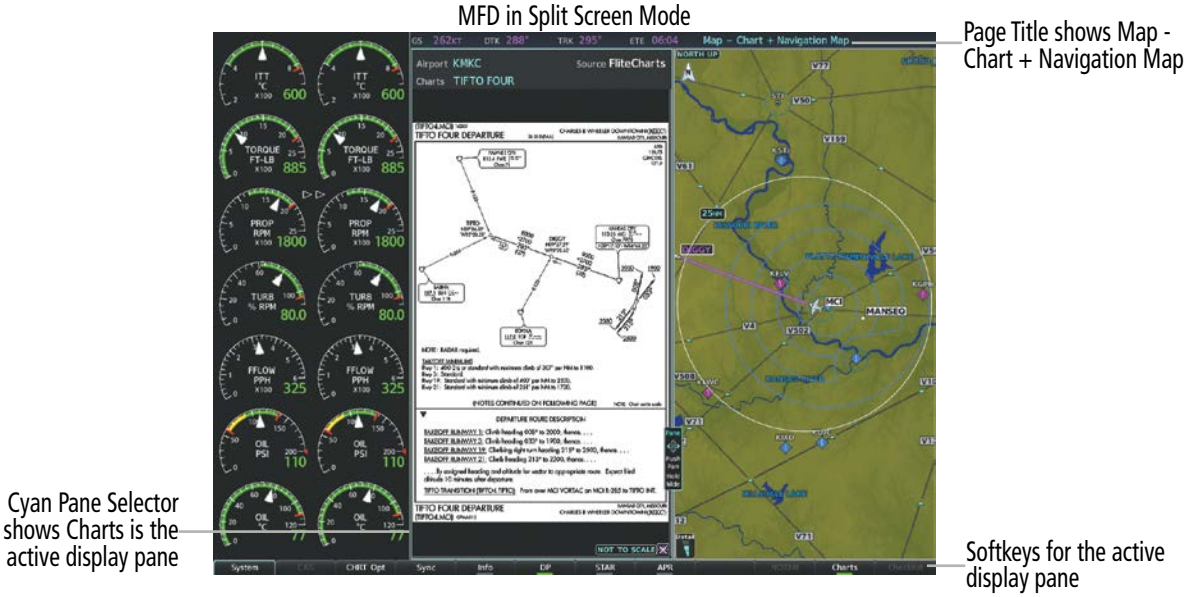


Figure 1-14 Split Screen Mode

CONTROLLING DISPLAY PANES

In split screen mode, the active display pane is outlined by a cyan box called the pane selector. Softkeys and menu options will automatically change depending on which display pane is active. Display panes may be displayed vertically in Narrow View, or horizontally in Wide View. In Narrow View, move the **Joystick** left or right to move the pane selector. In Wide View, move the **Joystick** up and down to move the pane selector. To change between Wide View and Narrow View, push and hold the **Joystick**.

Figure 1-15 Split Screen in Wide View

For information on viewing Charts and the Active 'FPL - Active Flight Plan' Page with the Flight Plan map, see the Flight Management Section.

For more information on Charts and how to enable Charts Full Screen, see the Additional Features Section.

Enabling/disabling split screen mode:

1) From the 'Map - Navigation Map' Page or the 'FPL - Active Flight Plan' Page press the **Charts** Softkey, or press the **MENU** Key and select 'Chart Mode On'.

2) To disable the split screen mode, press the **Charts** Softkey again or press the **MENU** Key and select 'Chart Mode Off'. The display returns to the base page, either the 'Map - Navigation Map' Page or the 'FPL - Active Flight Plan' Page.

SYSTEM SETTINGS

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

Figure 1-16 System Setup Pages

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

Restoring system setup defaults:

1) 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.

CREW PROFILES

System settings may be saved under a crew profile. When the system is powered on, the last selected crew profile is shown on the MFD Power-up Screen. The system can store up to 25 profiles; the currently active profile, the amount of memory used, and the amount of memory available are shown at the top of the 'Aux - System Setup 1' Page in the box labeled "Crew Profile". From here, crew profiles may be created, selected, renamed, or deleted. Crew profiles may also be exported from the system to an SD card, or imported from an SD card into the system.

Crew Profile Import/Export Messages

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

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

Table 1-6 Crew Profile Messages

Creating a profile:

1) Select the 'Aux - System Setup (1 or 2)' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight 'Create' in the 'Crew Profile' Box.
4) Press the **ENT** Key. A 'Create Profile' Window is displayed.
5) Use the **FMS** Knob to enter a profile name up to 16 characters long and press the **ENT** Key. Crew profile names cannot begin with a blank as the first letter.

6) In the next field, use the small **FMS** Knob to select the desired settings upon which to base the new profile. Profiles can be created based on Garmin factory defaults, default profile settings (initially based on Garmin factory defaults unless edited by the pilot), or other previously created profile settings.
7) Press the **ENT** Key.
8) With 'Create' highlighted, press the **ENT** Key to create the profile

   Or:

   Use the large **FMS** Knob to select 'Create & Activate' and press the **ENT** Key to activate the new profile.
9) To cancel the process, select 'Cancel' with the large **FMS** Knob and press the **ENT** Key.

NOTE: After restoring the Default crew profile, SVT will no longer be synced between the pilot and copilot PFD. To restore the sync, set SVT to display terrain on both PFD(s).

Selecting an active profile:

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

Renaming a profile:

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

Deleting a profile:

1) Select the 'Aux - System Setup (1 or 2)' Page.
2) Push the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight 'Delete' in the 'Crew Profile' Box.
4) Press the **ENT** Key.
5) In the 'Delete Profile' Window, turn the **FMS** Knob to select the profile to delete.

6) Press the **ENT** Key.

7) With 'Delete' highlighted, press the **ENT** Key.

8) To cancel the process, use the large **FMS** Knob to select 'Cancel' and press the **ENT** Key.

Importing a profile from an SD card:

1) Insert an SD card containing the crew profile(s) into the top card slot on the MFD.

2) Turn the **FMS** Knob to select the 'Aux - System Setup (1 or 2)' Page.

3) Press the **Import** Softkey.

   Or:

   a) Press the **MENU** Key.

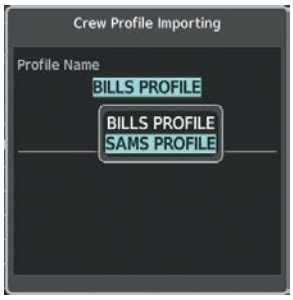
   b) Turn the **FMS** Knob to highlight 'Import Crew Profile' and press the **ENT** Key.

4) The system displays the 'Crew Profile Importing' Window with 'Import' highlighted. Turn the large **FMS** Knob to highlight the 'Profile Name' Field, then scroll to the desired profile name with the large and small FMS Knobs, then press the **ENT** Key. Then press the **ENT** Key with 'Import' highlighted.

5) If the imported profile name is the same as an existing profile on the system, the system displays an 'Overwrite existing profile? OK or CANCEL' prompt. Press the **ENT** Key to replace profile on the system with the profile imported from the SD card, or turn the **FMS** Knob to highlight 'CANCEL' and press the **ENT** Key to return to the 'Crew Profile Importing' Window.

6) If successful, the system displays 'Crew profile import succeeded.' in the window below. With 'OK' highlighted, press the **ENT** or **CLR** Keys or push the **FMS** Knob to return to the 'Aux - System Setup (1 or 2)' Page. The imported profile becomes the active profile.

Crew Profile Importing and Import Results Window



Crew Profiles Available for Import from SD Card

Import Successful

Figure 1-17 Pilot Profile Import on the 'Aux - System Setup (1 or 2)' Page

Exporting a profile to an SD card:

1) Insert the SD card for storing the Crew Profile into the top card slot on the MFD.

2) Turn the **FMS** Knob to select the 'Aux - System Setup (1 or 2)' Page.

3) Press the **Export** Softkey. The system displays the 'Crew Profile Exporting' Window.

Or:

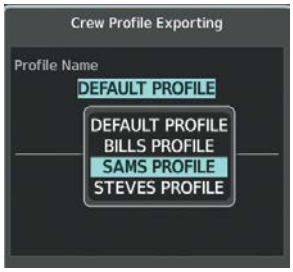
a) Press the **MENU** Key.

b) Turn the **FMS** Knob to highlight 'Export Crew Profile' and press the **ENT** Key.

4) To export the crew profile using the current selected profile, press the **ENT** Key with 'Export' highlighted. To change the selected profile, turn the large **FMS** Knob to highlight the 'Profile Name' Field, then scroll to the desired profile name with the large and small **FMS** Knobs, then press the **ENT** Key. Then press the **ENT** Key with 'Export' highlighted.

5) If the selected profile to be exported is the same as an existing profile file name on the SD card, the system displays an 'Overwrite existing profile? OK or CANCEL' prompt. Press the **ENT** Key to replace the profile on the SD card with the profile to be exported, or turn the **FMS** Knob to highlight 'CANCEL' and press the **ENT** Key to return to the 'Pilot Profile Exporting' Window without exporting the profile.

6) If successful, the window displays 'Crew profile export succeeded.' With 'OK' highlighted, press the **ENT** or **CLR** Keys, or push the **FMS** Knob to return to the 'Aux - System Setup (1 or 2)' Page.



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

Export Successful

Figure 1-18 Pilot Profile Export on the 'Aux - System Setup (1 or 2)' Page

DATE/TIME

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

Figure 1-19 System Time (Local 24-hr Format)

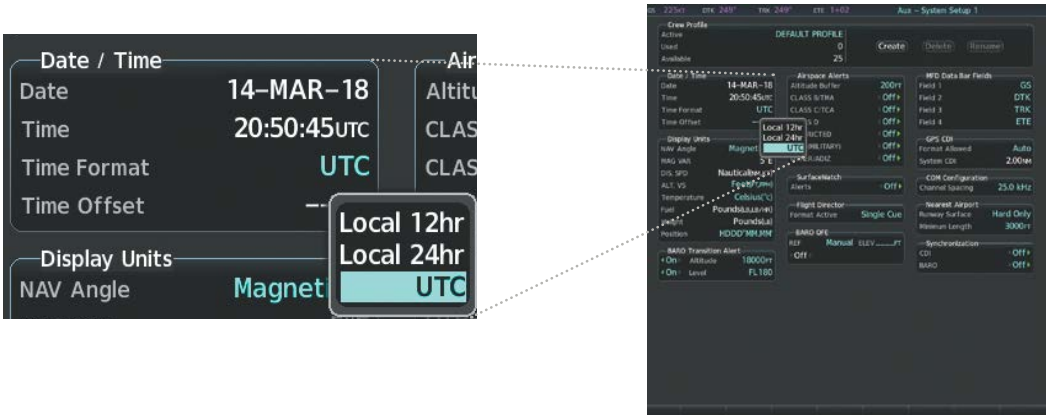


Figure 1-20 Date/Time Settings ('Aux - System Setup 1' Page)

Configuring the system time:

1) 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 '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.

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, the Temperature units, and the Position units can be set from here.

Category	Settings	Affected Quantities
Navigation Angle	Magnetic (North)* True (North)	Heading Course Bearing Track Desired Track Wind direction ('Trip Planning' Page)
Distance and Speed**	Nautical	Crosstrack error (HSI) Bearing distances (information windows) DME distance (information window) Flight plan distances Map ranges DIS, GS, TAS, XTK Fields (Navigation Data Bar) All distances on MFD Altitude buffer distance (System Setup) Arrival Alert trigger distance (System Setup) All speeds on MFD †
Altitude and Vertical Speed	Feet Meters	All altitudes on MFD All elevations on MFD ††
Temperature	Celsius* Fahrenheit	All temperatures on PFD Total Air Temperature ('Trip Planning' Page) †††
Fuel and Fuel Flow**	Pounds	Fuel parameters ('Trip Planning' Page) †††
Weight**	Pounds	N/A
Position	HDDD°MM.MM'* HDDD°MM'SS.S" MGRS 1m MGRS 10m UTM/UPS	All positions

* Default setting

** Not configurable

† Excludes: airspeed indicator, altitude, true airspeed (PFD), wind speed vector, map range ('Map - Traffic Map' Page, 'Map - TAWS-A (or TAWS-B)' Page), CDI scaling (System Setup), and fuel range calculation (EIS)

†† Excludes: altimeter, Vertical Speed Indicator, and VNV altitudes (Active Flight Plan). QFE settings can be in meters.

††† Excludes: Engine Indication System (EIS)

Table 1-7 Display Units Settings ('Aux - System Setup 1' Page)

Changing a display unit setting:

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

BARO TRANSITION ALERT

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

AIRSPACE ALERTS

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

ARRIVAL ALERTS

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

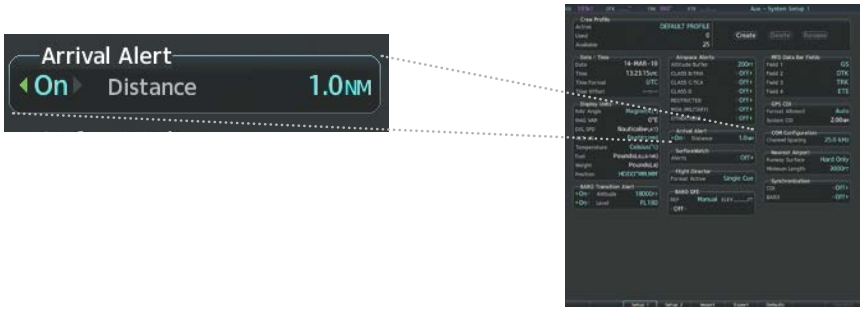


Figure 1-21 Arrival Alert Settings ('Aux - System Setup 1' Page)

Enabling/disabling the Arrival Alert:

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

SURFACEWATCH

See the Additional Features Section for the discussion on SurfaceWatch.

FLIGHT DIRECTOR

See the Flight Instruments Section for the discussion on the Flight Director format.

BARO QFE

See the Flight Instruments Section for the discussion on the Barometric QFE settings.

MFD DATA BAR FIELDS

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

GPS CDI

See the Flight Instruments Section for the discussion on GPS CDI.

COM CONFIGURATION

See the Audio & CNS Section for the discussion on the COM Configuration for Channel Spacing.

NEAREST AIRPORT

See the Flight Management Section for the discussion on the Nearest Airport settings.

STABILITY AND PROTECTION

See the Additional Features Section for information on enabling and disabling the Stability and Protection feature.

TOUCHDOWN CALLOUTS

See the Flight Instruments Section for the discussion on Touchdown Callout settings.

PAGE NAVIGATION

The large **FMS** Knob displays the Page Group Tabs and navigates through the tabs. The small **FMS** Knob navigates through the pages within a specific group. 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' Box on the 'Aux - System Setup 2' Page.

Off – Displays the Page Group Tabs with one click of the large **FMS** Knob.

On – Displays the Page Group Tabs and navigates to the next tab with one click of the large **FMS** Knob. The amount of time the Page Group Tabs are displayed is set to 3 seconds.

Selecting page navigation settings:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
2) Press the **Setup 2** Softkey, if necessary.
3) Push the **FMS** Knob momentarily to activate the flashing cursor.
4) Turn the large **FMS** Knob to highlight the 'Change On 1st Click' Field in the 'Page Navigation' Box.
5) Turn the small **FMS** Knob to select 'Off' or 'On'.
6) Push the **FMS** Knob momentarily to remove the flashing cursor.

AUDIO

The 'Audio' Box on the 'Aux - System Setup 2' Page displays the audio alert voice setting (male or female) and allow the pilot and copilot to enable/disable the 3D Audio feature and swap left and right audio within the respective headset earpieces. Refer to the Audio & CNS Section for more information about 3D audio.

Figure 1-22 Audio Setting

Changing the audio alert voice:

1) Use the **FMS** Knob 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 in the 'Audio' Box.
4) Turn the small **FMS** Knob to display and highlight the desired voice and press the **ENT** Key.

Enabling/Disabling 3D Audio:

1) Use the **FMS** Knob 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 'Pilot 3D Audio' or 'Copilot 3D Audio' 'On/ Off' Field in the 'Audio' Box.
4) Turn the small **FMS** Knob clockwise to turn 3D Audio On or counterclockwise to turn Off.

Swapping left/right audio in a headset:

1) Use the **FMS** Knob 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 'Pilot L-R Swap' or 'Copilot L-R Swap' 'On/ Off' Field in the 'Audio' Box.
4) Turn the small **FMS** Knob clockwise to turn the Swap On or counterclockwise to turn Off.

CHARTS

See the Additional Features Section for information on setting up auto taxi charts.

SYSTEM UTILITIES

UTILITY PAGE

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

Figure 1-23 Utility Page

TIMERS

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

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

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

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

The system records the time at which departure occurs, depending on whether the pilot prefers the time to be recorded from system power-up or from aircraft lift off. The displayed departure time can also be reset to display the current time at the point of reset. The format in which the time is displayed is controlled from the 'Aux - System Setup 1' Page.

Setting the generic timer (MFD 'Aux - Utility' Page):

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 desired starting time is desired:
   a) Use the large **FMS** Knob to highlight the HH:MM:SS 'Generic' 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.

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 field next to the flight timer.
4) Turn the small **FMS** Knob to select the starting criterion (Pwr-On or In-Air) and press the **ENT** Key.

Resetting the flight timer:

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

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.
4) Turn the small **FMS** Knob to select the starting criterion (Pwr-On or In-Air) and press the **ENT** Key.

Resetting the departure time:

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

Trip Statistics

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

Resetting trip statistics:

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 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", etc.) 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 appear in the 'Alerts' Window on the PFD and cause the **Alerts** Softkey label to change to a flashing "Message" label. Pressing the **Message** Softkey opens the 'Alerts' Window and acknowledges the scheduler message. The softkey reverts to the "Alerts" label. Pressing the softkey again removes the 'Alerts' Window from the display and the scheduler message is deleted from the message queue.

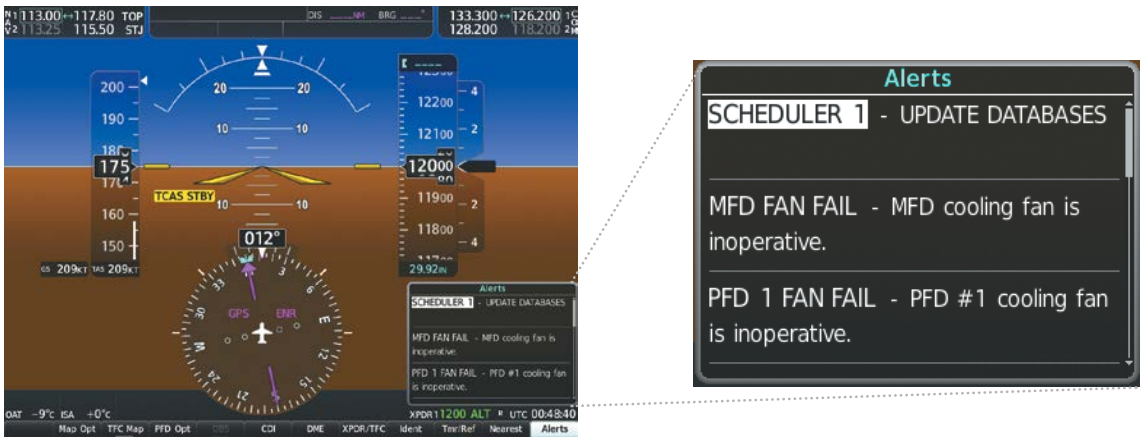


Figure 1-24 PFD Alerts Window

Entering a scheduler message:

1) 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 '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 field next to the 'Type' Field.

6) Turn the small **FMS** Knob to select set the message alert type:

- Event — Message issued at the specified date/time
- One-time — Message issued when the message timer reaches zero (default setting)
- Periodic — Message issued each time the message timer reaches zero

7) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.

8) For periodic and one-time message, use the **FMS** Knob to enter the timer value (HHH:MM:SS) from which to countdown and press the **ENT** Key.

9) For event-based messages:

a) Use the **FMS** Knob to enter the desired date (DD-MMM-YYY) and press the **ENT** Key.

b) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.

c) Use the **FMS** Knob to enter the desired time (HH:MM) and press the **ENT** Key.

10) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to enter the next message.

Deleting a scheduler message:

1) Select the 'Aux - Utility' Page.

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

3) Turn the large **FMS** Knob to highlight the name field of the scheduler message to be deleted.

4) Press the **CLR** Key to clear the message text. If the **CLR** Key is pressed again, the message is restored.

5) Press the **ENT** Key to confirm message deletion.

.

1.5 DISPLAY BACKLIGHTING

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

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

Figure 1-25 PFD Setup Menu

Adjusting display backlighting:

1) Press either PFD **MENU** Key to display the 'PFD Setup' Menu. 'Auto' is now highlighted next to 'PFD1 Display'. If desired, turn the large **FMS** Knob to select 'Auto' next to 'MFD Display' or 'PFD2 Display'.

2) Turn the small **FMS** Knob to select 'Manual' and press the **ENT** Key. The intensity value is now highlighted.

3) Use the **FMS** Knob to enter the desired backlighting then press the **ENT** Key.

4) To remove the menu, press the **CLR** Key or the **MENU** Key.

Adjusting key backlighting:

1) Press the PFD **MENU** Key to display the 'PFD Setup' Menu. 'Auto' is now highlighted next to 'PFD1 Display'.

2) Turn the large **FMS** Knob to highlight 'PFD1 Display', 'MFD Display', or 'PFD2 Display', as desired.

3) Turn the small **FMS** Knob in the direction of the green arrowhead to display 'PFD1 Key', 'MFD Key', or 'PFD2 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** Key or the **MENU** Key.

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SECTION 2 FLIGHT INSTRUMENTS

NOTE: *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 easy-to-scan Primary Flight Displays (PFD) featuring 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 PFD's and are explained in other sections of this Pilot's Guide.

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

- Airspeed Indicator, showing
  - True Airspeed
  - Ground Speed
  - Mach number
  - Airspeed awareness ranges
  - Reference flags
- Attitude Indicator with slip/skid indication
- Altimeter, showing
  - Barometric setting
  - Selected Altitude
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Horizontal Situation Indicator, showing
  - Turn Rate Indicator
  - Bearing pointers and information windows
  - DME Information Window (optional)
  - Course Deviation Indicator (CDI)
- DME Tuning Window
- Outside Air Temperature (OAT)
- International Standard Atmosphere (ISA) temperature deviation
- System Time
- Wind Data
- Vertical Navigation Indications
- Radar Altimeter (Optional)

The PFDs also display various alerts and annunciations.

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

Figure 2-1 Primary Flight Display (Default)

1. Selected Heading
2. Wind Data
3. Map/HSI
4. DME Information Window (optional)
5. Bearing Information Windows
6. Minimum Descent Altitude/ Decision Height
7. Selected Course
8. Current Vertical Speed
9. Vertical Deviation Indicator (VDI)
10. VNV Target Altitude

Figure 2-2 Additional PFD Information

2.1 FLIGHT INSTRUMENTS

AIRSPEED INDICATOR

NOTE: *Refer to the current version of the pertinent flight manual for speed criteria and Vspeed values.*

The Airspeed Indicator displays airspeed on a moving tape rolling number gauge. The true airspeed (TAS) is displayed in knots below the Airspeed Indicator. When displayed, the Mach number appears above the Airspeed Indicator. The ground speed is displayed to the left of the TAS. The numeric labels and major tick marks on the moving tape are shown at intervals of 10 knots, while minor tick marks on the moving tape are indicated at intervals of 5 knots. Speed indication starts at 40 knots, with 60 knots of airspeed viewable at any time. The actual airspeed is displayed inside the black pointer. The pointer remains black until reaching the high airspeed limit, at which point it turns red.

The Mach number appears above the Airspeed Indicator. During climb, the pilot must select the Airspeed Reference (IAS or Mach), automatic switching does not occur. For descent, if Mach airspeed reference is selected (above 16,000 ft), the aircraft descends in Mach until the Mach airspeed reference reaches 250 KIAS, at which point the airspeed reference automatically switches to IAS at that airspeed value. Refer to AFCS Section for more information on Airspeed Reference.

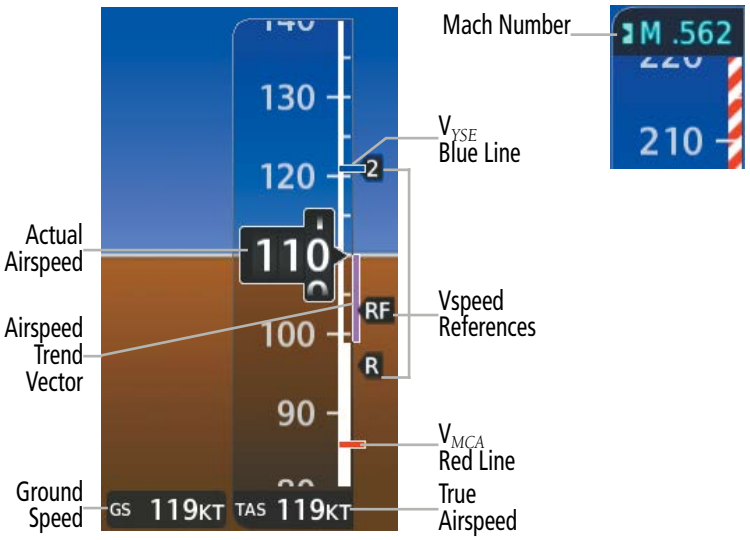


Figure 2-3 Airspeed Indicator

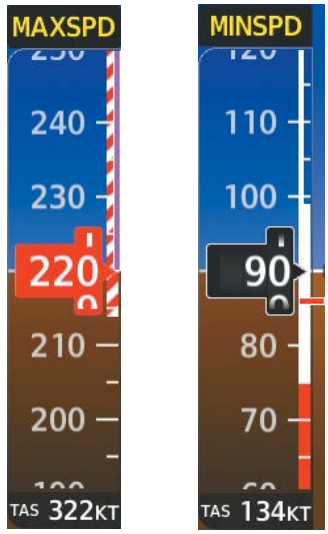


Figure 2-4 Overspeed/Minimum Speed Indications

Speeds above the maximum operating speed, V_{MO} or M_{MO} depending on aircraft altitude, appear in the high speed warning range, represented on the airspeed tape by red/white "barber pole" coloration.

A red low speed awareness range extends up to the low speed awareness velocity, V_{LSA}. An aural stall warning is generated as the aircraft approaches a stall condition.

The Airspeed Trend Vector is a vertical magenta line that appears to the right of the color-coded speed range strip when airspeed is either accelerating or decelerating. One end of the magenta line is anchored to the tip of the airspeed pointer while the other end moves continuously up or down corresponding to the rate of acceleration or deceleration. For any constant rate of acceleration or deceleration, the moving end of the line shows approximately what the indicated airspeed value will be in six seconds. If the trend vector crosses VMO/MMO, the text of the actual airspeed readout changes to amber while the pointer remains black. 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.

Vspeeds can be changed and their flags turned on/off from the Timer/References Window. When active (on), the Vspeeds are displayed at their respective locations to the right of the airspeed scale. All Vspeed values are reset and all Vspeed flags are turned off during power up.

	Vspeed	Flag
Takeoff	V_R	R
	V_2	2
Landing	V_{REF}	RF

Table 2-1 Vspeed Flag Labels

Vspeeds are categorized as either takeoff or landing. The order in which the categories are displayed is determined by whether the aircraft is on the ground or in the air. If the aircraft is on the ground, the takeoff Vspeeds are displayed at the top of the Vspeed list. If the aircraft is in the air, the landing Vspeeds are displayed at the top.

The maximum speed with approach flaps is displayed as a solid white triangle to the right of the airspeed scale. This indication is always displayed and cannot be turned off by the pilot.

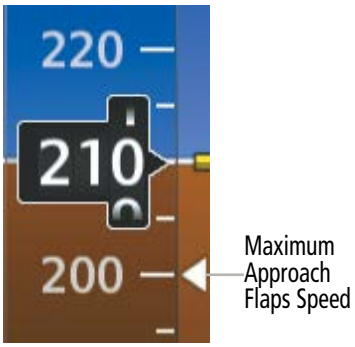


Figure 2-5 Maximum Flaps Extended Speed Reference

Changing Vspeeds and turning Vspeed flags 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-kt 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.

Figure 2-6 Takeoff and Landing Vspeeds ('Timer/References' Window)

Vspeed flags can be turned on or off and values restored all at once or by category (takeoff and landing).

Modifying Vspeeds (on, off, restore defaults):

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

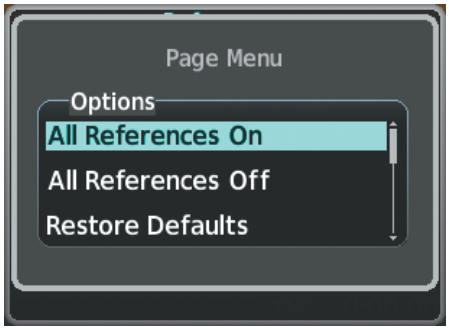
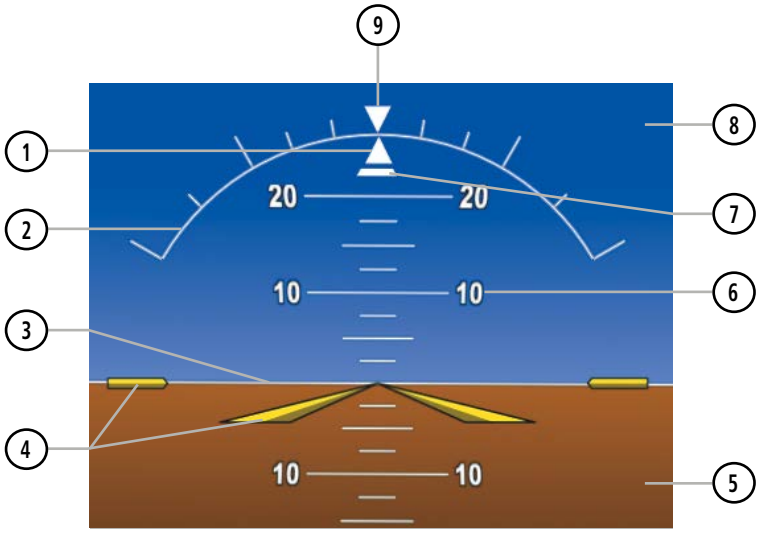


Figure 2-7 Page Menu ('Timer/References' Window)

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.



1. Roll Pointer
2. Roll Scale
3. Horizon Line
4. Aircraft Symbol
5. Land Representation
6. Pitch Scale
7. Slip/Skid Indicator
8. Sky Representation
9. Roll Scale Zero

Figure 2-8 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 80°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°. When the Synthetic Vision Technology (SVT) is activated, the pitch scale is reduced to 10° up and 7.5° down. Refer to Section 2.2 Garmin SVT (Synthetic Vision Technology) for details when the optional Synthetic Vision Technology System (SVT™) is installed.

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. A one bar displacement on the Slip/Skid Indicator is equal to 1/2 ball of displacement on a traditional inclinometer.

Figure 2-9 Slip/Skid Indication

When the optional Garmin Electronic Stability and Protection (Garmin ESP™) system is available, the Pitch Limit Indicator will appear on the Attitude Indicator at the corresponding pitch attitude, if the angle of attack is within six degrees of a stall condition. The Pitch Limit Indicator is subsequently removed when the angle of attack is seven degrees or greater from a stall condition. The indicator appearance is based on the selected flight director Command Bar/aircraft symbol format. Refer to the Additional Features and AFCS Sections for more information about ESP.

NOTE: *The Pitch Limit Indicator will continue to be displayed if the autopilot envelope protection fails.*

The amber symbolic aircraft on the Attitude Indicator changes appearance based on selection of AFCS Flight Director Command Bar format (see the AFCS Section for details). Both PFDs show the same Command Bar format and Aircraft Symbol. The Command Bar format (single-cue or cross-pointer) may be selected from the Aux - System Setup 1 Page. If a compatible lift computer is installed, the cross-pointer option will be unavailable.

Changing Command Bar format:

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

   'Single Cue' to display Command Bars as a single cue.

   Or:

   'X Pointer' to display Command Bars as a cross-pointer.

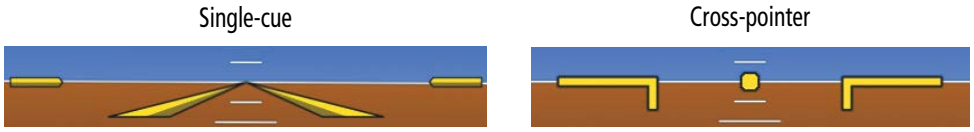


Figure 2-10 Flight Director Format ('Aux- System Setup 1' Page)

ALTIMETER

The Altimeter displays barometric altitude values on a moving tape rolling number gauge. The pilot can choose display units format for the Altimeter as feet or meters.

If the altitude is displayed in feet, the Altimeter shows 600 feet of barometric altitude at a time, with numeric labels and major tick marks displayed at intervals of 100 feet. Minor tick marks are at intervals of 20 feet.

If the altitude is displayed in meters, the Altimeter shows 180 meters of barometric altitude at a time, with numeric labels and major tick market displayed at intervals of 50 meters. Minor tick marks are at intervals of 10 meters.

The name of the chosen altimeter units ('FEET' or 'METERS') appears near the bottom of the Altimeter.

The Indicated Altitude is displayed in the black pointer.

The Altitude Trend Vector is a vertical magenta line that appears to the left of the altitude range strip when the aircraft is either climbing or descending. One end of the magenta line is anchored to the tip of the altitude pointer while the other end moves continuously up or down according to the rate of vertical speed. For any constant rate of vertical speed, the moving end of the line shows approximately what the indicated altitude value will be in six seconds. The trend vector is absent if the altitude remains constant or if data needed for calculation is not available due to a system failure.

Setting the Selected Altitude:

Turn the **ALT SEL** Knob to set the Selected Altitude in 100-ft increments.

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

When the altimeter is configured for metric units, the selected altitude is adjusted in 50 meter increments.

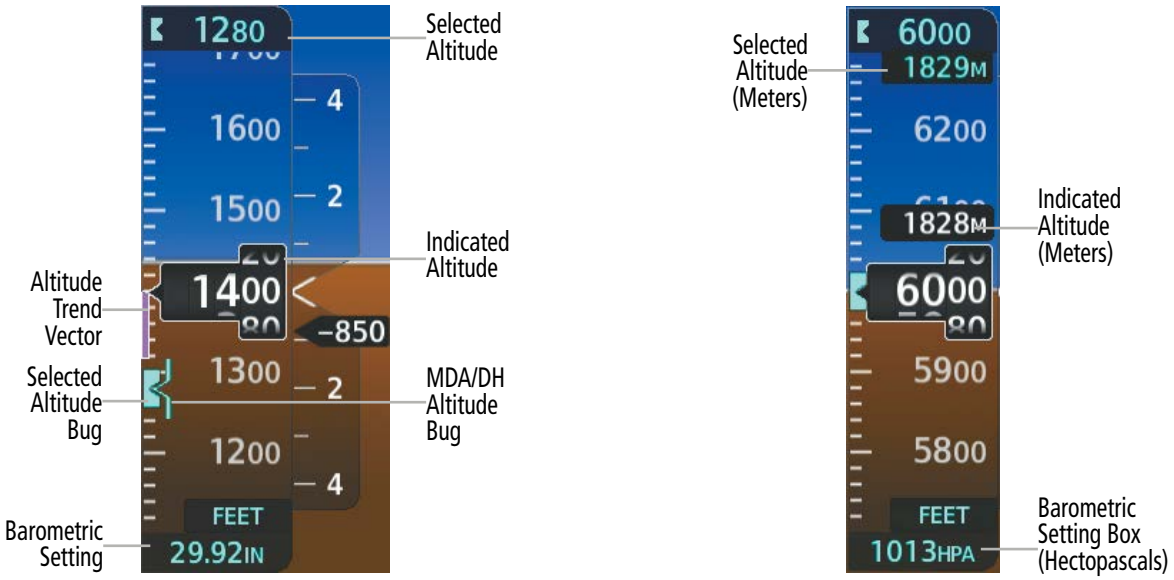


Figure 2-11 Altimeter

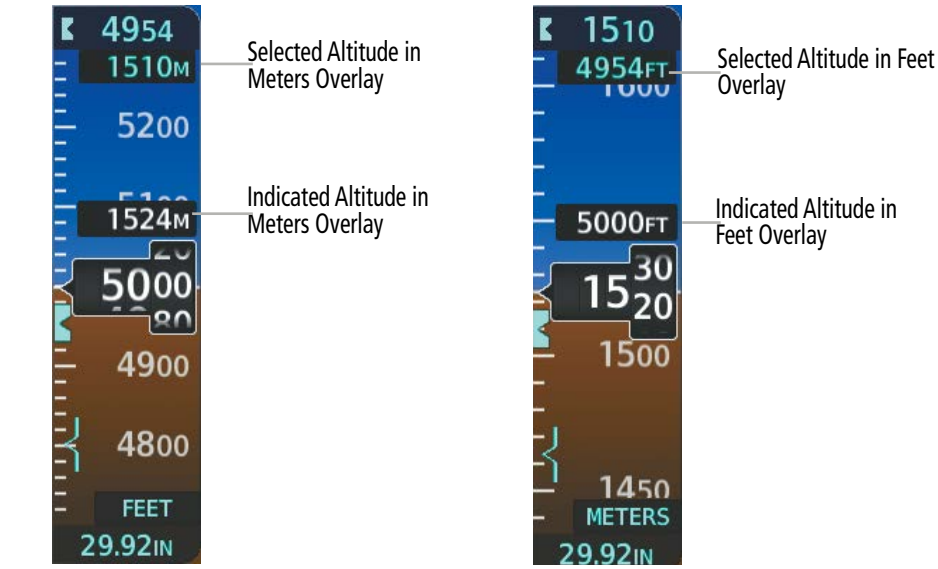


Figure 2-12 Altimeter with Altitude Units Overlays

NOTE: *Changing the Altitude Display Units on the MFD 'Aux -System Setup 1' Page does not change the 'Barometric Setting' Box on the PFD. The 'Barometric Setting' Box can be changed with the PFD Softkeys.*

Selecting the altitude display units:

1) Turn the **FMS** Knobs to select the 'Aux - System Setup 1' Page on the MFD.
2) If necessary, press the **Setup 1** Softkey to display the 'Aux - System Setup 1' Page.
3) Push the **FMS** Knob to activate the cursor.
4) Turn the large **FMS** Knob to highlight the 'ALT, VS' datafield in the 'Display Units' Window.
5) Turn the small **FMS** Knob to highlight either 'Feet (FT, FPM)' or 'Meters (MT, MPS)' and press the **ENT** Key. This setting affects altitude displays system-wide, in addition to those shown on the PFD.

The pilot can choose to display overlays for the indicated altitude and Selected Altitude using alternate display units. For example, if the Altimeter is displaying feet, the system can show a metric overlay for the indicated and selected altitudes without changing the scale or display units of the Altimeter.

Displaying altitude in meters:

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

The barometric pressure setting is displayed below the Altimeter in inches of mercury (in Hg) or hectopascals (hPa). Adjusting the altimeter barometric setting creates discontinuities in VNAV 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 VNAV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

NOTE: *Adjusting the altimeter barometric setting creates discontinuities in VNAV 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 VNAV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.*

Selecting the altimeter barometric pressure setting:

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

Selecting standard barometric pressure:

Push the **BARO** Knob to select standard pressure; STD BARO is displayed in barometric setting box.

Or:

1) Press the **PFD Opt** Softkey to display the second-level softkeys.
2) Press the **STD Baro** Softkey; STD BARO is displayed in barometric setting box.

Figure 2-13 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.

If the barometric altimeter settings differ between PFD's by more than 0.02 Hg, the readouts turn amber. The settings can be synchronized from the 'Aux - System Setup' Page on the MFD. Once the settings are synchronized, the readouts will turn from amber to cyan.

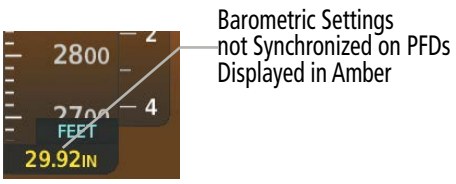


Figure 2-14 Barometric Setting on PFDs not Synchronized

Synchronizing the altimeter barometric pressure settings:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.
2) If necessary, press the **Setup 1** Softkey to display the 'Aux - System Setup 1' Page.
3) Push the **FMS** Knob to activate the cursor.
4) Turn the large **FMS** Knob to highlight 'BARO' in the 'Synchronization' Box.
5) Turn the small **FMS** Knob clockwise to 'On' or counterclockwise to 'Off'.
6) Push the **FMS** Knob to deactivate the cursor.

BAROMETRIC TRANSITION ALTITUDE ALERT

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 Alerts, and choose the altitude or flight level used to trigger the alerts.

Setting the Baro Transition Alerts:

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

BARO QFE ALTIMETER SETTING

WARNING: *A QFE altimeter setting should only be used in the terminal environment for the corresponding issuing airport to ensure adequate obstacle clearance.*

When a QFE altimeter setting is used, the BARO QFE setting enables the system to automatically adjust certain altitudes in the system between QNH (height above sea level) and QFE (height above airport reference datum). Altitudes that may be automatically adjusted by the system between QFE and QNH altitudes are displayed in parenthesis when based on a BARO QFE setting. Refer to PFD Annunciations and Alerting Functions in this section for QFE annunciations.

BARO QFE mode should be enabled and the altimeter should be set to the QFE setting in conjunction with each other. This can be done automatically by arming QFE while the baro setting is still set to STD BARO ahead of time; at the appropriate time set the baro setting on the PFD to the QFE setting when QFE operation is required. When both PFD baro settings are set to something other than STD BARO with QFE armed, BARO QFE mode will automatically become active.

When entering QFE VNAV altitude constraints, it is important to note that only the current QFE reference is used. It is not possible to enter a QFE constraint for the destination while the origin is the current reference. Therefore, while QFE is active and the QFE reference is the origin:

» QFE constraints cannot be entered for the destination airport/runway

» QFE constraints cannot be entered for any arrival/approach waypoints

» Entering an MSL/AGL constraint for any departure/enroute waypoints displays a message clarifying that the constraint will be shown as a converted QFE value relative to the origin

Note: *'FMS ORIG' and 'FMS DEST' references do not dynamically update with flight plan changes. Always verify QFE settings when changing the QFE reference (airfield, runway, etc.) or flight plan and re-enter settings on the 'Aux - System Setup 1' Page.*

Note: *VPTH, VSD, and VNV discontinuities may occur when switching from QNH to QFE Baro settings.*

Setting the BARO QFE while on the ground:

1) Set the appropriate QFE BARO setting on both PFDs.

2) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.

3) Push the **FMS** Knob to activate the cursor.

4) Turn the large **FMS** Knob to select the 'REF' Field in the 'BARO QFE' Box.

5) Use the small **FMS** Knob to select 'Manual' or 'FMS ORIG', and press the **ENT** Key to accept.

6) If 'Manual' was selected, use the **FMS** Knobs to enter the field elevation of the departure airport in the 'ELEV' Field and press the **ENT** Key.

7) If 'FMS ORIG' was selected, the field elevation of the selected departure airport/runway from the flight plan will be shown in the 'BARO QFE' Box. Verify this information is correct.

8) The 'On/Off' Field will automatically highlight, turn the small **FMS** Knob to change the selection from 'Off' to 'On'.

9) Push the **FMS** Knob to deactivate the cursor. QFE mode is now active.

Change the BARO setting on both PFDs to STD BARO to disable BARO QFE.

Setting the BARO QFE while in flight:

1) Set the BARO setting to STD BARO on both PFDs.

2) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.

3) Push the **FMS** Knob to activate the cursor.

4) Turn the large **FMS** Knob to select the 'REF' Field in the 'BARO QFE' Box.

5) Use the small **FMS** Knob to select 'Manual' or 'FMS DEST', and press the **ENT** Key to accept.

6) If 'Manual' was selected, use the **FMS** Knobs to enter the field elevation of the destination airport in the 'ELEV' Field and press the **ENT** Key.

7) If 'FMS DEST' was selected, the field elevation of the selected destination airport/runway from the flight plan will be shown in the 'BARO QFE' Box. Verify this information is correct.

8) The 'On/Off' Field will automatically highlight, turn the small **FMS** Knob to change the selection from 'Off' to 'On'.

9) Push the **FMS** Knob to deactivate the cursor. BARO QFE mode is now armed.

10) Enter the desired QFE BARO setting to activate the BARO QFE mode.

Change the BARO setting on both PFDs to STD BARO to disable BARO QFE. The desired BARO setting can now be entered.

During QFE operations an annunciation will be displayed to the left of the altimeter.

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 of the Baro Transition Alerts, and choose the altitude or flight level used to trigger the alerts.

Setting the Baro Transition Alerts:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.

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

3) Turn the large **FMS** Knob to highlight Altitude or Level in the 'Baro Transition Alert' Box.

4) Turn the small **FMS** Knob to turn the alerts 'OFF' or 'ON' and press the **ENT** Key.

5) Turn the small **FMS** Knob to change the altitude or level and press the **ENT** Key.

6) To cancel the selection, push the **FMS** Knob.

VERTICAL SPEED INDICATOR (VSI)

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

The Vertical Speed Indicator (VSI) displays the aircraft vertical speed using a non-moving tape. The current vertical speed is displayed in the pointer along the tape. The pilot can choose the display units format for the VSI and altimeter as feet or meters.

If the VSI is displayed in feet, numeric labels with major tick marks appear at 2000 and 4000 feet per minute. Minor tick marks appear for every 1000 fpm. If the current vertical speed is at least 100 fpm, digits appear in the pointer. If the rate of ascent/descent exceeds 4000 fpm, the pointer appears at the corresponding edge of the tape while displaying the current vertical speed numerically.

If the VSI is displayed in meters, numeric labels with major tick marks appear at 10 and 200 meters per second. Minor tick marks appear for every 5 meters per second. If the current vertical speed it least 0.5 meters per second, digits appear in the pointer. If the rate of ascent or descent exceeds 20 meters per second, the pointer appears at the corresponding edge of the tape while displaying the current vertical speed numerically.

A magenta chevron bug is displayed as the Required Vertical Speed Indication (RVSI) for reaching a VNV Target Altitude once the "TOD [Top of Descent] within 1 minute" alert has been generated. See the Flight Management Section for details on VNV features, and refer to Section 2.3, Supplemental Flight Data, for more information about VNV indications on the PFD.

VERTICAL DEVIATION

The Vertical Deviation Indicator (VDI) uses a magenta chevron to indicate the VNV vertical deviation when Vertical Navigation (VNV) is being used; the VDI appears in conjunction with the "TOD within 1 minute" alert. Full-scale deflection (two dots) is 1000 feet. The VDI is removed from the display if vertical deviation becomes invalid. See the Flight Management and AFCS sections for details on VNV features, and refer to Section 2.3, Supplemental Flight Data, for more information about VNV indications on the PFD.

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

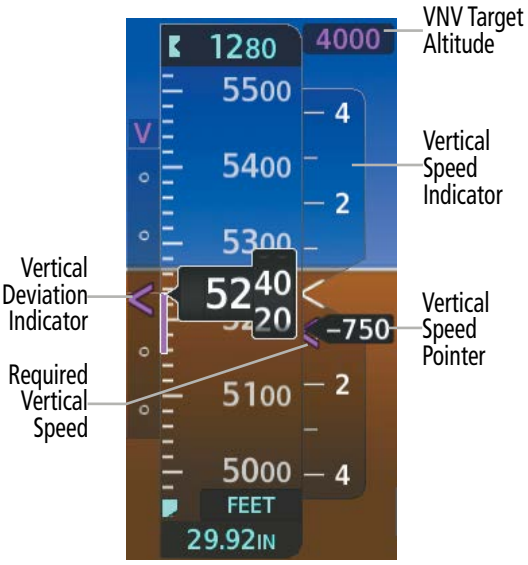


Figure 2-15 Vertical Speed and Deviation Indicator (VSI and VDI)

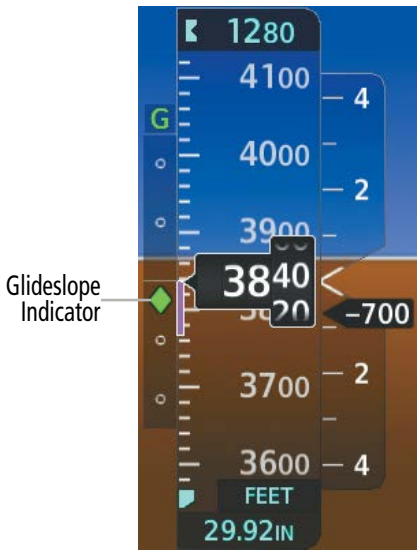


Figure 2-16 Glideslope Indicator

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 approach service levels supporting SBAS vertical guidance (L/VNAV, LPV) or advisory vertical guidance (LNAV+V, LP+V, Visual). The Glidepath Indicator, a magenta diamond appears on the display 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, and LP+V, and Visual is +/- 148 feet (45 meters).
- LPV is +/- 49 feet (15 meters).

A hollow gray diamond represents a preview of the glidepath indicator. This is shown while inbound to the FAF waypoint, but before the FAF waypoint is the next active waypoint. The preview is also shown 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 Final Approach Fix (FAF), "NO GP" is displayed in place of the diamond.

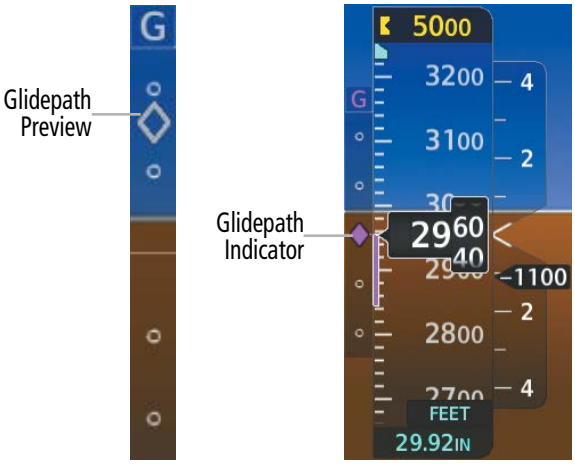


Figure 2-17 Glidepath Indicator

While executing an LNAV/VNAV approach, and between the FAF and MAP, the Vertical Deviation Limit Indicators appear as vertical white lines indicating the area where deviation exceeds allowable limits for the glidepath. The Vertical Deviation Limit Indicator provides a scaled representation of +/- 75 feet of the calculated glidepath. The "window" between the lines represents the area of acceptable deviation. The length of the lines will change while progressing through the final approach. When the Glidepath Indicator enters an excessive deviation area, the Glidepath and Vertical Deviation Limit Indicators are amber.

While executing an LNAV/VNAV approach and SBAS is unavailable, baro-VNAV (barometric vertical navigation) is used for vertical guidance. This occurs due to any of the following conditions:

- SBAS fails or becomes unavailable prior to the FAF
- The aircraft is outside of SBAS coverage
- SBAS is manually disabled on the GPS Status page

Baro-VNAV is also the source of vertical approach guidance if the LNAV/VNAV procedure does not support SBAS vertical guidance.

While baro-VNAV is being utilized, the Glidepath Indicator appears as a magenta pentagon.

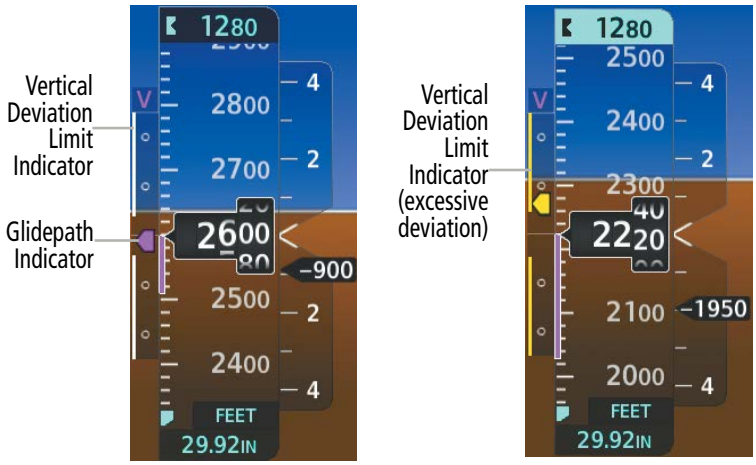
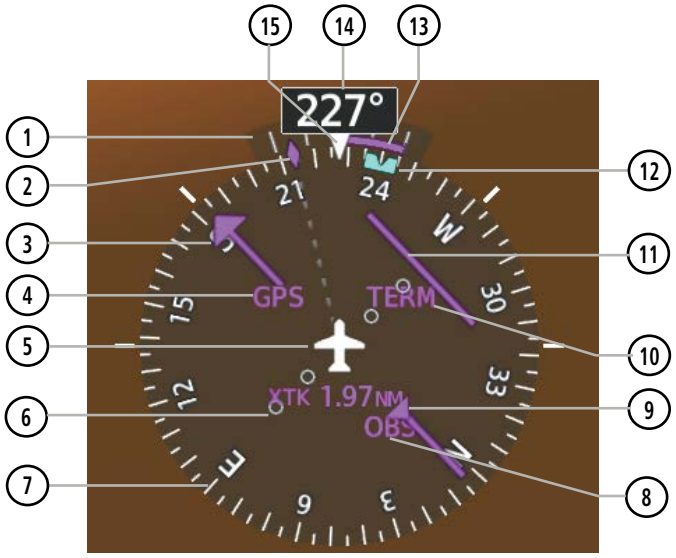


Figure 2-18 Glidepath Indicator (Baro-VNAV) and Vertical Deviation Limit Indicators

HORIZONTAL SITUATION INDICATOR (HSI)

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

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



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

Figure 2-19 Horizontal Situation Indicator (360˚ HSI)

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

Figure 2-20 HSI Map

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

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

NOTE: *When OBS mode is active to a VOR waypoint, the course pointer and current track indicator are relative to the published magnetic variation of the VOR which can be outdated with respect to the current magnetic variation. Consequently, in OBS mode a slight offset may exist between indicated heading and selected course and track indicator even when there is no crosswind.*

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.

For either HSI display format, 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. 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. The Desired Track (DTK) is shown in magenta to the upper right of the HSI when the selected navigation source is FMS and OBS Mode is not active. The Selected Course (CRS) is shown to the upper right of the HSI when the selected navigation source is VOR or LOC and in magenta when the selected navigation source is FMS with OBS Mode active.

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.

The Selected Heading is shown to the upper left of the HSI for 3 seconds after being adjusted The cyan bug on the compass rose corresponds to the Selected 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 (see OBS Mode for adjusting a GPS course).

Figure 2-21 Heading and Course Indications

The Selected Course is shown to the upper right of the HSI for 3 seconds after being adjusted.

The Current Track Indicator, represented by a magenta diamond on the HSI, is the current over the ground track the aircraft is flying.

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation ('Mag Var') or referenced to true north (denoted '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 2-22 Heading and Course Indications (True)

Changing the navigation angle setting:

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

DIRECTIONAL GYRO (DG) MODE (GRS 7800 INSTALLATIONS ONLY)

DG Mode allows the pilot to manually input a heading value. While DG Mode is not active, a amber heading value annunciation indicates that reliable magnetic variation data is unavailable.

Selecting DG Mode:

1) Press the **PFD Opt** Softkey.
2) Press the **Sensors** Softkey.
3) Press the **HDG** Softkey.
4) Press the **DG Slave** Softkey to activate DG mode. Press the **DG Free** Softkey to deactivate DG mode.
5) Press the **Back** Softkey three times to return to the top-level softkeys.

Figure 2-23 DG Mode

NOTE: *When operating the system with the magnetic sensor uncoupled from the AHRS, the displayed heading and heading information used by some system components (e.g. traffic system, AFCS, and weather radar) will be different from the heading calculated by the AHRS. The difference is an amount equal to the difference between the current Magnetic Field Variation Database (MV DB) value, and the MV DB value when the magnetic sensor was uncoupled. Due to the convergence of isogonic lines, this condition is most noticeable at or near the north and south magnetic poles.*

NOTE: *HDG SYNC does not apply magnetic variation correction to true GPS tracks.*

Once active, 'FREE' is annunciated to the left of the heading value on the HSI. While in DG Mode and reliable magnetic variation data is not available, the heading value is cyan. While in DG Mode and reliable magnetic variation data is available, the heading value is amber. The HDG-, HDG+, HDG SYNC, and TRACK SYNC keys are enabled, and can be operated as follows:

- Pressing the HDG- or HDG+ softkey to slew the heading up or down.
- Pressing the HDG SYNC Bug softkey to synchronize the heading to the current selected heading
- Pressing the TRACK SYNC softkey to synchronize the heading to the current track

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 2-24 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. The pointers are cyan and are single- (BRG1) or double-lined (BRG2); an icon is shown in the respective information window to indicate the pointer type. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring (shown when bearing pointers are selected but not necessarily visible due to data unavailability).

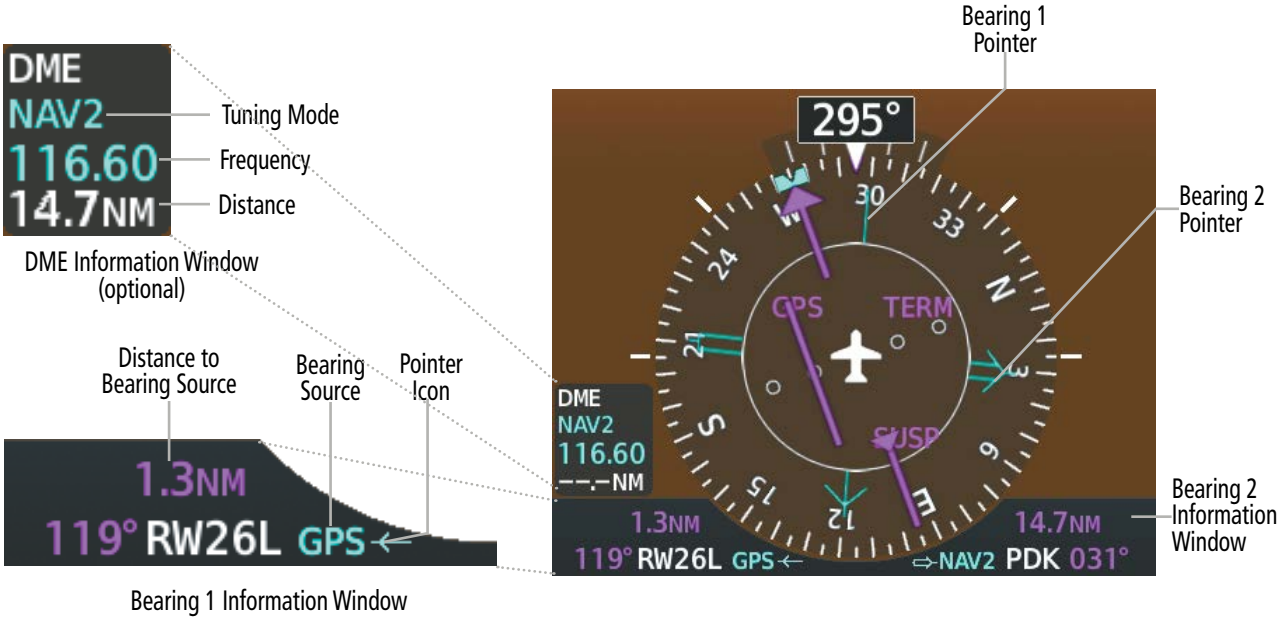


Figure 2-25 HSI with Bearing and DME Information

When a bearing pointer is displayed, its associated information window is also displayed. The Bearing Information windows are displayed to the lower sides of the HSI and show:

» 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

If the NAV radio is the bearing source and is tuned to an ILS frequency (refer to the Audio Panel and CNS Section for information on tuning the radios), the bearing pointer is removed from the HSI and the frequency is 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 in lieu of a frequency.

The bearing pointer is removed from the HSI and "NO DATA" is displayed in the information window if:

» The NAV radio is not receiving the tuned VOR station
» 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 **Bearing 1** or **Bearing 2** Softkey to display the desired bearing pointer and information window with a NAV source.
3) Press either **Bearing 1** or **Bearing 2** Softkey again to change the bearing source to GPS.
4) Press either **Bearing 1** or **Bearing 2** Softkey a third time to change the bearing source to ADF (note: ADF radio installation is optional).
5) To remove the bearing pointer and information window, press either **Bearing 1** or **Bearing 2** Softkey again.

DME INFORMATION WINDOW

NOTE: *DME radio installation is optional.*

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

Displaying the DME Information Window:

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

COURSE DEVIATION INDICATOR (CDI)

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

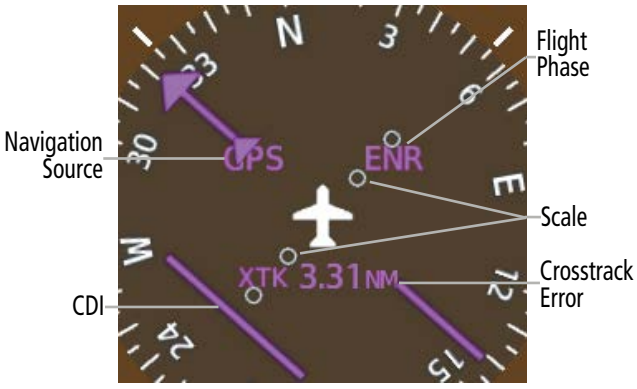


Figure 2-26 Course Deviation Indicator

The CDI can display two sources of navigation: GPS or NAV (VOR, localizer). Color indicates the current navigation source: magenta (for GPS) or green (for VOR and LOC); the Selected Course readout also follows these color indications. When coupled to GPS, the full scale limits for the CDI are defined by a GPS-derived distance. When coupled to a VOR or localizer (LOC), the CDI has the same angular limits as a mechanical CDI. If the CDI exceeds the maximum deviation on the scale (two dots) while coupled to GPS, the crosstrack error (XTK) is displayed below the white aircraft symbol.

Figure 2-27 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.

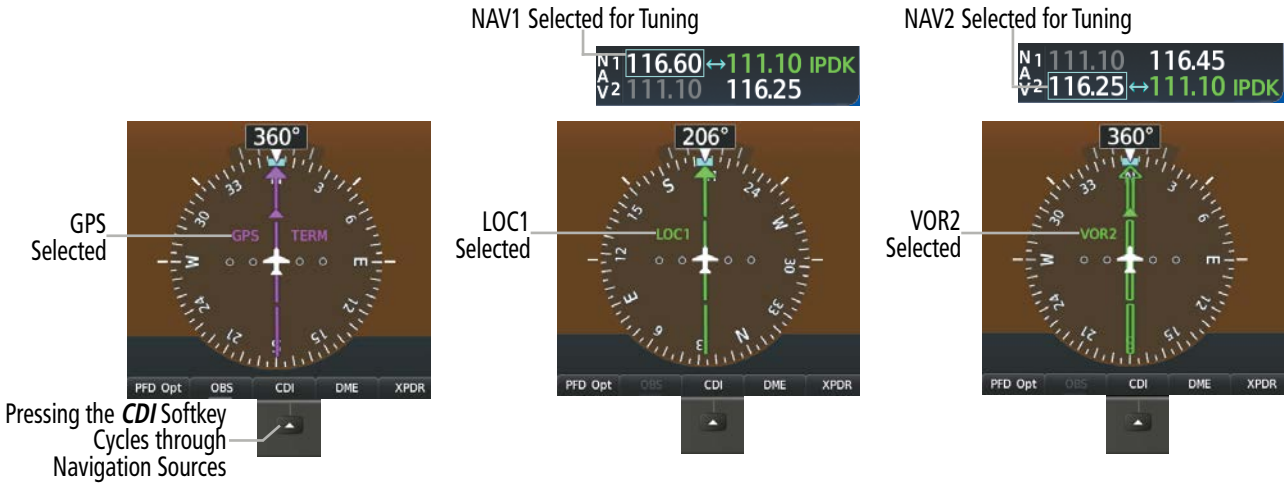


Figure 2-28 Selecting a Navigation Source

If the same VOR/LOC navigation source is selected on both PFDs, the navigation source annunciation turns amber on both displays (unless synchronized). Once the CDIs are synchronized (CDI SYNC turned on), they remain synchronized until the setting is turned off.

Synchronizing the CDIs:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.
2) If necessary, press the **Setup 1** Softkey to display the 'Aux - System Setup 1' Page.
3) Push the **FMS** Knob to activate the cursor.
4) Turn the large **FMS** Knob to highlight the 'CDI Sync' in the 'Synchronization' Box.
5) Turn the small **FMS** Knob clockwise to 'On' or counterclockwise to 'Off'.
6) To cancel the selection, push the **FMS** Knob or press the **CLR** Key.

The system automatically switches 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 switches 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; see the Flight Management Section) also causes the CDI to switch to LOC navigation source; GPS steering guidance is not provided after this switch.

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 switches from GPS to LOC. The probability of this occurring varies based on air temperature.

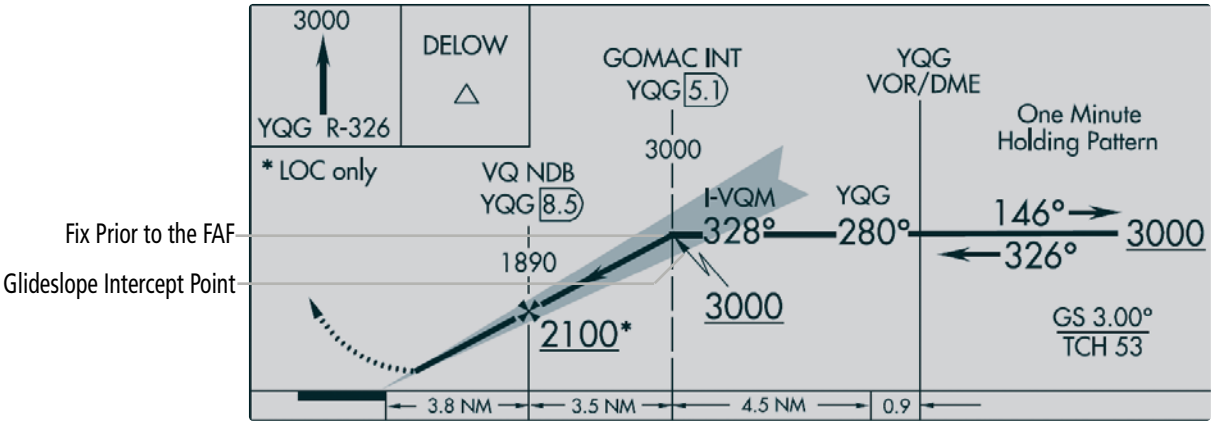


Figure 2-29 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

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

Changing the selected GPS CDI setting:

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

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

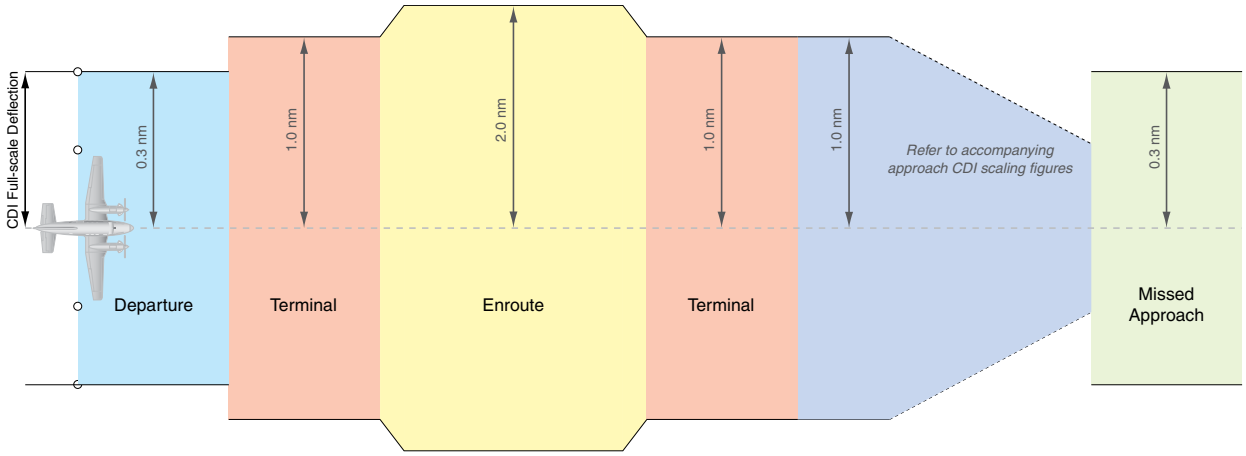


Figure 2-30 Automatic CDI Scaling

» Once a departure procedure is active, 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 procedure is not aligned with the departure runway
- The next leg in the departure procedure is not CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see Glossary for leg type definitions)
- After any leg in the departure procedure that is not 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 Figures 2-31 and 2-32). 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 Vector-to-Final (VTF) is 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 preceding missed approach legs must be aligned with the final approach segment course and the aircraft must not have passed the turn initiation point.

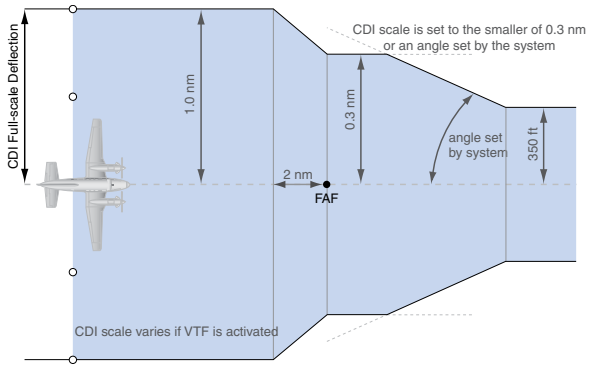


Figure 2-31
Typical LNAV and LNAV+V Approach CDI Scaling

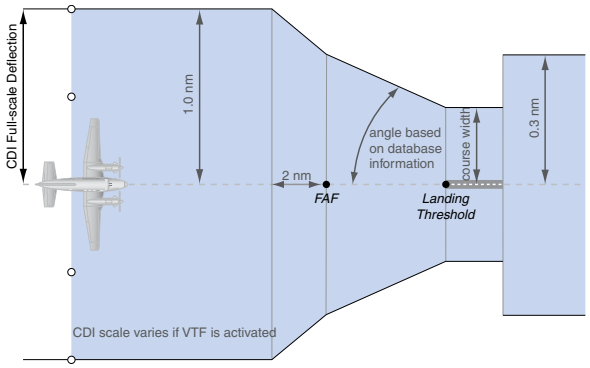


Figure 2-32
Typical LNAV/VNAV, LP, and LPV Approach CDI Scaling

» When a ***missed approach*** is activated, the CDI scale changes to 0.3 nm.

» The system automatically switches back to ***terminal*** scaling 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 CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF
- After any leg in the missed approach procedure that is not 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 (see Figure 2-31)
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 (see Figure 2-32)
Approach (LPV)	LPV	
Approach (LP with Advisory Vertical Guidance)	LP+V	
Approach (LP)	LP	
Missed Approach	MAPR	0.3 nm

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

Table 2-2 Automatic GPS CDI Scaling

OBS MODE

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

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

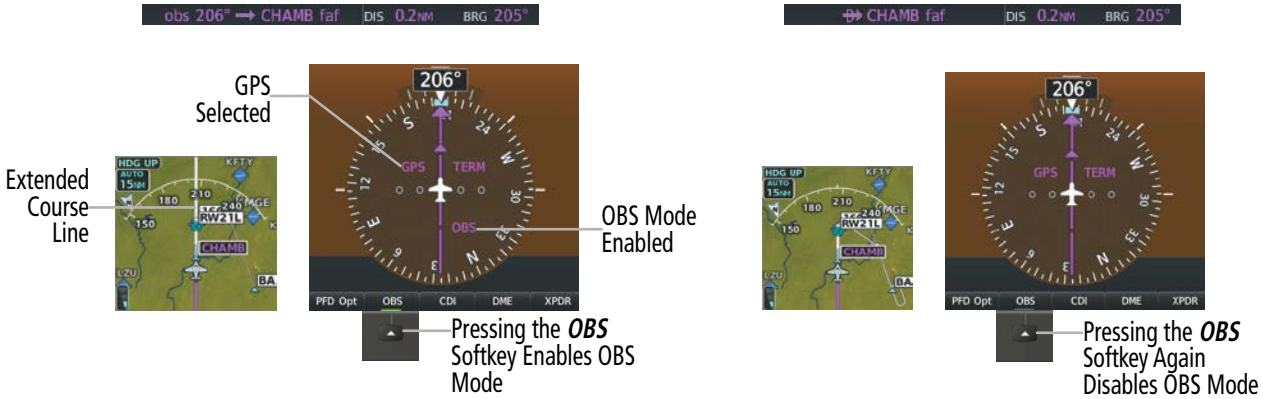


Figure 2-33 Omni-bearing Selector (OBS) Mode

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 GPS 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.

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

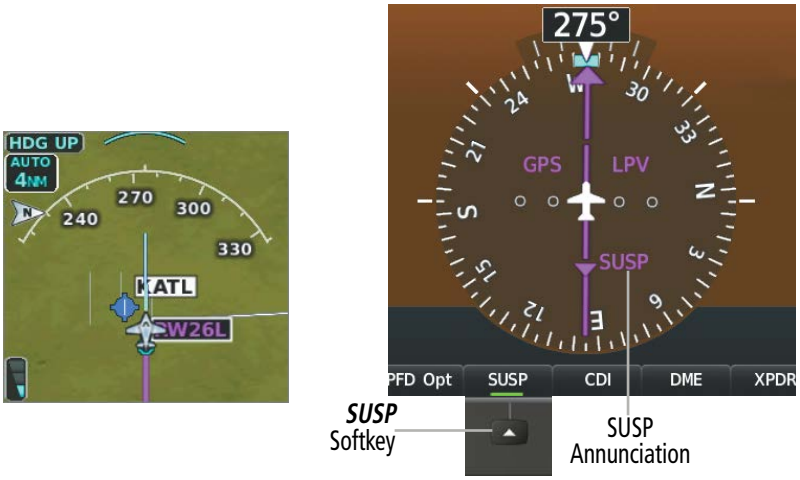


Figure 2-34 Suspending Automatic Waypoint Sequencing

2.2 GARMIN SVT (SYNTHETIC VISION TECHNOLOGY)

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

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

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 vertical field of view is 48 degrees. The horizontal field of view is 71 degrees in full screen and 50 degrees in split mode. 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 of 4.9 arc-seconds, meaning that the terrain elevation contours are stored in squares measuring 4.9 arc-seconds on each side, is required for the operation of SVT. Loss of any of the required data, including temporary loss of the GPS signal, will cause SVT to be disabled (although the softkeys will still appear functional) until the required data is restored.

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

TAWS 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 alerts are displayed in red and amber 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 will take up to 30 seconds to be displayed. The standard, non-SVT PFD display will be shown in the interim.

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

The following SVT enhancements appear on the PFD:

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

Figure 2-35 Synthetic Vision Imagery

NOTE: *The terrain feature is not a substitute for standard course and altitude deviation information provided by the altimeter, CDI, and VDI.*

SVT OPERATION

SVT is activated from the PFD using the softkeys located along the bottom edge of the display. Pressing the softkeys turns the related function on or off.

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**, **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. A green annunciator on the softkey label indicates the feature is activated.

The **APT Sign** Softkey is only available when the **Terrain** Softkey is activated (softkey annunciator is green). When the **Terrain** Softkey is activated the Flight Path Marker is automatically displayed on the PFD.

- **Terrain** Softkey enables synthetic terrain depiction.
- **HDG LBL** Softkey enables the display of heading marks and digits on the zero pitch line.
- **Airport Sign** Softkey enables airport signposts.
- The crew profile defines the state (on or off) of these features.

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 each press of the **Terrain** Softkey.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

Activating and deactivating Pathways:

1) Press the **PFD Opt** Softkey.
2) Press the **SVT** Softkey.
3) Press the **Pathways** Softkey. The Pathways display will cycle on or off with each press of the **Pathways** Softkey.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

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 each press of the **HDG LBL** Softkey.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

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 each press of the **APT Sign** Softkey.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

SVT FEATURES

Figure 2-36 SVT on the Primary Flight Display

FLIGHT PATH MARKER

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

The FPM is always 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 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 2-37 Flight Path Marker Position is Affected by Wind

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.

HORIZON HEADING

The Horizon Heading is synchronized with the HSI and shows the 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.

TRAFFIC

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

NOTE: *In situations where a TA is occurring in close proximity to the aircraft, such as while taxiing, a large amber TA symbol may appear on the SVT display.*

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 appear on the SVT display. Traffic symbols and coloring are consistent with that used for traffic displayed on the navigation maps and the Traffic Map Pane. 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.

AIRPORT SIGNS

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

Figure 2-38 Airport Signs

PATHWAYS

NOTE: *SVT Pathways are not available when the Cross Pointer symbolic aircraft format is selected.*

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

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

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 PFD maps or MFD map indicating an inactive leg.

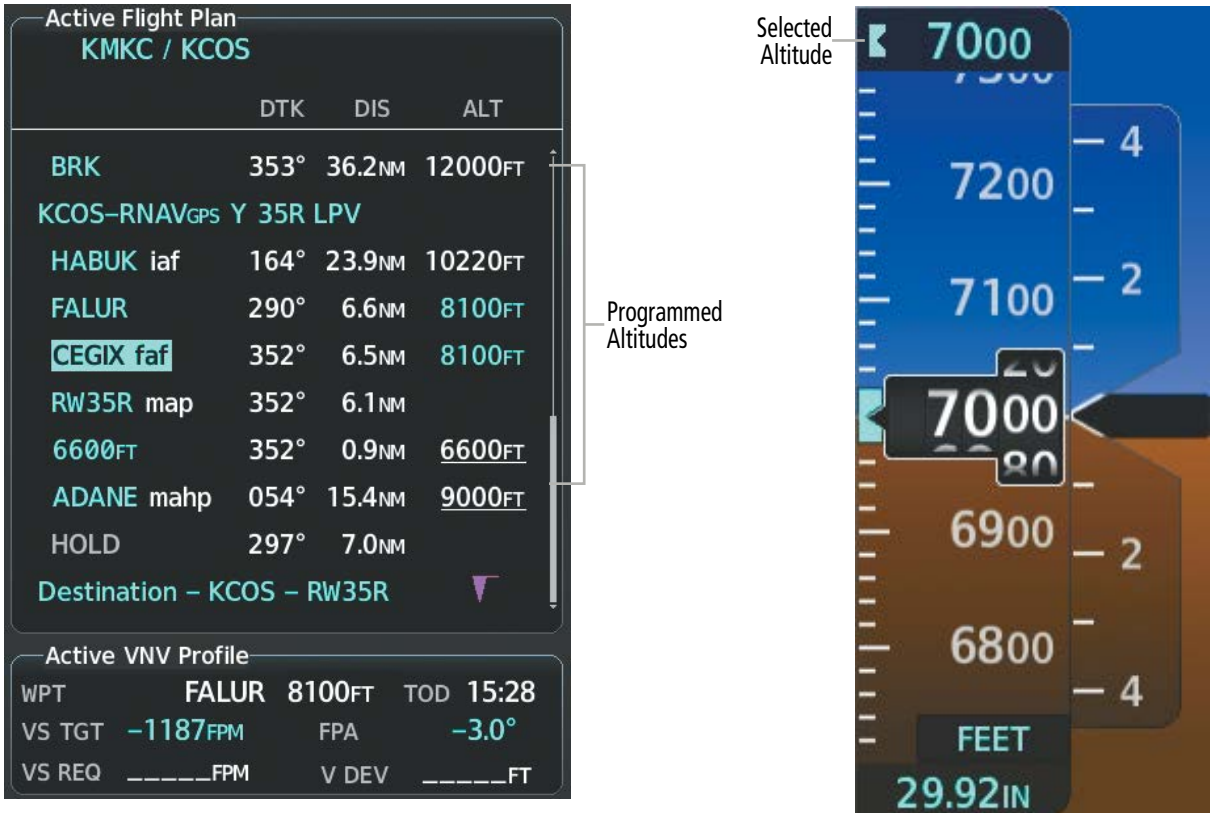


Figure 2-39 Programmed and Selected Altitude

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

Departure and Enroute

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

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

Descent and Approach

During an approach, Pathways 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. During the arrival/approach phases of flight, gray pathways indicate the anticipated preview glidepath/glideslope. The gray Approach Preview Pathways will be displayed beginning at the start of the segment leading to the FAF waypoint. 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.

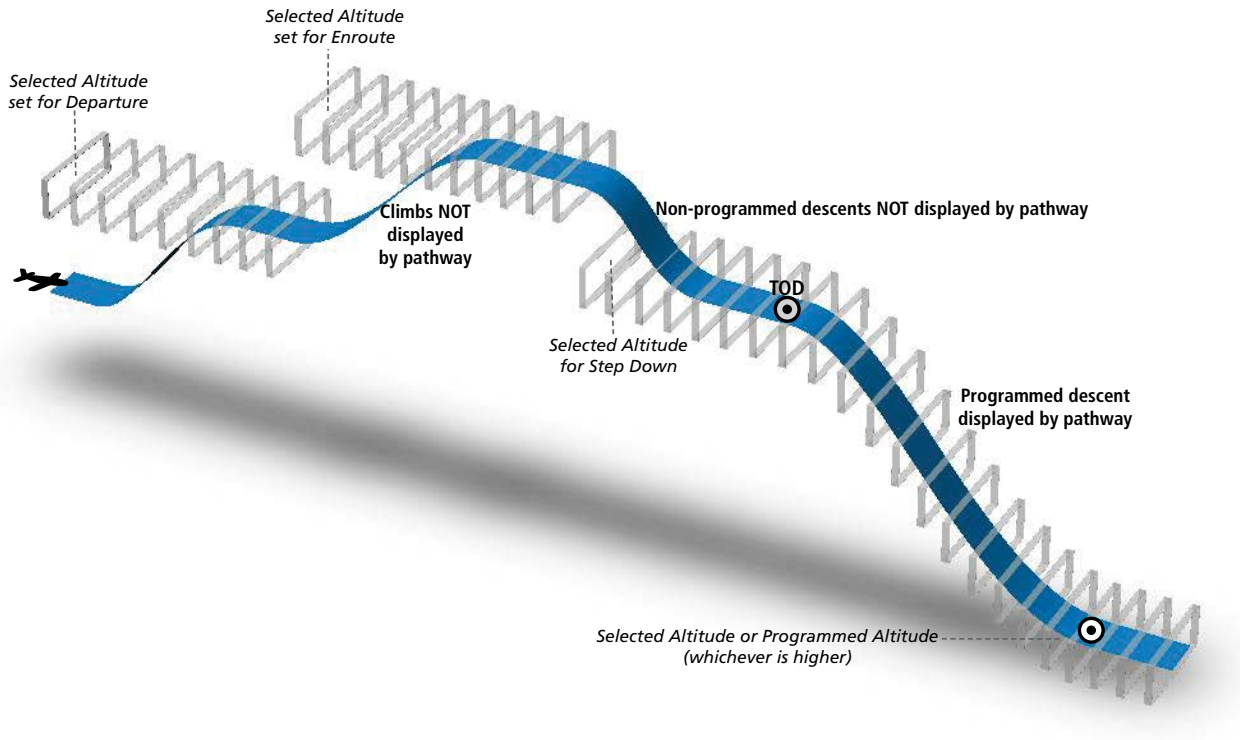


Figure 2-40 SVT Pathways, Enroute and Descent

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.

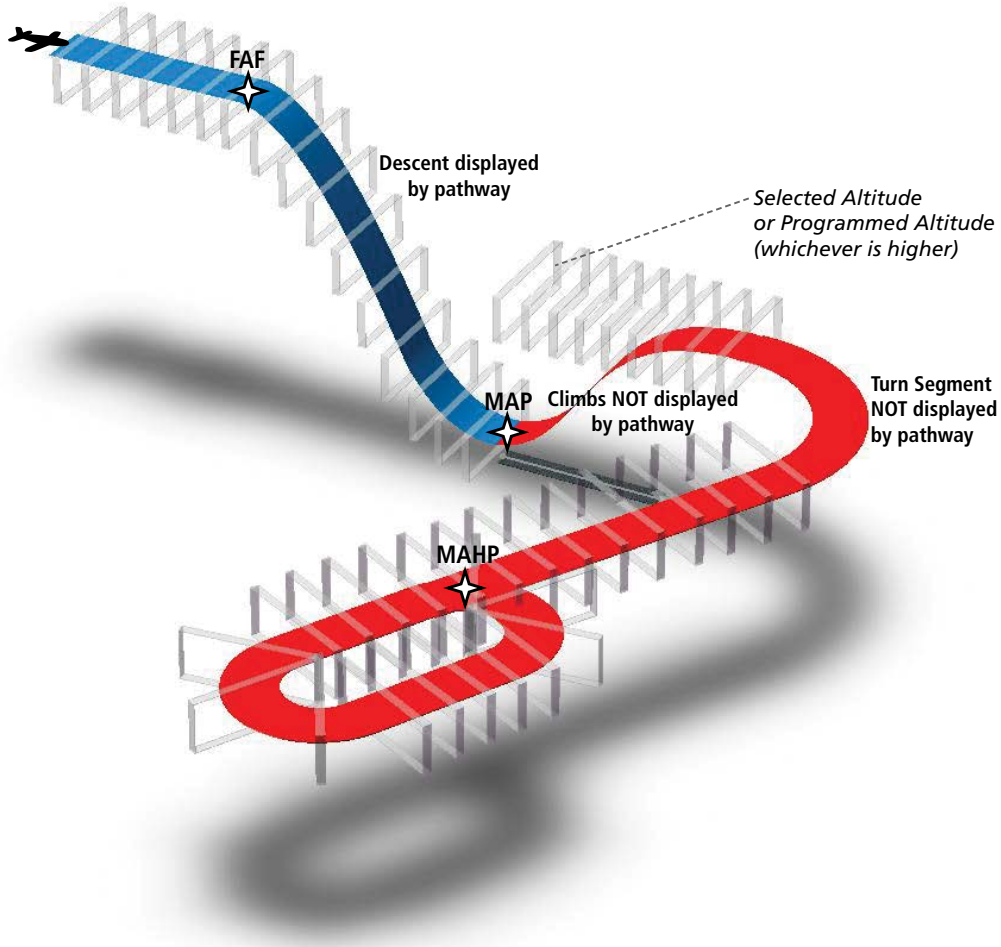


Figure 2-41 SVT Pathways, Approach, Missed Approach, and Holding

RUNWAYS

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

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.*

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

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

Figure 2-42 Airport Runways

TAWS ALERTING

Terrain alerting on the synthetic terrain display is triggered by Forward-looking Terrain Avoidance (FLTA) alerts, and corresponds to the yellow terrain shading for a caution alert and the red shading for a warning alert on the navigation maps and TAWS Page. For more detailed information regarding TAWS, 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 2-43 Terrain 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 2-44 Obstacle Alert

FIELD OF VIEW

The PFD field of view can be represented on the MFD 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.

Enabling/Disabling SVT Field of View on the Navigation Map:

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

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

SVT View on the PFD

Field of View on the MFD

Figure 2-45 PFD and MFD Field of View Comparison

2.3 SUPPLEMENTAL FLIGHT DATA

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

GENERIC TIMER

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

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

TEMPERATURE DISPLAYS

The Outside Air Temperature (OAT) and deviation from International Standard Atmosphere (ISA) temperature are displayed in the lower left corner of the PFD under normal conditions, or below the true airspeed in Reversionary Display Mode. Both are displayed in degrees Celsius (°C).

Figure 2-46 Outside Air Temperature

Changing temperature display units:

1) Select the 'Aux - System Setup 1' Page on the MFD using the **FMS** Knob.
2) Push the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the TEMP field in the Display Units box.
4) Turn the small **FMS** Knob to highlight either 'Celsius' or 'Fahrenheit' and press the **ENT** Key to confirm the selection.
5) To cancel the selection, push the **FMS** Knob or press the **CLR** Key.

WIND DATA

Wind direction and speed in knots can be displayed 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 shows "NO WIND DATA". Wind data can be displayed in three different ways:

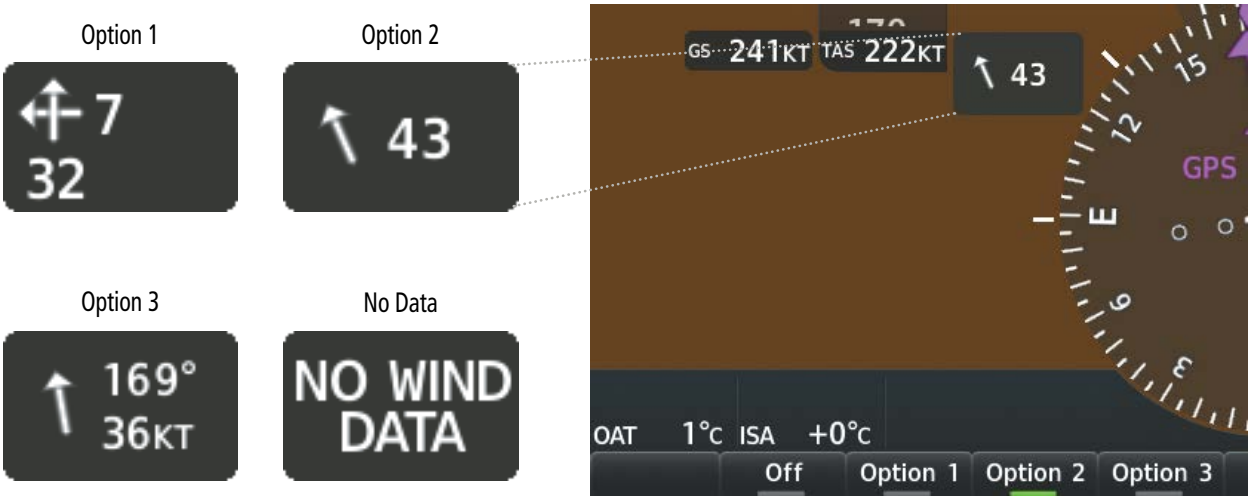


Figure 2-47 Wind Data

Displaying wind data:

1) Press the **PFD Opt** Softkey.
2) Press the **Wind** Softkey to display wind data below the Selected Heading.
3) Press one of the **Option** Softkeys to change how wind data is displayed:
   - **Option 1**: Wind direction arrow and speed
   - **Option 2**: Wind direction arrow with true digital direction and speed
   - **Option 3**: Wind direction arrows with headwind, tailwind, and crosswind speed components
4) To remove the window, press the **Off** Softkey.

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 Table 2-3.

Figure 2-48 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 selected 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 2-3 VNV Indication Removal Criteria

2.4 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

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

MARKER BEACON ANNUNCIATIONS

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

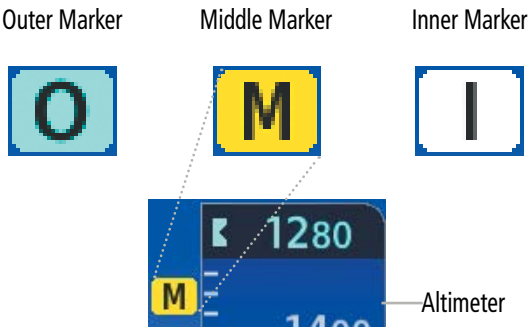


Figure 2-49 Marker Beacon Annunciations

ALTITUDE ALERTING

The Altitude Alerting function 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 Altitude Alerter is independent of the Garmin AFCS, but aural and visual alerts are generated only when the Garmin AFCS is installed. The following occur when approaching the Selected Altitude:

- Upon passing through 1000 feet of the Selected Altitude, the Selected Altitude (shown above the Altimeter) changes to black text on a cyan background, flashes for 5 seconds, and an aural tone is generated.
- When the aircraft passes within 200 ft of the Selected Altitude, the Selected Altitude changes to cyan text on a black background and flashes for 5 seconds.
- After reaching the Selected Altitude, if the pilot flies outside the deviation band (±200 feet of the Selected Altitude), the Selected Altitude changes to amber text on a black background, flashes for 5 seconds, and an aural tone is generated.

Figure 2-50 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION

NOTE: *The Low Attitude Annunciation requires SBAS. Terrain alerts from Terrain-SVT or TAWS-B systems will appear instead of the Low Altitude Annunciation when these systems are operating and not inhibited.*

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

Figure 2-51 Low Altitude on GPS SBAS Approach

MINIMUM ALTITUDE ALERTING

For altitude awareness, a barometric 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 operated off then on. For example, while enroute, the crew may choose to set the MEA. When the crew loads an approach, the set minimum altitude alert is removed, and the crew 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 ft 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 2-52 Barometric 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. The function is reset when the power is cycled or a new approach is activated.

Setting the Minimum Altitude Alert and bug:

1) Press the **Tmr/Ref** Softkey.
2) Turn the large **FMS** Knob to highlight the 'Minimums' Field.
3) Turn the small **FMS** Knob to select 'BARO', 'TEMP COMP', or 'RAD ALT.' '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 when 'BARO' or 'TEMP COMP' is selected, or up to 2,500 feet when 'RAD ALT' is selected).
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 2-53 BARO and TEMP COMP Minimum Altitude Alerting

NOTE: *For temperature compensated minimums to be displayed on the PFDs, the active flight plan must contain an airport.*

NOTE: *The temperature at the destination can be entered on the MFD 'FPL - Active Flight Plan' Page. There is only one compensation temperature for the system, therefore, changing the temperature will affect both the loaded approach altitudes and the minimums. Refer to the Flight Management section for information about applying temperature compensation to approach altitudes*

RADAR ALTIMETER

When the radar height (the aircraft altitude above ground level detected by the radar altimeter) is between zero and 2500 feet, the current value is displayed in white to the right of the current aircraft heading. Display of radar height becomes more sensitive as the height above ground decreases (Table 2-4).

Figure 2-54 Current Radar Height

Radar Height Range	Shown to Nearest
0 to 200 feet	5 feet
200 to 1500 feet	10 feet
1500 to 2500 feet	50 feet

Table 2-4 Radar Altimeter Sensitivity

When the radar altimeter is selected as the altitude source for the minimum descent altitude alerting function, the color of the radar height changes to amber upon reaching at or below the MDA/DH.

Figure 2-55 RAD ALT Setting ('Timer/References' Window)

Figure 2-56 RA as Altitude Source for MDA/DH

A ground line is shown on the Altimeter to display the aircraft's height relative to the ground. If the data becomes invalid, the message "RA FAIL" is displayed in amber in the RA box. The Radar Altimeter test is done on the MFD but is displayed on the PFDs to the right of the current heading.

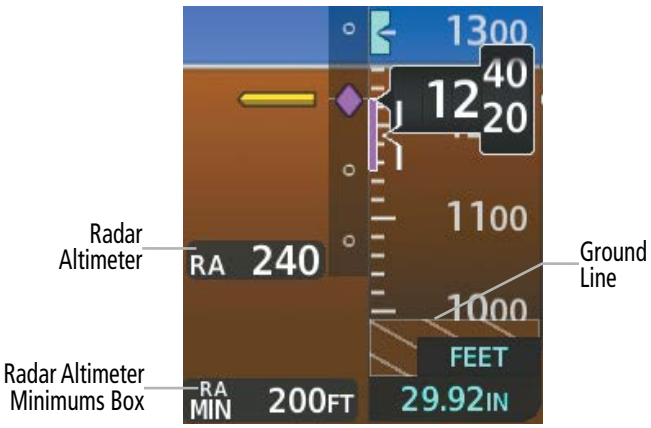


Figure 2-57 Altimeter Displaying the Ground Line (RAD ALT)

Figure 2-58 Radar Altimeter with Invalid Data

Testing the Radar Altimeter (KRA 405B only):

1) Turn the large **FMS** Knob to select the Aux page group on the MFD.
2) Turn the small **FMS** Knob to select the 'Aux - System Status 1' Page.
3) Press the **RA Test** Softkey to enable or disable the test.

   The 'RA TEST' annunciation is displayed above the RA box. To cancel the test, press the **RA TEST** Softkey again, or turn the **FMS** Knob to exit the 'Aux - System Status' Page.

When test mode is active, 'RA TEST' is annunciated above the RA box and 40 feet will be displayed in the RA box.

Figure 2-59 Radar Altimeter with Test Annunciation

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-5 can appear on the HSI when abnormal GPS conditions occur. Refer to the Flight Management Section for more information on Dead Reckoning (DR) Mode.

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

Table 2-5 Abnormal GPS Conditions Annunciated on HSI

Figure 2-60 Example HSI Annunciations

DR Mode causes the following items on the PFD to be shown in amber:

- CDI (when GPS is the selected navigation source; removed after 20 minutes in DR mode operation)
- Current Track Indicator
- Wind data and pointers in the Wind Data Box on the PFD
- GPS bearing pointers
- Distances in the Bearing Information windows
- Active Flight Plan distances, bearings, and ETE values

The accuracy items should be verified when operating in DR Mode.

COMPARATOR ANNUNCIATIONS

The Comparator monitors critical values generated by redundant sensors. If differences in the sensors exceed a specified amount, a comparator annunciation is displayed in black text on an amber background. If one or both of the sensed values are unavailable, the comparator annunciation is black text on a white background.

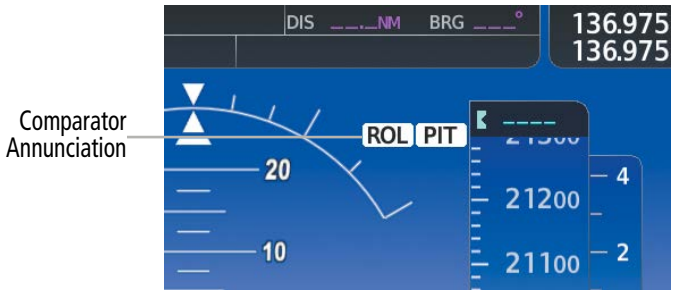


Figure 2-61 Sensor Comparator Annunciations on the PFD

The following is a list of the possible annunciations:

Comparator Annunciation	Condition
ALT	Difference in altitude sensors is ≥ 200 ft.
IAS	If both airspeed sensors detect < 35 knots, this is inhibited.
	If either airspeed sensor detects ≥ 35 knots, and the difference in sensors is > 10 knots.
	If either airspeed sensor detects ≥ 80 knots, and the difference in sensors is > 7 knots.
HDG	Difference in heading sensors is > 6 degrees.
PIT	Difference in pitch sensors is > 5 degrees.
ROL	Difference in roll sensors is > 6 degrees.
VDI	Difference in temperature compensated altitudes is > 50 ft.
ALT	No data from one or both altitude sensors.
IAS	No data from one or both airspeed sensors.
HDG	No data from one or both heading sensors.
PIT	No data from one or both pitch sensors.
ROL	No data from one or both roll sensors.
VDI	No temperature compensated altitude data available.

Table 2-6 Comparator Annunciations

REVERSIONARY SENSOR ANNUNCIATIONS

Reversionary sensor selection is annunciated on the PFD. These annunciations reflect reversionary sensors selected on one or both PFDs. Pressing the **Sensor** Softkey gives access to **ADC1**, **ADC2**, **AHRS1**, and **AHRS2** Softkeys. These softkeys allow manual switching of sensors. In the case of certain types of sensor failures, the System may make some sensor selections automatically. The GPS sensor cannot be switched manually.

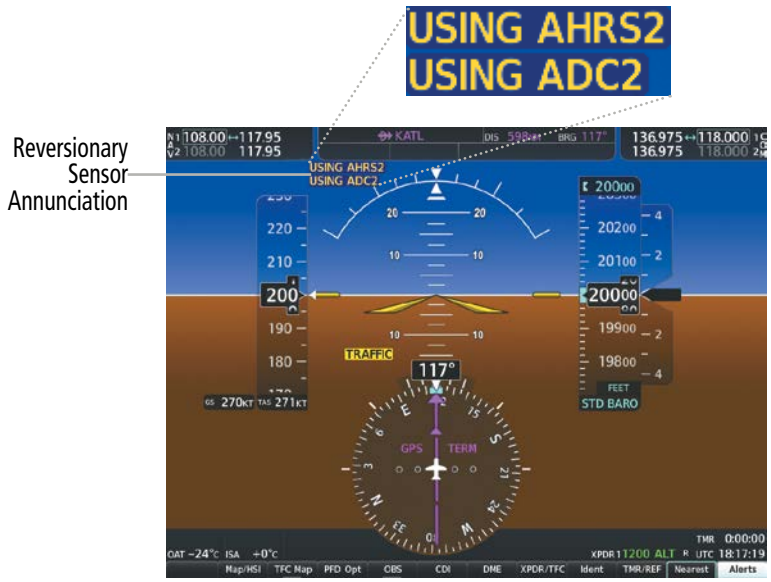


Figure 2-62 Reversionary Sensor Annunciations

Reversionary Sensor Window Text	Condition
BOTH ON ADC1	Both PFDs are displaying data from the number one Air Data Computer..
BOTH ON ADC2	Both PFDs are displaying data from the number two Air Data Computer.
BOTH ON AHRS1	Both PFDs are displaying data from the number one Attitude & Heading Reference System.
BOTH ON AHRS2	Both PFDs are displaying data from the number two Attitude & Heading Reference System.
BOTH ON GPS1	Both PFDs are displaying data from the number one GPS receiver.
BOTH ON GPS2	Both PFDs are displaying data from the number two GPS receiver.
USING ADC1	PFD2 is displaying data from the #1 Air Data Computer.
USING ADC2	PFD1 is displaying data from the #2 Air Data Computer.
USING AHRS1	PFD2 is displaying data from the #1 AHRS.
USING AHRS2	PFD1 is displaying data from the #2 AHRS.
USING GPS1	PFD2 is displaying data from the #1 GPS.
USING GPS2	PFD1 is displaying data from the #2 GPS.

Table 2-7 Reversionary Sensor Annunciations

SVT TROUBLESHOOTING

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

SVT becomes disabled without the following data resources:

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

REVERSIONARY MODE

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

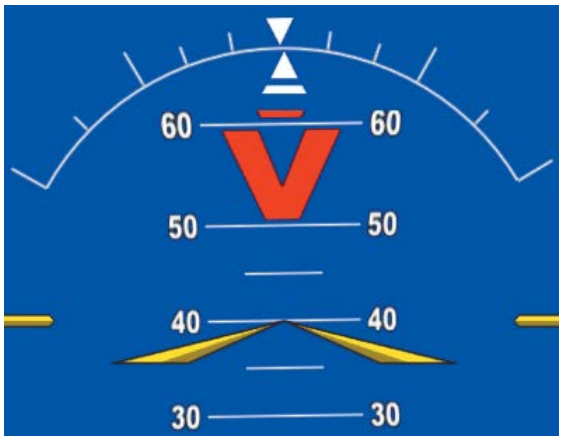
UNUSUAL ATTITUDES

Unusual attitudes are displayed with red chevrons overlaid on the display indicating the direction to fly to correct the unusual attitude condition. The display shows either a brown or blue colored bar at the top or bottom of the screen to represent earth or sky. This is intended to prevent losing sight of the horizon during extreme pitch attitudes.

The blue colored bar is also displayed when terrain gradient is great enough to completely fill the display.

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

Nose High



Nose Low

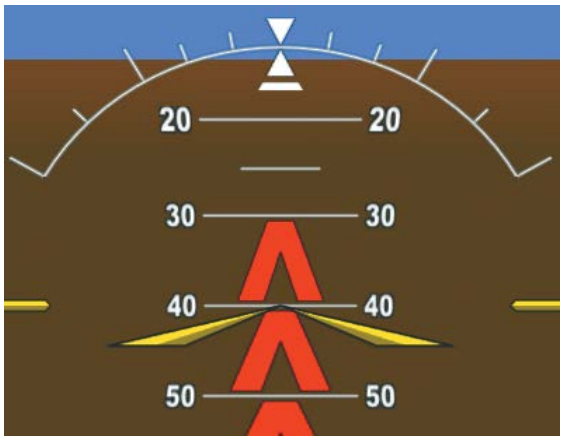


Figure 2-63 Pitch Attitude Warnings

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 corresponding softkeys are disabled) when the aircraft experiences unusual attitudes:

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

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 2-64 Blue Sky Bar with Full Display Terrain

SECTION 3 ENGINE INDICATION SYSTEM

The G1000 NXi Engine Indication System (EIS) displays critical engine and fuel flow parameters on the left side of the Multi Function Display (MFD) during normal operations (Figure 3-1). In Reversionary Mode, the display(s) are configured to combine the Primary Flight Display (PFD) symbology with the EIS (Figure 3-3).

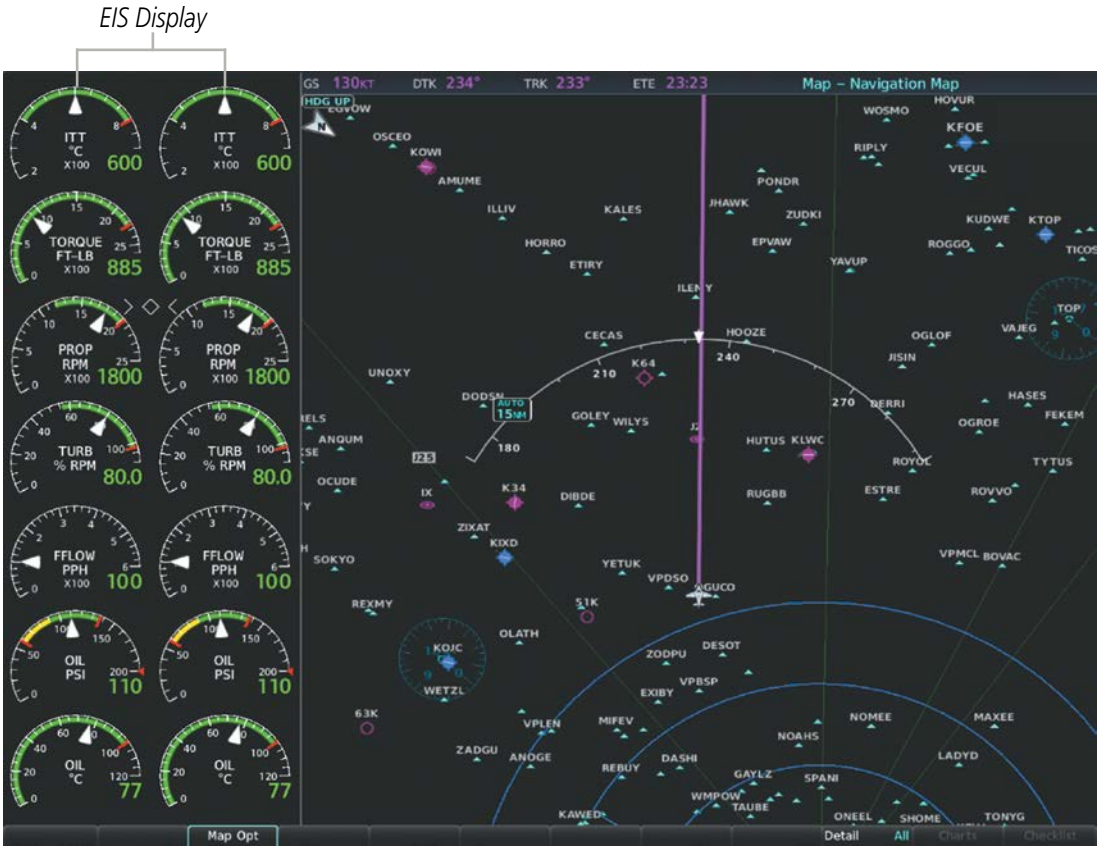


Figure 3-1 MFD (Normal Mode)

EIS information is presented using gauges and digital displays. Green bands on the instrument scales 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 (except for the Fuel Flow gauges, which do not display bands). During normal operating conditions, an instrument's pointer appears in white and the text is green.

When an unsafe operating condition occurs, the pointer and digit color change to amber or red, indicating a caution or warning. If a cautionary time limit is exceeded, the pointers and digits may flash red, even if the parameter is still within the cautionary range. If the sensor data for a parameter becomes invalid or unavailable, ared 'X' is displayed across the indicator and/or display. If the sensor data for a parameter is out of range, dashes '---' are displayed instead of a numeric value .

3.1 EIS DISPLAY

NOTE: *The gauges displayed and the values shown in this section are taken from an example Beechcraft 200/B200 configuration. Refer to the current version of the pertinent flight manual for specific values and operating limitations.*

200/B200 Example Configuration

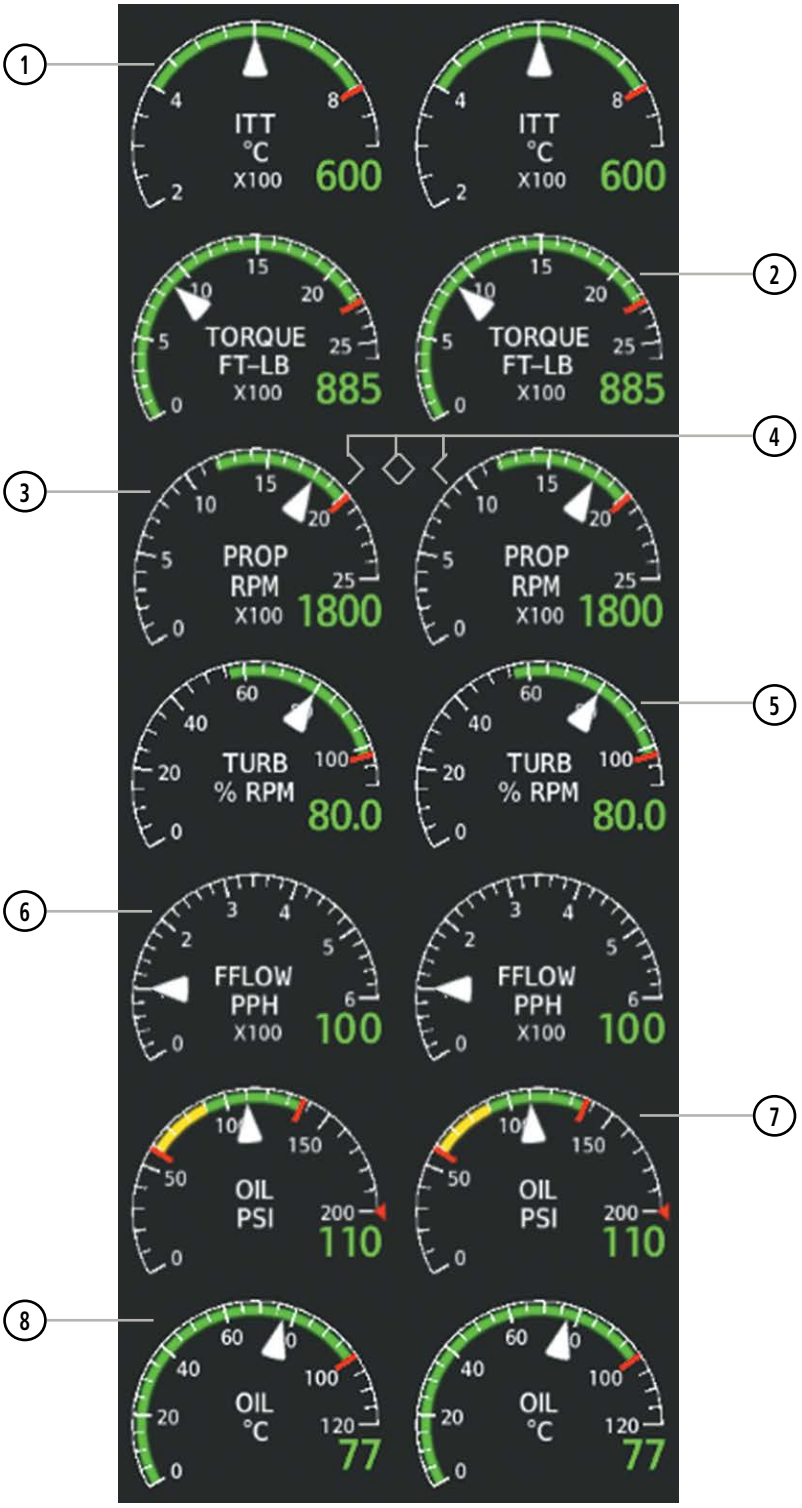


Figure 3-2 EIS Display (Normal Mode)

NOTE: *Refer to the current version of the pertinent flight manual for specific engine gauge values and operating limitations.*

1 Interstage Turbine Temperature

The Interstage Turbine Temperature (ITT) Gauge is located at the top of the EIS display. This gauge differs for engine start and running conditions.

ITT Engine Running

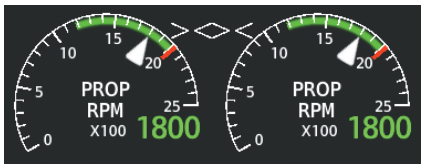
ITT Engine Start

2 Torque

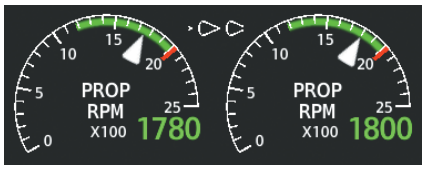
The Torque Gauge displays engine power in foot-pounds and is located beneath the ITT gauge.

3 Propeller Tachometer

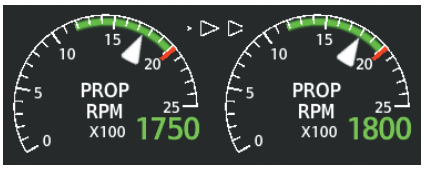
The Tachometer displays the propeller speed in revolutions per minute (RPM). The Tachometer is equipped with a propeller sync indicator, which points towards the higher-speed propeller when propellers are out of sync. The indicator changes linearly with RPM difference between the left and right propellers. A full diamond is displayed when the propellers are synchronized and transitions to a full arrowhead when the difference is greater or equal to 50 rpm.



Propellers Synchronized



Propellers Out of Sync (less than 50 rpm)



Propellers Out of Sync (greater than or equal to 50 rpm)

4 Propeller Sync

Displays a diamond when propellers are in sync. Indicates when propellers are out of sync by the diamond changing to an arrowhead. The arrowhead points towards the propeller turning at a higher-speed.

5 Turbine Speed

Displays turbine speed in a percentage of the revolutions per minute (rpm)

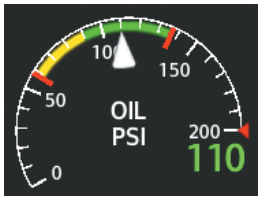
6 Fuel Flow

Displays current fuel flow in pounds per hour (pph)

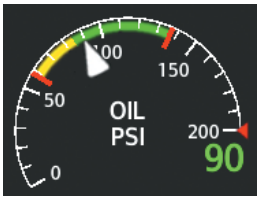
(7) Oil Pressure

The Oil Pressure Gauge is located beneath the Fuel Flow gauge. Oil pressure is displayed in pounds per square inch (psi) from 0 to 200 psi. Safe operating pressure is more than 90 psi and less than 135 psi (varies based on altitude above FL210 and type of engines installed; refer to the current version of the pertinent flight manual). A red triangle represents the maximum oil transient pressure at 200 psi.

Below FL210



Above FL210



(8) Oil Temperature

Displays the oil temperature in degrees Celsius (°C)

3.2 EIS DISPLAY IN REVERSIONARY MODE

PFD1 will revert to reversionary (or backup) mode automatically during an MFD failure in flight. In the event of PFD1 or PFD2 failure, the Display Backup button must be pressed to enter reversionary mode. Reversionary mode is a mode of operation in which all important flight information is presented identically on at least one of the operating displays (see Figure 3-3). Flight parameters are presented in the same format as in normal mode (refer to the System Overview for information about display Reversionary Mode).

Figure 3-3 Reversionary Mode (200/B200)

In the event of display failure, the display modes are as follows:

- **PFD1 failure** – Press the Display Backup button on the left Audio Panel. MFD enters reversionary mode; PFD2 remains in normal mode.
- **MFD failure** – Press the Display Backup buttons on both Audio Panels. PFD1 and PFD2 enter reversionary mode.
- **PFD2 failure** – Press the Display Backup button on the right Audio Panel. MFD enters reversionary mode; PFD1 remains in normal mode.

Figure 3-4 Display Backup Button

REVERSIONARY DISPLAY

The EIS Reversionary Mode Display gauges have a different shape and share one title (i.e. ITT, TORQUE) for each pair of gauges. White tick marks are displayed only at the minimum and maximum values. Green bands on the instrument scales indicate normal ranges of operation; amber and red bands indicate caution and warning, respectively. No minor tick marks or numeric labels are displayed. Prop Synchronization information is not displayed while in Reversionary Mode.

NOTE: *The gauges displayed and the values shown in this section are taken from an example Beechcraft 200/B200 configuration. Refer to the current version of the pertinent flight manual for specific values and operating limitations.*

200/B200 Example Configuration

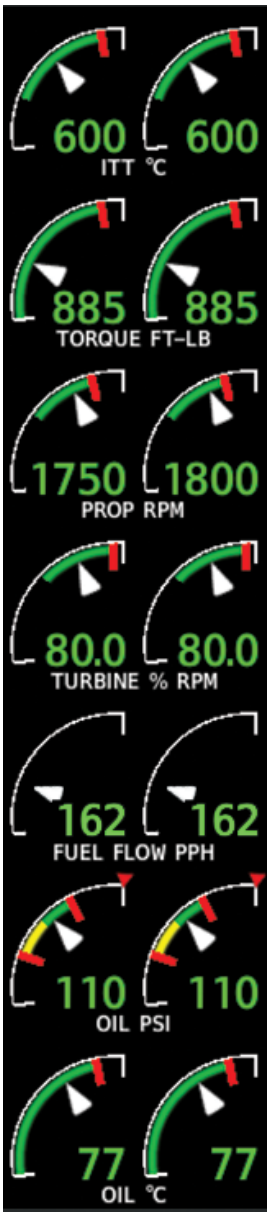


Figure 3-5 EIS Reversionary Mode Display

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 Beechcraft 200/B200 Series is performed by the following Line Replaceable Units (LRUs):

- Primary Flight Display (PFD) (2)
- Multi Function Display (MFD)
- Integrated Avionics Unit (2)
- Audio Panel (2)
- Mode S Transponder (2)
- PFD/MFD Controller

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

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

The Mode S Transponders are controlled with softkeys and the **FMS** Knobs. The Transponder Data Box is located to the left of the System Time Box. The data box displays the selected transponder, the active four-digit code, mode, and a reply status (Figure 4-1).

AUDIO PANEL VOLUME CONTROL

The **VOL/CRSR** Knobs control selection and volume for audio sources that may not be adjustable anywhere else in the system. The small knob controls the volume. Turning the large knob activates and/or moves the cursor (flashing white annunciator or flashing blue annunciator in Blue-Select Mode) to select the audio source to adjust. The cursor will time-out after a few seconds and the position of the cursor will always default back to the **CREW** Key. Pressing the small knob cancels the cursor.

COM and **NAV** volumes may be adjusted either using the audio panel or using the **PFD COM** and **NAV VOL** Knobs. These two methods of adjustment affect the same volume control for each radio; there are not two separate adjustments.

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 COM transceiver frequency is displayed in green. If available, the COM frequency source is pulled from the database and displayed below 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 pressing the **DME** Softkey.

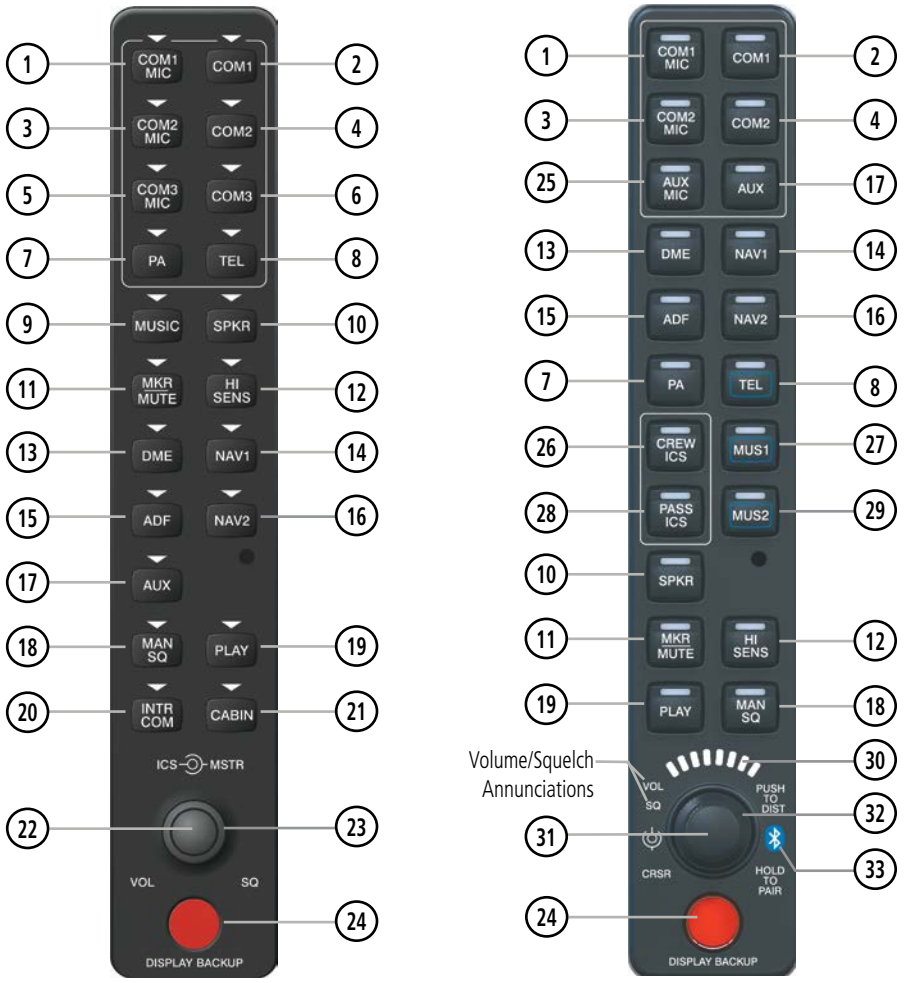
10. **ENT Key –** Validates or confirms DME pairing mode and Auto-tune selection.

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



GMA 1347D GMA 1360D

Figure 4-2 Audio Panel Controls

NOTE: *When a GMA 1347D key is selected, the annunciator above the key is illuminated. When a GMA 1360D Key is selected, the in-key annunciation is illuminated.*

	Control Name	Description	GMA 1347D	GMA 1360D
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 receiver audio can be added by pressing the **COM2** Key. When the PTT is active the annunciation will be flashing.	X	X
2	**COM1**	When selected, audio from the #1 COM receiver can be heard.	X	X
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. When the PTT is active the annunciation will be flashing.	X	X
4	**COM2**	When selected, audio from the #2 COM receiver can be heard.	X	X

	Control Name	Description	GMA 1347D	GMA 1360D
5	**COM3 MIC**	Reserved for optional COM radio.	X	
6	**COM3**	Reserved for optional COM radio.	X	
7	**PA**	Selects the passenger address system. The selected COM transmitter is deselected when the **PA** Key is pressed. A solid annunciation indicates PA mode is active, while a flashing annunciation indicates PTT has been keyed.	X	X
8	**TEL**	When selected, activates the SATCOM transceiver enabling telephone audio and MIC.	X	
		Selects/Deselects the TEL audio source and assigns the Bluetooth device to the TEL audio. Press the **TEL** key until the annunciator turns blue. The in-key annunciator will cycle from OFF to WHITE to BLUE. WHITE selects the wired audio source and BLUE selects the Bluetooth audio source. NOTE: The Bluetooth audio can only be assigned to one source at a time. Once the Bluetooth audio is assigned to an audio source, the remaining entertainment audio sources will only cycle between OFF and WHITE.		X
9	**MUSIC**	Toggles the Music 1 input on or off. Pressing and holding toggles music muting on or off..	X	
10	**SPKR**	Selects and deselects the on-side flight deck speaker. COM, NAV, AUX, PA, and MKR receiver audio can be heard on the speaker.	X	X
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.	X	X
12	**HI SENS**	Press to increase marker beacon receiver sensitivity. Press again to return to low sensitivity.	X	X
13	**DME**	Turns optional DME audio on or off.	X	X
14	**NAV1**	When selected, audio from the #1 NAV receiver can be heard.	X	X
15	**ADF**	Turns optional ADF receiver audio on or off.	X	X
16	**NAV2**	When selected, audio from the #2 NAV receiver can be heard.	X	X
17	**AUX**	Not used in Beechcraft 200/B200 Series aircraft.	X	
		Reserved for optional audio.		X
18	**MAN SQ**	Enables manual squelch for the intercom. When the intercom is active, press the **ICS** Knob to illuminate SQ. Turn the **ICS** Knob to adjust squelch.	X	
		Enables manual squelch for the intercom. When the intercom is active, press the **VOL/SQ** Knob to illuminate the squelch annunciation. Turn the **VOL/SQ** Knob to adjust squelch.		X
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.	X	X
20	**INTR COM**	Selects and deselects the pilot/copilot intercom on both Audio Panels.	X	

	Control Name	Description	GMA 1347D	GMA 1360D
21	**CABIN**	Initiates intercom communications with passengers in the cabin.	X	
22	**ICS Knob**	Turn to adjust intercom volume or squelch. Press to switch between volume and squelch control as indicated by illumination of VOL or SQ. The **MAN SQ** Key must be selected to allow squelch adjustment.	X	
23	**MSTR Knob**	The Master Volume Control adjusts volume for the blended NAV, COM, intercom audio, and alert warnings.	X	
24	**DISPLAY BACKUP Button**	Manually selects PFD/MFD Reversionary Mode.	X	X
25	**AUX MIC**	Reserved for optional audio.		X
26	**CREW ICS**	Controls the crew intercom system. Press and hold to enable/disable onside Bluetooth recording mode.		X
27	**MUS1**	Selects/Deselects the MUS1 audio source and assigns the Bluetooth device to the MUS1 audio. Press the **MUS1** key until the annunciator turns blue. The in-key annunciator will cycle from OFF to WHITE to BLUE. WHITE selects the wired audio source and BLUE selects the Bluetooth audio source. NOTE: The Bluetooth audio can only be assigned to one source at a time for each audio panel. Once the Bluetooth audio is assigned to an audio source, the remaining entertainment audio sources will only cycle between OFF and WHITE.		X
28	**PASS ICS**	Controls the passenger intercom system.		X
29	**MUS2**	Selects/Deselects the MUS2 audio source and can assign the Bluetooth device to the MUS2 audio. Press the **MUS2** key until the annunciator turns blue. The in-key annunciator will cycle from OFF to WHITE to BLUE. WHITE selects the wired audio source and BLUE selects the Bluetooth audio source. NOTE: The Bluetooth audio can only be assigned to one source at a time for each audio panel. Once the Bluetooth audio is assigned to an audio source, the remaining entertainment audio sources will only cycle between OFF and WHITE.		X
30	**Volume/Squelch Indicator**	Indicates volume/squelch setting relative to full scale.		X
31	**Volume/ Squelch (VOL/ SQ) Control Knob**	Turn the smaller knob to control volume or squelch of the selected source (indicated by the flashing white or blue annunciator). When the volume control cursor is not active press to switch to Blue-Select mode. If the volume control cursor is active, press twice (once to cancel the cursor, twice to activate Blue-Select mode). Press and hold for five seconds to enable the audio panel as discoverable for pairing. The Bluetooth Annunciator will flash to indicate that the unit is discoverable. The unit will remain discoverable for 90 seconds or until a successful pair is established. Once a successful pair is established, the audio "Bluetooth paired" is played.		X
32	**Cursor (CRSR) Control Knob**	Turn to move the cursor (flashing white or blue annunciator) to the desired source.		X
33	**Bluetooth® Connection Annunciator**	A flashing cyan annunciator indicates the unit is discoverable. A solid blue annunciator indicates an active Bluetooth connection.		X

PFD/MFD CONTROLLER

The PFD/MFD Controller is a pedestal-mounted interface allowing MFD operation, data entry, COM and NAV tuning, and transponder control. Many procedures can be performed using the PFD/MFD Controller rather than the display bezel controls. Annunciators beside the **FMS**, **XPDR**, **COM**, and **NAV** keys illuminate when their respective control modes are selected. The unit is in FMS control mode by default on system power-up.

The appropriate frequency box on the selected display is outlined by a light blue selection box, which flashes for a few seconds to indicate PFD/MFD Controller activity. Selection of a different display control or radio tuning mode results in cancelation of the previous radio tuning mode.

Figure 4-3 PFD/MFD Controller

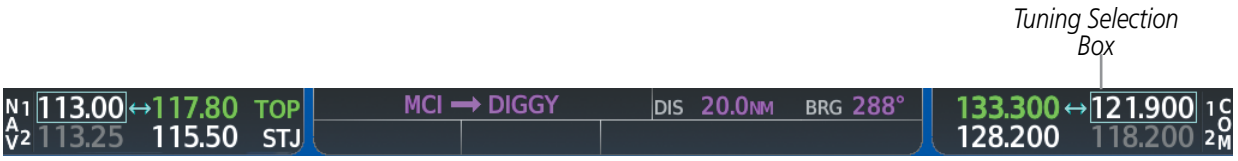


Figure 4-4 Frequency Tuning with the PFD/MFD Controller

1. **CLR Key** – Erases information, cancels entries, or removes menus. Press and hold to activate the Navigation Map Page on the MFD
2. **MENU Key** – Displays a list of options for accessing additional features or making setting changes.

(3) **ENT Key** – Validates or confirms a menu selection or data entry.

(4) **FMS Knob** – Flight Management System Knob. This knob provides tuning capability for the COM and NAV radios when the appropriate **COM** or **NAV** key is pressed. When the **XPDR** Key is pressed, the transponder code may be entered using the **FMS** Knob. The large knob moves the cursor in the window. The small knob selects individual characters for the highlighted cursor location.

(5) **FMS Key** – Sets the **FMS** Knob to control FMS functions on the MFD. When pressed, an annunciator next to the key illuminates indicating adjustment of the **FMS** Knob will now affect FMS functions.

(6) **COM Key** – Sets the **FMS** Knob to control tuning of the COM radios. The first press will select COM1, as indicated by an illuminated "1" to the left of the key. Press again to select COM2. This is annunciated with a "2" to the right of the key. Each subsequent press of the **COM** Key will switch between COM1 and COM2. Use the **FMS** Knob to tune the selected COM The COM Tuning Selection Box is outlined with a light blue line when the COM frequency is active on the PFD/MFD Controller (Figure 4-4).

(7) **Frequency Transfer Key (EMERG)** – Transfers the standby and active COM or NAV frequencies. Press and hold for two seconds to tune the emergency frequency (121.500 MHz) automatically into the COM active frequency field.

(8) **NAV Key** – Sets the **FMS** Knob to control tuning of the NAV radios. The first press will select NAV1, as indicated by an illuminated "1" to the left of the key. Press again to select NAV2. This is annunciated with a "2" to the right of the key. Each subsequent press of the **NAV** Key will switch between NAV1 and NAV2. Use the **FMS** Knob to tune the selected NAV. The NAV Tuning Selection Box is outlined with a light blue line when the NAV frequency is active on the PFD/MFD Controller.

(9) **XPDR Key** – Sets the **FMS** Knob to enter transponder codes. When pressed, an annunciator next to the key illuminates indicating the **FMS** Knob can now be used for transponder code entry. Transponder code entry can be performed with either the number keypad or **FMS** Knob.

(10) **IDENT Key** – Press to activate the IDENT function of the transponder. When the **IDENT** Key is pressed, a green IDNT indication is displayed in the mode field of the Transponder Data Box for 18 seconds.

(11) **SEL Key** – The center of this key activates the selected MFD softkey, while the right and left arrows move the softkey selection box to the right and left, respectively.

(12) **Decimal Key** – Enters a decimal point.

(13) **BKSP Key** – Moves cursor back one character space and removes last character entered.

(14) **Alphanumeric Keys** – Allows data entry (rather than using the **FMS** Knob to select characters/numbers).

4.2 COM OPERATION

COM TUNING BOXES

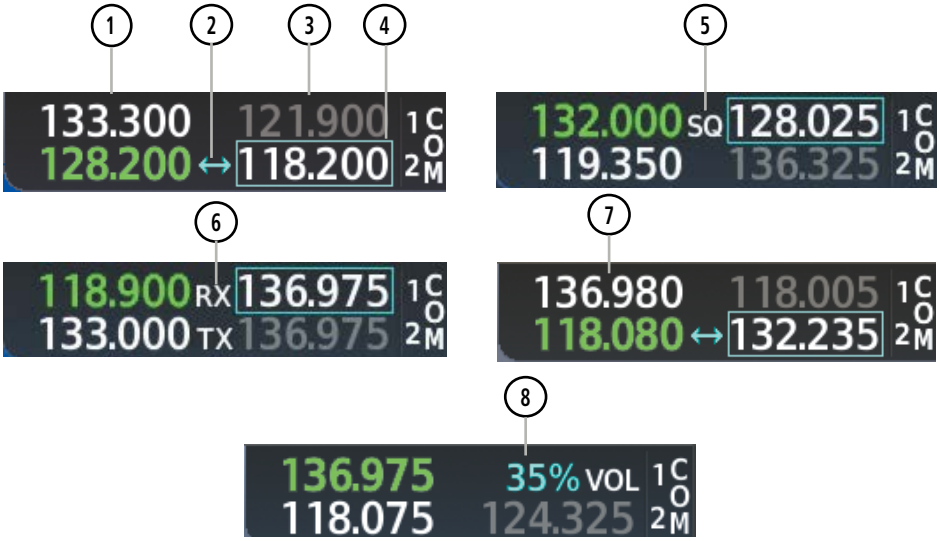


Figure 4-5 COM Tuning Box Indications

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

2. **Frequency Transfer Arrow** – Moves between the upper and lower radio frequency fields with the Frequency Tuning Box. Indicates which COM transceiver is selected for frequency transfer between the Standby and Active fields.

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** – Moves between the upper and lower radio frequency fields with the Frequency Transfer Arrow. Indicates which COM transceiver is to be tuned in the Standby Field.

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.

When the same COM radio is selected on both Audio Panels, the pilot has transmit priority on COM1, the copilot has transmit priority on COM2.

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.

Manual COM frequency tuning from the PFD/MFD Controller

1) Press the **COM** Key to enable the **FMS** Knob for COM tuning. The COM Tuning Selection Box is shown.
2) Press the **COM** Key again, if needed, to select the desired COM radio (1 or 2).
3) Turn the **FMS** Knob to tune the desired frequency in the COM Tuning Box (large knob for MHz; small knob for kHz).

   Or:

   Press the numeric keys on the keypad to enter a Frequency.
4) Press the **Frequency Transfer** Key to transfer the frequency to the active field.

If an error is made during frequency entry with the numeric keypad, pressing the **BKSP** Key moves the cursor back one space. If an incorrect frequency is entered, reenter the correct one using the same procedure.

QUICK-TUNING AND ACTIVATING 121.500 MHZ

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

Figure 4-6 Quickly Tuning 121.500 MHz

AUTO-TUNING THE COM FREQUENCY

COM frequencies can be automatically tuned from the following:

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

AUTO-TUNING FROM THE PFD

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

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

1) Press the **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 4-7 Nearest Airports Window (PFD)

AUTO-TUNING FROM THE MFD

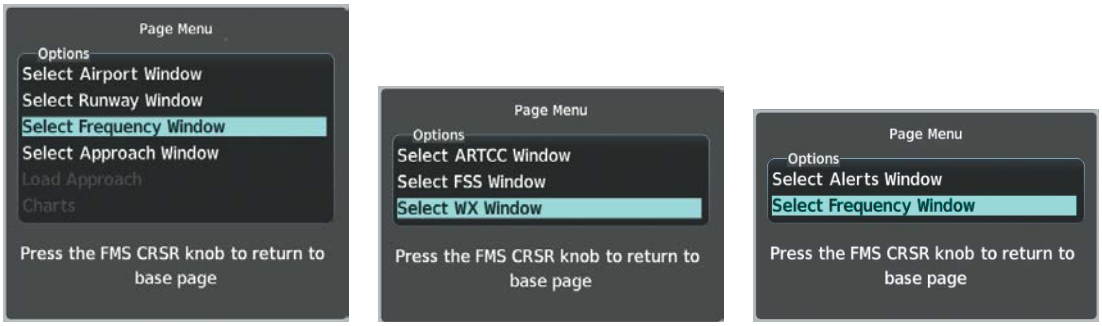
Frequencies can be automatically loaded into the COM Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key.

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 **ENT** Key to display the 'Load Frequency' Window.
5) Turn the **FMS** Knob to place the cursor on the desired NAV frequency field.
6) Press the **ENT** Key to load the NAV frequency into the selected NAV 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.
5) Press the **ENT** Key to display the 'Load Frequency' Window.
6) Turn the **FMS** Knob to select the desired NAV frequency field.
7) Press the **ENT** Key to load the NAV frequency into the selected NAV frequency field.



Nearest Airports Menu *Nearest Frequencies Menu* *Nearest Airspaces Menu*

Figure 4-8 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 4-9 WPT – Airport Information Page

COM frequencies can also be auto-tuned from the 'NRST – Nearest Airspaces' Page, 'NRST – Nearest Frequencies' Page, and 'NRST – Nearest Airports' Page 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 'Aux - System Setup 1' Page.

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 G1000 softkeys are blank.

Figure 4-10 'AUX – System Setup 1' Page

4.3 NAV OPERATION

NAV TUNING BOXES

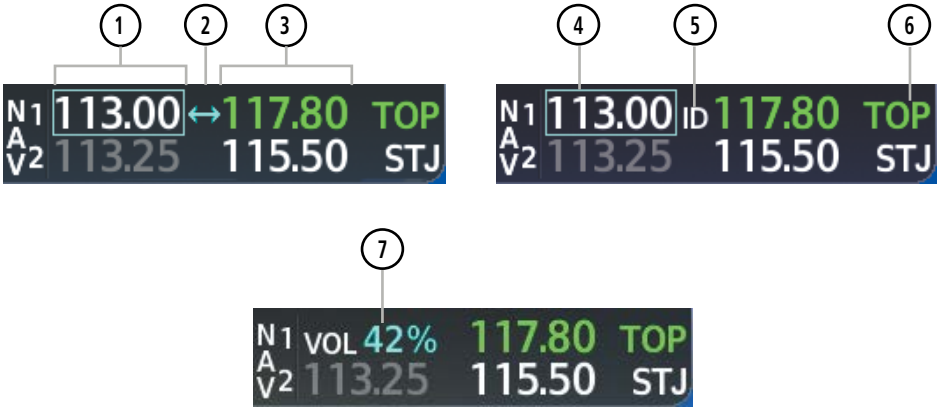


Figure 4-11 NAV Tuning Box Indications

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

While cycling through the **CDI** Softkey selections, the 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 PFDs.

Manually tuning a NAV frequency:

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

Manual NAV frequency tuning from the PFD/MFD Controller

1) Press the **NAV** Key to enable the **FMS** Knob for NAV tuning. The NAV Tuning Selection Box is shown.
2) Press the **NAV** Key again, if needed, to select the desired NAV radio (1 or 2).
3) Turn the **FMS** Knob to tune the desired frequency in the NAV Tuning Box (large knob for MHz; small knob for kHz).

   Or:

   Press the numeric keys on the keypad to enter a Frequency.
4) Press the **Frequency Transfer** Key to transfer the frequency to the active field.

If an error is made during frequency entry with the numeric keypad, pressing the **BKSP** Key moves the cursor back one space. If an incorrect frequency is entered, reenter the correct one using the same procedure.

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 display the 'Load Frequency' Window.
5) Turn the **FMS** Knob to place the cursor on the desired NAV frequency field.
6) Press the **ENT** Key to load the NAV frequency into the selected NAV frequency field.

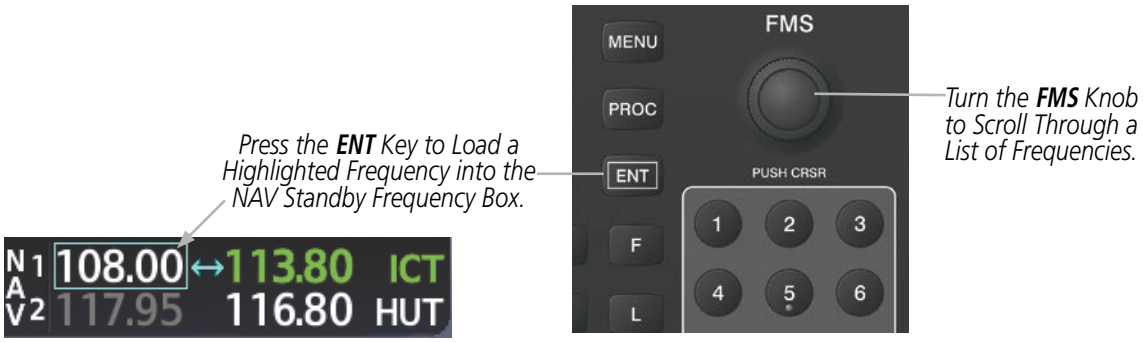
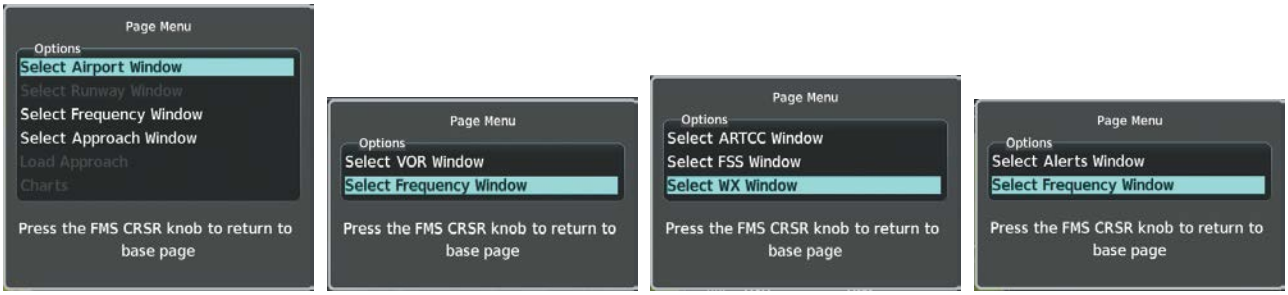


Figure 4-12 NAV Frequency Auto-Tuning from the MFD

Or:

1) When on the NRST pages, press the **MENU** Key on the PFD/MFD Controller to display the page menu.
2) Turn the large **FMS** Knob to scroll through the menu options.
3) Press the **ENT** Key to place the cursor in the desired window.
4) Scroll through the frequency selections with the **FMS** Knob.
5) Press the **ENT** Key to display the 'Load Frequency' Window.
6) Turn the **FMS** Knob to select the desired NAV frequency field.
7) Press the **ENT** Key to load the NAV frequency into the selected NAV frequency field.



Nearest Airports Menu *Nearest VOR Menu* *Nearest Frequencies Menu* *Nearest Airspaces Menu*

Figure 4-13 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.

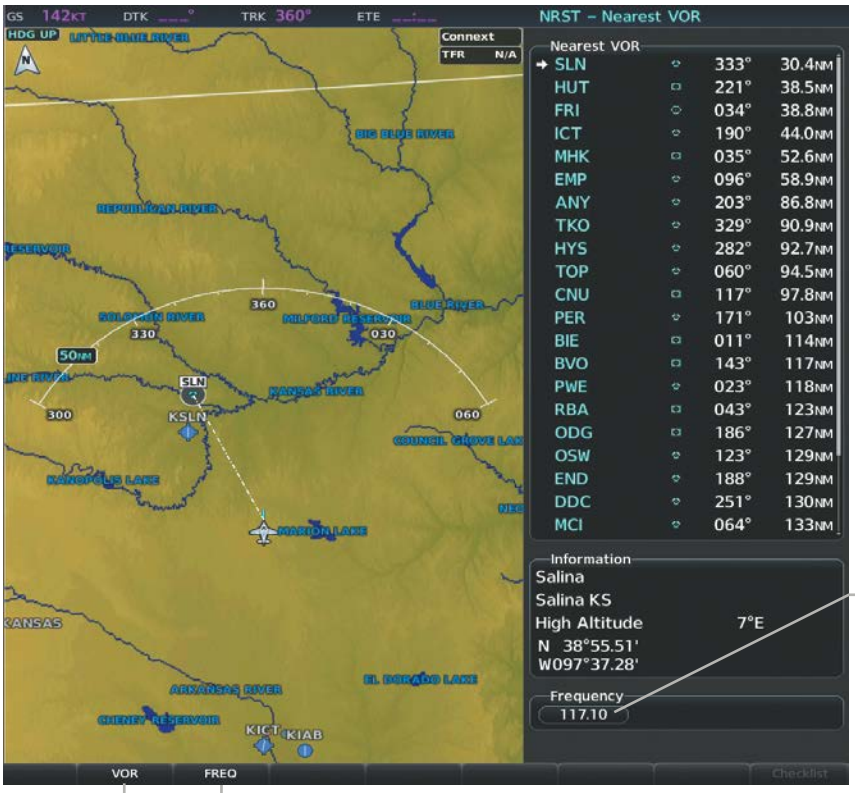


Figure 4-14 Loading the NAV Frequency from the NRST – Nearest VOR Page

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 both PFD1 and PFD2.

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.

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 system for use, the system remembers the last frequency used for DME tuning and the NAV1, NAV2, or HOLD state prior to shutdown.*

The 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.

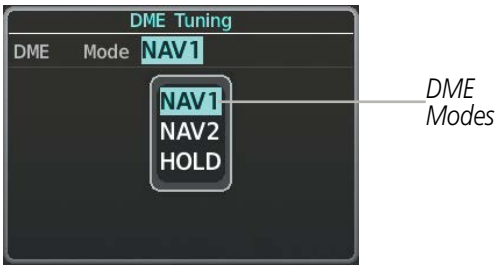


Figure 4-15 DME Tuning Window

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 TRANSPONDERS

The GTX 335R, GTX 345R and GTX 3000 (optional) Mode S Transponders provide Mode A, Mode C, and Mode S interrogation and reply capabilities. Selective addressing or Mode Select (Mode S) capability includes the following features:

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

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

GTX 33D/335/345 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 pressed, the Mode Selection softkeys appear: **XPDR1**, **XPDR2**, **Standby**, **On**, **ALT**, **VFR**, **Code**, **Ident**, and **Back**.

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

Pressing the **Back** Softkey during code selection reverts to the Mode Selection Softkeys. Pressiing 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.

Pressing 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.

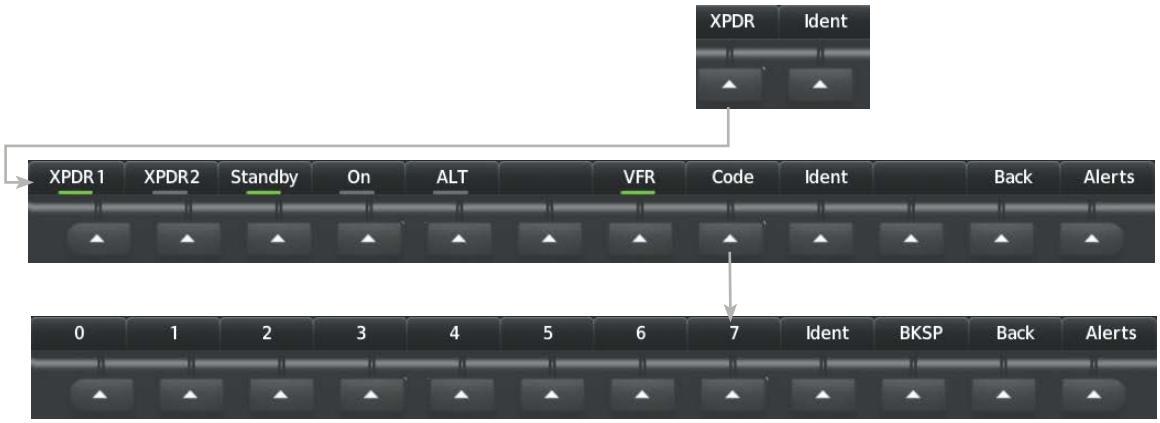


Figure 4-16 XPDR Softkeys (PFD)

Selecting and activating Transponder 1 or Transponder 2:

1) Press the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.
2) Press the **XPDR1** Softkey or the **XPDR2** Softkey to select and activate the desired transponder.

When turning on the system for use, the system activates Transponder 1 as the default unit, regardless of which transponder was active prior to shutdown. When switching between Transponder 1 and Transponder 2, the code and mode remain the same. If a new code is entered in the active transponder, switching transponders does not bring back the previous code.

GTX 33D/335/345 TRANSPONDER MODE SELECTION

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

Selecting a transponder mode:

1) Press the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.
2) Press the **XPDR1** or **XPDR2** Softkey to select the active transponder.
3) Press the desired softkey to activate the transponder mode.

STANDBY MODE (MANUAL)

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

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

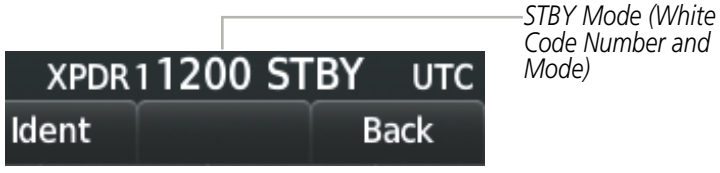


Figure 4-17 Standby Mode

MANUAL ON MODE

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

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

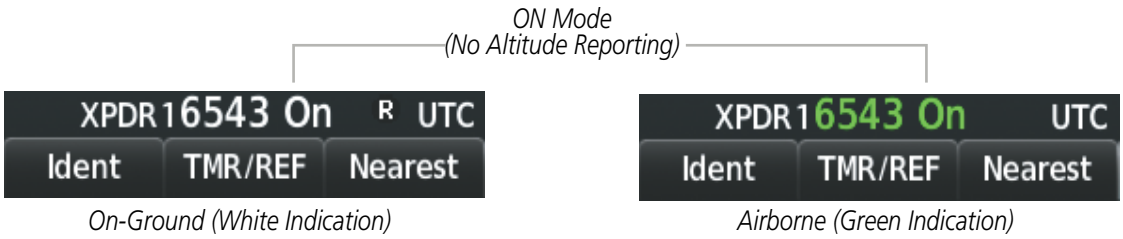


Figure 4-18 ON Mode

ALTITUDE MODE (AUTOMATIC OR MANUAL)

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

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

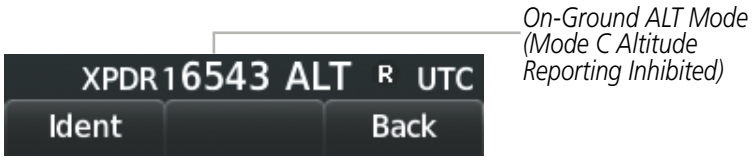


Figure 4-19 Altitude Mode

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

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

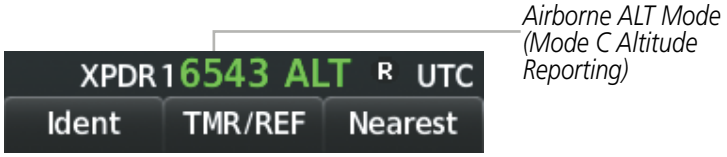


Figure 4-20 Altitude Mode

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.

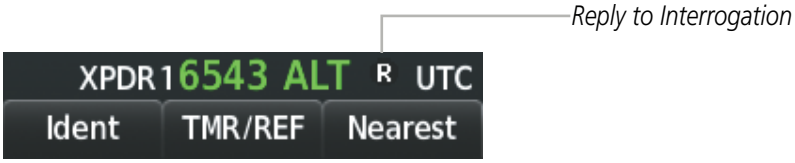


Figure 4-21 Reply Indication

GTX 3000 TCAS II TRANSPONDER CONTROLS (OPTIONAL)

Transponder function is displayed on three levels of softkeys on the PFD: Top-level, Transponder/Traffic Selection, and Mode Selection or Code Entry. When the top-level **XPDR/TFC** Softkey is selected, the Function Select softkeys appear: **XPDR1**, **XPDR2**, **MODE**, **TCAS**, **Code**, **Ident**, **Back**.

When the **MODE** Softkey is pressed, the Mode Selection softkeys appear: **Standby**, **On**, **ALT**, **TA Only**, **TA/RA**, **Back**.

When the **Code** Softkey is pressed, 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. Pressing the numbered softkeys in sequence enters the transponder code. If an error is made, pressing the **BKSP** Softkey moves the code selection cursor to the previous digit. Pressing the **BKSP** Softkey again moves the cursor to the next previous digit.

Pressing the **Back** Softkey returns to the previous 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.

Pressing the **Ident** Softkey while in 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.

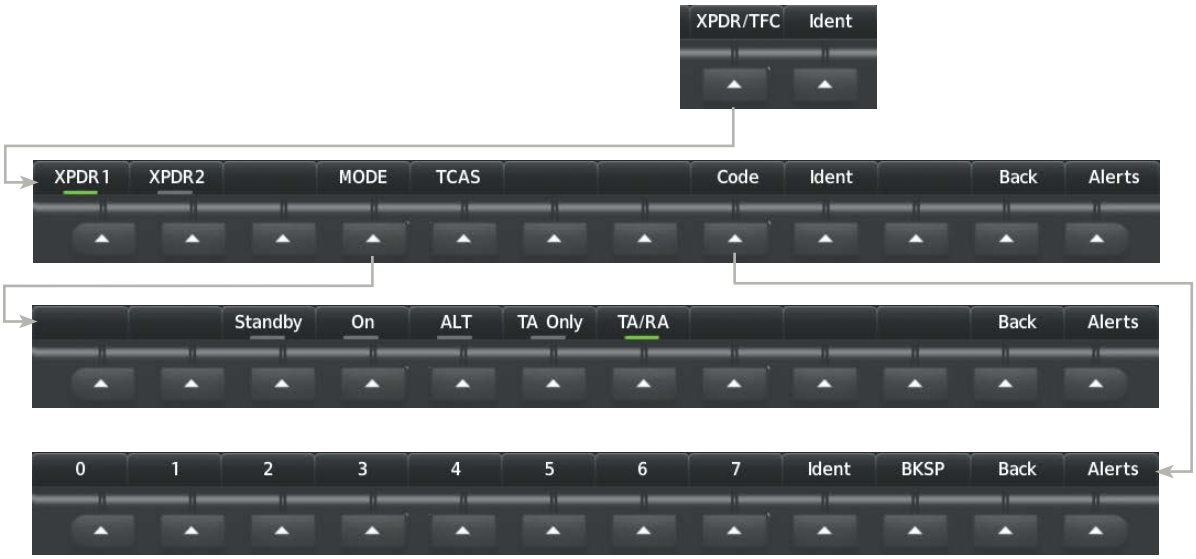


Figure 4-22 Transponder Softkeys (with TCAS II option)

GTX 3000 TCAS II TRANSPONDER MODE SELECTION (OPTIONAL)

Mode selection can be automatic (Altitude Mode) or manual (Standby, On, and Altitude Modes). The **Standby**, **On**, **ALT**, **TA Only**, and **TA/RA** Softkeys can be accessed by pressing the **XPDR/TFC** Softkey, then the **MODE** Softkey.

Selecting a transponder mode:

1) Press the **XPDR/TFC** Softkey.
2) Press the **MODE** Softkey to display the Transponder Mode Selection Softkeys.
3) Press the desired softkey to activate the transponder mode (STBY, On, or ALT).

Selecting a TCAS II mode:

1) Press the **XPDR/TFC** Softkey.
2) Press the **MODE** Softkey to display the TCAS II Mode Selection Softkeys.
3) Press the desired softkey to activate the TCAS II mode (TA Only or TA/RA).

STANDBY MODE (MANUAL)

NOTE: *In Standby Mode, the IDENT function is inhibited. TCAS II is switched to Standby Mode, because the transponder is not capable of supporting TCAS II operation in Standby Mode.*

Standby Mode can be selected at any time by pressing the **STBY** Softkey. In Standby, the transponder does not reply to interrogations, but new codes can be entered. When Standby is selected, a white STBY indication and transponder code appear in the mode field of the Transponder Data Box.

Figure 4-23 Standby Mode

NOTE: *TCAS II is switched to Standby Mode, because the transponder is not capable of supporting TCAS II operation in On Mode.*

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

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

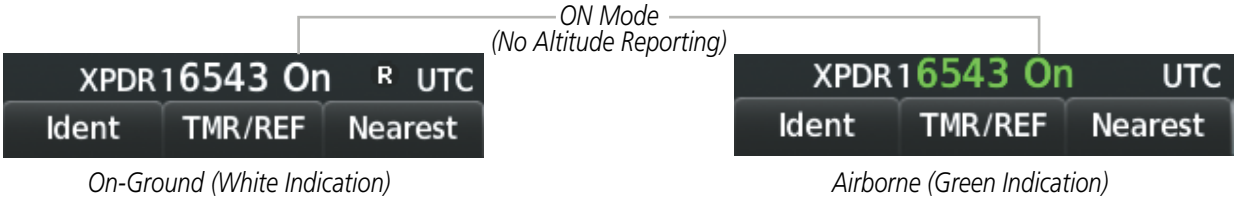


Figure 4-24 On Mode

ALTITUDE MODE (AUTOMATIC OR MANUAL)

NOTE: *TCAS II is switched to Standby Mode when the altitude mode is manually selected using the* ***ALT*** *Softkey.*

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

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

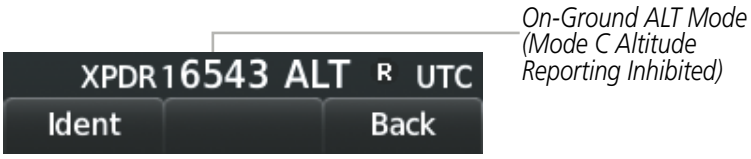


Figure 4-25 Altitude Mode

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

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

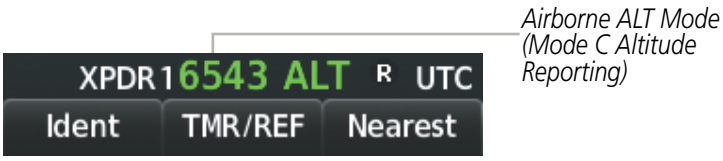


Figure 4-26 Altitude Mode

ENTERING A TRANSPONDER CODE

Entering a transponder code with softkeys:

1) Press the **XPDR** or **XPDR/TFC** 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 selected within 10 seconds, or the entry is cancelled and restored to the previous code. Pressing the **BKSP** Softkey moves the code selection cursor to the previous digit. Five seconds after the fourth digit has been entered, the transponder code becomes active.

Figure 4-27 Entering a Code

Entering a transponder code with the PFD FMS Knob:

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

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

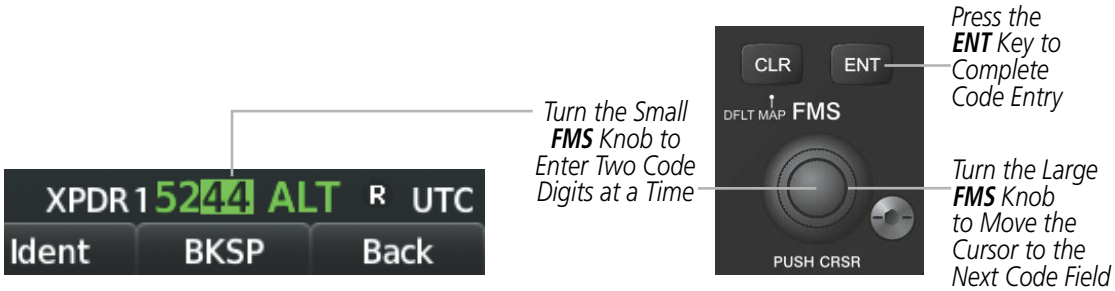


Figure 4-28 Entering a Code with the FMS Knob

Entering a transponder code with the PFD/MFD Controller:

1) Press the **XPDR** Key to select the transponder code field.
2) Turn the small **FMS** Knob on the PFD to enter the first two code digits, turn the large **FMS** Knob to select the last two digits, and turn the small **FMS** Knob to enter the last two code digits.

   Or:

   Press the numeric keys on the keypad to enter a code.

If an error is made during code entry with the numeric keypad, pressing the **BKSP** Key moves the cursor back one space. If an incorrect code is entered, reenter the correct one using the same procedure.

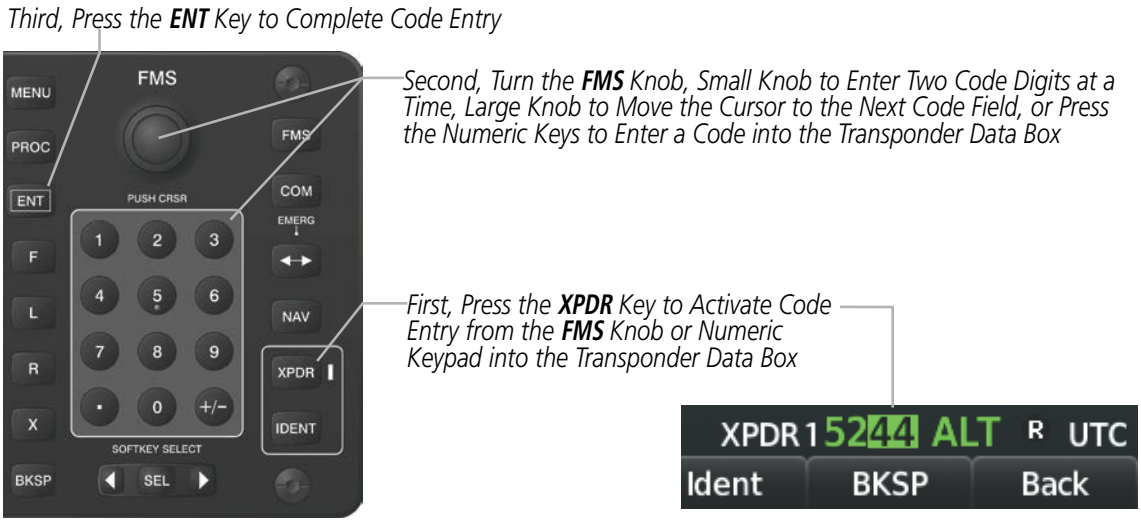


Figure 4-29 Transponder Code Entry from the PFD/MFD Controller

VFR CODE

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

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

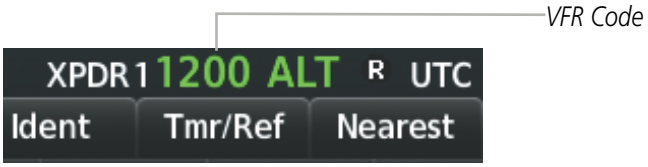


Figure 4-30 VFR Code

IDENT FUNCTION

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

Pressing 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 pressed, 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 pressed while in Mode or Code Selection, the system reverts to the top-level softkeys.

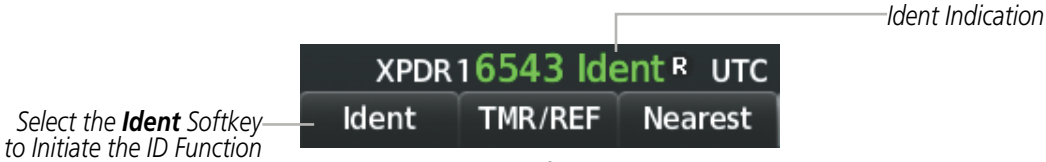


Figure 4-31 Ident Softkey and Indication

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

NOTE: *When the oxygen mask switch on the instrument panel is selected, each pilot's microphone audio is heard on the cross-side speaker. The on-side speaker is also enabled and cannot be deselected.*

Each Audio Panel is connected to a separate flight deck speaker for listening to all of the radios. Each **SPKR** Key controls the on-side speaker unless oxygen masks are in use. During oxygen mask use the on-side speaker is always enabled.

Pressing the **SPKR** Key selects and deselects the speaker. Except for oxygen mask use, speaker audio is muted when the PTT Key is pressed.

UNMUTED INPUTS

Aural alerts are always present on the headset and are on the speaker when the SPKR is selected. These warnings and the aircraft radios are not heard on the passenger headphones.

INTERCOM SYSTEM (ICS) (GMA 1347)

Pressing the **INTR COM** Key on either Audio Panel selects and deselects the intercom on both Audio Panels. The annunciator is lit when the intercom is active. The intercom connects the pilot and copilot together. Either the pilot or copilot may select or deselect the intercom.

The **CABIN** Key initiates two way communication between the pilot or copilot and the passengers in the cabin. The annunciator is lit when the cabin intercom is active on either Audio Panel.

When the flight crew wants to communicate with the passengers, the pilot or copilot presses the **CABIN** Key to signal that communication is desired. The cabin signal must be acknowledged to begin intercom conversation.

The **MAN SQ** Key allows either automatic or manual control of the intercom squelch setting. Pressing the **MAN SQ** Key enables manual squelch control, indicated by the MAN SQ annunciator.

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

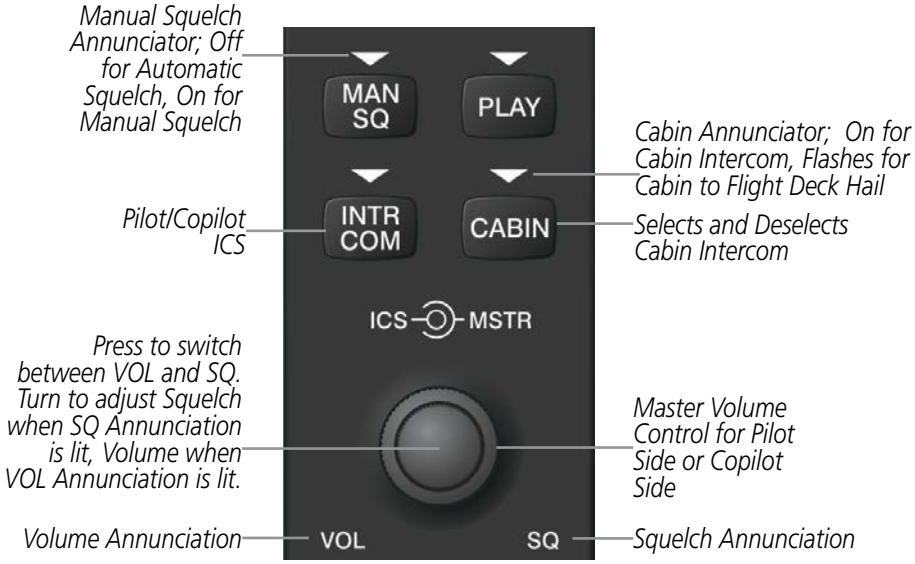


Figure 4-32 Intercom Controls (GMA 1347)

INTERCOM SYSTEM (ICS) (GMA 1360)

The GMA 1360D includes an intercom system, two MUSIC inputs, and one telephone/entertainment input for the pilot, copilot and passengers. The intercom provides Crew and Passenger audio isolation.

Pilot (Audio Panel #1) **Copilot (Audio Panel #2)**

Figure 4-33 Intercom Controls (GMA 1360)

Press the **CREW ICS** Key and/or the **PASS ICS** Key to enable intercom audio for the selected position. If the annunciators are lit, those positions will share intercom audio. If an annunciator is NOT lit that position is isolated from the others. The **CREW ICS** Key is shared betweeen the Audio Panels for ICS distribution. The **PASS ICS** Key is not shared betweeen the Audio Panels for ICS distribution.

INTERCOM MODES

Audio Panel #1	Audio Panel #2	Pilot Hears	Copilot Hears	Passenger Hears
		Onside Radios Aural Alerts	Onside Radios Aural Alerts	Passenger MIC
		Onside Radios Aural Alerts Copilot MIC	Onside Radios Aural Alerts Pilot MIC	Passenger MIC
		Onside Radios Aural Alerts Passenger MIC	Onside Radios Aural Alerts	Pilot MIC Passenger MIC Pilot Selected Radio
		Onside Radios Aural Alerts	Onside Radios Aural Alerts Passenger MIC	Copilot MIC Passenger MIC Copilot Selected Radios
		Onside Radios Aural Alerts Copilot MIC Passenger MIC	Onside Radios Aural Alerts Pilot MIC	Pilot MIC Passenger MIC Pilot Selected Radios
		Onside Radios Aural Alerts Passenger MIC	Onside Radios Aural Alerts Passenger MIC	Pilot MIC Copilot MIC Passenger MIC Pilot Selected Radios Copilot Selected Radios
		Onside Radios Aural Alerts Copilot MIC	Onside Radios Aural Alerts Pilot MIC Passenger MIC	Copilot MIC Passenger MIC Copilot Selected Radios
		Onside Radios Aural Alerts Copilot MIC Passenger MIC	Onside Radios Aural Alerts Pilot MIC Passenger MIC	Pilot MIC Copilot MIC Passenger MIC Pilot Selected Radios Copilot Selected Radios

INTERCOM VOLUME AND SQUELCH

The **VOL/CRSR** Knob controls selection and volume or manual squelch adjustment for audio sources that may not be adjustable anywhere else in the system. The small knob controls the volume or squelch. Turning the large knob activates and/or moves the cursor (flashing white annunciator or flashing blue annunciator in Blue-Select Mode) to select the audio source to adjust. The cursor will time-out after a few seconds and the position of the cursor will always default back to the **CREW** Key. Pressing the small knob cancels the cursor.

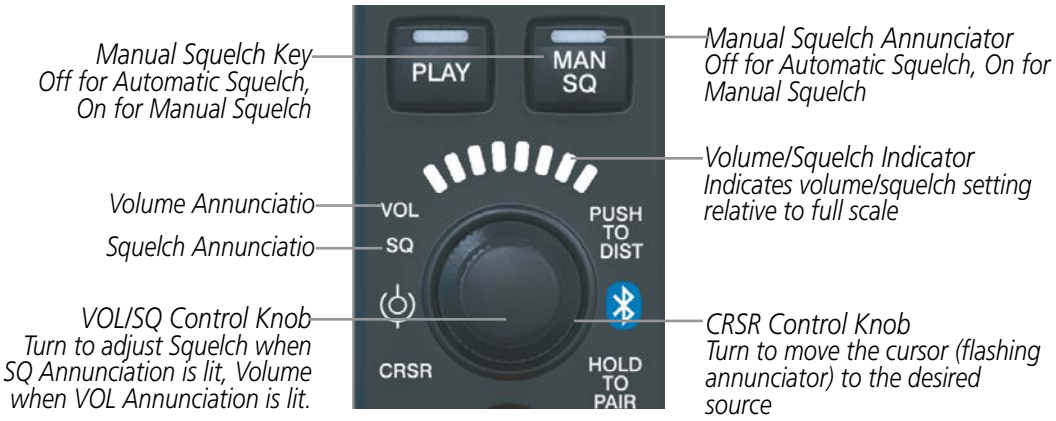


Figure 4-34 Volume/Squelch Control (GMA 1360)

PASSENGER ADDRESS (PA) SYSTEM

A passenger address system is provided by pressing the **PA** Key to deliver messages to the passengers. The message is heard by the other pilot on the headset only if the **CREW ICS** Key is enabled. PA messages are one way from the flight deck to the passengers.

A Push-to-talk (PTT) must be pressed to deliver PA announcements to the passengers over their headphones.

When PA is selected on the Audio Panel, the annunciator flashes about once per second while pressing the PTT, the COM MIC annunciators are no longer lit, and the active COM frequency for that Audio Panel changes to white, indicating that there is no COM selected.

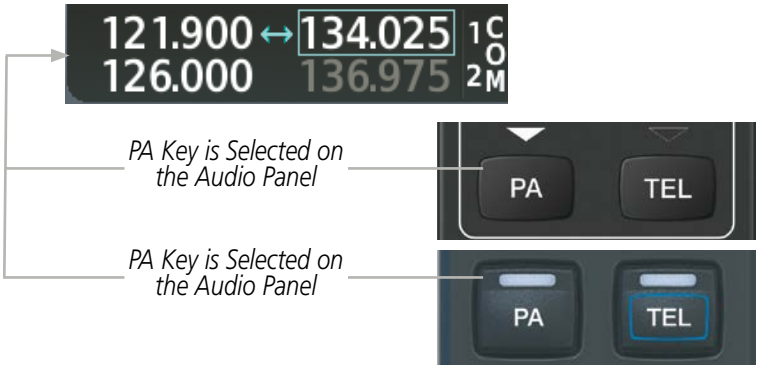


Figure 4-35 PA Key Selected for Cabin Announcements

SIMULTANEOUS COM OPERATION

Both the pilot and the copilot can transmit and receive simultaneously over separate COM radios. The selected COM MIC Annunciator flashes when either pilot's microphone PTT is pressed.

If both pilots select the same COM radio, the pilot has priority on COM1 and the copilot has priority on COM2.

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.

Press the microphone push-to-talk button to stop playback.

Powering off the unit automatically clears all recorded blocks.

Figure 4-36 PLAY Key

3D AUDIO (GMA 1360)

3D Audio is useful when multiple audio sources are present while using COM1 or COM2. By using different responses in each ear, 3D audio processing creates spatial separation from each audio source, aiding in the distinction of which audio source the pilot is hearing.

Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If an aircraft is not wired to support stereo headsets, or the crew does not use stereo headsets, then COMs audio will be distributed to both ears regardless of the 3D audio functionality selection.

With a single COM selected and 3D Audio enabled, the listener will hear the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM1 at the 11 o'clock position and at the 1 o'clock position. The scope of 3D Audio is limited to COM audio for pilot and copilot stations. All other audio (alerts, side-tones, intercom, etc.) will be distributed equally to both ears.

Enabling 3D Audio

See the Audio discussion in System Overview for information on operation of 3D Audio. When 3D Audio is enabled, the aural message "3D audio left" is heard in the left ear followed by "3D audio right" in the right ear. If the aural messages are not heard in only the left and then the right ear respectively, the cause may be aircraft wiring or headset settings. Refer to the following table if a headset or aircraft wiring problem is suspected.

3D Audio Troubleshooting				
Symptom(s)	**Cause(s)**		**Solution(s)**	
"3D audio left" message heard in both ears. "3D audio right" message not heard	1)	Mono headset in use	1)	Use a stereo headset
	2)	Stereo headset in use with mono/stereo switch set to 'mono'	2)	Set mono/stereo switch on headset to 'stereo'
	3)	Aircraft wiring has left audio wired to both left and right channels of stereo headset jack	3)	If after checking solutions #1 and #2 see a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.
"3D audio left" message heard in both ears, followed by "3D audio right" message heard in both ears	1)	Mono headset in use	1)	Use a stereo headset
	2)	Stereo headset in use with mono/stereo switch set to mono	2)	Set mono/stereo switch on headset to 'stereo'
	3)	Incorrect aircraft wiring (left/right shorted together)	3)	If after checking solutions #1 and #2 see a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.
"3D audio right" message heard in both ears. "3D audio left" not heard	1)	Incorrect aircraft wiring (right channel used for mono instead of left or left/right swapped)	1)	See a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.
"3D audio left" message heard in right ear only followed by "3D audio right" message heard in left ear only	1)	Stereo headset is on backwards	1)	Verify correct orientation from the left/right indication on each side of the headset or the position of the boom mic (usually attached on left side). If the headset is backwards left/right position information will be swapped.
	2)	Incorrect aircraft wiring (left/right channels swapped)	2)	See a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.
"3D audio left" message heard in left ear only, no audio heard in right ear.	1)	Aircraft wired for mono intercom	1)	See a service center to wire the installation for stereo headsets.
"3D audio right" message heard in right ear only, no audio heard in left ear	1)	Incorrect aircraft wiring (right channel used for mono instead of left, or left/right swapped)	1)	See a service center as soon as possible to inspect/correct wiring. This wiring fault can cause fail-safe audio not to function.

TELEPHONE/ENTERTAINMENT INPUTS

ENTERTAINMENT INPUTS (GMA 1347)

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.

TELEPHONE/ENTERTAINMENT INPUTS (GMA 1360)

The audio panel provides three stereo telephone/entertainment inputs:

- The **TEL** Key, the **MUS1** Key and the **MUS2** Key control a telephone or entertainment device connected to the rear of the audio panel or connected using Bluetooth.
- SiriusXM Radio audio, if equipped, is wired to the MUS1 and MUS2 inputs.

Distribution of the entertainment inputs are configured in Blue-Select Mode.

Iridium phone distribution for passengers can be controlled by either audio panel, but the volume adjustment is controlled only by the on-side audio panel, even if TEL has been deselected.

Telephone and Entertainment Muting

Telephone and entertainment muting is configured at installation. Regardless of configuration, telephone and entertainment audio is always muted during alerts.

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.

BLUE-SELECT MODE (GMA 1360)

The music (MUS) and telephone (TEL) audio are distributed using the Blue-Select Mode. The following example indicates that the pilot will hear the telephone, and all passengers will hear the Music 2 audio.

Pilot (Audio Panel #1) Copilot (Audio Panel #2)

Figure 4-37 Blue-Select Mode (Telephone/Entertainment Distribution)(GMA 1360)

The Blue-Select Mode is entered by pressing the small knob when the volume control cursor (flashing white annunciator) is not active. If the volume control cursor is active, press the small knob twice. The first press will cancel the volume control cursor, the second will activate Blue-Select Mode.

The annunciator over the **TEL** Button will be flashing blue. Any combination of the annunciators over the **CREW ICS** Button and the **PASS ICS** Button may be blue. Select the desired button to turn the blue annunciator on or off to distribute the telephone audio to selected crew/passenger positions. Turn the large knob to select MUS1 or MUS2, and select the crew/passenger positions to receive the music audio. The **CREW ICS** Key is not shared between the Audio Panels for Blue-Select Mode. The **PASS ICS** Key is shared between the Audio Panels for Blue-Select Mode.

Selecting any button other than CREW ICS, PASS ICS, TEL, MUS1, or MUS2 will cancel Blue-Select Mode. Pressing the **VOL/SQ** Knob will also cancel Blue-Select Mode. After approximately ten seconds with no input, the Blue-Select Mode will automatically cancel.

NOTE: *Bluetooth telephone audio is not available for distribution to the passenger position via Blue Select Mode.*

BLUETOOTH® SETUP (GMA 1360)

NOTE: *Pairing is only necessary during the first attempt to connect a Bluetooth device. Once paired, the Audio Panel and the device will connect automatically.*

PAIRING A BLUETOOTH DEVICE WITH AN AUDIO PANEL

Press and hold the **VOL/SQ** Knob for two seconds. The Bluetooth Annunciator flashes to indicate the unit is discoverable and the aural message "**Bluetooth discoverable**" is heard. The Audio Panel will remain discoverable for 90 seconds or until a successful pair is established. Once paired, the Bluetooth Annunciator turns steady blue and the aural message "**Bluetooth connected/paired**" is heard.

ASSIGNING AN AUDIO SOURCE TO THE BLUETOOTH DEVICE

To enable a telephone conversation utilizing a Bluetooth connection to either GMA-1 or GMA-2 , press the **TEL** Key (Blue Select Mode). Pressing the **TEL** Key on GMA-1 telephone audio will only be heard by the pilot. Pressing the **TEL** Key on GMA-2 telephone audio will only be heard by the copilot. Adjusting the distribution of blue **TEL** audio to the passenger position is not possible. Music can be heard by either pilot position or passengers by pressing the **MUS1** Key (Blue Select Mode) on each GMA and adjusting the distribution as desired.

For music sources that are selected on by both pilots, the Bluetooth distribution to passengers is shared between audio panels (if one pilot turns passenger distribution on or off, that is reflected on the other pilot's audio panel).

And although music can be distributed to all passengers by either audio panel, music volume for passengers is adjusted only by the audio panel that each passenger is connected to.

Bluetooth audio will maintain a separate volume level and Blue Select distribution from the wired audio source.

NOTE: *The Bluetooth audio can only be assigned to one source per Audio Panel at a time. Once the Bluetooth audio is assigned to an audio source, the remaining entertainment audio sources on that Audio Panel will only cycle between OFF and WHITE.*

ADDITIONAL BLUETOOTH CONTROL FUNCTIONS

When the Audio Panel detects a recording device as the Bluetooth connected device, the CREW ICS Annunciator will turn BLUE. All audio heard by the Pilot will be recorded. Press and hold the **CREW** ICS Button to enable/disable Bluetooth Recording mode.

4.6 AUDIO PANELS PREFLIGHT PROCEDURE

NOTE: *If the flight crew is 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 max 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 flight crew is now able to set the ICS squelch manually. If manual squelch is set to full open (SQ annunciated and the small knob 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 the flight crew in maximizing the use of the Audio Panels as well as prevent flight crew induced issues. These preflight procedures should be performed each time a flight crew boards the aircraft to insure awareness of all audio levels in the Audio Panels and radios.

Once this procedure has been completed, the master volume controls on both Audio Panels may now be adjusted. The flight crew can change settings, keeping in mind the notes above.

Setting the Audio Panels during preflight:

1) Verify that the CREW ICS and PASS ICS annunciators are lit.

2) Adjust radio volume levels (COM, NAV, etc.) to a suitable level.

3) Use the Blue-Select Mode to distribute TEL, MUS1, and MUS2 appropriately.

4) Use the **VOL/SQ** Knob to adjust the intercom volumes to the desired level.

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 on the PFD to advise the crew of a stuck microphone.

The **COM1 MIC** Key Annunciator or the **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.

PFD FAILURE, DUAL SYSTEM

If PFD1 fails, COM1 and NAV1 display a red X on both remaining displays. NAV1 is unavailable. COM1 automatically tunes 121.500 MHz, but the frequency is not shown. The COM1 emergency frequency is available to both the copilot and pilot.

If PFD2 fails, COM2 and NAV2 display a red X on the remaining PFD display. NAV2 is unavailable. COM2 tunes 121.500 MHz, but the frequency is not shown. The COM2 emergency frequency is available to both the copilot and pilot.

AUDIO PANEL FAIL-SAFE OPERATION

If there is a failure of both Audio Panels, a fail-safe circuit connects the pilot's headset and microphone directly to the COM1 transceiver and the copilot's headset directly to the COM2 transceiver. Audio is not available on the speakers.

If there is a failure of one Audio Panel, the remaining one does not have access to the others side's COM and NAV. For example, if the pilot side Audio Panel fails, the copilot side Audio Panel has access to all the radios except for COM1 and NAV1. If a single Audio Panel has failed, COM volume control is not adjustable on the failed Audio Panel, audio volume will default to a set level.

REVERSIONARY MODE

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

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 three full color displays: two Primary Flight Displays (PFD) and one Multi Function Display (MFD). The information to successfully navigate the aircraft using the GPS sensors is displayed on the PFD and the MFD. A brief description of the GPS navigation data on the PFD 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), or Missed Approach (MAPR)).

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

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

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

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

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

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

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

NAVIGATION STATUS BOX AND DATA BAR

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

Figure 5-4 PFD Navigation Status Box

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

The symbols used in the PFD status box are:

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

Table 5-1 PFD Status Bar 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)
- **ISA** (Temperature at standard pressure)
- **LDG** (ETA at final destination)
- **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

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

Changing a field in the MFD Navigation Data Bar:

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

5.2 USING MAP DISPLAYS

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

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

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

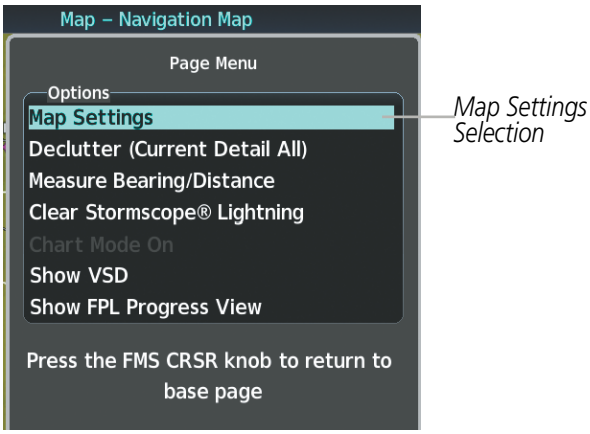


Figure 5-7 Navigation Map Page Menu

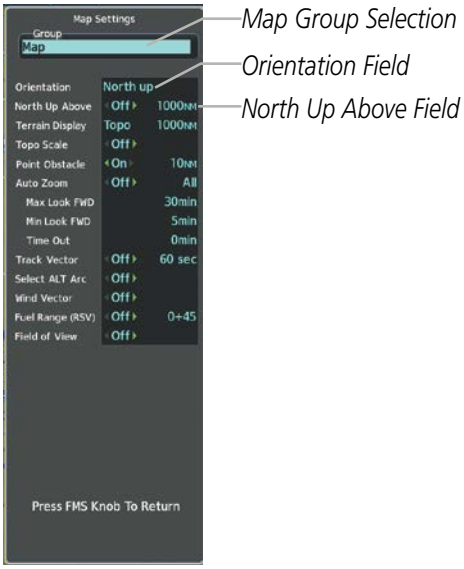


Figure 5-8 Map Settings Menu - Map Group

Changing the Navigation Map orientation:

1) With the 'Map - Navigation Map' Page displayed, press the **MENU** Key. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key to display the 'Map Settings' Menu.
3) Select the 'Map' Group.
4) Press the **ENT** Key.
5) Turn the large **FMS** Knob, or press the **ENT** Key once, to select the 'Orientation' Field.
6) Turn the small **FMS** Knob to select the desired orientation.
7) Press the **ENT** Key to select the new orientation.
8) Press 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' Menu is displayed.
3) Select the 'Map' group.
4) Press the **ENT** Key.
5) Highlight the 'North Up Above' Field.
6) Select 'On' or 'Off' using the small **FMS** Knob.
7) Press the **ENT** Key to accept the selected option. The flashing cursor highlights the range field.
8) Use the small **FMS** Knob to select the desired range.
9) Press the **ENT** Key to accept the selected option.
10) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

MAP RANGE

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

Figure 5-9 Map Range

AUTO ZOOM

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

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

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

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

- When the maximum 'look forward' time is set to zero, the upper limit becomes the maximum range available (1000 nm).
- When the minimum 'look forward' time is set to zero, the lower limit becomes 1.5 nm.

Configuring automatic zoom:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Menu 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) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

MAP PANNING

Map panning allows the pilot to:

- View parts of the map outside the displayed range without adjusting the map range
- Highlight and select locations on the map
- Review information for a selected airport, NAVAID or user waypoint
- Designate locations for use in flight planning
- Graphically create user waypoints
- Measure the bearing distance from the aircraft present position to any location on the navigation map, or between any two points on the navigation map
- 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.*

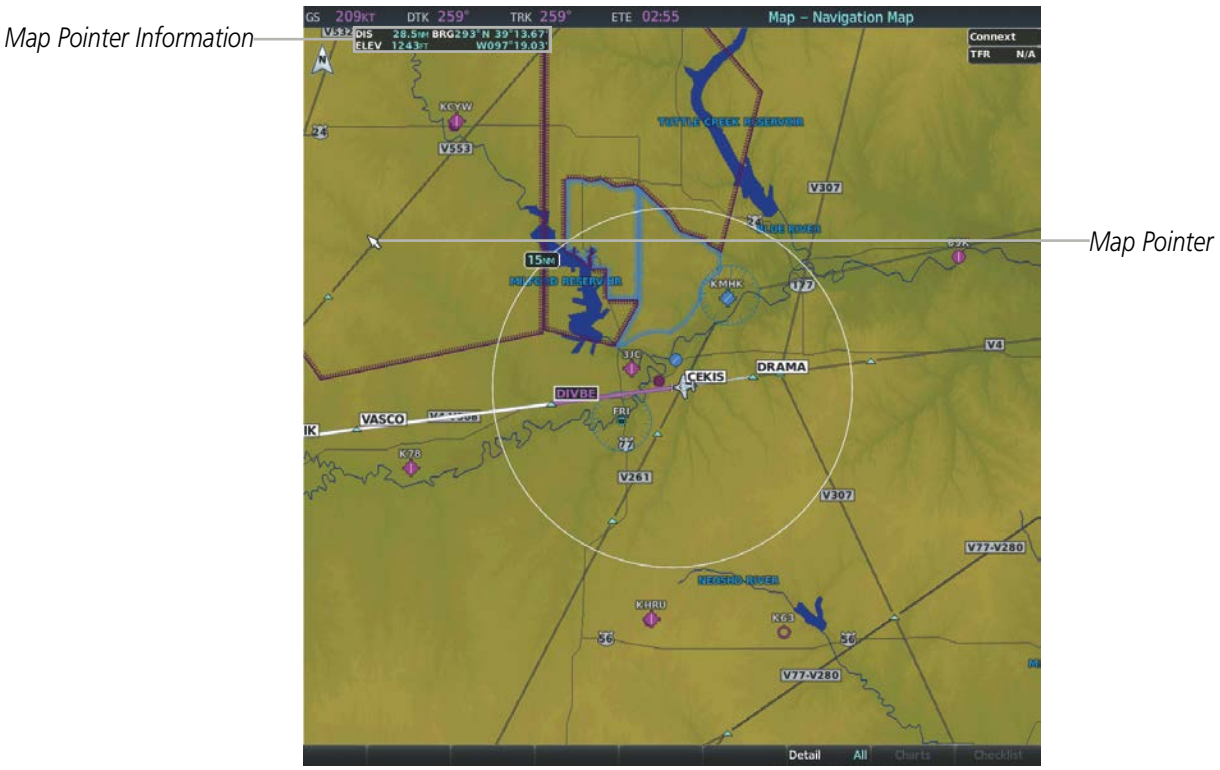


Figure 5-10 Navigation Map - Map Pointer Activated

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

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

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.

Panning the map:

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

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

1) With the desired map page displayed 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 'WPT - <Waypoint> Information' Page for the selected waypoint.
3) Press the **Go Back** Softkey, the **CLR** Key, or the **ENT** Key to return to the 'Map - Navigation Map' Page showing the selected waypoint.

Reviewing information for a special-use or controlled airspace:

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

MEASURING BEARING AND DISTANCE

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

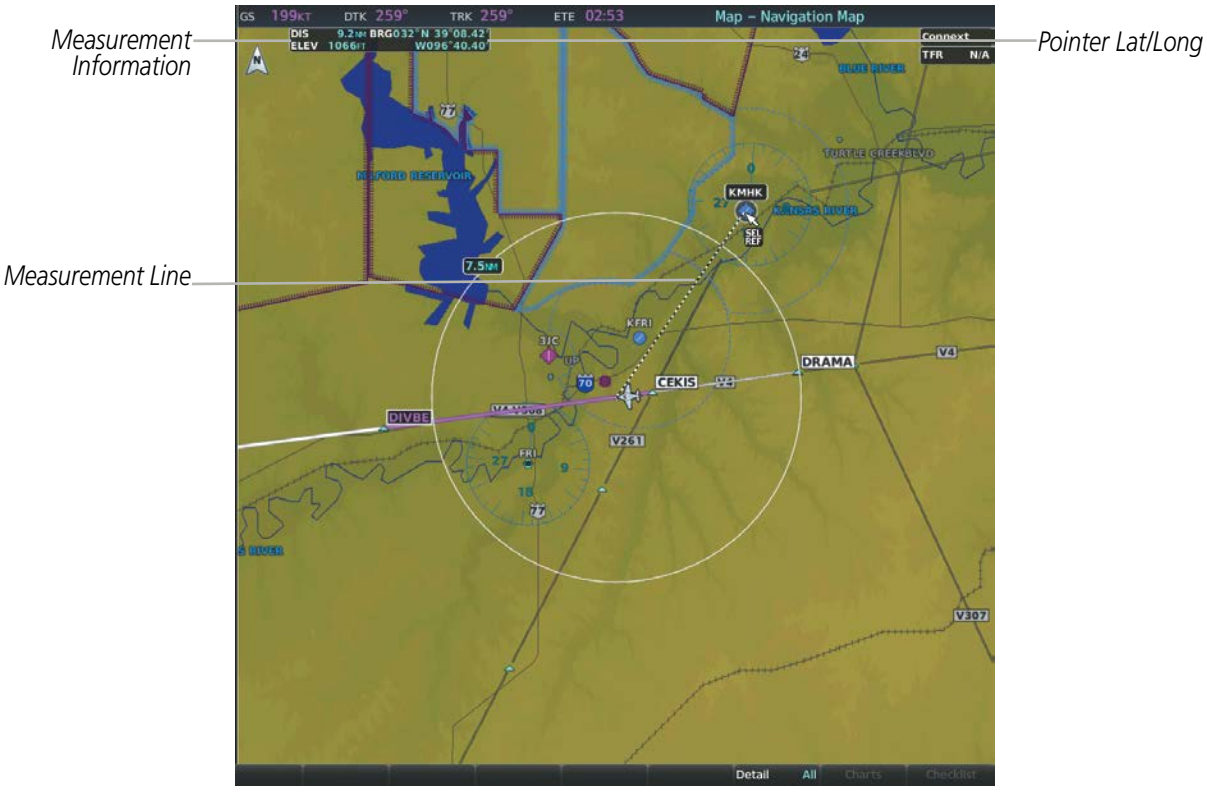


Figure 5-12 Navigation Map - Measuring Bearing and Distance

Measuring bearing and distance between any two points:

1) Press the **MENU** Key (with the 'Map - Navigation Map' Page 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 navigation maps can display 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.

Topographic data can be displayed or removed as described in the following procedures. Topographic data can also be displayed on the selectable VSD Inset at the bottom of the navigation map. In addition, the Navigation Map can display a topographic scale (located in the lower right hand side of the map) showing a scale of the terrain elevation and minimum/maximum displayed elevations.(the profile map is not available if TAWS-A is configured).

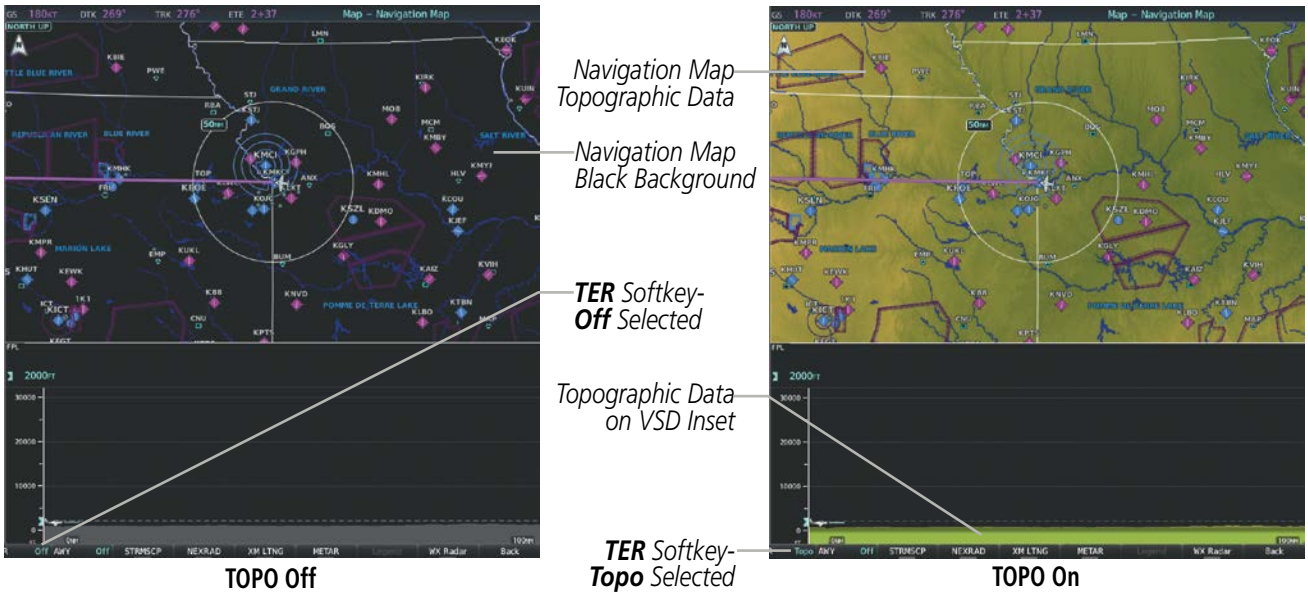


Figure 5-13 Navigation Map - Topographic Data

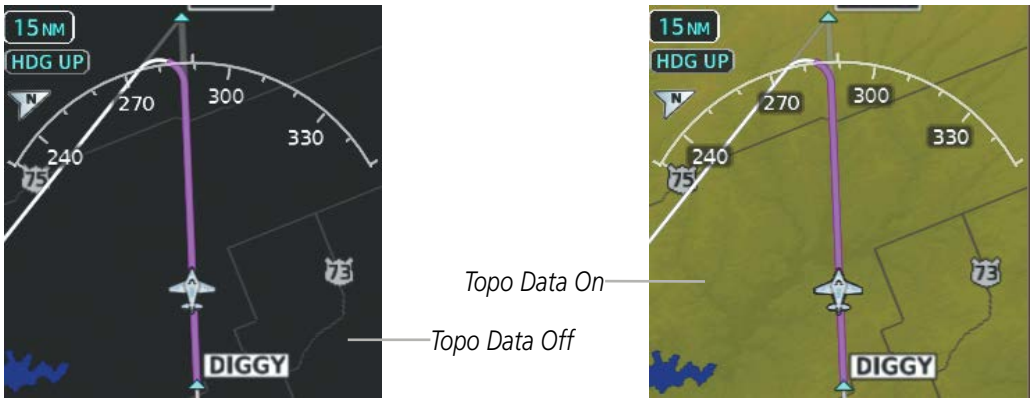


Figure 5-14 PFD Inset Map - Topographic Data

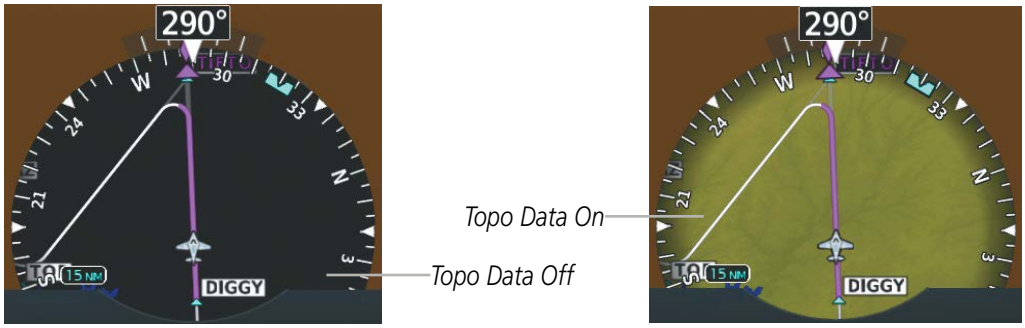


Figure 5-15 HSI Map - Topographic Data

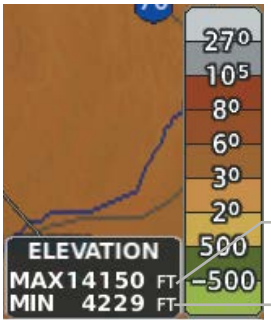


Figure 5-16 Navigation Map - Topo Scale

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

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

Displaying/removing topographic data on the PFD Inset Map or the HSI Map:

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

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

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' Menu 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' 'Off, Topo, REL' field.
6) Turn the small **FMS** Knob to select 'Topo' or 'Off'.
7) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

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' Menu 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) Press 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' Menu 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' 'On/Off' field.
5) Turn the small **FMS** Knob to select 'On' or 'Off'.
6) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

MAP SYMBOLS

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

LAND SYMBOLS

The following items are configured on the land menu:

Land Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
User Waypoint		25	1000
Highways and Roads			
Interstate Highway (Freeway)		50	400
International Highway (Freeway)		50	400
US Highway (National Highway)		15	150
State Highway (Local Highway)		2.5	100
Local Road (Local Road)	N/A	4	25
Railroads (RAILROAD)		7.5	25
Large City (> 200,000)		100	1000
Medium City (> 50,000)		50	400
Small City (> 5,000)		25	100
State/Province		400	1000
River/Lake		75	100
Latitude/Longitude (LAT/LON)		1	1000

Table 5-2 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the aviation menu:

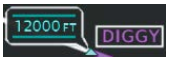
Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Large Airport (Longest Runway ≥ 8100 ft)		100	1000
Medium Airport (8100 ft > Longest Runway ≥ 5000 ft, or Longest Runway < 5000 ft with control tower)		50	400
Small Airport (Longest Runway < 5000 ft without a control tower)		25	150
Taxiways (SafeTaxi)	See Additional Features	1.5	5
Runway Extension		7.5	150
Missed Approach Preview On/Off (Missed APPR)	N/A	N/A	N/A
Intersection (INT)		25	40
Non-directional Beacon (NDB)		25	50
VOR		50	250
VOR Compass Rose On/Off	N/A	N/A	N/A
Visual Reporting Point (VRP)		25	40
Temporary Flight Restriction (TFR)		250	1000
VNAV Constraints		1000	1000

Table 5-3 Aviation Symbol Information

AIRSPACE SYMBOLS

The following items are configured on the airspace menu:

Airspace Symbols	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)		*	*
Class B/Terminal Manoeuvring Area** and surrounding Airways** (CL B/TMA/AWY)		50	150
Class C Airspace/Control Area (CL C/CTA)		50	100
Class D Airspace/ Class A Airspace (CL A/D)		10	100
Restricted and Prohibited Areas (Restricted)		50	100
Military Operations Areas (MOA (Military))		50	250
ADIZ, Alert, Danger, and Warning (Other)	(see below)	50	250
ADIZ			
Alert			
Danger/Warning			

* Label placement and range is determined by the system for best display and minimal clutter
** Applies to European airspace only

Table 5-4 Airspace Symbol Information

SYMBOL SETUP

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

Setting up the 'Land', 'Aviation' or 'Airspace' group items:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Menu is displayed.
3) Turn the small **FMS** Knob to select the desired group.
4) Press the **ENT** Key. The cursor flashes on the first field.
5) Turn the large **FMS** Knob to select the desired option.
6) Turn the small **FMS** Knob to select the desired setting (e.g. On/Off or maximum range).
7) Press the **ENT** Key to accept the selected option and move the cursor to the next item.
8) Repeat steps 5-7 as necessary.
9) Press the **FMS** Knob to return to the '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
User Waypoints		X	X
Latitude/Longitude Grid		X	X
NAVAIDs (does not declutter if used to define airway)		X	X
VRPs		X	X
Intersections (does not declutter if used to define airway)		X	X
Class B Airspaces/TMA		X	X
Class C Airspaces/TCA		X	X
Class D Airspaces		X	X
Other Airspaces/ADIZ		X	X
Obstacles		X	X
Cities	X	X	X
Roads	X	X	X
Railroads	X	X	X
State/Province Boundaries	X	X	X

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

Decluttering the MFD navigation map:

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.

AIRWAYS

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 (Victor Airways or T-Routes) start 1,200 feet above ground level (AGL) and extend up to 18,000 feet mean sea level (MSL). Low Altitude Airways are designated with a "V" or a "T" before the airway number.

High Altitude Airways (Jet Routes or Q-Routes) start at 18,000 feet MSL and extend upward to 45,000 feet MSL. High Altitude Airways are designated with a "J" or a "Q" before the airway number.

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.

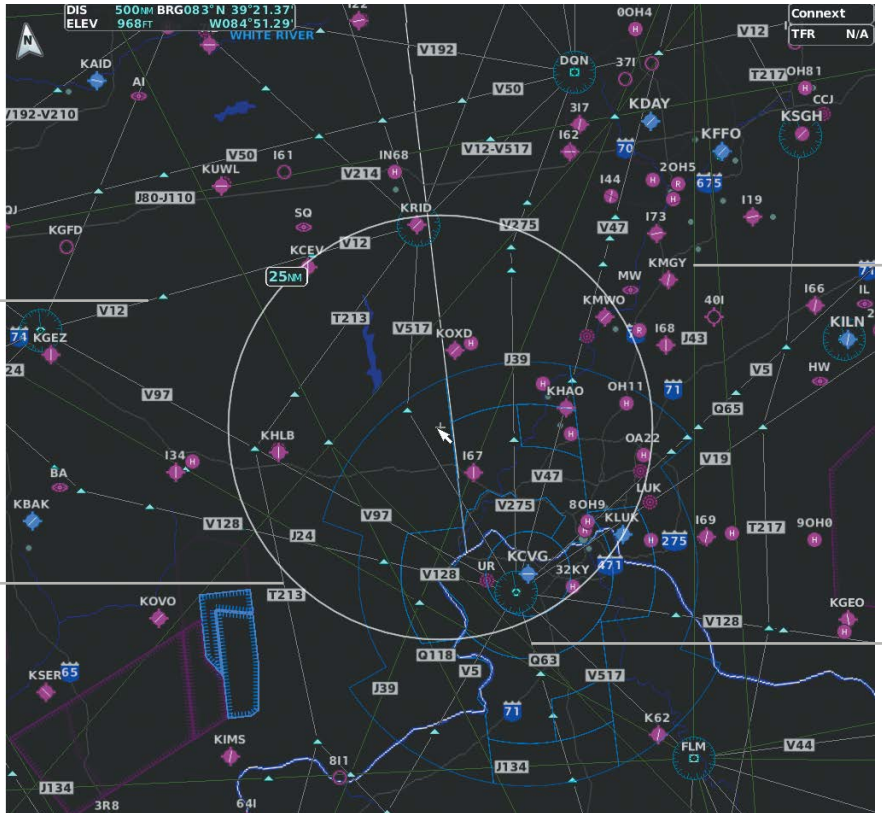


Figure 5-17 Airways on MFD Navigation Page

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.

The following items are configured on the airways menu:

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

Table 5-6 Airways Symbol Information

Displaying/removing airways:

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

Or:

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

Figure 5-18 Navigation Map Settings - Airways Group Setup

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' Menu 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 'High ALT Airways' range field.

5) To change the range setting, turn the small **FMS** Knob to display the range list.
6) Select the desired range using the small **FMS** Knob.
7) Press the **ENT** Key.
8) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

ADDITIONAL NAVIGATION MAP ITEMS

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

See the Hazard Avoidance Section for information on displaying obstacles (Point Obstacle, Wire Obstacle) on the map.

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' Menu is displayed.
3) Turn the small **FMS** Knob to select the 'Map' Group.
4) Press the **ENT** Key. The cursor flashes on the first field.
5) Turn the large **FMS** Knob to select the desired option.
6) Turn the small **FMS** Knob to select 'On' or 'Off'.

   Or:

   If it is a data field, use the **FMS** Knob to select the range or time value.
7) Press the **ENT** Key to accept the selected option and move the cursor to the next item.
8) Repeat steps 5-7 as necessary.
9) Press the **FMS** Knob to return to the Navigation Map.

TRACK VECTOR

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

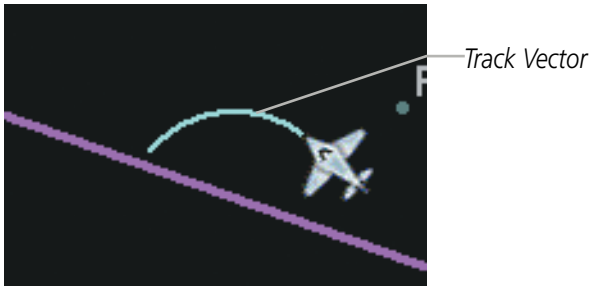


Figure 5-19 Navigation Map -Track Vector

SELECTED ALTITUDE INTERCEPT ARC

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

Figure 5-20 Navigation Map - Range to 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 5-21 Navigation Map - Wind Vector

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

FUEL RANGE RING

The map can display a fuel range ring which shows the remaining flight distance. A dashed green circle indicates the selected range to reserve fuel. A solid green circle indicates the total endurance range. If only reserve fuel remains, the range is indicated by a solid amber circle. Fuel reserve time can be input into the Fuel Range (RSV) time field within the 'Map Settings' Menu.

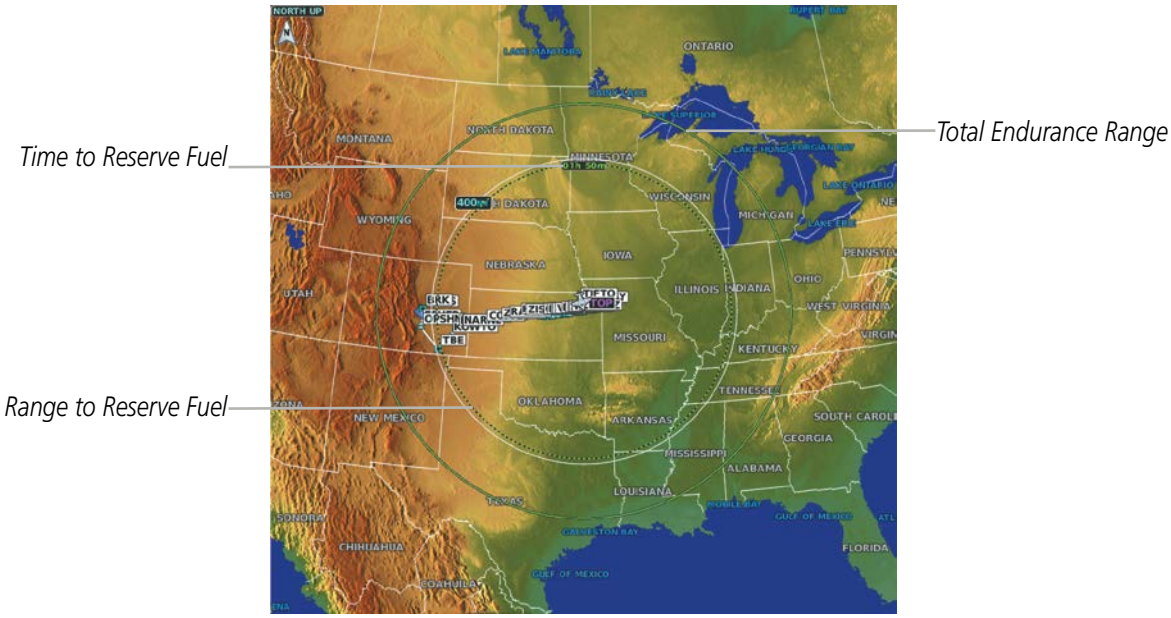


Figure 5-22 Navigation Map - Fuel Range Ring

FIELD OF VIEW (SVT)

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

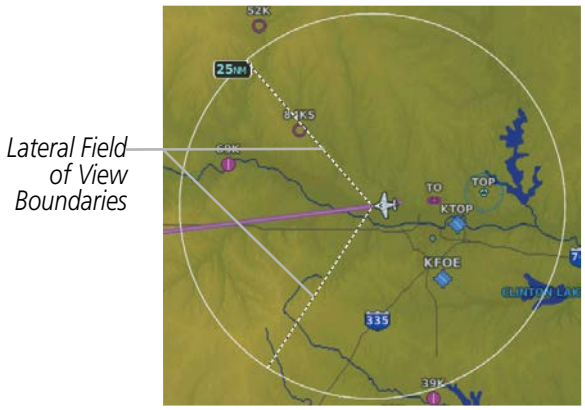


Figure 5-23 Navigation Map - Field of View

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 5-24 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 5-25 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 Navigation Map 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 **1** is displayed.

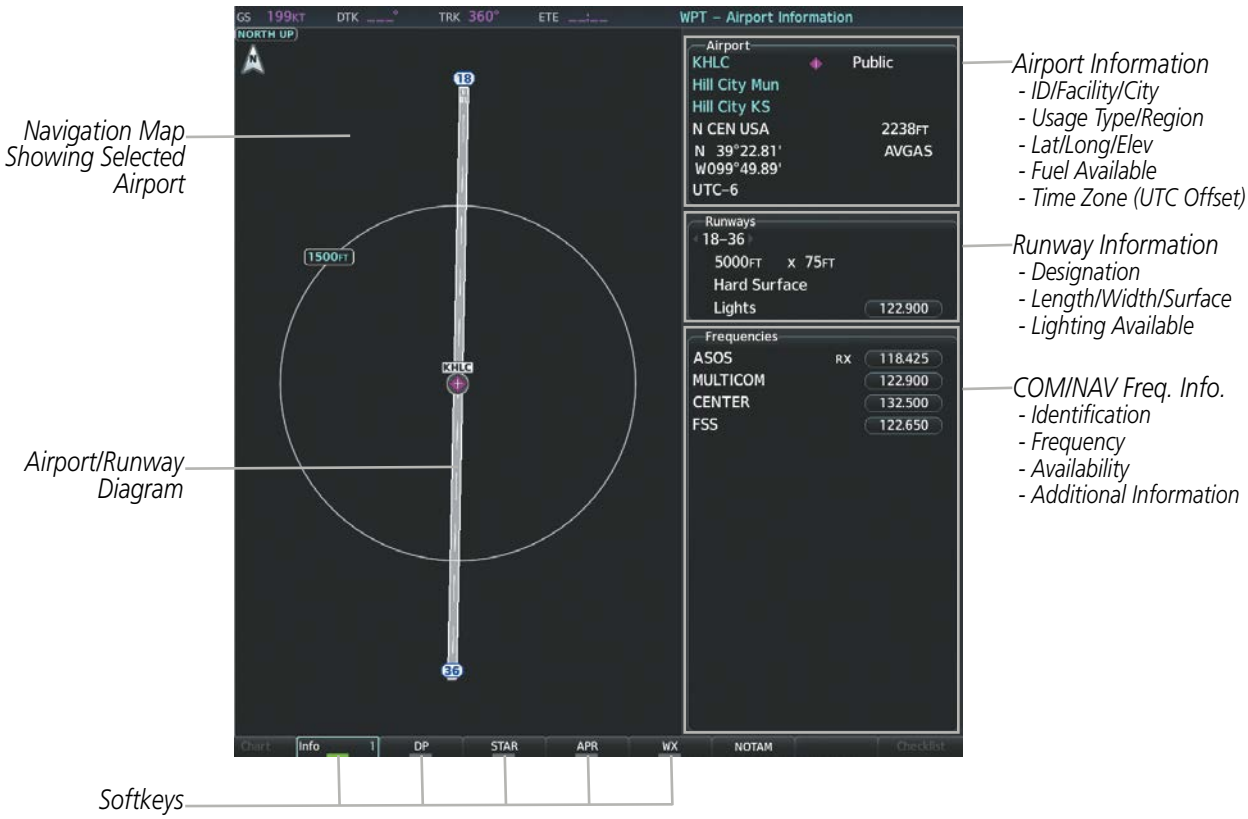


Figure 5-26 Airport Information

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 (for pilot-controlled lighting)
- COM Availability: TX (transmit only), RX (receive only), PT (part time), i (additional information available)

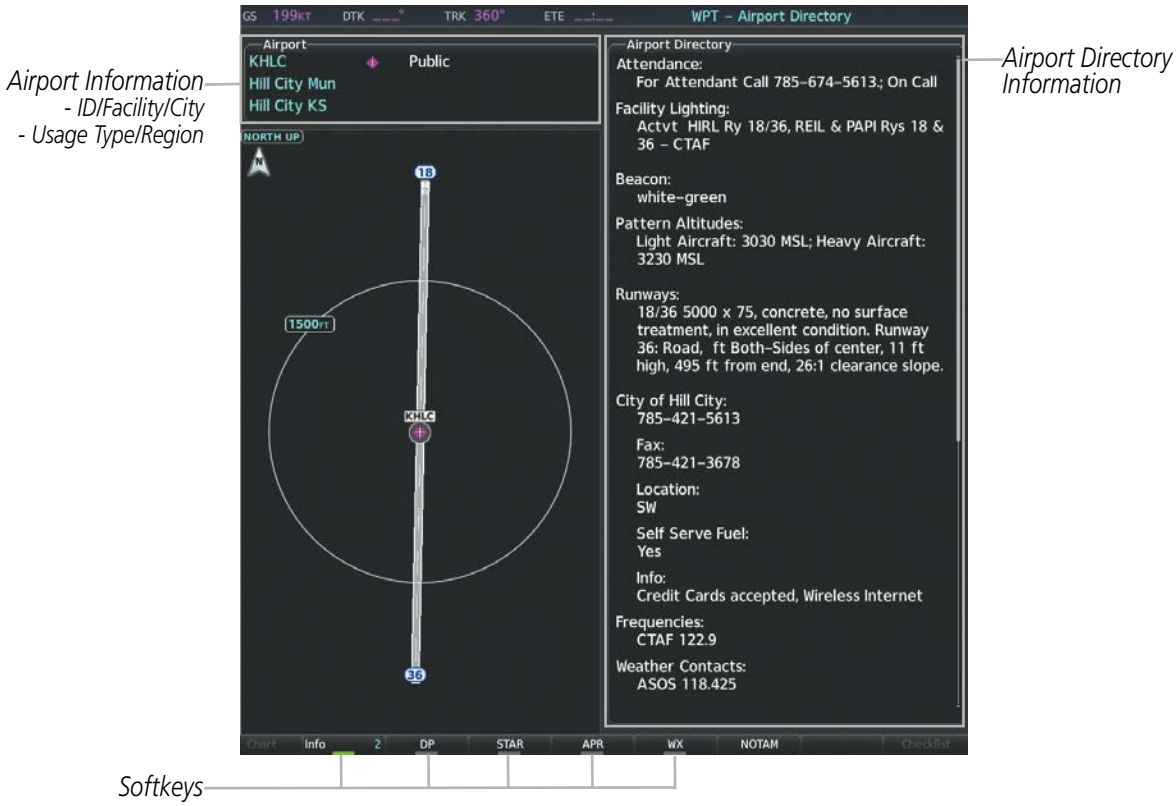


Figure 5-27 Airport Directory Example

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

Airport: Identifier, Type, Name, City, State, Map	**Control Tower:** Full/Part-time Hours, Days Open	**Attendance:** Annual, weekly, daily, hours
Facility Lighting and Beacon: Hours operating, Type and Location, CTAF, beacon colors	**Noise Abatement:** Flying Procedures	**Pattern Altitudes:** Aircraft Class/ Altitude
Runways: Headings, Length, Width, Facility Obstructions, Surface, Condition, Clearance Slope	**FBO:** Name/Type, Frequencies, Services, Fees, Fuel, Credit Cards, Phone/Fax, Hours Internet, Courtesy Car	**Aircraft Businesses/Clubs:** Name, Type (sales, training, servicing), Frequencies/Phone/Fax, Credit Cards, Internet, Services
Frequencies: Type/Frequency	**Weather Contacts:** Service Type and Frequencies/Phone (AWOS/ ASOS)	**Obstructions:** General Airport Obstructions
Flight Service Station (FSS): FSS Name, Phone Numbers	**Approaches:** Types	**General Information and/or Notes:** Fees, Airport Notes, local area information

Special Operations at Airport: Helicopters, etc.	**Restaurants:** On the Field and Nearby	**Transportation:** Taxi Services, Car Rentals, Type and Availability (public, shuttle, limo, etc.)
Attractions: Hotels, Museums, Raceways, Golfing, etc.	**NAVAIDS:** Type, Identifier, Frequency, Radial, Distance	**Charts:** VFR Sectional
Elevation: Airfield Elev (ft)	**Mag Var:** Airfield Mag Var (degrees)	**Airport Manager:** Phone

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

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

Table 5-7 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).

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

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

Selecting a runway:

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

Viewing a destination airport:

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

NEAREST AIRPORT

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

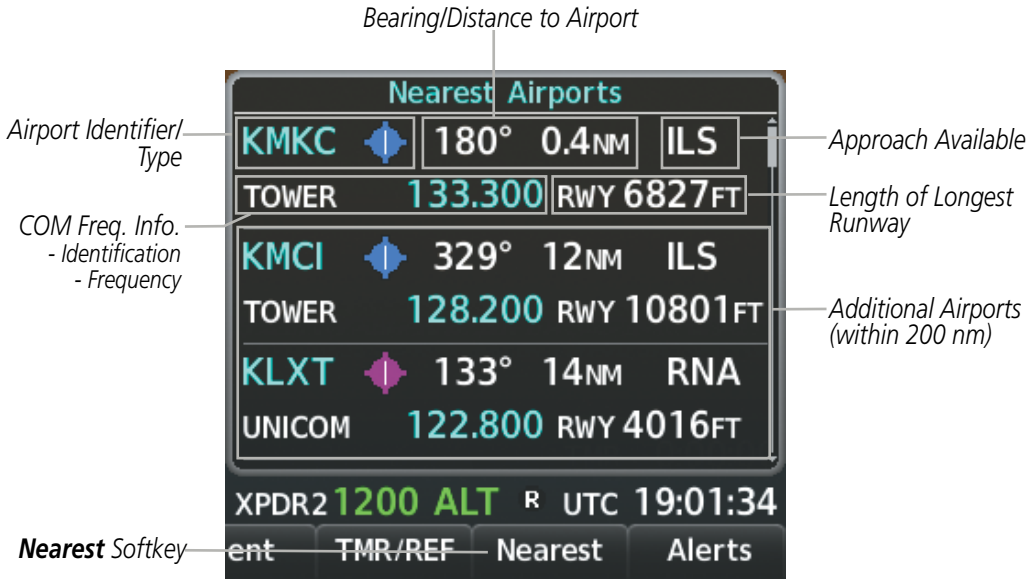


Figure 5-28 Nearest Airports on PFD

Pressing the **ENT** Key displays the PFD 'WPT - 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 5-29 Airport Information on PFD

Viewing information for a nearest airport on the PFD:

1) Press the **Nearest** Softkey to display the 'Nearest Airports' Window. Press the **FMS** Knob to activate the cursor.
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. In addition to displaying a map of the currently selected airport and surrounding area, the page displays nearest airport information in five boxes labeled 'Nearest Airports', 'Information', 'Runways', 'Frequencies', and 'Approaches'.

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

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

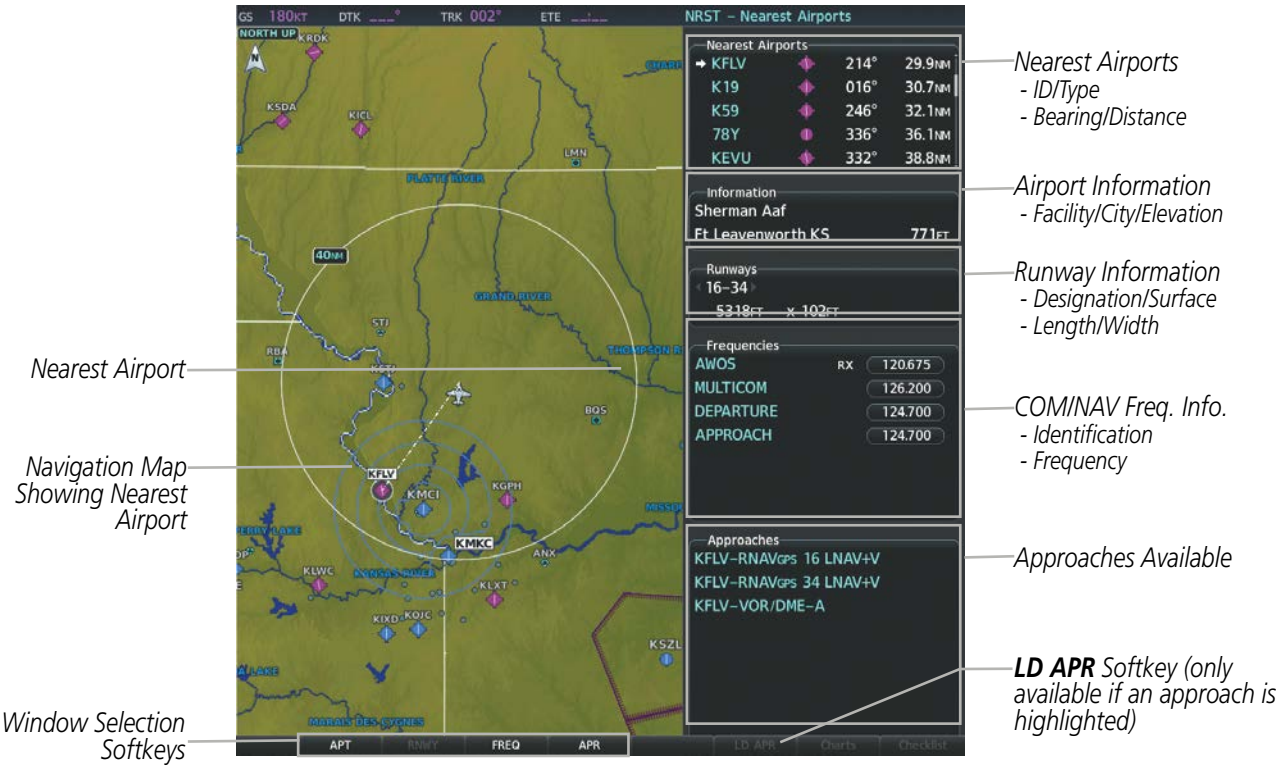


Figure 5-30 Nearest Airport

Viewing information for a nearest airport on the MFD:

1) Turn the large **FMS** Knob to select the 'NRST' Page Group.
2) Turn the small **FMS** Knob to select the '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.
3) Press the **APT** Softkey; or press the **FMS** Knob; or press the **MENU** Key, highlight 'Select Airport Window' and press the **ENT** Key. The cursor is placed in the 'Nearest Airports' Box. The first airport in the nearest airports list is highlighted.
4) Turn the **FMS** Knob to highlight the desired airport. (Pressing the **ENT** Key also moves to the next airport.)
5) Press the **FMS** Knob to remove the flashing cursor.

Viewing runway information for a specific airport:

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

NON-AIRPORT WAYPOINTS

WAYPOINT INFORMATION

Non-Airport Waypoints are considered to be Intersections, VORs, NDBs, VRPs, and User Waypoints. For each of these waypoints, their respective information pages 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 waypoint 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 page (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, deleted, 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.*

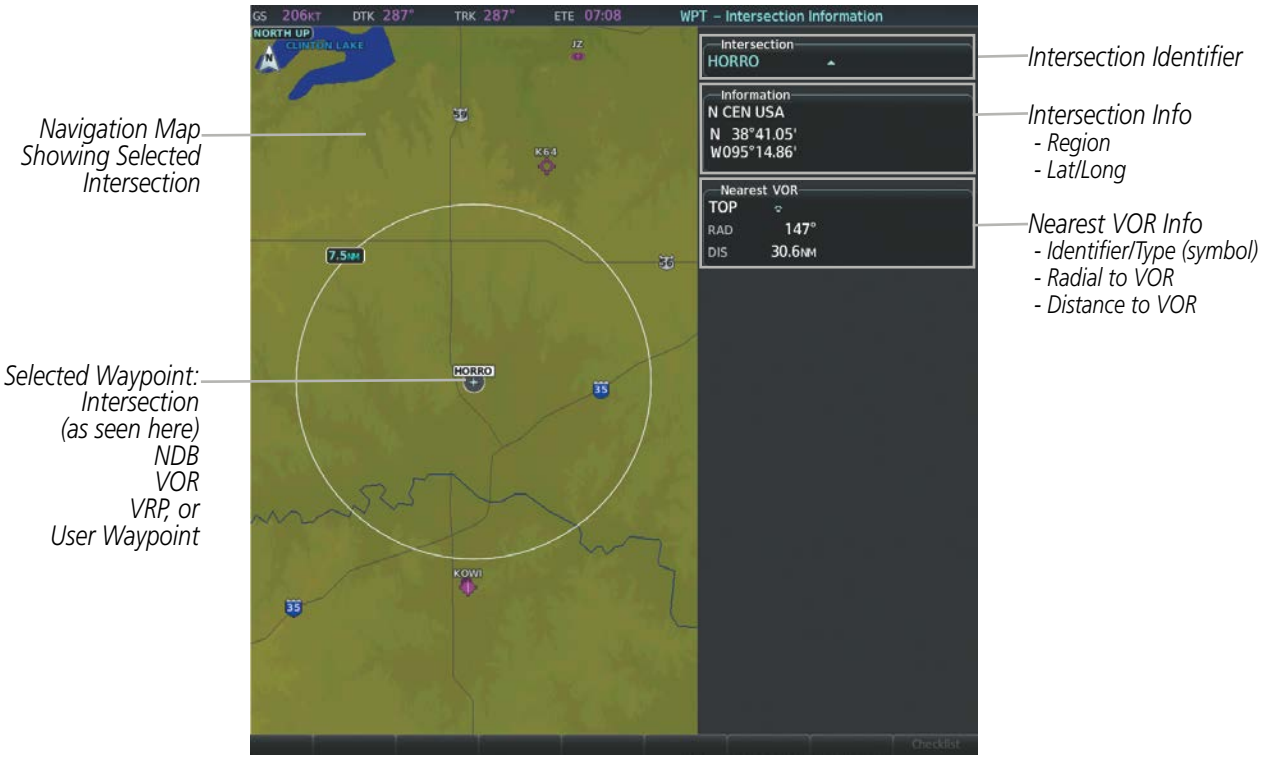


Figure 5-31 Non-Airport Waypoint Information (Intersection Example)

Figure 5-32 Non-Airport Waypoint Information Pages (NDB, VOR, VRP, and User Waypoint)

Viewing Non-Airport Waypoints:

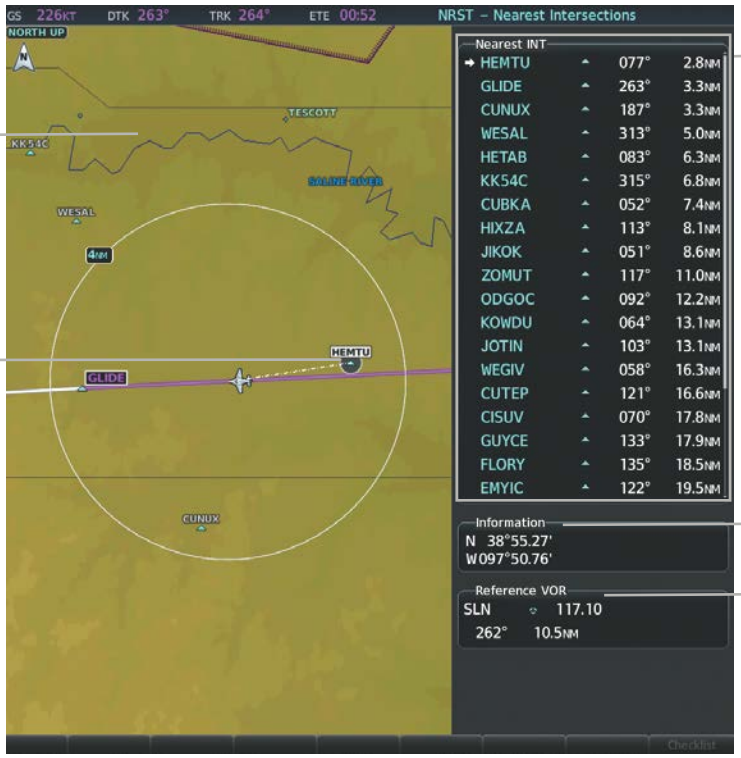
1) Turn the large **FMS** Knob to select the 'WPT' Page Group.
2) Turn the small **FMS** Knob to select the 'WPT - Intersection, NDB, VOR, VRP, or User WPT Information' Page.
3) Press the **FMS** Knob to display the flashing cursor in the 'Intersection, NDB, VOR, VRP, or User Waypoint' Box.
4) Use the **FMS** Knobs and enter an identifier, facility name, or location.
5) Press the **ENT** Key, if needed.
6) Press the **FMS** Knob to remove the flashing cursor.

NEAREST NON-AIRPORT WAYPOINTS

The Nearest pages can be used to quickly find waypoints close to the aircraft. The system will display a scrollable list of 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.



Navigation Map Example: Showing Nearest Intersection

Nearest Non-Airport Waypoint:
- Intersection (this example)
- NDB
- VOR
- VRP, or
- User Waypoint

Nearest Intersections
- White arrow indicates the selected waypoint shown.

Note: See next Figure for NDB, VOR, VRP, and User Waypoint examples.

Intersection Info
- Lat/Long

Reference VOR Info
- Identifier/Type (symbol)
- Radial to VOR
- Distance to VOR

Figure 5-33 Nearest Intersection Example

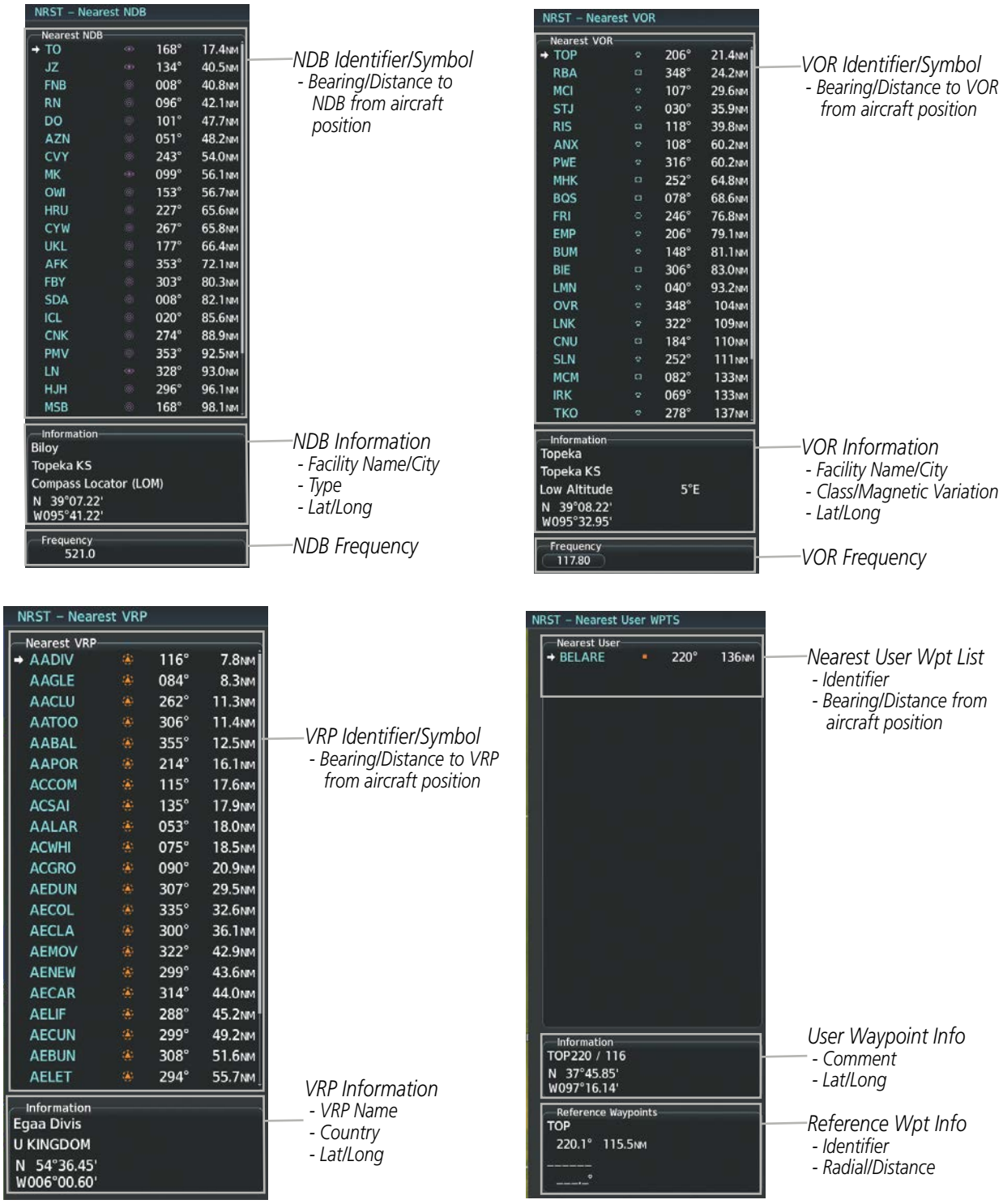


Figure 5-34 Nearest Non-Airport Waypoints (NDB, VOR, VRP, and User WPTS)

Viewing Nearest Non-Airport Waypoints:

1) Turn the large **FMS** Knob to select the 'NRST' Page Group.
2) Turn the small **FMS** Knob to select the 'NRST - Nearest Intersections, NDB, VOR, VRP, or User WPTS' Page.
3) Press 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.
4) If needed, press the **ENT** Key or turn either **FMS** Knob as needed to select an identifier.
5) Press the **FMS** Knob to remove the flashing cursor.

CREATING USER WAYPOINTS

User waypoints can be created from the 'WPT - User WPT Information' Page in the following ways:

Creating user waypoints from the 'WPT - User WPT Information' Page:

1) Press the **New** Softkey, or press the **MENU** Key and select 'Create New User Waypoint'.
2) Enter a user waypoint name (up to six characters).
3) Press the **ENT** Key. The current aircraft position is the default location of the new waypoint.
4) If desired, define the type and location of the waypoint in one of the following ways:

   Select "RAD/RAD" using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Window 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' Window 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' Window using the **FMS** Knobs.
5) Press the **ENT** Key to accept the new waypoint.
6) If desired, change the storage method of the waypoint to temporary by moving the cursor to "Temporary" and pressing the **ENT** Key to check or uncheck the box.
7) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) Press the **FMS** Knob to activate the cursor.
2) Enter a user waypoint name (up to six characters).
3) Press the **ENT** Key. The message 'Are you sure you want to create the new User Waypoint AAAAAA?' is displayed.
4) With 'Yes' highlighted, press the **ENT** Key.
5) If desired, define the type and location of the waypoint in one of the following ways:

   Select "RAD/RAD" using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Window 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' Window 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' Window using the **FMS** Knobs.
6) Press the **ENT** Key to accept the new waypoint.
7) If desired, change the storage method of the waypoint to "Temporary" or "Normal" by moving the cursor to "Temporary" and pressing the **ENT** Key to check or uncheck the box.
8) Press the **FMS** Knob to remove the flashing cursor.

Creating a user waypoint from the 'FPL - Active Flight Plan' Page:

1) Press the **FPL** Key.
2) Press the **FMS** Knob to activate the cursor (not required on the PFD).
3) Select the point in the flight plan before which to add the new user waypoint. The new waypoint is placed directly in front of the highlighted waypoint.
4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window. (Turning it clockwise displays a blank 'Waypoint Information' Window, turning it counter-clockwise displays the 'Waypoint Information' Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, or user waypoints).
5) 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.
6) The message 'AAAAA does not exist. Create User Waypoint?' is displayed. Press the **ENT** Key with 'Yes' highlighted.
7) The 'WPT - User WPT Information' Page is displayed. If desired, define the type and location of the waypoint in one of the following ways:

   Select "RAD/RAD" using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Window 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' Window 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' Window using the **FMS** Knobs.

8) Press the **ENT** Key to accept the new waypoint.

9) If desired, change the storage method of the waypoint to temporary or normal by moving the cursor to "Temporary" and pressing the **ENT** Key to check or uncheck the box.

10) Turn the large **FMS** Knob to highlight 'Load WPT to FPL' and press the **ENT** Key. The 'FPL - Active Flight Plan' Page is displayed with the new user waypoint added to the flight plan.

Creating user waypoints from map pages:

1) Push the **Joystick** to activate the panning function and pan to the map location of the desired user waypoint.

2) Press the **ENT** Key. The 'WPT - User WPT Information' Page is displayed with the captured position.

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

3) Enter a user waypoint name (up to six characters).

4) Press the **ENT** Key to accept the selected name.

5) If desired, define the type and location of the waypoint in one of the following ways:

Select "RAD/RAD" using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Window 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' Window 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' Window using the **FMS** Knobs.

6) Press the **ENT** Key to accept the new waypoint.

7) If desired, change the storage method of the waypoint to temporary or normal by moving the cursor to "Temporary" and pressing the **ENT** Key to check or uncheck the box.

8) Press the **FMS** Knob to remove the flashing cursor.

9) Press the **Go Back** Softkey to return to the map page.

EDITING USER WAYPOINTS

Once a user waypoint has been created, it may be edited, renamed, or deleted. A system generated comment for a user waypoint incorporates the reference waypoint identifier, bearing, and distance. If a system generated comment has been edited, a new comment can be generated.

The default type of user waypoint (normal or temporary) can be changed using the 'WPT — User Waypoint Information' 'Page. Temporary user waypoints are automatically deleted upon the next power cycle.

Editing a user waypoint comment or location:

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

DELETING USER WAYPOINTS

Deleting a single user waypoint:

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

Or:

1) With the 'WPT - User WPT Information' Page displayed, press 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) Press the **MENU** Key.
4) Turn the **FMS** Knob to highlight 'Delete User Waypoint'.
5) Press the **ENT** Key twice to confirm the selection.
6) Press the **FMS** Knob to remove the flashing cursor.

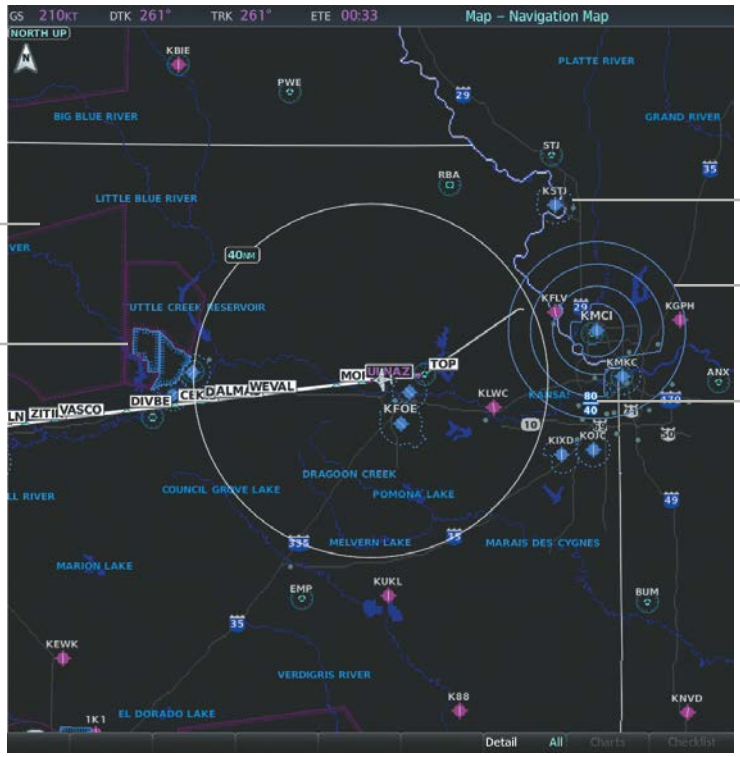
NOTE: *The option to 'Delete All User Waypoints' is not available while the aircraft is in flight.*

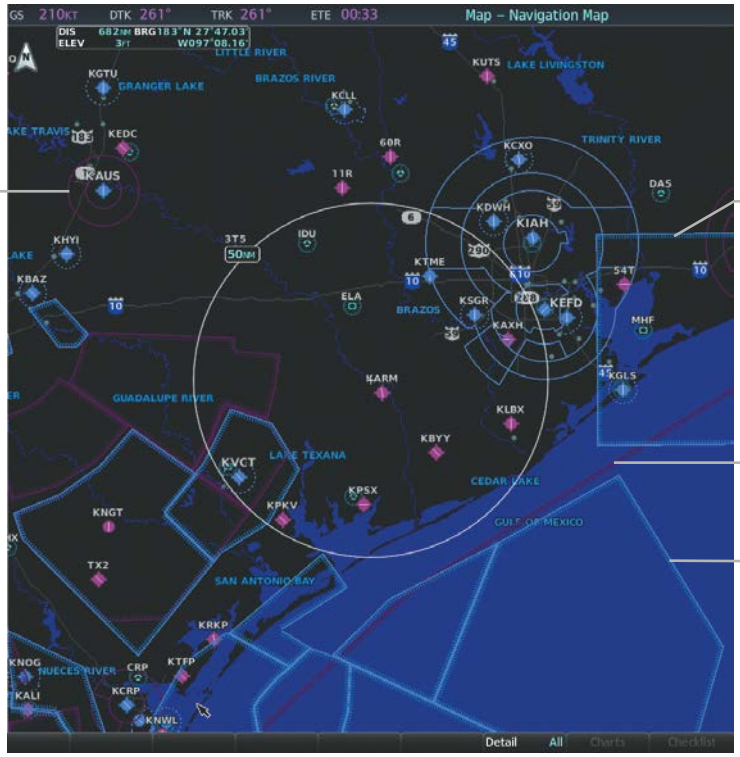
Deleting all user waypoints:

1) With the 'WPT - User WPT Information' Page displayed, press 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) Press the **MENU** Key.
4) Turn the **FMS** Knob to highlight 'Delete All User Waypoints.'
5) Press the **ENT** Key twice to confirm the selection.
6) Press the **FMS** Knob to remove the flashing cursor.

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 Table 5-4 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.





MOA (Military)
Restricted Area
Class C Airspace
Class D Airspace
Class B Airspace
Airspace Altitude Label
Alert Area
ADIZ
Warning Area

Figure 5-35 Airspaces

Displaying and removing airspace altitude labels:

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

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 - Navigation Map' Page. It simply turns on/off the message provided in the 'Alerts' Window on the PFD when the aircraft is approaching or near an airspace.

Pressing the PFD **Message** Softkey displays the 'Alerts' Window on the PFD. The following airspace alerts are displayed in the 'Alerts' Window:

Message	Comments
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
ARSPC AHEAD – Airspace ahead – less than 10 minutes.	Special use airspace is ahead of aircraft 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 5-8 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) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the desired field in the 'Airspace Alerts' Box.
4) Turn the small **FMS** Knob clockwise to turn the airspace alert On or counterclockwise to turn the alert Off.
5) Press the **FMS** Knob to remove the flashing cursor.

Changing the altitude buffer distance setting:

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

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

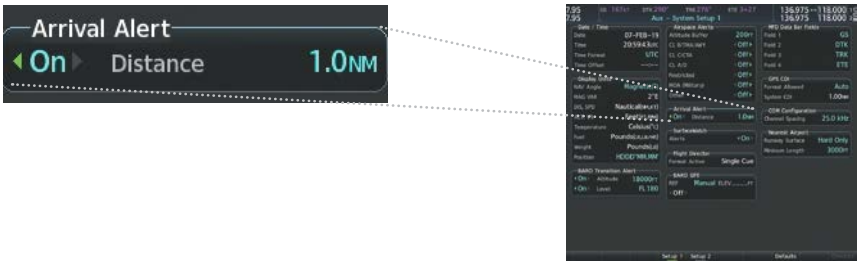


Figure 5-36 Arrival Alert Settings (System Setup 1 Page)

Enabling/disabling the Arrival Alert:

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

Changing the arrival alert trigger distance:

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

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'.

The map on the 'NRST – Nearest Airspaces' Page automatically zooms in on the nearest airspace as listed in the 'Airspace Alerts' Box and an information window about that airspace is shown on the map. Use the **FMS** Knob to select and view other nearest airspaces on the map. If there are no nearest airspaces listed, the map will be centered around the aircraft present position.

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 5-37 Nearest Airspaces

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 **FMS** Knob; or press the **MENU** Key, highlight 'Select Alerts Window', and press the **ENT** Key. The cursor is placed in the 'Airspace Alerts' Box.
3) Select the desired airspace.
4) Press the **FMS** Knob to remove the flashing cursor.

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.

Smart Airspace Off

Smart Airspace On

Figure 5-38 Smart Airspace

Turning smart airspace on or off:

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

5.5 DIRECT-TO-NAVIGATION

The Direct-to method of navigation, initiated by pressing the D→ Key on either the MFD Controller or the PFD, is quicker to use than a flight plan when the desire is to navigate to a single point such as a nearby airport.

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

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

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

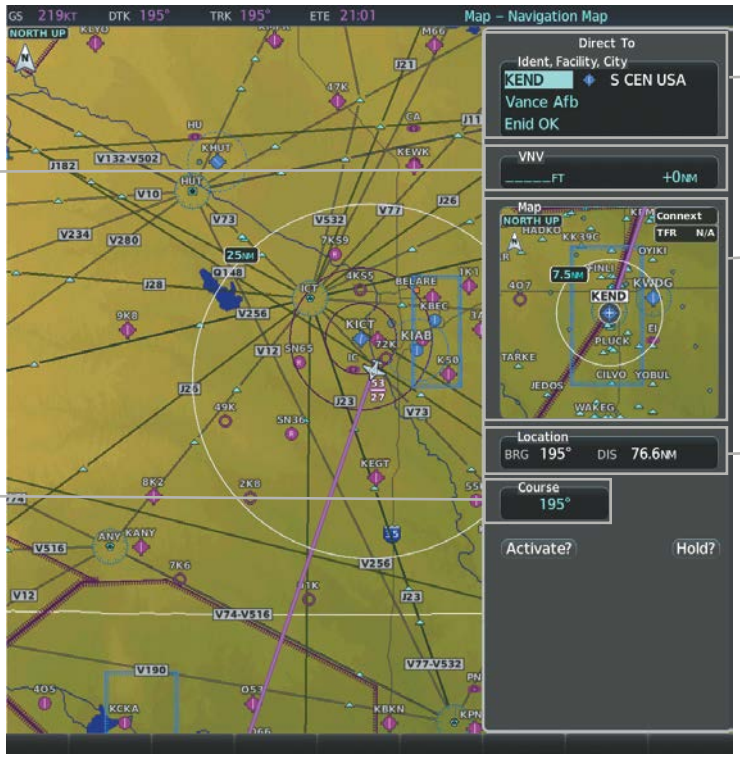


Figure 5-39 Direct-to - MFD

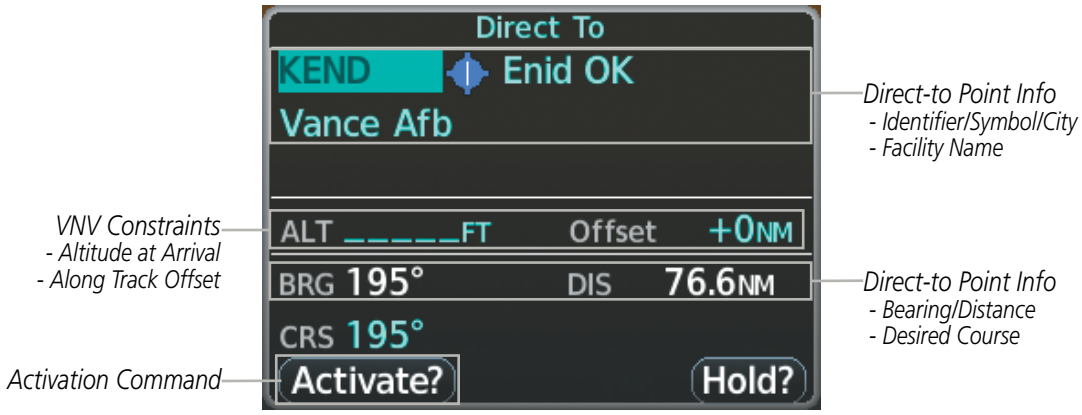


Figure 5-40 Direct-to - PFD

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

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

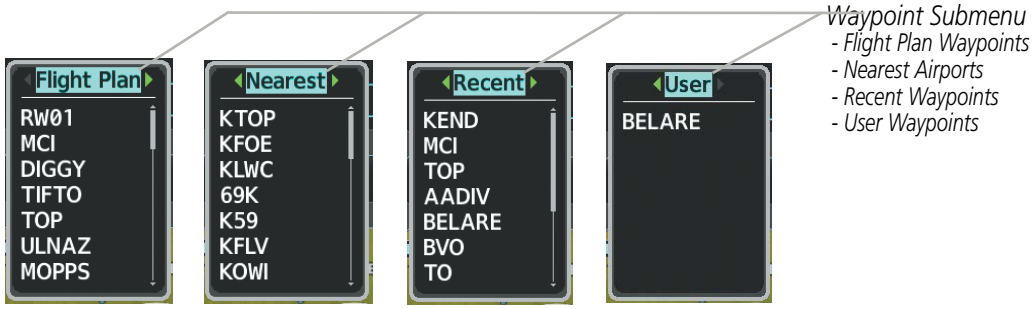


Figure 5-41 Waypoint Submenu

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

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

Or:

1) Select the 'FPL - Active Flight Plan' Page on the MFD, or the 'Flight Plan' Window on the PFD.
2) Press 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 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 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 D→ 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 press the **FMS** Knob.
2) Use the **FMS** Knob to select the desired airport (the nearest one is already selected).
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 manual direct-to course:

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 large **FMS** Knob to highlight the 'CRS' or 'Course' Field.
3) Highlight the 'CRS' or 'Course' Field.
4) Enter the desired course.
5) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
6) Press the **ENT** Key again to activate the direct-to.

Reselecting the direct course from the current position:

1) Press the D→ Key. The 'Direct To' Window is displayed with the cursor flashing in the 'Ident, Facility, City' Box.
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 pointer on the 'Map - Navigation Map' Page. If no airport, NAVAID, or user waypoint exists at the desired location, a temporary waypoint named 'MAPWPT' is automatically created at the location of the map arrow.

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

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

Cancelling a Direct-to:

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

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

5.6 FLIGHT PLANNING

INTRODUCTION

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

Flight Plan Leg Type	Symbol
Active Course Leg*	
Active Heading Leg*	
Active Roll Steering Path*†	
Course Leg in the current flight segment	
Course Leg not in the current flight segment	
Heading Leg	
Roll Steering Path †	
Future Roll Steering Path ‡	
Turn Anticipation Arc	

* The active leg or path is the one currently being flown, and is shown in magenta.

† A Roll Steering Path is displayed for: transitions between two disconnected legs (i.e. holding), some procedure turn segments, parallel track segments, or transitions after some fly-over waypoints (discussed later in this section).

‡ A Roll Steering Path that is beyond the next leg will appear as a Future Roll Steering Path. When a Future Roll Steering Path becomes the next leg, it appears as a Roll Steering Path.

Table 5-9 Flight Plan Leg Symbols

Up to 99 flight plans with up to 100 waypoints each can be created and stored in memory. Upon power up, the previously active flight plan is retained and automatically repopulated if the aircraft position is at the origin airport and the aircraft is on the ground. If, however, the aircraft is not 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. One flight plan can be activated at a time and becomes the active flight plan. The active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, departure, or arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information if the procedure has not been modified. If an approach, departure, or arrival procedure is no longer available,

the procedure is deleted from the affected stored flight plan(s), and an alert is displayed (see Miscellaneous Messages in Appendix A) advising that one or more stored flight plans need to be edited.

Whenever an approach, departure, or arrival procedure is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan along with a header line describing the instrument procedure the pilot selected. The original enroute portion of the flight plan remains active (unless an instrument procedure is activated) when the procedure is loaded.

When the database is updated, the airways need to be reloaded also. Each airway segment is reloaded from the database given the entry waypoint, the airway identifier and the exit waypoint. This reloads the sequence of waypoints between the entry and exit waypoints (the sequence may change when the database is updated). The update of an airway can fail during this process. If that happens, the airway waypoints are changed to regular (non-airway) flight plan waypoints, and an alert is displayed (see Miscellaneous Messages in Appendix A).

The following could cause the airway update to fail:

- Airway identifier, entry waypoint or exit waypoint not found in the new database.
- Airway entry/exit waypoint is not an acceptable waypoint for the airway – either the waypoint is no longer on the airway, or there is a new directional restriction that prevents it being used.
- Loading the new airway sequence would exceed the capacity of the flight plan.

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)

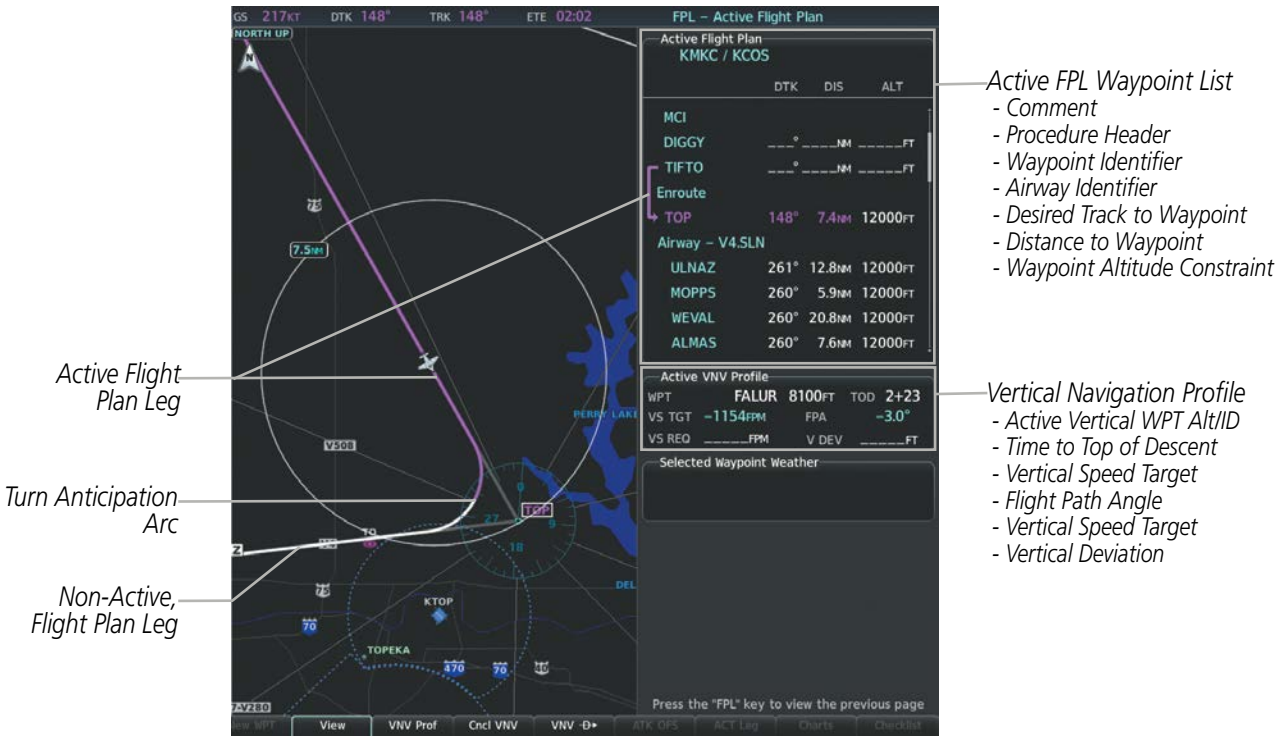


Figure 5-42 Active Flight Plan

Figure 5-43 Flight Plan on PFD

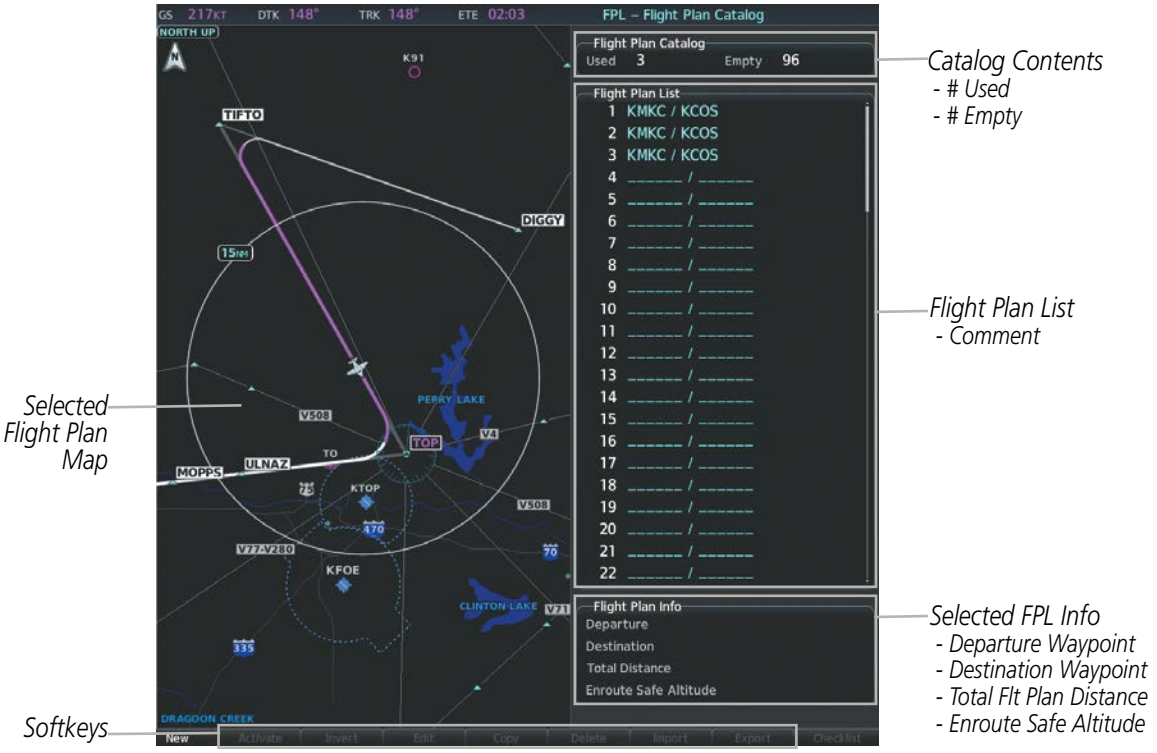


Figure 5-44 Flight Plan Catalog

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

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.

Auto-designation occurs between 15 and 60 seconds after display power-up 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" or "Recent" submenu or the MFD 'WPT - Airport Information' Page until the airport waypoint is loaded into the flight plan.*

FLIGHT PLAN VIEWS

Flight plan information can be viewed in different locations and formats. The Flight Plan Progress inset may be displayed on 'Map - Navigation Map' Page. The 'FPL - Active Flight Plan' Page format can be modified in several ways; and the MFD Split Screen feature can provide different display configurations of the flight plan, navigation map and charts. For flight plan profile information see the Flight Management, Vertical Situation Display section.

FLIGHT PLAN PROGRESS INSET

Active flight plan progress can be displayed on the 'Map - Navigation Map' Page.

NOTE: *ETE can be displayed as either HH+MM (ETE greater than 60 minutes) or MM:SS (ETE less than 60 minutes).*

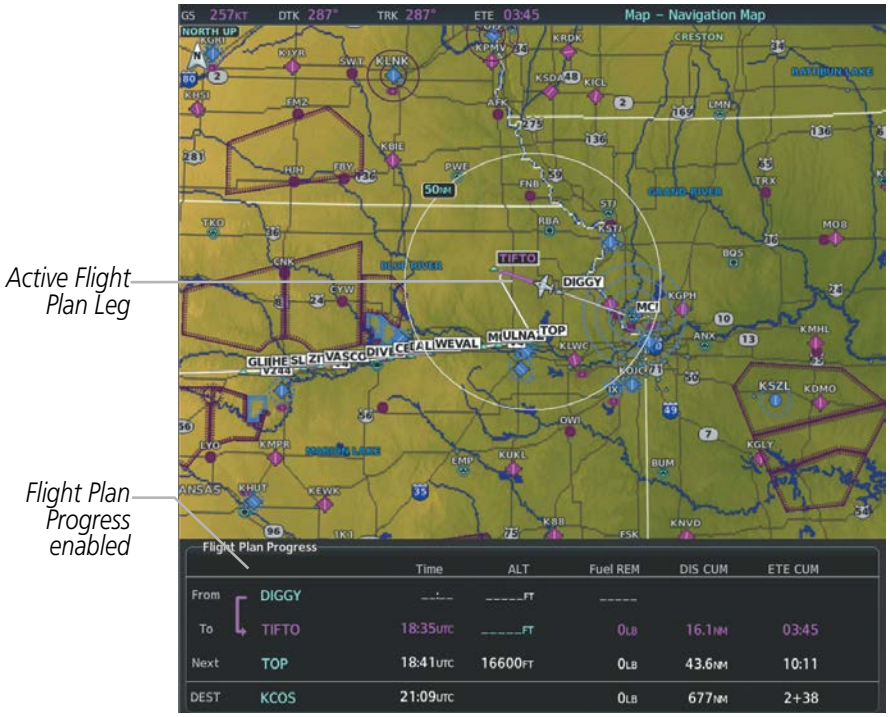


Figure 5-45 Flight Plan Progress on the Navigation Map

Displaying/removing the active flight plan progress on the navigation map:

1) Select the 'Map - Navigation Map' Page.
2) Press the **Map Opt** Softkey.
3) Press the **Inset** Softkey.
4) Press the **FPL PROG** Softkey to display the active flight plan progress.
5) To remove the active flight plan progress from the navigation map, press the **Off** softkey.

ACTIVE 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:

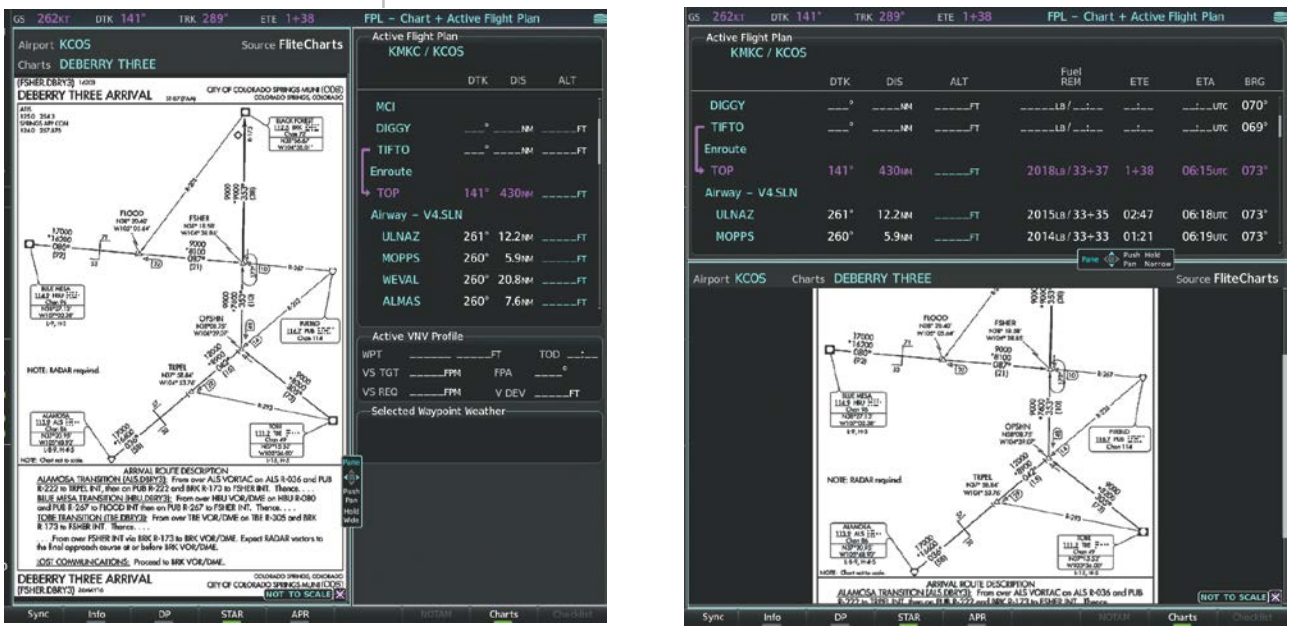
1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **View** Softkey to display the **Wide**, **Narrow**, **Leg-Leg**, and **CUM** Softkeys.
3) Press the **CUM** Softkey to view cumulative waypoint distance, or press the **Leg-Leg** Softkey to view leg-to-leg waypoint distance.
4) Press the **Wide** Softkey to display the wide view, or press the **Narrow** Softkey to display the narrow view.
5) Press the **Back** Softkey to return to the top level active flight plan softkeys..

SPLIT SCREEN

Charts may be viewed alongside the active flight plan in split screen mode. Pressing the **Charts** Softkey from the 'FPL-Active Flight Plan' Page will remove the active flight plan map to display a Charts Pane alongside the 'Active Flight Plan' Pane. The Active Page Title will change to 'FPL - Chart + Active Flight Plan'. The active flight plan map can be re-displayed. However, displaying the map in split screen on the 'Active Flight Plan' Pane limits the flight plan content which can be displayed. For example, displaying the Flight Plan Map while in split screen narrow view removes the 'Active VNV Profile' Box. See the following figures depicting the different split screen displays with the active flight plan.

See the System Overview section for more information on Split Screen Mode. For more information on Charts, see the Additional Features Section.

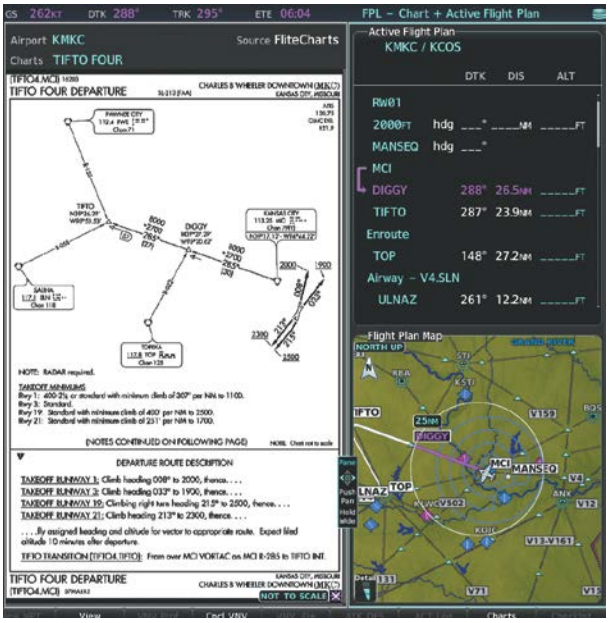
Display Title shows 'Chart + Active Flight Plan'



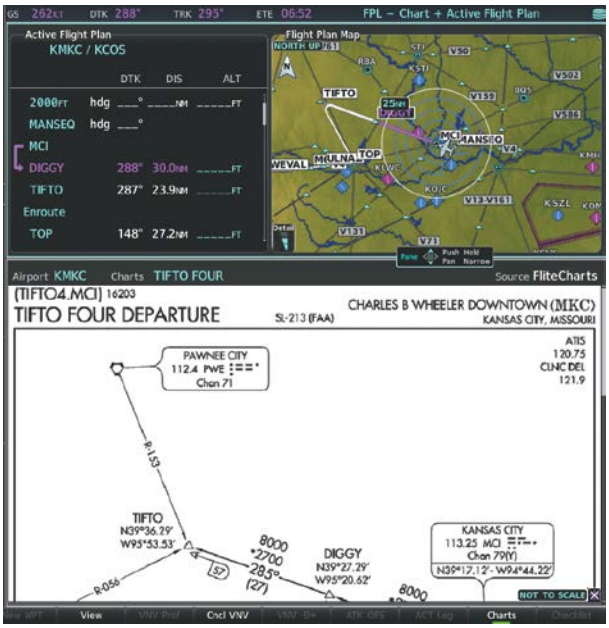
Split Screen Narrow View

Split Screen Wide View

Figure 5-46 Split Screen Mode Narrow and Wide View



Split Screen Narrow View with Flight Plan Map



Split Screen Wide View with Flight Plan Map

Figure 5-47 Split Screen Mode with Flight Plan Map

Viewing charts and 'FPL - Active Flight Plan' Page in split screen mode:

1) Press the **FPL** Key for the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **Charts** Softkey. Split screen mode is now enabled displaying a Charts Pane alongside the 'Active Flight Plan' Pane. The Charts Pane is highlighted by a cyan border indicating it is the active pane.
3) To quickly view the chart corresponding to the active flight plan leg, press the **Sync** Softkey.

Displaying the flight plan map on the 'FPL - Active Flight Plan' Page in split screen mode:

1) Press the **FPL** Key for the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **Charts** Softkey. Split screen mode is now enabled displaying a Charts Pane alongside the 'Active Flight Plan' Pane. The Charts Pane is highlighted by a cyan border indicating it is the active pane.
3) Move the **Joystick** to select the 'Active Flight Plan' Pane as the active display pane.
4) Press the **MENU** Key. 'Show Flight Plan Map' is highlighted. Press the **ENT** Key.
5) To removed the Flight Plan Map, press the **MENU** Key and select 'Hide Flight Plan Map'. Press the **ENT** Key.

CREATING A 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 navigation maps. Stored flight plans are listed on the 'FPL - Flight Plan Catalog' Page, and are available for activation (becomes the active 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 an active flight plan:

1) Press the **FPL** Key. Press the small **FMS** Knob to activate the cursor (only on MFD).
2) Select the origin airport and runway (as required).
   a) Highlight the field below the Origin header to enter the origin airport identifier using the **FMS** Knob.
   b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the origin waypoint.
   c) Press the **ENT** Key. The 'Set Airport and Runway' Window is displayed with the 'Runway' Field highlighted.

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.*

   d) Turn the small FMS Knob to select the runway, and press the **ENT** Key.
   e) Press the **ENT** Key again to add the origin airport/runway to the flight plan.
3) Repeat step number 2 for the destination airport and runway.
4) Select the enroute waypoints.
   a) Highlight the location to insert the waypoint using the **FMS** Knob (If the enroute header is selected, the new waypoint is placed following the header. If an enroute waypoint or the dashes are selected, the new waypoint will be placed ahead of the selected item).
   b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the waypoint. The active flight plan is modified as each waypoint is entered.
5) Repeat step number 4 to enter each additional enroute waypoint.
6) When all waypoints have been entered, press the **FMS** Knob to remove the cursor (if required).

Creating a stored flight plan:

1) From the MFD, press the **FPL** Key.
2) Turn the small **FMS** Knob clockwise to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **New** Softkey; or press the **MENU** Key, highlight 'Create New Flight Plan', and press the **ENT** Key to display a blank flight plan for the first empty storage location.
4) Select the origin airport and runway.
   a) Highlight the field below the Origin header to enter the origin airport identifier using the **FMS** Knob.
   b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the origin waypoint.
   c) Press the **ENT** Key. The 'Set Airport and Runway' Window is displayed with the 'Runway' Field highlighted.

d) Turn the small **FMS** Knob to select the runway, and press the **ENT** Key.

e) Press the **ENT** Key again to add the origin airport/runway to the flight plan.

5) Repeat step number 4 for the destination airport and runway.

6) Select the enroute waypoints.

a) Highlight the location to insert the waypoint using the **FMS** Knob (If the enroute header is selected, the new waypoint is placed following the header. If an enroute waypoint or the dashes are selected, the new waypoint will be placed ahead of the selected item.)

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

c) Press the **ENT** Key. The stored flight plan is modified as each waypoint is entered.

7) Repeat step number 6 to enter each additional enroute waypoint.

8) When all waypoints have been entered, press the **FMS** Knob to remove the cursor.

FLIGHT PLAN WAYPOINT AND AIRWAY MODIFICATIONS

Active and stored 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

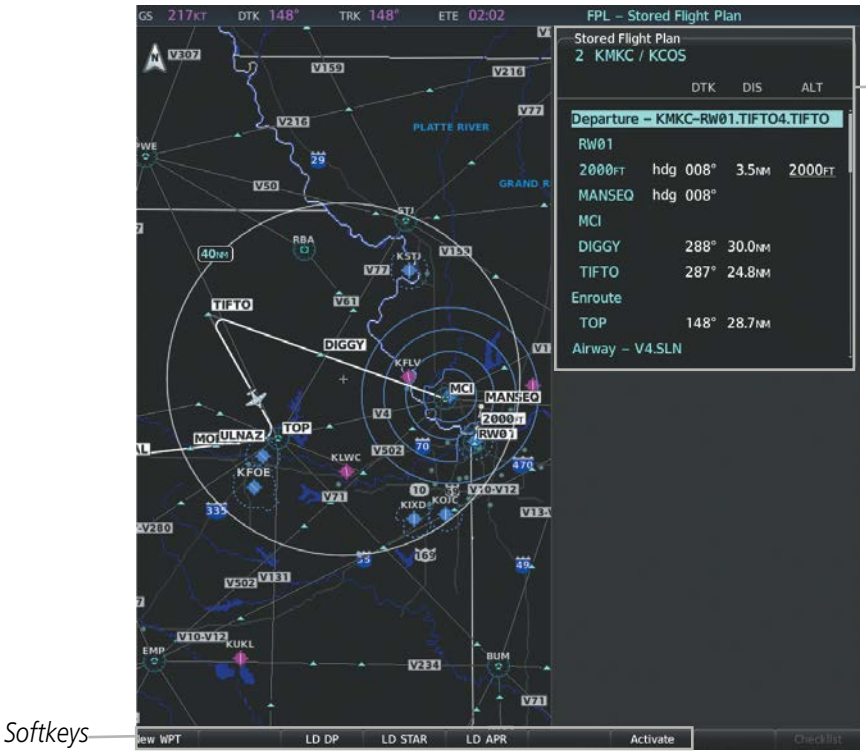
Waypoints can be added to the active flight plan or any stored flight plan. Choose the flight plan, select the desired point of insertion, enter the waypoint, and it is added in front of the selected waypoint. Flight plans are limited to 100 waypoints (including waypoints within airways and procedures). If the number of waypoints in the flight plan exceeds 100, the message "Flight plan is full. Remove unnecessary waypoints." appears and the new waypoint(s) are not added to the flight plan.

Adding Waypoints

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.*

NOTE: *If the flight plan is successfully edited in the 'Flight Plan' Window from PFD while the MFD 'FPL - Active Flight Plan' Page is in the process of being edited, the 'Flight Plan Modified By Other User' Window will appear on the MFD. Press the **ENT** key to return to the 'FPL - Active Flight Plan' Page with the accepted changes.*



Stored Flight Plan Selected
- *Memory Slot*
- *Comment*
- *Procedure Identifier*
- *Waypoint Identifier*
- *Airway Identifier*
- *Desired Track to Waypoint*
- *Distance to Waypoint*
- *Waypoint Altitude Constraint*

Softkeys

Figure 5-48 FPL - Stored Flight Plan

Adding a waypoint to the active flight plan:

1) Press the **FPL** Key.
2) Press the **FMS** Knob to activate the cursor (not required on the PFD).
3) Select the point in the flight plan before which to add the new waypoint. The new waypoint is placed directly in front of the highlighted waypoint.
4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window. (Turning it clockwise displays a blank 'Waypoint Information' Window, turning it counter-clockwise displays the 'Waypoint Information' Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, or user waypoints).
5) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The active flight plan is modified as each waypoint is entered.

Creating and adding user waypoints to the active flight plan using the map pointer:

1) Press the **FPL** Key.
2) Press the **FMS** Knob on the MFD to activate the cursor.
3) Select the point in the flight plan to add the new waypoint.
4) Push the **Joystick** on the MFD to activate the panning function on the 'FPL - Active Flight Plan' Page and pan to the map location of the desired user waypoint.
5) Press the **LD WPT** Softkey; or press the **MENU** Key, select 'Load Waypoint', and press the **ENT** Key. The user waypoint is created with a name of USRxxx (using the next available in sequence) and is added to the active flight plan.

Adding a waypoint to an existing stored flight plan:

1) On the 'FPL - Flight Plan Catalog' Page, press the **FMS** Knob to activate the cursor.
2) Highlight the desired flight plan.
3) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select "EDIT" and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
4) Select the point in the flight plan to add the new waypoint. The new waypoint is placed directly in front of the highlighted waypoint.
5) Turn the small **FMS** Knob to display the 'Waypoint Information' Window. (Turning it clockwise displays a blank 'Waypoint Information' Window, turning it counter-clockwise displays the 'Waypoint Information' Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, user, or airway waypoints).
6) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The new waypoint now exists in the flight plan.

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'.

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

Removing an individual waypoint from the active flight plan:

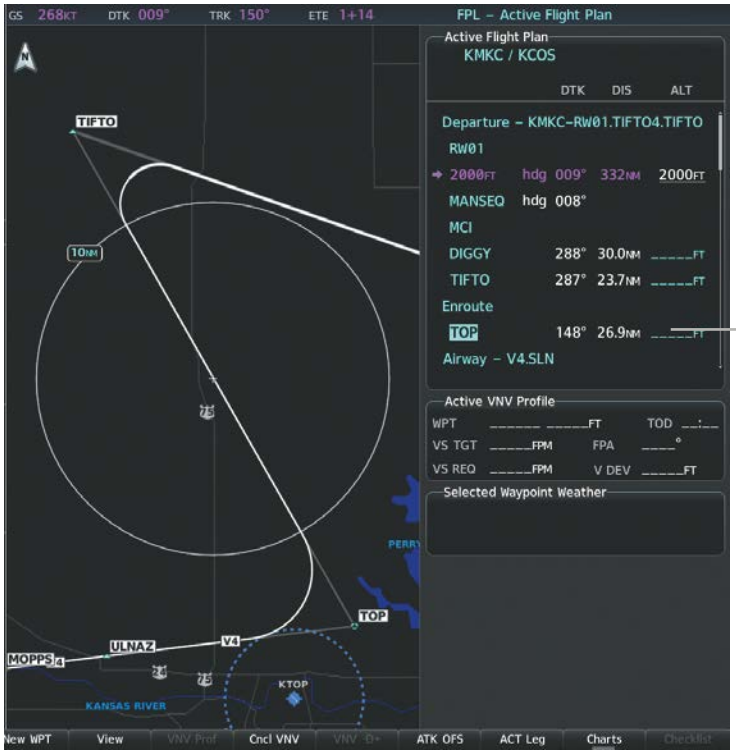
1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint to be removed.
3) Press the **CLR** Key. The 'Remove XXXXX?' 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) Press the **FMS** Knob to remove the flashing cursor.

Removing an individual waypoint from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Turn the large **FMS** Knob to highlight the waypoint to be removed.
6) Press the **CLR** Key. The 'Remove XXXXX?' window is displayed.
7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
8) Press the **FMS** Knob to remove the flashing cursor.

Fly-Over Waypoint Designation

Waypoints entered in the enroute segment of the flight plan may be treated as fly-by waypoints, unless otherwise designated. A fly-by waypoint is a waypoint that marks the intersection of two straight paths, with the transition from one path to another being made by the aircraft using a precisely calculated turn that "flies by" but does not vertically cross the waypoint. A fly-over waypoint is a waypoint that must be crossed vertically by the aircraft.



Enroute Segment - TOP as Fly-By Waypoint

Figure 5-49 TOP Fly-By Waypoint

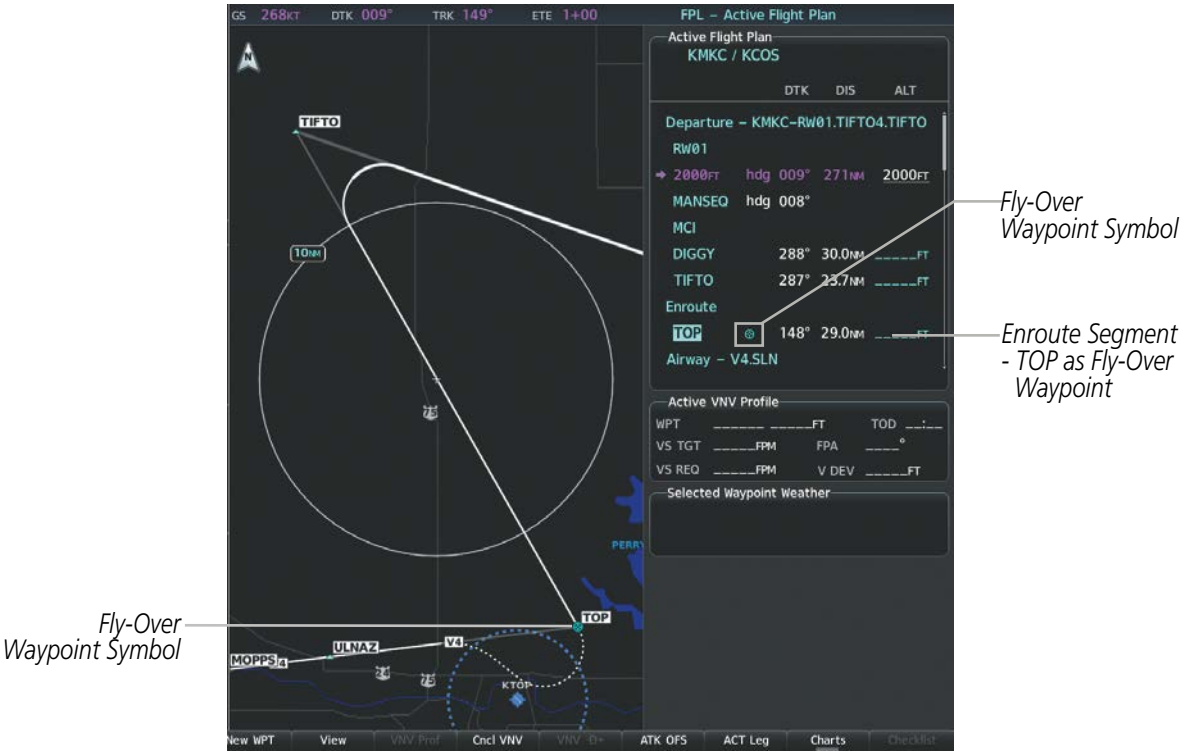


Figure 5-50 TOP Fly-Over Waypoint

A fly-over waypoint is a waypoint that must be crossed vertically by the aircraft. If the system determines that 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.

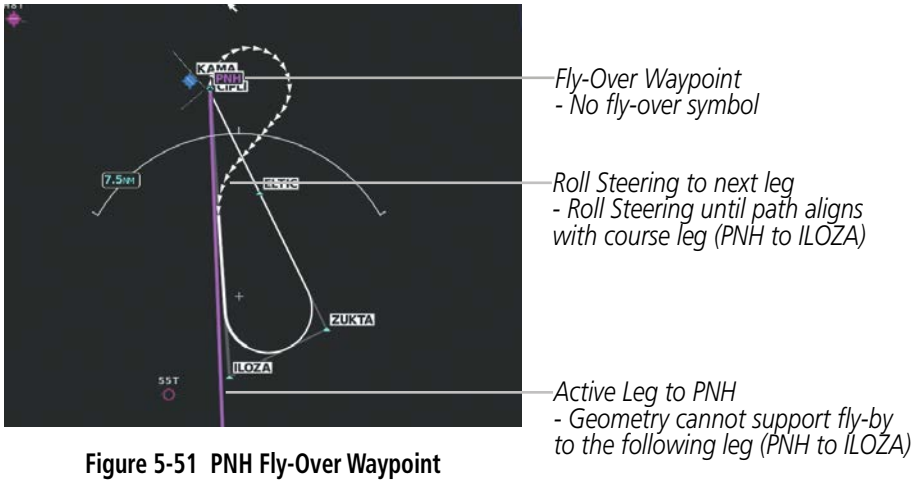


Figure 5-51 PNH Fly-Over Waypoint

A fly-over waypoint may also be manually designated by the pilot, in which case, the fly-over waypoint symbol is displayed.

Designating a fly-over waypoint:

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

   Or:

   For a stored flight plan, highlight the desired flight plan on the 'FPL - Flight Plan Catalog' Page' and press the **Edit** Softkey.

2) Highlight the desired waypoint.

3) Press the **MENU** Key, highlight 'Set Fly-Over Waypoint', and press the **ENT** Key. The 'Set <waypoint> to be a fly-over 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.

5) To change the waypoint back to a fly-by waypoint, highlight the desired waypoint. Press the **MENU** Key, highlight 'Set Fly-By Waypoint', and press the **ENT** Key. The 'Set <waypoint> to be a fly-by waypoint?' Window is displayed. With 'OK' highlighted, press the **ENT** Key.

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.

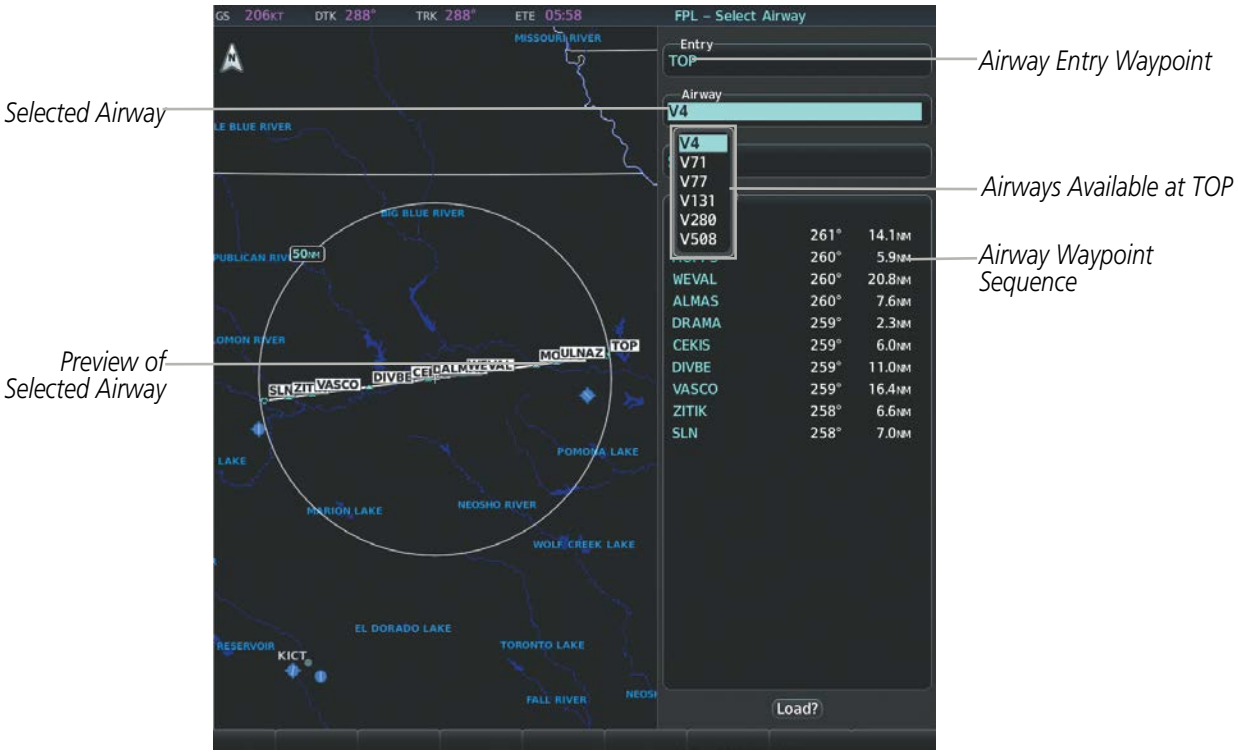


Figure 5-52 Select Airway - Selecting Airway

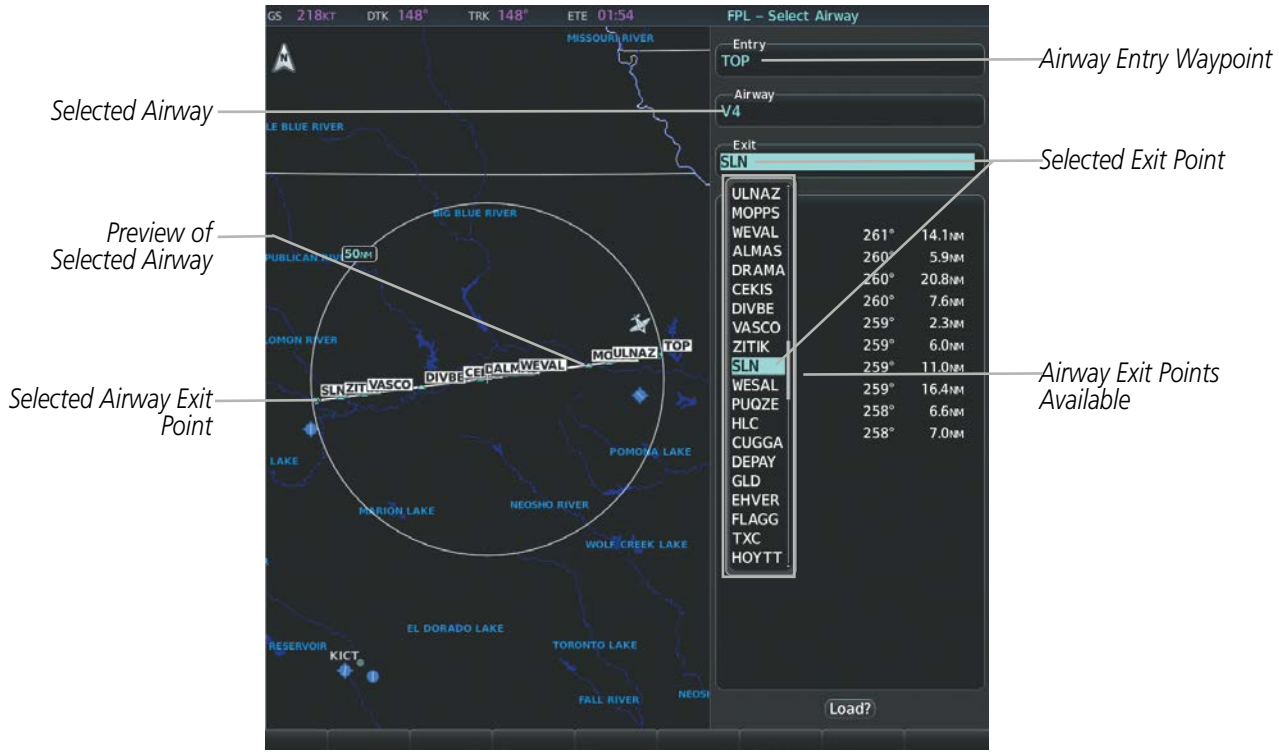


Figure 5-53 Select Airway - Selecting Exit Point

Adding an airway to the active flight plan:

1) Press the **FPL** Key.
2) Press the **FMS** Knob to activate the cursor (not required on the PFD).
3) Turn the large **FMS** Knob to highlight the waypoint after the desired airway entry point. If this waypoint is not a valid airway entry point, a valid entry point should be entered at this time.
4) Turn the small **FMS** Knob one click clockwise and press the **LD AIRWY** Softkey (MFD only), or press the **MENU** Key and select "Load Airway". The 'FPL - Select Airway' Page is displayed. The **LD AIRWY** Softkey or the "Load Airway" menu item is available only when a valid airway entry waypoint has been chosen (the waypoint ahead of the cursor position).
5) Turn the **FMS** Knob to select the desired airway from the list, and press the **ENT** Key. Low altitude airways are shown first in the list, followed by "all" altitude airways, and then high altitude airways.
6) Turn the **FMS** Knob to select the desired airway exit point from the list, and press the **ENT** Key. 'Load?' is highlighted.
7) Press the **ENT** Key. The system returns to editing the flight plan with the new airway inserted.

Adding an airway to a stored flight plan:

1) On the 'FPL - Flight Plan Catalog' Page, press the **FMS** Knob to activate the cursor.
2) Highlight the desired flight plan.
3) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select "EDIT" and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
4) Turn the large **FMS** Knob to highlight the waypoint after the desired airway entry point. If this waypoint is not a valid airway entry point, a valid entry point should be entered at this time.
5) Turn the small **FMS** Knob one click clockwise and press the **LD AIRWY** Softkey (MFD only), or press the **MENU** Key and select "Load Airway". The 'FPL - Select Airway' Page is displayed. The **LD AIRWY** Softkey or the "Load Airway" menu item is available only when a valid airway entry waypoint has been chosen (the waypoint ahead of the cursor position).
6) Turn the **FMS** Knob to select 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.
7) Turn the **FMS** Knob to select the desired airway exit point from the list, and press the **ENT** Key. 'Load?' is highlighted.
8) 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 over the whole route such that it can be flown only one direction.

For example, airway "UR975" in North Africa has more complicated directional restrictions within the list of airway waypoints. That is, each waypoint may have its own conditional route in relation to another waypoint.

In the US, airways that are "one-way" for specified hours of operation are not uncommon. These airways are always bidirectional in the system database.

The system only allows correct airway sequences to be inserted. If the pilot subsequently inverts the flight plan, the system inverts the airway waypoint sequence and removes the airway header.

Removing Airways

Removing an entire airway from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the Active 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the header of the airway to be 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) Press the **FMS** Knob to remove the flashing cursor.

Removing an entire airway from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Turn the large **FMS** Knob to highlight the white header of the airway to be removed.
6) Press the **CLR** Key. The 'Remove <airway name> from flight plan?' window is displayed.
7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
8) Press the **FMS** Knob to remove the flashing cursor.

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 active 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.

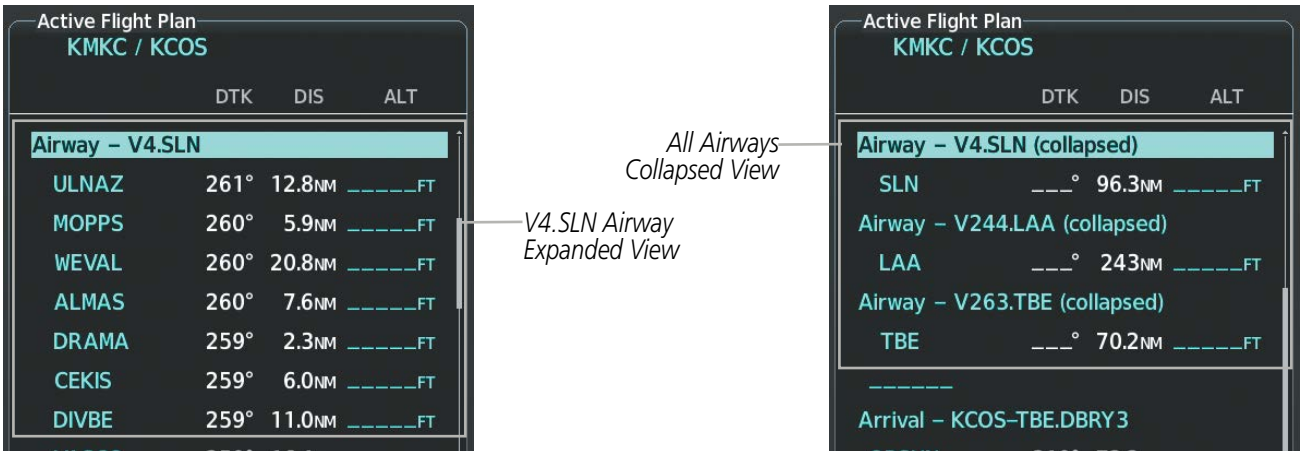


Figure 5-54 Expanded/Collapsed Airways

Collapsing/expanding the airways in the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Collapse Airways' or 'Expand Airways', and press the **ENT** Key. The airways are collapsed/expanded.

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 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) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the destination waypoint for the desired leg.
3) Press the **ACT Leg** Softkey (MFD only); or press the **MENU** Key, highlight 'Activate Leg', and press the **ENT** Key. A confirmation window is displayed with 'Activate' highlighted.
4) Press the **ENT** Key to activate the flight plan leg. To cancel, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

ALONG TRACK OFFSETS

A waypoint having an "along track offset" distance from an existing waypoint can be entered into a flight plan. Along track offset waypoints lie along the path of the existing flight plan, and can be used to make the system reach a specified altitude before or after reaching the specified flight plan waypoint. Offset distances can be entered from 1 to 999 nm in increments of 1 nm. Entering a negative offset distance results in an along track offset waypoint inserted before the selected waypoint, whereas entering a positive offset distance results in an along track offset waypoint inserted after the selected waypoint. Multiple offset waypoints are allowed.

A waypoint must be adjacent to its parent waypoint in the flight plan, so the system limits the along-track distance to less than the length of the leg before or after the selected waypoint. If the selected waypoint is the active waypoint, the distance is limited to less than the distance to go to the active waypoint. Assigning an along track offset to a leg with indeterminate length is not permitted. An along track offset is not allowed at or after the final approach fix of an approach.

An along track offset distance cannot be modified once entered. If the along track offset distance must be changed, the existing along track offset waypoint must be removed and a new one created with the new offset distance.

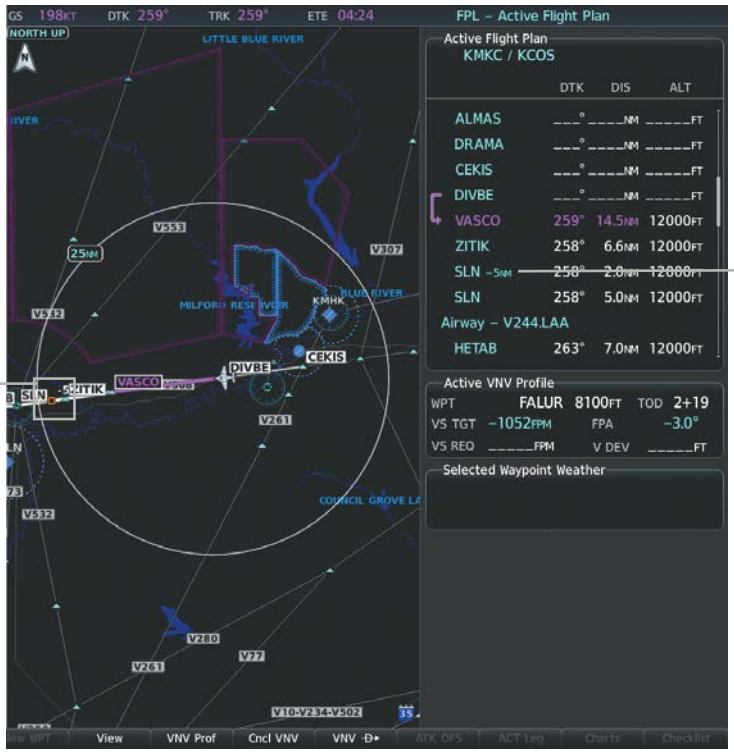


Figure 5-55 Along Track Offset

Entering an along track offset distance:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the along track offset.
3) Press the **ATK OFS** Softkey (MFD only); or press the **MENU** Key, highlight 'Create ATK Offset Waypoint', and press the **ENT** Key.
4) Enter a positive or negative offset distance in the range of +/- 1 to 999 nm (limited by leg distances).
5) Press the **ENT** Key to create the offset waypoint.
6) Press the **FMS** Knob to remove the flashing cursor.

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 over the 'VNV' Box altitude field.
3) Enter the desired altitude using the **FMS** Knob.
4) Press the **ENT** Key to accept the altitude constraint; if the selected waypoint is an airport, an additional choice is displayed. If the waypoint is an airfield, 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 'VNV' offset distance field.
6) Enter the desired along-track distance before the waypoint.
7) Press the **ENT** Key. 'Activate?' is highlighted.
8) Press the **ENT** Key to activate.

CLOSEST POINT OF FPL

'Closest Point of FPL' calculates the bearing and closest distance at which a flight plan passes a reference waypoint, and creates a new user waypoint along the flight plan at the location closest to a chosen reference waypoint.

Determining the closest point along the active flight plan to a selected waypoint:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the Active 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Closest Point Of FPL", and press the **ENT** Key. A window appears with the reference waypoint field highlighted.
3) Enter the identifier of the reference waypoint 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 (PTK) feature allows creation of a parallel course offset of 1 to 50 nm left or right of the current flight plan. When Parallel Track is activated, the course line drawn on the map pages shows the parallel course, and waypoint names have a lower case "p" placed after the identifier. 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 that the system is unable to activate the parallel track with the message 'Parallel Track Unavailable Approach Leg Active'.
- If the offset direction and distance results in an unreasonable route geometry (e.g., there is a sharp turn of more than 120 degrees), the status indicates that the system is unable to activate the parallel track because of invalid geometry ('Parallel Track Unavailable Invalid Route Geometry').
- If the active leg is not a track between two fixes (TF) or a course to a fix (DF) leg, the status indicates that the system is unable to activate the parallel track because parallel track is not available for the active leg type ('Parallel Track Unavailable Not Allowed for Active Leg').

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.*

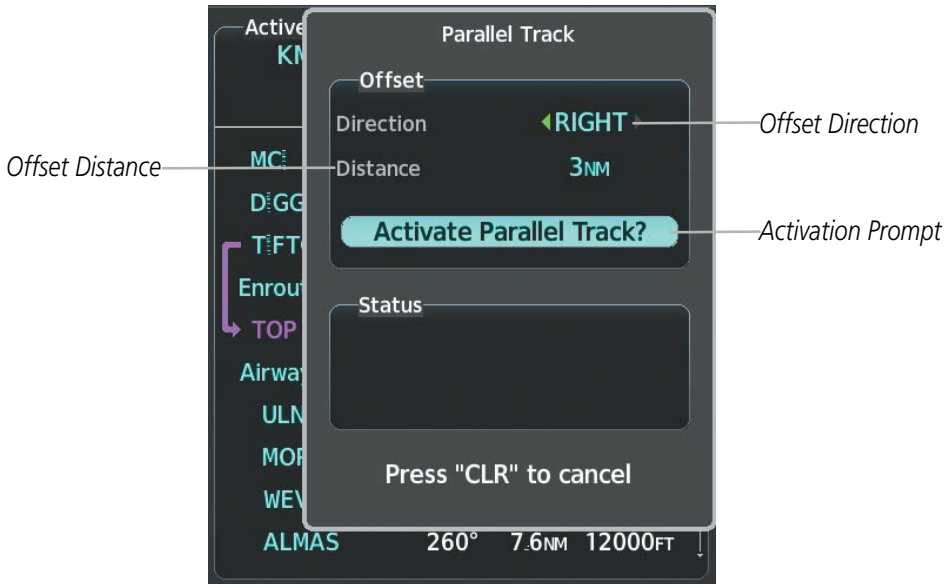


Figure 5-56 Parallel Track

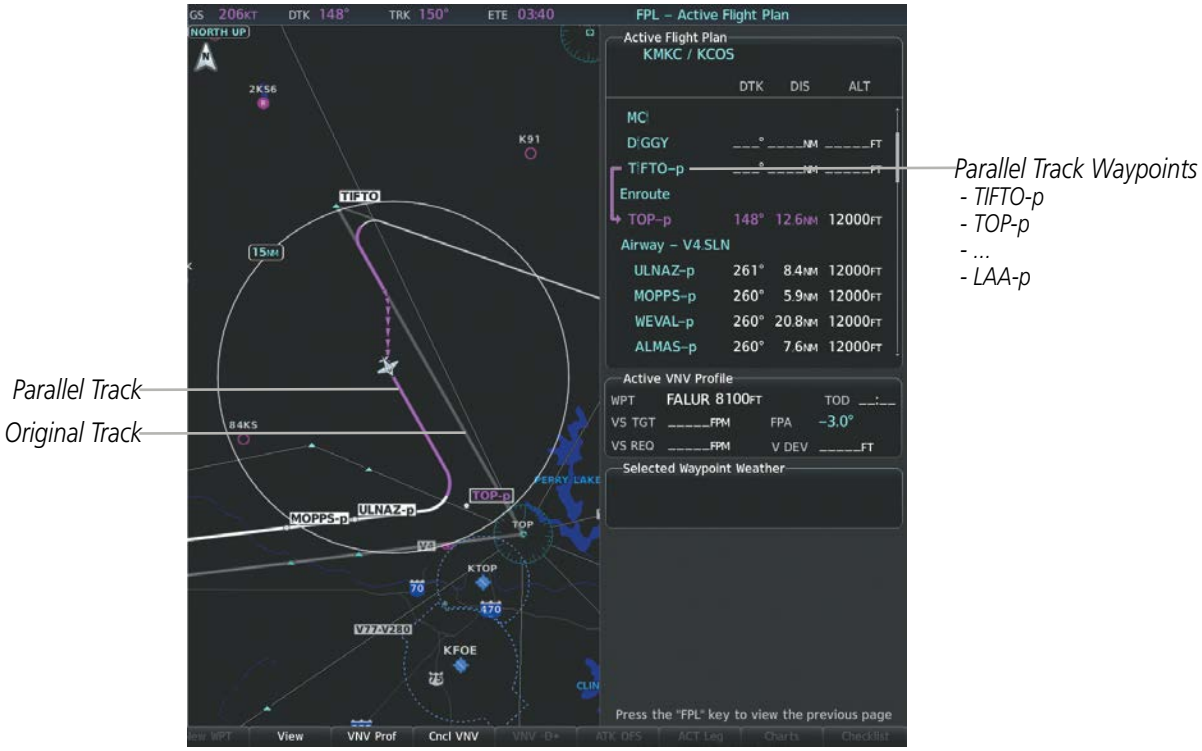


Figure 5-57 Parallel Track Active

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 1-99 nm and press the **ENT** Key. 'Activate Parallel Track' is highlighted.
5) Press the **ENT** Key to activate parallel track. Press the **FMS** Knob or the **CLR** Key to cancel the parallel track activation.

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?' 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.

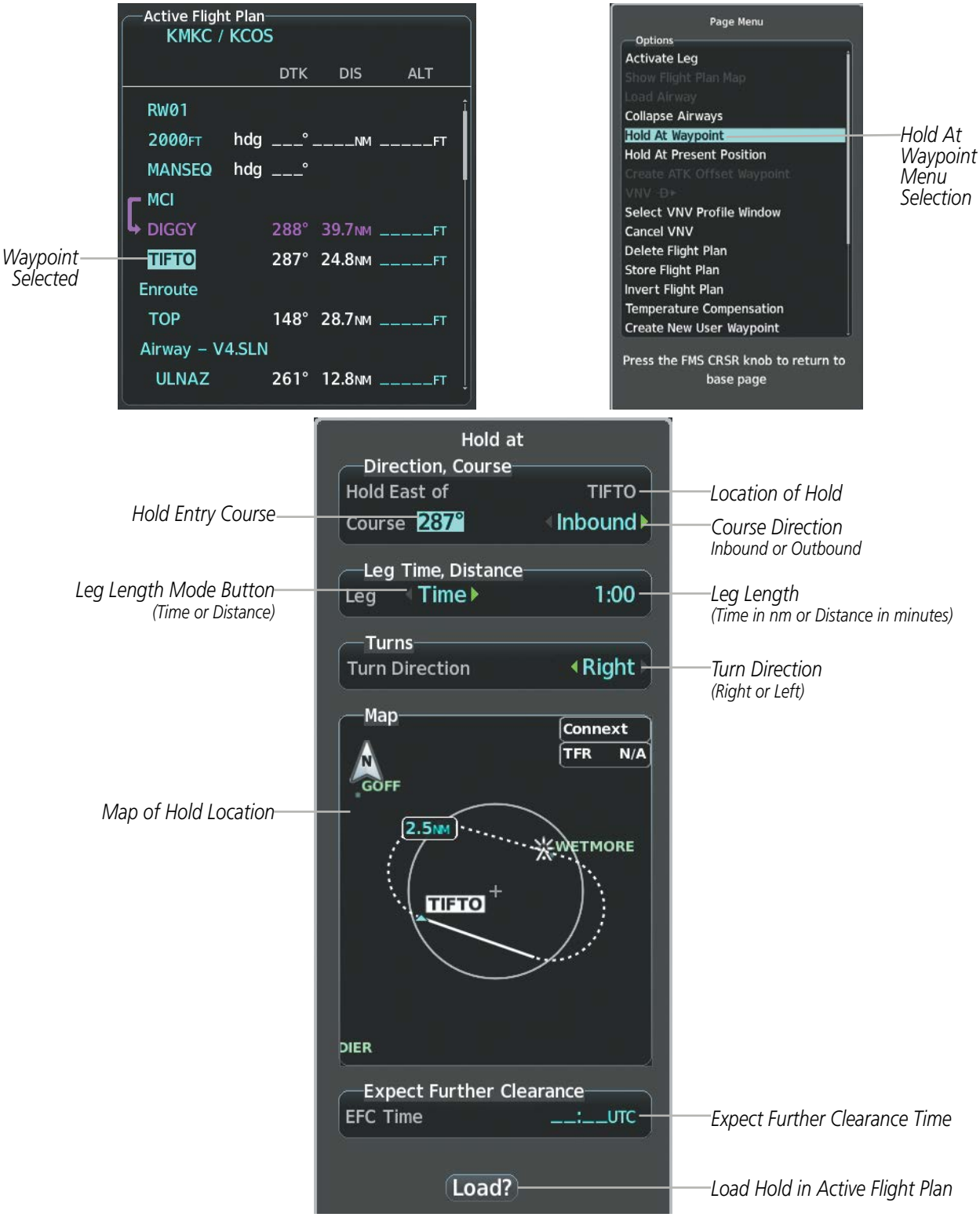


Figure 5-58 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

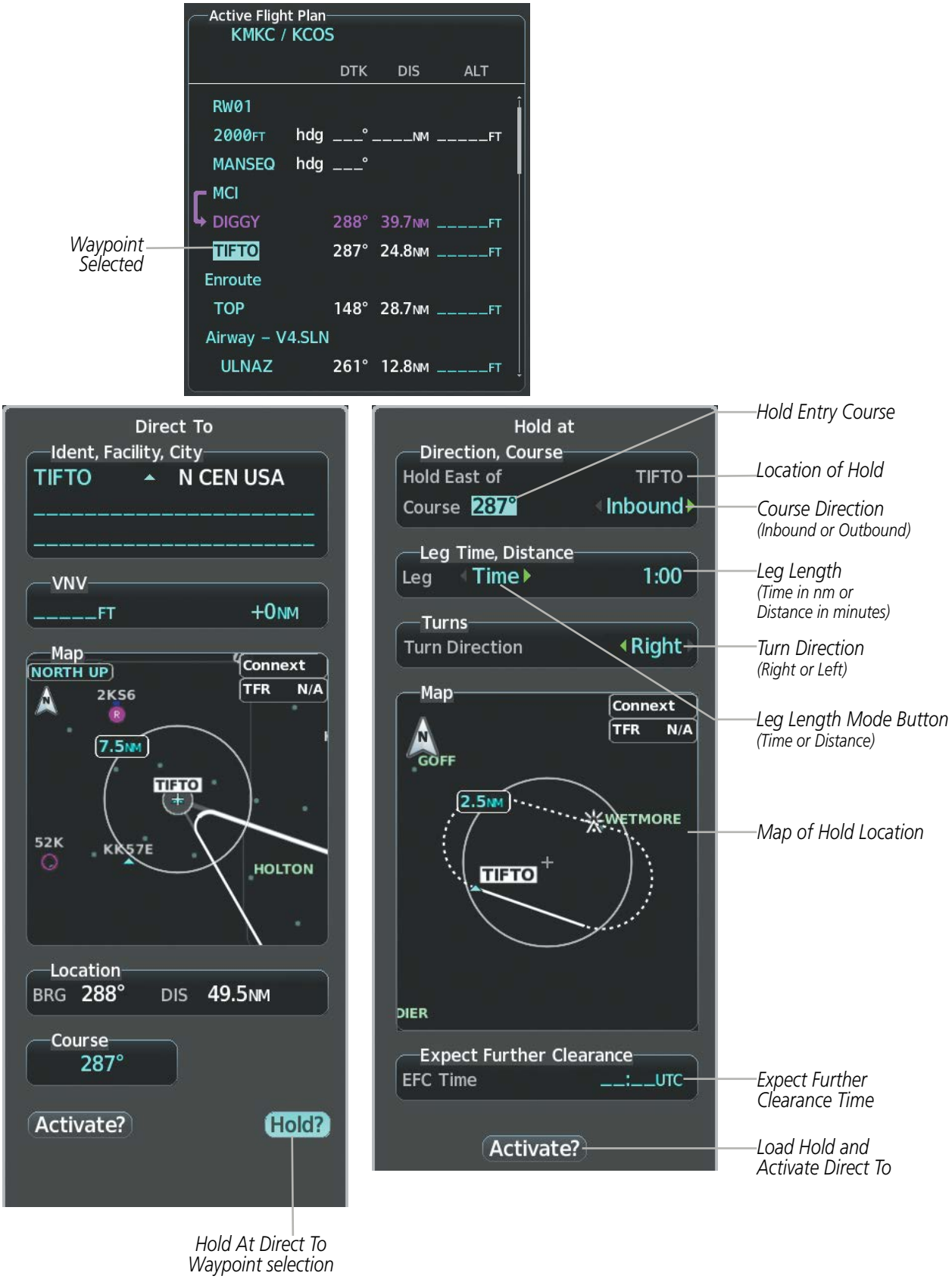


Figure 5-59 Creating a User Defined Holding Pattern at a Direct To Waypoint

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

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the Active 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the hold.
3) Press the **MENU** Key, highlight 'Hold At Waypoint', and press the **ENT** Key. The 'Hold at' Window appears with the course field highlighted.
4) Use the **FMS** Knobs to edit the entry 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 time/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 Active '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 entry 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 time/length, and press the **ENT** Key.
7) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
8) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC Time), and press the **ENT** Key.
9) Press the **ENT** Key while 'Activate?' is highlighted to create an Offroute Direct-to hold waypoint at the aircraft present position and activate the hold.

Creating a user-defined hold at a direct-to waypoint:

1) Press a Direct-To Key and set up the direct-to waypoint as desired, but select 'Hold?' instead of 'Activate?' when finished (MFD or PFD).
2) Use the **FMS** Knobs to edit the entry 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 time/length, and press the **ENT** Key.
6) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
7) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC TIME), and press the **ENT** Key.
8) Press the **ENT** Key while 'Activate?' is highlighted to activate the direct-to with the user-defined hold defined at the direct-to waypoint. (If the direct-to waypoint is part of the active flight plan, the HOLD is inserted into the active flight plan. If the direct-to waypoint is not part of the active flight plan, an off-route direct-to hold is created.)

Exiting a user-defined hold inserted into the active flight plan:

Press the **SUSP** Softkey. The system will provide guidance to follow the holding pattern to the inbound course and resume automatic waypoint sequencing.

Removing a user-defined hold inserted into the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the Active 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the HOLD waypoint.
3) Press the **CLR** Key. A 'Remove Holding Pattern?' confirmation window is displayed.
4) Select 'OK' and press the **ENT** Key. The holding pattern is removed from the active flight plan. Select 'Cancel' and press the **ENT** Key to cancel the removal of the holding pattern.

Removing a user-defined hold at an off-route direct-to:

1) Press a **Direct To** Key to display the 'Direct To' Window (PFD or MFD).
2) Press the **MENU** Key to display the 'Page Menu' Window with the cursor on the 'Cancel Direct-To NAV' selection.
3) Press the **ENT** Key. The holding pattern is removed.

MANAGING FLIGHT PLANS

The pilot can manage flight plans by importing/exporting via SD Card or mobile device, 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 mobile device via the Wireless Transceiver (FlightStream 510). Transfer of a flight plan to a mobile device is controlled by the mobile device. When a mobile device is attempting to transfer a flight plan to the system, the pending flight plan may be ignored, previewed, stored, or activated by the pilot.

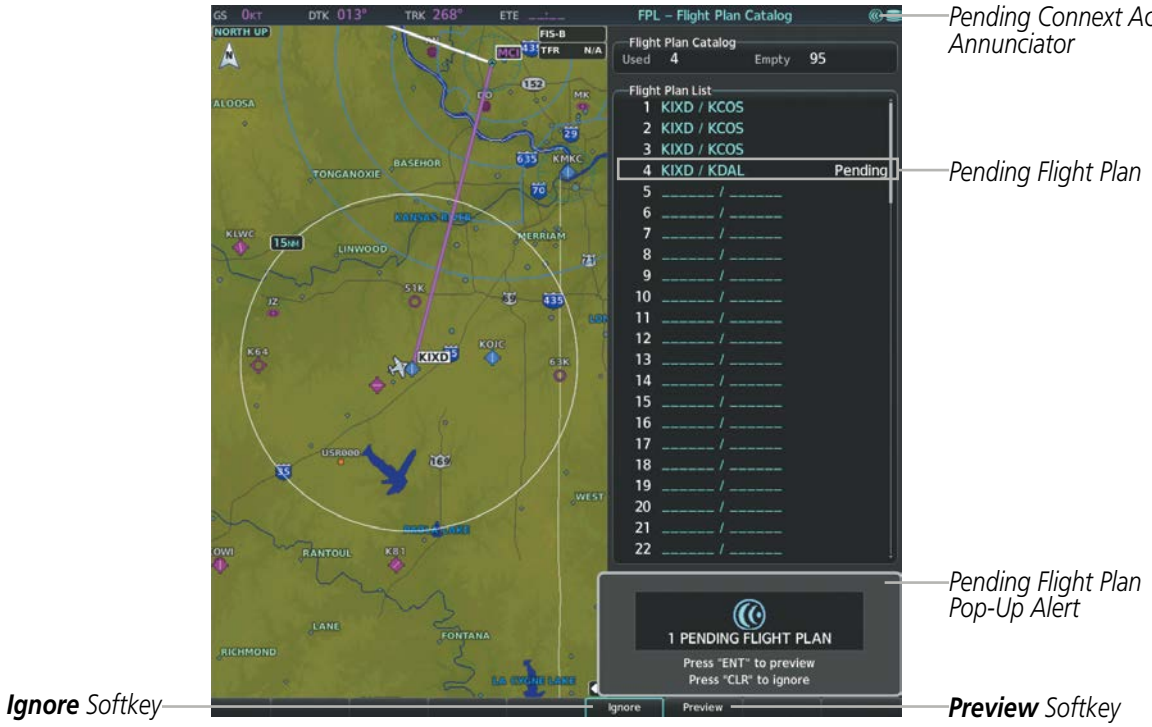


Figure 5-60 Pending Flight Plan Transfer

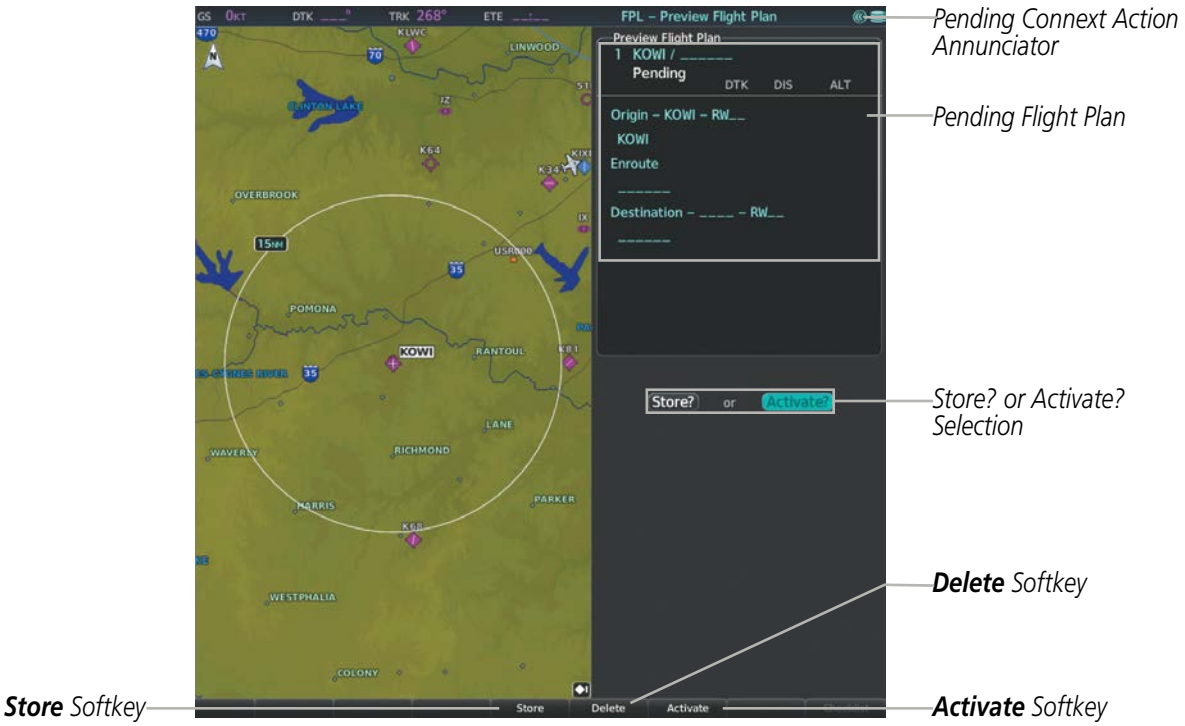


Figure 5-61 Preview Flight Plan

Ignoring a flight plan transfer from a wireless connection:

1) When a flight plan transfer has been initiated from a mobile device, a Pending Flight Plan pop-up alert appears in the lower right corner of the MFD, and an 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 mobile device, 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) Press 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) Press the **FMS** Knob to activate the cursor.
   b) Turn the **FMS** Knob to highlight 'Store?'.
   c) Press the **ENT** Key to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

   Or:

   a) Press the **MENU** Key.
   b) Turn the **FMS** Knob to highlight 'Store Flight Plan'.
   c) Press the **ENT** Key to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

Activating a pending flight plan:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the pending flight plan.
3) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.
4) Press the **Activate** Softkey. The 'Activate Flight Plan?' window is displayed.

   Or:

   a) Press the **FMS** Knob to activate the cursor.
   b) Turn the **FMS** Knob to highlight 'Activate?'.
   c) Press the **ENT** Key. The 'Activate Flight Plan?' window is displayed.

   Or:

   a) Press the **MENU** Key.
   b) Turn the **FMS** Knob to highlight 'Activate Flight Plan'.
   c) Press the **ENT** Key. The 'Activate Flight Plan?' window is displayed.

5) With 'OK' highlighted, press the **ENT** Key to activate the pending flight plan. The pending flight plan becomes the active flight plan and is removed from the '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) Press the **FMS** Knob to activate the cursor.
4) Turn the **FMS** Knob to highlight the desired pending flight plan.
5) Press the **Delete** Softkey. The 'Delete Flight Plan XX?' window is displayed.

   Or:

   Press the **CLR** Key. The 'Delete Flight Plan XX?' window is displayed.

   Or:

   a) Press the **MENU** Key.
   b) Turn the **FMS** Knob to highlight 'Delete Flight Plan'.
   c) Press the **ENT** Key. The 'Delete Flight Plan XX?' window is displayed.

6) With 'OK' highlighted, press the **ENT** Key to delete the pending flight plan. The pending flight plan is removed from the '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) Press the **FMS** Knob to activate the cursor.
5) Turn either **FMS** Knob to highlight an empty or existing flight plan.
6) Press the **Import** Softkey; or press the **MENU** Key, select "Import Flight Plan", and press the **ENT** Key.

   If an empty slot is selected, a list of the available flight plans on the SD card will be displayed.

   Or:

If an existing flight plan is selected, an "Overwrite existing flight plan? OK or Cancel" prompt is displayed. Press the **ENT** Key to choose to overwrite the selected flight plan and see the list of available flight plans on the SD card. If overwriting the existing flight plan is not desired, select "Cancel" using the **FMS** Knob, press the **ENT** Key, select another flight plan slot, and press the **Import** Softkey again.

7) Turn the small **FMS** Knob to highlight the desired flight plan for importing.
8) Press the **ENT** Key to initiate the import.
9) Press the **ENT** Key again to confirm the import.

NOTE: *If the imported flight plan contains a waypoint with a name that duplicates the name of a waypoint already stored on the system, the system compares the coordinates of the imported waypoint with those of the existing waypoint. If the coordinates are different, the imported waypoint is automatically renamed by adding characters to the end of the name.*

Exporting a flight plan to an SD Card:

1) Insert the SD card into the top card slot on the MFD.
2) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
3) Turn the small **FMS** Knob to select the 'FPL - Flight Plan Catalog' Page.
4) Press the **FMS** Knob to activate the cursor.
5) Turn the large **FMS** Knob to highlight the flight plan to be exported.
6) Press the **Export** Softkey; or press the **MENU** Key, select "Export Flight Plan".
7) If desired, change the name for the exported file by turning the large **FMS** Knob to the left to highlight the name, then use the small and large **FMS** Knobs to enter the new name, and press the **ENT** Key.
8) Press the **ENT** Key to initiate the export.
9) Press the **ENT** Key to confirm the export.

NOTE: *The exported flight plan will not contain any procedures or airways.*

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 partially imported.'	Some flight plan waypoints were successfully imported from the SD card, however others had errors and were not imported. A partial stored flight plan now exists in the system.
'File contained user waypoints only.'	The file stored on the SD card did not contain a flight plan, only user waypoints. One or more of these waypoints did not import successfully.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints that the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

Table 5-10 Flight Plan Import/Export Messages

INVERTING A FLIGHT PLAN

A flight plan may be inverted (reversed) for navigation back to the original departure point. The 'Inverting and activating a stored flight plan' procedure is discussed within the Stored Flight Functions portion of this section.

Inverting the active flight plan:

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 'Invert Flight Plan', and press the **ENT** Key. An 'Invert active flight plan?' confirmation window is displayed.
3) Select 'OK'.
4) Press the **ENT** Key to invert and activate the active flight plan. To cancel, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

Inverting and activating a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Press the **Invert** Softkey; or press the **MENU** Key, highlight 'Invert & Activate FPL?', and press the **ENT** Key. The 'Invert and activate stored flight plan?' window is displayed.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

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, which suspends navigation by the system.

Deleting the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the Active 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Delete Flight Plan', and press the **ENT** Key. The 'Delete all waypoints in flight plan?' window is displayed.
3) With 'OK' highlighted, press the **ENT** Key to delete the active flight plan. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

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.

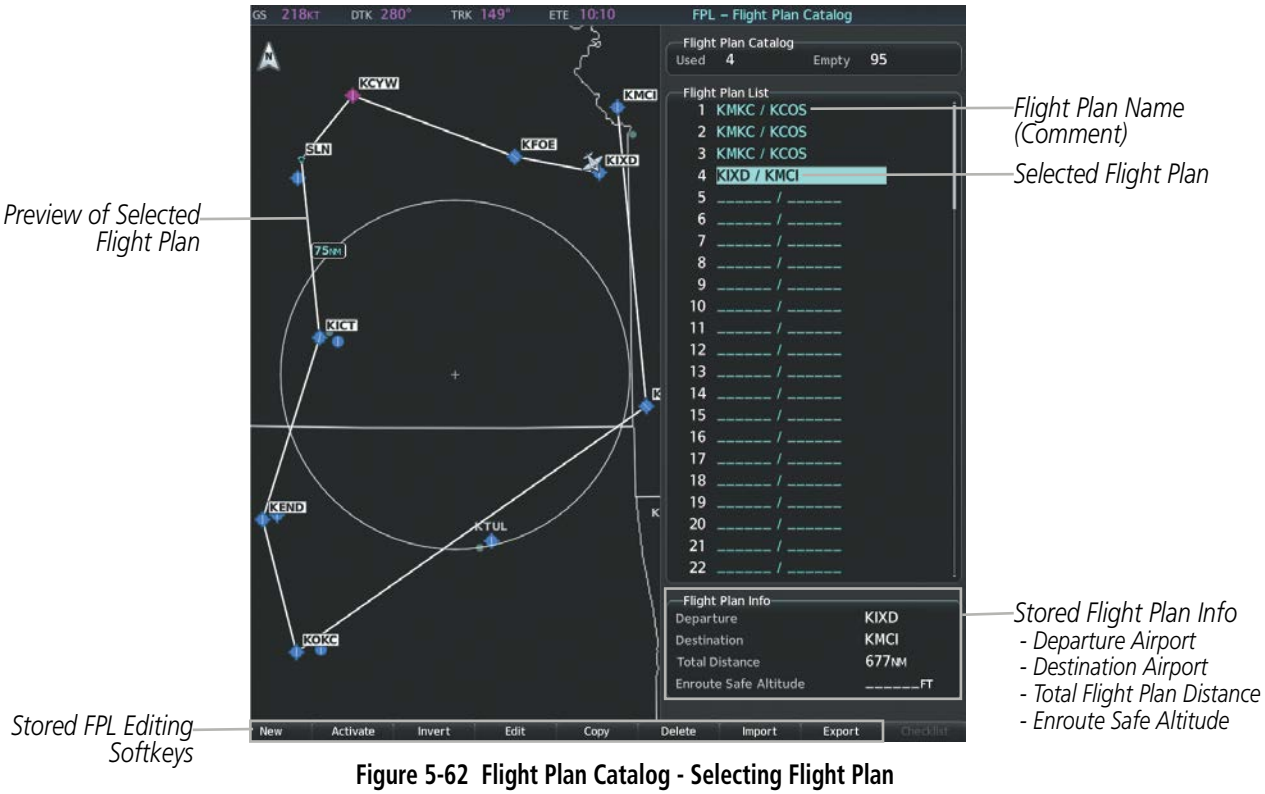


Figure 5-62 Flight Plan Catalog - Selecting Flight Plan

Viewing information about a stored flight plan:

1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.

2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired flight plan.

4) The Flight Plan 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) Press the **FMS** Knob to exit the 'FPL - Stored Flight Plan' Page.

Storing an active flight plan from the 'FPL - Active Flight Plan' Page or the 'Flight Plan' Window:

1) Press the **MENU** Key.

2) Highlight 'Store Flight Plan'.

3) Press the **ENT** Key.

4) With 'OK' highlighted, press the **ENT** Key. The flight plan is stored in the next available position in the flight plan list on the 'FPL - Flight Plan Catalog' Page.

Activating a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) 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) Press 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) Press 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)

Changing the active flight plan comment:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Press the **FMS** Knob to activate the cursor and turn the large **FMS** Knob to highlight the comment field.
3) Use the **FMS** Knobs to edit the comment.
4) Press the **ENT** Key to accept the changes.
5) Press the **FMS** Knob to remove the flashing cursor.

Changing a stored flight plan comment:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
3) Open the 'FPL - Stored Flight Plan' Page:

   Press the **Edit** Softkey.

   Or:

   a) Press the **ENT** Key. The 'Activate stored flight plan?' window is displayed.
   b) Turn the large **FMS** Knob to highlight the 'Edit' button.
   c) Press the **ENT** Key.

   Or:

   a) Press the **MENU** Key.
   b) Select 'Edit Flight Plan' and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the comment field.
5) Use the **FMS** Knobs to edit the comment.
6) Press the **ENT** Key to accept the changes.
7) Press the **FMS** Knob to remove the flashing cursor.

5.7 VERTICAL NAVIGATION

NOTE: *The system supports vertical path guidance and altitude constraints for the following leg types: AF, CD, CF, CI, CR, DF, FC, FD, PI, RF, and TF. Altitude constraints are not retained in stored flight plans.*

The 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 control operations 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.

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 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

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.*

NOTE: *Inhibiting VNV prevents automatic waypoint sequencing and FPA calculations. Subsequently enabling VNV after it had been inhibited, may result in a steep FPA and inaccurate VSD profile depiction.*

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.

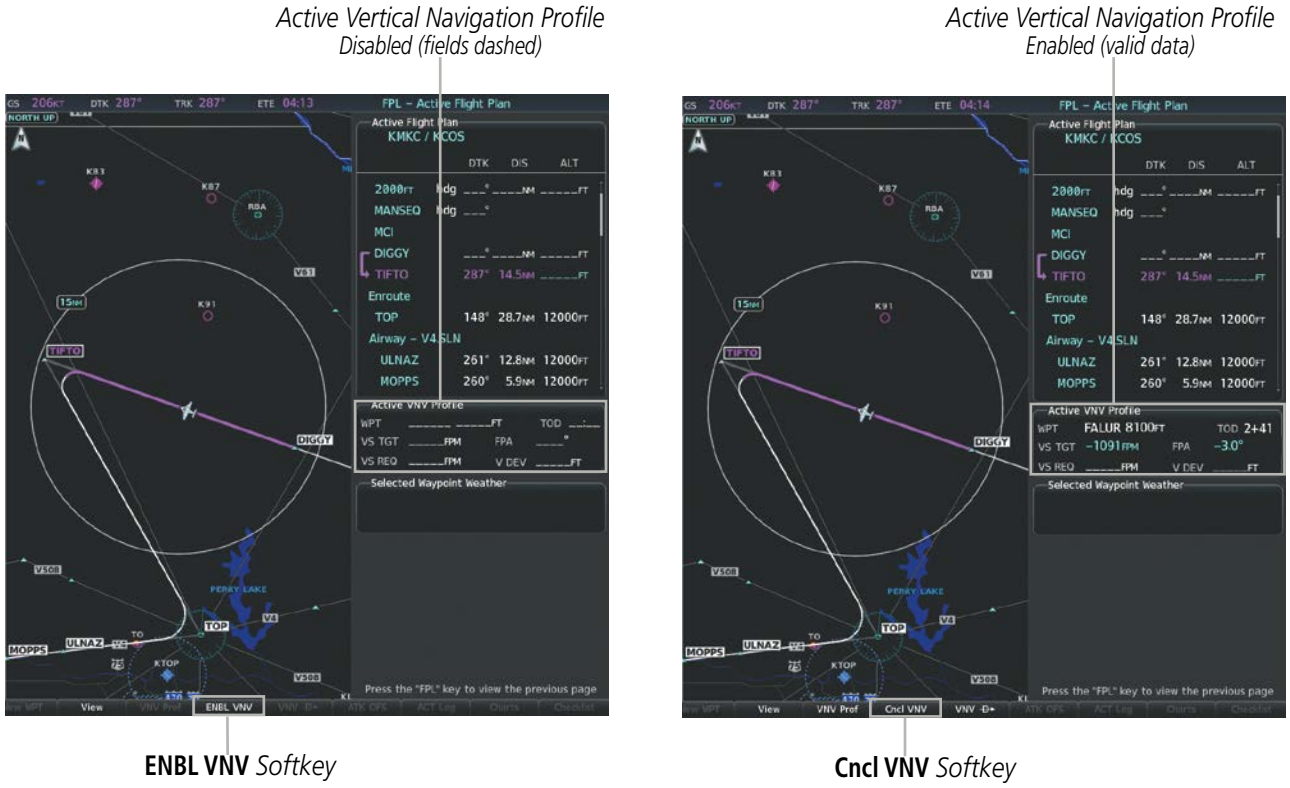


Figure 5-63 Enabling/Disabling Vertical Navigation

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.

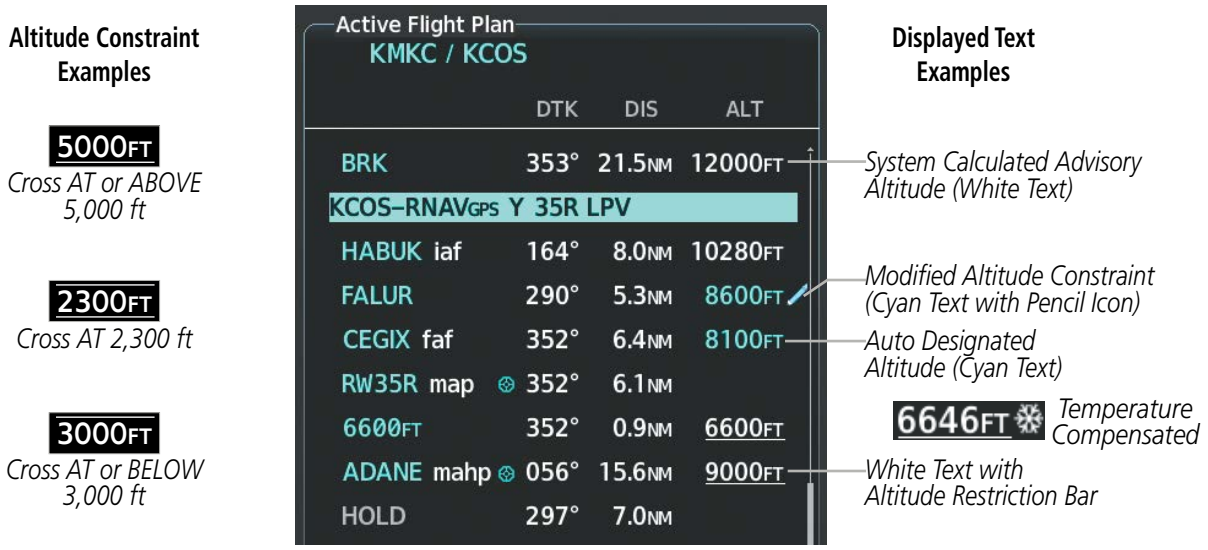


Figure 5-64 Waypoint Altitude Constraints

White Text	Cyan Text
5000FT Advisory altitude calculated by the system estimating the altitude of the aircraft as it passes over the navigation point. No white line above or below to indicate a potential constraint. 5000FT Altitude retrieved from the navigation database. White line above or below indicates the type of constraint, as shown in the preceding figure. These altitudes are provided as a reference, and are not designated to be used in determining vertical guidance.	8600FT Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manual modified data entry. 8100FT The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.

Table 5-11 Altitude Constraint Color Coding

When a procedure is loaded, the system will auto-designate (automatically enter and enable) altitude constraints to be used for vertical guidance. 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.

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.

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.*

A designated altitude constraint may be rendered invalid if any of the following are true:

- Meeting the constraint requires the maximum flight path angle or maximum vertical speed to be exceeded
- Meeting the constraint requires the aircraft to climb
- The descent constraints are not sequentially descending.

Altitude constraints can be modified or deleted 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.

Entering/designating or modifying an altitude constraint:

1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) Enter an altitude constraint value using the **FMS** Knobs. To enter altitudes as a flight level, turn the small **FMS** Knob counter-clockwise past zero or clockwise past 9 on the first character, and the system automatically changes to show units of Flight Level. Turn the large **FMS** Knob clockwise to highlight the first zero and enter the three digit flight level.
4) Press the **ENT** Key to accept the altitude constraint; if the selected waypoint is an airport, an additional choice is displayed. Turn the small **FMS** Knob to choose 'MSL' or 'AGL', and press the **ENT** Key to accept the altitude.

Removing/undesignating an altitude constraint:

1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) 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 on the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) Press the **CLR** Key. A 'Remove or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.
4) Select 'Revert' and press the **ENT** Key. The altitude is changed to the navigation database value.
5) Press the **FMS** Knob to remove the flashing cursor.

QFE CONSTRAINTS

QFE Constraints

Baro QFE settings may be enabled within the System Setup Page so that the altimeter will read zero at the selected airfield reference point (Origin or Destination airfield) or to a manual setting. Once QFE is enabled, altitude constraints based on Baro QFE may be entered or modified in the flight plan. All former QNH altitude constraints in the flight plan will be displayed as the height above the reference airfield and will be in parenthesis. QNE altitudes in the flight plan will continue to appear as "FLXXX" in white or cyan text without parenthesis. See the Flight Instruments Section for more information on how to enable Baro QFE.

NOTE: *The system will generate a system message and inhibit VNAV guidance when the aircraft is vertically approaching a flight level altitude constraint with QFE active. The system will automatically resume VNAV guidance if QFE is disabled or the flight level altitude constraint is bypassed.*

NOTE: *'FMS ORIG' and 'FMS DEST' references do not dynamically update with flight plan changes. Always verify QFE settings when changing the QFE reference (airfield, runway, etc.) or flight plan and re-enter settings within the Avionics Settings.*

Entering or modifying a Baro QFE altitude constraint:

1) With Baro QFE enabled, press the **FPL** Key for the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **FMS** Knob, and turn the large **FMS** Knob to highlight the desired waypoint altitude constraint ('ALT').
3) Turn the small **FMS** Knob to begin entry of the altitude constraint, and use the **FMS** Knobs to enter the constraint in reference to Baro QFE. If modifying an existing Baro QFE altitude constraint, turning the small **FMS** Knob displays the existing constraint in MSL in the entry field. If adding a new altitude constraint, turning the small **FMS** Knob displays '00000FT' in the entry field.
4) Press the **ENT** Key. Turn the small **FMS** Knob to highlight 'QFE' and press the **ENT** Key to accept the altitude constraint. The constraint is shown in parenthesis indicating it is based on the Baro QFE setting.

Figure 5-65 Baro QFE Altitude Constraints

VERTICAL SPEED AND FLIGHT PATH ANGLE CONSTRAINTS

The vertical navigation profile can be modified by directly entering a vertical speed target ('VS TGT') and/or flight path angle ('FPA') in the 'Active VNV Profile' Box.

Modifying the VS TGT and FPA:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **VNV Prof** Softkey; or press the **MENU** Key, highlight 'Select VNV Profile Window', and press the **ENT** Key. The cursor is now located in the 'Active VNV Profile' Box.
3) Turn the **FMS** Knobs as needed to edit the values.
4) Press the **FMS** Knob to remove the flashing cursor.

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, BOC/TOC, TOD/BOD, and destination runway) can be displayed on the VSD, depending on the selected mode. See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.

The VSD horizontal range is equal to the navigation map indicated range when the VSD is in Track mode. When the VSD is in Flight Plan mode, the horizontal range is the lower of twice the navigation map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the navigation map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

The aircraft symbol is displayed on the left side of the VSD. The position of the aircraft symbol on the vertical scale is close to the top for a descent phase, at the bottom for on-ground or a climb phase, and in the middle for a cruise phase or if the phase is unknown.

If two waypoints are close together, and their labels or constraint values overlap enough to obscure any text, one waypoint label/constraint value is removed and the vertical dashed line for that waypoint is displayed as darker gray. The priority for which waypoint remains displayed is: (1) the current TO waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Terrain/obstacles are available on the VSD, and will be shown if the aircraft altitude is low enough for the terrain/obstacles to be in view (terrain will be shown in gray if the terrain is selected Off on the navigation map). The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan between the aircraft present position and the end of the map range or active flight plan. The predefined width is determined by the flight phase.

Constraint Type	Numeric Representation	Altitude Constraint Icon
AT (Designated Altitude Constraint)	3000FT	
AT or ABOVE (Un-designated Altitude Constraint derived from the database)	5000FT	
AT or BELOW (Un-designated Altitude Constraint derived from the database)	3000FT	

Table 5-12 Altitude Constraint Icons

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.*

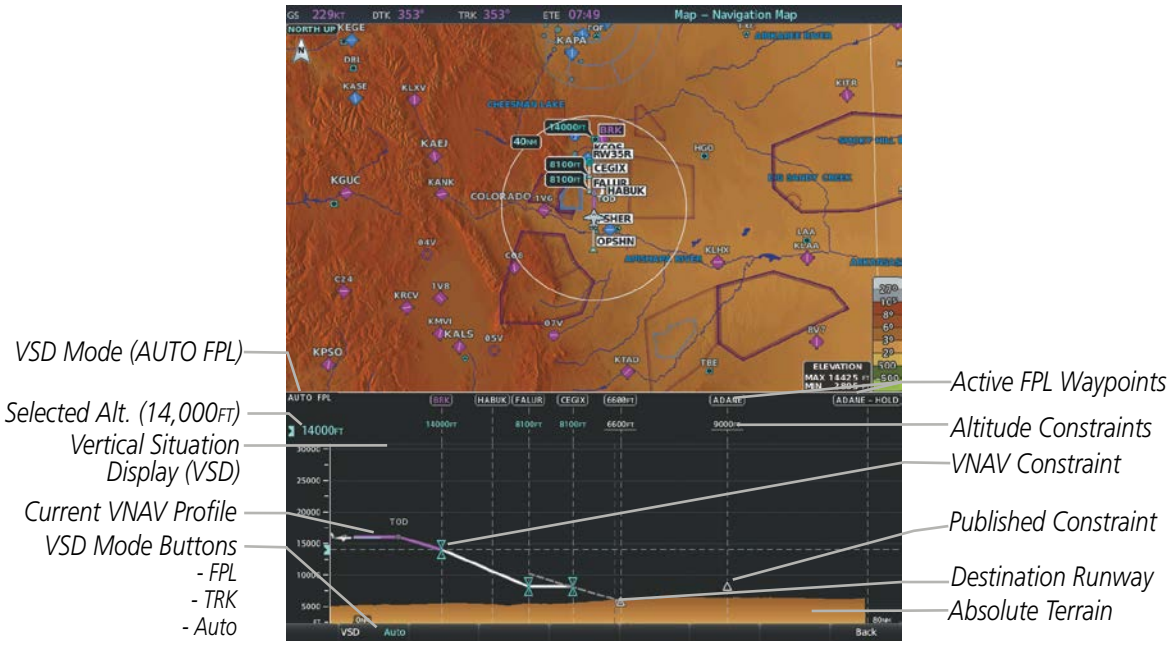


Figure 5-66 Vertical Situation Display (VSD)

VSD Mode Button	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 5-13 VSD Modes

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

Table 5-14 VSD Width of Swath

VSD MESSAGES

Under certain conditions, some messages may appear in conjunction with others.

Message	Description
'Loading...'	VSD is loading data due to a range change, full/half switch, or first being selected for display.
'Flight Plan Not Available'	Flight Plan mode is selected and there is not a flight plan loaded with at least one leg.
'Flight Plan mode unavailable because aircraft off course and active leg over 200 NM'	All of the following are true: - Flight Plan mode is selected - The active leg is greater than 200 nm - The aircraft is outside the swath
'Aircraft Beyond Active Leg'	Flight Plan mode is selected and the aircraft's position, as projected on the flight plan, is past the end of the active leg.
'VSD Not Available'	At least one of the following is true: - Valid terrain database not available - GPS MSL altitude not available - Current barometric altitude not available - Neither current track nor current heading available - GPS position not available - Map range setting is less than 1 nm
'VSD Data Old. Deselect and Reselect VSD'	VSD data has failed to update for 2 seconds or more.

Table 5-15 VSD System Messages

Enabling the Vertical Situation Display:

1) Select the 'Map - Navigation Map' Page.
2) Press the **Map Opt** Softkey.
3) Press the **Inset** Softkey.
4) Press the **VSD** Softkey to enable the Vertical Situation Display.
5) Press the VSD Mode softkey to choose between **Auto**, **FPL**, or **TRK**.

Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Show VSD' and press the **ENT** Key.
4) Press the **Map Opt** Softkey.
5) Press the **Inset** Softkey.
6) Press the VSD Mode softkey to choose between **Auto**, **FPL**, or **TRK**.

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.
3) Turn the **FMS** Knob to highlight 'Hide VSD' and 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 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) Press the **FMS** Knob to activate the cursor and turn the large **FMS** Knob to highlight the desired waypoint.

NOTE: *The selected waypoint must have a designated altitude constraint (cyan number) to be used. If not, the first waypoint in the flight plan with a designated altitude constraint is selected.*

3) Press the **VNV** Softkey; or press the **MENU** Key, highlight 'VNV Direct-To', and press the **ENT** Key. An 'Activate vertical Direct-to to: NNNNNFT at XXXXXX?' confirmation window is displayed.
4) Press the **ENT** Key. Vertical guidance begins to the altitude constraint for the selected waypoint.
5) Press the **FMS** Knob to remove the flashing cursor.

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.

5.8 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.

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 5-67 Procedure Leg Identifiers

Viewing available procedures at an airport:

1) From the 'WPT - Airport Information' Page (first page in the WPT group), press the **DP, STAR,** or **APR** Softkey.
2) The 'WPT - Departure Information' Page is displayed, defaulting to the airport displayed on the 'WPT - Airport Information' Page. Press the **FMS** Knob to activate the cursor. To select another airport, 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 **FMS** Knobs, as required, to highlight a runway or transition. Press the **ENT** Key to select the runway or transition. The cursor moves to the next box. 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 or the **Info 2** 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 5-68 Departure Selection

Figure 5-69 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, press 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 highlight the Departure. 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) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
3) Press the **LD DP** Softkey; or press the **MENU** Key, select "Load Departure", and press the **ENT** Key. The 'PROC - Departure Loading' Page is displayed.
4) Select a departure. Press the **ENT** Key.
5) Select a runway served by the selected departure, if required. Press the **ENT** Key.
6) Select a transition for the selected departure. Press the **ENT** Key.
7) Press the **ENT** Key to load the selected departure procedure.

Removing a departure procedure from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, and highlight 'Remove Departure'.
3) Press the **ENT** Key. A confirmation window is displayed listing the departure procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.

Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob, and turn to highlight the departure header in the active flight plan.
3) Press the **CLR** Key. A confirmation window is displayed listing the departure procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

Removing a departure from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Highlight and remove the departure:
   a) Turn the large **FMS** Knob to highlight the white header of the departure.
   b) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

   Or:

   a) Press the **MENU** Key to display the 'Page Menu' Window and turn the **FMS** Knob to highlight 'Remove Departure'.
   b) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' window is displayed.
6) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
7) Press the **FMS** Knob to remove the flashing cursor.

ARRIVALS

A Standard Terminal Arrival (STAR) can be loaded at any airport that has one available. Only one arrival can be loaded at a time in a flight plan. If an arrival is loaded when another arrival is already in the active flight plan, the new arrival replaces the previous arrival. The route is defined by selection of an arrival, the transition waypoints, and a runway.

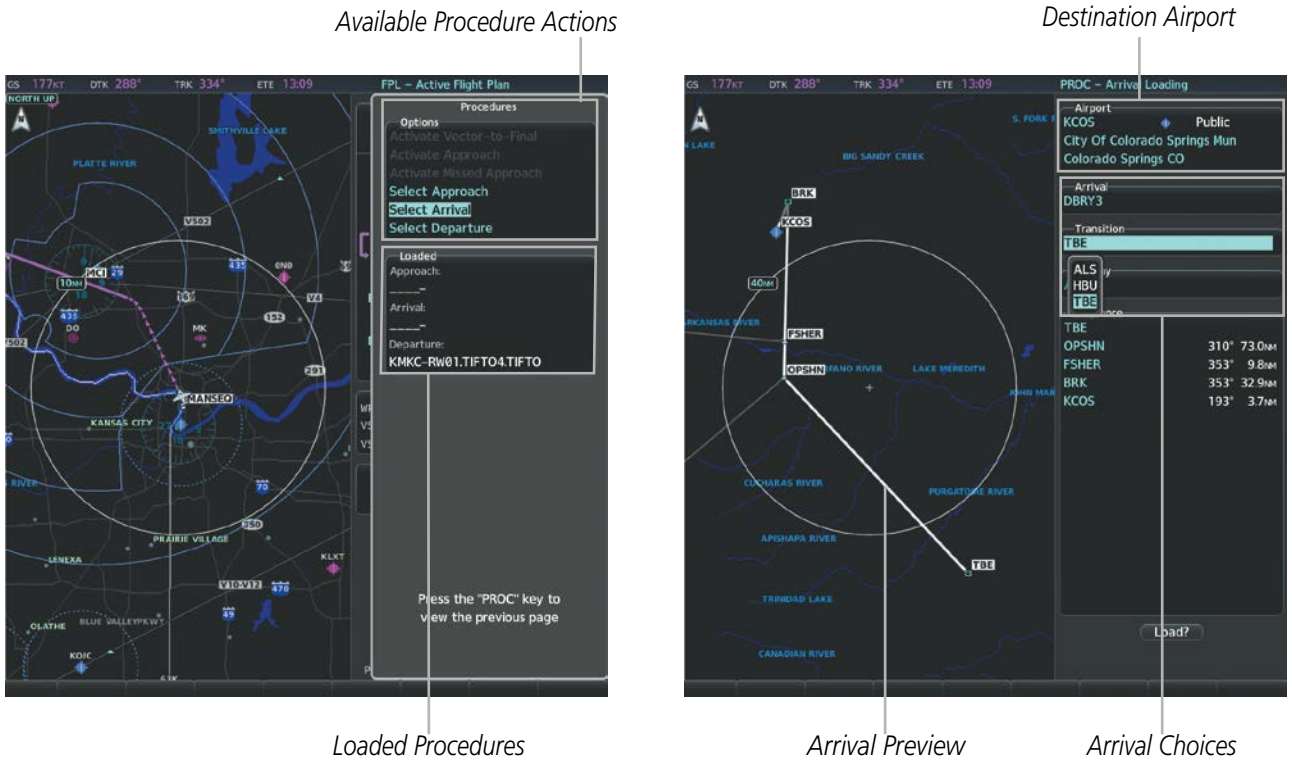


Figure 5-70 Arrival Selection

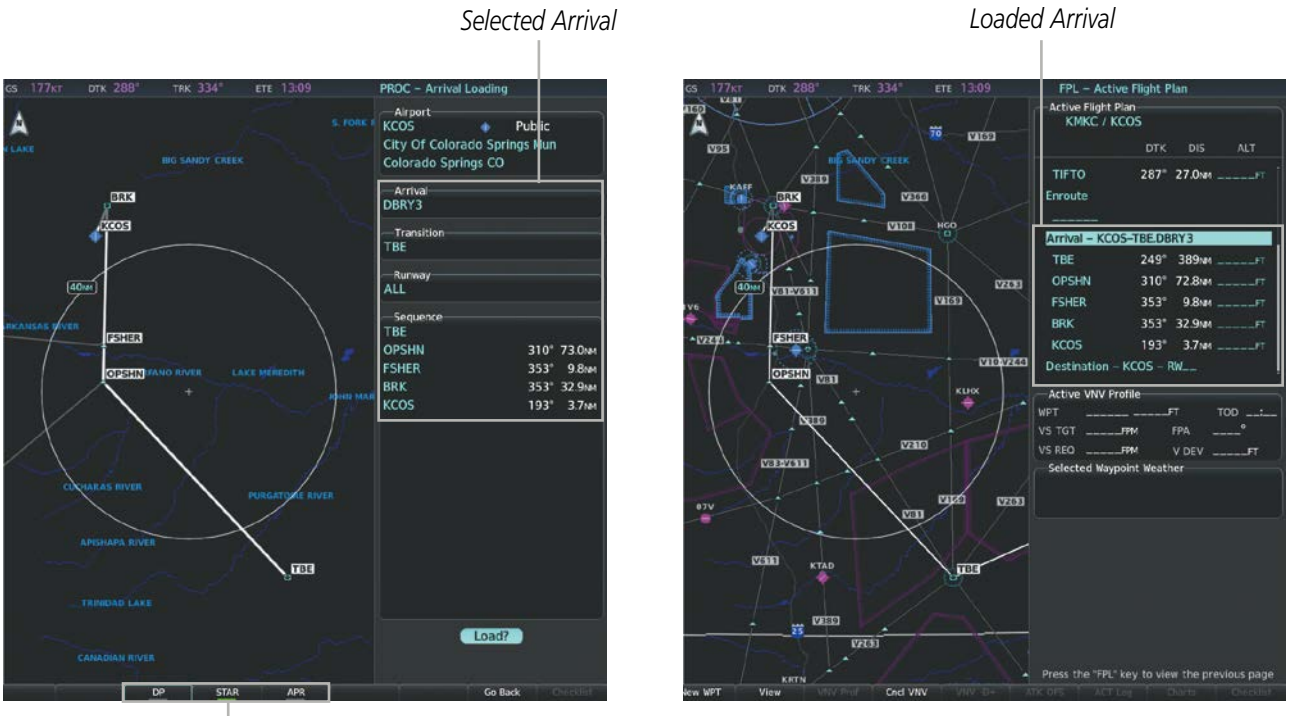


Figure 5-71 Arrival Loading

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, press 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) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
3) Press the **LD STAR** Softkey; or press the **MENU** Key, select "Load Arrival", and press the **ENT** Key. The 'PROC - Arrival Loading' Page is displayed.
4) Select an arrival. Press the **ENT** Key.
5) Select a transition for the selected arrival. Press the **ENT** Key.

6) Select a runway served by the selected arrival, if required. Press the **ENT** Key.

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

Removing an arrival from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).

2) Press the **MENU** Key, and highlight 'Remove Arrival'.

3) Press the **ENT** Key. A confirmation window is displayed listing the arrival procedure.

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

Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).

2) Press the **FMS** Knob, and turn to highlight the arrival header in the active flight plan.

3) Press the **CLR** Key. A confirmation window is displayed listing the arrival procedure.

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

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

Removing an arrival from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.

2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.

4) Press the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.

5) Highlight and remove the arrival:

   a) Turn the large **FMS** Knob to highlight the white header of the arrival.

   b) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

   Or:

   a) Press the **MENU** Key to display the 'Page Menu' Window and turn the **FMS** Knob to highlight 'Remove Arrival'.

   b) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

6) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

7) Press the **FMS** Knob to remove the flashing cursor.

APPROACHES

INSTRUMENT APPROACH

NOTE: *If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.*

An Approach Procedure (APPR) can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.

When selecting an approach, a "GPS" designation to the right of the procedure name indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach (e.g., VOR or ILS). The final course segment of ILS approaches, for example, must be flown by tuning the NAV receiver to the proper frequency and selecting that NAV receiver on the CDI.

The SBAS GPS allows for flying LNAV, LNAV+V, LNAV/VNAV, LP, LP+V, and LPV approach service levels according to the published chart. LNAV+V is an LNAV with advisory vertical guidance provided for assistance in maintaining a constant vertical glidepath similar to an ILS glideslope on approach. This guidance is displayed on the system PFD in the same location as the ILS glideslope using a magenta diamond. In all cases where LNAV+V is indicated by the system during an approach, LNAV minima are used. The active approach service level is annunciated on the HSI as shown in the following table:

HSI Annunciation	Description	Example on HSI
LNAV	GPS approach using LNAV MDA. Available only if GPS available. If GPS unavailable, abort.	***Approach Service Level*** *- LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV*
LNAV+V	GPS approach using LNAV MDA with advisory vertical guidance. Available only if SBAS or Baro/VNAV available, otherwise downgrades to LNAV. If GPS unavailable, abort.	
L/VNAV	GPS approach using LNAV/VNAV DA. Available with Baro/VNAV or SBAS availability. If both SBAS and Baro/VNAV unavailable, downgrades to published LNAV MDA.	
LP	GPS approach using LP MDA. Available only if SBAS available. If SBAS unavailable, downgrades to published LNAV MDA.	
LP+V	GPS approach using LP MDA with advisory vertical guidance. Available only if SBAS available. If SBAS unavailable, downgrades to published LNAV MDA.	
LPV	GPS approach using LPV DA. Available only if SBAS available. If SBAS unavailable, downgrades to L/VNAV published DA. If after the FAF, downgrades to published LNAV MDA.	

Table 5-16 Approach Service Levels

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). A 3 degree glide path is calculated from the missed approach point up to each waypoint along the extended straight-in path.

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.

Loading and activating a visual approach 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, if necessary, and press the **ENT** Key.
   b) Select a visual approach from the list and press the **ENT** Key.
4) Select a transition and press the **ENT** Key.
5) Minimums:
   a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO', 'TEMP COMP', or 'RAD ALT', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.
   b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

      Or:

      To skip setting minimums, press the **ENT** Key.
6) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure ('Load' is only available if there is no previous approach already loaded in flight plan); or turn the large **FMS** Knob to highlight 'Activate' and press the **ENT** Key procedure.

   When GPS is not approved for the selected final approach course, the message '-NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach>' is displayed. With 'Yes' highlighted, press the **ENT** Key.

   When a visual approach is selected, the message 'Obstacle clearance is not provided for visual approaches' is displayed. With 'OK' highlighted, press the **ENT** Key.
7) The message 'Obstacle clearance is not provided for visual approaches' is displayed. Press **ENT** to continue.

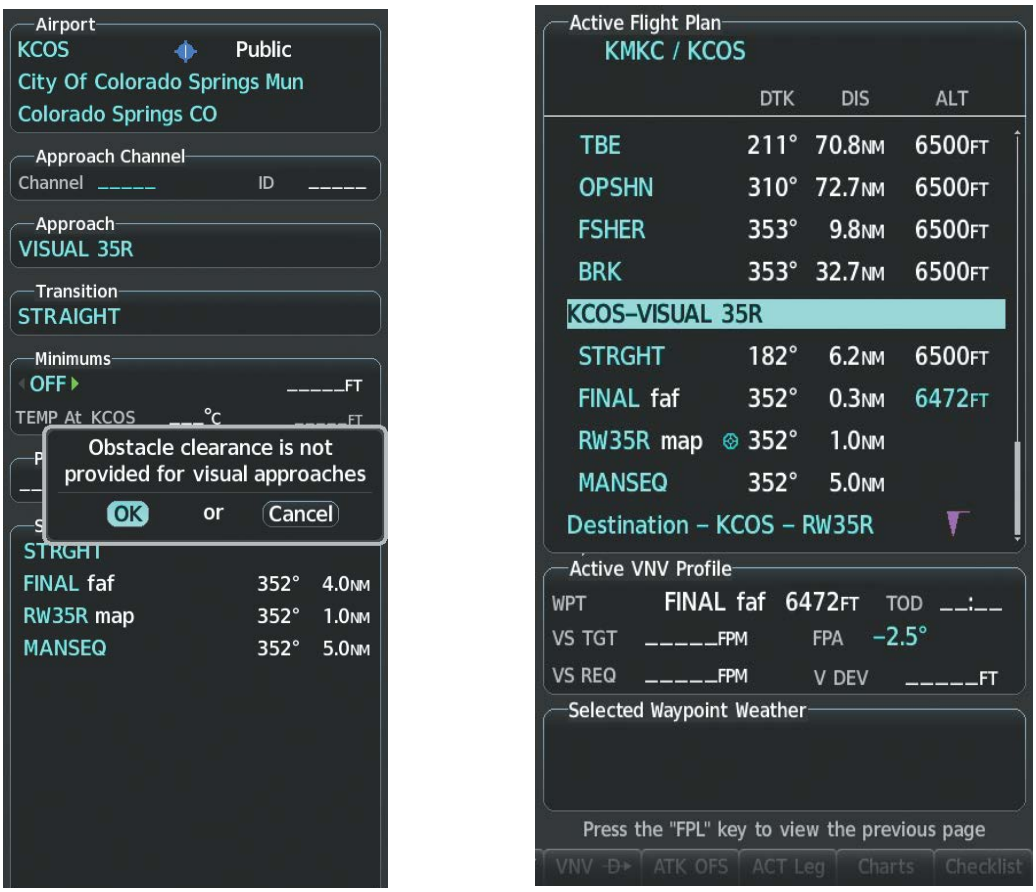


Figure 5-72 Loading Visual Approach

APPROACH SELECTION AND REMOVAL

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: *When GPS is not approved for the selected final approach course, the message '- NOT APPROVED FOR GPS -' is displayed. GPS provides guidance to the approach, but the HSI must to be switched to a NAV receiver to fly the final course of the approach.*

NOTE: *When there is no arrival procedure in the flight plan, loading an approach after a destination airport has already been entered will result in a duplicate destination airport waypoint being added to the end of the enroute segment.*

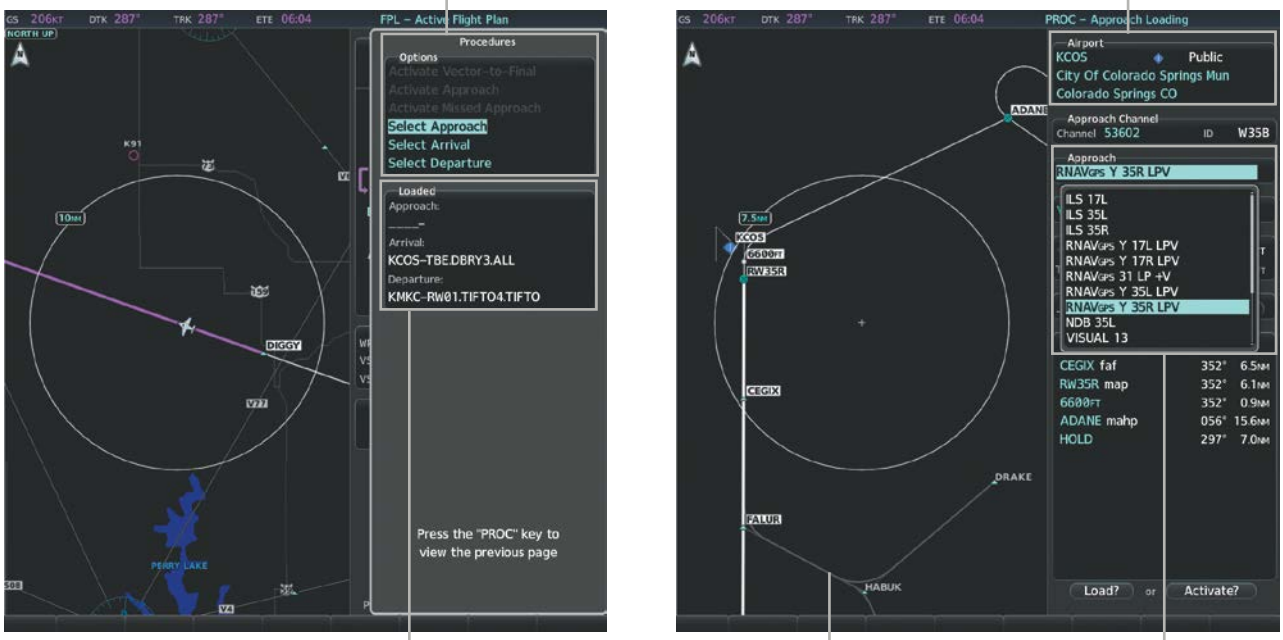


Figure 5-73 Approach Selection

Figure 5-74 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) Minimums
   a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO', 'TEMP COMP' or 'RAD ALT', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.
   b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

   Or:

   To skip setting minimums, press the **ENT** Key.
6) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate' and press the **ENT** Key to load and activate the approach procedure.

   When GPS is not approved for the selected final approach course, the message '- NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' is displayed. With 'Yes' highlighted, press the **ENT** Key.

   When a visual approach is 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) Press the **FMS** Knob, then turn the large **FMS** Knob to highlight the desired nearest airport. The airport is previewed on the map.
3) Press the **APR** Softkey; or press the **MENU** Key, highlight 'Select Approach Window', and press the **ENT** Key.
4) Turn the **FMS** Knob to highlight the desired approach.
5) Press the **LD APR** Softkey; or press the **MENU** Key, highlight 'Load Approach', and press the **ENT** Key. The 'PROC - Approach Loading' Page is displayed with the 'Transition' Field highlighted.
6) Turn the **FMS** Knob to highlight the desired transition, and press the **ENT** Key.

7) Minimums

   a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO', 'TEMP COMP' or 'RAD ALT', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.

   b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

      Or:

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

8) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate?' and press the **ENT** Key to load and activate the approach procedure.

   When GPS is not approved for the selected final approach course, the message '- NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' is displayed. With 'Yes' highlighted, press the **ENT** Key.

   When a visual approach is 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) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
3) Press the **LD APR** Softkey; or press the **MENU** Key, select "Load Approach", and press the **ENT** Key. The 'PROC - Approach Loading' Page is displayed.
4) Select the airport and approach:

   a) Use the **FMS** Knob to select an airport and press the **ENT** Key.

   b) Select an approach from the list and press the **ENT** Key.

      Or:

   a) If necessary, push the **FMS** Knob to exit the approach list, and use the large **FMS** Knob to move the cursor to the Approach 'Channel' Field.

   b) Use the **FMS** Knob to enter the approach channel number, and press the **ENT** Key to accept the approach channel number. The airport and approach are selected.

5) Select a transition for the selected approach. Press the **ENT** Key.
6) Press the **ENT** Key to load the selected approach procedure.

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 GPS is not approved for the selected final approach course, the message '- NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' is displayed. With 'Yes' highlighted, press the **ENT** Key.

   When a visual approach is selected, the message 'Obstacle clearance is not provided for visual approaches' is displayed. With 'OK' 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 on the MFD. The 'Page Menu' Window is displayed with 'Load & Activate Approach' highlighted.
4) Press the **ENT** Key.

   When GPS is not approved for the selected final approach course, the message '- NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' is displayed. With 'Yes' highlighted, press the **ENT** Key.

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

Removing an approach from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, and highlight 'Remove Approach'.
3) Press the **ENT** Key. A confirmation window is displayed listing the approach procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'Cancel' and press the **ENT** Key.

   Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob, and turn to highlight the approach header in the active flight plan.
3) Press the **CLR** Key. A confirmation window is displayed listing the approach procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

Removing an approach from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.

4) Press the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.

5) Highlight and remove the approach:

   a) Turn the large **FMS** Knob to highlight the white header of the approach.

   b) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

   Or:

   a) Press the **MENU** Key to display the 'Page Menu' Window and turn the **FMS** Knob to highlight 'Remove Approach'.

   b) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

6) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

7) Press the **FMS** Knob to remove 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 the navigation map.

In this missed approach procedure, the altitude immediately following the MAP (in this case '6600FT') is not part of the published procedure. It is simply a Course to Altitude (CA) leg which guides the aircraft along the runway centerline until the altitude required to safely make the first turn toward the MAHP is exceeded. This altitude is provided by the navigation database, and may be below, equal to, or above the published minimums for this approach. In this case, if the aircraft altitude is below the specified altitude (6,600 feet) after crossing the MAP, a direct-to is established to provide a course on runway heading until an altitude of 6,600 feet is reached. After reaching 6,600 feet, a direct-to is established to the published MAHP (in this case ADANE). If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix (ADANE) to begin the missed approach procedure.

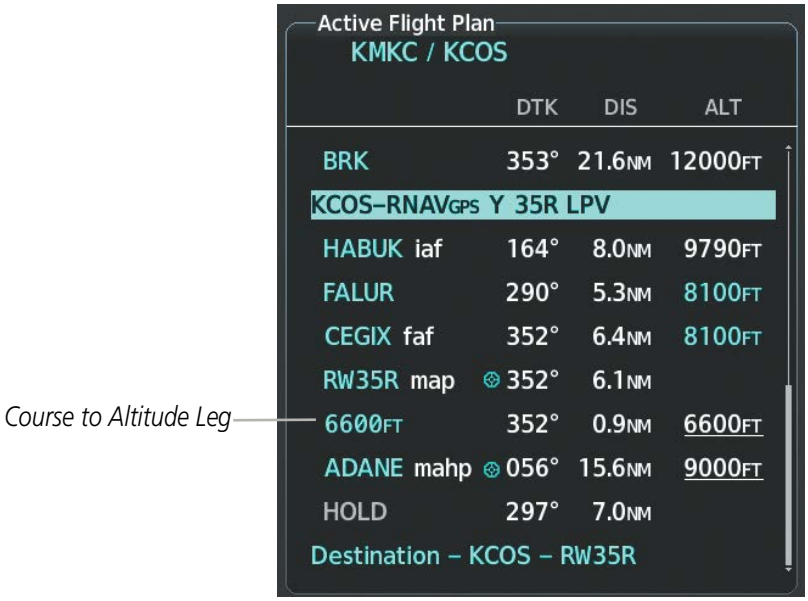


Figure 5-75 Course to Altitude

In some missed approach procedures this Course to Altitude leg may be part of the published procedure. For example, a procedure may dictate a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude would appear in the list of waypoints as '5500FT'. Again, if the aircraft altitude is lower than the prescribed altitude, a direct-to is established on a Course to Altitude leg when the missed approach procedure is activated.

Activating a missed approach in the active flight plan:

Press the **Go-Around** Button. Prior to the MAP, the aircraft will continue to laterally navigate to the MAP before executing the missed approach. Otherwise, the aircraft automatically sequences to the MAHP.

Or:

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

Or:

1) Press the **PROC** Key.
2) Turn the large **FMS** Knob to highlight 'Activate Missed Approach'.
3) Press the **ENT** Key. Prior to the MAP, the aircraft will continue to laterally navigate to the MAP before executing the missed approach. Otherwise, the aircraft automatically sequences to the MAHP.

TEMPERATURE COMPENSATED ALTITUDE

If desired, the system can compensate the loaded approach altitudes based on a pilot-supplied temperature at the destination. For example, if the pilot enters a destination temperature of – 40° C, the system increases the approach altitudes accordingly. Temperature compensated altitudes are displayed with a snowflake ( ) icon.

Manually setting temperature compensation for approach loaded 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.

NOTE: *The temperature at the destination can be entered in the 'Temperature Compensation' Window on the MFD, or in the 'References' Window on the PFD. There is only one compensation temperature for the system, therefore, changing the temperature will affect both the loaded approach altitudes and the minimums. Refer to the Flight Instruments section for information about applying temperature compensation to the MDA/DH.*

5) Press the **ENT** Key. 'Activate Compensation?' is highlighted.
6) Press the **ENT** Key. The compensated altitudes for the approach are shown in the flight plan.

Cancelling temperature compensation setting for approach loaded 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.*

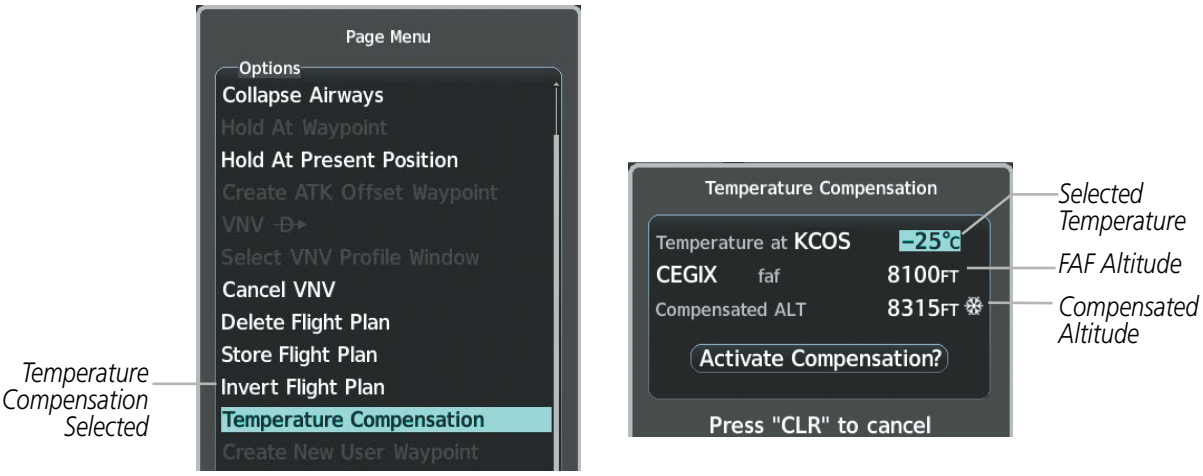


Figure 5-76 Manually Setting Temperature Compensation

Figure 5-77 Temperature Compensation set for approach loaded altitudes

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) Turn the large **FMS** Knob to highlight 'Select Approach'. Press the **ENT** Key.
3) Use the **FMS** Knob and the **ENT** Key to select the desired 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 to Load or Activate the approach. The approach is added to the active flight plan, and the temperature compensated minimums are displayed on the PFD.

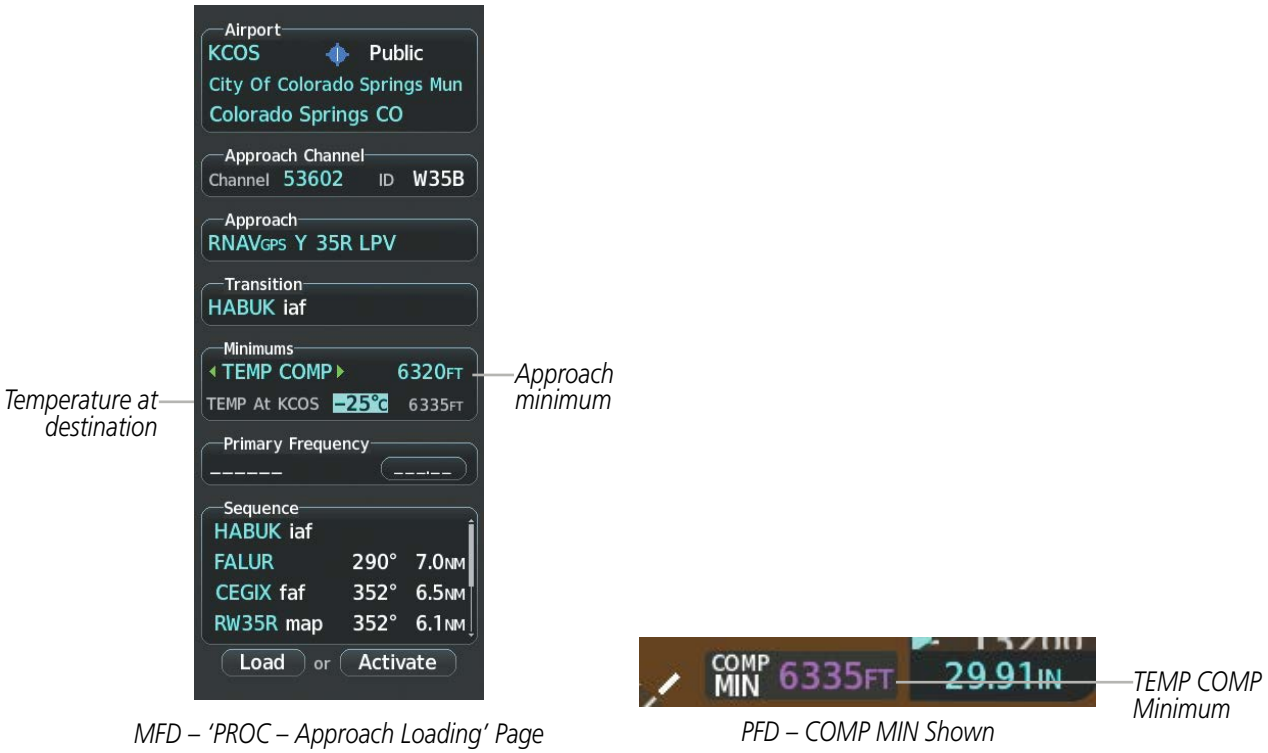


Figure 5-78 Entering Temp Comp Minimums for an Approach

5.9 TRIP PLANNING

The system allows the pilot to view trip planning information, fuel information, and other information for a specified flight plan or flight plan leg based on automatic data, or based on manually entered data. Weight planning is also available, based on manually entered fuel data and the active flight plan (to estimate remaining fuel).

TRIP PLANNING

All of the input of data needed for calculation and viewing of the statistics is done on the 'Aux - Trip Planning' Page located in the 'Aux' Page Group.

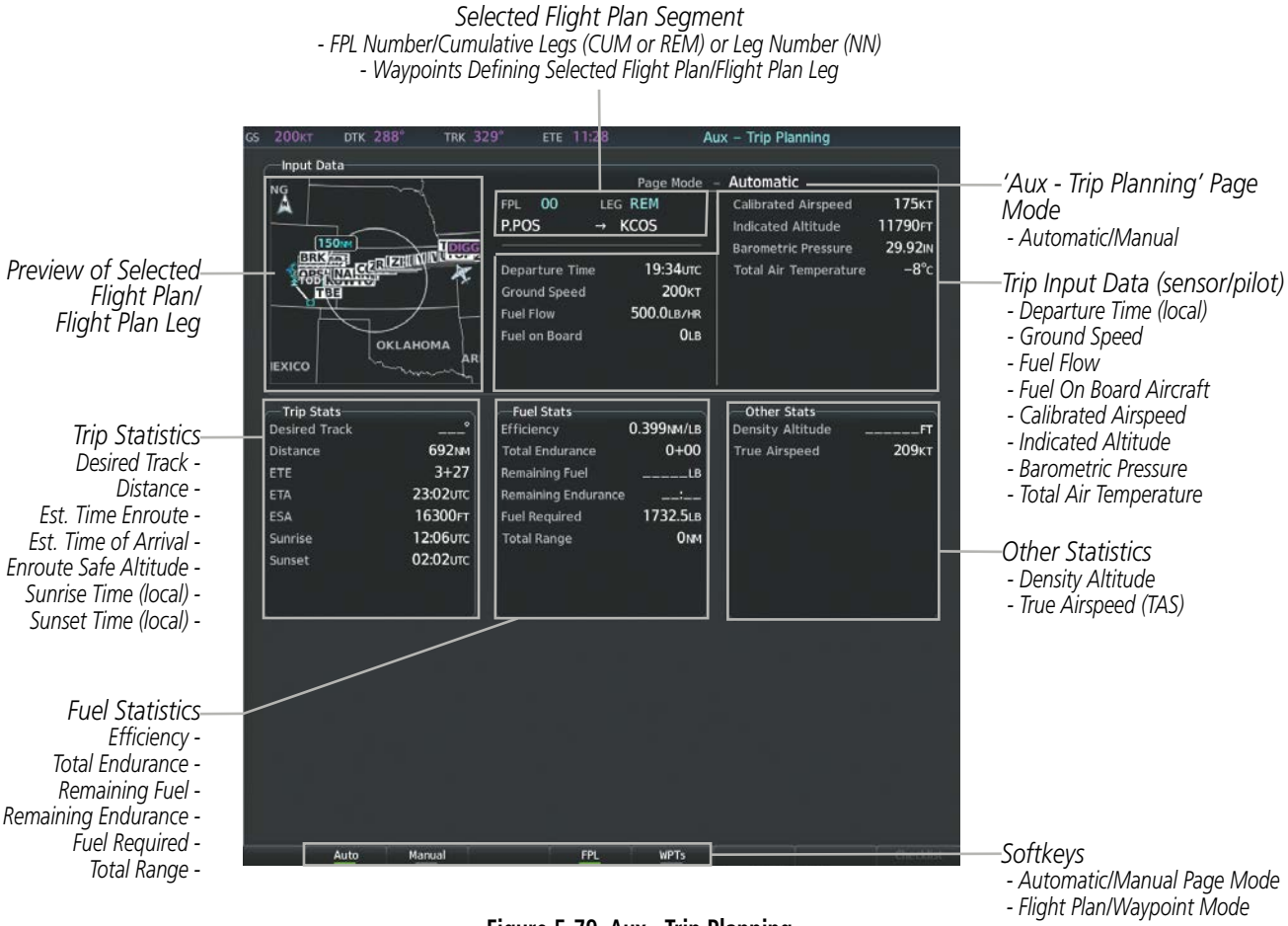


Figure 5-79 Aux - Trip Planning

The trip planning inputs are based on sensor inputs (automatic page mode) or on pilot inputs (manual page mode). Some additional explanation of the sources for some of the inputs is as follows:

- Departure Time - This defaults to the current time in automatic page mode. The computations are from the aircraft present position, so the aircraft is always just departing.
- Calibrated Airspeed - The primary source is from the air data system, and the secondary source of information is GPS ground speed.
- Indicated Altitude - The primary source is the barometric altitude, and the secondary source of information is GPS altitude.

TRIP STATISTICS

The trip statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs.

In flight plan mode (FPL) with a stored flight plan selected (NN), and the entire flight plan (CUM) selected, the waypoints are the starting and ending waypoints of the selected flight plan.

In flight plan mode (FPL) with a stored flight plan selected (NN), and a specific leg (NN) selected, the waypoints are the endpoints of the selected leg.

In flight plan mode (FPL) with the active flight plan selected (00), and the remaining flight plan (REM) selected, the 'from' waypoint is the present position of the aircraft and the 'to' waypoint is the endpoint of the active flight plan.

In flight plan mode (FPL) with the active flight plan selected (00), and a specific leg (NN) selected, the 'from' waypoint is the current aircraft position and the 'to' waypoint is the endpoint of the selected leg.

In waypoint (WPTs) mode these are manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Desired Track - Desired Track is shown as nnn° and is the desired track between the selected waypoints. It is dashed unless only a single leg is selected.
- Distance - The distance is shown in tenths of units up to 99.9, and in whole units up to 9999.
- Estimated time enroute (ETE) - ETE is shown as hours:minutes until less than an hour, then it is shown as minutes:seconds.
- Estimated time of arrival (ETA) - ETA is shown as hours:minutes and is the local time at the destination.
  - If in waypoint mode then the ETA is the ETE added to the departure time.
  - If a flight plan other than the active flight plan is selected it shows the ETA by adding to the departure time all of the ETEs of the legs up to and including the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
  - If the active flight plan is selected the ETA reflects the current position of the aircraft and the current leg being flown. The ETA is calculated by adding to the current time the ETEs of the current leg up to and including the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
- Enroute safe altitude (ESA) - The ESA is shown as nnnnnFT.
- Destination sunrise and sunset times (Sunrise, Sunset) - These times are shown as hours:minutes and are the local time at the destination.

FUEL STATISTICS

The fuel statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs. Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Fuel efficiency (Efficiency) - This value is calculated by dividing the current ground speed by the current fuel flow.
- Time of fuel endurance (Total Endurance) - This time is shown as hours:minutes. This value is obtained by dividing the amount of fuel on board by the current fuel flow.
- Fuel on board upon reaching end of selected leg (Remaining Fuel) - This value is calculated by taking the amount of fuel onboard and subtracting the fuel required to reach the end of the selected leg.
- Fuel endurance remaining at end of selected leg (Remaining Endurance) - This value is calculated by taking the time of fuel endurance and subtracting the estimated time enroute to the end of the selected leg.
- Fuel required for trip (Fuel Required) - This value is calculated by multiplying the time to go by the fuel flow.
- Total range at entered fuel flow (Total Range) - This value is calculated by multiplying the time of fuel endurance by the ground speed.

OTHER STATISTICS

These statistics are calculated based on the system sensor inputs or the manual trip planning inputs.

- Density Altitude
- True Airspeed

The pilot may select Automatic or Manual page mode, and flight plan (FPL) or waypoint (WPTs) mode. In automatic page mode, only the FPL, LEG, or waypoint IDs are editable (based on FPL/ WPTs selection). 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.

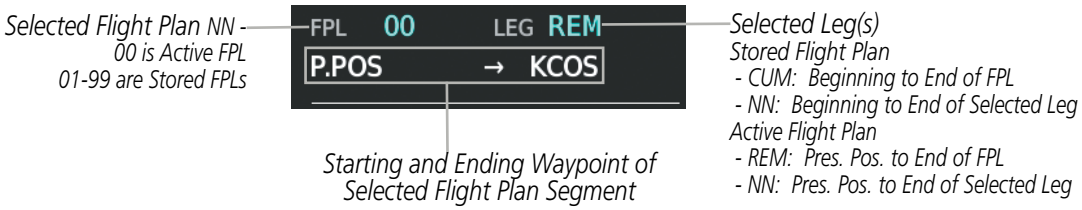


Figure 5-80 Trip Planning - Flight Plan Mode

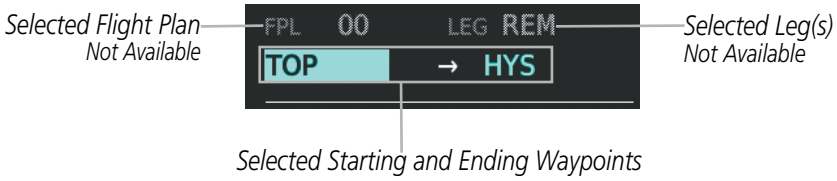


Figure 5-81 Trip Planning - Waypoint Mode

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, press the **FMS** Knob to activate the cursor in the 'FPL' Field.
2) Turn the small **FMS** Knob to select the desired flight plan number.
3) Turn the large **FMS** Knob to highlight 'CUM' or 'REM'. The statistics for each leg can be viewed by turning the small **FMS** Knob to select the desired leg. The Trip Planning Map also displays the selected data.

Selecting waypoints for waypoint mode:

1) From the 'Aux - Trip Planning' Page, press the **WPTs** Softkey; or press the **MENU** Key, highlight 'Waypoints Mode', and press the **ENT** Key. The cursor is positioned in the waypoint field directly below the 'FPL' Field.
2) Turn the **FMS** Knobs to select the desired waypoint (or select from the 'Page Menu' 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.

WEIGHT PLANNING

The 'Aux - Weight Planning' Page is available to manage actual weight, estimated weight, and fuel quantity.

NOTE: *All weight planning page data fields display data rounded to the nearest 10 pounds or 5 kilograms.*

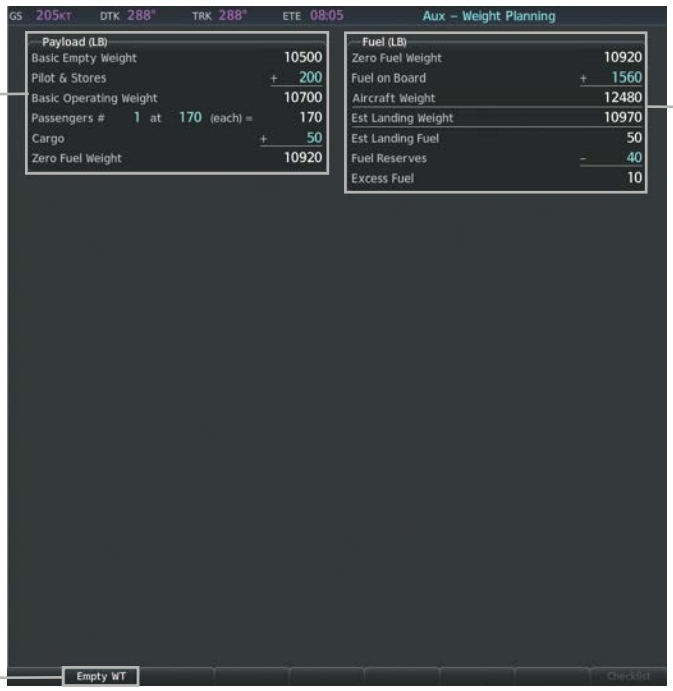


Figure 5-82 Weight Planning

The following three fuel calculations can be completed when a destination waypoint has been entered into the flight plan and one of the following has occurred: 1) the aircraft is in the air, or 2) the aircraft is on the ground with the 'Aux - Trip Planning' Page fields completed in Manual Mode. Otherwise, these three fuel fields will display invalid values consisting of four dashes:

- Est Landing Weight = Zero Fuel Weight + Estimated Landing Fuel Weight.
- Est Landing Fuel = Fuel on Board Weight - (fuel flow x ETE)
- Excess Fuel = Estimated Landing Fuel Weight - Fuel Reserves Weight

WEIGHT WARNING CONDITIONS

If the zero fuel weight is greater than the maximum allowable zero fuel weight, then the zero fuel weight is displayed in amber.

If the aircraft weight is greater than the maximum allowable takeoff weight, then the aircraft weight is displayed in amber.

If the estimated landing weight is greater than the maximum allowable landing weight, then the estimated landing weight is displayed in amber.

If the estimated landing fuel weight is positive, but less than or equal to the fuel reserves weight, the following values are displayed in amber:

- Estimated fuel at landing weight
- Excess fuel weight

If the estimated landing fuel weight is zero or negative, then the following values are displayed in amber:

- Estimated fuel at landing weight
- Excess fuel weight

WEIGHT COMPILATIONS

The basic operating weight is calculated by adding the basic empty weight and the pilot and stores weight. The total weight of passengers is calculated by multiplying the number of passengers by the average passenger weight. The 'Zero Fuel Weight' is calculated by adding the basic empty, pilot and stores, passenger, and cargo weights.

Entering basic empty weight:

1) Press the **Empty WT** Softkey; or press the **MENU** Key, highlight 'Set Basic Empty Weight', and press the **ENT** Key to select the 'Basic Empty Weight' Field.
2) Turn the small **FMS** Knob to enter the basic empty weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering a pilot and stores weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Pilot & Stores' Field.
2) Turn the small **FMS** Knob to enter the pilot and stores weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering the number of passengers:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Passengers #' Field.
2) Turn the small **FMS** Knob to enter the number of passengers.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering the average passenger weight:

1) Press the **FMS** Knob to activate the cursor and highlight the passenger weight field.
2) Turn the small **FMS** Knob to enter the average passenger weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering the cargo weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Cargo' Field.
2) Turn the small **FMS** Knob to enter the cargo weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering a fuel on board weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Fuel on Board' Field.
2) Turn the small **FMS** Knob to enter the fuel on board.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering fuel reserve:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Fuel Reserves' Field.
2) Turn the small **FMS** Knob to enter the fuel reserves amount.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor

5.10 ABNORMAL OPERATION

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

NOTE: *Dead Reckoning Mode only functions in Enroute (ENR) or Oceanic (OCN) phase of flight. In all other phases, an invalid GPS solution produces a "NO GPS POSITION" annunciation on the map and the system stops using GPS.*

While in Enroute or Oceanic phase of flight, if the system detects an invalid GPS solution or is unable to calculate a GPS position, the system automatically reverts to Dead Reckoning (DR) Mode. In DR Mode, the system uses its last-known position combined with continuously updated airspeed and heading data (when available) to calculate and display the aircraft's current estimated position.

It is important to note that estimated navigation data supplied by the system in DR Mode may become increasingly unreliable and must not be used as a sole means of navigation. If while in DR Mode airspeed and/or heading data is also lost or not available, the DR function may not be capable of accurately tracking estimated position and, consequently, the system may display a path that is different than the actual movement of the aircraft. Estimated position information displayed by the system through DR while there is no heading and/or airspeed data available should not be used for navigation.

DR Mode is inherently less accurate than the standard GPS/SBAS Mode due to the lack of satellite measurements needed to determine a position. Changes in wind speed and/or wind direction compound the relative inaccuracy of DR Mode. Because of this degraded accuracy, other navigation equipment must be relied upon for position awareness until GPS-derived position data is restored.

DR Mode is indicated on the system by the appearance of the letters 'DR' superimposed in amber over the 'own aircraft' symbol as shown in the following figure. In addition, 'DR' is prominently displayed in amber on the HSI slightly above and to the right of the aircraft symbol on the CDI as shown in the following figure. The CDI deviation bar remains, but is removed from the display after 20 minutes in DR Mode. The autopilot will remain coupled in DR mode as long as the deviation info is available (20 min.) Lastly, but at the same time, a 'GPS NAV LOST' alert message appears on the PFD. Normal navigation using GPS/SBAS source data resumes automatically once a valid GPS solution is restored.

As a result of operating in DR Mode, all GPS-derived data is computed based upon an estimated position and is displayed as amber text on the display to denote degraded navigation source information as shown in the following figure. If the VSD Inset is selected on the MFD, 'VSD Not Available' will be displayed.

NOTE: *GPS derived information will remain displayed in magenta (not amber) on the Flight Plan Progress inset when operating in Dead Reckoning mode. However, this information shall still be considered as degraded navigation source information.*

Also, while the system is in DR Mode, some terrain functions are not available. Additionally, the accuracy of all nearest information (airports, airspaces, and waypoints) is questionable. Finally, airspace alerts continue to function, but with degraded accuracy.

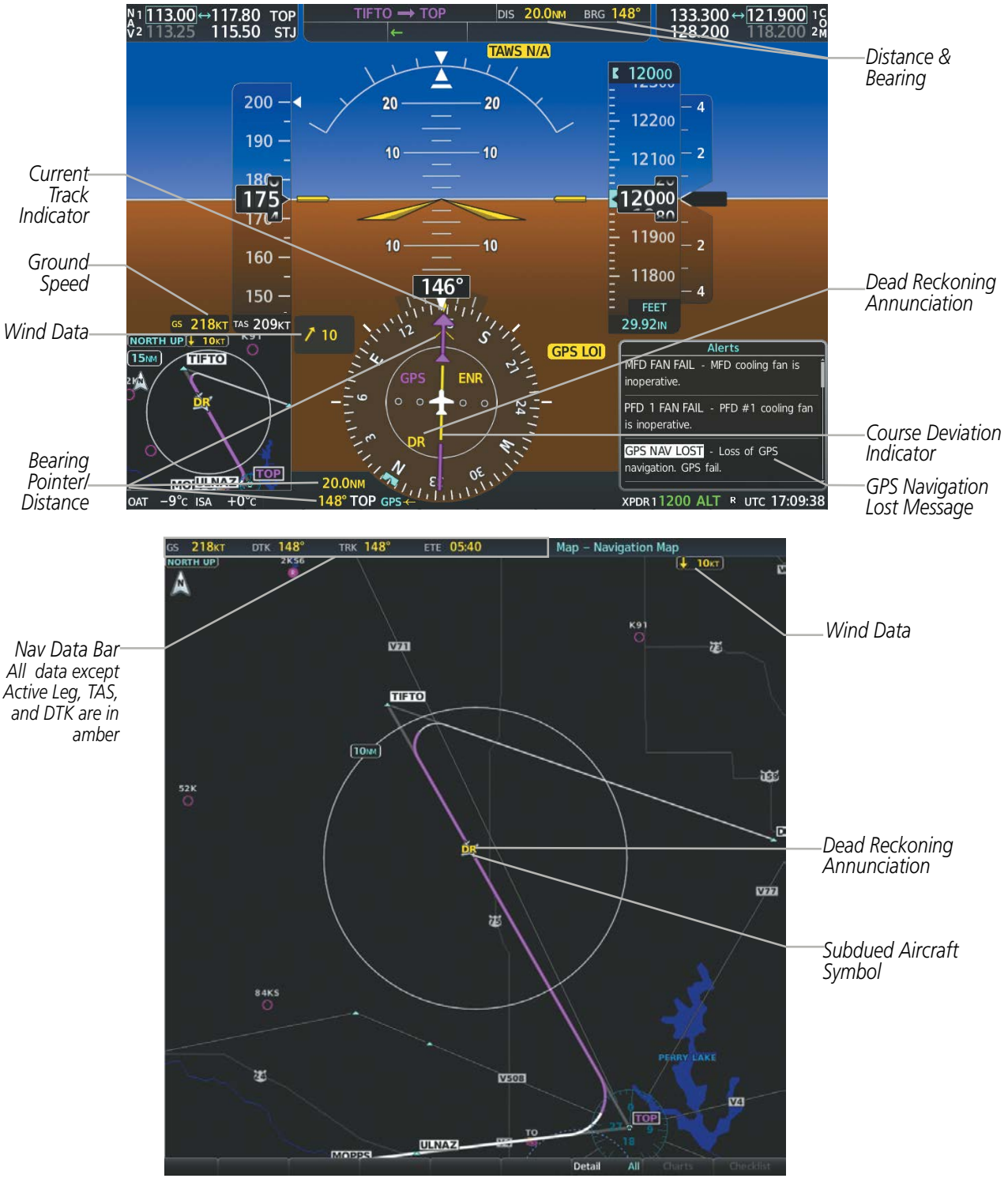


Figure 5-83 Dead Reckoning Mode - GPS Derived Data Shown in Amber

SECTION 6 HAZARD AVOIDANCE

Hazard avoidance features available for the G1000 NXi 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)
- GSR 56 Garmin Connext Weather (Optional)
- Flight Information Services-Broadcast (Optional)
- GWX 68/70/75 Airborne Color Weather Radar
- L-3 Stormscope® WX-500 Lightning Detection System (Optional)

Terrain Avoidance

- TAWS-B (Terrain Awareness and Warning System - Class B)
- TAWS-A (Terrain Awareness and Warning System - Class A) (Optional)

Traffic

- Garmin GTS 825 Traffic Advisory System (TAS) (Optional)
- Garmin GTS 855 Traffic Alert and Collision Avoidance System I (TCAS I) (Optional)
- Garmin GTS 8000 Traffic Alert and Collision Avoidance System II (TCAS II) (Optional)
- L-3 SKYWATCH® SKY 497 TAS (Optional)
- L-3 SKYWATCH® HP SKY 899 TAS/TCAS I (Optional)
- Honeywell® KTA 870 TAS (Optional)
- Collins TCAS 94 TCAS II (Optional)
- Collins TCAS 4000 TCAS II (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, Garmin Connext 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 69A SXM data link receiver and an active service subscription, updates its weather data periodically and automatically, and transmits this information to the aircraft's receiver via satellite on the S-Band frequency. This service provides continuous reception capabilities at any altitude throughout North America.

The FIS-B Weather service, available when equipped with a capable transponder or data link receiver 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.

The Garmin Connext Weather service, available when equipped with the Garmin GSR 56 Iridium Satellite Transceiver and an active service subscription, provides data link weather information to the aircraft after the pilot defines a geographic area and subsequently selects a manual or automatically recurring Connext Data Request. The transceiver then contacts the Garmin Connext Weather service using the Iridium Satellite telephone system and retrieves the weather data for the specified area. The Garmin Connext Weather service offers worldwide weather coverage, but the availability of individual weather products, such as radar precipitation, varies by region.

NOTE: *To check the availability of Garmin Connext weather products offered in a particular region, visit flygarmin.com.*

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 enabled 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 Aux 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. An empty box appears next to an unavailable weather product; a green filled box appears next to an available weather product. During activation, it may take several minutes for weather products in the selected subscription package to become available.

NOTE: *Not all weather products offered by SiriusXM are supported for display on this system. This pilot's guide only discusses supported weather products.*

Figure 6-1 'Aux - XM Information' Page

ACTIVATING GARMIN CONNEXT WEATHER

Garmin Connext weather requires an active Iridium satellite network account and an active subscription to the Garmin Connext Weather service.

A subscriber account must be established for the Iridium transceiver prior to using the Iridium Satellite System for telephone services. Before setting up an Iridium account, obtain the serial number of the Iridium Transceiver (GSR1) and the System ID by selecting the 'Aux - System Status' Page. Then go to the website www.flygarmin.com and follow the instructions for establishing an account for Garmin Connext data services. After an account has been established, Garmin provides an access code that must be entered and successfully transmitted to the Garmin Connext service via the Iridium satellite network.

Figure 6-2 Identification Needed for Iridium Registration

Registering the system to receive Garmin Connext Weather:

1) With the aircraft outside and having a clear view of the sky, turn the large **FMS** Knob on the MFD to select the Map page group.
2) Turn the small **FMS** Knob to select the 'Map - Weather Data Link (CNXT)' Page. If another data link weather source such as 'XM' or 'FIS-B' is displayed in the page title, it will be necessary to change the data link weather source to CNXT before continuing. Refer to 'Viewing the Weather Data Link (CNXT) Page' procedure to change the data link source to prior to registration.
3) If the system displays the Connext Registration Window, proceed to step 6. Otherwise, press the **MENU** Key. The page menu window is now displayed.
4) Turn the large **FMS** Knob to select 'Register With Connext' in the menu list.
5) Press the **ENT** Key.

Figure 6-3 Enter Access Code

6) Enter the access code provided by Garmin in the 'Access Code' field.

7) Press the **ENT** Key. 'Register' is highlighted.

8) Press the **ENT** Key. The system contacts Garmin through the Iridium network. System registration is complete when the Current Registration Window displays the correct information for the Airframe, Tail Number, Airframe Serial Number, and Iridium Serial Number.

9) When finished, push the **FMS** Knob to remove the Connext Registration Window.

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 in contrast relies on external service providers to collect, process, and transmit weather information to the aircraft. This information can come from a variety of sources such as government agencies. Due to the time it takes to collect, process, and distribute data link weather information, it is imperative for pilots to understand that data link weather information is not real-time information and may not accurately depict the current conditions.

For each data link weather product which can be displayed as a map overlay, such as radar precipitation, 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. For the Garmin Connext service, the pilot schedules a one-time or repeating data request at regular intervals.

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) With the PFD Inset Map or HSI Map displayed, press the **Map/HSI** Softkey.
2) Press the **WX LGND** Softkey to show/remove the weather product age information for PFD maps.

Tables 6-1 and 6-2 show the weather product symbols where applicable, and expiration times, for SiriusXM Weather and FIS-B Weather, respectively. The data link weather service providers and their respective weather data vendors define and control the data update intervals, which are subject to change. These update intervals represents the interval at which the service provider 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.

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	Symbol	Expiration Time (Minutes)
NEXRAD Composite (US)		30
NEXRAD Composite (Regional)		30
METARs		90
Pilot Weather Report (PIREP)		90
Winds Aloft		*
SIGMETs/AIRMETs		60
No Radar Coverage	No product image	30
Terminal Aerodrome Forecast (TAF)	No product image	60
Temporary Flight Restriction (TFR)		60
** The Winds Aloft product no longer issues an expiration time. It uses the best applicable model data for the time given, if one is available, to set an expiration time.*		

Table 6-2 FIS-B Weather Product Symbols and Data Timing

The following table shows the Garmin Connext Weather product symbols and expiration times. The pilot chooses how often to contact the Garmin Connext Weather service in order to retrieve weather data through the Connext Data Request. This data link weather request rate represents the interval at which Garmin Connext Weather Service makes available the most current known weather data. It does not necessarily represent the rate at which the service receives new data from various weather sources.

Garmin Connext Weather Product	Symbol	Expiration Time (Minutes)
Connext Radar		30
Cloud Tops		60
Connext Lightning		30
SIGMETs		60
AIRMETs		60
Meteorological Aerodrome Report (METARs)		90
Winds Aloft		90
Pilot Weather Reports (PIREPs)		90
Temporary Flight Restrictions (TFRs)		60
Terminal Aerodrome Reports (TAFs)	no product image	60

† *Canadian radar precipitation data provided by Environment Canada.*
ˆ *Australian radar precipitation data provided by the Australia Bureau of Meteorology.*

Table 6-3 Garmin Connext Weather Product Symbols and Data Timing

DISPLAYING DATA LINK WEATHER PRODUCTS

WEATHER DATA LINK PAGE

The 'Map - Weather Data Link (XM/FIS-B/CNXT)' Page is the principal map page for viewing data link weather information. This page provides the capability for displaying the most data link weather products of any map on the system. The Weather Data Link Page also provides system-wide controls for selecting the data link weather source, if more than one source has been installed. The page title indicates the selected data link weather source (e.g., "XM", "FIS-B" or "CNXT").

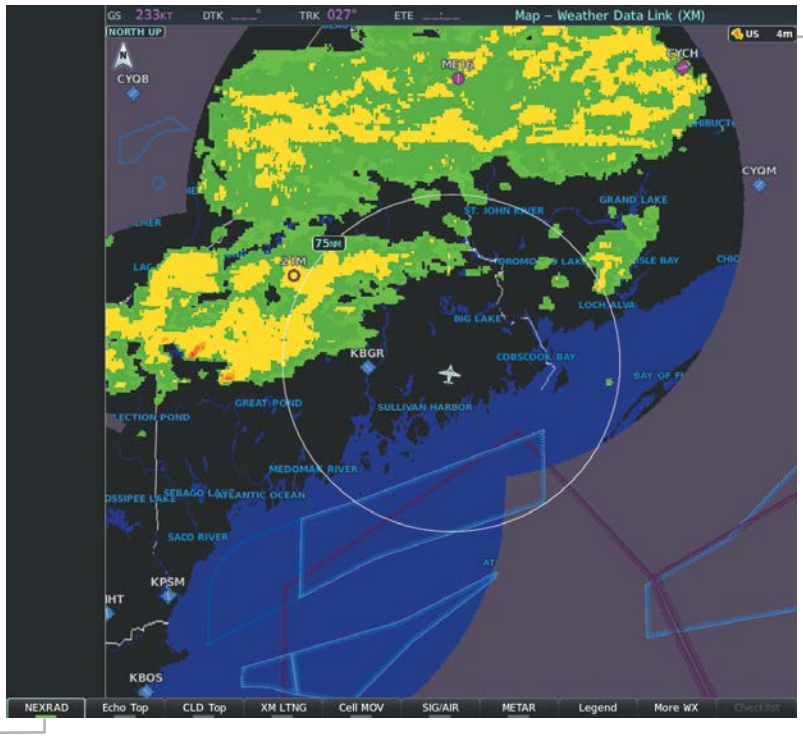


Figure 6-4 'Map - Weather Data Link (XM)' Page

Viewing the Weather Data Link Page and changing the data link weather source, if applicable:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the Weather Data Link (XM or CNXT 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', 'Display Connext Weather' or 'Display FIS-B Weather' (choices may vary depending on the installed equipment).
   b) Press the **ENT** Key.

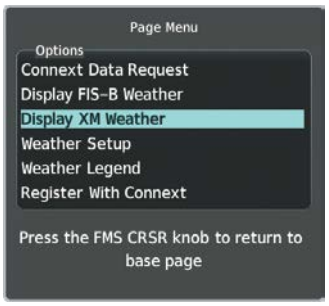


Figure 6-5 Changing the Data Link Weather Source

The system presents the softkeys for the selected source on the Weather Data Link Page, and for weather product map overlays used throughout the system. The following tables show the softkeys for the Weather Data Link Page based on the selected weather source.

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.

Level 1	Level 2	Level 3	Description
		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.
		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.

WEATHER DATA LINK (CNXT) PAGE SOFTKEYS)

Level 1	Level 2	Level 3	Description
PRECIP			Enables/disables the Precipitation weather product overlay.
IR SAT			Enables/disables the Infrared Satellite weather product overlay.
SIG/AIR			Enables/disables the SIGMET/AIRMET weather product overlay.
METAR			Enables/disables the METAR weather product overlay.
Legend			Enables/disables the Connext Weather Legends Window. Softkey available for selection when at least one Connext Weather product is enabled.
More WX			Displays second-level Connext Weather product softkeys.
	Wind		Displays third level softkeys for enabling/disabling the Winds Aloft weather product and selecting a winds aloft altitude.
		PREV	Shows the previous level of winds aloft altitude softkeys.
		Off	Disables the Winds Aloft weather product overlay.
		Softkeys available for selecting winds from the Surface to 42,0000 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 Connext Weather Legends Window. Softkey available for selection when at least one Connext 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.

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.
IR SAT			Enables/disables the Infrared Satellite weather product overlay.
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.

Level 1	Level 2	Level 3	Description
	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.
		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 Weather Data Link Page can display a legend for each enabled weather product.

Viewing legends for displayed weather products on the Weather Data Link Page:

1) Select the Weather Data Link Page.
2) Press the **Legend** Softkey to display the legends for the displayed weather products.

   Or:

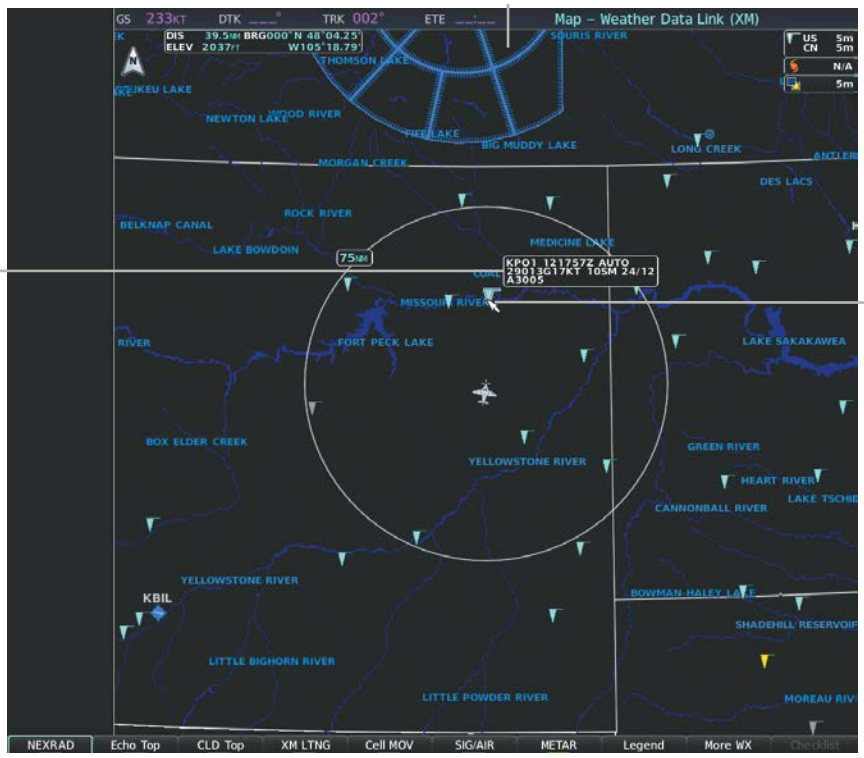
   a) Press the **MENU** Key.

   b) Select 'Weather Legend' and press the **ENT** Key.
3) Turn the **FMS** Knob to scroll through the legends if more are available than fit in the window.
4) To remove the XM Weather Legends Window, press the **Legend** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Additional information about the following weather products can be displayed by panning the Map Pointer over the following products on the Weather Data Link Page:

- Echo Tops
- Cloud Tops
- Cell Movement
- SIGMETs
- AIRMETs
- METARs
- County Warnings
- TFRs
- AIREPs
- PIREPs

The map panning feature is enabled by pressing the **Joystick**. The map range is adjusted by turning the **Joystick**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.



Additional Information on Weather Feature Selected with Map Pointer

METAR flag selected with Map Pointer

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

Certain weather products, such as METARs or TFRs have full text associated with a graphic shown on the map. When a weather product is selected with the Map Pointer, press the **ENT** Key. The system displays the full text for the selected weather product in a window. To remove the window, press the **FMS** Knob or the **CLR** Key.

The Weather Data Link Page also has a page menu that can be accessed by pressing the **MENU** Key. It has controls for enabling/disabling the weather products as an alternative to using the softkeys.

Customizing the Weather Data Link Page

The Weather Data Link Page includes controls for selecting the maximum map range to display each weather product on the page. If the pilot increases the map range beyond this selected maximum range, the system removes the weather product from the map. If more than one data link weather source has been installed, the system uses the same maximum map range for the comparable weather product of another source.

Setting up and customizing the Weather Data Link Page:

1) Select the Weather Data Link Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Weather Setup', then press the **ENT** Key.
4) Turn the small **FMS** Knob to select 'Product Group 1' or 'Product Group 2', and press the **ENT** Key.
5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
6) Turn the small **FMS** Knob to scroll through options for each product (On/Off, range settings, etc.).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the Weather Data Link (XM) Page with the changed settings.

NOTE: *'Product Group 2' is only applicable to SiriusXM and Garmin Connext Weather.*

The pilot can select a map orientation for the Weather Data Link Page, or choose to synchronize the map orientation to the same orientation used on the 'Map - Navigation Map' Page.

Selecting a map orientation for the Weather Data Link Page:

1) Select the Weather Data Link Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Weather Setup'.
4) Turn the small **FMS** Knob to display the Group options.
5) If SiriusXM is the selected data link weather source, turn the small **FMS** Knob to highlight the 'Map' Group and press the **ENT** Key.

   Or:

   If FIS-B or Garmin Connext is the selected data link weather source, turn the large **FMS** Knob to highlight the 'Orientation' field at the bottom of the Product Group 1 list.
6) Turn the small **FMS** Knob to highlight the desired map orientation: North up, Track up, HDG up, or SYNC, then press the **ENT** Key.

Restoring default Weather Data Link Page settings:

1) Select the Weather Data Link Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Weather Setup', then press the **ENT** Key.
4) Press the **MENU** Key.
5) Highlight the desired default(s) to restore (all or for selection) and press **ENT** Key.
6) When finished, press the **FMS** Knob or press the **CLR** Key.

If multiple data link weather services are installed, customizing the display settings for the corresponding weather products shown in Table 6-4 will result in identical settings for all services.

SiriusXM Weather Product and Softkey	Garmin Connext Weather Product	FIS-B Weather Product
Next-generation Radar (NEXRAD) and No Radar Coverage	Precipitation (PRECIP) and No Radar Coverage	Next-generation Radar (NEXRAD) and No Radar Coverage
Cloud Top (CLD TOP)	Infrared Satellite (IR SAT)	Not Available
SiriusXM Lightning (XM LTNG)	Garmin Connext Data Link Lightning (DL LTNG)	Not Available
SIGMETs/AIRMETs (SIG/AIR)	SIGMETs/AIRMETs (SIG/AIR)	SIGMETs/AIRMETs (SIG/AIR)
Meteorological Aerodrome Report (METARs)	Meteorological Aerodrome Report (METARs)	Meteorological Aerodrome Report (METARs)
Winds Aloft (WIND)	Winds Aloft (WIND)	Winds Aloft (WIND)
Pilot Weather Report (PIREPs)	Pilot Weather Report (PIREPs)	Pilot Weather Report (PIREPs)

Table 6-4 Weather Data Link Map Settings Shared for Multiple Weather Data Link Sources

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 Maps	Navigation Map Page	Weather Data Link Page	Weather Information Page	Aux - Trip Planning Page	Nearest Page Group	Flight Plan Pages
NEXRAD/Radar Precipitation	+	+	+		+	+	+
Cloud Top			+				
Echo Top			+				
Infrared Satellite			+				
Data Link Lightning	+	+	+		+	+	+
Cell Movement		+	+		+		
SIGMETs/AIRMETs			+				
METARs	+	+	+	+	+	+	+
Surface Analysis & City Forecast			+				
Freezing Levels			+				
Winds Aloft		+*	+				
County Warnings			+				
Cyclone Warnings			+				
Icing Potential			+				
PIREPs			+	+			
AIREPs			+	+			
Turbulence (TURB)			+				
No Radar Coverage	+	+	+		+	+	+
TFRs	+	+	+	+	+	+	+
TAFs			+	+			

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

Table 6-5 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 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.
3) To enable/disable a data link lightning weather product on a PFD, press the **Lightning** Softkey.
   a) Press the **Datalink** Softkey to enable data link lightning or press the **LTNG Off** Softkey.
   b) Press the Back Softkey twice to return to the top-level PFD Softkeys.

NOTE: *Data link lightning is not applicable to the FIS-B Weather service.*

On the MFD maps, the weather product icon and age appear automatically when a weather is enabled and the range is within the maximum display limits. On PFD maps, this information is available using the PFD softkeys.

Enabling/disabling the weather product icon and age display (PFD maps):

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the **WX LGND** Softkey to enable/disable the weather product age, source, and icon box display on PFD Maps.

The setup menus for the 'Map - Navigation Map' Page and the Weather Data Link Page control the map range settings above which weather products data are decluttered from the display. If a map range larger than the weather product map range setting is selected, the weather product data is removed from the map. The page menus also provide an alternative to using the softkeys to enable/disable data link weather product overlays on maps.

CONNEXT DATA REQUESTS

NOTE: *Data requests are not applicable to the SiriusXM Weather or FIS-B Weather services.*

The Connext Data Request Menu provides the pilot with the options to define the requested weather coverage area(s), choose automatic weather update intervals (if desired), and the ability to send or cancel weather data requests. A Request Status Window inside the menu shows the status of the Connext Data Request.

Before a Connext Data Request can occur, a valid request coverage area must be defined from which all currently available Garmin Connext Weather products will be retrieved. At a minimum, either the aircraft's present position or a waypoint (as part of a flight plan or entered directly in the 'WAYPOINT' coverage field) must be part of the request coverage area, otherwise the request status window indicates 'INVALID COVERAGE AREA' and the system will not allow a request to occur.

It is not necessary for a destination (based on an active flight plan), a flight plan, or waypoint to be specified prior to enabling these coverage areas; however no weather data will be retrieved for these option(s) until a flight plan or waypoint is provided, respectively.

Manually Requesting Garmin Connext Weather information:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **MENU** Key.
3) With 'Connext Data Request' highlighted, press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the desired coverage option(s) and press the **ENT** Key to show or hide a green check mark to select one of more of the following coverage selections:

   • Present Position – Requests data based on current location.

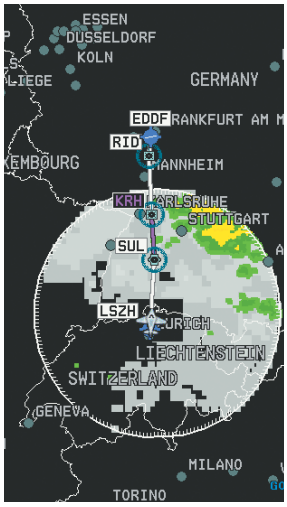
   • Destination – Requests data based on the active flight plan destination (Direct-To destinations excluded). See the Flight Management section for more information about entering and activating flight plans.

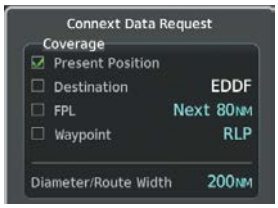
   • FPL – Requests data along an active flight plan, if one currently exists. Turn the small **FMS** Knob to select the desired flight plan look-ahead distance option (or choose 'Remaining FPL' to request weather data for the remainder of the flight plan), then press the **ENT** Key.

- Waypoint – Requests data based on a waypoint (which may be off-route). Turn the large and small **FMS** Knobs to enter a waypoint, then press the **ENT** Key.

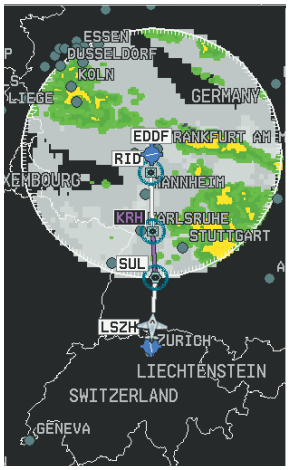
5) Turn the large **FMS** Knob highlight to the 'Diameter / Route Width' distance field and turn the small **FMS** Knob to select the desired diameter and route width of the request, then press the **ENT** Key.

6) Turn the large **FMS** Knob until the 'Send Request' field is highlighted. Press the **ENT** Key to initiate the request immediately or press the **FMS** Knob to return to the 'Map - Weather Data Link (CNXT)' Page without requesting weather data.

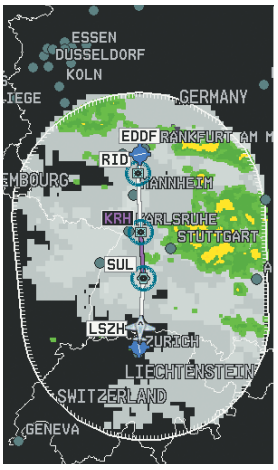


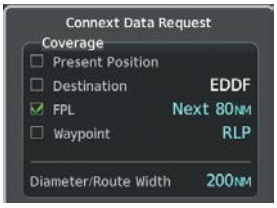


Present Position Selected, 200 nm Diameter Requested

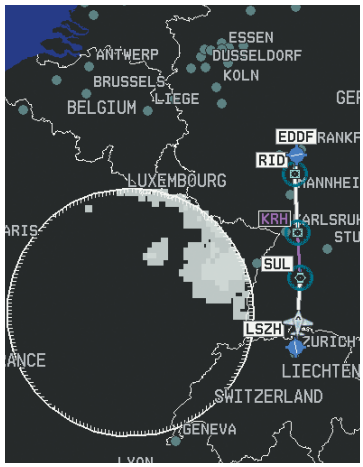


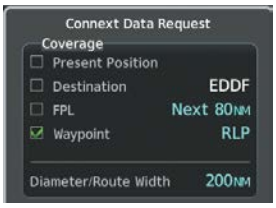
Destination Selected, 200 nm Diameter Requested





Next 80 nm of Flight Plan Selected, 200 nm Route Width Requested





Off-Route Waypoint Selected, 200 nm Diameter Requested

Figure 6-7 Garmin Connext Weather Data Request Results with Precipitation Data Displayed

During a Connext Data Request, the Request Status Window initially displays "Contacting Connext...". Once a connection is established, the Request Status Window displays "Receiving Wx Data... Time Remaining:" with an estimated data transfer time (either minutes or seconds). If desired, the Connext Data Request Menu may be removed while the data request is processing by pressing the **FMS** Knob; the data request will continue

to process in the background. Connext Data Requests typically take between 1 to 4 minutes to complete depending on the size of the selected weather coverage area, the amounts of weather activity present, and the Iridium signal strength.

The system retrieves all available Garmin Connext Weather products within the selected coverage area during an initial Connext Data Request, regardless of which products (if any) are currently enabled for display. On subsequent requests, the system retains previously retrieved textual data (such as METARs and TAFS) if it has not expired, while new textual weather data matching the current coverage area and all graphical weather data is transferred to the aircraft during every data request.

At the completion of a successful weather data request, the Request Status Window indicates 'OK' if the Connext Data Request menu is still within view.

Cancelling a Connext Data Request in Progress:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **MENU** Key.
3) With 'Connext Data Request' highlighted, press the **ENT** Key.
4) Turn the large **FMS** Knob to select the 'Cancel Request' field and press the **ENT** Key. The request status box indicates 'Request Cancelled'.
5) Press the **FMS** Knob to return to the 'Map - Weather Data Link (CNXT)' Page.

The flight crew can schedule Connext Data Requests to recur automatically. Automatic requests remain enabled until the flight crew them, or the system power is removed. The Request Status Window indicates the number of minutes or seconds until the next automatic data request occurs.

NOTE: *If automatic Connext Data Requests were enabled prior to the system entering Reversionary Mode, the automatic weather data requests will continue in Reversionary Mode, however the Connext Data Request Window and its associated options will not be available in Reversionary Mode.*

Enabling/disabling automatic Connext Data Requests:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **MENU** Key.
3) With 'Connext Data Request' highlighted, press the **ENT** Key.
4) Choose the desired weather coverage options.
5) Turn the large **FMS** Knob to select the 'Update Rate' field. Then turn the small **FMS** Knob to highlight the desired automatic update frequency (Off, 5 Min, 10 Min, 15 Min, 20 Min, 30 Min, 45 Min, or 60 Min), then press the **ENT** Key.
6) The 'Send Request' field is highlighted and a countdown timer is displayed in the 'Request Status' Window based on the currently selected update rate. Press the **ENT** Key to immediately send an immediate Connext Data Request.

   Or:

   Press the **FMS** Knob to return to the 'Map - Weather Data Link (CNXT)' Page.

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 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.

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.

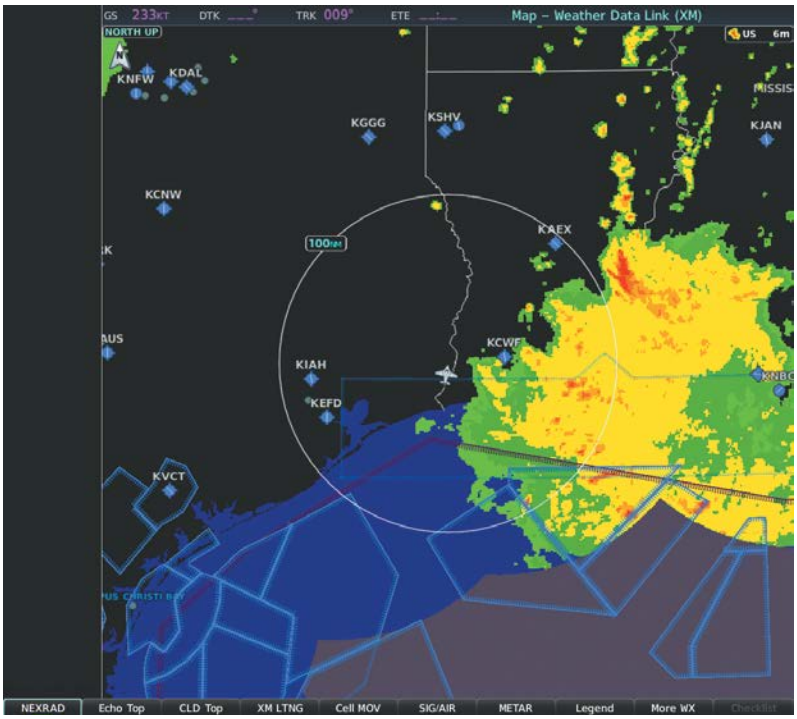


Figure 6-8 NEXRAD Data on the 'Map - Weather Data Link (XM)' Page

Enabling/disabling NEXRAD weather information on the 'Map - Weather Data Link (XM)' Page:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **NEXRAD** Softkey.

Enabling/disabling NEXRAD weather information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **NEXRAD** Softkey.

Enabling/disabling NEXRAD weather information on PFD maps:

1) Press the **Map/HSI** Softkey.
2) Press the **NEXRAD** Softkey.

A mosaic of data from all the available NEXRAD radar sites is shown for the selected region (US or Canada). The pilot can change the region on the 'Map - Weather Data Link (XM)' Page.

Changing the NEXRAD coverage region:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **MENU** Key.
3) Turn the large **FMS** Knob to highlight 'Weather Setup' and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the NEXRAD Region datafield.
5) Turn the small **FMS** Knob to highlight 'US' or 'CNDA' (Canada) and press the **ENT** Key.

The system can animate a loop of NEXRAD information. The animated view is available on the 'Map - Weather Data Link (XM)' Page, and on navigation maps with the exception of the PFD Inset or HSI Map. When enabled, animation begins after the system has received at least two recent NEXRAD images since the last avionics power cycle. When NEXRAD animation is enabled, a timeline appears in the upper-right corner of the map. A pointer on the timeline indicates the relative position of the displayed frame of animation, from oldest to newest. The NEXRAD weather product age corresponds to the displayed frame. The system can show up to six frames of NEXRAD animation when the USA coverage option is selected, and up to three frames of animation when Canada is selected. Due to the time it takes to accumulate successive frames, allow approximately 30 minutes in order for the maximum number of frames to be available for animation.

Displaying Time-Lapse NEXRAD Animation 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 Animation On/Off field.
4) Turn the small FMS Knob to select 'On' or 'Off', then press the **ENT** Key.
5) To remove the menu, push the **FMS** Knob or the **CLR** Key.

The pilot enables/disables the NEXRAD animation feature for navigation maps from the 'Map - Navigation Map' Page.

Displaying Time-Lapse NEXRAD Animation on navigation maps:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the **FMS** Knob to select the 'Weather' Group and press the **ENT** Key.
5) Turn the large **FMS** Knob to highlight the NEXRAD Animation On/Off field.
6) Turn the small **FMS** Knob to highlight 'On' or 'Off' and press the **ENT** Key.
7) To remove the menu, push the **FMS** Knob or the **CLR** Key.

The display of No Radar Coverage is always active when either the NEXRAD or Echo Tops weather products are enabled for display. Areas where NEXRAD radar coverage and Echo Tops information is not currently available, or outside of the selected coverage area, or is not being collected are indicated in a gray shade of purple.

Reflectivity

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.

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. Radar reflectivity can be separated into two elements: Base or Composite.

The base reflectivity precipitation weather product shows the radar returns from the perspective of a single antenna tilt angle. The composite reflectivity precipitation weather product shows the *highest* radar energy received from multiple antenna tilt angles. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation.

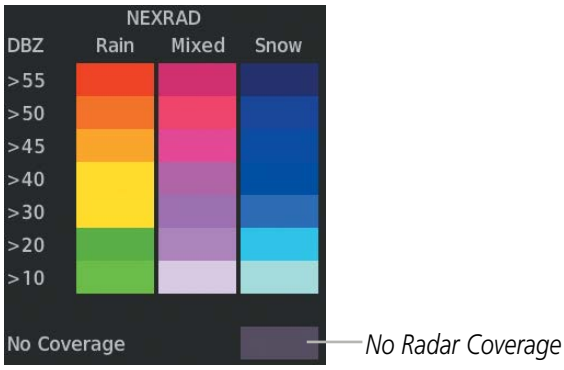
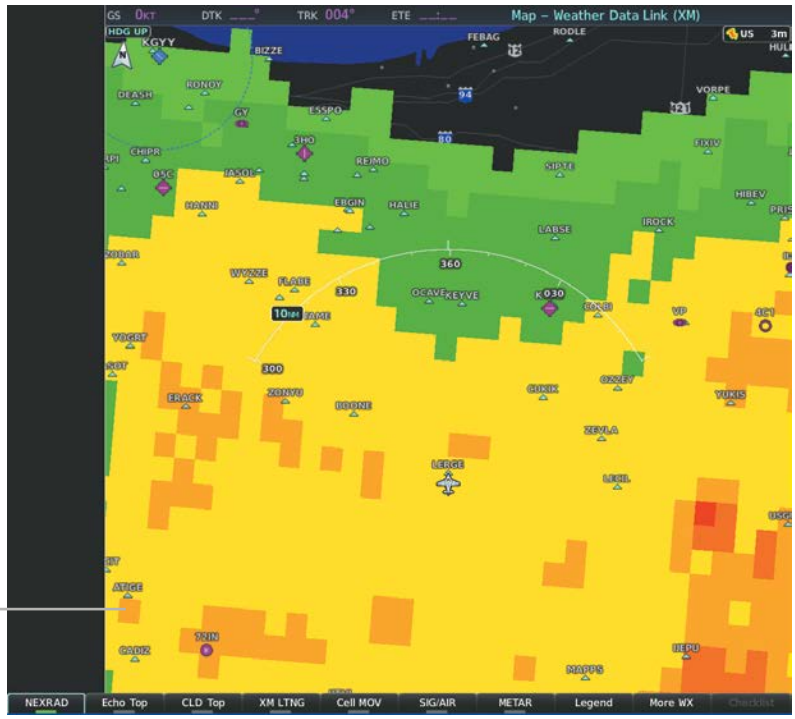


Figure 6-9 NEXRAD Weather Product Legend

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 two square kilometers for US composite or when Base (Canadian and other regions) is selected approximately four square kilometers. The intensity level reflected by each square represents the highest level of radar reflectivity sampled within the area.
- Unknown precipitation below 52°N is displayed as rain regardless of actual precipitation type.



Block represents approximately 2 km²

Figure 6-10 NEXRAD Weather Product at a 10 NM Map Range

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 55ºN.
- Any precipitation displayed between 52ºN and 55ºN 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.

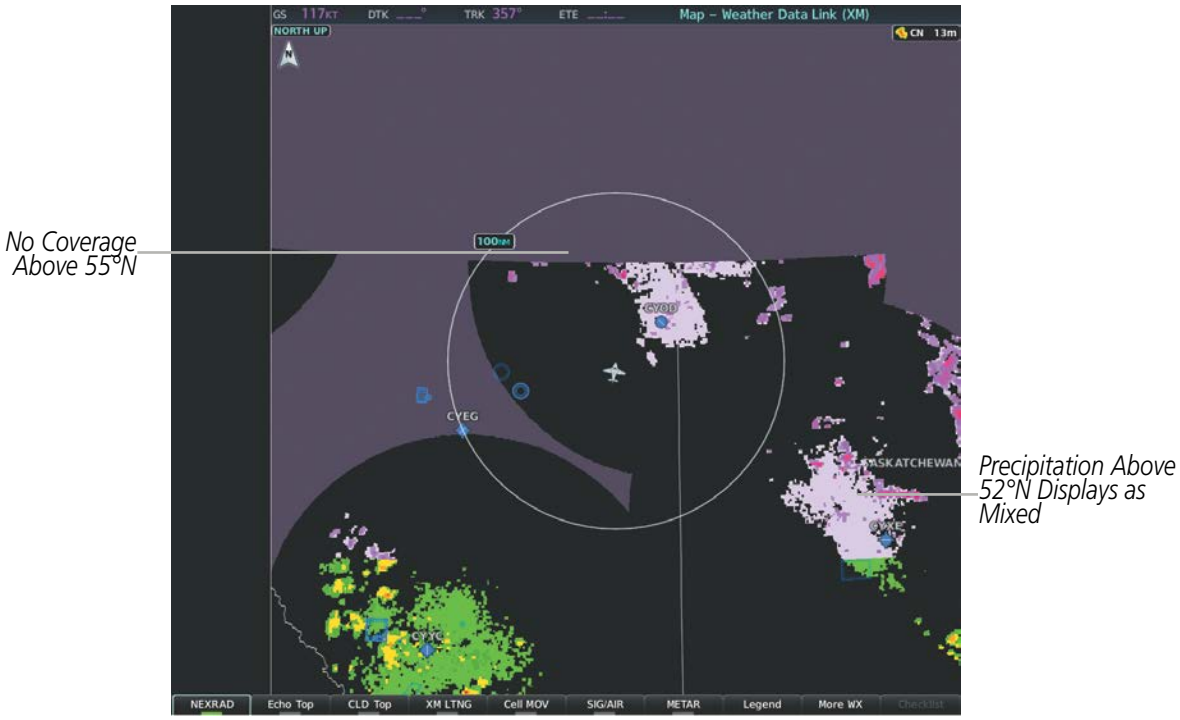


Figure 6-11 NEXRAD Weather Product - Canada

NEXRAD (FIS-B)

NOTE: *The NEXRAD weather product cannot be displayed at the same time as relative terrain.*

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.

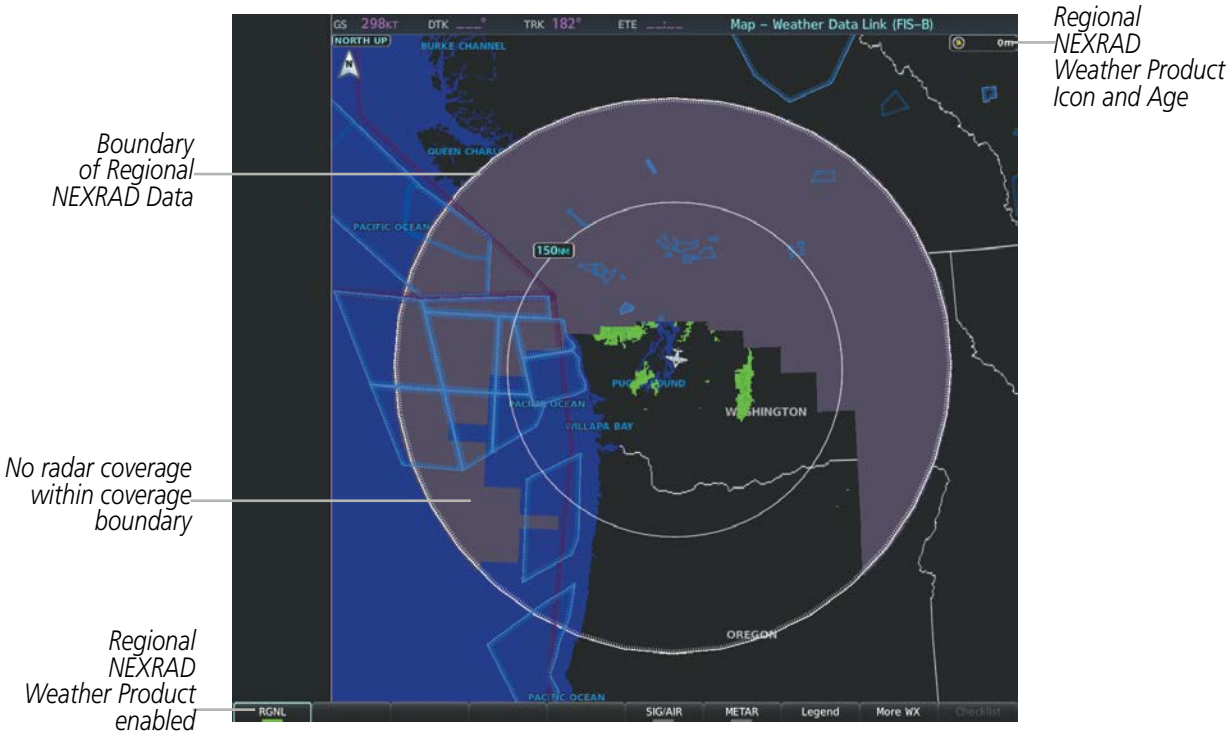


Figure 6-12 Regional NEXRAD Weather Product on the 'Map - Weather Data Link (FIS-B)' Page

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) Press the **NEXRAD** Softkey. Each press cycles though a coverage option as the softkey name changes (**US**, **RGNL**, or **US/RGNL**.

Or:

1) Press the **MENU** Key.

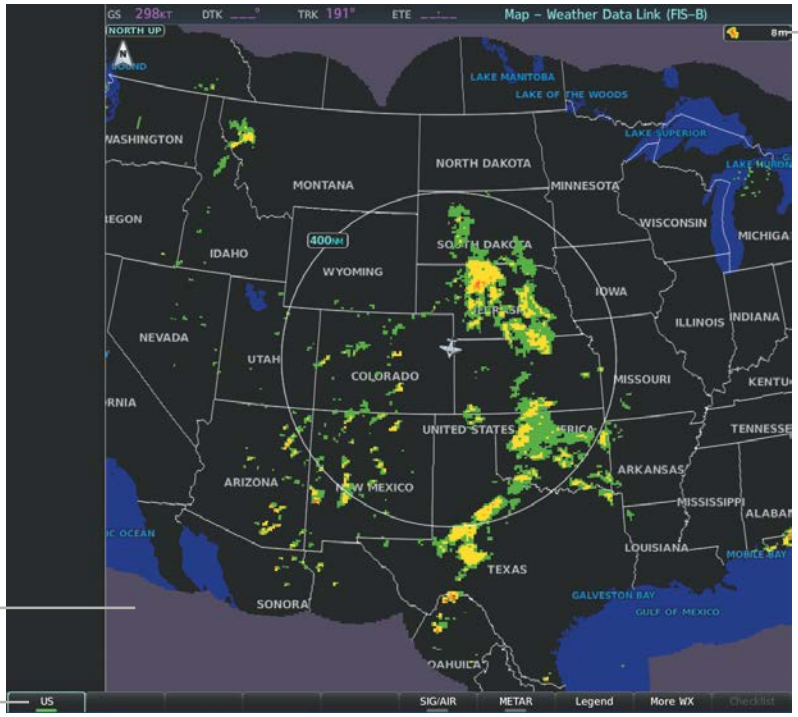
2) Turn the **FMS** Knob to highlight 'Weather Setup' and press the **ENT** Key.

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.



Continental USA NEXRAD Weather Product Icon and Age

No radar coverage

Regional NEXRAD Weather Product enabled

Figure 6-13 Continental US (CONUS) NEXRAD Weather Product on the 'Map - Weather Data Link (FIS-B)' Page

NOTE: *When both NEXRAD options are enabled on the Weather Data Link (FIS-B) Page, a combined version is displayed.*

Displaying the FIS-B NEXRAD weather product on the 'Map - Navigation Map' Page:

1) Press the **Map Opt** Softkey.
2) Press the **NEXRAD** Softkey.
3) To change the type of NEXRAD displayed, press the **MENU** Key.
4) With 'Map Settings' highlighted, press the ENT Key.
5) Turn the small **FMS** Knob to select the 'Weather' Group, then press the **ENT** Key.
6) Turn the large **FMS** Knob to highlight the NEXRAD Data 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 FIS-B NEXRAD weather product on PFD maps:

1) Press the **Map/HSI** Softkey.
2) Press the **NEXRAD** Softkey to enable/disable the display of NEXRAD information.

The regional NEXRAD weather product coverage area varies, as it is determined by the data received from ground-based sources. When the regional NEXRAD weather product is enabled, a white spiked boundary encloses this area to indicate the geographic limits of the regional NEXRAD coverage being displayed. The system shows composite radar data from all available NEXRAD sites inside of this boundary area.

If the continental United States version of the NEXRAD weather product is shown (**US** Softkey enabled), the coverage boundary is not shown on the map.

This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the 'Map - Weather Data Link (FIS-B)' Page. For the NEXRAD legend, press the **Legend** Softkey when the NEXRAD weather product is enabled.

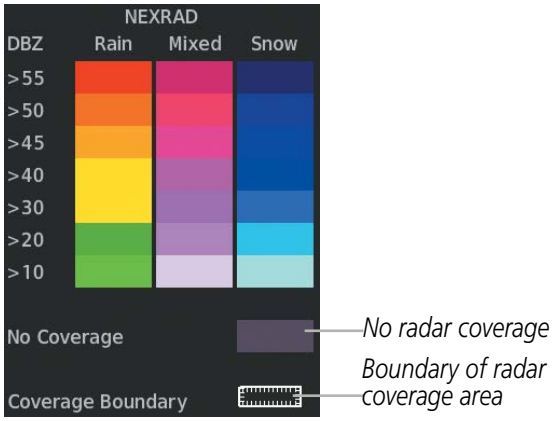


Figure 6-14 NEXRAD Weather Product Legend

The display of no radar coverage is enabled when NEXRAD is selected for display. Areas where radar data is not currently available, has not yet been received, or is not being collected are indicated in gray shade of purple.

NOTE: *If the system has not received all available NEXRAD weather data (such as during initial FIS-B signal acquisition or in areas of marginal or poor signal reception), the system may display areas of no radar coverage which are subsequently removed as radar data is received. It may take up to approximately ten minutes to receive all FIS-B data, when adequate reception is available.*

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD Limitations

NEXRAD radar images may have certain limitations:

- At smaller map ranges, individual blocks of NEXRAD weather data are viewable. For the regional version of the NEXRAD weather product, the smallest block represents 1.5 nm wide by 1 nm tall. For the continental United States version of the NEXRAD weather product, each block is 7.5 nm wide by 5 nm wide. The color of each block represents the *highest* radar reflectivity detected within that area.
- The continental US version of the NEXRAD weather product is not available above 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.

PRECIPITATION (GARMIN CONNEXT)

NOTE: *Precipitation data cannot be displayed at the same time as relative terrain data.*

The Precipitation weather product provides radar precipitation information in selected radar coverage areas. This information comes from individual weather radar sites and weather data sources such as government agencies. Each radar site or source may provide weather data at differing rates and times. Periodically, the Garmin Connext Weather service compiles the available information to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the Precipitation weather product. Individual images--gathered from each radar site--differ in age, and are always older than the displayed Precipitation weather product age.

Because of the time required to detect, assemble, and distribute the Precipitation 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 Precipitation 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.

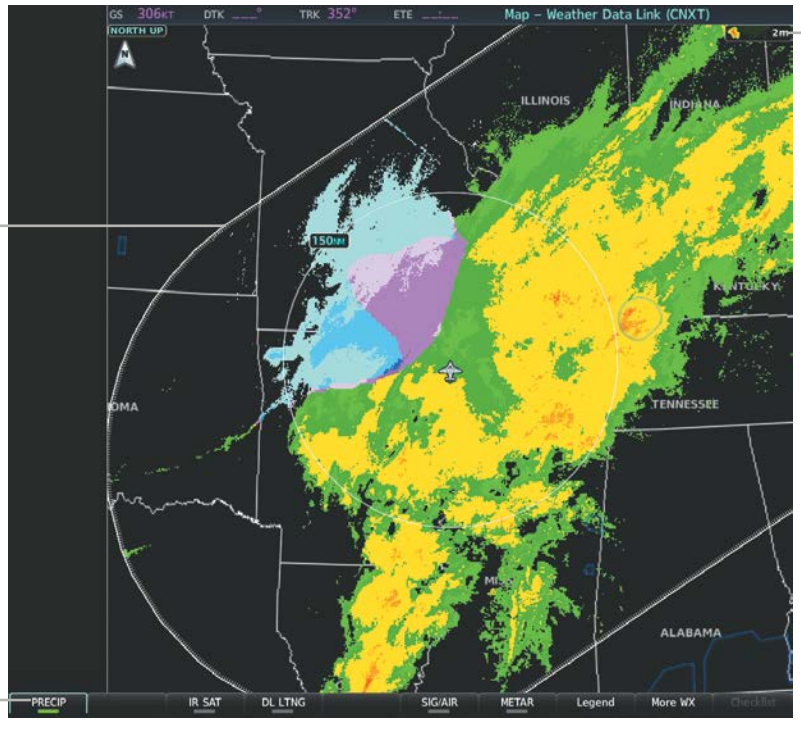


Figure 6-15 Precipitation Weather Product on the 'Map - Weather Data Link (CNXT)' Page

Displaying Precipitation weather information:

1) Press the **Map Opt** Softkey (for PFD maps, press the **Map/HSI** or **Map Opt** Softkey). This step is not necessary on the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **PRECIP** Softkey.

The system displays either base or composite radar imagery, depending on the region.

Region	Radar Reflectivity Type
United States	Composite Reflectivity
Canada, Europe, Australia	Base Reflectivity

All weather product legends can be viewed on the 'Map - Weather Data Link (CNXT)' Page. For the Precipitation legend, select the **Legend** Softkey when Precipitation is selected for display.

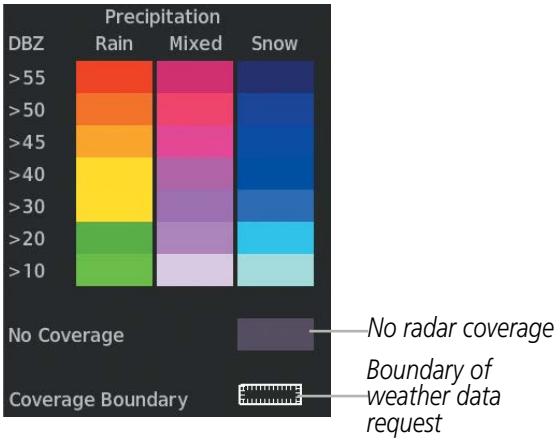


Figure 6-16 Precipitation Weather Product Legend

The display of radar coverage is enabled active when Precipitation is selected for display. Areas where precipitation radar coverage is not currently available or is not being collected are indicated in gray shade of purple. A white boundary line depicting the selected coverage area of the Connext Data Request encloses the precipitation data when this weather product is displayed.

Reflectivity

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.

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. Radar reflectivity can be separated into two elements: Base or Composite.

The base reflectivity precipitation weather product shows the radar returns from the perspective of a single antenna tilt angle. The composite reflectivity precipitation weather product shows the *highest* radar energy received from multiple antenna tilt angles. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation.

Radar Limitations

Radar images may have certain limitations:

- Radar base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- Radar base reflectivity is sampled at the minimum antenna elevation angle. An individual radar site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.
- When zoomed in to a range of 30 NM, each square block on the display represents an area of four square kilometers.
- Colors displayed from NEXRAD and airborne weather radar systems are not interchangeable. Refer to the applicable legends based on the weather source.

The following may cause abnormalities in displayed 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 (SIRISUXM)

NOTE: *Echo Tops cannot be displayed at the same time as Cloud Tops or NEXRAD data is displayed.*

The Echo Tops weather product shows the location, elevation, and direction of the highest radar echo. The highest radar echo does not indicate the top of a storm or clouds; rather it indicates the highest altitude at which precipitation is detected. Information is derived from NEXRAD data.

Figure 6-17 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.

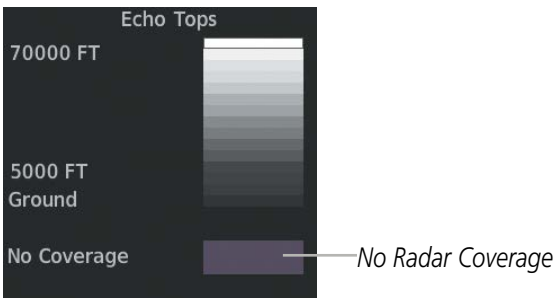
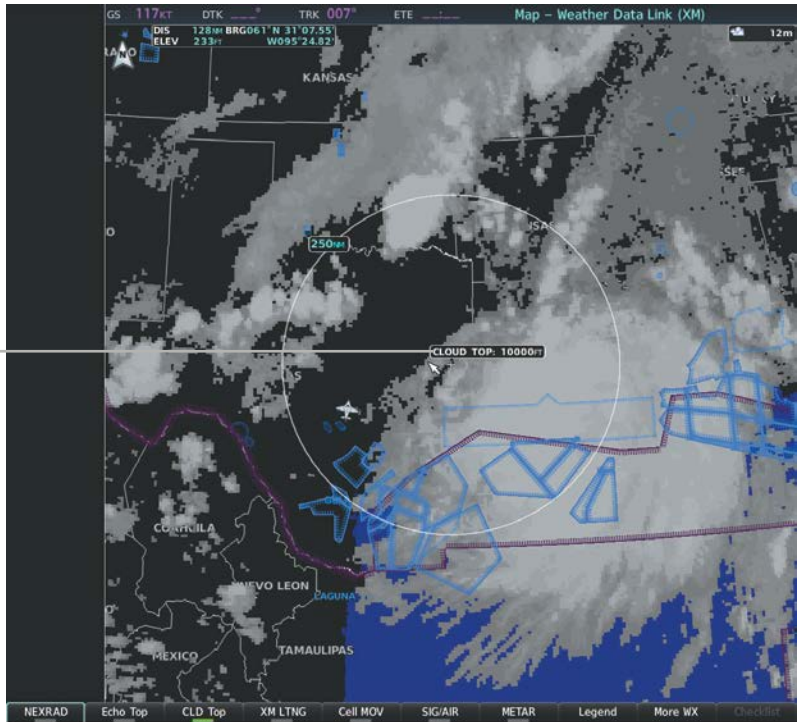


Figure 6-18 Echo Tops Legend

CLOUD TOPS (SIRIUSXM)

NOTE: *Cloud Tops and Echo Tops cannot be displayed at the same time.*

The Cloud Tops weather product depicts cloud top altitudes as determined from satellite imagery.



Altitude for selected Cloud Top

Figure 6-19 Cloud Tops Weather Product

Displaying Cloud Tops information:

1) Select the 'Map - Weather Data Link (XM)' Page with the **FMS** Knob.
2) Press the **CLD Top** Softkey.

Since Cloud Tops and Echo Tops use the same color scaling to represent altitude, display of these weather products is mutually exclusive. When Cloud Tops is activated, Echo Tops data is removed.

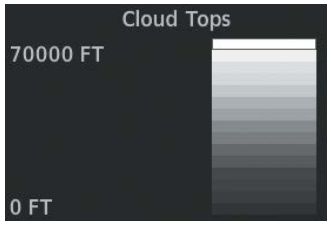


Figure 6-20 Cloud Tops Legend

DATA LINK LIGHTNING (SIRIUSXM, GARMIN CONNEXT)

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.

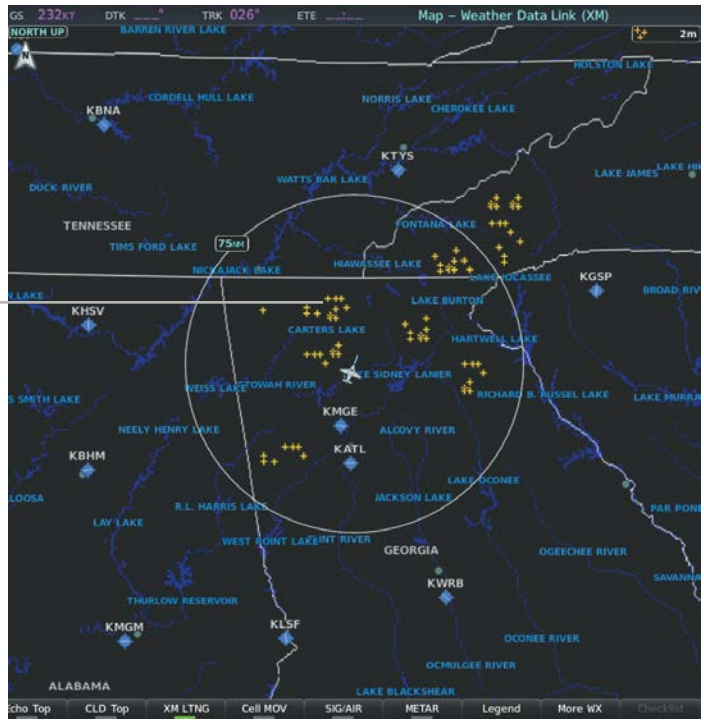


Figure 6-21 SiriusXM Lightning Weather Product on the 'Map - Weather Data Link (XM)' Page

Displaying Data Link Lightning information on Weather Data Link Page:

1) Turn the **FMS** Knob to select the 'Map - Weather Data Link (XM or CNXT)' Page.
2) Press the **XM LTNGSoft** Softkey or the **DL LTNG** Softkey.

To display the Lightning legend on the 'Map - Weather Data Link (XM or CNXT)' Page, press the **Legend** Softkey when Data Link Lightning is selected for display.

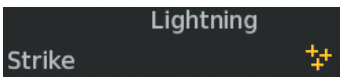


Figure 6-22 SiriusXM Lightning Legend

Displaying Data Link Lightning information on the 'Map - Navigation Map' Page:

1) Turn the **FMS** Knob to select the 'Map - Navigation Map' Page.
2) Press the **Map Opt** Softkey.
3) Press the **XM LTNG** or **DL LTNG** Softkey.

Displaying 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.
4) When finished, press the **Back** Softkey.

NOTE: *The source of the data link lightning weather product for the PFD Maps is determined by which source is selected on the 'Map - Weather Data Link (XM or CNXT)' Page.*

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.

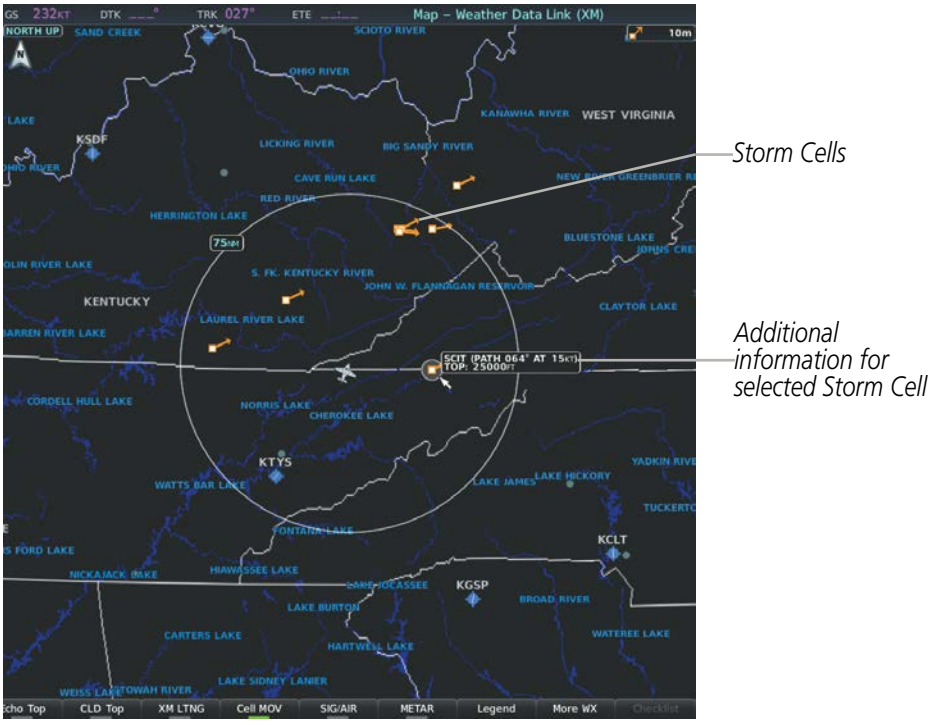


Figure 6-23 Cell Movement Weather Product on the 'Map - Weather Data Link (XM)' Page

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) Press the **Cell MOV** Softkey.

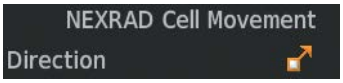


Figure 6-24 Cell Movement Legend

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 the **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.

INFRARED SATELLITE (GARMIN CONNEXT)

The Infrared Satellite (IR SAT) weather product depicts cloud top temperatures from satellite imagery. Brighter cloud top colors indicate cooler temperatures occurring at higher altitudes.

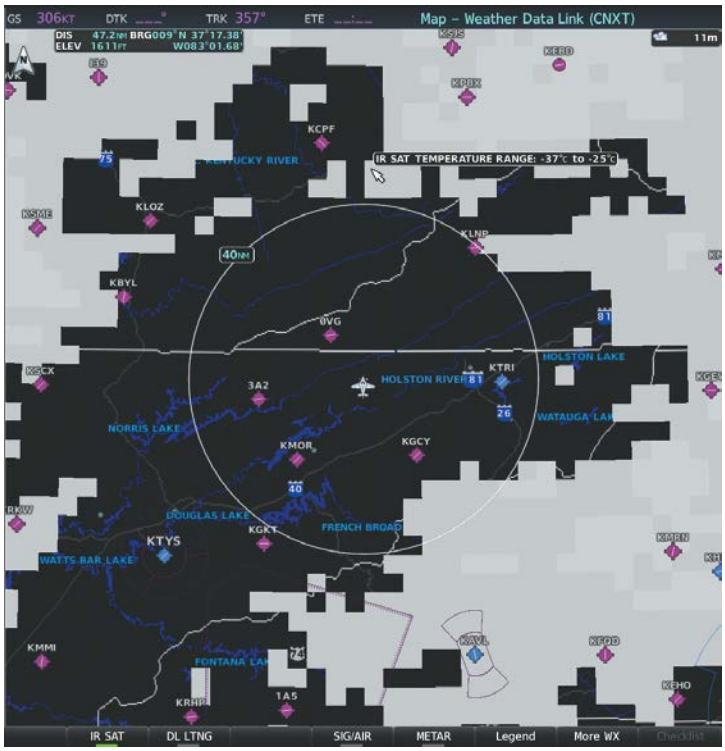


Figure 6-25 Infrared Satellite Weather Product on the 'Map - Weather Data Link (CNXT)' Page

Displaying Infrared Satellite information:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **IR SAT** Softkey.

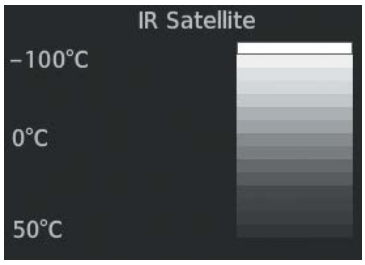


Figure 6-26 Infrared Satellite Legend

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 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.*

NOTE: *For Garmin Connext Weather only, the entire SIGMET or AIRMET is shown on the map as long as any portion of it is issued within the selected coverage area of the Connext Data Request.*

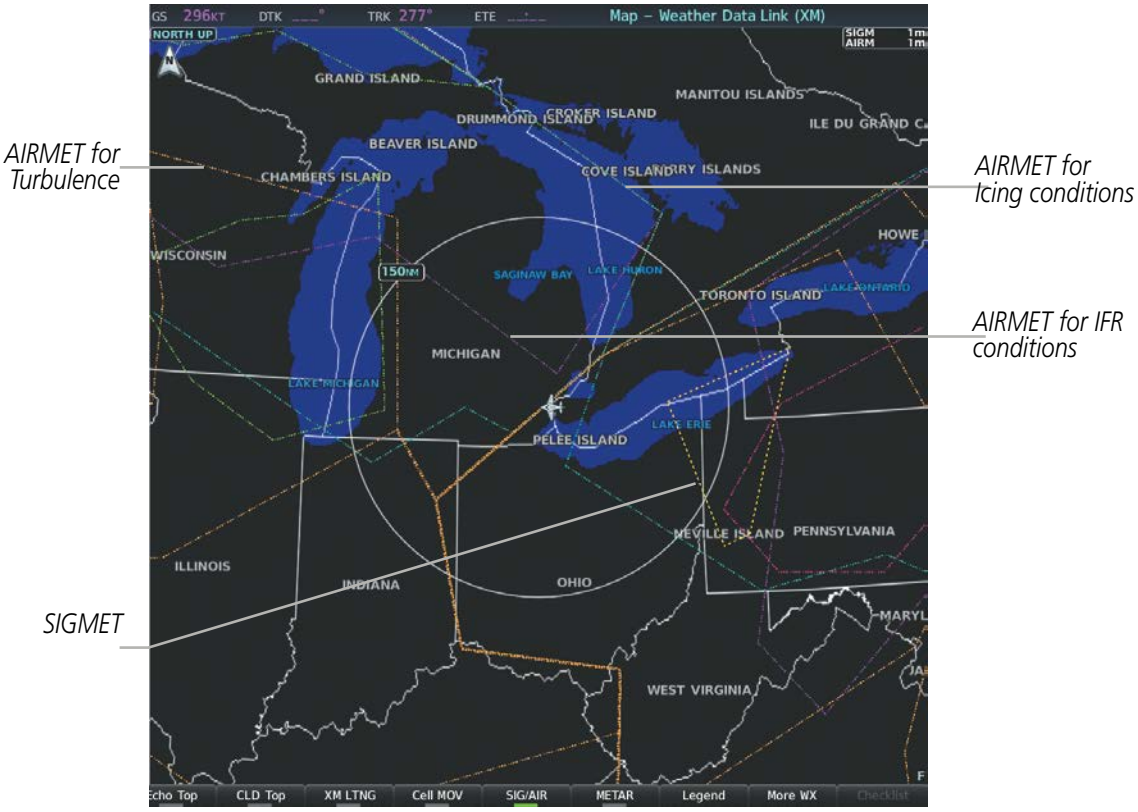


Figure 6-27 SIGMET/AIRMET Weather Product

Displaying SIGMETs and AIRMETs:

1) Select the 'Map - Weather Data Link (XM or CNXT or FIS-B)' Page.
2) Press the **SIG/AIR** Softkey.
3) To view the text of the SIGMET or AIRMET, press the **Joystick** and move the Map Pointer over the icon.
4) Press the **ENT** key. The following figure shows sample SIGMET text.

Sample SIGMET Text *SIGMET/AIRMET Legend*

Figure 6-28 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. If the METAR age is identical form all available Data Link sources, the system selects one METAR to display in the following order of source priority: SiriusXm, FIS-B, and Garmin Connext.

Additional Information on Weather Feature Selected with Map Pointer

METAR flag selected with Map Pointer

Figure 6-29 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 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 or FIS-B or CNXT)' Page, 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 Weather Data Link Page.

Or:

1) Select the 'WPT - Airport Information' Page on the MFD.
   a) Press the **WX** Softkey to select the 'WPT - Weather Information' Page.
2) Press the **FMS** Knob to display the cursor.
3) Use the **FMS** Knob to enter the desired airport and press the **ENT** Key.
4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note that the METAR text must be completely scrolled through before scrolling through the TAF text.

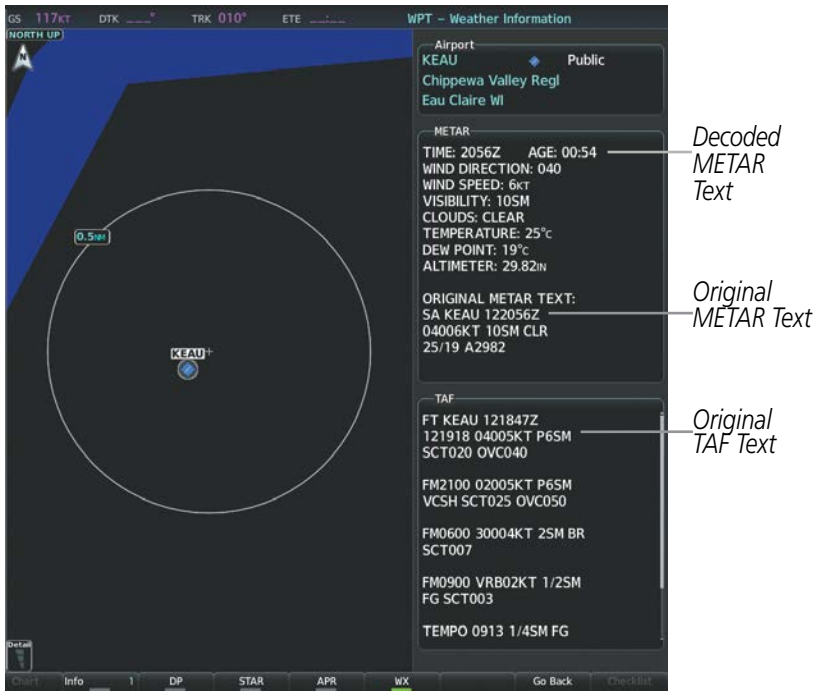


Figure 6-30 METAR and TAF Information on the 'WPT - Weather Information' Page

To display the METAR legend on the 'Map - Weather Data Link (XM)' Page, press the **Legend** Softkey when METARs are enabled for display.

The METAR flag color is determined by the information in the METAR text. The system displays a gray METAR flag when the system cannot determine the METAR category based on the information available.

Figure 6-31 METAR Legend

The system also shows METAR flags and their associated text on the 'FPL - 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 'FPL - 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.
4) Press the **Joystick** and pan to the desired METAR flag. Original METAR text appears on the map.
5) 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.

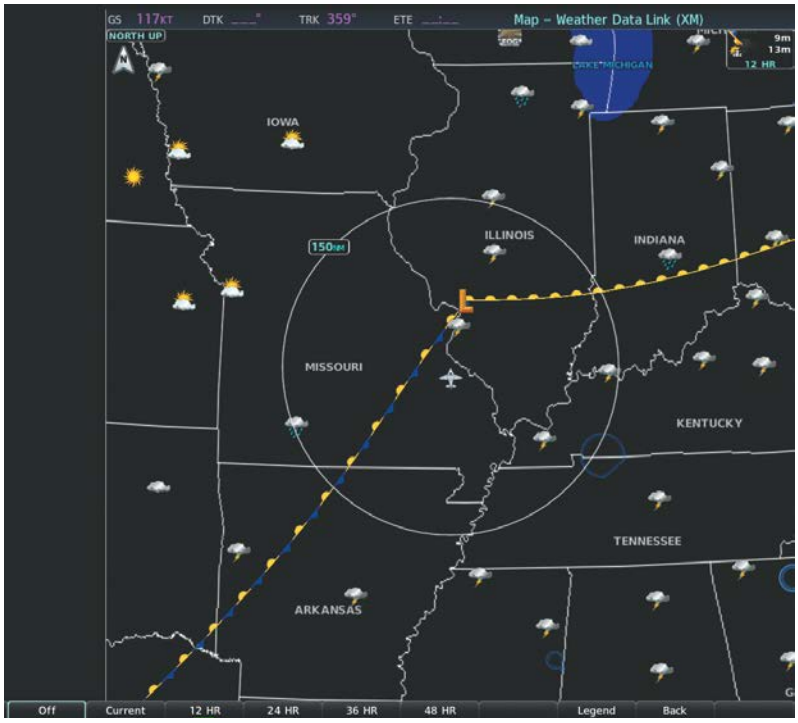


Figure 6-32 Surface Analysis Data - 24-Hour

Displaying Surface Analysis and City Forecast information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **More WX** Softkey.
3) Press the **SFC** Softkey.
4) Press the softkey for the desired forecast time: **Current**, **12 HR**, **24 HR**, **36 HR**, or **48 HR**. The **SFC** Softkey label changes to show the forecast time selected.

   Or:

   Press the **Off** Softkey to disable the display of the weather product.

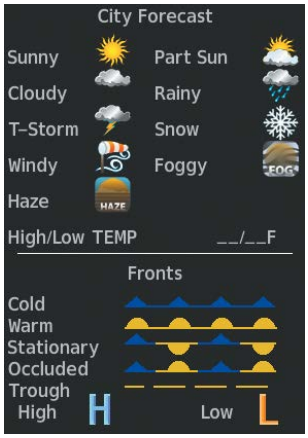


Figure 6-33 Surface Analysis Legend

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.

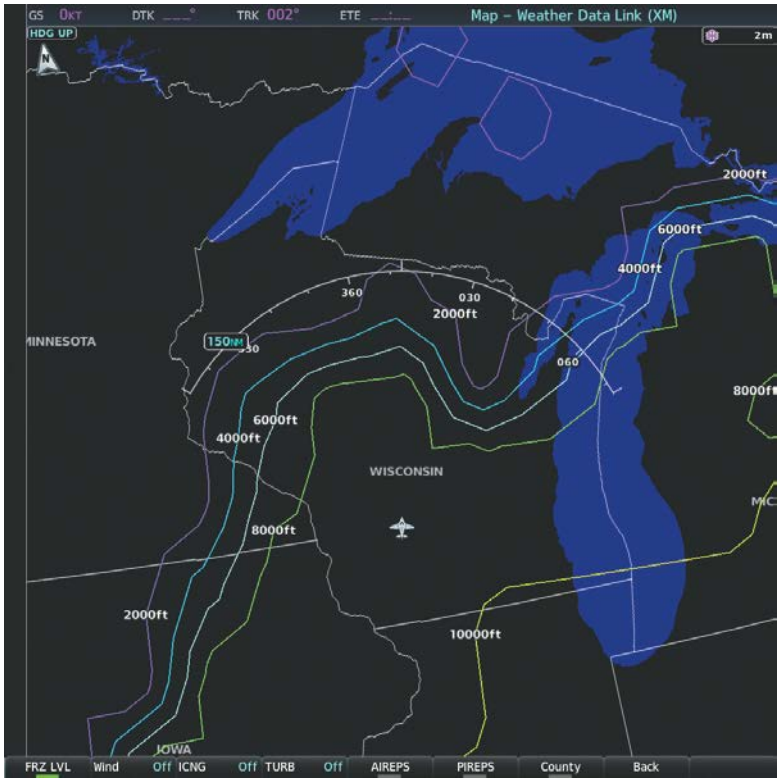


Figure 6-34 Freezing Levels Weather Product on the 'Map - Weather Data Link (XM)' Page

Displaying Freezing Level information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **More WX** Softkey.
3) Press the **FRZ LVL** Softkey.

Figure 6-35 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 or FIS-B)' Page.
2) Press the **More WX** Softkey.
3) Press the **Wind** Softkey.
4) Press a softkey for the desired altitude level: **SFC** (surface) up to 42,000 feet. Press the **Next** or **Prev** Softkey to cycle through the altitude softkeys. The **Wind** Softkey label changes to reflect the altitude selected.

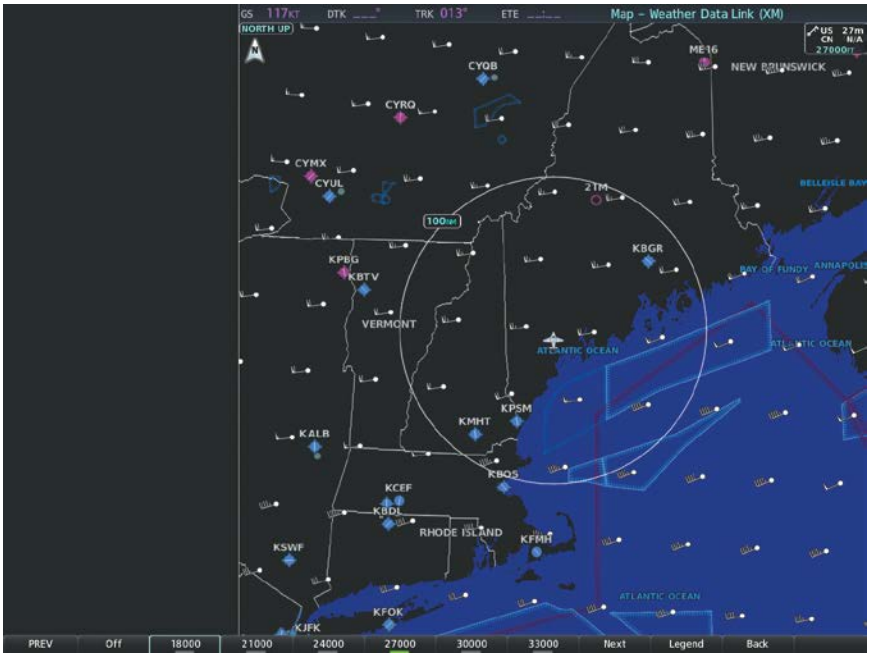


Figure 6-36 Winds Aloft Weather Product with 27,000 Feet Selected

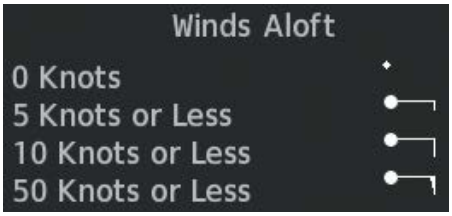


Figure 6-37 Winds Aloft Data with Legend

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 6-38 'Map - Navigation Map' Page with Winds Aloft Data in the VSD

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-6.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-6 VSD Headwind/Tailwind Component Symbols

NOTE: *VSD Winds Aloft is not available when FIS-B is the selected data link weather source.*

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.

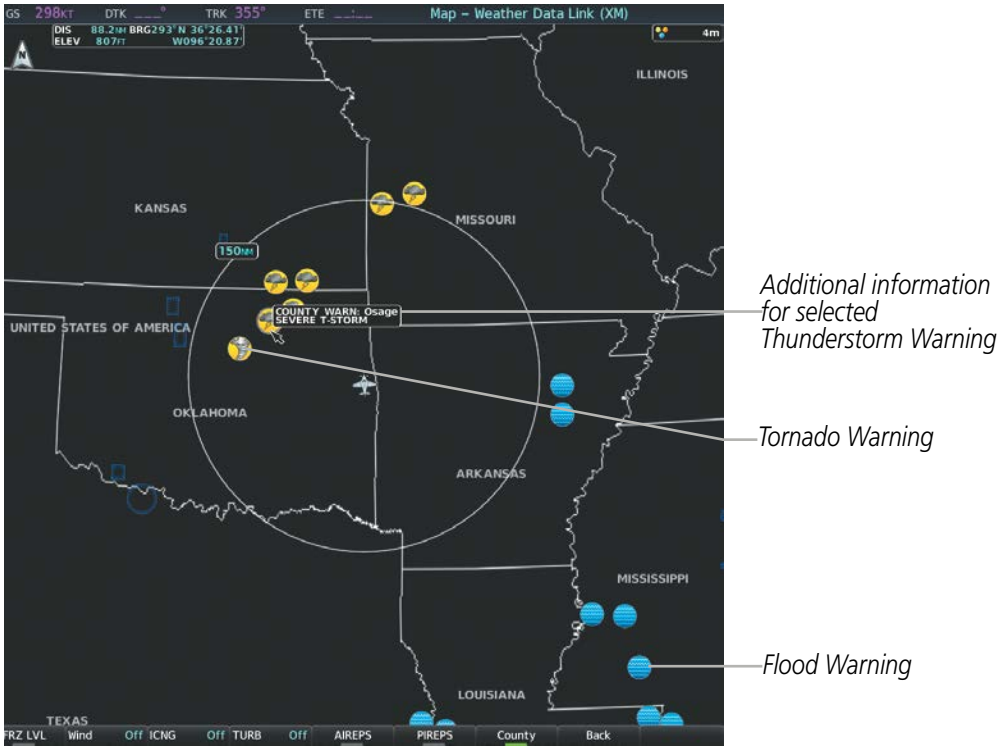


Figure 6-39 County Flood and Severe Weather Warnings

Displaying County Warning information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **More WX** Softkey.
3) Press the **County** Softkey.

Figure 6-40 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.

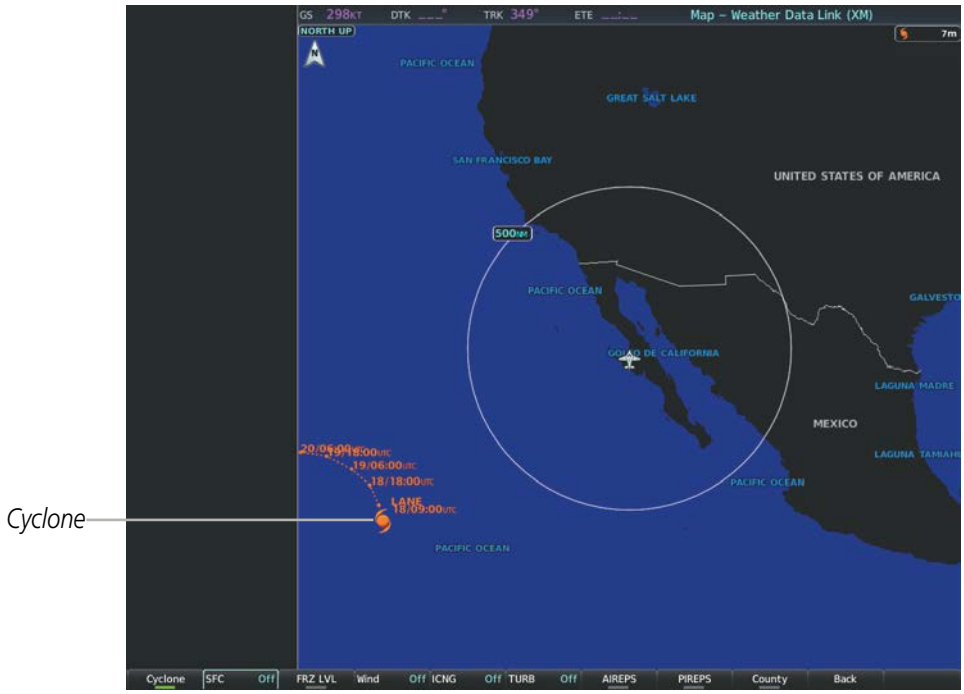


Figure 6-41 Cyclone Weather Product on the 'Map - Weather Data Link (XM)' Page

Displaying cyclone (hurricane) track information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **More WX** Softkey.
3) Press the **Cyclone** Softkey.

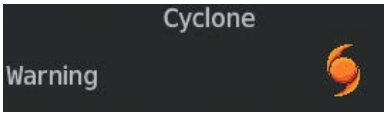


Figure 6-42 Cyclone Legend

NOTE: *The Cyclone weather product is not available unless at least one cyclone or tropical storm has been received. The weather product age indicates 'N/A' when no cyclone or tropical storm has been received.*

ICING (CIP & SLD) (SIRIUSXM)

The Current Icing Product (CIP) weather product shows a graphical view of the current icing environment. Icing severity is displayed in four categories: light, moderate, severe, and extreme (not specific to aircraft type). The CIP product is not a forecast, but a presentation of the current conditions at the time of the analysis.

Supercooled Large Droplet (SLD) icing conditions are characterized by the presence of relatively large, super cooled water droplets indicative of freezing drizzle and freezing rain aloft. SLD threat areas are depicted as magenta dots over the CIP colors.

Displaying Icing data:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **More WX** Softkey.
3) Press the **ICNG** Softkey.
4) Press a softkey for the desired altitude level: 1,000 feet up to 30,000 feet. Press the **Next** or **PREV** Softkey to cycle through the altitude softkeys. The **ICNG** Softkey label changes to indicate the altitude selected.

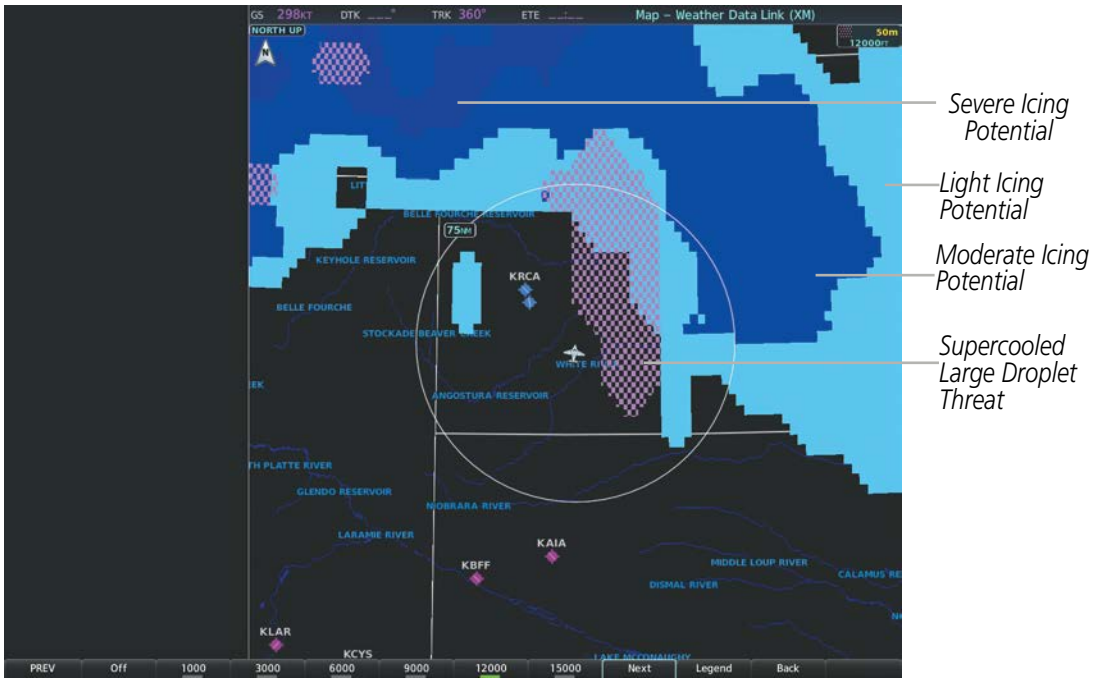


Figure 6-43 Icing Weather Product, 12,000 Feet Selected

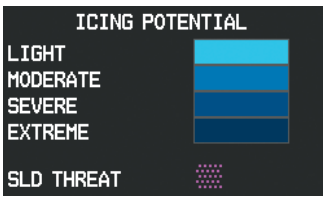


Figure 6-44 Icing Potential Legend

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) Press the **More WX** Softkey.
3) Press 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.

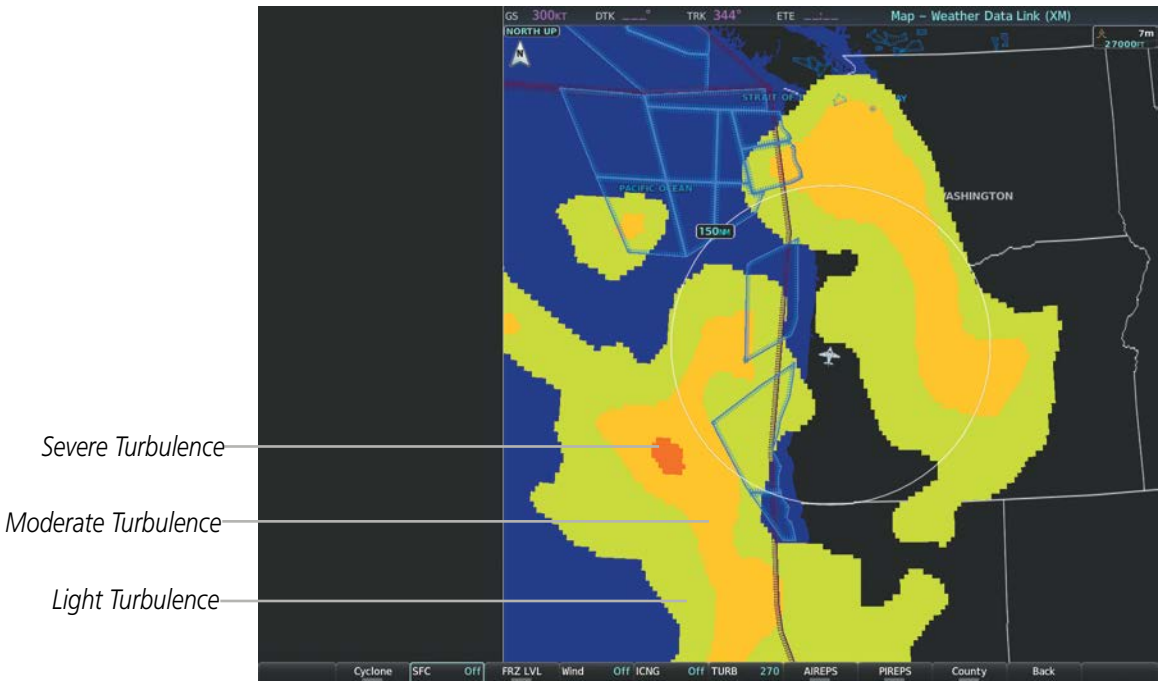


Figure 6-45 Turbulence Weather Product with 27,000 Feet Selected

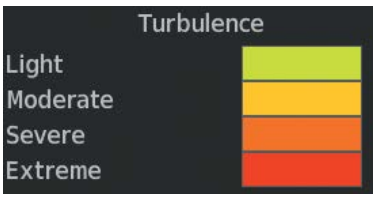


Figure 6-46 Turbulence Legend

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.

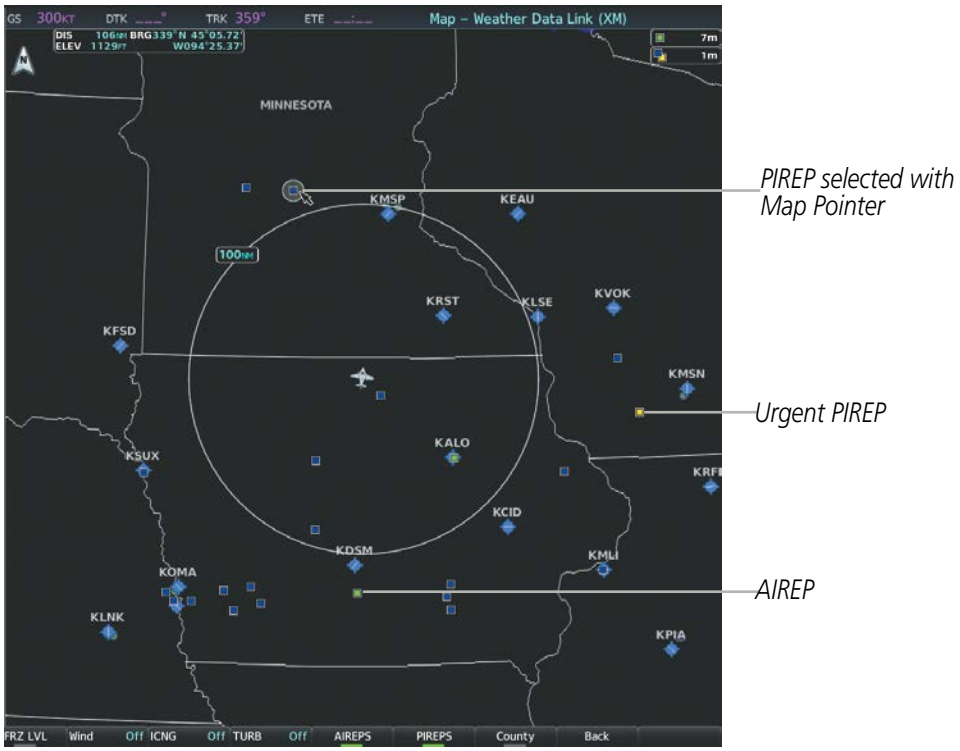


Figure 6-47 AIREPs and PIREPs on the 'Map - Weather Data Link (XM)' Page

Displaying PIREP and AIREP text:

1) Select the 'Map - Weather Data Link (XM or FIS-B or CNXT)' Page.
2) Press the **More WX** Softkey.
3) Press the **PIREPS** Softkey or the **AIREPS** Softkey. (Note the **AIREPS** Softkey is only available with the SiriusXM Weather service.)
4) Press the **Joystick** and pan to the desired weather report. A gray circle will appear around the weather report when it is selected.
5) Press the **ENT** Key. The Weather Information Page is shown with PIREP or AIREP text. The data is first displayed in a decoded fashion, followed by the original text. Note the original text may contain additional information not present in the decoded version.
6) Use the **FMS** Knob or the **ENT** Key to scroll through the PIREP or AIREP text.
7) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link Page.

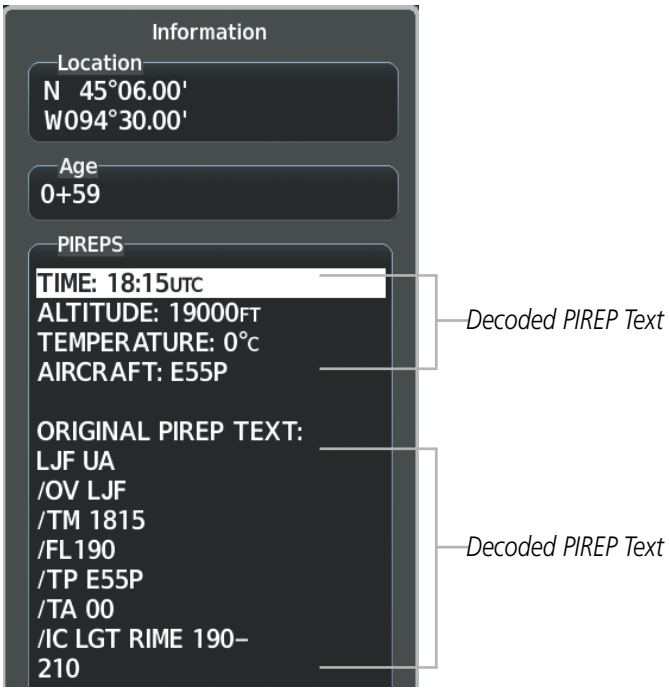


Figure 6-48 PIREP Text on the Weather Data Link (XM) Page

The PIREP color is determined by the type (routine or urgent).

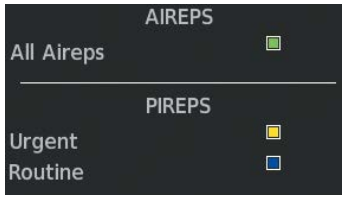


Figure 6-49 AIREPs & PIREPs Legend

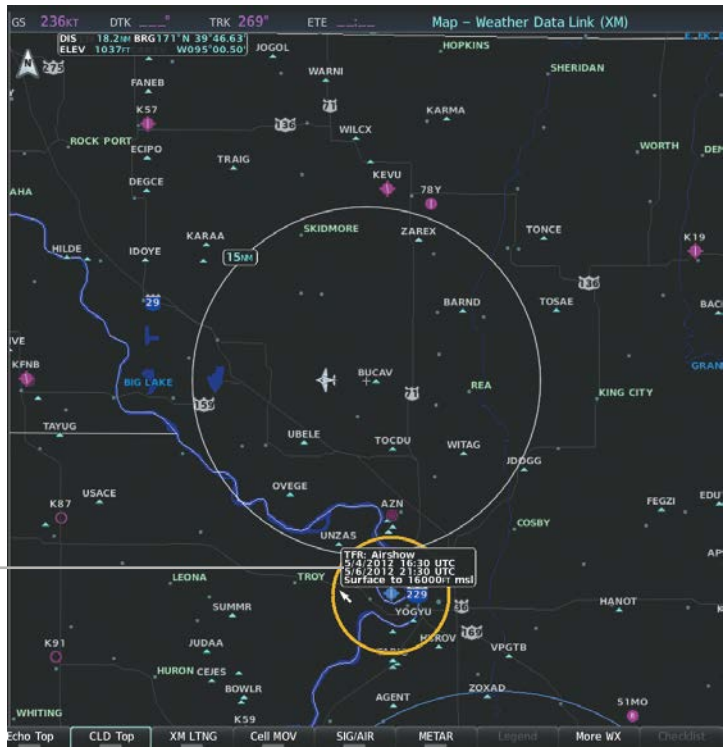
TFRS

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.*

NOTE: *Temporary Flight Restriction (TFR) data from Garmin Connext is only available in the United States (not including any U.S. territories.) Refer to http://sites.garmin.com/connext for product coverage information.*

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.



Information for selected TFR

Figure 6-50 TFR Data on the 'Map - Weather Data Link (XM)' Page

Displaying TFR Data:

1) Select the 'Map - Weather Data Link (XM or FIS-B or CNXT)' Page or 'Map - Navigation Map' Page.
2) Press the **Joystick** and pan the map pointer over a TFR to highlight it. The system displays TFR summary information above the map.
3) Press the **ENT** Key. The system displays a pop-up menu.
4) If necessary, turn the **FMS** Knob to select 'Review Airspaces' and press the **ENT** Key. The system displays the TFR Information window.
5) Press the **FMS** Knob or the **CLR** Key to remove the TFR Information window.

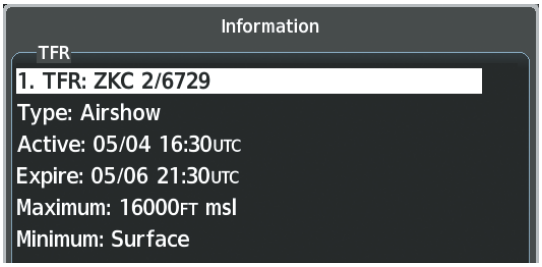


Figure 6-51 Full Text for Selected TFR

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 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 settings.
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 6-52 Viewing FIS-B Weather Status on 'Aux - ADS-B Status' Page

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 6-7 'Aux - ADS-B Status' Page Messages for FIS-B Weather

ABNORMAL OPERATIONS FOR GARMIN CONNEXT WEATHER

If the system cannot complete a Connext Data Request, one or more messages will appear in the Request Status Window.

Weather Request Status Message	Description
Auto requests inhibited Send manual request to reset.	The system has disabled automatic weather data requests due to excessive errors. Automatic weather data requests have stopped. Send a manual weather data request to resume automatic updates.
Auto update retry: ## Seconds	The system will attempt another automatic weather data request after an error occurred during the previous request. Timer counts down until the next automatic request occurs.
Connext Comm Error [1]	A general error has occurred. If the error persists, the system should be serviced.
Connext Comm Error [2]	A communications error has occurred with the GIA. The system should be serviced.
Connext Comm Error [3]	A general error has occurred. If the error persists, the system should be serviced.
Connext Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or a GIA is off-line.
Connext Comm Error [5]	This can occur if the Iridium or Garmin Connext services are not accessible. Check Iridium signal strength. If this error persists, the system should be serviced.
Connext Comm Error [6]	A communications error has occurred. It this error persists, the system should be serviced.
Connext Comm Error [7]	A weather data transfer has timed out. Check Iridium signal strength and re-send the data request.
Connext Comm Error [8]	A server error has occurred or invalid data received.
Connext Comm Error [9]	An error occurred while reading or writing data. If the error persists, the system should be serviced.
Connext Login Invalid	There is a problem with the Garmin Connext registration. Contact Garmin at the phone number listed at its website, www.flygarmin.com for assistance.
Connext Server Temp Inop	The Garmin Connext Weather data server is temporarily out of service, but is expected to return to service in less than 30 minutes.
Connext Server Inop	The Garmin Connext Weather data server will be out of service for at least 30 minutes.
Invalid Coverage Area	The weather data request coverage area does not contain at least one of the following: a waypoint, a flight plan, or a flight plan destination. Verify at least one of the coverage options is enabled (checked) and contains required criteria, then re-send the data request.
No Connext Subscription	The system is not be currently subscribed to Garmin Connext services or the access code is incorrect. Verify the access code. Contact Garmin at the phone number listed at its website, www.flygarmin.com for assistance.
Reduce Request Area	The size of the received weather data has exceeded system memory limits. Reduce the size of the coverage area and issue another Connext Data Request to ensure all available weather data has been received.
Request Canceled	The user has cancelled a Connext Data Request.
Request Failed - Try Again	The weather data request timed-out. Re-send data request.

Table 6-8 Abnormal Garmin Connext Data Request Status Messages

When the system is operating in Reversionary Mode, only those weather products which can be displayed on the PFD maps will be available for display (see Table 6-5 for a list of weather products and their associated map availability).

If manual Connext Data Requests were enabled prior to entering Reversionary Mode, no new weather data will be retrieved while operating in Reversionary Mode. If automatic Connext Data Requests were enabled prior to Reversionary Mode operation, the system will continue the automatic data requests in Reversionary Mode (provided automatic requests have not been inhibited due to a system error).

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.*

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.*

The system can display L-3 WX-500 Stormscope lightning detection system information on the 'Map - 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 6-9 Lightning Age and Symbols

USING THE STORMSCOPE PAGE

On the 'Map - Stormscope®' Page, lightning information can be displayed at the ranges of 25 nm, 50 nm, 100 nm, and 200 nm.

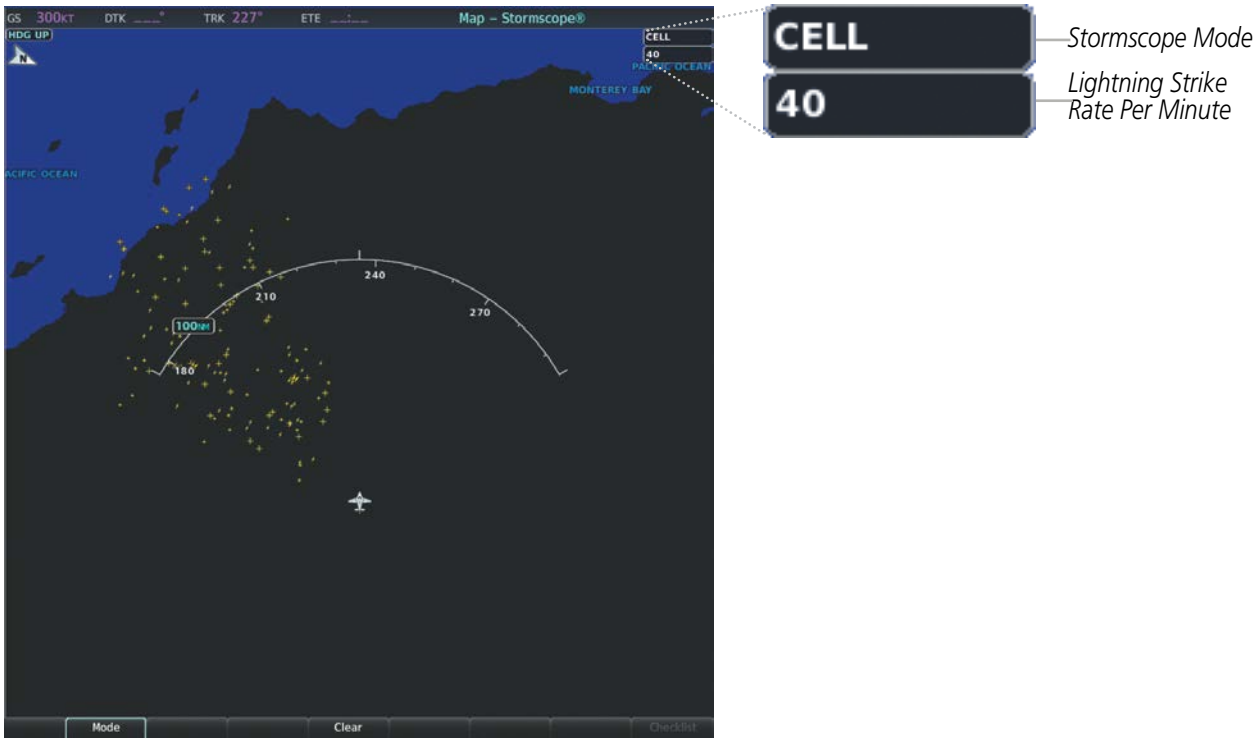


Figure 6-53 'Map - Stormscope®' Page with Lightning Information

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 'Map - Stormscope®' Page.
3) Turn the **Joystick** clockwise to increase the map range or counter-clockwise to decrease the map range.

Selecting 'cell' or 'strike' mode on the 'Map - Stormscope®' Page:

1) Select the 'Map - Stormscope®' Page.
2) Press the **Mode** Softkey. The **Cell** and **Strike** softkeys are displayed.
3) Press the **Cell** Softkey to display 'CELL' data or press the **Strike** Softkey to display 'STRIKE' data. 'CELL' or 'STRIKE' is displayed in the mode box in the upper right corner of the 'Map - Stormscope®' Page.
4) Press the **Back** Softkey to return to the top-level softkeys for the 'Map - Stormscope®' Page.

Or:

1) Select the 'Map - Stormscope®' Page.
2) Press the **MENU** Key to display the 'Map - 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 press the **FMS** Knob.

ADDITIONAL STORMSCOPE DISPLAYS

The Pilot can overlay Stormscope lightning information on navigation maps. When the overlay is enabled, and the map range is within the maximum map range setting limits to display Stormscope lightning, a Stormscope icon appears on the map. On the 'Map - Navigation Map' Page, the selected Stormscope mode and strike rate appear in the upper-right corner of the map. The 'Map - Navigation Map' Page also had menus for selecting the Stormscope mode, and for selecting the maximum map range to display lightning symbols for navigation maps.

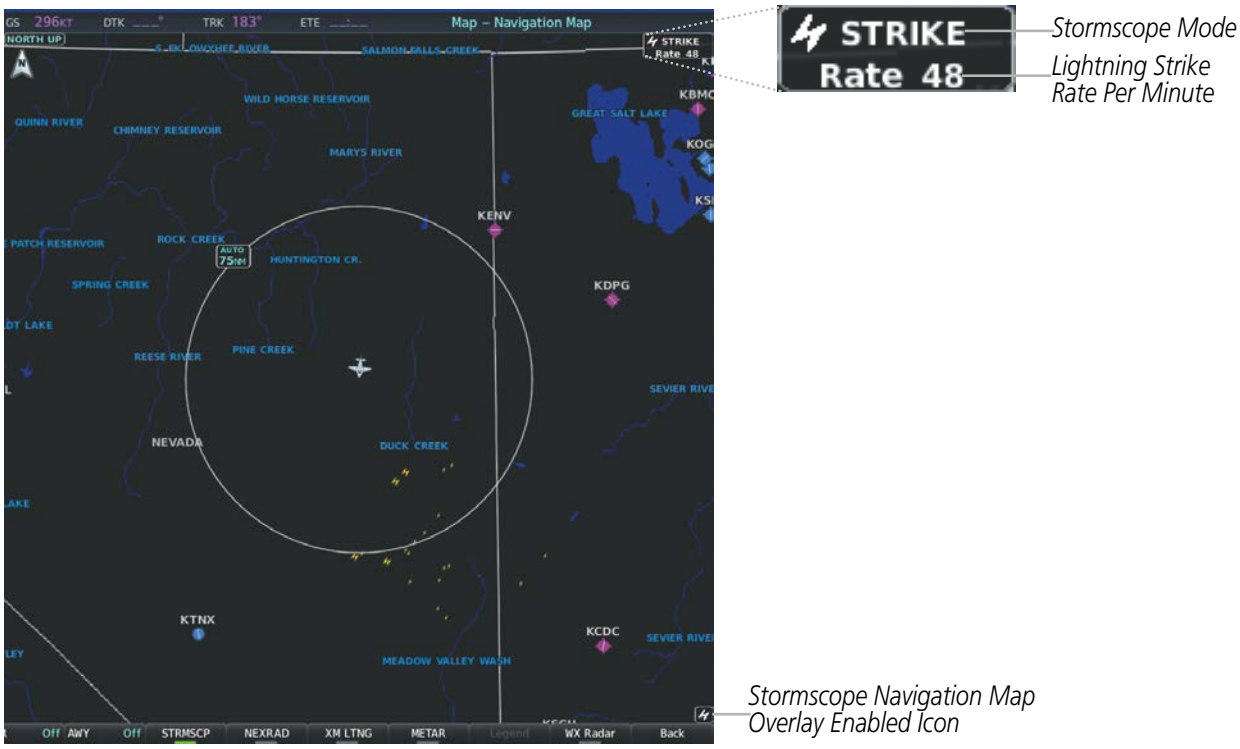


Figure 6-54 'Map - Navigation Map' Page with Stormscope Lightning Overlay Enabled

Displaying Stormscope information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **STRMSCP** Softkey.

Setting up Stormscope options on the 'Map - Navigation Map' Page:

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.

The following options are available:

- 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.

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.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

STORMSCOPE ABNORMAL OPERATIONS

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 'Map - Stormscope®' Page.
2) Press 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.

6.3 AIRBORNE COLOR WEATHER RADAR

SYSTEM DESCRIPTION

The Garmin GWX 68 Airborne Color Weather Radar is a four-color digital pulsed radar with 6.5 kilowatts of output power. It combines excellent range and adjustable scanning profiles with a high-definition target display. The pulse width is four microseconds (µs) on all ranges except the 2.5 nm range. The GWX 68 uses a one µs pulse width at this range to reduce the targets smearing together on the display for better target definition at close range.

The Garmin GWX 70/75 Airborne Color Weather Radar is a solid-state pulsed radar with forty watts of output power. The radar combines excellent range and adjustable scanning profiles with a high-definition target display. The GWX 70/75 has an effective pulse length of 27.31 microseconds (µs), and the system optimizes the pulse length to maximize resolution at each range setting.

Differences between the GWX 68 and GWX 70/75 are discussed throughout this section, where applicable.

The KingAir 300/B300 Series uses a 12-inch antenna that is fully stabilized to accommodate 30º of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers pilot-adjustable horizontal scan angles. A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

Radar features include:

- Extended Sensitivity Time Constant (STC) logic that automatically correlates distance of the return echo with intensity, so cells do not suddenly appear to get larger as they get closer.
- WATCH™ (Weather ATtenuated Color Highlight) helps identify possible shadowing effects of short-range cell activity, identifying areas where radar return signals are weakened or attenuated by intense precipitation (or large areas of lesser precipitation) and may not fully reflect the weather behind a storm.
- Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges are not being monitored.

If a GWX 70/75 is installed, the following features may also be available:

- Altitude-Compensated Tilt (ACT) management, which automatically adjusts the antenna tilt angle as the aircraft altitude changes.
- Independent weather radar scans for each PFD HSI Map while the aircraft is in the air.
- Optional Turbulence Detection presents areas of turbulence associated with precipitation using Doppler measurements.
- Optional Ground Clutter Suppression (GCS), to remove ground clutter from the displays.

NOTE: *Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.*

PRINCIPLES OF AIRBORNE WEATHER RADAR

The term RADAR is an acronym for RAdio Detecting And Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is reflected back to the radar receiver as a return echo. The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving.

Radar detection is a two-way process that requires 12.36 µs for the transmitted microwave pulses to travel out and back for each nautical mile of target range. It takes 123.6 µs for a transmitted pulse to make the round trip if a target is ten nautical miles away.

The airborne weather radar has the capability to detect the velocity of precipitation moving toward or away from the radar antenna. As the radar pulse beam strikes a moving object, the frequency of the returned echo shifts in relation to the speed at which the object is moving. This effect is analogous to the audible pitch change observed when an emergency vehicle's siren gets closer or moves away. Doppler radar employs this effect to detect areas of precipitation moving at a high rate of speed (indicative of turbulence), and to determine when an object, such as the ground, is stationary. The system can use this information to suppress the display of ground clutter.

Airborne weather radar should be used to avoid severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities, and crew experience. Airborne weather radar is efficient at detecting wet precipitation such as rain, wet snow, and water coated hail, however it will not detect clouds or mist. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them, as these areas may contain severe turbulence or other hazards such as hail. In addition, Doppler radar measurement of precipitation velocity only occurs when rain or hail is moving along the radar beam and either toward or away from the antenna. Airborne weather radar systems cannot detect Clear Air Turbulence (CAT) as there are no particulate for the radar to detect.

Airborne weather radar has other capabilities beyond weather detection. It also has the ability to detect and provide distance to cities, mountains, coastlines, rivers, lakes, and oceans.

NEXRAD AND AIRBORNE WEATHER RADAR

Both Airborne Weather Radar and NEXRAD measure weather reflectivity in decibels (dB). A decibel is a logarithmic expression of the ratio of two quantities. Airborne Weather Radar measures the ratio of power against the gain of the antenna, while NEXRAD measures the energy reflected back to the radar, or the radar reflectivity ratio.

Although both radar systems use colors to identify the different echo intensities, the thresholds and colors are not interchangeable. Airborne color radar values from the installed weather radar system must not be confused with NEXRAD radar values. In addition, NEXRAD depicts lower intensity returns than airborne weather radar. Airborne weather radar return images will not appear the same as NEXRAD return images.

Convective weather activity is known to develop rapidly, with cell growth capable of exceeding several thousand feet per minute. Airborne weather radar provides the flight crew with real-time weather avoidance information for precipitation detected within the airborne weather radar's beam. NEXRAD information is **not** real-time. It is intended to assist the flight crew with hazardous weather avoidance planning. NEXRAD images are comprised of individual radar scans arriving at a network at different rates and times, which are periodically compiled into a mosaic (the NEXRAD weather product) and transmitted via data link. Due to inherent delays in this process, it is common for the displayed NEXRAD images to be significantly older than the current weather situation, and may also differ from information the airborne weather radar presents.

Because NEXRAD operates from an extensive network of ground-based radar antennas performing 360° scans, it is capable of providing information on large-scale weather patterns such as precipitation associated with significant frontal activity from multiple radar locations. The airborne weather radar can perform up to 90° scan, but is more affected by distance and precipitation attenuation discussed earlier in this section. Other factors including curvature of the earth (particularly at map ranges greater than 150 miles), antenna tilt setting, and aircraft altitude may also cause the airborne weather radar's antenna beam to miss areas of precipitation which are detected by NEXRAD. In addition, since the airborne weather radar's beam often produces ground returns, it may be difficult to distinguish precipitation from ground returns, especially stratus rain when the aircraft is above the precipitation.

Both airborne weather radar and the NEXRAD system can detect a radar top of a storm cell. Airborne weather radar can display this information in vertical scan mode, while NEXRAD radar top information appears in the Echo Tops SiriusXM Weather Product (Refer to Section 6.1 for more information about SiriusXM Weather). Because airborne weather radar and NEXRAD use different detection thresholds, a radar top from airborne weather radar may appear 5,000 feet or more below the NEXRAD-derived Echo Top. Furthermore, radar top information provided from either source is not the actual or true top of the storm, which is only observable with the eyes in clear air and may be much higher than the radar top detected by either system.

Because airborne weather radar and NEXRAD present information using similar (but not interchangeable colors), only one radar source may be shown on a map Display Page at a time. Pilots should carefully consider information from airborne and data link weather sources, in addition to other available resources to avoid flight into hazardous weather conditions.

ANTENNA BEAM ILLUMINATION

Radar beams are much like the beam of a flashlight, in that they will illuminate targets within the beam. Just as with a flashlight, the further the beam travels, the wider it becomes and the less effective it is at illuminating targets. The certified beam width contains 90% of the energy of the radar signal, with the strongest part of the beam in the center. Pointing the center of the beam at targets to investigate provides the best returns for a particular target.

The remaining 10% of beam energy (outside the certified beam) has sufficient strength and the antenna has the sensitivity to display highly reflective targets, including additional weather and ground returns. Weather returns from this portion of the beam energy will most likely be under representative of the true intensity of the hazards, because they are so far from the center of the beam (and outside of the certified beam width). The strong reflective nature of terrain features will cause the display of ground clutter well short of where the certified beam width intersects the ground. For the 12-inch antenna this additional beam energy represents approximately four additional degrees at the top and bottom of the certified beam width of 8 degrees.

The following figure depicts the radar beam as seen from the side, with both the certified beam width and the additional beam energy illustrated. With the aircraft at 30,000 ft. AGL and a radar tilt angle of zero degrees, ground clutter may be observed starting at approximately 36 NM. The cell located 20 NM from own ship would be over-scanned by the beam, and as a result would not be represented on the radar display. The cell located 80 NM from own ship displays radar tops of 22,000 ft. AGL which is relatively close to the beam center, so this cell would be represented on the display. However, utilizing a lower radar tilt angle would better depict the precipitation intensities of this cell. The cell located at approximately 190 NM displays radar tops of 28,000 ft. AGL, while the center of the beam is at about 65,500 ft. AGL (due to the Earth's curvature at that distance). While this particular cell may appear on the display due to being within the certified beam width, it would most likely be under-represented due to being so distant from the beam center. The radar tilt angle would need to be adjusted downwards to properly explore this cell's precipitation intensity.

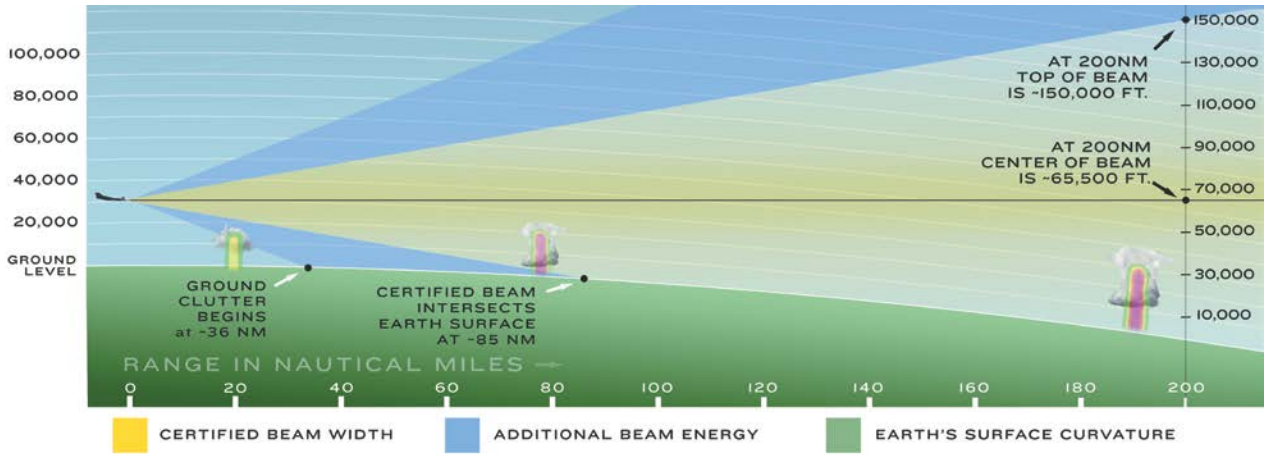


Figure 6-55 Radar Beam in Relation to the Curvature of the Earth from a 12 inch Antenna

RADAR SIGNAL ATTENUATION

The phenomenon of radar signal attenuation affects the operation of weather radar. When the radar signal is transmitted, it is progressively absorbed and scattered, making the signal weaker. This weakening, or attenuation, is caused by two primary sources, distance and precipitation.

Distance attenuation occurs due to the fact that the radar energy leaving the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam is one fourth the energy reflected from an equivalent target 20 miles away. This would appear to the operator that the storm is gaining intensity as the aircraft gets closer. Internal signal processing within the equipped weather radar system compensates for much of this distance attenuation.

Attenuation due to precipitation is not as predictable as distance attenuation. It is also more intense. As the radar signal passes through moisture, a portion of the radar energy is reflected back to the antenna. However, much of the energy is absorbed. If precipitation is very heavy, or covers a large area, the signal may not reach completely through the area of precipitation. The weather radar system cannot distinguish between an attenuated signal and an area of no precipitation. If the signal has been fully attenuated, the radar displays a radar shadow. This appears as an end to the precipitation when, in fact, the heavy rain may extend much further. A cell containing heavy precipitation may block another cell located behind the first, preventing it from being displayed on the radar. Never fly into these shadowed areas and never assume that all of the heavy precipitation is being displayed unless another cell or a ground target can be seen beyond the heavy cell. The WATCH® feature of the installed weather radar system can help to identify these shadowed areas. Areas in question appear as shadowed or gray on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and scratching, pitting, and pinholes on the radome surface can cause damage and system inefficiency.

RADAR SIGNAL REFLECTIVITY

Precipitation

Precipitation or objects more dense than water, such as the surface of the earth or solid structures, are detected by the weather radar. The weather radar does not detect clouds, thunderstorms, or turbulence directly. It detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow, or wet hail. The larger the raindrop, the better the reflectivity. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice crystals, dry snow, and dry hail have low levels of reflectivity as shown in the illustration, and often are not displayed by the radar. Additionally, a cloud that contains only small raindrops, such as fog or drizzle, does not reflect enough radar energy to produce a measurable target return.

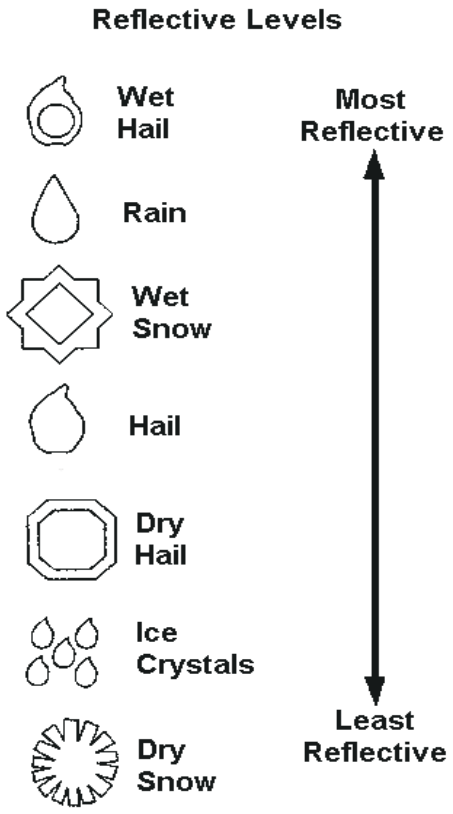


Figure 6-56 Precipitation Type and Reflectivity

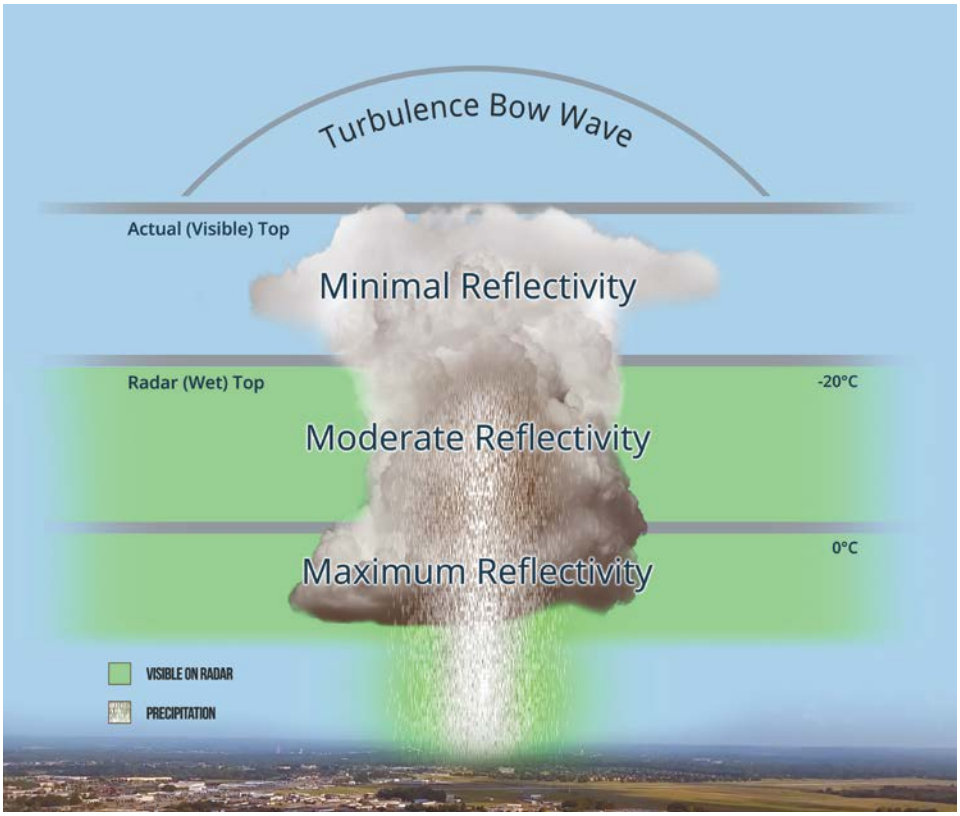


Figure 6-57 Precipitation Reflectivity by Altitude

When using the airborne weather radar to explore a more intense thunderstorm cell, it is critical to understand where radar returns can be expected to be intense, and where they can be expected to decrease to a point where no returns will be displayed. Since wet precipitation reflects radar energy far better than dry precipitation, strong radar returns can be expected at lower altitudes, with the strongest radar returns found near the melting level. At higher altitudes, precipitation becomes frozen, and reflectivity is significantly reduced. At a certain altitude within in a thunderstorm cell, returns will begin to diminish. This is the "echo top" of a cell, where radar can no longer detect the frozen precipitation, but this is not the actual top of the cell, which could extend significantly further into the atmosphere. Since it is difficult to detect the actual tops of a thunderstorm cell with radar, and invisible bow waves may extend beyond visible tops, overflight of thunderstorms should never be attempted.

Ground Returns

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be adjusted so shorelines, rivers, lakes, and cities are well defined. Increasing the gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and provides stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls, using up all or most of the radar energy. In this case, no return signal is received from this area, causing the display to show a dark spot which could indicate a pass where no pass exists.

Ground Clutter Suppression (Optional)

Ground Clutter Suppression (GCS) enhances the flight crews ability to differentiate precipitation returns from ground clutter, by suppressing most, but not all, returns from ground objects. The optional feature is most effectively used by first obtaining the desired tilt and range settings, and then activating GCS. For normal surveillance of an air mass, tilt angle and range should be adjusted to obtain minimal ground clutter prior to activation of the GCS feature. This ensures that the radar beam is functioning and tilt is set to observe the air above the ground clutter before that clutter is suppressed. The same holds true for investigating suspected precipitation returns. Tilt angle and range should be set to maximize the precipitation return image prior to activation of GCS to suppress clutter.

Angle of Incidence

The angle at which the radar beam strikes the target is called the Angle of Incidence. The figure illustrates the incident angle ('A'). This directly affects the detectable range, the area of illumination, and the intensity of the displayed target returns. A large incident angle gives the radar system a smaller detectable range and lower display intensity due to minimized reflection of the radar energy.

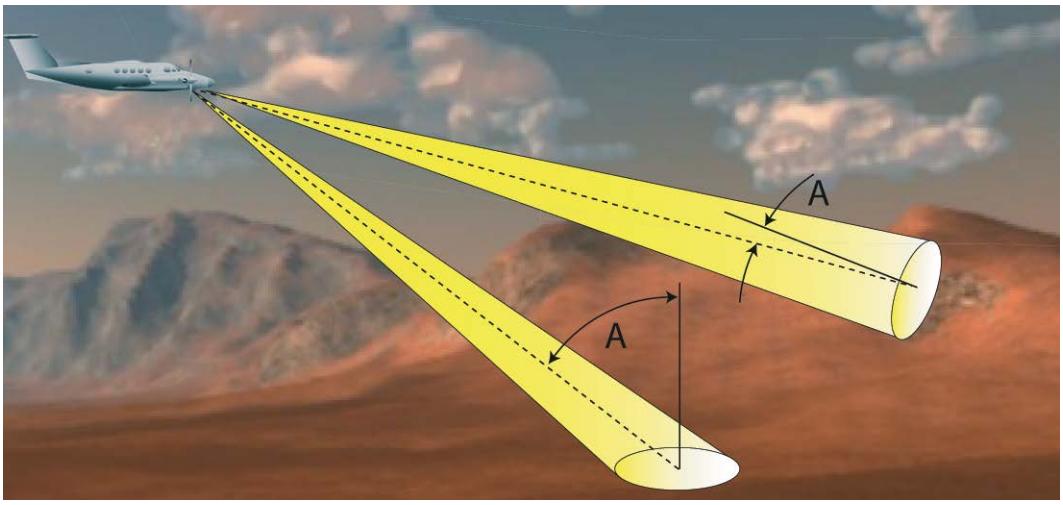


Figure 6-58 Angle of Incidence

A smaller incident angle gives the radar a larger detectable range of operation and the target display shows a higher intensity. Since more radar energy is reflected back to the antenna with a low incident angle, the resulting detectable range is increased for mountainous terrain.

SAFE OPERATING DISTANCE

WARNING: *Do not operate the weather radar in a transmitting mode when personnel or objects are within the MPEL boundary.*

The following information establishes a minimum safe distance from the antenna for personnel near operating weather radar. The minimum safe distance is based on the FCC's exposure limit at 9.3 to 9.5 GHz for general population/uncontrolled environments, which is 1 mW/cm2. See Advisory Circular 20-68B for more information on safe distance determination.

MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)

The zone in which the radiation level exceeds the US Government standard of 1 mW/cm2 is the semicircular area of at least 12 feet from the 12-inch antenna. All personnel must remain outside of this zone. This recommendation slightly exceeds the calculation methods defined in Advisory Circular 20-68B. With a scanning or rotating beam, the averaged power density at the MPEL boundary is significantly reduced.

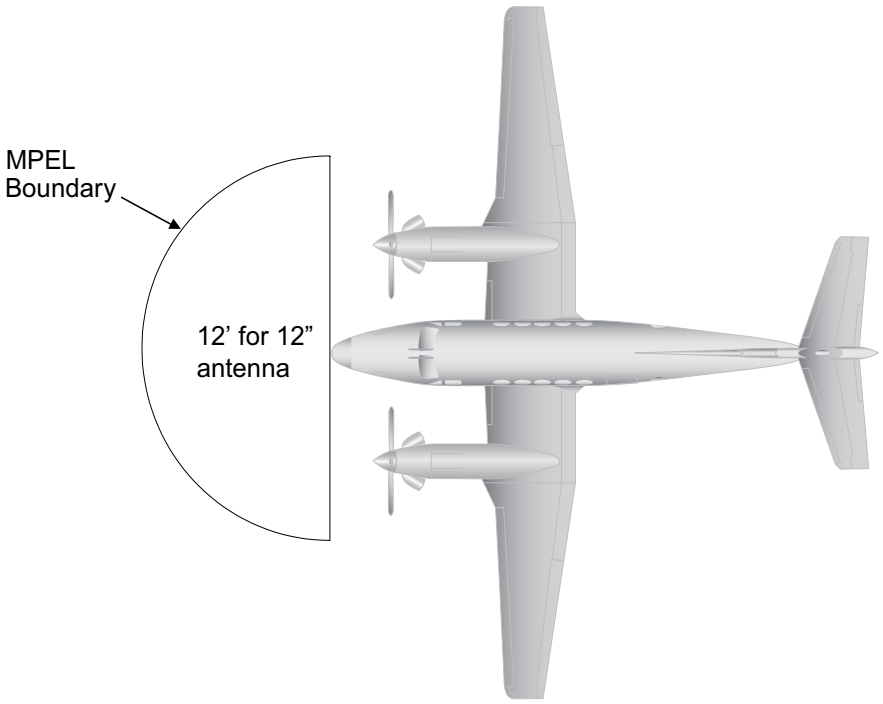


Figure 6-59 MPEL Boundary

BASIC ANTENNA TILT AND RANGE SETUP

Proper antenna tilt management techniques are a major factor for the successful use of any airborne weather system. If the antenna tilt angle is set too low, the radar display will show excessive ground returns, making it difficult for the pilot to distinguish adverse weather phenomena from ground clutter. If the antenna tilt angle is set too high, the radar beam will overscan the top of the adverse weather. In either of these examples, the flight crew would be unable to adequately recognize critical weather information.

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that works in all situations, but this method does provide good overall parameters for the monitoring of intense weather threats. Correct application of tilt angle is directly dependent on the storms height and intensity and its relative distance from own ship. Adjusting the airborne weather radar tilt angle setting until minimal ground clutter is displayed is the simplest setup method for general surveillance of precipitation returns. For ranges of up to 80 NM this ground clutter should appear on the outer portion of the radar display. At ranges greater than 80 NM, the displayed ground clutter will move lower on the radar display due to the curvature of the earth. By displaying a minimal amount of ground clutter on the installed weather radar system the flight crew can ensure the system is operating and that the air mass above the ground clutter is being scanned.

When a strong a weather return is detected within the ground clutter it must be further investigated to determine the source of this return. Further tilt angle adjustment of the airborne radar may be required to explore this return. Adjusting the radar tilt angle upwards can reveal the radar tops of this return, while adjusting the tilt angle downwards may be necessary to investigate the strongest intensity of a particular return.

Effective airborne weather radar range management during all phases of flight should be based on the volume of air to be scanned for returns ahead of own aircraft, to allow sufficient time needed to investigate, analyze, decide, and tactically maneuver around these hazardous weather returns. Longer ranges may be used to tactically identify intense weather returns that may warrant further investigation, and closer ranges may be used during the investigation process.

There is no one tilt or range setting that works for all situations. It is best to remember that active tilt and range management is necessary to identify and then investigate returns.

NOTE: *When a strong weather return is displayed on the weather radar, the tilt angle may be adjusted to explore return intensities at various altitudes to aid in determination of radar tops.*

NOTE: *It is the sole responsibility of the flight crew to avoid areas of hazardous weather by adequate margins.*

CAUTION: *Overflight of thunderstorms should not be considered safe, as extreme turbulence and hail may exist significantly above observed returns.*

MANAGING TILT ANGLE AND RANGE

There are many factors to be considered in order to become proficient at using airborne weather radar in all situations. The following setup provides a good starting point for the practical application of radar tilt management.

Radar tilt management can easily be remembered by use of the 1-10-1000 rule. The summary of this rule is the fact that when the flight crew changes the radar tilt angle by 1 degree the resulting change will displace the center of the beam 1000 feet vertically at a range of 10 nautical miles. Applying the 1-10-1000 rule to various distances provides the flight crew with the ability to determine how much a 1-degree change in tilt will move the beam vertically. The radar tilt angle is capable of being adjusted in one-quarter degree increments, allowing for greater accuracy in the placement of the beam center at desired altitudes.

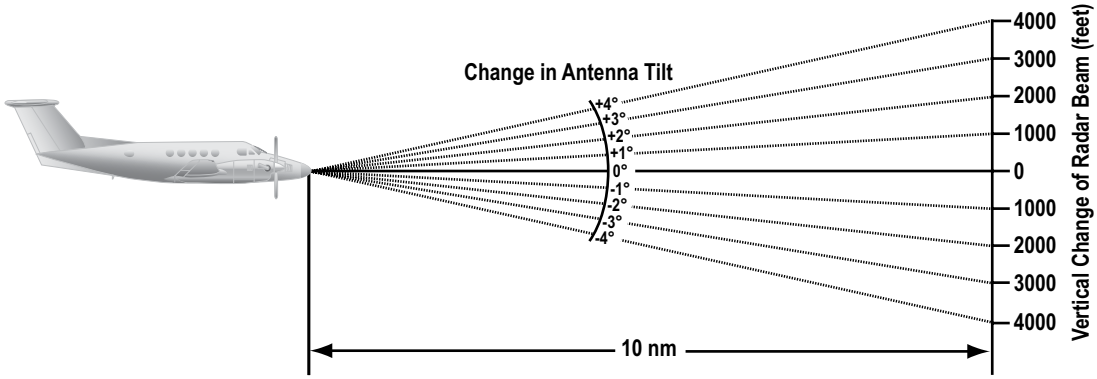


Figure 6-60 Vertical Change in Radar Beam per Nautical Mile

The 12-inch phased array antenna has a certified beam width of 8 degrees, which means that the beam is 8,000 feet in height (and width) at 10 NM and 80,000 feet in height (and width) at 100 NM.

- At 20 NM range the beam height changes by 2,000 ft. per degree of tilt change.
- At 40 NM range the beam height changes by 4,000 ft. per degree of tilt change.
- At 100 NM range the beam height changes by 10,000 ft. per degree of tilt change.

Additionally, setting the tilt to UP 4.00 degrees places the bottom of the certified beam at the same altitude as the aircraft, which is a technique used to determine whether radar tops reach your current altitude.

Phase of Flight	Tilt Angle	Range Setting	Notes
Taxi	Up 7.50° to 10.00°	20 NM	Activate weather mode when clear of ramp area.
Takeoff / Initial Climb	Up 7.50° to 10.00° Altitude Compensated Tilt On	40 - 60 NM	If precipitation is observed in the departure path, gain can be reduced to aid in identification of intense returns.
10,000 Ft. AGL	Up 3.00 to 5.00° Altitude Compensated Tilt On	60 - 80 NM	Range setting is dependent upon ground speed and time available for deviations.
Cruise	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviations. Tilt angle set to show minimal ground clutter.
Descent To 10,000 FT	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviation.
Descent Below 10,000 FT	Up 7.50° to 10.00° Altitude Compensated Tilt On	40 - 60 NM	Range setting is dependent upon ground speed and time available for deviation. Tilt angle set to show ground clutter in outer 1/3 of radar display.
Approach	Up 7.50° to 10.00° Altitude Compensated Tilt On	20 NM	These settings allow for observation of the approach area and the missed approach holding area.

Table 6-10 Typical Tilt Settings by Phase of Flight

NOTE: *Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.*

ALTITUDE COMPENSATED TILT (ACT)

The Altitude Compensated Tilt feature enables the equipped weather radar system to automatically adjust the antenna beam tilt angle setting based on changes of the aircraft's altitude. For example, if the ACT feature is enabled and the aircraft climbs, the system compensates by adjusting the tilt downward. As the aircraft descends with ACT enabled, the system adjusts the antenna tilt upward. The system uses the ground as a reference for adjusting the antenna tilt angle setting with ACT enabled.

WEATHER MAPPING AND INTERPRETATION

WEATHER DISPLAY INTERPRETATION

When evaluating various target returns on the weather radar display, the colors denote precipitation intensity and rates shown in the table.

NOTE: *The color white only represents turbulence on the GWX 75 when the turbulence detection option is installed.*

Weather Mode Color	Intensity (in dBz)	Approximate Precipitation Rate (in/hr.)
Black	< 23 dBZ	< .01.
Green	23 dBZ to < 32 dBZ	.01 - 0.1.
Yellow	32 dBZ to < 41 dBZ	0.1 - 0.5
Red	41 dBZ to < 50 dBZ	0.5 - 2
Magenta	50 dBZ and greater	> 2

Table 6-11 Precipitation Intensity Levels (GWX-68)

Weather Mode Color	Intensity (in dBz)	Approximate Precipitation Rate (in/hr.)
Black	< 23 dBZ	< .01
Green	23 dBZ to < 33 dBZ	.01 - 0.1
Yellow	33 dBZ to < 41 dBZ	0.1 - 0.5
Red	41 dBZ and greater	Greater than 0.5
Magenta (Optional)	TURB- (Optional) Turbulence Detection uses the color magenta to show areas of rain or hail that may also contain turbulence	

Table 6-12 Precipitation Intensity Levels (GWX-70)

Weather Mode Color	Intensity (in dBz)
Black	< 23 dBZ
Green	23 dBZ or 24 dBZ
Green	25 dBZ or 26 dBZ
Green	27 dBZ or 28 dBZ
Green	29 dBZ or 30 dBZ
Green	31 dBZ or 32 dBZ
Yellow	33 dBZ or 34 dBZ
Yellow	35 dBZ or 36 dBZ
Yellow	37 dBZ or 38 dBZ
Yellow	39 dBZ or 40 dBZ
Red	41 dBZ or 42 dBZ
Red	43 dBZ or 44 dBZ
Red	45 dBZ or 46 dBZ
Red	47 dBZ or 48 dBZ
Magenta	49 dBZ to 50 dBZ
Magenta	51 dBZ to 53 dBZ
Magenta	> 54 dBZ
White	TURB- Turbulence Detection uses the color white to show areas of rain or hail that may also contain turbulence

Table 6-13 Precipitation Intensity Levels (GWX-75)

In addition, when the optional Turbulence Detection feature is enabled, the system uses the color Magenta (GWX-70) or white (GWX-75) to show areas of rain or hail which likely contain turbulence.

THUNDERSTORMS

Updrafts and downdrafts in thunderstorms carry water through the cloud. The more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar. Avoid these areas by an extra wide margin.

- In areas where the displayed target intensity is red or magenta (indicating large amounts of precipitation), the turbulence (areas of white) is considered severe.
- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.
- Areas that show red, magenta or white are associated with hail, as well as heavy precipitation. While areas of turbulence will be displayed as magenta (GWX 70) or white (GWX 75). Vertical scanning and antenna tilt management may be necessary to identify areas of maximum intensity.
- Areas of radar shadowing which can result from an attenuated (weakened) signal from a nearby storm, hiding a larger and more dangerous storm which may exist in the apparently benign area directly behind the nearby return.

Along squall lines (multiple cells or clusters of cells in a line) individual cells may be in different stages of development. Areas between closely spaced, intense targets may contain developing clouds not having enough moisture to produce a return. However, these areas could have strong updrafts or downdrafts. Targets showing wide areas of green are generally precipitation without severe turbulence.

Irregularities in the target return may also indicate turbulence, appearing as hooks, fingers, or scalloped edges. These irregularities may be present in green areas with no yellow, red, or magenta areas and should be treated as highly dangerous areas. Avoid these areas as if they are red or magenta.

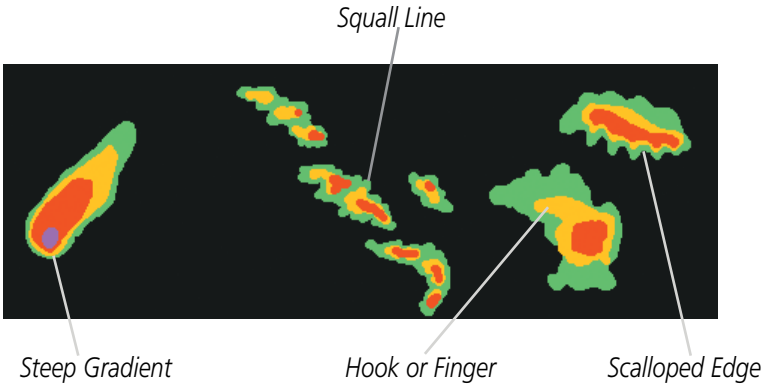


Figure 6-61 Cell Irregularities

Thunderstorm development is rapid. A course may become blocked within a short time. When displaying shorter ranges, periodically select a longer range to see if problems are developing further out. That can help prevent getting trapped in a blind alley or an area that is closed at one end by convective weather.

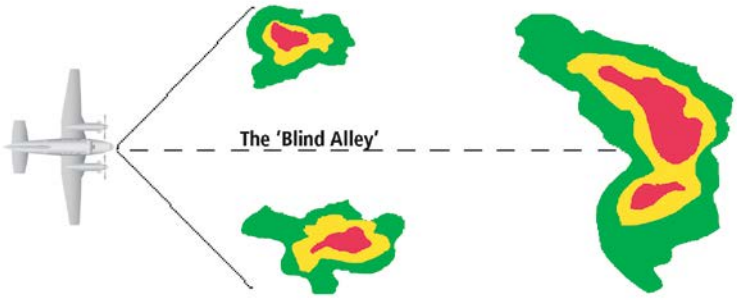
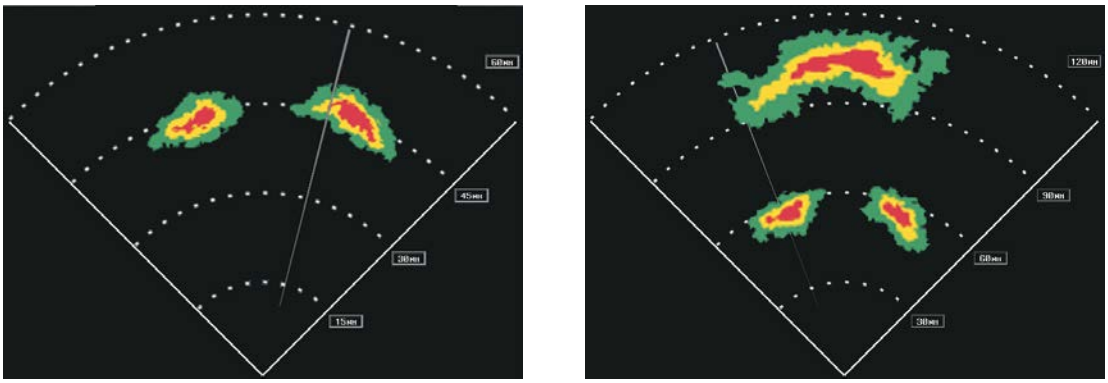


Figure 6-62 The Blind Alley - Horizontal Scan

In areas of multiple heavy cells, use the Vertical Scan feature along with antenna tilt management to examine the areas. Remember to avoid shadowed areas behind targets.



The Blind Alley at Close Range *The Large Storm Behind*

Figure 6-63 The Blind Alley

Tornadoes

There are no conclusive radar target return characteristics which identify a tornado. However, tornadoes may be present if the following characteristics are observed:

- A narrow, finger-like portion extends and in a short time curls into a hook and closes on itself.
- A hook, which may be in the general shape of the numeral 6 (9 in the southern hemisphere), especially if bright and projecting from the southwest quadrant (northeast quadrant in the southern hemisphere) of a major thunderstorm.
- V-shaped notches.
- Doughnut shapes.

These shapes do not always indicate tornadoes, and tornado returns are not limited to these characteristics. Confirmed radar observations of tornadoes most often have not shown shapes different from those of a normal thunderstorm display.

Hail and Radar Tops

Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability that it contains hail. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell as detected by radar. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. Neither the radar top nor the actual top necessarily indicate the top of the hazardous area, which may be much higher.

Hail can fall below the minimum reflectivity threshold for radar detection. It can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.

Stratus Precipitation

Detecting areas of low altitude, stratus precipitation while the aircraft altitude is significantly above the precipitation is difficult to accomplish with airborne weather radar. This is because as the radar beam detects the low altitude precipitation, it also receives significant ground returns which are displayed with the precipitation. Raising the antenna tilt angle may reduce the ground returns, however the radar beam is likely to overshoot the low-altitude precipitation when the aircraft is at a high altitude above the precipitation.

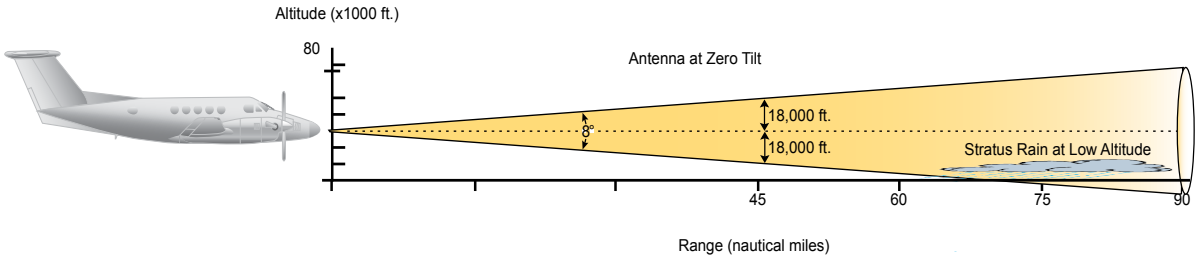


Figure 6-64 Stratus Rain Combines with Ground Returns when Aircraft is at Higher Altitudes

As the aircraft descends to a lower altitude, increasing the antenna tilt angle may help to reduce unwanted ground returns and make the display of stratus precipitation more apparent.

OPERATION IN WEATHER MODE

WARNING: *Do not operate the weather radar in a transmitting mode when personnel or objects are within the MPEL boundary.*

WARNING: *Do not assume weather radar transmission is disabled unless all display panes displaying weather radar are set to Standby Mode, and are displaying 'STANDBY' in the center of each weather radar display.*

CAUTION: *In Standby mode, the antenna is parked at the center line. It is always a good idea to ensure the radar is in Standby mode before taxiing the aircraft to prevent the antenna from bouncing on the bottom stop and possibly causing damage to the radar assembly.*

NOTE: *Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.*

When the weather radar system is in the Weather or Ground Map mode, the system automatically switches to Standby mode on landing.

In Reversionary mode, the weather radar system automatically switches to Standby mode. The system remains in Standby mode until both displays are restored. In Reversionary mode, the weather radar system cannot be controlled.

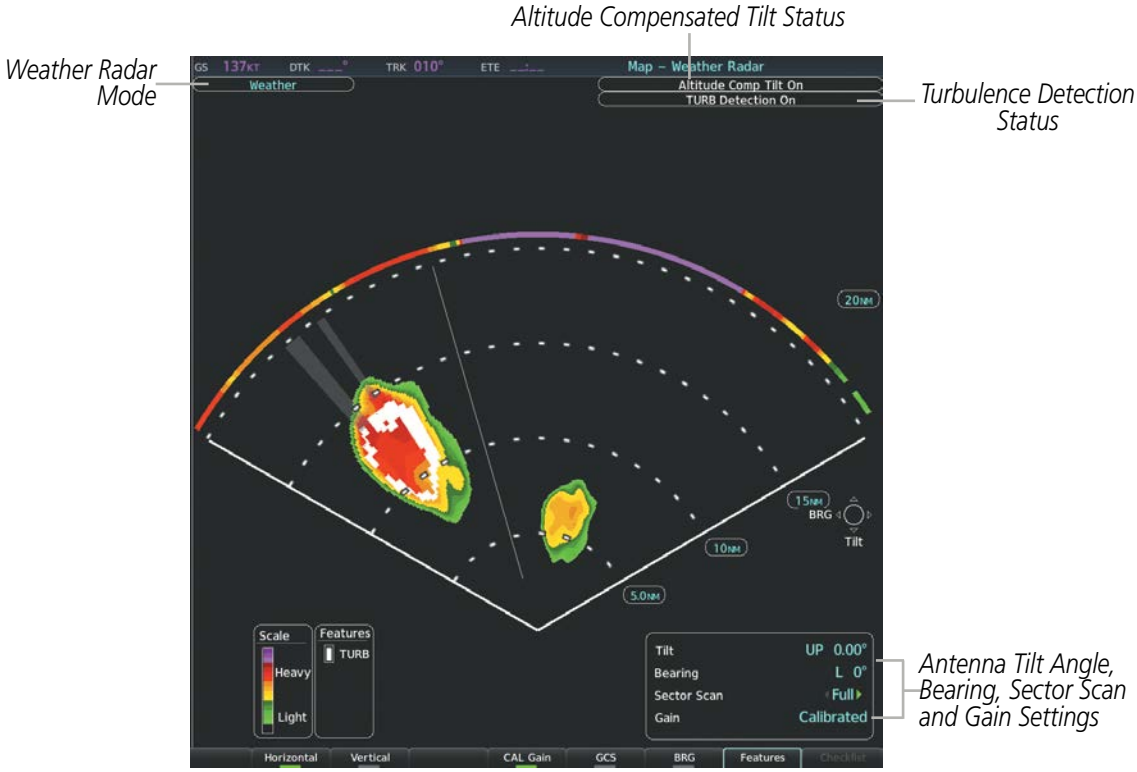


Figure 6-65 Weather Radar Page with a Horizontal Scan Selected (GWX-75)

Displaying weather on the Weather Radar Page:

1) Select the Weather Radar Page in the Map Page Group with the **FMS** Knob.
2) Select the **Mode** Softkey.
3) While on the ground, select the **Standby** Softkey. For the GWX 68 only, a one-minute warm-up period is initiated (countdown is displayed on the screen). After the warm-up is complete, the radar enters the Standby Mode. The warm-up period is not applicable to the GWX 70/75.
   a) Select the **Weather** Softkey. A confirmation window is displayed.
   b) Turn the small **FMS** Knob to highlight **YES** and press the **ENT** Key to continue radar activation.

   Or:

   If the aircraft is airborne, select the **Weather** Softkey. For the GWX 68 only, a one-minute warm-up period is initiated (countdown is displayed on the screen). After the warm-up is complete, the radar begins transmitting. The warm-up period is not applicable to the GWX 70/75.
4) Turn the **Joystick** to select the desired map range.
5) The horizontal scan is initially displayed. If desired, select the **Vertical** Softkey to change to vertical scanning.

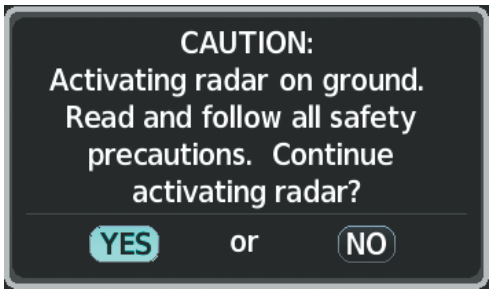


Figure 6-66 Confirming Activating Radar

Vertically scanning a storm cell:

NOTE: *Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.*

1) While in the Horizontal Scan view, press the **BRG** Softkey. This places the cursor in the BEARING field and displays the Bearing Line.

   If the Bearing Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Bearing Line. Press the **ENT** Key.

2) Press the **ENT** Key.

3) Turn the small **FMS** Knob to place the Bearing Line on the desired storm cell or other area to be vertically scanned.

4) Press the **Vertical** Softkey. A vertical scan of the selected area is now displayed.

5) The small **FMS** Knob may be used to move the scanned bearing line a few degrees right or left.

6) Turn the **Joystick** to adjust the range.

7) Press the **FMS** Knob to remove the cursor.

8) To select a new area to be vertically scanned, press the **Horizontal** Softkey to return to the Horizontal Scan view and repeat the previous steps.

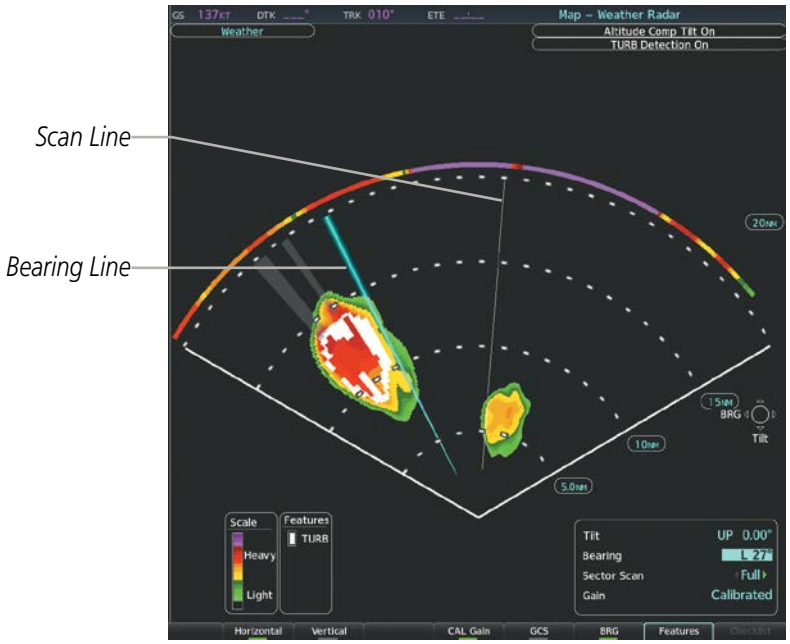


Figure 6-67 Bearing Line on Horizontal Scan (GWX-75)

The **Joystick** can also be used to adjust bearing from left to right.

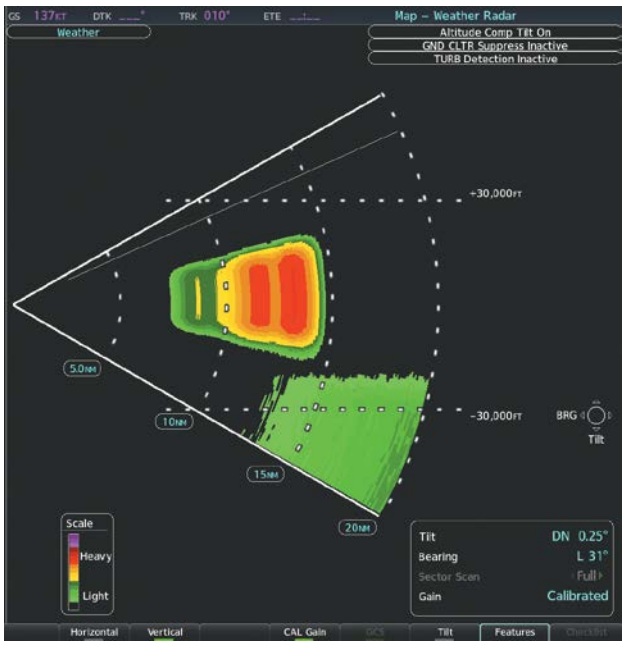


Figure 6-68 Vertical Scan Display (GWX-75)

Adjusting Antenna Tilt Angle

In order to make an accurate interpretation of a storm cell, the radar beam should be pointed at the wet part of the weather cell to record the proper rainfall intensity (color level). The ideal aiming point is just below the freezing level of the storm. The best way to find this point is to use the Vertical Scan feature. The antenna tilt angle can be centered on the strongest return area in the vertical scan to get a more accurate view of the coverage and intensity of the target in the horizontal scan.

Adjusting antenna tilt on the Horizontal Scan display:

1) Press the **FMS** Knob to activate the cursor in the TILT field.
2) Turn the small **FMS** Knob to select the desired antenna tilt angle.
3) Press the **ENT** Key.
4) Press the **FMS** Knob to remove the cursor.

The **Joystick** can also be used to adjust tilt up and down.

Adjusting antenna tilt on the Vertical Scan display:

1) Press the **Tilt** Softkey to activate the cursor in the TILT field and display the Tilt Line.

   If the Tilt Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Tilt Line. Press the **ENT** Key.

2) Turn the small **FMS** Knob to adjust the antenna tilt angle. The selected tilt angle is implemented when Horizontal Scan is again selected.

The **Joystick** can also be used to adjust tilt.

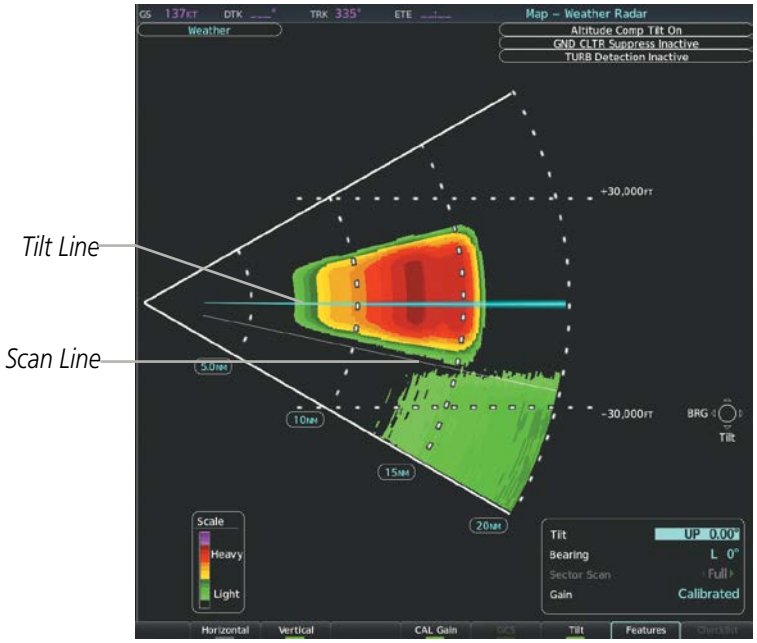
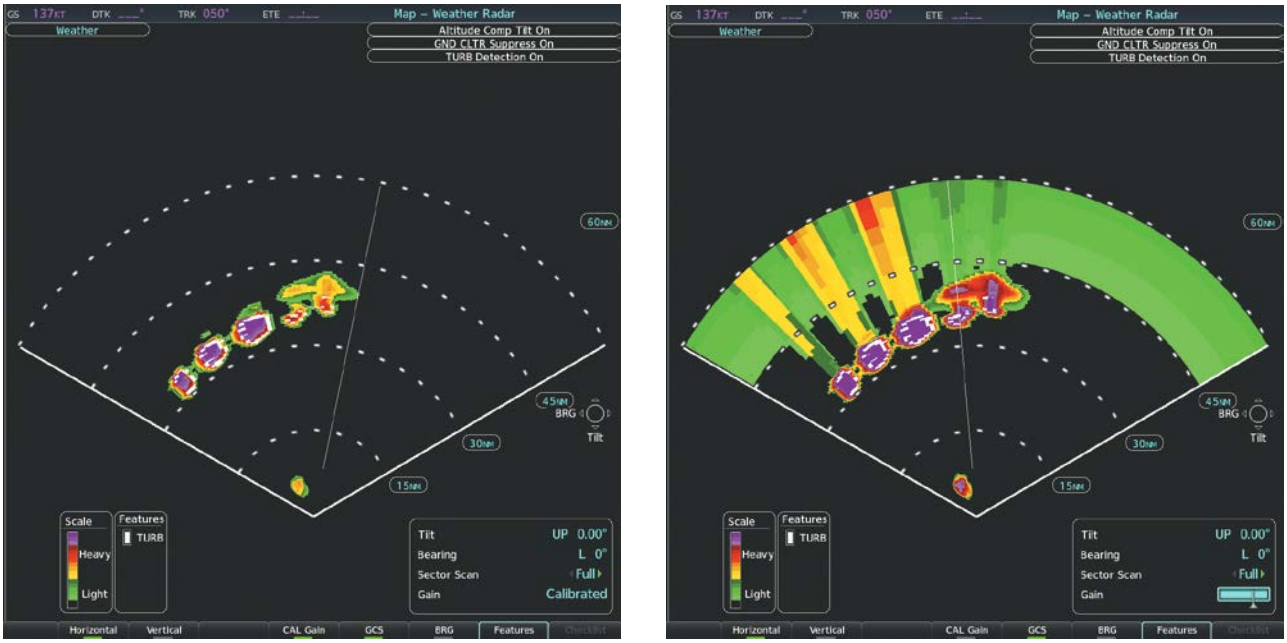


Figure 6-69 Adjusting Antenna Tilt Angle on a Vertical Scan Display (GWX-75)

Enabling/disabling manual gain adjustment:

WARNING: *Changing the gain in weather mode causes precipitation intensity to be displayed as a color not representative of the true intensity. Remember to return the gain setting to Calibrated for viewing the actual intensity of precipitation.*

1) Press the **Gain** Softkey to activate the cursor in the Gain field.
2) Turn the small **FMS** Knob to adjust the gain for the desirable level. The gain setting is visible in the Gain field as a movable horizontal bar in a flashing box. The line pointer is a reference depicting the calibrated position.
3) Press the **FMS** Knob to remove the cursor.
4) Press the **Gain** Softkey again to return to the calibrated gain setting. 'Calibrated' is displayed in the Gain field.



Calibrated Gain Setting *Manual Gain Set Greater than Calibrated Gain Setting*

Figure 6-70 Gain Calibration (GWX-75)

Enabling/disabling Sector Scanning:

1) While in horizontal scan mode, press the **BRG** Softkey to display the Bearing Line and place the cursor in the BEARING field. If the Bearing Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Bearing Line.
2) Press the **ENT** Key.
3) Turn the small **FMS** Knob to place the Bearing Line in the desired position. The location of the Bearing Line becomes the center point of the Sector Scan.
4) Turn the large **FMS** Knob to place the cursor in the Sector Scan field.
5) Turn the small **FMS** Knob to highlight the desired scan. Selecting 'Full' enables a 90º scan (GWX 68) or 120º scan (GWX 70/75).
6) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.
7) Press the **BRG** Softkey again to remove the Bearing Line and cursor. The bearing reference is reset to 0º.

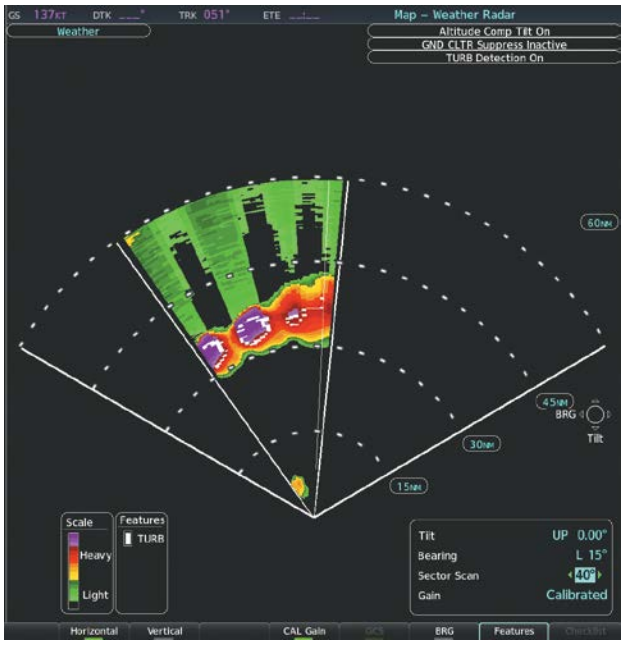


Figure 6-71 40° Sector Scan (GWX-75)

TURBULENCE DETECTION

The optional Turbulence Detection feature, available with the GWX 70/75, identifies areas of turbulence associated with precipitation using the color magenta (GWX 70) or white (GWX 75) during a horizontal scan. The magenta or white areas represent precipitation moving at a high rate of speed either toward or away from the radar antenna, using Doppler radar measurements. This feature cannot detect areas of Clear Air Turbulence.

The Turbulence Detection feature is only available in Weather Mode while a horizontal scan is selected. The GWX 70/75 can detect turbulence up to 40 nm in front of the aircraft. However, while the optional Turbulence Detection is enabled on the GWX 70, if the radar range is 160 nm or greater, or a vertical scan is selected, the system automatically removes turbulence information and shows a 'TURB Detection Inactive' annunciation on the 'Map - Weather Radar' Page. The GWX 75 does not share this limitation as the GWX 70, turbulence detection will be shown regardless of the range selected beyond 40 nm. If the system is missing information needed to detect turbulence, a 'TURB Detection Unavailable' annunciation appears on the "Map - Weather Radar' Page (Table 6-16).

Enabling/Disabling Turbulence Detection during a Horizontal Scan:

1) Select the 'Map - Weather Radar' Page.
2) With the radar in weather mode, press the **Features** Softkey.
3) To activate or deactivate the turbulence detection feature, press the **TURB** Softkey. Turbulence detection is enabled when the softkey annunciator is green; turbulence detection is disabled when the softkey annunciator is gray. The system indicates the current turbulence detection feature status in the upper right of the 'Map - Weather Radar' Page (Table 6-16).

Weather Attenuated Color Highlight (WATCH™)

While in horizontal scan mode, this feature can be used as a tool to determine areas of possible inaccuracies in displayed intensity due to weakening of the radar energy. This weakening is known as attenuation. The radar energy weakens as it passes through areas of intense precipitation, large areas of lesser precipitation, and distance. Issues with the radome also attenuates the radar energy. All these factors have an effect on the return intensity. The more energy that dissipates, the lesser the displayed intensity of the return. Accuracy of the displayed intensity of returns located in the shaded areas are suspect. Make maneuvering decisions with this information in mind. Proper antenna tilt management should still be employed to determine the extent of attenuation in a shaded area.

To activate or deactivate the WATCH feature, press the **WATCH** Softkey.

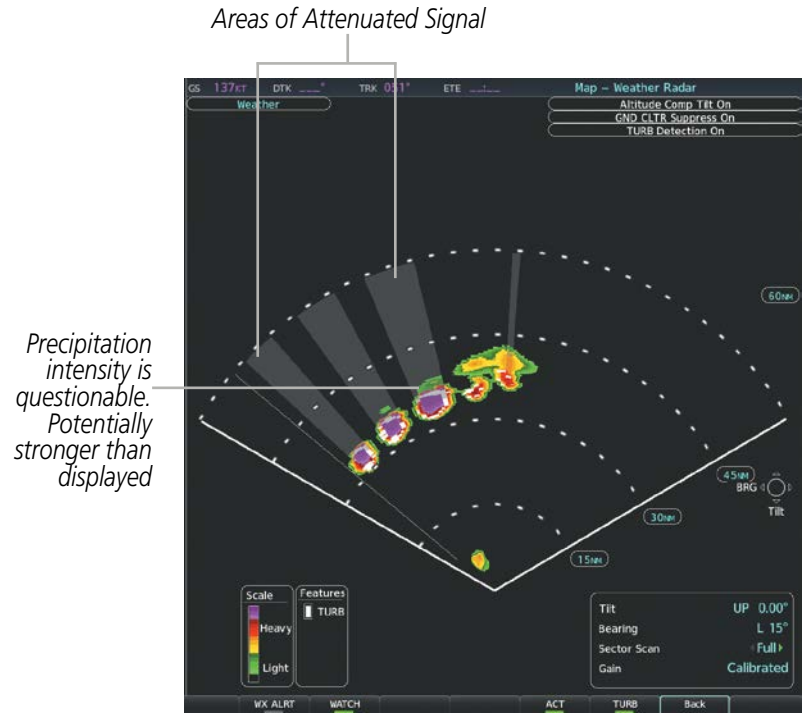


Figure 6-72 Horizontal Scan with WATCH Enabled (GWX-75)

REMOVING GROUND CLUTTER

The optional Ground Clutter Suppression (GCS) feature which is available on either the GWX 70/75, the system can distinguish between reflected ground returns (such as terrain features and buildings) and airborne weather phenomena. Ground clutter may be most pronounced when using a low antenna tilt angle, or when approaching mountainous terrain.

The Ground Clutter Suppression feature is available while the weather radar Sector Scan is set to **Full**. When Ground Clutter Suppression is enabled, the system removes echoes determined to be ground clutter from the display. While viewing a map with GCS enabled, adjustment of the map range or antenna tilt angle will momentarily cause the display of ground clutter to return.

NOTE: *The GCS feature of the airborne weather radar may remove the display of low-intensity precipitation in addition to ground returns when the feature is enabled.*

NOTE: *The ground clutter suppression feature is optional.*

Enabling/disabling Ground Clutter Suppression:

1) Select the 'Map - Weather Radar' Page.
2) Press the **Mode** Softkey.
3) To enable or disable the ground clutter suppression feature, press the **GCS** Softkey. Ground clutter suppression is enabled when the softkey annunciator is green; ground clutter suppression is disabled when the annunciator is gray.

Weather Alert Bands and PFD Alert

The Weather Alert feature indicates the presence of heavy precipitation between the ranges of 80 and 320 nm regardless of the currently displayed range. Weather Alerts are displayed as red bands along the outer range ring at the approximate azimuth of the detected returns.

If a Weather Alert is detected within ±10° of the aircraft heading, and the **WX ALRT** Softkey is enabled, the system also displays an alert on the PFD in the Alerts Window.

If the antenna tilt is adjusted too low, a weather alert can be generated by ground returns. To avoid unwanted weather alerts from being displayed on the PFD, deselect the **WX ALRT** Softkey.

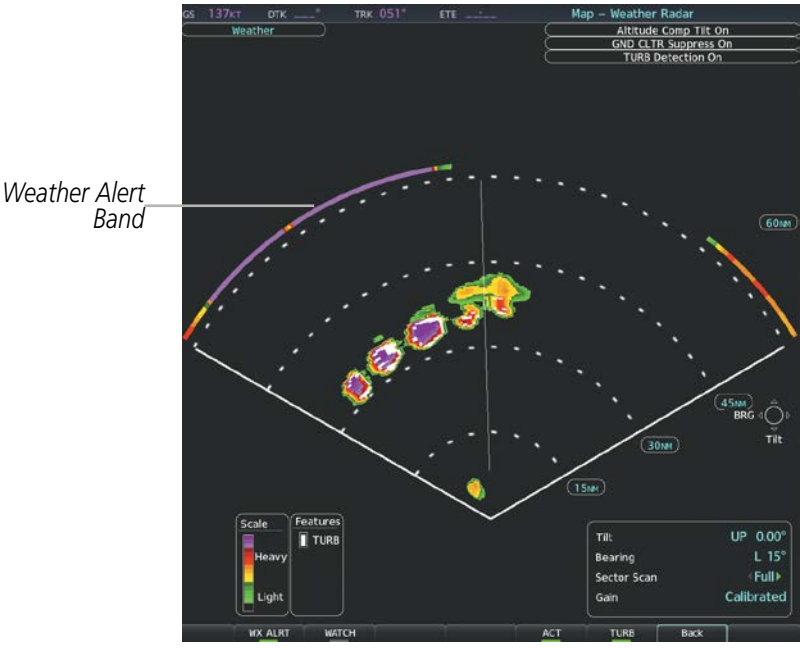


Figure 6-73 Weather Alert Bands on the 'Map - Weather Radar' Page (GWX-75)

The pilot can enable or disable the Weather Alert Bands and the Weather Alerts which appear in the Alerts Window on the PFD, press the **WX ALRT** Softkey.

Enabling/disabling the Weather Alerts Bands and Alerts Window Message:

1) Select the 'Map - Weather Radar' Page.
2) Select the **Features** Softkey.
3) Select the **WX ALRT** Softkey to enable/disable the Weather Alert Bands and Alerts Window message for severe weather head.
4) Select the **Back** Softkey to return to the top-level softkeys.

Enabling/disabling the Weather Alerts Bands and Alerts Window Message on the PFD.

1) If necessary, enable the HSI Map on the PFD.
2) On the PFD, press the **Map/HSI** Softkey.
3) Press the **WX Radar** Softkey to enable/disable the airborne weather radar HSI Map overlay.
4) Press the **RDR Opt** Softkey.
5) Press the **Features** Softkey.
6) Press the **WX ALRT** Softkey to enable/disable the Weather Alert Bands and Alerts Window message for severe weather head.
7) Press the **Back** Softkey three times to return to the top-level softkeys.

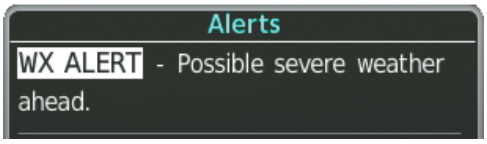


Figure 6-74 Weather Alert on PFD

GROUND MAPPING AND INTERPRETATION

A secondary use of the weather radar system is for the presentation of terrain. This can be a useful tool for verifying aircraft position. A picture of the ground is represented much like a topographical map that can be used as a supplement to the navigation map on the MFD.

Ground Map mode uses a different gain range than Weather mode. Different colors are also used to represent the intensity levels. The displayed intensity of ground target returns are defined in the table below. Use of the **Gain** and **Tilt** Softkeys help improve contrast so that specific ground targets can be recognized more easily. As previously discussed, the type and orientation of the target in relation to the aircraft affects the intensity displayed.

When the weather radar system is in either the Weather or Ground Map mode, the system automatically switches to Standby mode upon landing.

Ground Map Mode Color	Intensity
Black	0 to 2 dB
Cyan	3 dB to < 13 dB
Yellow	13 dB to less than 21 dB
Magenta	21 dB to less than 29 dB
Blue	29 dB and greater

Table 6-14 Ground Target Return Intensity Levels

Operation in Ground Map Mode:

1) Press the **Mode** Softkey.
2) Press the **Ground** Softkey to place the radar in Ground Map mode.
3) Press the **Back** Softkey.
4) Press the **FMS** Knob to activate the cursor.
5) Turn the large **FMS** Knob to place the cursor in the Tilt field.
6) Adjust the antenna tilt angle by turning the small **FMS** Knob to display ground returns at the desired distance.
7) Press the **FMS** Knob to remove the cursor.

ADDITIONAL WEATHER RADAR DISPLAYS

NOTE: *The NEXRAD weather product cannot be displayed simultaneously on the 'Map - Navigation Map' Page with weather radar information.*

The 'Map - Weather Radar' Page is the principal map page for viewing airborne weather radar information. Airborne weather radar information may also be shown as an overlay on the 'Map - Navigation Map' Page. The airborne weather radar is also available on the HSI Map (GWX 70/75), with independent weather radar controls for each PFD, allowing for different settings and modes for each display. The radar range increases or decreases automatically as the map range increases or decreases.

When the airborne weather radar overlay is enabled on a navigation map, a weather radar information box appears on the map. It indicates the selected radar mode, radar range, antenna tilt angle, and gain setting. The navigation map overlay uses a horizontal scan. For the GWX 68 only, the weather radar must be in horizontal scan mode on the Weather Radar Page in order for the weather radar to display data on the 'Map - Navigation Map' Page, otherwise the system indicates 'N/A' in the information box until horizontal scan mode is selected on the 'Map - Weather Radar' Page. The GWX 70/75 allow for either horizontal or vertical scan to be selected on the 'Map - Weather Radar' Page, and shows a horizontal scan on the navigation maps with the weather radar overlay.

The pilot may enable airborne weather radar information with other map overlays on navigation maps, such as traffic, absolute terrain information, and aviation data. However, relative terrain and data link weather radar (such as NEXRAD) cannot be enabled simultaneously with airborne weather radar information on the same navigation map. If relative terrain or data link radar is enabled, the system automatically disables the airborne weather radar overlay for the selected map.

NOTE: *When viewing airborne weather radar information overlay on the 'Map - Navigation Map' Page, selecting a Heading Up navigation map orientation may be desired, since it is identical to the orientation on the 'Map - Weather Radar' Page.*

Figure 6-75 Airborne Weather Radar Overlay on the 'Map - Navigation Map' Page

Enabling/disabling Airborne Weather Radar Overlay on the 'Map - Navigation Map' Page:

1) Select the 'Map- Navigation Map' Page.
2) Select the **Map Opt** Softkey.
3) Select the **WX Radar** Softkey.

Or:

1) On the 'Map - Navigation Map' Page, press the **MENU** Key.
2) With 'Map Settings' highlighted, press the **ENT** Key.
3) Turn the small **FMS** Knob to select the 'Weather' group, then press the **ENT** Key.
4) Turn the large **FMS** Knob to scroll through the product selections and highlight the 'Weather Radar' overlay selection ('On' or 'Off'). Turn the small **FMS** knob to highlight the desired selection.
5) To remove the menu, press the **FMS** Knob or **CLR** Key.

Weather radar controls on the 'Map - Navigation Map' Page are limited to adjustment of the radar range, bearing, and antenna tilt angle. The airborne weather radar overlay is viewable at Navigation Map Ranges between 1.5 and 500 nautical miles. At map ranges beyond these limits, the system removes the weather radar information from the map. Adjusting the range on the 'Map - Navigation Map' Page simultaneously adjusts the range of the weather radar proportionally. This radar range is annunciated in the weather radar information box that appears when the overlay is enabled. When the radar range is adjusted on the 'Map - Navigation Map' Page, system synchronizes the same range to the 'Map - Weather Radar' Page.

The radar bearing is adjustable in one degree increments on the 'Map - Navigation Map' Page using the **Joystick** when the overlay is enabled. The bearing line appears on the 'Map - Navigation Map' Page as a white dashed line, and is displayed during and momentarily after adjustment.

Radar antenna tilt angle is adjustable in 0.25 degree increments on the 'Map - Navigation Map' Page using the **Joystick**. An up or down arrow next to the antenna tilt angle setting indicates the direction of the antenna tilt angle.

Adjusting the bearing and antenna tilt angle on the 'Map - Navigation Map' Page:

1) With the weather radar overlay enabled, push the **Joystick** twice. The bearing and tilt legend is displayed.
2) Move the **Joystick** up to adjust the antenna tilt angle downward, or move the **Joystick** up to adjust the antenna tilt angle upward.
3) Move the **Joystick** left or right to adjust the bearing line in the desired direction. The bearing line is displayed during and momentarily after adjustment.

If either a GWX 70 or GWX 75 is installed and the aircraft is in the air, PFD softkeys control the airborne weather radar overlay when the HSI Map is displayed. These softkeys are subdued if the aircraft is on the ground. The pilot and copilot can select a weather radar mode for each PFD (Standby, Weather, Ground), make adjustments to antenna gain, antenna tilt angle, or enable/disable antenna stabilization or Altitude Compensated Tilt features. Weather radar settings on the HSI Map are independent for each PFD. For example, the pilot's PFD may have Weather Mode selected while the copilot's PFD may have Standby Mode selected. Both the GWX 70 and GWX 75 weather radars perform multiple scans as necessary to accommodate displays of weather radar data among the PFDs and MFD.

When the airborne weather radar overlay is enabled on the HSI Map, a weather radar information box appears on the right side of this map. It indicates the selected radar mode, radar range, antenna tilt angle, and gain setting. When increasing or decreasing the HSI Map range the corresponding airborne weather radar range overlay will be the same as the HSI Map range, in most cases. However, a few instances do exist where the selected airborne weather radar overlay range does not match the current displayed HSI Map range. For example, if 25 nm is selected for the HSI Map range, the airborne weather radar range will be automatically selected to 40 nm, but only 25 nm of radar data will be displayed.

NOTE: *The aircraft must be in the air in order for HSI Map airborne weather radar softkeys to become available.*

Controlling of weather radar information on the HSI Map (GWX-70/75):

1) If necessary, enable the HSI Map on the PFD.
2) On the PFD, press the **Map/HSI** Softkey.
3) Press the **Wx Radar** Softkey to enable/disable the airborne weather radar HSI Map overlay.
4) Press the **RDR Opt** Softkey.
5) To select a weather radar mode, press the **Mode SEL** Softkey
   a) Press a softkey for the desired mode: **Standby**, **Weather,** or **Ground**.
   b) When finished, press the **Back** Softkey.
6) Press the **Gain-** Softkey to decrease the gain setting or press the **Gain+** Softkey to increase the gain setting in increments of 0.5 with each press, or press and hold the softkey for continuous adjustment. A gain setting of 0.0 is equivalent to the calibrated gain setting.
7) Move the PFD **Joystick** up to adjust the antenna tilt angle downward, or move the **Joystick** down to adjust the antenna tilt angle upward.
8) Press the **WX Alert** Softkey to enable/disable the display of Weather Alerts.
9) Press the **ACT** Softkey to enable/disable the Altitude Compensated Tilt feature.
10) Press the **GCS** Softkey to enable/disable the optional Ground Clutter Suppression feature.
11) Press the **TURB** Softkey to enable/disable the optional Turbulence Detection feature.
12) When finished adjusting the HSI Map display of the airborne weather radar, press the **Back** Softkey.

The airborne weather radar overlay uses the same colors as those shown on the 'Map - Weather Radar' Page to indicate the intensity of radar returns. However, the display of gray WATCH radar attenuation and red weather alert bands is exclusive to the 'Map - Weather Radar' Page. Because data link radar precipitation and relative terrain present information using similar colors, enabling the airborne weather radar overlay on the navigation amps disables the display of the data link radar and relative terrain information for this page.

Figure 6-76 HSI Map with Airborne Weather Radar Overlay and Softkeys

SYSTEM STATUS

The system displays the radar mode annunciation in the upper left corner of the 'Map - Weather Radar' Page. Additional information may be displayed in the center of the 'Map - Weather Radar' Page as a center banner annunciation. Refer to the following tables for a list of annunciations and their locations for airborne weather radar.

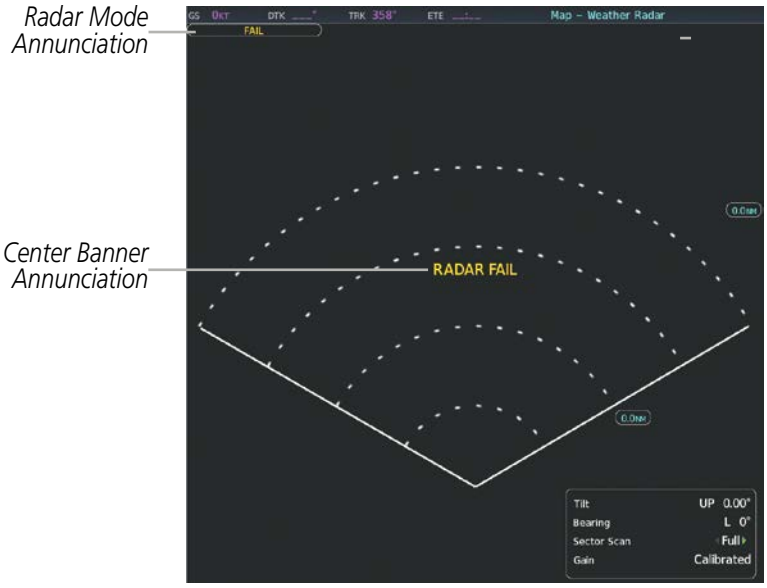


Figure 6-77 Radar System Status Indications on 'Map - Weather Radar' Page

Radar Mode	Radar Mode Annunciation Box	Center Banner Annunciation
Standby	STANDBY	STANDBY
Weather	WEATHER	None
Ground Mapping	GROUND	None
Radar Failed*	FAIL	RADAR FAIL
** See Table 6-17 for additional failure annunciations*		

Table 6-15 Radar Modes on the 'Map - Weather Radar' Page

The system displays the status of the weather radar features in the upper-right corner of the 'Map - Weather Radar' Page.

Radar Feature Status	Description
STAB INOP	The radar is not receiving pitch and roll information. The antenna stabilization feature is inoperative.
ALTITUDE COMP TILT ON	The altitude-compensated tilt feature is selected on.
ALTITUDE COMP TILT OFF	The altitude-compensated tilt feature is selected off.
GND CLTR SUPPRESS ON	The ground clutter suppression feature is selected on.
GND CLTR SUPPRESS OFF	The ground clutter suppression feature is selected off.
GND CLTR SUPPRESS INACTIVE	The ground clutter suppression feature is enabled, but the radar is in a mode which cannot support ground clutter suppression (e.g. vertical scan or sector scan).
GND CLTR SUPPRESS UNAVAILABLE	The radar is missing data needed to suppress ground clutter.
TURB DETECTION ON	The turbulence detection feature is selected on. (GWX 70/75)
TURB DETECTION OFF	The turbulence detection feature is selected off. (GWX 70/75)
TURB DETECTION INACTIV	Turbulence detection is inactive when a radar is in a mode which cannot support turbulence detection. (GWX 70/75)
TURB DETECTION UNAVAILABLE	The radar is missing data needed to detect turbulence. (GWX 70/75)

Table 6-16 Radar Feature Status Annunciations on the 'Map - Weather Radar' Page

If the weather radar unit fails, an annunciation as to the cause of the failure is shown as a banner in the center of the 'Map - Weather Radar' Page.

Weather Radar Page Center Banner Annunciation	Description
BAD CONFIG	The radar configuration is invalid. The radar should be serviced.
RDR FAULT	The radar unit is reporting a fault. The radar should be serviced.
RADAR FAIL	The system is not receiving valid data from the radar unit. The system should be serviced.

Table 6-17 Abnormal Radar Status Annunciations on the 'Map - Weather Radar' Page

6.4 TAWS-B

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

NOTE: *Terrain data is not displayed if the aircraft is out of the installed terrain database coverage area.*

NOTE: *The data contained in the TAWS-B databases comes from government agencies. Garmin accurately processes and cross-validates the data but cannot guarantee the accuracy and completeness of the data.*

TAWS-B (Terrain Awareness and Warning System - Class B) is an optional feature to increase situational awareness and aid in reducing controlled flight into terrain (CFIT). TAWS-B provides visual annunciations and voice alerts when terrain and obstacles are within the given altitude threshold from the aircraft. The displayed alerts and warnings are advisory in nature only.

TAWS-B satisfies TSO-C151b Class B requirements for certification.

TAWS-B requires the following information to operate properly:

- A valid terrain/obstacle/airport terrain database.
- A valid 3-D GPS position solution.

TAWS-B 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, per TSO-C151b. However, the displayed information should never be understood as being all-inclusive and data may still contain inaccuracies.

TAWS-B 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. GSL altitude is used to determine TAWS-B alerts. 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 TAWS-B are referenced to MSL. Using the GPS position and GSL altitude, TAWS-B displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, the GPS position and GSL altitude are used to calculate and "predict" the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, TAWS-B 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

TAWS-B 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 TAWS On-Ground Legend shown in Figure 6-78. When the aircraft is in the air, the system displays relative terrain information using red, yellow, green, and black, as shown on the TAWS In-Air Legend shown in Figure 6-78. 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. If a TAWS alert occurs, the relative terrain colors transition to the TAWS In-Air Legend if in the TAWS On-Ground Legend was shown in order to provide the flight crew with the most information possible.

Figure 6-78 Relative Terrain Legend

During an alert, the system shows potential impact areas over terrain or obstacles using bright yellow (caution) or bright red (warning) on navigation maps and on the 'Map - TAWS-B' Page.

The colors and symbols in Figure 6-79 and Tables 6-18 and 6-19 and 6-20 represent terrain, obstacles, and potential impact areas.

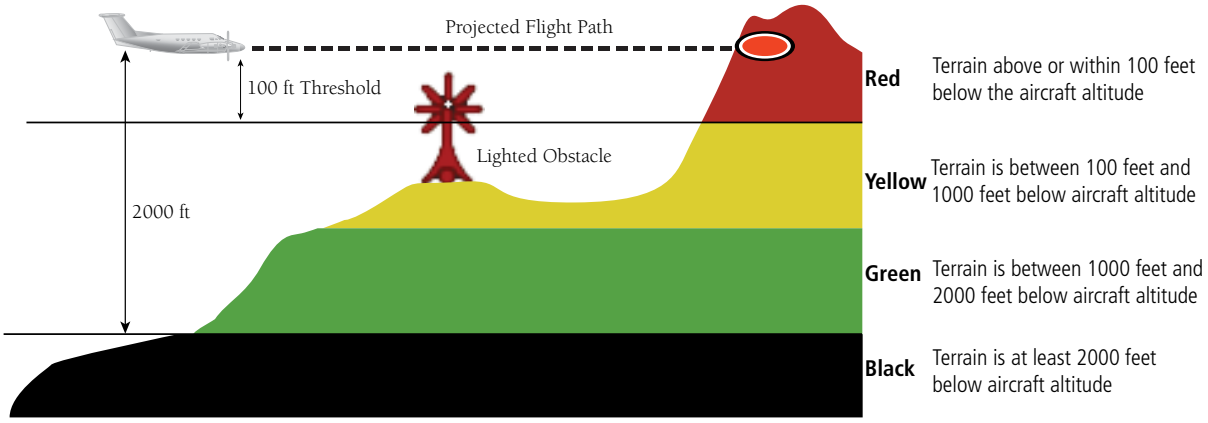


Figure 6-79 In-Air Terrain Altitude/Color Correlation for TAWS

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 6-18 TAWS 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 6-19 TAWS-B Wind Turbine Obstacles and Colors

Potential Impact Area Examples	Alert Type	Example Annunciation
	Warning	PULL UP
	Caution	TERRAIN

Table 6-20 TAWS-B Potential Impact Area with Annunciations

The 'Map - TAWS-B' Page is the principal map page for viewing TAWS-B information. TAWS-B information can be also displayed on the following maps and pages as an additional reference:

- PFD Inset Map
- Navigation Map Page
- Trip Planning Page
- Flight Plan Page

Enabling/disabling relative terrain information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **TER** Softkey to cycle through terrain options. The selected mode is displayed in cyan: Off, Topo, Rel. Press the **TER** Softkey until 'Rel' is displayed on the softkey.

Displaying relative terrain information (PFD Maps):

1) Press the **Map/HSI** Softkey (**Map Opt** Softkey for TCAS II installations).
2) Press the **Rel Ter** Softkey.

When TAWS-B is selected on maps other than the TAWS-B Page, an icon to indicate the feature is enabled for display and a legend for TAWS-B terrain colors are shown. The legend appears without the icon on the 'Map - TAWS-B' Page.

The Navigation Map Page Setup Menu provides a means in addition to the softkeys for enabling/disabling the 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. For terrain data, the enable/disable function applies only to the MFD, while the range setting also affects the PFD Inset Map.

Terrain data can be selected for display independently of obstacle data; however, obstacles for which warnings and cautions are issued are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the 'Map - TAWS-B' 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 'Map - Navigation Map' Page. 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 – Selects the display of topo, relative terrain, or no terrain, and selects the maximum map 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).
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.

TAWS-B PAGE

The 'Map - TAWS-B' Page is specialized to show terrain, obstacle, and potential impact area data in relation to the aircraft's current altitude, without clutter from the basemap. It is the principal page for viewing TAWS-B information. Aviation data (airports, VORs, and other NAVAIDs) can be enabled for reference. If an obstacle and the projected flight path of the aircraft intersect, the display automatically zooms in to the closest potential point of impact on the 'Map - TAWS-B' Page.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the **Joystick** from 1 to 200 nm, as indicated by the map range rings (or arcs).

Displaying the TAWS-B Page:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the 'Map - TAWS-B' Page.

Showing/hiding aviation information on the 'Map - TAWS-B' Page:

1) Press the **MENU** Key.
2) Turn the **FMS** Knob to highlight 'Show Aviation Data' or 'Hide Aviation Data' (choice dependent on current state) and press the **ENT** Key.

Figure 6-80 'Map - TAWS-B' Page

TAWS-B ALERTS

Alerts are issued when flight conditions meet parameters that are set within TAWS-B software algorithms. TAWS-B alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, the system displays visual annunciations with voice alerts. Table 6-21 shows TAWS-B alert types with corresponding annunciations and voice alerts.

When an alert occurs, the system displays annunciations on the PFDs and MFD. The TAWS-B Alert Annunciation is shown to the upper left of the Altimeter on the PFDs and below the Terrain Legend on the MFD. If the TAWS-B Page is not displayed at the time of the alert, a pop-up alert appears on the MFD. When a pop-up alert occurs, do one of the following:

- Press the **CLR** Key (removes the pop-up alert), or
- Press the **ENT** Key (accesses the 'Map - TAWS-B' Page).

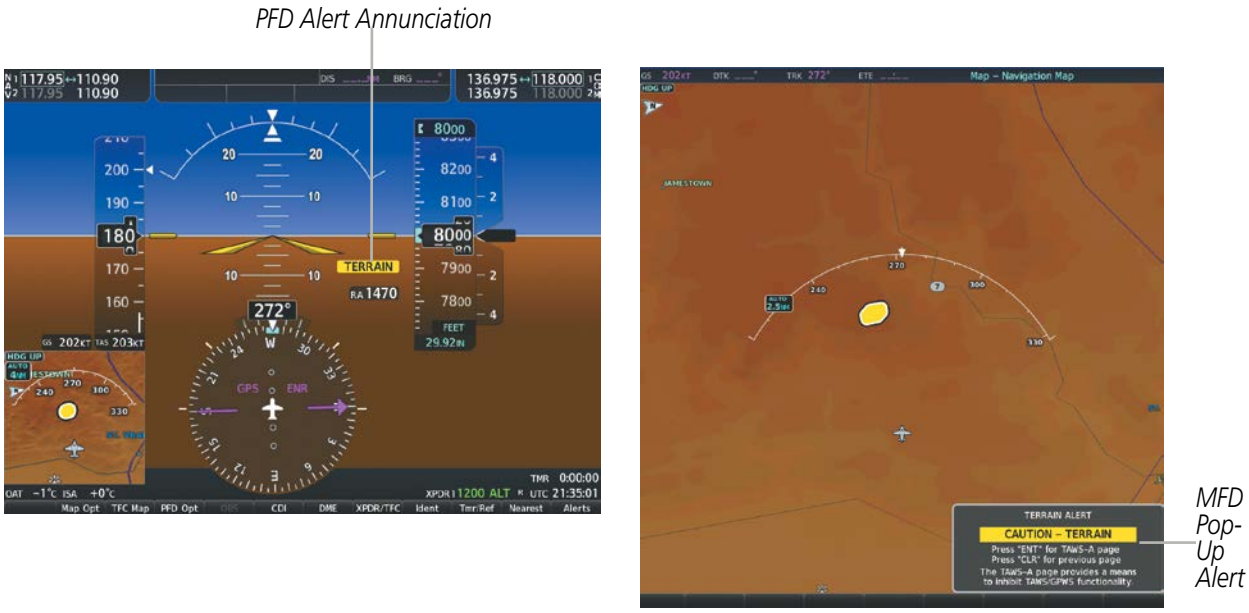


Figure 6-81 TAWS-B Alert Annunciations

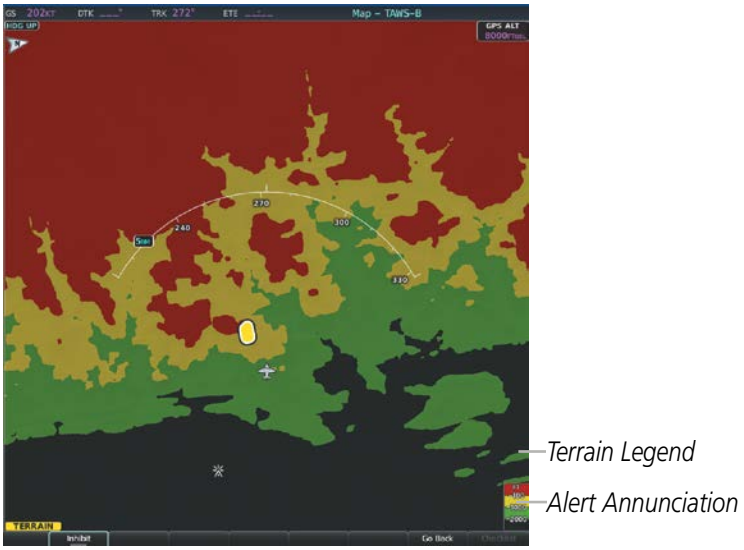


Figure 6-82 'Map - TAWS-B' Page with Alert
(Shown after pressing the ENT Key during the MFD Pop-Up Alert)

Alert Type	PFD/MFD** Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Voice Alert
Excessive Descent Rate Warning (EDR)	PULL UP	PULL–UP	"Pull-Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN – PULL–UP or TERRAIN AHEAD – PULL–UP	"Terrain, Terrain; Pull-Up, Pull-Up"* 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"* 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"* or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE – PULL–UP or OBSTACLE AHEAD – PULL–UP	"Obstacle, Obstacle; Pull-Up, Pull-Up"* 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"* or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain"* or "Terrain Ahead; Terrain Ahead"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION OBSTACLE or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"* or "Obstacle Ahead; Obstacle Ahead"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION OBSTACLE or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"* 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"

Alert Type	PFD/MFD** Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Voice Alert
Negative Climb Rate Caution (NCR)	TERRAIN	DONT SINK or TOO LOW – TERRAIN	"Don't Sink"* or "Too Low, Terrain"

** 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.*
*** Annunciation is displayed on the MFD when terrain display is enabled.*

Table 6-21 TAWS-B Alerts Summary

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide suitable notification when the aircraft is determined to be closing (descending) upon terrain at an excessive speed. Figure 6-83 shows the parameters for the alert as defined by TSO-C151b.

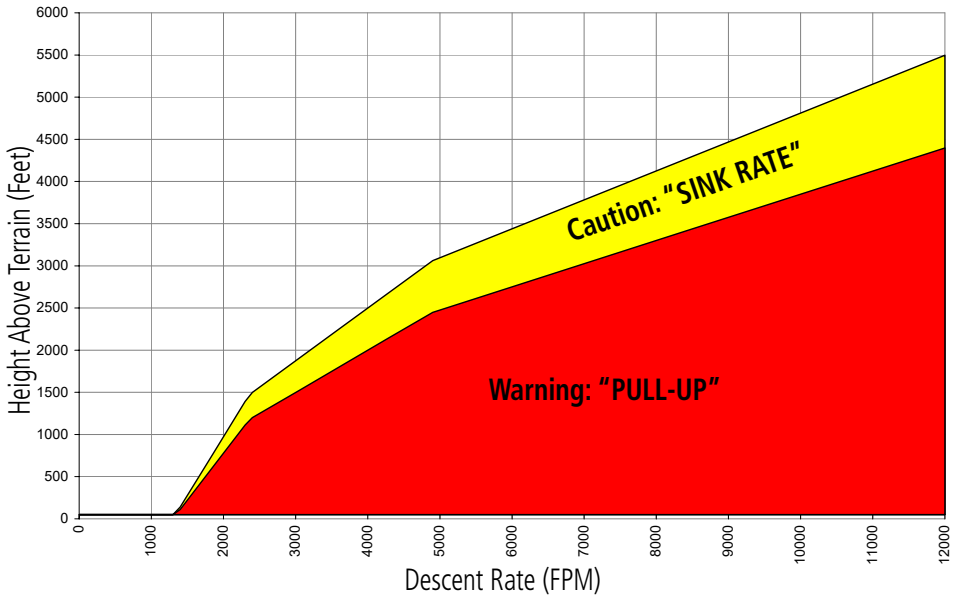


Figure 6-83 Excessive Descent Rate Alert Criteria

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of TAWS-B compares the aircraft's projected flight path with known terrain and obstacles in their respective databases and issues four types of alerts as either a caution or a warning:

Reduced Required Terrain Clearance (RTC) and **Reduced Required Obstacle Clearance (ROC)** alerts are issued when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values in Figure 6-84. When an RTC alert is issued, the system displays a potential impact area on navigation maps and the 'Map - TAWS-B' Page.

Imminent Terrain Impact (ITI) and **Imminent Obstacle Impact (IOI)** alerts are issued when the aircraft is below the elevation of a terrain or obstacle cell in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact area on the navigation maps and the 'Map - TAWS-B' Page. The alert is annunciated when the projected vertical flight path is calculated to come within minimum clearance altitudes in Figure 6-84.

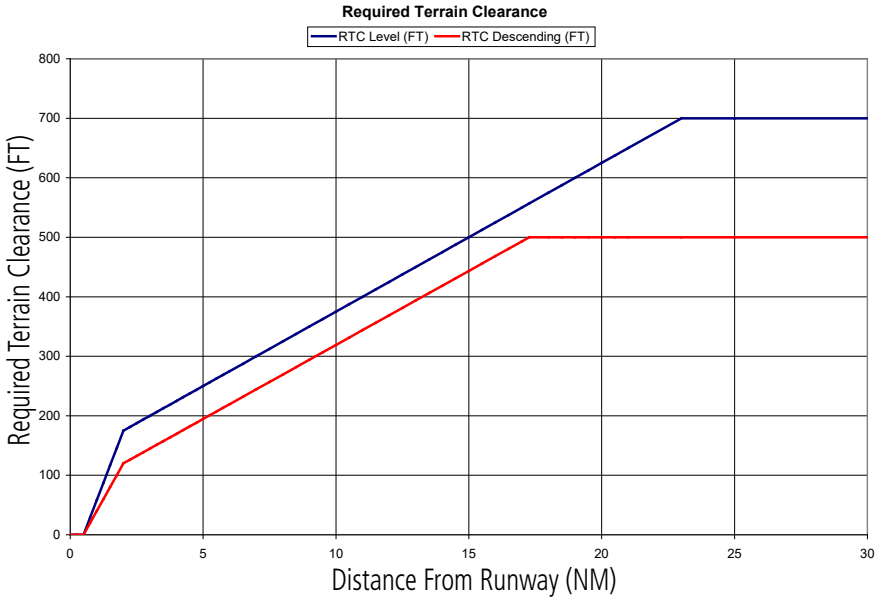


Figure 6-84 FLTA Alert Minimum Terrain and Obstacle Clearance Values

The system automatically suppresses FLTA alerts from occurring under any of the following conditions:

- The aircraft is less than 200 feet above the destination elevation and within 0.5 nm of the destination.
- The aircraft is less than 50 feet above terrain or on the ground.
- The aircraft is between runway ends.

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.

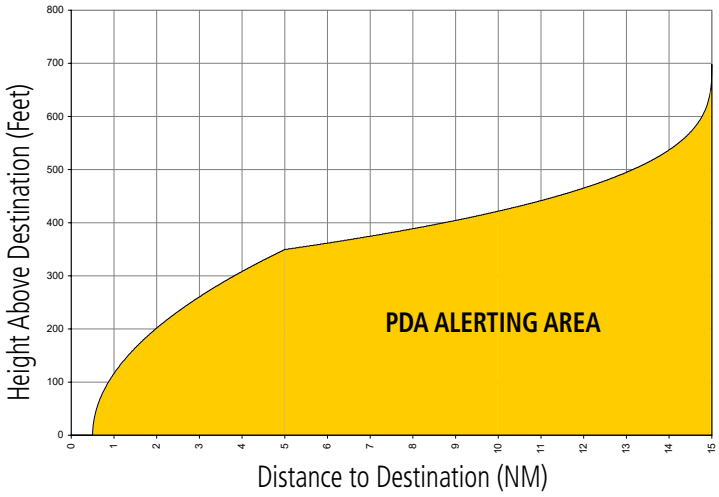


Figure 6-85 PDA Alerting Threshold

PDA and FLTA visual annunciations and voice alerts can be manually inhibited. Discretion should be used when inhibiting TAWS-B and the system should be enabled when appropriate. When TAWS-B is inhibited, the alert annunciation 'TAWS INH' is shown on the PFD and MFD.

Figure 6-86 TAWS PDA and FLTA Alerting Inhibited Annunciation

Inhibiting/enabling TAWS-B alerting:

1) Select the 'Map - TAWS-B' Page.

2) Press the **Inhibit** Softkey to inhibit or enable TAWS-B (choice dependent on current state).

Or:

a) Press the **MENU** Key.

b) Select 'Inhibit TAWS' or 'Enable TAWS' (choice dependent on current state) 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.

ALTITUDE VOICE CALLOUT (VCO) ALERT

The system provides a ***"Five-hundred"*** voice alert when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within five nautical miles of an airport, the ***"Five Hundred"*** voice alert is based on the nearest runway threshold elevation. When the aircraft is more than five nautical miles from the nearest airport, the ***"Five Hundred"*** voice alert is based on the height above terrain, by comparing the aircraft's GPS-GSL altitude to the terrain database.

There are no display annunciations or pop-up alerts that accompany the VCO alert. This alert cannot be inhibited.

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.

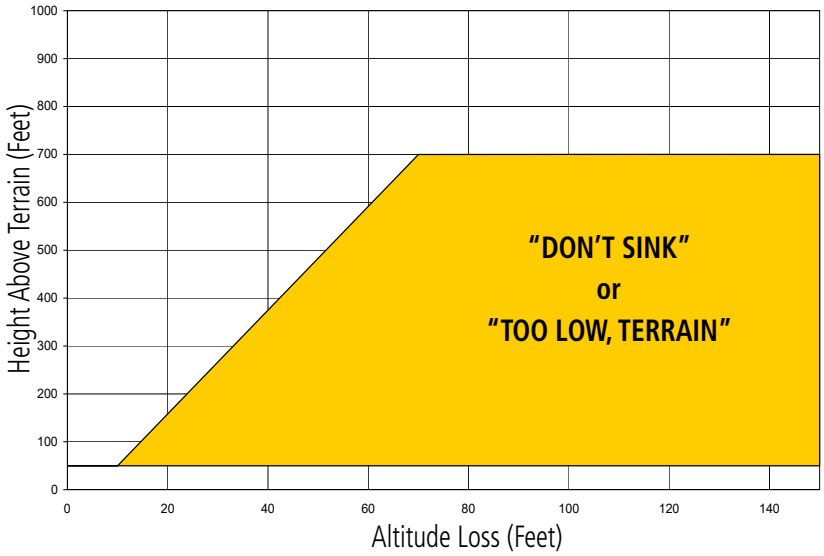


Figure 6-87 Negative Climb Rate (NCR) Altitude Loss

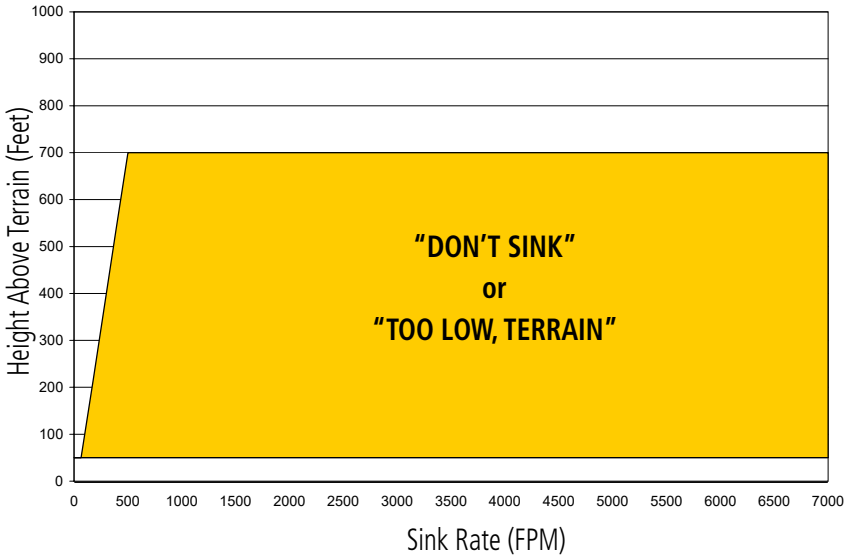


Figure 6-88 Negative Climb Rate (NCR) Sink Rate

SYSTEM STATUS

During power-up, TAWS-B conducts a system test of its alerting capabilities. The system test can also be manually initiated. The system issues a voice alert when the test has concluded. TAWS-B System Testing is unavailable when ground speed exceeds 30 knots.

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' visual 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 annunciation 'TAWS N/A' is generated in the annunciation window and on the TAWS-B Page. If in-flight, the voice alert ***"TAWS Not Available"*** is also generated. When the GPS signal is restored and the aircraft is within the database coverage area, the voice alert "TAWS Available" is generated.

Alert Type	PFD/MFD TAWS-B Page Annunciation	TAWS-B Page Center Banner Annunciation	Voice Alert	TAWS Alert Types Not Available
System Test in progress	TAWS TEST	TAWS TEST	None	None Available
System Test pass	None	None	"TAWS System Test OK"	
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"	FLTA, PDA
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None	
No GPS position	TAWS N/A	NO GPS POSITION	"TAWS Not Available"	FLTA, PDA, VCO
Excessively degraded GPS signal, or out of database coverage area	TAWS N/A	None	"TAWS Not Available"	FLTA, PDA
Sufficient GPS signal reception restored	None	None	"TAWS Available" (voice alert only in flight)	
TAWS Alerting is inhibited-	TAWS INH	None	None	FLTA, PDA

Table 6-22 TAWS-B System Status Annunciations

6.5 VERTICAL SITUATION DISPLAY (VSD) TERRAIN

The system offers a Vertical Situation Display (VSD), which includes a profile of terrain and obstacles in an inset window on the bottom of the 'Map - Navigation Map' Page. Although the VSD does not display TAWS alerts and potential impact areas, the VSD does use many of the same colors and symbols as TAWS to depict relative terrain and obstacles within the VSD. Refer to the TAWS discussion for more information about relative terrain and obstacle color correlation and symbols.

Enabling/Disabling the Vertical Situation Display (VSD):

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 or disable the VSD.

Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Select 'Show VSD' or 'Hide VSD' (choice dependent on current state) and press the **ENT** Key.

The same controls which enable/disable the display of relative terrain and obstacles on the 'Map - Navigation Map' Page also control the display of this information in the VSD.

Enabling/Disabling VSD Relative Terrain on the 'Map - Navigation Map' Page (when VSD is enabled):

1) Select the 'Map - Navigation Map' Page.
2) Press the **Map Opt** Softkey.
3) Press the **Terrain** Softkey. Each selection cycles though an option displayed in cyan: Off (disables terrain), Topo (to show topographical data) or REL (to show relative terrain).

VSD DISPLAY

When the VSD is enabled, terrain and obstacles in the VSD will be shown if the aircraft altitude is low enough or the VSD altitude range is high enough for the terrain to be in view (absolute terrain will be shown in gray if the **TER** Softkey is selected off on the 'Map - Navigation Map' Page).

The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the aircraft track between the aircraft present position and the end of the map range. The predefined width is determined by the flight phase, as annunciated on the HSI, and is widest during enroute or oceanic phases.

Flight Phase	Total VSD Width
Approach	0.6 nm
Departure	0.6 nm
Terminal	2.0 nm
Enroute	4.0 nm
Oceanic	4.0 nm

Table 6-23 VSD Terrain Width Varies with Phase of Flight

The forward looking swath of terrain is based on the selected VSD Mode, annunciated in the top-left corner of the VSD Inset Window. In Flight Plan Mode, the contour follows the active flight plan, and if no active flight plan is present, the VSD Inset Window displays 'Flight Plan Not Available'. In Track Mode, the contour is based on the aircraft ground track. In Auto Mode, the contour is based on the active flight plan, when available, otherwise, it is based on the ground track.

Selecting a VSD Mode:

1) Select the 'Map - Navigation Map' Page.
2) Press the **Inset** Softkey.
3) Press the **VSD** Softkey displaying the VSD mode in cyan. Each press of the softkey cycles through a mode selection: FPL (flight plan), TRK (track), or Auto.

When the 'Map - Navigation Map' Page range is adjusted with the **Joystick**, the horizontal distance of the VSD is adjusted to match the distance shown on the map range arc, down to one nautical mile. If the 'Map - Navigation Map' Page range is adjusted below one nautical mile, the VSD range remains at one nautical mile. When the 'Map - Navigation Map' Page range is adjusted to remove altitude-correlated colored terrain data (as shown in the Terrain Legend) or obstacles from the 'Map - Navigation Map' Page, these items are also removed from the VSD; only an outline of the terrain will be displayed in black in the VSD Inset Window. Refer to the TAWS discussions for more information about displaying terrain or obstacles on the 'Map - Navigation Map' Page.

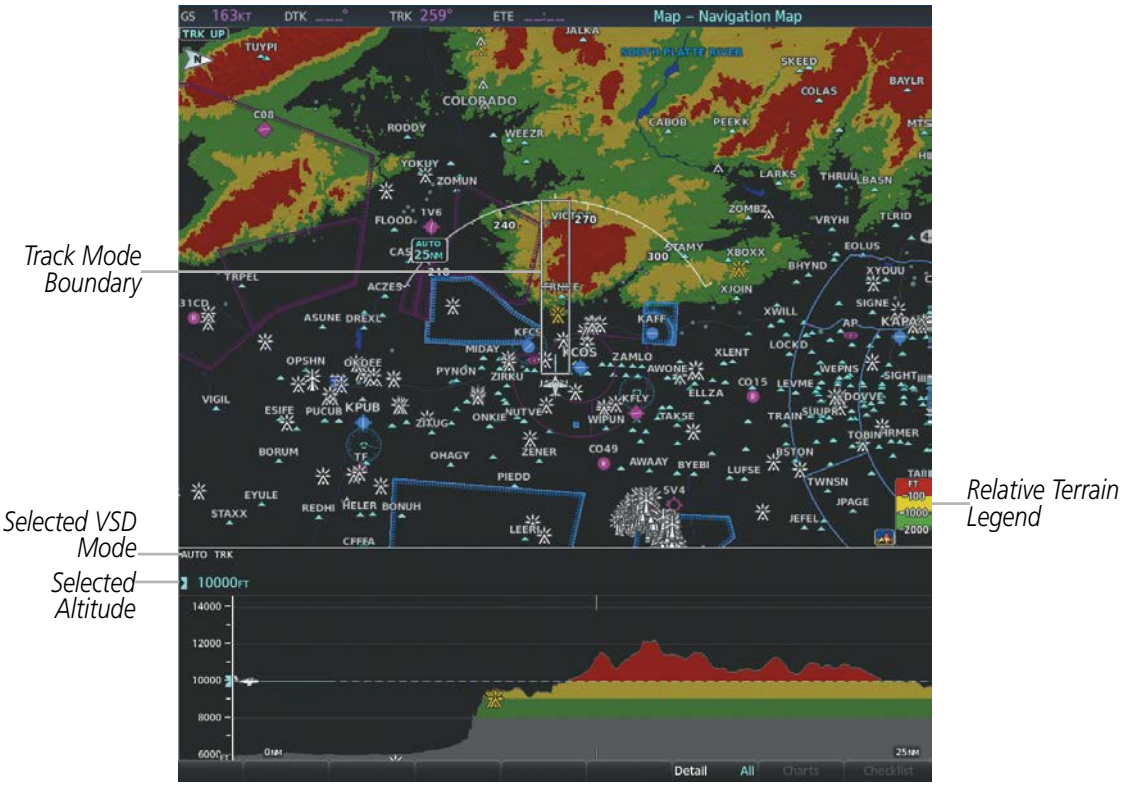


Figure 6-89 VSD on the 'Map - Navigation Map' Page with Relative Terrain Information

Obstacles with heights greater than 200 feet AGL appear relative to aircraft altitude along the altitude scale. The top of the obstacle symbol on the scale represents the obstacle's height AGL. If the obstacle's height AGL is higher than can be represented by the obstacle symbol itself (e.g. for unusually tall obstacles), a vertical line appears below the obstacle symbol in order to depict the top of the obstacle symbol at its height AGL.

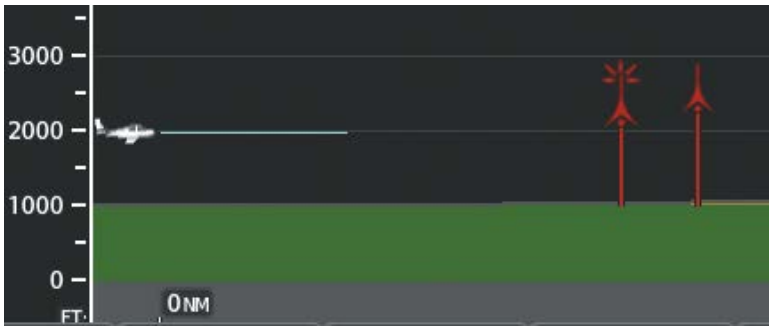


Figure 6-90 VSD with Tall Obstacles

TRACK MODE BOUNDARY

The Track Mode Boundary represents the horizontal and lateral boundaries of the VSD. The boundary is shown as a white rectangle on the 'Map - Navigation Map' Page and is only available when the VSD is enabled in Track Mode. White range markers both edges of the Track Mode Boundary rectangle match the range markers along the distance scale inside the VSD Inset Window whenever the profile range is at least four nautical miles (or 7.5 km if configured for metric units).

The Track Mode Boundary may be enabled/disabled, and the 'Map - Navigation Map' Page range at which the Profile Path is removed from map display can be changed.

Customizing the Track Mode Boundary display on the 'Map - Navigation Map' Page:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select the 'VSD' Group and press the **ENT** Key.
5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
   - TRK Mode BNDRY – Enables/disables the display of the Track Mode Boundary and sets maximum range at which Track Mode Boundary is shown.
6) Turn the small **FMS** Knob to scroll through options (ON/OFF, range settings).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

6.6 TAWS-A

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

NOTE: *Terrain data is not displayed when the aircraft is outside of the installed terrain database coverage area.*

NOTE: *The data contained in the TAWS databases comes from government agencies. Garmin accurately processes and cross-validates the data but cannot guarantee the accuracy and completeness of the data.*

TAWS-A (Terrain Awareness and Warning System - Class A) is an optional feature to increase situational awareness and aid in reducing controlled flight into terrain (CFIT). TAWS-A provides visual annunciations and voice alerts when terrain and obstacles are within the given altitude threshold from the aircraft. The displayed alerts and warnings are advisory in nature only.

TAWS-A satisfies TSO-C151b Class A and TSO-92c requirements for certification.

Class A TAWS requires the following components:

- A valid terrain/obstacle/airport terrain database.
- A valid 3-D GPS position solution.
- Valid flap and landing gear status inputs.
- A valid radar altimeter.

TAWS-A 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, per TSO-C151b. However, the displayed information should never be understood as being all-inclusive and the data may still contain inaccuracies.

TAWS-A uses information from the GPS receiver to provide a horizontal position and altitude, along with additional altitude input from the radar altimeter. GPS altitude is derived from satellite measurements. The system converts GPS altitude to a height above geodetic sea level (GSL), which is the height above mean seal level (MSL) calculated geometrically. GSL altitude accuracy is affected by factors such as satellite geometry, but it is not subject to variations in pressure and temperature that normally affect pressure altitude devices. GSL altitude does not require local altimeter settings to determine MSL altitude. 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 TAWS-A are referenced to mean sea level (MSL). Using the GPS position and GSL altitude, TAWS-A displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, the GPS position and GSL altitude are used to calculate and "predict" the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, TAWS-A can provide advanced alerts of predicted dangerous terrain conditions.

TAWS-A incorporates radar altimeter input with the GSL altitude to provide a more accurate position reference when at lower altitudes for certain alert types, and to retain a level of ground proximity warning capability in the unlikely event of a terrain or obstacle database failure.

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 GPS-MSL altitude. This variation results in the aircraft's true altitude differing from the baro-corrected altitude.

TAWS-A provides the following alert types:

- Forward Looking Terrain Avoidance (FLTA) Alerting, which consists of:
  - Required Terrain Clearance (RTC) / Required Obstacle Clearance (ROC) Alerting.
  - Imminent Terrain Impact (ITI) / Imminent Obstacle Impact (IOI) Alerting.
- Premature Descent Alerting (PDA).
- Ground Proximity Warning System (GPWS) Alerting, which consists of:
  - Excessive Descent Rate (EDR) Alerting.
  - Excessive Closure Rate (ECR) to Terrain Alerting.
  - Flight Into Terrain (FIT) Alerting.
  - Negative Climb Rate (NCR) after takeoff Alerting.
  - Excessive below Glideslope/Glidepath Deviation (GSD) Alerting.
  - Altitude Voice Call Out (VCO) Alerting.

RELATIVE TERRAIN SYMBOLOGY

TAWS-A 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 TAWS On-Ground Legend shown in Figure 6-91. When the aircraft is in the air, the system displays relative terrain information using red, yellow, green, and black, as shown on the TAWS In-Air Legend shown in Figure 6-91. 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. If a TAWS alert occurs, the relative terrain colors transition to the TAWS In-Air Legend if in the TAWS On-Ground Legend was shown in order to provide the flight crew with the most information possible.

Figure 6-91 Relative Terrain Legend

During an alert, the system shows potential impact areas over terrain or obstacles using bright yellow (caution) or bright red (warning) on navigation maps and on the 'Map - TAWS-A' Page.

The colors and symbols in Figure 6-92 and Tables 6-24 and 6-25 and 6-26 represent terrain, obstacles, and potential impact areas.

DISPLAYING TAWS-A DATA

TAWS-A uses yellow (caution) and red (warning) to depict terrain and obstacles (with heights greater than 200 feet above ground level, AGL) alerts relative to aircraft altitude. Colors are adjusted automatically as the aircraft altitude changes.

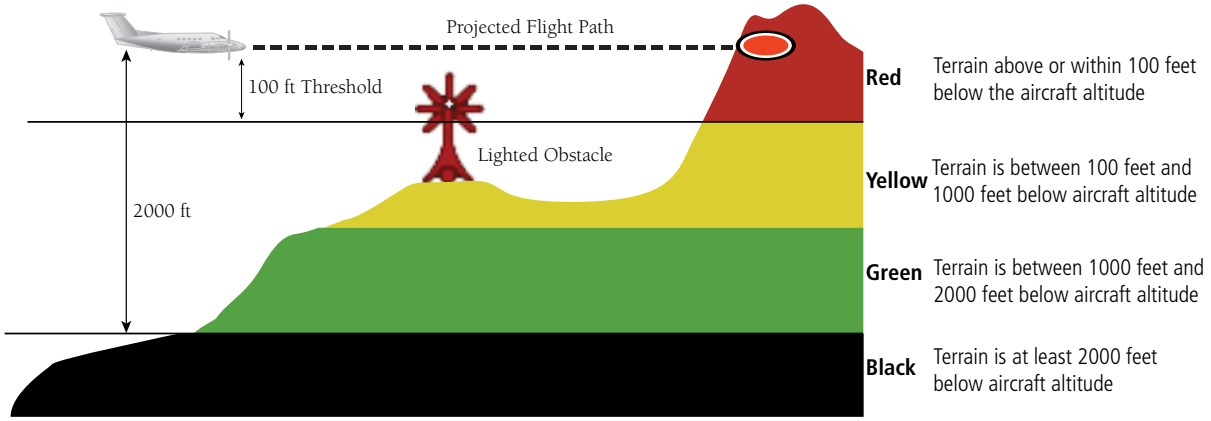


Figure 6-92 In-Air Terrain Altitude/Color Correlation for TAWS

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 6-24 TAWS Relative Obstacle Symbols and Colors

Unlighted Wind Turbine Obstacle	Lighted Wind Turbine Obstacle	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 6-25 TAWS-B Wind Turbine Obstacles and Colors

Potential Impact Area Examples	Alert Type	Example Annunciation
or	Warning	PULL UP
or	Caution	TERRAIN

Table 6-26 TAWS-B Potential Impact Areas with Annunciations

The 'Map - TAWS-A' Page is the principal map page for viewing TAWS-A information. TAWS-A information can be also displayed on the following maps and pages as an additional reference:

- PFD Inset Map
- Navigation Map Page
- Trip Planning Page
- Flight Plan Page

Enabling/disabling relative terrain information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **TER** Softkey to cycle through terrain options. The selected mode is displayed in cyan: Off, Topo, Rel. Press the **TER** Softkey until 'Rel' is displayed on the softkey.

Displaying relative terrain information (PFD Maps):

1) Press the **Map/HSI** Softkey (**Map Opt** Softkey for TCAS II installations).
2) Press the **Rel Ter** Softkey.

When TAWS-A is selected on maps other than the 'Map - TAWS-A' Page, an icon to indicate the feature is enabled for display and a legend for TAWS-A terrain colors are shown. The legend appears without the icon on the 'Map - TAWS-A' Page.

The Navigation Map Page Setup Menu provides a means in addition to the softkeys for enabling/disabling the 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. For terrain data, the enable/disable function applies only to the MFD, while the range setting also affects the PFD Inset Map.

Terrain data can be selected for display independently of obstacle data; however, obstacles for which warnings and cautions are issued are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the 'Map - TAWS-A' 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 – Selects the display of topo, relative terrain, or no terrain, and selects the maximum map 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).
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.

TAWS-A PAGE

The 'Map - TAWS-A' Page shows terrain, obstacle, and potential impact area data in relation to the aircraft's current altitude, without clutter from the basemap. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference. If an obstacle and the projected flight path of the aircraft intersect, the system reduces the 'Map - TAWS-A' Page map range if necessary to clearly show the potential impact area.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the **Joystick** from 1 to 200 nm, as indicated by the map range rings (or arcs).

Displaying the TAWS-A Page:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the 'Map - TAWS-A' Page.

Showing/hiding aviation information on the 'Map - TAWS-A' 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.

Red Terrain is above or within 100' below the aircraft altitude)

Yellow Lighted Obstacle is between 100' and 1000' below aircraft altitude

Red Wind Turbine Obstacle is above or within 100' below aircraft altitude

TAWS Flap Override Annunciation

Red Lighted Obstacle is above or within 100' below aircraft altitude

Yellow Terrain is between 100' and 1000' below the aircraft altitude)

Relative Terrain Legend

Figure 6-93 'Map - TAWS-A' Page

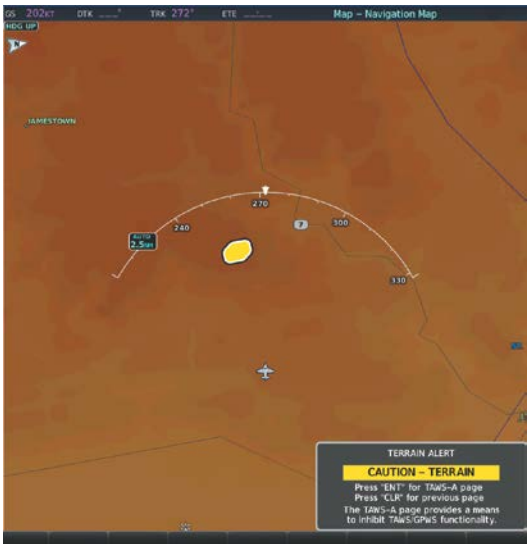
TAWS-A ALERTS

Alerts are issued when flight conditions meet parameters that are set within TAWS-A software algorithms. TAWS-A alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, the system displays visual annunciations with voice alerts. Table 6-27 shows TAWS-A alert types with corresponding annunciations and voice alerts.

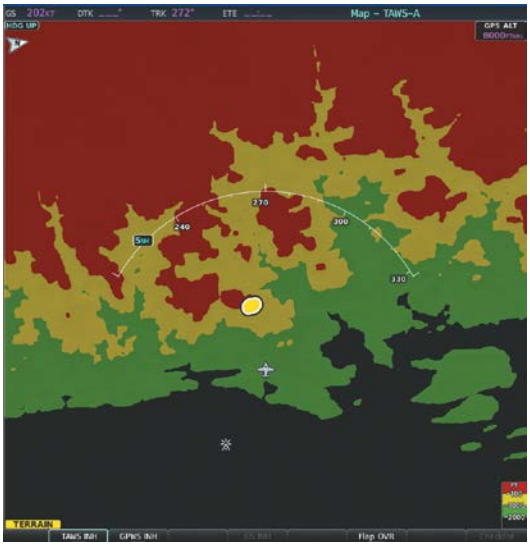
When an alert is issued, annunciations appear on the PFD and MFD. The TAWS-A Alert Annunciation is shown to the upper left of the Altimeter or upper right of the Airspeed indicator on the PFD and below the Terrain Legend on the MFD. If the 'Map - TAWS-A' Page is not already displayed on the MFD, a pop-up alert appears on the MFD while an alert is active. When a pop-up alert occurs, do one of the following:

- Press the **CLR** Key (removes the pop-up alert), or
- Press the **ENT** Key (accesses the 'Map - TAWS-A' Page).

PFD with TAWS-A Annunciations



MFD Pop-Up Alert (on non-TAWS-A pages)



'Map - TAWS-A' Page with Alert Annunciation

Figure 6-94 Example TAWS-A Annunciations

Alert Type	PFD/MFD TAWS-A Page Annunciation	MFD Map Page Pop-Up Alert (Except TAWS-A Page)	Voice Alert
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN – PULL–UP * or TERRAIN AHEAD – PULL–UP	"Terrain, Terrain; Pull-Up, Pull-Up"* 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"* 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"* or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE – PULL–UP or OBSTACLE AHEAD – PULL–UP	"Obstacle, Obstacle; Pull-Up, Pull-Up"* or "Obstacle Ahead, Pull-Up; Obstacle Ahead, Pull-Up"
Excessive Descent Rate Warning (EDR)	PULL UP	PULL–UP	"<whoop> <whoop> Pull-Up"
Excessive Closure Rate Warning (ECR)	PULL UP	PULL–UP	"<whoop> <whoop> Pull-Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain"* or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN * or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION OBSTACLE * or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"* or "Obstacle Ahead; Obstacle Ahead"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION OBSTACLE * or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"* or "Obstacle Ahead; Obstacle Ahead"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW – TERRAIN	"Too Low, Terrain"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Excessive Closure Rate Caution (ECR)	TERRAIN	TERRAIN	"Terrain, Terrain"
Negative Climb Rate Caution (NCR)	TERRAIN	DONT SINK * or TOO LOW – TERRAIN	"Don't Sink"* or "Too Low, Terrain"
Flight Into Terrain High Speed Caution (FIT)	TERRAIN	TOO LOW – TERRAIN	"Too Low, Terrain"

* Alerts with multiple messages are configurable. Alerts for the default configuration are indicated with asterisks.

Table 6-27 TAWS-A Alerts Summary

Alert Type	PFD/MFD TAWS-A Page Annunciation	MFD Map Page Pop-Up Alert (Except TAWS-A Page)	Voice Alert
Flight Into Terrain Gear Caution (FIT)	TERRAIN	TOO LOW – GEAR	"Too Low, Gear"
Flight Into Terrain Flaps Caution (FIT)	TERRAIN	TOO LOW – FLAPS	"Too Low, Flaps"
Flight Into Terrain Takeoff Caution (FIT)	TERRAIN	TOO LOW – TERRAIN	"Too Low, Terrain"
Glide Slope Deviation Caution (GSD) (depends on approach type)	GLIDESLOPE or GLIDEPATH	GLIDESLOPE or GLIDEPATH	"Glideslope" or "Glidepath"
Altitude Voice Callout (VCO)	None	None	"Five Hundred", "Four Hundred"*, "Three Hundred"*, "Two Hundred"*, "One Hundred"*

* Alerts with multiple messages are configurable. Alerts for the default configuration are indicated with asterisks.

Table 6-27 TAWS-A Alerts Summary

FORWARD LOOKING TERRAIN AVOIDANCE (FLTA)

The Forward Looking Terrain Avoidance (FLTA) feature of TAWS-A compares the aircraft's projected flight path with known terrain and obstacles in their respective databases and issues four types of alerts as either a caution or a warning:

Reduced Required Terrain Clearance (RTC) and **Reduced Required Obstacle Clearance (ROC)** alerts are issued when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values. When an RTC alert is issued, a potential impact area is displayed on the 'Map - TAWS-A' Page.

Imminent Terrain Impact (ITI) and **Imminent Obstacle Impact (IOI)** alerts are issued when the aircraft is below the elevation of a terrain or obstacle cell in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact area displayed on the 'Map - TAWS-A' Page. The alert is annunciated when the projected vertical flight path is calculated to come within minimum clearance altitudes.

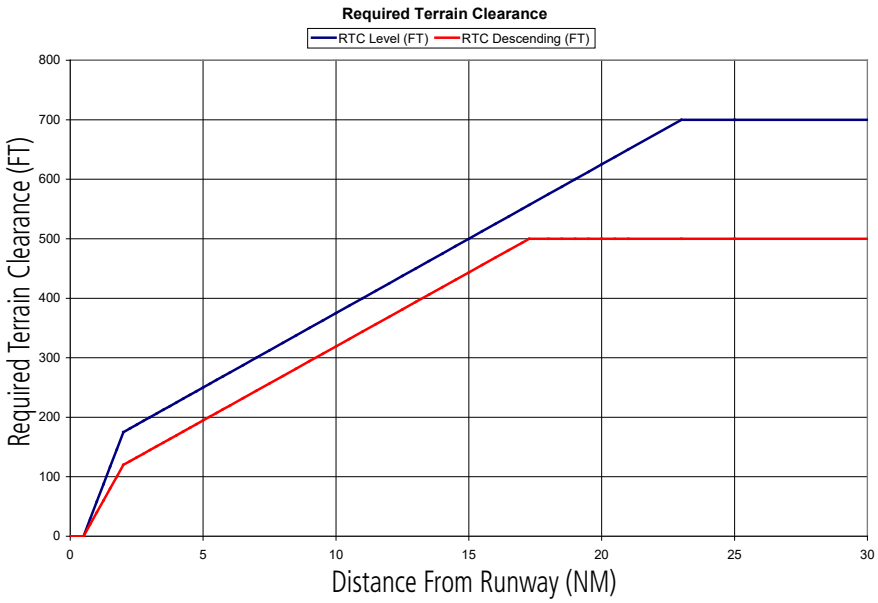


Figure 6-95 FLTA Alert Minimum Terrain and Obstacle Clearance Values

The system automatically suppresses FLTA alerts from occurring under any of the following conditions:

- The aircraft is less than 200 feet above the destination elevation and within 0.5 nm of the destination.
- The aircraft is less than fifty feet above terrain or on the ground.
- The aircraft is between runway ends.

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.

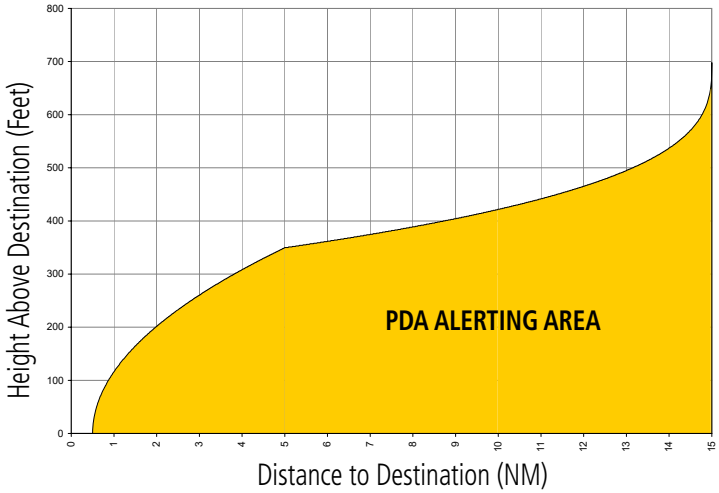


Figure 6-96 PDA Alerting Threshold

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.

Inhibiting FLTA and PDA Alerts

NOTE: *The 'Inhibit TAWS' function only inhibits FLTA and PDA alerts. Alerting for GPWS alerts (EDR, ECR, NCR, FIT) and GSD is controlled independently from FLTA and PDA alerts.*

FLTA and PDA visual annunciations and voice alerts can be manually inhibited. Discretion should be used when inhibiting alerts and the system should be enabled when appropriate. When PDA and FLTA alerts are inhibited, the alert annunciation 'TAWS INH' is shown on the PFD and on the 'Map - TAWS-A' Page annunciation window of the MFD.

Figure 6-97 TAWS-A Page Menu and Inhibit Annunciation

Inhibiting/enabling FLTA and PDA alerting:

1) Select the 'Map - TAWS-A' Page.
2) Press the **TAWS INH** Softkey to inhibit or enable TAWS-A (choice dependent on current state).

Or:

1) Press the **MENU** Key.
2) Select 'Inhibit TAWS' or 'Enable TAWS' (choice dependent on current state) and press the **ENT** Key.

If PDA and FLTA alerts are inhibited when the Final Approach Fix is the active waypoint in a GPS SBAS approach, a 'LOW ALT' annunciation may appear on the PFD next to the Altimeter if the current aircraft altitude is at least 164 feet below the prescribed altitude at the Final Approach Fix. See the Flight Instruments Section for details.

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide suitable notification when the aircraft is determined to be closing (descending) upon terrain at an excessive speed. Figure 6-98 shows the parameters for the alert as defined by TSO-C151b.

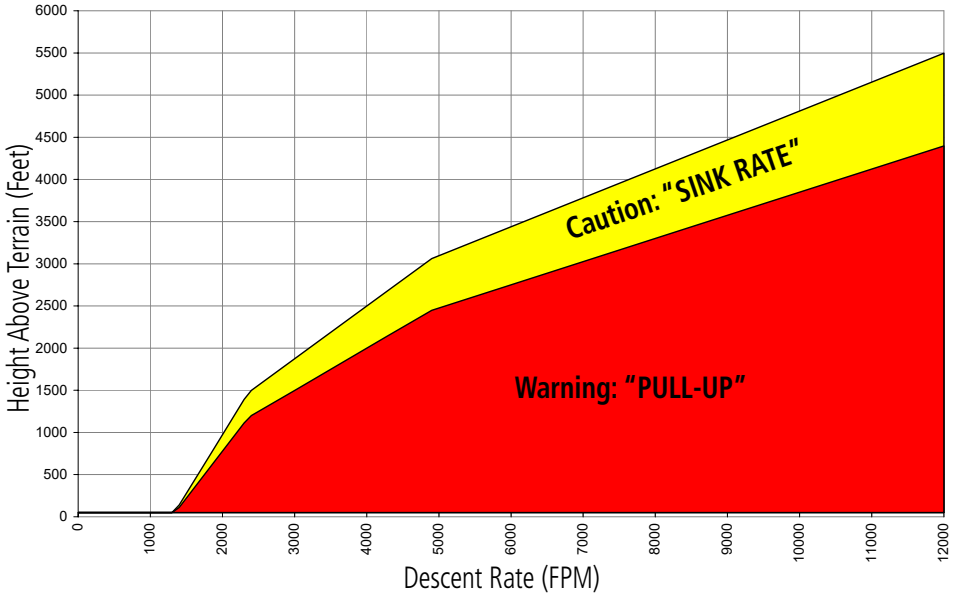


Figure 6-98 Excessive Descent Rate Alert Criteria

EXCESSIVE CLOSURE RATE ALERT

The **Excessive Closure Rate (ECR)** alert provides suitable notification when the aircraft is determined to be closing upon terrain at an excessive speed for a given aircraft gear and flap configuration.

Figures 6-99 and 6-100 show the ECR alerting criteria for flaps in the landing configuration and for all other flight phases respectively.

ECR alerts are automatically inhibited when the aircraft is five nautical miles from the nearest airport, except when FLTA is not available (causing the TAWS N/A or TAWS FAIL annunciation to be displayed), in which case ECR alerting will remain active until landing.

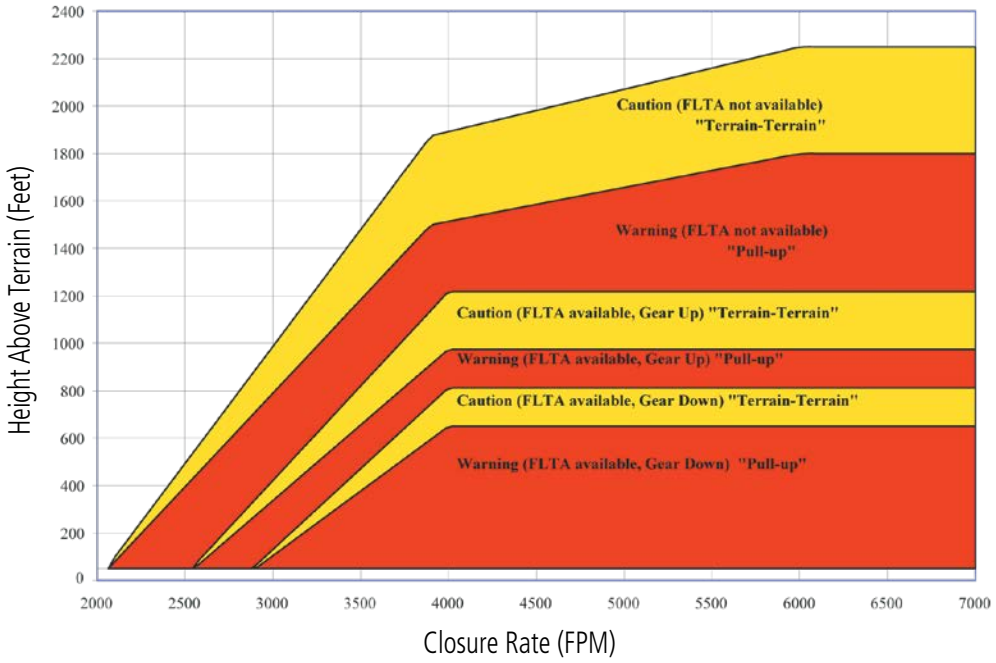


Figure 6-99 Excessive Closure Rate Alert Criteria (Flaps Up or Takeoff Configuration)

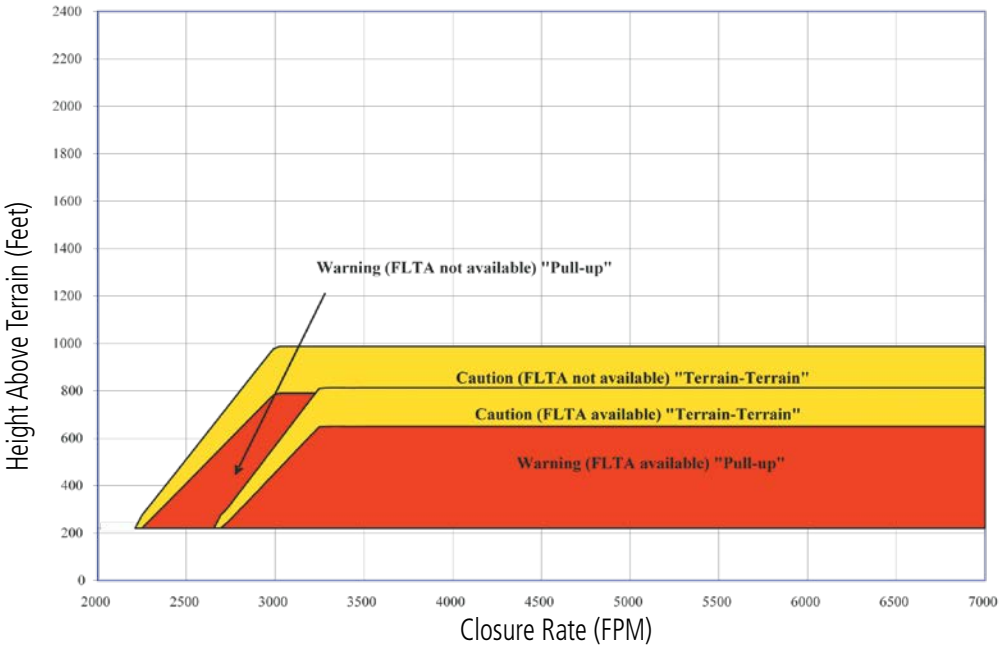
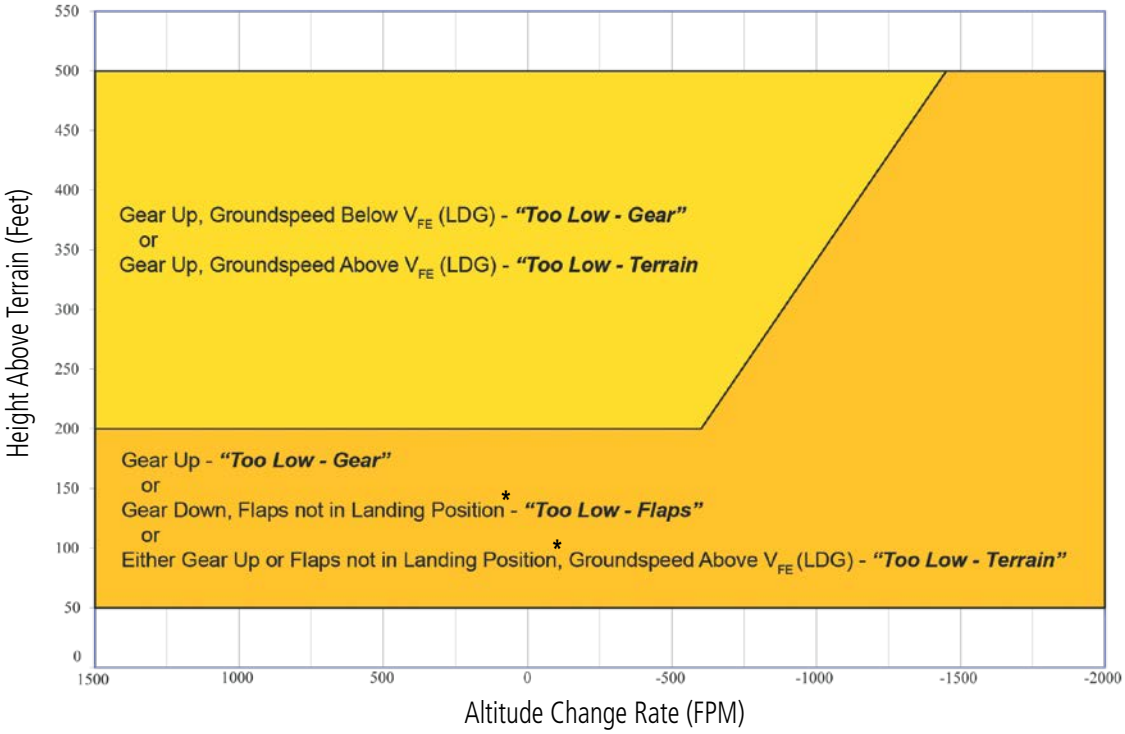


Figure 6-100 Excessive Closure Rate Alert Criteria (Flaps in Landing Configuration)

FLIGHT INTO TERRAIN ALERT

Flight Into Terrain (FIT) alerts occur when the aircraft is too low with respect to terrain based on landing gear status, flap position, and groundspeed. FIT caution alerts are issued when flight conditions meet the criteria shown in the following figure.



** Flap position will not trigger alert if Flap Override option is enabled; see discussion below.*

Figure 6-101 Flight Into Terrain Caution Alert Criteria

To reduce nuisance FIT alerts on approaches where flap extension is not desired (or is intentionally delayed), the pilot may override FIT alerting based on the flap position, while all other FIT alerting remains in effect.

Figure 6-102 TAWS-A Page Menu and FIT Flap Override Annunciation

Overriding Flaps-based FIT alerting:

1) Select the 'Map - TAWS-A' Page.
2) Press the **Flap OVR** Softkey.

Or:

1) Press the **MENU** Key.
2) Select 'Flap Override' or 'Disable Flap Override' (choice dependent on current state) and press the **ENT** Key.

When the Flaps Override option is enabled, the annunciation 'FLAP OVR' is annunciated on the PFD and on the 'Map - TAWS-A' Page of the MFD. If GPWS alerts are also inhibited (which include FIT), the 'FLAP OVR' annunciation is not shown.

FIT alerts also occur during takeoff or go-around if the aircraft's height above ground level (as determined by the radar altimeter) is too close to rising terrain. TAWS-A will issue the voice alert **"Too Low - Terrain"** and visual annunciations when conditions enter the caution alert area.

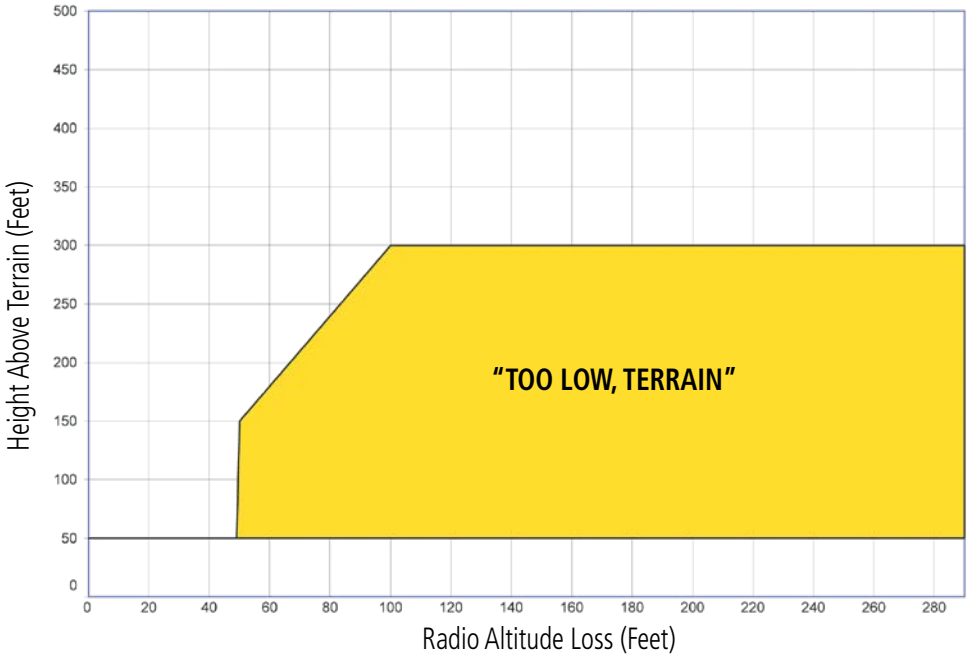


Figure 6-103 FIT Alerting After Takeoff

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT

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 an annunciation and a pop-up terrain alert on the MFD if the 'Map - TAWS-A' Page is not already displayed. NCR alerting for TAWS-A 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 five nautical miles or less.
- Heading change from the departure heading is less than 110 degrees.
- Landing gear or flaps are configured for takeoff.

NCR alerts can be triggered by either altitude loss or sink rate.

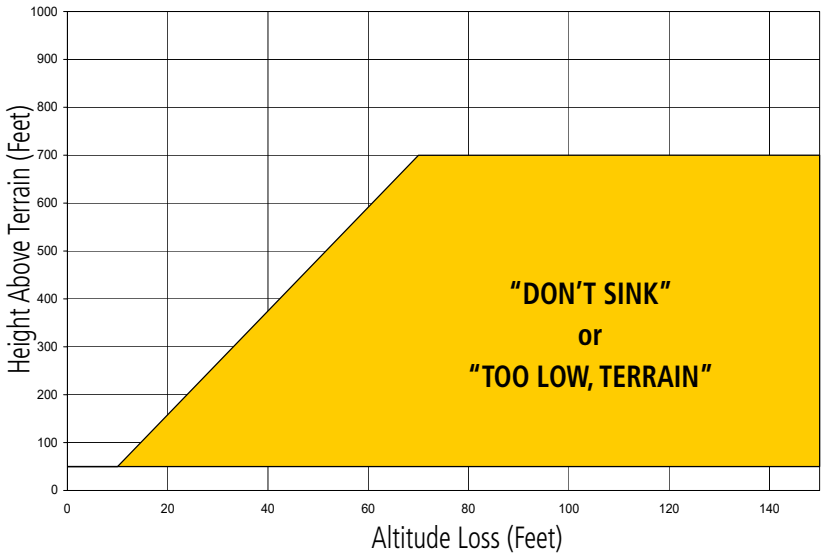


Figure 6-104 Negative Climb Rate (NCR) Altitude Loss

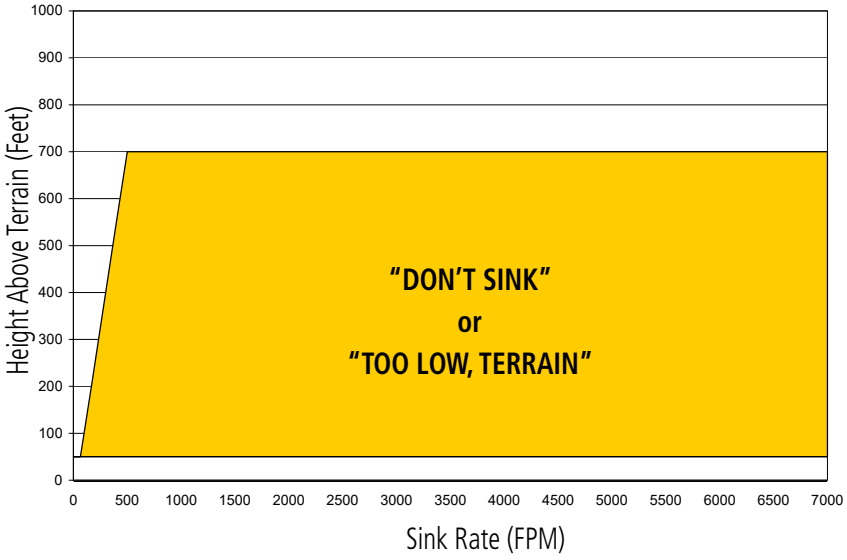


Figure 6-105 Negative Climb Rate (NCR) Sink Rate

Inhibiting GPWS Alerts (EDR, ECR, FIT, and NCR)

NOTE: *The 'Inhibit GPWS' function only affects GPWS alerts (EDR, ECR, NCR, and FIT). Alerting for FLTA, PDA, and GSD is controlled independently from the GPWS alerts listed below.*

EDR, ECR, FIT, and NCR visual annunciations and voice alerts can be manually inhibited as a group. Discretion should be used when inhibiting alerts and the GPWS system should be enabled when appropriate. When these alerts are inhibited, the alert annunciation 'GPWS INH' is shown on the PFD and on the TAWS-A Page annunciation window of the MFD.

Figure 6-106 TAWS-A Page Menu and GPWS Inhibit Annunciation

Inhibiting/enabling GPWS alerting:

1) Select the 'Map - TAWS-A' Page.
2) Press the **GPWS INH** Softkey to inhibit or enable GPWS alerts (choice dependent on current state).

   Or:

   a) Press the **MENU** Key.

   b) Select 'Inhibit GPWS' or 'Enable GPWS' (choice dependent on current state) and press the **ENT** Key.

EXCESSIVE BELOW GLIDESLOPE/GLIDEPATH DEVIATION ALERT

A **Glideslope Deviation** or **Glidepath Deviation (GSD)** caution alert is issued when the system detects that the aircraft is significantly below the glidepath for the selected approach in relation to the aircraft's height above terrain.

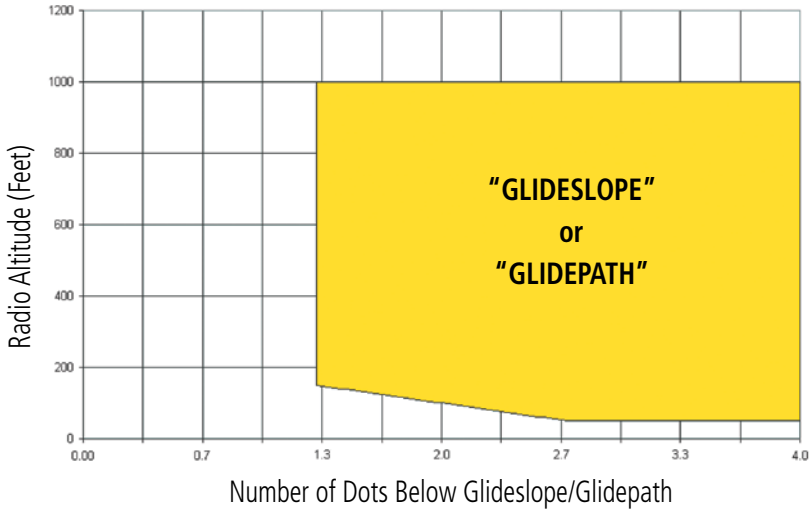


Figure 6-107 Excessive Below Glideslope/Glidepath Deviation Alert Criteria

GSD alerting is only active after departure and the following conditions are met:

- An ILS approach is active or an FMS approach is active with one of the following SBAS approach service levels: LPV, LP+V, or LNAV/VNAV.
- Aircraft is below 1000 feet AGL.
- Gear is configured for landing.

When a GSD caution alert occurs on an ILS approach, the visual annunciation 'GLIDESLOPE' is issued with the '***Glideslope***' voice alert. If a GSD caution alert occurs on an LNAV/VNAV, or LNAV+V approach, the visual annunciation 'GLIDEPATH' is issued with the '***Glidepath***' voice alert.

Inhibiting GSD Alerts

NOTE: *GSD alerting may only be inhibited while a GSD alert is occurring. GSD alerts are inhibited independently from all other FLTA, PDA, and GPWS alerts.*

During a GSD alert, the PFD Softkeys are displayed to provide an option to inhibit the alert. A 'GLIDESLOPE' alert will display a **GS INH** Softkey to inhibit the alert. A 'GLIDEPATH' alert will display a **GP INH** Softkey to inhibit the alert. When an inhibit Softkey is pressed, the PFD Softkeys return to the top-level display. Press the **Back** Softkey to return to the top level of the PFD Softkeys without inhibiting the GSD alert.

Figure 6-108 GSD Glideslope Alert and PFD Softkeys

GSD alerts may also be inhibited on the 'Map - TAWS-A' Page while a GSD alert is occurring.

Inhibiting/Enabling GSD alerting (only available during a GSD alert):

1) Select the 'Map - TAWS-A' Page.
2) Press the **GS INH** Softkey or the **GP INH** Softkey to inhibit or enable GSD alerts (softkey choice dependent on present GSD alert type).

Or:

1) Press the **MENU** Key.
2) Select the option to inhibit or enable the glideslope or glidepath alerting (choice dependent on present GSD alert type) and press the **ENT** Key.

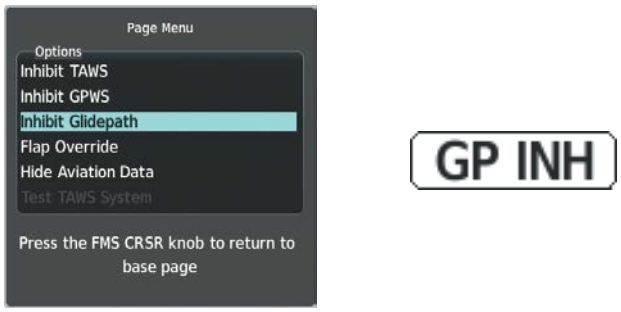


Figure 6-109 TAWS-A Page Menu and Glideslope Alerting Inhibited Annunciation

ALTITUDE VOICE CALLOUT (VCO)

TAWS-A provides voice alerts as the aircraft descends, beginning at 500 feet above the terrain, using radar altitude (if greater than five nautical miles from the nearest airport), or 500 feet above the nearest runway Touch Down Zone Elevation using GPS-GSL altitude (if less than five nm from the nearest airport. Upon descent to this altitude, the system issues a ***'five hundred'*** voice alert.

Additional VCO alerts occur as the aircraft descends through 450, 400, 350, 300, 250, 200, 150, 100, 50, 40, 30, 20, and 10 feet. There are no display annunciations or pop-up alerts that accompany the voice alerts. The ***'five hundred'*** voice alert cannot be inhibited. If Touchdown Callouts are set to On, then each individual callout can be selected On or Off.

SYSTEM STATUS

During power-up, TAWS-A conducts a system test of its alerting capabilities. The system test can also be manually initiated. A voice alert occurs at the conclusion of the test. TAWS-A System Testing is disabled when ground speed exceeds 30 knots. TAWS-A terrain alerts will not be issued while a test is in progress.

Alert Type	PFD/MFD TAWS-A Page Annunciation	TAWS-A Page Center Banner Annunciation	Voice Alert
TAWS System Fail.	**TAWS FAIL**	**TAWS FAIL**	"TAWS System Failure"
TAWS Not Available.	**TAWS N/A**	**NO GPS POSITION** (if GPS position lost)	"TAWS Not Available"
GPWS System Fail.	**GPWS FAIL**	None	"GPWS System Failure"
System Test in progress.	**TAWS TEST**	**TAWS TEST**	None
TAWS System Test pass.	None	None	"TAWS System Test OK"
TAWS PDA/FLTA Alerting Inhibited.	**TAWS INH**	None	None
GPWS Alerting Inhibited.	**GPWS INH**	None	None
GSD Alerting Inhibited.	**GS INH** or **GP INH**	None	None
'Too Low - Flaps' FIT alerting inhibited.	**FLAP OVR**	None	None

Table 6-28 TAWS-A System Test Status Annunciations

Manually testing the TAWS-A System:

1) Select the 'Map - TAWS-A' 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-A ABNORMAL OPERATIONS

TAWS-A continually monitors several system-critical items such as database validity, flap and landing gear position, radar altimeter input, and GPS status.

If no PFD or MFD contains Terrain, Airport Terrain, and Obstacle databases (or the databases are invalid), the voice alert ***"TAWS System Failure"*** is generated along with the 'TAWS FAIL' alert annunciation.

TAWS-A 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 'TAWS N/A' is generated in the annunciation window and on the 'Map - TAWS-A' Page. The voice alert ***"TAWS Not Available"*** is also generated if airborne, and some TAWS-A terrain alerts will not be issued (Table 6-29), while GPWS alerting (which are not dependent on GPS position) will continue to operate. When the GPS signal is re-established and the aircraft is within the database coverage area, the voice alert ***"TAWS Available"*** is generated.

TAWS-A also requires radar altimeter input. Should the radar altimeter input fail or become degraded, the annunciation 'GPWS FAIL' is generated in the annunciation window and on the TAWS-A Page. The voice alert ***"GPWS System Failure"*** is also generated. The 'GPWS FAIL' annunciation will also occur if both GPS altitude and barometric altitude are unavailable. If only the GPWS system has failed, GPWS-based alerts will not be available, while other TAWS-A alerting remains unaffected.

Alert Type	PFD/MFD TAWS-A Page Annunciation	TAWS-A Page Center Banner Annunciation	Voice Alert	TAWS Alert Types Not Available
TAWS System Test Fail; Terrain, Airport Terrain or Obstacle database unavailable or invalid on all GDUs; software mismatch among GDUs; TAWS audio fault	TAWS FAIL *	TAWS FAIL	"TAWS System Failure"	FLTA, PDA
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None	Not applicable
No GPS position	TAWS N/A	NO GPS POSITION	"TAWS Not Available"	FLTA, PDA, GSD†, VCO*
Excessively degraded GPS signal, or out of database coverage area	TAWS N/A	None	"TAWS Not Available"	FLTA, PDA
Sufficient GPS signal reception restored	None	None	"TAWS Available" (voice alert only in flight)	
Radar Altimeter invalid, Vertical Speed Invalid, GPS and Baro Altitude invalid, Software mismatch among GDUs, TAWS configuration mismatch among GDUs, TAWS audio fault	GPWS FAIL *	None	"GPWS System Failure"	EDR, ECR, NCR, FIT, GSD

* VCO alerts are not issued if both TAWS and GPWS systems have failed or are not available

† GSD alert will be available if a valid ILS is being used for navigation, even in no valid GPS signal is being received.

Table 6-29 TAWS-A Abnormal Status Alerts

If the aircraft bank angle exceeds 30°, TAWS-A will disable ECR alerts. ECR alert availability returns when the bank angle is reduced for at least eight seconds.

6.7 TAS/TCAS I 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: *If an optional Honeywell KTA 870 TAS is installed, refer to the applicable Pilot's Guide from the manufacturer for detailed information about that traffic system.*

NOTE: *Refer to the SKYWATCH® (SKY497/SKY899) Pilot's Guide for a detailed discussion of the TAS.*

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.*

NOTE: *Traffic images depict Garmin Traffic Systems there are no Third Party Interface images included in this documentation.*

This section covers the optional Garmin GTS 825, Honeywell KTA 870, or L-3 Skywatch 497 Traffic Advisory System (TAS) and Garmin GTS 855 or L-3 Skywatch 899 Traffic Alert and Collision Avoidance I System (TCAS I). Differences in these traffic systems, when applicable, are also discussed in this section.

The Garmin traffic system enhances flight crew situational awareness by displaying traffic information for transponder-equipped aircraft. The system also provides visual annunciations and a voice traffic alerts to assist the flight crew visually acquire traffic.

The traffic system is capable of tracking up to 75 intruding aircraft equipped with Mode A or C transponders, and up to 30 intruders equipped with Mode S transponders. A maximum of 30 aircraft with the highest threat potential can be displayed simultaneously. No traffic surveillance is provided for aircraft without operating transponders.

TAS THEORY OF OPERATION

When the traffic system is in Operating Mode, the system interrogates the transponders of intruding aircraft while monitoring for transponder replies. The system uses this information to derive the distance, relative bearing, and if reported, the altitude and vertical trend for each aircraft within its surveillance range. The traffic system then calculates a closure rate to each intruder based on the projected Closest Point of Approach (CPA). If the closure rate meets the threat criteria for a Traffic Advisory (TA), the traffic system provides visual annunciations and voice alerts.

TRAFFIC SURVEILLANCE VOLUME

The traffic surveillance system actively monitors the airspace within ±10,000 feet of own altitude. Under ideal conditions, the TAS system scans transponder traffic up to 22 NM in the forward direction. The TCAS I system scans for transponder traffic up to 40 NM in the forward direction. The range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. In areas of greater transponder traffic density, the on-board traffic system automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.

When the traffic system is paired with the optional GTX 335 1090 MHz ES (Extended Squitter) transponder, the traffic system uses Automatic Dependent Surveillance - Broadcast (ADS-B) position reports from participating aircraft to enhance the positional accuracy of traffic displayed within the TAS or TCAS I surveillance range.

NOTE: *Do not confuse this functionality with full ADS-B capability, which can provide traffic information from ADS-B Ground-Based Transceivers (GBTs) and ADS-B traffic outside of the TAS/TCAS I surveillance volume.*

When the traffic system is paired with the optional GTX 345R transponder, the traffic system also uses Automatic Dependent Surveillance - Broadcast (ADS-B) position reports from participating aircraft to enhance the positional accuracy of traffic displayed within the TAS or TCAS I surveillance range, in addition to broadcasts from traffic outside of the TAS/TCAS I surveillance range. It also receives information from ADS-B Ground Based Transceivers (GBTs). This includes the Traffic Information Service-Broadcast (TIS-B) service and Automatic Dependent Surveillance-Rebroadcast (ADS-R) service; refer to the ADS-B Traffic section for more information about these features.

TRAFFIC DISPLAY SYMBOLOGY

NOTE: *If an optional Honeywell KTA 870 TAS is installed, refer to the applicable Pilot's Guide from the manufacturer for detailed information about that traffic system.*

The system displays traffic using the symbols shown in the following tables depending on the type of equipment installed.

Traffic Symbol	Description
	Other Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-30 TAS/TCAS I Symbol Description

Traffic Symbol	Description
	Traffic Advisory with ADS-B directional information. Points in the direction of the intruder aircraft track.
	Proximity Advisory with ADS-B directional information. Points in the direction of the aircraft track.
	Other Non-threat traffic with ADS-B directional information. Points in the direction of the intruder aircraft track.

Table 6-31 Traffic with ADS-B Symbology (GTX 33/335 Transponder)

Symbol	Description
	Traffic Advisory with directional information. Points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory out of the selected display range with directional information. Displayed at outer range ring at proper bearing.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with directional information. Points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with directional information. Points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with directional information. Points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-32 ADS-B Traffic Symbology with GTX 345R Transponder

A Traffic Advisory (TA), displayed as an amber circle or amber circle with an enclosed triangle, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range (off scale) is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

A Proximity Advisory (PA), displayed as a solid white diamond or triangle, indicates the intruding aircraft is within ±1200 feet and is within a six nautical mile range, but is still not considered a TA threat.

Other Non-Threat traffic, shown as an open white diamond or triangle, is displayed for traffic beyond a six nautical mile range 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.

If the intruding aircraft is providing ADS-B track information, a motion vector line extending beyond the traffic symbol in the direction of the track may also be displayed when either absolute or relative motion vectors are enabled.

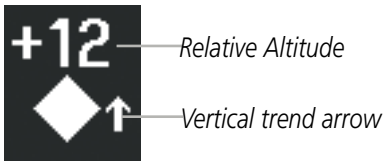


Figure 6-110 Intruder Altitude and Vertical Trend Arrow

Figure 6-111 Intruder Traffic with ADS-B Directional Information and Motion Vector

TA ALERTING CONDITIONS

NOTE: *If an optional Honeywell KTA 870 TAS is installed, refer to the applicable Pilot's Guide from the manufacturer for detailed information about that traffic system.*

NOTE: *Refer to the SKYWATCH® (SKY497/SKY899) Pilot's Guide for a detailed discussion of the TAS.*

The traffic system automatically adjusts its TAS/TCAS I TA sensitivity level to reduce the likelihood of nuisance TA alerting during flight phases likely to be near airports. Level A (less) TA sensitivity is used when the aircraft's landing gear is extended, or when the radar altimeter (if equipped) indicates own aircraft is below 2000' AGL. In all other conditions, Level B (greater) TA sensitivity is used to assess TA threats.

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 6-33 TA Sensitivity Level and TA Alerting Criteria

TRAFFIC ALERTS

NOTE: *If an optional Honeywell KTA 870 TAS is installed, refer to the Pilot's Guide from the manufacturer for information about voice alerts for that traffic system.*

NOTE: *Refer to the SKYWATCH® (SKY497/SKY899) Pilot's Guide for a detailed discussion of the TAS.*

When the traffic system detects a new TA, the following occur:

- A single ***"Traffic!"*** voice alert is generated, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA (Table 6-33). The voice alert, "***Traffic! 12 o'clock, high, four miles***," indicates the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.
- A 'TRAFFIC' Annunciation appears at the right of the Airspeed Indicator on the PFD, flashes for five seconds, and remains displayed until no TAs are detected in the area.
- If the PFD Inset Map or HSI Map was already displayed, the traffic is shown on the map. Otherwise the Traffic Map is shown on the PFD.

If the bearing of TA traffic cannot be determined, an amber text banner will be displayed in the center of the Traffic Map 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 6-112 Traffic Annunciation (PFD)

Bearing	Relative Altitude	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 6-34 TA Descriptive Voice Announcements

SYSTEM TEST

NOTE: *If an optional Honeywell KTA 870 TAS is installed, refer to the applicable Pilot's Guide from the manufacturer for information about applicable voice alerts for the system test.*

NOTE: *Refer to the SKYWATCH® (SKY497/SKY899) Pilot's Guide for a detailed discussion of the TAS.*

NOTE: *Traffic surveillance is not available during the system test. Use caution when performing a system test during flight.*

The traffic system provides a system test mode to verify normal operation. The test takes approximately ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols appears on any displayed traffic maps. The test pattern corresponds to the current aircraft heading. A climbing TA is shown to the west, level Other Non-Threat traffic shown to the northwest, and a descending Proximity Advisory is in the northeast, relative to own aircraft.

The voice alert indicates the traffic system test is complete, and the system enters Standby Mode.

Traffic System	Voice Alert
GTS 825 (TAS)	"TAS System Test Passed."
	"TAS System Test Failed."
GTS 855 (TCAS I)	"TCAS One System Test Passed."
	"TCAS One System Test Failed."

Table 6-35 System Test Voice Alerts GTX 335R or GTX 3000

Traffic System	Voice Alert
GTS 825 (TAS)	"Traffic System Test Passed."
	"Traffic System Test Failed."
GTS 855 (TCAS I)	"Traffic System Test Passed."
	"Traffic System Test Failed."

Table 6-36 System Test Voice Alerts GTX 345R

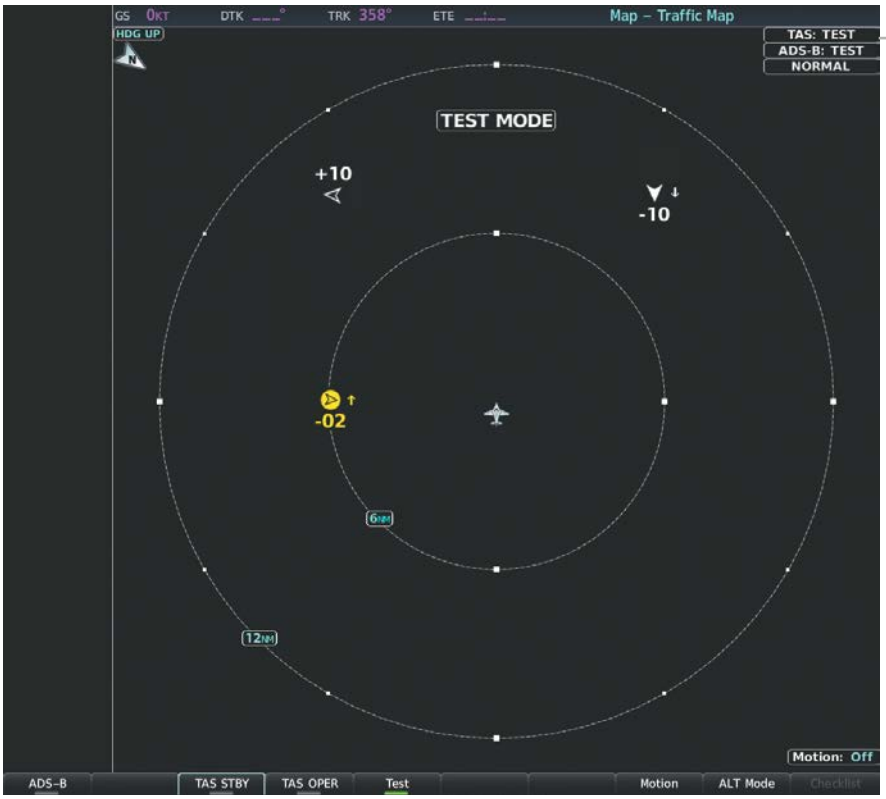
When the system test is complete, the traffic system enters Standby Mode.

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 traffic test pattern display.
4) Press the **Test** Softkey.

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Test Mode'.
2) Press the **ENT** Key.



TAS/TCAS I Test Mode

Figure 6-113 'Map - Traffic Map' Page with Test Mode Enabled

OPERATION

NOTE: *The traffic system automatically transitions from* ***Standby*** *to* ***Operating*** *mode eight seconds after takeoff. The system also automatically transitions from* ***Operating*** *to* ***Standby*** *mode 24 seconds after landing.*

NOTE: *If a Honeywell KTA 870 TAS is installed, the* ***Normal*** *Softkey appears on the Traffic Map Page, which is used to select the TAS Operating Mode.*

NOTE: *Refer to the SKYWATCH® (SKY497/SKY899) Pilot's Guide for a detailed discussion of the TAS.*

After power-up, 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.

Pressing the **Operate** Softkey allows the system to switch from Standby Mode to Operating Mode as necessary. Pressing the **Standby** Softkey causes the system to enter Standby Mode.

Switching from operating mode to standby mode:

On the 'Map - Traffic Map' Page, press the **Standby** Softkey.

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Standby Mode'.
2) Press the **ENT** Key.

Switching from standby mode to operating mode:

On the 'Map - Traffic Map' Page, press the **Operate** Softkey.

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Operate Mode'.
2) Press the **ENT** Key. The traffic system switches from Standby Mode to Operating Mode as necessary.

TRAFFIC MAP PAGE

The 'Map - Traffic Map' Page shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. It is the principal map page for viewing traffic information. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick** (up to 40 nm) as indicated by the map range rings.

The system annunciates the traffic mode and altitude display mode in the upper right corner of the 'Map - Traffic Map' Page.

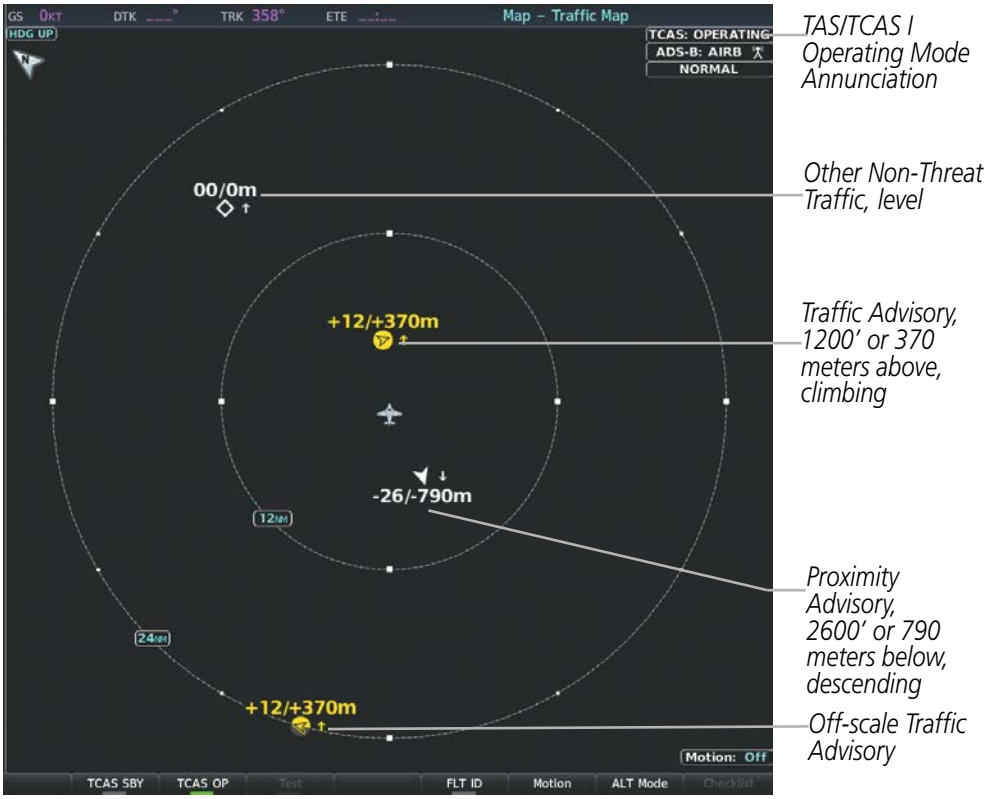


Figure 6-114 'Map - Traffic Map' Page with TAS/TCAS I and ADS-B Traffic Displayed (Meters Overlay)

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) Press the **TAS OPER** Softkey to begin displaying traffic. 'OPERATING' is displayed in the Traffic mode field.
4) Press the **TAS STBY** Softkey to place the system in the Standby mode. 'STANDBY' is displayed in the Traffic mode field.

Altitude Display Mode

The pilot can select the volume of airspace in which Other Non-Threat and Proximity Advisory traffic is displayed. TAs occurring outside of these limits will always be shown.

Changing the altitude range:

1) On the 'Map - Traffic Map' Page, press the **ALT Mode** Softkey.
2) Press 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 'Map - Traffic Map' Page, press the **Back** Softkey.

Or:

1) Press the **MENU** Key.
2) Turn the small **FMS** Knob to select one of the following (see softkey description in step 2 above):
   - Above.
   - Normal.
   - Below.
   - Unrestricted.
3) Press the **ENT** Softkey.

Flight ID Display

The Flight IDs of other aircraft (when available) can be enabled for display on the 'Map - Traffic Map' Page. When a flight ID is received, it will appear above or below the corresponding traffic symbol on the 'Map - Traffic Map' Page when this option is enabled.

NOTE: *The Flight ID display traffic feature is not available in all installations.*

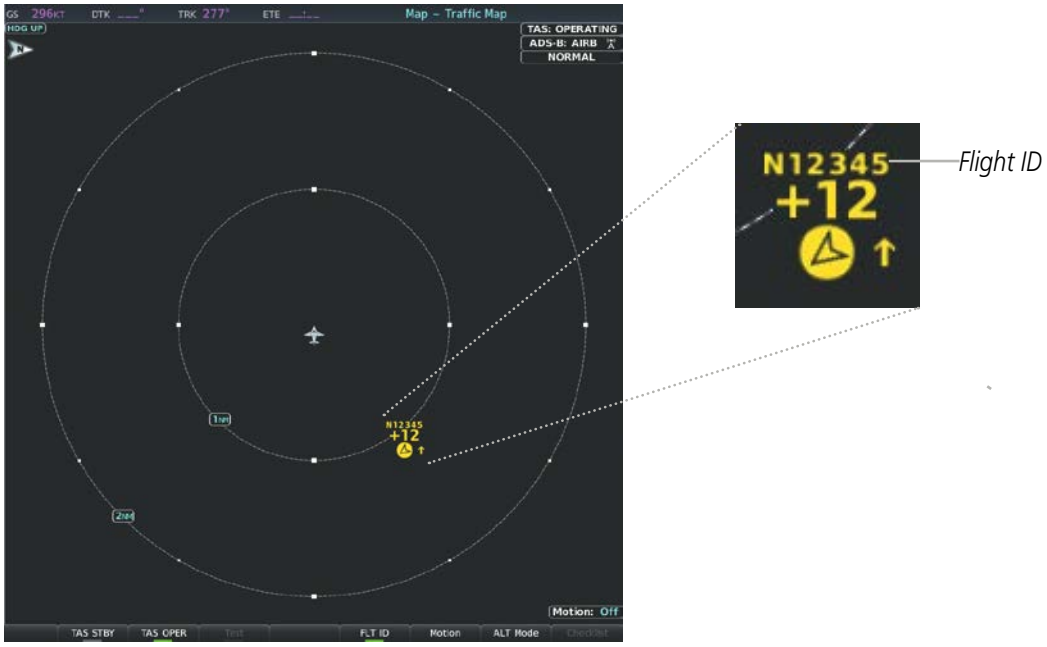


Figure 6-115 'Map - Traffic Map' Page with Flight IDs Enabled

Enabling/Disabling Flight ID Display:

On the 'Map - Traffic Map' Page, press the **FLT ID** Softkey.

Or:

1) Press the **MENU** Key.
2) Turn the small **FMS** Knob to choose 'Show Flight IDs' or 'Hide Flight IDs' (choice dependent on current state).
3) Press the **ENT** Key.

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 and 6 nm.
   - 6 and 12 nm.
   - 12 and 24 nm.
   - 24 and 40 nm.

ADDITIONAL TRAFFIC DISPLAYS

NOTE: *If an optional Honeywell KTA 870 TAS is installed, refer to the applicable Pilot's Guide from the manufacturer for detailed information about that traffic system.*

Traffic information can be displayed on the following maps on the MFD when the traffic system is operating:

- 'Map - Navigation Map' Page
- 'Map - Traffic Map' Page
- 'Aux - Trip Planning' Page
- Nearest Pages
- Flight Plan Pages

Traffic information can also be displayed on the PFD when the Synthetic Vision Technology (SVT) option is installed and enabled. See the Flight Instruments Section for details.

Enabling/disabling traffic information (MFD maps other than the 'Map - Traffic Map' Page):

1) Press the **Map Opt** Softkey.
2) Press the **Traffic** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the 'Map - Traffic Map' Page, a traffic icon is shown to indicate traffic is enabled for display.

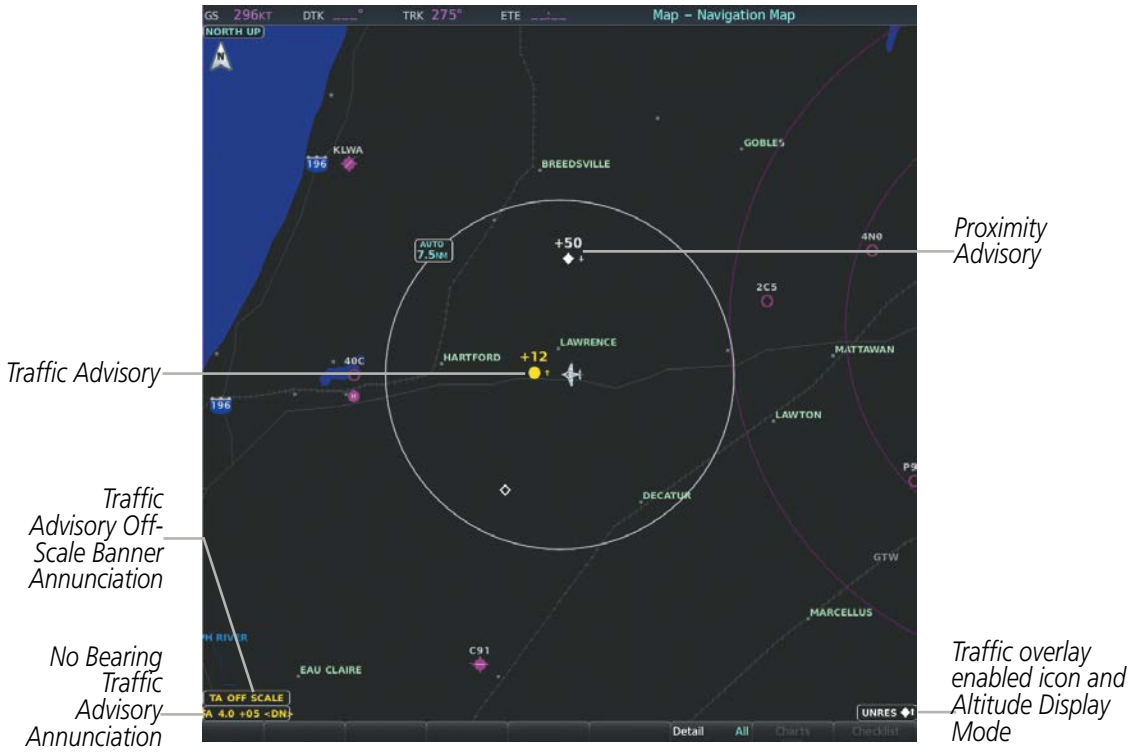


Figure 6-116 Displaying Traffic on the 'Map - Navigation Map' Page

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) Press 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 Map is available on the PFD by pressing the **TFC Map** Softkey. If no previous maps were displayed on the PFD, a Inset Traffic map will be displayed. If a PFD navigation map was previously displayed either Inset or HSI, pressing the **TFC Map** Softkey will display a traffic map in that location. When a traffic map is displayed the map will be displayed in heading up orientation. Traffic information can also be overlaid with navigation, topographic and optional datalink weather information on navigation maps.

Enabling/disabling Inset Traffic Map:

On the PFD, press the **TFC Map** Softkey.

Or:

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.

Showing the HSI Traffic Map:

1) Press the **Map/HSI** Softkey.
2) Press the **Layout** Softkey.
3) Press the **HSI Trfc** Softkey.

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*	**FAIL**	
** See Table 6-38 for additional failure annunciations*		

Table 6-37 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.

Traffic Map 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 6-38 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*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
NO TRFC DATA	Data is not being received from the traffic unit.
**Shown as symbol on 'Map - Traffic Map' Page* ***Shown in center of 'Map - Traffic Map' Page*	

Table 6-39 Traffic Status Annunciations

6.8 ADS-B TRAFFIC

WARNING: *Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.*

WARNING: *Do not rely solely upon the display of traffic information to accurately depict all of the traffic information within range of the aircraft. Due to lack of equipment, poor signal reception, and/or inaccurate information from other aircraft, traffic may be present but not represented on the display.*

The optional Garmin GTX 345 transponder sends and receives Automatic Dependent Surveillance-Broadcast (ADS-B) traffic information on the 1090 MHz Extended Squitter (1090 ES) frequency. It receives ADS-B traffic and data link weather information on the 978 MHz Universal Access Transceiver (UAT) frequency. The system provides visual annunciations and voice traffic alerts to help the pilot visually acquire potentially conflicting traffic. This discussion covers the traffic features of the GTX transponder; refer to the Flight Information Service-Broadcast (FIS-B) Weather section for more information about the UAT data link weather features of the GTX 345.

ADS-B SYSTEM OVERVIEW

ADS-B is a core technology in the FAA NextGen air traffic control system and is comprised of three segments: ADS-B (Broadcast), ADS-R (Rebroadcast), and Traffic Information Service-Broadcast (TIS-B).

ADS-B is the automatic broadcast of position reports by aircraft, surface vehicles, and transmitters on fixed objects. These broadcasts contain information such as GPS position, identity (Flight ID, Call Sign, Tail Number, ICAO registration number, etc), ground track, ground speed, pressure altitude, and emergency status.

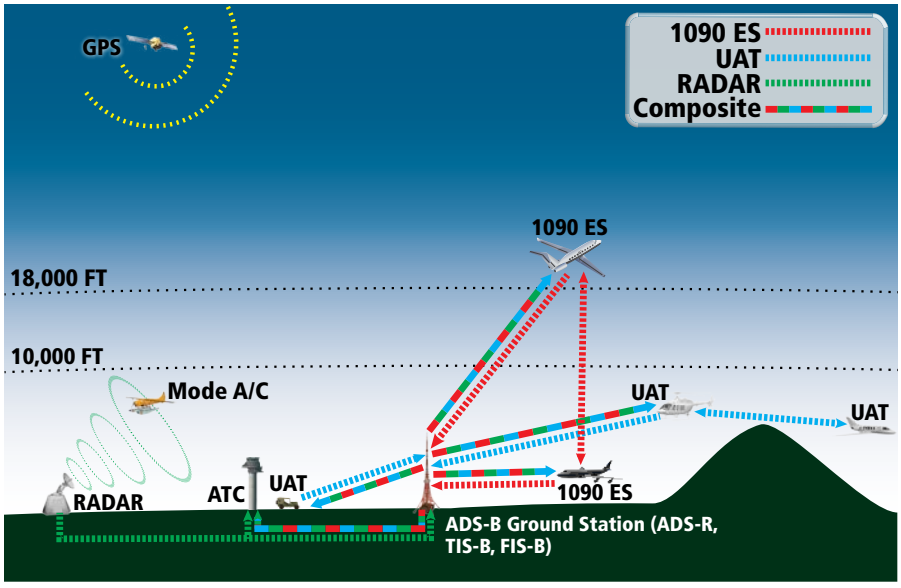


Figure 6-117 ADS-B System

For the purpose of distinguishing between levels of ADS-B service, there are three classifications of aircraft or system capability: ADS-B In, ADS-B Out, and ADS-B participating. ADS-B In refers to the capability to receive ADS-B information. ADS-B Out refers to the capability to transmit ADS-B information. ADS-B participating refers to the capability to both send and receive ADS-B information. Aircraft lacking either ADS-In, ADS-B Out, or both ADS-B capabilities may also be referred to as ADS-B nonparticipating aircraft.

AUTOMATIC DEPENDENT SURVEILLANCE-REBROADCAST (ADS-R)

Because it is not required that ADS-B In capable aircraft be able to receive ADS-B data on both the 1090 MHz and 978 MHz data links, a method exists to get data from one data link to the other. ADS-R is the rebroadcast of ADS-B data by FAA ground stations, which provide this service by taking data from one link and rebroadcasting it on the other. For example, two aircraft are in the service volume for a ground station, and one is transmitting on 1090 MHz and the other on 978 MHz, the ground station retransmits the data from each aircraft on the other link to ensure the two aircraft can "see" each other.

Because the GTX 345R transponder sends and receives ADS-B traffic reports on the 1090 ES frequency, but only receives traffic reports on the 978 MHz UAT frequency, the presence of an ADS-R ground station is necessary for an aircraft with only UAT-capabilities to 'see' the aircraft with the GTX 345R transponder.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

TIS-B provides the bridge between the radar-based ATC system and the ADS-B-based system. When an ADS-B In or Out capable aircraft is within the service volume of an FAA ADS-B ground station, the ground station broadcasts a portion of the ATC radar data to the aircraft. This aircraft is then included in the list of aircraft being provided TIS-B service and is then considered a "TIS-B participant."

TIS-B coverage is available when the aircraft is within ground station coverage, in Secondary Surveillance Radar coverage, and the other aircraft is also in Secondary Surveillance Radar coverage, and is transmitting its altitude.

The ground station provides ATC radar information for other aircraft within ±3,500 feet and 15 NM of the participant, to include altitude, position, ground speed, and ground track. TIS-B broadcasts occur once every three to thirteen seconds, depending on the characteristics of the ground station providing the TIS-B service.

The following table describes the aircraft that are observed by a GTX 345R-equipped aircraft according to the level of equipment installed in the other aircraft.

Other Aircraft Equipment	Viewable by GTX 345R Equipped Aircraft
1090ES Out Equipped	Yes
UAT Receive Only Capable	No
UAT Transmit Equipped	Yes
No Transponder, No ADS-B	No
Non ADS-B Equipped, but with Mode C or S Transponder	Yes*
* *Only when in ADS-B ground station coverage and when the other aircraft is in ATC radar coverage, or own aircraft is equipped with a TAS/TCAS I system and traffic is within the TAS/TCAS I surveillance range.*	

Table 6-40 Aircraft Available for Viewing by an ADS-B Equipped Own Aircraft

ADS-B WITH TAS/TCAS I

When an optional active traffic system, such as a Traffic Advisory System (TAS) or Traffic Alert and Collision Avoidance System (TCAS I) is also installed and operating with the GTX 345R transponder, the transponder receives traffic from the active traffic system and attempts to match (or "correlate") this traffic with ADS-B traffic the transponder is tracking. When a correlation is made, the only the traffic with the most accurate information is displayed to the flight crew. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This correlation of traffic by the transponder improves the accuracy of the traffic displayed, while reducing the occurrence of the same aircraft being displayed twice.

NOTE: *When operating on the edges of ATC radar coverage or when using an optional active traffic system providing intermittent traffic data, a single aircraft may be briefly or periodically depicted as two aircraft on the display.*

CONFLICT SITUATIONAL AWARENESS & ALERTING

Conflict Situational Awareness (CSA) is an alerting algorithm which provides ADS-B traffic alerting similar to the TAS/TCAS I systems discussed previously.

The transponder issues a voice alert when a Traffic Advisory (TA) is displayed, for example "Traffic! Two O'clock, Low, Two Miles."

The own aircraft altitude above terrain determines the sensitivity of the CSA algorithm to minimize nuisance alerts. Radar Altitude (if available), Height Above Terrain, and Geodetic Sea Level (GSL) altitude are used to adjust the sensitivity of the CSA algorithm in accordance with the following table:

Sensitivity Level	Radar Altitude (Feet)	Height Above Terrain (HAT)	GPS Phase of Flight	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (feet)	Protected Volume (NM)
4	Up to 1000 (RA or HAT)	Any	Any	Any	20	850	0.20
4	Unavailable	Any	Any	Any	20	850	0.20
4	Unavailable	Unavailable	Approach	Any	20	850	0.20
5	>1000 <=2350	Any	Any	Any	25	850	0.20
5	Unavailable	>1000 <=2350	Any	Any	25	850	0.20
5	Unavailable	Unavailable	Terminal	Any	25	850	0.20
6	Unavailable or >2350	Unavailable or >2350	Not approach and not Terminal (including unavailable)	<=5000	30	850	0.35
7	Unavailable or >2350	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>5000 <=10,000	40	850	0.55
8	Unavailable or >2350	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>10,000 <=20,000	45	850	0.80
9	Unavailable or >2350	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>20,000 <=42,000	48	850	1.10
10	Unavailable or >2350	Unavailable or >2350	Not approach and not Terminal (including unavailable)	> 42,000	48	1200	1.10

Table 6-41 CSA Alerting Thresholds for ADS-B Traffic

When the system detects a new Traffic Advisory (TA), the following occur:

- The system issues a single ***"Traffic!"*** voice alert, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA (Table 6-40). For example, the announcement "***Traffic! 12 o'clock, high, four miles***," would indicate the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.
- A 'TRAFFIC' annunciation appears to the right of the Airspeed Indicator on the PFD, flashes for five seconds, and remains displayed until no TAs are detected in the area.
- If the PFD Inset Map or HSI Map was already displayed, the traffic is shown on the displayed map. Otherwise the Traffic Map is shown on the PFD.

If the bearing of TA traffic cannot be determined, a yellow text banner will be displayed in the center of the Traffic Map 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 a factor.

Figure 6-118 Traffic Annunciation (PFD)

Bearing	Relative Altitude	Approximate Distance (nm)
"One o'clock" through "Twelve o'clock" or "No Bearing"	"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	"Zero miles", "Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"

Table 6-42 TA Descriptive Voice Announcements

NOTE: *ADS-B traffic voice alerts are suppressed when below 500 feet.*

AIRBORNE AND SURFACE APPLICATIONS

The GTX 345R can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five NM and 1,500 feed above the nearest airport. When the AIRB application is active, the system only displays traffic which is airborne.

The SURF application is on when the aircraft is within five NM and less than 1,500 feet above field elevation. When the SURF applications is on, the system displays airborne and on the ground traffic. At a Traffic Map Page range of one nm or less, the airport environment (including taxiways and runways) appears in addition to traffic. The airport displays are derived from the SafeTaxi database. Refer to the Additional Features section for more information about SafeTaxi displays.

NOTE: *Do not rely on the solely on the traffic display to determine the runway alignment of traffic, especially when runways are in close proximity to each other.*

Due to the varying precision of the data received via ADS-B, ADS-R, and TIS-B services, not all traffic symbols may not be depicted on the traffic display. Because higher data precision is required for traffic to be displayed in the SURF environment, some traffic eligible for AIRB will not be displayed while SURF is on. Availability for AIRB and SURF is depicted on the AUX-ADS-B Status Page, discussed later in this section.

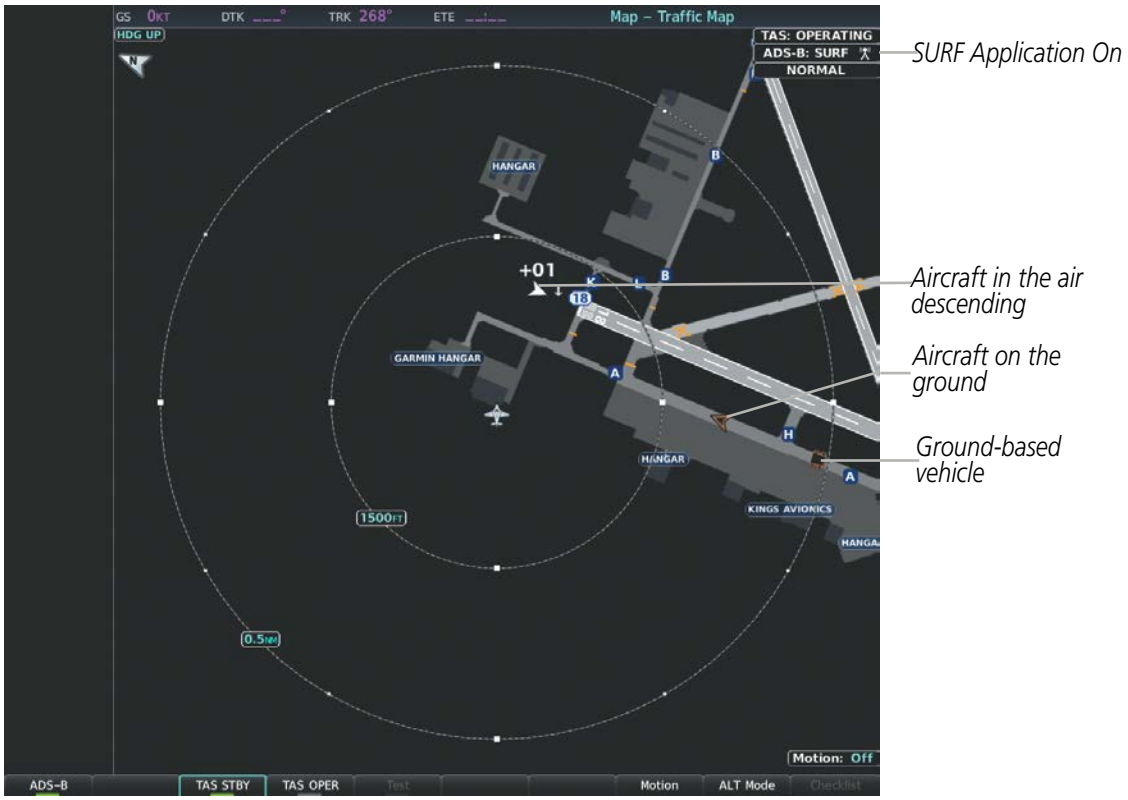


Figure 6-119 'Map - Traffic Map' Page with SURF Mode On

TRAFFIC DESCRIPTION

The symbols used to display ADS-B traffic are shown in Table 6-43. Above or below the traffic symbol is the traffic identifier, and altitude. A small up or down arrow next to the traffic symbol indicates that the traffic is climbing or descending at a rate of at least 500 feet per minute.

Symbol	Description
	Traffic Advisory with directional information. Points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory out of the selected display range with directional information. Displayed at outer range ring at proper bearing.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with directional information. Points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with directional information. Points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with directional information. Points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-43 ADS-B Traffic Symbology

OPERATION

TRAFFIC MAP PAGE

The Traffic Map Page shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick**, as indicated by the map range rings.

The traffic mode and altitude display mode are annunciated in the upper left corner of the page.

Figure 6-120 'Map - Traffic Map' Page with ADS-B Traffic Displayed

Enabling/disabling the display of ADS-B traffic.

1) Select the 'Map - Traffic Map' Page.
2) Press 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.
2) Ensure the **ADS-B** Softkey is disabled.
3) If the optional TAS/TCAS I is installed, ensure the **TAS STBY** Softkey or the **TCAS STBY** Softkey is enabled (Garmin GTS 825/855 Only).
4) 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 PFDs. 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.

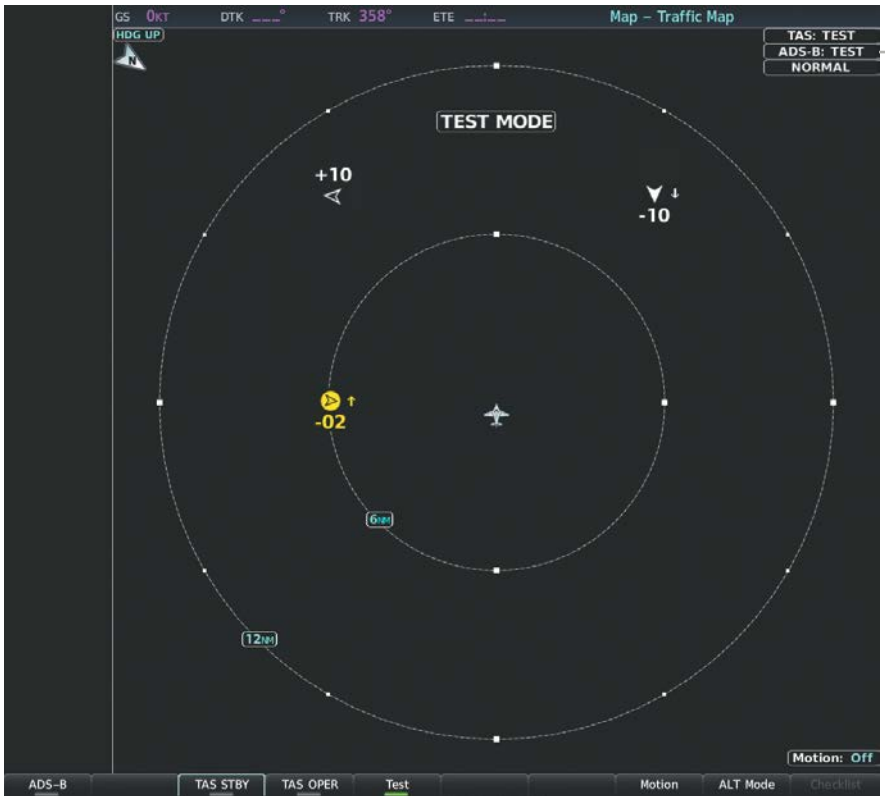


Figure 6-121 'Map - Traffic Map' Page with Test Mode Enabled

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, press the **ALT Mode** Softkey.
2) Press 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, press 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 step 2 above):
   - 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 6-122 'Map - Traffic Map' Page with Absolute Motion Vectors Enabled

Figure 6-123 'Map - Traffic Map' Page with Relative Motion Vectors Enabled

Enabling/disabling the Motion Vector display:

1) Select the 'Map - Traffic Map' Page.
2) Press the **Motion** Softkey.
3) Press one of the following softkeys:
   - **Absolute:** Displays the motion vector pointing in the absolute direction.
   - **Relative:** Displays the motion vector relative to own aircraft.
   - **Off:** Disables the display of the motion vector.

   Or:
1) Select the '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) Press the **Motion** Softkey.
3) Press the **Duration** Softkey.
4) Press a softkey for the desired duration (**30 SEC**, **1 MIN**, **2 MIN**, **5 MIN**).
5) When finished, press 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. The first selected traffic symbol is highlighted in cyan. Additional information appears in a window in the upper-right corner of the 'Map - Traffic Map' Page.
3) To select a different aircraft symbol, turn the **FMS** Knob to move the cyan bracket until the selected aircraft traffic symbol is highlighted.
4) When finished, press the **FMS** Knob again to disable the traffic selection.

Traffic Map Page Display Range

The 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:
   - 750 ft .
   - 750 ft and 1500 ft.
   - 1500 ft and 0.5 nm.
   - 0.5 nm and 1 nm.
   - 1 nm 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. Refer to the previous TAS/TCAS I 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	NO TRK/HDG	
ADS-B Failed*	ADS-B: FAIL	FAILED	
** See Table 6-46 for additional failure annunciations*			

Table 6-44 ADS-B Modes

The 'Traffic Map' Page displays a white antenna icon to indicate the successful reception of ADS-B traffic services from a ground station. A white-X over this icon indicates reception of ADS-B services is unavailable.

ADS-B Ground Station Reception Status	Traffic Map Page Icon
Receiving ADS-B traffic services from a ground station	
Not receiving ADS-B traffic services from a ground station	

Table 6-45 ADS-B 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 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 6-46 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*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
NO TRFC DATA	Data is not being received from the traffic unit.
**Shown as symbol on 'Map - Traffic Map' Page* ***Shown in center of 'Map - Traffic Map' Page*	

Table 6-47 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 6-124 Viewing ADS-B Traffic Status on ADS-B Status Page

ADS-B Status Page Item	Status Message	Description
Traffic Application Status: Airborne (AIRB), Surface (SURF), Airborne Alerts (CSA)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) determine the application should be active. Required input data is available, and it meets performance requirements.
	Not Available	Traffic application is not available. Required input data is available, but it does not meet performance requirements.
	Fault	Traffic application is not available. Required input data is not available or the application has failed.
	Not Configured	Traffic application is not available, because it has not been configured. If this annunciation persists, the system should be serviced.
	----------	Traffic application status is invalid or unknown.
TIS-B/ADS-R Coverage	Available	The system is receiving the ADS-R coverage from an FAA ground station.
	Not Available	The system is not receiving the ADS-R coverage from an FAA ground station.
	----------	ADS-R coverage is invalid or unknown.
GPS Status: GPS Source	External #1	The 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 a number of minutes.

Table 6-48 'AUX-ADS-B Status' Page Messages for ADS-B Traffic

6.9 TCAS II TRAFFIC

WARNING: *Traffic information shown on system displays is provided as an aid in visually acquiring traffic. Traffic avoidance maneuvers are based upon TCAS II Resolution Advisories, ATC guidance, or positive visual acquisition of conflicting traffic.*

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 displays.*

NOTE: *If an optional Collins TCAS II is installed, refer to the applicable Pilot's Guide from the manufacturer for detailed information about that traffic system.*

NOTE: *Failure of the Radar Altimeter will result in the failure of TAS/TCAS II Traffic System.*

A Traffic Alert and Collision Avoidance System II (TCAS II) improves flight safety by monitoring the airspace for other aircraft with operating transponders in the vicinity. The TCAS II system provides traffic information to the displays, and if separation from other aircraft is within certain limits, the system issues Traffic Advisories (TAs) to assist the flight crew in the visual acquisition of traffic, or Resolution Advisories (RAs) to provide recommended vertical guidance maneuvers to resolve a traffic conflict.

THEORY OF OPERATION

When the TCAS II system is operating in TA/RA or TA Only Mode, the system interrogates the transponders of other aircraft in the vicinity, and monitors for replies from these transponders. Based on successive replies, the system tracks the range, bearing, and if reported, the altitudes of other aircraft. For each detected aircraft transponder, the system calculates the time to, and separation at, the closest point of approach (CPA) around potential collision area surrounding own aircraft. Based on this time, the own aircraft altitude, and the selected TCAS II system mode, the system determines if a TA or RA should be issued for the detected intruder traffic.

Altitude in Feet*	TA Time to CPA in Seconds	RA Time to CPA in Seconds
Up to 1000	20	*RA not issued below 1000' AGL*
1000-2350	25	15
2350-5000	30	20
5000-10000	40	25
10000-20000	45	30
20000 and above	48	35

* System uses pressure altitude except when Radar Altimeter altitude is displayed on the PFDs, in which case Radar Altitude takes precedence.

Table 6-48 Altitude-based TCAS II TA and RA Alert Thresholds

The TCAS II system categorizes detected traffic into four groups of increasing threat potential:

- Other Non-Threat Traffic, displayed as a hollow white diamond, is not currently a threat.
- Proximity Advisory (PA) Traffic, displayed as a filled white diamond, is not currently a threat, but is within six nm and ±1200 feet of own-aircraft altitude.
- Traffic Advisory (TA), displayed as a filled amber circle, indicates traffic is within 20-48 seconds of a potential collision area. If a Traffic Map is shown, and the TA traffic is beyond the selected map range, the system displays a half-TA symbol at the edge of the map at the approximate relative bearing of the TA traffic. If TA traffic subsequently meets the criteria for an RA, the system will issue an RA.
- Resolution Advisory (RA), displayed as a filled red square, indicates traffic is within 15-35 seconds of a potential collision area. If a Traffic Map is shown, and the RA traffic is beyond the selected map range, the system displays a half-RA symbol at the edge of the map at the approximate relative bearing of the RA traffic.

Traffic Symbol	Description
	Other Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale
	Resolution Advisory (RA)
	Resolution Advisory Off Scale

Table 6-49 TCAS II Traffic Symbol Description

TCAS II ALERTS

When the TCAS II unit issues a TA or RA, the following occur:

- The TCAS II system issues a voice alert.
- A 'TRAFFIC' annunciation appears above the Roll Scale on the PFDs, flashes for five seconds, and remains displayed until no TAs or RAs are detected in the area. RA TRAFFIC annunciations are white text with red backgrounds; TA 'TRAFFIC' annunciations are black text with amber backgrounds. If a TA and RA occur simultaneously, only the red and white RA 'TRAFFIC' annunciation is shown.
- If the PFD Inset Map or HSI Map was already displayed, the traffic is shown on the displayed map. Otherwise the Traffic Map is shown on the PFDs.

- During an RA only, voice alert(s) provide vertical guidance to resolve the traffic conflict. The Vertical Speed Indicator displays a range of vertical speeds to fly to or avoid as applicable. Additional voice alerts may occur to denote changes in the RA status, as necessary.

Figure 6-125 Traffic Annunciation with Resolution Advisory (PFD)

RESOLUTION ADVISORIES

Resolution Advisories (RAs) include recommended vertical guidance maneuvers to be flown in order to resolve a traffic conflict. If other aircraft involved in the RA encounter are also equipped with a TCAS II system, the traffic systems coordinate the recommended maneuvers using the Mode S data link in order to produce complimentary responses to resolve the RA. While an RA is occurring, the system monitors the status, and if necessary, strengthens, weakens, reverses the RA, or declares the aircraft is clear of the traffic conflict.

RAs are categorized into the preventive and corrective types.

Preventive RAs

The system issues a preventive RA to indicate the present vertical speed will resolve the traffic conflict. The system indicates a range of vertical speeds to be avoided, indicated by one or more red bands inside the VSI. The current vertical speed is outside of the avoidance area during a preventive RA.

Preventive RA Type	Required Vertical Speed (fpm)
Do Not Climb	< 0
Do Not Climb > 500 fpm	< 500
Do Not Climb > 1000 fpm	< 1000
Do Not Climb > 2000 fpm	< 2000
Do Not Descend	> 0
Do Not Descend > 500 fpm	> -500
Do Not Descend > 1000 fpm	> -1000
Do Not Descend > 2000 fpm	> -2000

Table 6-50 Preventive RA Types with Required Vertical Speeds

CORRECTIVE RA

A corrective RA indicates the current vertical speed must be changed to resolve a traffic conflict. The VSI indicates a range of vertical speeds to be avoided on the VSI, and the current vertical speed appears in white with a red background. The VSI also indicates a green "fly to" vertical speed range to be flown in order to resolve the RA conflict. In some cases, the TCAS II system logic determines it will be necessary to for own aircraft to cross through the intruder aircraft's altitude to resolve the traffic conflict.

Corrective RA Type	Required Vertical Speed (fpm)
Climb	1500 to 2000
Crossing Climb	
Crossing Maintain Climb	1500 to 4400
Maintain Climb	
Reduce Descent	0
Descend	-1500 to -2000
Crossing Descend	
Crossing Maintain Descent	-1500 to -4400
Maintain Descent	
Reduce Climb	0

Table 6-51 Corrective RA Types with Required Vertical Speeds

TCAS II VOICE ALERTS FOR TRAFFIC

The table below lists the voice alerts the TCAS II system issues in the course of a TA or RA.

Alert Type	Voice Alert
TA	*"Traffic, Traffic"*
Climb RA	*"Climb, Climb"*
Descend RA	*"Descend, Descend"*
Altitude Crossing Climb RA	*"Climb, Crossing Climb; Climb, Crossing Climb"*
Altitude Crossing Descend RA	*"Descend, Crossing; Descend; Descend, Crossing; Descend"*
Reduce Climb RA	*"Level Off, Level Off"*
Reduce Descent RA	*"Level Off, Level Off"*
RA Reversal to Climb RA	*"Climb, Climb NOW; Climb, Climb NOW"*
RA Reversal to Descend RA	*"Descend, Descent NOW; Descend, Descend NOW"*
Increase Climb RA	*"Increase Climb, Increase Climb"*
Increase Descent RA	*"Increase Descent, Increase Descent"*
Maintain Rate RA	*"Maintain Vertical Speed, Maintain"*
Altitude Crossing, Maintain Rate RA (Climb and Descend)	*"Maintain Vertical Speed, Crossing Maintain"*
Weakening of RA	*"Level Off, Level Off"*
Preventive RA	*"Monitor Vertical Speed"*
RA Removed	*"Clear of Conflict"*

Table 6-52 TCAS II RA Voice Alerts

Corrective Climb

Corrective Descend

Preventive Don't Climb

Preventive Don't Descend

Preventive Don't Climb and Don't Descent Greater than 500 FPM

Level Off, Level Off

Figure 6-126 Example Resolution Advisory Displays

SYSTEM TEST

The TCAS II system can be tested using softkeys on the PFD or MFD.

Testing the TCAS II system on the PFD:

1) Press the **XPDR/TFC** Softkey.
2) Press the **TCAS** Softkey.
3) Press the **Test** Softkey.

Testing the TCAS II system on the MFD:

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 traffic test pattern display.
4) Press the **Test** Softkey.

   Or:

   a) Press the **MENU** Key
   b) Turn the small **FMS** knob to select 'Test Mode'.
   c) Press the **ENT** Key.

During a TCAS II system test, the system displays a traffic test pattern appears on the 'Map - Traffic Map' Page of the MFD, and on the PFD Inset Traffic Map (which appears if not already displayed.) The PFD displays a Resolution Advisory (RA) alert annunciation, and vertical speed indicator indicating not to descend, and not to climb greater than 2000 feet per minute. The system test takes approximately eight seconds to complete.

Condition	Voice Alert
System Test Passed	"TCAS Two System Test Passed"
System Test Failed	"TCAS Two System Test Failed"

Table 6-53 Garmin GTS 8000 System Test Voice Alerts

Visual annunciations will also indicate a system test has failed.

PFD *MFD 'Map - Traffic Map' Page*

Figure 6-127 TCAS II System Test Displays

OPERATION

To display TCAS II Traffic, the system must be in TA Only or TA/RA Mode. These modes can be accessed on the PFD or on the 'Map - Traffic Map' Page of the MFD.

Switching from standby mode to TA Only or TA/RA mode on the MFD:

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) Select the **TA Only** Softkey or the **TA/RA** Softkey

   Or:

   a) Press the **MENU** Key.
   b) Turn the small **FMS** knob to select 'TA Only Mode' or 'TA/RA Mode'.
   c) Press the **ENT** Key. The unit switches from Standby Mode to TA Only or TA/RA Mode as necessary.

Switching from standby mode to TA Only or TA/RA mode on the PFD:

1) Press the **XPDR/TFC** Softkey.
2) Press the **MODE** Softkey.
3) Press the **TA Only** Softkey or the **TA/RA** Softkey

Switching from TA Only or TA/RA mode to standby mode:

On the MFD:

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 **TFC STBY** Softkey

Or:

a) Press the **MENU** Key.

b) Turn the small **FMS** knob to select 'Traffic Standby Mode'.

c) Press the **ENT** Key.

NOTE: *The GTS 8000 TCAS II system automatically selects TA ONLY Mode when the aircraft is below 1000' AGL. After landing, the GTS 8000 automatically selects STANDBY Mode.*

TRAFFIC MAP PAGE

The 'Map - Traffic Map' Page shows surrounding TCAS II traffic data in relation to the aircraft's current position and altitude, without basemap clutter. It is the principal map page for viewing TCAS II traffic. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick** from 2 to 40 nm, as indicated by the map range rings.

The traffic operating mode and altitude display mode are annunciated in the upper left corner of the 'Map - Traffic Map' Page.

Figure 6-128 'Map - Traffic Map' Page for TCAS II

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) Press the **TA Only** Softkey or the **TA/RA** Softkey to begin displaying traffic. 'TA ONLY' or 'TA/RA' is displayed in the Traffic mode field.
4) Press the **Relative** or **Absolute** Softkey to display the relative or absolute altitude of other aircraft. When absolute altitude is displayed, the system may revert to displaying relative altitude after 30 seconds if the TCAS II system is providing altitude which is not corrected for the local barometric pressure setting.
5) Press the **TFC STBY** Softkey to place the system in the Standby mode. 'STANDBY' is displayed in the Traffic mode field.
6) Turn the **Joystick** clockwise to display a larger area or counter-clockwise to display a smaller area.

Altitude Display

The flight crew can select the volume of airspace in which Other Non-Threat and proximity traffic is displayed. Traffic Advisories (TAs) and Resolution Advisories (RAs) outside of these limits will always be shown.

Changing the traffic altitude display range on the PFD:

1) Press the **XPDR/TFC** Softkey.
2) Press the **TCAS** Softkey.
3) Press the **ALT RNG** Softkey.
4) Press one of the following altitude range 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 detected traffic in the air is displayed.
5) Press the **Back** Softkey.

Changing the traffic altitude display range on the MFD:

1) On the 'Map - Traffic Map' Page, select the **ALT RNG** Softkey.
2) Press one of the following Softkeys (see softkey description in step 4 above):
   - **Below**
   - **Normal**
   - **Above**
   - **UNREST**
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 step 4 above):
   - Above.
   - Normal.
   - Below.
   - Unrestricted.
3) Press the **ENT** Softkey.

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** from 2 to 40 nm, 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:
   - 750 ft.
   - 750 ft and 1500 ft.
   - 1500 ft and 0.5 nm.
   - 0.5 nm and 1 nm.
   - 1 nm and 2 nm.
   - 2 and 6 nm.
   - 6 and 12 nm.
   - 12 and 24 nm.
   - 24 and 40 nm.

ADDITIONAL TRAFFIC DISPLAYS

Traffic information can be displayed on the following maps on the MFD when the unit is operating:

- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Traffic information can also be displayed on the PFD when the Synthetic Vision Technology (SVT) option is installed and enabled. See the Flight Instruments Section for details.

Displaying traffic information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **Traffic** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the 'Map - Traffic Map' Page, a traffic icon is shown to indicate traffic is enabled for display.

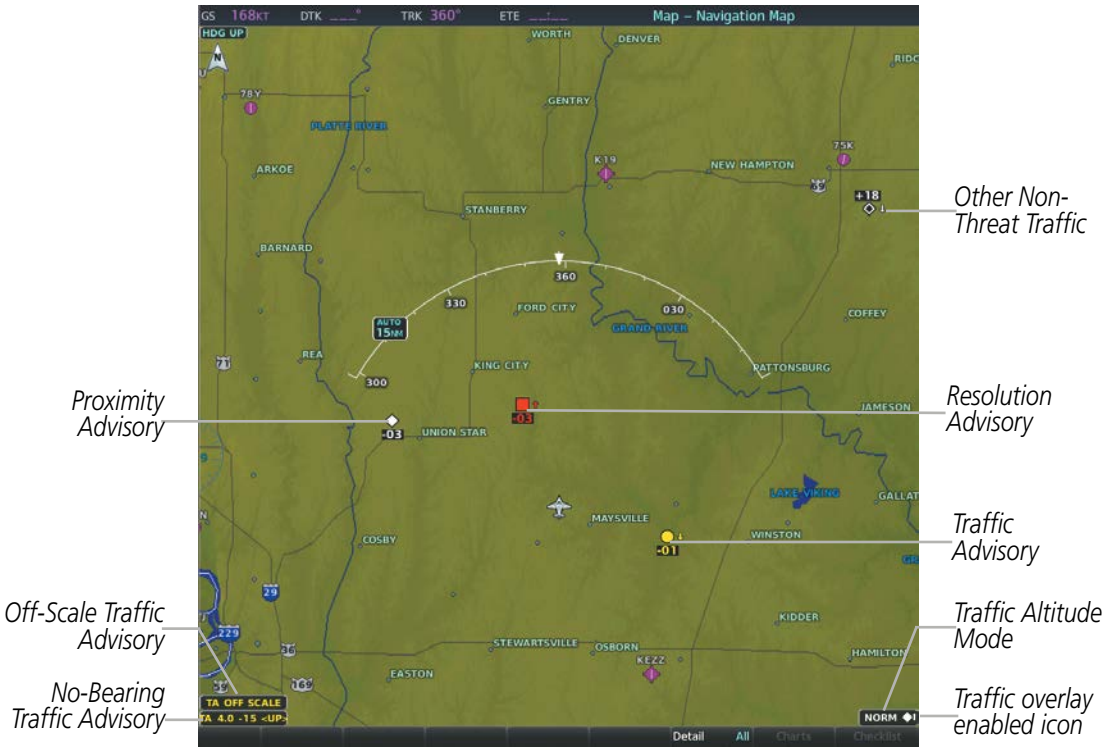


Figure 6-129 TCAS II Traffic on the 'Map - Navigation Map' Page

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/RA/PA - Displays Traffic Advisories, Resolution Advisories, and Proximity Advisories.
     - TA/RA Only - Displays Traffic Advisories and Resolution Advisories only.
   - Traffic Symbols – Selects the maximum range at which traffic symbols are shown.
   - Traffic Labels – Selects the maximum range at which traffic labels are shown with the option to turn off.
6) Turn the small **FMS** Knob to scroll through options (On/Off, range settings, etc.).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the '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 Traffic Map Page use settings based on those selected for the 'Map - Navigation Map' Page.

Traffic information can also be displayed on the PFD by pressing the **TFC Map** Softkey. A traffic map will appear in heading up orientation. Traffic information can also be overlaid with navigation, topographic and optional datalink weather information.

Enabling/disabling the traffic overlay on the PFD inset navigation map:

1) Press the **Map Opt** Softkey.
2) Press the **Traffic** Softkey to enable/disable the display traffic information on the Inset Map or HSI Map.
3) When finished, press the **Back** Softkey.

SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the 'Map - Traffic Map' Page.

Operating Mode	PFD Annunciation	Traffic Map Mode Annunciation	Traffic Display Status Icon (Other Maps)
TCAS II Self-test Initiated (TEST)	None	**TEST** ('TEST MODE' also shown in white on top center of page)	
Traffic Advisory and Resolution Advisory (TA/RA)	None	**TA/RA**	
Traffic Advisory Only (TA ONLY)	TA ONLY	**TA ONLY**	
TCAS II Standby (Shown if Altitude Reporting, On, or Standby Mode Selected), or after landing or on-ground power up.	On the ground: TCAS STBY In the air: TCAS STBY	**STANDBY** (also shown in white in center of page on ground, amber in the air)	
TCAS II Failed*	TCAS FAIL	**NO DATA** or **DATA FAILED** or **UNIT FAILED**	
** See Table 6-55 for additional failure annunciations.*			

Table 6-54 TCAS II Modes

If the traffic system fails, an annunciation as to the cause of the failure is shown in the center of the 'Map - Traffic Map' Page.

Traffic Map Center Banner Annunciation	Description
NO DATA	Data is not being received from the TCAS II unit.
DATA FAILED	Data is being received from the TCAS II unit, but the unit is self-reporting a failure.
TCAS FAIL	Incorrect data format received from the TCAS II unit.

Table 6-55 TCAS II Failure Annunciations on the 'Map - Traffic Map' Page

When the display of traffic information is enabled on navigation maps, the following annunciations may appear in the lower left corner of these maps.

Traffic Status Banner Annunciation	Description
RA OFF SCALE	A Resolution Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
RA X.X ± XX <UP> or <DN>	System cannot determine bearing of Resolution Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend <UP> for climbing <DN> for descending traffic, if altitude trend is available.
TA X.X ± XX <UP> or <DN>	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend <UP> for climbing or <DN> for descending traffic, if altitude trend is available.
TCAS FAIL	TCAS II unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
NO TCAS DATA	Data is not being received from the TCAS II unit.

**Shown as symbol on 'Map - Traffic Map' Page*
***Shown in center of 'Map - Traffic Map' Page*

Table 6-56 TCAS II Traffic Status Annunciations

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SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS OVERVIEW

NOTE: The current version of the pertinent flight manual always supersedes this Pilot's Guide.

The Garmin Automatic Flight Control System (AFCS) is a digital, fully integrated within the system avionics architecture. The System Overview section provides a block diagram to support this system description. Garmin AFCS functionality is distributed across the following Line Replaceable Units (LRUs):

- GDU 1050A (2) PFD
- GDU 1550 (1) MFD
- GIA 64E (2) or GIA 63W (2) (Optional) IAUs
- GSA 80 (4) Roll, Pitch, Yaw, and Pitch-Trim Servos (3)
- GSM 85A / GSM 86 (4) Servo Gearboxes

The Garmin AFCS can be divided into these main operating functions:

- **Flight Director (FD) —** The aircraft has two flight directors, each operating within an IAU and referred to as pilot-side and copilot-side. Commands for the selected flight director are displayed on both PFDs. 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 Pitch Trim (MEPT) —** The pitch trim servo provides manual electric pitch trim capability when the autopilot is not engaged.

BASIC AUTOPILOT OPERATION

This section provides an overview for autopilot engagement and disengagement. A more detailed description follows in Section 7.5.

- **Autopilot Engagement —** The autopilot may be engaged by pushing the **AP** Key on the AFCS Controller. 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/YD DISC** Switch, which is located on the control stick. 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 Controller.
  - Pressing the **GA** Switch (located on the left throttle).
  - Operating the **MEPT** Switch (located on each control wheel).
  - Pulling the autopilot circuit breaker.
  - In the event of unexpected autopilot behavior, pressing and holding the **AP/YD DISC** Switch will disconnect the autopilot and remove all power to the servos.

7.2 AFCS CONTROLS

AFCS CONTROLLER

The AFCS Controller is positioned above the MFD, and has the following controls:

(1)	**HDG Key**	Selects/deselects Heading Select Mode.
(2)	**APR Key**	Selects/deselects Approach Mode.
(3)	**NAV Key**	Selects/deselects Navigation Mode.
(4)	**FD Key**	Activates/deactivates the flight director only. Pressing once turns on the selected flight director in the default vertical and lateral modes. Pressing again deactivates the flight director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
(5)	**XFR Key**	Transfers between the pilot and copilot flight directors and controls which flight director the autopilot is tracking.
(6)	**ALT Key**	Selects/deselects Altitude Hold Mode.
(7)	**VS Key**	Selects/deselects Vertical Speed Mode.
(8)	**FLC Key**	Selects/deselects Flight Level Change Mode.
(9) (17)	**CRS Knobs**	Adjust the Selected Course (while in VOR, LOC, or OBS Mode) in 1° increments on the Horizontal Situation Indicator (HSI) of the corresponding PFD. Press to re-center the Course Deviation Indicator (CDI) and return course pointer directly TO the bearing of the active waypoint/station.
(10)	**SPD Key**	Toggles Airspeed Reference between IAS and Mach for Flight Level Change Mode.
(11)	**NOSE UP/DN Wheel**	Adjusts the reference in Pitch Hold, Vertical Speed, and Flight Level Change modes.
(12)	**VNV Key**	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control.
(13)	**ALT SEL Knob**	Controls the Selected Altitude in 100-ft increments (a finer resolution of 10 feet is available under approach conditions).
(14)	**YD Key**	Engages/disengages the yaw damper.
(15)	**AP Key**	Engages/disengages the autopilot.
(16)	**BANK Key**	Manually selects/deselects Low Bank Mode.
(18)	**BC Key**	Selects/deselects Backcourse Mode.
(19)	**HDG Knob**	Adjusts the Selected Heading and bug in 1° increments on the HSI (both PFDs). Press to synchronize the Selected Heading to the current heading on the pilot-side PFD.

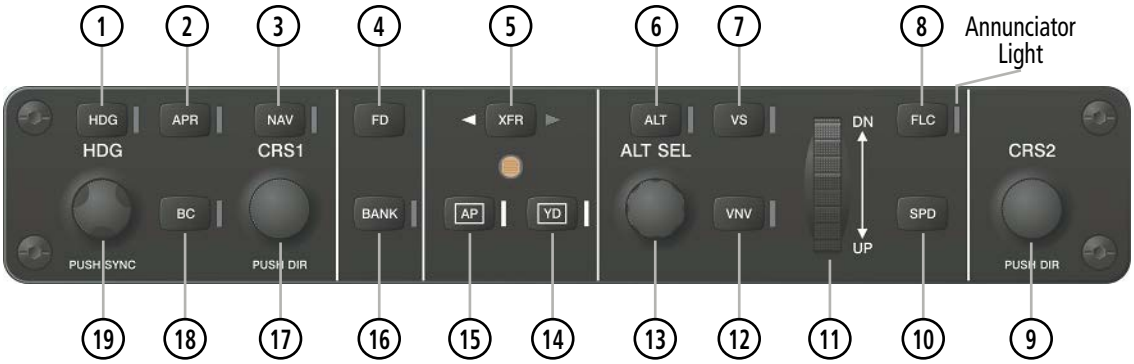


Figure 7-1 GMC 710 AFCS Control Unit

ADDITIONAL AFCS CONTROLS

The following AFCS controls are located separately from the AFCS Controller:

AP/YD DISC TRIM INTRPT Switch (Autopilot Disconnect/ Trim Interrupt)	Disengages the autopilot, yaw damper, and flight director and interrupts pitch trim operation. An **AP/YD DISC** Switch is located on each control wheel. This switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.
CWS Button (Control Wheel Steering)	While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in a Vertical Navigation, Glideslope, or Glidepath Mode) and roll (if in Roll Hold Mode). A **CWS** Button is located on each control wheel. Upon release of the **CWS** Button, the flight director may establish new pitch and roll references, depending on the current vertical and lateral modes. CWS operation details are discussed in the respective mode sections of this manual.
GA Button (Go Around)	Selects flight director Takeoff (on ground) or Go Around (in air) 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. Unless a compatible lift computer is installed, pressing the **GA** Button disengages the autopilot. The **GA** Button is located on the left throttle.
MEPT Switch (Manual Electric Pitch Trim)	Used to command manual electric pitch trim. An **MEPT** Switch is located on each control wheel. The pilot side **MEPT** Switch has priority over the copilot side **MEPT** Switch. This composite switch is split into left and right sides. The left switch is the ARM contact and the right switch controls the DN (forward) and UP (rearward) contacts. Pushing the **MEPT** ARM Switch disengages the autopilot, if currently engaged, but does not affect yaw damper operation. The **MEPT** ARM Switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone. Manual trim commands are generated only when both sides of the switch are operated simultaneously. If either side of the switch is active separately for more than three seconds, MEPT function is disabled and 'PTRM' is displayed as the AFCS Status Annunciation on the PFDs. The function remains disabled until both sides of the switch are inactivated.

7.3 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFDs. With the flight director active, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (–15°, +20°) and roll (25°) angles, vertical acceleration, and roll rate are limited to values established during AFCS certification. The flight director also provides commands to the autopilot.

NOTE: *If the sensor information (other than attitude) required for a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis.*

NOTE: *If the attitude information required for the default flight director modes becomes invalid or unavailable, the autopilot automatically disengages.*

ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in following table (when the flight director is not active) activates the pilot-side flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the displays by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GA Button	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
FLC Key	Roll Hold (default)	ROL	Flight Level Change	FLC
VNV Key	Roll Hold (default)	ROL	Vertical Path Tracking*	VPTH
NAV Key	Navigation**	GPS VOR LOC	Pitch Hold (default)	PIT
BC Key	Backcourse***	BC	Pitch Hold (default)	PIT
APR Key	Approach**	GPS VOR LOC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT

*Valid VNV flight plan must be entered before **VNV** Key press activates flight director.
The selected navigation receiver must have a valid VOR or LOC signal or active GPS course before ***NAV* or ***APR*** Key press activates flight director.
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 PFDs 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. Mode keys on the AFCS controller are accompanied by annunciator lights which are illuminated when their respective modes are armed or active.

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation, when the **FD** Key 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 amber 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.

FLIGHT DIRECTOR SELECTION

The Garmin AFCS has two flight directors, each operating within an Integrated Avionics Unit (IAU). The autopilot follows the selected flight director only, indicated by an arrow pointing toward either the pilot or copilot side, in the center of the AFCS Status Box. Flight directors may be switched by pressing the **XFR** Key. The annunciator light arrow for the selected flight director is also illuminated beside the **XFR** Key. When the flight directors are switched, the vertical and lateral modes revert to default.

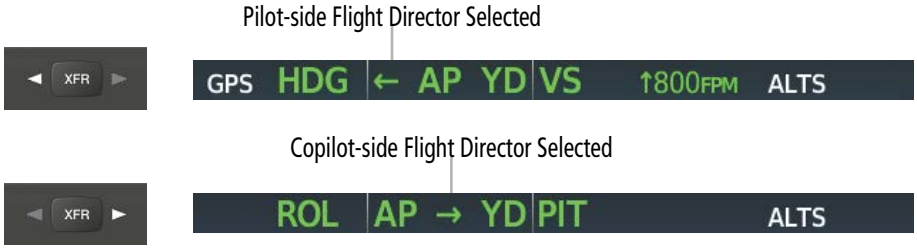


Figure 7-4 Flight Director Selection Indications

COMMAND BARS

SINGLE-CUE

Upon activation of the flight director, Command Bars are displayed in magenta on the PFDs as a single cue or cross pointers. The Aircraft Symbol (in amber) changes to accommodate the Command Bar format; the Command Bars do not override the Aircraft Symbol. The single-cue Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.

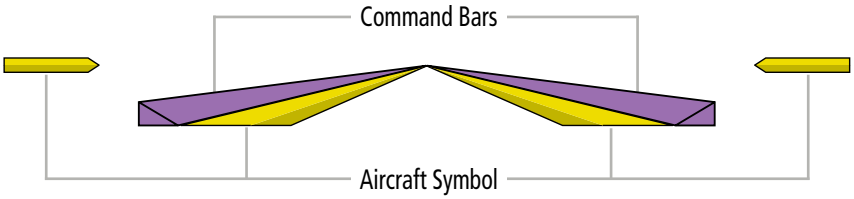


Figure 7-5 Single-cue Command Bars

CROSS-POINTER

Command Bars displayed as a cross pointer move independently to indicate pitch (horizontal bar) and roll (vertical bar) commands. Both PFDs show the same Command Bar format. If a compatible lift computer is installed, the cross-pointer option will be unavailable.

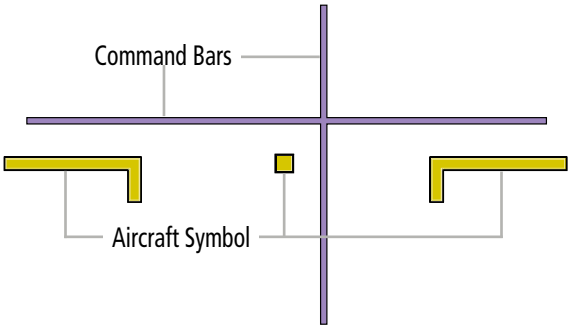


Figure 7-6 Cross-pointer Command Bars

Changing Command Bar format:

1) Use the **FMS** Knob to select the 'Aux - System Setup' Page on the MFD.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight 'Format Active' in the 'Flight Director' box.
4) Turn the small **FMS** Knob to highlight the desired format.

   'Single Cue' to display Command Bars as a single cue.

   Or:

   'X Pointer' to display Command Bars as a cross-pointer.

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°.

7.4 AFCS MODES

The AFCS is capable of operating in a variety of independent Vertical Modes, Lateral Modes, and a 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. Increments of change and acceptable ranges of values for each of these references using the **NOSE UP/DN** Wheel are also listed in the table.

Vertical Mode	Description	Control	Annunciation		Reference Range	Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT		-15° to +20°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS			
Altitude Hold	Holds the current Altitude Reference	**ALT** Key	ALT	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	-4000 to +4000 fpm	100 fpm
Flight Level Change, IAS Hold	Maintains the current aircraft airspeed (in IAS or Mach) while the aircraft is climbing/descending to the Selected Altitude	**FLC** Key	FLC	nnn KT	100 to 259 kt	1 kt
Flight Level Change, Mach Hold			FLC	M .nnn	M 0.15 to 0.52	M 0.01

*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) or switched (the **XFR** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the 'PIT' annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

Changing the Pitch Reference

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the **NOSE UP/DN** Wheel.
- Pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button.

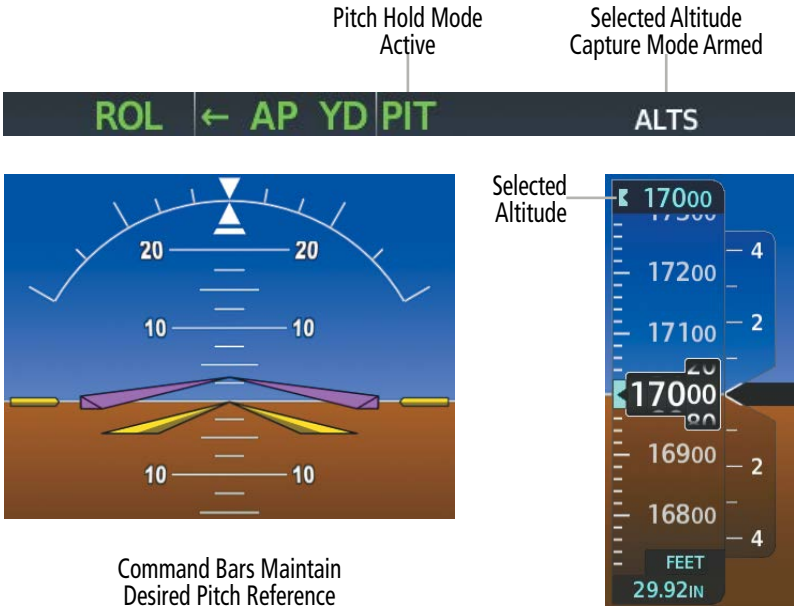


Figure 7-7 Pitch Hold Mode

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
» Takeoff/Go Around (if the Selected Altitude is at least 400 feet above the current aircraft altitude)
» 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 SEL** 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.

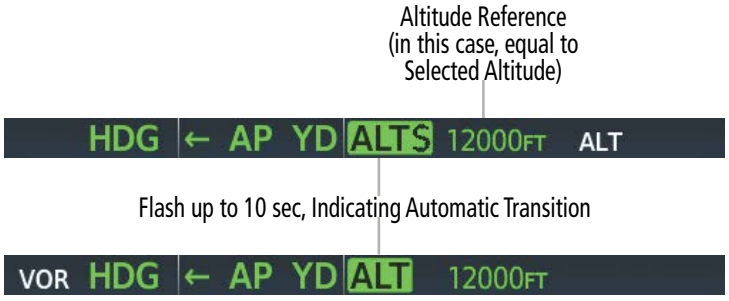


Figure 7-8 Automatic Mode Transitions During Altitude Capture

Changing the Selected Altitude

***NOTE:** Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.*

Use of the **ALT SEL** 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 SEL 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/DN** Wheel.
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Altitude Reference, then releasing the **CWS** Button at the desired altitude (the new altitude is now the Altitude Reference).

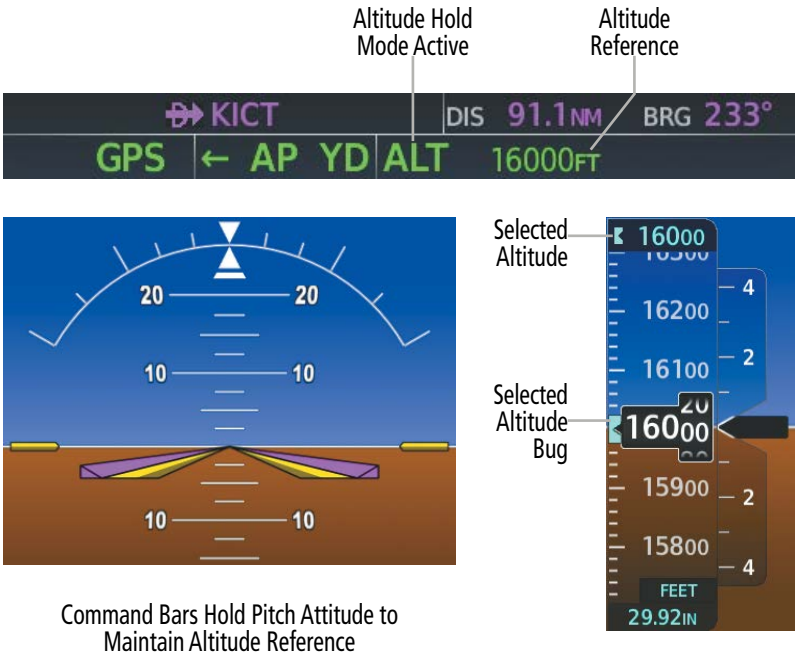


Figure 7-9 Altitude Hold Mode

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/DN** Wheel.
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button.

NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the CWS Button must be pressed again after the Selected Altitude is reached.*

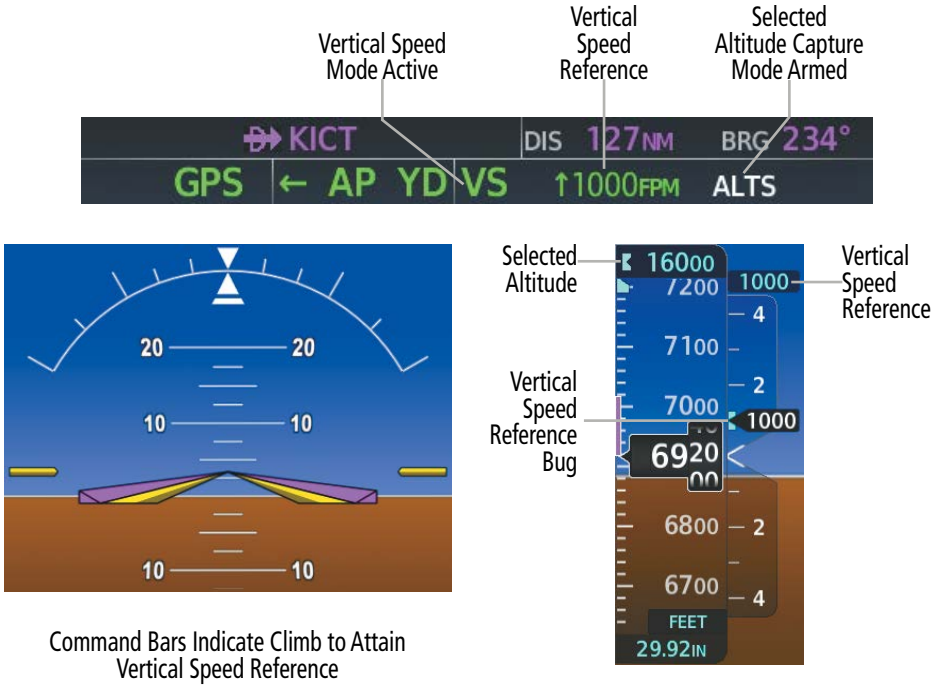


Figure 7-10 Vertical Speed Hold Mode

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 (in IAS or Mach) 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, Mach, and altitude.

The Airspeed Reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by a green 'FLC' annunciation beside the Airspeed Reference in the AFCS Status Box. The Airspeed Reference is also displayed directly above the Airspeed Indicator, along with a bug corresponding to the Airspeed Reference along the tape.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The flight director maintains the current altitude until either engine power or the Airspeed Reference are adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

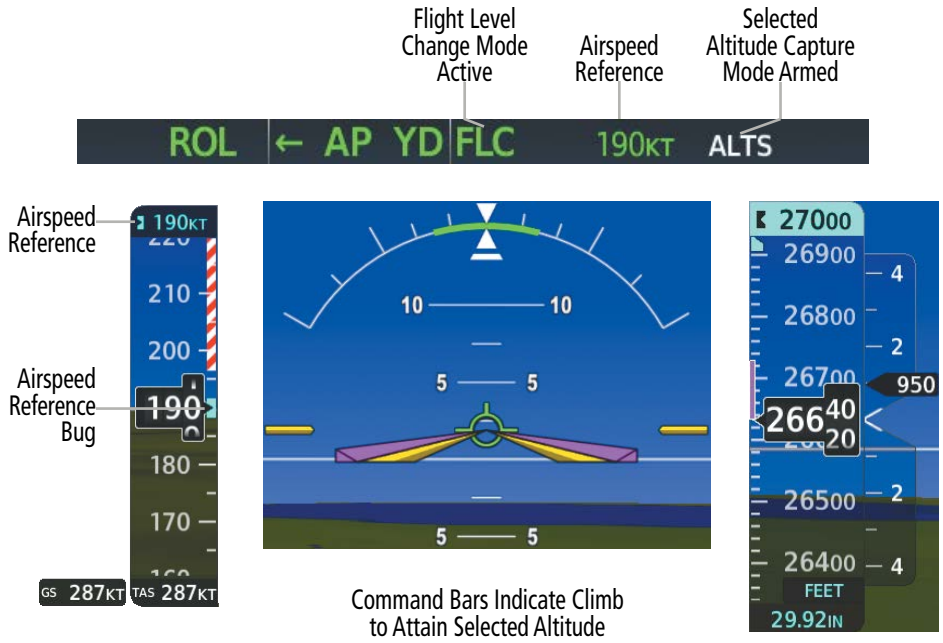


Figure 7-11 Flight Level Change Mode (IAS)

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/DN** Wheel.
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the **CWS** Button.

NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Airspeed Reference is not changed. To adjust the Airspeed Reference in this case, the CWS Button must be pressed again after the Selected Altitude is reached.*

Switching Between Indicated and Mach Airspeed

During climb, the pilot must select the Airspeed Reference (IAS or Mach), automatic switching does not occur. For descent, if Mach airspeed reference is selected (above 16,000 ft), the aircraft descends in Mach until the Mach airspeed reference reaches 250 KIAS, at which point the airspeed reference automatically switches to IAS at that airspeed value. The system determines aircraft climb or descent by the relationship between the current and Selected altitudes.

Airspeed Reference units can be manually toggled between IAS and Mach units using the **SPD** Key. When the FLC Airspeed Reference is displayed in Mach, the Airspeed Reference Bug is displayed on the Airspeed Indicator at the IAS corresponding to the selected Mach target speed and the current Mach number is shown only in the AFCS Status Box.

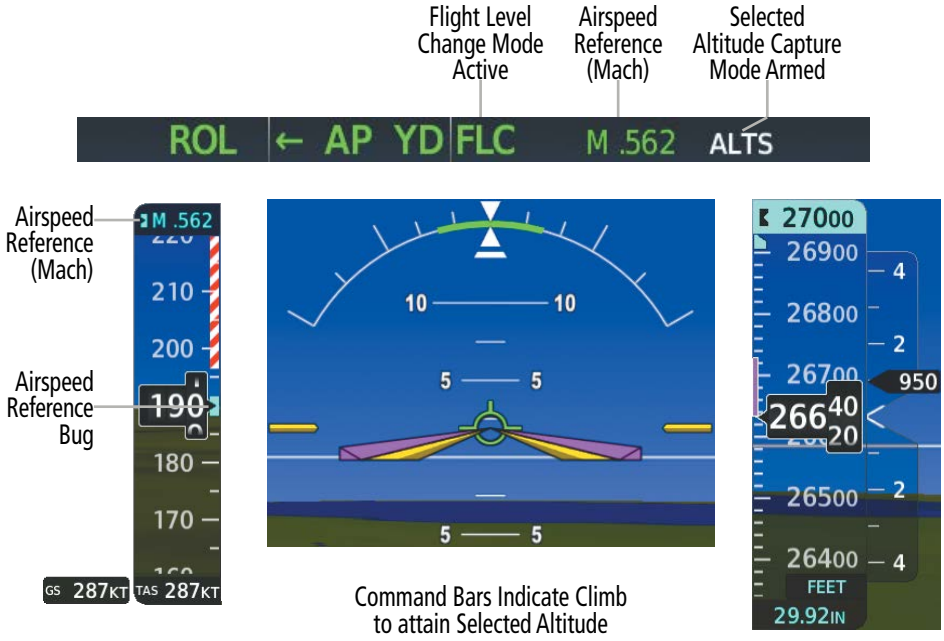


Figure 7-12 Flight Level Change Mode (Mach)

LATERAL MODES

The following table relates each lateral mode to its respective control and annunciation. Refer to the combination modes section for information regarding Takeoff and Go Around modes.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	25°
Low Bank	Limits the maximum commanded roll angle	**BANK** Key	*	15°
Heading Select	Captures and tracks the Selected Heading	**HDG** Key	HDG	25°
Navigation, GPS Arm/Capture/Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	25°
Navigation, VOR Enroute Arm/Capture/Track			VOR	25°
Navigation, LOC Arm/Capture/Track (No Glideslope)			LOC	25°

* No annunciation appears in the AFCS Status Box. The acceptable bank angle range is indicated in green along the Roll Scale of the Attitude Indicator.

Table 7-3 Flight Director Lateral Modes

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 7-13 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 25°	Maintains current aircraft roll attitude
> 25°	Limits bank to 25°

Table 7-4 Roll Hold Mode Responses

Changing the Roll Reference

The roll reference can be changed by pressing the **CWS** Button, establishing the desired bank angle, then releasing the **CWS** Button.

Figure 7-14 CWS Annunciation

LOW BANK MODE

When in Low Bank Mode, the flight director limits the maximum commanded roll angle to 15°. Low bank arc limits are displayed in green along the Roll Scale.

Low Bank Mode can be manually selected/deselected by pressing the **BANK** Key while in Heading Select or Navigation Modes (GPS and VOR). Low Bank Mode is activated automatically above 20,500 feet. The flight director deactivates Low Bank Mode when descending through 20,500 feet. The annunciator light next to the **BANK** Key illuminates while Low Bank Mode is selected.

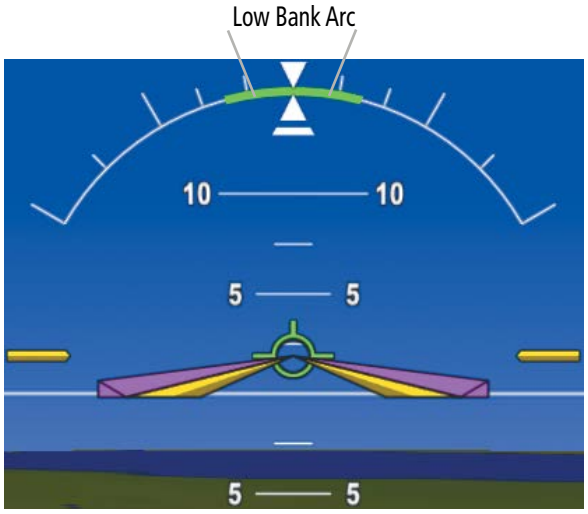


Figure 7-15 Low Bank Mode Limits

HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a cyan bug on the HSI and in the box to the upper left of the HSI.

Changing the Selected Heading

NOTE: Pressing the HDG Knob synchronizes the Selected Heading to the current heading.

The Selected Heading is adjusted using the **HDG** Knob. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

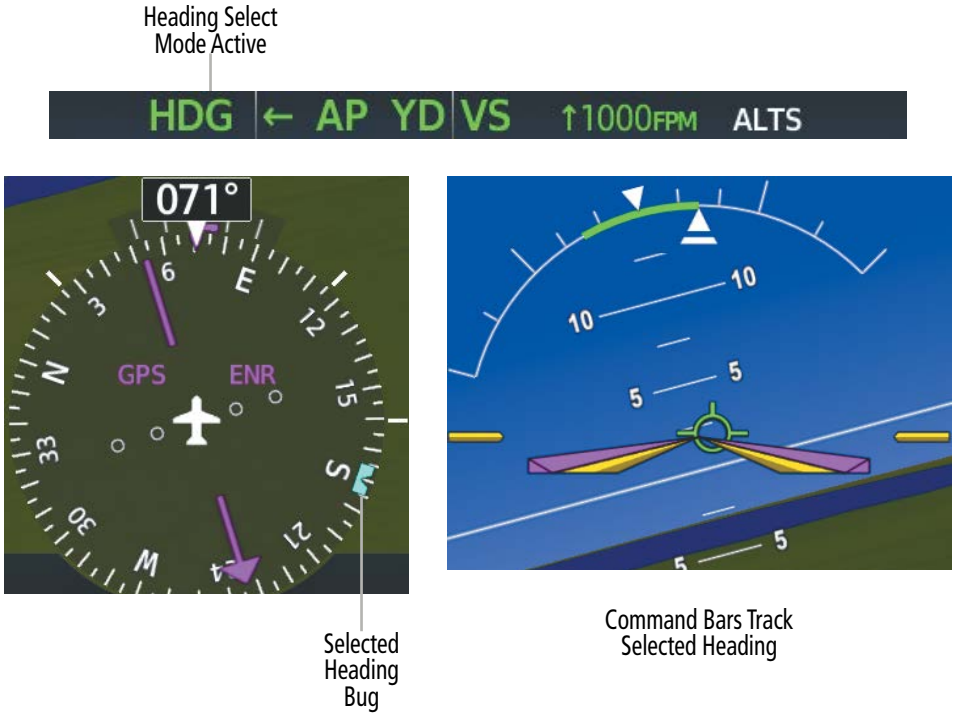


Figure 7-16 Heading Select Mode

NAVIGATION MODE

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: *If NAV is pressed to arm the GPS capture before activating a Direct-To, the GPS mode may not capture the Direct-To course.*

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.*

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 non-precision GPS and LOC approaches where vertical guidance is not required.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI shows less than one dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active lateral mode.

HDG Active VOR Armed

Figure 7-17 GPS Navigation Mode Active

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 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 Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

COMBINATION MODES

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	Max Roll Command Limit	Reference Range
Vertical Navigation Modes					
VNAV Path Tracking Mode	Captures and tracks descent legs of an active vertical profile	**VNV** Key	VPTH		
VNV Target Altitude Capture Mode	Captures the Vertical Navigation (VNV) Target Altitude	*	ALTV		
VOR Approach Mode					
VOR Arm/Capture/Track	Captures and tracks VOR navigation source	**APR** Key	VAPP	25°	

Mode	Description	Control	Annunciation	Max Roll Command Limit	Reference Range
GPS Approach Mode					
GPS Arm/Capture/Track	Captures and tracks GPS navigation source	**APR** Key	GPS	25°	
Glidepath Mode	Captures and tracks the SBAS glidepath on approach		GP		
LOC Approach Mode					
Approach, ILS Arm/Capture/Track	Captures and tracks the LOC navigation source	**APR** Key	LOC	25°	
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Backcourse Arm/Capture/Track	Captures and tracks the LOC source for backcourse approaches	**BC** Key	BC	25°	
Takeoff	Commands a constant pitch angle on the ground in preparation for takeoff	**GA** Button	TO		8.6°
Go Around**	Commands a constant pitch angle in the air	**GA** Button	GA		8°
Level	Autopilot engages and commands pitch angle necessary to establish zero vertical fpm	***	LVL		N/A

*ALTV is armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude.

**Go Around mode disengages the autopilot unless a compatible lift computer is installed.

***Level mode can only become activated as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the optional ESP feature.

Table 7-5 Flight Director Combination Modes

VERTICAL NAVIGATION

NOTE: *VNV is disabled when parallel track or Dead Reckoning Mode is active, or when waypoint sequencing is suspended.*

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 GPS Navigation 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.

VNAV Path Tracking Mode (VPTH)

NOTE: *If another vertical mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.*

NOTE: *Pressing the **CWS** Button while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Button.*

When a vertical profile (VNV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' ('GP/V' or 'GS/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.

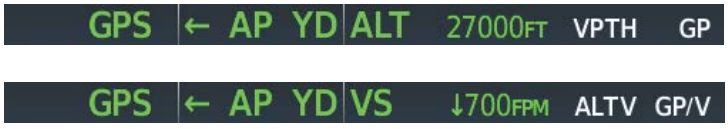


Figure 7-18 Vertical Path Tracking Armed Annunciations

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 PFDs in magenta.

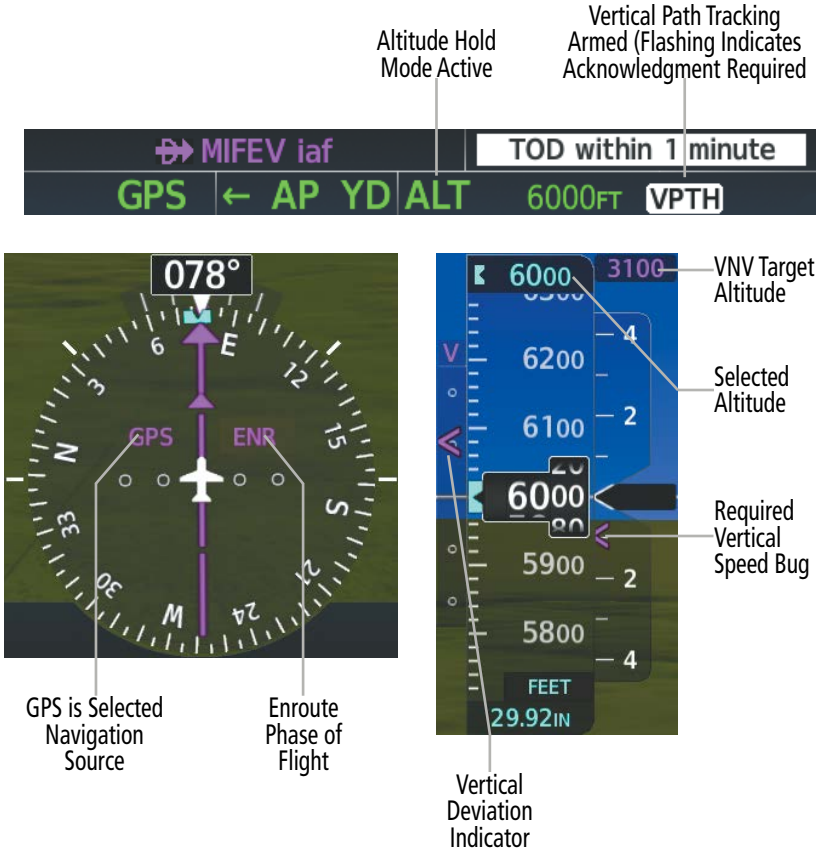


Figure 7-19 Vertical Path Capture

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.

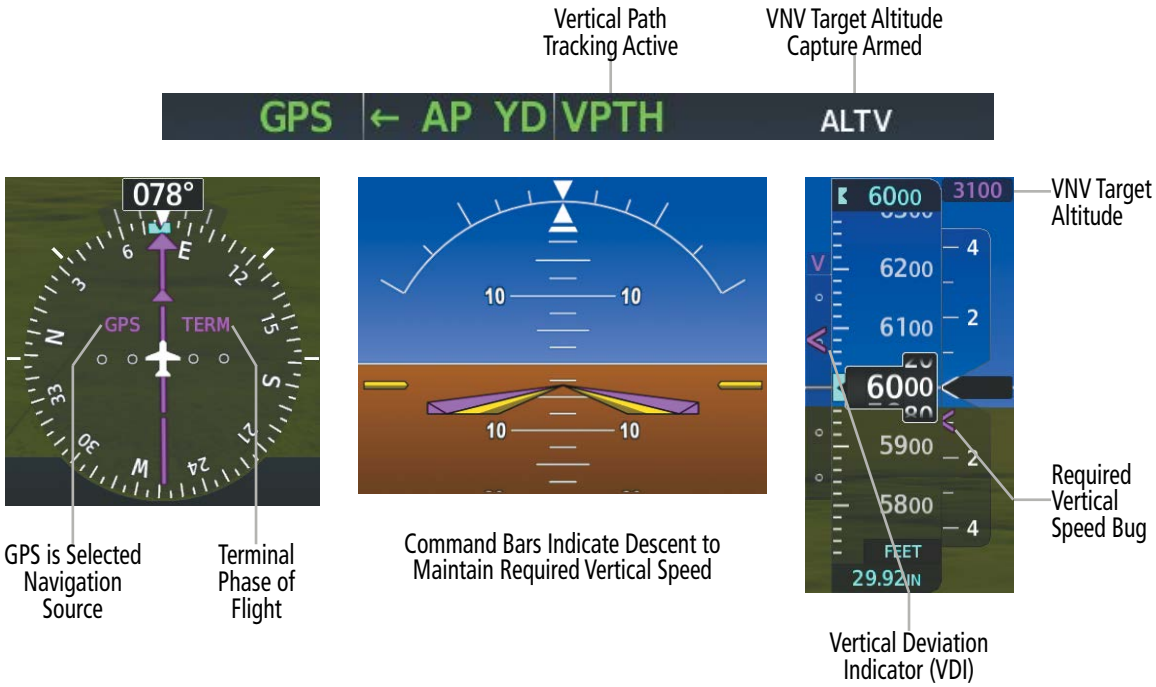


Figure 7-20 Vertical Path Tracking Mode

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 7-21 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied:

- At least 10 seconds have passed since the non-path transition was initiated
- Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

VNV Target Altitude Capture Mode (ALTV)

NOTE: *Armed VNV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNV Target Altitude Capture Mode is armed.*

VNV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates that the VNV Target Altitude is to be captured. VNV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the GPS Navigation Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Status Box, the active VNV Target Altitude is displayed above the Vertical Speed Indicator.

NOTE: *When the Selected Altitude is set to the VNV Target Altitude, Selected Altitude Capture Mode (ALTS) will be armed even though the altitude value is part of the active VNAV flight plan.*

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RSVI) 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.

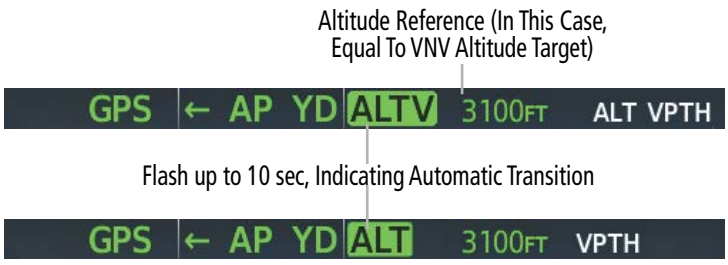


Figure 7-22 Automatic Mode Transitions During Altitude Capture

Changing the VNV Target Altitude

*NOTE: Pressing the **CWS** Button while in VNV Target Altitude Capture Mode does not cancel the mode.*

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the GPS Navigation Section for details).

APPROACH MODE

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)

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode. 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

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.

Figure 7-23 VOR Approach Mode

GPS Approach Mode

When GPS Approach Mode is armed, Glidepath Mode is also armed. GPS Approach Mode can be utilized to fly non-precision and precision approaches (Glidepath Mode).

Selecting GPS Approach Mode Without a Glidepath:

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 **NAV** Key.

Glidepath Mode (GP)

NOTE: *Pressing the **CWS** Button while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Button.*

Glidepath Mode utilizes GPS Approach mode with precision guidance. Glidepath Mode is used to track the WAAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Figure 7-24 Glidepath Mode Armed

Selecting GPS Approach Mode with a Glidepath:

1) Ensure a GPS approach with vertical guidance (LPV, LNAV/VNAV, LP+V, LNAV+V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
2) Ensure that 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 (SBAS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV or LNAV+V are considered Nonprecision Approaches (NPA) and are flown to an MDA even though vertical glidepath (GP) information may be provided.*

WARNING: *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.*

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath. Once the following conditions have been met, the glidepath can be captured:

- The active waypoint is at or after the final approach fix (FAF)
- Vertical deviation is valid
- The CDI is at less than full scale deviation
- Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

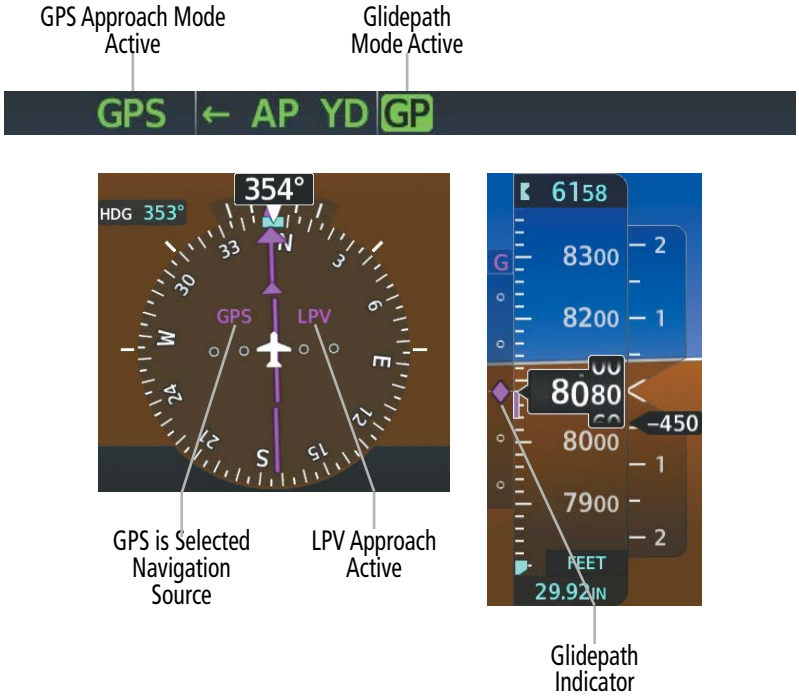


Figure 7-25 Glidepath Mode

Localizer Approach Mode

LOC Approach Mode allows the autopilot to fly a LOC approach and an ILS approach with a glideslope. When LOC Approach Mode is armed, Glideslope Mode is also armed automatically. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode Without a Glideslope:

1) Ensure a valid localizer frequency is tuned.
2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **NAV** Key.

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.

Glideslope Mode

Glideslope Mode utilizes LOC Approach mode with precision guidance.

Selecting LOC Approach Mode with a Glideslope:

1) Ensure a valid localizer frequency is tuned.
2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

Or:

1) Ensure that 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.

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope.

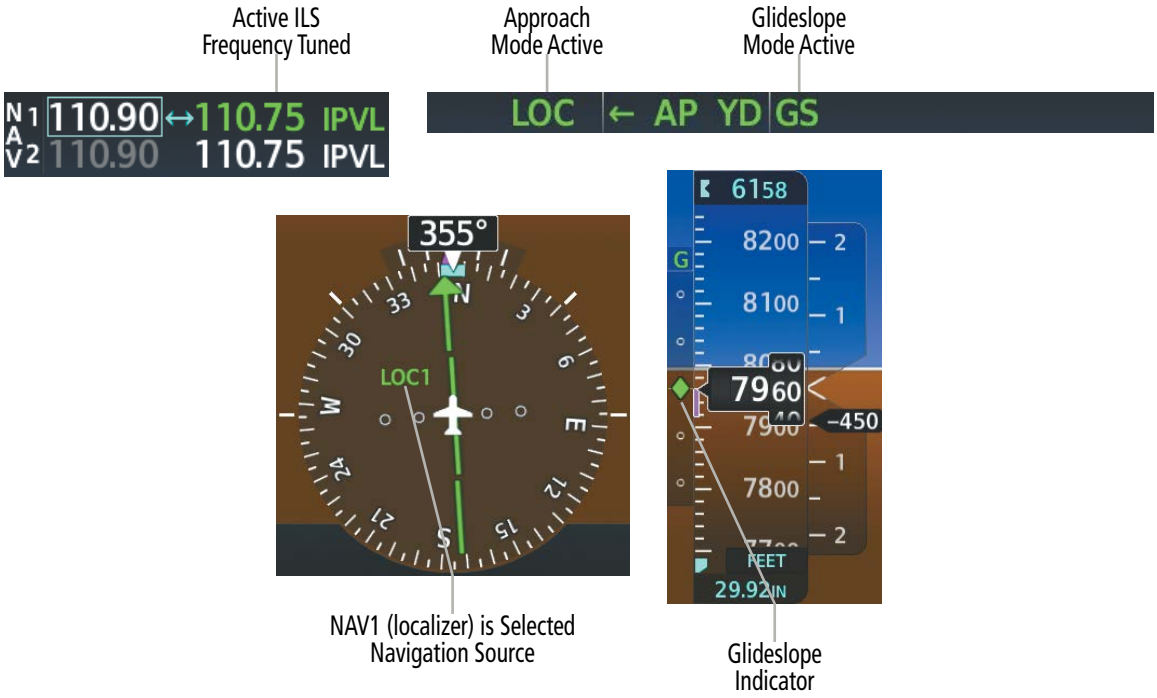


Figure 7-26 Glideslope Mode

Once the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

- Approach Mode is active and a Vectors-To-Final is activated
- Approach Mode is active and Navigation source is manually switched
- During a LOC/ILS approach GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

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** Button and hand-flying the aircraft does not change the Selected Course while in Approach or Backcourse Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

Backcourse Mode (BC) Mode

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.

Selecting Backcourse 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 **BC** Key.

Figure 7-27 LOC2 is Selected Navigation Source

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.

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.

TAKEOFF AND GO AROUND MODES

Takeoff and Go Around modes are coupled pitch and roll modes and are annunciated as both the vertical and lateral modes when active. In these modes, the flight director commands a constant set pitch attitude and wings level. The **GA** Button is used to select both modes. The mode entered by the flight director depends on whether the aircraft is on the ground. Selected Altitude Capture Mode is automatically armed when the aircraft is at least 400 feet below the Selected altitude at the time Takeoff or Go Around Mode is selected.

Takeoff Mode (TO)

Takeoff Mode provides an attitude reference during rotation and takeoff. This mode can be selected only while on the ground by pushing the **GA** Button. The flight director Command Bars assume a wings-level, pitch-up attitude. Autopilot engagement while Takeoff Mode is active is inhibited while the aircraft is on the ground.

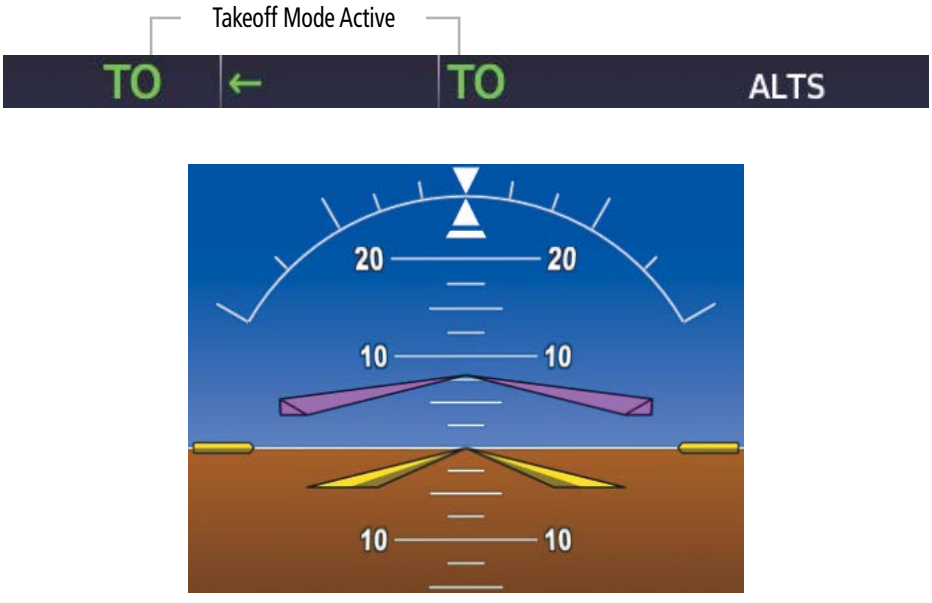
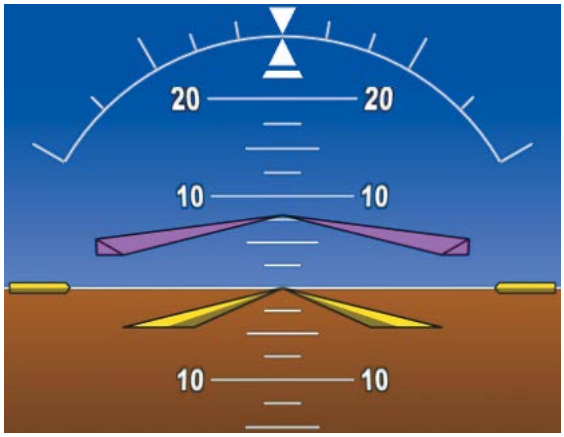


Figure 7-28 Takeoff Mode Active

Go Around Mode (GA)

Pressing the **GA** Button while in the air activates the flight director in wings-level, pitch-up attitude, allowing the execution of a missed approach or a go around. Attempts to modify the aircraft attitude (i.e., with the **NOSE UP/DN** Wheel or **CWS** Button) result in reversion to Pitch Hold Mode.

Figure 7-29 Takeoff and Go Around Modes



Command Bars Indicate Climb

Figure 7-30 Takeoff and Go Around Modes

LEVEL MODE (LVL)

Level (LVL) mode becomes active only as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the optional ESP feature.

When the normal flight envelope thresholds have been exceeded for more than 50% of the last 20 seconds, Level mode is activated. The autopilot will engage and provide input to bring the aircraft back into straight and level flight based on zero degrees roll angle and zero feet per minute vertical speed. An aural "ENGAGING AUTOPILOT" alert sounds and the lateral and vertical flight director annunciations will display "LVL". The AFCS will remain in Level mode until the pilot selects another mode.

Figure 7-31 Level Mode

7.5 AUTOPILOT AND YAW DAMPER OPERATION

NOTE: Refer to the current version of the pertinent flight manual for specific instructions regarding emergency procedures.

The autopilot and yaw damper operate the flight control surface servos to provide automatic flight control. The autopilot controls the aircraft pitch and roll attitudes following commands received from the flight director. Pitch autotrim provides trim commands to the pitch trim servo to relieve any sustained effort required by the pitch servo. Autopilot operation is independent of the yaw damper.

The yaw damper reduces Dutch roll tendencies and coordinates turns. It can operate independently of the autopilot and may be used during normal hand-flight maneuvers. Yaw rate commands are limited to 6 deg/sec by the yaw damper.

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 gearboxes are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

PITCH AXIS AND TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during flight director maneuvers. Flight director pitch commands are rate- and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim servo. The pitch trim servo commands the motor to reduce the average pitch servo effort.

When the autopilot is not engaged, the pitch trim servo may be used to provide manual electric pitch trim (MEPT). This allows the aircraft to be trimmed using a control wheel switch rather than the trim wheel. Manual trim commands are generated only when both halves of the **MEPT** Switch are operated simultaneously. Trim speeds are scheduled with airspeed to provide more consistent response.

The pilot side **MEPT** Switch has priority over the copilot side **MEPT** Switch.

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.

YAW AXIS

The yaw damper uses yaw rate and roll attitude to dampen the aircraft's natural Dutch roll response. It also uses lateral acceleration to coordinate turns.

ENGAGING THE AUTOPILOT AND YAW DAMPER

*NOTE: Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the **CWS** Button to disengage the pitch and roll servos while the autopilot remains active.*

When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated.

The annunciator lights on the AFCS controller for the autopilot and yaw damper are illuminated. The flight director engages in Pitch and Roll Hold Modes when initially activated.

Figure 7-32 Autopilot and Yaw Damper Engaged

When the **YD** Key is pressed, the system engages the yaw damper independently of the autopilot and the yaw damper annunciator light is illuminated.

Autopilot and yaw damper status are displayed in the center of the AFCS Status Box. Engagement is indicated by green 'AP' and 'YD' annunciations, respectively.

CONTROL WHEEL STEERING (CWS)

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. CWS activity has no effect on yaw damper engagement.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.

Figure 7-33 CWS Annunciation

In most scenarios, releasing the **CWS** Button reengages the autopilot with a new reference. 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.

DISENGAGING THE AUTOPILOT AND YAW DAMPER

The Autopilot and Yaw Damper can be disengaged manually or automatically by the system.

MANUAL DISENGAGEMENT

The autopilot is manually disengaged by pushing the **AP** Key on the AFCS Controller or the **MEPT ARM** Switch. The Yaw Damper is manually disengaged by pushing the **YD** Key on the AFCS Controller. Manual disengagement is indicated by a five-second flashing amber 'AP' or 'YD' annunciation and a three-second autopilot disconnect aural alert.

Figure 7-34 Manual Autopilot Disengagement

Pushing the **AP/YD DISC** Switch disengages both the yaw damper and the autopilot simultaneously. When the yaw damper and autopilot are manually disengaged, both the 'AP' and 'YD' annunciation turn amber and flash for 5 seconds and a three-second autopilot disconnect aural alert is generated.

Figure 7-35 Yaw Damper Disengagement

After manual disengagement, the autopilot disconnect aural alert may be cancelled by pushing the **MEPT** ARM or **AP/YD DISC** Switch (**AP/YD DISC** Switch also cancels the flashing 'AP' annunciation).

AUTOMATIC AUTOPILOT DISENGAGEMENT

Automatic autopilot disengagement is indicated by a flashing red and white 'AP' annunciation seen below and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the **AP/YD DISC** or **MEPT** ARM Switch. Automatic autopilot disengagement occurs due to:

» System failure.

» Invalid sensor data.

» Inability to compute default flight director modes (FD also disengages automatically).

AUTOMATIC YAW DAMPER DISENGAGEMENT

Yaw damper disengagement is indicated by a five-second flashing amber 'YD' annunciation. Automatic yaw damper disengagement occurs when autopilot disengagement is caused by failure in a parameter also affecting the yaw damper. This means the yaw damper can remain operational in some cases where the autopilot automatically disengages. A localized failure in the yaw damper system or invalid sensor data also cause yaw damper disengagement.

Figure 7-36 Automatic Autopilot and Yaw Damper Disengagement

7.6 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The annunciations in the following table (listed in order of increasing priority) can appear on the PFDs above the Airspeed and Attitude indicators. Only one annunciation may occur at a time, and messages are prioritized by criticality.

Alert Condition	Annunciation	Description
Rudder Mistrim Right	RUD→	Yaw servo providing sustained force in the indicated direction
Rudder Mistrim Left	←RUD	
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 **MEPT** Switch)	PTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move **MEPT** Switches separately to unstick
Yaw Damper Failure	YAW	YD control failure
Roll Failure	ROLL	Roll axis control failure; AP and YD inoperative
Pitch Failure	PTCH	Pitch axis control failure; AP and YD inoperative
System Failure	AFCS	AP and MEPT are unavailable; FD may still be available, but YD inoperative
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion Do not press the **AP/YD DISC** Switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test failed; aural alert sounds at failure

Table 7-6 AFCS Status Alerts

AFCS VOICE ALERTS

The voice alerts listed in the following table relate to AFCS; for a complete list of voice alerts, see Appendix A.

Voice Alert	Description
"Autopilot"	Warning – Autopilot is disengaged Single alert for manual AP disengagement Continuous alert for automatic AP disengagement; cancelled with **AP DISC** Switch
"Flight Director"	Single warning – Flight director has reverted to a default mode
"Trim, Trim, Trim"	Continuous advisory (stops after 6 seconds) – **MEPT** Switch malfunction

Table 7-7 AFCS Voice Alerts

OVERSPEED PROTECTION

NOTE: Overspeed protection is not active in ALT, GS or GP modes.

Airspeed is monitored by the Flight Director and pitch commands are limited for overspeed protection. Overspeed protection is provided in situations where the Flight Director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding the certified maximum Autopilot airspeed.

When an Autopilot overspeed condition occurs, a flashing amber 'MAXSPD' annunciation appears above the Airspeed Indicator. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.

Figure 7-37 MAXSPD Annunciation Example

UNDERSPEED PROTECTION

Underspeed Protection is available when the optional Electronic Stability and Protection (ESP) system is installed and the autopilot is on. It is designed to discourage aircraft operation below minimum established airspeeds.

When the aircraft reaches a predetermined airspeed (specific to each flap setting), an amber 'MINSPD' annunciation will appear above the airspeed indicator.

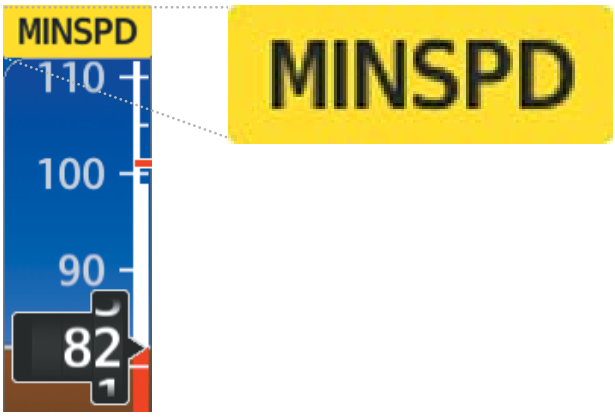


Figure 7-38 MINSPD Annunciation Example

If the aircraft continues to decelerate, Underspeed Protection functionality depends on which vertical flight director mode is selected. For the purpose of this discussion, the vertical flight director modes can be divided into two categories: Those in which it is important to maintain altitude for as long as possible (altitude-critical modes), and those in which maintaining altitude is less crucial (non-altitude critical modes).

ALTITUDE-CRITICAL MODES (ALT, GS, GP, TO, GA, FLC)

If the aircraft decelerates to stall warning, the lateral and vertical flight director modes will change from active to armed. The autopilot will provide input causing the aircraft to pitch down to maintain an airspeed no less than stall warning activation speed plus two knots, and the wings to level.

When airspeed increases (as a result of adding power/thrust) to above the IAS at which stall warning turns off, plus two knots, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical and lateral flight director modes will change from armed to active.

NON-ALTITUDE CRITICAL MODES (VS, VNAV, IAS,)

If the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed will appear to the right of the vertical speed indicator. The vertical flight director mode will change from active to armed, and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed.

When sufficient power/thrust is available, the autopilot will recapture the previously selected vertical reference and the flight director mode will change from armed to active.

NOTE: *When the autopilot is outside normal operating limits, it uses more aggressive commands to return to normal limits.*

7.7 ABNORMAL OPERATION

SUSPECTED AUTOPILOT MALFUNCTION

NOTE: Consult the aircraft documentation for the location of circuit breakers as well as specifics that may supplement or amplify this procedure.

If an autopilot failure or trim failure is suspected to have occurred, perform the following steps:

1) Firmly grasp the control wheel.
2) Press and hold the **AP/YD DISC** Switch. The autopilot will disconnect and power is removed from the trim motor. Power is also removed from all primary servo motors and engaged solenoids. Note the visual and aural alerting indicating autopilot disconnect.
3) Retrim the aircraft as needed. Substantial trim adjustment may be needed.
4) Pull the appropriate circuit breaker(s) to electrically isolate the servo and solenoid components.
5) Release the **AP/YD DISC** Switch.

OVERPOWERING AUTOPILOT SERVOS

In the context of this discussion, "overpowering" refers to any pressure or force applied to the pitch controls when the autopilot is engaged. A small amount of pressure or force on the pitch controls can cause the autopilot automatic trim to run to an out-of-trim condition. Therefore, any application of pressure or force to the controls should be avoided when the autopilot is engaged.

Overpowering the autopilot during flight will cause the autopilot's automatic trim to run, resulting in an out-of-trim condition or cause the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the autopilot is disengaged.

The following steps should be added to the preflight check:

1) Check for proper autopilot operation and ensure the autopilot can be overpowered.
2) Note the forces required to overpower the autopilot servo clutches.

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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
- Satellite Telephone and SMS Messaging Services (Optional)
- WiFi Connections (Optional)
- SiriusXM® Satellite Radio Entertainment (Optional)
- SurfaceWatch™
- Flight Data Logging
- Connext® Bluetooth Connections (Optional)
- Auxiliary Video
- Electronic Stability and Protection (ESP™) (Optional)

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. Either ChartView or FliteCharts may be configured in the system, but not both.

Iridium Telephone Services and SMS messaging is an optional subscription service offered through Garmin Connext® and Iridium Satellite LLC. Voice and SMS messaging communications are through the Iridium Satellite Network. Data communications are through Iridium Data Services, or a wireless network (WiFi) when the aircraft is on the ground.

The optional SiriusXM Satellite Radio entertainment audio feature of the SiriusXM Datalink 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 SurfaceWatch™ feature provides voice and visual annunciations to aid in maintaining situational awareness and avoid potential runway incursions and excursions during ground and air operations in the airport environment.

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.

The system provides a control and display interface to an auxiliary video system.

The optional Electronic Stability and Protection (ESP™) system discourages aircraft operation outside the normal flight envelope.

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
- Inset Map (PFD)
- Weather Datalink Page
- Airport Information Page
- Intersection Information Page
- NDB Information Page
- VOR Information Page
- User Waypoint Information Page
- Trip Planning Page
- Nearest Pages
- Active and Stored Flight Plan Pages

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the example shown, the aircraft is on taxiway Bravo inside the High Alert Intersection boundary on KSFO airport. Airport Hot Spots are outlined in magenta. When panning over the airport, features such as runway holding lines and taxiways are shown at the cursor.

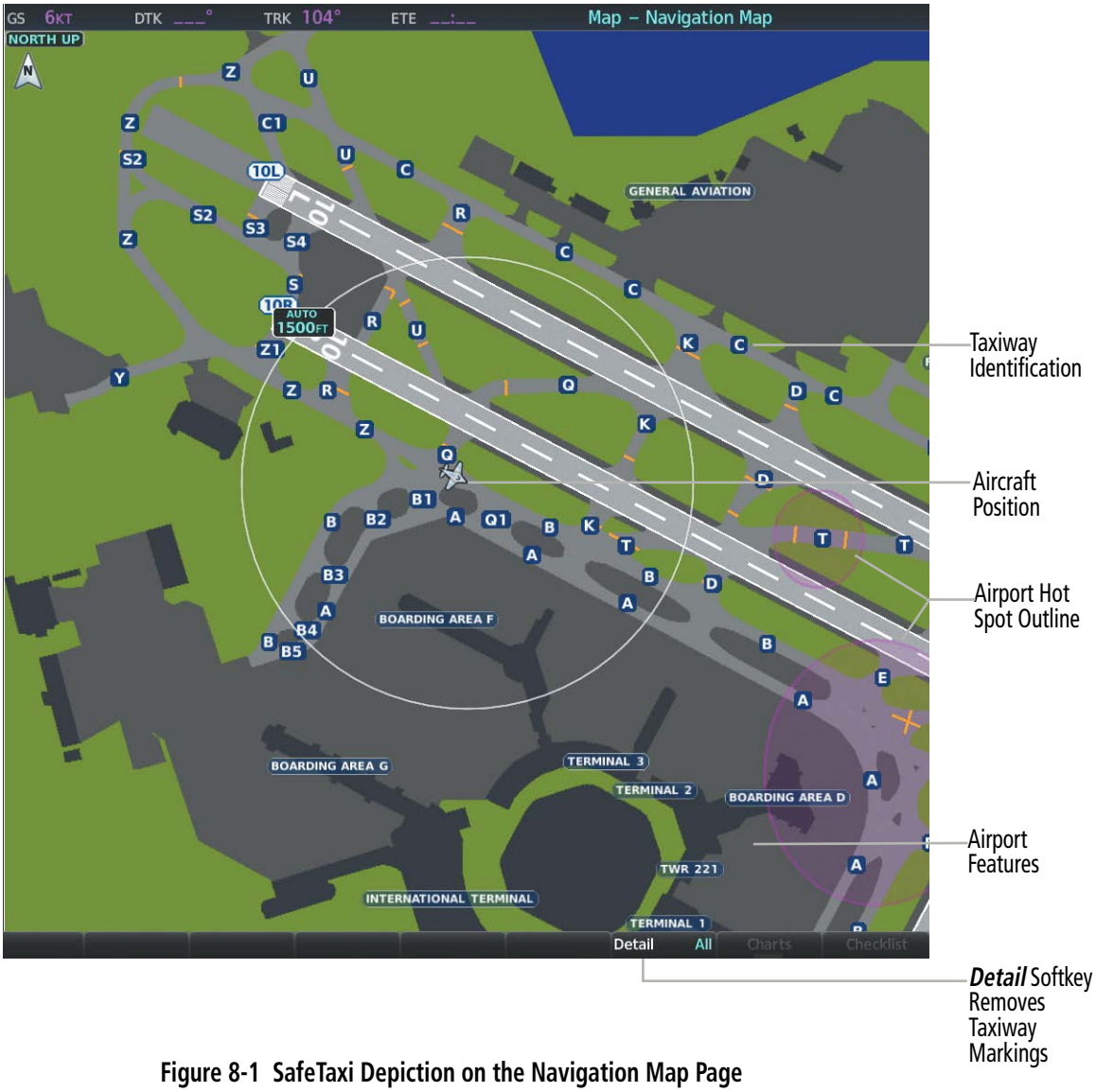


Figure 8-1 SafeTaxi Depiction on the Navigation Map Page

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. Pressing the **Detail All** Softkey removes the taxiway markings and airport feature labels. Pressing the **Detail 3** Softkey removes VOR station ID, the VOR symbol, and intersection names if within the airport plan view. Pressing the **Detail 2** Softkey removes the airport runway layout, unless the airport in view is part of an active route structure. Pressing 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.

Figure 8-2 Navigation Map Page Menu, Map Setup Option

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

Figure 8-3 Map Setup Menu, Aviation Group, SafeTaxi Range Options

8.2 CHARTS

Electronic charts that resemble the paper versions of AeroNav Services terminal procedures charts (FliteCharts) and Jeppesen terminal procedures charts (ChartView) can be displayed on the MFD.

When the databases for both chart types are purchased and loaded in the system, the desired charts brand, or source, can be selected for viewing. The active chart source for a particular procedure is shown on the information pane under Source.

Selecting preferred charts source:

1) While viewing a chart press the **MENU** Softkey to display the Page Menu options.
2) Turn the large **FMS** Knob to highlight the 'Charts 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).

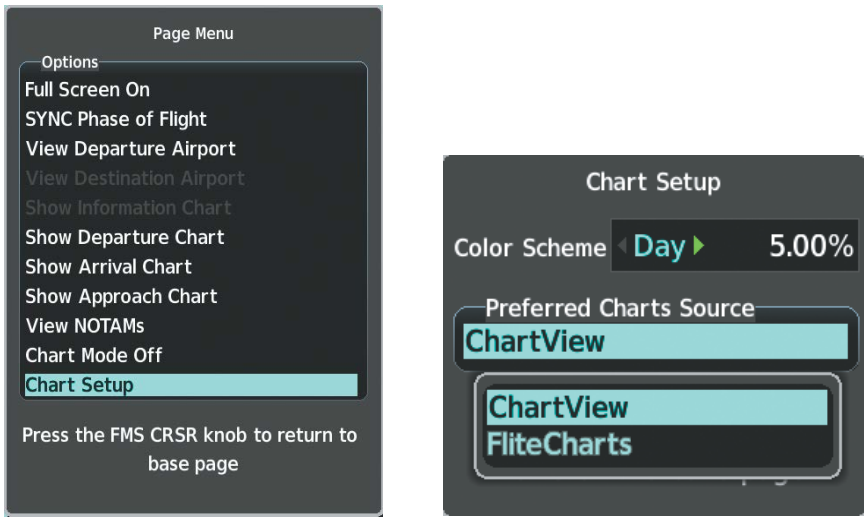


Chart Setup Option | Preferred Charts Source Option

Figure 8-4 Preferred Charts 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 plan view of approach charts and on airport diagrams. Airport Hot Spots are outlined in magenta.

The georeferenced 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 plan view, 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 plan view, not to the off-scale area.

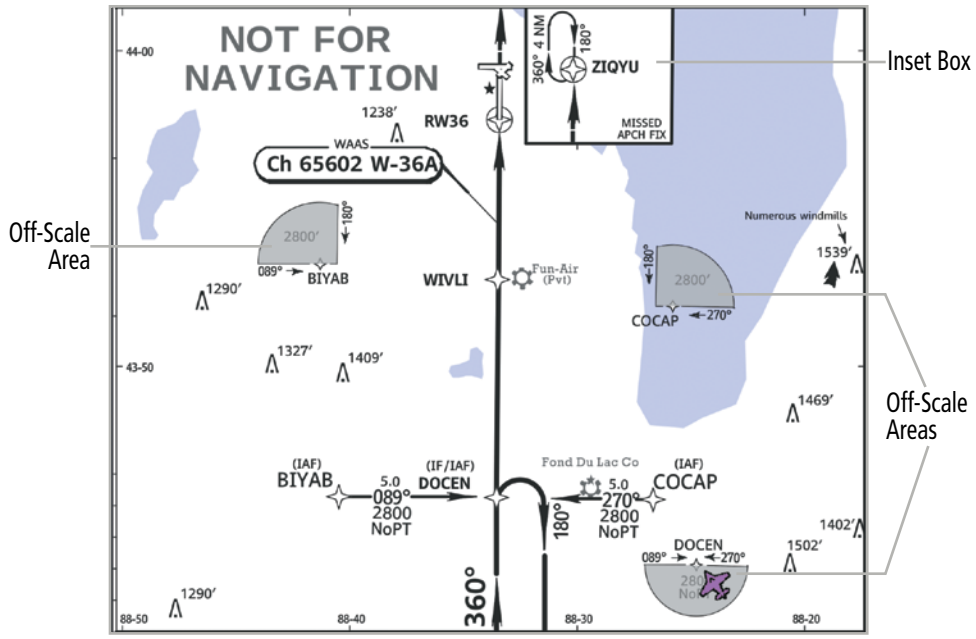


Figure 8-5 Sample Chart Indicating Off-Scale Areas

NOTE: *Do not maneuver the aircraft based solely upon the georeferenced aircraft symbol.*

The ChartView database subscription is available from Jeppesen, Inc. Available data includes:

- Arrivals (STAR).
- Departure Procedures (DP).
- Approaches (APR).
- Airport Diagrams.
- NOTAMs.

TERMINAL PROCEDURES CHARTS

Selecting terminal procedures charts:

While viewing the 'Map - Navigation Map' Page, 'NRST - Nearest Airport' Page, or 'FPL - Active Flight Plan' Page, press the **Charts** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn the large **FMS** Knob to scroll through the 'Options' Menu and select Show Charts.
3) Press the **ENT** Key to display the charts.
4) Use the softkeys at the bottom of the screen to select the appropriate chart.

Navigation Map Page Options Menu

Chart Softkeys

Figure 8-6 Selecting Charts

When no terminal procedure chart is available, the banner No Available Charts appears on the screen. The 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 8-7 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 8-8 Unable To Display Chart Banner

When a chart is not available by pressing the **Charts** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **Charts** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the 'WPT – Airport Information' page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the 'Map - Navigation Map' Page, 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) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the Approach Box. (Press the **APR** Softkey if the Approach Box is not currently shown).
4) Turn the small and large **FMS** Knob to enter the desired airport identifier.
5) Press the **ENT** Key to complete the airport selection.
6) Turn the large **FMS** Knob to select the Approach Box.
7) Turn the small **FMS** Knob to show the approach chart selection choices.
8) Turn either **FMS** Knob to scroll through the available charts.
9) Press the **ENT** Key to complete the chart selection.

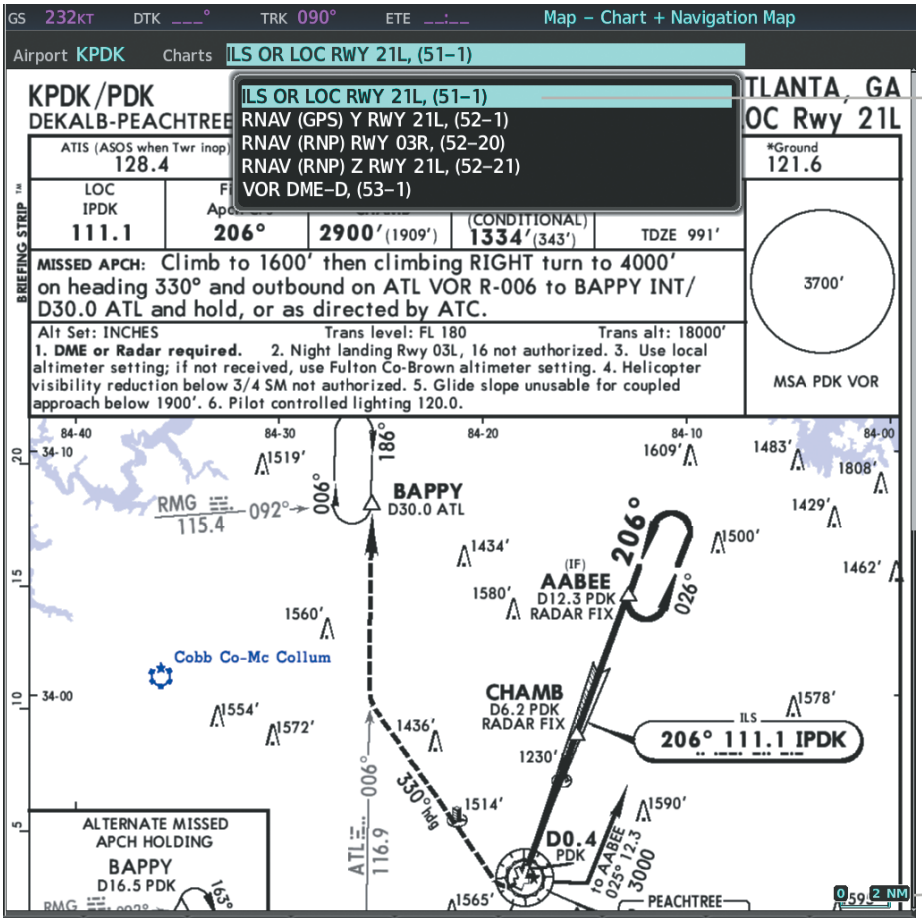


Figure 8-9 Approach Information Page, Chart Selection

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.

Pressing the **Chart** Softkey switches between the ChartView diagram and the associated map in the WPT page group.

The aircraft position is shown in magenta on the ChartView diagrams when the location of the aircraft is within the chart boundaries.

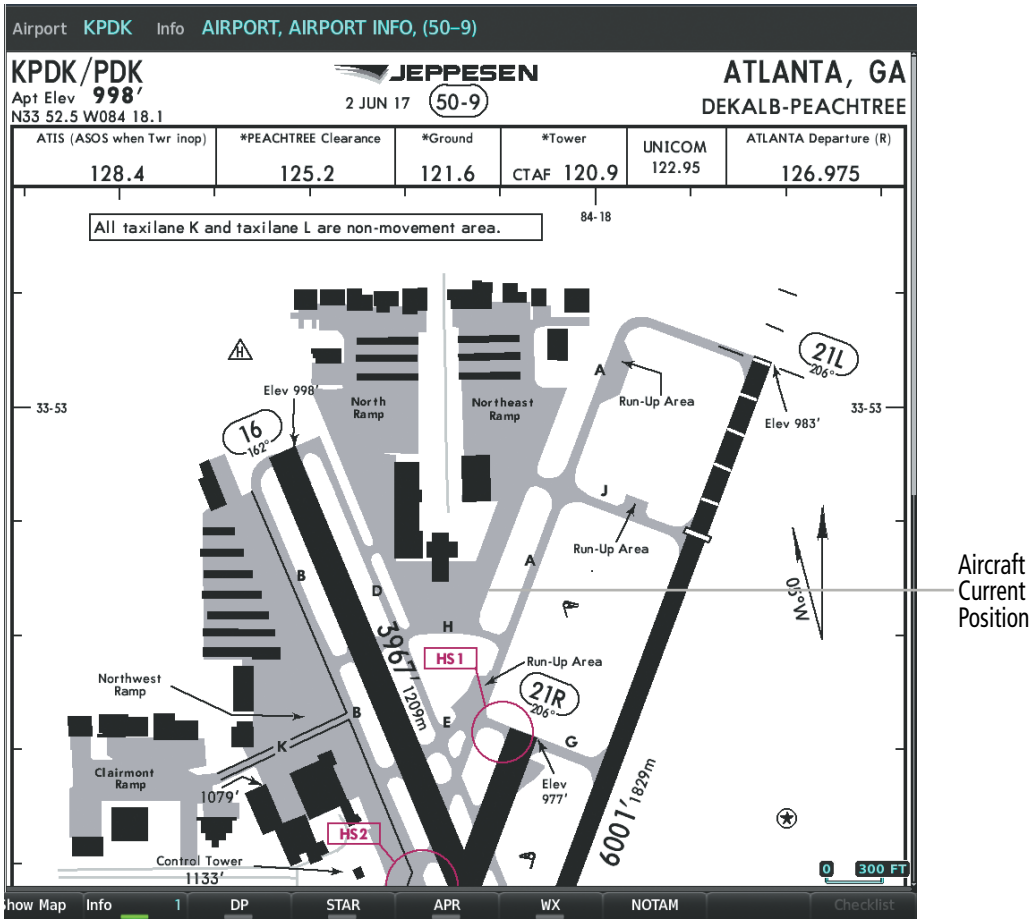


Figure 8-10 Approach Information Page, Info View, Full Screen Width

In the example shown in following figure, the Class B Chart is selected. Pressing the **ENT** Key displays the Charlotte Class B Airspace Chart.

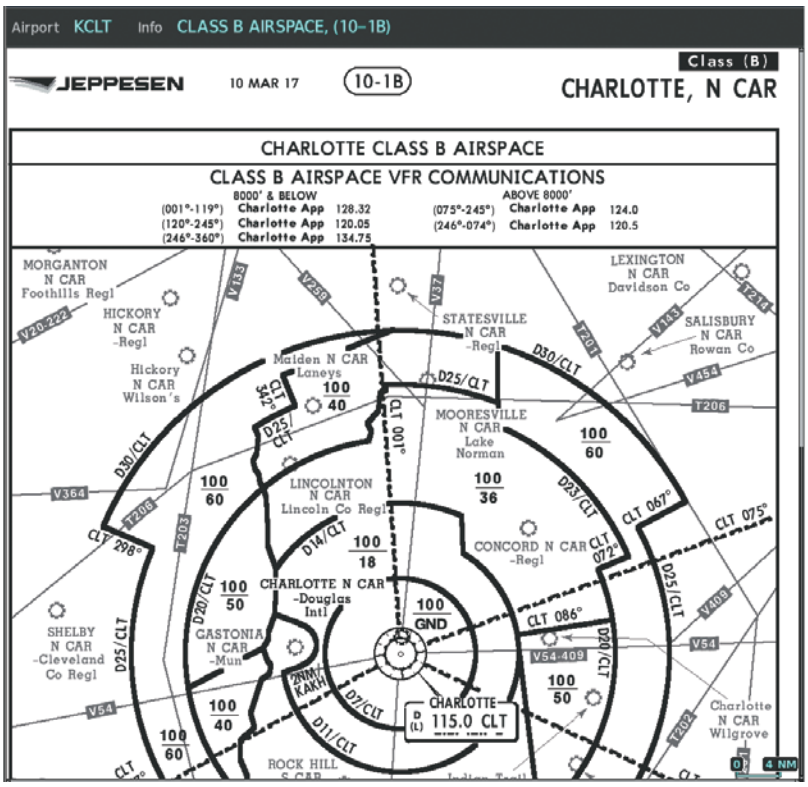


Figure 8-11 Airport Information Page, Class B Chart Selected from Info View

The following options are available:

» Pressing the **SYNC** Softkey displays the database linked chart associated with the current phase of flight.

» 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 Datalink Receiver, when available. Weather information is available only when a SiriusXM Datalink Receiver is installed and the SiriusXM Weather subscription is current.

» Recent NOTAMS applicable to the current ChartView cycle are included in the ChartView database. Pressing the **NOTAM** Softkey shows the local NOTAM information for selected airports, when available. When NOTAMS are not available, the **NOTAM** Softkey label appears subdued and is disabled. The **NOTAM** Softkey may appear on the Airport Information Page and all of the chart page selections. Pressing the **NOTAM** Softkey again removes the NOTAMS information.

NOTE: *A subdued softkey label indicates the function is disabled.*

NOTE: *Only NOTAMs applicable to specific information conveyed on the displayed Jeppesen chart are available when the **NOTAM** Softkey is pressed. There may be other NOTAMs available pertaining to the flight that may not be displayed. Contact Jeppesen for more information regarding Jeppesen database published NOTAMs.*

CHART OPTIONS

Pressing the **CHRT Opt** Softkey displays the next level of softkeys, the chart options level.

» Pressing the **ROT CCW** Softkey rotates the displayed chart counter clockwise in 90 degree increments.

» Pressing the **ROT CW** Softkey rotates the displayed chart clockwise in 90 degree increments.

» Pressing the **All** Softkey shows the complete approach chart on the screen.

» Pressing the **Header** Softkey shows the header view (approach chart briefing strip) on the screen.

» Pressing the **Plan** Softkey shows the approach chart two dimensional plan view.

» Pressing the **Profile** Softkey displays the approach chart descent profile strip.

» Pressing the **Minimums** Softkey displays the minimum descent altitude/visibility strip at the bottom of the approach chart.

» If the chart scale has been adjusted to view a small area of the chart, pressing the **Fit 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.

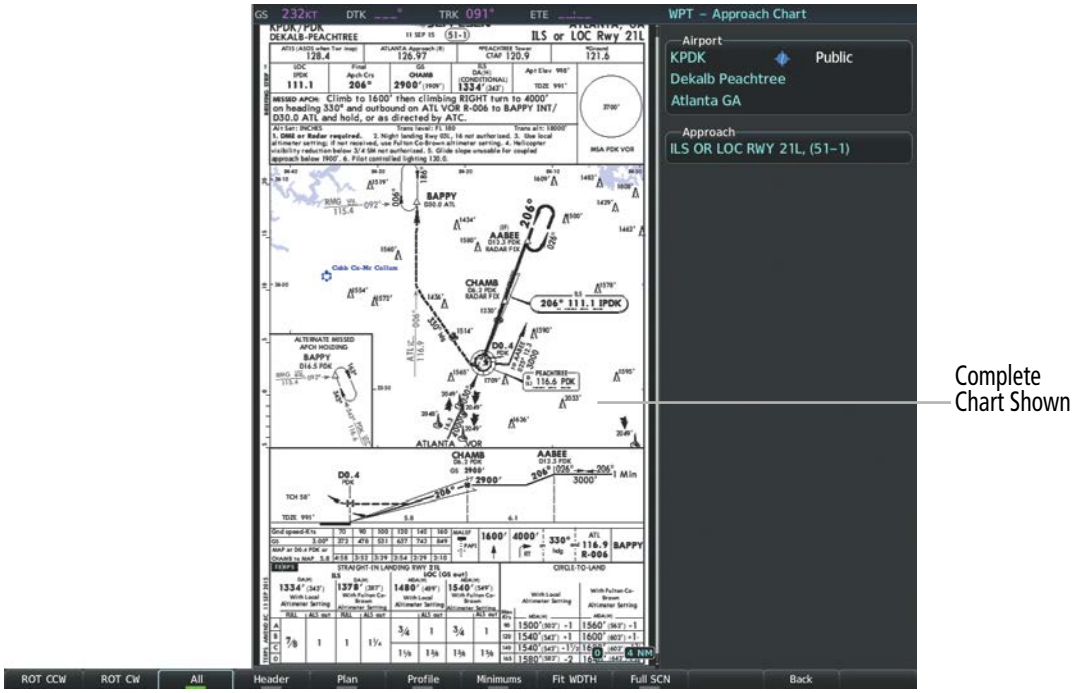


Figure 8-12 Approach Information Page, ALL View

Selecting Additional Information:

1) While viewing the Airport Taxi Diagram, press the **Full SCN** Softkey to display the information windows (Airport, Info).

2) Press the **FMS** Knob to activate the cursor.

3) Turn the large **FMS** Knob to highlight the Airport, Info, Runways, or Frequencies Box.

4) Turn the small **FMS** Knob to select the Info Box choices. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.

5) Press the **FMS** Knob again to deactivate the cursor.

Pressing the **Back** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys. The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

1) While viewing a terminal chart press the **MENU** Key to display the Page Menu Options.
2) Turn the large **FMS** Knob to highlight the 'Full Screen Off' option and press the **ENT** Key..

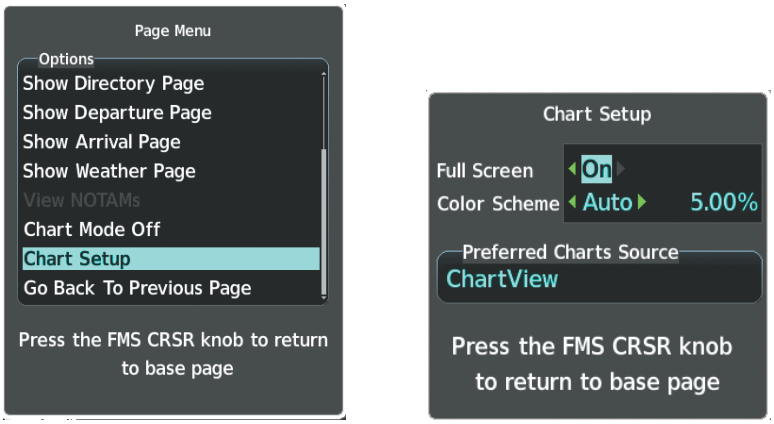


Chart Setup Option Full Screen On/Off Selection

Figure 8-13 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.

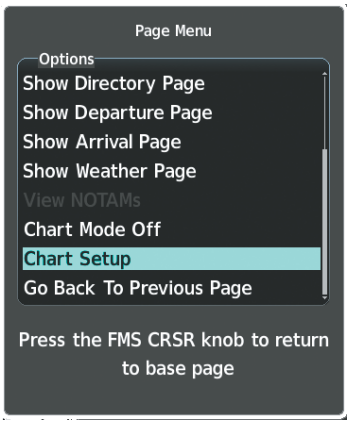


Figure 8-14 Page Menu Chart Setup

3) Turn the large **FMS** Knob to move to the Color Scheme Option.

4) Turn the small **FMS** Knob to choose between Day, Auto, and Night Options.

5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

   The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

6) Press the **FMS** Knob when finished to remove the Chart Setup Menu.

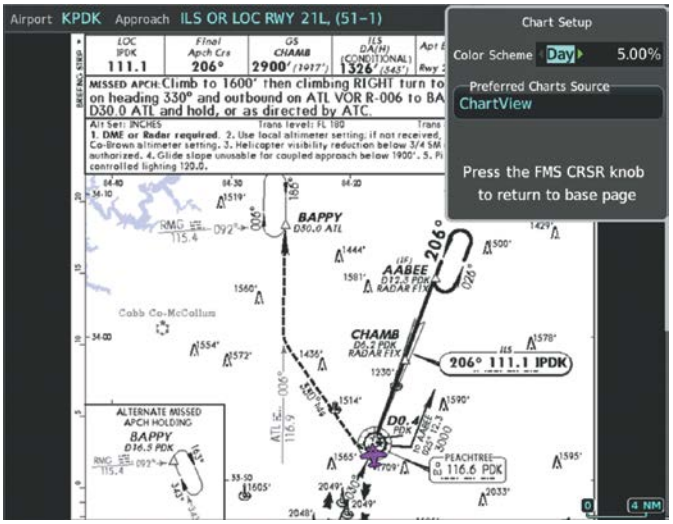


Figure 8-15 Arrival Information Page, Day View

Figure 8-16 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 georeferenced 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 georeferenced. These charts will display an Aircraft Not Shown Icon in the lower right corner of the MFD.

Figure 8-17 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 plan view, 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 plan view, not to the off-scale area.

The FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR).
- Departure Procedures (DP).
- Approaches (APR).
- Airport Diagrams.

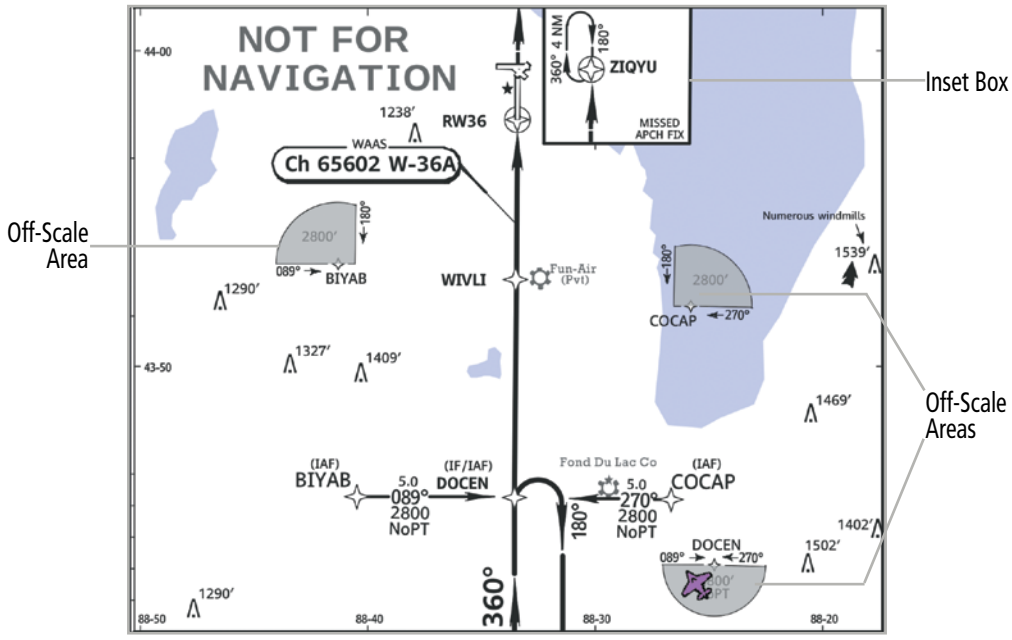


Figure 8-18 Sample Chart Indicating Off-Scale Areas

NOTE: *Do not maneuver the aircraft based solely upon the georeferenced aircraft symbol.*

TERMINAL PROCEDURES CHARTS

Selecting terminal procedures charts:

While viewing the 'Map - Navigation Map' Page, 'NRST - Nearest Airport' Page, or 'FPL - Active Flight Plan' Page, press the **Charts** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn the large **FMS** Knob to scroll through the 'Options' Menu to 'Show Charts.'
3) Press the **ENT** Key to display the chart.

While on the Page Menu, 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 8-19 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 8-20 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 airport runway diagram is usually displayed on the 'WPT - Airport Information' page after the **Info** Softkey is pressed. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the 'Map - Navigation Map' Page, 'FPL - Active Flight Plan' Page, or 'NRST - Nearest Airports' Page, press the **Charts** Softkey. The airport diagram or approach chart is displayed on the 'WPT - Airport Information' Page.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the 'Charts' Box. (Press the **APR** Softkey if not already selected).

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 'Charts' 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.

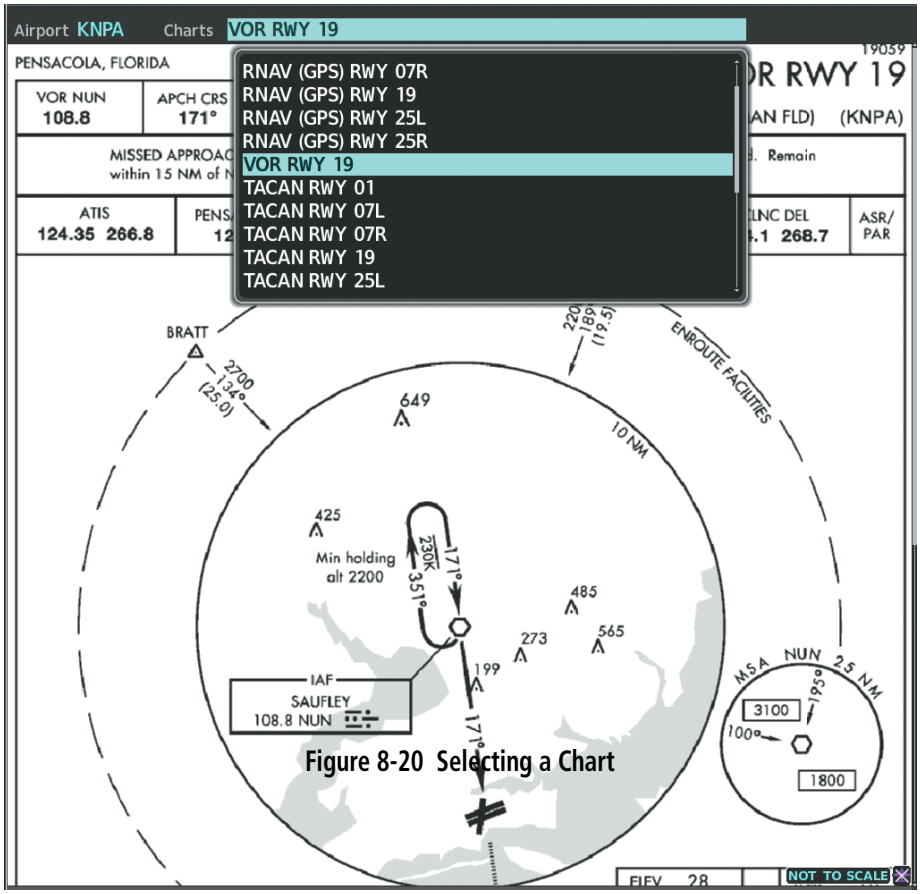


Figure 8-20 Selecting a Chart

Figure 8-21 Approach Information Page, Chart Selection

While the Approach Box is selected using the **FMS** Knob, the softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart can be panned using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is not shown on FliteCharts. The Chart Scale Box displays a banner NOT TO SCALE, and the Aircraft Not Shown Icon is displayed in the lower right corner of the screen (see above).

» Pressing the **CHRT Opt** Softkey displays the next level of softkeys, the chart options level (see below).
» Pressing the **SYNC** Softkey displays the database linked chart associated with the current phase of flight.
» Pressing the **Info** Softkey displays the Airport Diagram.
» 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 **Charts** Softkey switches between the FliteCharts diagram and the associated map in the WPT page group.

CHART OPTIONS

» Pressing the **CHRT Opt** Softkey displays the next level of softkeys, the chart options level
» Pressing the **ROT CCW** Softkey rotates the chart counterclockwise.
» Pressing the **ROT CW** Softkey rotates the chart clockwise.
» Pressing the **Fit WIDTH** Softkey fits the width of the chart in the display viewing area.
» 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 'Full Screen Off' Option and press the **ENT** Key.

The full screen view can be turned back on by following the previous steps and selecting 'Full Screen On' Option.

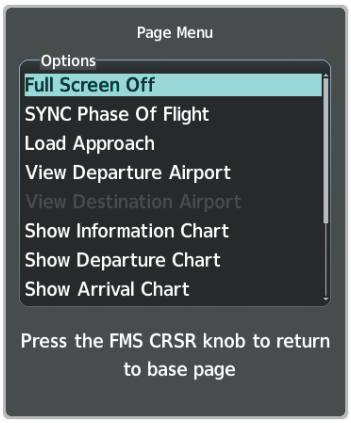


Figure 8-22 Full Screen On or Off

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 Charts 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 'Charts Setup' Menu Option and press the **ENT** Key.

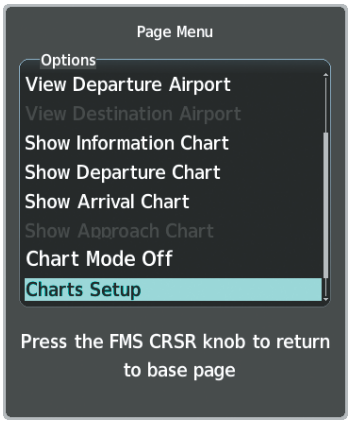


Figure 8-23 Page Menu Chart Setup

3) Turn the large **FMS** Knob to move to the 'Color Scheme' Option.

4) Turn the small **FMS** Knob to choose between 'Day', 'Auto', and 'Night' Options.

5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

   The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

6) Press the **FMS** Knob when finished to remove the 'Charts 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
- 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 7.5 nm or more will show the Sectional chart. Once the range is decreased below 7.5 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 georeferenced 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 georeferenced. IFR/VFR charts may be viewed by selecting the 'Map - IFR/VFR Charts' Page.

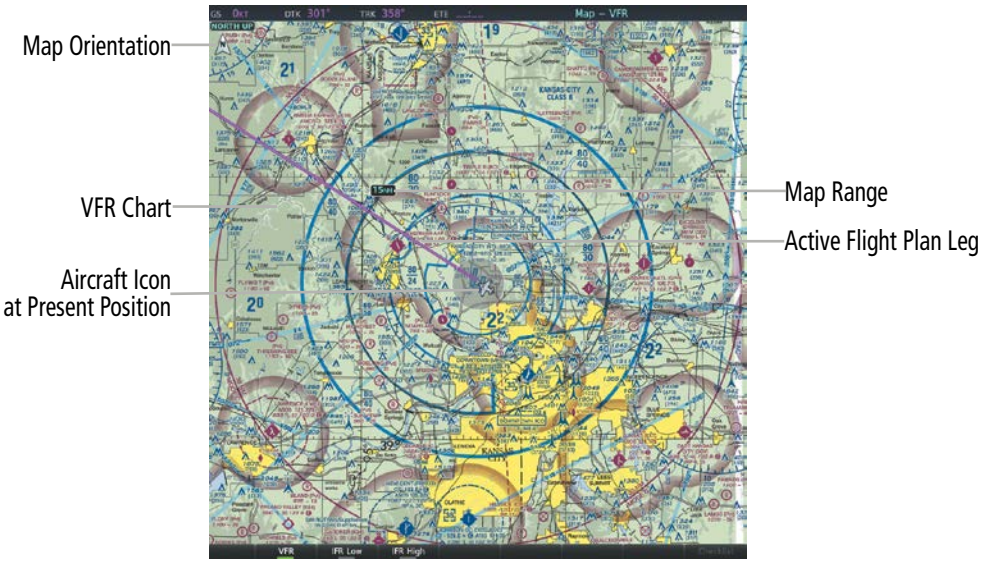


Figure 8-24 GPS Navigation Information on the VFR Chart

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.

Modifying the IFR Low, IFR High, VFR Charts settings:

1) Select the 'Map - IFR/VFR Charts' Page.
2) Press the **Map Opt** Softkey to display the Map Options.
3) Press the **Traffic** Softkey to enable/disable traffic overlaid onto the charts displayed.

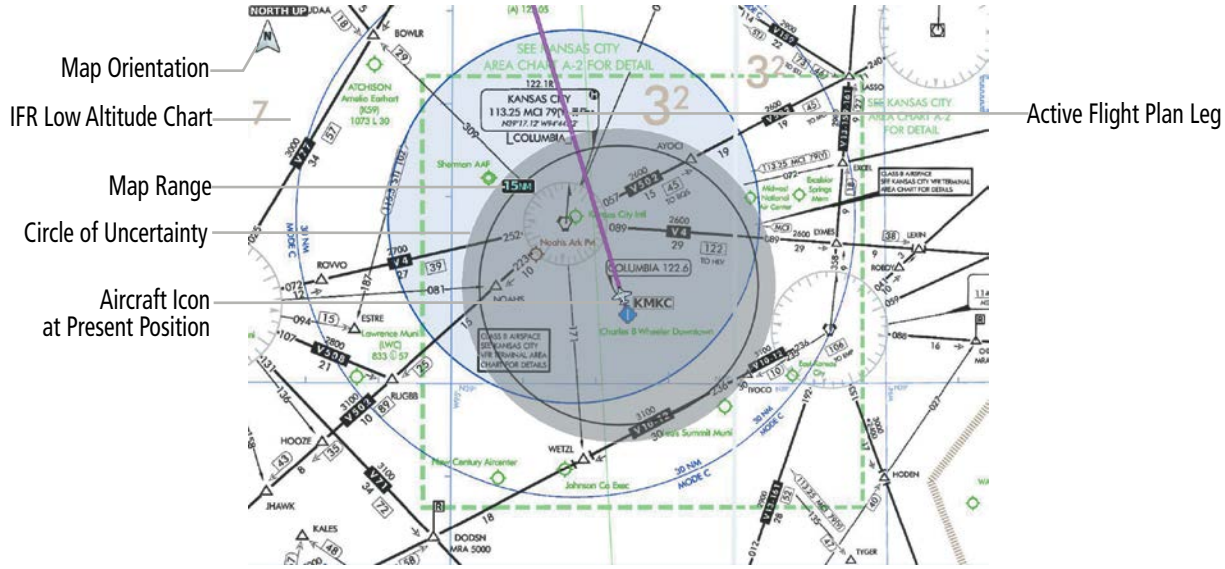


Figure 8-25 GPS Navigation Information on the IFR Low Altitude Chart

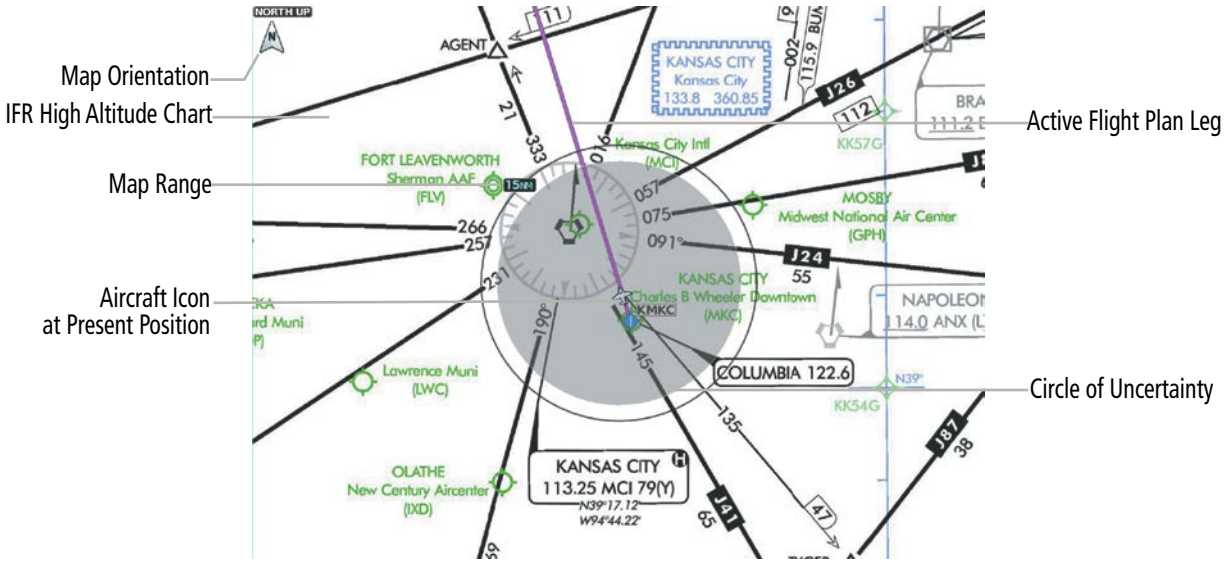


Figure 8-26 GPS Navigation Information on the IFR High Altitude Chart

8.3 DATABASE CYCLE NUMBER AND REVISIONS

CYCLE NUMBER AND REVISION

Databases that may be available include FliteCharts, Obstacle, Terrain, IFR/VFR, Navigation, ChartView, SafeTaxi. Data is revised and expiration dates vary. Data is still viewable during a period that extends from the cycle expiration date to the disables date. When turning on the system, the Power-up Page displays the current status of the databases. As an example, see the table below for the various FliteCharts Power-up Page displays and the definition of each. The expiration date and disables date varies for each database.

Example Power-up Page Display Text
FliteCharts Data: └ N/A
FliteCharts Data: └ Expires DD-MMM-YYYY
FliteCharts Data: └ Disables DD-MMM-YYYY
FliteCharts Data: └ Disabled

Table 8-1 Database Power-up Page Annunciations

White text, such as 'FliteCharts Data Expires' plus a date, indicates the chart database is current. Amber 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 cyan or amber text. Dates shown in cyan are current data. Dates shown in amber 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.

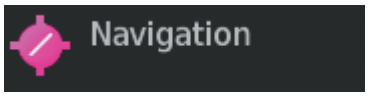
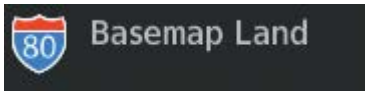
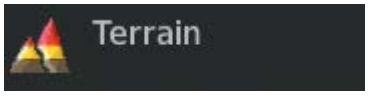
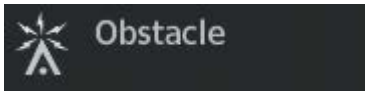
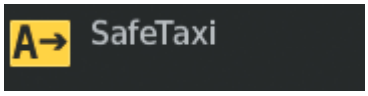
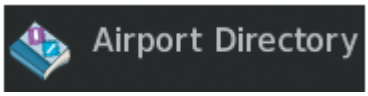
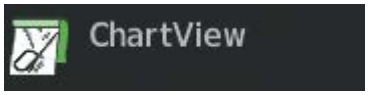
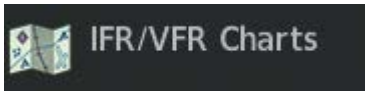
Example Power-up Page Display Text	Database Cycle Number Format	Revision Cycle
	YYII	28 days
	YYMI	Not Applicable
	YYTI	Not Applicable
	YYBI	56 days
	YYSI	56 days
	YYDI	56 days
	YYII	28 days
	YYII	14 days
	YYII	28 days

Table 8-2 Database Startup, Format and Cycle

8.4 SATELLITE TELEPHONE AND TEXT MESSAGING (SMS)

NOTE: *An account must be established to access the Iridium satellite network for voice/SMS.*

The Iridium Transceiver provides an airborne low speed datalink, Iridium Satellite Telephone service, and Short Message Service (SMS). The Iridium Transceiver can also be paired with the optional WiFi Datalink, providing a high speed (IEEE 802.11g) WiFi datalink between the aircraft and a ground computer network while the aircraft is on the ground.

The telephone is available to the flight crew through the audio panel and headsets. An optional handset may be installed in the aircraft cabin to be used for voice communication between the aircraft cabin and the cockpit and for Iridium telephone service in the aircraft cabin.

Operation of these features in the cockpit is accomplished through the 'Aux - Telephone', 'Aux - Text Messaging', and 'Aux - Maintenance WiFi Setup' Pages. For operation using the cabin handset, consult the instructions provided with the handset.

REGISTERING WITH GARMIN CONNEXT®

A subscriber account must be established prior to using the Iridium Satellite System. Before setting up an Iridium account, obtain the serial number of the Iridium Transceiver (GSR1) and the System ID by selecting the 'Aux - System Status' Page. Setup can be completed by visiting www.flygarmin.com.

DISABLE/ENABLE IRIDIUM TRANSCEIVER

Iridium telephone and data communications may be turned on or off by performing these simple steps.

Disabling/enabling telephone and low speed data services:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' Page Group.
2) Turn the small **FMS** Knob to select the 'Aux - Telephone' Page.

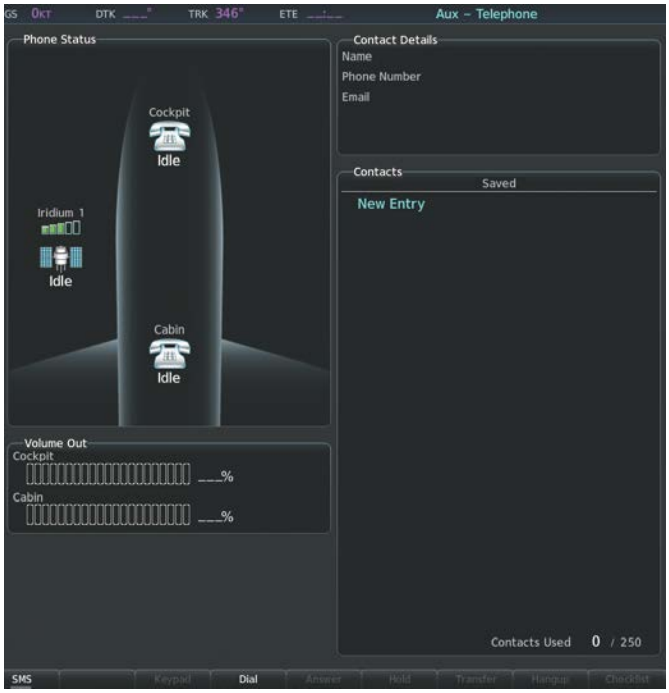


Figure 8-27 Report Status Page

3) Press the **MENU** Key. The Page Menu window is now displayed.

4) Turn the **FMS** Knob to select 'Disable Iridium Transmission' in the menu list.

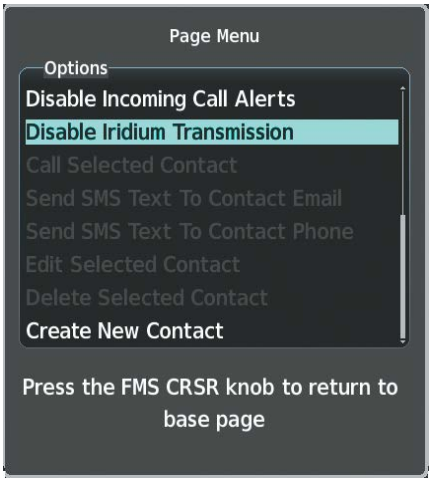


Figure 8-28 Select Disable Iridium Transmission

5) Press the **ENT** Key. The Iridium transceiver is now disabled.

6) To enable the Iridium transceiver, repeat steps 1 through 3, then select 'Enable Iridium Transceiver.'

TELEPHONE COMMUNICATION

The pilot or copilot can place and answer calls on the Iridium satellite network as well as to or from the telephone handset in the cabin. Calls can also be answered or made from the optional cabin phone, however, only actions initiated from the cockpit will be discussed here. See the cabin handset user guide for more information. Control and monitoring of telephone functions are accomplished through the 'Aux - Telephone' Page.

Viewing the Telephone Page:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - Telephone' or 'Aux - Text Messaging' Page.

3) If necessary, press the **Phone** Softkey to display the 'Aux - Telephone' Page.

The phone status display gives a graphical representation of the current disposition of voice and/or data transmissions.

Internal Phone	External Phone	Description
		Phone is Idle
		Phone is ringing
		Phone has a dial tone (off hook) or connected to another phone
		Phone dialed is busy
		Phone is dialing another phone
		Phone has failed
		Phone status not known
		Phone is disabled
		Phone is reserved for data transmission
		Calling other phone or incoming call from other phone
		Other phone is on hold
		Phones are connected

Table 8-3 Telephone Symbols

CONTACTS

The names, telephone number, and email addresses can be saved in a list of contacts for easy use when making telephone calls.

Entering a new contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.
2) If necessary, turn either **FMS** Knob to place the cursor on 'New Entry.'
3) Press the **ENT** Key. The cursor moves the 'Name' field of the 'Contact Details' window.
4) Enter the desired name of the new contact. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
5) Press the **ENT** Key. The cursor moves to the 'Phone Number' field.
6) Enter the desired telephone number. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
7) Press the **ENT** Key. The cursor moves to the 'Email' field.
8) Enter the desired email address. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
9) Press the **ENT** Key. The **Save** Button is highlighted.
10) Press the **ENT** Key. The new contact entry is added to the list of saved contacts.

Delete a contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.
2) Turn either **FMS** Knob to place the cursor on the desired contact name.
3) Press the **Delete** Softkey. A confirmation window is displayed.
4) With 'OK' highlighted, press the **ENT** Key to delete the selected contact.

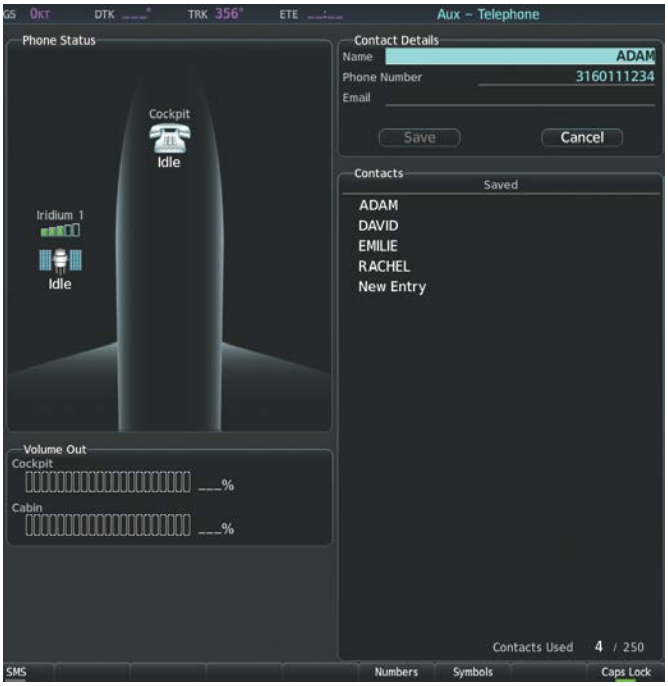


Figure 8-29 Editing a Contact

Editing a contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.
2) Turn either **FMS** Knob to place the cursor on the desired contact name.
3) Press the **Edit** Softkey. The cursor is placed in the 'Name' field. Enter the desired changes. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
4) Press the **ENT** Key when each field is complete. The **Save** Button is now highlighted.
5) Press the **ENT** Key to save the changes.

INCOMING CALLS

When viewing MFD pages other than the 'Aux - Telephone' Page, a pop-up alert will be displayed and an aural alert "Incoming Call" will be heard. If the call is from the cabin, Cabin will be displayed. If the incoming call is an Iridium network call, Iridium will be displayed. The pop-up alert may be inhibited at times, such as during takeoff. In addition to the pop-up alert, a ringing phone symbol will be displayed to the right of the MFD page title. Also, the voice alert "Incoming Call" will be heard on the selected cockpit audio.

NOTE: *The **Push-to-Talk** Switch is not utilized for telephone communication. The microphone is active after pressing the **Answer** Softkey, and stays active until the call is terminated.*

Answering an incoming call in the cockpit:

1) Press the **TEL** Key on the appropriate audio panel.
2) Press the **Answer** Softkey on the MFD.

   Or:

   a) While viewing the 'Aux - Telephone' Page, press the **MENU** Key to display the Page Menu.
   b) Turn either **FMS** Knob to place the cursor on 'Answer Incoming Call.'
   c) Press the **ENT** Key.

Pressing the **Ignore** Softkey will extinguish the pop-up window and leave the call unanswered. Pressing the **Phone** Softkey will display the 'Aux - Telephone' Page allowing additional call information to be viewed before answering.

Muting incoming call alerts:

1) With the 'Aux - Telephone' Page displayed, press the **MENU** Key on the MFD to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Disable Incoming Call Alerts.'
3) Press the **ENT** Key. The voice and pop-up alert will not be displayed now when an incoming call is received.

OUTGOING CALLS

Voice calls can be made from the cockpit to the handset in the cabin, or to an external phone through the Iridium Satellite Network.

Making a call to the cabin:

1) Press the **TEL** Key on the appropriate audio panel.
2) Press the **Dial** Softkey on the MFD.
3) Press the **ENT** Key. The cursor will move from 'Cabin' to 'OK.'
4) Press the **ENT** Key again. The cabin phone will now ring.

When the cabin phone is answered, the connection is established. To exit the call, press the **Hangup** Softkey.

Making an external call from the cockpit using the Iridium satellite network:

1) Press the **TEL** Key on the appropriate audio panel.
2) Press the **Dial** Softkey on the MFD.
3) Turn the small **FMS** Knob to select 'Iridium.'
4) Press the **ENT** Key. The cursor has now moved to the phone number entry field.

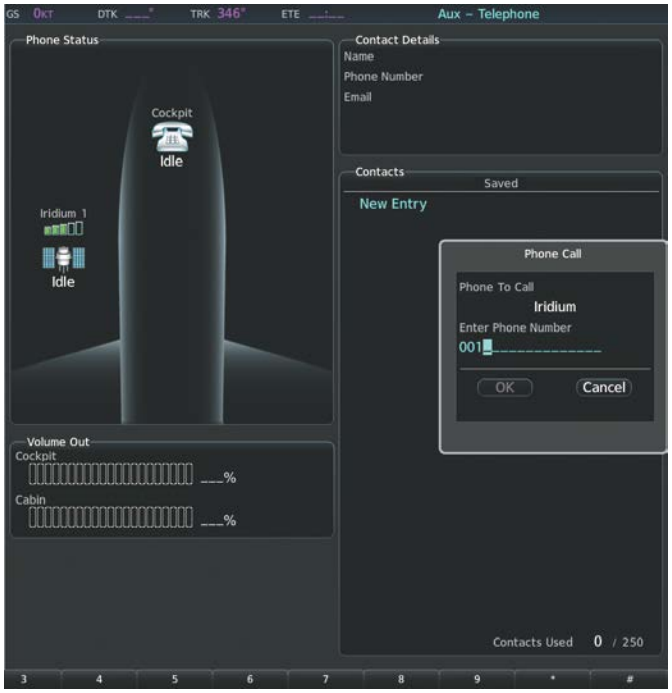


Figure 8-30 Enter Phone Number

5) Enter the desired telephone number (country code first) by pressing the number softkeys on the MFD or by pressing the numeric keys on the MFD Control Unit.
6) Press the **ENT** Key. 'OK' is highlighted.

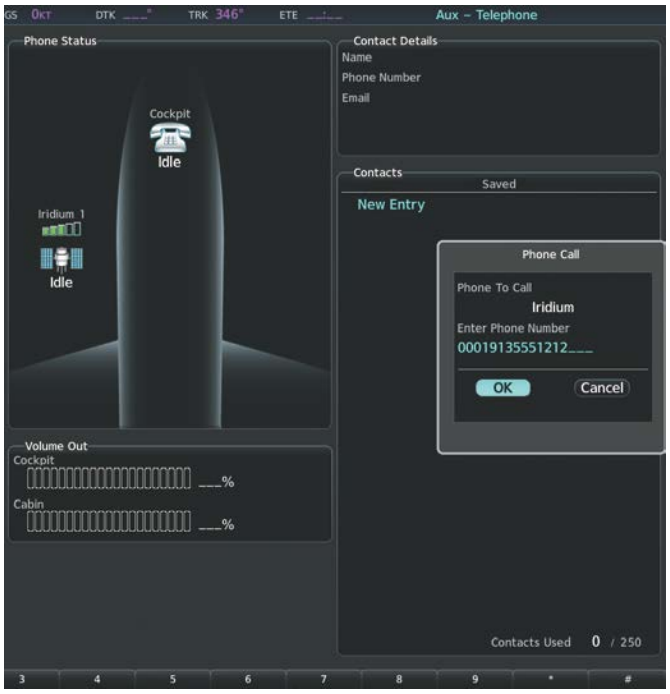


Figure 8-31 Make the Call

7) Press the **ENT** Key. The system will begin calling the number.

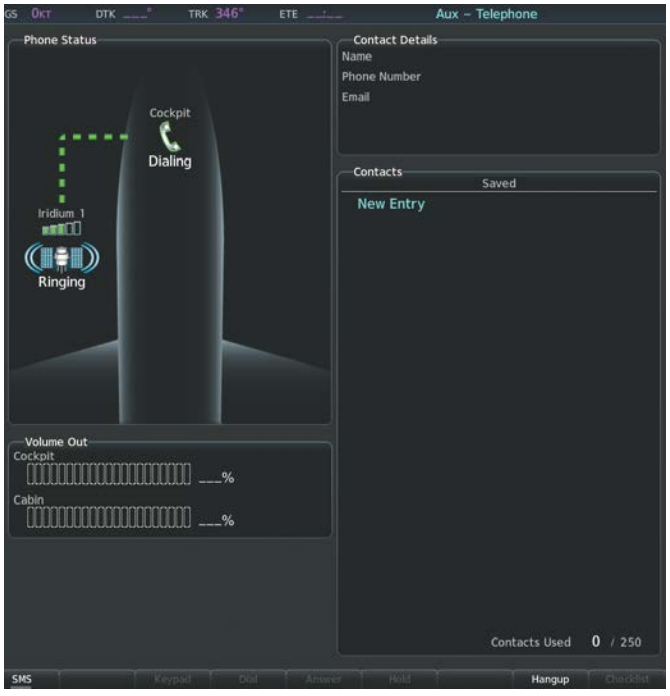


Figure 8-32 System is Making the Connection

When the phone is answered, the connection is established. To exit the call, press the **Hangup** Softkey.

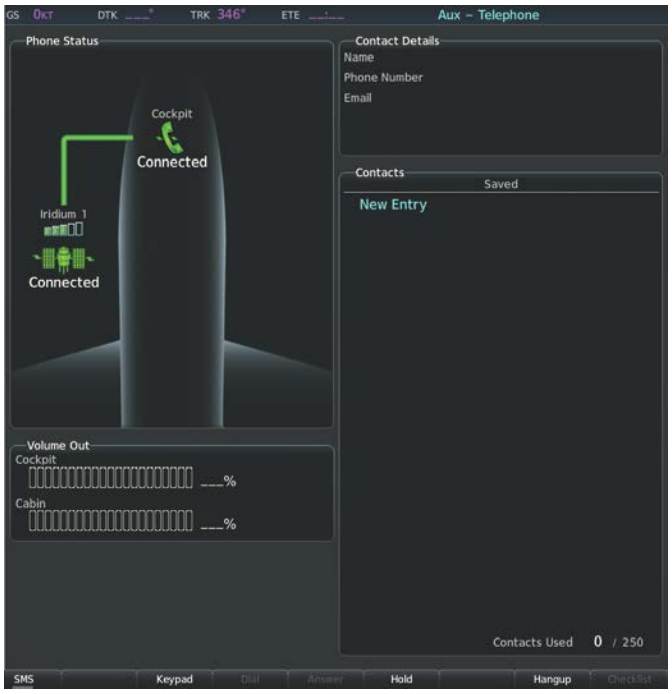


Figure 8-33 Phone is Answered, Connection Complete

Making an external call from the cockpit by using the Contact List:

1) Press the **TEL** Key on the appropriate audio panel.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the small **FMS** Knob to select the desired contact name in the list of contacts.
4) Press the **Call** Softkey. The external call is initiated and the number associated with the contact name is dialed.

PLACING THE COCKPIT PHONE ON HOLD

Placing a call on hold:

Press the **Hold** Softkey on the MFD.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Put Current Call On Hold.'
3) Press the **ENT** Key.

The cockpit phone is now isolated from the call. This figure illustrates a call between the cockpit and an external phone in which the cockpit phone has been put on hold. Press the **Hold** Softkey again to resume the call.

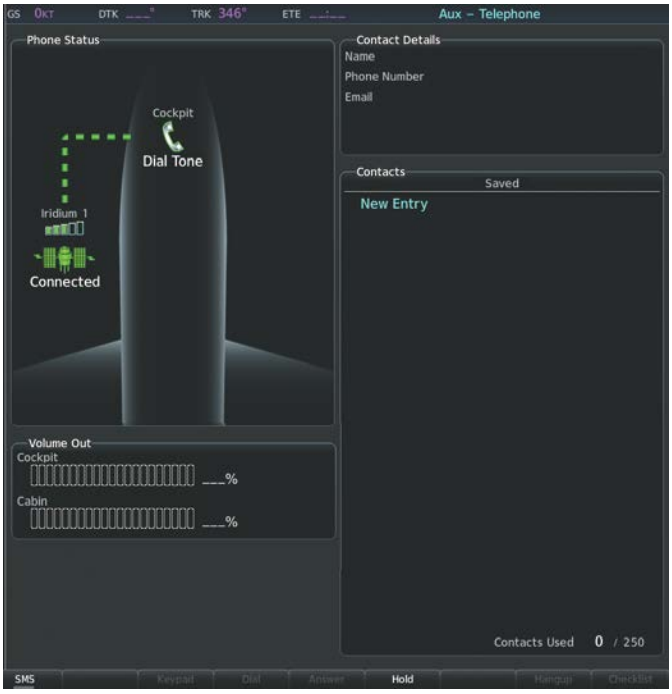


Figure 8-34 Cockpit Phone on Hold

TRANSFERRING A CALL FROM THE COCKPIT

From the cockpit phone, a external call can be transferred to the cabin phone, or a call with the cabin phone can be transferred to an external phone.

In this example, an active call to the cabin is transferred to an external number. Therefore, the window shows the 'Iridium' option. If the active call is with an external phone, 'Cabin' would be the option.

Transferring a call:

1) Press the **Trans** Softkey on the MFD.

   Or:

   a) Press the **MENU** Key to display the Page Menu.

   b) Turn either **FMS** Knob to place the cursor on 'Transfer Current Call.'

   c) Press the **ENT** Key.

2) Press the **ENT** Key. The cursor now highlights the phone number entry field.

3) Enter the phone number to which the call is being transferred, as discussed earlier for making an external call on the Iridium satellite network.

4) Press the **ENT** Key. 'OK' is now highlighted.

5) Press the **ENT** Key again to place the call.

When the external phone is answered, the call connection is indicated.

MAKING A CONFERENCE CALL FROM THE COCKPIT

The cabin or an external phone can be added to a call already in progress.

Adding another phone to an active call:

1) Press the **Conf** Softkey on the MFD.

   Or:

   a) Press the **MENU** Key to display the Page Menu.

   b) Turn either **FMS** Knob to place the cursor on 'Conference Current Call.'

   c) Press the **ENT** Key.

In this example, an external phone will be added to an active call to the cabin. Therefore, the window shows the 'Iridium' option. If the active call is with an external phone, 'Cabin' would be the option.

2) Press the **ENT** Key. The cursor now highlights the phone number entry field.

3) Enter the phone number to be added to the call, as discussed earlier for making an external call on the Iridium satellite network.

4) Press the **ENT** Key. 'OK' is now highlighted.

5) Press the **ENT** Key again to place the call.

When the external phone is answered, the call connection is indicated.

TEXT MESSAGING (SMS)

The pilot or copilot can send and receive text messages on the Iridium satellite network. Messages may be sent to an email address or text message capable cellular telephone. Message length is limited to 160 characters, including the email address.

The text messaging user interface is mainly through the 'Aux - Text Messaging' Page.

Viewing the Text Messaging Page:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - Telephone' or 'Aux - Text Messaging' Page.

3) If necessary, press the **SMS** Softkey to display the 'Aux - Text Messaging' Page.

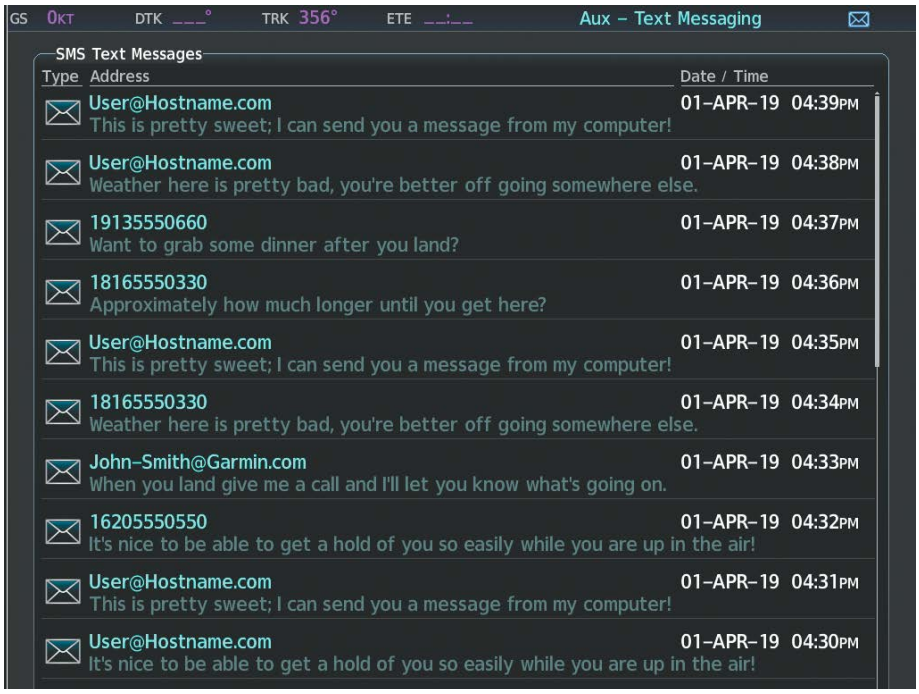


Figure 8-35 Text Messaging Page

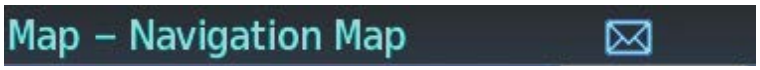
Message Symbol	Description
	Received text message that has not been opened
	Received text message that has been opened
	Saved text message, draft not sent
	System is sending text message
	Text message has been sent
	System failed to send text message
	Predefined text message

Table 8-4 Text Message Symbols

VIEWING A TEXT MESSAGE WHEN RECEIVED

When viewing MFD pages other than the 'Aux - Text Messaging' Page, a pop-up alert will be displayed when a new text message is received.

New Text Message Pop-up



New Text Message Symbol on MFD Page

Figure 8-36 New Text Message Received

Press the **View** Softkey to view the message. Pressing the **Ignore** Softkey will extinguish the pop-up window and leave the text message unopened. Pressing the **Ignore All** Softkey will extinguish the pop-window and ignore all future incoming text messages. Pressing the **SMS** Softkey will display the 'Aux - Text Messaging' Page.

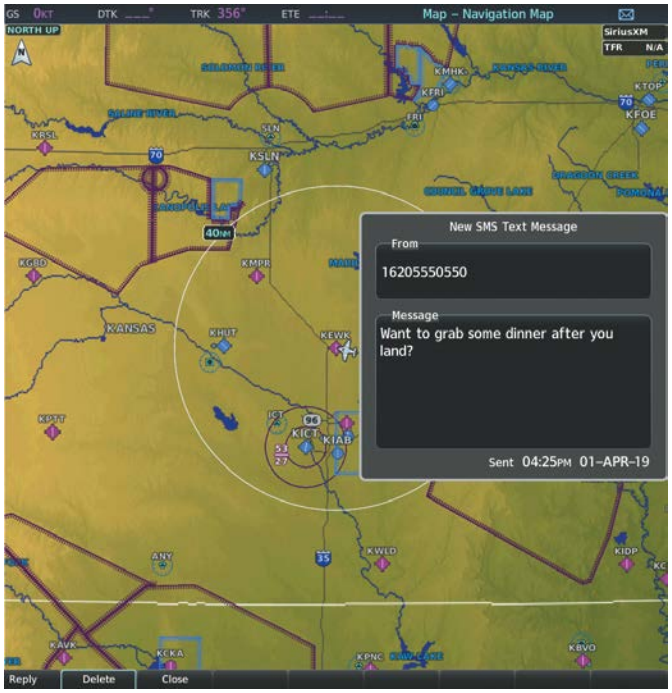


Figure 8-37 Text Message Displayed from Pop-Up Alert

The pop-up alerts may be enabled or disabled through the Page Menu.

Enabling/disabling incoming text message pop-up alerts:

1) With the 'Aux - Text Messaging' Page displayed, press the **MENU** Key on the MFD to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Disable New Message Popups' or 'Enable New Message Popups.'
3) Press the **ENT** Key. The pop-up alert will not be displayed when an incoming text message is received.

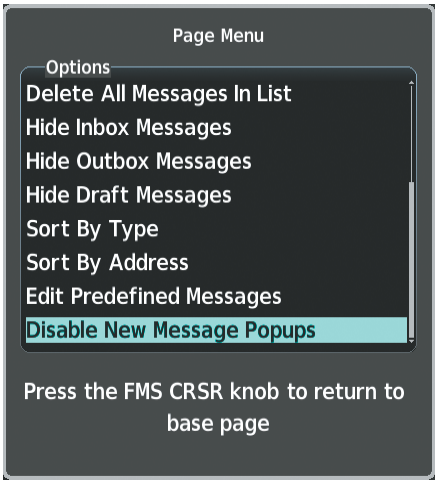


Figure 8-38 Disabling New Text Message Pop-Ups

REPLY TO A TEXT MESSAGE

After reading a text message, a reply may be sent.

Replying to a text message:

While viewing the text message, press the **Reply** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Reply To Message.'
3) Press the **ENT** Key.

SENDING A TEXT MESSAGE

Text messages may be sent from the 'Aux - Text Messaging' Page.

Sending a new text message:

1) While viewing the 'Aux - Text Messaging' Page, press the **New** Softkey.

   Or:

   a) Press the **MENU** Key to display the Page Menu.
   b) Turn either **FMS** Knob to place the cursor on 'Draft New Message.'
   c) Press the **ENT** Key.

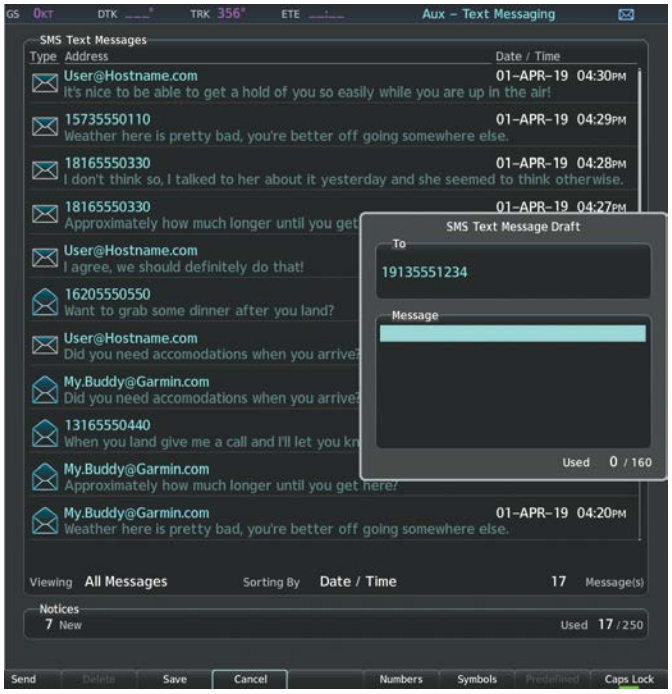


Figure 8-39 Composing a New Text Message

2) The SMS Text Message Draft Window is now displayed with the cursor in the 'To' field. Enter the desired telephone number or email address. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or combination of the **FMS** Knob on the controller and softkeys on the MFD. The **FMS** Knob is used to enter letters and numbers, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

3) Press the **ENT** Key. The cursor is now displayed in the 'Message' field.

4) Enter the desired message using any combination of entry methods as described in step 2.

5) Press the **ENT** Key.

6) Confirm you wish to send the message by pressing the **ENT** Key with 'Yes' highlighted. Select 'No' to return to the message entry field and either press the **Cancel** Softkey to delete the message or press the **Save** Softkey to save the message as a draft.

Text messages and emails may also be sent to contacts from the 'Aux - Telephone' Page.

Sending a new text message/email to a saved contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.

2) Turn either **FMS** Knob to place the cursor on the desired contact name.

3) Press either the **Text Email** Softkey to send to the email address saved for the contact or the **Text Phone** Softkey to send to the phone number saved for the contact. The cursor is placed in the 'To' field. Confirm the contact you wish to send a message to by pressing the **ENT** Key.

4) Enter the desired message, then press the **ENT** Key.

5) Confirm you wish to send the message by pressing the **ENT** Key with 'Yes' highlighted. Select 'No' to return to the message entry field and either press the **Cancel** Softkey to delete the message or press the **Save** Softkey to save the message as a draft.

PREDEFINED TEXT MESSAGES

Time and effort can be saved in typing text messages that are used repeatedly by saving these messages as a predefined message.

Creating a predefined text message:

1) While viewing the 'Aux - Text Messaging' Page, press the **MENU** Key to display the Page Menu.

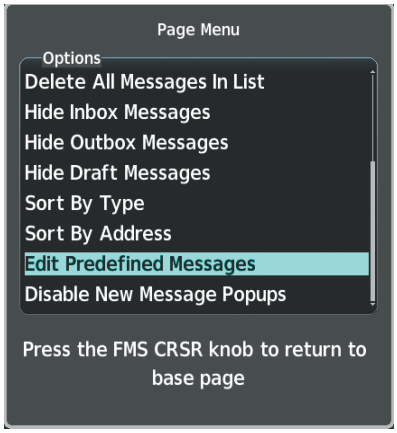


Figure 8-40 Creating/Editing Predefined Messages

2) Turn either **FMS** Knob to select 'Edit Predefined Messages.'
3) Press the **ENT** Key. The Predefined Messages view is now displayed.
4) Press the **New** Softkey.

   Or:

   a) Press the **MENU** Key to display the Page Menu.

   b) Turn either **FMS** Knob to place the cursor on 'Draft New Predefined Message.'

   c) Press the **ENT** Key. The Predefined SMS Text Message Window is now displayed.

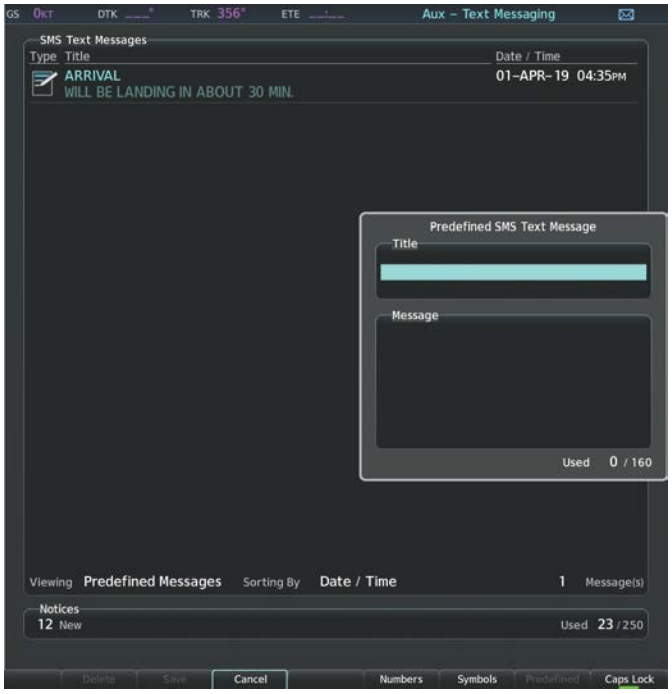


Figure 8-41 Composing a Predefined Message

5) The cursor is displayed in the 'Title' field. Enter the desired message title. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or combination of the **FMS** Knob on the controller and softkeys on the MFD. The **FMS** Knob is used to enter letters and numbers, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

6) Press the **ENT** Key. The cursor is now displayed in the 'Message' field.

7) Enter the desired message using any combination of entry methods as described in step 5.

8) Press the **ENT** Key.

9) Press the **Save** Softkey. The new predefined message is now shown in the displayed list. Pressing the **Cancel** Softkey will delete the message without saving.

10) Press the **MENU** Key to display the Page Menu.

11) Turn either **FMS** Knob to place the cursor on 'Cancel Drafting Message.'

12) Press the **ENT** Key.

Sending a predefined text message:

1) While viewing the 'Aux - Text Messaging' Page, press the **New** Softkey.

2) The Predefined SMS Text Message Window is now displayed with the cursor in the 'TO' field. Enter the desired telephone number or email address. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or combination of the **FMS** Knob on the controller and softkeys on the MFD. The **FMS** Knob is used to enter letters and numbers, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press

the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

3) Press the **ENT** Key. The cursor is now displayed in the 'Message' field.

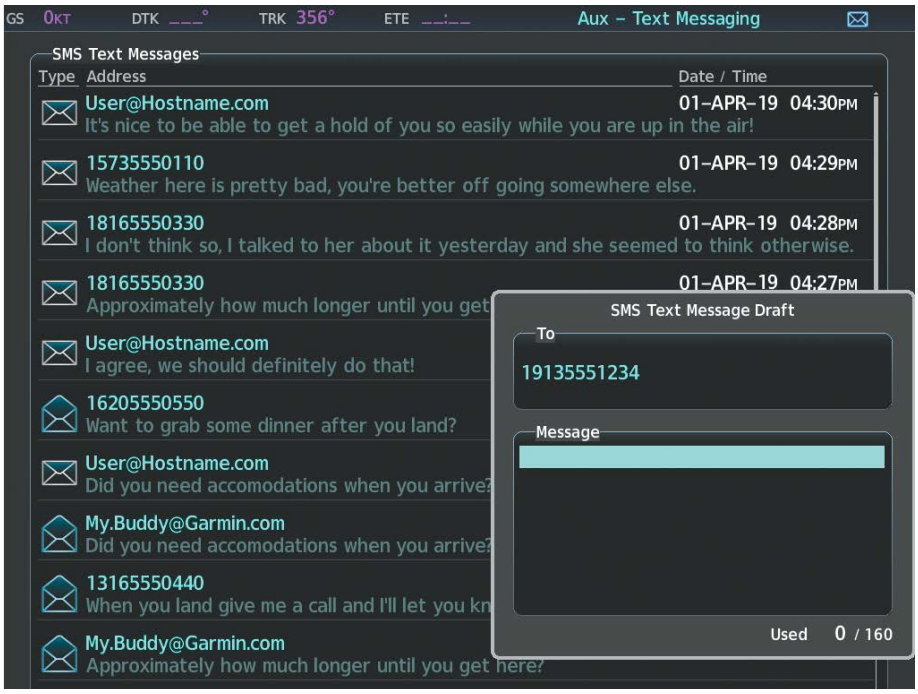


Figure 8-42 Predefined Message Softkey Shown When Composing a Message

4) Press the **PREDEFD** Softkey. The Predefined Message Menu Window is displayed.

5) Turn either **FMS** Knob to select the desired predefined message.

6) Press the **ENT** Key. The predefined message text is inserted into the message field. If desired, the message can be edited by using the FMS Knobs.

7) Press the **ENT** Key.

8) Press the **Send** Softkey to transmit the message.

TEXT MESSAGE BOXES

Received text messages reside in the Inbox as 'Read' or 'Unread' messages. The Outbox contains 'Sent" and 'Unsent' text messages. Saved messages that are meant to be sent later are stored as Drafts. Each text message box may be viewed separately, or together in any combination.

Showing Inbox messages:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Inbox** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.

2) Turn either **FMS** Knob to place the cursor on 'Show Inbox Messages.'

3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window.

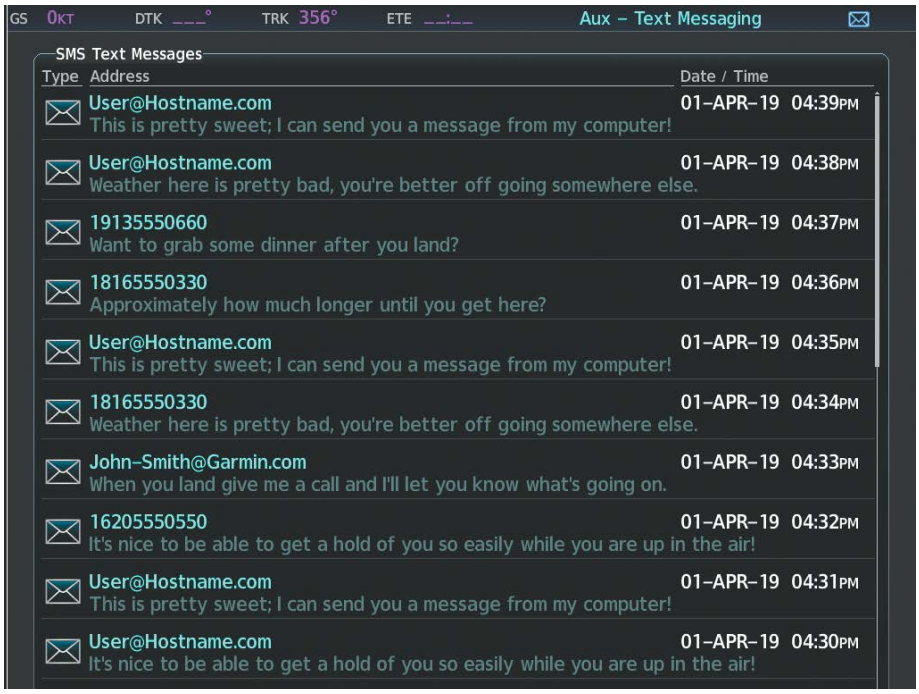


Figure 8-43 Text Message Inbox

Showing Outbox messages:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Outbox** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Show Outbox Messages.'
3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window.

Showing Draft messages:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Drafts** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Show Draft Messages.'
3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window.

MANAGING TEXT MESSAGES

The viewed messages may be listed according to the date/time the message was sent or received, the type of message (read, unread, sent, unsent, etc.), or by message address.

Viewing messages sorted by message date/time:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Time** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Sort By Date/Time.'
3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing messages sorted by message type:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Type** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Sort By Type.'
3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing messages sorted by address:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Address** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Sort By Address.'
3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing the content of a text message:

1) While viewing the 'Aux - Text Messaging' Page, select the desired message box.
2) Press the **FMS** Knob to activate the cursor.
3) Turn either **FMS** Knob to select the desired message.
4) Press the **View** Softkey.

Or:

Press the **ENT** Key.

Or:

a) Press the **MENU** Key to display the Page Menu.
b) Turn either **FMS** Knob to place the cursor on 'View Selected Message.'
c) Press the **ENT** Key.

Message content is displayed.

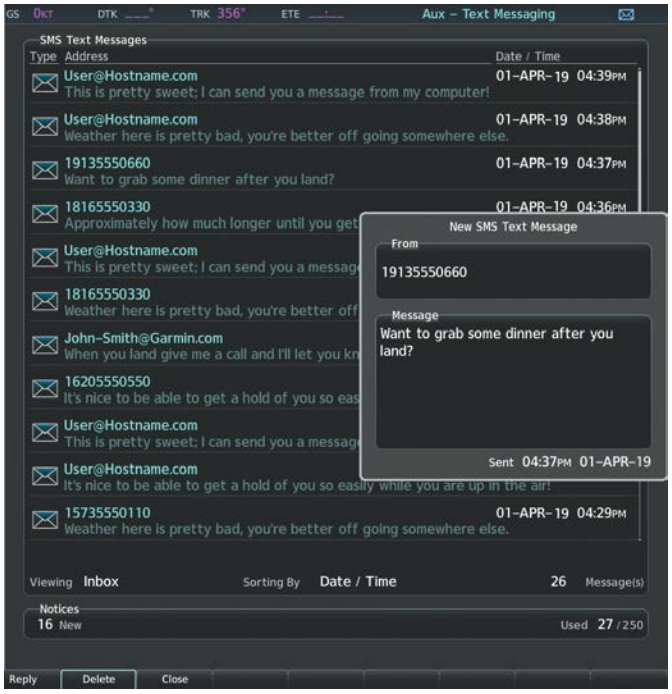


Figure 8-44 Viewing Message Content

5) To close the text message, press the **Close** Softkey.

   Or:

   a) Press the **MENU** Key to display the Page Menu.

   b) Turn either **FMS** Knob to place the cursor on 'Close Message.'

   c) Press the **ENT** Key.

Marking selected message as read:

1) While viewing the Inbox on the 'Aux - Text Messaging' Page, press the **FMS** Knob to activate the cursor.
2) Turn either **FMS** Knob to select the desired message.
3) Press the **MRK Read** Softkey.

   Or:

   a) Press the **MENU** Key to display the Page Menu.

   b) Turn either **FMS** Knob to place the cursor on 'Mark Selected Message As Read.'

   c) Press the **ENT** Key.

   The message symbol now indicates the message has been opened.

Marking all messages as read:

1) While viewing the Inbox on the 'Aux - Text Messaging' Page, press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Mark All New Messages As Read.'
3) Press the **ENT** Key. A confirmation window is displayed.
4) With cursor highlighting 'YES', press the **ENT** Key. The message symbols now indicate all the message have been opened.

Deleting a message:

1) While viewing the Inbox on the 'Aux - Text Messaging' Page, press the **FMS** Knob to activate the cursor.
2) Turn either **FMS** Knob to select the desired message.
3) Press the **Delete** Softkey.

   Or:

   a) Press the **MENU** Key to display the Page Menu.
   b) Turn either **FMS** Knob to place the cursor on 'Delete Selected Message.'
   c) Press the **ENT** Key.

8.5 WIFI CONNECTIONS

The optional WiFi Datalink provides a high speed IEEE 802.11g WiFi datalink between the aircraft and a ground computer network while the aircraft is on the ground and located within range of the network.

The system is capable of WEP64, WEP128,WPA-PSK, and WPA2-PSK encryption formats. WPA-Enterprise and WPA2-Enterprise are not supported. Connections that require web proxies, captive portals, or other elements that require user credentials, including a user name and password or a redemption or access code; or require action such as accepting a user agreement, are not supported.

Control and monitoring of WiFi functions are accomplished through the 'Aux - Maintenance WiFi Setup' Page.

Viewing the WiFi Setup Page:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' Page Group.
2) Turn the small **FMS** Knob to select the 'Aux - Maintenance WiFi Setup' Page.

Setting up a new WiFi connection:

1) Press the **Avail** Softkey on the MFD. A list of available networks will be displayed in the Available Networks window. Signal strength is shown for each network, as well as security requirements and whether the network has been saved in the system's memory.

Figure 8-45 Available WiFi Networks

2) If necessary, press the **Rescan** Softkey to have the system scan again for available networks.

Or:

a) Press the **MENU** Key to display the Page Menu.

b) Turn either **FMS** Knob to place the cursor on 'Rescan Available Networks.'

c) Press the **ENT** Key.

3) Press the **FMS** Knob to place the cursor in the list of networks.

4) Turn either **FMS** Knob to select the desired network.

Figure 8-46 Desired Network Selected

5) Press the **Connect** Softkey.

Or:

a) Press the **MENU** Key to display the Page Menu.

b) Turn either **FMS** Knob to place the cursor on 'Connect to Selected Network.'

c) Press the **ENT** Key.

6) If the network is secured, a window will be displayed in order to enter the necessary passcode. Use the **FMS** Knobs to enter the desired alpha numeric characters. Press the **CapsLock** Softkey to enter upper case letters. If there is no security associated with the network, proceed to step 9.

7) Press the **ENT** Key. 'OK' will be highlighted.

8) Press the **ENT** Key again.

9) The Save Settings window is now displayed with the cursor highlighting 'Save Connection.'

10) The selected network can be saved to system memory to make re-connection easier at a later time.

Connecting the selected network without saving:

a) Turn the large FMS Knob to move the cursor to highlight 'Connect.'

b) Press the **ENT** Key.

Saving and connect the selected network:

a) Press the **ENT** Key. A checkmark is placed in the check box and the cursor moves to the airport field.

b) Using the **FMS** Knobs, enter an airport identifier to be associated with the saved network. This aids in identifying the network later in the event of duplicate network names.

c) Press the **ENT** Key. The cursor moves to 'Connect.'

d) Press the **ENT** Key again to connect to the selected network.

Editing a saved network:

1) While viewing list of saved networks, press the **FMS** Knob to activate the cursor.

2) Turn either **FMS** Knob to highlight the network to be edited.

3) Pressing the **ENT** Key at this point will check or uncheck the Auto Connect check box. When a checkmark is present, the system will automatically connect to the network when within range.

4) Press the **Edit** Softkey. The cursor now appears in the Connection Settings window.

5) Turn the large **FMS** Knob to select the network attribute to be edited.

6) Turn the small **FMS** Knob to begin editing the field.

7) When the entry is complete, press the **ENT** Key.

8) Turn the large **FMS** Knob or press the **ENT** Key until 'Save' is highlighted.

9) Press the **ENT** Key.

Disconnecting a WiFi network:

Press the **DISCNCT** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.

2) Turn either **FMS** Knob to place the cursor on 'Disconnect From Network.'

3) Press the **ENT** Key.

Deleting a saved WiFi network:

1) While viewing the list of saved networks, press the **FMS** Knob to activate the cursor.

2) Turn either **FMS** Knob to highlight the network to be deleted.

3) Press the **Delete** Softkey. The selected network is removed from the list.

8.6 SIRIUSXM RADIO ENTERTAINMENT

NOTE: *Refer to the Hazard Avoidance Section for information about SiriusXM Weather products.*

The optional SiriusXM Satellite Radio entertainment feature of the SiriusXM Datalink 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 Datalink 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 SiriusXM Datalink Receiver. 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 Datalink Receiver.
- On the XM Information Page on the MFD.
- On the XM Satellite Radio Activation Instructions included with the unit (available at www.flygarmin.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 'Aux' Page Group.

3) Select the 'Aux - XM Radio' page.

4) Press the **Info** Softkey to display the XM Information Page.

5) Verify that the desired services are activated.

6) Press the **Lock** Softkey.

7) Turn the large **FMS** Knob to highlight YES.

8) To complete activation, press the **ENT** Key.

Figure 8-47 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 amber Activation Required message is displayed in the center of the Weather Datalink 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 'Aux' 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.

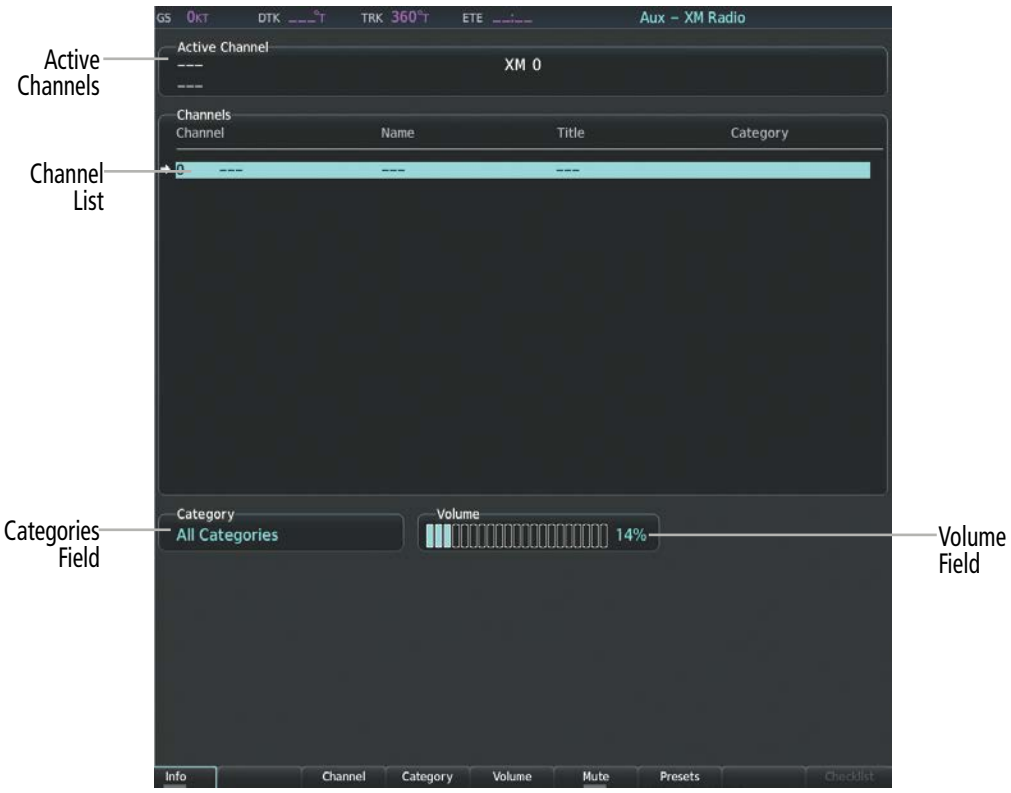


Figure 8-48 XM Radio Page

ACTIVE CHANNEL AND CHANNEL LIST

The Active Channel Box on the XM Radio Page displays the currently selected channel that the SiriusXM Radio is using.

The Channels List Box of the XM Radio Page shows a list of the available channels for the selected category. Channels can be stepped through one at a time or may be selected directly by channel number.

Selecting a channel from the channel list:

1) While on the XM Radio Page, 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) Press the **FMS** Knob to highlight the channel list and turn the large **FMS** Knob to scroll through the channels.
2) Press the **ENT** Key to activate the selected channel.

Selecting a channel directly:

1) While on the XM Radio Page, 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.

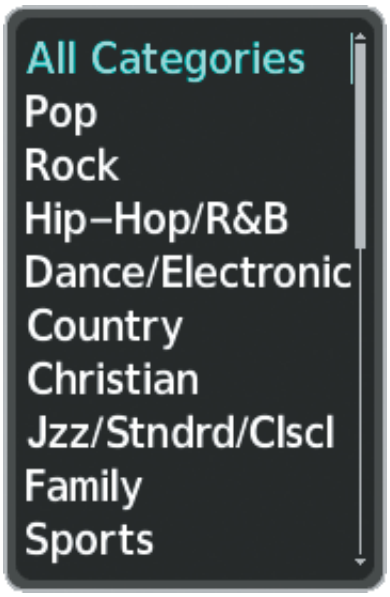


Figure 8-49 Categories List

PRESETS

Up to 15 channels from any category can be assigned a preset number. The preset channels are selected by pressing 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.

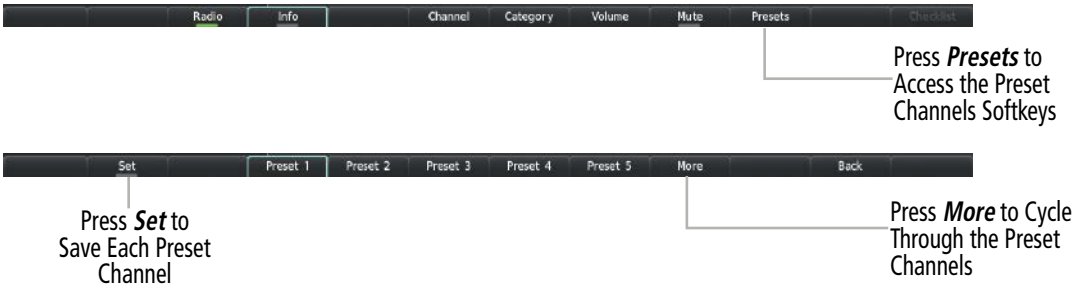


Figure 8-50 Accessing and Selecting SiriusXM Preset Channels

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 selected, the volume can also be adjusted using the small **FMS** Knob.)

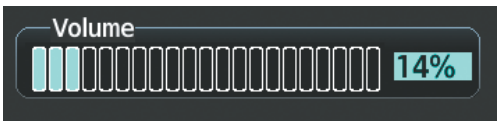


Figure 8-51 Volume Control

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.

8.7 SURFACEWATCH

NOTE: *The SafeTaxi database must be available to provide information regarding taxiways, aprons and other objects in the airport environment.*

NOTE: *When the flight plan is modified, data manually entered on the 'FPL - SurfaceWatch' Page will be cleared.*

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
- Runway distance remaining
- 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 SurfaceWatch feature is not available in Reversionary Mode.

Inhibiting/uninhibiting SurfaceWatch:

1) Select the 'Aux - System Setup 1' Page**.**
2) Press the **FMS** Knob momentarily to activate the flashing cursor..
3) Turn the large **FMS** Knob to highlight the 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 8-52 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 following figure, the aircraft is currently 'APPROACHING' taxiway E (TWY E). 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 by the crew.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from, or landing on, a runway different than that entered by the crew.
TWY LANDING	"Taxiway"	Issued when the aircraft is landing on a non-runway (e.g. a taxiway).

Table 8-5 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.

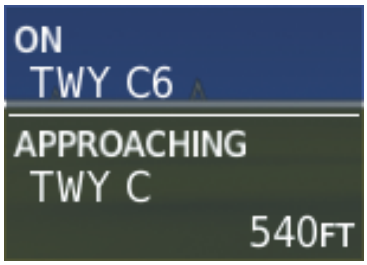


Figure 8-53 Typical Taxiway Information Displayed in the Information Box

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 as shown in the following figure.

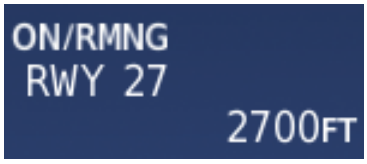


Figure 8-54 Typical Runway Information Displayed in the Information Box

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

NOTE: *Landing alerts are removed when the pilot initiates a climb during go-around.*

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.

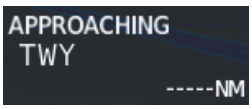


Figure 8-55 Typical Information Displayed During a Taxiway Landing Alert

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 as indicated in following figure.

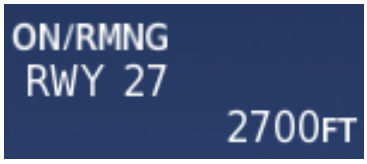


Figure 8-56 Typical Information Displayed During a Runway Too Short Alert

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 see following figure.

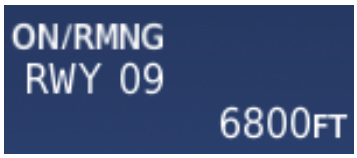


Figure 8-57 Typical Information Displayed During a Check Runway Alert

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) Press 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) Press 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) Press 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.

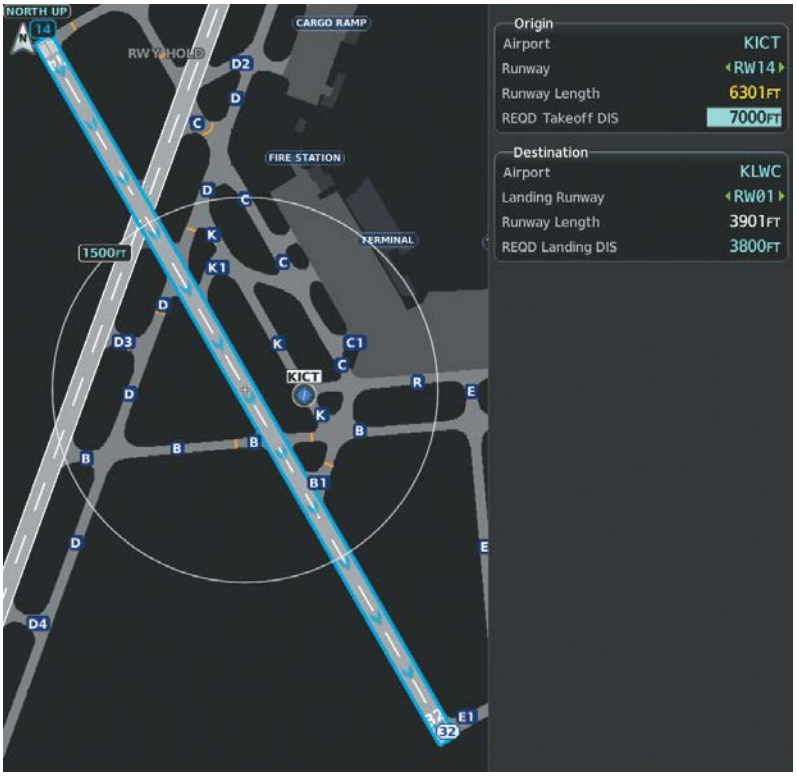


Figure 8-58 SurfaceWatch Setup Page (MFD)

Figure 8-59 SurfaceWatch Info and Cyan Runway Outline (PFD)

8.8 FLIGHT DATA LOGGING

NOTE: *Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.*

The Flight Data Logging feature will automatically store critical flight and engine data on an SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

Data is written to the SD card once each second while the MFD is powered on. All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the system is powered on, provided an SD card has been inserted.

The status of the Flight Data Logging feature can be viewed on the 'Aux - Utility' Page. If no SD card has been inserted, "NO CARD" is displayed. When data is being written to the SD card, "LOGGING DATA" is displayed.

The .csv file may be viewed with Microsoft Excel® or other spreadsheet applications.

NOTE: *If the optional Wireless Transceiver is installed, Flight Data Logging will be available through Connext and the Garmin Pilot application. See Garmin Pilot User's Guide for further information.*

The following is a list of data parameters the system is capable of logging for the aircraft.

- Date
- Time
- GPS altitude (MSL)
- GPS altitude (WGS84 datum)
- Baro-Corrected altitude (feet)
- Baro Correction (in/Hg)
- Indicated airspeed (kts)
- Vertical speed (fpm)
- GPS vertical speed (fpm)
- OAT (degrees C)
- True airspeed (knots)
- Pitch Attitude Angle (degrees)
- Roll Attitude Angle (degrees)
- Lateral and Vertical G Force (g)
- Ground Speed (kts)
- Ground Track (degrees magnetic)
- Latitude (degrees; geodetic; +North)
- Longitude (degrees; geodetic; +East)
- Magnetic Heading (degrees)
- HSI source
- Selected course
- Com1/Com2 frequency
- Nav1/Nav2 frequency
- CDI deflection
- VDI/GP/GS deflection
- Wind Direction (degrees)
- Wind Speed (knots)
- Active Waypoint Identifier
- Distance to next waypoint (nm)
- Bearing to next waypoint (degrees)
- Magnetic variation (degrees)
- Autopilot On/Off
- AFCS roll/pitch modes
- AFCS roll/pitch commands
- GPS fix
- GPS horizontal alert limit
- GPS vertical alert limit
- SBAS GPS horizontal protection level
- SBAS GPS vertical protection level
- Fuel Qty (right & left)(gals)
- Fuel Flow (gph)
- Turbine RPM
- Oil Pressure (psi)
- Oil Temperature (deg. F)
- Torque

The file containing the recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.

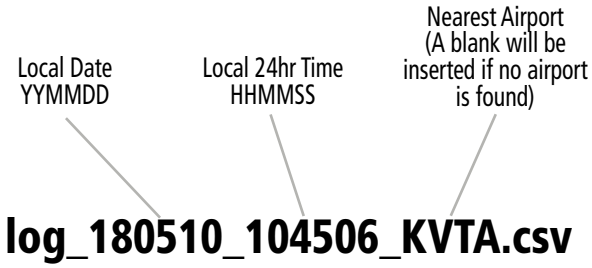


Figure 8-60 Log File Format

Data logging status can be monitored on the 'Aux - Utility' Page.

8.9 CONNEXT SETUP

The Connext Setup Page 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.

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.

Changing the Bluetooth Name:

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to place the cursor in the 'Bluetooth Name' field.
3) Enter the desired name by using the large **FMS** Knob to select the character field, and the small **FMS** Knob select the desired alphanumeric character for that field.
4) Press the **ENT** Key. The cursor is removed and the new name is displayed.

Enabling/Disabling Flight Plan Importing from Garmin Pilot:

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to place the cursor in the 'Flight Plan Import' field.
3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled.'
4) Press the **FMS** Knob to remove the cursor.

Enabling/Disabling WiFi Database Importing from Garmin Pilot:

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to place the cursor in the 'WiFi Database Import' field.
3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled.'
4) Press the **FMS** Knob to remove the cursor.

Enabling/Disabling Automatic Reconnection of a Specific Paired Device:

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to highlight the desired paired device.
3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled.' Selecting 'Enabled' allows the system to automatically connect to a previously paired device when detected.
4) Press the **FMS** Knob to remove the cursor.

Removing a Specific Paired Device from the List of Paired Devices:

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to highlight the desired paired device.
3) Press the **Remove** Softkey. A confirmation screen is displayed.
4) If necessary, turn the large **FMS** Knob to select 'Yes.'
5) Press the **ENT** Key to remove the device from the list of paired devices.

8.10 AUXILIARY VIDEO (OPTIONAL)

The system provides a control and display interface to an optional auxiliary video system. The system can display video for up to two inputs.

There are four modes of operation of the auxiliary video display: Full-Screen, Full-Screen with Digital Zoom, Split-Screen with Map, and Split-Screen with Map and Digital Zoom.

Displaying auxiliary video:

1) Turn the large **FMS** Knob to select the 'Aux' Page Group.
2) Turn the small **FMS** Knob to select Video and display the 'Aux - Video' Page.

Control of the 'Aux - Video' Page can also be accessed through the Page Menu.

Selecting video menu options:

1) While viewing the 'Aux - Video' Page press the **MENU** Key to display the Page Menu Options.
2) Turn the large **FMS** Knob to highlight the desired video adjustment option and press the **ENT** Key.

Once the **ENT** key is pressed on any option, the page menu closes and returns to the 'Aux - Video' Page.

VIDEO SETUP

Video brightness, contrast, and saturation may be adjusted be selecting the setup function. While viewing the setup function softkeys, after 45 seconds of softkey inactivity, the system reverts to the 'Aux - Video' Page softkeys.

Adjusting the video settings:

1) With the 'Aux - Video' Page displayed, press the **Setup** Softkey.
2) Press the **Bright -** or **Bright +**, to adjust display brightness in five percent increments from 0 to 100%.
3) Press the **Contrast-** or **Contrast +**, to adjust display contrast in five percent increments from 0 to 100%.
4) Press the **SAT -** or **SAT +**, to adjust display saturation in five percent increments from 0 to 100%.
5) If desired, return the display to the default settings by pressing the **Reset** Softkey.
6) Press the **Back** Softkey to return to the previous softkey level.

DISPLAY SELECTION

Pressing the **Hide Map** Softkey removes the map and displays video on the full screen. Pressing the **Hide Map** Softkey again restores the map view and the small video image.

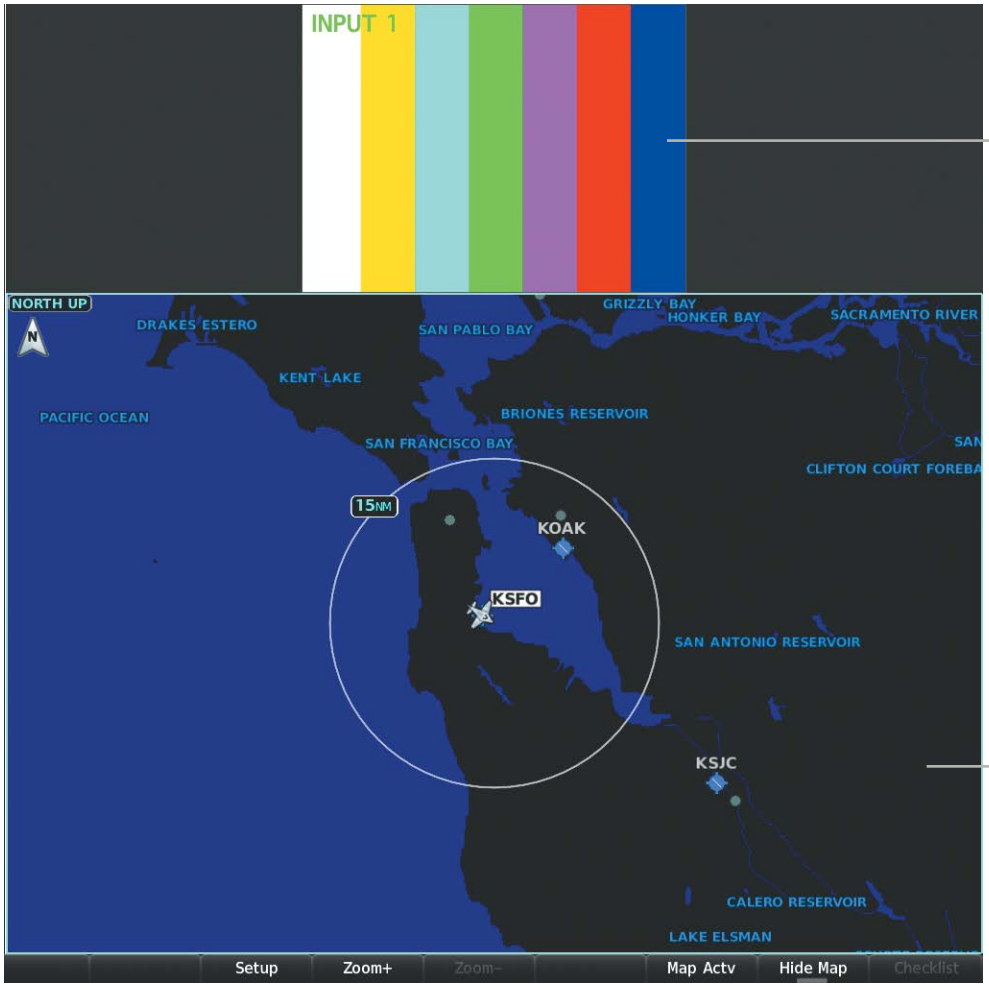


Figure 8-61 Aux - Video Split-Screen

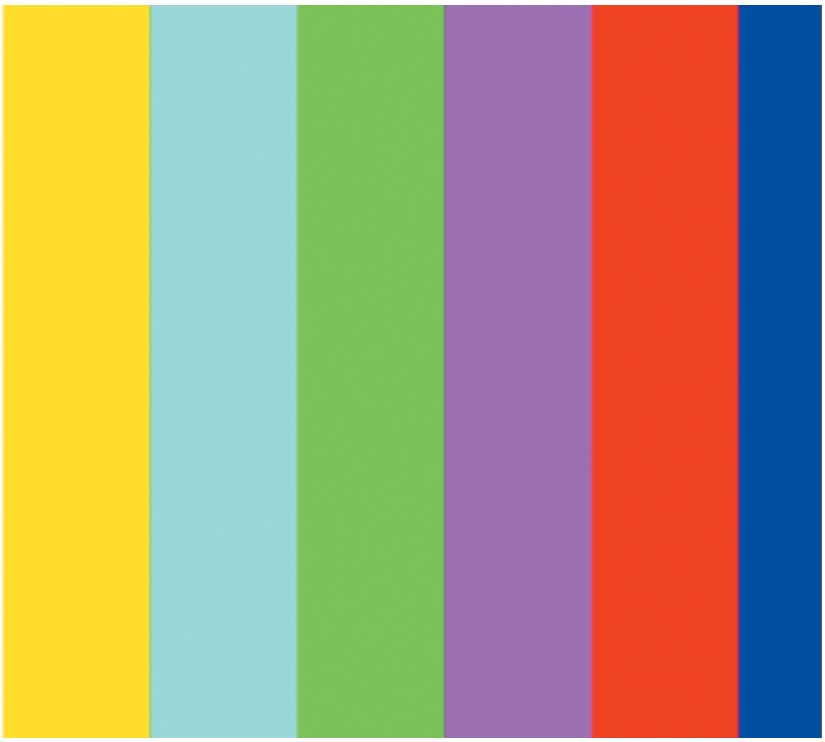


Figure 8-62 Full Screen Video Display

ZOOM/RANGE

Pressing the **Zoom +** or **Zoom -** Softkeys increases or decreases video display magnification between 1x and 10x.

The **RANGE** Knob can be used to increase or decrease the range setting on the map display or zoom in and out on the video display. While in the Split-Screen mode, pressing the **Map Actv** or **Vid Actv** Softkey determines which display the **RANGE** Knob adjusts. Pressing the softkey to display Map Actv allows the **RANGE** Knob to control the range setting of the map display. Pressing the softkey to display Vid Actv allows the **RANGE** Knob to control the zoom setting of the video display.

When zooming in on the video display, a Zoom Window will appear in the upper right of the display. A box within this window indicates the portion of the display currently being viewed. The currently displayed portion of the full display may be adjusted by using Joystick.

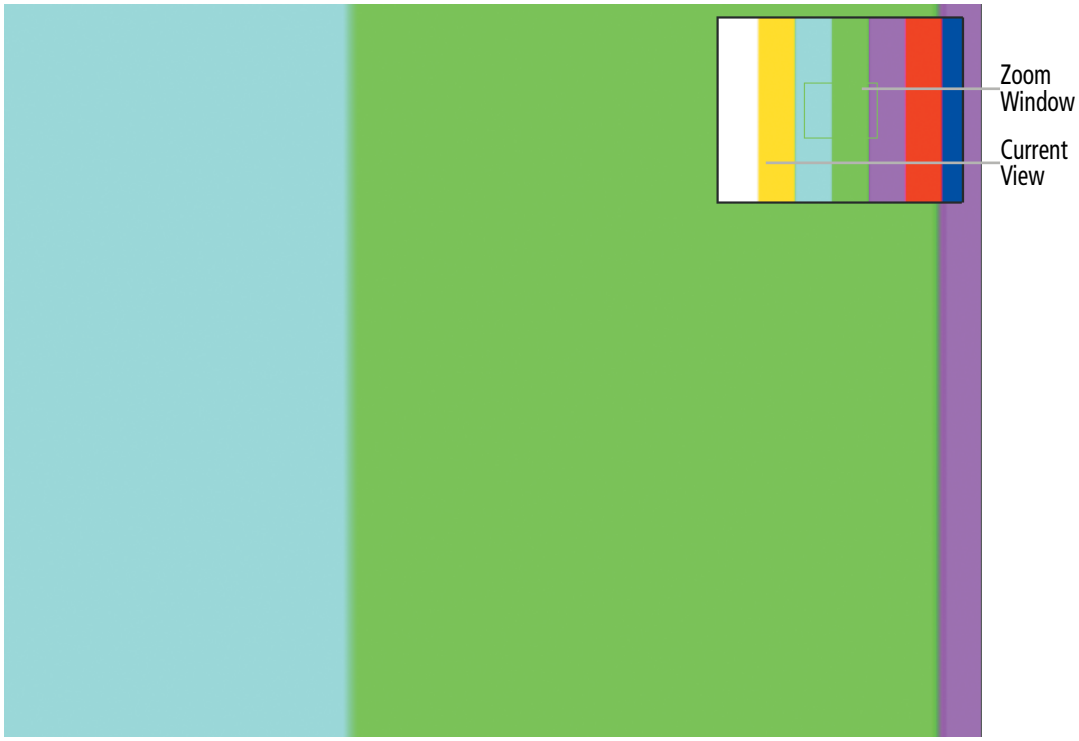


Figure 8-63 Zoom Window

8.11 ELECTRONIC STABILITY & PROTECTION (ESP™)

Electronic Stability and Protection (ESP™) is an optional feature that is intended to discourage the exceedance of attitude, established airspeed and angle of attack parameters. This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, Vmo, Mmo, and/or angle of attack) beyond the normal flight parameters. Enhanced stability for each condition is provided by applying a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude, high airspeed, or when a stall is imminent.

As the aircraft deviates further from the normal attitude, angle of attack, or airspeed continues to increase, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range. Except in the case of high airspeed, when maximum force is reached, force remains constant up to the maximum engagement limit. Above the maximum engagement limit, forces are no longer applied. There is no maximum engagement related to a high airspeed condition.

When ESP has been engaged for more than ten seconds (cumulative; not necessarily consecutive seconds) of a 20-second interval, the autopilot is automatically engaged with the flight director in Level Mode, bringing the aircraft into level flight. An aural "Engaging Autopilot" alert is played and the flight director mode annunciation will indicate 'LVL' for vertical and lateral modes.

The pilot can interrupt ESP by pressing and holding either the Control Wheel Steering (**CWS**) or Autopilot Disconnect (**AP/YD DISC TRIM INTRPT**) switch. Upon releasing the **CWS** or **AP/YD DISC TRIM INTRPT** switch, ESP force will again be applied, provided aircraft attitude, angle of attack and/or airspeed are within their respective engagement limits. ESP can also be overridden by overpowering the servo's mechanical torque limit.

ESP can be enabled or disabled on the 'Aux - System Setup 2' Page on the MFD.

Enabling/disabling ESP:

1) Turn the large **FMS** Knob to select the 'Aux' Page Group.
2) Turn the small **FMS** Knob to select the 'System Setup' Page.
3) Press the **Setup 2** Softkey to display the 'Aux - System Setup 2' Page.
4) Press the **FMS** Knob to activate the cursor.
5) Turn the large **FMS** Knob to place the cursor in the 'Stability & Protection' Field.
6) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled.'
7) Press the **FMS** Knob to remove the cursor.

ESP is automatically enabled on system power up.

ROLL ENGAGEMENT

Roll Limit Indicators are displayed on the roll scale at 45° right and left, indicating where ESP will engage. As roll attitude exceeds 45°, ESP will engage and the on-side Roll Limit Indicator will move to 30°. The Roll Limit Indicator is now showing where ESP will disengage as roll attitude decreases.

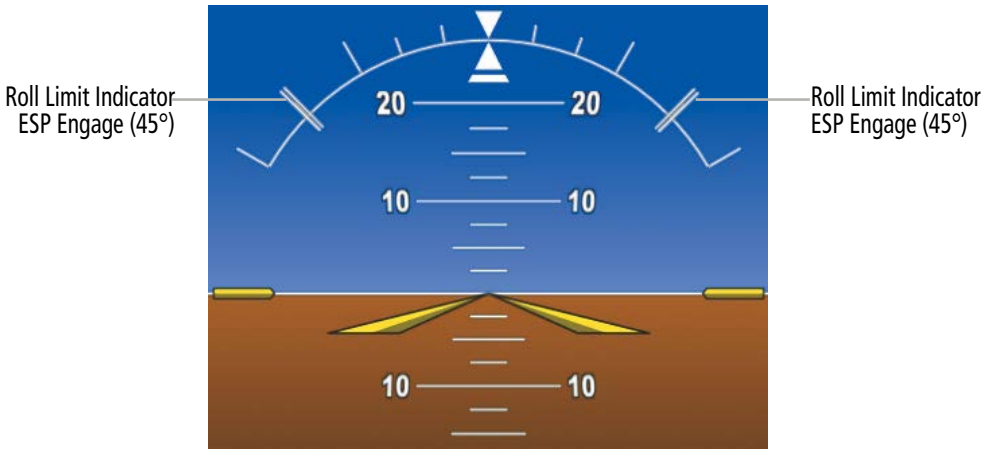


Figure 8-64 ESP Roll Engagement Indication (ESP NOT Engaged)

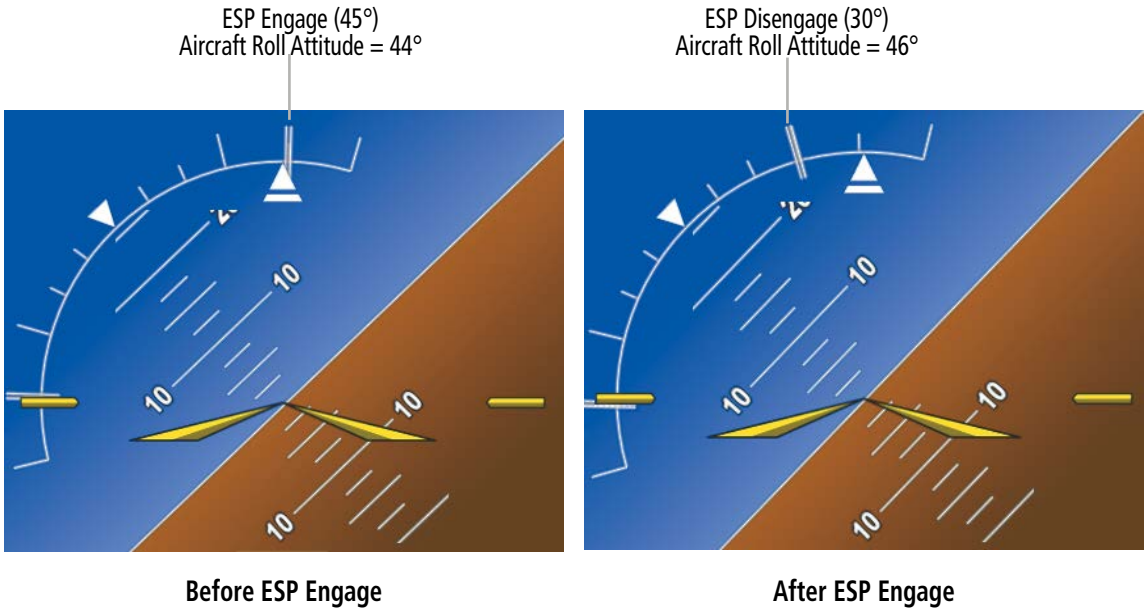


Figure 8-65 Roll Increasing to ESP Engagement

Once engaged, ESP force will be applied between 30° and 75°. The force increases as roll attitude increases and decreases as roll attitude decreases. The applied force is intended to encourage pilot input that returns the airplane to a more normal roll attitude. As roll attitude decreases, ESP will disengage at 30°.

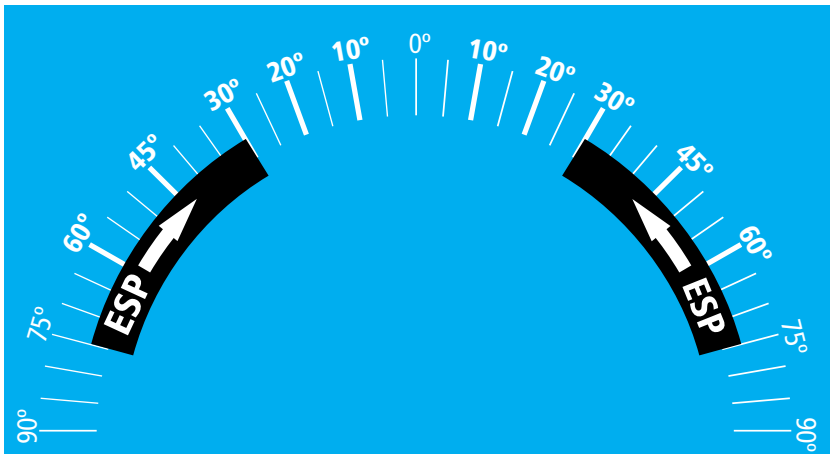


Figure 8-66 ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)

ESP is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75°.

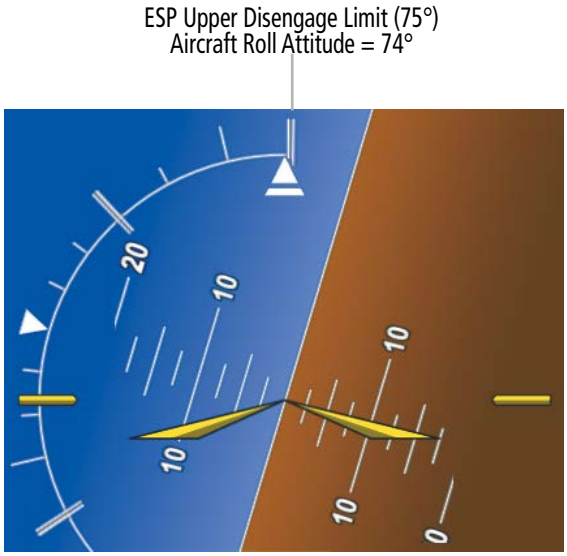


Figure 8-67 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP engages at 20° nose-up and 17° nose-down. Once ESP is engaged, it will apply opposing force between 15° and 50° nose-up and between 12° and 50° nose-down. Maximum opposing force is applied between 25° and 50° nose-up and between 22° and 50° nose-down.

The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft.

There are no indications marking the pitch ESP engage and disengage limits in these nose-up/nose-down conditions.

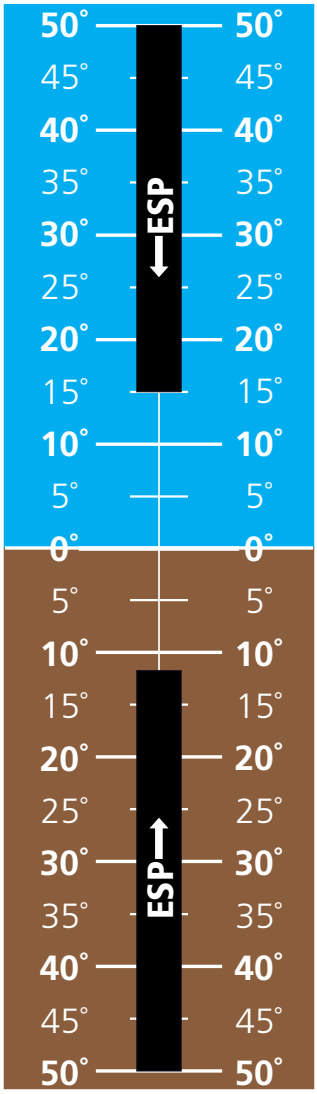


Figure 8-68 ESP Pitch Operating Range When Engaged
(Force Increases as Pitch Increases & Decreases as Pitch Decreases)

ANGLE OF ATTACK PROTECTION

When a compatible lift computer is installed with the system, angle of attack protection is provided as part of the ESP feature. ESP force may be applied if the lift computer determines a stall warning condition is imminent. In this condition, the Pitch Limit Indicator will be initially displayed 4° below this computed pitch attitude. When pitch attitude equals that indicated by the Pitch Limit Indicator, ESP will engage, applying a force in the direction necessary to lower the nose of the aircraft.

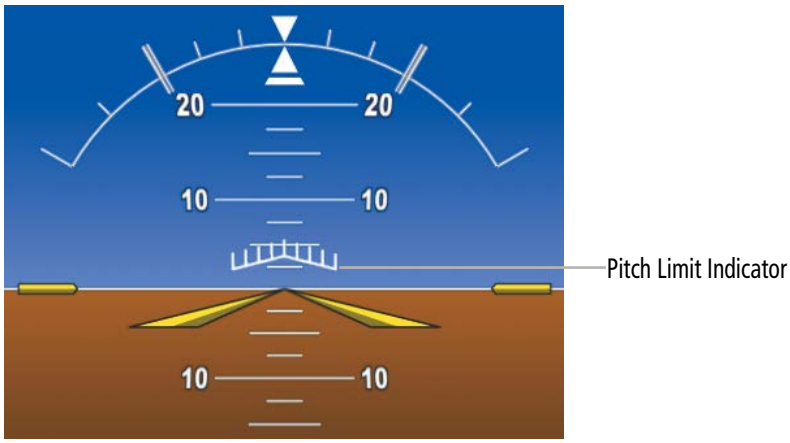


Figure 8-69 Pitch Limit Indicator

HIGH AIRSPEED PROTECTION

Exceeding Vmo or Mmo will result in ESP applying force to raise the nose of the aircraft. When the high airspeed condition is remedied, ESP force is no longer applied.

8.12 ABNORMAL OPERATION

IRIDIUM AND WIFI RECEIVER TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the 'Aux - System Status' Page for Iridium Receiver (GSR 56), WiFi Datalinks (GDL 59), or Sirius XM Datalink Receiver (GDL 69/69A) status, serial number, and software version number. If a failure has been detected in the GDL 69/69A 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.

Figure 8-70 LRU Information Window on System Status Page

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

» Ensure the installed Datalink 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 Datalink Receiver or Iridium Transceiver

GDL 69/69A TROUBLESHOOTING

Ensure that nothing is plugged into the MUSIC 1 or MUSIC 2 jacks because that would prevent SiriusXM radio from being heard

If a failure still exists, the following messages may provide insight as to the possible problem:

Message	Message Location	Description
CHECK ANTENNA	XM Information Page (MFD)	Datalink Receiver antenna error; service required
UPDATING	XM Information Page (MFD)	Datalink 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 Datalink 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 8-6 GDL 69/69A Datalink Receiver Messages

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ANNUNCIATIONS AND ALERTS

NOTE: The current version of the pertinent flight manual supersedes information found in this document.

The Alerting System conveys alerts using the following:

- **Annunciation Window:** The Annunciation Window displays abbreviated annunciation text. Text color is based on alert levels described later in the Alert Levels Definitions section. The Annunciation Window is located to the right of the Altitude and Vertical Speed boxes on the display.
- **Alerts Window:** The Alerts Window displays text messages for up to 64 prioritized alert messages. Pressing the **Alerts** 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 message list.
- **Softkey Annunciation:** During certain alerts, the **Alerts** Softkey may appear as a flashing annunciation to accompany an alert. The **Alerts** Softkey assumes a new label (Message). 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. Selecting 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.

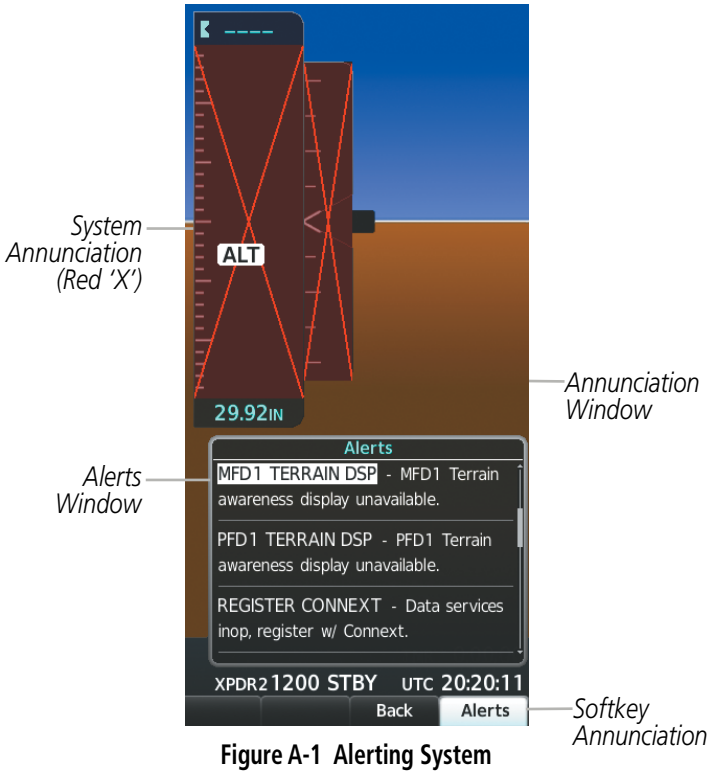

Figure A-1 Alerting System

- **Audio Alerting System:** The system issues audio alert tones when specific system conditions are met. See the Alert Level Definitions Section for more information. The annunciation tone may be tested from the 'AUX - System Status' Page.

Testing the system annunciation tone and annunciator lights:

1) Use the **FMS** Knob to select the 'AUX - System Status' Page.
2) Press the **Ann Test** Softkey.

   Or:

   a) Press the **MENU** Key.

   b) Highlight 'Enable Annunciator Test Mode' and press the **ENT** Key.

AIRCRAFT ALERTS

The following alert is configured specifically for the Beechcraft 200/B200 Series. Red annunciation window text signifies warnings. See the current version of the pertinent flight manual for recommended pilot actions.

WARNING ANNUNCIATIONS

Annunciation Window Text	Description
UNDERSPEED PROTECT ACTIVE	Underspeed protection is active.

MESSAGE ADVISORIES

Advisory alerts issue a flashing **Message** Softkey annunciation. Pressing the **Message** Softkey acknowledges the presence of the advisory alert and displays the alert text message in the Alerts Window.

Alerts Window Message
AVN FAN 1 FAIL - Avionics cooling fan #1 is inoperative.
AVN FAN 2 FAIL - Avionics cooling fan #2 is inoperative.
ESP CONFIG – ESP config error. Config service req'd.
ESP DEGRADE – ESP AOA mode is inoperative*.
ESP DEGRADE – ESP IAS mode is inoperative.
ESP FAIL – ESP is inoperative.
ESP OFF – ESP selected off.
MFD FAN FAIL - MFD cooling fan is inoperative.
PFD 1 FAN FAIL - PFD #1 cooling fan is inoperative.
PFD 2 FAN FAIL - PFD #2 cooling fan is inoperative.
TAWS FLAP FAULT – Flaps detected in the LDG position.
TAWS GEAR FAULT – Landing Gear detected in the DOWN position.
WOW FAULT – Miscompare between weight on wheels inputs.
WOW INVALID – Weight on wheels inputs invalid.
YD OFF – AP engaged without Yaw Damper

*only available when compatible lift computer is installed.

VOICE ALERTS

The following voice alerts are announced by the system using a male or female gender (see the 'AUX - System Setup' Page for the default configured voice gender; contact a Garmin-authorized service center to change the audio alert voice). Terrain Awareness and Warning System voice alerts are also generated (refer to the TAWS Alerts section).

Voice Alert	Description
"Minimums"	The aircraft has descended below the preset minimum descent altitude or decision altitude.
"Vertical track"	The aircraft is one minute from Top of Descent. Issued only when vertical navigation is enabled.
"Airspeed"	The aircraft is in an underspeed condition. See the AFCS section for more details.
"Engaging autopilot"	The ESP system is engaging the autopilot. See the AFCS section for more details.
"Traffic"	Played when a Traffic Advisory (TA) is issued with the TIS system, the optional GTS 820/825 TAS system, or the optional GTS 850/855 TCAS I system. See the Hazard Avoidance section for additional details on GTS 820/825/850/855 voice alerts.
"TIS Not Available"	The aircraft is outside the Traffic Information Service (TIS) coverage area.
"Traffic, Traffic" "Traffic"	Played when a Traffic Advisory (TA) is issued with the optional SKY 497/SKY899 TAS system, or the optional KTA 870 TAS system. See the Skywatch PG or KTA 870 PG for additional details on voice alerts. Played for each subsequent TA (KTA 870 only).
"Traffic Advisory System Test Passed" "SKYWATCH System Test Passed" "TAS System Test OK" "TAS System Test Passed" "TCAS One System Test Passed" "TCAS Two System Test Passed"	Played when the optional traffic system passes a pilot-initiated self test. - SKY 497 TAS - SKY 899 TAS - KTA 870 TAS - GTS 825 TAS - GTS 855 TCAS I - GTS 8000 TCAS II
"Traffic Advisory System Test Failed" "SKYWATCH System Test Failed" "TAS System Test Fail" "TAS System Test Failed" "TCAS One System Test Failed" "TCAS Two System Test Failed"	Played when the optional traffic system fails a pilot-initiated self test. - SKY 497 TAS - SKY 899 TAS - KTA 870 TAS - GTS 825 TAS - GTS 855 TCAS I - GTS 8000 TCAS II
"One o'clock" through "Twelve o'clock" or "No Bearing"	Intruder bearing (GTS 825/855 only)
"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	Intruder relative altitude (GTS 825/855 only)
"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"	Intruder distance (GTS 825/855 only)

SYSTEM MESSAGE ANNUNCIATIONS

When a new message is issued, the **Message** Softkey flashes to alert the flight crew of a new message. It continues to flash until acknowledged by pressing the softkey. Active messages are displayed in white text. Messages that have become inactive change to gray text. The **Message** Softkey flashes if the state of a displayed message changes or a new message is displayed. The inactive messages can be removed from the Message Window by pressing the flashing **Message** Softkey. The softkey label then returns to **Alerts.**

System Messages convey messages to the flight crew regarding problems with the system. Typically, a large red 'X' appears in a window when a related LRU fails or detects invalid data.

The following section describes various system annunciations. Refer to the current version of the pertinent flight manual for additional information regarding pilot responses to these annunciations.

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

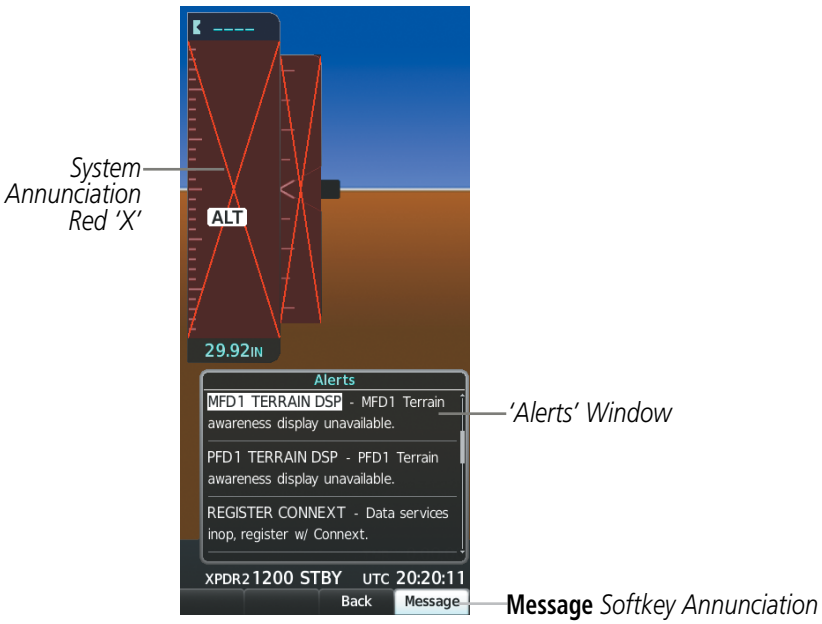

Figure A-2 System Messages

SYSTEM MESSAGES

This section describes various system message advisories. Certain messages are issued due to an LRU or an LRU function failure. Such messages are normally accompanied by a corresponding red 'X' annunciation as shown previously in the System Annunciation section.

NOTE: *This Section provides information regarding system message advisories that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The current version of the pertinent flight manual 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 that the altitude error correction is unavailable. The system should be serviced.
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	GDC1 is reporting that the airspeed error correction is unavailable. The system should be serviced.
ADC1 SERVICE – ADC1 needs service. Return unit for repair.	The GDC1 should be serviced.
ADC2 ALT EC – ADC2 altitude error correction is unavailable.	GDC2 is reporting that the altitude error correction is unavailable. The system should be serviced.
ADC2 AS EC – ADC2 airspeed error correction is unavailable.	GDC2 is reporting that the airspeed error correction is unavailable. The system should be serviced.
ADC2 SERVICE – ADC2 needs service. Return unit for repair.	The GDC2 should be serviced.
AHRS MAG DB – AHRS magnetic model database version mismatch.	The #1 AHRS and #2 AHRS magnetic model database versions do not match.
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 operating exclusively in no-GPS mode.	The #1 AHRS is operating exclusively in no-GPS mode. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving any GPS information.	The #1 AHRS is not receiving any or any useful GPS information. Check Current version of the pertinent flight manual 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 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 SERVICE – AHRS1 needs service. Return unit for repair.	A failure has been detected in the #1 AHRS. The system should be serviced.
AHRS1 SRVC – 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 valid 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.
AHRS2 CAL – AHRS2 calibration version error. Srvc req'd.	The #2 AHRS calibration version error. The system should be serviced.
AHRS2 CONFIG – AHRS2 config error. Config service req'd.	AHRS #2 configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS2 GPS – AHRS2 operating exclusively in no-GPS mode.	The #2 AHRS is operating exclusively in no-GPS mode. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving any GPS information.	The #2 AHRS is not receiving any or any useful GPS information. Check Current version of the pertinent flight manual limitations. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving backup GPS information.	The #2 AHRS is not receiving backup GPS information. The system should be serviced.
AHRS2 GPS – AHRS2 using backup GPS source.	The #2 AHRS is using the backup GPS path. Primary GPS path has failed. The system should be serviced when possible.
AHRS2 SERVICE – AHRS2 needs service. Return unit for repair.	A failure has been detected in the #2 AHRS. The system should be serviced.
AHRS2 SRVC – AHRS2 Magnetic-field model needs update.	The #1 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS2 TAS – AHRS2 not receiving valid 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 ADVISORY – SBAS VNAV not available. Using Baro VNAV.	SBAS VNAN not available. Check GPS sensor.
APR DWNGRADE – Approach downgraded.	Vertical guidance generated by SBAS is unavailable, use LNAV only minimums..
APPR INACTV – Approach is not active.	The system notifies the pilot that the loaded approach is not active. Activate approach when required.
ARSPC AHEAD – Airspace ahead less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft will penetrate the special use 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.
CHECK CRS – Database course for LOC1 / [LOC ID] is [CRS]°.	Selected course for LOC1 differs from published localizer course by more than 10 degrees.
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.
COM #[1, 2] INOP - CAL – Check COM calibration.	COM 1 and/or COM 2 calibration version error. Check COM calibration.
COM #[1, 2] INOP - CRNT – Check COM current.	COM 1 and/or COM 2 current is low. Check COM current.
COM #[1, 2] INOP - NTRL – Com internal fault.	COM 1 and/or COM 2 has an internal fault.

Message	Comments
COM #[1, 2] INOP - SYNTH – COM synthesizer lock fault.	The COM 1 and/or COM 2 has a synthesizer lock fault.
COM #[1, 2] INOP - VOLT – Check COM voltage.	COM 1 and/or COM 2 has low voltage.
COM1 CONFIG – COM2 config error. Config service req'd.	The COM2 configuration settings do not match backup configuration memory. The system should be serviced
COM1 MANIFEST – COM1 software mismatch, communication halted.	COM1 software mismatch. The system should be serviced.
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 MANIFEST – COM2 software mismatch, communication halted.	COM2 software mismatch. The system should be serviced.
COM2 PTT – COM2 push-to-talk key is stuck.	The COM2 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 RMT XFR – COM2 remote transfer key is stuck.	The COM2 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 SERVICE – COM2 needs service. Return unit for repair.	The system has detected a failure in COM2. COM2 may still be usable. The system should be serviced when possible.
COM2 TEMP – COM2 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
CONFIRM BARO QFE – Confirm BARO QFE Reference Elevation	Confirm BARO QFE Reference Elevation.
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.
DATABASES EXPIRED – Restart avionics to activate standby databases.	The databases in the system have expired. Restart the system move the standby databases to active status.
DATABASES MISMATCHED – Restart displays to correct mismatch.	The GDUs have different database versions or regions. Restart the system move the standby databases to active status.
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.

Message	Comments
DB CHANGE – Database changed. Verify user modified procedures.	This occurs when a stored flight plan contains a procedure that is no longer consistent with the navigation database. This alert is issued only after an navigation database update. Verify that the user-modified procedures in stored flight plans are correct and up to date.
DB MISMATCH – Navigation database mismatch. Xtalk is off.	The PFDs and MFD have different navigation database versions or regions 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 PFDs and MFD have different obstacle database versions or regions 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 PFDs and MFD have different terrain database versions or regions 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 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-up, 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 na me/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.
FS510 CARD ERROR – FS510 not detected in MFD Bottom Slot.	The multimedia card was removed from the bottom card slot of the MFD. The multimedia card needs to be reinserted.
GCU CNFG – GCU Config error. Config service req'd.	GCU 477 configuration settings do not match those of backup configuration memory. The system should be serviced.
GCU FAIL – GCU is inoperative.	A failure has been detected in the GCU 477. The GCU 477 is unavailable.
GCU KEYSTK – GCU [keyname] Key is stuck	A key is stuck on the GCU 477 bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
GCU1 MANIFEST – GCU software mismatch, ommunication halted.	The GCU 477 has incorrect software installed. The system should be serviced.
GDC1 MANIFEST – GDC1 software mismatch, communication halted.	The GDC1 has incorrect software installed. The system should be serviced.
GDC2 MANIFEST – GDC2 software mismatch, communication halted.	The GDC2 has incorrect software installed. The system should be serviced
GDL59 CONFIG – GDL 59 config error. Config service req'd.	GDL 59 configuration settings do not match those of backup configuration memory. The system should be serviced.

Message	Comments
GDL59 FAIL – GDL 59 has failed.	A failure has been detected in the GDL 59. The receiver is unavailable. The system should be serviced.
GDL59 MANIFEST – GDL59 software mismatch, communication halted.	The GDL 59 has incorrect software installed. The system should be serviced.
GDL59 RTR FAIL – The GDL 59 router has failed.	A failure has been detected in the GDL 59 router. The system should be serviced.
GDL59 SERVICE – GDL 59 needs service. Return unit for repair.	A failure has been detected in the GDL 59. The system should be serviced.
GDL69 CONFIG – GDL 69 config error. Config service req'd.	GDL 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 69A SXM. The receiver is unavailable. The system should be serviced
GDL69 MANIFEST – GDL software mismatch, communication halted.	The GDL 69A SXM has incorrect software installed. The system should be serviced.
GEA # [1, 2] INOP - CAL – Check GEA rigging.	There is a problem with the GEA rigging. Check the rigging.
GEA # [1, 2] INOP - CNFG – Check GEA software and configuration.	There is a problem with the GEA software configuration. Check the configuration. If the problem persists, the system should be serviced.
GEA # [1, 2] INOP - COMM – Check GEA config module connection.	There is a problem with the GEA config module connection. Check the connection.
GEA # [1, 2] INOP - INTRL – GEA internal fault.	The GEA has an internal fault. The system should be serviced.
GEA # [1, 2] INOP - SENS – Check GEA configuration.	There is an error in the GEA configuration. Check the configuration. If the problem persists, the system should be serviced.
GEA # [1, 2] INOP - TEMP – Check GEA config module cooling.	The GEA configuration module has insufficient cooling. If the problem persists, the system should be serviced.
GEA # [1, 2] INOP - VOLT – Check GEA voltages.	The GEA voltage is low. Check GEA voltages.
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 has incorrect software installed. The system should be serviced.
GEA2 CONFIG – GEA2 config error. Config service req'd.	The GEA2 configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA2 MANIFEST – GEA2 software mismatch, communication halted.	The #2 GEA has incorrect software installed. The system should be serviced.
GEO LIMITS – AHRS1 too far North/ South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.
GEO LIMITS – AHRS2 too far North/ South, no magnetic compass.	
GFC MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.

Message	Comments
GIA #[1, 2] INOP - CRNT – Check GIA current.	GIA 1 and/or GIA 2 current is low. The current should be checked.
GIA #[1, 2] OVER TEMP – Check GIA temperature.	GIA 1 and/or GIA 2 is reporting an over-temperature condition.
GIA #[1, 2] INOP - SERIAL – Check GIA serial communication.	Loss of GIA 1 and/or GIA 2 serial communication. Check GIA serial communication.
GIA #[1, 2] INOP - VOLT – Check GIA voltage.	GIA 1 and/or GIA 2 low voltage. Check voltage.
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.
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.
GMA XTALK – GMA crosstalk error has occurred.	An error has occurred in transferring data between the two GMAs. The system should be serviced.
GMA1 CONFIG – GMA1 configuration 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.

Message	Comments
GMA2 CONFIG – GMA2 configuration error. Config service req'd.	The audio panel configuration settings do not match backup configuration memory. The system should be serviced.
GMA2 FAIL – GMA2 is inoperative.	The audio panel self-test has detected a failure. The audio panel is unavailable. The system should be serviced.
GMA2 MANIFEST – GMA2 software mismatch. Communication halted.	The audio panel has incorrect software installed. The system should be serviced.
GMA2 SERVICE – GMA2 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.
GMC CNFG – GMC Config error. Config service req'd.	Error in the configuration of the GMC 710.
GMC FAIL – GMC is inoperative.	A failure has been detected in the GMC 710. The GMC 710 is unavailable.
GMC KEYSTK – GMC [keyname] Key is stuck	A key is stuck on the GCMC 710 bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
GMC MANIFEST – GMC software mismatch, communication halted.	The GMC 710 has incorrect software installed. The system should be serviced.
GMU1 MANIFEST – GMU1 software mismatch, communication halted.	The GMU 44 has incorrect software installed. The system should be serviced.
GMU2 MANIFEST – GMU2 software mismatch, communication halted.	The GMU 44 has incorrect software installed. The system should be serviced.
GPS #[1, 2] INSPECT RQRD - BATT – Check GPS battery.	The GPS battery needs to be checked.
GPS #[1, 2] INSPECT INOP - CAL – Check GPS calibration.	GPS 1 and/or GPS 2 calibration version error. Check GPS calibration.
GPS NAV LOST – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.
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.
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.	
GRA1 CAL – GRA1 calibration error. Service req'd.	A calibration error has been detected in the GRA. The system should be serviced.
GRA1 CONFIG – GRA1 config error. Config service req'd.	The GRA configuration settings do not match those of backup configuration memory. The system should be serviced.
GRA1 MANIFEST – GRA1 software mismatch, communication halted.	The GRA has incorrect software installed. The system should be serviced.
GRA1 SERVICE – GRA1 needs service. Return unit for repair.	A failure has been detected in the GRA. The system should be serviced.

Message	Comments
GRA1 TEMP – GRA1 over temperature.	The GRA temperature is too high. If the problem persists, the system should be serviced.
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	The #1 AHRS has incorrect software installed. The system should be serviced.
GRS2 MANIFEST – GRS2 software mismatch, communication halted.	The #2 AHRS has incorrect software installed. The system should be serviced.
GSD1 CONFIG – GSD1 config error. Config service req'd.	GSD1 and the CDU have different copies of the GSD1 configuration.
GSD1 COOLING – GSD1 temperature too low.	GSD1 is reporting a low temperature condition.
GSD1 MANIFEST – GSD1 software mismatch. Communication halted.	GSD1 has incorrect software installed. The system should be serviced.
GSD1 SERVICE – GSD1 needs service. Return unit for repair.	GSD1 is reporting an internal error condition. The GSD may still be usable.
GSR1 FAIL – GSR1 has failed.	A failure has been detected in the #1 GSR 56. The system should be serviced.
GTS CONFIG – GTS Config error. Config service req'd.	The GTS and GDU have different copies of the GTS configuration, or the Mode S address is invalid. 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.
GTX2 MANIFEST – GTX2 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GWX CONFIG – GWX config error. Config service req'd.	GWX configuration settings do not match those of the GDU configuration. The system should be serviced.
GWX FAIL – GWX is inoperative.	The GDU is not receiving status packet from the GWX is reporting a fault. The GWX radar system should be serviced.
GWX MANIFEST – GWX software mismatch, communication halted.	The GWX has incorrect software installed. The system should be serviced.
GWX SERVICE – Needs service. Return unit for repair.	A failure has been detected in the GWX. The GWX may still be usable.
HDG FAULT – AHRS1 magnetometer fault has occurred.	A fault has occurred in the #1 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
HDG FAULT – AHRS2 magnetometer fault has occurred.	A fault has occurred in the #2 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
HOLD EXPIRED – Holding EFC time expired.	Expect Further Clearance (EFC) time has expired for the User Defined Hold.
HW MISMATCH – GIA hardware mismatch. GIA1 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable. The system should be serviced.
HW MISMATCH – GIA hardware mismatch. GIA2 communication halted.	
INSIDE ARSPC – Inside airspace.	The aircraft is inside the special use 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.

Message	Comments
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.
MANIFEST – PFD2 software mismatch. Communication halted.	
MFD1 BACKLIGHT CAL INV – MFD1 calibration lost. Return for repair.	The MFD backlight calibration cannot be found or is invalid. The system should be serviced.
MFD1 CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified MFD contains invalid data.
MFD1 CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified MFD. The SD card needs to be reinserted.
MFD1 CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified MFD contains invalid data.
MFD1 CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified MFD. The SD card needs to be reinserted.
MFD1 CONFIG – MFD1 configuration 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 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 obstacle database error exists.	The MFD detected a failure in the obstacle database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
MFD1 DB ERR – MFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
MFD1 DB ERR – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
MFD1 KEYSTK – MFD1 [key name] Key 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 SERVICE – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
MFD1 SOFTWARE – MFD1 mismatch, communication halted.	The specified GDU has different software versions installed. The system should be serviced.
MFD1 VOLTAGE – MFD1 has low voltage. Reducing power usage.	The MFD voltage is low. The system should be serviced.

Message	Comments
NAV DB UPDATED – Active navigation database updated.	System has updated the active navigation database from the standby navigation database.
NAV #[1, 2] INOP - CAL–- Check COM calibration.	NAV 1 and/or NAV 2 calibration version error. Check COM calibration.
NAV #[1, 2] INOP - CONFIG – Check NAV software and config.	There is a problem with the NAV 1 and/or NAV 2 software configuration. Check the configuration. If the problem persists, the system should be serviced.
NAV #[1, 2] INOP - CRNT – Check COM current.	NAV 1 and/or NAV 2 current is low. Check COM current.
NAV #[1, 2] INOP - INTRL – Com internal fault.	NAV 1 and/or NAV 2 has an internal fault.
NAV #[1, 2] INOP - SERIAL – Check NAV serial communication.	Loss of NAV 1 and/or NAV 2 serial communication. Check NAV serial communication.
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.
NAV #[1, 2] INOP - SYNTH LOCK – COM synthesiser lock fault.	NAV 1 and/or NAV 2 has a synthesizer lock fault.
NO RUNWAY POSITION DATA – Inhibit SurfaceWatch. No Runway position data.	Inhibit SurfaceWatch.
NO WGS84 WPT – Non WGS 84 waypoint for navigation -[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.
NON-MAG UNITS – Non-magnetic NAV ANGLE display units are active.	Navigation angle is not set to MAGNETIC at power-up.
PFD1 BACKLIGHT CAL – PFD1 calibration lost. Return for repair.	The PFD backlight calibration cannot be found or is invalid. The system should be serviced.
PFD POSITIONS DIFFERENT – PFD positions mismatch. Check position sensors.	There is a mismatch in the position sensed by the PFDs. Check position sensor settings. If message persists the system should be serviced.
PFD1 CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified PFD contains invalid data.
PFD1 CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD. The SD card needs to be reinserted.
PFD1 CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD contains invalid data.

Message	Comments
PFD1 CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD. The SD card needs to be reinserted.
PFD1 DB ERR – MFD1 obstacle database error exists.	The PFD detected a failure in the obstacle database. Reload databases with new data card. If problem persists, delete databases and reload with a new card
PFD1 DB ERR – PFD1 multiple database errors exists.	The PFD detected a failure in more than one database. Reload databases with new data card. If problem persists, delete databases and reload with a new card
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 terrain database error exists.	The PFD detected a failure in the terrain database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
PFD1 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
PFD1 KEYSTK – PFD1 [key name] Key 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 PFD1 self-test has detected a problem. The system should be serviced.
PFD1 SOFTWARE – PFD1 mismatch, communication halted.	The specified GDU has different software versions installed. The system should be serviced.
PFD1 VOLTAGE – PFD1 has low voltage. Reducing power usage.	The PFD1 voltage is low. The system should be serviced.
PF2 BACKLIGHT CAL – PFD2 calibration lost. Return for repair.	The PFD backlight calibration cannot be found or is invalid. The system should be serviced.
PFD2 CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified PFD contains invalid data.
PFD2 CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD. The SD card needs to be reinserted.
PFD2 CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD contains invalid data.
PFD2 CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD. The SD card needs to be reinserted.
PFD2 CONFIG – PFD2 configuration error. Config service req'd.	The PFD configuration settings do not match backup configuration memory. The system should be serviced.
PFD2 COOLING – PFD2 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.
PFD2 DB ERR – PFD2 multiple database errors exists.	The PFD detected a failure in more than one database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
PFD2 DB ERR – PFD2 obstacle database error exists.	The PFD detected a failure in the obstacle database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
PFD2 DB ERR – PFD2 terrain database error exists.	The PFD detected a failure in the terrain database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
PFD1 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU. Reload databases with new data card. If problem persists, delete databases and reload with a new card.

Message	Comments
PFD2 KEYSTK – PFD1 [key name] Key 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.
PFD2 SERVICE – PFD2 needs service. Return unit for repair.	The PFD2 self-test has detected a problem. The system should be serviced.
PFD2 SOFTWARE – PFD2 mismatch, communication halted.	The specified GDU has different software versions installed. The system should be serviced.
PFD2 VOLTAGE – PFD2 has low voltage. Reducing power usage.	The PFD2 voltage is low. The system should be serviced.
PTK FAIL – Parallel track unavailable: bad geometry.	Bad parallel track geometry.
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.
REGISTER CONNEXT – Data services are inoperative, register w/CONNEXT.	The GDL 59 is not registered with Garmin Flight Data Services, or its current registration data has failed authentication.
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 Navigation angle is non-magnetic. Select the MAGNETIC NAV ANGLE display units.
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 Navigation angle is magnetic. Select the alternate NAV ANGLE display units.
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 – 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 – SVT DISABLED: Terrain DB resolution too low.	Synthetic Vision is disabled because a terrain database of sufficient resolution is not currently installed.
TERRAIN AUD CFG – Trn Awareness audio config error. Service req'd.	Terrain audio alerts are not configured properly. The system should be serviced

Message	Comments
TERRAIN DISABLED – Terrain Awareness DB resolution too low.	TAWS is disabled because a terrain database of sufficient resolution is not currently installed.
TERRAIN DSP – [PFD1, PFD2 or MFD1] Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in the specified PFD or MFD is missing or invalid.
TIMER EXPIRD – Timer has expired.	The system notifies the pilot that the timer has expired.
TRAFFIC FAIL – Traffic device has failed.	The system is no longer receiving data from the traffic system. The traffic device should be serviced.
TRN AUD FAIL – Trn Awareness audio source unavailable.	The audio source for terrain awareness is offline. Check GIA1 or GIA 2.
UNABLE RNP – Estimated position error exceeds RNP.	The estimated GPS position error exceeds the RNP limits. Check GPS sensors.
UNABLE RNP APR – GPS integrity lost. Check GPS sensors.	The estimated GPS position error exceeds the requirements for the current approach. Check GPS sensor
UNABLE V WPT – Can't reach current vertical waypoint.	The current vertical waypoint can not be reached within the maximum flight path angle and vertical speed constraints. The system automatically transitions to the next vertical waypoint.
VNV UNAVAILABLE. – Excessive crosstrack error.	The current crosstrack exceeds the limit, causing vertical deviation to go invalid.
VNV UNAVAILABLE. – Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.
VNV UNAVAILABLE. – Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
VNV UNAVAILABLE. – Unsupported leg type in flight plan.	The lateral flight plan contains a procedure turn, vector, or other unsupported leg type prior to the active vertical waypoint. This prevents vertical guidance to the active vertical waypoint.
WPT ARRIVAL – Arriving at waypoint -[xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
WX ALERT – Possible severe weather ahead.	The GWX indicates severe weather within ±10 degrees of the aircraft heading at a range of 80 to 320 nm.
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.

Message	Comments
XPDR1 ADS-B NO TX – Transponder: ADS-B out has failed.	ADS-B is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
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.
XPDR2 CONFIG – XPDR2 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR2 ADS-B NO TX – Transponder: ADS-B out has failed.	ADS-B is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR2 SRVC – XPDR2 needs service. Return unit for repair.	The #2 transponder should be serviced when possible.
XPDR2 UNDER TEMP – Transponder: Transponder under temp.	The system has detected an under temperature condition in XPDR2. 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.

CAUTION: *Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.*

The system uses Secure Digital (SD) cards to load various types of data. For basic flight operations, SD cards are used for database updates. Not all SD cards are compatible with the system.

Databases may be loaded through Garmin Pilot and the Bluetooth Transceiver. When loading databases through Garmin Pilot and the Bluetooth Transceiver, the Bluetooth Transceiver must be enabled on the system and the multimedia 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-up screen and the effective date on the 'Aux – Databases' Page being displayed in amber.*

LOADING UPDATED DATABASES

CAUTION: *Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.*

NOTE: *When loading database updates, the 'DB Mismatch' 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.*

The cycles and dates for both standby and active databases are displayed on the "Aux – Databases" page on the MFD. Any active databases with expiration dates in the past will be highlighted with amber text. When an expired active database has a standby database that is ready to become effective, a cyan double-sided arrow will be displayed between the database cycles. When this arrow is visible, it indicates that the standby and active databases in that row will be switched on the next power cycle, activating the current standby database. Databases can also be manually selected (or deselected) by highlighting a list item and pressing the **ENT** Key, provided a valid, verified standby database is present.

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

The 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.

UPDATING DATABASES USING A SUPPLEMENTAL DATA CARD

All databases are updated through a single SD card in the bottom slot of the MFD. When the card is inserted, the databases on the card will be copied to standby and synchronized across all powered, configured units. 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 PC equipped with an appropriate SD card reader is used to unpack and program the new databases onto an existing Supplemental Data Card. Equipment required to perform the update is as follows:

- Windows-compatible PC computer
- SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent
- Updated database obtained from the Garmin website
- Supplemental SD Cards

Updating Databases:

1) With the system OFF, remove an SD Card from the bottom SD card slot of the MFD.

2) Download and install the databases on an SD card.

3) Put the SD Card in the bottom SD card slot of the MFD.

4) Turn the system ON.

5) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

6) Turn the large **FMS** Knob and select Aux.

7) Turn the small **FMS** Knob and select Databases.

8) Monitor the Sync Status on the 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.

10) Remove the SD card from the bottom slot of the MFD if desired.

NOTE: *The **Restart** Softkey is enabled only when the aircraft is on the ground.*

11) Press the **Restart** Softkey to restart the system and load the updated database(s), or remove power from the system if the **Restart** Softkey is diminished. A 10 second restart countdown will appear. Press the **Restart** Button in the display window to continue with the restart of the system.

Or:

Remove power from the system if the **Restart** Softkey is diminished.

12) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

13) Turn the large **FMS** Knob and select Aux.

14) Turn the small **FMS** Knob and select the Databases.

15) Verify that the standby databases transferred and are now in the 'Active' column.

Figure B-2 'Aux - Databases' Page - Updated Databases

16) To manually activate any databases that did not transfer to the 'Active' column:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

b) Turn the small **FMS** Knob as necessary to select the database title.

c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.

Or:

Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

d) Remove and reapply power to the system.

e) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

f) Turn the large **FMS** Knob and select Aux.

g) Turn the small **FMS** Knob and select Databases.

h) Verify that the standby databases transferred and are now in the 'Active' column.

17) For additional information on each database, 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.

Or:

Press the **Menu** Key and select 'Details' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

18) To view database information for an individual display:

a) Turn the large **FMS** Knob and select Aux.

b) Turn the small **FMS** Knob and select System Status.

c) Press the Display Database Selection Softkey (MFD1 DB, PFD1 DB, PFD2 DB) to show database information for each display. Use the small **FMS** Knob to scroll through the database information. Press the **ENT** Key or the **FMS** Knob to exit.

UPDATING DATABASES USING BLUETOOTH TRANSCEIVER

In order to load databases through Garmin Pilot and the Bluetooth Transceiver, the Bluetooth Transceiver must be enabled on the system and inserted in the bottom SD slot of the MFD. A mobile device with Garmin Pilot must be paired with the Bluetooth Transceiver over Bluetooth (Refer to the Additional Features section). When there is at least one paired device available to connect, the Bluetooth 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 Bluetooth 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 Bluetooth Transceiver, and is not connected to another bluetooth device, the mobile device should connect automatically to the Bluetooth Transceiver. If the mobile device is connected to another bluetooth device, then the Bluetooth Transceiver will not connect automatically.*

Updating Databases from any MFD page (except the 'Aux - Databases' Page):

1) Insert the Bluetooth Transceiver SD Card in the bottom slot of the MFD if not already inserted.

2) Turn the system ON.

3) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

4) On the mobile device, start Garmin Pilot and touch **Home > Connext > Database Concierge.**

5) Turn the large **FMS** Knob and select Aux.

6) Turn the small **FMS** Knob and select the Connext Setup.

7) Ensure that Wifi Database Import is enabled in the 'Device' Window (Refer to Additional Features section for instructions to enable Wifi Database Import).

Figure B-3 'Connext Setup' Page

8) Verify that the mobile device is enabled via Bluetooth in the Bluetooth settings on the mobile device.

9) In the 'Paired Devices' Window on the 'Connext Setup' Page, ensure the system is paired with the mobile device in use. (Refer to Additional Features for instructions on connection to a preferred device).

NOTE: *The database updates may now be continued from any MFD page, however, the update windows shown in these instructions will not be shown on the 'Aux - Databases' Page. Use the instructions for updating databases from the 'Aux - Databases' Page if desired.*

10) Press the **Update** Softkey when the following window appears. (Pressing the **View** Softkey will allow database updates to be viewed from the 'Aux Databases' Page, however, the windows shown below will not appear on the 'Aux Databases' Page. Pressing the **Ignore** Softkey will postpone the updates until further action is taken.)

Figure B-4 Database Update Available

11) If using a device that has not been previously paired with the system, a password prompt will appear on the mobile device. Enter the password shown in the 'Password' Field of the 'Aux - Connext Setup' Page.

12) The following window will appear. Database update progress may be monitored on the mobile device.

Figure B-5 Starting Database Transfer

13) When the transfer is complete, the following screen will appear.

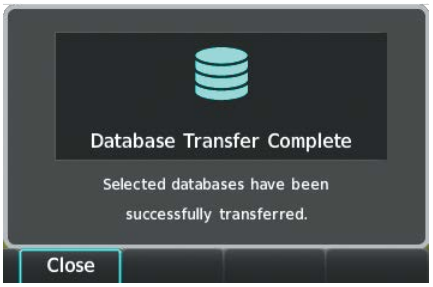

Figure B-6 Database Transfer Complete

14) Press the **Close** Softkey.

NOTE: *The **Restart** Softkey is enabled only when the aircraft is on the ground.*

15) Press the **Restart** Softkey to restart the system and load the updated database(s), or remove power from the system if the **Restart** Softkey is diminished. A 10 second restart countdown will appear. Press the **Restart** Button in the display window to continue with the restart of the system.

Or:

Remove power from the system if the **Restart** Softkey is diminished.

16) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

17) Turn the large **FMS** Knob and select Aux.

18) Turn the small **FMS** Knob and select Databases.

19) Verify that the standby databases transferred and are now in the 'Active' column.

Figure B-7 'Aux Databases' Page with Updated Databases

20) To manually activate any databases that did not transfer to the 'Active' column:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

b) Turn the small **FMS** Knob as necessary to select the database title.

c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.

Or:

Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

NOTE: *The **Restart** Softkey is enabled only when the aircraft is on the ground.*

d) Press the **Restart** Softkey to restart the system and load the updated database(s), or remove power from the system if the **Restart** Softkey is diminished. A 10 second restart countdown will appear. Press the **Restart** Button in the display window to continue with the restart of the system.

Or:

Remove power from the system if the **Restart** Softkey is diminished.

e) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

f) Turn the large **FMS** Knob and select Aux.

g) Turn the small **FMS** Knob and select Databases.

h) Verify that the standby databases transferred and are now in the 'Active' column.

21) For additional information on each database, 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.

Or:

Press the **Menu** Key and select 'Details' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

22) To view database information for an individual display:

a) Turn the large **FMS** Knob and select Aux.

b) Turn the small **FMS** Knob and select System Status.

c) Press the Display Database Selection Softkey (MFD1 DB, PFD1 DB, PFD2 DB) to show database information for each display. Use the small **FMS** Knob to scroll through the database information. Press the **ENT** Key or the **FMS** Knob to exit.

Updating Databases from the 'Aux - Databases' Page:

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 Bluetooth Transceiver, and is not connected to another bluetooth device, the mobile device should connect automatically to the Bluetooth Transceiver. If the mobile device is connected to another bluetooth device, then the Bluetooth Transceiver will not connect automatically.*

1) Insert the Bluetooth Transceiver SD Card in the bottom slot of the MFD if not already inserted.
2) Turn the system ON.
3) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.
4) On the mobile device, start Garmin Pilot and tap **Home > Connext > Database Concierge.**
5) Turn the large **FMS** Knob and select Aux.
6) Turn the small **FMS** Knob and select the Connext Setup.
7) Ensure that Wifi Database Import is enabled in the 'Device' Window (Refer to Additional Features section for instructions to enable Wifi Database Import).

Figure B-8 'Connext Setup' Page

8) Verify that the mobile device is enabled via Bluetooth in the Bluetooth settings on the mobile device.
9) In the 'Paired Devices' Window on the 'Connext Setup' Page, ensure the system is paired with the mobile device in use. (Refer to Additional Features for instructions on connection to a preferred device).
10) Press the **Device** Softkey to view databases that are ready to be loaded from the mobile device (pressing the **Stby/Actv** Softkey will again display the current Standby and Active databases).
11) 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 to the system will be indicated by a single cyan arrow.
12) Press the **Update** Softkey.
13) If using a device that has not been previously paired with the system, a password prompt will appear on the mobile device. Enter the password shown in the 'Password' Field of the 'Aux - Connext Setup' Page.
14) Database Update status will appear in the 'Status' Window at the top of the page. Monitor update progress in the 'Status' Window, or on the mobile device.

Figure B-9 Device Database Transfer

15) When all databases have been successfully transferred from the mobile device and appear in the Standby column, remove and reapply power to the system.

16) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

17) Turn the large **FMS** Knob and select Aux.

18) Turn the small **FMS** Knob and select Databases.

19) Verify that the standby databases transferred and are now in the 'Active' column.

Figure B-10 'Aux - Databases' Page with Updated Databases

20) To manually activate any databases that did not transfer to the 'Active' column:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

b) Turn the small **FMS** Knob as necessary to select the database title.

c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.

Or:

Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

NOTE: *The **Restart** Softkey is enabled only when the aircraft is on the ground.*

d) Press the **Restart** Softkey to restart the system and load the updated database(s), or remove power from the system if the **Restart** Softkey is diminished. A 10 second restart countdown will appear. Press the **Restart** Button in the display window to continue with the restart of the system.

Or:

Remove power from the system if the **Restart** Softkey is diminished.

e) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

f) Turn the large **FMS** Knob and select Aux.

g) Turn the small **FMS** Knob and select Databases.

h) Verify that the standby databases transferred and are now in the 'Active' column.

21) For additional information on each database, 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.

Or:

Press the **Menu** Key and select 'Details' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

22) To view database information for an individual display:

a) Turn the large **FMS** Knob and select Aux.

b) Turn the small **FMS** Knob and select System Status.

c) Press the Display Database Selection Softkey (MFD1 DB, PFD1 DB, PFD2 DB) to show database information for each display. Use the small **FMS** Knob to scroll through the database information. Press the **ENT** Key or the **FMS** Knob to exit.

DATABASE DELETION FEATURE

If databases are not properly loading or functioning, and an attempt has been made to load the databases using a new SD card or multimedia card, it may be necessary to delete the databases from the system.

Deleting databases:

1) Turn the large **FMS** Knob and select 'Aux'.
2) Turn the small **FMS** Knob and select 'Databases'.
3) Press the **Menu** Key.
4) Turn the small **FMS** Knob to select 'Delete Databases.'
5) Press the **ENT** Key.
6) A prompt will appear to confirm deletion of all internal databases. Push the **ENT** Key.

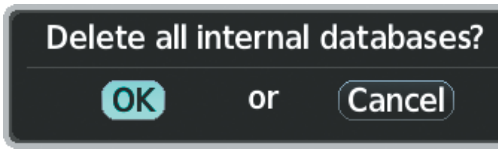

Figure B-11 Delete Databases Confirmation Window

7) Another prompt will appear to confirm deletion of all internal databases. Push the **ENT** Key.

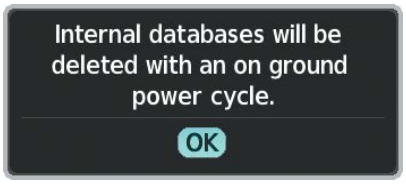

Figure B-12 Delete Databases Confirmation Window

8) Remove and reapply power to the system.
9) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.
10) Turn the large **FMS** Knob and select Aux.
11) Turn the small **FMS** Knob and select Databases.
12) Confirm that all databases have been deleted 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 each AHRS (GRS1 and GRS2). If the system determines the MV DB needs to be updated, a prompt is displayed on the MFD, as shown in Figure B-13. Note, in the following example, GRS1 is the first AHRS to indicate an update is available. In actuality, this is dependent on which AHRS is the first to report status to the system. GRS2 may be displayed before GRS1. The order is not important, only that both AHRS be updated.

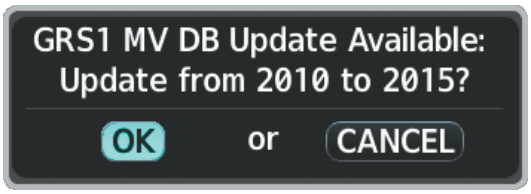

Figure B-13 GRS1 Magnetic Field Variation Database Update Prompt

Loading the magnetic field variation database update:

1) 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.

Figure B-14 Uploading Database to GRS1

2) When the upload is complete, the prompt for the next GRS upload is displayed, as seen in Figure B-15.

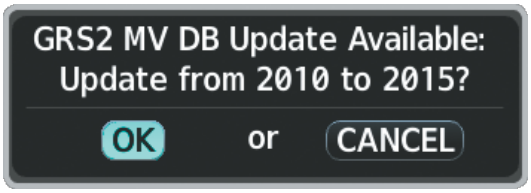

Figure B-15 GRS2 Magnetic Field Variation Database Update Prompt

3) With 'OK' highlighted, press the **ENT** Key on the MFD. A progress monitor is displayed as shown in Figure B-16. When the upload is complete, the system is ready for use.

Figure B-16 Uploading Database to GRS2

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AVIATION TERMS AND ACRONYMS

A	Amps
AC	Advisory Circular, Alternating Current
ACARS	Airborne Communications Addressing and Reporting System
ACC	Accuracy
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
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
AIM	Aeronautical Information Manual
AIRB	Airborne
AIRMET	Airman's Meteorological Information
AIRREP	Air Reports
ALRT	Alert
ALT	Altitude
ALT, ALTN	Alternator, Alternate
ALTS	Altitude Select, Selected Altitude Capture Mode
ALTV	VNAV Altitude Capture Mode
AM	Amplitude Modulation
AMPS	Amperes
ANNUNC/ANN	Annunciation/Annunciator
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
APT	Airport, Aerodrome, Automatic Pitch Trim
APTSIGNS	Airport Signs
APU	Auxiliary Power Unit
APV	Approaches with Vertical Guidance
ARINC	Aeronautical Radio Incorporated
ARSPC	Airspace
ARTCC	Air Route Traffic Control Center
ARV	Arrival
AS	Airspeed
ASB	Aviation Support Branch
ASOS	Automated Surface Observing System
AT	Auto Throttle
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon System
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
B	Both Runways
B ALT	Barometric Altitude
B/C, BC	Back Course
BARO	Barometer, Barometric
BATT	Battery
Bearing	The compass direction from the present position to a destination waypoint.
BFO	Beat Frequency Oscillator
BKLT	Backlight
BKSP	Backspace
Bluetooth	Wireless standard for data exchange over short distances
BOC	Bottom of Climb
BOD	Bottom of Descent
BRG	see also Bearing
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
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
CHT	Cylinder Head Temperature
CI	Course to Intercept Leg
CIP	Current Icing Potential
CL	Class
CLB	Climb
CLD	Cloud
CLR	Clear
CLTR	Clutter
CM	Centimeter
CMC	Central Maintenance Computer
CN	Canada
CNS	Communication, Navigation, & Surveillance
CO	Carbon Monoxide
COM	Communication Radio
COMP	Compensated, Compensation
CONFIG	Configuration
CONUS	Continental United States
COOL	Coolant
COPLT	Copilot
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.
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
CTA	Control Area
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
D ALT	Density Altitude
D-ATIS	Digital Automatic Terminal Info Service
DB, DBASE	Database
dBZ	Decibels 'Z' (Radar Return)
DCL	Departure Clearance
DCLTR, DECLTR	Declutter
DEC FUEL	Decrease Fuel
DEG	Degree
DEIC, DEICE	De-icing
DEP	Departure
DESC	Descent
Desired Track	The desired course between the active "from" and "to" waypoints.
DEST, DES	Destination, Destination Airport Identifier
DEV	Deviation
DF	Direct to Fix Leg
DFLT	Default
DG	Directional Gyro
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
Distance	The 'great circle' distance from the present position to a destination waypoint.
DL LTNG	Datalink Lightning
DLS	Data Link System
DME	Distance Measuring Equipment
DN	Down
DNALT	Density Altitude
DOD	Department of Defense
DOP	see also Dilution of Precision
DP	Departure Procedure
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
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
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
EPE	see also Estimated Position Error
EPU	Estimated Position Uncertainty
ERR	Error
ES	Extended Squitter
ESA	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.
ETA	see also Estimated Time of Arrival
ETE	see also Estimated Time Enroute
EVS	Enhanced Vision System
EXPIRD	Expired
EXT	External
°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
FAR	Federal Aviation Regulations
FBO	Fixed Base Operator
FC	Course From Fix to Distance Leg
FCC	Federal Communication Commission
FCST	Forecast
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	Flight Level Change
FLT	Flight, Flight Timer
FLTA	Forward Looking Terrain Avoidance
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
FREQ	Frequency
FRMT	Format
FRZ	Freezing
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/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
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
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 that the aircraft is travelling relative to a ground position.
GRS	Garmin Reference System
GS	Ground Speed, Glideslope
GSA	Garmin Servo Adapter
GSD	Glideslope/Glidepath Deviation, Garmin Data Concentrator
GSL	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
HA	Hold Terminating at Altitude Leg
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
HM	Hold with Manual Termination Leg
HNS	Hybrid Navigation System
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
HOV	Hover
HOV-P	Hover Prediction
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
HTR	Heater
HUL	Horizontal Uncertainty Level
HYD	Hydraulic

Hz	Hertz (cycles per second)
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
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
IMC	Instrument Meteorological Conditions
IN	Inch
IN Hg	Inches of Mercury
INACTV	Inactive
INC FUEL	Increase Fuel
IND	Indicator, Indicated
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
INFO	Information
INH	Inhibit
INOP	Inoperative
INS	Inertial Navigation System
INT	Intersection(s)
INTEG	Integrity (RAIM unavailable)
INTERN, INTRL	Internal
INV	Invalid
IOI	Imminent Obstacle Impact
IR	Infrared
IrDA, IRDA	Infrared Data Association
ISA	International Standard Atmosphere; ISA Relative Temperature
ISO	International Standards Organization
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.
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	Longitude, Longitudinal
LP	Localizer Performance
LPV	Localizer Performance with Vertical Guidance
LRU	Line Replaceable Unit
LSB V	Lower Sideband Voice
LT	Left
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
MAN	Manual
MAN IN	Manifold Pressure (inches Hg)
MAN SQ	Manual Squelch
MANSEQ	Manual Sequence
MAP	Missed Approach Point
MASQ	Master Avionics Squelch
MAX	Maximum
MAXSPD	Maximum Speed (overspeed)
MB	Marker Beacon
MCP	Maximum Continuous Power
MDA	Barometric Minimum Descent 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
Minimum Safe Altitude (MSA)	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.
MKR	Marker Beacon
MMO (VMO)	Maximum Speed
MOA	Military Operations Area
MON	Monitor
MORA	Minimum Off-Route Altitude
MOV	Movement
MPEL	Maximum Permissible Exposure Level
MPM	Meters per Minute
MSA	see also Minimum Safe Altitude
MSAS	Multi-functional Satellite Augmentation System
MSG	Message
MSL	Mean Sea Level
MT, M	Meter
MTN	Mountain
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
NEXRAD	Next Generation Radar
NG	Gas Producer Rotation Speed
NM	Nautical Mile(s)
NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
NOTAM	Notice To Airman
NP	Power Turbine Speed
NR	Rotor Speed
NRST	Nearest
NWS	National Weather Service
O	Outer Marker
OAT	Outside Air Temperature

OBD, OUTBD	Outboard
OBS	Omni Bearing Selector
OBSCR	Obscuratiion
OCL	Oceanic Clearance
OEM	Original Equipment Manufacturer
OFST	Offset
OGE	Out of Ground Effect
OOOI	Out of the gate, Off the ground, On the ground, and In the gate
OVR	Override
OXY	Oxygen
P ALT	Pressure Altitude
P. POS	Present Position
PA	Passenger Address, Proximity Advisory
PASS	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
POA	Plain Old ACARS
POF	Phase of Flight
POH	Pilot's Operating Handbook
POHS	Pilot's Operating Handbook Supplement
POS, POSN	Position
PPH	Pounds per Hour
PPM	Parts per Million
PRES, PRESS	Pressure
PREV	Previous
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
QNH	Sea Level Pressure
QTY	Quantity
R	Right, Right Runway
RA	Resolution Advisory, Radio Altimeter
RAD	Radial
RAD ALT	Radio Altimeter
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RAT	Ram Air Temperature
RCVR	Receiver
RDR	Radar
RECIRC	Recirculate/Recirculating
REF	Reference
REM	Remaining (fuel remaining), Reminder, Removed
REQ	Required
RES	Reserve (fuel reserve entered by pilot)
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
ROC	Required Obstacle Clearance
ROL	Roll
ROM	Read Only Memory
RPM	Revolutions Per Minute
RQRD	Required
RST FUEL	Reset Fuel

RSV	Reserve (fuel reserve entered by pilot)
RT	Right
RTC	Required Terrain Clearance
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
SCIT	Storm Cell Identification and Tracking
SD	Secure Digital
SEC	Second(s)
SEL, SLCT	Select
SELCAL	Selective Calling
SENS	Sense
SFC	Surface
SIAP	Standard Instrument Approach Procedures
SID	Standard Instrument Departure
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
SMBL	Symbol
SMS	Short Message System
SNGL	Single
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
STATS	Statistics
STBY	Standby
STC	Sensitivity Time Constant, Supplemental Type Certificate
STD	Standard
STR	Strip
STRMSCP	Stormscope
SUA	Special Use Airspace
SUPPRESS	Suppression
SURF	Surface
SUSP	Suspend
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
TACAN	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
TEL	Telephone
TEMP	Temperature
TERM	Terminal
TF	Track Between Two Fixes Leg
TFR	Temporary Flight Restriction

TGT	Target
THR	Thrust
TIS	Traffic Information Service
TIS-B	Traffic Information Service-Broadcast
TIT	Turbine Inlet Temperature
TKE	see also Track Angle Error
TLA	Throttle Lever Angle, Thrust Lever Angle
TMA	Terminal Maneuvering Area
TMR/REF	Timer/Reference
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
TTL	Total
TURB	Turbulence
TURN	Procedure Turn
TWIP	Terminal Weather Information for Pilots
TX	Transmit
UA	Routine PIREP
UAT	Universal Access Transceiver
UHF	Ultra-High Frequency
UNAVAIL	Unavailable
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
VAPP	VOR Approach Mode
V_{APP} , V_{AC}	Approach Climb Speed
VAR	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
V_{LE}	Maximum Landing Gear Extended Speed
V_{LNDx}	Approach Speed (Flaps at x°)
V_{LO}	Maximum Landing Gear Operating Speed
VLOC	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
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
VTF	Vector to Final
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
WGS-84	World Geodetic System - 1984
WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
WILCO	Will Comply
WNDSHR	Windshear
WOG	Weight on Gear
WOW	Weight on Wheels
WPT	Waypoint(s)
WT	Weight
WW	World Wide
WX	Weather
XFER, XFR	Transfer
XFLOW	Crossflow
XM LTNG	SiriusXM Lightning
XMIT	Transmit
XMSN	Transmission
XPDR	Transponder
XTALK	Cross-Talk
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.

Can "slant Golf" ("/G") be filed using the G1000 NXi?

"/G" may be filed for a flight plan. The system meets the requirements of TSO-C145a Class 3 or TSO-C145c Class 3, and ETSO C145 Class 3 installations. GPS approaches are not to be flown with an expired database. See the approved current version of the pertinent flight manual as well as the Aeronautical Information Manual (AIM) for more information.

What does the OBS Softkey do?

The **OBS** Softkey is used to select manual sequencing of waypoints. Activating OBS mode sets the current active-to waypoint as the primary navigation reference and prevents the system from sequencing to the next waypoint in a flight plan. When OBS mode is cancelled, automatic waypoint sequencing is continued, and the system automatically activates the next waypoint in the flight plan once the aircraft has crossed the present active waypoint.

Normal (OBS not activated)	OBS
• 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 pressing the **ACT Leg** Softkey then the **ENT** Key to approve the selection. The GPS then provides navigation along the selected flight plan leg.

When does turn anticipation begin?

The system smooths adjacent leg transitions based on a normal 15° bank angle (with the ability to roll up to 30°) and provides three pilot cues for turn anticipation:

- A waypoint alert ('Next DTK ###° in # seconds' or 'Next HDG ###° in # seconds') appears on the PFD 10 seconds before the turn point and flashes as it counts down to zero.
- A flashing turn advisory ('Turn [right/left] to ###° in # seconds') appears on the PFD 10 seconds before the turn and flashes as it counts down to zero. 'Turn [right/left] to ###° now' or 'Next [DTK/HDG] to ###° now' is displayed when the pilot is to begin the turn and the HSI (GPS mode) automatically sequences to the next DTK or HDG value.
- The To/From indicator on the HSI flips momentarily to indicate that the midpoint of the turn has been crossed.

When does the CDI scale change?

Once a departure is activated, the 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.

MISCELLANEOUS MAP SYMBOLS

Item	Symbol
ARTCC Frequency or FSS Frequency	
Map Pointer (when panning)	
Measuring Pointer	
User Waypoint	
Vertical Navigation Along Track Waypoint	
Parallel Track Waypoint	
Unanchored Flight Path Waypoint	
Displayed when aircraft GPS location is valid, but heading is invalid.	
Top of Descent (TOD)	
Bottom of Descent (BOD)	
Navigating using Dead Reckoning	

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