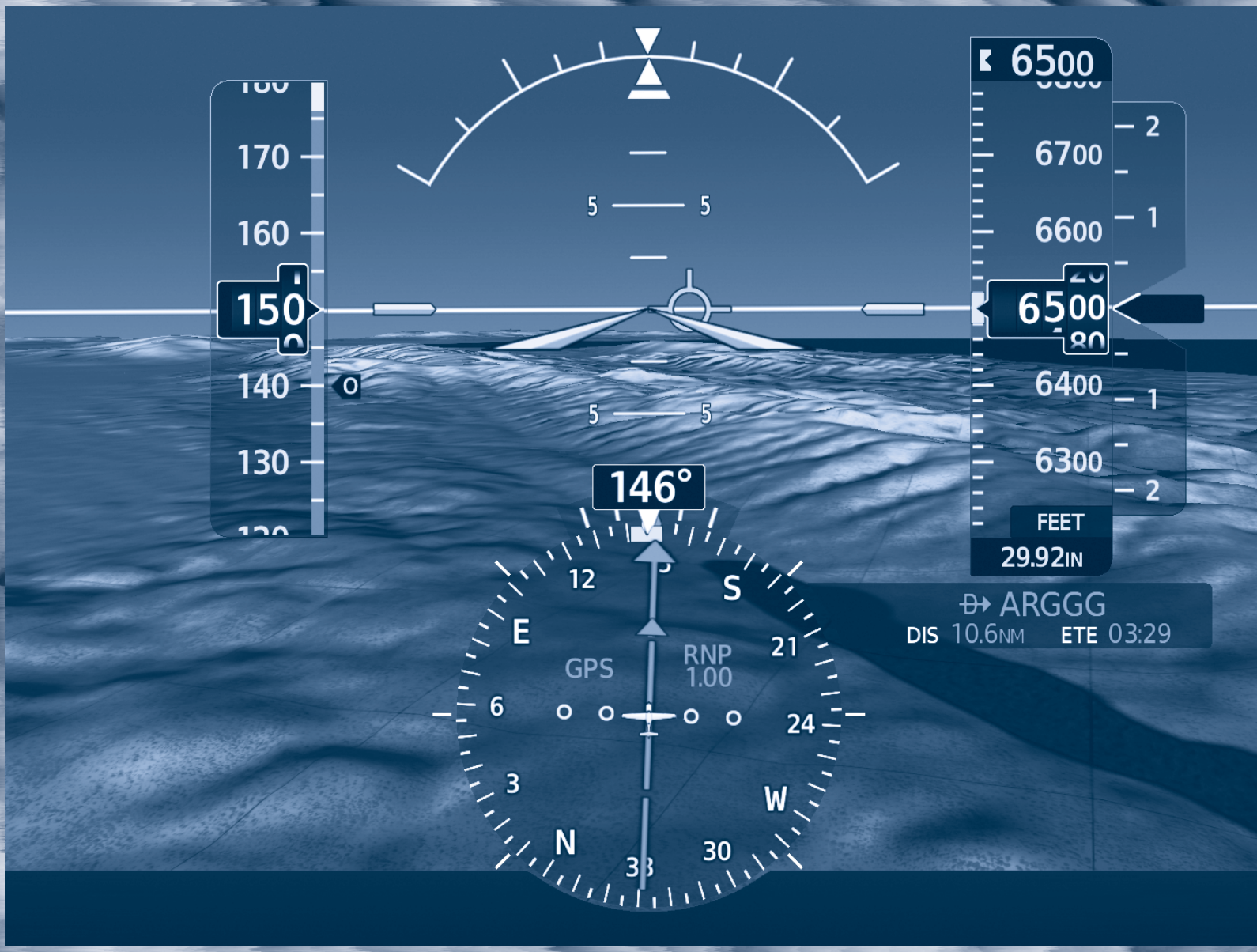
GARMIN

CIRRUS PERSPECTIVE TOUCH+

Pilot's Guide



CIRRUS SR2x

System Software Version 3956.Q2 or later

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

ENGINE AND AIRFRAME SYSTEMS

AUDIO & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AUTOMATIC FLIGHT CONTROL SYSTEM

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This manual reflects the operation of System Software version 3956.Q2 or later for the Cirrus Perspective Touch+ by Garmin Integrated Avionics System. Where used, references to 'SR2x' are inclusive of the SR20, SR22, and SR22T. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions. Always refer to the approved current pertinent flight manual for a description of systems, limitations, and procedures.

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PAP

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

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

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

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

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

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

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

WARNING: *Do not use terrain avoidance displays as the sole source of information for maintaining separation from terrain and obstacles. Garmin obtains terrain and obstacle data from third party sources and cannot independently verify the accuracy of the information.*

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

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

WARNING: *Do not rely on the autopilot to level the aircraft at the MDA/DH when flying an approach with vertical guidance. The autopilot will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.*

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

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

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

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

WARNING: *Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.*

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

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

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

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

CAUTION: *Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NOTE: *The nose of the 'own ship' symbol represents the location of the aircraft. The center of any traffic symbol represents the location of that traffic. The traffic and own ship symbols are an abstract representation and do not reflect the physical extent of the aircraft/traffic, and should not replace other methods for identifying traffic.*

NOTE: *The pilot/operator must review all portions of the flight plan following a flight plan import from any source.*

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

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

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

NOTE: *Operate G2000 system power through at least one cycle in a period of four days of continuous operation to avoid an autonomous system reboot.*

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Record of Revisions				
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190-02955-00	A	Aug, 2022	All	Initial Release for GDU 32.01.10
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SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

The Cirrus Perspective+ Integrated Avionics by Garmin presents flight instrumentation, position, navigation, communication, and identification information to the pilot through large-format displays. The Garmin Automatic Flight Control System (AFCS) provides the Flight Director (FD), Autopilot (AP), Yaw Damper (YD - optional), and manual electric trim (MET) functions. Refer to the AFCS section for more information.

LINE REPLACEABLE UNITS (LRU)

- **GDU 1250W** (2) (Standard) or **GDU 1450W** (2) (Alternate) – The Garmin Display Unit (GDU) features a 14-inch, or optional 12-inch, light emitting diode (LED) Widescreen Ultra Extended Graphics Array (WUXGA) 1920 x 1200 resolution backlit display. In normal operation, the left/pilot side GDU operates as the Primary Flight Display (PFD) and the right/copilot side GDU operates as the Multi Function Display (MFD). The display units communicate with each other, the Touchscreen Controllers, and with the on-side Integrated Avionics Unit (IAU) through a High-Speed Data Bus (HSDB) Ethernet connection.
- **GTC 585** (2) – The Touchscreen Controllers are centrally located in the cockpit and provide a user interface to the system for data entry and control of the GDU displays and communication equipment.. The unit installed on the left/pilot side is designated as GTC1; the unit installed on the right/copilot side is designated as GTC2. The Touchscreen Controllers communicate with each other and the on-side GDU (PFD / MFD). GTC2 communicates with the Audio Controller.
- **GIA 64W** (2) – The GIA, Integrated Avionics Units (IAU), function as the main communications hub, linking several LRUs with each on-side GDU. Each GIA contains a GPS Satellite-Based Augmentation System (SBAS) receiver, a very high frequency (VHF) communication/navigation/glideslope (COM/NAV/GS) receiver, a Flight Director (FD) and system integration microprocessors. The GIA units communicate directly with each other through HSDB connection.
- **GEA 71B** (1) – Receives and processes signals from the engine and airframe sensors. This unit communicates with both GIAs using an RS-485 digital interface.
- **GSU 75** (2) – ADAHRS combines air data and altitude/heading data units. 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 through ARINC 429 to the PFD, MFD, and GIA. The GSU 75 contains advanced sensors (including accelerometers and rate sensors) and interfaces with the GMU to obtain magnetic field information, and with the GIA to obtain GPS information. ADAHRS modes of operation are discussed later in this document.
- **GMU 44B** (2) – The Magnetometer measures local magnetic field and sends the data to the GSU for processing to ascertain aircraft magnetic heading. This unit receives power directly from the GSU and communicates with the it, using an RS-485 digital interface.
- **GTP 59** (2) – The Temperature Probe provides Outside Air Temperature (OAT) data to the GSU.
- **GMA™ 36B** (1) – The Audio Controller integrates navigation/communication radio (NAV/COM) digital audio, intercom, and marker beacon audio. It is connected to GTC2 and each IAU.
- **GMC 707** (1) – Provides the controls for the Garmin AFCS through an RS-232 digital interface allowing communication with the PFD and MFD.

- **GTX 335R (1) or GTX 345R** (1) (Alternate) – Solid-state transponders that provide Modes A, C, S and ADS-B capability. The optional GTX 345R also provides ADS-B In/Out. The transponder can be controlled from the GTCs. The transponder communicates with the both GIAs through an RS-232 digital interface.
- **GSA 87** (2) – The Servos are used for automatic control of the pitch, roll, and optional yaw damper. These units interface with each IAU.
- **GTA 82** (1) – The Pitch Trim Adapter takes input from the trim switches, GIA and GSA to control the DC motor to drive the aircraft trim system.
- **GTS 800** (1) (Optional) – The GTS 800 provides real-time traffic information to the MFD (and, indirectly, to the inset map of the PFD). The GTS 800 communicates with the MFD with an HSDB connection. The GTS 800 also has an analog audio connection to the Audio Panel.
- **GDL 69A SXM** (1) (Optional) – The Data Link Satellite Radio Receiver provides weather information to the MFD (and, indirectly, to the inset map of the PFD) as well as digital audio entertainment. The unit communicates with the GTC1 through an HSDB connection. A subscription to the SiriusXM Satellite Radio and/or SiriusXM Weather service is required to enable the GDL 69A SXM capabilities.
- **GSR 56** (1) (Optional) – The Iridium Transceiver provides telephone voice communication by means of pilot and copilot headsets. The unit can also send and receive data over the Iridium satellite network. The GSR 56 is connected the #1 GIA 64W with an RS-232 digital interface, with analog connections to the audio panel.
- **Flight Stream 510** (1) (Optional) – Provides wireless connectivity between a compatible tablet/mobile device and the avionics system. It is inserted into an MFD Secure Digital (SD) card slot.

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

- **Enhanced Vision System**
- **KN 63** DME
- **KR 87** ADF
- **CO Guardian** Carbon Monoxide Detector
- **L3 Stormscope WX 500** Lightning Detection

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

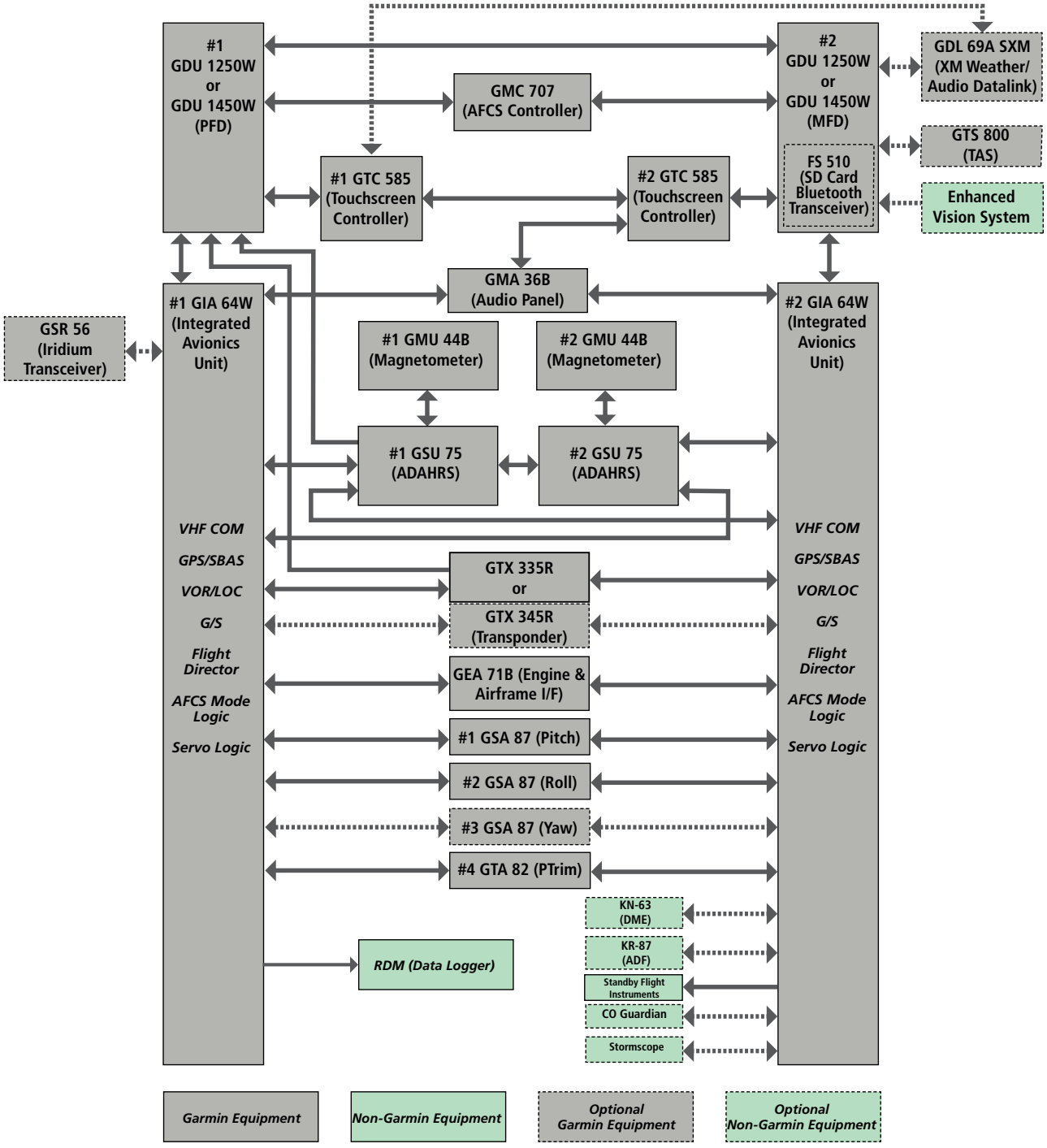


Figure 1-1 LRU Block Diagram

1.2 SYSTEM CONTROLS

The system controls are located on the GTCs, PFD, MFD, and AFCS Controller. These controls simplify operation, minimize crew workload, and reduce the time required to access sophisticated functionality. The Touchscreen Controllers are discussed in this section. AFCS controls are described in the AFCS section. See the Audio and Communication/Navigation/Surveillance (CNS) Section for detailed information about NAV/COM controls.

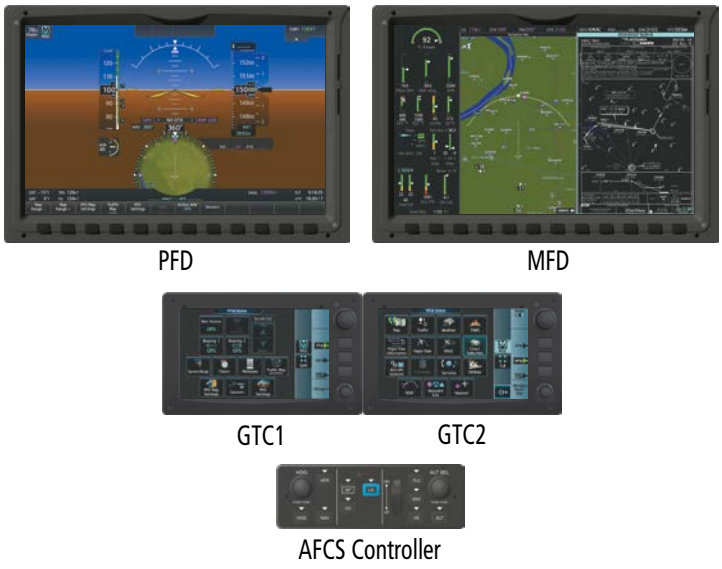


Figure 1-2 System Controls

PFD CONTROLS



Figure 1-3 PFD Controls

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

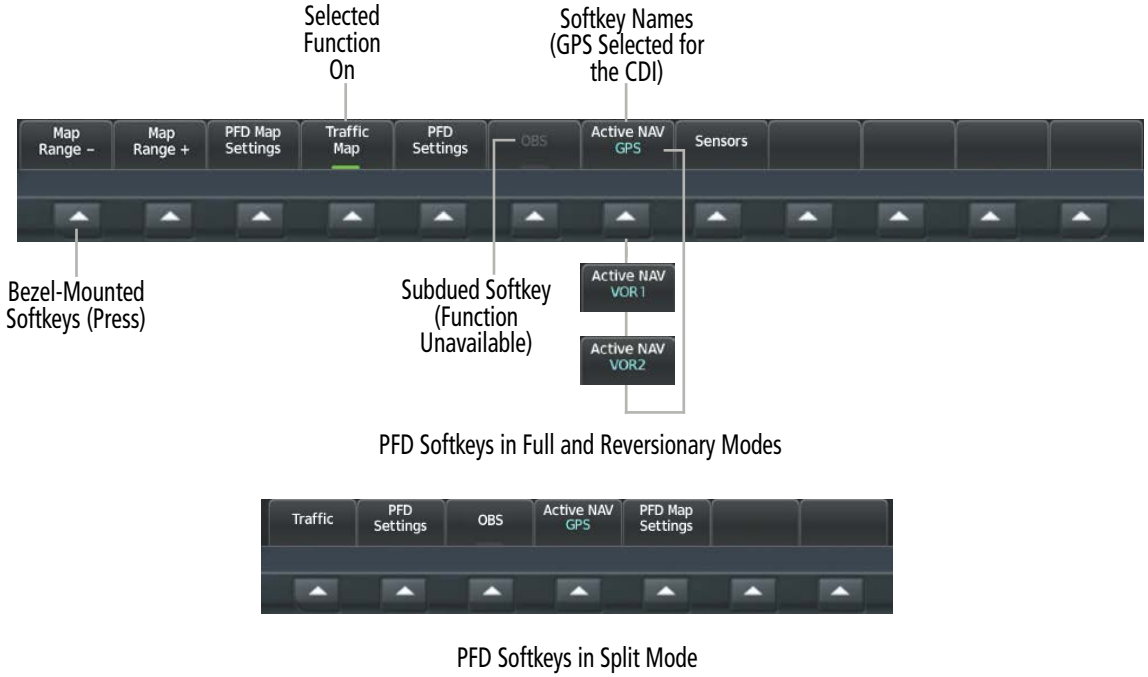


Figure 1-4 Top Level PFD Softkeys

PRIMARY FLIGHT WINDOW (PFW) / MULTI-FUNCTION WINDOW (MFW)

The PFW and MFW are the graphical content viewed on the PFD and MFD respectively, while the PFD and MFD are the complete display units with screens, bezels and softkeys.

Typically, the PFD depicts the PFW display containing primary flight information, while the MFD displays the MFW which depicts the EIS and various selectable MFW panes (e.g., Navigation Map).



Figure 1-5 PFW and MFW Displays on PFD and MFD in Normal and Half Mode

In split-screen mode, the PFD can display one MFW window in addition to PFW content. The MFD can display PFW content, but only in Reversionary mode. See descriptions for the Touchscreen Controller functions and Reversionary mode for more information on the display of the PFW and the MFW.

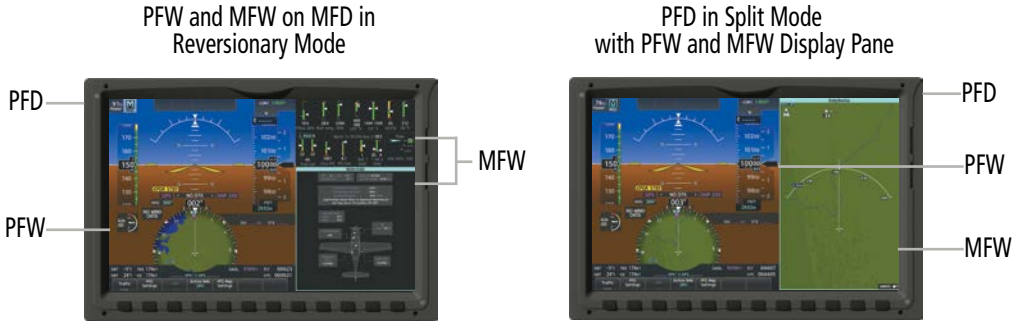


Figure 1-6 PFW and MFW Displays in Reversionary / Split Screen Modes

TOUCHSCREEN CONTROLLER

The two Touchscreen Controllers, designated as GTC1 and GTC2, are panel-mounted user interfaces allowing for ease of data entry, Display Pane operation, and NAV/COM tuning. Many procedures in this Pilot's Guide are performed using a Touchscreen Controller.

The **PFW** and **MFW** softkeys provide buttons for controlling the Primary Flight Window (PFW) and Multi-function Window (MFW) that appear on the displays. The NAV COM softkey provides the control for the 'NAV/COM Home' Screen on the Touchscreen Controller.

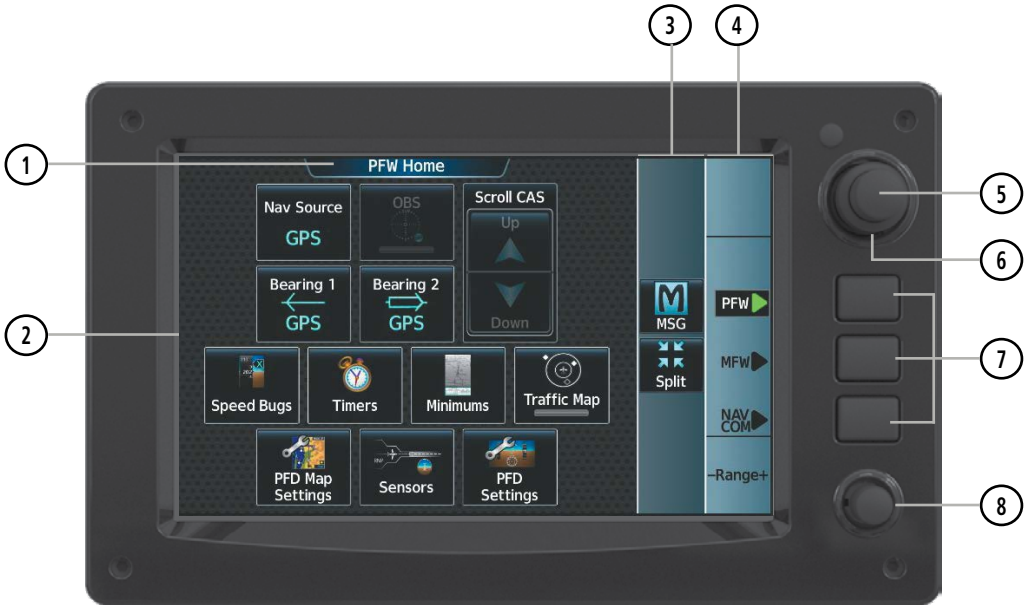


Figure 1-7 Touchscreen Controller

(1) Screen Title	Displays the title of the current screen.
(2) Screen	Displays set of context sensitive controls and data.
(3) Button Bar	Displays System level buttons (e.g., **Home**, **MSG**, **Full**/**Half**/**Split**, Scroll **Up**/**Down**, **Back**, **Enter**, **Cancel**).
(4) Label Bar	Displays labels to show status and current functions of knobs and softkeys, when functions are available.

(5) Small Upper Knob	Provides functions as labeled on the Label Bar (e.g., Display Pane selection, COM Freq/ switching/Hold, data entry/map panning).
(6) Large Upper Knob	Provides functions as labeled on the Label Bar (e.g., Display Pane selection, COM Freq/ switching/Hold, data entry/map panning).
(7) Softkeys	Provides functions as labeled on the Label Bar (e.g., PFW, MFW, NAV/COM selection).
(8) Lower Knob	Provides functions as labeled on the screen (e.g., COM volume/squelch/map range adjustment/checklist item control).

The Touchscreen Controller uses a grid of infrared beams and sensors to detect the location of touch input, even when the operator is wearing gloves. Objects or debris on the glass surface can interfere with these infrared beams and cause unintended activation of buttons. A screen cleaning procedure, described later in this section, is available to temporarily disable the touch recognition capability to facilitate screen cleaning.

In normal operation, GTC 1 can control the PFW, MFW and NAV/COM, while GTC 2 can control the PFW and NAV/COM. The crew selects a control mode for a given controller (e.g., PFW, MFW, NAV/COM) by pressing context-sensitive softkeys located on the right portion of each controller bezel. These softkeys are aligned with labels for each control mode currently available on a given controller. A box appears around the selected control mode, and a green arrow points to the currently selected softkey.

The Touchscreen Controller functions are arranged by screen. Each screen has a title which appears at the top of the screen area. The contents of each screen change dynamically in response to the selected control mode, and to crew or system input. At the top level of each mode is a corresponding home screen containing mode-specific controls. 'PFW Home' is the home screen for PFD / PFW control mode. 'MFW Home' is the home screen for MFD / MFW (i.e., Display Pane) control mode. 'NAV/COM Home' is the home screen for NAV/COM control mode.

The Touchscreen Controller available functions for the selected control mode are accessible from the 'MFW Home' Screen. The 'MFW Home' Screen may be accessed any time it is not currently displayed by touching the **Home** Button in the Button Bar, below or to the right of the screen area. Procedures in this Pilot's Guide generally begin from the 'MFW Home' Screen as a reference point. However, it is not necessary to return to the 'MFW Home' Screen before performing each procedure if the appropriate screen is already displayed.

As the Touchscreen Controller is used, certain selections will cause another screen to be displayed. To return to the previous screen, touch the **Back** or **Cancel** Button (as applicable) in the Button Bar, or touch the **Home** Button to return to the 'MFW Home' Screen. If the 'MFW Home' Screen was the previous screen, pressing either the **Back** or **Home** Button will also return to the 'MFW Home' Screen.

If the system issues a message, the **MSG** Button is shown. Touching this button will display the 'Notifications' Screen. The Button Bar also contains buttons for controlling the size of MFW Display Panes (Full or Half Mode), and PFW Display Panes (Full or Split Mode), discussed later in this section. The following buttons may be displayed on the Button Bar, depending on current availability and/or settings.

	Returns to the Home Screen		Selects split display mode on the PFD.
	Returns to the previous screen		Selects half-display mode on the MFD.
  	Displays the 'Notifications' Screen on Touchscreen Controller. Flashes when a new system message is issued. The button will display as 'WARN' or 'CAUT' in red or amber respectively to alert of warning and caution messages. Refer to the Appendices Section for more information about the alerting system.		Selects full-display mode when controlling the MFD. Selects full display mode when controlling the PFD.
	Displays the Telephone 'Notifications' Screen on Touchscreen Controller. Flashes when a new telephone call is received.		Scrolls up in a list
	Displays the 'Initialization' Screen on Touchscreen Controller. Button appears on the 'MFW Home' Screen if initialization tasks have not been completed.		Scrolls down in a list
	During Initialization, selects the next Task in the Initialization process.		Cancels data entry and returns to the previous screen
	Displays the 'SMS Text Messaging' Inbox Screen on Touchscreen Controller. Flashes when a new SMS message is received.		Accepts entered data into the system.
	Displays the Connext 'Notifications' Screen on the Touchscreen Controller. Flashes when a new Connext message is received.		Opens 'Direct To' Screen on the Touchscreen Controller

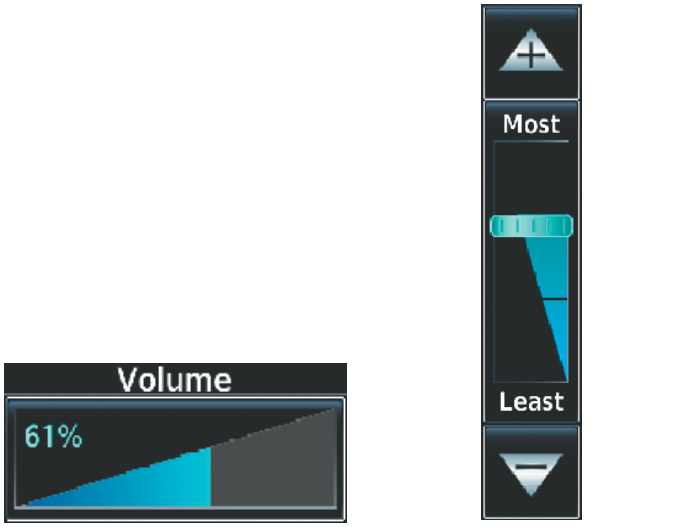
The Label Bar, on the right side of the Touchscreen Controller, displays the current function of each control as a reference. These functions include Map Range adjustment, Display Pane selection, radio volume/squelch adjustment, COM radio tuning, and data entry.

The labels change based on the context of the options being performed. If a Touchscreen Controller knob cannot be used because of a failure in a system component (COM, NAV, Audio, etc.), the Label Bar also indicates this status; refer to the Audio and CNS Section for more information about radio failures.

The Touchscreen Controller recognizes input based on a touch, a gesture (such as sliding a finger), or by pressing or turning the knobs or softkeys.

On-screen buttons are selected by momentarily touching them with a finger and then releasing. It is not necessary to apply pressure, as the infrared touchscreen surface detects only the presence and movement of the finger, not pressure. When touched, the button background is highlighted in blue until the finger is released. If enabled, an aural 'click' sound is also issued to confirm the button has been touched. When releasing the finger, make sure it is released within the boundary of the button, otherwise the input is considered invalid. If enabled, an aural tone is heard to indicate the touch input was not accepted.

Some adjustments are made using horizontal or vertical sliders. To use, simply touch within the slider box and slide the finger in the desired slider bar direction, then release the finger. The finger may move outside of the slider box during adjustment; slider movement stops when either the finger is released or the slider has reached its maximum travel. In some cases, the slider can also be adjusted by touching a **+** or **-** Button if it accompanies the slider, such as in the Map Detail Adjustment Slider shown in the following figure. In addition, a slider adjustment may also be accomplished using knobs on the Touchscreen Controller if the Label Bar indicates the selected slider supports this additional control.



Volume Adjustment Slider Map Detail Adjustment Slider

Figure 1-8 Sliders on the Touchscreen Controller

When a window on the Touchscreen Controller screen contains more information than the window can currently show, a scroll bar and scroll buttons appear. To scroll inside of a window, touch the controller while moving the finger up or down accordingly or touch and drag the finger up or down. To scroll more quickly, move the finger up or down rapidly. Scrolling can also be performed by pressing the **Up** or **Down** scroll buttons, each touch of the scroll button will display one 'page' of information. Press and hold the **Up** or **Down** scroll buttons for a continuous scroll.

Some screens provide tabs as a means to group multiple categories of information or buttons. Touch the desired tab to display its contents and manage settings or information. The selected tab is highlighted.



Figure 1-9 Touchscreen Controller with Tabs and Scroll Arrows

Elements on the Touchscreen Controller screens (such as buttons and sliders) may appear subdued to indicate their functions are currently not available. Generally, pilot-selectable fields appear in cyan. In some cases, the system may highlight the expected button in cyan which completes a data entry process or function.

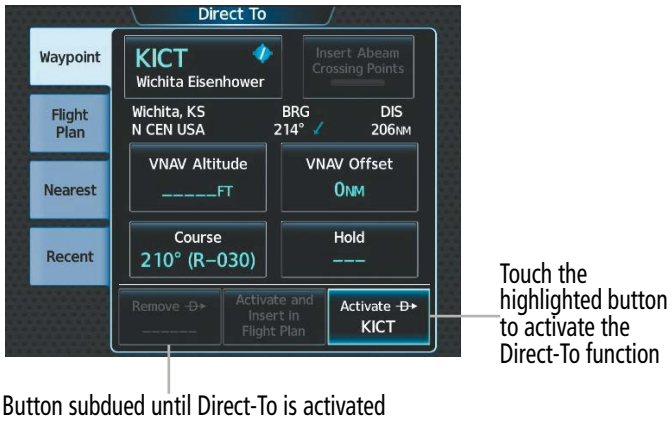


Figure 1-10 Subdued Buttons on Touchscreen Controller

BUTTON TYPES

Annunciator Buttons operate in an on/off state. An 'on' or enabled button displays a green annunciator; an 'off' or disabled button displays a subdued annunciator. Touch the annunciator button to change its state.



Figure 1-11 Touchscreen Controller Annunciator Buttons

Datafield Buttons can be modified based on information the pilot can enter or change, and often contain cyan alphanumeric text. Touching datafield buttons will either display a pop-up window from which a selection can be made, or display a keypad to supply the data. See the Data Entry discussion in this section for more information.

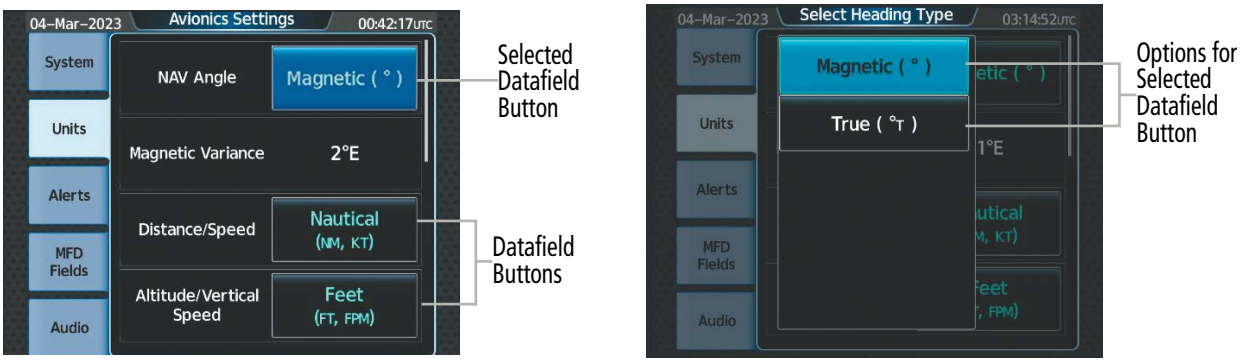


Figure 1-12 Touchscreen Controller Datafield Buttons

If a system failure causes a button function to be inaccessible, an amber 'X' appears over the button. These buttons will not respond if touched.

SCREEN OVERVIEW

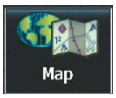
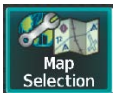
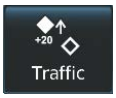
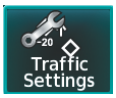
The following is a brief overview of the major screens used to access Touchscreen Controller functions. Additional specific screens used to perform functions are shown and discussed in detail throughout this Pilot's Guide.

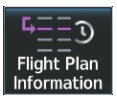
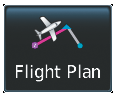
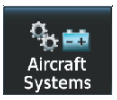
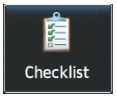
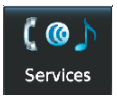
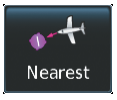
NOTE: *Screen appearance including available buttons may differ based on installed options and equipment.*

MFW MODE TOUCHSCREEN CONTROLLER SCREENS

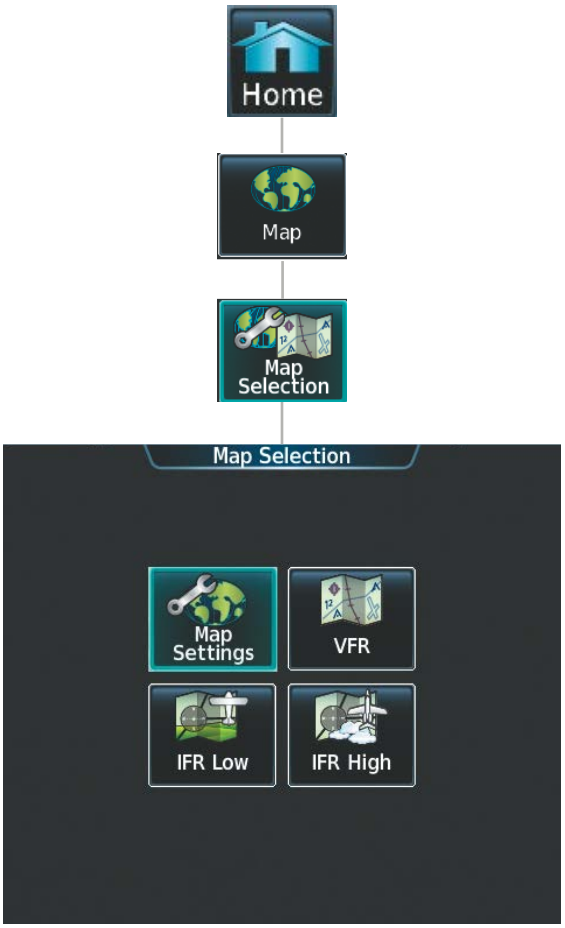
MFW HOME



 **or** 	Shows 'Navigation Map' Pane in the selected Display Pane. When the 'Navigation Map' Pane is displayed, the button becomes the **Map Selection** Button. Touch the **Map Selection** Button to access the 'Map Settings' Screen on the Touchscreen Controller.
 **or** 	Shows 'Traffic Map' Pane in the selected Display Pane. When the 'Traffic Map' Pane is displayed, the button becomes the **Traffic Settings** Button. Touch the **Traffic Settings** Button to access the 'Traffic Settings' Screen on the Touchscreen Controller.
 **or** 	Shows a 'Weather <SiriusXM, Connext, Stormscope, or FIS-B>' Pane in the selected Display Pane. When the weather pane is displayed, the button becomes the **Weather Selection** Button. Touch the **Weather Selection** Button to access the 'Weather Selection' Screen on Touchscreen Controller.

 **or** 	Shows the 'TAWS' Pane in the selected Display Pane. When the 'TAWS' Pane is displayed, the button becomes the **TAWS Settings** Button. Touch the **TAWS Settings** Button to access the 'TAWS Settings' Screen on Touchscreen Controller.
	Accesses 'Flight Plan Information' Screen on Touchscreen Controller.
	Accesses 'Active Flight Plan' Screen on the Touchscreen Controller.
	Accesses 'Procedures' Screen on Touchscreen Controller. Additional map displays may be shown as procedures are selected.
	Accesses 'Charts' Screen on Touchscreen Controller. Charts are shown on the selected Display Pane.
	Accesses 'Systems' Screen on Touchscreen Controller. Systems data can be selected for display on the Touchscreen Controller, and displayed on a Display Pane. Also provides access to systems controls, systems tests, and optional video controls.
	Accesses the Checklists for display in the selected Display Pane.
	Accesses the 'Services' Screen on Touchscreen Controller. Includes optional Iridium phone, and text messaging services, Networks and Pairing, Bluetooth Phone, Music, Position Reports, Connext Setup, and Contacts.
	Accesses the 'Utilities' Screen on Touchscreen Controller. Includes Trip Planning functions, Minimums, Trip Statistics, Timer, Scheduled Messages, FMS Sensors, Initialization, Electronic Documents (optional), Screen Cleaning, Crew Profile, and Setup. If SurfaceWatch option is not installed, Weight and Balance functions are also on the 'Utilities' Screen.
	Accesses the 'PERF' Screen. Provides controls for entering takeoff, landing, PERF Datalink wind and temperature and weight and balance data and speed bugs.
	Provides information about Airports, Intersections, VORs, NDBs, VRPs, User Waypoints. Also allows creation of User Waypoints.
	Provides information about the nearest Airports, Intersections, VORs, NDBs, VRPs, User Waypoints, Airspace, ARTCC facilities, Flight Service Stations, and Weather reporting stations.

'Map Selection' Screen



Touching the **Map** Button on the 'Map Selection' Screen displays the 'Navigation Map' Pane and the button name will change to **Map Settings**. Additionally, once touched, the **Map Settings** Button displays the 'Navigation Map Settings' Screen which is discussed in the Flight Management Section.

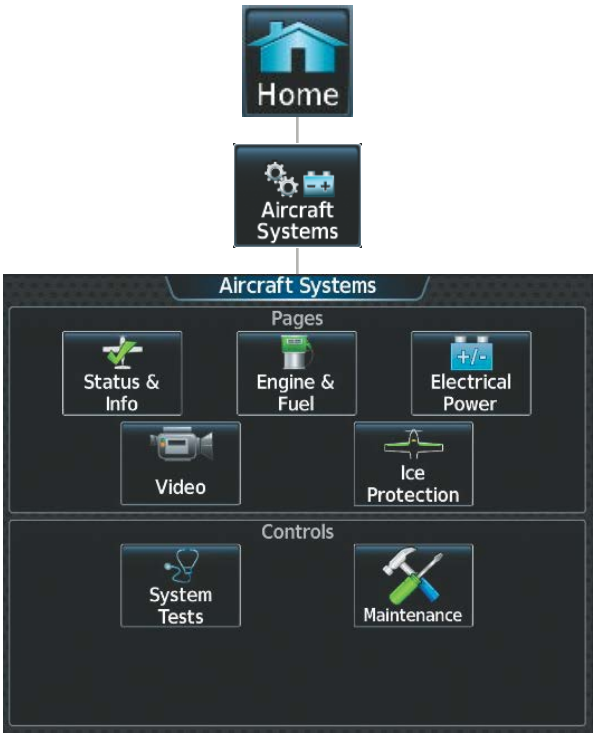
Touching the **VFR**, **IFR Low,** or **IFR High** Buttons will respectively display the 'VFR', 'IFR Low', or 'IFR High' Panes. After touching the **IFR Low** or **IFR High** Button, the button name will change to 'IFR Low Settings' or 'IFR High Settings' respectively. Touching either settings button again opens the 'IFR/VFR Charts Settings' Screen which is discussed in the Additional Features Section.

'Weather Selection' Screen



Touching a button within the 'Weather Selection' Screen (shown above) will display a respective 'SiriusXM Weather', 'Connext Weather', 'Stormscope' or 'FIS-B Weather' Pane. Additionally, once touched, the button name will change to a 'Settings' syntax. Touching any of these 'settings' buttons will open a settings screen discussed in the Hazard Avoidance Section.

'Aircraft Systems' Screen



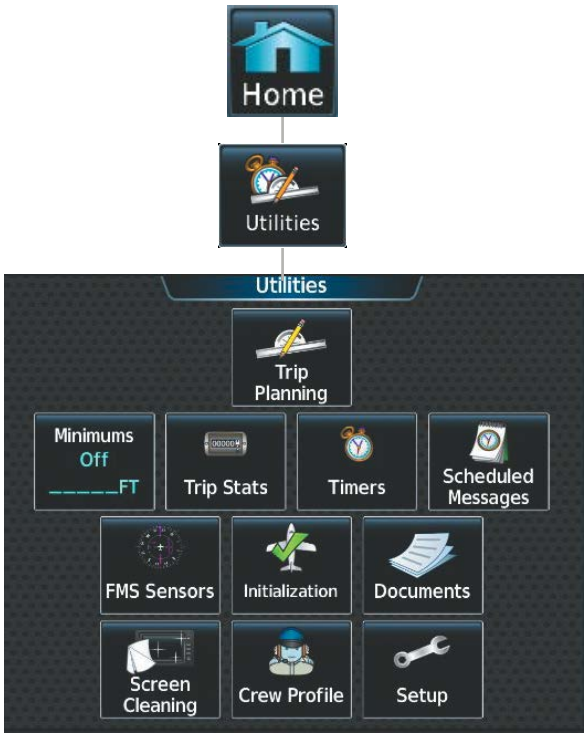
Status & Info	Shows the 'Status & Info' Pane, with synoptic information about the aircraft doors, brakes, oxygen and oil temperature. Also shows approximate values and parameters for certain performance calculations.
Engine & Fuel	Shows the 'Engine & Fuel' Pane, with information about fuel quantities, flow, valve, pump states and other engine information (e.g. CHT/EGT, MAP, and MAT). When the **Engine & Fuel** Button is touched, the **Lean Assist** Button will be displayed on the 'Aircraft Systems' Screen.
Electrical Power	Shows the 'Electrical Power' Pane, with information about the batteries, alternators, and electrical buses.
Video	Shows the 'Video' Pane in the selected Display Pane. Provides controls for adjusting EVS video on the display (brightness, contrast, saturation).
Ice Protection	Shows the 'Ice Protection' Pane, with synoptic information about the ice protection system, OAT, and pitot and AOA heat. When the **Ice Protection** Button is touched, the **IPS Left, IPS Auto,** and **IPS Right** buttons will be displayed on the 'Aircraft Systems' Screen.
System Tests	Displays the 'System Tests' Screen. This screen provides controls for testing the following systems: ADS-B and optional TAWS.
Maintenance	Provides functions accessible to maintenance personnel with password.

'Services' Screen



Music	The 'Music' Screen provides controls for the optional SiriusXM Satellite Radio including channel information, selection, and volume settings.
Position Reports	Accesses the optional 'Connext Position Reports' Screen. Provides controls for sending automatic or manual position reports.
Contacts	Accesses the optional 'Contacts' Screen for management of contact information including phone and email addresses. Also provides quick access to stored contacts using phone, SMS, or email.
Satellite Phone	The 'Satellite Phone' Screen (available with the Iridium voice telephone option) shows the status of the Iridium satellite telephone connection and provides telephone controls.
Networks & Pairing	Provides controls and settings for networks and for pairing of devices.
Satellite SMS Text	The 'Satellite SMS Text Messaging' Screen (available with the Iridium voice telephone option) provides management of incoming and outgoing SMS (short message service) text messages.
Bluetooth Phone	The 'Pilot Bluetooth Phone' Screen allows for adjustment of Bluetooth phone settings.
Connext Setup	Provides settings for automated database downloads, Personal Electronic Device (PED), Aircraft Report Intervals, Connext Registration (**REG** Tab), and time and dates for past and future automated database downloads (**Events** Tab).

'Utilities' Screen



Trip Planning	Shows the 'Trip Planning' Pane in the selected Display Pane, and accesses the 'Trip Planning' Screen on the Touchscreen Controller.
Minimums Off _____FT	Accesses the 'Minimums' Screen on the Touchscreen Controller. Provides controls for the Minimum Descent Altitude/Decision Height alerting function. Button displays the current minimums altitude and source if provided.
Trip Stats	Accesses the 'Trip Statistics' Screen on the Touchscreen Controller. Shows information regarding Flight Time, Departure/Arrival Time, Odometer, Trip Odometer, Trip Air Odometer, Fuel Used, Average Ground Speed, Maximum Ground Speed, Average Wind Speed, Average Wind Direction, Sunrise, and Sunset. Total Time and Flight Time are displayed in the 'Trip Statistics' Window. Also provides settings for resetting trip statistics.
Timer	Accesses the 'Timer' Screen on the Touchscreen Controller. Controls the timer on the PFD.
Scheduled Messages	Used to create custom messages to be displayed one-time or periodically. The Touchscreen Controller displays these System Messages on the 'Notifications' Screen.
FMS Sensors	Accesses the 'Sensors' Screen to change RNP, update the aircraft position, enable/disable sensors, and check sensor status and RAIM. Displays the 'GPS1…' or 'GPS2 Status' Pane.
Initialization	Displays the 'Initialization' Screen on the Touchscreen Controller. Provides controls for selecting the Crew Profile, checking Database Status, Safety Info, Initial Fuel, Weight and Balance, Flight Plan, and optional Takeoff Data.
Documents	Shows optional controls for viewing electronic documents on the Touchscreen Controller, and displays documents in the selected Display Pane.
Screen Cleaning	Feature temporarily disables touchscreen glass input to allow for manual cleaning. Turn or press any knob or softkey on the Touchscreen Controller to exit Screen Cleaning Mode.

	Displays 'Crew Profile' Screen, which provides controls for activating and managing crew profiles.
	Displays the 'Setup' Screen, which provides controls for avionics settings and status, SiriusXM Info, ADS-B Status and for displaying the status of avionics databases.

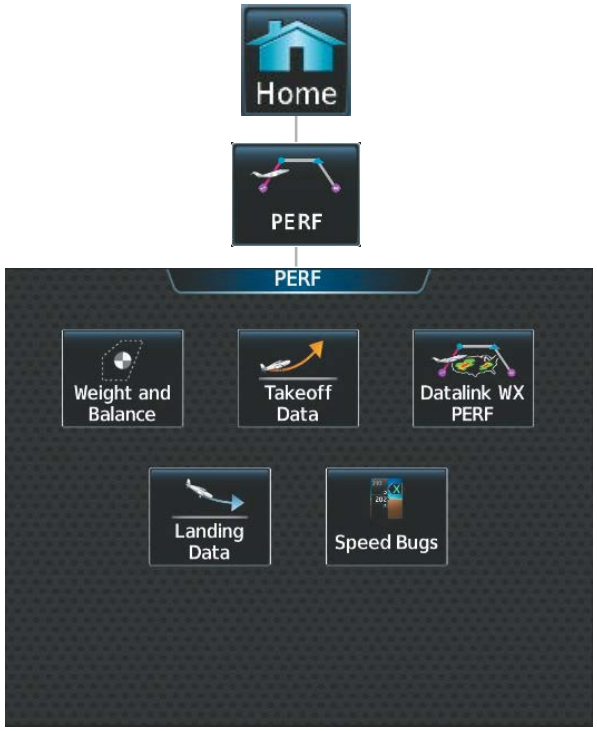
'SETUP' SCREEN



	Provides controls for changing system avionics settings, such as, time format, units of measure, airspace alert settings, and MFD Data Bar Fields.
	Displays information on the Touchscreen Controller for installed LRUs, system software, and databases.
	Shows the 'SiriusXM Information' Screen on the Touchscreen Controller. Used to activate audio and data services from SiriusXM Satellite Radio and to verify subscriptions of SiriusXM Weather products.
	Provides access to the 'Database Status' Screen for checking database cycle information.
	Provides access to the optional 'ADS-B' Status Screen for information on the reception of ADS-B services.

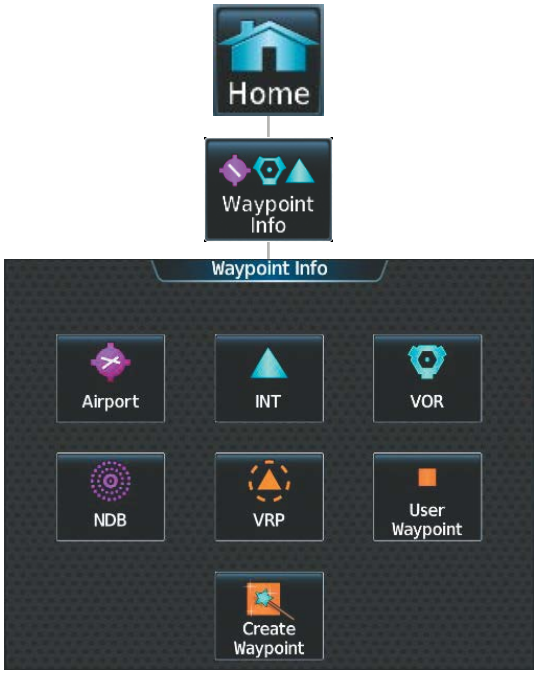
'PERF' Screen

NOTE: *SurfaceWatch option required for 'PERF' Screen to be shown.*



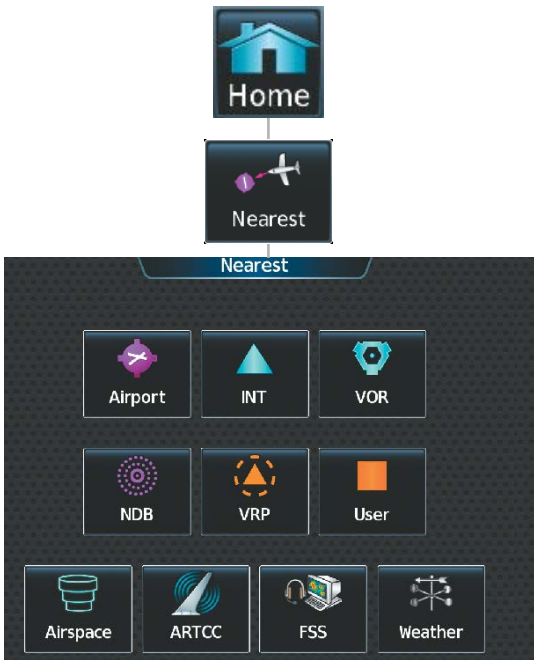
Aircraft takeoff, landing, and performance related functions, settings, and processes for the buttons within the 'PERF' Screen are discussed in the Flight Management Section.

'Waypoint Info' Screen



Functions, settings, and processes for the buttons within the 'Waypoint Info' Screen are discussed in the Flight Management Section.

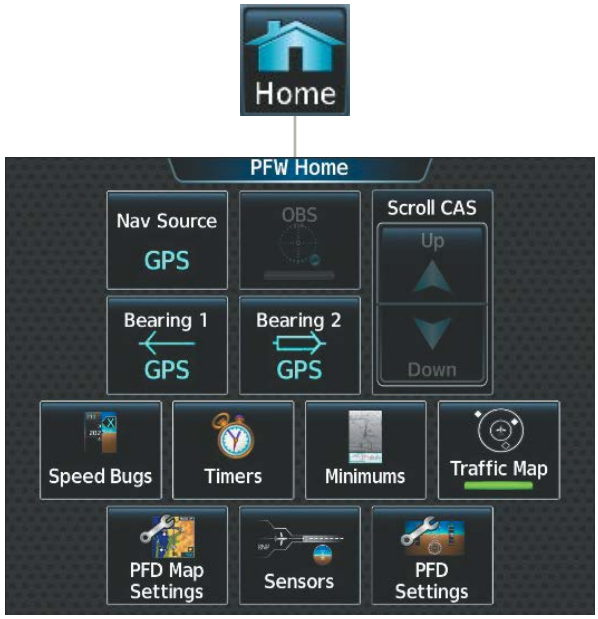
'Nearest' Screen



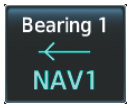
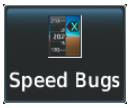
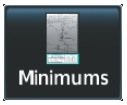
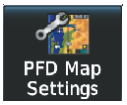
Functions, settings, and processes for the buttons within the 'Nearest' Screen are discussed in the Flight Management Section.

PFW MODE TOUCHSCREEN CONTROLLER SCREENS

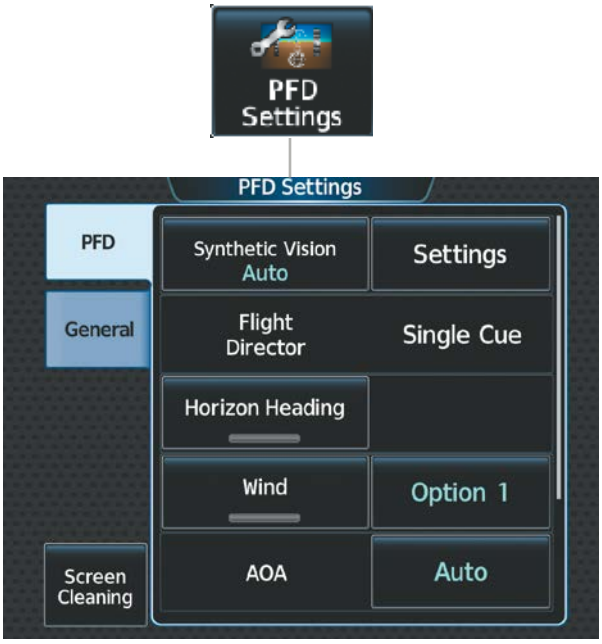
PFW Home



Nav Source GPS	Cycles through GPS, LOC1/VOR1 and LOC2/VOR2 navigation modes on the CDI

 or 	Selects OBS mode on the CDI when navigating by GPS (only available with active leg). When OBS is active the annunciator is green. Selects SUSP mode on the CDI when navigating by GPS. When SUSP is active the annunciator is green.
	Displays pop-up window with selection buttons for Bearing 1 Pointer selections Off, NAV1, NAV2, GPS, ADF, BEST GLIDE, and WPT.
	Displays pop-up window with selection buttons for Bearing 2 Pointer selections Off, NAV1, NAV2, GPS, ADF, BEST GLIDE, and WPT.
	CAS messages cannot be scrolled. These buttons will remain inactive.
	Accesses the 'Speed Bugs' Screen on Touchscreen Controller, where the speed bugs can be configured.
	Accesses the 'Timer' Screen on the Touchscreen Controller. Controls timer on PFD.
	Accesses the 'Minimums' Screen on the Touchscreen Controller. Set MDA or DH.
	Shows the Traffic Map on the PFD in inset format when the PFD is in Full Mode and turns the annunciator green. Shows the 'Traffic Map' Pane on the PFD when the PFD is in Split Mode, but the green/subdued annunciator is no longer displayed.
	Accesses the 'PFD Map Settings' Screen on the Touchscreen Controller. The Inset Map is not available when in split mode.
	Accesses the 'Sensors' Screen. Allows for manual selection of ADC and AHRS sensors, and access to RNP/EPE settings and Position Sensors settings.
	Accesses the 'PFD Settings' Screen to view or set PFD Mode, Flight Director Active Format, SVT, Flight Path Marker, AOA, Horizon Heading, Wind, Meters Overlay, Baro Select Units, Time Format, Time Offset, COM Channel Spacing, and Screen Cleaning function.

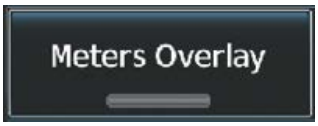
PFD Settings



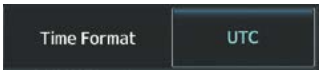
Screen Cleaning	Deactivates touch input on the Touchscreen Controller to facilitate cleaning. Press or turn a knob on the controller to resume touch input.

PFD Tab

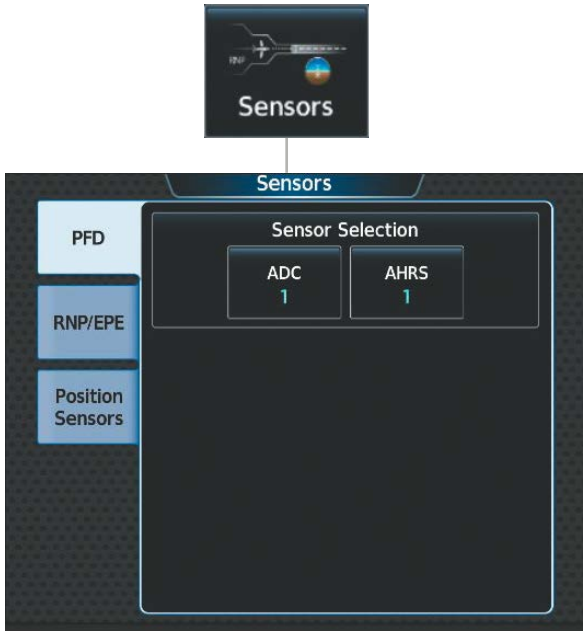
Synthetic Vision Auto / Settings	**Synthetic Vision** Button selects Synthetic Vision Mode on the PFD. • **Auto:** Selects SVT Auto Mode. • **Flight:** Selects SVT Flight Mode. • **Off**: SVT is off.
Flight Director / Single Cue	Shows the type of Flight Director available. Single Cue is the only available format.
Horizon Heading	Enables/disables display of compass heading along the Zero-Pitch line. When Enabled, the annunciator is green. Button is subdued when synthetic terrain is disabled.
Wind / Option 1	**Option 1:** Wind direction arrows with wind direction and speed. **Option 2:** Wind direction arrows with headwind and crosswind components.
AOA / Auto	Selects the display mode for the Angle of Attack (AOA) indicator on the PFD. • **Auto**: Automatically displays the Angle of Attack Indicator when the aircraft is in a landing configuration, or when normalized AOA is greater than 0.35. • **On**: Displays the Angle of Attack (AOA) Indicator on the PFD / PFW. • **Off**: Removes AOA Indicator from the PFD / PFW.

	Enables/disables the display of the meter overlay on the Altimeter.
	**Inches (IN):** Displays the BARO setting as inches of mercury. **Hectopascals (HPA):** Displays the BARO setting as hectopascals.

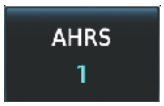
General Tab

	Selects the Time Format: **Local 12hr**, **Local 24hr**, or **UTC.**
	Displays the Local and UTC time offset.
	Selects the COM Channel Spacing: **25 kHz** or **8.33 kHz.**

PFD Sensors



PFD Tab

	Accesses the 'ADC Sensor' Screen where the #1 or #2 Air Data Computer (ADC) can be manually selected.
	Accesses the 'AHRS Sensor' Screen where the #1 or #2 AHRS sensors can be manually selected.
RNP/EPE Tab	Accesses button to change RNP Setting. Displays GPS current position. Refer to content later in this section for more information.
Position Sensors Tab	Accesses buttons to select SBAS and SBAS settings, select GPS1 and GPS2 sensors, check sensor status and RAIM. Displays the 'GPS1...' or 'GPS2 Status' Pane. Refer to content later in this section for more information.

CONTROLLING DISPLAY PANES

In normal operations, the pilot uses GTC1 to select and control Display Panes in MFD control mode. The system highlights the border of the selected display pane being controlled in cyan (purple in Reversionary Mode). The Label Bar indicates when the upper knobs may be used to select a Display Pane for control by displaying the word 'Pane' with three icons below it representing each possible pane location. The configuration of each display determines the number of Display Panes currently available for control (Full, Half, or Split Modes). A cyan (purple in Reversionary Mode) icon represents the selected Display Pane. A black icon represents a Display Pane available for selection, but is not currently selected. A subdued icon represents a Display Pane not currently shown, and therefore cannot be controlled. See the following figures for examples of touchscreen control of Display Panes in MFD Mode.

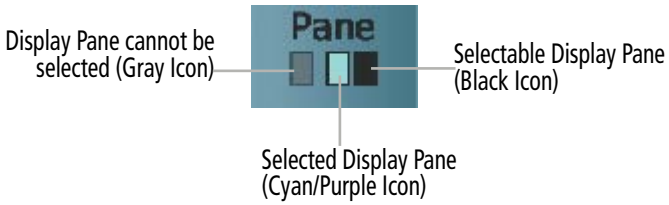


Figure 1-13 Touchscreen Controller Display Pane Control Icons

MFD FULL AND HALF MODES

The MFD provides the capability to show Display Panes in either Full Mode or Half Mode, provided the selected Display Pane is capable of being shown in a Full Mode format. The presence of either the **Full** or **Half** Mode Button on the Touchscreen Controller Button Bar indicates the availability of one of these modes for the selected Display Pane. Touch the **Full** Button to show the selected Display Pane in Full Mode. Touch the **Half** Button to return to Half Mode. In Full Mode, the MFD shows the EIS Display and a single, enlarged Display Pane. In Half Mode, the MFD shows the EIS Display and two Display Panes (mode selections do not affect the EIS Display formatting). When in Reversionary Mode, MFD Full and Half modes are unavailable, GTC 1 converts to the SFD (standby flight display) and GTC 2 controls the PFW / MFW split screen. See 'Reversionary Display Operation' in this section for more information.

When system power is applied on the ground, the MFD begins operation in Half Mode.

PFD FULL AND SPLIT MODES

The PFD shows a full PFD display in Full Mode, and a condensed PFD with a Display Pane in Split Mode. The Display Pane on the PFD in Split Mode is the same size as a Display Pane on the MFD in Half Mode. A **Full** or **Split** Button in the Button Bar indicates which display mode is available for the PFD. Additionally, a **PFD Mode** Button is available on the 'PFD Settings' Screen, which can be used to select Full or Split Mode on the PFD. Display panes can only be chosen from the 'MFW Home' Screen on the GTC 1.

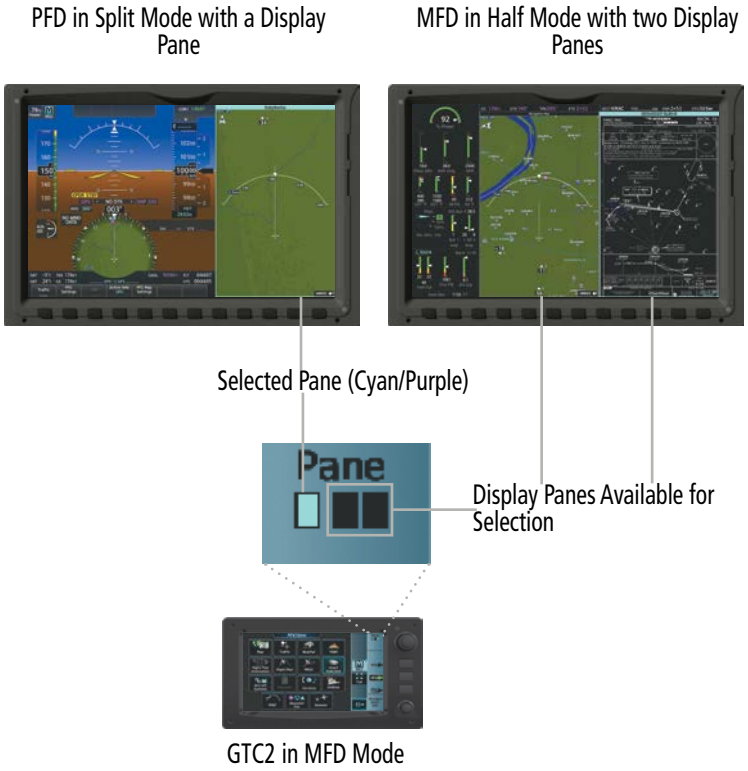


Figure 1-14 GTC2 Display Pane Control from the MFD Home Screen (PFD Split Mode active)

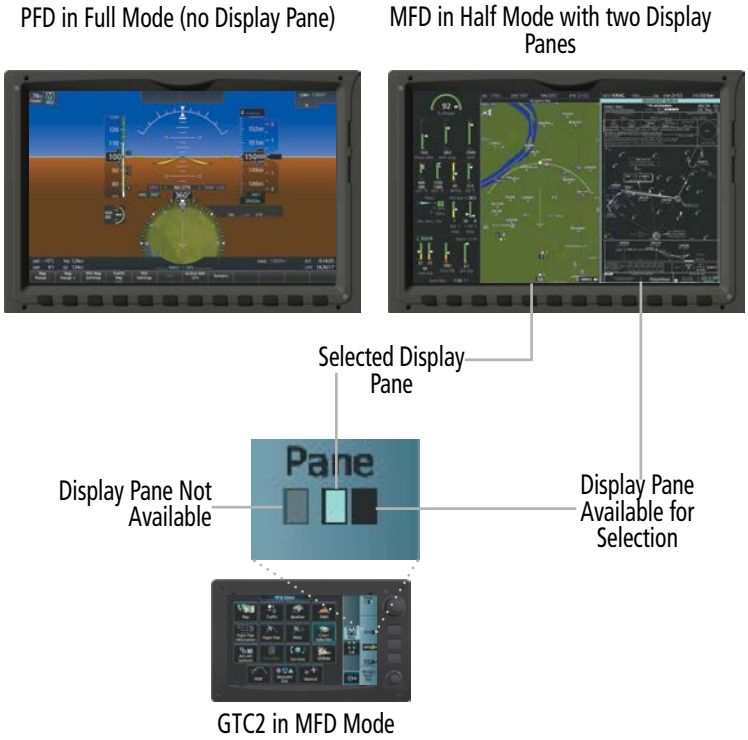


Figure 1-15 GTC2 Display Pane Control from the MFD Home Screen (MFD Half Mode active)

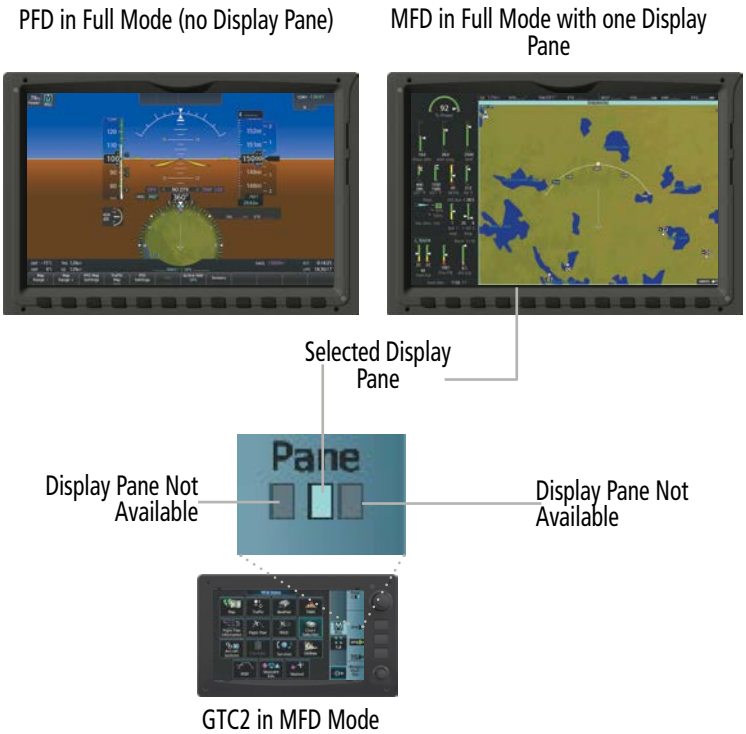


Figure 1-16 GTC2 Display Pane Control from the MFD Home Screen (MFD Full Mode active)

DATA ENTRY

Two methods exist for directly entering alphanumeric data (e.g., waypoint identifiers, barometric minimum descent altitude) into the system: using the Touchscreen Controller alphanumeric keypad, or the large and small upper knob on the Touchscreen Controller. In some instances, such as when entering an identifier, the system anticipates the desired identifier based on the characters being entered. In this case, if the desired identifier appears, use the **Enter** Button to confirm the entry without entering the rest of the identifier manually. This can save the pilot from entering all the characters of the identifier.

Besides character-by-character data entry, the system also provides a shortcut for entering waypoint identifiers. When the cursor is on a field awaiting entry of a waypoint identifier, touching the **Find** Button accesses four different lists of waypoint identifiers for quick selection: Recent, Nearest, Flight Plan (if active flight plan waypoints are available), and a Favorite waypoints list. In addition, the system provides the ability to search by Facility Name or by City. The system automatically completes the identifier, facility, and city fields with the information for the selected waypoint.

Using the Touchscreen Controller keyboard to enter alphanumeric data:

1) Select a Datafield Button on the Touchscreen Controller for which data entry is required (i.e. waypoint, radio frequency, etc.). A keypad will appear, and the Datafield Button will be highlighted in cyan.
2) Touch the desired letters or numbers, one at a time.
3) If an alphabetic keypad is displayed and numbers are desired, touch the **123...** Button.
4) If the numeric keypad is displayed and letters are desired, touch the **ABC...** Button.
5) To accept the entry, touch the **Enter** Button. Otherwise, touch the **Back, Cancel,** or **Home** Button (on the Button Bar) to exit the datafield without saving the entry.



Figure 1-17 Entering Text on the Keypad

Using the Touchscreen Controller large and small upper knobs to enter data:

1) Select a datafield button on the Touchscreen Controller for which data entry is required (i.e. waypoint, radio frequency, etc.). A keypad will appear, and the data field will be highlighted in cyan.
2) Begin entering data by turning the small upper knob to select a character for the first placeholder.

   Turning the knob to the right scrolls through the alphabet (where appropriate) toward the letter Z, starting in the middle at K, and the digits zero through nine. Turning the knob to the left scrolls in the opposite direction.
3) Turn the large upper knob to move the cursor to the next placeholder in the field.
4) Repeat, using the small upper knob to select a character and the large upper knob to move the cursor, until the field is complete.
5) Push the upper knob or touch the **Enter** Button to confirm entry. Otherwise, touch the **Back** or **Home** Button to exit the field without saving the entry.

SOFTKEY FUNCTION

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

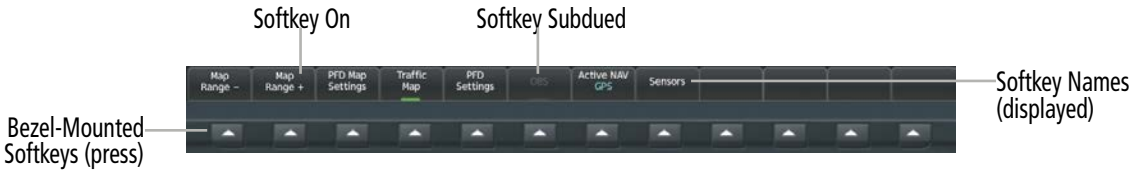


Figure 1-18 Softkeys (First-Level PFD Configuration)

PFD SOFTKEYS

The PFD softkeys provide control over the PFW 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.

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 **PFD Map Settings** 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 Range -				Decreases the PFD Map display range.
Map Range +				Increases the PFD Map display range.
PFD Map Settings				Displays the PFD Map display settings softkeys.
	Map Layout			Displays softkeys used to select map layouts.
		Map Off		Removes the PFD Map from the display.
		Inset Map		Displays the Inset Map.
		HSI Map		Displays the HSI Map.
		Inset Traffic		Overlays a dedicated traffic display on the Inset Map.
		HSI Traffic		Overlays a dedicated traffic display on the HSI.
	Detail			Selects desired amount of map detail; cycles through declutter levels (only available if HSI Map is enabled): **All** (no declutter): All map features visible. **DCLTR 1**: Declutters land data. **DCLTR 2**: Declutters land and SUA data. **Least**: Removes everything except for the active flight plan.

Level 1	Level 2	Level 3	Level 4	Description
	Weather Legend			Displays or removes the name of the selected data link weather provider (SiriusXM, Connext, FIS-B) and the weather product icon and age box (for enabled weather products).
	Traffic			Adds or removes the display of traffic on the PFD Map. The softkey annunciator is green when the traffic function is on. When the traffic function is off, the annunciator is gray.
	Storm-scope			Adds or removes the display of Stormscope information on the PFD Map (optional). The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray.
	Terrain Settings			Selects the display of terrain information softkeys on the PFD Map:
		Off		Removes terrain information from the PFD Map.
		Absolute		Displays absolute terrain information.
		Relative		Displays relative terrain information.
		Absolute + Relative		Displays absolute and relative terrain information on the HSI Map.
	Data Link Settings			Displays data link settings softkeys based on current installation and configuration options.
		Data Link		Selects the data link source for weather data displayed on the PFD Map (optional): **Connext**: Selects Garmin Connext as the weather source. **SiriusXM**: Selects SiriusXM as the weather source. **FIS-B**: Selects FIS-B as the weather source.
		NEXRAD		Selects type of NEXRAD coverage when FIS-B is the selected data link source: **CONUS**: Selects coverage for continental U.S. **Regional**: Selects coverage for a region, which provides a higher resolution. **Combined**: Combines CONUS and regional coverages. Or: Selects type of NEXRAD coverage when SiriusXM is the selected data link source: **COMP**: Displays composite reflectivity image. **Base**: Displays base reflectivity image.

Level 1	Level 2	Level 3	Level 4	Description
		Storm Cell Movement		Adds or removes the display of storm cell movement information on the PFD Map (only available when SiriusXM is selected as the data link weather source). The softkey annunciator is green when the function is on. When the function is off, the annunciator is subdued.
		NEXRAD Animation		Adds or removes the display of NEXRAD animation on the Inset Map (only available when SiriusXM is selected as the data link weather source). NEXRAD animation is not available for display on the HSI Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is subdued.
	WX Overlay			Selects the display of weather information on the PFD Map based on the installation and configuration options. **SiriusXM**: Selects SiriusXM as the weather source for the display of weather data when SiriusXM is selected as the weather source using the **Data Link** Softkey. **Connext**: Selects Connext as the weather source for the display of weather data when Connext is selected as the weather source using the **Data Link** Softkey. **FIS-B**: Selects FIS-B as the weather source for the display of weather data when FIS-B is selected as the weather source using the **Data Link** Softkey. **Off**: Removes weather data from the Inset or HSI Map.
	Datalink Lightning			Softkey is available when SiriusXM or Connext is selected as the weather source using the **Data Link** Softkey. Adds/removes the display of SiriusXM or Connext information on the PFD Map. The softkey annunciator is green when the lightning function is on. When the lightning function is off, the annunciator is gray.
	METAR			Adds or removes the display of SiriusXM, Connext, or FIS-B sourced METAR data on the PFD Map. The softkey annunciator is green when the METAR data is enabled. When the METAR data is off, the annunciator is gray.
Traffic Map				Replaces the PFD Map with a dedicated traffic display. The softkey annunciator is green when the dedicated traffic display is on. When the PFD Map is on, the softkey annunciator is gray.
PFD Settings				Displays the PFD settings softkeys.
	SVT Mode			Displays the Synthetic Vision Technology (SVT) settings softkeys.
		Auto		Selects SVT Auto Mode. The softkey annunciator is green when the function is on.
		Flight		Selects SVT Flight Mode. The softkey annunciator is green when the function is on.

Level 1	Level 2	Level 3	Level 4	Description
		Off		SVT mode off. The softkey annunciator is green when the function is off.
	SVT Settings			Displays SVT Settings softkeys.
		Pathways		Displays Pathway boxes on the synthetic vision display.
		Runway Locator		Displays cyan chevrons and cyan mile markers which extend 10 nm from the programmed runway.
		Airport Signs		Displays position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are included when the airport is within approximately 9 nm.
		Wire		Displays power lines on the synthetic vision display.
	Attitude Instruments			Displays the softkeys for enabling or disabling Synthetic Vision Technology (SVT) features.
		Horizon Heading		Displays compass heading along the Zero-Pitch Line.
	PFD Mode			Enables or disables a Display Pane to the right or left (depending on pilot-side or copilot-side) on the PFD / PFW: **FULL**: Display Pane is disabled. The PFD / PFW display occupies the full screen. **Split**: Display Pane is enabled. The PFD / PFW screen is split between the PFD / PFW display and the Display Pane.
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS, ADF1, and Off.
	Bearing 2			Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS, ADF1, and Off.
	Other PFD Settings			Displays additional PFD / PFW settings softkeys.
		Wind		Displays the wind option softkeys.
			→DEG KT	Total wind direction arrow with digital numeric direction and speed.
			↑→KT	Headwind/tailwind and crosswind arrows with numeric speed components.
			Off	Wind information not displayed.
		AOA		Selects the display mode for the Angle of Attack (AOA) Indicator on the PFD / PFW: **Auto:** Selects AOA 'Auto' mode. (See Flight Instruments section) **On**: Displays AOA Indicator on the PFD / PFW. **Off**: Removes AOA Indicator from the PFD / PFW.

Level 1	Level 2	Level 3	Level 4	Description
		Altitude Units		Displays softkeys to select altitude unit parameters.
			Meters	Displays altimeter meters overlay.
			IN	Displays the BARO setting as inches of mercury.
			HPA	Displays the BARO setting as hectopascals.
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. 'SUSP' will replace 'OBS' when waypoint sequencing is suspended.
Active NAV				Cycles through GPS, NAV1, and NAV2 navigation modes on the CDI.
Sensors				Displays the sensor selection softkeys.
	ADC Settings			Displays the ADC selection softkeys.
		ADC 1		Selects the number 1 ADC. The softkey annunciator is green when selected.
		ADC 2		Selects the number 2 ADC. The softkey annunciator is green when selected.
	AHRS Settings			Displays the AHRS selection softkeys.
		AHRS 1		Selects the number 1 AHRS. The softkey annunciator is green when selected.
		AHRS 2		Selects the number 2 AHRS. The softkey annunciator is green when selected.

Table 1-1 PFD / PFW Softkeys – Full Mode

When Split Mode is enabled on the PFD / PFW, an MFD / MFW Display Pane will be shown on the PFD / PFW, replacing five softkeys. The following table lists PFD / PFW softkey functions when operating the PFD / PFW in Split Mode.

Level 1	Level 2	Level 3	Level 4	Level 5	Description
Traffic					Displays the Traffic Map on the Display Pane on the PFD / PFW.
PFD Settings					Displays the PFD / PFW settings softkeys.
	Attitude Settings				Displays the softkeys for enabling or disabling Synthetic Vision Technology (SVT) features.
		SVT Mode			Displays buttons for SVT mode.
			Auto		Selects SVT Auto Mode (Auto Mode is identical to Flight Mode). The softkey annunciator is green when the function is on.
			Flight		Selects SVT Flight Mode. The softkey annunciator is green when the function is on.
			Off		SVT mode off. The softkey annunciator is green when the function is off.
		SVT Settings			Displays additional SVT overlay softkeys (optional).

Level 1	Level 2	Level 3	Level 4	Level 5	Description
			Pathways		Displays Pathway boxes on the synthetic vision display.
			Wire		Displays power lines on the synthetic vision display.
		SVT Airports			Displays Airport Signs softkey
			Runway Locator		Displays cyan chevrons and cyan mile markers which extend 10 nm from the programmed runway.
			Airport Signs		Displays position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are included when the airport is within approximately 9 nm.
		Altitude Instruments			Displays the softkeys for enabling or disabling Synthetic Vision Technology (SVT) features.
			Horizon Heading		Displays Pathway boxes on the SVT display.
	PFD Mode				Enables or disables a Display Pane to the right or left (depending on pilot-side or copilot-side) on the PFD / PFW: **FULL**: Display Pane is disabled. The PFD / PFW display occupies the full screen. **Split**: Display Pane is enabled. The PFD / PFW screen is split between the PFD / PFW display and the Display Pane.
	Bearing 1				Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS, ADF1, and Off.
	Bearing 2				Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS, ADF1, and Off.
	Other PFD Settings				Displays additional PFD / PFW settings softkeys.
		Wind			Displays the wind option softkeys.
			→DEG KT		Total wind direction arrow with digital numeric direction and speed.
			↑→KT		Headwind/tailwind and crosswind arrows with numeric speed components.
			Off		Wind information not displayed.
		AOA			Selects the display mode for the Angle of Attack (AOA) Indicator on the PFD / PFW: **Auto:** Selects AOA 'Auto' mode. (See Flight Instruments section) **On**: Displays AOA Indicator on the PFD / PFW. **Off**: Removes AOA Indicator from the PFD / PFW.
		Altitude Units			Displays softkeys to select altitude unit parameters.
			Meters		Displays altimeter overlay in meters.

Level 1	Level 2	Level 3	Level 4	Level 5	Description
			IN		Displays the BARO setting as inches of mercury.
			HPA		Displays the BARO setting as hectopascals.
		Sensors			Displays the sensor selection softkeys.
			ADC Settings		Displays the ADC selection softkeys.
				ADC 1	Selects the number 1 ADC. The softkey annunciator is green when selected.
				ADC 2	Selects the number 2 ADC. The softkey annunciator is green when selected.
			AHRS Settings		Displays the AHRS selection softkeys.
				AHRS 1	Selects the number 1 AHRS. The softkey annunciator is green when selected.
				AHRS 2	Selects the number 2 AHRS. The softkey annunciator is green when 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. 'SUSP' will replace 'OBS' when waypoint sequencing is suspended.
Active NAV					Cycles through GPS, NAV1, and NAV2 navigation modes on the CDI.
PFD Map Settings					Displays HSI Map settings softkeys (the Inset Map is not available when PFD / PFW is in Split Mode).
	HSI Map Layout				Displays softkeys used to select HSI Map layouts.
		Map Off			Removes the PFD Map from the display.
		HSI Map			Displays the HSI Map.
		HSI Traffic			Overlays a dedicated traffic display on the HSI.
	Map Range -				Decreases the HSI Map display range (only available if HSI Map is enabled).
	Map Range +				Increases the HSI Map display range (only available if HSI Map is enabled).
	Map Overlays				Displays HSI Map overlay softkeys (only available if HSI Map is enabled).
		Terrain Settings			Selects the display of terrain information on the HSI Map:
			Off		Removes terrain information from the PFD Map.
			Absolute		Displays absolute terrain information.
			Relative		Displays relative terrain information.
			Absolute + Relative		Displays absolute and relative terrain information on the HSI Map.

Level 1	Level 2	Level 3	Level 4	Level 5	Description
		Data Link Settings			Displays Datalink softkeys.
			Data Link		Selects the data link source for weather data displayed on the PFD Map (optional): **Connext**: Selects Garmin Connext as the weather source. **SiriusXM**: Selects SiriusXM as the weather source. **FIS-B**: Selects FIS-B as the weather source.
			NEXRAD		Selects type of NEXRAD coverage when FIS-B is the selected data link source: **CONUS**: Selects coverage for continental U.S. **Regional**: Selects coverage for a region, which provides a higher resolution. **Combined**: Combines CONUS and regional coverages. Or: Selects type of NEXRAD coverage when SiriusXM is the selected data link source: **COMP**: Displays composite reflectivity image. **Base**: Displays base reflectivity image.
			Storm Cell Movement		Adds or removes the display of storm cell movement information on the PFD Map (only available when SiriusXM is selected as the data link weather source). The softkey annunciator is green when the function is on. When the function is off, the annunciator is subdued.
		WX Overlay			Selects the display of weather information on the PFD Map: **SiriusXM**: Selects SiriusXM as the weather source for the display of weather data when SiriusXM is selected as the weather source using the **Data Link** Softkey. **Connext**: Selects Connext as the weather source for the display of weather data when Connext is selected as the weather source using the **Data Link** Softkey. **FIS-B**: Selects FIS-B as the weather source for the display of weather data when FIS-B is selected as the weather source using the **Data Link** Softkey. **Off**: Removes weather data from the Inset or HSI Map.

Level 1	Level 2	Level 3	Level 4	Level 5	Description
		Datalink Lighting			Softkey is available when SiriusXM or Connext is selected as the weather source using the **Data Link** Softkey. Adds/removes the display of SiriusXM or Connext information on the PFD Map. The softkey annunciator is green when the lightning function is on. When the lightning function is off, the annunciator is gray.
		More			Displays more map overlay softkeys.
			METAR		Adds or removes the display of SiriusXM, FIS-B, or Connext METAR data (based on data link weather source selection) on the HSI Map. The softkey annunciator is green when the METAR data is on. When the METAR data is off, the annunciator is subdued.
			Detail		Selects desired amount of map detail; cycles through declutter levels: **All** (no declutter): All map features visible. **DCLTR 1**: Declutters land data. **DCLTR 2**: Declutters land and SUA data. **Least**: Removes everything except for the active flight plan.
			Weather Legend		Adds or removes the name of the selected data link weather provider (SiriusXM, FIS-B, Connext) and the weather product icon and age box (for enabled weather products).
			Traffic		Adds or removes the display of traffic on the HSI Map. The softkey annunciator is green when the traffic function is on. When the traffic function is off, the annunciator is subdued.
			Storm-scope		Adds or removes the display of Stormscope information on the HSI Map (optional). The softkey annunciator is green when the function is on. When the function is off, the annunciator is subdued.

Table 1-2 PFD / PFW Softkeys - Split Mode

SECURE DIGITAL CARDS

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

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

The PFD and 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 for various databases, checklists, system software updates, recording flight data, and storing electronic documents.

Not all SD cards are compatible with the system. Use only SD cards supplied by Garmin or the aircraft manufacturer.

Insert an SD card

Insert the SD card in the SD card slot by pushing the card in until the spring latch engages. The front of the card should remain flush with the face of the display bezel.

Remove an SD card

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

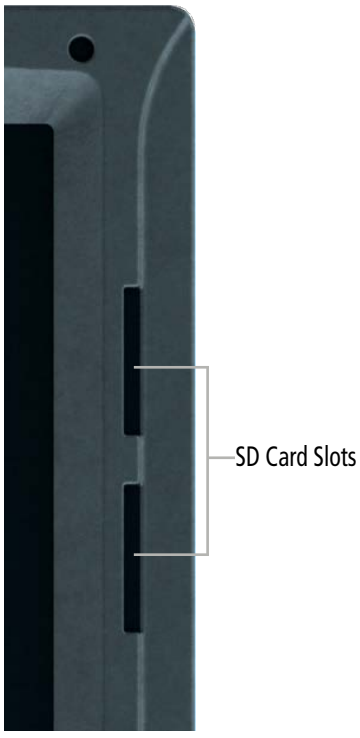


Figure 1-19 Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

The displays are connected with a single Ethernet bus for high-speed communication. As shown in Figure 1-1, each IAU is connected to a single display. This allows the units to share information, enabling true system integration.

SYSTEM INITIAL POWER APPLICATION

NOTE: *See the current version of the pertinent flight manual for specific procedures concerning avionics power application and emergency power supply operation.*

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

Upon initial power application, annunciator lights on the AFCS Controller illuminate momentarily.

On the PFD, the AHRS initializes and displays "AHRS ALIGN: Keep Wings Level". The AHRS will typically display valid attitude and altitude within the first minute of power application. When configured to be in Split Mode, the 'Checklist' Pane appears on the right portion of the PFD.

When the MFD receives power, it shows the Engine Indication System (EIS) display, the 'Navigation Map' Pane and 'Aircraft Status' Pane. The 'Navigation Map' Pane initially shows a "NO GPS POSITION" banner annunciation. When the system has acquired a sufficient number of satellites, the current aircraft position appears on any displayed navigation maps.

GTC1 displays the 'PFW Home' Screen. GTC2 displays the 'Initialization' Screen.

NORMAL OPERATION

PFD AND MFD

In normal operations, the PFD presents primary, graphical flight instrumentation (such as heading, airspeed, altitude, vertical speed) in either Full Mode or Split Mode. In Full Mode, the PFD information occupies the entire display. In Split Mode, the PFD is condensed to accommodate a Display Pane on the right-side portion of the PFD.

PFD in Split Mode with a Display Pane



MFD Operating in Half Mode with Two Display Panes



Figure 1-20 PFD and MFD in Normal Operations (Split and Half Modes shown)

The MFD shows Engine Indications on the left portion of the display. It also shows either a single Display Pane in Full Mode, or two Display Panes side-by-side in Half Mode.

TOUCHSCREEN CONTROLLERS

In normal operation, both Touchscreen Controllers can control the PFW and NAV/COM functions, while only the left Touchscreen Controller (GTC1) can control the active MFW. When the MFW is selected, turning either upper knob clockwise moves the cyan pane selection highlight to the right, and turning either upper knob counter-clockwise moves the cyan pane selection highlight to the left. Refer to the Controlling Display Panes discussion for more information.

REVERSIONARY DISPLAY OPERATION

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

If either the PFD or MFD fails or is off-line, the system automatically shows a display Reversionary Mode. This mode combines a PFW display, an EIS display, and a Display Pane on the operating display in a condensed format. If the system is unable to detect a failed PFD or MFD, the pilot can manually activate display Reversionary Mode by pressing the red **DISPLAY BACKUP** Button mounted between the PFD and MFD.

PFD Failed



MFD Operating in Reversionary Mode



GTC1 in Standby Flight Display Mode



GTC2



Figure 1-21 Reversionary Mode with Failed PFD

If the PFD fails or is off-line, GTC1 shows the Standby Flight Display, using attitude and air data from the standby sensors. The Standby Flight Display includes an Airspeed Indicator, Attitude Indicator, Altimeter and Altimeter Setting. Softkeys and knobs on GTC1 control the Standby Flight Display; refer to the Flight Instruments Section for more information about these controls. GTC2 provides the PFW or MFW Screens, and NAV/Com control modes on the MFD operating in Reversionary Mode. Other conditions besides a PFD failure may cause the Standby Flight Display to appear; refer to the AHRS Operation discussion for more information on these conditions.

If the MFD fails or is off-line, GTC1 continues to operate as a Touchscreen Controller (i.e., no Standby Flight Display), and allows the selection of PFD Mode or NAV/Com Mode.

If both the PFD and MFD fail, GTC1 shows the Standby Flight Display. Since the PFD and MFD are not available to control, the 'PFW Home' Screen and 'MFW Home' Screen on any remaining Touchscreen Controller displays a large amber 'X' on the controller when PFD or MFD control mode is selected.

TOUCHSCREEN CONTROLLER FAILURE

If GTC2 fails or is off-line, GTC1 continue to provide the same control modes as were previously available (PFW, MFW, NAV/COM). The Standby Flight Display is not available if GTC1 encounters a complete failure (for example, if GTC1 is not receiving any power.)

If both Touchscreen Controllers fail or are off-line, the PFD and MFD continue to operate in Normal Mode, however, controls for the PFW, MFW, and NAV/COM tuning will be unavailable. Refer to the Audio and CNS Section for more information on NAV/COM failure modes.

ADAHRS OPERATION

In addition to using internal sensors, the GSU 75 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. If either of these external measurements is unavailable or invalid, the ADAHRS uses air data information for attitude determination. Eight ADAHRS modes of operation are available (see following table) and depend upon the combination of available sensor inputs. Loss of air data, GPS, or magnetometer sensor inputs is communicated to the pilot by system messages.

NOTE: *Aggressive maneuvering in reversionary mode can degrade ADAHRS accuracy.*

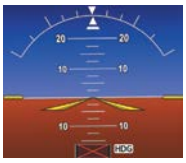
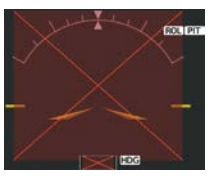
ADAHRS Mode	GPS Data Available	Mag Data Available	Air Data Available	Condition	Attitude Indicator
ADAHRS Normal	Yes	Yes	Yes	Valid Pitch/Roll/Heading.	
ADAHRS no-Air Data	Yes	Yes	No		
ADAHRS no-GPS	No	Yes	Yes		
ADAHRS no-GPS/no-Mag	No	No	Yes	Valid Pitch/Roll. Heading will coast-on-gyros until it becomes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

Table 1-3 ADAHRS Operation

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

STANDBY FLIGHT DISPLAY

The Standby Flight Display (SFD) appears on GTC1 due to certain failure conditions (e.g. loss of all primary AHRS, loss of all primary ADCs, loss of PFD). Additionally, the SFD also appears if all valid sensors miscompare.



Figure 1-22 GTC1 with Standby Flight Display

The SFD shows the airspeed, altitude and attitude of the aircraft. Standby ADAHRS (data is fed to the Standby Flight Display from a non-Garmin standby ADAHRS sensor on the aircraft. GTC1 may not be returned to normal Touchscreen Controller operation until the condition(s) that caused the Standby Flight Display to originally appear are resolved. Once the condition(s) are resolved, GTC1 may be returned to normal operation by twice pressing the red Display Backup Button mounted between the PFD and MFD.

Softkeys and knobs on the GTC1 control the Standby Flight Display; refer to the Flight Instruments Section for information about controlling the Standby Flight Display.

GPS RECEIVER OPERATION

Each Integrated Avionics Unit (IAU) contains a GPS receiver. Information collected by the specified receiver (GPS1 for the left/pilot side or GPS2 for the right/copilot side) may be viewed on the 'GPS1 or GPS2 Status' Pane and the 'GPS Status' Screen on the Touchscreen Controller.

Internal system checking is performed to ensure both GPS receivers are providing accurate data to the system. In some circumstances, both GPS receivers may be providing accurate data, but one receiver may be providing a more accurate solution than the other. In this case, the GPS receiver producing the more accurate solution is automatically coupled to the PFD. If one GPS receiver is not providing accurate data to the system, the annunciation 'BOTH ON GPS 1' or 'BOTH ON GPS 2' will appear, notifying the pilot that the GPS information being displayed is from one of the two GPS receivers. These GPS sensor annunciations are most often seen after system power-on when one GPS receiver has acquired satellites before the other, or one of the GPS receivers has not yet acquired 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 by touching the **MSG** Button on the Touchscreen Controller. If no failure message exists, check the 'GPS Status' Screen and compare the information for GPS1 and GPS2. Discrepancies may indicate a problem.

GTC1



MFW

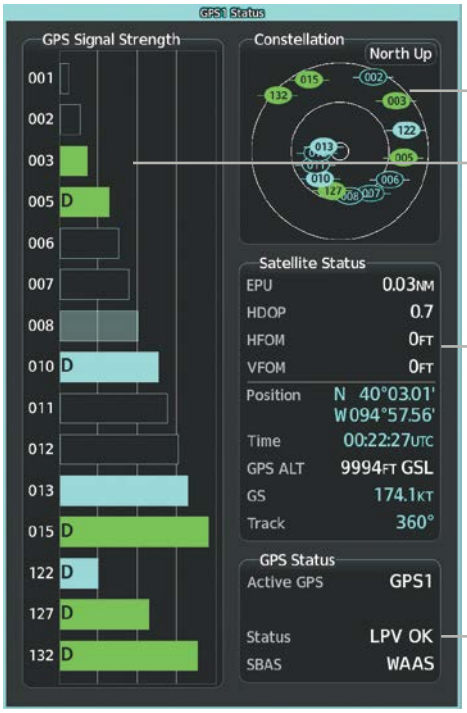


Figure 1-23 GPS Receiver Information

Displaying information for a GPS receiver:

1) From MFW Home, touch **Utilities > FMS Sensors**.

   Or:

   From PFW Home, touch **Sensors**.

2) Touch the **Position Sensors** Tab.

3) Touch the **GPS1** or **GPS2** Button to select the #1 or #2 GPS receiver respectively. The button annunciator is green when enabled and gray when disabled.

4) Touch the **GPS1** or **GPS2 Status** Button to select the #1 or #2 GPS receiver respectively. The system displays the GPS2 Status Pane for the GPS receiver selected.



Figure 1-24 GPS Position Sensor Settings

SATELLITE CONSTELLATION DIAGRAM

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

Each satellite is represented by an oval containing the satellite identification number. Satellites whose signals are currently being used are represented by solid ovals.

SATELLITE SIGNAL STATUS

The accuracy of the aircraft 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 99.9% 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 Wi0.0 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 status type (ENR OK, TERM OK, LNAV OK, LPV OK) for the active GPS receiver (GPS 1 or GPS 2) is shown in the lower right of the GPS 1 and GPS 2 Status Pane. 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 ascertain the satellites that should be in view. 'ACQUIRING' is indicated as the status until a sufficient number of satellites have been acquired for computing a solution.

When the receiver is in the process of acquiring a 3D navigational GPS solution, 3D NAV is indicated as the status until the 3D differential fix has finished acquisition. SBAS (Satellite-Based Augmentation System) indicates 'INACTIVE'. When acquisition is complete, the status indicates 'LPV OK' and SBAS indicates 'ACTIVE'. If SBAS providers are disabled, SBAS status will read 'DISABLED'.

GPS SATELLITE SIGNAL STRENGTHS

The GPS 1 and GPS 2 Status Panes 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).

SBAS SELECTION

In certain situations, such as when the aircraft is outside or on the fringe of the EGNOS, MSAS, WAAS, or GAGAN coverage area, it may be desirable to disable the reception of the applicable SBAS signal (although it is not recommended). When enabled, the annunciator on the applicable button shows green.

Enabling/disabling individual SBAS providers:

1) From MFW Home, touch **Utilities > FMS Sensors**.

   Or:

   From PFW Home, touch **Sensors**.

2) Touch the **Position Sensors** Tab.
3) Touch the SBAS **Settings** Button.
4) Touch the **EGNOS**, **MSAS**, **WAAS**, or **GAGAN** (any combination) Annunciator Button(s) to enable or disable. A green annunciation indicates an enabled SBAS selection, disabled selections are gray.

RAIM (RECEIVER AUTONOMOUS INTEGRITY MONITORING) 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.

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

Receiver Autonomous Integrity Monitoring (RAIM) is a GPS receiver function that performs a consistency check on all tracked satellites. RAIM ensures the available satellite geometry allows the receiver to calculate a position within a specified RAIM protection limit (2.0 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.

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

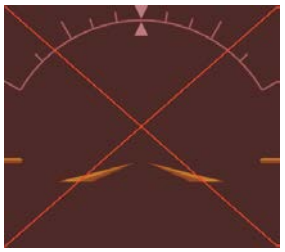
Predicting RAIM availability:

1) From MFW Home, touch **Utilities > FMS Sensors**.
2) Touch the **Position Sensors** Tab.
3) Touch the **GPS1** or **GPS2** Button and select the **GPS1 Status** or **GPS2 Status** Button. The button annunciator is green when enabled and gray when disabled.
4) Touch the **RAIM Prediction** Tab.
5) Touch the **Location** Button.
6) Touch the **Waypoint** Button to enter the location for which RAIM will be predicted. Touch the **Present Position** Button to enter the aircraft current position as the prediction location.
7) If the **Waypoint** Button was touched in step 6, enter the waypoint identifier using the alphanumeric buttons or the large and small upper knobs. If the **Present Position** Button was touched in step 6, proceed to step 9.
8) Touch the **Enter** Button. The location selected for RAIM prediction is now displayed on the **Location** Button.
9) Touch the **Arrival Time** Button.
10) Enter the planned arrival time for the selected location using the numeric buttons.
11) Touch the **Enter** Button. The time is now displayed on the **Arrival Time** Button.
12) Touch the **Arrival Date** Button.
13) Touch the button for the desired year. If necessary, touch and drag in the window, or use the **Up** and **Down** buttons to display the desired year.
14) Touch the button for the desired month. If necessary, touch and drag in the window, or use the **Up** and **Down** buttons to display the desired month.
15) Touch the button for the desired day. If necessary, touch and drag in the window, or use the **Up** and **Down** buttons to display the desired day. The selected date is now displayed on the **Arrival Date** Button.
16) Touch the **Compute RAIM** Button. One of the following will be displayed in the 'RAIM Status:' Field:
    - 'Computing'— RAIM calculation in progress.
    - 'Available'— RAIM is predicted to be available for the specified waypoint, time, and date.
    - 'Not Available'— RAIM is predicted to be unavailable for the specified waypoint, time, and date.
    - '____'— RAIM has not been computed for the specified waypoint, time, and date combination.
    - 'Computing'—RAIM calculation in progress
    - 'Available'—RAIM is predicted to be available for the specified waypoint, time, and date
    - 'Not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date
    - '____'—RAIM has not been computed for the specified waypoint, time, and date combination

ANNUNCIATIONS

When an LRU or an LRU function fails, a large red or amber 'X' (depending on the LRU) is typically displayed on items associated with the failed data. The following table depicts various system annunciations. Refer to the current version of the pertinent flight manual for additional information regarding pilot responses to these annunciations.

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

System Annunciation	Comment
	ADAHRS is aligning.
	Display system is not receiving attitude information from the ADAHRS (GRS unit).
	ADAHRS calibration incomplete or configuration module failure.
	GPS information is either not present or is invalid for navigation use. Note that ADAHRS utilizes GPS inputs during normal operation. ADAHRS operation may be degraded if GPS signals are not present (see the current version of the flight manual).
	Display system is not receiving valid groundspeed information.

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

1.4 INITIALIZATION

Initialization is a process that prompts the flight crew to perform system checks and enter flight parameters, and is completed before each flight using the Touchscreen Controllers. After powering up the system on the ground, the 'Initialization' Screen appears on GTC1. On this screen, the pilot can select a Crew Profile, verify database statuses, view initialization information from the aircraft manufacturer, perform system tests, enter weight, fuel, flight plan information, and takeoff data (if SurfaceWatch is installed).



Figure 1-25 'Initialization' Screen

Each initialization task is represented on the 'Initialization' Screen by a task button and check box. Each task button provides a shortcut to the screen associated with the task. Depending on the task, a green completed check mark appears on the button when the flight crew views the screen for a given task, or provides at least the minimum amount of information needed to mark the task as completed.

Once all Initialization Tasks are marked complete, touch the **Accept Initialization** Button to exit the 'Initialization' Screen and view the 'MFW Home' Screen. Touching the **Accept Initialization** Button before the completion of all Initialization Tasks will cause a pop-up screen to appear as shown below. Touching the **OK** Button on the pop-up screen acknowledges the incomplete initialization and opens the 'MFW Home' Screen; touching the **Cancel** Button removes the pop-up.



Figure 1-26 System Initialization Exit Confirmation

Initialization tasks may be completed or revised at any time during the same power cycle. The system will even work in the background to apply check marks to completed Initialization Tasks that are accessed on the 'MFW Home' Screen. The 'Initialization' Screen may also be accessed at any time by touching **Home** > **Utilities** > **Initialization**.

Initialization may be accomplished multiple times within the same power cycle by accessing the 'Initialization' Screen and touching the **Reset Initialization** Button. This removes the green check marks and arms the "Init process not completed..." pop-up warning.



Figure 1-27 Initialization Pop-up Warning

Initializing the system:

1) Touch **Crew Profile** and select a Crew Profile from the list of available profiles. (Crew Profiles are discussed later in this section for more information on creating, importing, and exporting Crew Profiles)
2) Touch **Database Status** to view the Cycle number, Effective and Expiration dates for the Navigation, Standby Navigation, Basemap, Terrain, Obstacle, SafeTaxi, Airport Directory, FliteCharts or ChartView, IFR/VFR Charts, and Checklist databases. (See Appendix B Database Management for details on updating Databases)
3) Touch the **Next** Button to proceed to the 'Safety Information' Screen. A Display Pane appears with information from the aircraft manufacturer. Touch the **Next** or **Previous** Button as necessary to view the information.
4) Touch the **Next** Button to proceed to the 'Initial Fuel' Screen to input initial fuel quantity information.
5) Touch the **Next** Button to proceed to the 'Weight and Balance' Screen to provide weight and fuel information. (See the Flight Management Section, Trip Planning - Weight and Fuel Planning details).
6) Touch **Next** to proceed to the 'Active Flight Plan' Screen to **Add Origin**, **Add Enroute Waypoints** and **Add Destination**. (See the Flight Management Section, Flight Planning for details).
7) Touch the **Next** Button to proceed to the 'Takeoff Data' Screen (available with the SurfaceWatch™ option). Input information about the origin airport runway. Refer to the Flight Management Section for more information about entering Takeoff Data.
8) Touch the **INIT** Button to return the 'Initialization' Screen. As each task is completed a green checkmark appears in the completed column on the 'Initialization' Screen,



Figure 1-28 System Initialization Completed Tasks

9) Touch **Accept Initialization** to accept the initialization values and proceed to the 'MFW Home' Screen. Or Touch **Reset Initialization** to reset initialization values.

1.5 SYSTEM MANAGEMENT

The Touchscreen Controllers allow management of various system settings, in addition to providing status and database information for the system. The system stores the settings in the active Crew Profile, and this information is retained through a system power cycle. Refer to the Crew Profile discussion later in this section for more information.

AVIONICS SETTINGS

Avionics Settings are categorized into five tabs (**System**, **Units**, **Alerts**, **MFD Fields**, and **Audio**). Settings the flight crew can change are accompanied by buttons. Settings that cannot be changed by the flight crew are displayed for informational purposes, without corresponding buttons.

SYSTEM SETTINGS



- Time display format (local 12 hour, local 24 hour, or UTC)
- Time offset
- Keyboard Format (Alphabetical or QWERTY)
- Sliding Flight Plan Keyboard
- Flight Director Active Format (Single Cue)
- COM transceiver channel spacing (8.33 or 25.0 kHz)
- Stability and Protection (On or Off)
- Nearest Airport Runway Surface (Any, Hard Only, or Hard/Soft)
- Nearest Airport Minimum Length
- Show Airport Chart on Landing (On or Off)
- Show Taxi Route on Landing (On or Off)
- Allow User Approach Mode Select
- Automatically Switch BARO

***NOTE:** The time offset is used to define current local time. UTC (also called GMT or Zulu) date and time are calculated directly from the GPS satellite signals and cannot be changed.*

Setting the Time Format:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings**.
2) If not selected, touch the **System** Tab.
3) Touch the Time Format Button (displays currently selected time format in cyan).
4) Touch a time format option button (**Local 12hr**, **Local 24hr**, or **UTC**).

Setting the Time Offset Value (for Local 12hr or Local 24hr selections):

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings**.
2) If not selected, touch the **System** Tab.
3) Touch the Time Offset button (currently selected time offset shown in cyan).
4) Input the desired value using the numeric keypad or the upper large and small upper knobs and touch the **ENTER** Button.

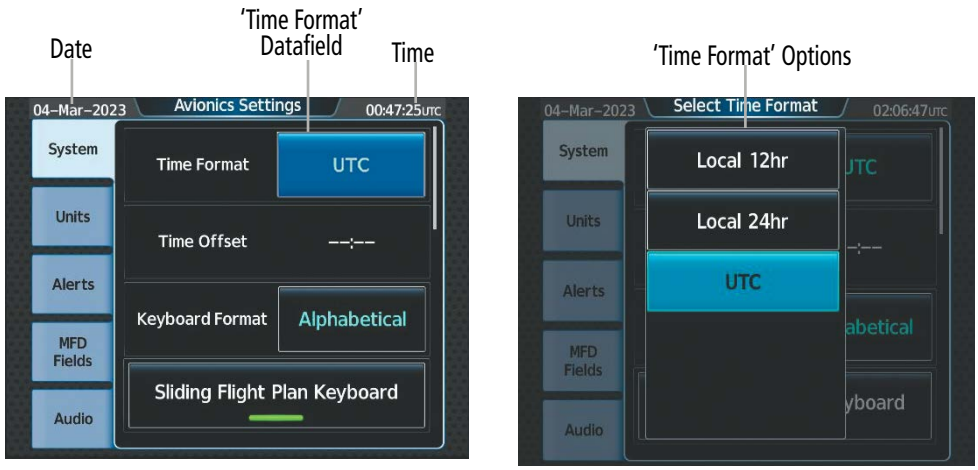
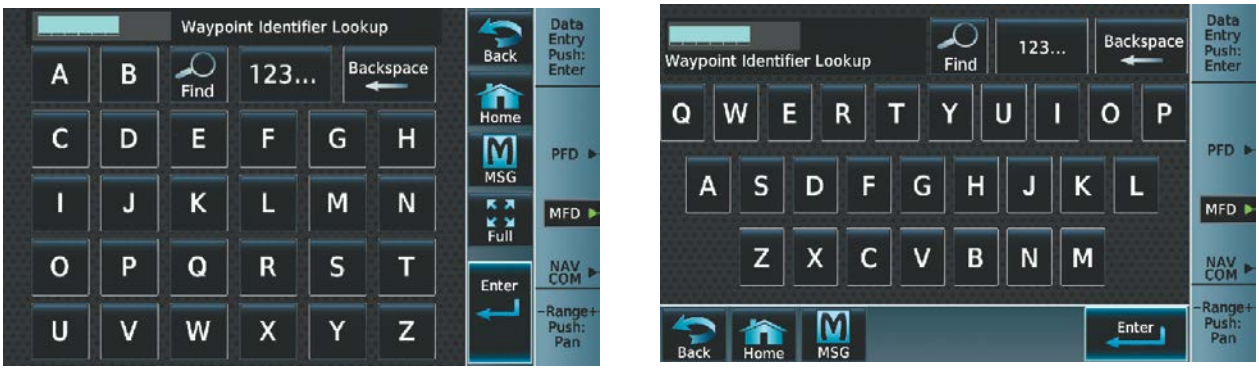


Figure 1-29 Time Format Settings

KEYPAD FORMAT

The system offers two keypad formats. The alphabetical format and QWERTY format is shown in the following figure. While the QWERTY keypad is displayed, the Button Bar appears below the keypad area.



Alphabetical Keypad

QWERTY Keypad

Figure 1-30 Keypad Formats on the Touchscreen Controller

Selecting a keypad format:

1) From MFW Home, touch **Utilities > Setup > Avionics Settings**.
2) If not selected, touch the **System** Tab.
3) Touch the Keyboard Format datafield button.
4) Touch either the **Alphabetical** or **QWERTY** Button to select the desired keypad format.

COM CHANNEL SPACING

The 'COM Channel Spacing' datafield allows the pilot to select 8.33 kHz or 25.0 kHz COM frequency channel spacing. Refer to the Audio and CNS section for more information.

ELECTRONIC STABILITY AND PROTECTION

Garmin Electronic Stability and Protection (ESP™) is intended to discourage the exceedance of attitude, airspeed, and angle of attack (AOA) parameters. This feature will only operate when the aircraft is above 200 feet AGL and the autopilot is not engaged. The pilot can enable/disable ESP on the 'Avionics Settings' Screen. Refer to the Additional Features section for more information.

Nearest Airport Runways

Nearest airport matching criteria (such as minimum runway length and/or surface type) can be entered to prevent airports with small runways or runways that are not of appropriate surface from being displayed in the list as nearest airports. Refer to the Flight Management Section for more details.

Showing Airport Charts on Landing

The system can automatically display a chart for the current airport upon landing to enhance situational awareness while taxiing. Refer to the Additional Features section for more information about displaying charts.

Enabling/disabling the display of airport charts on landing:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings**.
2) If not selected, touch the **System** Tab.
3) Scroll and touch the Show Airport Chart on Landing Button.
4) Touch the **On** Button to enable the feature or the **Off** Button to disable the feature.

Allow User Approach Mode Select

When enabled, the lateral service level and vertical source can be modified. Refer to the Flight Management section for more information on 'Allow User Approach Mode' Select'.

Automatically Switch BARO

When Automatically Switch BARO is enabled the system will automatically switch to the STD Baro setting upon climbing past the transition altitude. It will switch back to the previous altimeter setting upon descending back through the transition altitude Refer to the Flight Instruments section for more information.

UNITS SETTINGS



- Nav Angle
- Magnetic Variance
- Distance/Speed
- Altitude/Vertical Speed
- External Temperature
- Cockpit/Cabin Temperature
- Fuel
- Weight
- Position Format
- Pressure

The **Units** Tab allows for configuration of the measurement units. A button appears next to the current unit setting only for those units which the flight crew can modify. Measurement units without an associated button are shown only for informational purposes and cannot be modified by the flight crew.

» Nav angle (Magnetic or True)
  - When set to 'Magnetic (°)', magnetic variation is calculated into the displayed value. When 'True (°T)' is selected, no magnetic variation is calculated and a 'T' is displayed next to the value.
  - Affects Current Heading, Selected Heading, and Selected Course.
  - Affects the BRG, DTK, TKE, TRK, and XTK fields.

» Distance/Speed (Metric or Nautical)

» Altitude/Vertical Speed (Feet or Meters)

» External Temperature (Celsius or Fahrenheit)

» Cockpit/Cabin Temperature (Celsius or Fahrenheit)
  - Affects the displays of cockpit and cabin temperature on the 'Environmental' Pane.

» Fuel (Gallons or Liters)

» Weight (Pounds or Kilograms)

» Position Format (HDDD° MM.MM' or HDDD°MM' SS.S")
  - Affects all position displays.

» Pressure

Changing unit settings:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings**.
2) If not selected, touch the **Units** Tab.
3) Scroll if necessary and touch button corresponding to the units to be changed (current units selection displayed in cyan).
4) Touch a units button from the list.

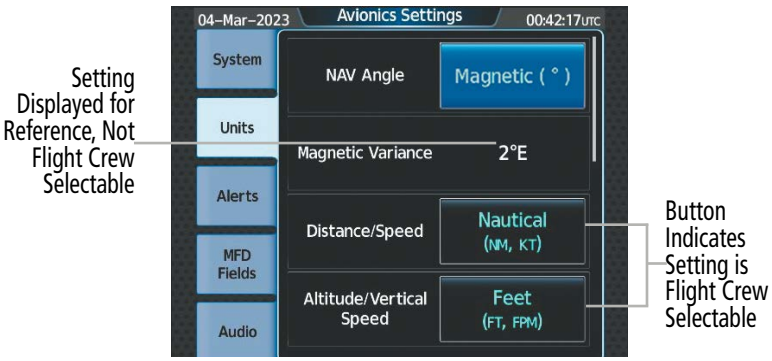


Figure 1-31 Viewing Unit Data on the 'Avionics Settings' Screen

ALERTS SETTINGS



- BARO Transition ALT Climb (On/Off)
- BARO Transition LVL Descent (On/Off)
- SurfaceWatch Inhibit (On/Off)
- Stabilized APPR Inhibit (On/Off and Settings)
  - Wind Inhibit (On/Off)
  - Flap Override (On/Off)
  - GS/GP Inhibit
- Airspace Alert Alt Buffer (ft)
- Airspace Alert Settings (Settings)
  - Class B/TMA/AWY (On/Off)
  - Class C/CTA (On/Off)
  - Class A/D (On/Off)
  - Restricted (On/Off)
  - MOA (Military) (On/Off)
  - Other (On/Off)

The **Alerts** Tab allows configuration of the following alert settings:

» Baro transition alert (climb and descent)
» SurfaceWatch alert inhibit
» Stabilized Approach Inhibit
» Altitude buffer distance alert
» Airspace alerts

Baro Transition Alert settings

The Baro Transition Alert flashes the barometric pressure setting. The Baro Transition Alert serves as a reminder to the pilot to change the barometric pressure setting to standard when climbing through the barometric transition altitude, or to change the barometric pressure setting from standard to the local altimeter setting when descending through the barometric transition altitude. Refer to the Flight Instruments Section for more information about the Baro Transition Alert.

SurfaceWatch Inhibit

The optional SurfaceWatch™ feature alerts to the flight crew in certain potentially unsafe conditions during taxi, takeoff, and landing. SurfaceWatch also displays an Information Box on the PFD. The flight crew can inhibit the SurfaceWatch alerts and displays using the 'Avionics Settings' Screen. Refer to the Additional Features Section for more information on the SurfaceWatch feature.

Stabilized Approach Inhibit

The Stabilized Approach functionality provides aural and visual annunciations to notify the flight crew of unstable conditions during an approach. The flight crew can inhibit the alerts and displays using the 'Avionics Settings' Screen. Refer to the Additional Features Section for more information on Stabilized Approach alerts.

Arrival and Airspace Alert Settings

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). The system is also capable of providing alerts as the aircraft approaches special-use airspace. For Airspace Alert Altitude Buffer settings, Arrival Alerts, and Airspace specific alerts, see the Flight Management Section.

MFD FIELDS SETTINGS



- MFD Data Bar Field 1
- MFD Data Bar Field 2
- MFD Data Bar Field 3
- MFD Data Bar Field 4

The MFD Navigation Data Bar displays four navigation data bar fields. The system assigns each data bar field a corresponding number, 1 through 4, as displayed from left-to-right. Refer to the Flight Management section for more information.

NOTE: *ETE can be displayed as either (H)H+MM (ETE greater than 60 minutes) or MM:SS (ETE less than 60 minutes).*

AUDIO SETTINGS



- Audio Alert Voice
  - Male
  - Female
- COM Frequency Changed Tone (On/Off)
- Pilot 3D Audio (On/Off)
- Pilot L-R Swap (On/Off)
- Copilot 3D Audio (On/Off)
- Copilot L-R Swap (On/Off)

Audio

From the **Audio** Tab the audio alert voice gender can be set to male or female. Pilot and Copilot 3D audio can be enabled or disabled. Also, the 3D audio left/right reference may be changed so that COM 1 and COM 2 audio is heard in the desired ear. Refer to the Audio and CNS section for more information.

To change the audio alert voice:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings.**
2) If not selected, touch the **Audio** Tab.
3) Touch the Audio Alert Voice button (current voice gender displayed in cyan).
4) Touch the audio alert voice gender button (**Male** or **Female**).

AVIONICS STATUS

The 'Avionics Status' Screen provides information about installed LRUs, airframe system software, and databases.

LRU INFO

The **LRU Info** Tab on the 'Avionics Status' Screen displays the status, serial numbers, and software version numbers for all detected system LRUs. The system displays a green checked box for each active LRUs. An amber 'X' box indicates a failed LRU. Inform a service center or Garmin dealer if a LRU has failed.

Viewing LRU information:

1) From MFW Home, touch **Utilities > Setup > Avionics Status.**
2) If not selected, touch the **LRU Info** Tab.
3) Scroll as needed and touch an LRU button to display a pop-up window with additional information for the selected LRU.
4) When finished, touch the pop-up window (if displayed), or touch **Back** or **Home**.

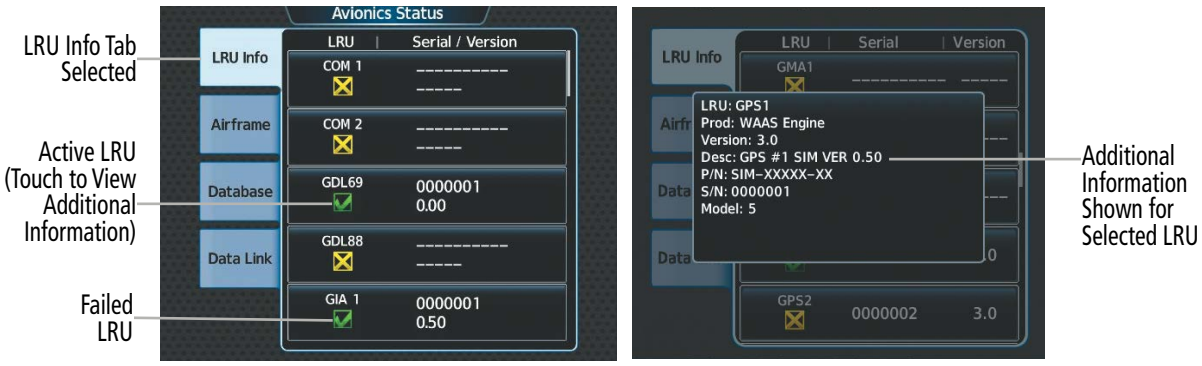


Figure 1-32 Viewing LRU Info Information on the Touchscreen Controller

AIRFRAME

The **Airframe** Tab of the 'Avionics Status' Screen displays pertinent information about the airframe including the System ID number, System Software Version number, Configuration ID, and Cockpit Reference Guide part number.

Viewing airframe information:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Status**.
2) If not selected, touch the **Airframe** Tab.
3) Scroll as needed to view the airframe information.

DATABASE

The **Database** Tab of the 'Avionics Status' Screen displays pertinent information on all system databases (PFD1, MFD1, GTC1, and GTC2).

Viewing database information:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Status**.
2) If not selected, touch the **Database** Tab.
3) Touch **MFD1, PFD1, GTC1,** or **GTC2,** Buttons to view database information for the selected LRU.
4) Scroll as needed to view the database information for the selected LRU, then touch **Back** or **Home.**

DATA LINK

The **Data Link** Tab of the 'Avionics Status' Screen displays pertinent information about SATCOM including the Signal Strength, Connection Status, IMEI, and Serial Number.

Viewing airframe information:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Status**.
2) If not selected, touch the **Data Link** Tab.
3) Touch the **SATCOM** Button to view SATCOM information.

ADDITIONAL SETUP FEATURES

SIRIUSXM INFO

Information regarding SiriusXM services may be found in the Audio and CNS Section, Hazard Avoidance Section, and Additional Features Section.

DATABASE STATUS

For more information on Database Status, see Appendix B and the Additional Features Section.

ADS-B STATUS

For more information on ADS-B Status, see the Hazard Avoidance Section.

1.6 UTILITIES

The Timer and Trip Statistics features provide a stopwatch-like generic timer, a total time in flight timer, and a record of the time of departure as well as distance tracking—odometer, trip odometer, and average ground speeds and maximum ground speeds.

TRIP PLANNING

See the Flight Management Section for information on the Trip Planning feature.

MINIMUMS

See the Flight Instrument Section and the Flight Management Section for information on setting Baro Minimums.

TRIP STATISTICS

Flight Time and Departure Time may each be set to begin either at Power-On or at the time the aircraft lifts off ('In-Air'). Both the Flight Time and the Departure time may be reset at any time. Resetting the Flight Time returns the timer to zero. Resetting the Departure Time inputs the current time at the point of reset.

The system records the time at which arrival occurs. The Arrival Time may be set up to reset when the system is powered on, when the aircraft becomes airborne, or manually.

The Odometer presents a total distance traveled since the last reset. The Trip Odometer presents a total distance traveled for the active flight plan since the last reset.

The Hour Meter shows accumulated engine time. It starts counting up when either engine is running and the aircraft is in air. The Hour Meter stops counting when the engine has stopped running or the aircraft is on the ground. This is a system timer and is not pilot adjustable.

Fuel Used presents the fuel used since the last reset. Average Ground Speed, Maximum Ground Speed, Average Wind Speed, and Average Wind Direction present the given information as measured since the last reset. Each may be set up to reset at the time of Power-On, lift off ('In-Air'), or manually.

The Sunrise and Sunset times can be displayed in UTC after airports are selected for either setting.

Total Time and Flight Time are displayed in the 'Trip Statistics' Window.

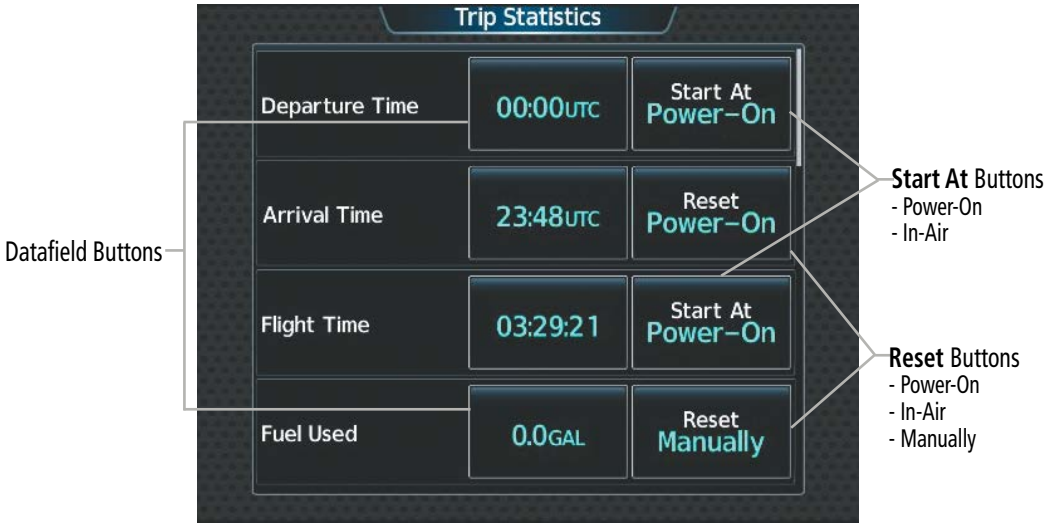


Figure 1-33 'Trip Statistics' Screen

Setting the start criterion for Flight Time and Departure Time:

1) From MFW Home, touch **Utilities > Trip Stats.**
2) Touch the **Start At** Button for either the Flight Time or the Departure Time.
3) Touch either the **Power-On** or **In-Air** Button to select the 'Start At' Time and return to the 'Trip Statistics' Screen.

Setting the reset criterion for Arrival Time, Odometer, Trip Odometer, Fuel Used, Avg Ground Speed, Max Ground Speed, Trip Air Odometer, Avg Wind Speed or Avg Wind Direction:

1) From MFW Home, touch **Utilities > Trip Stats.**
2) If necessary, scroll to reveal the desired statistic. Touch the corresponding **Reset** Button.
3) Touch either the **Power-On**, **In-Air** or **Manually** Button to select the reset mode and return to the 'Trip Statistics' Screen.

Resetting a Trip Statistic:

1) From MFW Home, touch **Utilities > Trip Stats**.
2) If necessary, scroll to reveal the desired statistic. Touch the corresponding Datafield button.
3) Touch the **Reset** Button to reset the arrival time or touch the **Cancel** Button.

Setting Sunrise / Sunset:

1) From MFW Home, touch **Utilities > Trip Stats**.
2) Scroll to display the 'Sunrise' or 'Sunset' statistic. Select the desired datafield button.
3) Enter the origin waypoint:

   Use the upper knobs or the keypad to enter the origin waypoint.

   Or:

   a) Touch the **Find** Button to display the 'Find Waypoint' Screen.
   b) Touch the **Nearest**, **Recent**, **Flight Plan**, or **Favorites** Tab and select the waypoint from the list of waypoints.

   Or:

   a) Touch the **Find** Button to display the 'Find Waypoint' Screen.
   b) Then, touch the **Search** Tab to display the **Search By** Button.
   c) If necessary, touch the **Search By** Button to choose Search by City or Search by Facility.
   d) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.
   e) Use the keypad to select the name, and the **Enter** Button to accept the entry and display the search results.

TIMERS

PFD or User Timers 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. Additionally, a timer expired message displays on the 'Notifications' Screen of the Touchscreen Controller with an associated flashing **MSG** Button. Messages can be set to display based on a specific date and time (Event). The timer is reset before reaching zero on a countdown, and the digits are reset to the initial value. If the timer is counting up when reset, the digits are zeroed.

Setting a generic or user timer:

1) From MFW Home, touch **Utilities** > **Timers**.

   Or

   From PFW Home, touch **Timers**.

2) Touch the appropriate timer button (PFD 1 Timer, User Timer 1, User Timer 2, etc.**)**.
3) Touch the **Time** Button.
4) Input the desired time using the numeric keypad or the large and small right knobs, then touch the **Enter** Button or press the right knob.
5) Touch the **Up** for timer count from zero to the time set in step 4.

   Or:

   Touch the **Down** Button to count from the time selected in step 4 to zero.
6) Touch the **Start** Button. The button changes to 'Stop'.
7) To stop the timer, touch the **Stop** Button.
8) To reset the timer, touch the **Reset** Button.



Figure 1-34 Timer Selection



Figure 1-35 'Edit Timer' Screen

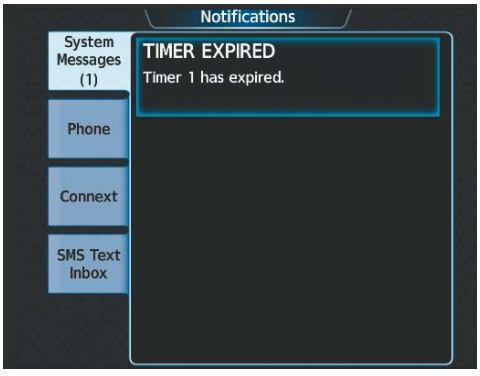


Figure 1-36 'Notifications' Screen Timer Expired Message

Adding a user timer:

1) From MFW Home, touch **Utilities** > **Timers** > **Add Timer**.

   Or

   From PFW Home, touch **Timers** > **Add Timer**.

2) Touch the **Timer Expired Message** Button.

3) Input the desired message using the keypad or the large and small right knobs, then touch the **Enter** Button or press the right knob.

   Or:

1) From MFW Home, touch **Utilities** > **Timers** > **Add Timer**.

   Or

   From PFW Home, touch **Timers** > **Add Timer**.

2) Touch the **Create** Button.

3) Touch the User Timer Button for the newly created user timer.

4) Touch the **Timer Expired Message** Button.

5) Input the desired message using the keypad or the large and small right knobs, then touch the **Enter** Button or press the right knob.



Figure 1-37 'Edit Timer' Screen - Create

Deleting a user timer:

1) From MFW Home, touch **Utilities** > **Timers**.

   Or

   From PFW Home, touch **Timers**.

2) Touch the desired timer button (User Timer 1, User Timer 2 , etc.).

3) Touch the **Delete** Button.



Figure 1-38 'Edit Timer' Screen - Delete

SCHEDULED MESSAGES

The Scheduled Messages feature can be used to enter and display reminder messages (e.g., Change oil, RVSM checks, or Altimeter-transponder check) on the 'Notifications' Screen of the Touchscreen Controller with an associated flashing **MSG** Button. Messages can be set to display based on a specific date and time (Event), once the message timer reaches zero (One Time), or recurrently whenever the message timer reaches zero (Periodic). Message timers set to periodic alerting automatically reset to the original timer value once the message is displayed. When power is cycled, all messages are retained until deleted, and message timer countdown is resumed. Event messages triggered when the system is powered off will be displayed the next time the system is powered on.

Entering a scheduled message:

1) From MFW Home, touch **Utilities** > **Scheduled Messages**.
2) Touch the **Add Message** Button.
3) Touch the **Message** Button.
4) The keypad is displayed. Enter the message name using the keypad or large and small upper knobs
5) Touch the **Enter** Button. The message name is displayed on the **Message** Button.
6) Touch the **Frequency** Button.
7) Touch the **Event**, **One Time**, or **Periodic** Button. The selection is displayed on the **Frequency** Button.
8) Touch the **Time** Button.
9) Enter the time value using the keypad. If the **Event** Button was selected in step 7, time is entered in a clock format (HH:MM LCL) as local time. If the **One Time** or **Periodic** Buttons were selected in step 7, the time is entered in a HH:MM:SS format.
10) Touch the **Enter** Button. The time is displayed on the **Time** Button.
11) If the **Event** Button was selected in step 7, touch the **Date** Button. The **Date** Button is subdued and disabled if the **One Time** or **Periodic** Buttons were selected in step 7.
12) Touch the desired year, then the month, followed by the day.

Editing a scheduled message:

1) From MFW Home, touch **Utilities** > **Scheduled Messages**.
2) Touch the button with the name of the message to be edited. The 'Message Options' Window is displayed.

3) Touch the **Edit Message** Button.

4) Select the desired message parameter to be edited and perform the needed steps as discussed previously for entering a scheduled message.

Resetting the time for an existing scheduled one-time or periodic message:

1) From MFW Home, touch **Utilities** > **Scheduled Messages**.

2) Touch the button with the name of the message to reset its time. The scheduled message time is immediately reset and begins the count-down.

Deleting a scheduled message:

1) From MFW Home, touch **Utilities** > **Scheduled Messages**.

2) Touch the name of the message to be deleted. The 'Message Options' Window is displayed.

3) Touch the **Delete Message** Button. Touch the **Delete All Messages** Button to delete all saved messages.

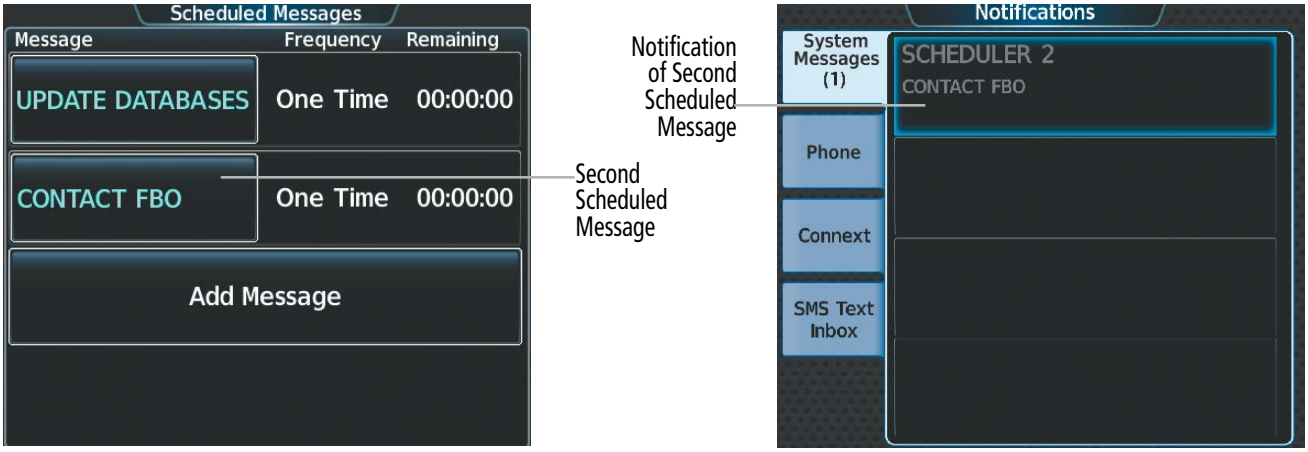


Figure 1-39 Scheduled Message Example

DOCUMENTS

See the Additional Features Section for information on Documents.

SCREEN CLEANING

Screen Cleaning mode temporary deactivates touch input on the Touchscreen Controller screen to facilitate cleaning. The screen can be cleaned using a microfiber or soft cotton cloth lightly dampened with clean water. Do not use chemical cleaning agents, as these may damage the coating on the glass surface.

Cleaning the Touchscreen Controller screen:

1) From MFW Home, touch **Utilities** > **Screen Cleaning**.

2) The Touchscreen Controller indicates the screen may be cleaned. Clean the screen as needed.

3) Press or turn any knob to return to the 'Utilities' Screen.

CREW PROFILES

The system automatically stores various settings and selections within crew profiles. These include a wide range of parameters for both the pilot and copilot including (but not limited to) map settings, avionics settings, PFD settings, user waypoints, and weight and balance information.

After applying power to the system, the 'Initialization' Screen on the Touchscreen Controller shows the currently active crew profile, which was active during the previous power cycle. If needed, the flight crew may activate a different crew profile on the 'Initialization' Screen or the 'Crew Profile' Screen.

The 'Crew Profile' Screen provides additional capabilities for managing crew profiles. The system can store up to 25 crew profiles. From here, crew profiles may be added, renamed, activated, copied, or deleted. In addition, crew profiles can be imported from an SD card, or exported to an SD card. By default, 'DEFAULT PROFILE' is the active crew profile. This profile cannot be deleted or renamed.

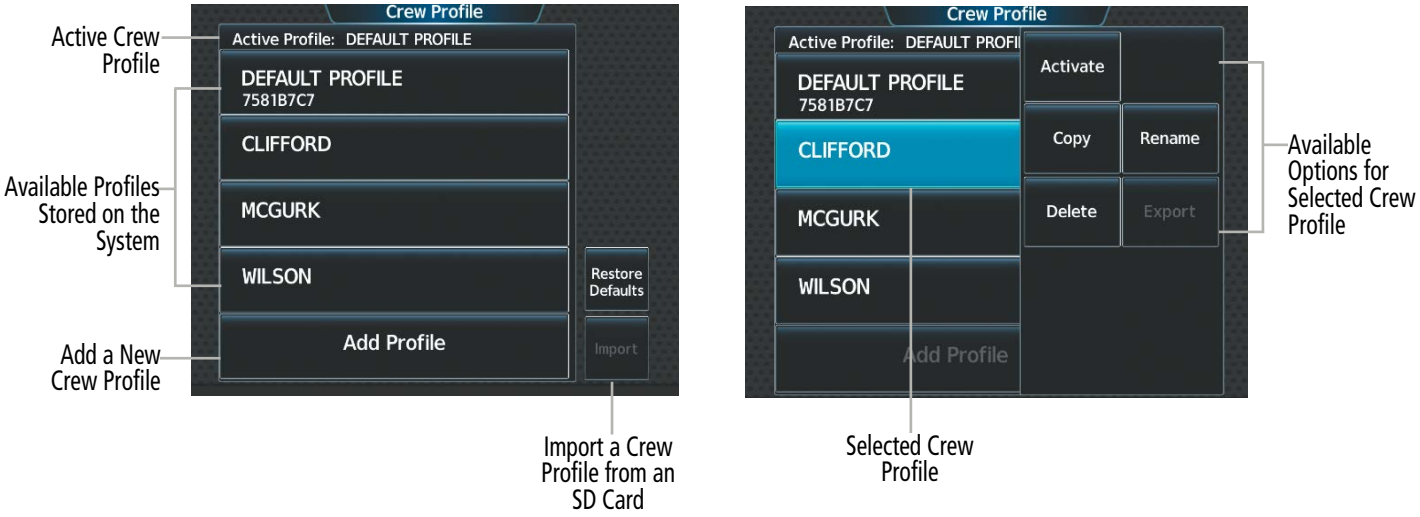


Figure 1-40 Managing Crew Profiles on the 'Crew Profile' Screen

Add a new crew profile:

1) From MFW Home, touch **Utilities > Crew Profile**.
2) Scroll if necessary, and touch the **Add Profile** Button.
3) Input the name to assign to the crew profile using the keypad or the large and small upper knobs. Crew profiles may be up to 16 characters long and cannot share the exact name of another crew profile.
4) Touch the **Enter** Button or push the upper knob.

Activate a crew profile:

1) From MFW Home, touch **Utilities > Crew Profile**.
2) Scroll if necessary, and touch the button for the crew profile to be activated.
3) Touch the **Activate** Button. When finished, the system displays the name of the selected crew profile in the 'Active Profile' Window.

Copy an existing crew profile:

1) From MFW Home, touch **Utilities > Crew Profile**.
2) Scroll if necessary, and touch the button for the crew profile to be copied.
3) Touch the **Copy** Button.

4) Input the name to assign to the copied crew profile using the keypad or the large and small upper knobs. Crew profiles may be up to 16 characters long and cannot share the exact name of another crew profile.

5) Touch the **Enter** Button or push the upper knob. The 'Crew Profile' Screen displays the name of the copied profile in the list.

Rename an existing Crew Profile:

1) From MFW Home, touch **Utilities > Crew Profile**.

2) Scroll if necessary, and touch the button for the crew profile to be renamed.

3) Touch the **Rename** Button.

4) Input the new name to assign to the selected crew profile using the keypad or the large and small upper knobs, then touch **Enter** or push the upper knob. Crew profiles may be up to 16 characters long, and cannot share the exact name of an existing crew profile. The 'Crew Profile' Screen displays the name of the renamed crew profile in the list.

Delete a crew profile:

1) From MFW Home, touch **Utilities > Crew Profile**.

2) Scroll if necessary, and touch the button for the crew profile to be deleted.

3) Touch the **Delete** Button.

4) Touch the **OK** Button to confirm and delete the crew profile, or touch the **Cancel** Button if it is not desired to delete the crew profile.

NOTE: *The system cannot delete the currently active crew profile. If necessary, activate another crew profile before deletion.*

Import a crew profile from an SD card:

1) If necessary, insert an SD card containing a crew profile into the top card slot on the MFD.

2) From MFW Home, touch **Utilities > Crew Profile**.

3) Touch the **Import** Button.

4) Scroll if necessary, and touch the button for the crew profile to be imported.

NOTE: *The system may not be able to import a crew profile that was created/saved using a previous software version.*

Export a crew profile to an SD card:

1) If necessary, insert an SD card to store a crew profile into the top card slot on the MFD.

2) From MFW Home, touch **Utilities > Crew Profile**.

3) Scroll if necessary, and touch the button for the crew profile to be exported from the list.

4) Touch the **Export** Button.

CREW PROFILE IMPORT/EXPORT MESSAGES

In some circumstances, some messages may appear in a pop-up window in conjunction with others:

Crew Profile Import/Export Results	Description
'No crew profile plan files found to import.'	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 1-4 Crew Profile Import/Export Messages

SECTION 2 FLIGHT INSTRUMENTS

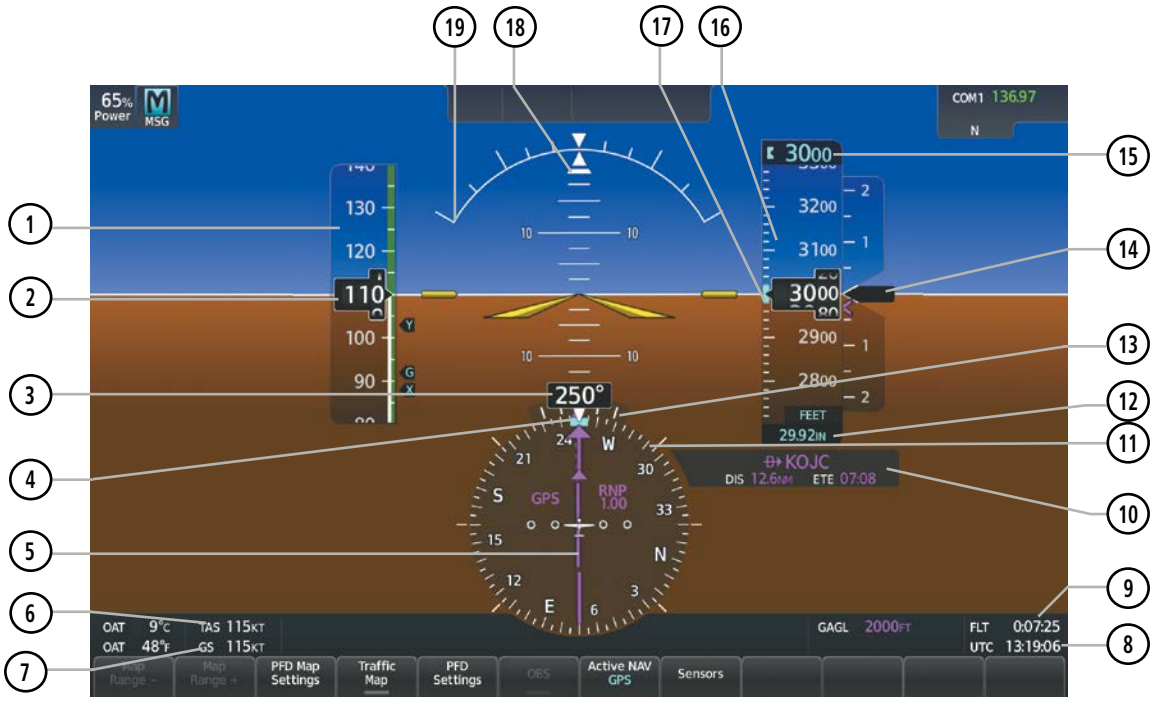
NOTE: *The Automatic Flight Control System (AFCS) provides additional indications such as bugs and annunciations on selected flight instruments during certain AFCS flight director modes. Refer to the AFCS Section for more information about these indications.*

The system increases pilot situational awareness by providing easy-to-scan Primary Flight Displays (PFDs) featuring a large horizon, airspeed, attitude, vertical speed, and course deviation information. In addition to the flight instruments, navigation, communication, terrain, traffic, and weather information are also presented on the PFDs and are explained in other sections of this Pilot's Guide.

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

- Airspeed Indicator, showing
  - Indicated airspeed
  - Airspeed awareness ranges
  - Vspeed reference bugs
- Ground Speed
- True airspeed
- Attitude Indicator with slip/skid indication
- Altimeter, showing
  - Trend vector
  - Barometric setting
  - Selected Altitude
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Vertical Navigation (VNAV) indications
- Horizontal Situation Indicator (HSI), showing
  - Turn Rate Indicator
  - Bearing pointers
  - Navigation source
  - Course Deviation Indicator (CDI)
  - HSI Map
- Generic Timer
- Wind data
- Time
- Angle of Attack (AOA) Indicator

The PFD also displays various alerts and annunciations discussed throughout this Pilot's Guide. See Appendix A for details.



1. Airspeed Indicator
2. Indicated Airspeed
3. Current Heading
4. Selected Heading Bug
5. Course Deviation Indicator (CDI)
6. True Airspeed
7. Ground Speed
8. System Time
9. Timer
10. Navigation Status Box
11. Horizontal Situation Indicator (HSI)
12. Barometric Altimeter Setting
13. Turn Rate Indicator
14. Vertical Speed Indicator (VSI)
15. Selected Altitude
16. Altimeter
17. Selected Altitude Bug
18. Slip/Skid Indicator
19. Attitude Indicator

Figure 2-1 Primary Flight Display



1. Reversionary Sensor Annunciation
2. Indicated Airspeed
3. Selected Heading
4. Wind Data
5. Angle of Attack Indicator
6. Outside Air Temperature (OAT) in Degrees Celsius
7. Outside Air Temperature (OAT) in Degrees Fahrenheit
8. GPS Above Ground Level
9. HSI Map
10. Minimum Descent Altitude/Decision Height
11. Aircraft Symbol
12. Flight ID
13. Percent Power (Engine)

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 numeric labels and major tick marks on the moving tape are shown at intervals of 10 knots. The minor tick marks on the moving tape are shown at intervals of five knots. Speed indication starts at 20 knots, with 60 knots of airspeed viewable at any time. The indicated airspeed is displayed inside the black pointer. The pointer remains black until reaching the never-exceed speed (V_{NE}), at which point it flashes for 5 seconds and turns steady red.

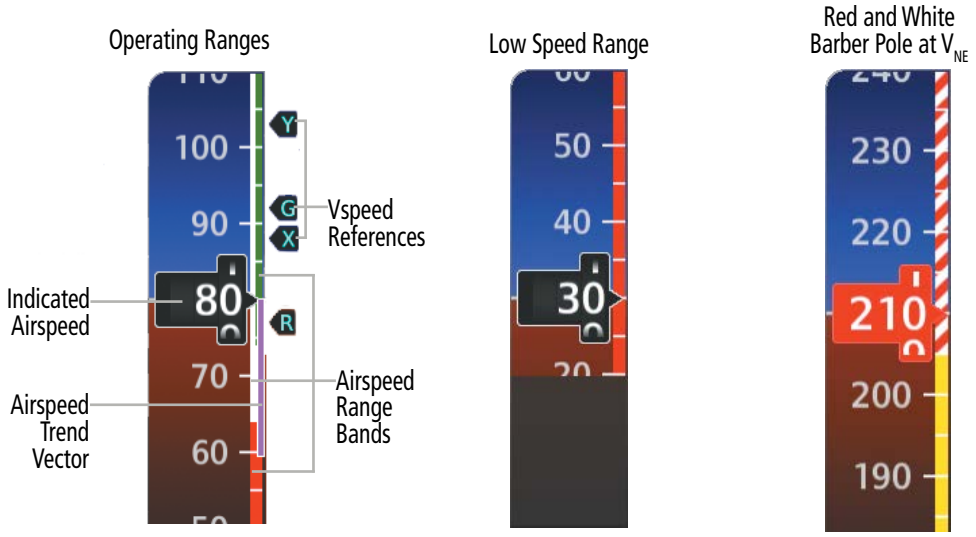


Figure 2-3 Airspeed Indicator Ranges

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

A red low speed awareness band extends up to the low speed awareness velocity, V_{LSA}.

NOTE: *The ice protection system (optional) must be operated in accordance with the approved flight manual limitations. This option is only available in SR22 models.*

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

AIRSPEED REFERENCE BUGS

Speeds can be changed and their bugs enabled or disabled. When enabled, the Vspeeds are displayed at their respective locations to the right of the airspeed scale. By default, all Vspeed values are reset and all bugs turned off during power application.

	Vspeed	Bug
General	Vx	X
General	Vy	Y
General	Vglide	G
Takeoff	Vr	R

Table 2-1 Vspeed Bug Labels

The system categorizes Vspeed reference bugs as takeoff, landing, or general, and these bugs are grouped by their respective tabs on the Speed Bugs Screen. Vspeed bugs in the general category may be enabled at any time.

Prior to the display of Indicated Airspeed, enabled speed reference bugs appear in a list from highest to lowest at the bottom of the airspeed tape. Once indicated airspeed increases, enabled bugs appear in their respective positions along the right side of the airspeed tape. While the aircraft is in the air, if landing category Vspeed bugs are enabled, but outside of the viewable range of the airspeed tape, these bugs appear in a list at the bottom of the airspeed tape.

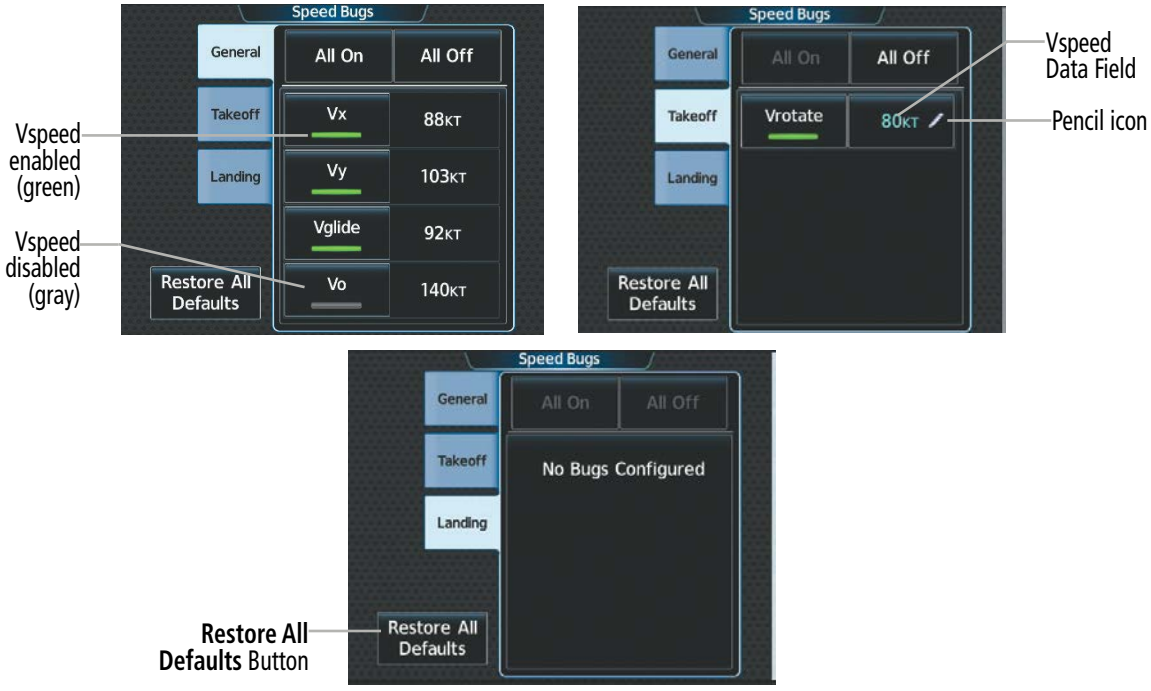


Figure 2-4 General, Takeoff, and Landing Vspeed Settings on the 'Speed Bugs' Screen

Changing Vspeeds and enabling/disabling Vspeed Bugs:

1) From PFW Home, touch **Speed Bugs**.
2) Touch the General, Takeoff, or Landing Tab.
3) To enable or disable a Vspeed bug, touch the button for the Vspeed bug. The button annunciation is green when the Vspeed bug is enabled and gray when disabled.
4) To change the Vrotate speed, touch the Vrotate Data Field and input a value using the keypad or large and small upper knobs, then touch the **Enter** Button or push the small upper knob**.** A pencil icon next to a Vspeed value indicates the Vspeed is a pilot-selected value (see figure 2-4).

Or

1) From MFW Home, touch **PERF > Speed Bugs**.
2) Touch the General, Takeoff, or Landing Tab.
3) To enable or disable a Vspeed bug, touch the button for the Vspeed bug. The button annunciation is green when the Vspeed bug is enabled and gray when disabled.
4) To change the Vrotate speed, touch the Vrotate Data Field and input a value using the keypad or large and small upper knobs, then touch the **Enter** Button or push the upper knob**.** A pencil icon next to the Vspeed value indicates the Vspeed is a pilot-selected value.

Enabling or disabling all General, Takeoff or Landing Vspeed bugs:

1) From PFW Home, touch **Speed Bugs**.
2) Touch the General, Takeoff, or Landing Tab.
3) To enable all Vspeed bugs, touch the **All On** Button.
4) To disable all Vspeed, touch the **All Off** Button.

Or

1) From MFW Home, touch **PERF > Speed Bugs**.
2) Touch the General, Takeoff, or Landing Tab.
3) To enable all Vspeed bugs, touch the **All On** Button.
4) To disable all Vspeed, touch the **All Off** Button.

Restoring Vspeed defaults:

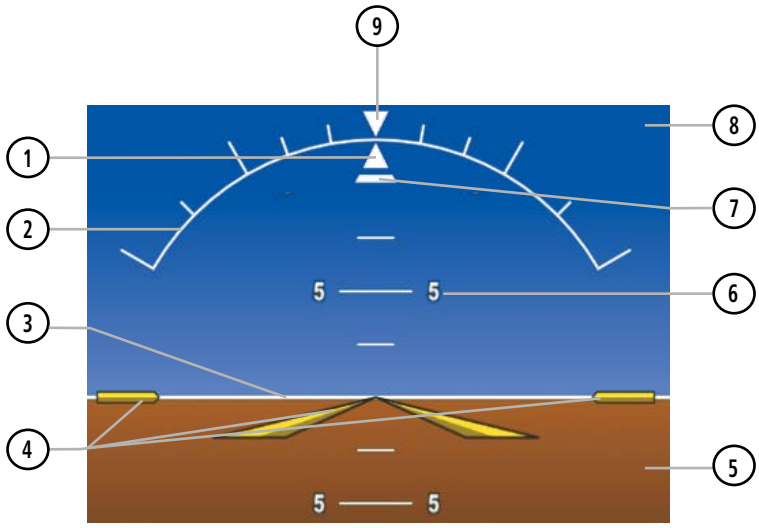
1) From PFW Home**,** touch **Speed Bugs**.
2) Touch the **Restore All Defaults** Button. Vspeeds are restored to default values and all Vspeed buttons are disabled.

Or

1) From MFW Home, touch **PERF > Speed Bugs**.
2) Touch the **Restore All Defaults** Button. Vspeeds are restored to default values and all Vspeed buttons are disabled.

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 (Formatted for Single-cue Command Bars)
5. Land Representation
6. Pitch Scale
7. Slip/Skid Indicator
8. Sky Representation
9. Roll Scale Zero

Figure 2-5 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 every 5°. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°.

The inverted white triangle indicates zero on the roll scale. Major tick marks at 30° and 60° and minor tick marks at 10°, 20°, and 45° are shown to the left and right of the zero. Angle of bank is indicated by the position of the pointer on the roll scale.

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



Figure 2-6 Slip/Skid Indication

When the Garmin Electronic Stability and Protection (Garmin ESP™) system is available, additional indications may appear on the pitch and roll scales; refer to the Additional Features and AFCS Sections for more information about Garmin ESP.

ALTIMETER

The Altimeter displays barometric altitude values on a moving tape rolling number gauge which can be configured to display 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 Indicated Altitude is displayed in the black pointer.

Selecting the Altitude/Vertical Speed Display Units:

1) From MFW Home, touch **Utilities > Setup > Avionics Settings**.
2) Touch the **Units** Tab.
3) Scroll and touch the **Altitude/Vertical Speed** Button.
4) Touch either the **Feet (FT, FPM)** Button or the **Meters (MT, MPS)** Button.
5) When finished, touch the **Back** Button or the **Home** Button.

This setting affects altitude and vertical speed displays used throughout the system, in addition to those shown on the PFD. Refer to the System Overview section for more information on units settings.

***NOTE:** The altimeter units shown on the Standby Flight Display are not affected by the selection chosen in the previous procedure.*

When a Selected Altitude is set, a cyan Selected Altitude Intercept Arc (if enabled) is displayed on the navigation maps when the aircraft is climbing or descending. This arc appears at the estimated position the aircraft will intercept the Selected Altitude; refer to the Flight Management Section for additional information about the Selected Altitude Intercept Arc.

SELECTED ALTITUDE

Setting the Selected Altitude:

1) Turn the **ALT** Knob on the AFCS Controller to update the Selected Altitude in 100-ft increments. Quickly turning the **ALT** Knob will change the selected altitude in larger increments.
2) If set, the Minimum Descent Altitude/Decision Height (MDA/DH) value is also available for the Selected altitude.
3) Push the **ALT** Knob to synchronize the selected altitude with the displayed altitude to the nearest 10 ft.

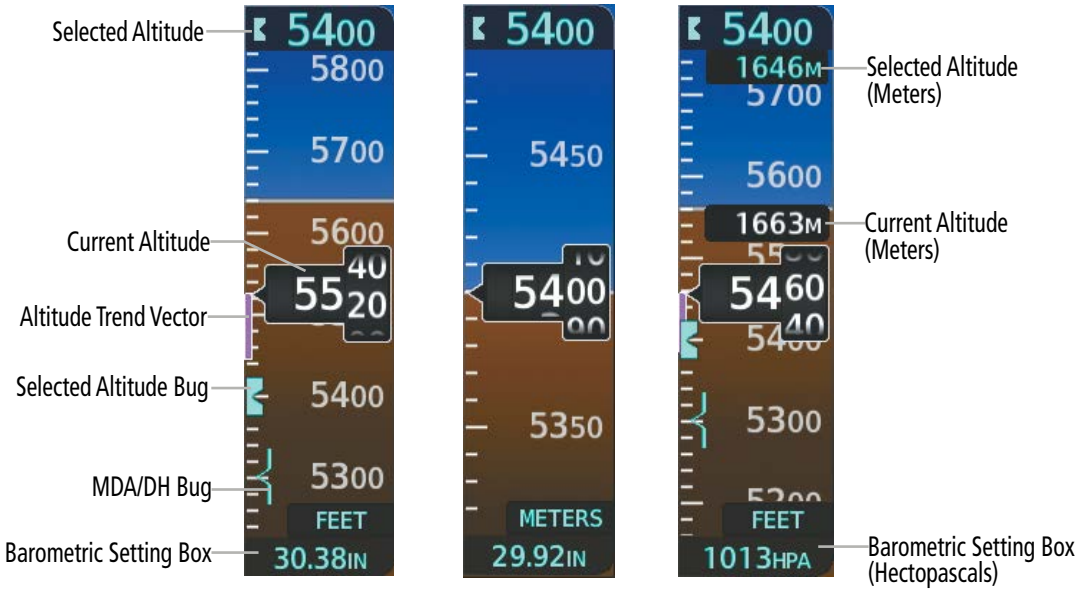


Figure 2-7 Altimeter Settings, In Hg and Metric

The system can display metric units overlays for the Indicated and Selected Altitudes, while the altimeter maintains its scale in feet.

Enabling/Disabling Meters Overlays on the Altimeter:

1) From PFW Home, touch **PFD Settings**.
2) Scroll and touch the **Meters Overlay** Button to enable (green annunciation).

Or:

1) Press the **PFD Settings** Softkey
2) Press the **Other PFD Settings** Softkey
3) Press the **Altitude Units** Softkey
4) Press the **Meters** Softkey to display the meters overlay. Press again to disable the overlay.
5) When finished, touch the **Back** Button.

A magenta Altitude Trend Vector extends up or down the left of the altitude tape, the end resting at the approximate altitude to be reached in 6 seconds at the current vertical speed. The trend vector is not shown if altitude remains constant or if data needed for calculation is not available.

The barometric pressure setting is displayed below the Altimeter in inches of mercury or hectopascals (hPa) when metric units are selected. Adjusting the altimeter barometric pressure setting creates discontinuities in VNV vertical navigation, 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.

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.*

ALTIMETER SETTING

Turning the **BARO** Knob changes the altimeter barometric pressure setting. Pushing the BARO Knob will set standard barometric pressure (29.92), displayed as 'STD BARO'. If 'STD BARO' has been set prior to turning the BARO Knob, an Altimeter Setting Preview Window is displayed upon turning the knob as shown in the following figure. The preview altimeter setting is cyan while turning the BARO Knob and momentarily afterwards, then it becomes gray. This feature allows setting the altimeter prior to descending below the standard barometric transition altitude. Pushing the BARO Knob after descending through the transition sets the previewed value to the current altimeter setting.



Figure 2-8 Altimeter Setting Preview

Selecting the Altimeter Barometric Pressure Setting:

1) Turn the **BARO** Knob to select the desired setting. If the setting is entered into the Altimeter Setting Preview Window, proceed to step 2.
2) Push the **BARO** Knob after descending past the barometric transition altitude.

Selecting standard barometric pressure:

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

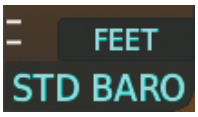


Figure 2-9 Standard Barometric Altimeter Setting

Changing Altimeter Barometric Pressure Setting Units:

1) From PFW Home**,** touch **PFD Settings**.
2) Scroll down, and touch the **Baro Select Units** Button.
3) Touch either the **Inches (IN)** or **Hectopascals (HPA)** Button.

Or

1) Press the **PFD Settings** Softkey.
2) Press the **Other PFD Settings** Softkey.
3) Press the **Altitude Units** Softkey.
4) Press either the **IN** or **HPA** Softkey.
5) When finished, touch the **Back** Button.

AUTOMATICALLY SWITCH BARO

When Automatically Switch BARO is enabled the system will automatically switch to the STD Baro setting upon climbing past the transition altitude. It will switch back to the previous altimeter setting upon descending back through the transition altitude.

Enabling/disabling Automatically Switch BARO:

1) From MFW Home, touch **Utilities** >**Setup** > **Avionics Settings**.
2) Touch the **System** Tab.
3) Touch the **Automatically Switch BARO** Button to turn the alert on or off.

BAROMETRIC TRANSITION ALTITUDE ALERT

The Baro Transition Alert serves as a reminder to the pilot to change the barometric pressure setting to standard when climbing through the barometric transition altitude, or to change the barometric pressure setting from standard to the local altimeter setting when descending through the barometric transition altitude. This is displayed by the flashing cyan barometric pressure setting when crossing the transition altitude.

There are two distinct options for alerts, BARO Transition ALT Climb when climbing through the transition altitude, and BARO Transition LVL Descent when descending through the transition level. Users may set the alerts individually through the following procedure, or may choose to use the published altitude by selecting the **Revert to Published** Button. Selecting this button after a user-defined entry has been made reverts to the published transition altitude of the origin airport for BARO Transition ALT Climb and of the destination airport for BARO Transition LVL Descent.

Setting the Baro Transition Alert:

1) From the MFW Home Screen, touch **Utilities** >**Setup** > **Avionics Settings**.
2) Touch the **Alerts** Tab.
3) To enable the alert, touch the **BARO Transition ALT Climb** Button or **BARO Transition LVL Descent** Button.
4) To set or change the Baro Transition Alert Altitude, touch the respective data field. Enter the desired altitude or flight level on the keypad, and touch the **Enter** Button.



Figure 2-10 BARO Transition Alert

VERTICAL SPEED INDICATOR (VSI)

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 1000 and 2000 feet per minute. Minor tick marks appear for every 500 fpm. If the current vertical speed is greater than 100 fpm, digits appear in the pointer. If the rate of ascent/descent exceeds 2000 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 5 and 10 meters per second. Minor tick marks appear for every 2.5 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 is displayed on the VSI to indicate the Required Vertical Speed for reaching a VNAV target altitude once the "TOD [Top of Descent] within 1 minute" alert has generated. See the Flight Management and AFCS sections for details on VNAV features. Refer to Section 2.3, Supplemental Flight Data, for more information about VNAV indications on the PFD.

VERTICAL DEVIATION

When Vertical Navigation (VNAV) is being used, the Vertical Deviation Indicator (VDI) appears to the left of the altimeter and is displayed with a magenta 'V' at the top of the scale and a magenta chevron indicating the baro-VNAV vertical deviation. The VDI appears in conjunction with the "TOD within 1 minute" alert. The VDI is removed from the display if vertical deviation becomes invalid. See the Flight Management Section for details on VNAV features, and refer to Section 2.3, Supplemental Flight Data, for more information about VNAV 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. The Glideslope Preview, a hollow gray diamond, is displayed when the navigation source is set to GPS, in addition to a localizer frequency being tuned on the navigation receiver and receiving glideslope information. When the system auto-switches the active navigation source to the localizer frequency the Glideslope Indicator is displayed as a solid green diamond. If a localizer frequency is tuned and there is no glideslope, "NO GS" is displayed in place of the diamond.

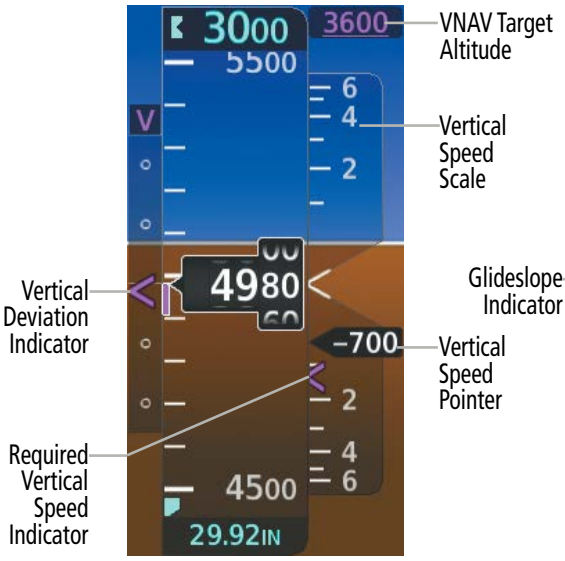


Figure 2-11 Vertical Speed and Deviation Indicators (VSI and VDI)

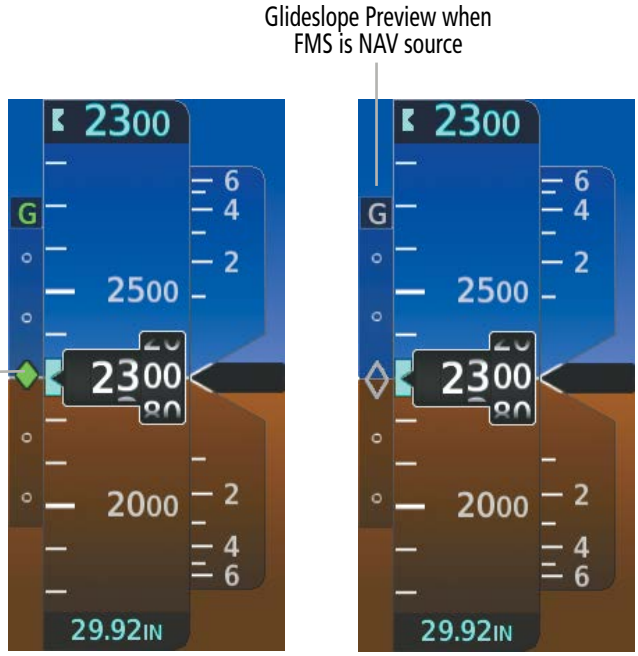


Figure 2-12 Glideslope Indicator

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

The Glidepath Indicator is a vertical deviation scale for GPS approach service levels supporting SBAS vertical guidance (LNAV/VNAV, LPV) or advisory vertical guidance (LNAV+V, LP+V, Visual). The Glidepath Indicator, a magenta diamond (see following figure) appears on the display as soon as the Final Approach Fix (FAF) becomes the active waypoint, and FMS is the selected navigation source. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is +/-492 feet (150 meters) and lower limit depends upon the approach service level as follows:

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

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

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.

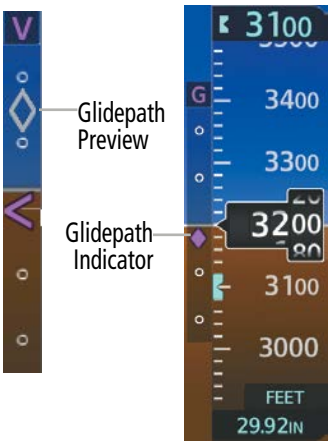


Figure 2-13 Glidepath Indicator

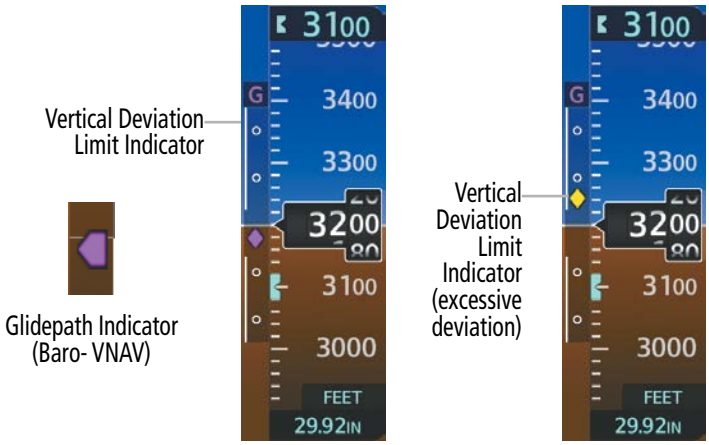


Figure 2-14 Glidepath Indicator with Vertical Deviation Limit Indicators

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 Screen of the Touchscreen Controller.

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 active, the Glidepath Indicator is labeled with a magenta 'V' and appears as a magenta pentagon, when active, or as a gray pentagon prior to being active. The pentagon is amber when excessive vertical deviation indicators are present, and the indicator is within an area of excessive deviation. The system automatically applies temperature compensation to this displayed glidepath using data from the aircraft's temperature probe. This compensation occurs without any action from the flight crew.

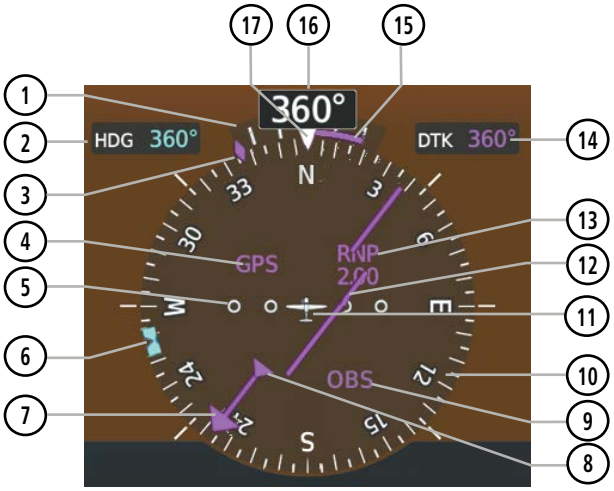
If the approach type downgrades past the final approach fix (FAF), "NO GP" is displayed in place of the pentagon.

NOTE: *For information about manually applying temperature compensation to waypoints prior to the Baro-VNAV approach glidepath becoming active, refer to the Flight Management Section.*

HORIZONTAL SITUATION INDICATOR (HSI)

The Horizontal Situation Indicator (HSI) displays a rotating compass in a heading-up orientation. Letters indicate the cardinal points and numeric labels occur every 30°. Major tick marks are at 10° intervals and minor tick marks at 5° intervals. A digital reading of the current heading appears on top of the HSI, and the current track is represented on the HSI by a magenta diamond bug. A dashed gray line appears below this bug as an additional visual representation of the current track. The HSI also presents turn rate, course deviation, bearing, and navigation source information and is available in two formats (360° compass rose and HSI Map).

The HSI with the HSI Map disabled contains 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 LOC1) or a double line arrow (VOR2 and LOC2) which points in the direction of the set course. The To/From arrow rotates with the course pointer and is displayed when the active NAVAID is received.



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

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

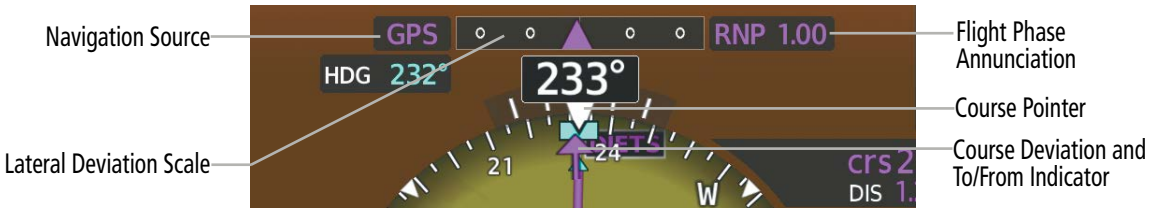


Figure 2-15 HSI Map

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 for three seconds after it is adjusted, if the HSI Map is disabled. If the HSI is enabled, the Selected Heading remains indefinitely. The Selected Heading 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 GPS 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 GPS with OBS Mode active. Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the HSI can appear in two different ways: an arrowhead (GPS, VOR, OBS) or a diamond (LOC).

When the pilot enables the HSI Map, the HSI is formatted to show a navigation map on the rotating compass card. The following information surrounds the compass rose 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/Suspect Mode Status
- Dead Reckoning (DR) Mode Annunciation
- Crosstrack Error (XTK)

Changing the HSI Display Format:

1) From PFW Home, touch **PFD Map Settings**.
2) Touch the **Layout** Button.
3) Touch the **HSI Map** Button.

Or

1) Press the **PFD Map Settings** Softkey.
2) Press the **Map Layout** Softkey.
3) Press the **HSI Map** Softkey.

Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the can appear in two different ways: an arrowhead (GPS, VOR, OBS) or a diamond (LOC).

The Selected Heading is shown to the upper left of the HSI for three seconds after being adjusted, if the HSI Map is disabled. If the HSI is enabled, the Selected Heading remains indefinitely. The Selected Heading corresponds to the cyan heading bug on the compass rose. While the HSI is displayed in HSI Map format, if the Selected Heading Bug is adjusted off the shown portion of the compass rose, the Selected Heading Bug will appear at the edge of the HSI Map.

Adjusting the Selected Heading:

1) Turn the **HDG** Knob on the AFCS Controller to set the Selected Heading.
2) Push the **HDG** Knob to synchronize the bug to the current heading.

Adjusting the Selected Course:

1) Turn the upper knob to set the Selected Course.
2) Push the upper knob to re-center the CDI and return the course pointer to the bearing of the active waypoint or navigation station.

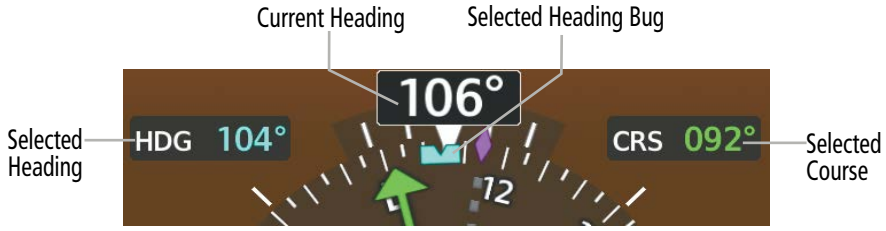


Figure 2-16 Heading and Course Indications (Magnetic)

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation or referenced to true north (denoted 'T'), and are set on the Avionics Settings Screen. 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 2-17 Heading and Course Indications (True)

Changing the Navigation Angle Setting:

1) From MFW Home, touch **Utilities** >**Setup** > **Avionics Settings**.
2) Touch the **Units** Tab.
3) Touch the **Nav Angle** Button.
4) Touch either the **Magnetic (°)** Button or **True (°T)** Button.



Figure 2-18 Navigation Angle Settings

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 six 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 four deg/sec, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.



Figure 2-19 Turn Rate Indicator and Trend Vector

BEARING POINTERS

Two bearing pointers and associated information can be displayed on the HSI for NAV and GPS sources by pressing the Bearing 1 Softkey or the Bearing 2 Softkey on the PFD or by touching the Bearing 1 Button or the Bearing 2 Button on the 'PFW Home' Screen of the GTC. The bearing pointers are cyan and are single-line (Bearing 1) or double-line (Bearing 2). A pointer symbol is shown in the NAV/DME Information Windows to indicate the navigation source. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring. Bearing pointers may be selected but not necessarily visible due to data unavailability.

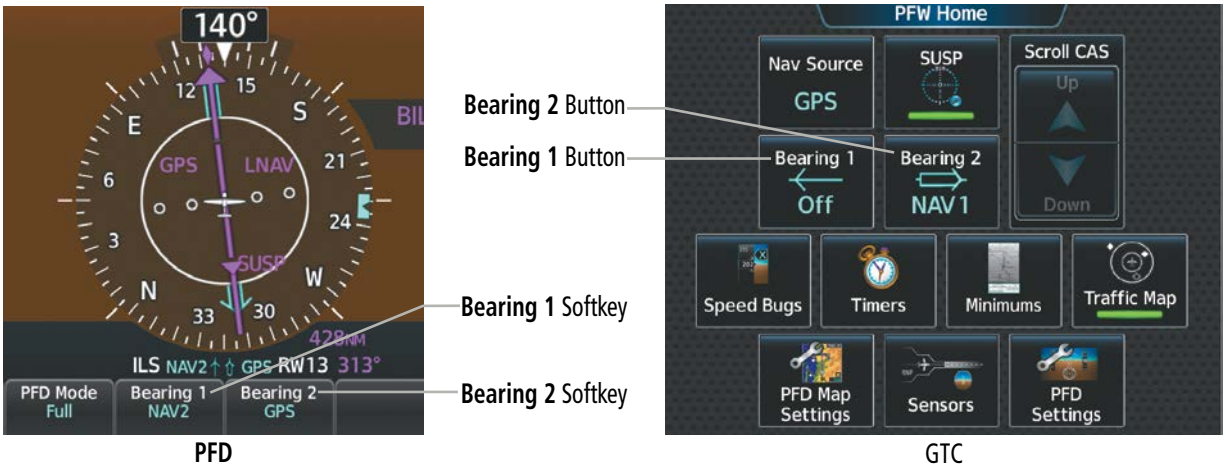


Figure 2-20 Bearing Pointer Selection

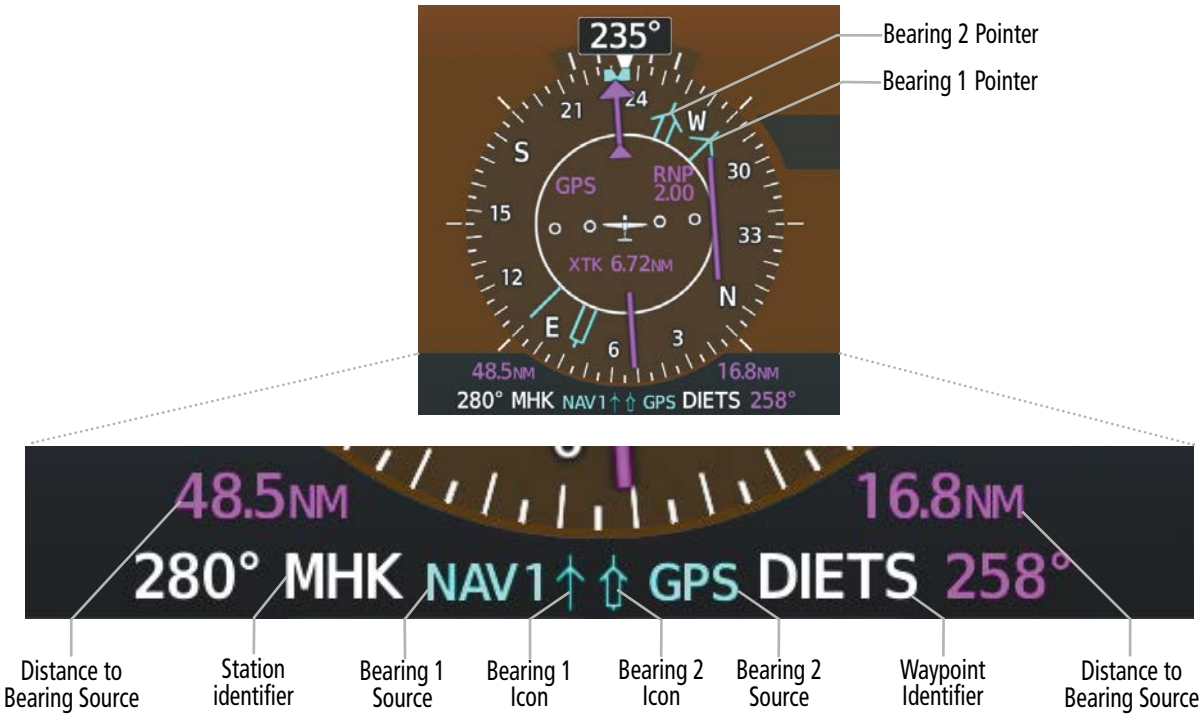


Figure 2-21 HSI with Bearing and DME Information

When a bearing pointer is displayed, the following information is displayed below the HSI:

- Bearing source (NAV, GPS, ADF, , BEST GLIDE, WPT)
- Pointer icon (Bearing 1 = single line, Bearing 2 = double line)
- Frequency
- Station or waypoint identifier
- GPS-derived great circle distance to bearing source

When the NAV radio is tuned to an ILS frequency, the bearing source and bearing pointer are removed from the HSI. When NAV1 or NAV2 is the selected bearing source, the frequency is replaced by the station identifier when the station is within range. If 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 dashes appear next to the bearing source if the NAV radio is not receiving the tuned VOR station or if GPS is the bearing source and no waypoint is active.

Selecting Bearing Display and Changing Sources:

1) From PFW Home, touch the **Bearing 1** Button or the **Bearing 2** Button to change the source with each touch (Off, GPS,NAV1, NAV2, ADF, BEST GLIDE, WPT).
2) To remove the bearing pointer and information, touch the **Bearing 1** Button or the **Bearing 2** Button followed by the **Off** Button.

Or

1) Press the **PFD Settings** Softkey.
2) Press the **Bearing 1** Softkey or the **Bearing 2** Softkey to change the source with each touch (NAV1, NAV2, GPS, ADF, WPT, and Off).

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.

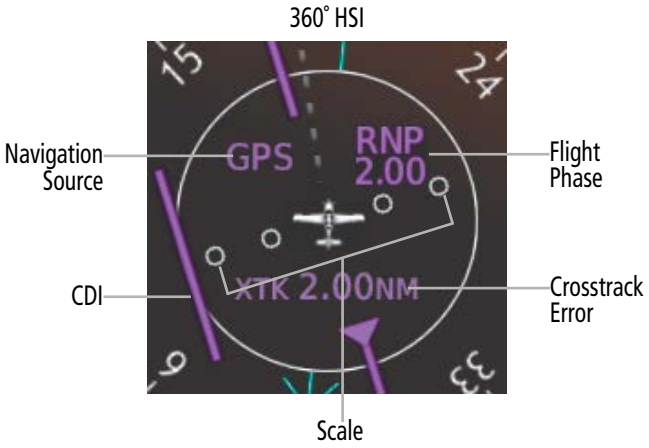


Figure 2-22 Course Deviation Indicator

The CDI can show GPS, VOR, or LOC as the navigation source. Color indicates the current navigation source, magenta for GPS and green for VOR and LOC. The full scale limits for the CDI are defined by an GPS-derived distance when coupled to the GPS. If the CDI exceeds the maximum deviation on the scale (two dots) while navigating with GPS, the crosstrack error (XTK) is displayed below the white aircraft symbol. When navigating using a VOR or localizer (LOC), the CDI scale indicates five degrees for the first dot and 10 degrees for the second dot.

An approach course preview appears as a dashed gray pointer and CDI on the HSI when GPS is the selected navigation source and all of the following conditions are met:

- A ILS or localizer approach is loaded.
- The approach frequency is tuned.
- The aircraft is in the terminal or approach flight phase.
- The aircraft is within 30 nm of the localizer.

As the aircraft approaches the final approach course, the two course pointers converge. When the system auto-switches to the localizer NAV source the pointer and CDI becomes green.

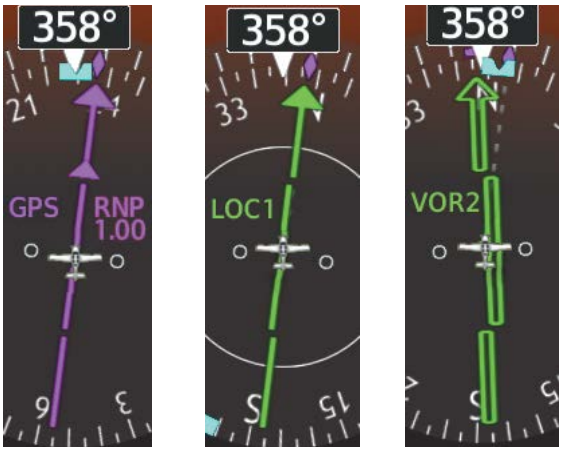


Figure 2-23 Navigation Sources

The FMS supports the use of GPS to aid in the conduct of VOR and VOR/DME approaches. In this configuration, a preview of the VOR final approach course is displayed on the HSI using the same criteria as used to determine when the preview for localizer-based approaches is available.

The VOR approach preview is not intended to alert the crew to a pending CDI navigation source change, rather it allows the crew to monitor deviations from the VOR course as a means of complying with the published approach procedure, while still using GPS to provide a course for the aircraft.

Some VOR approaches are approved for use of GPS as a substitute means of navigation, meaning it is not necessary to tune or monitor the VOR associated with the approach. These are referred to as "overlay approaches" and are indicated on the approach selection page by the presence of "GPS" after the VOR or VOR/DME prefix.

The system displays "LNAV" or "LNAV+V" after the approach title on the selection page and makes vertical deviation available as appropriate for NDB approaches in a fashion similar to VOR approaches. LNAV approaches provide lateral GPS based guidance to legs defined by the navigation database.

Changing Navigation Sources:

From PFW Home, touch the **Nav Source** Button to select GPS, VOR1/VOR2, or LOC1/LOC2.

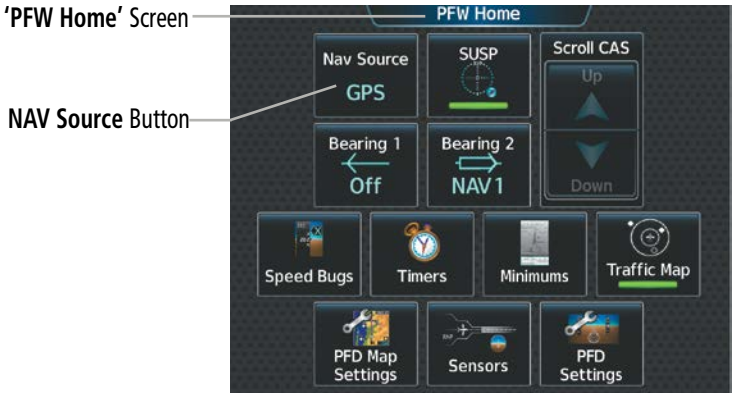


Figure 2-24 Selecting a Navigation Source using the GTC

Or:

1) Press the **Active NAV** Softkey to change from GPS to VOR1/LOC1.
2) Press the **Active NAV** Softkey again to change from VOR1/LOC1 to VOR2/LOC2.
3) Press the **Active NAV** Softkey a third time to return to GPS.



Figure 2-25 Selecting a Navigation Source using the PFD

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 (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 FMS to LOC. The probability of this occurring varies based on air temperature.

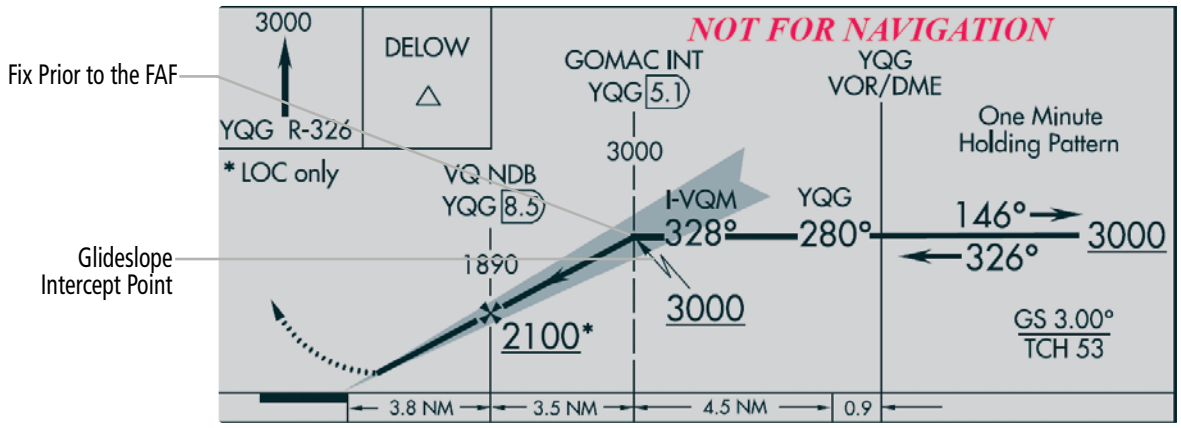


Figure 2-26 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

REQUIRED NAVIGATION PERFORMANCE AND ESTIMATED POSITION ERROR

GPS is the only sensor that meets the rigorous analysis necessary for RNP integrity requirements. Current position, manual position updates, current flight phase mode, Estimated Position Error (EPE), and RNP setting is accessed from the RNP/EPE Tab on the 'Sensors' Screen.

The RNP setting is automatically set by the system based upon the current phase of flight or information from the navigation database. The RNP setting may be manually adjusted to a lower RNP value. A higher RNP setting may only be entered if the current flight phase is enroute or oceanic and the database does not dictate a lower number. If RNP has been manually overridden, it will persist until canceled, power is cycled, or until the system sequences onto a leg that requires a lower RNP.

Setting the RNP Manually:

1) From MFW Home, touch **Utilities > FMS Sensors > RNP/EPE** Tab.
2) Touch the **RNP/EPE** Button.
3) Enter the new RNP setting using the keypad or large/small data entry knobs.
4) Touch the **Enter** Button or push the upper right knob. The new setting is now displayed on the HSI and on the RNP Button with a pencil icon to indicate it has been manually entered.

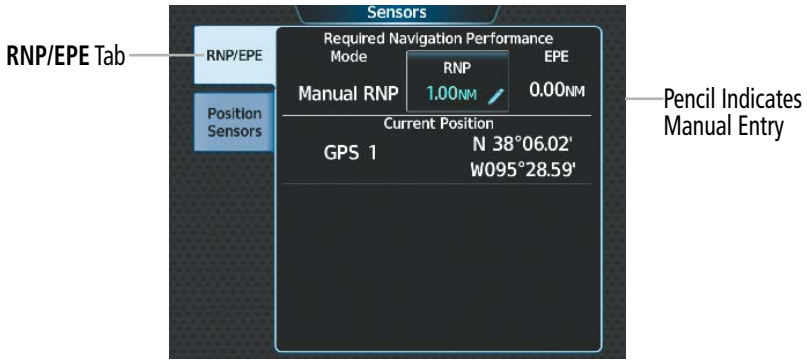


Figure 2-27 Manual RNP Setting

Canceling Manual RNP Setting:

1) From MFW Home, touch **Utilities** > **FMS Sensors**.
2) Touch the **RNP/EPE** Tab.
3) Touch the **RNP** Button.
4) Touch the **Restore Default** Button. The system now automatically sets the RNP.

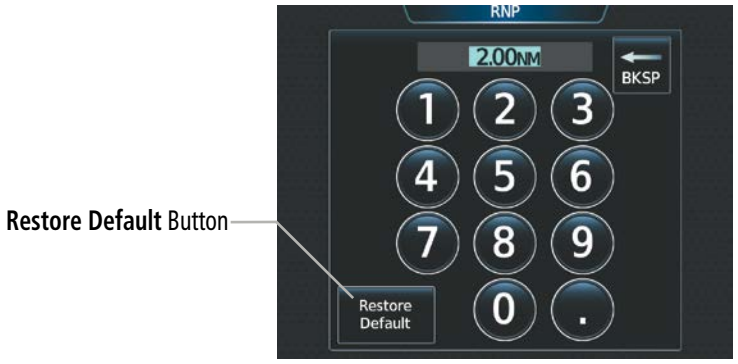


Figure 2-28 Canceling Manual RNP Setting

The RNP setting automatically adjusts to the desired limits based upon the current phase of flight.

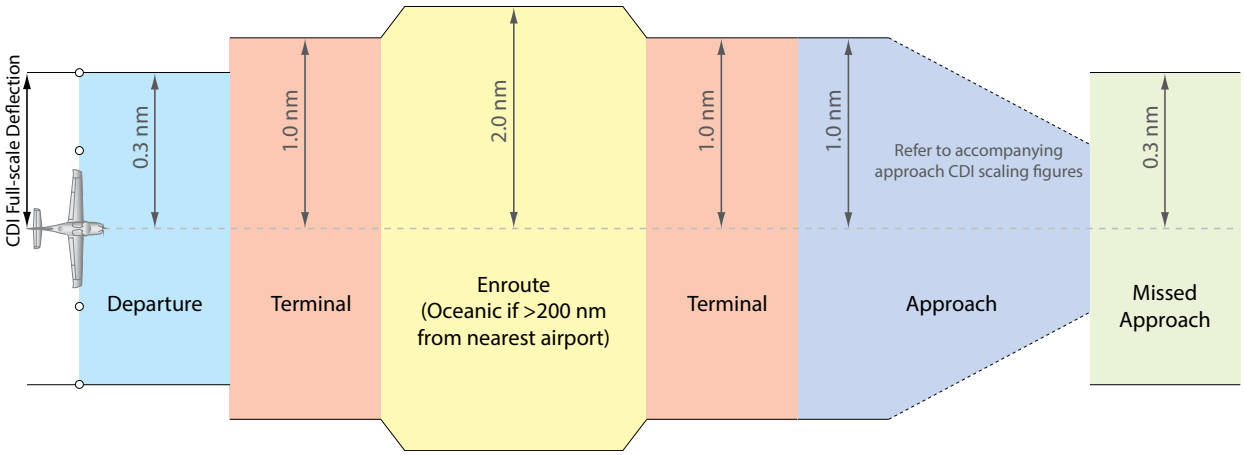


Figure 2-29 Automatic RNP CDI Scaling

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

» When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.

- If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for *oceanic* flight (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. This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vectors-To-Final (VTF) are selected.

» If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.

» If the active waypoint is part of the missed approach procedure, the active leg and the preceding missed approach legs must be aligned with the final approach segment course and the aircraft must not have passed the turn initiation point.

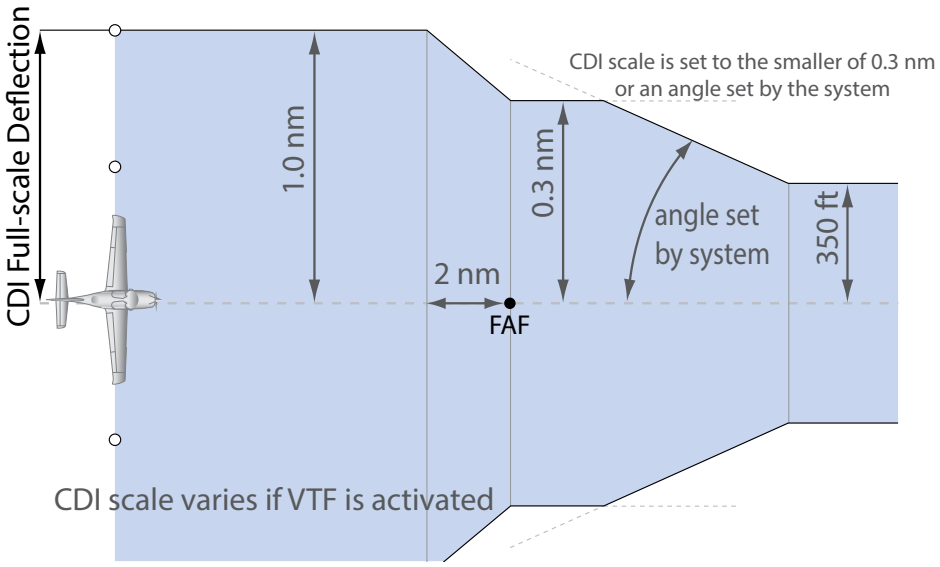


Figure 2-30 Typical LNAV and LNAV+V Approach CDI Scaling

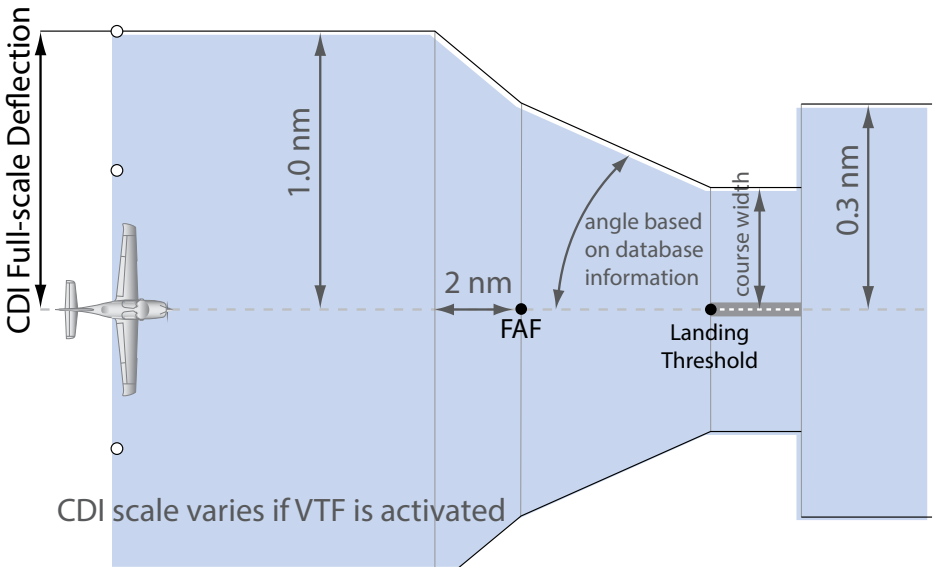


Figure 2-31 Typical LNAV/VNAV, LPV, LP+V, LP, and RNP Approach CDI Scaling

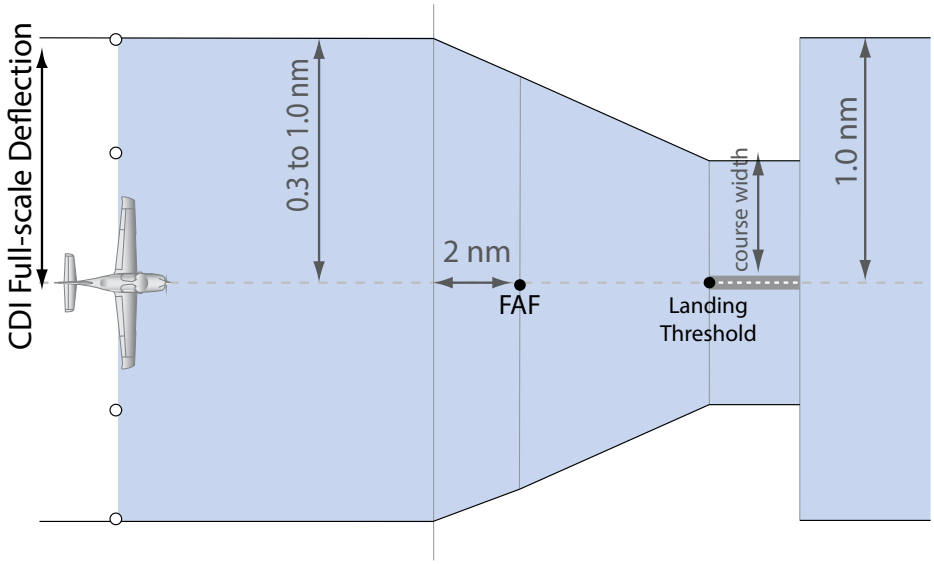


Figure 2-32 Typical RNP AR Approach (Optional) CDI Scaling

- When a *missed approach* is activated, the CDI scale changes to 0.3 nm and 'RNP 0.30' is annunciated on the HSI.
- The system automatically switches back to *terminal* mode under the following conditions:
  - » The next leg in the missed approach procedure is not aligned with the final approach path.
  - » The next leg in the missed approach procedure is an AF, HA, HF, HM, PI, RF, VA, VD, VI, VM, or VR leg.
  - » After any leg in the missed approach procedure that is not a CA or FA leg.

Flight Phase	Annunciation[1]	Automatic CDI Full-scale Deflection
Departure	RNP 0.30	0.3 nm
Terminal	RNP 1.00	1.0 nm
Enroute	RNP 2.00	2.0 nm
Oceanic	RNP 4.00	4.0 nm
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables (Figure 2-30)
Approach (Non-precision with Vertical Guidance)	LNAV + V	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (Figure 2-31)
Approach (LPV)	LPV	
Approach (LP)	LP	
Approach (LP+V)	LP+V	
Missed Approach	RNP 0.30	0.3 nm

[1] *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: *VNAV 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 displayed to the lower right of the aircraft symbol when OBS Mode is selected.

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 system resumes automatic sequencing of waypoints, and follows the course set in OBS Mode. The flight path on the moving map retains the modified course line. Sequencing will occur based upon the automatic waypoint sequencing criteria. Depending on aircraft position, crosstrack error, and turn anticipation arc, the system may sequence sooner than expected, or to a different waypoint than expected.



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

Enabling/Disabling OBS Mode While Navigating a GPS Flight Plan:

1) From PFW Home, touch the **OBS** Button to select OBS Mode.
2) Turn the upper knob to select the desired course to/from the waypoint. Push the upper Knob to synchronize the Selected Course with the bearing to the next waypoint.
3) Touch the **OBS** Button again to return to automatic waypoint sequencing.

Or

1) Press the OBS Softkey to select OBS Mode
2) Turn the upper knob to select the desired course to/from the waypoint. Push the upper 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 Button label changes to SUSP, indicating that suspension is active. To deactivate the suspension and resume automatic sequencing of approach waypoints, touch the SUSP Button.

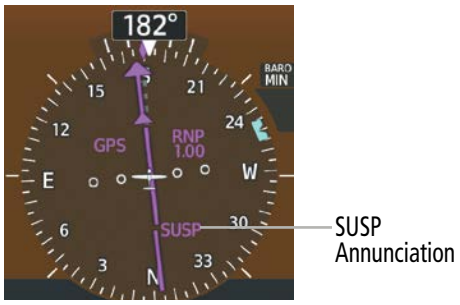


Figure 2-34 Suspension of Automatic Waypoint Sequencing

GPS ABOVE GROUND LEVEL ALTITUDE

The GPS Above Ground Level (GAGL) altitude is displayed by default in the lower right of the PFD under normal and reversionary display conditions. The GAGL will be displayed as black text on a white background in increments of 20 feet starting at 200 feet AGL. The GAGL will transition to a magenta text display when the aircraft exceeds 600 feet AGL.

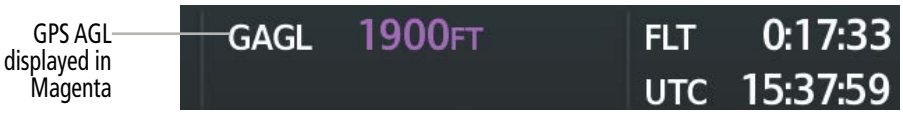


Figure 2-35 GPS Above Ground Level (GAGL) Display on the PFD

ANGLE OF ATTACK (AOA) INDICATOR

The Angle of Attack (AOA) Indicator is only available with the ice protection option.

The AOA Indicator appears on the PFW below the Airspeed Indicator and displays the normalized angle of attack. White, amber, and red arcs indicate AOA ranges. A normalized AOA value of 1.0 corresponds to a stall. The system dynamically calculates the red and amber arc ranges based on parameters such as bank angle, and flaps position. The red arc begins at the Stall Warning threshold and ends at 1.0 (Stall threshold). The amber arc represents maneuvering margin to a 35 degree bank angle. The pointer color matches the color of the arc associated with the current AOA value.

The flight crew can enable/disable the display of the AOA Indicator on the PFW, or select the Auto Mode. In auto mode, the AOA Indicator appears when the AOA is 0.2 or greater, or the flaps are partially or fully extended. Otherwise, the AOA Indicator is removed. Refer to Additional Features section for details regarding the optional Garmin ESP™.

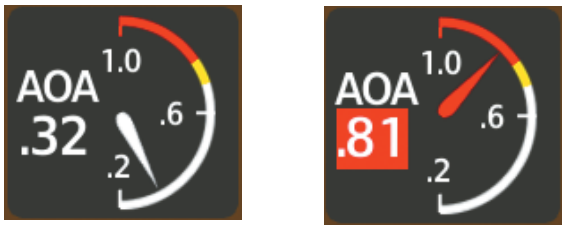


Figure 2-36 Angle of Attack (AOA) Indicator

Selecting the AOA Indicator Display Mode:

1) From PFW Home, touch the **PFD Settings** Button.
2) Touch the **AOA** Button.
3) Touch the On, Off, or Auto Button.

Or

1) Press the **PFD Settings** Softkey.
2) Press the **Other PFD Settings** Softkey.
3) Press the **AOA** Softkey to cycle through the different modes (On, Off, or Auto).



Figure 2-37 AOA Settings

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.*

Garmin SVT™ (Synthetic Vision Technology) is a visual enhancement to the system that depicts a forward-looking attitude display of the topography immediately in front of the aircraft. The field of view is 44 degrees to the left and 44 degrees to the right. SVT information is shown on the Primary Flight Display (PFD), or on the Multifunction Display (MFD) in Reversionary Mode. The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and a 4.9 arc-second database of terrain, obstacles, and other relevant features. The terrain data resolution of 4.9 arc-seconds, meaning that 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 until the required data is restored.

The SVT terrain display shows land contours (colors are consistent with those of the topographical map display), large water features, towers, and other obstacles over 200' AGL that are included in the obstacle database. Wire obstacles, such as power lines, may be also shown in the vicinity of airports; refer to the WireAware™ discussion later in this section for additional information. 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.

The Terrain Awareness and Warning System (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.

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 TAWS terrain or obstacle data displayed by the SVT.

The following SVT enhancements appear on the PFD:

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



Figure 2-38 Synthetic Vision Imagery

SVT OPERATION

SVT is enabled using PFD softkeys located along the bottom edge of the display or from the GTC. Pressing softkeys or buttons turns the related function(s) on or off. A green annunciation indicates the feature is enabled. Whenever SVT is enabled, the Flight Path Marker is automatically displayed on the PFD.

Softkey/Button	Function
Auto	Synthetic Vision will display Taxi View when on the ground and Flight View when in the air.
Flight	Synthetic Vision is always displayed.
Off	Synthetic Vision is not displayed.
Pathways	Displays/removes rectangular boxes that represent course guidance.
Runway Locator	Displays/removes cyan chevrons pointing towards the runway and aligned with its centerline. Numeric markers are depicted next to the chevrons denoting distance from the runway threshold.
Airport Signs	Displays/removes airport signposts.
Wire	Displays/removes wire obstacles present in the obstacle database.
Horizon Heading	Displays/removes heading marks and digits on the Zero Pitch Line.

Table 2-3 SVT Softkey and Button Functions

Enabling/Disabling SVT Modes:

1) From PFW Home, touch **PFD Settings > Synthetic Vision**.
2) Touch the Auto, Flight, or Off Button.

Or

1) Press the **PFD Settings** Softkey.
2) Press the **SVT Mode** Softkey.
3) Press the Auto, Flight, or Off Softkey.

Enabling/Disabling SVT Settings (SVT must be enabled):

1) From PFW Home, touch the **PFD Settings > Settings**.
2) Touch the Pathways, Runway Locator, Airport Signs, or Wire Buttons.

Or

1) Press the **PFD Settings** Softkey.
2) Press the **SVT Settings** Softkey.
3) Press the Pathways, Runway Locator, Airport Signs, or Wire Softkeys.

Enabling/Disabling SVT Horizon Heading (SVT must be enabled):

1) From PFW Home, touch **PFD Settings > Horizon Heading**.

Or

1) Press the **PFD Settings** Softkey.
2) Press the **Attitude Instruments** Softkey.
3) Press the **Horizon Heading** Softkey.



Figure 2-39 SVT Softkey Levels on the PFD



Figure 2-40 Synthetic Vision Button



Figure 2-41 SVT Settings Button

SVT FEATURES

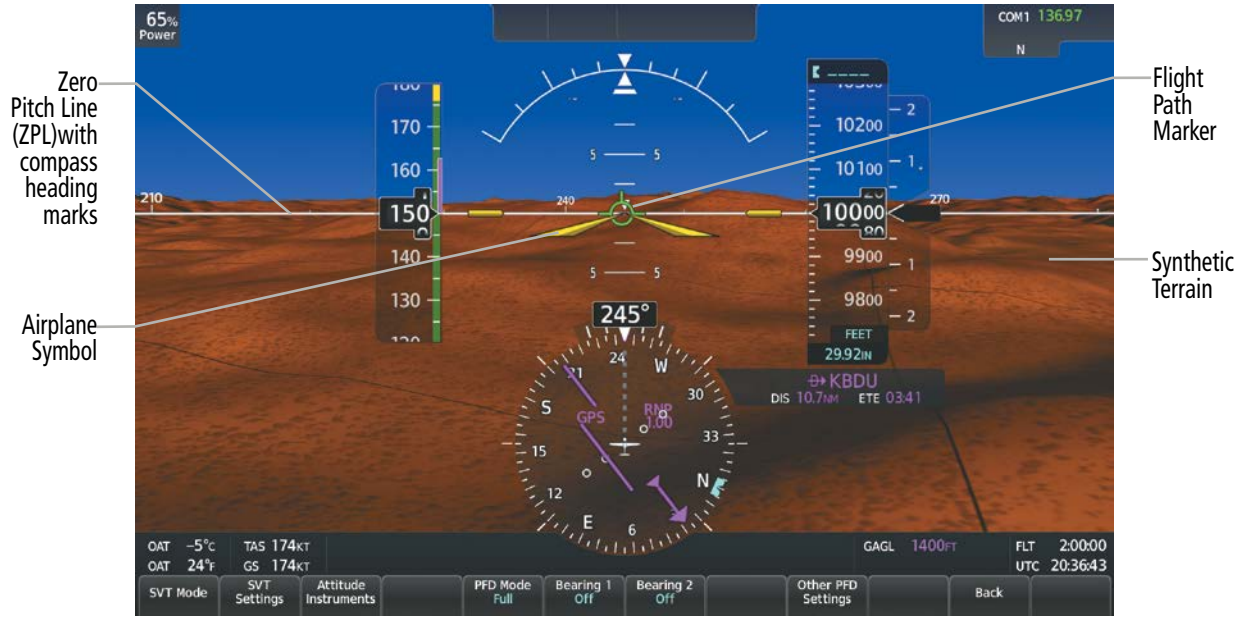


Figure 2-42 SVT Flight or Auto mode enabled

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

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 appears when the Synthetic Terrain feature is enabled. 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.



Figure 2-43 Flight Path Marker Position is Affected by Wind

ZERO PITCH LINE

The Zero Pitch Line (ZPL) 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 approximately 60 degrees of compass heading in 30-degree increments on the Zero Pitch Line. Horizon Heading tick marks and digits appearing on the zero pitch line are not visible behind either the airspeed or altitude display. Horizon Heading is used for general heading awareness, and is activated and deactivated using the GTC or PFD softkeys. Refer to SVT Operation in this section for procedures to display Horizon Heading.

TRAFFIC

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

Traffic symbols are displayed in their approximate locations as determined by the related traffic systems. Traffic symbols are displayed in three dimensions, appearing larger as they are getting closer, and smaller when they are further away. Traffic within 250 feet laterally of the aircraft will not be displayed on the SVT display. Traffic symbols and coloring are consistent with that used for traffic displayed in the Inset map or MFD traffic page. If the traffic altitude is unknown, the traffic will not be displayed on the SVT display. For more details refer to the traffic system discussion in the Hazard Avoidance section.

AIRPORT SIGNS

Airport Signs provide a visual representation of airport location and identification on the synthetic terrain display. When activated, the signs appear on the display when the aircraft is approximately 15 nm from an airport and disappear at approximately 4.5 nm. Airport signs are shown without the identifier until the aircraft is approximately eight nautical miles from the airport. Airport signs are not shown behind the airspeed or altitude display. Airport signs are activated and deactivated by pressing the Airport Signs Softkey (PFD) or touching the Airport Signs Button (GTC). Refer to SVT Operation in this section for procedures to display Airport Signs.



Figure 2-44 SVT Airport Signs

RUNWAYS

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.*

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. If the optional SurfaceWatch™ feature is installed, additional detail appears on the runways and taxiways; refer to the Additional Features section for more information.

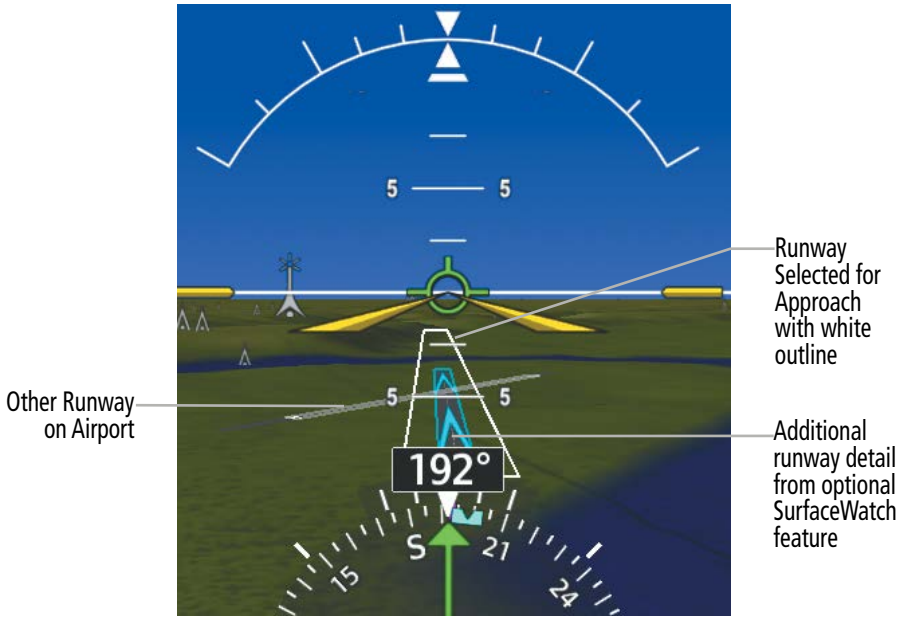


Figure 2-45 Airport Runways

Runway Locator

The Runway Locator feature will show a series of cyan chevrons leading to the destination airport. The Runway Locator chevrons will fade into view when the aircraft is within a 25 NM radius from the destination airport. Chevrons will initially show 4 NM intervals. As the aircraft gets closer to the airport chevrons will appear at 2 NM intervals and then 1 NM intervals. The chevrons will extend from the airport to a distance of no greater than 10 NM.

The number indicating the distance from the runway threshold will always appear to the side of the chevron opposite of the runway centerline approach. For example, if approaching from the left side of centerline, the numbers will appear on the right side of the chevron.

When over rough terrain, the chevrons will contour with that terrain to increase visibility.

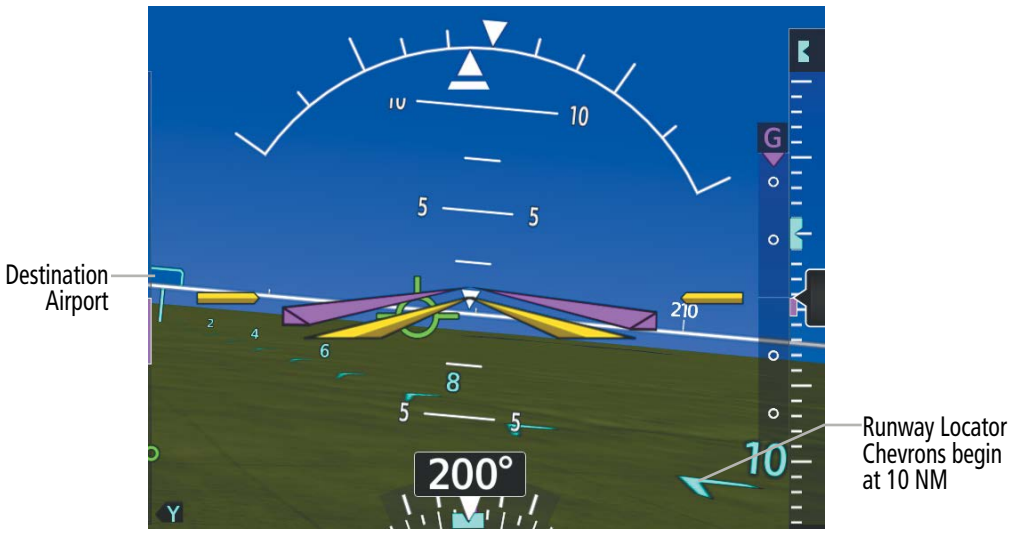


Figure 2-46 Runway Locator

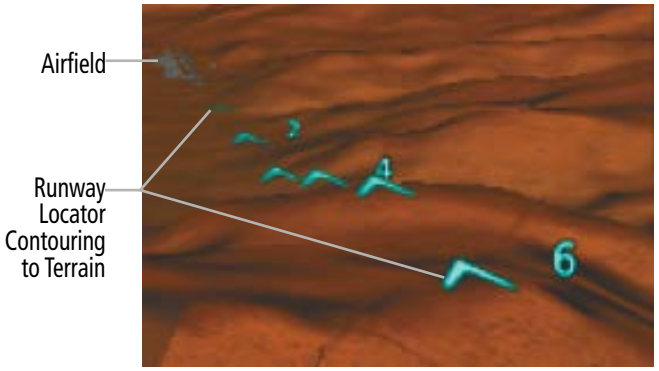


Figure 2-47 Runway Locator (Terrain Contouring)

TERRAIN ALERTING

Terrain alerting on the synthetic terrain display is triggered by Forward-Looking Terrain Avoidance (FLTA) alerts. In addition to the yellow terrain shading for a caution alert and the red shading for a warning alert, TAWS alerting or Terrain SVT will also indicate potential impact areas. These potential impact areas correspond to red and/or yellow symbols on the PFD Inset Map, Navigation Map Panes, and the TAWS or terrain SVT Pane. For more detailed information regarding TAWS or Terrain SVT, refer to the Hazard Avoidance Section.

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

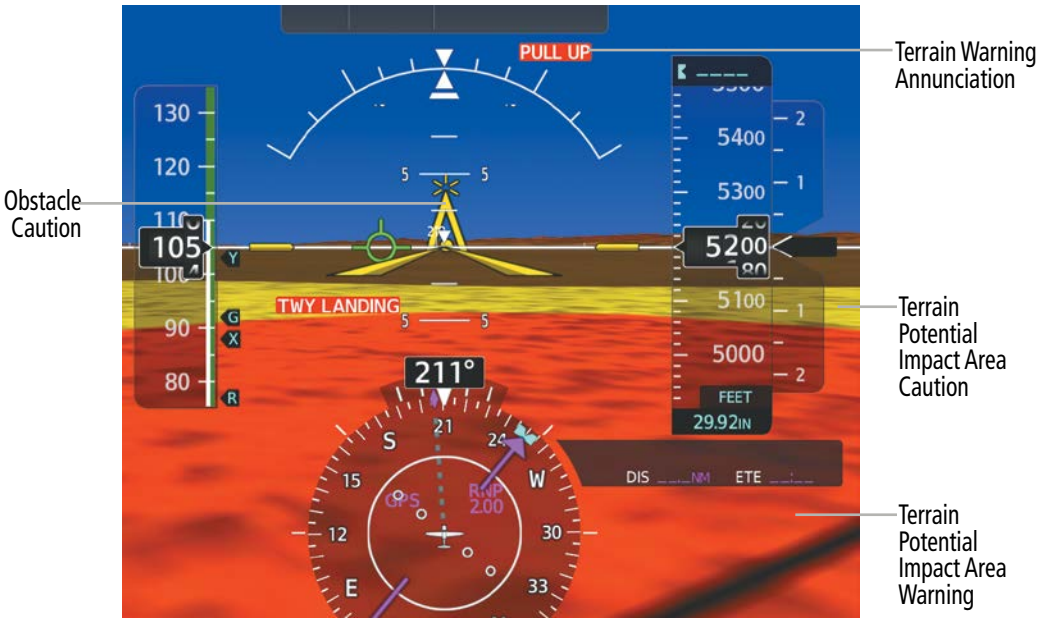


Figure 2-48 Terrain and Obstacle Alert

Obstacles are represented on the synthetic terrain display by standard two-dimensional tower symbols found on the navigation maps and charts. Obstacle symbols appear in the perspective view with relative height above terrain and distance from the aircraft. When employing the TAWS or Terrain SVT system, unlike the Inset Map and Navigation Map Pane, obstacles on the synthetic terrain display do not change colors to warn of potential conflict with the aircraft's flight path until the obstacle is associated with an actual TAWS or Terrain SVT Forward Looking Terrain Avoidance (FLTA) alert. Obstacles greater than 1000 feet below the aircraft altitude are not shown. Obstacles are shown behind the airspeed and altitude displays.

WIREAWARE POWER LINE OBSTACLES

WARNING: *The WireAware obstacle database does not contain all known power lines. And as such, obstacle avoidance is the sole responsibility of the flight crew.*

To enhance safety, SVT incorporates Garmin WireAware wire obstacle technology. WireAware database information mainly includes Hazardous Obstacle Transmission (HOT) power lines which are typically high voltage transmission lines depicted on the VFR Sectional charts, and are considered of special interest to pilots. These include power lines which may span rivers, valleys, canyons, or be in close proximity to airports/heliports. For wire obstacles present in the obstacle database, the system shows these on the maps as well as the Synthetic Vision display; see Hazard Avoidance section for more information about WireAware alerting.

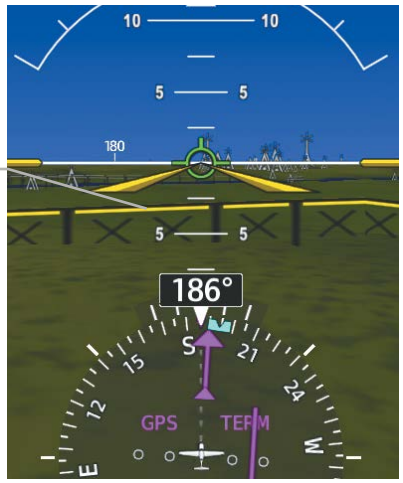


Figure 2-49 Wire Caution

FIELD OF VIEW

The PFD field of view can be represented on the Navigation Map Pane. 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 or Disabling the Field of View Indication:

1) From MFW Home, touch **Map Selection > Map Settings**.
2) Touch the **Other** Tab.
3) Scroll and touch the **Field of View** Button to enable/disable field of view display.

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

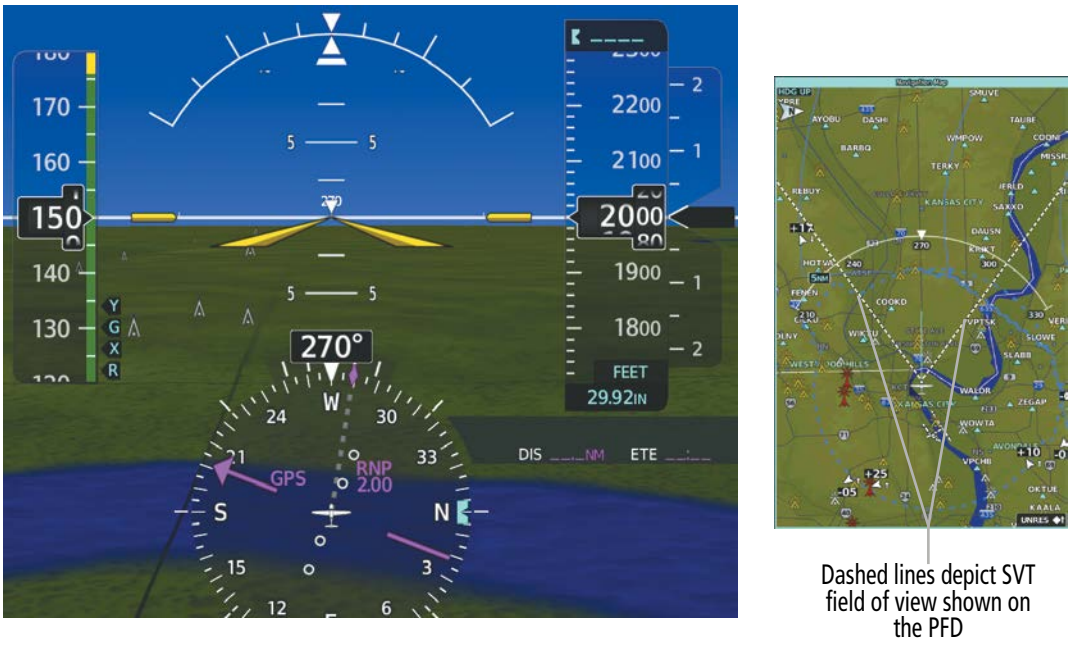


Figure 2-50 SVT with Field of View Enabled on the Navigation Map Pane

2.3 SUPPLEMENTAL FLIGHT DATA

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

WIND DATA

Wind data, such as direction and speed (relative to the aircraft) in knots, can be displayed on the bottom left of the PFD as shown in the following figure. When the window is selected for display, but wind information is invalid or unavailable, the system shows "NO WIND DATA". Wind data can be displayed in three different ways:

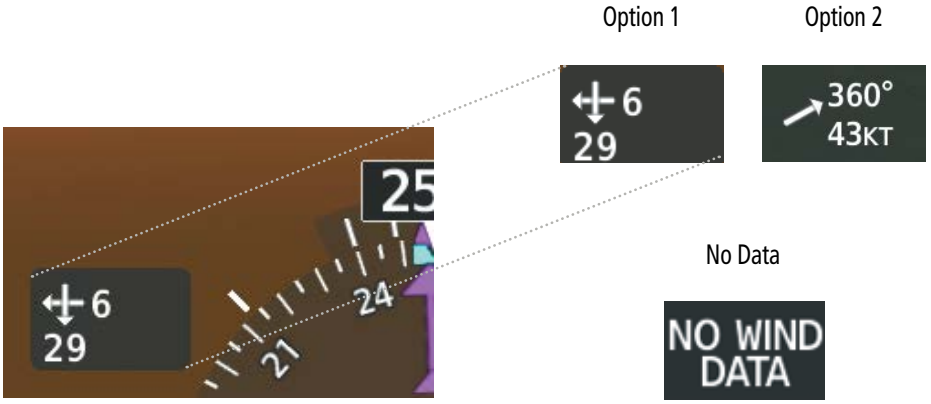


Figure 2-51 Wind Data

Displaying Wind Data:

1) From PFW Home, touch **PFD Settings > Wind**.
2) Touch the **Option 1** Button to display direction arrows with headwind and crosswind components or touch the **Option 2** Button to display wind direction arrow and speed.

Or

1) Press the **PFD Settings** Softkey.
2) Press the **Other PFD Settings** Softkey.
3) Press the **Wind** Softkey.
4 Press desired wind option softkey (**→ DEG KT, ↑→ KT,** or **Off**) to change how wind data is displayed.

TIMER

The timer can be accessed from PFD Home on the Touchscreen Controller, and allows for quick access for timing functions (either counting up or down) for the pilot.

Setting the Timer:

1) From PFW Home, touch the **Timers** Button.
2) Touch an existing timer button or **Add Timer** Button.
3) Input the desired time using the numeric keypad, then touch the **Enter** Button or push the upper knob.
4) Touch the Up or Down Button.
5) To start timer, touch the **Start** Button. When the timer is active, the button changes to a **Stop** Button.
6) To stop the timer, touch the **Stop** Button.
7) To reset the timer, touch the **Reset** Button.

VERTICAL NAVIGATION (VNAV) INDICATIONS

When a VNAV flight plan has been activated, VNAV indications (VNAV Target Altitude, RSVI, VDI) appear on the PFD in conjunction with the "TOD within 1 minute" message and double chime audio alert. See the Flight Management section for details on VNAV features. VNAV indications are removed from the PFD according to the criteria listed in the following table.



Figure 2-52 Vertical Navigation Indications (PFD)

Criteria	VNAV Indication Removed		
	Required Vertical Speed (RSVI)	Vertical Deviation (VDI)	VNAV Target Altitude
Aircraft > 1 min before the next TOD due to flight plan change	X	X	X
VNAV canceled	X	X	X
Distance to active waypoint cannot be computed due to unsupported flight plan leg type (see Flight Management Section)	X	X	Next valid VNAV target altitude displayed
Aircraft > 250 feet below active VNAV Target Altitude	X	X	X
Current crosstrack or track angle error has exceeded 75° limit	X	X	X
Active altitude-constrained waypoint can not be reached within maximum allowed flight path angle and vertical speed	X	X	

Table 2-4 VNAV 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.

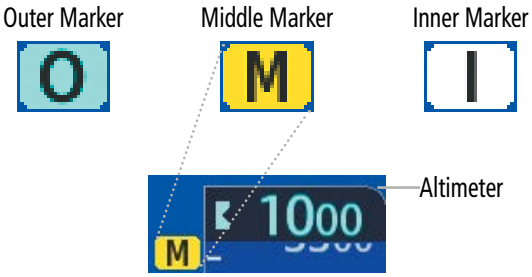


Figure 2-53 Marker Beacon Annunciations

ALTITUDE ALERTING

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

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



Figure 2-54 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION

NOTE: *The Low Altitude Annunciation is available only when SBAS is available and the TAWS system is inhibited or unavailable.*

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



Figure 2-55 Low Altitude on GPS SBAS Approach

MINIMUM ALTITUDE ALERTING

For altitude awareness, a Minimum Descent Altitude (MDA) or Decision Height (DH), based on barometric, radar (optional), or temperature compensated altitude can be set. When active, the altitude setting is displayed to the lower left of the Altimeter and with a bug at the corresponding altitude along the Altimeter (once the altitude is within the visible range of the tape).

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.

The following visual annunciations alert the pilot when approaching the MDA/DH:

- Once set, the 'BARO MIN', 'RA MIN' (optional), or 'TEMP COMP' box appears with the altitude in cyan text. The bug appears on the altitude tape in cyan once in range.
- When the aircraft passes through 100 feet of the MDA/DH, the bug and text turn white.
- Once the aircraft reaches the MDA/DH, the bug and text appear amber and the voice alert, "Minimums, Minimums", is heard.

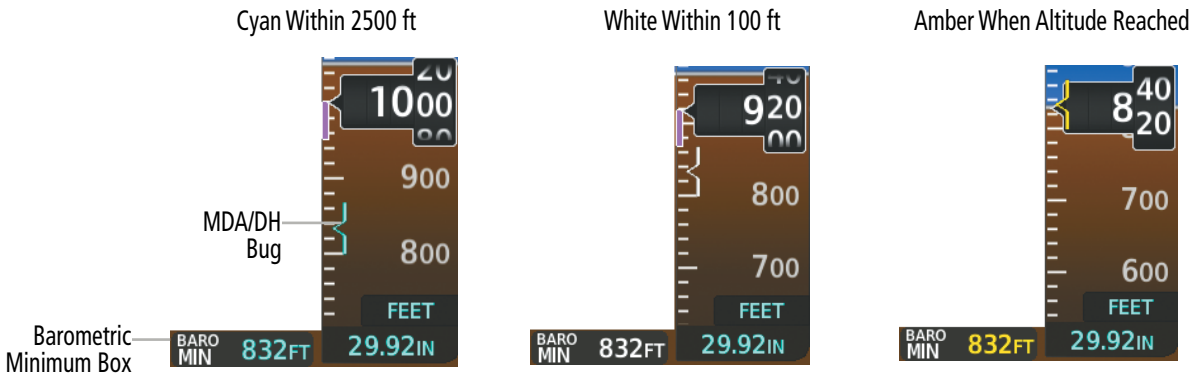


Figure 2-56 Barometric MDA/DH Alerting Visual Annunciations

Alerting is inhibited while the aircraft is on the ground and until the aircraft reaches 150 feet above the 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 Descent Altitude/Decision Height (MDA/DH) Bug:

1) From PFW Home, touch **Minimums**.

   Or:

   From MFW Home, touch **Utilities > Minimums.**

2) On the Minimums Screen, touch the **Minimums** Button.

3) To set the MDA/DH bug, touch the Baro, or Temp Comp Buttons. To disable Minimums, touch the **Off** Button.

4) If Temp Comp was selected, and the destination temperature was not entered previously, the Destination Temp Screen appears. Enter the destination temperature using the keypad or large and small knobs, then touch the **Enter** Button or push the small upper knob. If the temperature is negative, touch the +/– Button if necessary in order to place a minus sign in front of the temperature datafield.

5) Enter the MDA/DH altitude using the keypad or the large/small upper knob. When finished, touch the **Enter** Button or push the small upper knob.



Figure 2-57 Minimum Descent Altitude/Decision Height/Temp at Destination

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-5 can appear on or near the HSI when abnormal GPS conditions occur.

Annunciation	Location	Description
GPS LOI	Left of HSI	Loss of Integrity Monitoring – GPS integrity is insufficient for the current phase of flight
UNABLE RNP	Left of HSI and System Messages	The estimated GPS position error exceeds RNP limits. Check GPS signal.
GPS INTEG OK	Left of HSI	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

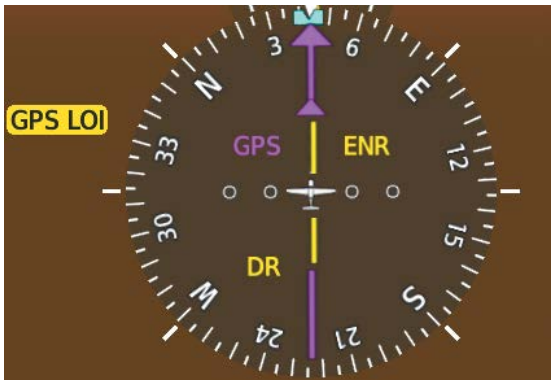


Figure 2-58 Abnormal GPS Condition Annunciations

In Dead Reckoning Mode the following items on the PFD are then shown in amber:

- CDI (when GPS is the selected navigation source; the CDI is removed after 20 minutes).
- Flight Phase.
- Current Track Bug.
- Wind Data.
- Distances to bearing sources displayed in the NAV/DME Information Bar.
- GPS bearing pointers.

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

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 a amber background. If one or both of the sensed values are unavailable, the comparator annunciation is black text on a white background. The following is a list of the possible annunciations:

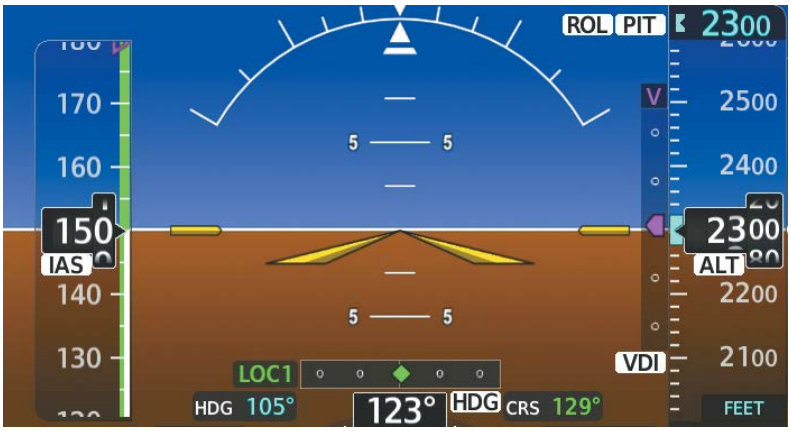


Figure 2-59 Sensor Comparator Annunciations on the PFD

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 for the AHRS and ADC is annunciated above the roll scale on the PFD. Reversionary sensor selection for the GPS is annunciated to the right of the HSI. These annunciations reflect reversionary sensors selected on the PFD. Pressing the PFD Opt Softkey accesses the Sensors Softkey. Pressing the Sensors Softkey accesses the ADC and AHRS softkeys. These softkeys allow switching of the sensors being viewed on the PFD. With certain types of sensor failures, the system may make some sensor selections automatically. The GPS sensor cannot be switched manually.

Reversionary Sensor Window Text	Condition
USING ADC2	PFD1 is displaying data from the #2 Air Data Computer.
USING AHRS2	PFD1 is displaying data from the #2 AHRS.

Table 2-7 Reversionary Sensor Annunciations

GARMIN SVT TROUBLESHOOTING

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

SVT becomes disabled without the following data resources:

- Attitude data.
- Heading data.
- GPS position data.
- 4.9 arc-second terrain data.
- Obstacle data.
- Terrain SVT or TAWS function is not available, in test mode, or failed.

UNUSUAL ATTITUDES

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

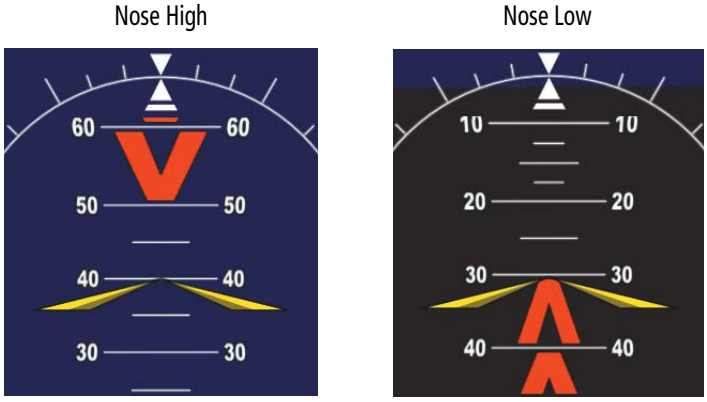


Figure 2-60 Pitch Attitude Warnings

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

If pitch exceeds +30°/-20° or bank exceeds 65°, some information displayed on the PFD is removed. The Altimeter, 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 when the aircraft experiences unusual attitudes:

- Traffic Annunciations
- AFCS Annunciations
- Flight Director Command Bars
- Inset Map
- True Airspeed
- Groundspeed
- Wind Data
- System Time
- Minimum Descent Altitude/ Decision Height display
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Altimeter Barometric Setting
- Selected Altitude
- VNAV Target Altitude
- Selected Heading
- Selected Course or Desired Track

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 2-61 Blue Sky Bar with Full Display Terrain

STANDBY FLIGHT DISPLAY

The Standby Flight Display (SFD) appears on GTC 1 due to certain failure conditions (e.g. loss of all primary AHRS, loss of all primary ADCs, loss of PFD). Additionally, the SFD also appears if all valid sensors are miscompared. If the MFD fails or is off-line, GTC1 continues to operate as a Touchscreen Controller (i.e., no Standby Flight Display), and allows the selection of MFW Mode, PFW Mode, and NAV/COM Mode.

If both the PFD and MFD fail, GTC1 shows the Standby Flight Display. Since the PFD and MFD are no longer available, the PFW Home Screen and the MFW Home Screen on the remaining Touchscreen Controller displays a large amber "X" on the controller if the PFW or MFW softkeys are pressed.

The Standby Flight Display displays the airspeed, altitude and attitude of the aircraft. Red chevrons will appear during excessive pitch up and down conditions. Standby air data is fed to the Standby Flight Display from a non-Garmin standby sensor on the aircraft. GTC 1 may not be returned to normal GTC operation until the condition(s) that caused the Standby Flight Display to originally appear are resolved. Once the condition(s) are resolved, GTC1 may be returned to normal operation by twice pressing the red Display Backup Button mounted between the PFD and MFD.

When the Standby Flight Display activates, the SFD barometric setting is initialized to be the same as the primary barometric setting from the PFD. After initialization, the SFD barometric can only be controlled by the lower knob on the GTC 1 (the SFD does not stay synchronized to the primary barometric setting after the SFD is active and initialized). If the Standby Flight Display baro setting differs from the primary baro on the PFD, both displays will be amber.

Conditions that will cause the SFD to display include:

- A difference in pitch sensors ≥ 7.5 degrees.
- A difference in roll sensors ≥ 8 degrees.
- A difference in pressure altitude sensors ≥ 250 ft.
- If airspeed is > 55 kts and the difference in sensors is >10 knots. If airspeed is < 55 kts, SFD is inhibited.
- If the SFD processor loses communication with the PFD (PFD failure).

- If the SFD processor loses communication with the GTC #1 main processor.
- If the DISPLAY BACKUP button is pressed into DISPLAY BACKUP Mode.

Softkeys and the upper and lower knobs on the GTC 1 control the Standby Flight Display.

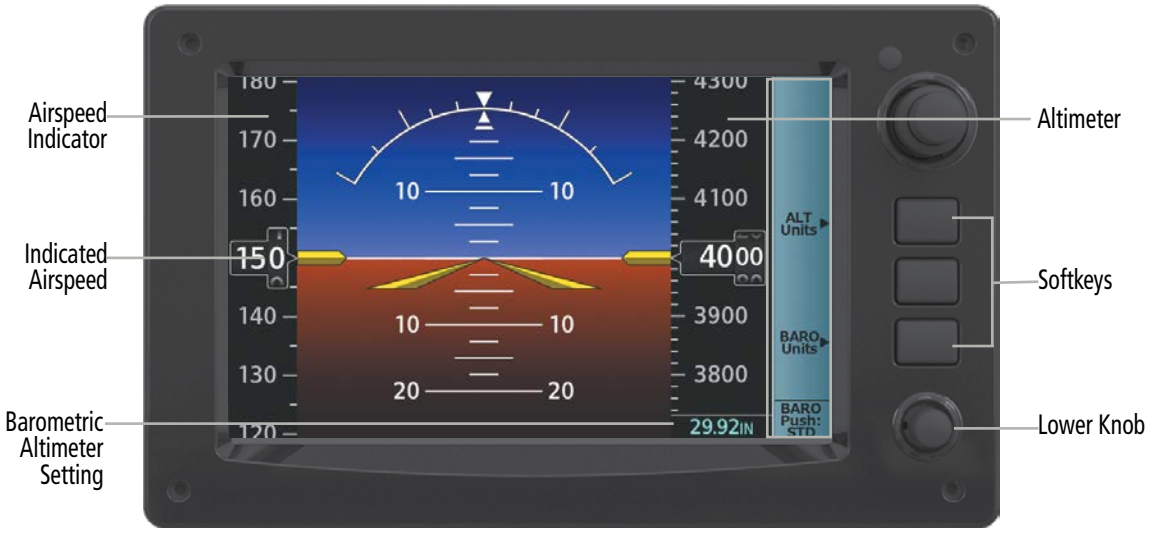


Figure 2-62 Touchscreen Controller

Selecting the Altimeter Barometric Pressure Setting on the Standby Flight Display:

Turn the lower knob on Touchscreen Controller to select the desired setting.

Changing Altimeter Barometric Pressure Setting Units on the Standby Flight Display:

Press the bottom softkey on the Touchscreen Controller to select either **Inches (IN)** or **Hectopascals (HPA)**.

Enabling/Disabling Metric Overlays on the Standby Flight Display:

Press the top softkey on Touchscreen Controller to select the metric altitude overlay.

Selecting Standard Barometric Pressure:

Push the lower knob to select standard pressure; 'STD BARO' is displayed in the Barometric Setting.

Blank Page

SECTION 3 ENGINE AND AIRFRAME SYSTEMS

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

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

- The **Engine Indication Systems** (EIS) displays electrical, fuel, engine, ice protection system, oxygen, flaps and power indications on the left side of the Multi Function Display (MFD).
- The **Aircraft Systems** Screen on the Touchscreen Controller provides additional display and control information for system tests and synoptics for system status, engine and fuel, electrical, and ice protection.

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



Figure 3-1 EIS (MFD - Normal)

3.1 ENGINE/AIRFRAME SYSTEMS INDICATIONS

NOTE: *Refer to the current version of the pertinent flight manual for the appropriate engine limits.*

Engine and airframe information is presented using gauges and numeric displays. During normal operating conditions, gauge pointers and display text appear in white. When unsafe operating conditions occur, gauge pointers and displays change color to indicate caution (amber) or warning (red). Black digits on an amber background or white digits on a red background are shown for numerical display values. Refer to each indicator description for additional details on display behavior.

When parameters are out of range of the display white dashes are shown. If sensor data for a parameter becomes invalid or unavailable, there will be an amber "X" across the indicator and/or display.

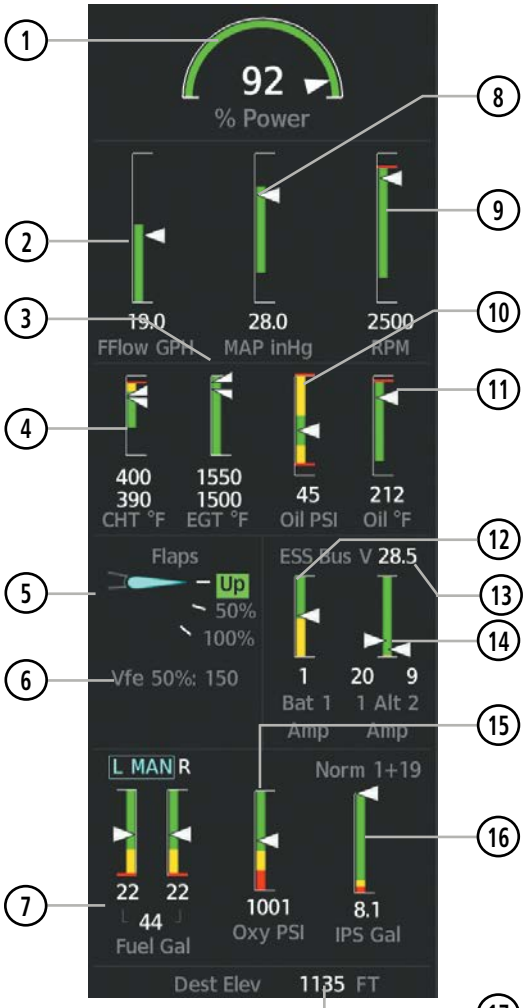


Figure 3-2 EIS Display (SR22)

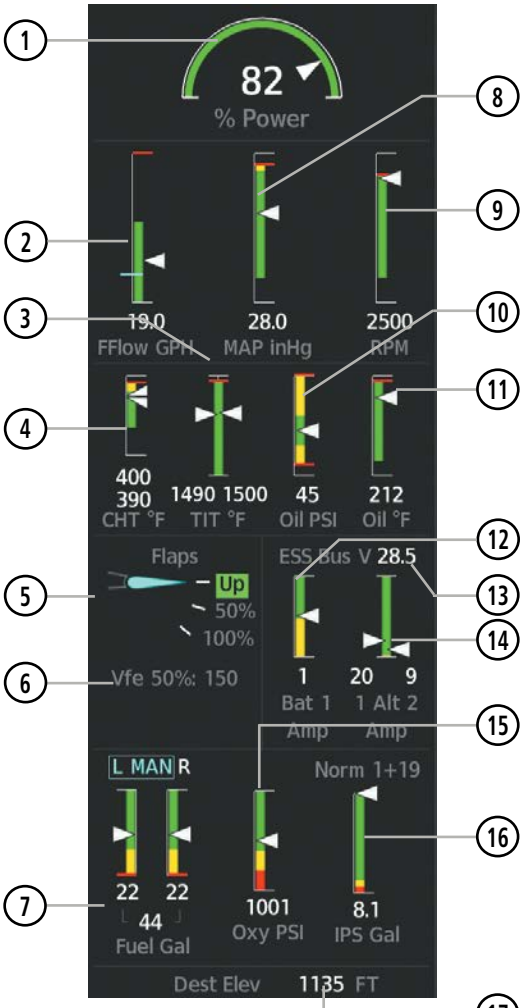


Figure 3-3 EIS Display (SR22T)

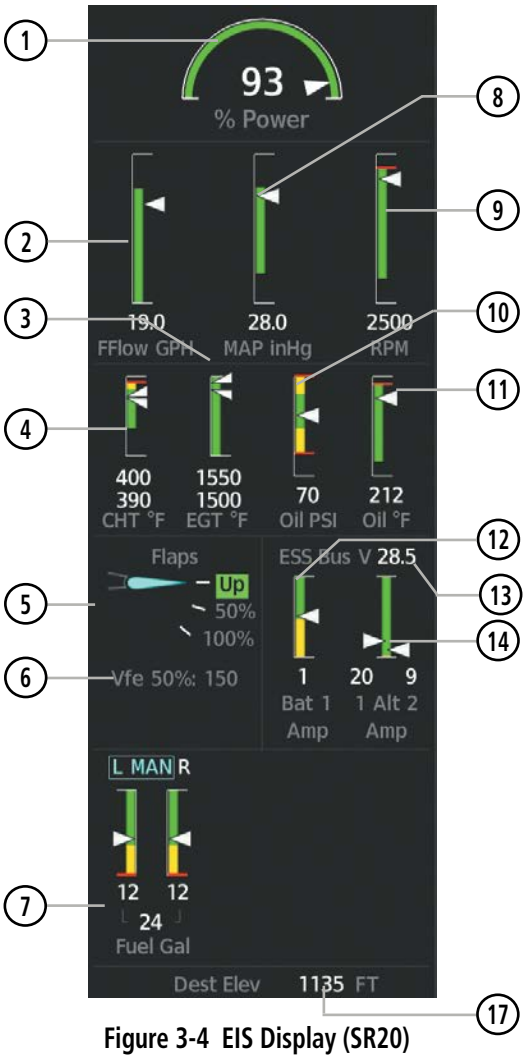


Figure 3-4 EIS Display (SR20)

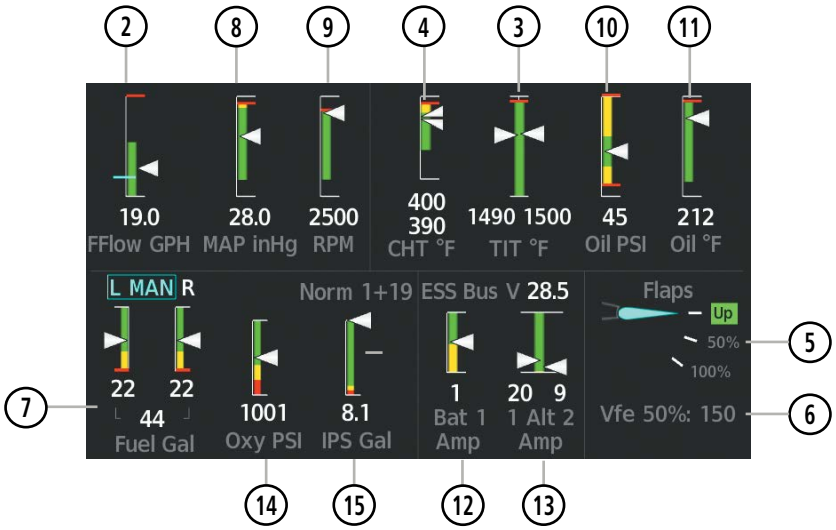
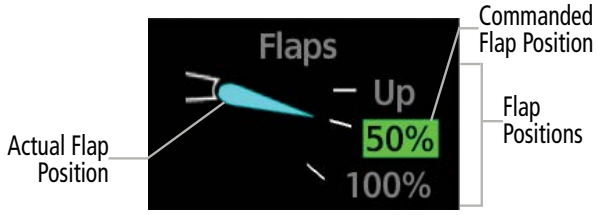


Figure 3-5 EIS Display (Reversionary)

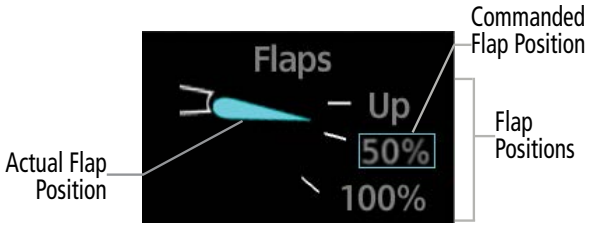
(1) **% Power**	A digital display and a white pointer along a green band indicate the % power normal operating range. The gauge will display 0 to 100% power while the numerical display will display 0 to 140%.
(2) **Fuel Flow (GPH)**	This indicates the current fuel flow in Gallons Per Hour (GPH).
(3) **Exhaust Gas Temperature (EGT) or Turbo Inlet Temperature (TIT)**	**Exhaust Gas Temperature** Displays the coldest and hottest Exhaust Gas Temperatures in degrees Fahrenheit. **Turbo Inlet Temperature** Displays the left and right Turbo Inlet Temperatures in degrees Fahrenheit.
(4) **Cylinder Head Temperature (CHT)**	Displays the head temperature of the hottest and coldest cylinder.

(5) Flap Position

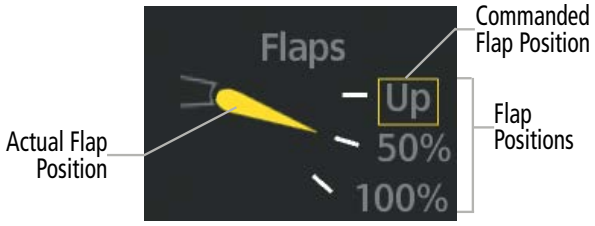
Flap position is normally displayed using a rotating pointer and the flap lever setting (Up, 50%, 100%). When the actual flap position is not the same as the commanded flap position, an amber box will be displayed around the commanded position and the pointer will be amber. When the actual flap position and the commanded flap position are the same, a green box will be displayed, and the pointer will be cyan. When the flaps are in transition to the commanded position, a white box will be displayed around the commanded position and the pointer will be cyan. Invalid flap position is indicated by an amber 'X' across the display.



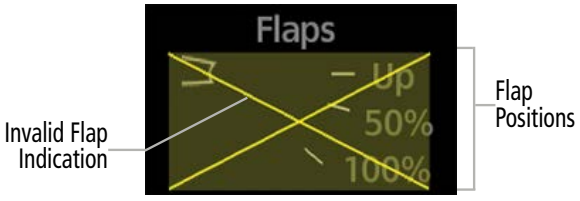
Commanded Flap Position Box - Normal



Commanded Flap Position Box - Transition



Commanded Flap Position Box - Caution



Invalid Flap Position Box - Amber X

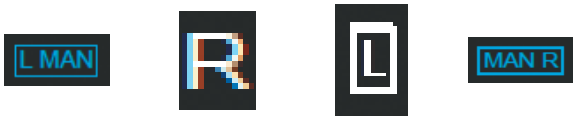
(6) V_{FE} (Flaps Extended Speed)

This displays the V_{FE} speeds for the airframe based on current flap deflection.

(7) Fuel Tank Quantity

The fuel quantity is displayed as a total fuel quantity, and individual quantities are shown for the left and right tanks. The Fuel Tank Left and Right arrows will change to amber or red as fuel depletes. The fuel amount will show black lettering over an amber box if in the amber range. The fuel amount will flash white over a red box if in the red range.

The tank selection indicator will appear above the fuel quantity indication. Cyan boxes indicate manual tank selection. White boxes indicate automatic tank selection.



Left Tank Manual Selection | Right Tank | Left Tank with Auto Selection Box | Right Tank Manual Selection

(8) Engine Manifold Pressure — Displays manifold pressure in inches of Mercury to indicate engine power.

(9) Tachometer — Displays propeller speed in revolutions per minute.

(10) Oil Pressure — Displays pressure of oil supplied to the engine in pounds per square inch (psi).

(11) Oil Temperature — Displays engine oil temperature in degrees Fahrenheit.

(12) Ammeter — Displays the battery 1 load in amperes.

(13) Essential Bus Voltage — Displays ESS Bus in Volts

(14) Alternator Load — Displays the Alternator 1 (Left) Load and Alternator 2 (Right) Load in amperes.

(15) Oxygen Pressure — Displays Oxygen Pressure in Pounds per Square Inch (PSI). If the oxygen system is on then the word "ON" will be displayed in a Cyan Box.

(16) Ice Protection Fluid — Displays total remaining Ice Protection Fluid in Gallons.



Pump Backup Mode

(17) Destination Elevation — Displays the field elevation for the selected destination airfield.

3.2 AIRCRAFT SYSTEMS

Synoptics diagrams show current conditions of certain aircraft functionalities on aviation system diagrams. Lines and components shown in the diagrams change color to indicate various conditions such as flow, normal, automatic, manual, advisory, caution, or warning. Refer to the specific synoptic sections for more information. Aircraft systems depicted in the synoptic diagrams include:

- Ice Protection (if equipped)
- Electrical
- Engine & Fuel
- Status & Information
- Video (if equipped)



Figure 3-6 'Aircraft Systems' Screen

STATUS & INFO

The 'Status & Info' Synoptics Page shows temperatures, aircraft information, landing information, hours, parking brake status, and door status. The Takeoff/Performance data block will change based on the aircraft status. Takeoff performance is shown when the aircraft is on the ground, landing performance is shown when the aircraft is in the air.

NOTE: *Performance Values are approximated from the Approved Flight Manual. Please refer to the Approved Flight Manual for more information.*

Accessing the Aircraft Status & Info Synoptics:

From MFD Home, touch **Aircraft Systems > Status & Info.**

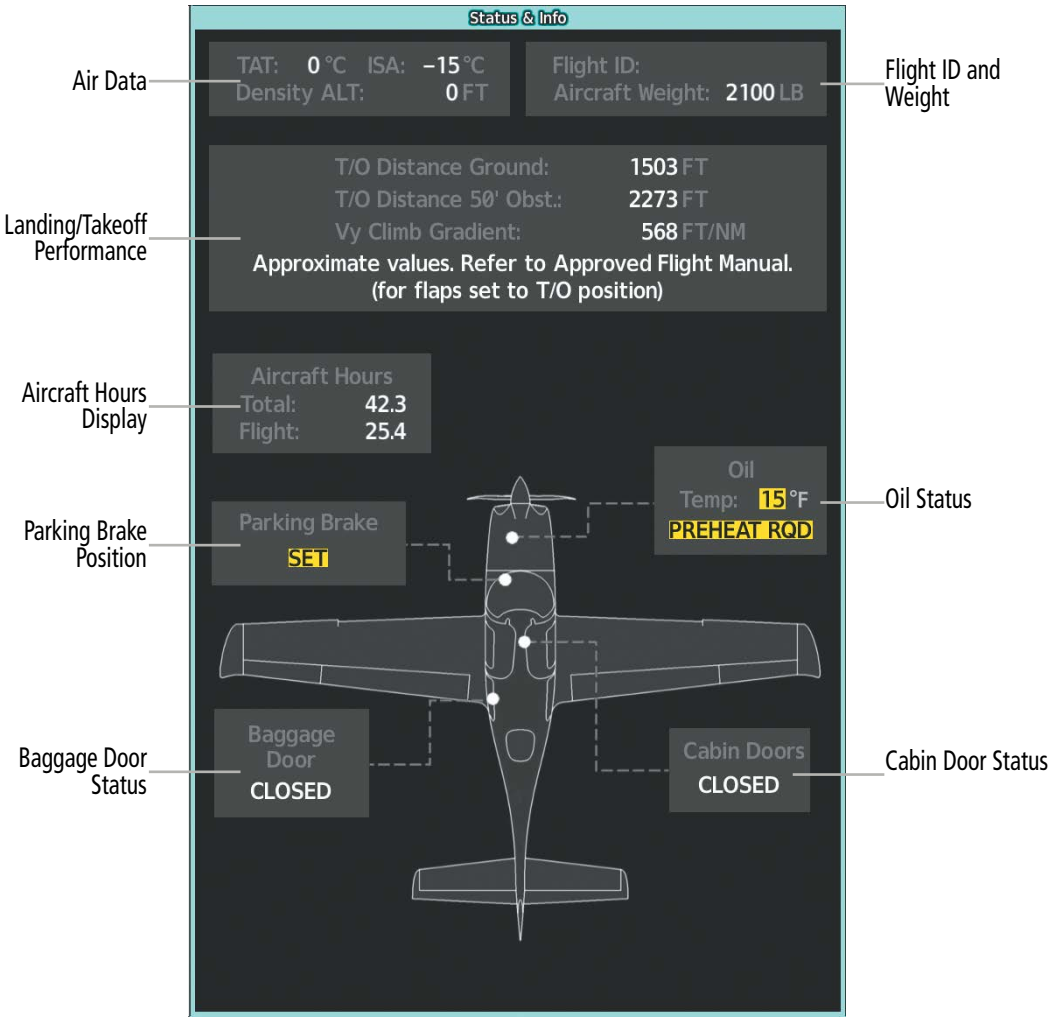


Figure 3-7 Status and Info

ENGINE & FUEL

The 'Engine & Fuel' Synoptic Page uses a simplified diagram of the aircraft's fuel system to display the system status. The fuel quantity and temperature displays repeat the displays from the EIS. When the fuel system is operating normally, all objects and lines are shown in green, blue or white on the system diagram. Lines between objects represent fuel lines. Green lines indicate there is flow. White lines indicate there is no flow. Blue lines represent flow with manual selection. Amber objects, text/background, or lines indicates an abnormal or caution state. Red objects or text/background indicate a warning state. Fuel tanks will show a green border when selected, a white border when unselected, a cyan border when manually selected, and an amber border when a caution state is detected. Fuel level will show green when normal, amber in caution state, and red in warning state.

Accessing the Engine & Fuel Synoptics:

From MFW Home, touch **Aircraft Systems > Engine & Fuel.**

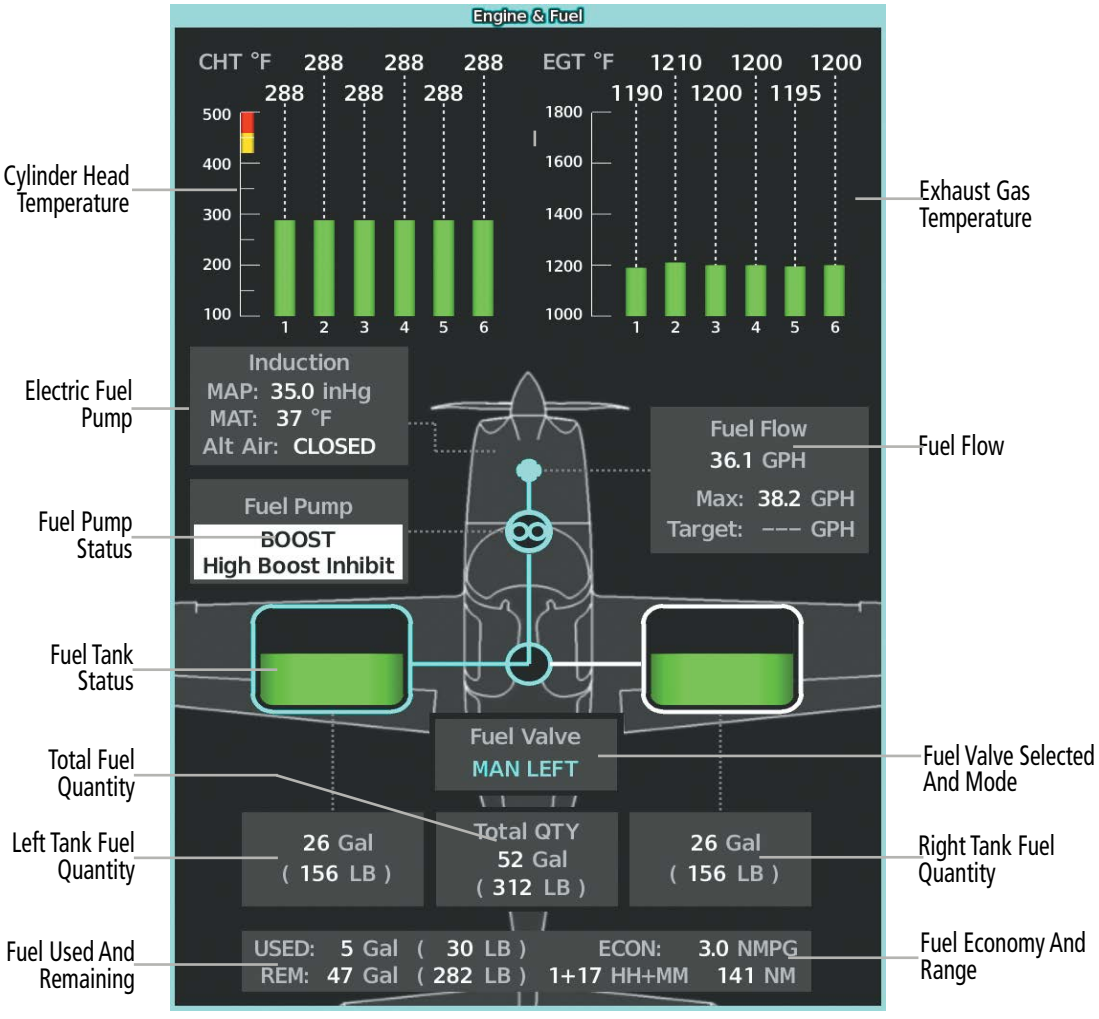


Figure 3-8 Fuel Synoptics (SR22T)

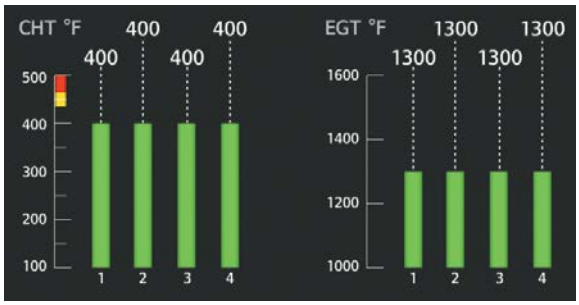


Figure 3-9 SR20 CHT/EGT



Figure 3-10 SR22 Fuel Flow



Auto Mode Manual Mode Off Unknown

Figure 3-11 Fuel Pump Status Icons



Auto Mode Manual Mode Off Unknown Caution

Figure 3-12 Fuel Selector Status Icons

ELECTRICAL

The 'Electrical Synoptic' Page uses a simplified diagram of the aircraft's electrical system to display the system status. When the electrical system is operating normally, all objects and lines are shown in green or white on the system diagram. Lines between objects represent electrical connections. Green lines indicate there is current flow. White lines indicate there is no current flow. Objects in green are active. Objects in white are inactive. Amber objects, text/background, or lines indicates an abnormal or caution state. Red objects or text/background indicates a warning state.

Accessing the Electrical Synoptics:

From MFW Home, touch **Aircraft Systems > Electrical Power.**

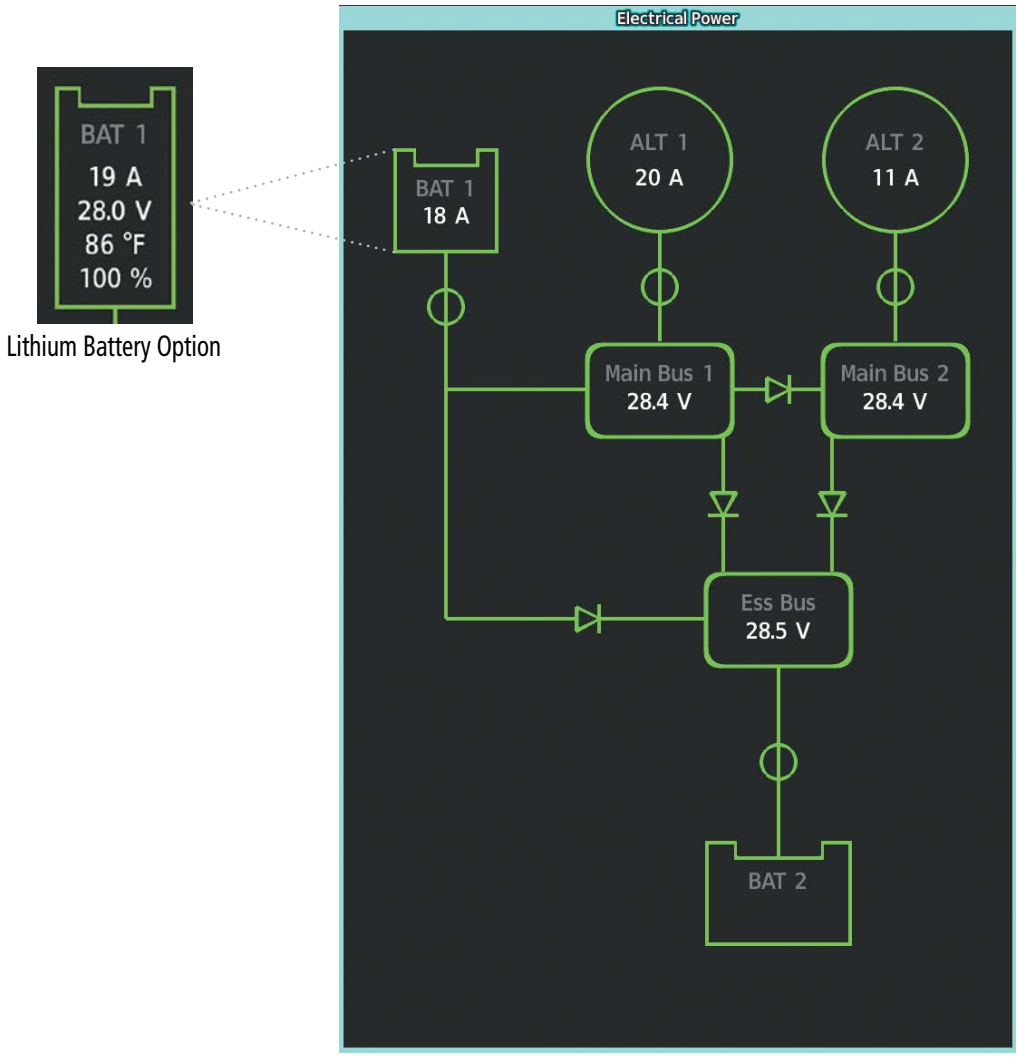


Figure 3-13 Electrical Synoptics



Figure 3-14 Electrical Synoptics Example Caution and Warning States

The electrical connections will take the color of their source, see the following figure:

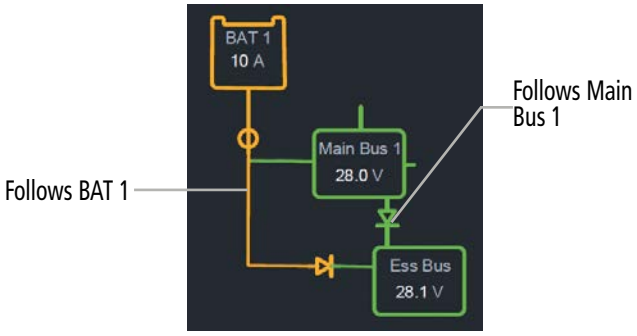


Figure 3-15 Electrical Lines

ICE PROTECTION

If the Ice Protection System is equipped, the 'Ice Protection' Synoptic Page uses a simplified diagram of the aircraft's ice protection system to display the system status. Lines between objects indicate connections to the Ice Protection System. Green lines indicate flow. White lines indicate there is no flow. Objects in green are active. Cyan objects are manually selected. Objects in white are inactive. Amber objects, text/background, or lines indicates an abnormal or caution state. Red objects, lines, or text/background indicates a warning state. IP Valve status will read in white if off, green if auto-selected, cyan if manually selected, or black on an amber background if in an abnormal status.

Accessing the Ice Protection Synoptics:

From MFW Home, touch **Aircraft Systems > Ice Protection.**

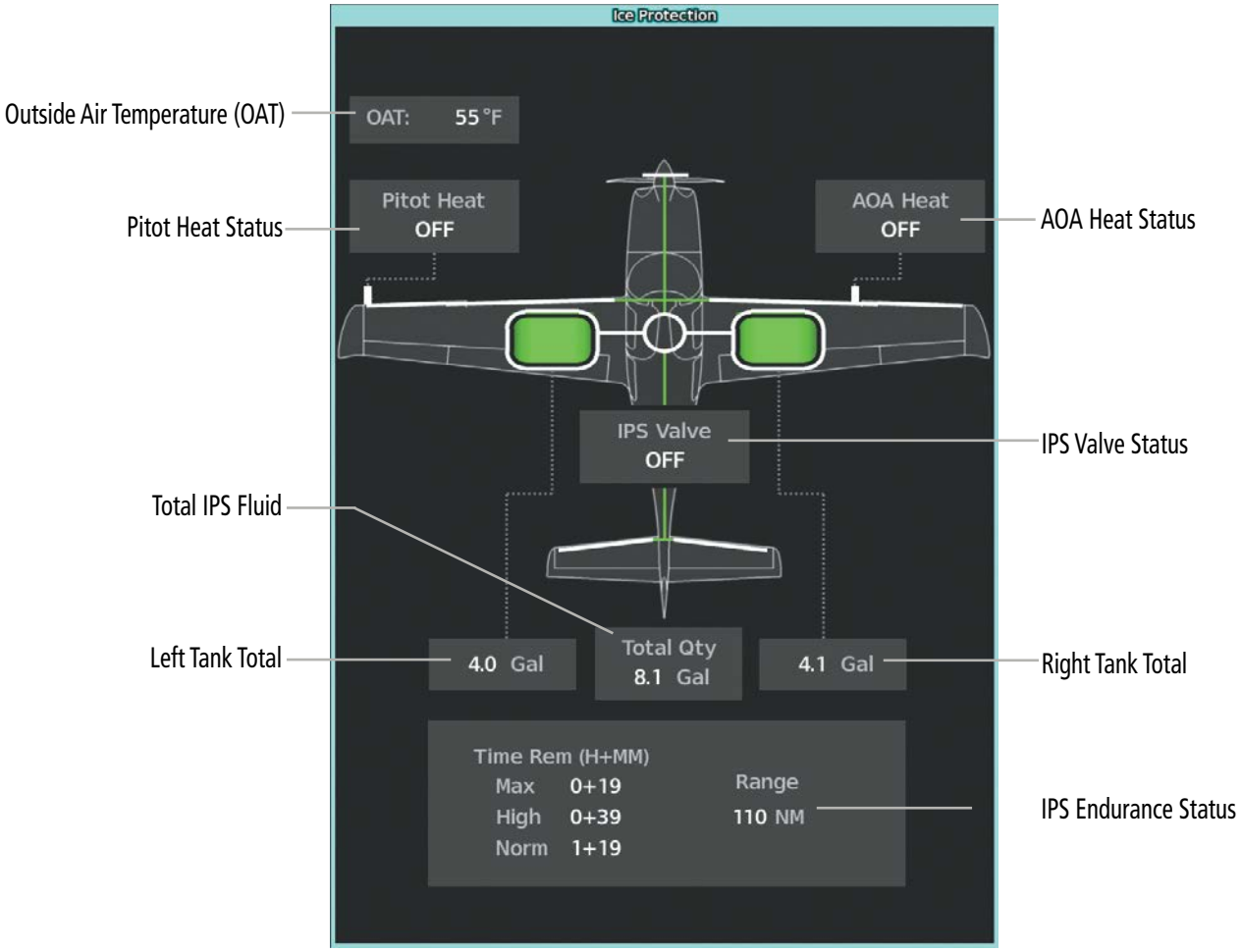


Figure 3-16 Ice Protection Synoptics



Figure 3-17 Ice Protection Tank Selection Status Icons

SYSTEM TESTS

NOTE: *Information on system tests is superseded by the current version of the pertinent flight manual.*

Pilot initiated systems tests are located on the 'System Test' Screen. These tests are ADS-B and TAWS. Touching a button for a specific test activates that particular System Test. The Test Status Annunciation displays the testing status ('Initializing, 'Test in Progress or 'Ready to Execute') for manual and automatic testing. Pilot initiated tests cannot run when automatic testing is active. Before a test is active, three cyan dashes will be displayed on the button. While a test is active, the button displays "In Progress" in cyan. The "In Progress" text pulses so the crew can quickly identify which test is currently being executed. When the test is complete, the button displays 'Done' (in cyan) or 'Fail' (in amber). All tests are mutually exclusive; the crew are unable to select any other test while a test is in progress, nor can a test be canceled.

Accessing the System Tests:

1) From MFW Home, touch **Aircraft Systems > System Tests**.
2) Touch the desired system test.



Figure 3-18 Aircraft 'System Tests' Screen

System Test	Description
ADS-B	Tests the Automatic Dependent Surveillance - Broadcast System (ADS-B).
TAWS	Tests the Terrain Awareness and Warning System (TAWS).

Table 3-1 System Tests

3.3 LEAN ASSIST MODE

NOTE: *The pilot should follow the engine manufacturer's recommended leaning procedures in the current version of the pertinent flight manual.*

A leaning assist function is available on the 'Engine & Fuel' Page to assist in the leaning process.

Accessing Lean Assist Mode:

1) From MFW Home, touch **Aircraft Systems**.

2) Touch the **Engine & Fuel** Button. The **Lean Assist** Button will now appear on the Aircraft Systems Screen.

3) Touch the **Lean Assist** Button.

When the **Lean Assist** Button is touched, the system initially highlights the number and places a cyan box around the EGT display of the cylinder with the hottest EGT. The Δ Peak temperature is the difference between the peak temperature and the present temperature for the peaked cylinder. When the first peak is detected, "1st" is annunciated below that cylinder's EGT bar and the temperature is enclosed in a cyan box.

The system continues to detect peak EGT's for each cylinder lean of peak as the fuel flow is decreased, and the peak of each cylinder's EGT is indicated by a cyan marker on the graph. Once all cylinders are lean of peak, the last cylinder to peak is denoted by the "Last" annunciation below its bar on the graph.

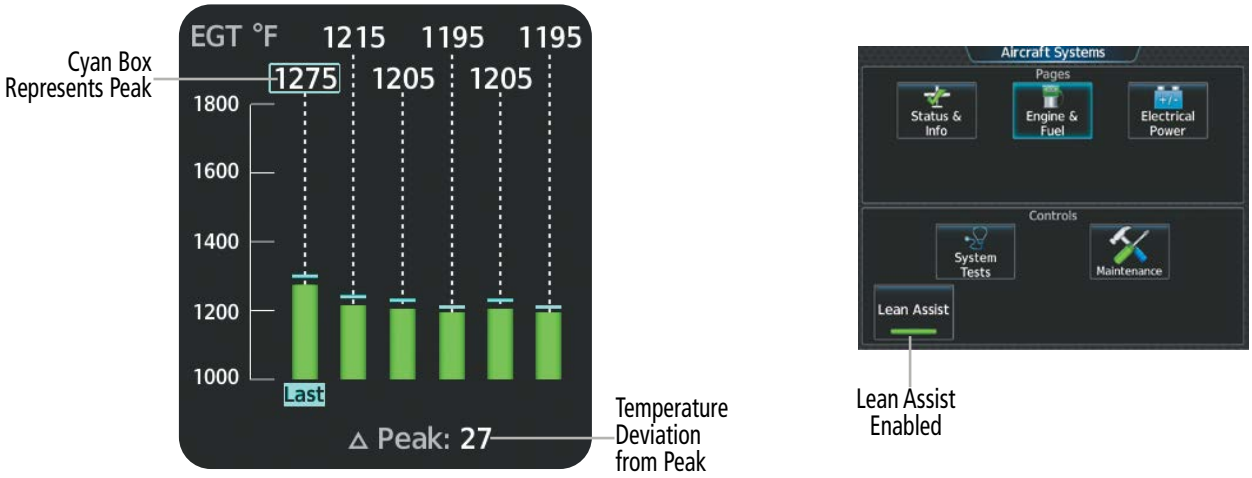


Figure 3-19 Lean Assist Mode (SR22)

3.4 REVERSIONARY MODE

In the event of a display failure, depending on the failed display(s), the operating display(s) may be re-configured to present Primary Flight Display (PFD) symbology together with condensed EIS and MFD information (refer to the System Overview for more information about Reversionary Mode).



Figure 3-20 EIS (Reversionary Mode)

SECTION 4 AUDIO AND CNS

4.1 OVERVIEW

NOTE: *All volume levels are saved between power cycles.*

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

The Touchscreen Controller provides tuning of the communication transceivers and microphone and receiver audio selection. The Audio Controller includes an intercom system (ICS) between the pilot, copilot, and passengers as well as a marker beacon receiver, and a COM clearance recorder.

The Mode S transponders are controlled with the Garmin Touchscreen Controller (GTC). The Transponder Code/Mode Button is located in the upper left corner of the 'NAV/COM Home' Screen, right below the Active Transponder Indication/IDENT Button. The Transponder Code/Mode Button displays the active four-digit code, mode, and reply status.

The following Audio and CNS features are discussed in this section:

- COM
- NAV
- Marker Beacon Receiver
- DME (Optional)
- ADF (Optional)
- Transponder
- Mono/Stereo Headsets
- Cockpit Speaker
- Intercom
- Clearance Recorder
- 3D Audio
- Simultaneous COM Operation
- Auxiliary Audio (Music)
- SiriusXM Radio Entertainment
- Audio Feedback (Clicks)
- Telephone
- Bluetooth Audio Controls

TOUCHSCREEN CONTROLLER AUDIO AND CNS CONTROLS

NOTE: *Changes made to the off-side 'Audio & Radios' Screen are not displayed on the same-side GTC CNS Bar.*



Figure 4-1 Touchscreen 'NAV/COM Home' Screen

#	Name	Description
1	**COM1 STBY Button**	Selects the COM1 standby frequency for tuning or transfer.
2	**COM1 Button**	Displays active COM1 frequency and transfers the standby and active COM1 frequencies.
3	**Large/Small Upper Knob**	Functions as labeled (see #4). *Frequency Entry:* Large knob increases/decreases MHz; Small knob increases/decreases kHz. Push the small knob to confirm the frequency. Push and hold the small knob to transfer the standby frequency to the active frequency. *Data Entry:* Large knob moves the cursor from field to field. Small knob edits character by character.

#	Name	Description
④	**Function Label**	Indicates Large/Small Upper Knob function. *Typical Frequency Entry:* COM1/COM2 Frequency, 'Push:1-2' indicates that pushing the small knob will change the cursor between COM1 and COM2. 'Hold:↕' indicates that pushing and holding the small knob will switch the standby and active frequencies. *Typical Data Entry:* Data Entry, 'Push: 1-2' indicates that pushing the small knob will accept the changes in a data field. 'Hold:↕' indicates that pushing and holding the small knob will switch the standby and active data fields.
⑤	**NAV/COM Softkey**	Displays the 'NAV/COM Home' Screen.
⑥	**Function Label**	Indicates Lower Knob function. *Typical:* Pilot COM1/COM2 Volume, Push: Squelch
⑦	**Lower Knob**	Functions as labeled (see #6).
⑧	**XPDR IDENT Button**	Transmits a distinct identity indication to Air Traffic Control (ATC).
⑨	**Keypad**	Used to find, enter, and edit the frequency in the selected standby COM frequency window.
⑩	**Play Button**	Used to playback or stop the COM audio recorded by the clearance recorder.
⑪	**COM2 Button**	Displays active COM2 frequency and transfers the standby and active COM2 frequencies.
⑫	**COM2 STBY Button**	Selects the COM2 standby frequency for tuning or transfer.
⑬	**Audio & Radios Button**	Displays the 'Audio & Radios' Screen used to control the communication, navigation, and audio settings for the pilot, copilot, and passengers. Also enables Bluetooth audio control for paired personal devices.
⑭	**Intercom Button**	Displays the 'Intercom' Screen used to connect or isolate pilot, copilot, and passengers and to control volume and squelch settings.
⑮	**MON Button**	Controls which COM receiver is being monitored.
⑯	**Pilot Music 1 Button**	Displays the SiriusXM Satellite Radio 'Music' Screen for the pilot position.
⑰	**Pilot Isolate Button**	Automatically deselects the intercom link between the pilot and the copilot/passengers.
⑱	**MIC Button**	Switches between the #1 COM transceiver and the #2 COM transceiver.
⑲	**Transponder Code/Mode Button**	Displays the 'Transponder' Screen and the current code and mode of the transponder. Select transponder mode using the mode buttons. Enter desired codes using the keypad or touch the **VFR** Button. While the transponder is replying to an interrogation, an R is displayed on the Transponder Code/Mode Button.
⑳	**XPDR IDENT Button**	Transmits a distinct identity indication to Air Traffic Control (ATC) when touched. The word IDENT is displayed in green and pulsates for the duration of the ident transmission.

COM/NAV DISPLAY



Figure 4-2 PFD Active NAV Window, Active COM Frequency Box

#	Name	Description
1	**Active NAV Source/Frequency Box**	Displays active NAV station ID and frequency. The DME distance will also display if the DME is set to the selected NAV source.
2	**Active COM Source/Frequency Box**	Displays selected communication source, frequency, and the communication source description (if available). A + sign next to the communication source description indicates there is more than one facility in the area that shares the same frequency. In this case, the closest facility name will be displayed.

4.2 COM OPERATION

COM TRANSCEIVER SELECTION AND ACTIVATION

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

NOTE: *The MIC and MON buttons on the 'NAV/COM Home' Screen only affect the pilot's radio selections, unless the copilot selects the Sync to Pilot option on the 'Audio & Radios' Screen.*

The COM Frequencies are displayed on the 'NAV/COM Home' Screen, on the 'Audio & Radios' Screen, and in upper right corner of the PFD. The COM transceiver can be selected for transmitting using the Touchscreen Controller.

On the 'NAV/COM Home' Screen the active COM1 or COM2 frequency is displayed in green. The standby frequency of the COM selected for tuning is cyan. When the standby frequency of the COM selected for tuning is being tuned with the upper knobs, the entire Standby Frequency Button is highlighted in cyan. The other standby frequency is white.

Selecting a COM Radio for transmission:

From NAV/COM Home, touch the **MIC** Button to switch between COM1 and COM2 radios.

Or:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the COM1 or COM2 **MIC** Button.

Selecting a COM Radio for monitoring:

From NAV/COM Home, touch the **MON** Button to monitor the desired COM.

Or:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the **COM1** Button or **COM2** Button.



Figure 4-3 Selecting a COM Radio for Transmission

CNS Bar Symbol	Description
	COM1 selected for transmission/monitoring
	COM2 selected for transmission/monitoring

Table 4-1 CNS Bar MIC/MON Button Symbols

TRANSMIT/RECEIVE INDICATIONS

During COM transmission, a white TX appears by the active COM frequency and the green MIC triangle will flash. During COM signal reception, a white RX appears by the active COM frequency.



Figure 4-4 COM Radio Transmit and Receive Indications

COM FREQUENCY TUNING

Selecting a COM1 or COM2 frequency from the 'NAV/COM Home' Screen:

1) Touch the COM1 **STBY** Button or COM2 **STBY** Button to select for tuning.

   Or:

   Push the small upper knob to select the desired **STBY** COM for tuning (selected standby frequency is cyan).

2) Use the keypad to select the frequency.

   Or:

   Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).

3) Touch the **Enter** Button to accept the new frequency as the COM1 or COM2 standby frequency (not required if tuning with the upper knobs).

   Or:

   Push the small upper knob.

   Or:

   Touch the COM1 or COM2 Standby Frequency Button.

   Or:

4) Touch the **XFER** Button to accept the new frequency as the COM1 or COM2 active frequency and transfer the previously active frequency to the standby frequency:

   Or:

   Push and hold the small upper knob.

   Or:

   Touch the COM1 or COM2 Active Frequency Button.

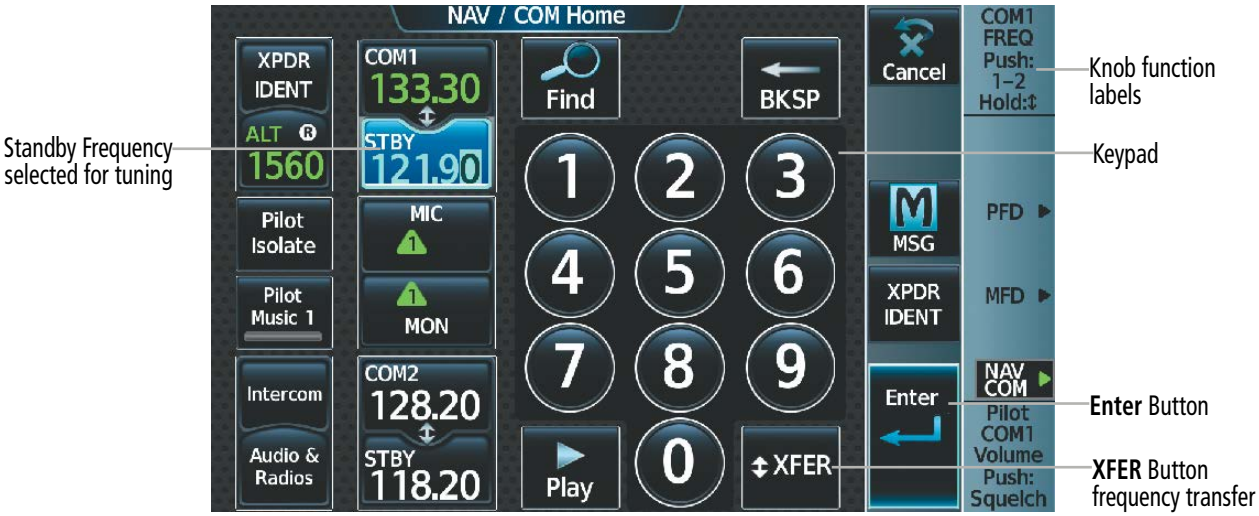


Figure 4-5 'NAV/COM Home' Screen - COM Frequency Tuning

COM frequency tuning from the 'Audio & Radios' Screen using the COM Frequency Buttons:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the COM1, or COM2 Frequency Button to display the COM1 or COM2 keypad.
3) Use the keypad to select the frequency.

   Or:

   Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
4) Touch the **Enter** Button to accept the new frequency as the standby frequency:

   Or:

   Push the small upper knob.

   Or:

   Touch the **XFER** Button to accept the new frequency as the active frequency:

   Or:

   Push and hold the small upper knob.

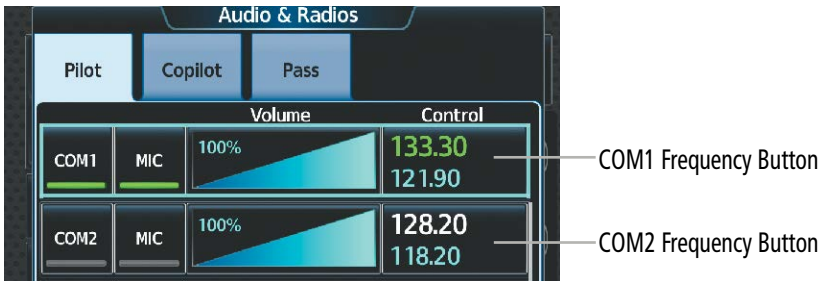


Figure 4-6 COM Frequency Buttons

COM frequency tuning from the 'Audio & Radios' Screen using the COM Volume Slider Buttons:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the COM1 or COM2 Volume Slider Button to select that radio for tuning.
3) Turn the large and small upper knobs to select the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
4) If desired, push and hold the small upper knob to accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency.

Transferring the active and standby COM frequencies:

From NAV/COM Home, touch the **COM1** Button or **COM2** Button to transfer the standby and active frequencies.

Or:

1) From NAV/COM Home, push the small upper knob to select the standby COM desired for transfer (selected standby frequency is cyan).
2) Push and hold the small upper knob to transfer the standby frequency to the active frequency.

Or:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the COM1 or COM2 Volume Slider Button to select the radio for frequency transfer.
3) Push and hold the small upper knob to transfer the frequencies.



Figure 4-7 COM Volume Slider

Selecting the Sync to Pilot Button:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the **Copilot** Tab or **Pass** Tab.
3) Touch the **Sync to Pilot** Button. 'Audio & Radios' Screen Buttons are not available to the copilot or passengers when **Sync to Pilot** Button is enabled.



Figure 4-8 Sync to Pilot Button Enabled

Finding and selecting a COM frequency using the Find Button:

1) From NAV/COM Home, touch the **Find** Button to display the 'Find COM Frequency' Screen.
2) Touch the tab for the desired type of frequency (Recent, Nearest, Dest, Flight Plan, or Favorite).
3) Scroll the list to find the desired frequency.
4) Touch the Frequency Button to accept the new frequency as the COM1 or COM2 standby frequency.

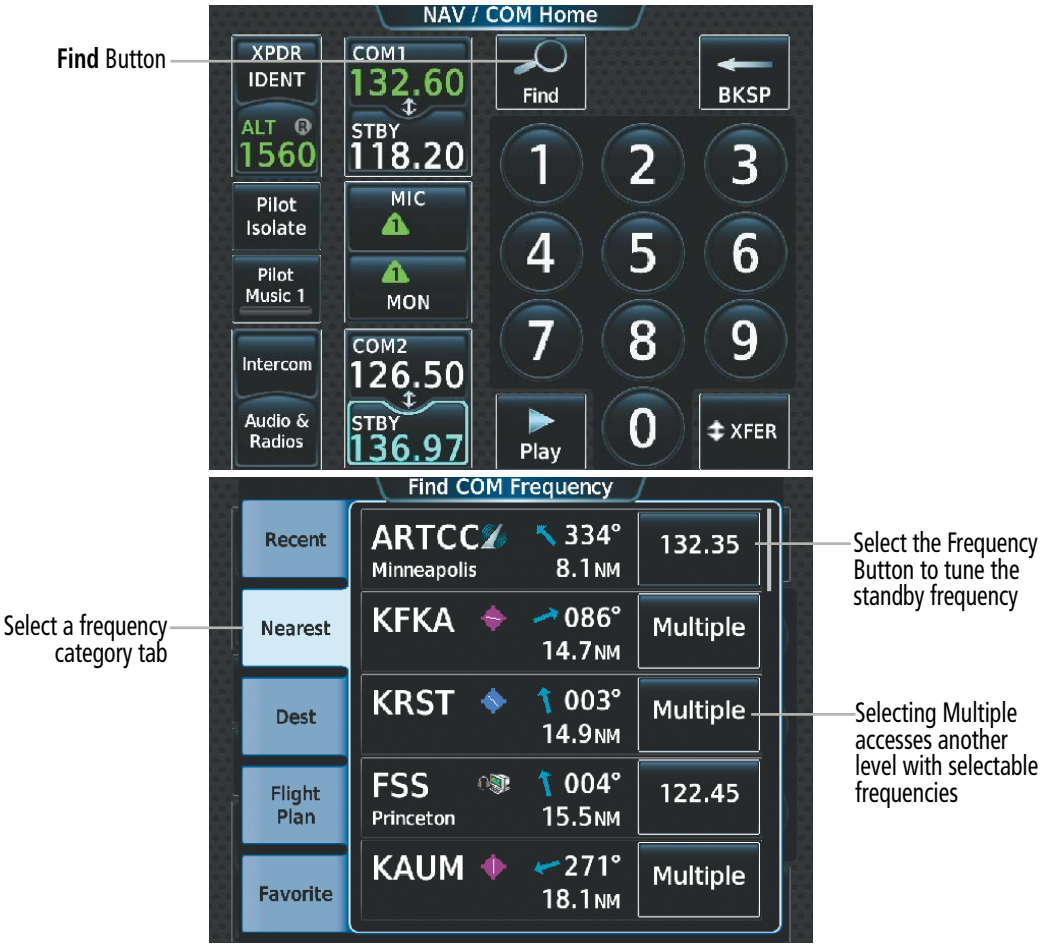


Figure 4-9 Find 'COM Frequency' Screen

Or:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the desired COM Frequency Button to display the keypad.

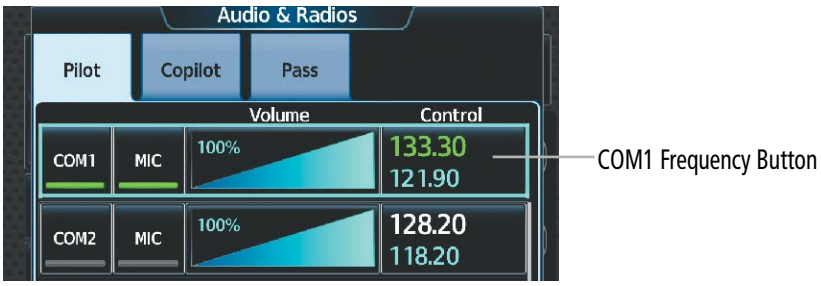


Figure 4-10 COM Frequency Buttons

3) Touch the **Find** Button to display the Find COM Frequency Screen.
4) Touch the tab for the desired type of frequency (Recent, Nearest, Dest, Flight Plan, or Favorite).
5) Scroll the list to find the desired frequency.
6) Touch the Frequency Button to accept the new frequency as the COM standby frequency.



Figure 4-11 'Find COM1 Frequency' Screen

Finding and selecting a COM frequency from the 'Airport Information' Screen:

1) From MFW Home, touch **Waypoint Info > Airport** to display the 'Airport Information' Screen.
2) If needed, touch the airport button to enter or find the desired airport.
3) Touch the **Freqs** Tab to display the 'Airport Frequencies' Screen.
4) Scroll the list to find the desired frequency.
5) Touch the Frequency Button to display the 'Load Frequency' Screen.
6) Touch the location button to load the frequency into COM1 or COM2 Active, Standby, or Favorites.

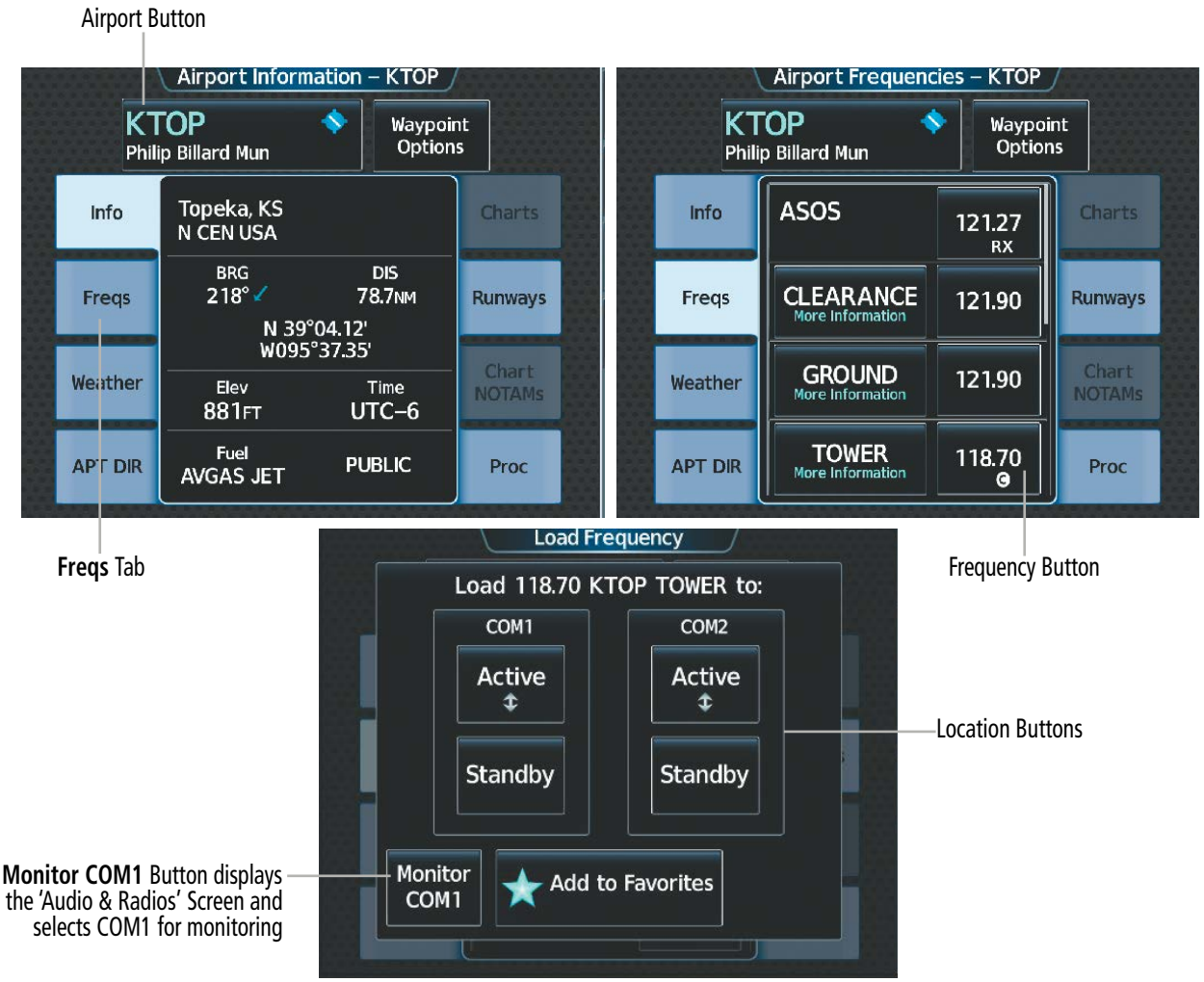


Figure 4-12 'Airport Information' Screen COM Tuning

Finding and selecting a COM1 or COM2 frequency from the 'Nearest Airport' Screen:

1) From MFW Home, touch **Nearest > Airport** to display the 'Nearest Airport' Screen.
2) Scroll the list to find the desired airport.
3) Touch the desired Airport Button to display the 'Waypoint Options' Window.
4) Touch the **Airport Info** Button to display the 'Airport Information' Screen.
5) Touch the **Freqs** Tab to display the 'Airport Frequencies' Screen.
6) Scroll the list to find the desired frequency.
7) Touch the Frequency Button to display the 'Load Frequency' Screen.
8) Touch the location button to load the frequency into COM1 or COM2 Active, Standby, or Favorites.

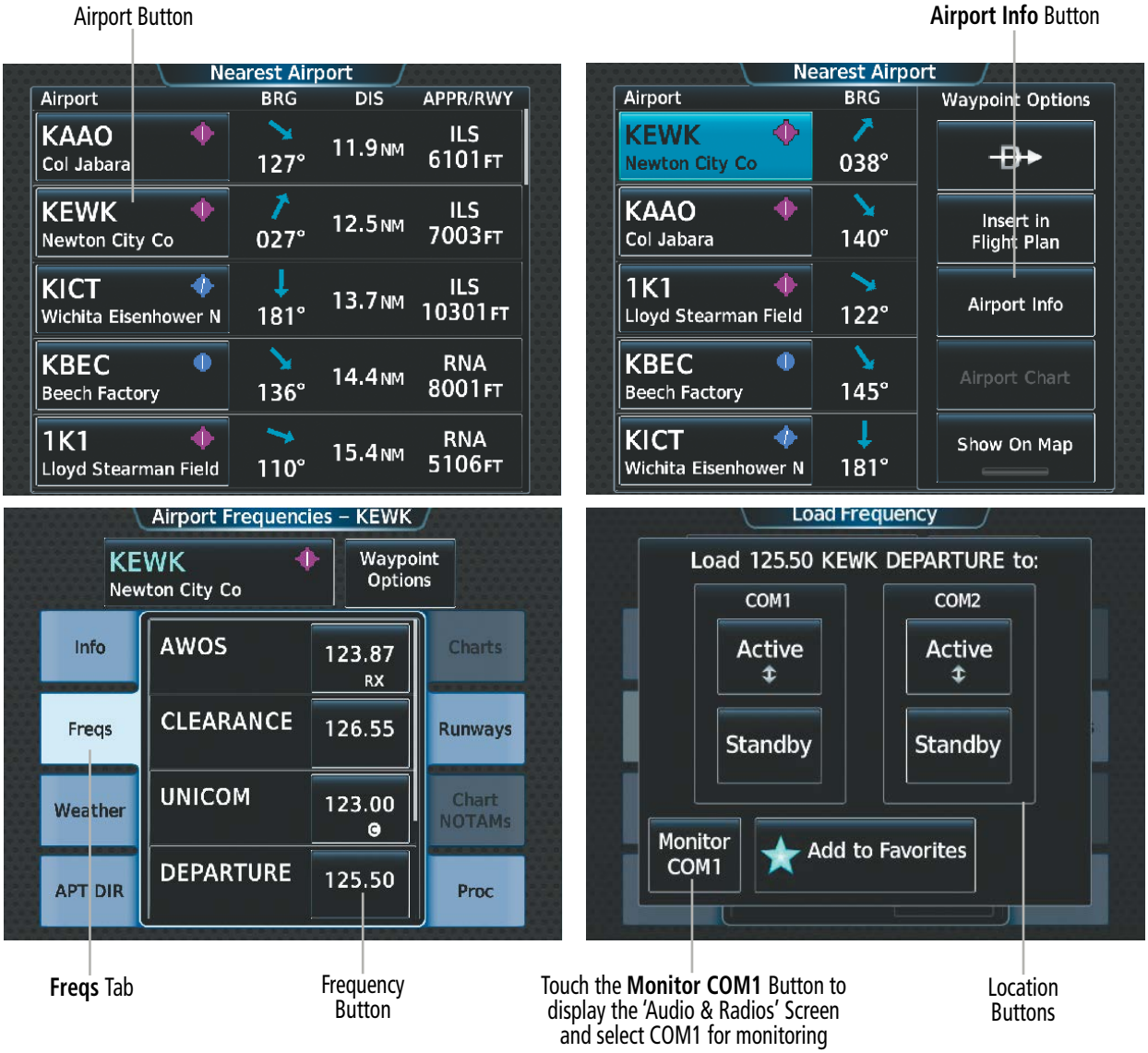


Figure 4-13 'Nearest Airport' COM Tuning

Finding and selecting a COM1 or COM2 frequency from the 'Nearest' Screen:

1) From MFW Home, touch the **Nearest** > (**Airspace** or **ARTCC** or **FSS** or **Weather**) to display the Nearest (Airspace or ARTCC or FSS or Weather) Screen.
2) Scroll the list to find the desired frequency.
3) Touch the Frequency Button to display the 'Load Frequency' Screen.
4) Touch the location button to load the frequency into COM1 or COM2 Active, Standby, or Favorites.

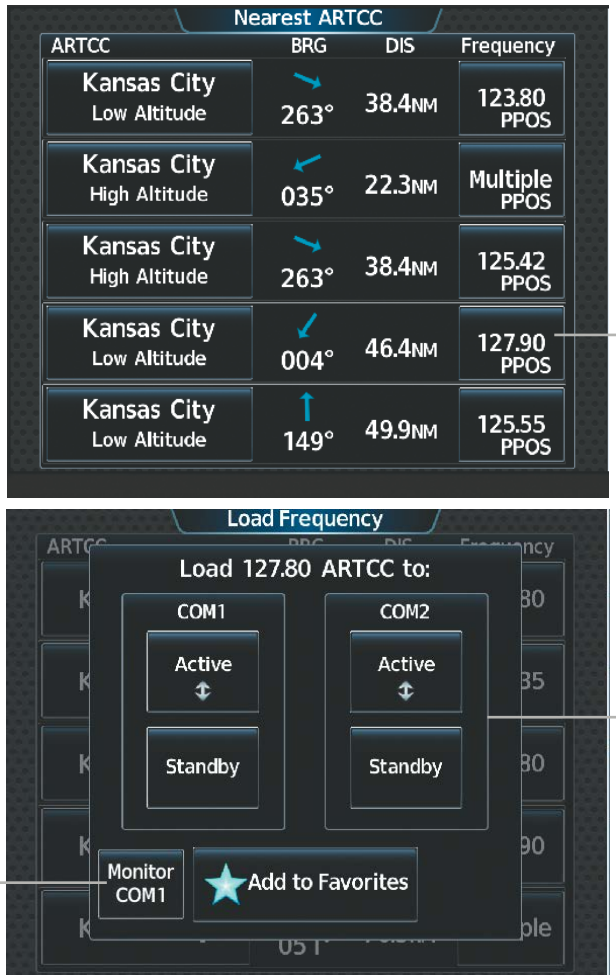


Figure 4-14 'Nearest ARTCC' Screen COM Tuning

Adding a COM frequency to favorites:

1) From NAV/COM Home, touch the **Find** Button.

   Or:

   From NAV/COM Home, touch the **Audio & Radios** Button, the COM1 or COM2 Frequency Button, and the **Find** Button.
2) Touch the **Favorite** Tab.
3) Touch the **Add Favorite Frequency** Button to display the 'Add User Frequency' Screen.

4) Touch the **Name** Button.
5) Enter the desired frequency name.
6) Touch the **Enter** Button.
7) Touch the **Frequency** Button.
8) Use the keypad to select the frequency.

   Or:

   Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
9) Touch the **Enter** Button.

   Or:

   Push the small upper knob.
10) Touch the **Add Favorite** Button.

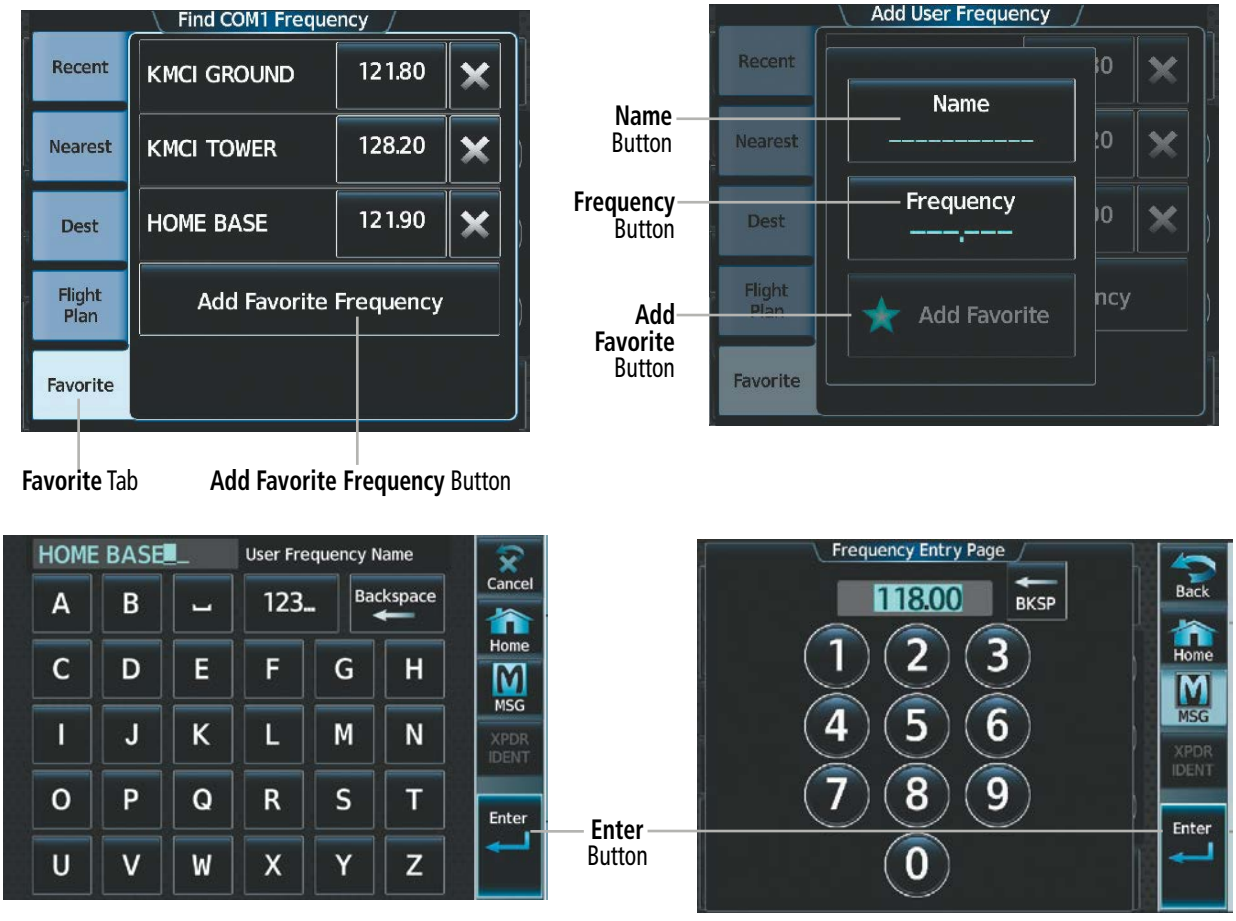


Figure 4-15 Adding a Frequency to Favorites

Adding a COM frequency to favorites from any 'Load Frequency' Screen:

1) From any 'Load Frequency' Screen, touch the **Add to Favorites** Button.
2) Touch the **Name** Button to change the name if desired.
3) Touch the **Add to Favorite** Button.

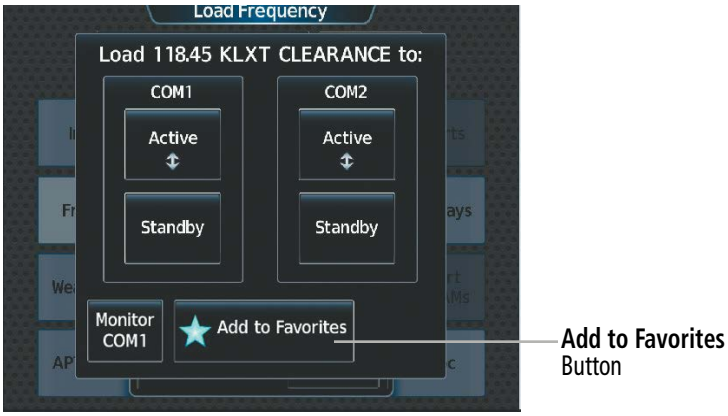


Figure 4-16 'Load Frequency' Screen - Add to Favorites Button

Selecting a COM frequency from favorites:

1) From NAV/COM Home, touch the **Find** Button.

   Or:

   From NAV/COM Home, touch the **Audio & Radios** Button, the COM1 or COM2 Frequency Button, and the **Find** Button.
2) Touch the **Favorite** Tab.
3) Touch the desired Frequency Button.
4) Touch the **Enter** Button to accept the new frequency as the standby frequency.

   Or:

   Push the small upper knob to accept the new frequency as the standby frequency.

   Or:

   Touch the **XFER** Button to accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency.

   Or:

   Push and hold the small upper knob to accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency.

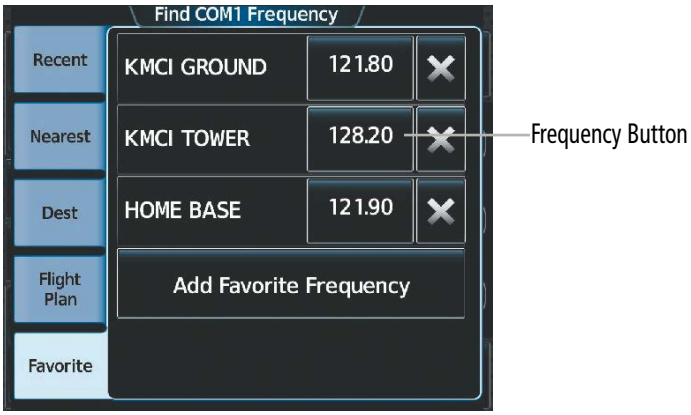


Figure 4-17 Selecting a COM Frequency from Favorites

Removing a COM frequency from Favorites:

1) From NAV/COM Home, touch the **Find** Button.

   Or:

   From NAV/COM Home, touch the **Audio & Radios** Button, the COM1 or COM2 Frequency Button, and the **Find** Button.

2) Touch the **Favorite** Tab.

3) Touch the **X** Button next to the frequency to be deleted.

4) Touch the **OK** Button to confirm.

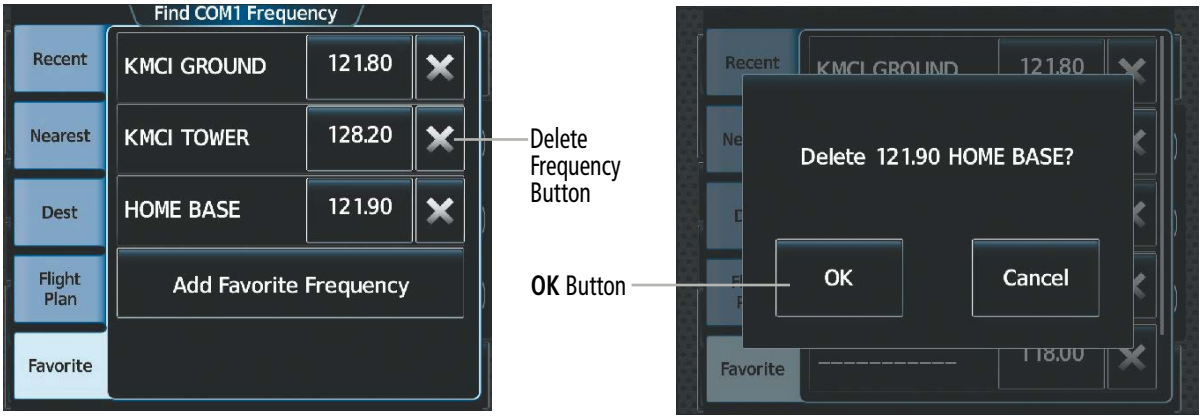


Figure 4-18 Deleting a COM Frequency from Favorites

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.



8.33-kHz Channel Spacing

25-kHz Channel Spacing

Figure 4-19 COM Channel Spacing

Changing COM frequency channel spacing:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings**.
2) Touch the System Tab.
3) Touch the **COM Channel Spacing** Button.
4) Select desired spacing (8.33 kHz or 25.0 kHz).

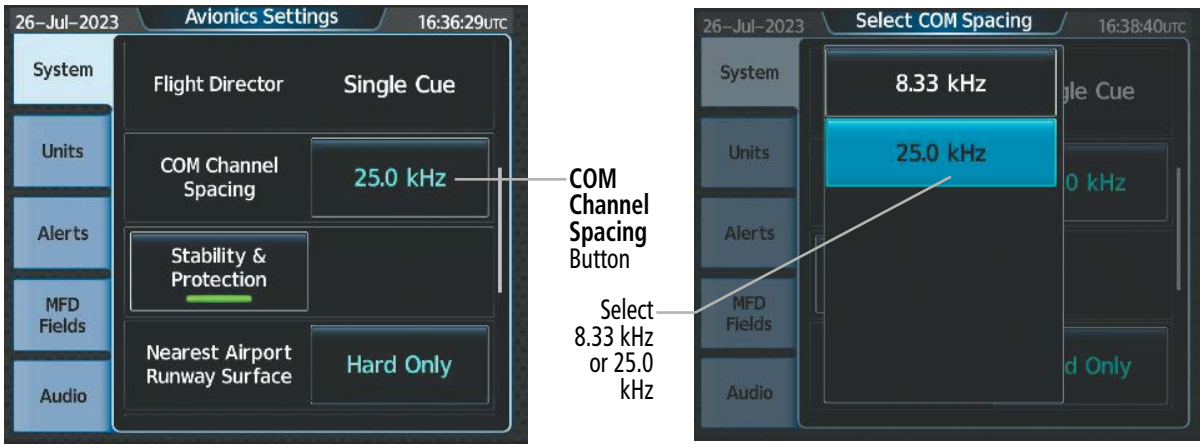


Figure 4-20 Changing COM Frequency Channel Spacing

AUTOMATIC SQUELCH

Automatic Squelch quiets unwanted static noise when no audio signal is received, while still providing good sensitivity to weak COM signals. To disable Automatic Squelch for the selected transceiver, push the lower knob while viewing the 'NAV/COM Home' Screen and while the selected audio source is a COM radio. When Automatic Squelch is disabled, COM audio reception is always on. Continuous static noise is heard over the headsets and speaker, if selected. Pushing the lower knob again enables Automatic Squelch .

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

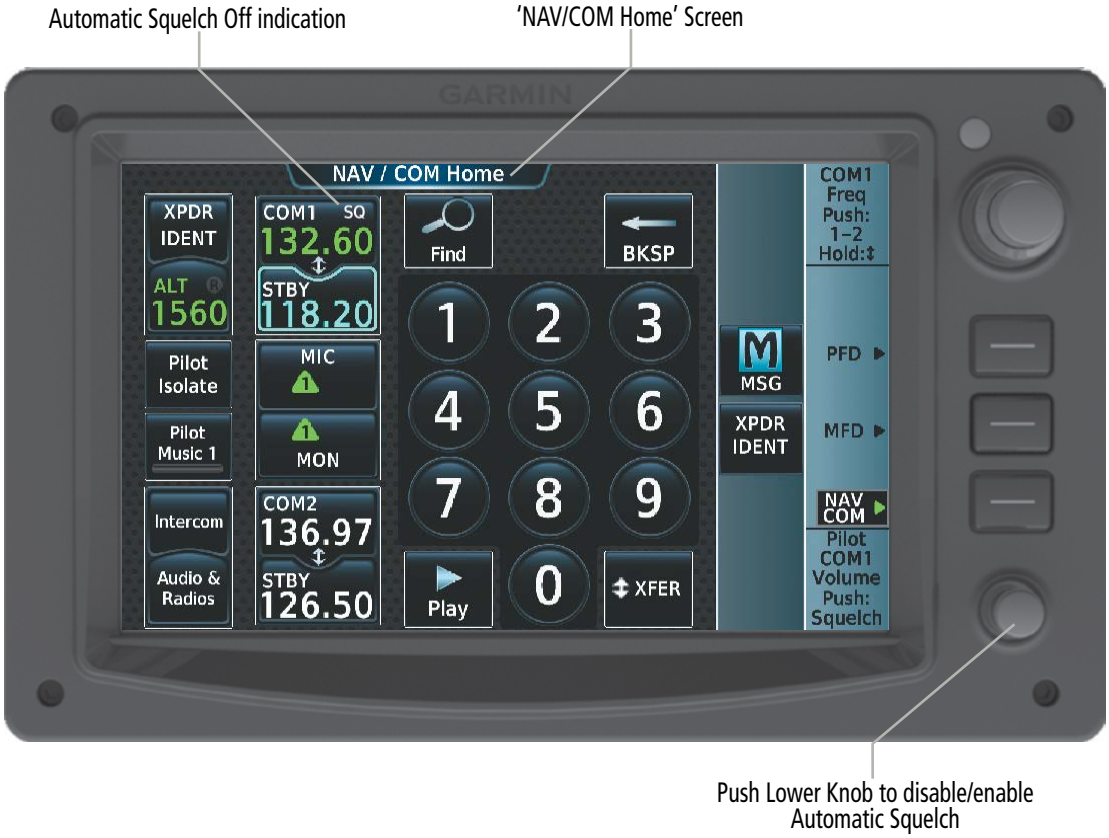


Figure 4-21 COM Radio Automatic Squelch Disable/Enable

VOLUME

The selected COM radio volume level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left on the COM Volume Slider . Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume. When adjusting volume, the level is displayed in place of the active frequency on the active COM button, and remains for two seconds after the change.

The pilot and copilot COM volume can be controlled independently. The Function Label for the lower knob will indicate which position is currently being controlled by the lower knob.



Figure 4-22 COM Volume Level

4.3 NAV OPERATION

NAV RADIO SELECTION AND ACTIVATION

The active NAV frequency selected for navigation is shown on the PFD when the corresponding NAV radio is the Active NAV source. Active and Standby NAV frequencies are shown on the Touchscreen Controller 'Audio & Radios' Screen.

A NAV radio is selected for navigation by touching the **Nav Source** Button located on the 'PFW Home' Screen or by pressing the **Active NAV** Softkey on the PFD. The NAV frequency selected for navigation is displayed in green. Touching the **Nav Source** Button or pressing the **Active NAV** Softkey once selects NAV1 as the navigation radio. Touching the **Nav Source** Button or pressing the **Active NAV** Softkey a second time selects NAV2 as the navigation radio. Touching the **Nav Source** Button or pressing the **Active NAV** Softkey a third time activates GPS mode. Touching the **Nav Source** Button or pressing the **Active NAV** Softkey again cycles back to NAV1.

The three navigation modes that can be selected are:

- VOR1 (or LOC1) – If NAV1 is selected, a green single line arrow 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 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 appears on the HSI. Both active NAV frequencies are displayed in white on the Touchscreen Controller 'Audio & Radios' Screen..

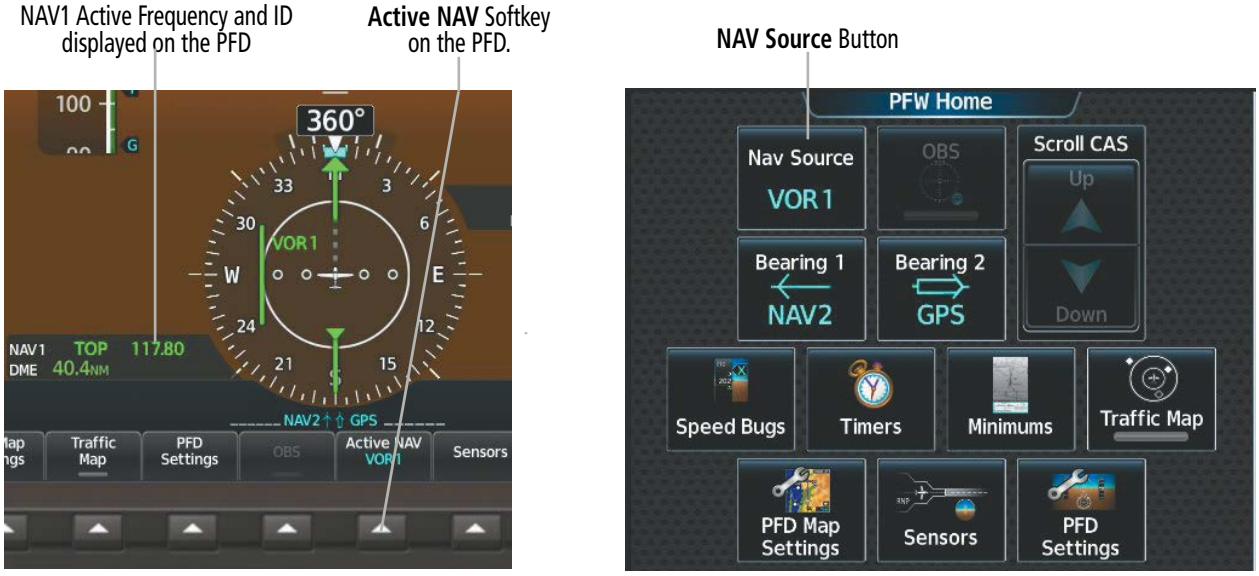


Figure 4-23 Selecting a NAV Radio for Navigation

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

NAV radios can be monitored by touching the **NAV1** Button or **NAV2** Button on the 'Audio & Radios' Screen. The selected audio can be heard over the headset and the speaker (if selected). All radios can be selected individually or simultaneously.

Selecting/deselecting a navigation radio for monitoring:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the **NAV1** Button or **NAV2** Button to select/deselect the radio for monitoring.



Figure 4-24 Selecting a NAV Radio for Monitoring

NAV RECEIVER TUNING

Tuning a NAV frequency from the 'Audio & Radios' Screen:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1 or NAV2 Frequency Button to display the NAV1 or NAV2 Standby Screen.
3) Use the keypad to select the desired frequency.

   Or:

   Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
4) Touch the **Enter** Button to accept the new frequency as the NAV1 or NAV2 standby frequency:

   Or:

   Push the small upper knob.

   Or:

   Touch the **XFER** Button to accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency:

   Or:

   Push and hold the small upper knob.

   Or:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1 or NAV2 Volume Slider to select NAV1 or NAV2 for tuning.
3) Turn the large and small upper knobs to select the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
4) If desired, push and hold the small upper knob to accept the new frequency as the NAV1 or NAV2 active frequency and transfer the previously active frequency to the standby frequency.



Figure 4-25 NAV Frequency Buttons and Volume Sliders



Figure 4-26 'NAV1 Standby' Screen

Transferring the active and standby NAV frequencies:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1/NAV2 Frequency Button to display the NAV1/NAV2 Standby Screen.
3) Touch the **XFER** Button or push and hold the small upper knob to transfer the frequencies.

Or:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1 or NAV2 Volume Slider to select the radio for frequency transfer.
3) Push and hold the small upper knob to transfer the frequencies.

Adding a NAV frequency to favorites:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1/NAV2 Frequency Button.
3) Touch the **Find** Button.
4) Touch the **Favorite** Tab.
5) Touch the **Add Favorite Frequency** Button.
6) Touch the **Name** Button.
7) Enter the desired frequency name.
8) Touch the **ENTER** Button or push the small upper knob.
9) Touch the **Frequency** Button.
10) Use the keypad to select the frequency.

Or:

Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).

11) Touch the **ENTER** Button or push the small upper knob.
12) Touch the **Add Favorite** Button.



Figure 4-27 Adding a NAV Frequency to Favorites

Adding a NAV frequency to favorites from any 'Load Frequency' Screen:

1) From any 'Load Frequency' Screen, touch the **Add to Favorites** Button.
2) If desired, touch the **Name** Button to change the name.
3) Touch the **Add Favorite** Button.

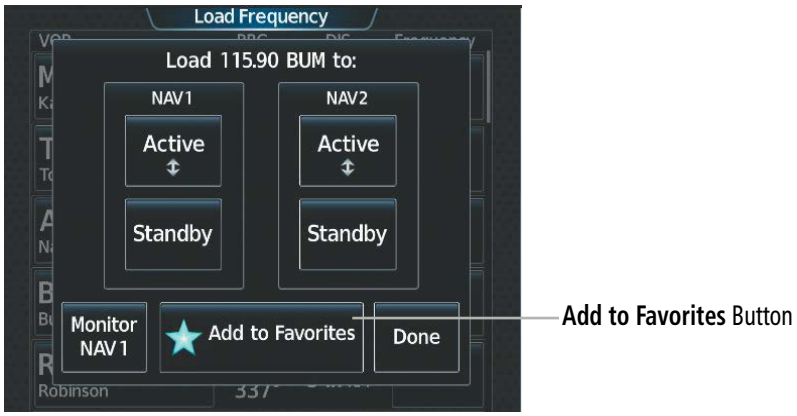


Figure 4-28 'Load Frequency' Screen - Add NAV Frequency to Favorites

Selecting a NAV frequency from favorites:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1/NAV2 Frequency Button.
3) Touch the **Find** Button.
4) Touch the **Favorite** Tab.
5) Touch the desired Frequency Button.
6) Touch the **Enter** Button to accept the new frequency as the standby frequency.

   Or:

   Push the small upper knob to accept the new frequency as the standby frequency.

   Or:

   Touch the **XFER** Button to accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency.

   Or:

   Push and hold the small upper knob to accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency.



Figure 4-29 Selecting a NAV Frequency from Favorites

Removing a frequency from favorites:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1/NAV2 Frequency Button.
3) Touch the **Find** Button.
4) Touch the **Favorite** Tab.
5) Touch the **X** Button next to the frequency to be deleted.
6) Touch the **OK** Button to confirm.

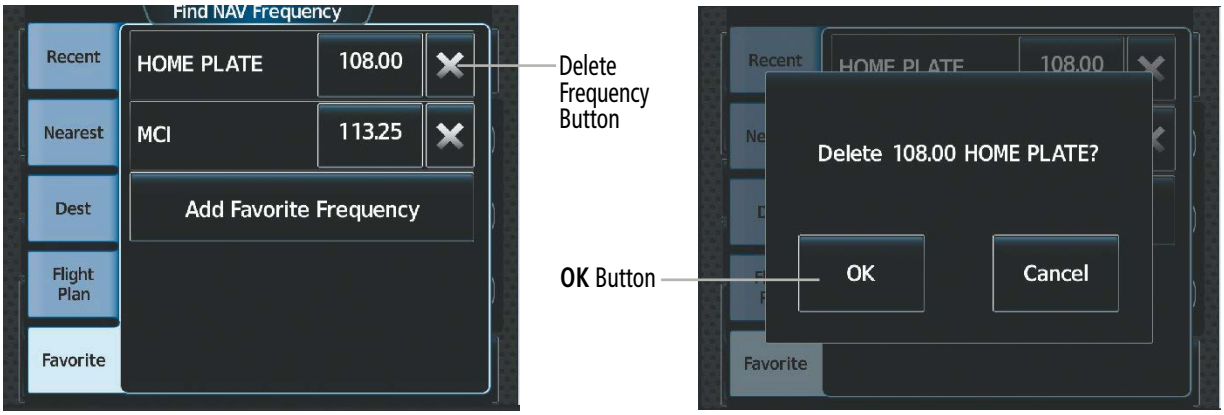


Figure 4-30 Deleting a NAV Frequency from Favorites

Finding and selecting a NAV frequency from the 'Airport Information' Screen:

1) From MFW Home, touch **Waypoint Info > Airport** to display the 'Airport Information' Screen.
2) If needed, touch the airport button to enter/find the desired airport.
3) Touch the **Freqs** Tab to display the 'Airport Frequencies' Screen.
4) Scroll the list to find the desired navigation frequency.
5) Touch the Frequency Button to display the 'Load Frequency' Screen.
6) Touch the location button to load the frequency to NAV1 or NAV2 Active/Standby or Favorites.
7) Touch the **Done** Button or the **Back** Button to return to the 'Airport Frequencies' Screen.

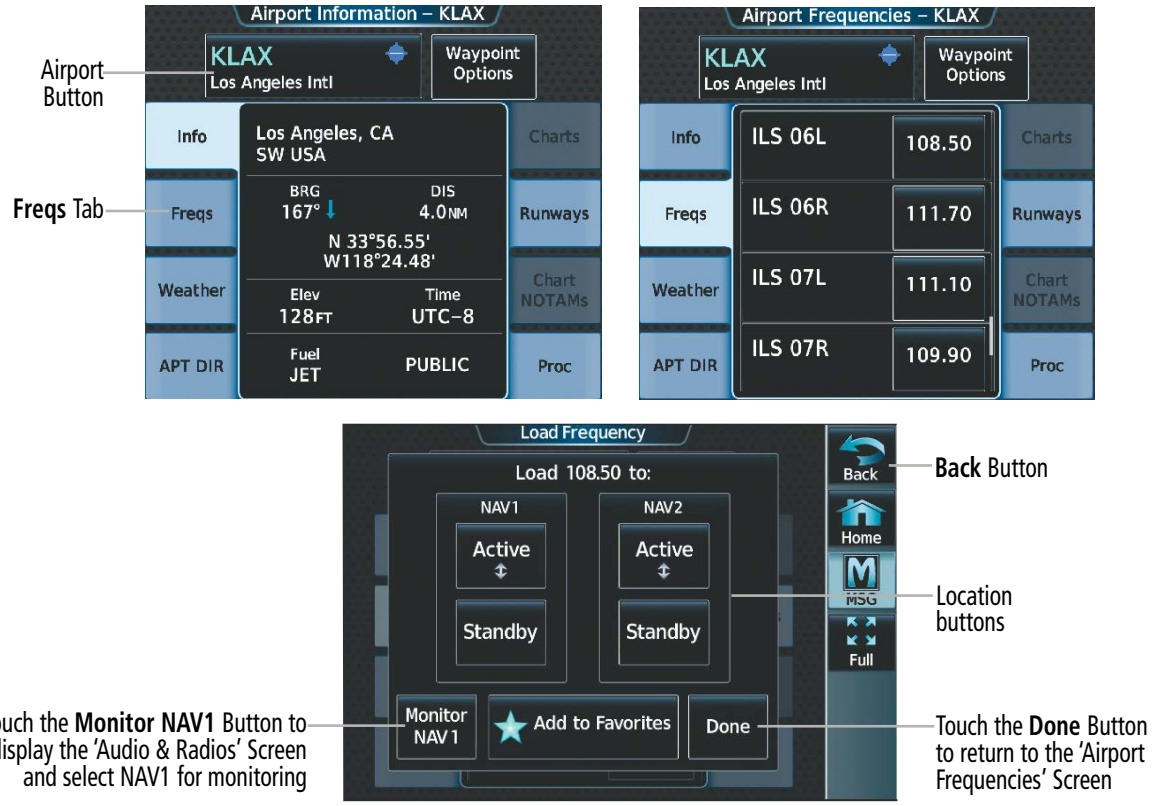


Figure 4-31 Airport Information Tuning

Finding and selecting a NAV frequency from the 'VOR Info' Screen:

1) From MFW Home, touch **Waypoint Info > VOR** to display the 'VOR Information' Screen.
2) If needed, touch the VOR button to enter/find the desired VOR.
3) Touch the Frequency Button to display the 'Load Frequency' Screen.
4) Touch the location button to load the frequency to NAV1 or NAV2 Active/Standby or Favorites.
5) Touch the **Done** Button or the **Back** Button to return to the 'VOR Information' Screen.



Figure 4-32 VOR Information Tuning

Finding and selecting a NAV frequency from the 'Nearest Airport' Screen:

1) From MFW Home, touch **Nearest > Airport** to display the 'Nearest Airport' Screen.
2) Touch the desired airport button to display the 'Waypoint Options' Window.
3) Touch the **Airport Info** Button to display the 'Airport Information' Screen.
4) Touch the **Freqs** Tab to display the 'Airport Frequencies' Screen.
5) Scroll the list to find the desired frequency.
6) Touch the Frequency Button to display the 'Load Frequency' Screen.
7) Touch the location button to load the frequency to NAV1 or NAV2 Active/Standby or Favorites.
8) Touch the **Done** Button or the **Back** Button to return to the 'Airport Frequencies' Screen.

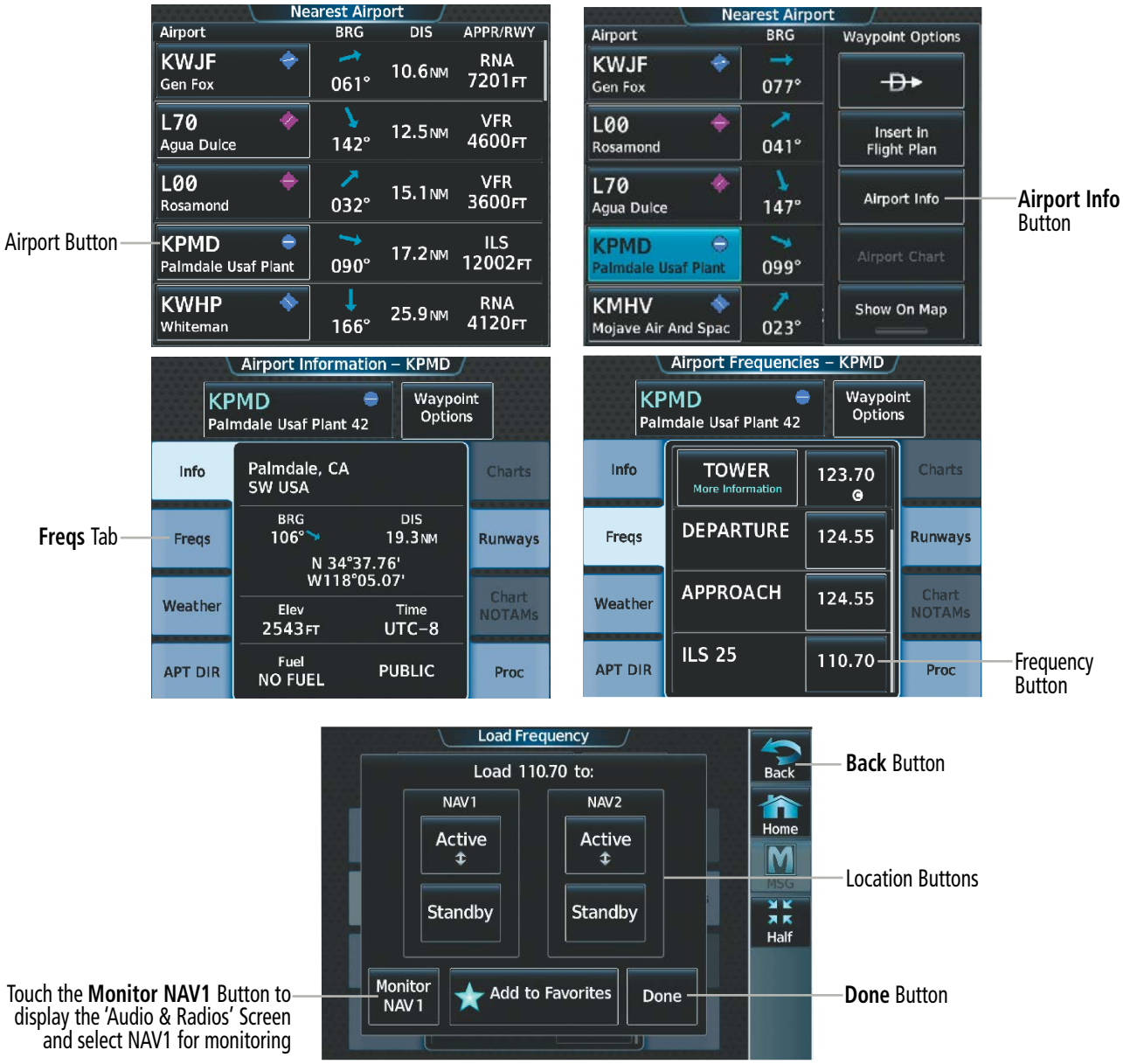


Figure 4-33 Nearest Airport Tuning

Finding and selecting a NAV frequency from the 'Nearest VOR' Screen:

1) From MFW Home, touch **Nearest > VOR** to display the 'Nearest VOR' Screen.
2) Scroll the list to find the desired frequency.
3) Touch the Frequency Button to display the 'Load Frequency' Screen.
4) Touch the location button to load the frequency to NAV1 or NAV2 Active/Standby or Favorites.
5) Touch the **Done** Button or the **Back** Button to return to the 'Nearest VOR' Screen.

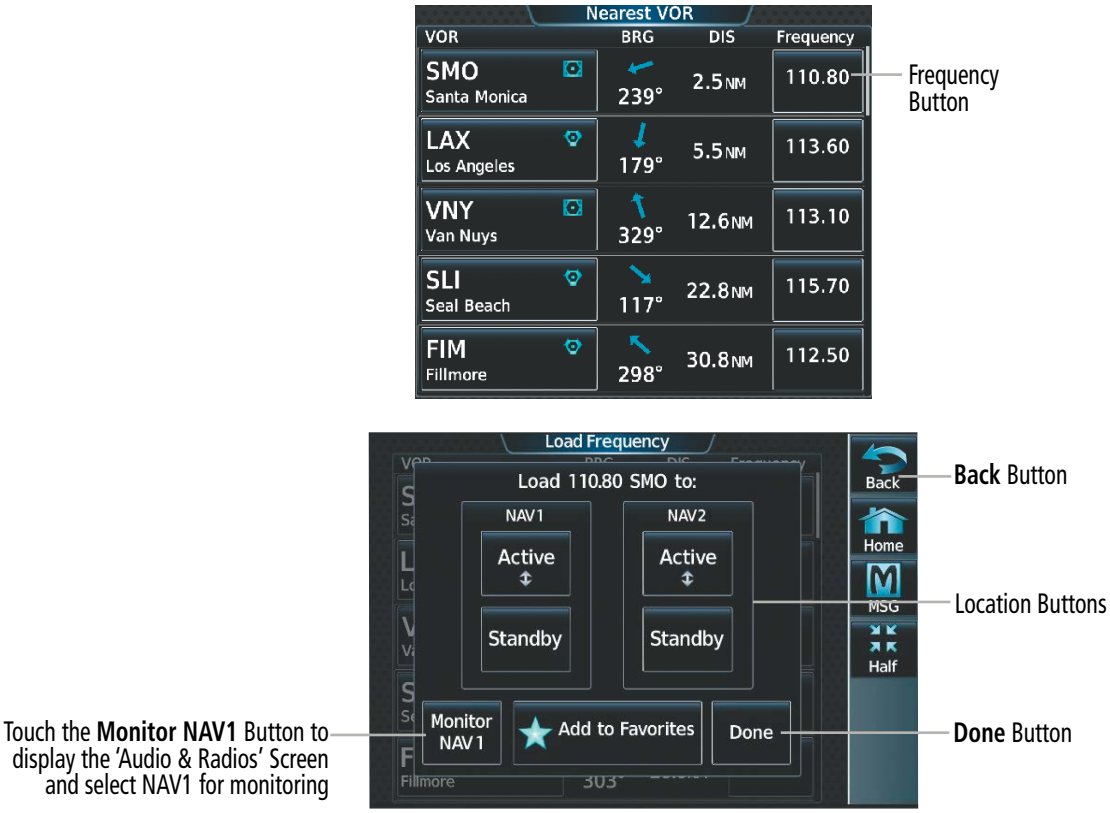


Figure 4-34 Nearest VOR Tuning

VOR/LOC ID

When the Morse code Identifier audio is on for a NAV radio, a white ID appears to the right of the active NAV frequency. Pushing the lower knob turns on/off the Morse code audio only for the selected radio. To turn both NAV IDs on/off, select each NAV in turn and push the lower knob to turn the Morse code on/off.

The decoded Morse code identifier received from the navigation source is displayed on the PFD in the Active Frequency and ID field, and also on the GTC on the NAV Frequency Button.



Figure 4-35 VOR/LOC ID Locations

VOLUME

While the NAV radio is selected, the radio volume level for that radio can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left on the NAV Volume Slider . Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume.

NAV Radio volume for the pilot and copilot can be controlled independently. Select the Pilot or Copilot Tab on the 'Audio & Radios' Screen to control the volume for that respective position. The Function Label for the lower knob will indicate which position is currently being controlled by the lower knob.

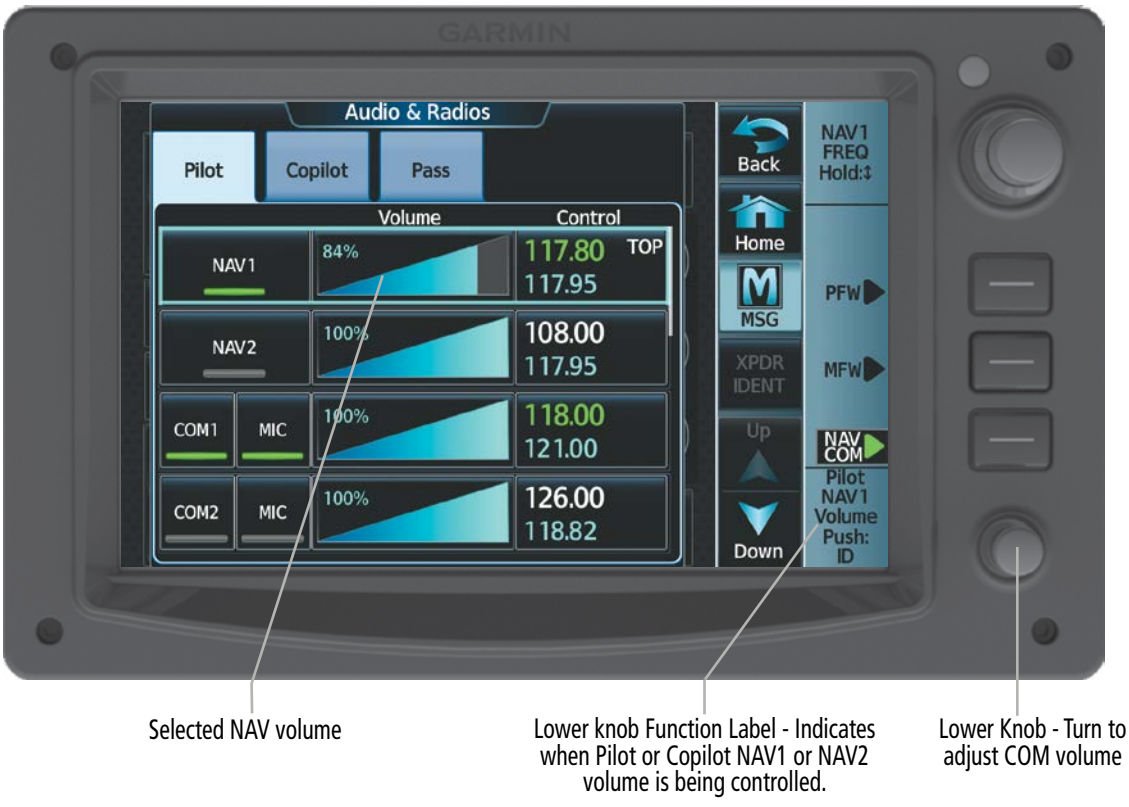


Figure 4-36 NAV Volume Level

AUTO-TUNING OF NAV FREQUENCIES

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 Instruments Section for details.*

NOTE: *In some circumstances the system may auto-tune a course for an unintended localizer facility because that facility shares the same frequency and is nearby the intended localizer facility. Always verify auto-tuned courses and frequencies with FAA published data and manually correct if required.*

NAV frequencies are automatically loaded into the NAV Frequency Box on approach activation. When loading or activating a VOR or ILS/LOC approach, the approach frequency is automatically transferred to a NAV frequency field as follows:

	Selected CDI NAV Source is NAV1 or NAV2	Selected CDI NAV Source is GPS
Approach LOADED	Selected CDI NAV radio - Approach Frequency is transferred to the standby frequency field. Non-selected CDI NAV radio - Approach Frequency is transferred to the active frequency field.	The approach frequency will be transferred to NAV1 and NAV2 active frequency fields and current NAV1 and NAV2 frequencies will be transferred to the standby fields.
Approach ACTIVATED	Approach Frequency is transferred to the active frequency field on both CDI NAV radios and previously active frequencies are transferred to standby.	

Table 4-2 Auto-tuning of NAV frequencies

MARKER BEACON RECEIVER

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

The marker beacon receiver is used as part of the ILS. The marker beacon receiver is always on and detects any marker beacon signals within the reception range of the aircraft. The receiver detects the three marker tones – outer, middle, and inner – and illuminates the marker beacon annunciations located to the left of the Altimeter on the PFD.

The Touchscreen Controller provides three different states of marker beacon audio operation; Selected, Deselected, and Muted. Pressing the **Marker** Button on the 'Audio & Radios' Screen selects and deselects marker beacon audio. The **Marker** Button annunciation indicates when marker beacon audio is selected.

Touching the **High Sense** Button switches between high and low marker beacon receiver sensitivity. The High Sense function (annunciation illuminated) is used to provide an earlier indication when nearing a marker during an approach. The Low Sense function (annunciation extinguished) results in a narrower marker dwell while over a station.

The Marker Beacon volume level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left on the Marker Beacon Volume Slider. Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume.

During marker beacon audio reception, pressing the flashing **MUTE** Button on the 'NAV/COM Home' Screen mutes the audio but does not affect the marker annunciations. The marker tone is silenced, then waits for the next marker tone. The flashing **MUTE** Button is also removed during audio muting. The audio returns when the next marker beacon signal is received.



Figure 4-37 Marker Beacon Controls



Figure 4-38 Marker Beacon Flashing Mute Button

ADF/DME TUNING (OPTIONAL)

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

The 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 following DME information is displayed on the Touchscreen Controller:

- DME tuning mode (DME transceiver pairing)
- DME receiver volume

The selected DME volume level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left on the NAV Volume Slider . Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume.

DME TUNING

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

The following DME modes 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 a DME mode:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Scroll the list to find the **DME** Button.
3) Touch the DME Mode Control Button to display the 'DME' Screen.
4) Touch the NAV1, NAV2, or HOLD Button to select desired DME mode. DME information will be displayed on the PFD in the Active NAV Source/Frequency Box. An 'H' next to the frequency indicates DME Hold mode.

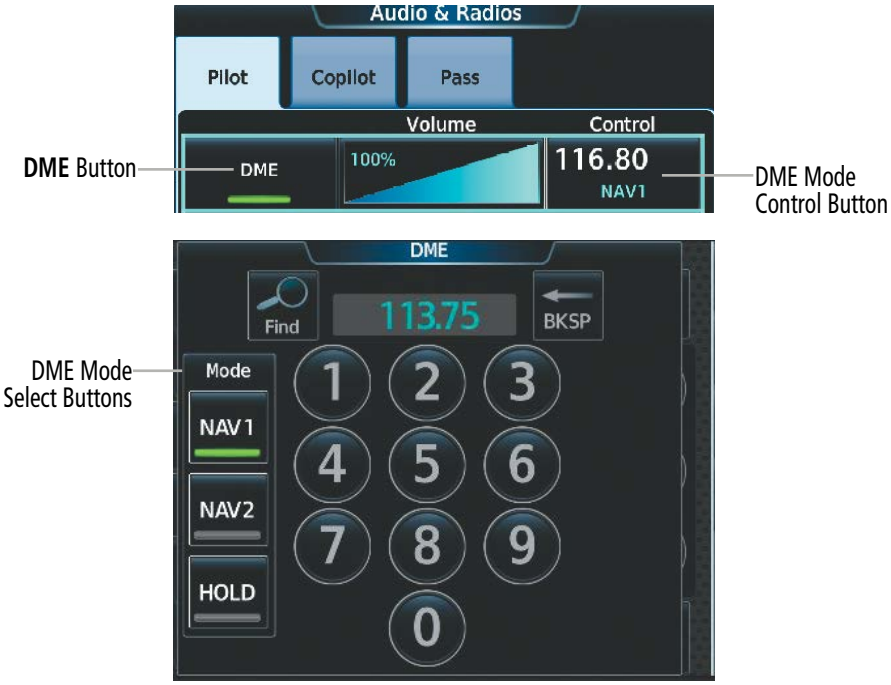


Figure 4-39 DME Mode Selection



Figure 4-40 DME Hold Indication on the PFD

4.4 MODE S TRANSPONDERS

The system is equipped with a Mode S transponder that provides Mode A, Mode C, and Mode S interrogation and reply capabilities. Selective addressing or Mode Select (Mode S) capability includes the following features:

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

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

TRANSPONDER CONTROLS

Active transponder selection, transponder mode selection, code entry, and IDENT activation are controlled and displayed on the Touchscreen Controller.



Figure 4-41 Transponder Display and Controls

TRANSPONDER MODE SELECTION

Mode selection can be automatic or manual. The Mode Selection Buttons can be accessed by touching the Transponder Code/Mode Button on the 'NAV/COM Home' Screen.

Selecting transponder mode:

1) From NAV/COM Home, touch the Transponder Code/Mode Button to display the 'Transponder' Screen.
2) Touch desired Mode Selection Button to activate the desired transponder mode.

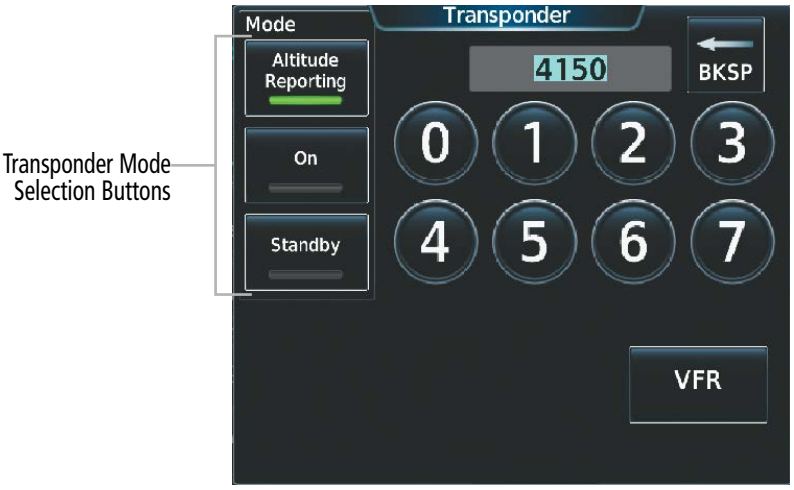


Figure 4-42 Transponder Mode Selection

STANDBY MODE

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

Standby Mode can be selected at any time by touching the **Standby** Button on the 'Transponder' Screen. In Standby, the transponder is powered and new codes can be entered, but no replies or squitters are transmitted. When Standby is selected, the transponder code is displayed in white, and a white STBY indication appears in the Transponder Code/Mode Button.



Figure 4-43 Standby Mode Indication

ON MODE

On Mode can be selected at any time by touching the **On** Button on the 'Transponder' Screen. On Mode generates Mode A and Mode S replies as well as transmission of acquisition and extended squitters, including ADS-B out. Mode C altitude reporting is inhibited. In On Mode, a white ON indication appears in the Transponder Code/Mode Button on the ground. A green ON indication appears in the Transponder Code/Mode Button when the aircraft is airborne.

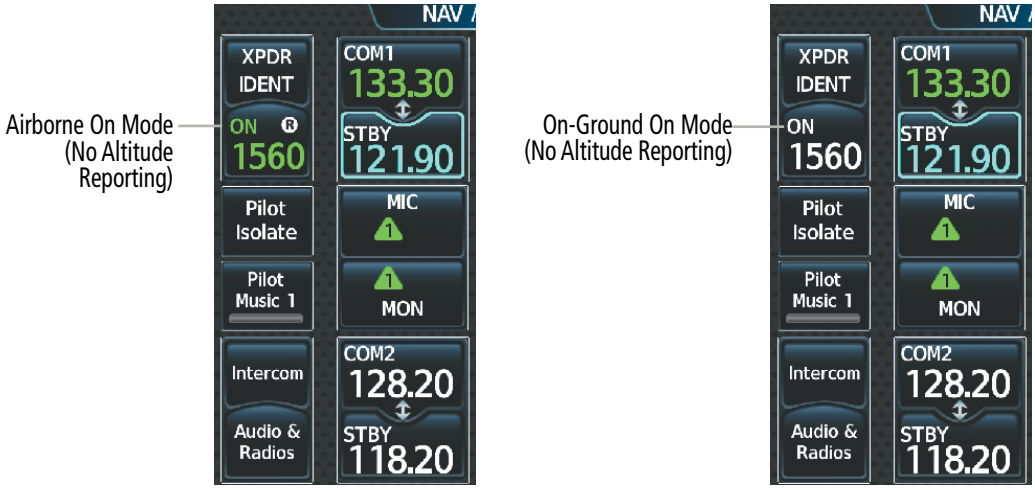


Figure 4-44 On Mode Indications

ALTITUDE REPORTING MODES

Altitude Reporting Mode is normally selected automatically when the aircraft is on the ground or airborne. Altitude Reporting Mode can also be selected manually by touching the **Altitude Reporting** Button on the 'Transponder' Screen. When Altitude Reporting Mode is selected, an ALT indication will appear on the Transponder Code/Mode Button. Selecting Altitude Reporting Mode enables transmission of transponder replies and squitters. Transmissions will include pressure altitude information. The ALT indication and transponder code on the Transponder Code/Mode Button will appear green while airborne and white while on the ground. When the transponder is operating with an air state of on-ground it will disable replies to Mode A, Mode C, and Mode S all-call interrogations so the aircraft will not show up on the traffic systems of other aircraft.

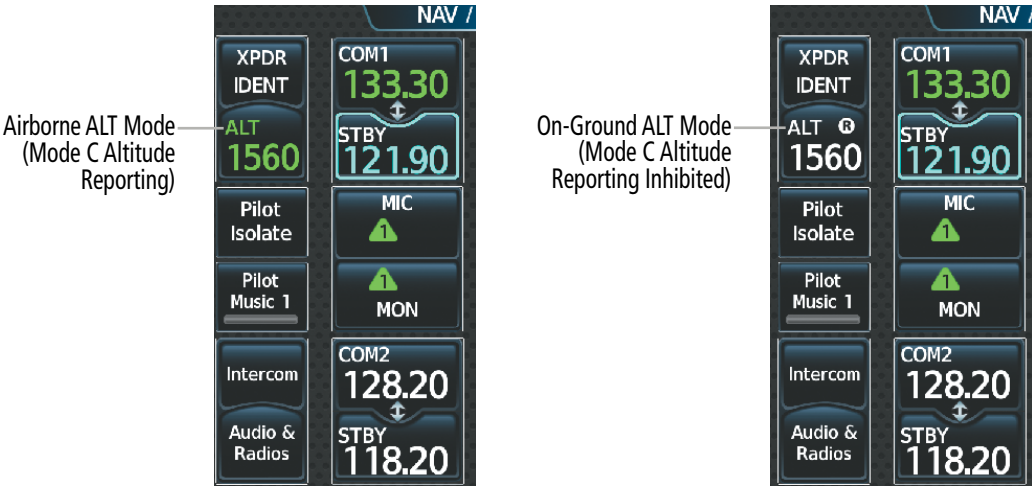


Figure 4-45 Altitude Reporting Mode

ENTERING A TRANSPONDER CODE

Entering a transponder code with the keypad:

1) From NAV/COM Home, touch the Transponder Code/Mode Button.
2) Use the keypad to select the desired code.
3) Touch the **Enter** Button to enter the new code.



Figure 4-46 Transponder Code Entry

Entering a transponder code with the knobs:

1) From NAV/COM Home, touch the Transponder Code/Mode Button.
2) Turn the large upper knob one click in any direction to select the first digit of the existing code.
3) Turn the small upper knob to enter the desired first digit.
4) Turn the large upper knob clockwise to move the cursor to the next digit.
5) Turn the small upper knob to enter the next digit and repeat steps 4 and 5 until complete.
6) Touch the **Enter** Button or push the small upper knob to enter the new code. Touching the **Cancel** Button before code entry is complete cancels code entry and restores the previous code.

VFR CODE

The VFR code can be entered either manually or by touching the **VFR** Button. When the **VFR** Button is selected, the pre-programmed VFR code is automatically displayed in the Transponder Code Button.

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

Entering the VFR code with the VFR Button:

1) From NAV/COM Home, touch the Transponder Code/Mode Button.
2) Touch the **VFR** Button.
3) Touch the **Enter** Button or push the small upper knob to enter the new code. Pressing the **Cancel** Button before code entry is complete cancels code entry and restores the previous code.

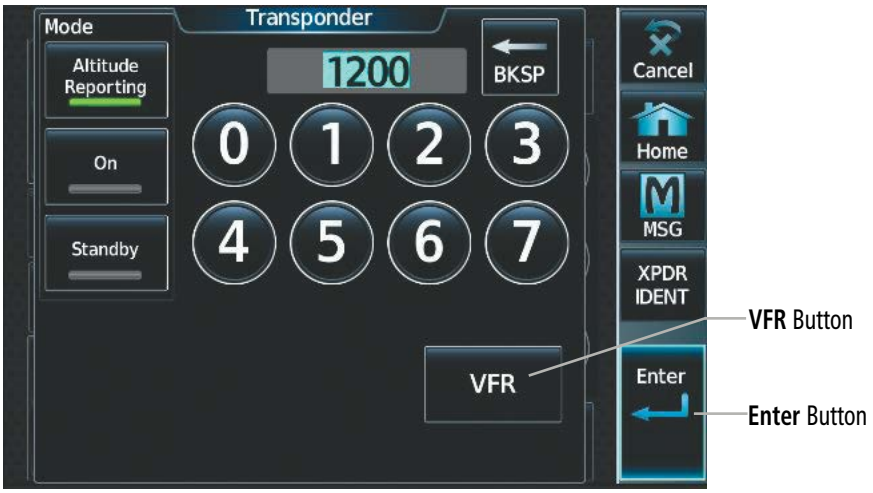


Figure 4-47 Transponder VFR Code Entry

REPLY STATUS

When the transponder sends replies to interrogations, a white R indication appears momentarily in the Transponder Code Button.

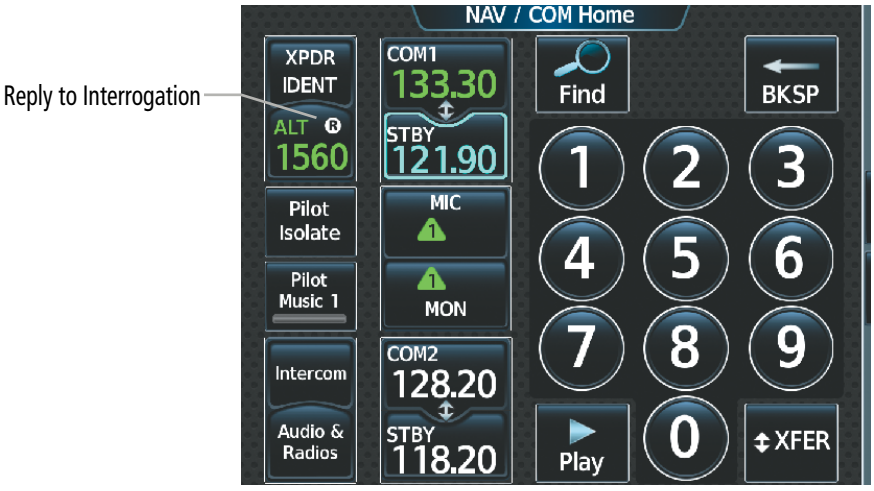


Figure 4-48 Transponder Reply Indication

IDENT FUNCTION

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

Touching the Active Transponder IDENT Button or the **XPDR IDENT** Button on the Button Bar 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. When active, the word IDENT appears in green on the Active Transponder **IDENT** Button and pulsates.



Figure 4-49 Transponder IDENT Controls

4.5 ADDITIONAL AUDIO FUNCTIONS

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 Controller, 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

Radio communications can be heard over the cockpit speaker by touching the **Speaker** Button on the 'Audio & Radios' Screen. Speaker audio is muted when the PTT is pushed. Certain aural alerts and warnings are always heard on the speaker, even when the speaker is not selected.

The speaker volume level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left using the Speaker Volume Slider. Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume.



Figure 4-50 Speaker Audio Selection

INTERCOM

The system includes an eight-mode intercom system (ICS) that connects or isolates the pilot, copilot, and passengers. Touch the **Intercom** Button to display the 'Intercom' Screen. The intercom links between the Pilot, Copilot, and Passengers are enabled/disabled by touching the connecting arrows.

Enabling/Disabling Intercom Connections:

1) From NAV/COM Home, touch the **Intercom** Button.
2) Touch link arrow to enable connection between positions. Arrow turns green.
3) Touch link arrow to disable connection between positions. Arrow turns gray.

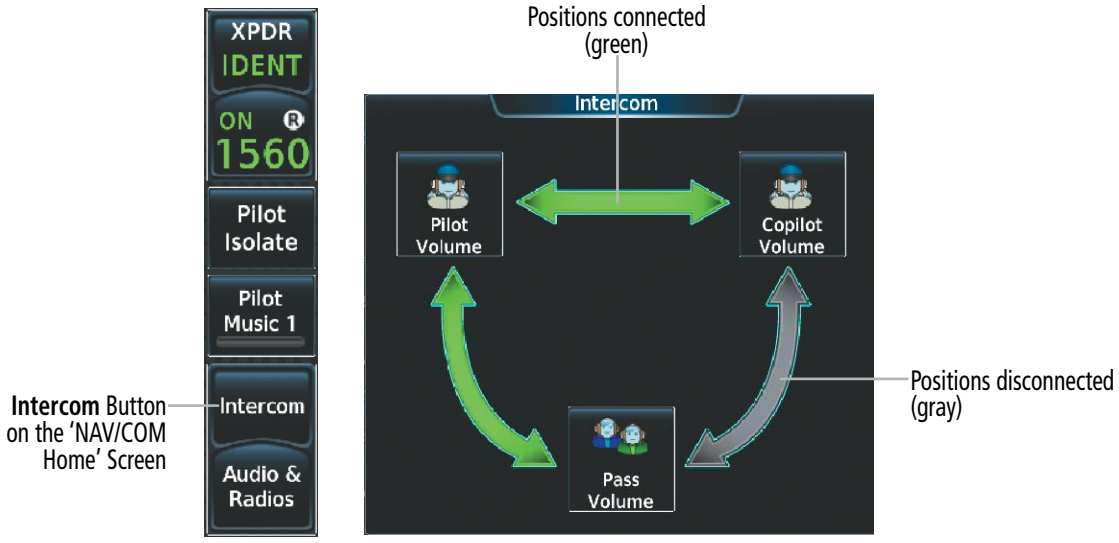


Figure 4-51 Intercom Controls

Touching the **Pilot Isolate** Button on the 'NAV/COM Home' Screen isolates the Pilot from the Copilot and Passengers and displays the 'Intercom' Screen. Touching the disabled links restores the audio connections.

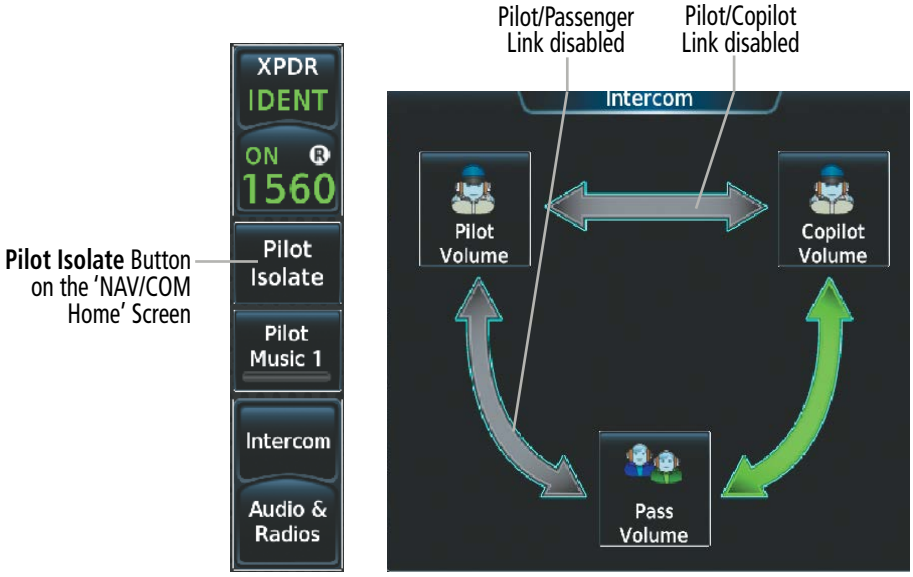


Figure 4-52 Pilot Isolation Button

INTERCOM VOLUME AND SQUELCH

The Touchscreen Controller controls the volume and squelch for the pilot, copilot, and passengers independently. The selected intercom volume or squelch level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left on the slider. Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume.

Adjusting the intercom volume:

1) From NAV/COM Home, touch the **Intercom** Button.
2) Touch the Pilot, Copilot, or Pass Volume Button to display the Intercom Settings Screen.
3) Adjust the volume by using the lower knob.

   Or:

   Slide your finger on the volume slider.

By default, automatic squelch is always enabled. To disable automatic squelch, touch the **Auto** Button on the intercom setting screen.

Adjusting intercom squelch:

1) From NAV/COM Home, touch the **Intercom** Button.
2) Touch the Pilot, Copilot, or Pass Volume Buttons to display the Intercom Settings Screen.
3) Touch the Squelch **Auto** Button to disable automatic squelch.
4) Adjust squelch manually using the lower knob.

   Or:

   Slide your finger on the squelch slider.

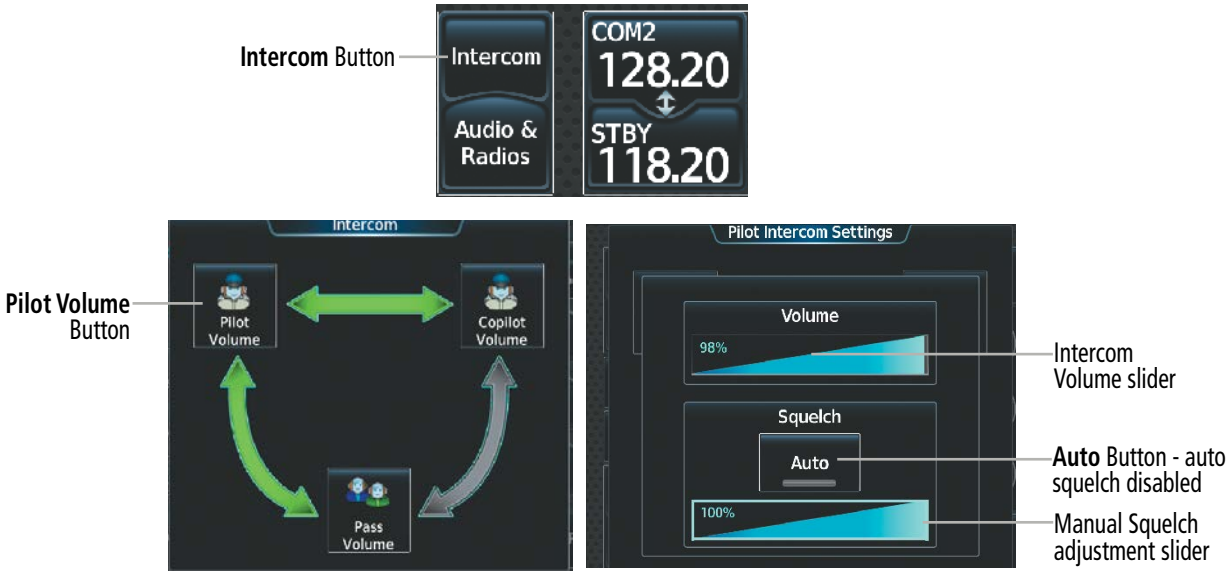


Figure 4-53 Intercom Volume and Squelch Controls

CLEARANCE RECORDER AND PLAYER

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

Touching the **Play** Button located on the 'NAV/COM Home' Screen or the **Recorder** (Play) Button on the 'Audio & Radios' Screen, plays the latest recorded memory block. The **Recorder** (Stop) Button is displayed while the audio is playing. When the present memory block has finished playing, the **Recorder** (Play) Button is displayed again.

Touching the **Recorder** (Stop) Button 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.

Touching the Play Previous Button begins playing the previously recorded memory block. Each subsequent touch of the Play Previous Button selects the previously recorded memory block, if any more exist. Touching the Play Next Button begins playing the next recorded memory block. Each subsequent touch of the Play Next Button selects the next recorded memory block, if any more exist.

Removing power from the system automatically clears all recorded blocks.

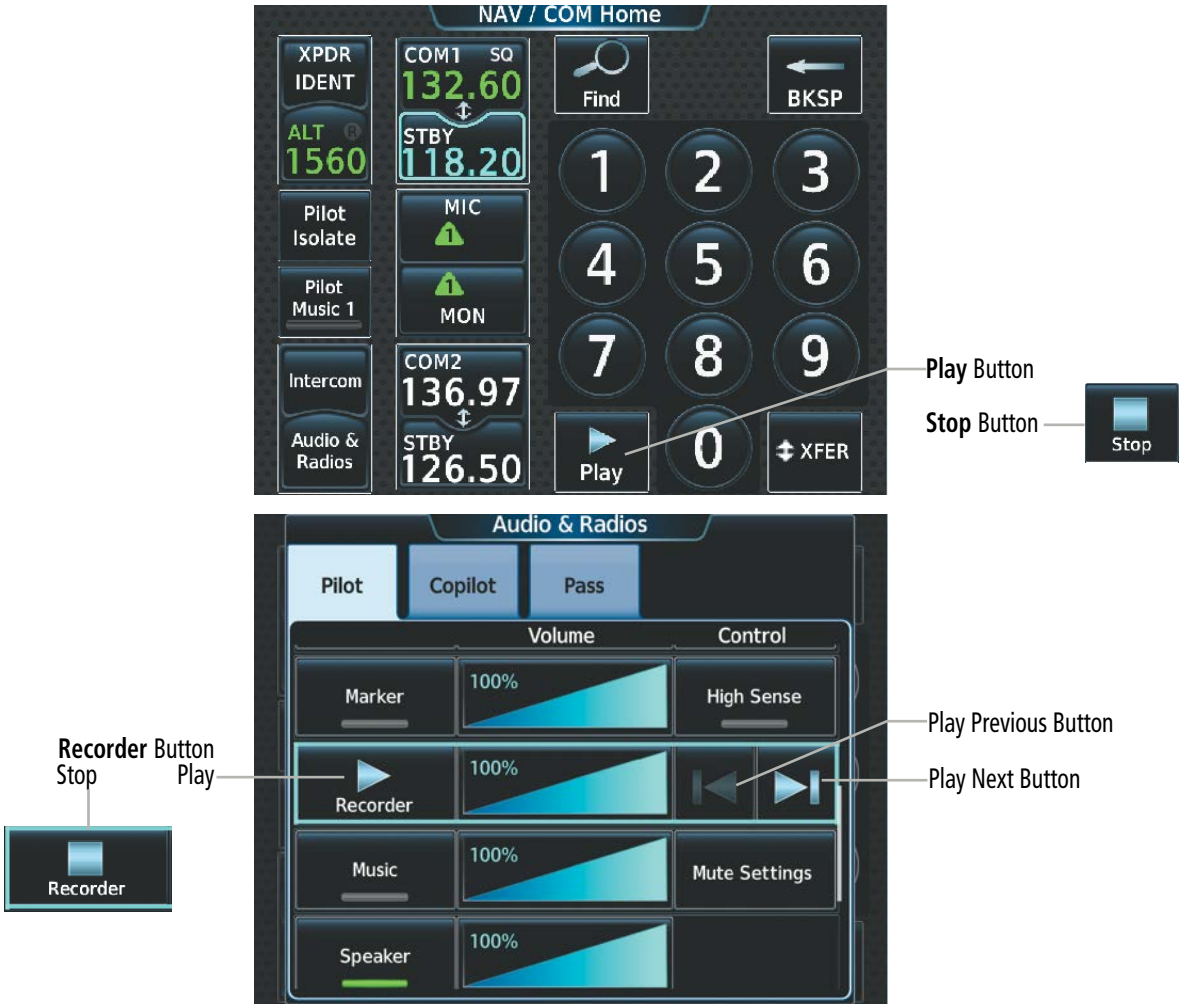


Figure 4-54 Recorder Controls

3D AUDIO

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 hears the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM1 at 11 o'clock and COM2 at the 1 o'clock position.

The scope of 3D audio is limited to COM audio for the pilot and copilot stations. All other audio (alerts, side-tones, intercom, etc.) is distributed equally to both ears.

Pilot and copilot 3D audio can be enabled or disabled. Also, the 3D audio left/right reference can be changed using the Left-Right Swap function. This allows pilots to use their microphone on either side of the headset while using 3D audio.

Enabling/Disabling 3D Audio:

1) From MFW Home, touch **Utilities > Setup > Avionics Settings**.
2) Touch the **Audio** Tab.
3) Touch the **Pilot 3D Audio** Button or **Copilot 3D Audio** Button.

Enabling/Disabling Left-Right Swap:

1) From MFW Home, touch **Utilities > Setup > Avionics Settings**.
2) Touch the **Audio** Tab.
3) Touch the **Pilot L-R Swap** Button or **Copilot L-R Swap** Button.

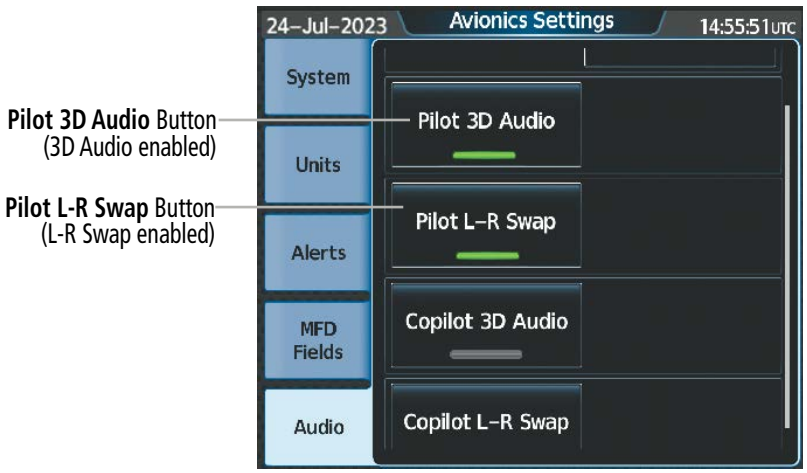


Figure 4-55 3D Audio and L-R Swap

SIMULTANEOUS COM OPERATION

Both the pilot and the copilot can transmit and receive simultaneously over separate COM radios. When using simultaneous COM operation, the active COM selections and indications for each position can be accessed through the respective Pilot or Copilot Tabs on the 'Audio & Radios' Screen.

The active COM indications on the 'NAV/COM Home' Screen will reflect the inputs that are selected on each tab. If the pilot and copilot select the same radio for transmission, the MIC and MON Button indications will display green triangles to indicate status.

The green MIC triangle on the 'NAV/COM Home' Screen will flash to indicate transmission from the pilot position only. The active COM radio and frequency for the Copilot will appear white on the 'NAV/COM Home' Screen and will include the transmit (TX) and receive (RX) indications as appropriate.

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

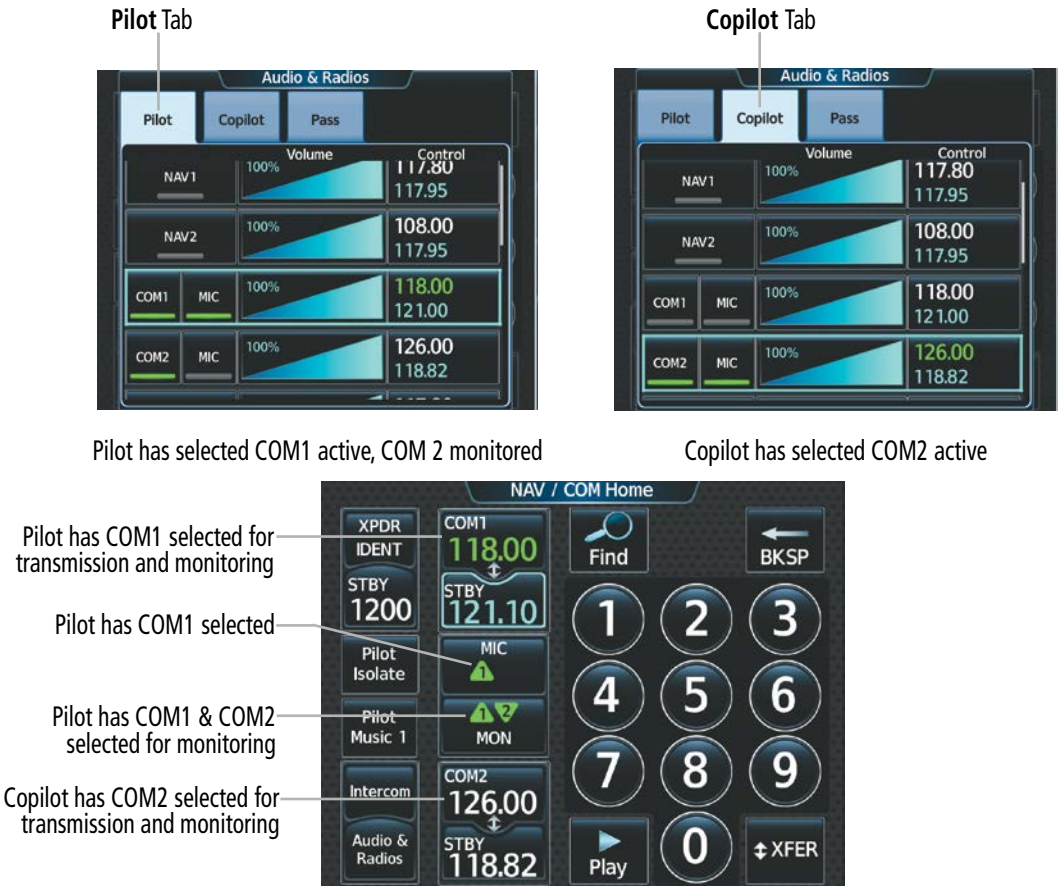


Figure 4-56 Simultaneous COM Operation

AUXILIARY AUDIO

Auxiliary audio provides SiriusXM Radio Audio from the Data Link Receiver and stereo auxiliary entertainment inputs. Stereo auxiliary entertainment is compatible with most personal portable entertainment devices such as MP3 players, cell phones, and tablets. Auxiliary audio is controlled with the **Pilot Music 1** Button and the **Music** Button.

Auxiliary audio volume can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left on the volume slider.

SIRIUSXM RADIO AUDIO:

To access SiriusXM entertainment touch the **Pilot Music 1** Button on the 'NAV/COM Home' Screen. Refer to the Additional Features Section for more details on SiriusXM Radio Audio and the Data Link Receiver.

AUXILIARY AUDIO INPUT

Selecting/deselecting the Auxiliary Audio input:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the Pilot, Copilot or Pass Tab.
3) Scroll the list to find the **Music** Button.
4) Touch the **Music** Button to select/deselect audio input.

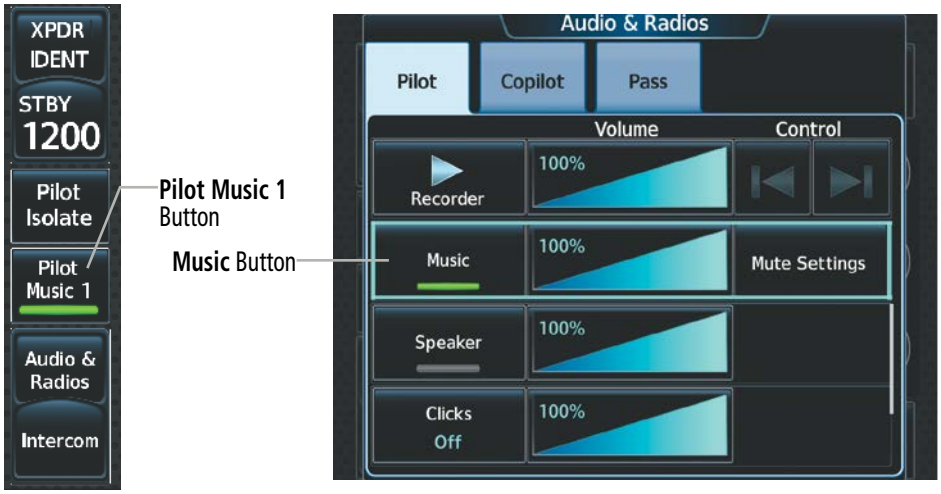


Figure 4-57 Auxiliary Audio Controls

AUXILIARY AUDIO MUTING

Auxiliary audio muting occurs when the configured activity (Intercom, Radio Inputs, and/or Aural Alerts) is active. Auxiliary audio is always soft muted when an interruption occurs from these sources. Soft muting is the gradual return of auxiliary audio to its original volume level. The time required for Auxiliary audio volume to return to normal is between one-half and four seconds.

Configuring SiriusXM audio Mute Settings:

1) From NAV/COM Home, touch the **Pilot Music 1** Button to display the 'Music' Screen.
2) Touch the **Volume** Button to display the 'Music Volume' Screen.
4) Touch the **Mute Settings** Button to display the 'Music Mute Settings' Screen.
5) Select the Intercom, Radio Inputs, and/or Aural Alerts Buttons to enable/disable mute SiriusXM audio.

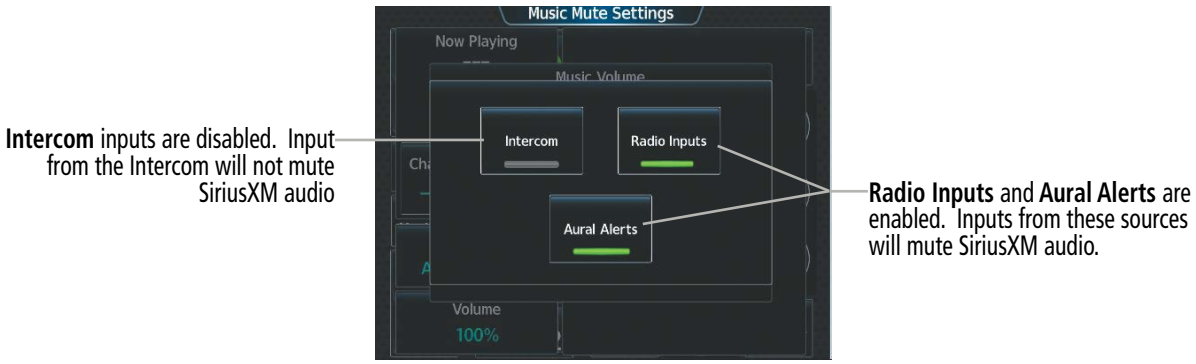


Figure 4-58 SiriusXM Audio Mute Settings

Configuring Auxiliary Audio Mute Settings:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the **Pilot**, **Copilot** or **Pass** Tab.
3) Scroll the list to find the **Music** Button.
4) Touch the **Mute Settings** Button to display the 'Music Mute Settings' Screen.
5) Select the Intercom, Radio Inputs, and/or Aural Alerts Buttons to enable/disable mute auxiliary audio.

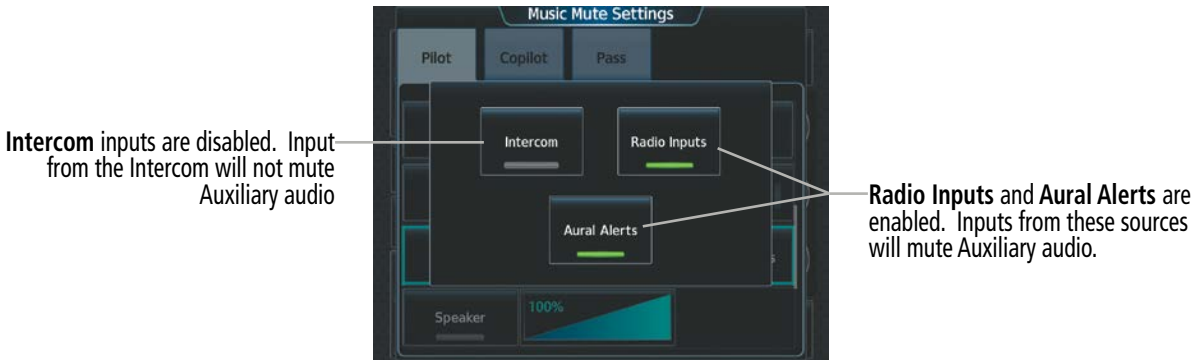


Figure 4-59 Music Mute Settings

AUDIO FEEDBACK (CLICKS)

Pilot or Copilot interaction with the Touchscreen Controller will produce audible feedback in the form of clicks. Incorrect touch commands or invalid interaction with the Touchscreen Controller will produce an error tone. The audible feedback can be configured to suit the preference of the user. The audio feedback (clicks) volume can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left on the volume slider.

Configuring audio feedback:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the **Pilot** or **Copilot** Tab.
3) Scroll the list to find the **Clicks** Button.
4) Touch the **Clicks** Button to display the 'Audio Feedback Settings' Screen.
5) Touch the desired audio feedback setting.

Setting	Description
Off	No feedback will be audible to the selecting position.
Errors Only	Only Error tones will be audible. All error tones from the Touchscreen Controllers will be audible to the selecting position.
On	All feedback tones will be audible. All feedback tones from the Touchscreen Controllers will be audible to the selecting position.

Table 4-3 Audio Feedback Settings

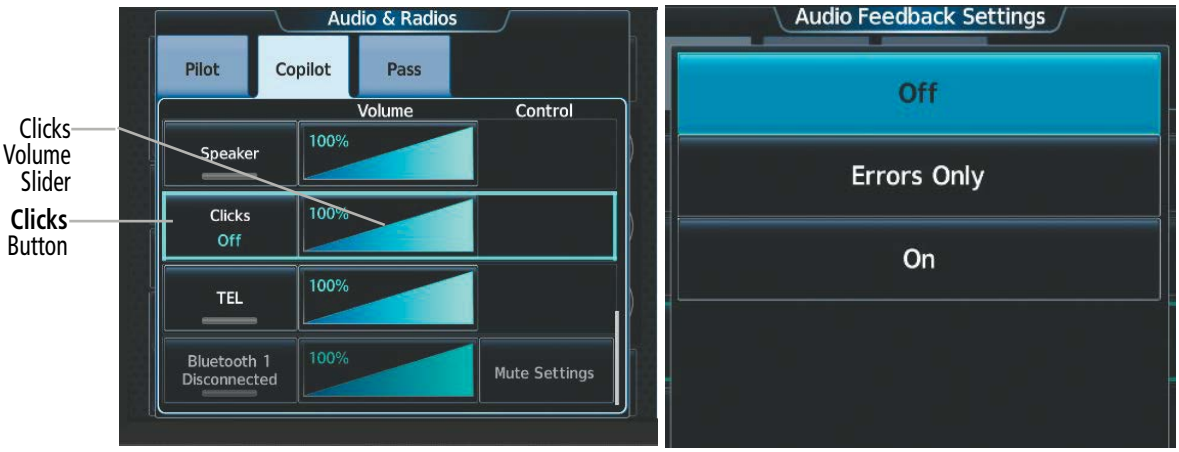


Figure 4-60 Audio Feedback (Clicks) Selection

TELEPHONE

The pilot and copilot headsets can be used for telephone communication. Pressing the **TEL** Button selects and deselects the telephone for use with the corresponding headset. Active radios can still be monitored on the headset while it is being used for telephone communication. Telephone communication is muted when the PTT is pushed.

The telephone volume level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the lower knob or by sliding your finger right or left using the Telephone Volume Slider . Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume.

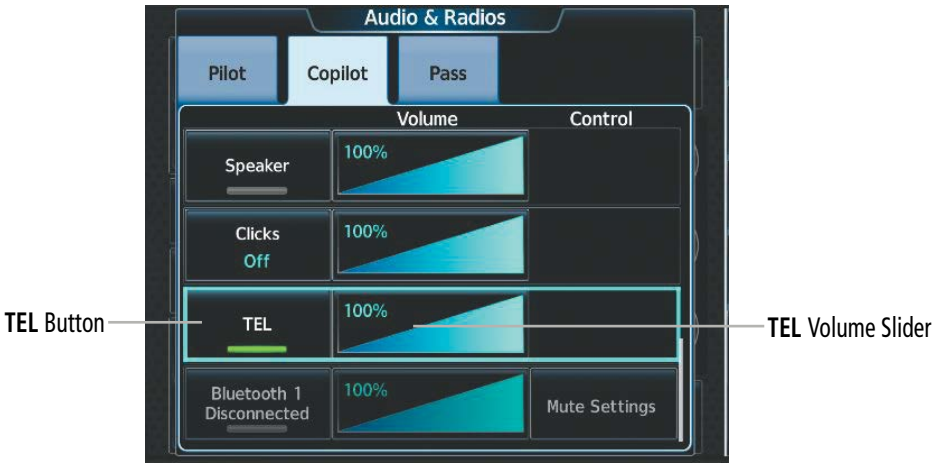


Figure 4-61 TEL Button Selected

BLUETOOTH AUDIO CONTROLS

The 'Connext® Setup' Screen allows for establishing Bluetooth connections between a mobile device running the Garmin Pilot™ application or between a mobile device and the GMA™. Refer to the Additional Features Section for how to establish Bluetooth connections.

Selecting a paired device as an audio source:

1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the Pilot, Copilot, or Pass Tab.
3) Scroll the list to find the paired device.
4) Touch the paired device button to enable/disable connected device audio.
5) Touch the **Music** Button (pilot/copilot tab) or **Music 1** Button (passenger tab) to enable/disable SiriusXM or other music source audio.
6) Adjust volume using the slider bar.
7) Adjust mute settings by touching the **Mute Settings** Button and selecting desired options.

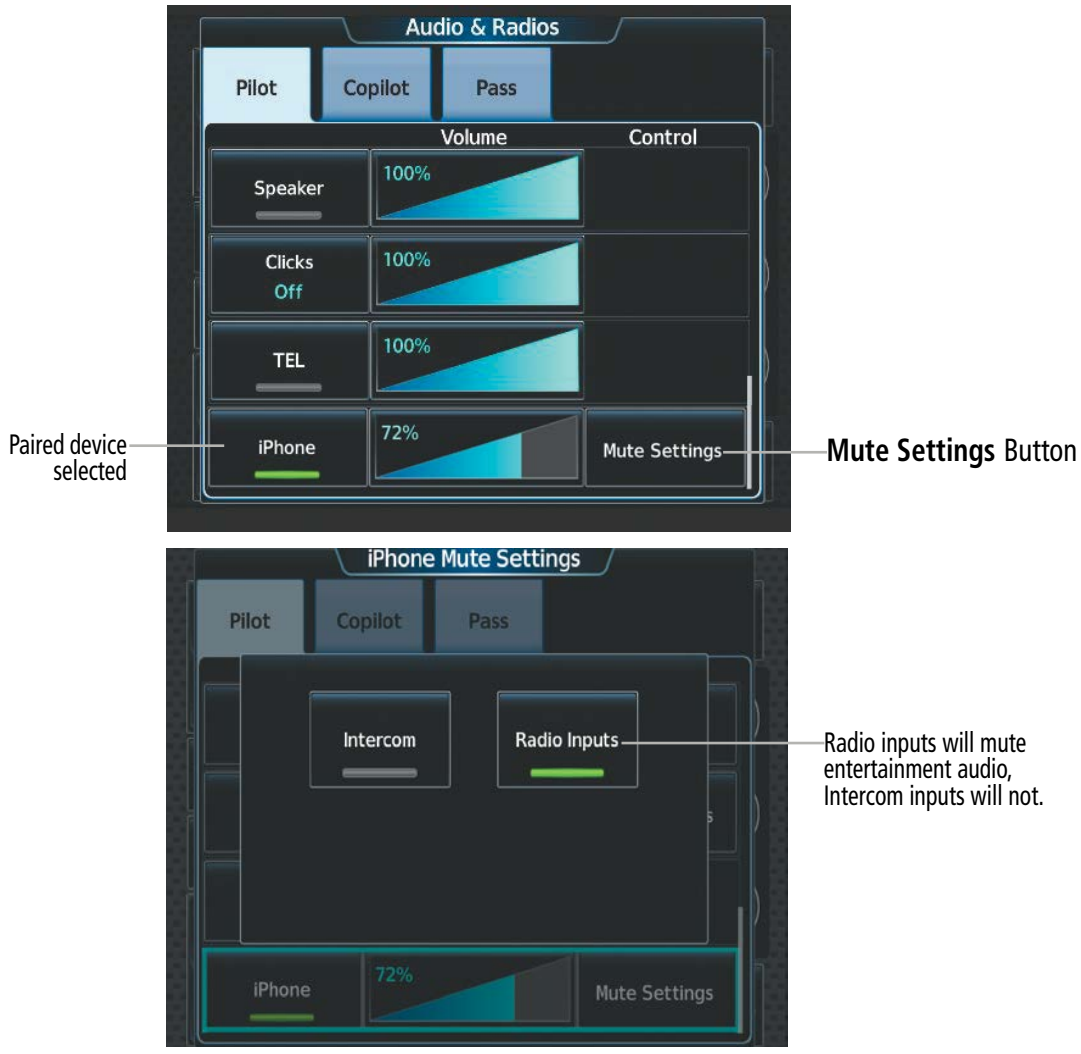


Figure 4-62 Bluetooth Audio Controls

4.6 ABNORMAL OPERATION

Abnormal operation includes equipment failures of the system components and failure of associated equipment, including switches and external devices. A failure of any communication or navigation system on the 'Audio & Radio' Screen will be displayed with a amber X.

STUCK MICROPHONE

If a push-to-talk (PTT) Key becomes stuck, the COM transmitter stops transmitting after 35 seconds of continuous operation. An 'L MIC STUCK ON' (pilot side) or an 'R MIC STUCK ON' (copilot side) CAS message will appear to advise the crew of a stuck microphone.

The **MIC** Button Annunciation flashes as long as the PTT Key remains stuck.

COM FAILURE

In case of a COM system failure, an amber X may appear on the frequency display.

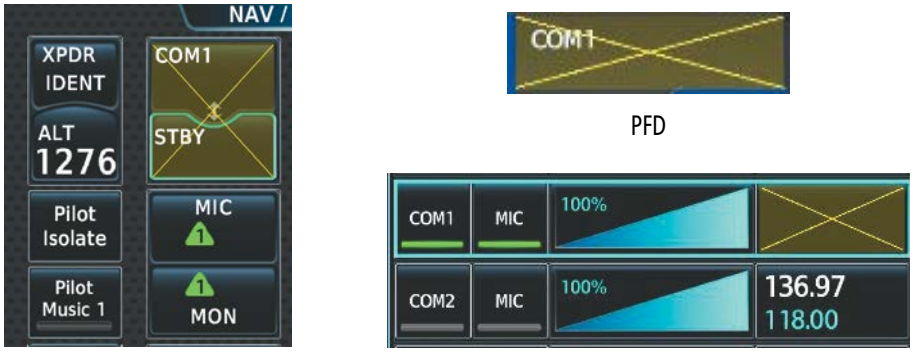


Figure 4-63 COM Failure Indications

COM TUNING DISCREPANCY

A discrepancy between the active COM frequency on the GTC, and the actual tuned frequency reported by the controlling GIA, causes the active COM frequency digits on the GTC and PFD to turn amber.

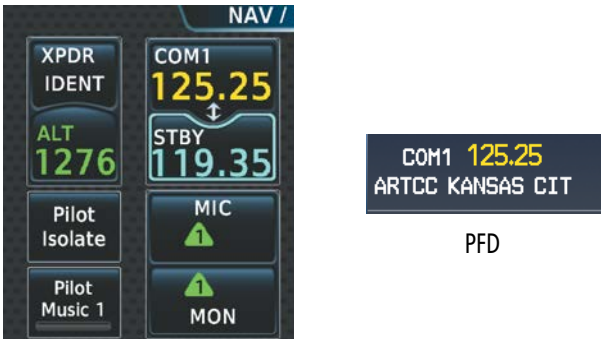


Figure 4-64 COM Tuning Discrepancy

NAVIGATION FAILURE

In case of a NAV system failure, an amber X may appear on the frequency display and PFD.



'Audio & CNS' Screen



PFD

Figure 4-65 NAV Tuning Failure Indications

AUDIO CONTROLLER FAIL-SAFE OPERATION

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

TOUCHSCREEN CONTROLLER FAILURE

In case of a Touchscreen Controller failure, the operational controller will control the pilot, copilot, and passenger audio and radios.

TRANSPONDER FAILURE

If the active transponder fails, green indications turn to yellow and the word FAIL is displayed on the Transponder Code/Mode Button.



Figure 4-66 Transponder Fail Indication

SECTION 5 FLIGHT MANAGEMENT

5.1 FLIGHT MANAGEMENT NAVIGATION DATA

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

The most prominent part of the system are the full color displays. The information to successfully navigate the aircraft using the GPS sensors is displayed on the PFW and the MFW. A brief description of the GPS navigation data on the PFW and MFW follows.

Navigation mode indicates which sensor is providing the course data (e.g., GPS, VOR), the RNP level, and approach service level (LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV, or VISUAL).

A smaller version of the Navigation Map may be displayed on the PFW as the Inset Map or the HSI Map. The Inset Map is displayed in the lower left corner of the PFW. The Inset Map cannot be displayed when the PFW is in Split Mode or when the system is in Reversionary Mode. 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 PFW Map.

The PFW Map is displayed by pressing the **PFD Map Settings** Softkey, pressing the **Map Layout** Softkey, then pressing either the **Inset Map** Softkey or the **HSI Map** Softkey. From the 'PFW Home' Screen, touching the **PFD Map Settings** Button, the **Layout** Button, then touching either the **Inset Map** Button or the **HSI Map** Button displays the PFW Map. Pressing the **Map Off** Softkey or touching the **Off** Button removes the PFW Map. Desired settings for map overlays on the PFW Map may be selected; overlays not listed on the 'PFD Map Settings' Screen are in sync with selections on the corresponding map display.

The 'Navigation Map' Pane displays aviation data (e.g., airports, VORs, airways, airspaces), geographic data (e.g., cities, lakes, highways, borders), absolute terrain data (map shading indicating elevation), and hazard data (e.g., traffic, terrain, weather). The amount of displayed data can be adjusted based on the selected map settings, detail level, and range. The 'Navigation Map' Pane can be oriented three different ways: North Up, Track Up, or Heading Up.

Aviation data and flight plan data may also be viewed on other display panes, such as a terrain or weather pane. Hereafter, references to "map displays" implies the 'Navigation Map' Pane and all other panes capable of displaying a map with aviation or flight plan data. An aircraft icon is placed on the map display at the location corresponding to the calculated present position. The aircraft position and the flight plan legs are accurately based on GPS calculations. The basemap upon which these are placed are from a source with less resolution, therefore the relative position of the aircraft to map features is not exact. The leg of the active flight plan currently being flown is shown as a magenta line on the map display. The other legs are shown in white.



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



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

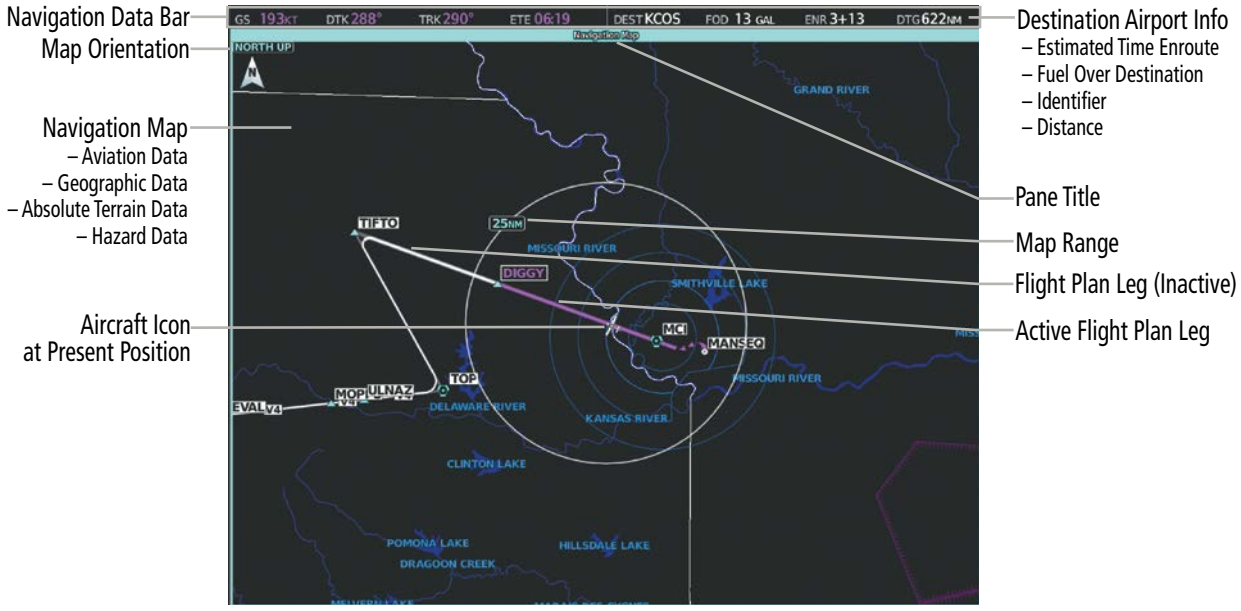


Figure 5-3 GPS Navigation Information on the MFW Navigation Map Display

PFW NAVIGATION STATUS BOX / MFW NAVIGATION DATA BAR

The PFW Navigation Status Box, located to the right of the HSI, contains two fields displaying the following information:



Figure 5-4 PFW Navigation Status Box

- Active flight plan leg (e.g., '⊕→ KICT' or 'KIXD → KCOS') **or** flight plan annunciations (e.g., 'Turn right to 021° in 8 seconds')
- Distance (DIS) and Estimated Time Enroute (ETE) to the next waypoint **or** flight plan annunciations (e.g., 'TOD within 1 minute')

The symbols used in the PFW Status Box are:

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

Table 5-1 PFW Navigation Status Box Symbols



Figure 5-5 MFW Navigation Data Bar and Destination Airport Info Bar

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

- **BRG** (Bearing)
- **CCG** (Current Climb Gradient)
- **DEST** (Destination Airport)
- **DIS** (Distance)
- **DNALT** (Density Altitude)
- **DTG** (Distance to Go to destination)
- **DTK** (Desired track)
- **END** (Endurance)
- **EOD** (Endurance Over Destination)
- **ESA** (Enroute Safe Altitude)
- **ETA** (Estimated Time of Arrival)
- **ETE** (Estimated Time Enroute)
- **FLT** (Flight Timer)
- **FOB** (Fuel on Board)
- **GAGL** (GPS AGL Altitude)
- **GS** (Groundspeed)
- **ISA** (International Standard Atmosphere)
- **LDG** (ETA at final destination)
- **LFE** (Landing Field Elevation)
- **MSA** (Minimum Safe Altitude)
- **TAS** (True Airspeed)
- **TKE** (Track Angle Error)
- **TOD** (Time of Top of Descent)
- **TRK** (Track)
- **VSR** (Vertical Speed Required)
- **XTK** (Cross-track error)

The navigation information displayed in the MFW data fields can be changed through the 'Avionics Settings' Screen. The default selections (in order left to right) are GS, DTK, TRK, and ETE.

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

Changing a field in the MFW Navigation Data Bar:

1) From MFW Home, touch **Utilities** > **Setup > Avionics Settings.**
2) Touch the **MFD Fields** Tab.
3) Touch the desired MFD Data Bar Field button. The respective 'Select MFD Data Bar Field' Screen will open.
4) Scroll as required and touch the desired field description to replace the previous information.
5) Repeat Steps 3 and 4, as necessary.

The Destination Airport Info Bar is also located at the top of the MFD and adjacent to the Navigation Data Bar. It contains four fields, in white text, with the following information:

- **DEST** (Destination Airport)
- **FOD** (Fuel over Destination)
- **ENR** (ETE to Final Destination)
- **DTG** (Distance to Go to destination)

5.2 USING MAP DISPLAYS

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

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

Map Settings are available when the 'Navigation Map' Pane is displayed. Map Settings may be accessed from the 'MFW Home' Screen or from the 'Flight Plan Options' Window for the active flight plan.

Viewing the map settings:

1) From MFW Home, touch **Map**.
2) Touch the **Map Selection** Button, if necessary. This button is only available if IFR/VFR charts are installed.
3) Touch the **Map Settings** Button. The 'Map Settings' Screen is displayed.

Or:

1) From MFW Home, touch **Flight Plan**.
2) Touch the **Flight Plan Options** Button.
3) Touch the **Map Settings** Button. The 'Map Settings' Screen is displayed.

MAP SETTINGS SYNCHRONIZATION

Map settings can be synchronized with the settings of any display, and will keep them synchronized when changes are made to the settings. The synchronization can be for the onside (the current user display) or offside (opposite display) independently, or for all displays.

Enabling/disabling map settings synchronization:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings** > **Map Sync**.
2) Touch the **Onside** Button or the **All** Button.
3) Touch the button for the desired setting.

Or:

Touch the **Off** Button to disable synchronization.



Figure 5-6 Map Settings Synchronization

MAP ORIENTATION

Three different orientation options are available for most system map display panes. This allows 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 display pane.



Figure 5-7 Map Orientation

- North up ('NORTH UP') aligns the top of the map display to north.
- Track up ('TRK 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 (default setting).

Changing the map display orientation:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Orientation** Button.
3) Touch the **Heading Up**, **Track Up**, or **North Up** Button to select the orientation.

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

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

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) If necessary, touch the **Other** Tab to display the options list.
3) Touch the **North Up Above** Button to enable/disable the function.
4) Touch the North Up Above Range Button to display the 'Map North Up Above' Window.
5) Scroll the list if necessary to find the desired range, and touch the Range Button.

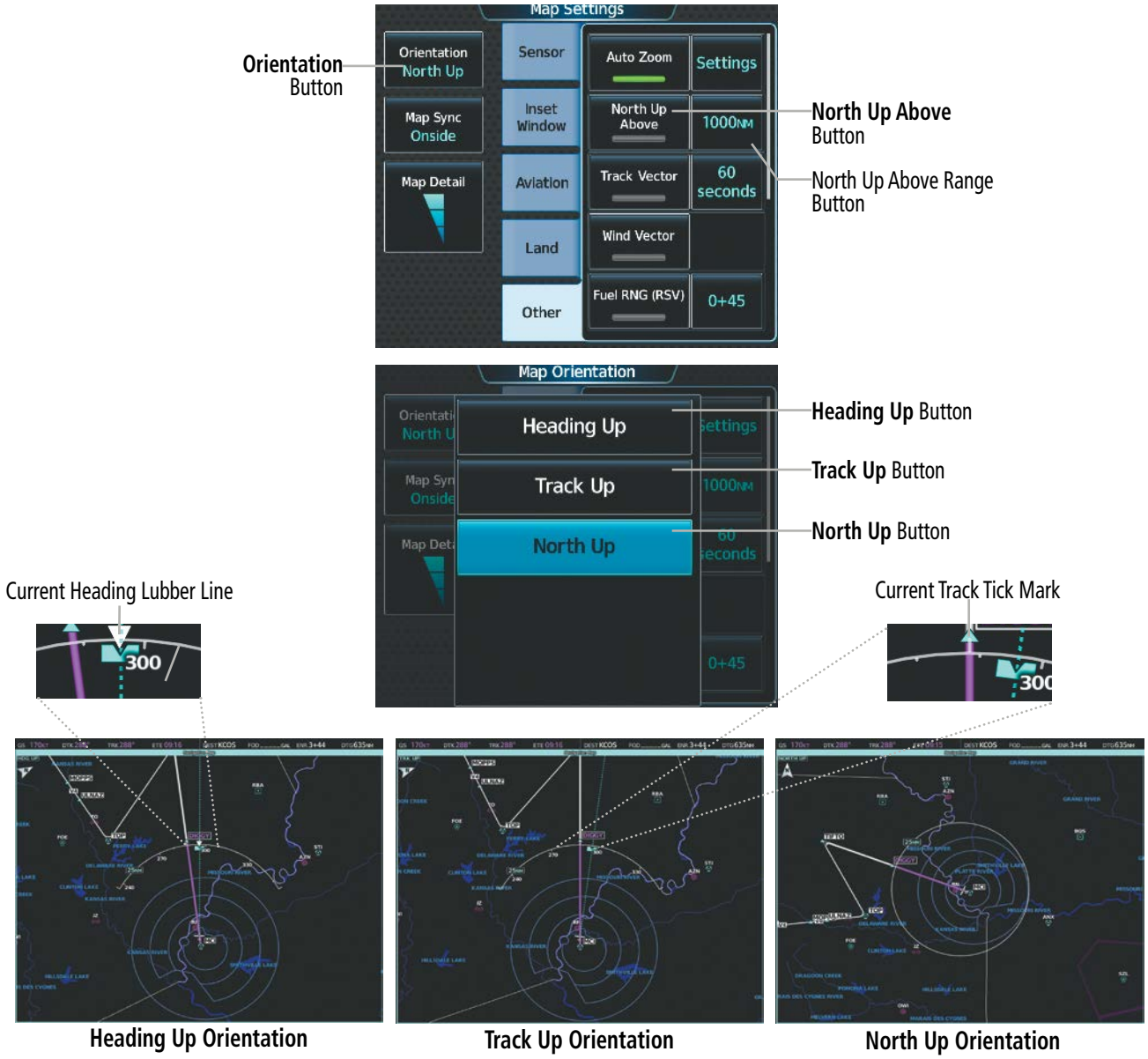


Figure 5-8 Map Orientation Selection

The range arcs include tick marks indicating compass directions. Track Up indicates current track with a tick mark on the outside of the arc. Heading Up indicates current heading with a heading lubber line, and the heading bug and reference line are displayed while the heading is being adjusted, and remain displayed for three seconds after the last adjustment.

MAP RANGE

There are 28 different map ranges available, from 250 feet to 1000 nm. Range is indicated in the upper left quadrant of the range ring shown around the aircraft icon. This indicated range is the range from the aircraft icon to the range ring, and roughly half the range to the top edge of the displayed map. To change the map range on any map: (1) turn the corresponding lower knob counter-clockwise to decrease the range, or clockwise to increase the range; (2) pressing the **Map Range –** Softkey to decrease the range, or the **Map Range +** Softkey to increase the range; or (3) push the lower knob, touch two fingers on the **Touchpad,** and move them apart to decrease range, or pinch using two fingers to increase range.



Figure 5-9 Map Range

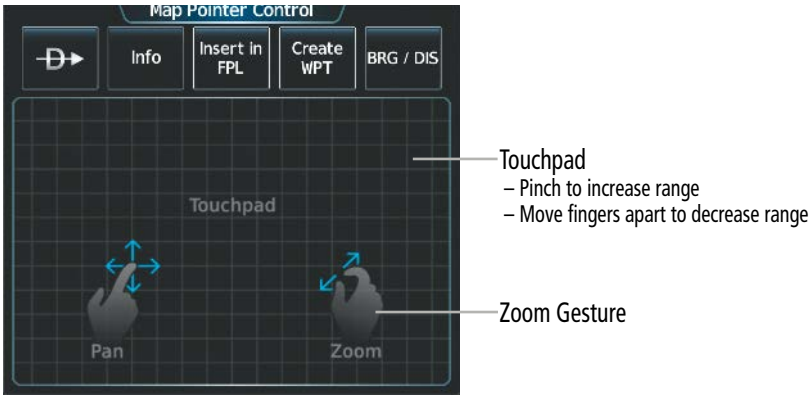


Figure 5-10 Touchpad Map Range Control

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 manually adjusting the range, 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 the Touchscreen Controller 'Map Settings' Screen). Auto zoom is suspended while the map pointer is active.

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

The auto zoom function can be turned on or off. Control of the ranges at which the auto zoom occurs is done by setting the minimum and maximum 'look forward' times (set on the Touchscreen Controller 'Map Settings' Screen). These times set 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 'Auto Zoom Time Out' time determines how long auto zoom is overridden by a manual adjustment. At the expiration of this time, the auto zoom range is restored. Setting the 'Auto Zoom Time Out' value to zero causes the manual override to never time out.

» When the 'Auto Zoom Max Look Fwd' time is set to zero, the upper limit becomes the maximum range available (1000 nm).

» When the 'Auto Zoom Min Look Fwd' time is set to zero, the lower limit becomes 0.75 nm.

Configuring automatic zoom:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) If necessary, touch the **Other** Tab to display the options list.
3) Touch the **Auto Zoom** Button to enable/disable auto zoom.
4) Touch the Auto Zoom **Settings** Button to display the 'Auto Zoom Settings' Window.
5) Touch the **Auto Zoom Max Look Fwd** Button to display the numeric keyboard.
6) Use the keypad and touch the **Enter** Button to enter the maximum look forward time. Times are from zero to 999 minutes.
7) Repeat Steps 5 and 6 for 'Auto Zoom Min Look Fwd' (zero to 99 minutes) and 'Auto Zoom Time Out' (zero to 99 minutes) functions using the corresponding button names.

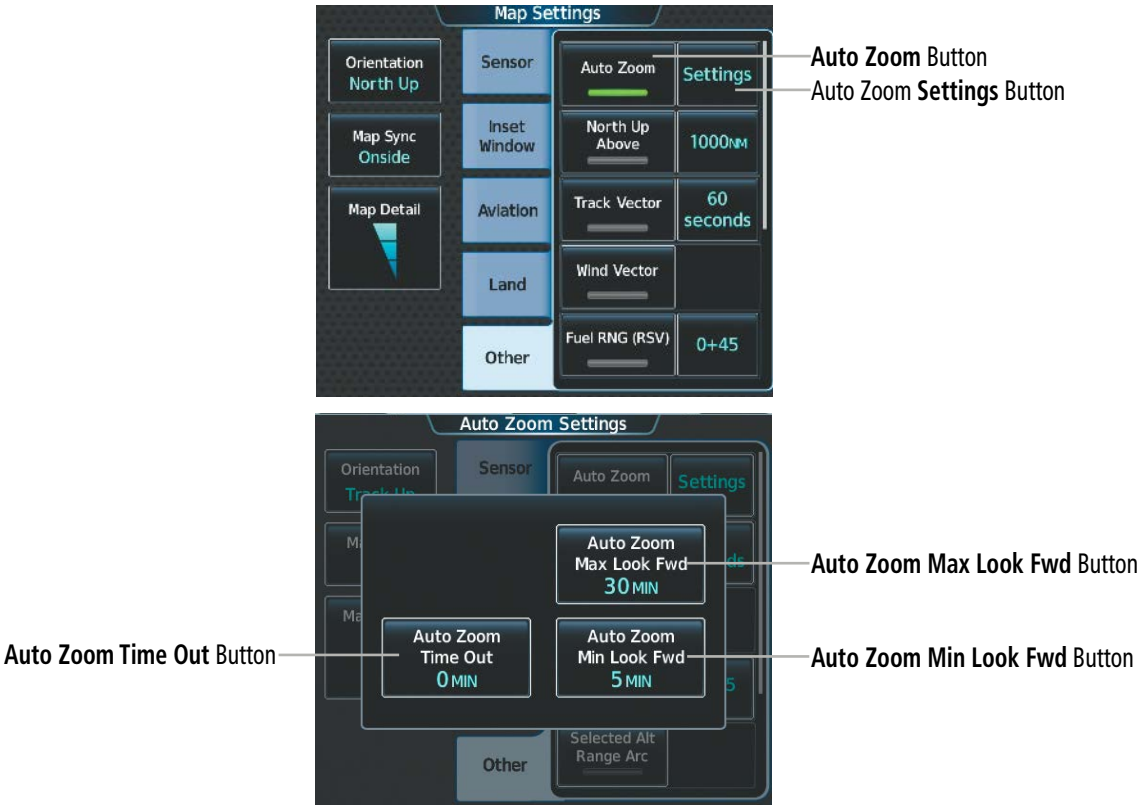


Figure 5-11 Auto Zoom Setup

MAP PANNING

The 'Map Pointer Control' Screen allows the pilot to:

- View parts of the map outside the displayed range without adjusting the map range by panning the map (the **Touchpad**)
- Highlight and select locations on the map (the **Touchpad**)
- Graphically initiate a Direct To a selected airport, NAVAID (VOR, Intersection, NDB), VRP, flight plan fix waypoint, or user waypoint (D▸ Button)
- Display an information screen for a selected airport, NAVAID (VOR, Intersection, NDB), VRP, user waypoint, or airspace (**Info** Button)
- Designate locations for use in flight planning (**Insert in FPL** Button and rerouting function for waypoint insertions, see Flight Planning portion of this section)
- Graphically create user waypoints (**Create WPT** Button)
- Measure the bearing and distance from the aircraft present position to any location on the map display, or between any two points on the map display (**BRG/DIS** Button)
- View obstacle, airspace, and airway information

When the Map Pointer function is selected by pushing the lower knob, the Map Pointer flashes on the map display, and the 'Map Pointer Control' Screen is displayed on the Touchscreen Controller. A window also appears at the upper left of the map display showing the latitude/longitude 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.

Map Panning functionality is not available for traffic and terrain panes.

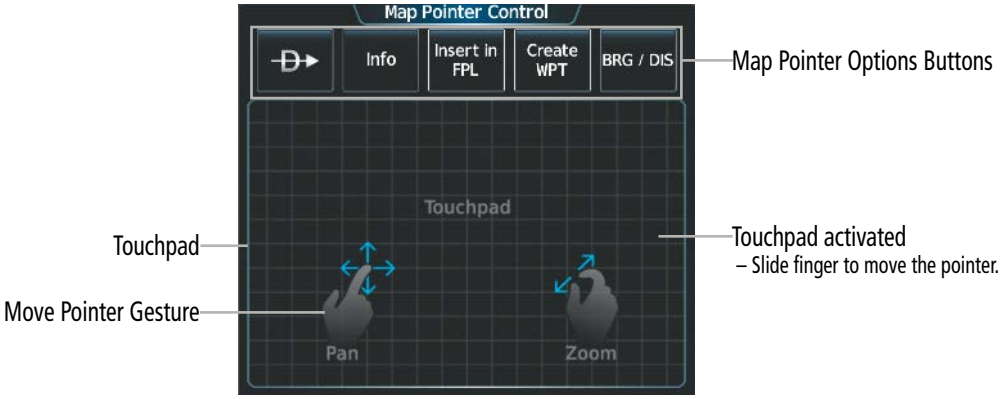


Figure 5-12 Touchpad Map Pointer Control

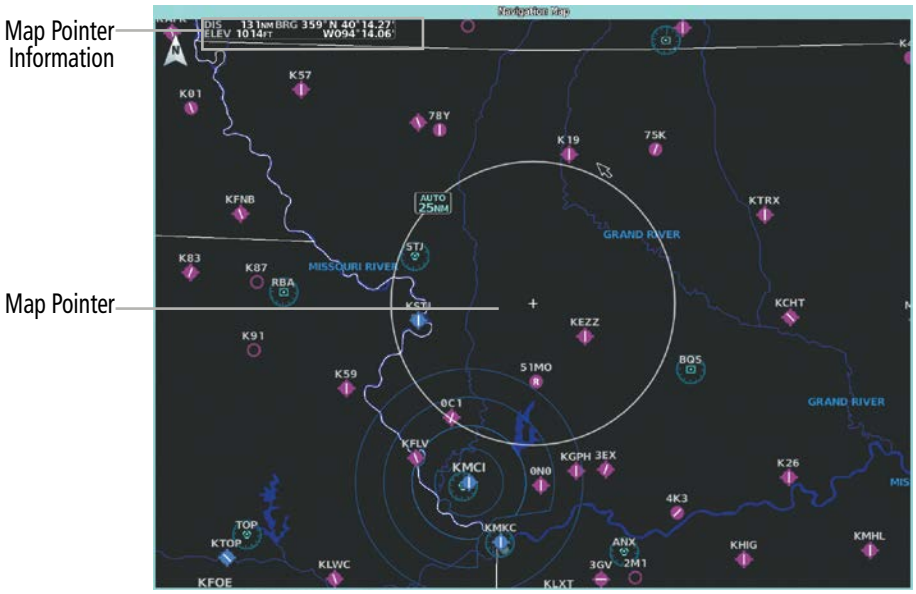


Figure 5-13 Navigation Map – Map Pointer Activated

Panning the map:

1) Push the lower knob to display the Map Pointer.
2) Turn the upper knobs on the Touchscreen Controller**,** or slide your finger on the **Touchpad**, to move the Map Pointer on the map. The map will pan when the pointer approaches the edge of the map.
3) Push either knob to remove the Map Pointer and recenter the map on the aircraft's current position.

   Or:

   Touch the **Back** Button on the Touchscreen Controller to remove the Map Pointer and recenter the map on the aircraft's current position.

When the Map Pointer is placed on a map item (waypoint, airway, or airspace boundary), the name is highlighted (even if the name was not originally displayed on the map). When placed on an airspace boundary, the name, class, ceiling and floor are shown in feet MSL. When placed on an airway, the name, Minimum Enroute Altitude, and defining waypoints and length for that airway segment are shown.

When highlighting waypoints and airspace on the map display, additional pertinent information is available by touching the **Info** Button on the Touchscreen Controller.

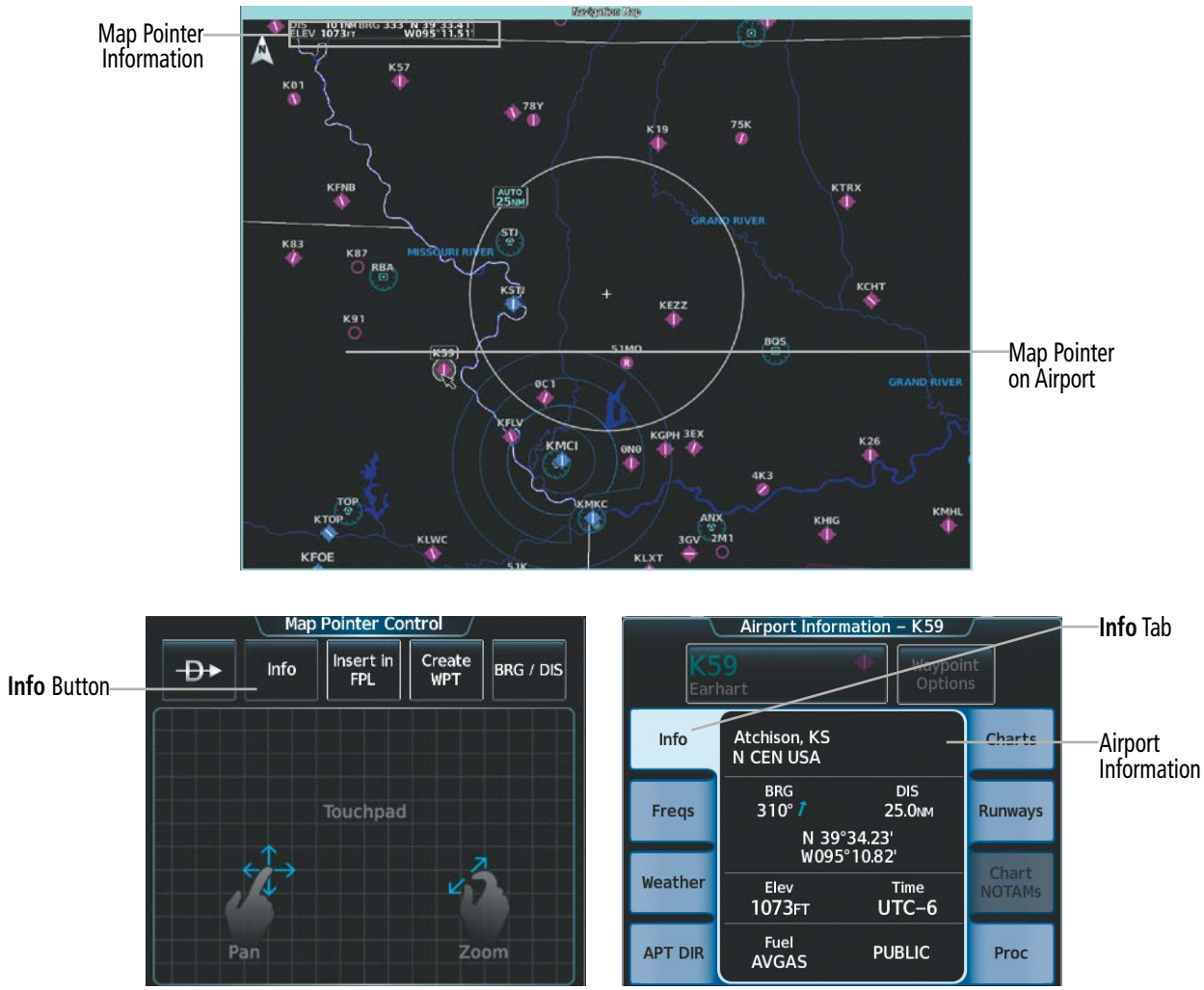


Figure 5-14 Map Pointer on Airport

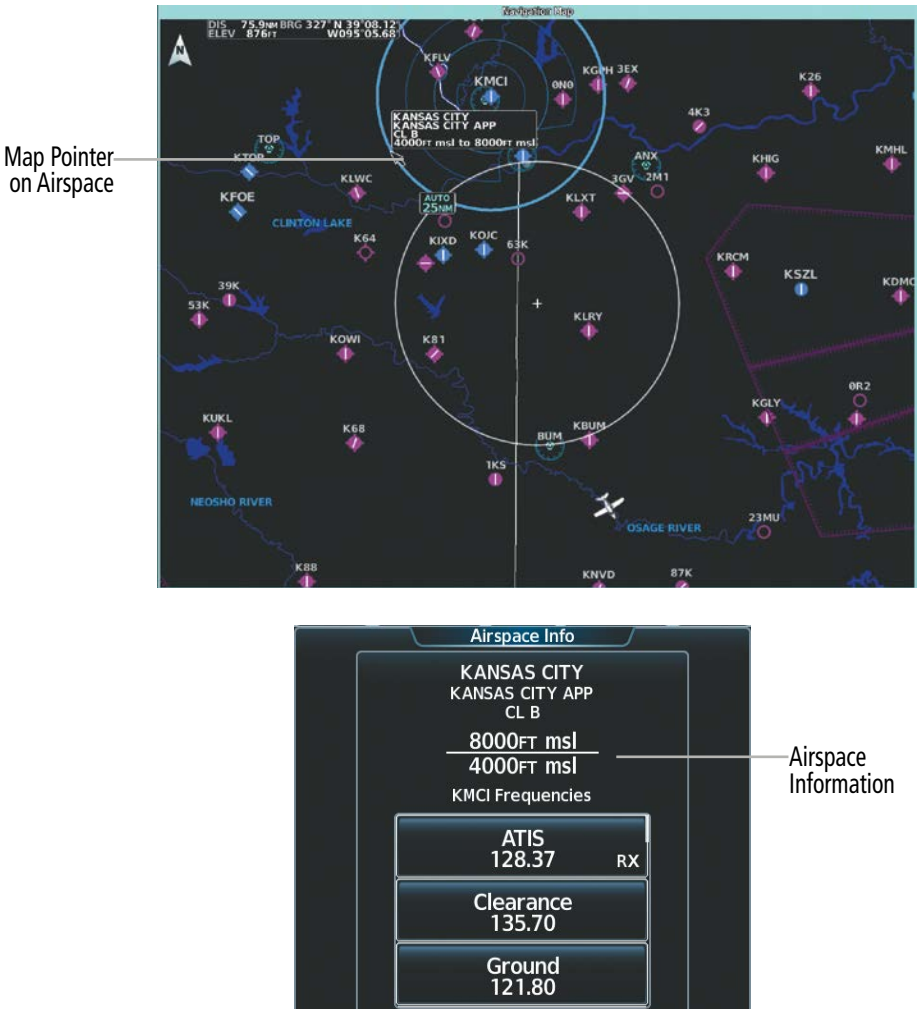


Figure 5-15 Map Pointer on Airspace

Reviewing information for a waypoint or airspace:

1) Place the Map Pointer on an airport, intersection, NAVAID, VRP, user waypoint, or airspace.
2) Touch the **Info** Button to display the respective information screen.
3) Touch the **Back** Button on the Touchscreen Controller to return to the 'Map Pointer Control' Screen without removing the Map Pointer from the map.

   Or:

   Push either knob to exit the waypoint information screen, remove the Map Pointer and recenter the map on the aircraft's current position.

If a map item is hidden behind another symbol due to the map zoom level, placing the map pointer over the visible symbol will allow the hidden map items to be selected. The 'Map Pointer Control' Screen will display the Map Item Button and arrow buttons. Touching the Map Item Button will display a list of map items, and touching an arrow button will cycle through the map items. For the following figure, the 'FOE' navigational aid is hidden behind the airfield 'KFOE'.

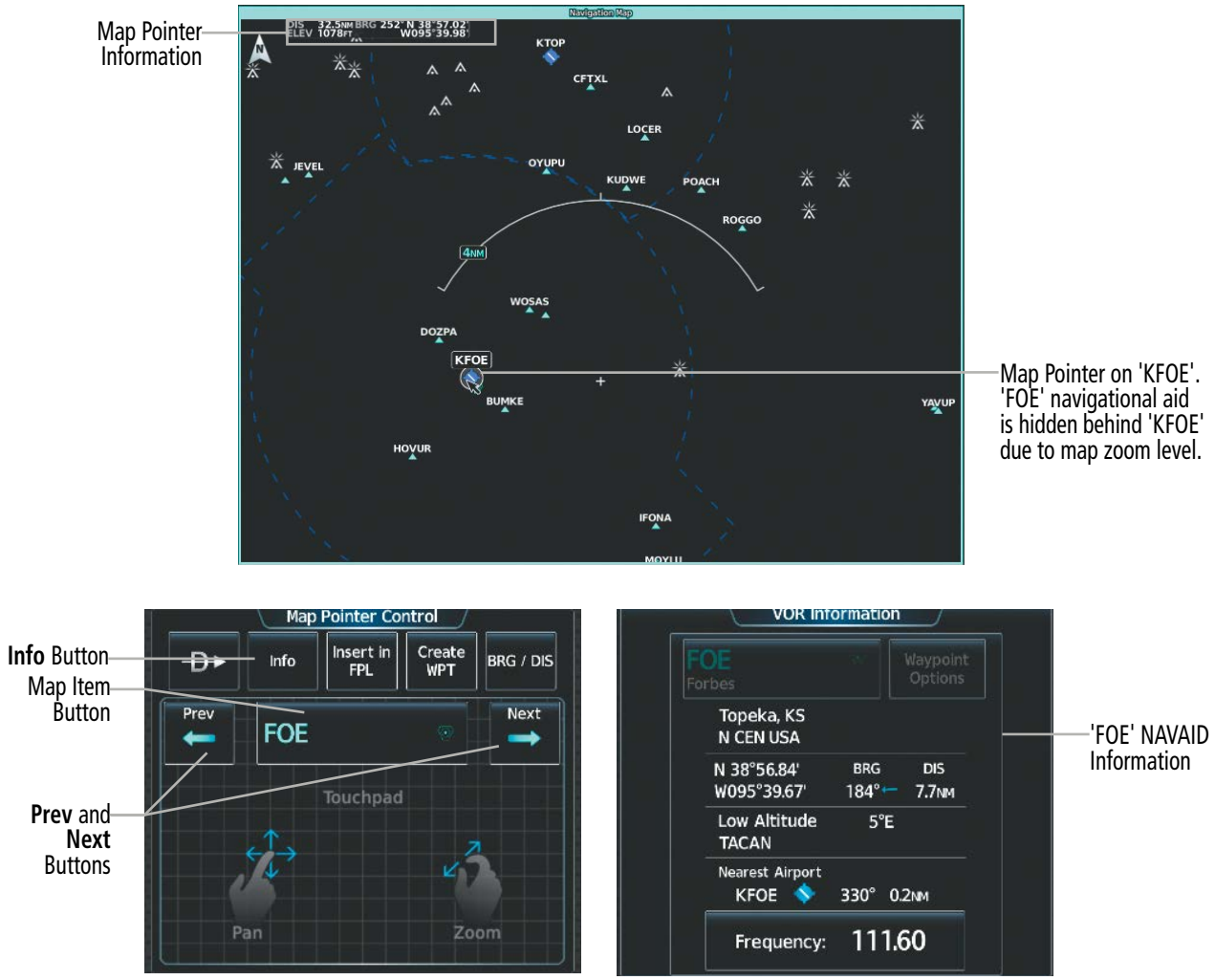


Figure 5-16 Map Pointer - hidden map items

Reviewing information for a waypoint or airspace:

1) Place the Map Pointer on an airport, intersection, NAVAID, VRP, user waypoint, or airspace.

Or:

Place the Map Pointer over multiple map items.

Touch the **Prev** or **Next** Button to cycle to the desired map item.

Or:

a) Touch the Map Item Button to open the 'Map Item Selection' Screen.

b) Touch the desired map item.

2) Touch the **Info** Button to display the respective information screen.

3) Touch the **Back** Button on the Touchscreen Controller to return to the 'Map Pointer Control' Screen without removing the Map Pointer from the map.

Or:

Push either knob to exit the waypoint information screen, remove the Map Pointer and recenter the map on the aircraft's current position.

MEASURING BEARING AND DISTANCE

Distance and bearing can be measured on map displays using the lower knob or the **Touchpad**. Measurement can be from the aircraft's present position to any point, or between any two points. The bearing and distance tool displays a dashed Measurement Line and a Measure Pointer to aid in graphically identifying the points to measure. Latitude/Longitude, distance, bearing and elevation data of the Measure Pointer is provided in a window at the top left of the map. Measure Pointer functionality is not available for traffic and terrain panes.

Measuring bearing and distance between the aircraft present position and any other point:

1) Push the lower knob. (Measure Pointer functionality is not available for traffic and terrain panes.)
2) Touch the **BRG/DIS** Button. A Measure Pointer is displayed on the map at the aircraft's present position.
3) Move the pointer using the **Touchpad** to the desired location. A dashed Measurement Line is drawn from the aircraft present position to the location of the Measure Pointer. The latitude/longitude, distance, bearing and elevation data of the Measure Pointer are displayed at the top left of the map. Move the pointer again to measure to any other point.
4) To exit the Measure Bearing/Distance function, push either knob**,** or touch the **Back** Button.

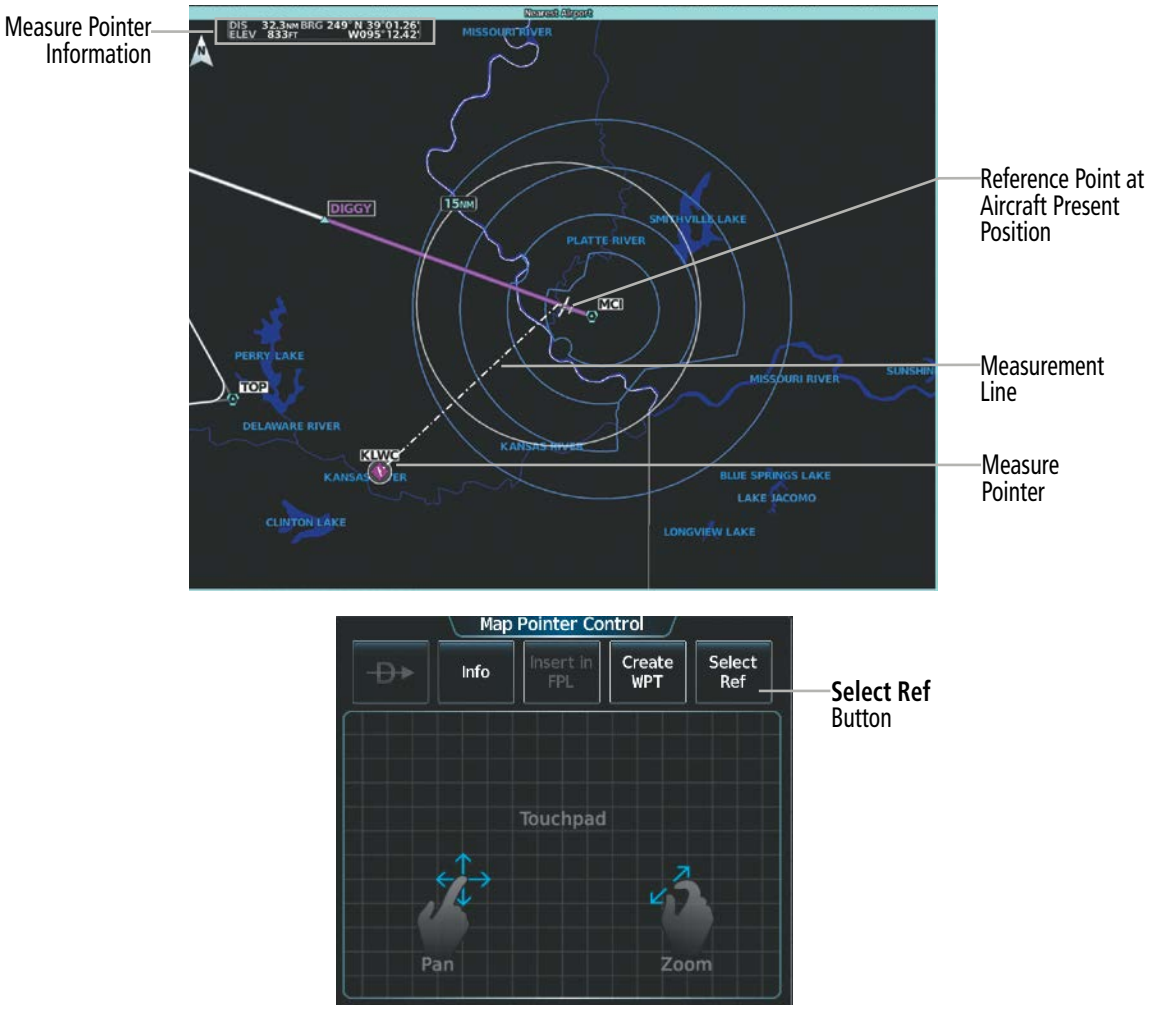


Figure 5-17 Measuring Bearing/Distance from Aircraft Present Position

Measuring bearing and distance between any two points:

1) Push the lower knob. (Measure Pointer functionality is not available for traffic and terrain panes.)
2) Touch the **BRG/DIS** Button. A Measure Pointer is displayed on the map at the aircraft's present position.
3) Move the pointer using the **Touchpad** to the desired reference location. A dashed Measurement Line is drawn from the aircraft present position to the location of the Measure Pointer. The latitude/longitude, distance, bearing and elevation data of the Measure Pointer are displayed at the top left of the map.
4) Touch the **Select Ref** Button to set the Measure Pointer location as the new reference point for measurement. The dashed Measurement Line is erased.
5) Move the pointer using the **Touchpad** to the desired location. A dashed Measurement Line is drawn from the reference point to the location of the Measure Pointer. The latitude/longitude, distance, bearing and elevation data of the Measure Pointer are displayed at the top left of the map.
6) Repeat Steps 3 through 5 to measure between other points.
7) To exit the Measure Bearing/Distance function, push either knob, or touch the **Back** Button.

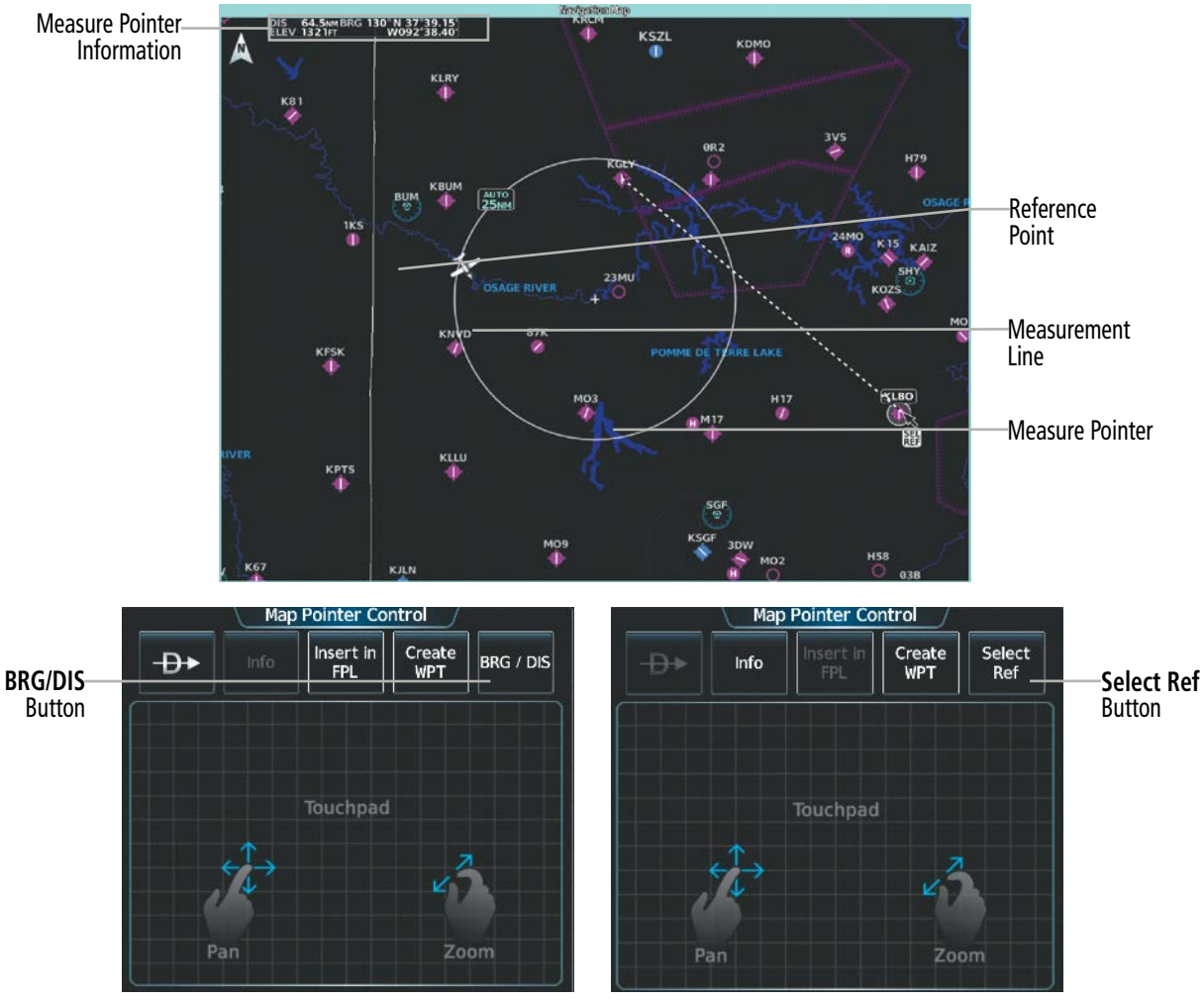


Figure 5-18 Measuring Bearing/Distance between Two Points

ABSOLUTE TERRAIN

Map displays can show various shades of absolute terrain colors representing land elevation, similar to aviation sectional charts. Absolute terrain data can be displayed or removed as described in the following procedures; however, absolute terrain data and the absolute terrain scale can not be displayed on traffic or terrain panes.

Absolute + Relative terrain discussion can be referenced in the Hazard Avoidance Section.

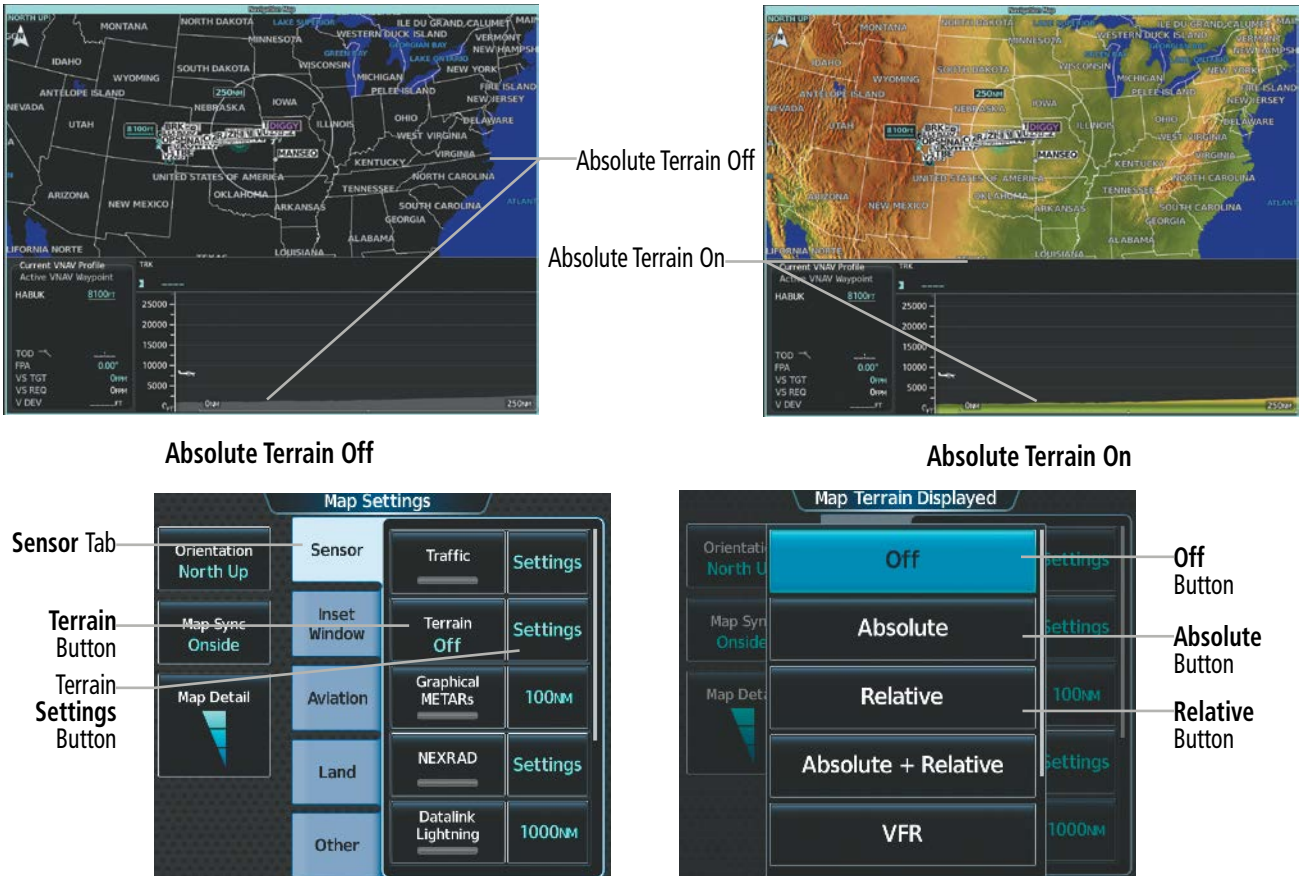


Figure 5-19 MFW Map Display - Absolute Terrain Data

Displaying/removing absolute terrain data:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Sensor** Tab, if necessary.
3) Touch the **Terrain** Button to display the 'Map Terrain Displayed' Window.
4) Touch the **Absolute** Button to display absolute terrain data, or touch the **Off** Button to remove absolute terrain data.

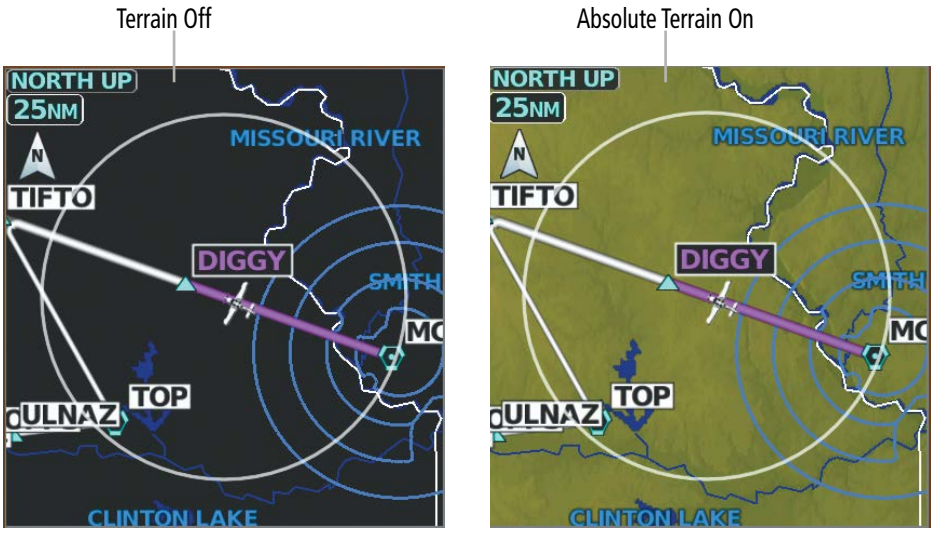


Figure 5-20 PFW Inset Map – Absolute Terrain Data

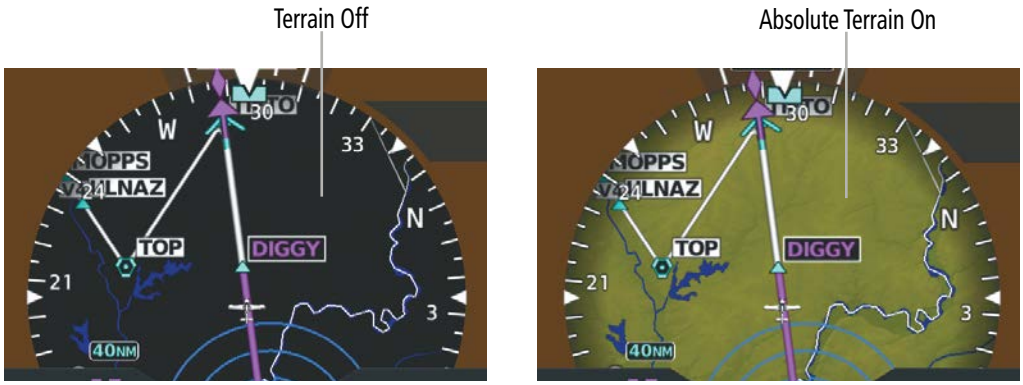


Figure 5-21 PFW HSI Map – Absolute Terrain Data

Displaying/removing absolute terrain data on the PFW Map:

1) From PFW Home, touch **PFD Map Settings.**
2) Touch the **Terrain** Button to display the 'Inset Map Terrain Displayed' Window.
3) Display or remove absolute terrain data:

   Touch the **Absolute** Button to display absolute terrain data on the PFW Map.

   Or:

   Touch the **Off** Button to remove absolute terrain data from the PFW Map.

Or:

1) Press the **PFD Map Settings** Softkey on the PFW.
2) Display or remove absolute terrain data:

   Press the **Terrain** Softkey until 'Absolute' is shown to display absolute terrain data on the PFW Map.

   Or:

   Press the **Terrain** Softkey until 'Off' is shown to remove absolute terrain data from the PFW Map.

Selecting an absolute terrain data range:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Sensor** Tab, if necessary.
3) Touch the Terrain **Settings** Button. A window is displayed providing terrain functions allowed by the system.
4) Touch the **Map Settings** Button. A window is displayed providing terrain settings.
5) Touch the **Terrain** Button to display the 'Map Terrain Range' Window.
6) Scroll the list if necessary to find the desired range, and touch the Range Button.

In addition, the map displays can show an absolute terrain scale (located in the lower right hand side of the map) showing a scale of the terrain elevation. The minimum and maximum terrain elevations on the Absolute Terrain Scale represent the terrain displayed within the 'Navigation Map' Pane.

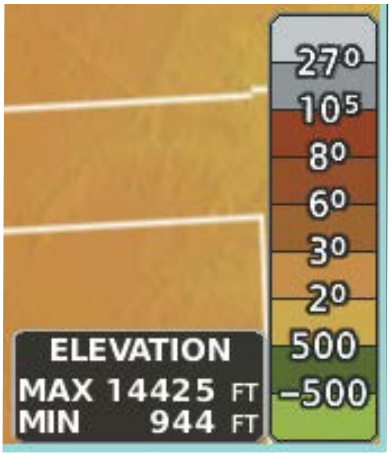


Figure 5-22 Absolute Terrain Scale

Displaying/removing the absolute terrain scale:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Sensor** Tab, if necessary.
3) Touch the Terrain **Settings** Button. A window is displayed providing terrain functions allowed by the system.
4) Touch the **Map Settings** Button. A window is displayed providing terrain settings.
5) Touch the **Absolute Terrain Scale** Button to display/remove the absolute terrain scale.

MAP SYMBOLS

This section discusses the types of land and aviation symbols that can be displayed. Each listed type of symbol can be turned on or off, and the maximum range to display each symbol can be set. The maximum range is based upon the range ring setting, not distance from the aircraft. The decluttering of the symbols from the PFW Map and MFW Map displays using the Map Detail Slider are also discussed.

LAND SYMBOLS

The following table describes items that are configured on the **Land** Tab on the 'Map Settings' Screen. See the Hazard Avoidance Section for more information on Obstacles.

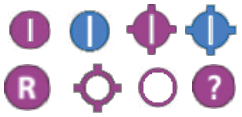
Land Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Obstacles (Point and Wire)	See Hazard Avoidance Section	10	25
Roads		see below	
- Interstate Highway (Freeway)		50	400
- International Highway (Freeway)		15	150
- US Highway (National Highway)		15	150
- State Highway (Local Highway)		10	100
- Local Road (Local Road)	N/A	4	25
- Railroad		7.5	25
Large City (> 200,000)		100	1000
Medium City (> 50,000)		50	400
Small City (> 5,000)		25	100
State/Province		750	1000
Rivers and Lakes (River/Lake)		75	100

Table 5-2 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the **Aviation** Tab of the 'Map Settings' Screen.

Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Low Altitude Airways (V and T Routes)		50	100
High Altitude Airways (J and Q Routes)		50	100
Class B Airspace Altitude Label (ceiling/floor)		Label placement and ranges are variable, in order to provide the best representation and minimal clutter	
Class C Airspace Altitude Label (ceiling/floor)			
Class D Airspace Altitude Label (ceiling)			
CL B/TMA/AWY	(see below)		
- Class B (CL B) and Terminal Maneuvering Area (TMA) [1]		50	150
- Airway (AWY) [1]			
CL C/CTA	(see below)		
- Class C Airspace (CL C)		50	100
- Control Area (CTA) [1]			
CL A/D	(see below)		
- Terminal Radar Service Area (TRSA), Controlled Traffic Region (CTR) [1], and Class A (CL A) [1]		10	100
- Class D			
- Aerodrome Traffic Zone (ATZ) [1]			
- Traffic Information Zone (TIZ) [1]			
Restricted and Prohibited Areas (Restricted)		50	100
Military Operations Areas (MOA (Military))		50	250

Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Other	(see below)		
- ADIZ		50	250
- Alert			
- Class E [1]			
- Class G [1]			
- Temporary [1]			
- Danger, Warning, Unknown, Special Rules [1], and Training [1]			
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 control tower)		25	150
Heliport		25	150
VOR Waypoint		50	250
- VOR Compass Rose On/Off		N/A	N/A
INT Waypoint		10	40
NDB Waypoint		25	50
VRP Waypoint		25	40
User Waypoint	(Route) (Airport)	1000	1000
SafeTaxi®	See Additional Features	1.5	5
Runway Extension		7.5	150
Missed Approach Preview On/Off		N/A	N/A
Altitude/Speed Constraints		1000	1000

[1] *Not located in the United States*

Table 5-3 Aviation Symbol Information

SYMBOL SETUP

Aviation and land symbol types (e.g. runway extensions, railroads) can be removed individually. Runway Extensions, when enabled, will be depicted under the following conditions:

» The enroute waypoint after the active leg is an airport.

» The off-route D waypoint is an airport.

» The destination airport has a loaded arrival or loaded/activated approach.

If a loaded arrival or loaded/activated approach is subsequently removed from the active flight plan, the system removes the runway extensions from the map.

Displaying/removing a land or aviation symbol type:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Aviation** Tab or the **Land**, Tab, if necessary.
3) Scroll the list to find the desired item.
4) Touch the annunciator button to display/remove the symbol type.

The preceding procedure can be used for selecting which Land or Aviation symbols (roads, cities, airspaces, etc) should be shown on the map display. In addition to displaying airspace boundaries, airspace altitude labels may also be shown, as explained in the following procedure.

Displaying and removing airspace altitude labels:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Aviation** Tab.
3) Touch the Airspaces **Settings** Button to display the 'Airspace Settings' Window.
4) Touch the **Airspace Altitude Labels** Button to display/remove the labels.

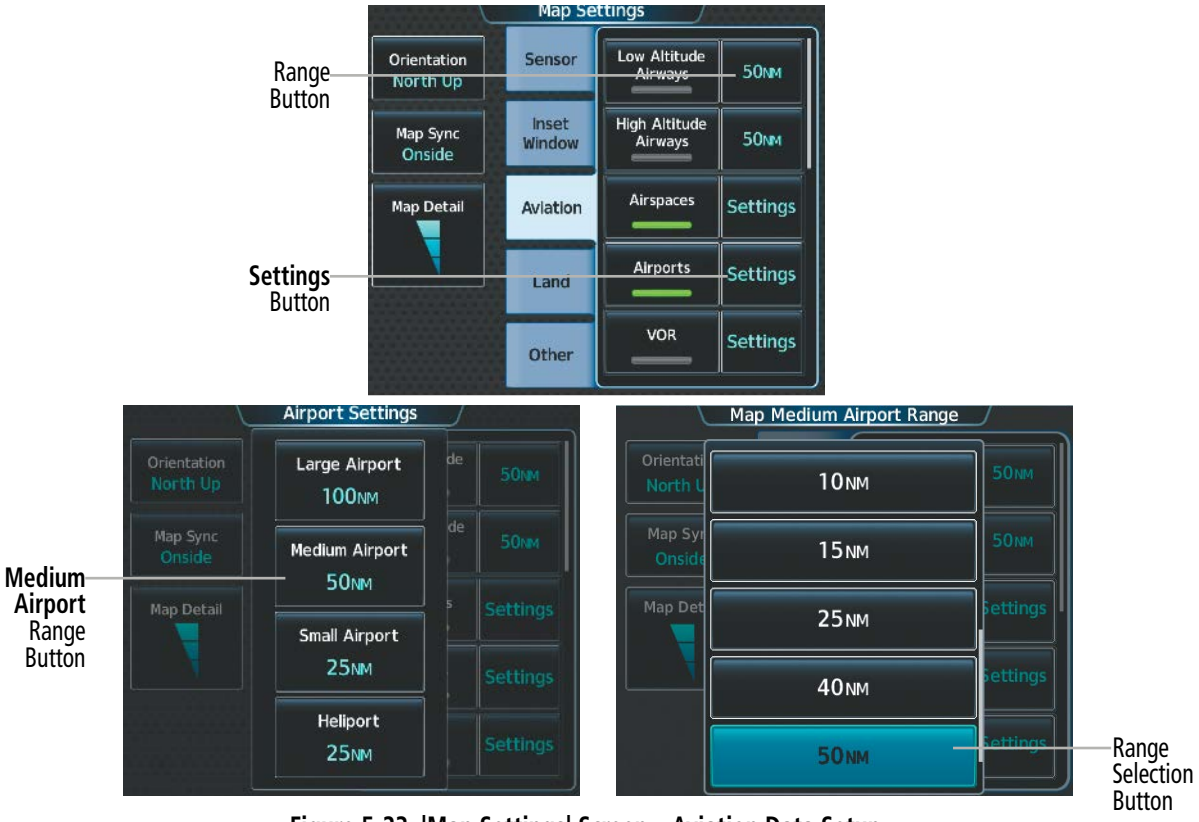


Figure 5-23 'Map Settings' Screen – Aviation Data Setup



Figure 5-24 'Map Settings' Screen – Land Data Setup

The Range Button sets the maximum range at which these items will be displayed.

Selecting an Aviation or Land item maximum range:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Aviation** Tab or **Land** Tab, if necessary.
3) Scroll the list to find the desired item.
4) If necessary, touch the **Settings** Button to display the Range Buttons.
5) Touch the Range Button to display the range choices.

6) Touch a Range Selection Button to select the maximum range.

7) Repeat Steps 3 through 6 as necessary.

Displaying/removing the VOR compass rose:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.

2) Touch the **Aviation** Tab, if necessary.

3) Scroll the list to find the VOR buttons.

4) Touch the VOR **Settings** Button to display the 'VOR Settings' Window.

5) Touch the **Compass Rose** Button to display/remove the VOR compass rose.

MAP DETAIL

The declutter feature allows the pilot to progressively step through four levels of map detail. Map detail level is adjusted using the Touchscreen Controller and shown on the map displays.

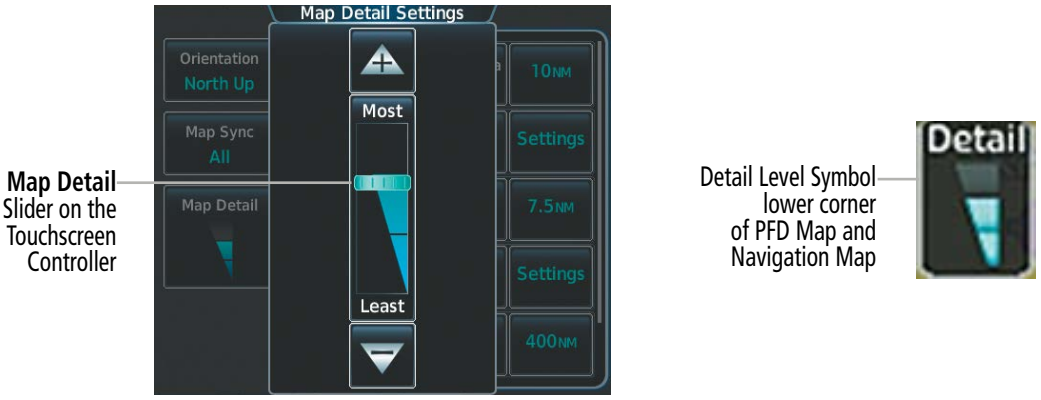


Figure 5-25 MFW Map Display – Map Detail

Adjusting the map detail:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings > Map Detail**.

2) Slide up or down on the Map Detail Slider to adjust the map detail.

Adjusting the PFW Map Detail:

1) From PFW Home, touch **PFD Map Settings > Map Detail**.

2) Slide up or down on the Map Detail Slider to adjust the PFW Map detail.

Or:

1) Press the **PFD Map Settings** Softkey on the PFW.

2) Press the **Detail** Softkey, as required, to cycle to the desired PFW Map detail.

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	DCLTR 1	DCLTR 2	Least
Data Link Radar Precipitation			X
Data Link Lightning			X
Graphical METARs			X
Airports			X
SafeTaxi			X
Runway Labels			X
TFRs			X
Restricted			X
MOAs (Military)			X
Intersections (does not declutter if used to define airway)		X	X
NAVAIDs (does not declutter if used to define airway)		X	X
User Waypoints		X	X
VRPs		X	X
Latitude/Longitude Grid		X	X
Class B / TMA / AWY airspaces		X	X
Class C / CTA airspaces		X	X
Class A / D airspaces		X	X
Other Airspaces		X	X
Obstacles		X	X
Cities	X	X	X
Roads	X	X	X
Railroads	X	X	X
State/Province Boundaries	X	X	X

Table 5-4 Map Items Decluttered for each Detail Level

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 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.

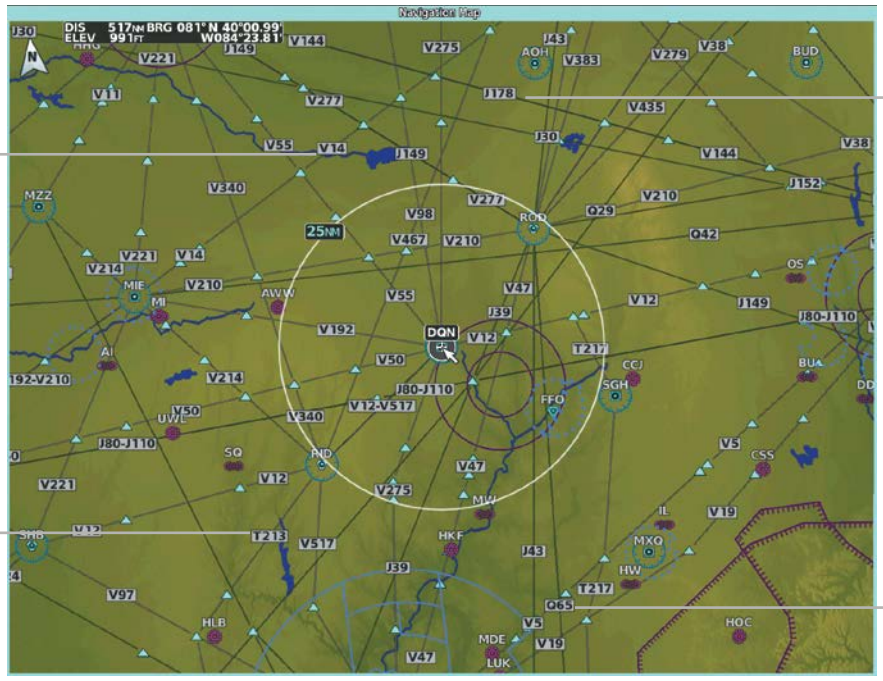


Figure 5-26 Airways on MFW Map Display

ADDITIONAL MAP DISPLAY ITEMS

Maps displays can show some additional items. Some items can be displayed through the use of the nearest frequency, map panning, and map measuring functions. The icons in the following table will be displayed when specific map functions are conducted or the heading or GPS solution is invalid:

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

Table 5-5 Miscellaneous Map Symbols

OTHER MAP DISPLAY ITEMS

The following procedure can be used to display other items (e.g. track vector, wind vector, fuel range ring, selected altitude range arc, SVT™ field of view, and latitude/longitude lines) individually through the 'Map Settings' Screen, **Other** Tab.

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

Displaying/removing other map items:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Other** Tab, if needed.
3) Scroll as required and touch the desired button to display/remove map items.

Track Vector

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



Figure 5-27 Track Vector

Selecting track vector look-ahead time:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Other** Tab, if needed.
3) Touch the Track Vector Time Button to display the Time Selection Buttons in the 'Map Track Vector Time' Window.
4) Scroll the list, if needed, and touch a Time Selection Button to select the look-ahead time.

Wind Vector

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

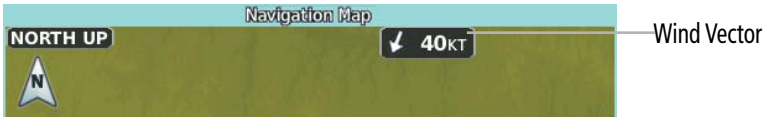


Figure 5-28 Wind Vector on MFW Map Display

NOTE: *The wind vector is not displayed until the aircraft is moving.*

Fuel Range Ring

Map displays can show a fuel range ring which shows an estimate of the remaining flight distance. A dashed green circle indicates the selected range to fuel reserves. A solid green circle indicates the total endurance range. If only fuel reserves remain, the range is indicated by a solid amber circle. Calculations are based on current fuel flow and ground speed.

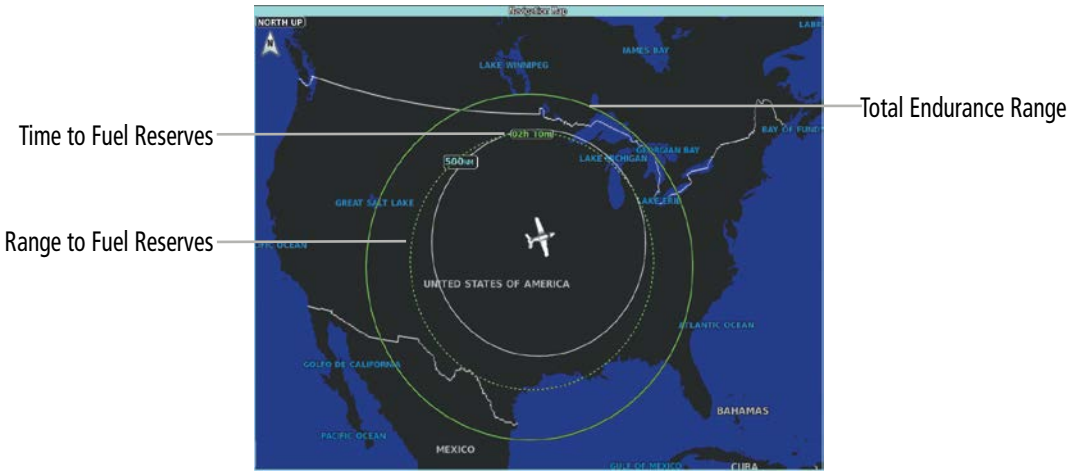


Figure 5-29 Fuel Range Ring

Selecting fuel reserves time:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Other** Tab, if needed.
3) Touch the Fuel RNG (RSV) Time Button to display the keypad.
4) Use the keypad and touch the **Enter** Button to enter the fuel reserves time.

Selected Altitude Range 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.

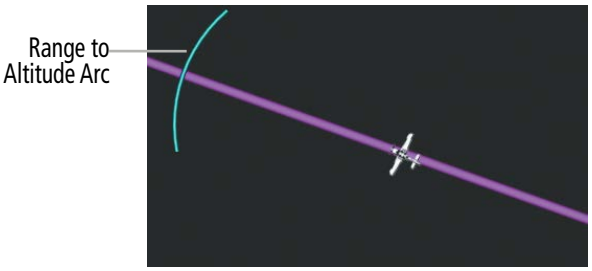


Figure 5-30 Selected Altitude Range Arc

Field of View (SVT)

Map displays can show the boundaries of the PFW 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.



Figure 5-31 Field of View

Latitude/Longitude Lines

Map displays can show the latitude and longitude lines. They are shown as cyan dashed lines. The Range Button sets the maximum range at which the lines will be displayed on the map. The default setting is 1 nm, while the maximum range is 1000 nm.

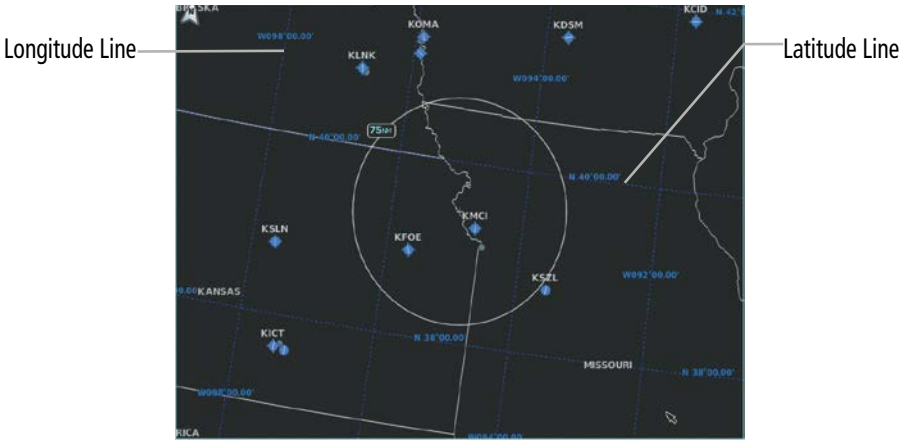


Figure 5-32 Latitude/Longitude Lines

The Range Button sets the maximum range at which the lines will be displayed on the map.

Selecting the lat/lon line maximum range:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Other** Tab, if necessary.
3) Touch the LAT/LON Lines Range Button to display the Range Selection Buttons.
4) Touch a Range Selection Button to select the maximum map display range.

GLIDE RANGE RING

The glide range ring appears as an irregularly shaped cyan polygon around the aircraft and represents how far the aircraft can glide before reaching 1000' AGL under an optimal aircraft glide configuration. Altitude, winds, turning factors, and terrain will change the size and shape of the ring. When the glide range ring is not using datalink forecast winds in its calculation, it will be annunciated on each map. Refer to the Hazard Avoidance Section for information on forecast winds. The glide range ring will be displayed when it has been enabled in map settings and the aircraft is at or above 1000' AGL.

NOTE: *The system will utilize the optimal glide range indicated airspeed at a zero flap setting as one factor in glide range calculations. Reference the current pertinent flight manual for the aircraft glide airspeed.*

NOTE: *The aircraft will always be displayed inside the Glide Range Ring, regardless of extreme winds higher than the aircraft's optimal glide range airspeed.*



Figure 5-33 Glide Range Ring

Displaying/removing the glide range ring:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Other** Tab.
3) Scroll as required and touch the **Glide Range** Button to enable/disable the display.

5.3 WAYPOINTS

Waypoints are published 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 found and tuned from waypoint data. Refer to the Audio and CNS Section for details.

WAYPOINT SELECTION

Waypoints can be selected by entering the ICAO identifier, entering the name of the facility, or by entering the city name. 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. If there is not a waypoint in the database matching the exact characters entered, the FastFind function will analyze the entered characters and use predictive logic based on current GPS location to suggest airports and waypoints. Touch the **Enter** Button to accept the suggested waypoint, or continue to enter characters until the intended waypoint is entered.

See the System Overview Section for detailed instructions on entering data in the system.



Figure 5-34 'Waypoint Info' Screen

If duplicate entries exist for an identifier, a 'Waypoint Duplicates' Screen is displayed when touching the **Enter** Button or pushing the upper knob.

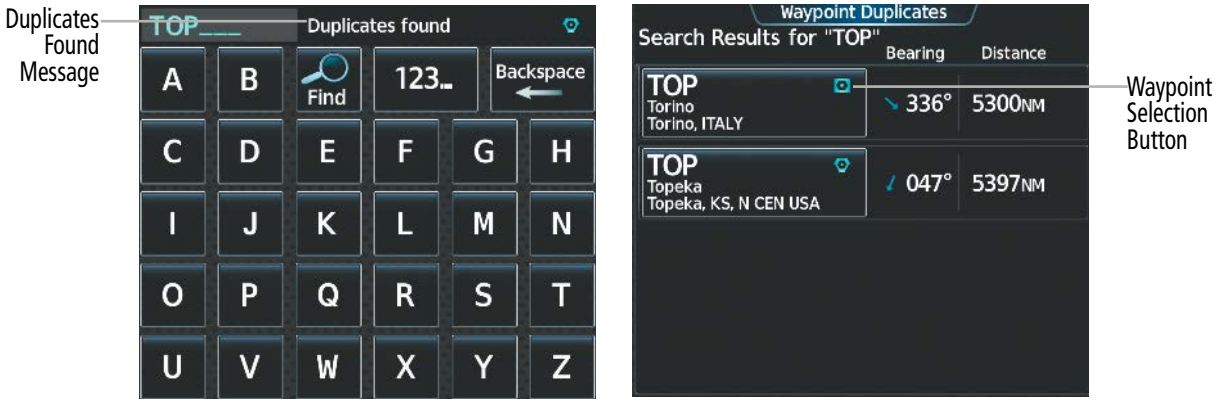


Figure 5-35 'Waypoint Duplicates' Screen

AIRPORTS

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

The 'Airport Information' Pane displays a map of the currently selected airport and surrounding area, and the 'Airport Information' Screen on the Touchscreen Controller allows the pilot to view airport information, load frequencies, review runways, and review instrument procedures that may be involved in the flight plan. For airports with multiple runways, information for each runway is available. See the Audio and CNS Section for more information on finding and tuning frequencies. After applying power to the system, and when the aircraft position is known, the 'Airport Information' Pane 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.

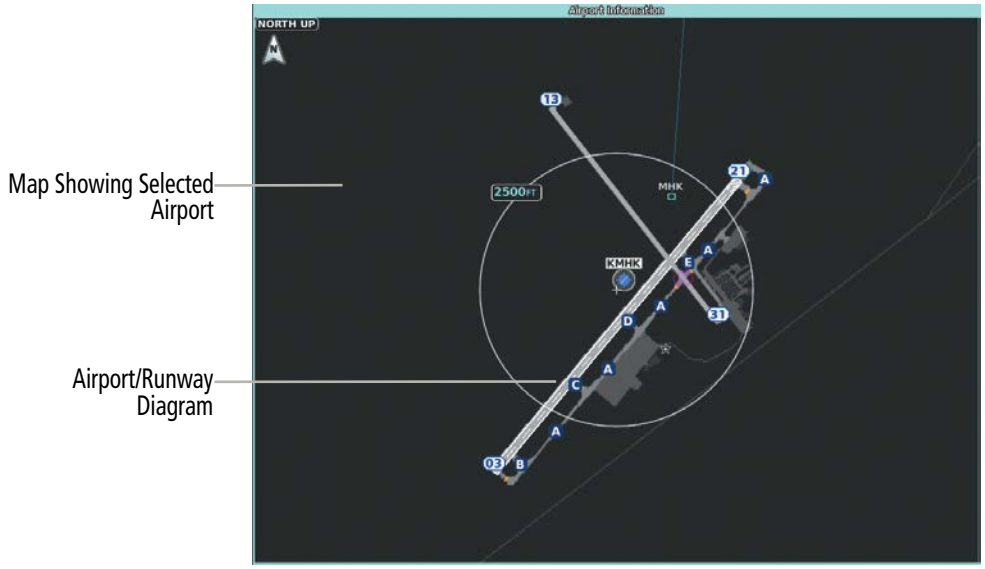


Figure 5-36 'Airport Information' Pane on MFW



Figure 5-37 'Airport Information' Screen

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

Usage type: PUBLIC, MILITARY, PRIVATE, or HELIPORT
Fuel Available: AVGAS, JET



Figure 5-38 'Airport Frequencies' Screen

The following descriptions and abbreviations are used on the 'Airport Frequencies' Screen:

COM Availability: TX (transmit only), RX (receive only), PT (part time), More Information (additional information available)
[1] **COM Frequencies:** Approach, Arrival, ASOS, ATIS, AWOS, Center, Class B, Class C, Clearance, Control, CTA, Departure, Director, Emergency, FSS, Gate, Ground, Helicopter, Military, Multicom, Other, Pre-Taxi, Radar, Radio, Ramp, Terminal, TMA, Tower, TRSA, Unicom
NAV Frequencies: ILS, LOC

[1] *When 'More Information' is displayed on the button, touching the button will display additional information.*

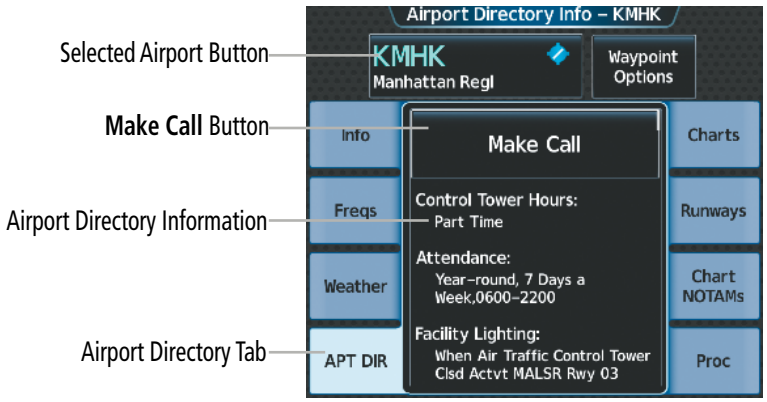


Figure 5-39 'Airport Directory Info' Screen

The Airport Directory Tab provides AC-U-KWIK® airport and FBO directory information for public airfields across the world. Information includes listings of airfield and FBO data, charter companies, fuel suppliers, ground transportation, maintenance, catering services, and much more. See the Additional Feature Section for more information on contacting airport agencies using the **Make Call** Button.

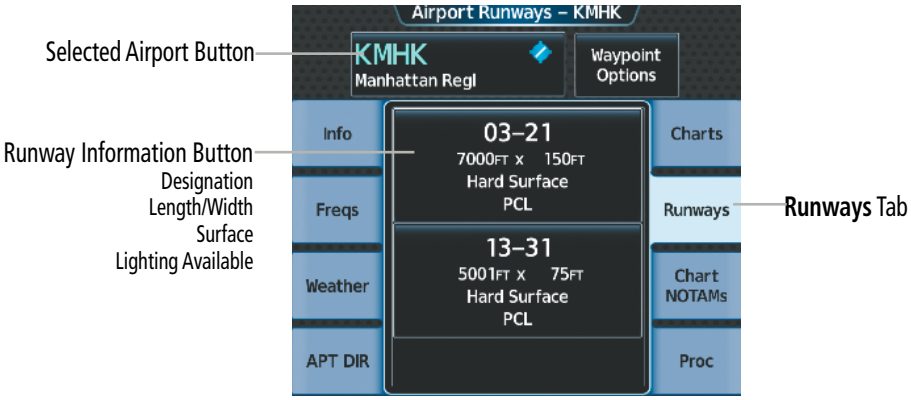


Figure 5-40 'Airport Runways' Screen

The **Runways** Tab brings up the 'Airport Runways' Screen with a Runway Information button for each runway at the selected airport. The Runway Information button contains information about each runway, and selects the runway, which scales the 'Airport Information' Pane to focus on the selected runway.

The following descriptions and abbreviations are used on the 'Airport Runways' Screen:

Runway surface type: Hard, Turf, Sealed, Gravel, Dirt, Soft, Unknown
Runway lighting type: No Lights, Part Time, Full Time, Unknown, or PCL (for pilot-controlled lighting)

See the Hazard Avoidance Section for the description of the information shown on the **Weather** Tab. See the Additional Features Section for the description of the information shown on the **Charts** Tab and the **Chart NOTAMs** Tab. See the discussion later in this section about loading procedures from the **Proc** Tab.

Selecting an airport for review by identifier:

1) From MFW Home, touch **Waypoint Info** > **Airport**.
2) Touch the **Info** Tab, if necessary.
3) Touch the Selected Airport Button to display the keypad.
4) Use the keypad to enter the airport identifier.
5) Touch the **Enter** Button to accept the identifier and display the airport information on the Touchscreen Controller.
6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the 'Airport Information' Pane, if necessary.

Finding and selecting an airport for review by facility name or city name:

1) From MFW Home, touch **Waypoint Info** > **Airport**.
2) Touch the **Info** Tab, if necessary.
3) Touch the Selected Airport Button to display the keypad.
4) Touch the **Find** Button to display the 'Find Waypoint' Screen.
5) Touch the **Search** Tab to display the **Search By** Button.
6) If necessary, touch the **Search By** Button to choose Search by City or Search by Facility.
7) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.

8) Use the keypad to enter the name.

9) Touch the **Enter** Button to accept the entry and display the search results.

10) Touch an Airport Selection Button to display the airport information on the Touchscreen Controller.

11) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the 'Airport Information' Pane, if necessary.

Finding and selecting an airport for review by category (Recent, Nearest, Flight Plan, or Favorites):

1) From MFW Home, touch **Waypoint Info** > **Airport**.

2) Touch the **Info** Tab, if necessary.

3) Touch the Selected Airport Button to display the keypad.

4) Touch the **Find** Button to display the 'Find Waypoint' Screen.

5) Touch the **Recent** Tab, **Nearest** Tab, **Active Flight Plan** Tab, or the **Favorites** Tab to display a list of airports in the selected category.

6) Touch an Airport Selection Button to display the airport information on the Touchscreen Controller.

7) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the 'Airport Information' Pane, if necessary.

Selecting a runway:

1) From MFW Home, touch **Waypoint Info** > **Airport**.

2) Touch the **Runways** Tab to display the runway information buttons.

3) Touch a Runway Information Button to select the runway.

4) Touch the **Waypoint Options** Button, then the **Show on Map** Button to view the runway on the active display pane, if necessary.

NEAREST AIRPORT

The 'Nearest Airport' Pane shows a map of the nearest airport and surrounding area, and the 'Nearest Airport' Screen on the Touchscreen Controller allows the pilot to view airport information, load frequencies, review runways, and review instrument procedures that may be involved in the flight plan. For airports with multiple runways, information for each runway is available. See the Audio and CNS Section for more information on finding and tuning frequencies.

The 'Nearest Airports' Screen displays a list of up to 25 nearest airports (five entries can be displayed at one time). If there are more than five, they are displayed in a scrollable list. The list only includes airports that are within 200 NM; the system will indicate when none are available within 200 NM.

A dashed white line is drawn on the 'Nearest Airport' Pane from the aircraft position to the selected nearest airport.

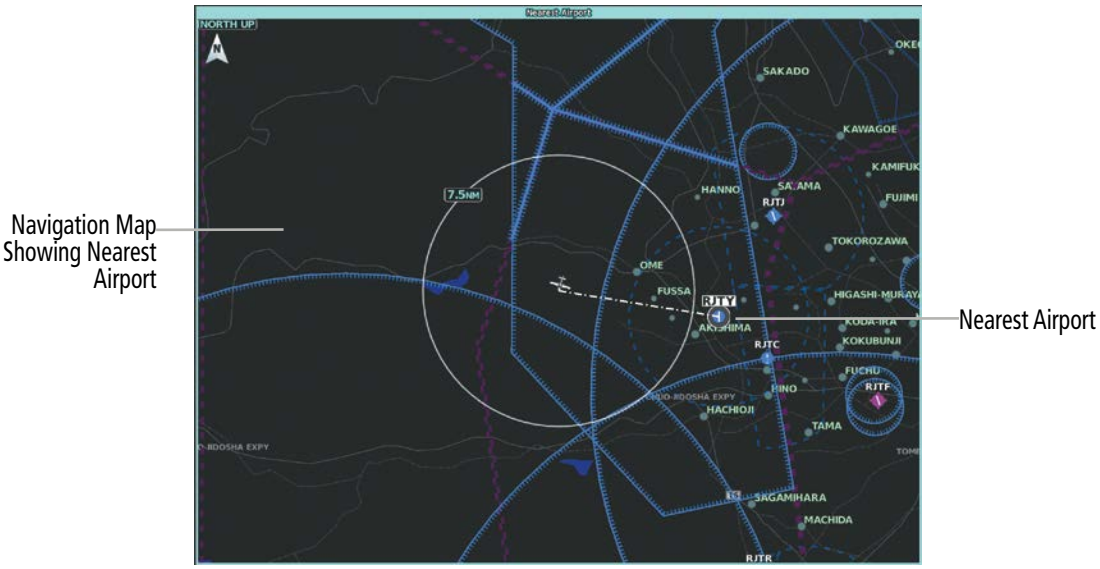


Figure 5-41 'Nearest Airport' Pane

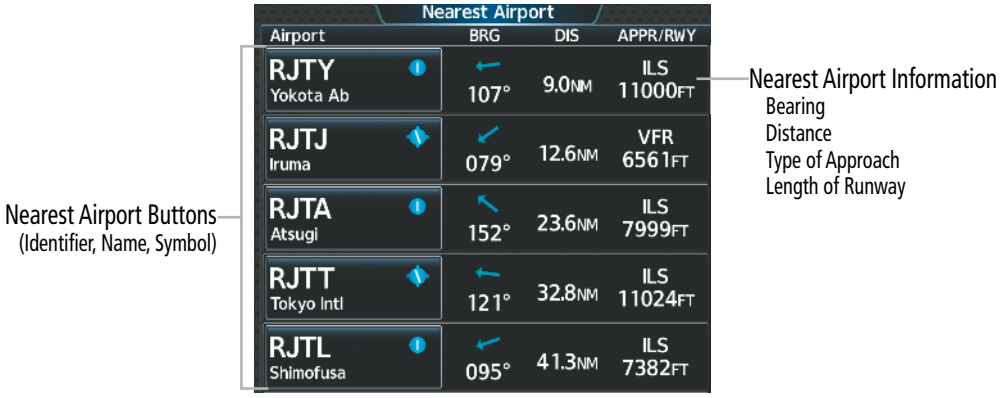


Figure 5-42 'Nearest Airport' Screen

Viewing information for a nearest airport:

1) From MFW Home, touch **Nearest** > **Airport**.
2) Touch a Nearest Airport Button to display the 'Waypoint Options' Window. If necessary, touch the **Show On Map** Button to highlight the airport on the 'Nearest Airport' Pane.
3) Touch the **Airport Info** Button to display the 'Airport Information' Screen.
4) Touch any tab to display the desired information on the Touchscreen Controller.

The minimum runway length and surface type used when determining the 25 nearest airports to display on the 'Nearest Airports' Screen are set on the 'Avionics Settings' Screen under the **System** Tab. 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 for runway length and "Hard Only" for runway surface type.

Selecting nearest airport surface matching criteria:

1) From MFW Home, touch **Utilities** > **Setup** > **Avionics Settings**.
2) Touch the **System** Tab, if necessary.
3) Scroll the list to display the Nearest Airport Runway Surface Button.
4) Touch the Nearest Airport Runway Surface Button to display the surface choices.
5) Touch a Surface Selection Button to set the surface criteria.

Selecting nearest airport minimum runway length matching criteria:

1) From MFW Home, touch **Utilities** > **Setup** > **Avionics Settings**.
2) Touch the **System** Tab, if necessary.
3) Scroll the list to display the Nearest Airport Min Rwy Length Button.
4) Touch the Nearest Airport Min Rwy Length Button to display the keypad.
5) Use the keypad to enter the minimum length.
6) Touch the **Enter** Button to accept the length criteria.

NON-AIRPORT AND USER CREATED WAYPOINTS

WAYPOINT INFORMATION

Non-Airport Waypoints are considered to be Intersections, VRPs, VORs, and NDBs. Non-airport waypoints and User Waypoints have respective Information Panes which show a map of the currently selected waypoint and surrounding area and the Touchscreen Controller shows waypoint information.

The 'VOR Information' Screen 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' Screen, and if it includes only DME, it is displayed as VOR-DME.



Figure 5-43 'Intersection Information' Screen

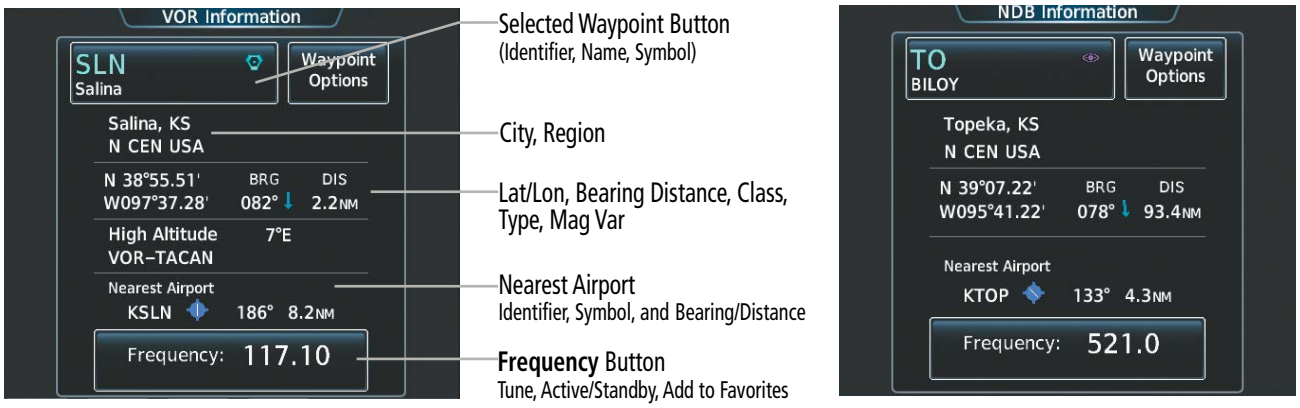


Figure 5-44 VOR and NDB Information Screens

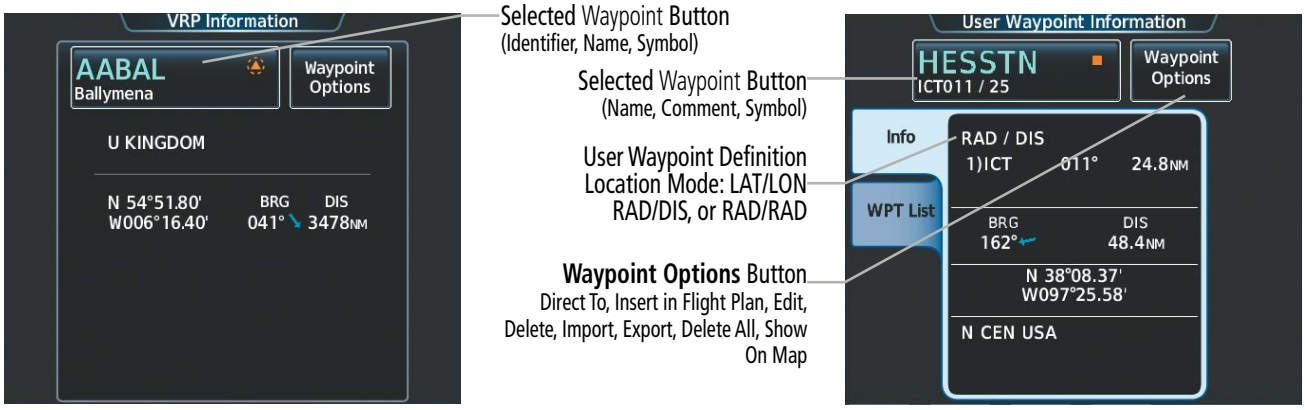


Figure 5-45 VRP and User Waypoint Information Screens



Figure 5-46 'Intersection Information' Pane

Selecting a non-airport waypoint or User Waypoint:

1) From MFW Home, touch the **Waypoint Info** Button.
2) Select the **INT, VRP, VOR, NDB,** or **User Waypoint** Button.
3) Choose the desired waypoint:
   a) Touch the Selected Waypoint Button to display the keypad.
   b) Use the keypad to enter the identifier or name.
   c) Touch the **Enter** Button to accept the identifier and display the waypoint's information on the Touchscreen Controller.

   Or:

   a) For choosing a User Waypoint, touch the **WPT List** Tab.
   b) Touch the desired User Waypoint Button.
4) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the Intersection, VRP, VOR, NDB, or User Waypoint Information Pane, if needed.

Finding and selecting a non-airport or User Waypoint by category (Recent, Nearest, Flight Plan, or Favorites):

1) From MFW Home, touch **Waypoint Info > INT, VRP, VOR, NDB** or **User Waypoint.**
2) Touch the Selected Waypoint Button to display the keypad.
3) Touch the **Find** Button to display the 'Find Waypoint' Screen.
4) Touch the **Recent** Tab, **Nearest** Tab, **Active Flight Plan** Tab, or the **Favorites** Tab to display a list of waypoints in the selected category.
5) Touch a Waypoint Selection Button to display that waypoint's information on the Touchscreen Controller.
6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the Intersection, VRP, VOR, NDB, or User WPT Information Pane, if needed.

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

Finding and selecting a non-airport waypoint for review by facility name or city name:

1) From MFW Home, touch **Waypoint Info > INT, VRP, VOR,** or **NDB.**
2) Touch the Selected Waypoint Button to display the keypad.
3) Touch the **Find** Button to display the 'Find Waypoint' Screen.
4) Touch the **Search** Tab to display the **Search By** Button.
5) If needed, touch the **Search By** Button to choose Search by City or Search by Facility.
6) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.
7) Use the keypad to enter the name.

8) Touch the **Enter** Button to accept the entry and display the search results.

9) Touch a Waypoint Selection Button to display the waypoint information on the Touchscreen Controller.

10) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the Intersection, VRP, VOR, NDB, or User WPT Information Pane, if needed.

NEAREST WAYPOINTS

The Nearest Intersection/VRP/VOR/NDB/User panes show a map of the nearest waypoint selected and surrounding area, and the Touchscreen Controller shows the selected waypoint information, plus an ability to initiate a direct-to or insert the waypoint into the flight plan.

The Nearest Intersection/VRP/VOR/NDB/User screen shows a list of up to 25 waypoints (five entries can be displayed at one time). If there are more than five, they are displayed in a scrollable list. Each list only includes waypoints that are within 200 NM; the system will indicate when none are available within 200 NM. When shown on a map, a dashed white line is drawn on the Nearest (Intersection/VRP/VOR/NDB/User) pane from the aircraft position to the selected nearest waypoint.

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



Figure 5-47 'Nearest VOR' Pane

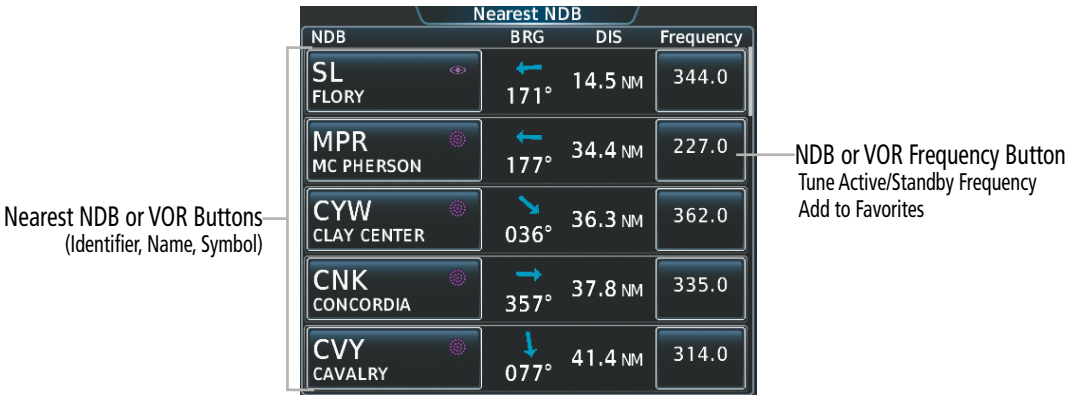


Figure 5-48 Nearest VOR/NDB Screen Layouts (Example: NDB)

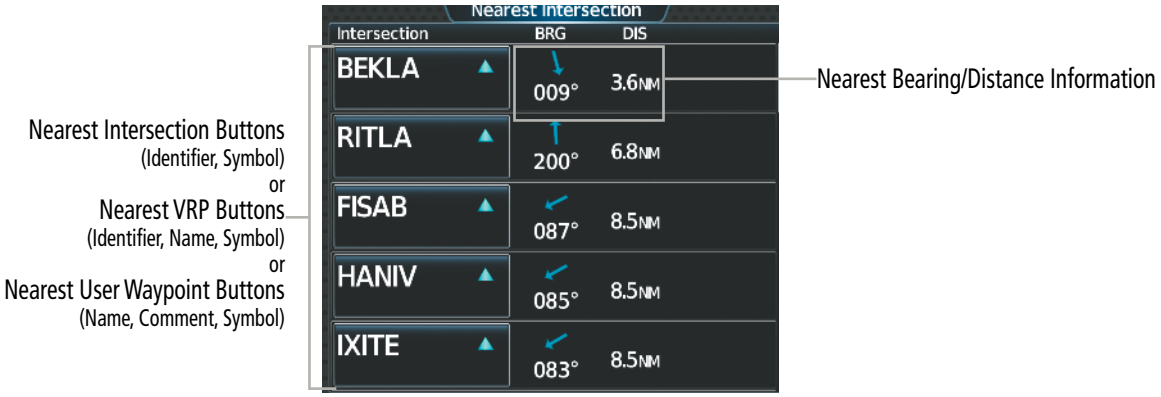


Figure 5-49 Nearest Intersection/VRP/User Screen Layouts (Example: Intersection)

Viewing information for nearest Intersection, VRP, VOR, NDB, or User Waypoint:

1) From MFW Home, touch **Nearest > INT, VRP, VOR, NDB,** or **User.**
2) Touch a Nearest Waypoint Button to display the 'Waypoint Options' Window.
3) Touch the **Show on Map** Button to display the Nearest Intersection/VRP/VOR/NDB/User pane, if needed.
4) Touch the **Intersection**, **VRP**, **VOR**, **NDB**, or **User Waypoint Info** Button to display the selected waypoint's information screen.

USER WAYPOINTS

The system can create, manage, and store up to 1,000 user-defined waypoints. Waypoints can be created as Route or Airport waypoints using the **Type** Button. Once a waypoint has been created, it can be renamed, deleted, or moved. Temporary user waypoints are erased upon system power down.

Any one of the following parameters may be used for defining the location of a user waypoint: Radial/Distance, Radial/Radial, Latitude/Longitude, or Present Position.

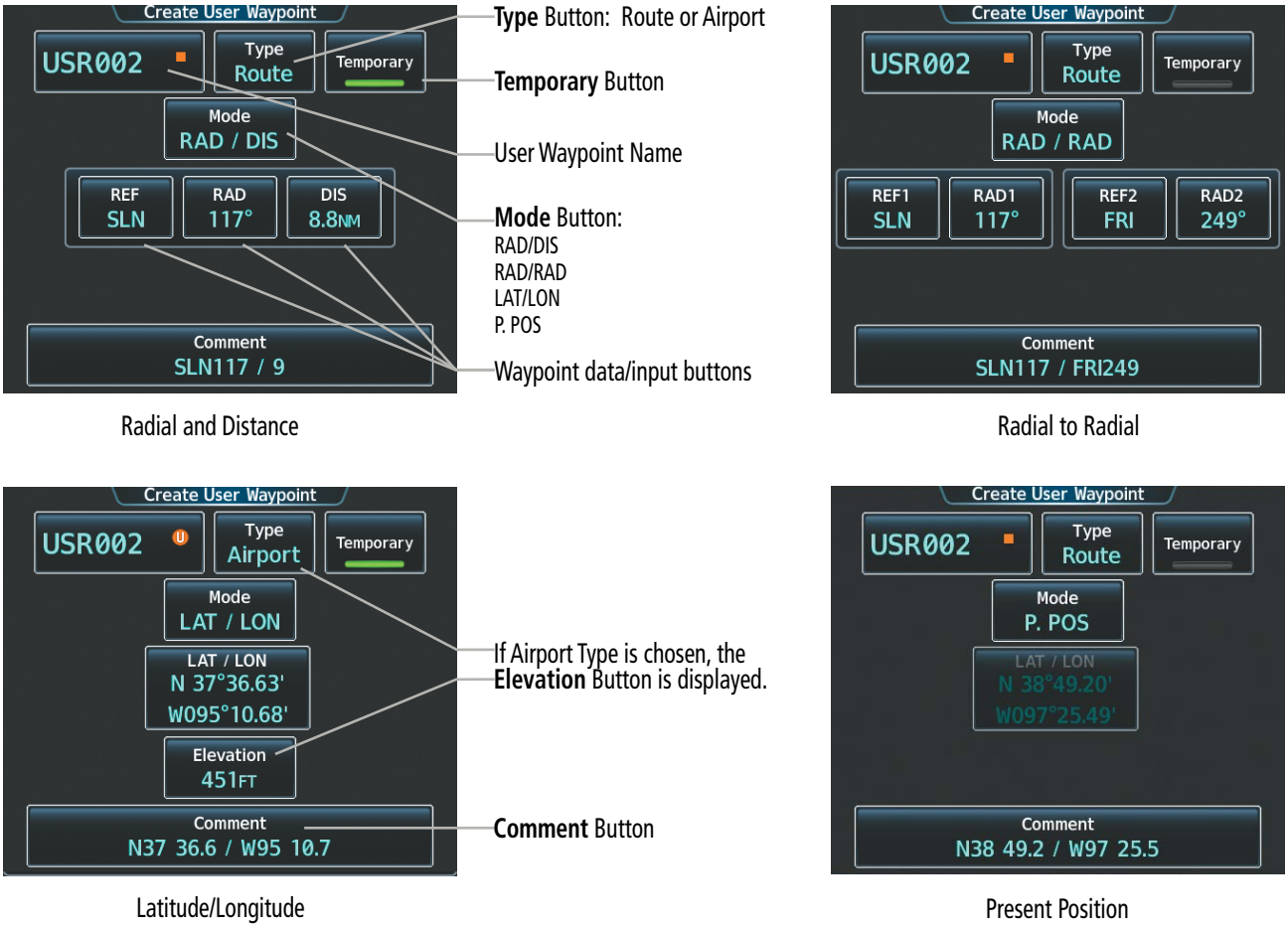


Figure 5-50 'Create User Waypoint' Screens – Mode Options

Creating user waypoints from the 'Create User Waypoint' Screen:

1) From MFW Home, touch **Waypoint Info**.
2) Access the 'Create User Waypoint' Screen:

   Touch the **Create Waypoint** Button.

   Or:

   a) Touch the **User Waypoint** Button.
   b) Touch the **WPT List** Tab.
   c) Touch the **Add User Waypoint** Button.
3) Touch the User Waypoint Name Button to display the keypad.
4) Use the keypad and the **Enter** Button to select a User Waypoint Name.
5) If desired, touch the **Type** Button to open the 'Select User Waypoint Type' Screen to change the setting from Route to Airport.
   a) Touch the **Airport** Button.
   b) Touch the **Elevation** Button.
   c) Use the keypad and the **Enter** Button to select the airport elevation.

6) If desired, define the location parameters of the waypoint in one of the following ways:
   a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen.
   b) Touch the **RAD/DIS** Button to select the bearing/distance from a waypoint.
   c) Touch the **REF** Button to display the keypad.
   d) Use the keypad and the **Enter** Button, or the Find function, to select the reference waypoint.
   e) Touch the **RAD** Button to display the keypad.
   f) Use the keypad and the **Enter** Button to select the radial.
   g) Touch the **DIS** Button to display the keypad.
   h) Use the keypad and the **Enter** Button to select the distance.

   Or:

   a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen.
   b) Touch the **RAD/RAD** Button to select the bearings from two waypoints.
   c) Touch the **REF1** Button to display the keypad.
   d) Use the keypad and the **Enter** Button, or the Find function, to select the waypoint.
   e) Touch the **RAD1** Button to display the keypad.
   f) Use the keypad and the **Enter** Button to select the radial.
   g) Repeat the previous steps for the second reference waypoint (**REF2** Button) and radial (**RAD2** Button).

   Or:

   a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen.
   b) Touch the **LAT/LON** Button to select the latitude/longitude mode.
   c) Touch the **LAT/LON** Button to display the keypad.
   d) Use the keypad and the **Enter** Button to select the latitude and longitude.

   Or:

   a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen.
   b) Touch the **P. POS** Button to select the present position type as defined by latitude/longitude values.
7) If desired, change the waypoint comment:
   a) Touch the **Comment** Button to display the keypad.
   b) Use the keypad and the **Enter** Button to select the comment.
8) If desired, touch the **Temporary** Button to change the waypoint storage method. When the annunciator on the button is green, the waypoint is only stored until the next power cycle. When the annunciator is gray, the waypoint is stored until manually erased.
9) Touch the **Create** Button to accept the new user waypoint. If RAD/RAD was used to define the waypoint, and the radials do not intersect, a message "The radials entered do not intersect" will be displayed. Touch the **OK** Button to return to the 'Create User Waypoint' Screen.

Creating user waypoints from map displays:

1) Push the lower knob to activate the panning function and display the 'Map Pointer Control' Screen on the Touchscreen Controller.
2) Use the **Touchpad** to pan to the map location of the desired user waypoint.
3) Touch the **Create WPT** Button. The 'Create User Waypoint' Screen is displayed with the captured position.
4) Touch the User Waypoint Name Button to display the keypad.
5) Use the keypad and the **Enter** Button to select a user waypoint name.
6) If desired, touch the **Type** Button to open the 'Select User Waypoint Type' Screen to change the setting from Route to Airport.
   a) Touch the **Airport** Button.
   b) Touch the **Elevation** Button.
   c) Use the keypad and the **Enter** Button to select the airport elevation.
7) If desired, change the waypoint comment:
   a) Touch the **Comment** Button to display the keypad.
   b) Use the keypad and the **Enter** Button to select the comment.
8) Touch the **Create** Button to create the new waypoint.
9) Touch the **Back** Button to deactivate the panning function and return to the previous display on the Touchscreen Controller.

Editing a user waypoint comment:

1) From MFW Home, touch **Waypoint Info** > **User Waypoint**.
2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired User Waypoint Selection Button.
3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.
4) Touch the **Edit** Button to display the 'Edit User Waypoint' Screen.
5) Touch the **Comment** Button to display the keypad.
6) Use the keypad and the **Enter** Button to select a user waypoint comment (up to 25 characters).
7) Touch the **Save** Button to accept the new comment.
8) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".
9) If the user waypoint is part of an existing flight plan, a second pop up window is displayed. Touch the **OK** Button in response to the question "User waypoint is part of at least one flight plan. Any modifications affect the associated flight plan(s).".

Editing a user waypoint name:

1) From MFW Home, touch **Waypoint Info** > **User Waypoint**.
2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired User Waypoint Selection Button.
3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.
4) Touch the **Edit** Button to display the 'Edit User Waypoint' Screen.
5) Touch the User Waypoint Name Button to display the keypad.
6) Use the keypad and the **Enter** Button to select a user waypoint name.
7) Touch the **Save** Button to accept the new name.
8) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".
9) If the user waypoint is part of an existing flight plan, a second pop up window is displayed. Touch the **OK** Button in response to the question "User waypoint is part of at least one flight plan. Any modifications affect the associated flight plan(s)."

Editing a user waypoint type, mode, elevation, and location:

1) From MFW Home, touch **Waypoint Info** > **User Waypoint**.
2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired User Waypoint Selection Button.
3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.
4) Touch the **Edit** Button to display the 'Edit User Waypoint' Screen.
5) To edit the type of User Waypoint:
   a) Touch the **Type** Button to display the 'User Waypoint Type' Window.
   b) Touch the **Route** Button to select the type and return to the previous screen.

   Or:

   a) Touch the **Type** Button to display the 'User Waypoint Type' Window.
   b) Touch the **Airport** Button to select the type and return to the previous screen.
   c) Touch the **Elevation** Button.
   d) Use the keypad and the **Enter** Button to select the airport elevation and return to the previous screen.
6) To edit the mode of User Waypoint:
   a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Window.
   b) Touch the **RAD/DIS** Button, the **RAD/RAD** Button, the **LAT/LON** Button, or the **P. POS** Button to select the mode and return to the previous screen.
7) If the P. POS Mode is selected, skip to step 8. Otherwise, perform the following to edit the location parameters of the waypoint:
   a) Touch the **REF** Button, the **RAD** Button, the **DIS** Button, or the **LAT/LON** Button to bring up the keypad.

b) Use the keypad and the **Enter** Button to select the user waypoint location.

c) Repeat as necessary until the location changes are complete (Reference Waypoint, Radial, Distance, or Latitude and Longitude).

8) Touch the **Save** Button to accept the changes.

9) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

10) If the user waypoint is part of an existing flight plan, a second pop up window is displayed. Touch the **OK** Button in response to the question "User waypoint is part of at least one flight plan. Any modifications affect the associated flight plan(s)."

Deleting a single user waypoint:

1) From MFW Home, touch **Waypoint Info** > **User Waypoint**.

2) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.

3) Touch the **Delete** Button.

4) Touch the **OK** Button in response to the question "Would you like to delete the user waypoint <waypoint>?".

Deleting all user waypoints:

1) From MFW Home, touch **Waypoint Info** > **User Waypoint**.

2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch any Waypoint Selection Button.

3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.

4) Touch the **Delete All** Button.

5) Touch the **OK** Button in response to the question "Would you like to delete all user waypoints?".

Importing user waypoints:

1) From MFW Home, touch **Waypoint Info** > **User Waypoint**.

2) Touch the **Waypoint Options** Button.

3) Touch the **Import** Button.

4) Touch the **OK** Button.

Exporting user waypoints:

1) From MFW Home, touch **Waypoint Info** > **User Waypoint**.

2) Touch the **WPT List** Tab to display the list of user waypoints.

3) Scroll the list, if needed, and touch a User Waypoint Button Information for the selected waypoint is displayed.

4) Touch the **Waypoint Options** Button.

5) Touch the **Export** Button.

6) Touch the **OK** Button in response to the question, 'Would you like to export user waypoints?'.

5.4 AIRSPACES

The system can display many types of airspaces. See the Map Symbols portion of this section for a complete listing of all airspaces, their associated symbols, and default and maximum map display ranges. Temporary Flight Restrictions (TFRs) are discussed in the Hazard Avoidance Section.

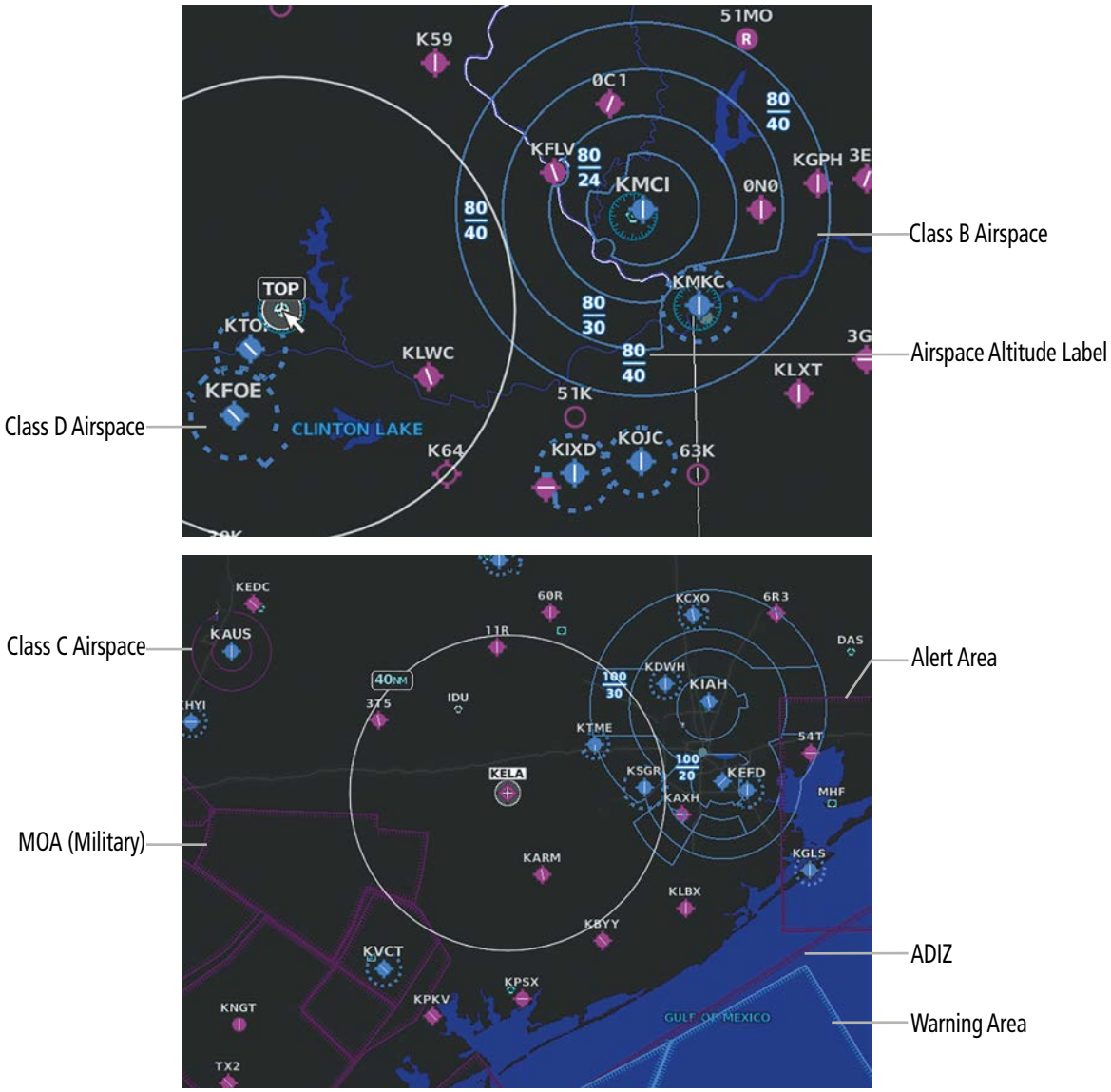


Figure 5-51 Airspaces

NEAREST AIRSPACE

SETTING AIRSPACE ALERTS

The **Alerts** Tab on the 'Avionics Settings' Screen allows the pilot to turn the controlled/special-use airspace alerts on or off. This does not affect the airspaces listed on the 'Nearest Airspace' Screen or the airspace boundaries depicted on map displays. It simply turns on/off the alert provided when the aircraft is approaching or near an airspace. Alerts for the following airspaces can be enabled/disabled.



Figure 5-52 Alerts Tab – Airspace Alerts

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.

Setting the altitude buffer distance:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings > Alerts** Tab.
2) Scroll as required, and touch the Airspace Alert Altitude Buffer (displays current selection in cyan).
3) Enter the desired altitude buffer value and touch the **Enter** Button.

Enabling/disabling an airspace alert:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings > Alerts** Tab.
2) Touch the Airspace Alerts **Settings** Button.
3) Touch any of the of the following buttons to enable/disable the corresponding alert: **CL B/TMA/AWY**, **CL C/CTA**, **CL A/D**, **Restricted**, **MOA (Military)**, **Other**. The button annunciator is green when alert is enabled, gray when disabled.

VIEWING NEAREST AIRSPACE INFORMATION

The 'Nearest Airspace' Screen and the 'Nearest Airspace' Pane can be used to quickly find airspaces close to the aircraft and its projected current ground track. The 'Nearest Airspace' Pane shows a map of airspace boundaries and surrounding area. The 'Nearest Airspace' Screen displays airspace information. In addition, a selected frequency associated with the airspace can be loaded from the 'Nearest Airspace' Screen.



Figure 5-53 'Nearest Airspace' Pane

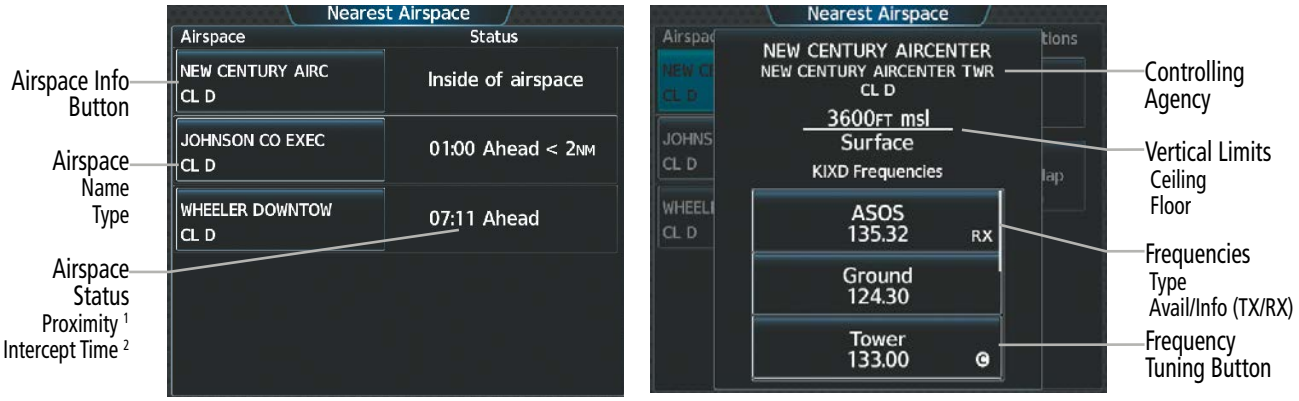


Figure 5-54 'Nearest Airspace' Screen

[1] *Proximity: Ahead, Inside, Ahead<2nm, Within 2nm*
[2] *Intercept Time: Only if Ahead or Ahead < 2nm*

Viewing information for the Nearest Airspace:

1) From MFW Home, touch **Nearest** > **Airspace**.
2) Touch a Nearest Airspace Button to display the 'Airspace Options' Window. If no airspace is projected, the 'Nearest Airspace' Screen will read "No Results Found".
3) Touch the **Show on Map** Button to display the selected airspace, if needed.
4) Touch the **Details** Button to display the selected nearest airspace information.

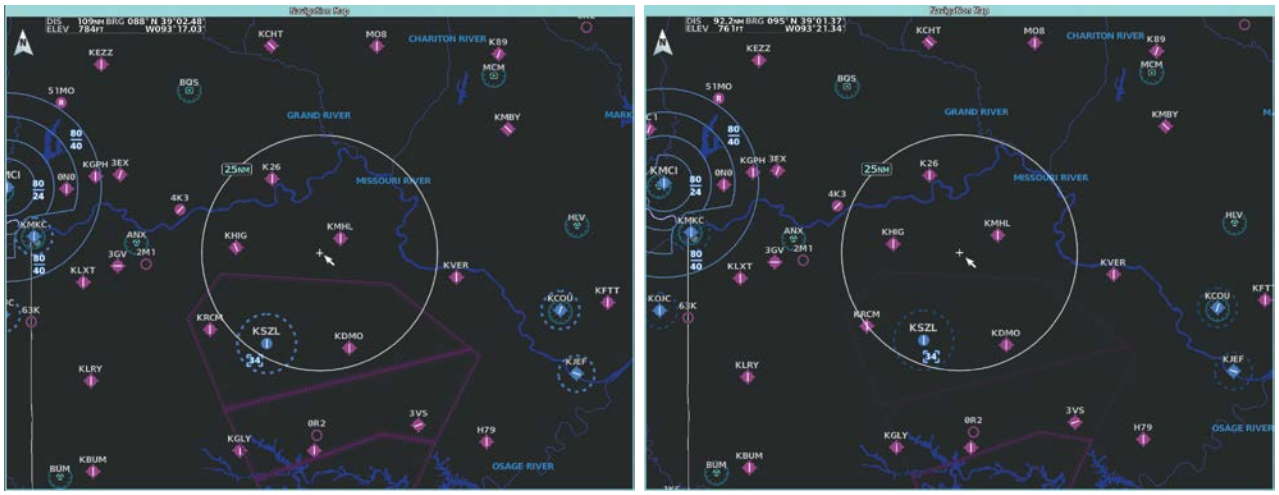
When an airspace alert occurs, the **MSG** Button on the Touchscreen Controller begins flashing. Touch the flashing button to view the list of alerts. The following airspace alerts are displayed in the 'Notifications' Screen:

Message	Comments
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
ARSPC AHEAD – Airspace ahead – less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft 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 5-6 Airspace Alert Messages

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 1500 feet of the vertical boundaries of the airspace, the airspace boundary is shown normally. If the current aircraft altitude is not within 1500 feet of the vertical boundaries of the airspace, the airspace boundary is shown subdued.



Smart Airspace Off Smart Airspace On

Figure 5-55 Smart Airspace

Enabling/disabling the Smart Airspace function:

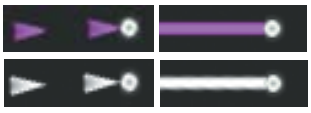
1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Aviation** Tab, if necessary.
3) Touch the Airspaces **Settings** Button to display the 'Airspace Settings' Window.
4) Touch the **Smart Airspace** Button to enable/disable the Smart Airspace function.

5.5 FLIGHT PLANNING

GENERAL INFORMATION

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

The system displays a calculated turn anticipation arc, and provides guidance to follow the arc. When the aircraft reaches the beginning of the arc, the guidance will prompt a turn, and the course pointer and desired track will indicate the course for the next flight plan leg. The CDI will indicate the cross track error relative to the arc for the duration of the turn. The flight plan leg will sequence to the next leg at the apex of the arc, indicated by the To/From Indicator momentarily switching to From, and the displayed FMS information updating to the new active leg.

Symbol Name	Description	Symbol
Course Leg	Course leg currently flown	
	A future course leg in the current phase of flight	
	A course leg in either a previously flown course leg, or a future course leg not in the current phase of flight	
Heading Leg	Heading leg currently flown	
	Future heading leg	
Roll Steering Path [1]	Turning path currently flown	
	Turning path for the next flight plan leg	
	Turning path beyond the next flight plan leg	
Turn Anticipation Arc	Displayed when sequencing to the next flight plan leg through a fly-by waypoint, a lead turn is created, adjusting for groundspeed	
Fly-Over Waypoint; Along Track Waypoint	Displayed as a fly-over waypoint; Displayed when an along track offset waypoint is created.	 (flyover); (along track)
Fixes	Fixes intersect the flight plan. The symbol represents either just a fix or when the fix is made into a flight plan fix waypoint.	
Flight Path Fix	A fix that terminates: manually, at a specified altitude, or at a specified distance or radial when flying a heading	
Top of Descent (TOD) and Bottom of Descent (BOD)	When vertically navigating, the system will display where the aircraft will begin complete the descent.	
Parallel Offset Waypoint	Displayed when the parallel offset course leg is abeam the original flight plan waypoints, and will appear as a Flight Path Fix, Along Track Waypoint, or Fly-Over Waypoint.	

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

Table 5-7 Flight Plan Symbols

NOTE: *See the AFCS Section for information on lateral guidance and course deviation per flight plan leg types.*

NOTE: *A flight plan leg with manual termination projects the path ahead of the aircraft for five nautical miles.*

The system allows creation, modification, and/or viewing of a flight plan as follows:

- 'Active Flight Plan' Screen on the Touchscreen Controller (create/modify/view the active flight plan)
- 'Standby Flight Plan' Screen on the Touchscreen Controller (create/modify/view the standby flight plan)
- 'Flight Plan Catalog' Screen on the Touchscreen Controller (create/modify/view a stored flight plan)
- 'Flight Plan' Window on the PFW (create/modify/view the active flight plan)
- 'Active Flight Plan' Inset Window on the 'Navigation Map' Pane (view the active flight plan)
- 'Flight Plan Progress' Inset Window on the 'Navigation Map' Pane (view the active flight plan)
- Vertical Situation Display on the 'Navigation Map' Pane (view upcoming vertical profile of the active flight plan)
- **Preview FPL** Button within the 'Flight Plan Options' and 'Standby Flight Plan Options' Screens on the Touchscreen Controller (view active/standby/stored flight plan on the display pane)
- **Flight Plan Legs** Button within the 'Flight Plan Information' Screen on the Touchscreen Controller (view active flight plan legs on the display pane)
- **Flight Plan History** Button within the 'Flight Plan Information' Screen on the Touchscreen Controller (view previously flown flight plan leg information on the display pane)

NOTE: *When a flight plan is in the process of being changed on a Touchscreen Controller, and the flight plan is changed on another GTC or by system automation, the system will display a window stating the, "Flight Plan has been modified by other user".*

The 'Active Flight Plan' Screen and the 'Standby Flight Plan' Screens are shown in the following figures.



Figure 5-56 'Active Flight Plan' Screen

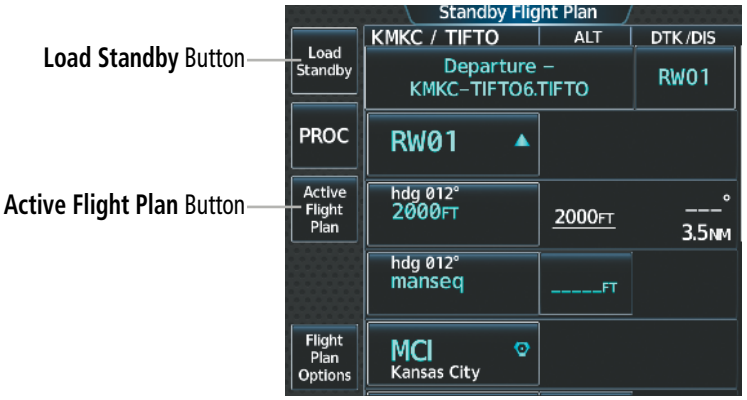


Figure 5-57 'Standby Flight Plan' Screen



Figure 5-58 'Flight Plan Catalog' Screen

FLIGHT PLAN DATA FIELDS

The two Flight Plan Data Fields located in the far right column of the flight plan for both the Active and Standby Flight Plan Screens each contain a field, displaying one of the following items:

- **CUM** (Cumulative Distance)
- **DIS** (Distance)
- **DTK** (Desired tack)
- **ESA** (Enroute Safe Altitude)
- **ETA** (Estimated Time of Arrival)
- **ETE** (Estimated Time Enroute)
- **FUEL** (Fuel to Destination)
- **FPA** (Flight Path Angle)

The navigation information displayed in the two data fields can be changed through the 'Flight Plan Options' Window.

Changing a field in the Active or Flight Plan Screen:

1) For the active flight plan: From MFW Home, touch **Flight Plan > Flight Plan Options**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan > Standby Flight Plan > Flight Plan Options**.

2) Touch the **Edit Data Fields** Button to display the 'Flight Plan Data Fields' Screen.

3) Touch the **Data Field 1** Button or the **Data Field 2** Button to display the 'Select Field Type' Screen.

4) Scroll the list if necessary and touch a data field type button to select the field type and return to the 'Flight Plan Data Fields' Screen.

5) Touch the other data field button to choose another data field type, if necessary.

FLIGHT PLAN DISPLAY

An active, standby or stored flight plan can be previewed on the 'Navigation Map' Pane by selecting the **Preview FPL** Button. When a waypoint in a flight plan is selected, the 'Waypoint Options' Window is displayed, and the page up/page down buttons are replaced by the previous/next waypoint buttons. This allows easier previewing of the flight plan on the active display pane.

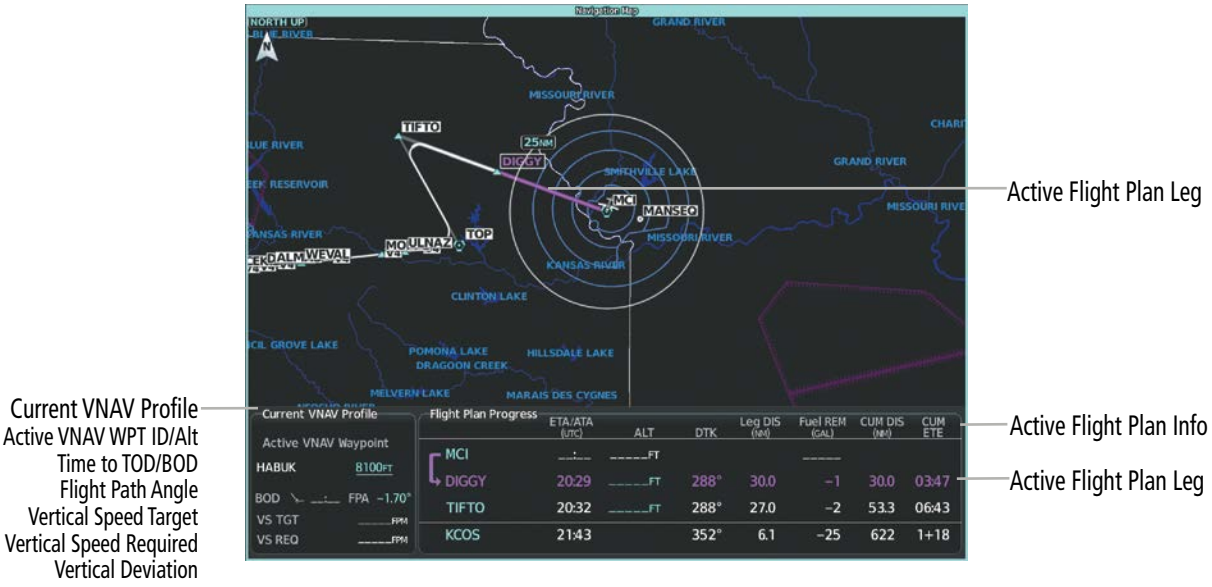


Figure 5-59 'Active Flight Plan' Inset displayed on 'Navigation Map' Pane

Displaying/removing the flight plan preview:

1) For the active flight plan: From MFW Home, touch **Flight Plan > Flight Plan Options**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan > Flight Plan Options**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

d) Touch the **Flight Plan Options** Button.

2) Touch the **Preview FPL** Button. A preview of the flight plan is shown on the active display pane.

3) To view a flight plan segment:
   a) Touch the **Back** Button.
   b) Scroll as needed, and touch the selection button corresponding to the desired segment of the flight plan.
   c) Touch the **Back** Button to return to the flight plan preview.
4) Touch the **Preview FPL** Button again or return to the 'MFW Home' Screen to disable the **Preview FPL** Button and remove the preview from the display.

Displaying/removing the Flight Plan Text Inset:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Inset Window** Tab.
3) Touch the **Flight Plan Text** Button to display/remove the active flight plan text on the 'Navigation Map' Pane.
4) Waypoint distances shown on the Flight Plan Text Inset may be set as leg to leg distances or cumulative distance by selecting the **CUM** Button or **Leg-Leg** Button next to the **Flight Plan Text** Button.

Displaying/removing the Flight Plan Progress Inset:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Inset Window** Tab.
3) Touch the **Flight Plan Progress** Button to display/remove the flight plan progress inset.

Detailed leg data for the Active Flight Plan can be viewed in the display pane.

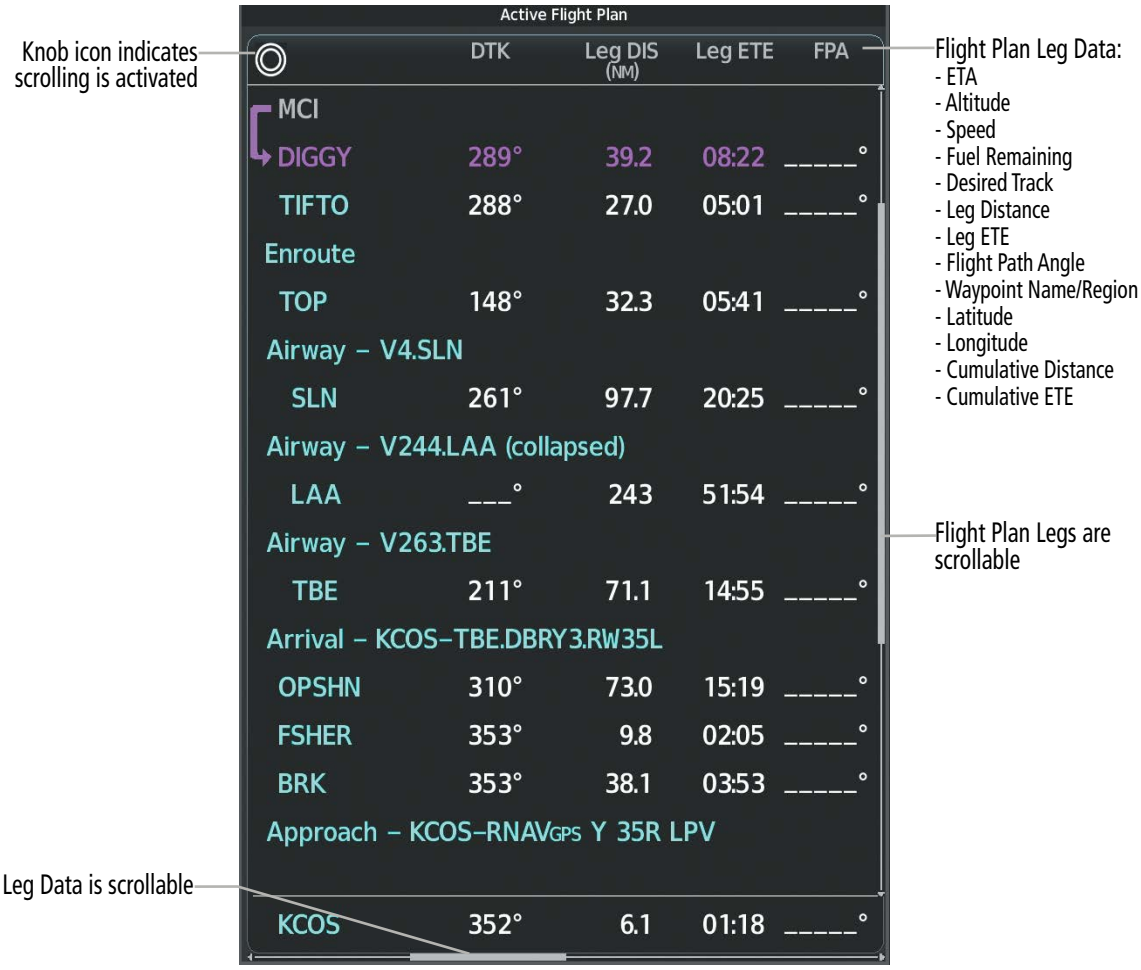


Figure 5-60 Active Flight Plan Leg Data

Viewing Flight Plan Legs for the active flight plan:

1) From MFW Home, touch **Flight Plan Information > Flight Plan Legs.**

   Or:

   From MFW Home, touch **Flight Plan > Flight Plan Options > Display FPL Legs**.

2) Push either knob to activate the scrolling function on the 'Active Flight Plan' Pane.

3) Turn the upper knobs to scroll the 'Active Flight Plan' Pane.

4) Touch the **Display FPL Legs** Button again (if previously used) to remove the 'Active Flight Plan' Pane from the display.

Historical flight data can be viewed for active flight plan waypoints that have been sequenced in flight. Data can be viewed in the display pane by touching the **Flight Plan History** Button.

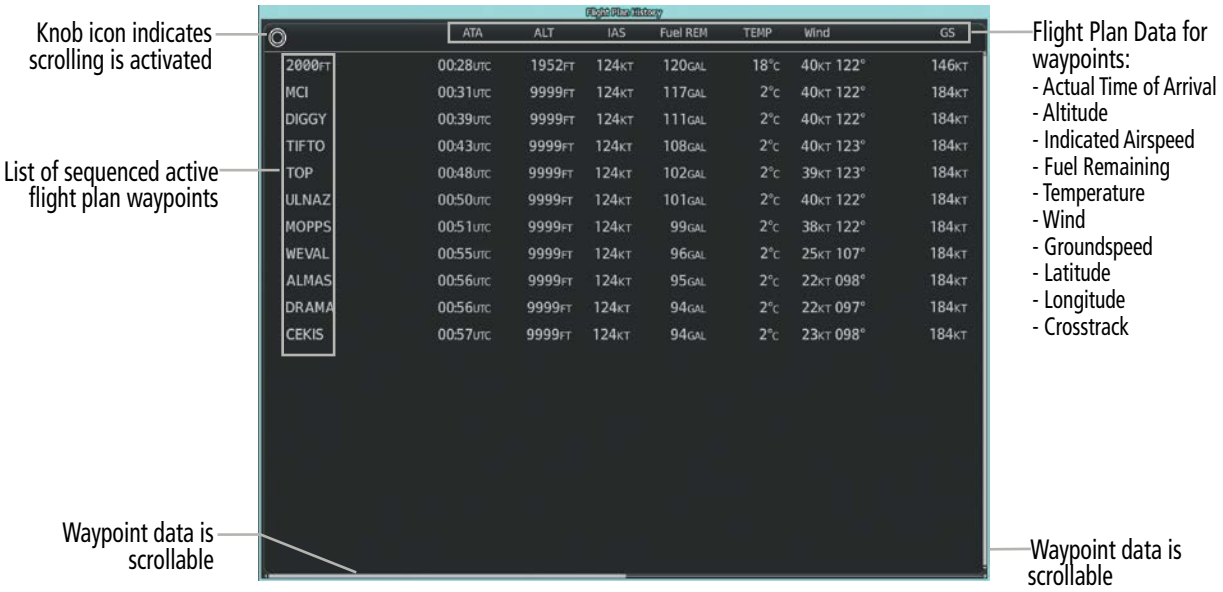


Figure 5-61 Flight Plan History

Viewing historical flight plan data:

1) From MFW Home, touch **Flight Plan Information > Flight Plan History.**
2) Push either knob to activate the scrolling function.
3) Turn the upper knobs to scroll the 'Flight Plan History' Pane.

Deleting flight plan history:

1) From MFW Home, touch **Flight Plan Information > Flight Plan History > Delete Flight Plan History.**
2) Touch the **OK** Button in response to the question, 'Clear current waypoints from the flight plan history?'.

DIRECT-TO NAVIGATION

The Direct-to method of navigation allows quick selection of a destination and provides guidance to the selected point. Initiate a direct-to by touching the D▸ Button on the Touchscreen Controller Button Bar. Once a direct-to is activated, the system establishes a course from the present position to the selected direct-to destination, with initial turn as needed. Course guidance is provided until the direct-to is canceled, replaced with a new direct-to, or a new flight plan leg or sequence is activated.

The 'Direct To' Screen on the Touchscreen Controller allows selection and activation of direct-to navigation, and displays selected direct-to waypoint data. Any waypoint can be entered as a direct-to destination.

The choice to “Activate and Insert in Flight Plan” is given on the 'Direct To' Screen when selecting a waypoint that is not already within the active flight plan (if direct-to navigation has already been activated, the choice to "Insert in Flight Plan" is given instead). If this action is selected, the system will provide direct-to navigation to the waypoint, and the waypoint will be inserted in the active flight plan before the waypoint selected. After arriving at the waypoint, guidance is resumed to the next flight plan waypoint.

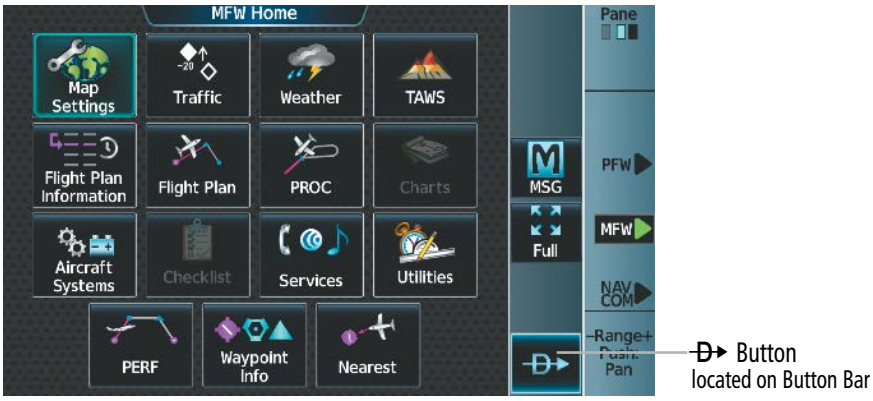


Figure 5-62 Button Bar - Direct-To Button

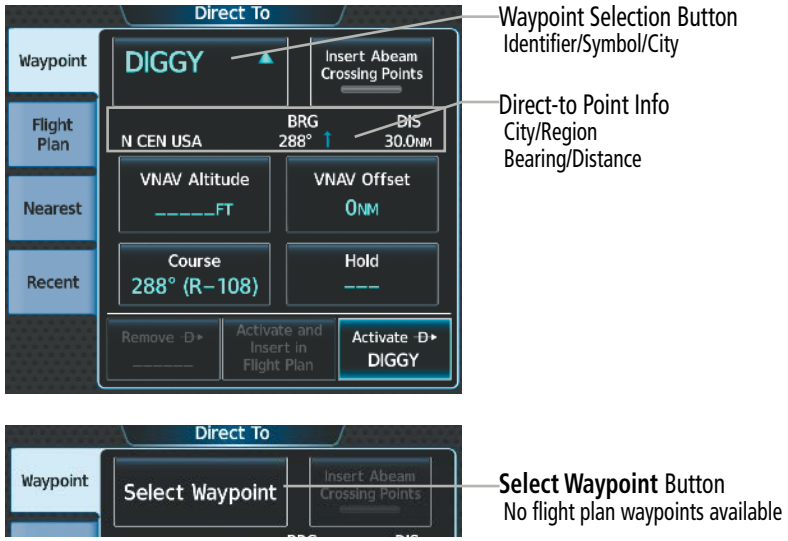


Figure 5-63 'Direct To' Screen

The direct-to function can be accessed from any waypoint information screen (Airport Information, Intersection Information, VOR Information, NDB Information, VRP Information, or User Waypoint Information), and from some of the nearest waypoint screens (Nearest Airport, Nearest Intersection, Nearest VOR, Nearest NDB, Nearest VRP, Nearest User, or Nearest Weather). If the direct-to is initiated from the 'Active Flight Plan' Screen when no waypoint has been selected, the default waypoint is either the active flight plan waypoint (if a flight plan is active) or no waypoint (**Select Waypoint** Button is active). Direct-to requests on waypoint information screens or nearest waypoint screens default to the displayed waypoint.

Selecting a nearby airport as a direct-to destination:

1) From MFW Home, touch **Nearest** > **Airport**.
2) Touch a Nearest Airport Button to display the 'Waypoint Options' Window. If desired, highlight the airport on the active display pane by touching the **Show On Map** Button.
3) Touch the Direct-To Button to choose the waypoint as the direct-to destination, and display the 'Direct To' Screen.
4) To activate direct-to navigation:

   Touch the **Activate** Direct-To Button to activate the direct-to.

   Or:

a) Touch the **Activate and Insert in Flight Plan** Button or the **Insert in Flight Plan** Button (only available if the selected waypoint is not in the flight plan) to display the 'Insert and Activate ⊣D▸ <waypoint> Before?' Window.

b) Touch the Waypoint Selection Button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Selecting any waypoint as a direct-to destination:

1) Select the screen containing the desired waypoint and select the desired waypoint.

2) If necessary, touch the **Waypoint Options** Button.

3) Touch the ⊣D▸ Button to choose the waypoint as the direct-to destination, and display the 'Direct To' Screen.

4) To activate direct-to navigation:

Touch the **Activate** ⊣D▸ Button to activate the direct-to.

Or:

a) Touch the **Activate and Insert in Flight Plan** Button or the **Insert in Flight Plan** Button (only available if the selected waypoint is not in the flight plan) to display the 'Insert and Activate ⊣D▸ <waypoint> Before?' Window.

b) Touch the Waypoint Selection Button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Selecting a waypoint as the direct-to destination by identifier, facility, or city name:

1) From MFW Home, touch ⊣D▸ on the Button Bar.

2) Touch the Waypoint Selection Button to display the keypad (available waypoints in flight plan).

Or:

Touch the **Select Waypoint** Button to display the keypad.

3) Select a waypoint as a direct-to destination:

Input the waypoint identifier using the keypad and touch the **Enter** Button to accept the identifier, and return to the 'Direct To' Screen.

Or:

a) Touch the **Find** Button to display the 'Find Waypoint' Screen.

b) Touch the **Search** Tab to display the **Search By** Button.

c) If needed, touch the **Search By** Button to choose Search by City or Search by Facility.

d) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.

e) Use the keypad to select the name.

f) Touch the **Enter** Button to accept the entry and display the search results.

g) Touch a Waypoint Selection Button to choose the waypoint as the direct-to destination, and return to the 'Direct To' Screen.

4) To activate direct-to navigation:

   Touch the **Activate** Direct-to Button to activate the direct-to.

   Or:

   a) Touch the **Activate and Insert in Flight Plan** Button or the **Insert in Flight Plan** Button (only available if the selected waypoint is not in the flight plan) to display the 'Insert and Activate Direct-to <waypoint> Before?' Window.

   b) Touch the Waypoint Selection Button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Selecting a waypoint as the direct-to destination by category (Nearest or Recent):

1) From MFW Home, touch Direct-to on the Button Bar.
2) Select the desired Tab:

   Touch the **Recent** Tab

   Or:

   a) Touch the **Nearest** Tab.

   b) If desired, touch the **Nearest Waypoint Filter** Button and touch the type of waypoint desired.

3) Touch a Waypoint Selection Button to choose the waypoint as the direct-to destination, and return to the 'Direct To' Screen.
4) Activate the direct-to

   Touch the **Activate** Direct-to Button to activate the direct-to.

   Or:

   a) Touch the **Activate and Insert in Flight Plan** Button or the **Insert in Flight Plan** Button (only available if the selected waypoint is not in the flight plan) to display the 'Insert and Activate Direct-to <waypoint> Before?' Window.

   b) Touch the Waypoint Selection Button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

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

1) From MFW Home, touch **Flight Plan.**
2) Touch a Waypoint Selection Button to display the 'Waypoint Options' Window.
3) Touch the Direct-to Button to choose the waypoint as the direct-to destination and display the 'Direct To' Screen.
4) Touch the **Activate** Direct-to Button to activate the direct-to.

   Or:

1) From MFW Home, touch Direct-to on the Button Bar.
2) Touch the **Flight Plan** Tab.

3) Touch a Waypoint Selection Button to choose the waypoint as the direct-to destination, and return to the **Waypoint** Tab of the 'Direct To' Screen.

4) Touch the **Activate** Button to activate the direct-to.

Or:

1) From MFW Home, touch the Button on the Button Bar to display the 'Direct To' Screen with the active flight plan waypoint selected as the direct-to destination.

2) Touch the **Activate** Button to activate the direct-to.

Or:

1) From MFW Home, touch **Flight Plan.**

2) Touch the Button to display the 'Direct To' Screen with the active flight plan waypoint selected the direct-to destination.

3) Touch the **Activate** Button to activate the direct-to.

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

Selecting a waypoint as a direct-to destination using the Map Pointer:

1) Push the lower knob to display the pointer.

2) Place the map pointer at the desired destination location.

3) If the pointer is placed on a waypoint, the waypoint ID is highlighted, and the Button is activated.

Or:

If the pointer is placed over multiple map items.

Touch the **Prev** or **Next** Button to cycle to the desired waypoint.

Or:

a) Touch the Map Item Button to open the 'Map Item Selection' Screen.

b) Touch the desired waypoint.

4) Touch the Button to display the 'Direct To' Screen with the selected point entered as the direct-to destination.

5) To activate direct-to navigation:

Touch the **Activate** Button to activate the direct-to.

Or:

a) Touch the **Activate and Insert in Flight Plan** Button or the **Insert in Flight Plan** Button (only available if the selected waypoint is not in the flight plan) to display the 'Insert and Activate <waypoint> Before?' Window.

b) Touch the Waypoint Selection Button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Removing a Direct To:

1) From MFW Home, touch ⊣D▸ on the Button Bar.
2) Touch the **Remove** ⊣D▸ Button.
3) Touch the **OK** Button in response to the question "Remove ⊣D▸ <waypoint>".

When navigating a direct-to, the system sets a direct great circle course to the selected destination. The direct course to a waypoint can be manually selected by entering either the course to the waypoint or the radial from the waypoint. Both methods will result in a course to the waypoint. For example, if cleared to SLN using the 270 degree course inbound, the pilot may choose either to touch the **Course** Button and enter "270", or touch the **Radial** Button and enter "090".

Selecting a manual direct-to course:

1) From MFW Home, touch ⊣D▸ on the Button Bar.
2) If necessary, touch the Waypoint Selection Button to enter the waypoint as the direct-to destination. Then, touch the **Course** Button to display the keypad.
3) Touch the **Course** or **Radial** Button.
4) Use the keypad to select the desired course to the waypoint or the radial from the waypoint.
5) Touch the **Enter** Button to accept the course, and return to the 'Direct To' Screen.
6) Touch the **Activate** ⊣D▸ Button to activate the direct-to using the manually selected course.



Figure 5-64 Direct To – Selecting a Manual Course

Reselecting the direct course from the current position:

1) From MFW Home, touch ⊣D▸ on the Button Bar.
2) Touch the **Activate** ⊣D▸ Button to activate the direct-to using the direct course.

When selecting an existing flight waypoint for a direct-to, abeam waypoints can be created and inserted into the flight plan for remaining flight plan waypoints between the aircraft and the direct-to waypoint. An abeam waypoint can only be created if the path to the direct-to waypoint will cross the un-sequenced flight plan waypoint laterally. Once inserted, the flight plan will navigate the direct-to while also sequencing through the abeam waypoints. The default name for the abeam waypoints will be the first three values of the original flight plan waypoint, (e.g. 'NAR' for the waypoint 'NARNE'), followed by the numeral '01'. Successive abeam waypoints will have a similar default name with an incremental numeric value (example: 'WIZ02' as displayed in the following figure). Once an abeam waypoint is created, it will remain in the flight plan, even if the direct-to is removed.

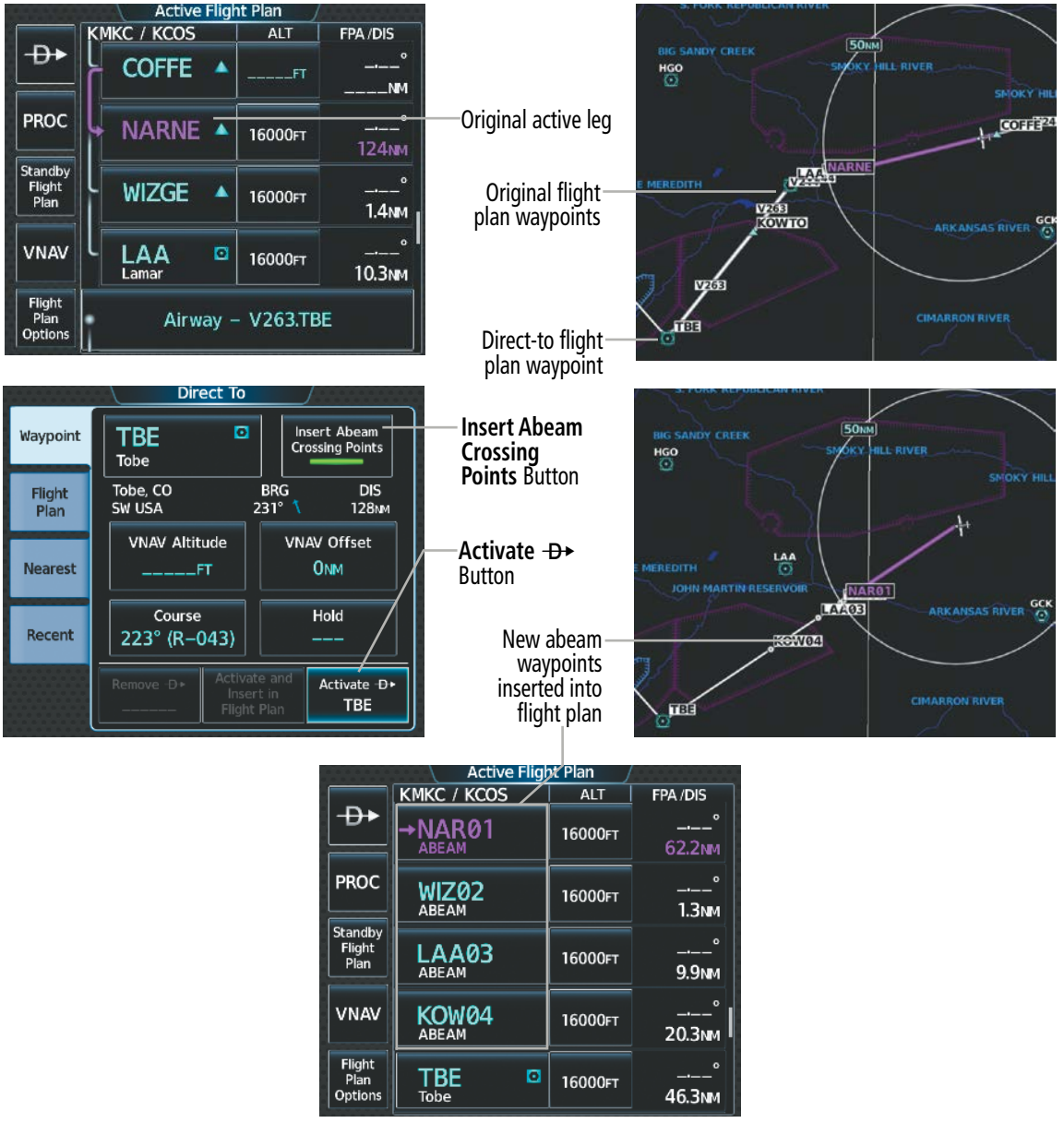


Figure 5-65 Direct To – Inserting Abeam Waypoints

Inserting abeam crossing waypoints within a direct-to course:

1) Choose the flight plan waypoint as the direct-to destination:
   a) From MFW Home, touch D▸ on the Button Bar.
   b) Touch the **Flight Plan** Tab.
   c) Scroll as required and touch a Waypoint Selection Button to choose the waypoint as the direct-to destination, and return to the **Waypoint** Tab of the 'Direct To' Screen.

   Or:

   a) From MFW Home, touch **Flight Plan.**
   b) Touch a Waypoint Selection Button to display the 'Waypoint Options' Window.
   c) Touch the D▸ Button to choose the waypoint as the direct-to destination and display the 'Direct To' Screen.
2) Touch the **Insert Abeam Crossing Points** Button to activate the insert abeam crossing waypoints feature.
3) Touch the **Activate** D▸ Button to activate the direct-to.

A direct-to with an altitude constraint designated for VNAV guidance creates a vertical 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. Direct-to vertical navigation and offset distances (along track offsets) are discussed later in this section.

FLIGHT PLAN KEYPAD OPERATION

OVERVIEW

This overview will discuss the overall format and functionality of the Flight Plan Keypad. More information on creating a flight plan, and entering airway and waypoint data into the flight plan will be discussed later in this section.

Operating the Flight Plan Keypad is essentially the same as operating other keypads that are exclusive to either alphabetical or numeric buttons. Two significant differences are the Flight Plan Keypad provides the ability to create User Waypoints while inserting them into the Active Flight Plan, and the ability to combine and enter multiple waypoints and airways as a continuous route into the flight plan.

Each character selection on the Flight Plan Keypad will be entered in the Route Entry Field. However, after 15 characters are entered (only 5 characters on the sliding flight plan keyboard), the entry field will begin to shift characters to the left away from view as additional characters are added.

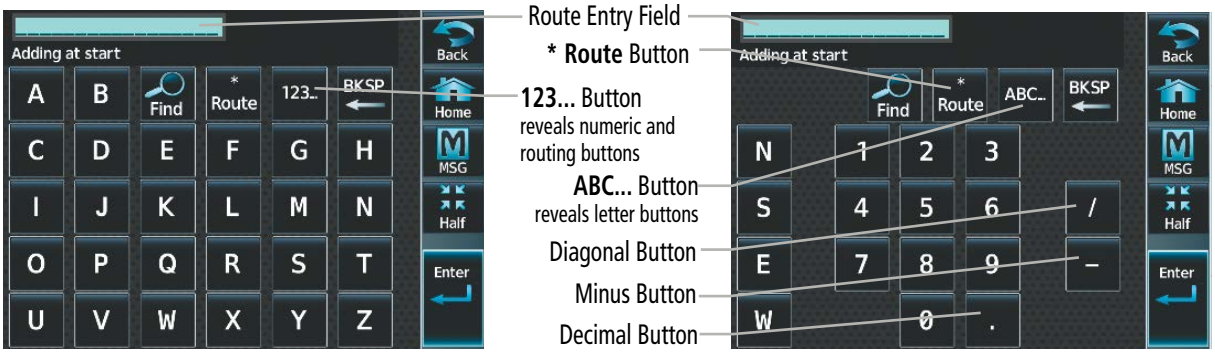


Figure 5-66 Alphanumeric Flight Plan Keypad for routing – 'Sliding Flight Plan Keyboard' Disabled

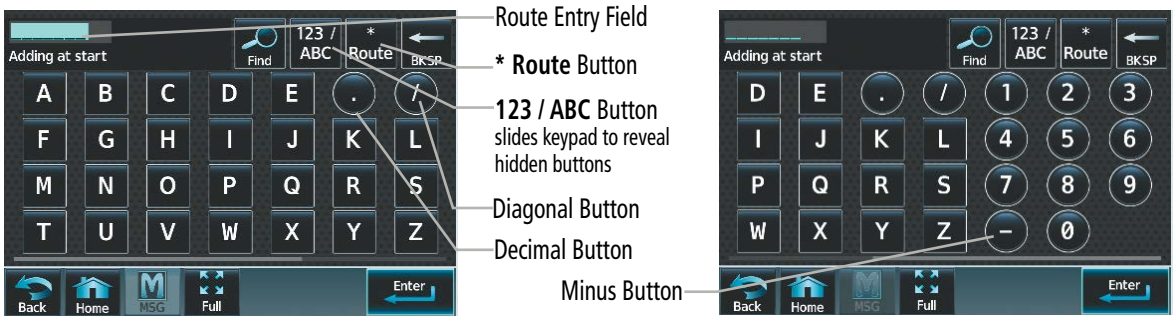


Figure 5-67 Alphanumeric Flight Plan Keypad for routing – 'Sliding Flight Plan Keyboard' Enabled

Flight plan route entry can be used with the Sliding Flight Plan Keyboard on or off. See the previous two figures for a comparison of keyboards.

Enabling/Disabling the Sliding Flight Plan Keyboard:

1) From MFW Home, touch **Utilities** > **Setup** > **Avionics Settings**. The System Tab is highlighted.
2) Touch the **Sliding Flight Plan Keyboard** Button to enable/disable.

When entering information into the flight plan keypad, the FastFind function will suggest airports and waypoints in the Route Entry Field based on location, but also the existing waypoints in the flight plan which are before and after the routing. Touch the **Enter** Button to accept the suggested waypoint and close the flight plan keypad, or touch the *** Route** Button to accept the suggested waypoint and continue routing, or continue to enter characters until the intended waypoint is entered. See the Waypoint Selection discussion earlier in this section for more information on FastFind functionality.

When creating a User Waypoint while adding it to the flight plan, the 'Create User Waypoint' Screen will be displayed to allow the flight crew to review the information before accepting entry into the flight plan. See the Waypoints portion of this section for information on User Waypoints.

The Diagonal (**/**), Decimal (**.**), Route (*** Route**), and Minus (**-**) buttons provide flexibility when entering flight plan data. The Diagonal button is used in many types of User Waypoint entries. The Decimal button is used to provide more fidelity in numeric User Waypoint entries (bearings and distance specifically). The asterisk route button is used to create route segments and the ability to enter them directly into the flight plan. The Minus button allows along track offset waypoints to be entered.

ROUTE ENTRY

The Flight Plan Keypad is utilized when editing the enroute portion of a flight plan which consists of waypoints and potentially airways. The *** Route** Button is used to delimit a route entry by displaying a * symbol in the Route Entry Field. All airways must have an entry and exit waypoint derived from the database. Therefore, the * is required before and after airway entry as shown in the table below.

The following table shows acceptable forms of route segment entry:

Route Entry	Description
"<entry wpt>*<airway>*<exit wpt>" Or "*<airway>*<exit wpt>"	Basic Airway Segment with a specified exit waypoint.

Route Entry	Description
"<entry wpt>*<airway1>*<airway2>*" Or "*<airway1>*<airway2>*"	Airway-to-airway transition. Airways must meet at a transition waypoint recognized by the system.
"<wpt1>*<wpt2>"	Direct routing (back-to-back waypoint entry)

Table 5-8 Acceptable Route Entry Patterns

Patterns for entering routes and waypoints are context sensitive. For example, in the sequence "ABC*V15", "V15" looks like it might be an airway, but it could easily be a waypoint. The system uses context to interpret the string. If "ABC" is a waypoint on airway V15, then the system will interpret "V15" as an airway. If "ABC" waypoint does not occur on airway V15, then the system will interpret "V15" as a waypoint.

Basic Airway Segment Entry

There are two forms of Basic Airway Segment entry, as shown in the following table:

Airway to Airway Route Entry	Description
"<entry wpt>*<airway>*<exit wpt>"	The entry waypoint is specified.
"*<airway>*<exit wpt>"	The entry waypoint already exists in the flight plan and is selected as the insertion point for the route entry.

Table 5-9 Acceptable Airway to Airway Route Entry Patterns

Entry for airways is dependent upon the following general rules:

- If the Airway Segment entry starts with "*", the system will pull the entry waypoint from the flight plan at the insertion point. The insertion point is defined based on how the Flight Plan Keypad was launched ("Insert Before", "Insert After" or "Add Waypoint or Route").
- The entry and exit waypoints must both exist on the specified airway segment.
- As entry progresses, auto-fill for waypoint identifiers are shown with subdued characters in the route entry field and waypoint name to the right of the route entry field.
- The 'Airway Selection' Screen will be used to confirm the selected waypoint sequence.
- Incomplete Airway Segments will be resolved on the 'Airway Selection' Screen (entry will be completed by selecting from lists).
- In the database, it is not uncommon to have multiple airway segments with the same airway identifier. However, specification of the entry waypoint (which must happen first) always identifies a unique segment.

The scenario provided below illustrates the entry of airway segment "TOP*V4*SLN". Entering "TOP" into the Route Entry Field, followed by touching the *** Route** Button finishes the selection of the entry waypoint and starts the entry of the airway identifier "V4". A second touch of the *** Route** Button ends the selection of the airway identifier. Then, an exit waypoint is determined.



Figure 5-68 Route Entry Process – Route Entry Field and Airway Entry Waypoint

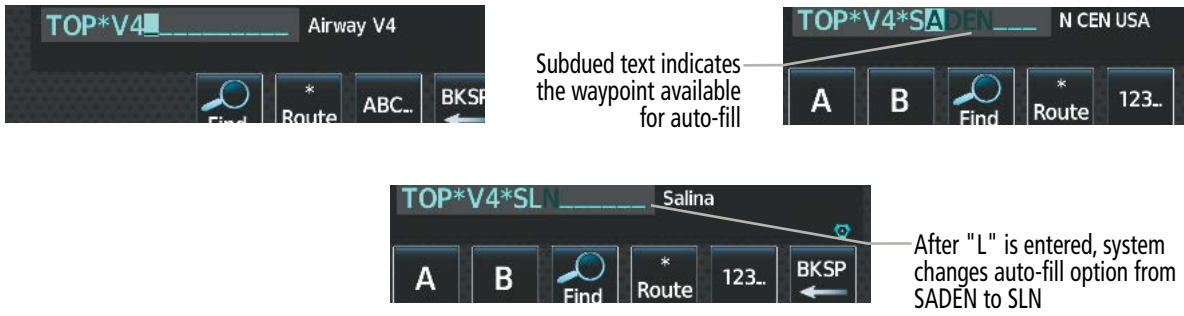


Figure 5-69 Route Entry Process – Airway and Exit Waypoint with Auto-Fill

Alternatively, if the airway entry point already exists in the flight plan and is selected as an insertion point for the route entry, the airway segment entry can be started by touching the *** Route** Button. Doing that, automatically pulls the entry waypoint from the flight plan ("TOP" in this case). The system will detect and avoid duplication of waypoint identifiers once the route entry is entered into the flight plan.

As the entry of the exit waypoint identifier starts, auto-fill is supported based on the list of waypoints that pass through the selected airway. The system will seek and auto-fill an exit waypoint based on this list in alphabetic order.

In the previous example, the first result of entering an "S" for the exit waypoint is "SADEN" (with the "ADEN" portion shown in subdued text). After an "SL" is entered, the auto-fill option changes to "SLN" (the "N" is subdued). Touching the **Enter** Button confirms the auto-fill entry.

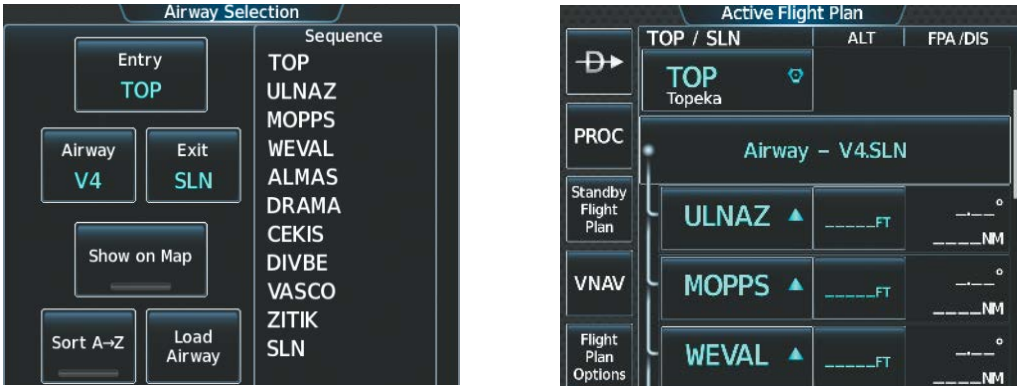


Figure 5-70 Route Entry Process – Confirmation and Loading of Selected Airway Segment

After the airway segment entry is complete ("TOP*V4*SLN") touching the **Enter** Button opens the 'Airway Selection' Screen which allows the pilot to review and confirm the selected waypoint sequence. Touching the **Load Airway** Button completes the action with the system returning to the flight plan screen (now showing the loaded airway segment).

The system will recognize incomplete or incorrect entries and will provide either a popup prompt or the 'Airway Selection' Screen to resolve the issue. For the two issues explained below, a 'Waypoint <waypoint> not found on airway <airway>. Open airway selection page?' Window will appear, prompting the pilot to either touch the **OK** or **Cancel** Button.

- The selected airway identifier does not include the selected entry waypoint.
- The selected exit waypoint is not found on the selected airway segment (identified by the entry waypoint and the airway identifier).

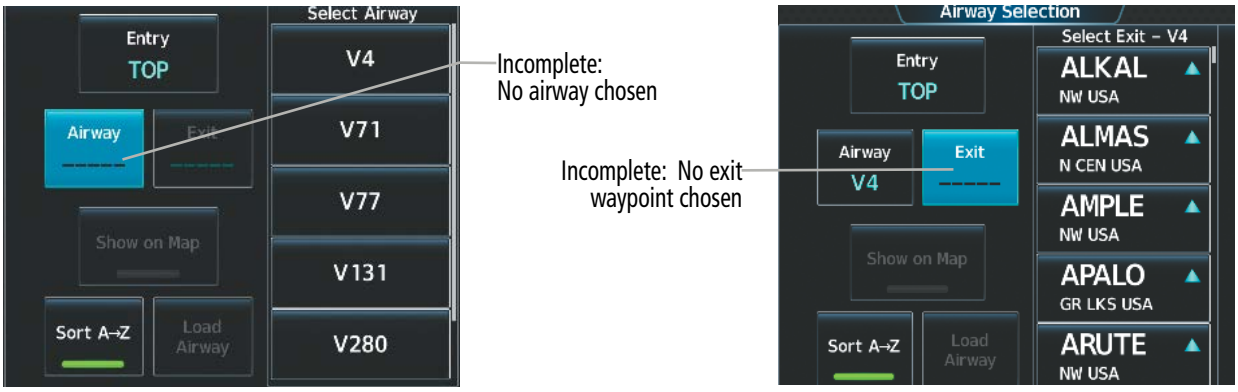


Figure 5-71 Route Entry Process – Incomplete or Incorrect Airway Segment Resolution

The 'Airway Selection' Screen can be used to resolve incomplete airway segment entries or highlight or incorrect entries as shown in the three examples above. In either an incomplete or incorrect case, the 'Airway Selection' Screen will be launched, showing the list of waypoints or airways to select (no options are provided for incorrect entries). For the three cases above:

- The first is incomplete since the **Enter** Button was touched after the airway identifier was entered, but the exit waypoint was not specified or does not match any connecting airway name or any waypoint on the selected airway.
- The next is incomplete since the **Enter** Button was touched after the *** Route** Button was touched but no airway identifier was entered.
- The last example is incorrect since the route identifier does not uniquely match any airway passing through the entry waypoint.

Airway-To-Airway Entry with Implied Transition Waypoint

Route entry can be done with Airway-to-Airway route segments where a published transition waypoint is implied by the specification of two intersecting airways. This can be done two ways as shown in the following table:

Airway to Airway Route Entry	Description
"<entry wpt>*<airway1>*<airway2>*"	The entry waypoint is specified.
"*<airway1>*<airway2>*"	The entry waypoint is implied (already in the flight plan) by the insertion point.

Table 5-10 Airway to Airway Route Entry Descriptions

Entry for an airway-to-airway route is dependent upon the following general rules:

- The two airways must have at least one published waypoint in common.
- It is not uncommon that two airways will have more than one waypoint in common. In that case, the system will use the transition waypoint closest to the entry waypoint in the sequence for the first airway.
- If the entry waypoint is on both airways, only the second airway will be loaded (airway segments must use at least two waypoints).
- The 'Airway Selection' Screen will be used to confirm each airway segment that will be loaded. When the first airway segment is reviewed, the connection to the second airway will be identified in the waypoint sequence list.

The scenario provided below illustrates the entry of two airway segments "RAPZZ*Q172*Q85*BUMMA". The implied transition waypoint (not entered) is KAATT. The selection of the entry waypoint and the first airway follows the same scheme as described in Basic Airway Segment Entry previously described. Instead of entering an exit waypoint for the first airway, a second connecting airway is entered.



Figure 5-72 Airway to Airway Entry – Initial Entry

Another touch of the *** Route** Button ends the selection of the second airway identifier, and the 'Airway Selection' Screen is displayed to review and confirm the waypoint sequence for the first airway segment.

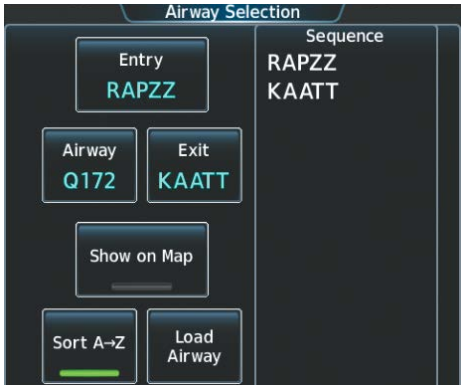


Figure 5-73 Airway to Airway Entry – Confirmation/Loading of First Airway Segment

Touching the **Load Airway** Button loads the first airway segment into the flight plan. Then, the system returns to the keypad in order to complete entry of the second airway segment ("Q85"). Since the system has already loaded the first airway segment ("RAPZZ*Q172*KAATT") into the flight plan, the Route Entry Field will be populated with the second airway identifier. Then, the exit waypoint of the second airway can be entered ("BUMMA"). Touching the **Enter** Button brings up the 'Airway Selection' Screen for the second airway segment. Touching the **Load Airway** Button completes the action with the system returning to the flight plan screen (now showing the loaded airway segment).

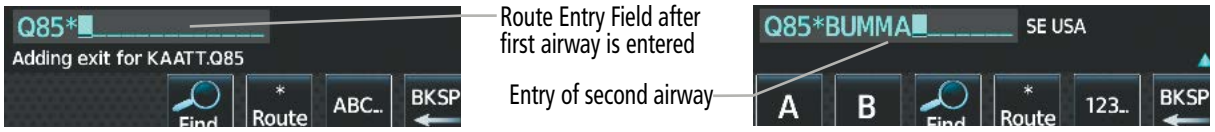


Figure 5-74 Airway to Airway Entry – After the First Airway Segment in the Flight Plan; Completing the Second Segment

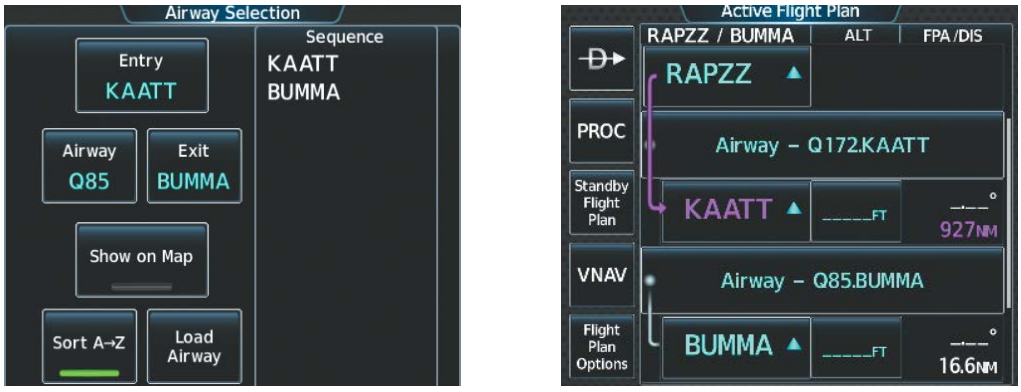


Figure 5-75 Airway to Airway Entry – Confirmation/Loading of Second Airway Segment and Resulting Flight Plan

If there is no common waypoint between the two selected airways, a popup window will appear that states, "Unable to find common waypoint between airways <airway1> and <airway2>. Open airway selection page?" Touch the **OK** or **Cancel** Button.

Back-To-Back Route Entries and Direct Routes

If a whole clearance is being entered into the flight plan, it is not desirable to keep returning to the flight plan screen after each route segment is confirmed. Therefore, the *** Route** Button may be utilized for entering the clearance in Route Entry Field.

Direct routing is assumed whenever a waypoint is followed by another waypoint (separated by the Route (*) character).

Back-to-back route entries may also be sequentially entered using the *** Route** Button. Entering a route segment and then touching the *** Route** Button prompts the system to move the data into the flight plan, leaving the entry waypoint for the next route segment pre-filled in the Route Entry Field. For example, an entire route clearance may consist of an airway route segment with entry and exit waypoints, followed by a direct route segment from waypoint to waypoint.

The following table shows how each how each route segment is to be entered into the Route Entry Field and the expected outcome from the system.

Keypad Entry of Route Segment (In Sequential Order)	Flight Plan Action	Characters Displayed in the Route Entry Field After the Flight Plan Action
"**MCI*J24*WELTS***"	Review and load J24 airway with entry point "MCI" and exit point "WELTS" into flight plan.	WELTS*
WELTS* "**JIGSY***"	WELTS to JIGSY leg added into flight plan.	JIGSY*
JIGSY* "**J134*FLM***"	Review and load J134 airway with entry point "JIGSY" and exit point "FLM" into flight plan.	FLM*

Keypad Entry of Route Segment (In Sequential Order)	Flight Plan Action	Characters Displayed in the Route Entry Field After the Flight Plan Action
FLM* "**J24*BIGAL***"	Review and load J24 airway with entry point "FLM" and exit point "BIGAL" into flight plan.	BIGAL*
BIGAL* "**AML**" **Enter** Key	BIGAL to AML leg added into flight plan. The flight plan is displayed showing all route segments that were added.	

Table 5-11 Example Sequence of Entries for Flight Plan

ADDING USER WAYPOINTS AND ALONG TRACK OFFSET WAYPOINTS USING ROUTE ENTRY

When entering the Lat/Lon, Radial/Distance, or Radial/Radial waypoint information into the Route Entry Field, the system will recognize the data as a user defined waypoint and will display the 'Create User Waypoint' Screen for reviewing and editing purposes. Touching the **Create** Button will save the User Waypoint and simultaneously add it to the flight plan.

For more information on creating and storing user waypoints, refer the Creating User Waypoints discussion previously in this Flight Management Section.

When entering along track offset waypoint information into the Route Entry Field, the system will recognize it as a normal waypoint. However, in order to be accepted into the routing, the along track offset waypoint must have a track established in the flight plan. This is accomplished by having a flight plan waypoint already loaded into the flight plan that is located after the along track offset waypoint.

For more information on along track offset waypoints, refer to the discussion later in this Flight Management Section.

Lat/Lon Waypoint Entry:

Entry for latitude/longitude waypoint information is dependent upon the following general rules:

- The **/** Button can be used to separate the latitude and longitude but is not required.
- "N" or "S" designates the latitude. "E" or "W" designates the longitude.
- A decimal point and up to two digits to the right can be used to enter latitude or longitude to the nearest 0.01 minute. Example: N3945.06W11215.93
- If a decimal point is not used, the first two digits of the latitude is degrees and additional digits (1 or 2) are interpreted as minutes. In similar fashion the first 3 digits of longitude are degrees and additional digits (1 or 2) are interpreted as minutes. If only one minute digit is entered, a trailing zero is implied. Example N203 is the same as N2030.00.
- If a decimal point is used, the first two digits left of the decimal point will be interpreted as arc minutes. Example: N4.4 is the same as N0004.40 while N4 is the same as N0400.00.
- Lat/Lon designators can be prefixes or suffixes. However, if the latitude designator is a prefix, the longitude designator must also be a prefix unless the **/** Button is used. Examples of allowed prefix/suffix combinations include: N38W094, 38N094W, N38/094W.
- A full lat/lon entry could use as many as 18 characters.



Figure 5-76 Latitude/Longitude Entry Example

After entering the Lat/Lon data into the Route Entry Field, touching the **Enter** Button opens the 'Create User Waypoint' Screen (LAT/LON Mode) with the LAT/LON and Comment portion pre-filled. Also by default, the 'Route' Type is selected for the waypoint, and the storage method will be selected as temporary. The pilot can make any needed corrections/additions (perhaps changing the user waypoint name, or storage method) before touching the **Create** Button.

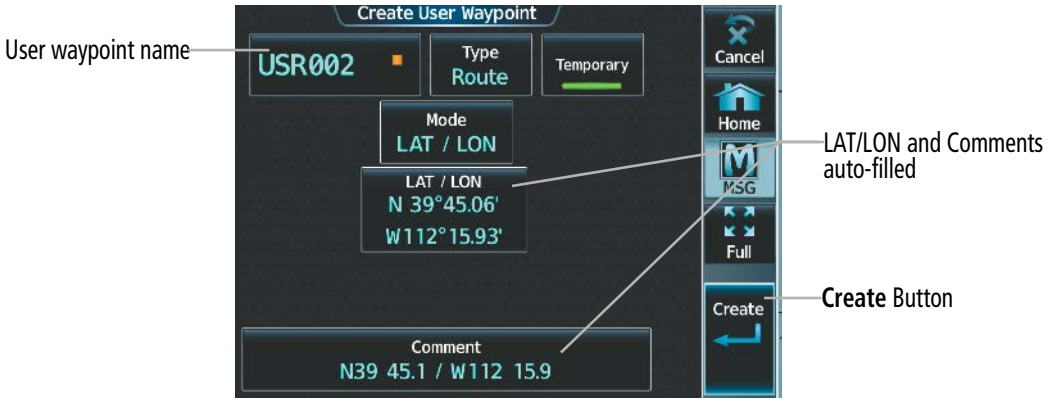


Figure 5-77 Latitude/Longitude Confirmation – Create User Lat/Lon Waypoint

When a Lat/Lon entry is not recognized as a pattern that can be accepted, the following pop-up boxes will be shown which explain the error.

- When minutes are entered with a value greater than 59.9: "Invalid User Waypoint Latitude Minutes Must Be Between 0 and 59. Open User Waypoint Page?"
- When an entered latitude value (including minutes) is greater than 90: "Invalid User Waypoint: Latitude Degrees Must Be Between 00 and 89. Open User Waypoint Page?"
- When an entered longitude value (including minutes) is greater than 180: "Invalid User Waypoint: Longitude Degrees Must Be Between 000 and 180. Open User Waypoint Page?
- When an entered Lat/Lon has a missing or misplaced N/S or E/W designator, or misplaced use of the decimal point: "Waypoint or airway not found: <waypoint>. Open create user waypoint page?"

Radial/Distance Waypoint Entry

Entry for Radial/DIS (place/bearing/distance) is dependent upon the following general rules:

- Place, bearing and distance must be entered in that order.
- The **/** Button can be used to delimit the entry elements. A "/" may be used to denote the bearing and distance. In the example, MZZ344/033, MZZ is place, 344 is bearing and 033 is distance. MZZ/344/033 is another acceptable form of entry. Since waypoints can also have numbers, use of the "/" between the waypoint name and bearing can prevent ambiguity.
- Place is 1 to 6 characters which will be recognized as a waypoint identifier.
- Bearing is a numeric value between 000 and 360 degrees. The decimal point can be used to specify tenths of degrees.

- Distance is a numeric value between 0 and 9999.9 nautical miles. Use of the decimal point is optional.
- Beginning the entry with "/" will cause the system to use a flight plan waypoint as the place.
  - ✈ If "Insert After" or "Insert Before" is selected, the highlighted flight plan waypoint will be used as the place.
  - ✈ If "Add Waypoint or Route" is selected, the last enroute waypoint will be used as the place.

Entry begins like the entry of an individual waypoint. When sufficient characters have been entered to uniquely identify a waypoint, touching the "/" ends the entry of "place" and starts the entry of "bearing" which is followed by "distance".



Figure 5-78 Radial/Distance – Initial Waypoint Name

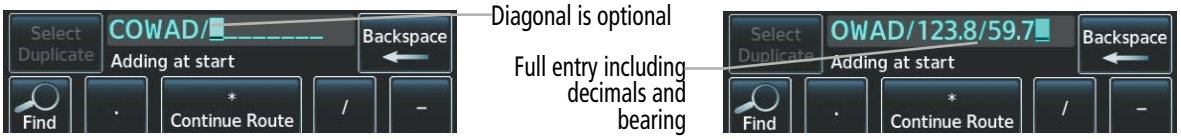


Figure 5-79 RAD/DIS – Full Entry with Bearing Example

Touching the **Enter** Button opens the 'Create User Waypoint' Screen (RAD/DIS Mode) with the REF, RAD and DIS, plus the Comment portion pre-filled. The pilot can make any needed corrections/additions (perhaps changing the identifier). By default, a temporary, Route-Type waypoint will be created.

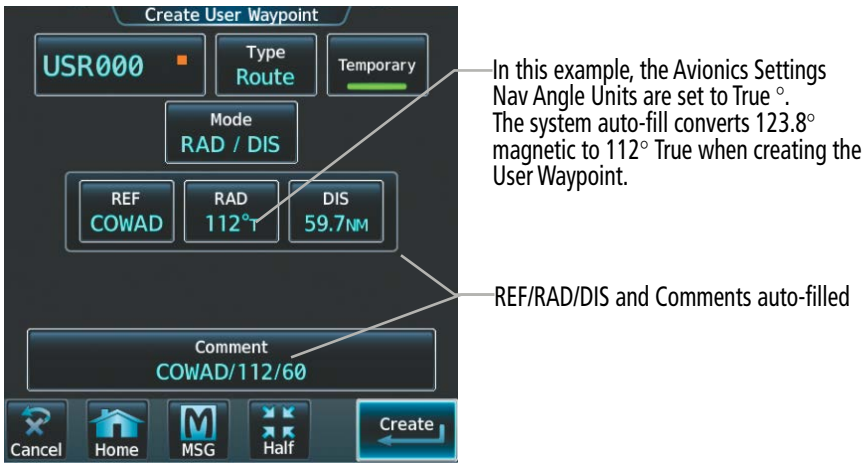


Figure 5-80 RAD/DIS – Confirmation and Creating User RAD/DIS Waypoint

When the Radial/Distance entry is not recognized as a pattern that can be accepted, the following pop-up boxes will be shown which explain the error.

- A bearing that is not in the range 0-360: "Invalid User Waypoint: Degrees Must Be Between 0 and 360. Open User Waypoint Page?"
- Distance that is not in the range 0-9999.9: "Invalid User Waypoint: Distance Must Be Between 0 and 9999.9. Open User Waypoint Page?"
- The system will attempt to interpret the intended waypoint entry when misplacing the entry of the decimal point. However, in some cases, an error message will appear: "Invalid user waypoint entered: <waypoint> Please use format: WPT/BRG/DIS Open create user waypoint page?"

Radial/Radial Waypoint Entry

A place/bearing/place/bearing entry is similar to the Radial/Distance place/bearing/distance entry (as discussed previously. Entry for Radial/Radial (place/bearing/place/bearing) is dependent upon the following general rules:

- Place1, bearing1, place2 and bearing2 must be entered in that order.
- The **/** Button is optional between a place and a bearing, but must be used consistently for both radials. The **/** Button is required before starting the entry of place2. There are two general formats for valid entries: DDC/200/HUT/240 and DDC200/HUT240. Since waypoints can also have numbers, use of the "/" between the waypoint name and bearing can prevent ambiguity.
- Bearing1 and Bearing2 are numeric values between 000 and 360 degrees. The decimal point can be used to specify tenths of degrees.
- Beginning the entry with "/" will cause the system to use a flight plan waypoint as place1.
  - ✈ If "Insert After" or "Insert Before" was selected, the highlighted flight plan waypoint will be used as the place1.
  - ✈ If "Add Waypoint or Route" was selected, the last enroute waypoint will be used as the place1.



Figure 5-81 RAD/RAD – Full Entry

After inputting the information, touching the **Enter** Button opens the 'Create User Waypoint' Screen (RAD/RAD Mode) with the REF1, RAD1, REF2, RAD2 and Comment portion pre-filled. The place1 and bearing1 data will fill the REF1 and RAD1 Fields respectively, and likewise for place2/bearing2. Also by default, the 'Route' Type is selected for the waypoint, and the storage method will be selected as temporary. The pilot can make any needed corrections/additions (perhaps changing the user waypoint name, or storage method).

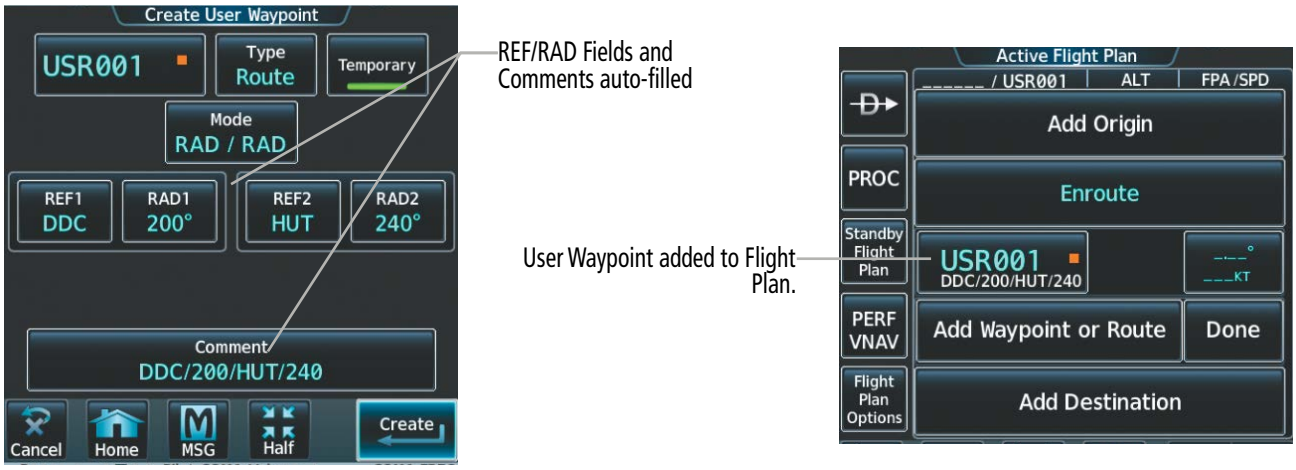


Figure 5-82 RAD/RAD – Confirmation and Creation of User RAD/RAD Waypoint

When the Radial/Radial entry is not recognized as a pattern that can be accepted, the following pop-up boxes will be shown which explain the error.

- A bearing that is not in the range 0-360: "Invalid User Waypoint: Degrees Must Be Between 0 and 360. Open User Waypoint Page?"

- The system will attempt to interpret the intended waypoint entry when misplacing the entry of the decimal point. However, in some cases, an error message will appear: "Invalid user waypoint entered: <waypoint> Please use format: WPT/BRG/DIS Open create user waypoint page?"
- When defining a place/bearing/place/bearing waypoint, it is possible the given bearings (radials) do not intersect. That condition is detected on the 'Create User Waypoint' Screen when the **Create** Button is touched. "The radials entered do not intersect"

User Waypoints Within a Route Entry

Direct routing and back-to-back route segment entries containing a user defined waypoint may be sequentially entered using the *** Route** Button. For example, an entire route clearance may consist of an airway route segment with entry and exit waypoints, followed by a direct route from the exit waypoint to a user defined waypoint, and then a direct route from the user defined waypoint to another waypoint.

The following table shows how each how each route segment is to be entered into the Route Entry Field and the expected outcome from the system. In this example, a Radial/Distance entry, "MZZ344/033", is used create a user waypoint within the route. "MZZ" is a place, "344" is the bearing, and "033" is the distance. ("MZZ/344/033" is another acceptable form of entry.)

Keypad Entry of Route Segment (In Sequential Order)	Flight Plan Action	Characters Displayed in the Route Entry Field After the Flight Plan Action
"**GLAZR*Q118*MZZ***"	Review and load Q118 airway with entry point "GLAZR" and exit point "MZZ" into flight plan.	MZZ*
MZZ* "**MZZ344/33***"	Edit and review the new user waypoint. "<waypoint name>" is created and placed into flight plan.	MZZ344/33*
MZZ344/33* "**OXI***" **Enter** Key	"<waypoint name>" to "OXI" leg is added into flight plan. The flight plan is displayed showing all route segments that were added.	

Table 5-12 Example Sequence of Entries, Creating and Adding a User Waypoint into Route Segment

Along Track Offset Waypoint Entry

Along track offset waypoints can be entered into the flight plan using the flight plan keypad.

- To enter an along track offset waypoint before a reference waypoint, enter the waypoint, "-" character, then a numeric value in nm. For example, ICT-5, will place the waypoint 5 nm before ICT along the track of the current flight plan.
- To enter an along track offset waypoint after a reference waypoint, enter the waypoint, then a numeric value in nm. For example, TOP7, will place the waypoint 7 nm after TOP along the track of the current flight plan.



***NOTE:** When using the route entry process to enter an along track offset waypoint, it will be necessary to enter data out of chronological order. The flight plan waypoint that is after the along track offset waypoint must be entered first, followed by the along track offset waypoint.*

NOTE: *Along track offset waypoints entered with the route entry process will offset from first sequential reference waypoint in the flight plan if the reference waypoint is in the flight plan more than once.*

CREATING A BASIC FLIGHT PLAN

The active flight plan is the flight plan to which the system is currently providing guidance, and is shown on the map displays. 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.

The standby flight plan and stored flight plan are available for activation (become the active flight plan). The standby flight plan may be used as a means to create a flight plan for future use. Once an active or standby flight plan is created, it can be stored to the Flight Plan Catalog.

Auto-designation will find 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 applying power to the system 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-nomination 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.

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." will appear and the new waypoint(s) will not be added to the flight plan.

The following procedure is intended to provide an example that best captures a basic flight plan. It will create a flight plan from the origin runway to the destination runway, to include enroute waypoints for which lateral navigation will be provided. Information on airways, waypoint constraints, and vertical navigation is discussed later in this section. Departures, arrivals, approaches, and missed approaches are discussed later in the Procedures portion of this section. Accessing Takeoff Data and Landing Data from the active flight plan is discussed later in the TOLA portion of this section.

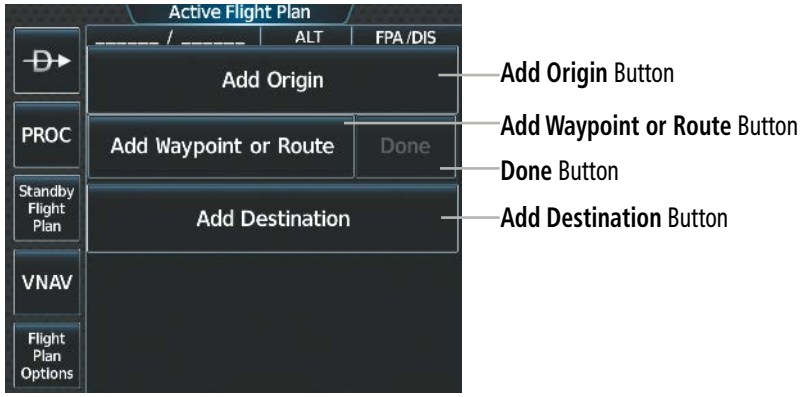


Figure 5-83 Active Flight Plan – Empty

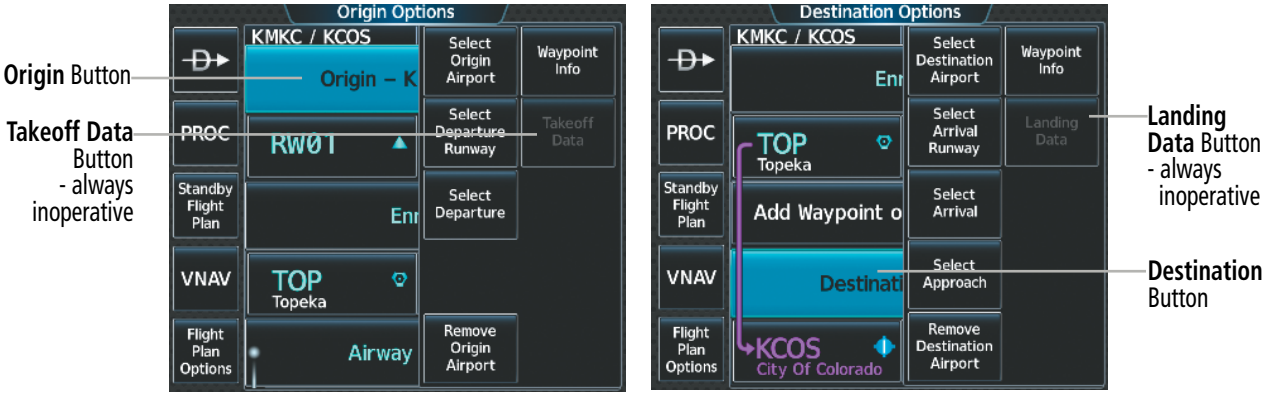


Figure 5-84 Active Flight Plan – Origin and Destination Options



Figure 5-85 Active Flight Plan – Origin and Destination Loaded



Figure 5-86 Active Flight Plan – Adding a Waypoint to the beginning of the Enroute Segment of the Flight Plan

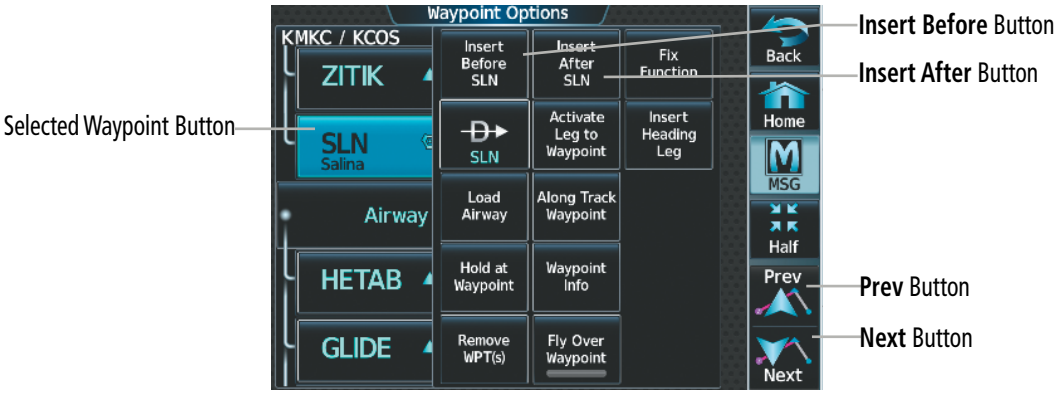


Figure 5-87 Active Flight Plan – 'Waypoint Options' Window

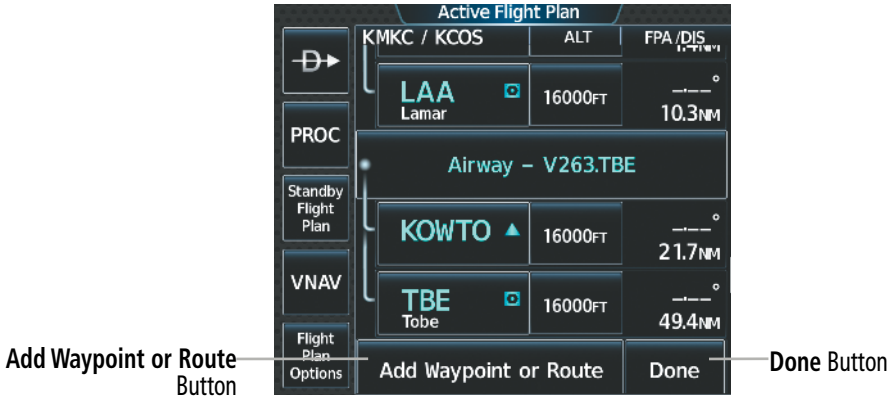


Figure 5-88 Active Flight Plan – Adding a Waypoint to the end of the Enroute Segment of the Flight Plan

Creating an active, standby or stored flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan.**

Or:

For a stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options**.

b) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.

c) Touch the **Create New Catalog Flight Plan** Button to display the 'Edit Stored Flight Plan' Screen.

2) If no change is necessary to the Origin auto-designated by the system, proceed to Step 4.

Or:

To input or change the departure runway, proceed to Step 4.

Or:

To change the Origin, touch the **Origin** Button. Then, touch the **Select Origin Airport** Button.

Or:

When there is no Origin in the flight plan, touch the **Add Origin** Button.

3) Enter the origin waypoint:

Use the upper knobs, or the keypad to enter the origin waypoint.

Or:

Touch the **Find** Button to display the 'Find Waypoint' Screen. Then, touch the **Nearest**, **Recent**, **Flight Plan**, or **Favorites** Tab and select the waypoint from the list of waypoints.

Or:

a) Touch the **Find** Button to display the 'Find Waypoint' Screen. Then, touch the **Search** Tab to display the **Search By** Button.

b) If necessary, touch the **Search By** Button to choose Search by City or Search by Facility.

c) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.

d) Use the keypad to select the name, and the **Enter** Button to accept the entry and display the search results.

e) Touch a Waypoint Selection Button to choose the waypoint.

4) To input the departure runway, touch the **Origin** Button to display the 'Select Runway' Screen. Touch a Runway Selection Button to select the departure runway and return to the flight plan.

Or:

To change the departure runway, touch the **Origin** Button to display the 'Origin Options' Window. Then, touch the **Select Departure Runway** Button. Touch a Runway Selection Button to select the runway and return to the flight plan.

5) Touch the **Add Destination** Button to display the keypad.

6) Select the identifier of the destination waypoint using one of the Step 3 procedures.

7) If needed, touch the **Destination** Button to display the 'Destination Options' Window. Touch the **Select Arrival Runway** Button to display the 'Select Runway' Screen. Touch a Runway Selection Button to select the destination runway and return to the flight plan.

8) Enter the enroute waypoints:

   If adding a waypoint to the end of the enroute segment of the flight plan, touch the **Add Waypoint or Route** Button to display the keypad

   Or:

   a) Touch a Waypoint Selection Button to display the 'Waypoint Options' Window.

   b) Touch the **Insert Before** Button or the **Insert After** Button to select where the new waypoint or route will be placed in relation to the selected waypoint. The keypad is displayed.

   Or:

   a) If adding a waypoint or route to the beginning of the enroute segment of the flight plan, touch the **Enroute** Button to display the 'Enroute Options' Window.

   b) Touch the **Insert Waypoint** Button to display the keypad.

9) Use the keypad and the **Enter** Button to enter the waypoint or route into the flight plan.

10) Repeat Steps 8 and 9 until finished adding enroute waypoints.

11) If you are finished adding enroute waypoints, touch the **Done** Button to remove the **Add Waypoint or Route** Button and the **Done** Button (This step is only necessary if creating a flight plan on the 'Active Flight Plan' Screen).

12) If needed, touch the **Origin** Button to display the 'Origin Options' Window to select a new origin airport, departure runway, departure procedure or to remove the origin airport.

13) If needed, touch the **Destination** Button to display the 'Destination Options' Window to select a new destination airport, arrival runway, arrival procedure, approach procedure, or to remove the destination airport.

FLIGHT PLAN MODIFICATION AND NAVIGATION

Active, standby, and stored flight plans can be edited at any time. Waypoints, headings, fixes 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.

WAYPOINTS

Adding and Removing Waypoints

Adding a waypoint to a flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan.**

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

   b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

   c) Touch the **Edit** Button.

2) Enter waypoints in the flight plan:

   If adding a waypoint to the end of the enroute segment of the flight plan, touch the **Add Waypoint or Route** Button to display the keypad (this step is not available from the 'Edit Stored Flight Plan' Screen).

   Or:

   a) Touch a Waypoint Selection Button to display the 'Waypoint Options' Window.

   b) Touch the **Insert Before** Button or the **Insert After** Button to select where the new waypoint or route will be placed in relation to the selected waypoint. The keypad is displayed.

   Or:

   a) If adding a waypoint or route to the beginning of the enroute segment of the flight plan, touch the **Enroute** Button to display the 'Enroute Options' Window.

   b) Touch the **Insert Waypoint** Button to display the keypad.

3) Use the keypad, upper knobs, or the Find function to select the new waypoint; or use the keypad to create a route entry.

4) Touch the **Enter** Button to accept the waypoint or route and place it in the flight plan.

5) If you are finished adding waypoints and routes, touch the **Back** Button to return to the previous screen.

Adding a waypoint to the active flight plan using the Waypoint Info Button:

1) From MFW Home, touch **Waypoint Info.**

2) Touch the **Airport** Button, **INT** Button, **NDB** Button, **VRP** Button, or the **User Waypoints** Button.

3) Choose the desired waypoint:

   a) Touch the Selected Waypoint Button to display the keypad.

   b) Use the keypad to enter the identifier or name of the desired waypoint.

   c) Touch the **Enter** Button to accept the entry and display the waypoint's information on the Touchscreen Controller.

   Or:

   a) To display the list of user waypoints, touch the **WPT List** Tab.

   b) Scroll the list as necessary and touch the desired User Waypoint Button.

4) Touch the **Waypoint Options** Button.

5) Touch the **Insert in Flight Plan** Button. The 'Insert Before Waypoint' Window is displayed.

6) Scroll the list as necessary, and touch the Waypoint Selection Button to select where to insert the new waypoint. The waypoint is inserted into the active flight plan before the selected waypoint.

   Or:

   Touch the **Insert at End** Button. The waypoint is inserted as the last waypoint in the active flight plan.

Adding a waypoint into the active flight plan using the Nearest Button:

1) From MFW Home, touch **Nearest**.
2) Touch the **Airport** Button, **INT** Button, **VOR** Button, **NDB** Button, **VRP** Button, or **User** Button.
3) Scroll as necessary and touch the desired waypoint button.
4) Touch the **Insert in Flight Plan** Button.
5) Scroll the list as necessary, and touch the Waypoint Selection Button to select where to insert the new waypoint. The waypoint will be inserted into the active flight plan before the selected waypoint.

   Or:

   Touch the **Insert at End** Button. The waypoint is inserted as the last waypoint in the active flight plan.

The Map Pointer can be used to add waypoints to the active, standby, and stored flight plans as a single waypoint or a series of waypoints. Waypoints can be added by moving the map pointer over an existing waypoint or any location on the map. The system will create User Waypoint (LAT/LON Mode) for map pointer locations not coinciding with a waypoint from the database. New flight plan waypoints can be added in succession using the map pointer, in essence, rerouting the original flight plan.

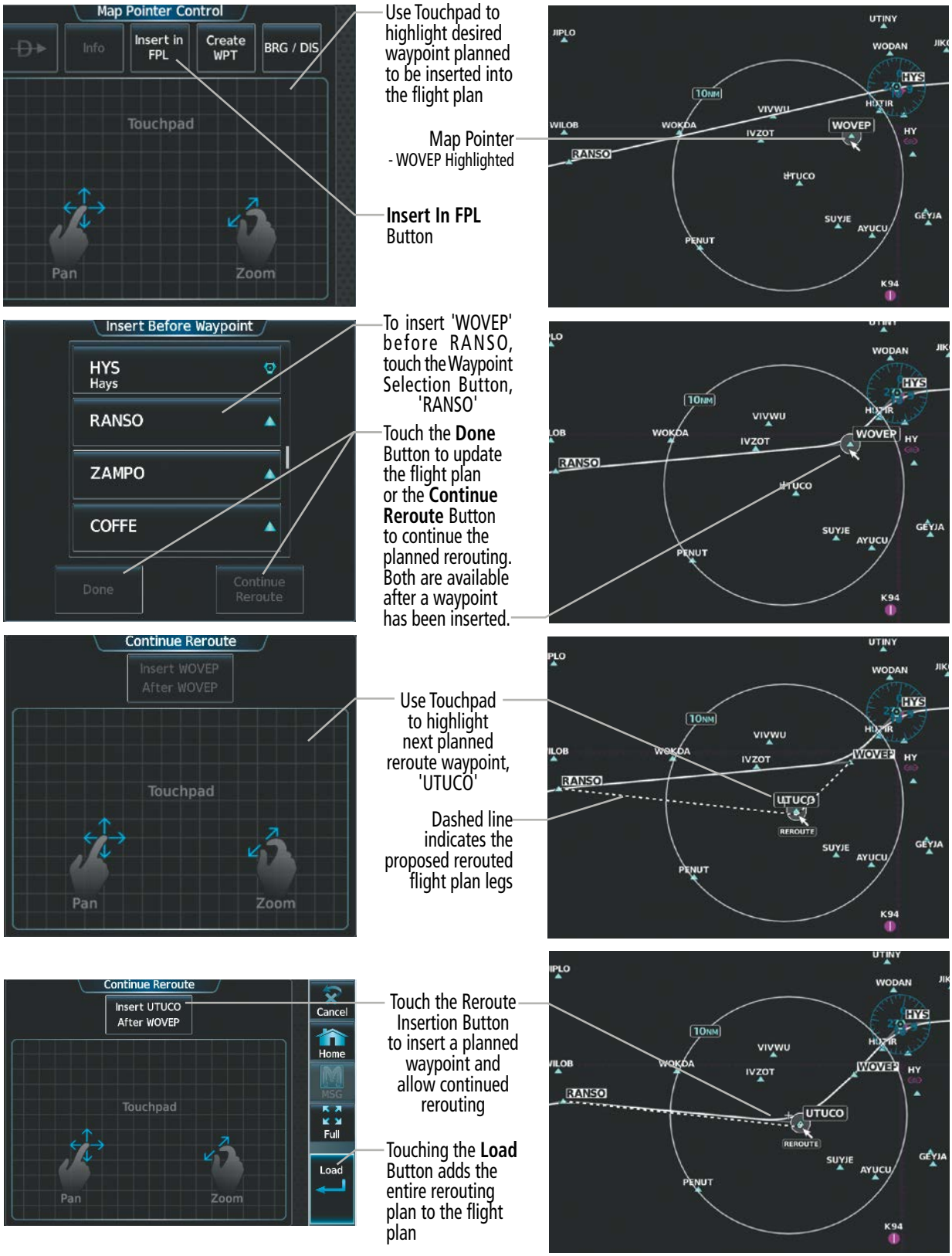


Figure 5-89 Flight Plan Rerouting

Adding waypoints using the Map Pointer (Rerouting):

1) For the active flight plan: Go to Step 2.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan > Flight Plan Options > Preview FPL**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button.

d) Touch the **Flight Plan Options** Button.

e) Touch the **Preview FPL** Button to display the stored flight plan map.

2) Push the lower knob to the display 'Map Pointer Control' Screen on the Touchscreen Controller, and to activate the Map Pointer.

3) Place the map pointer over a waypoint or map location for the next desired waypoint.

Or:

Place the map pointer over multiple map items.

Touch the **Prev** or **Next** Button to cycle to the desired waypoint.

Or:

a) Touch the Map Item Button to open the 'Map Item Selection' Screen..

b) Touch the desired waypoint.

4) Touch the **Insert In FPL** Button. The 'Insert Before Waypoint' Screen is displayed.

5) Scroll the list as necessary, and touch the Waypoint Selection Button to select where to insert the new waypoint. The waypoint is inserted before the selected waypoint.

Or:

Touch the **Insert at End** Button. The waypoint is inserted as the last waypoint in the active flight plan.

Or:

For airfield waypoints, touch the **Set as Destination** Button if desired. The waypoint is inserted as the flight plan destination.

If a new User Waypoint is inserted, the system will create a User Waypoint using the LAT/LON Mode. The default name of the new User Waypoint will be 'WPT' followed by the numerals '000'. Future rerouting requiring the creation of new User Waypoints will have similar default names with an incremental numeric value (example: 'WPT001', etc.).

6) Touch the **Done** Button to update the flight plan.

Or:

Add more waypoints to the planned rerouting:

a) Touch the **Continue Reroute** Button.

b) Use the **Touchpad** to move the pointer to a waypoint or the map location for the next desired waypoint.

c) Touch the Reroute Insertion Button to insert into the planned rerouting.

d) Touch the **Load** Button to add the entire rerouting to the flight plan, or repeat Step 6b and 6c.

Individual waypoints, airways, and entire procedures can be deleted from a flight plan. Some waypoints in the final approach segment (such as the FAF or MAP) can not be deleted individually. Attempting to delete a waypoint that is not allowed results in a window displaying 'Invalid flight plan modification.'

NOTE: *When a flight plan contains multiple instances of the same waypoint, editing any occurrence may affect the active leg. Verify all flight plan edits result in the desired active waypoint.*

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 or multiple waypoints from a flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button.

2) Scroll the list if necessary and touch a Waypoint Selection Button to display the 'Waypoint Options' Window. Then, touch the **Remove WPT(s)** Button.

3) To remove an individual waypoint, touch the **OK** Button in response to 'Remove <waypoint name>?'. The waypoint is removed. To cancel the request, touch the **Cancel** Button.

Or:

To remove a series of multiple waypoints:

a) Touch the **Remove Multiple** Button to display the 'Remove From <waypoint> Through' Window.

b) Touch a Waypoint Button that is sequenced before or after the previously selected waypoint. The confirmation window 'Remove <waypoint> Through <waypoint>?'.

c) Touch the **OK** Button to confirm the removal of the two selected waypoints and all waypoints sequenced between them, the **Edit** Button to return to the previous step, or the **Cancel** Button.

Fly-Over Waypoints

Waypoints entered in the enroute segment may be treated as either fly-by waypoints or fly-over waypoints. For both types of waypoints, the system will transition using a precisely calculated turn on course to the next waypoint.

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

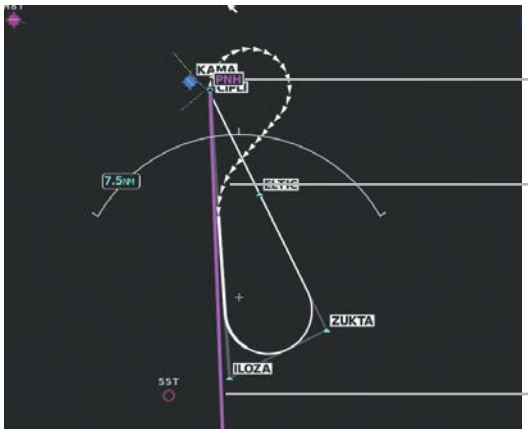


Figure 5-90 PNH Fly-Over Waypoint

A fly-over waypoint may also be manually designated by the pilot, in which case, the fly-over waypoint symbol is displayed.

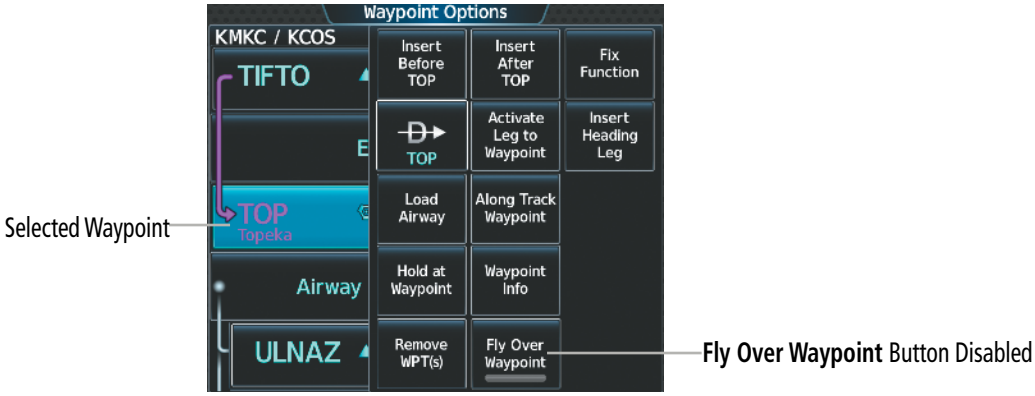


Figure 5-91 Waypoint Options, Fly-Over Waypoint Disabled (Fly-By)

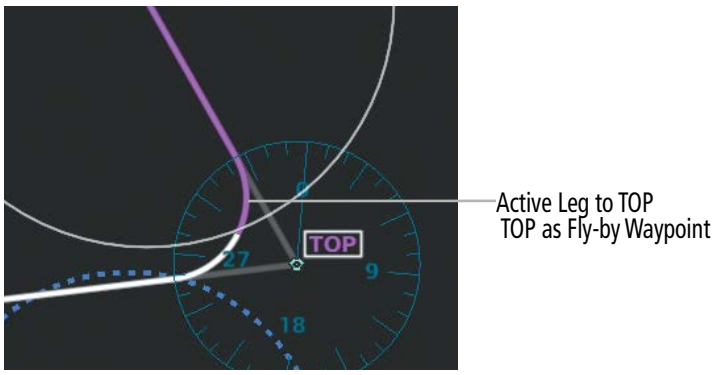


Figure 5-92 Fly-By Waypoint

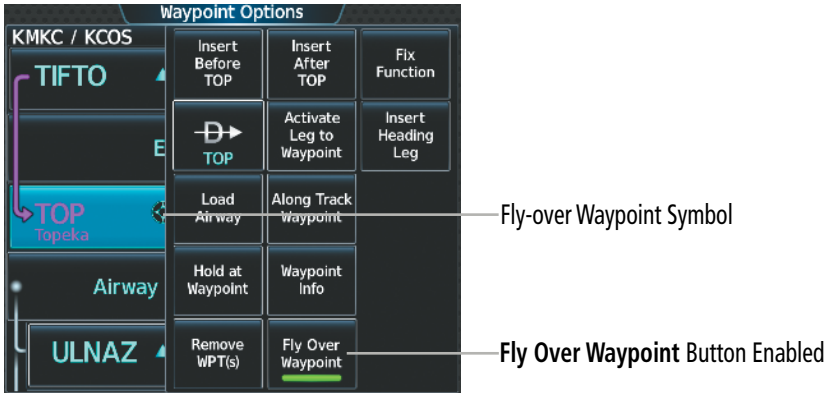


Figure 5-93 Waypoint Options, Fly-Over Waypoint Enabled

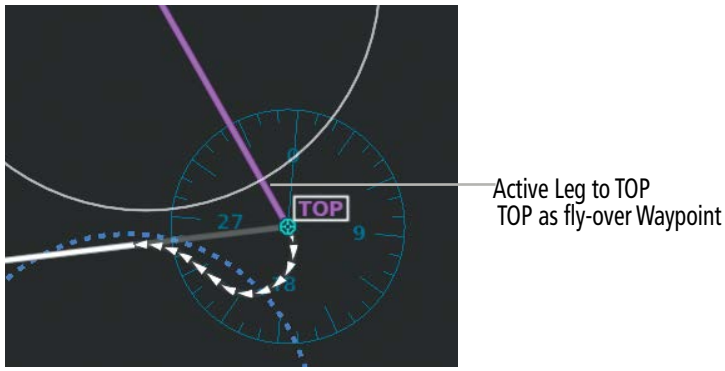


Figure 5-94 Fly-Over Waypoint

Enabling/disabling a fly over waypoint:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Touch a Waypoint Selection Button to display the 'Waypoint Options' Window.

3) Touch the **Fly Over Waypoint** Button to enable/disable the waypoint as a fly-over waypoint.

HEADINGS

Headings can be added and removed from the active flight plan. For details on sequencing headings in the flight plan, see the Procedures portion later in this section.

When adding a heading, it will be placed after the selected waypoint, and it can only be added when the following four conditions are met:

» The leg is not the first or last in the flight plan.

» The leg is not after a CI, PI, RF, FI, VM, or holding leg.

» The leg is not before an AF, RF, PI, VM or holding leg.

» The leg is inserting into one of the following flight plan locations:

- The enroute portion
- The second departure leg
- Both the arrival procedure's final leg and its navigation waypoint is the destination airport or runway
- The first approach leg for a VTF approach

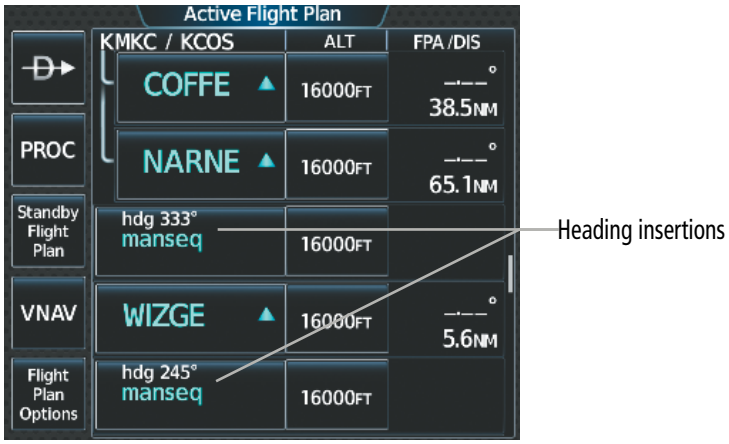


Figure 5-95 Active Flight Plan - Adding Headings

Adding a heading after a waypoint in the active flight plan:

1) From MFW Home, touch the **Flight Plan** Button.

2) Scroll the list as necessary, and touch the desired Waypoint Selection Button. The heading will be inserted after this waypoint.

3) Touch the **Insert Heading Leg** Button to display the keypad.

4) Use the keypad to enter the heading and touch **Enter**. A 'manseq' heading Waypoint Selection Button will be added to the active flight plan.

Editing a heading after a waypoint in the active flight plan:

1) From MFW Home, touch **Flight Plan**.
2) Scroll the list as necessary, and touch the desired 'manseq' heading Waypoint Selection Button to display the 'Waypoint Options' Window.
3) Touch the **Edit Heading Leg** Button to display the keypad.
4) Use the keypad to enter the heading and touch **Enter**.

Removing a heading from the active flight plan:

1) From MFW Home, touch the **Flight Plan** Button.
2) Scroll the list if necessary and touch the desired 'manseq' heading Waypoint Selection Button to display the 'Waypoint Options' Window.
3) Touch the **Remove WPT(s)** Button.
4) Touch the **OK** Button in response to 'Remove <waypoint name>?'. The heading is removed. To cancel the request, touch the **Cancel** Button.

FIXES

Fixes can help increase situational awareness while using the flight plan. Fixes (depicted as a green circle on the navigation map) occur where the fix definition (depicted as green dashes) intercepts the active flight plan. Fixes can be created, edited, and made into a flight plan waypoint if desired.

The default name of a new fix will be 'FIX-' followed by the numeral '00'. Future created fixes will produce a similar default name with an incremental numeric value (example: 'FIX-01').

Four types of fixes (Abeam, Radial, Distance, and LAT/LON) are possible. Each type of fix is defined using one or more pilot-entered values, which will create a flight plan intercept:

» Abeam fix: Interception perpendicular to the pilot-entered reference waypoint.
» Radial fix: Interception of the pilot-entered radial from the pilot-entered reference waypoint.
» Distance fix: Interception of the pilot-entered range from the pilot-entered reference waypoint.
» LAT/LON fix: Interception of the pilot-entered latitude or longitude. If both are entered, the system will use the latitude only.

If a fix definition is entered that does not intersect the active flight plan, a 'Reference does not intersect the flight plan' message will be displayed, and the fix definition cannot be completed.

If a fix definition intercepts the active flight plan in more than one location, then the fix will be where the intercept occurs first in the flight plan sequence. Once the aircraft has sequenced past this initial fix, the fix location will change to the next intercept location in the upcoming flight plan. The fix definition and its name will remain unchanged.

All created fix definitions and the fix itself will be displayed when viewing the active, standby and stored flight plan navigation maps. However, fixes are only created from intercepts with the active flight plan, so fix definitions and fixes seen on the standby and stored flight plans are overlays from the active flight plan. Additionally, if the active flight plan is changed, fix definitions for all fix types (except the Abeam fix) will still be displayed on the navigation map, as with any fixes that intersect the current active flight plan. The Abeam fix definition will only be displayed if the definition intercepts the active flight plan.

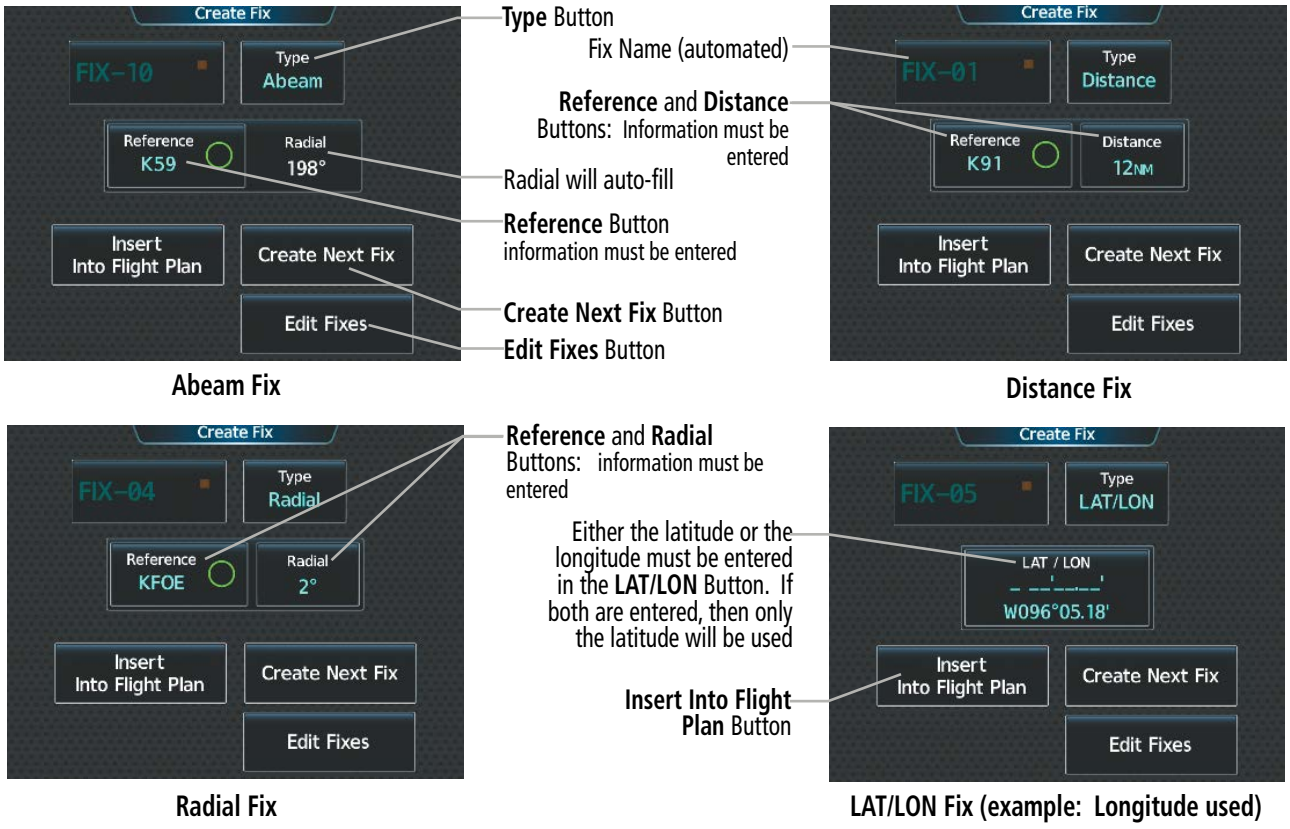


Figure 5-96 Fix Types - Fix Definitions



Figure 5-97 Active Flight Plan - 'Navigation Map' Fixes

Creating a fix:

1) From MFW Home:

Touch **Flight Plan > Flight Plan Options > Fix Function.**

Or:

a) Touch the **Flight Plan** Button.

b) Touch any Waypoint Selection Button to open the 'Waypoint Options' Window.

c) Touch the **Fix Function** Button.

2) Touch the **Type** Button to open the 'Select Fix Type' Screen.

3) Touch the button corresponding to the desired type of fix.

4) For an Abeam fix:

a) Touch the **Reference** Button.

b) Enter the waypoint identifier, and touch the **Enter** Button. The 'Radial' Field will auto-populate.

Or:

For a Radial fix:

a) Touch the **Reference** Button, enter the waypoint identifier, and touch the **Enter** Button.

b) Touch the **Radial** Button, enter the radial value, and touch the **Enter** Button.

Or:

For a Distance fix:

a) Touch the **Reference** Button, enter the waypoint identifier, and touch the **Enter** Button.

b) Touch the **Distance** Button, enter the distance value, and touch the **Enter** Button.

Or:

For a LAT/LON fix, touch the **LAT/LON** Button, to open the 'LAT/LON' Screen:

For a latitude intersecting fix, enter the latitude, and touch the **Enter** Button.

Or:

For a longitude intersecting fix, enter only the longitude, by touching the **E** or **W** Button followed by the full longitude value, and touch the **Enter** Button.

5) To show the new fix on the map:

a) Touch the **Edit Fixes** Button.

b) Scroll as required and touch the new fix button on the 'Fix List' Screen.

c) Touch the **Show On Map** Button to display the fix on the navigation map.

d) Touch the **Back** Button twice to return to the 'Create Fix' Screen.

6) Touch the **Done** Button to create the fix:

7) To create another fix, touch the **Create Next Fix** Button and repeat steps 2 - 6.

Editing a fix:

1) From MFW Home:

Touch **Flight Plan > Flight Plan Options > Fix Function.**

Or:

a) Touch the **Flight Plan** Button.

b) Touch any Waypoint Selection Button to open the 'Waypoint Options' Window.

c) Touch the **Fix Function** Button.

2) Touch the **Edit Fixes** Button.

3) Touch the desired Fix Button to edit.

4) Touch the **Edit** Button.

5) Re-enter the desired changes and touch the **Done** Button.

Deleting a fix or all fixes:

1) From MFW Home:

Touch **Flight Plan > Flight Plan Options > Fix Function.**

Or:

a) Touch the **Flight Plan** Button.

b) Touch any Waypoint Selection Button to open the 'Waypoint Options' Window.

c) Touch the **Fix Function** Button.

2) Touch the **Edit Fixes** Button.

3) Touch the desired Fix Button to delete.

4) Touch either the **Delete Fix** or the **Delete All Fixes** Button to delete the selected fix or all fixes, respectively.

5) Touch the **OK** Button to confirm the deletion.

Once a fix is created, it can be placed into the active flight plan as a flight plan waypoint, if desired. When a flight plan waypoint is created from a fix, it functions like any other flight plan waypoint, and can be moved into the standby and stored flight plans when copied from the active flight plan. It will be named similarly to the fix, except the hyphen will be removed (the fix 'FIX-04' would become the flight plan waypoint, 'FIX 04'). The appearance of the flight plan waypoint on the navigation map is the same as a fix (i.e. no visual change occurs). Once created, the flight plan waypoint is not affected by changes to the fix definition, even if the fix is deleted.

For a fix definition that intersects the flight plan in more than one location, only one of the fixes from the definition can represent a flight plan waypoint. In this case, the first waypoint created from the fix definition will be the only waypoint created from that definition, unless the waypoint is deleted.



Figure 5-98 Active Flight Plan - Waypoint added from a previously defined fix

Adding a waypoint to the active flight plan using fix information:

1) From MFW Home:

   Touch **Flight Plan > Flight Plan Options > Fix Function.**

   Or:

   a) Touch the **Flight Plan** Button.

   b) Touch any Waypoint Selection Button to open the 'Waypoint Options' Window.

   c) Touch the **Fix Function** Button.

2) Touch the **Edit Fixes** Button.

3) Touch the desired Fix Button to be added.

4) Touch **Edit** > **Insert Into Flight Plan**.

5) Scroll the list as necessary, and touch the Waypoint Selection Button to select where to insert the new waypoint. The waypoint is inserted into the active flight plan before the selected waypoint.

AIRWAYS

Airways can be added, removed, and collapsed/expanded from any flight plan.

When the database is updated, stored flight plan airways may 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 a flight plan airway can fail during this process. If that happens, the airway waypoints are changed to regular (non-airway) flight plan waypoints, and an alert is displayed (see messages in the Appendices).

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.

Adding and Removing Airways

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

Some airways have directional restrictions on all or part of the route. Airway "A2" in Europe has a directional restriction over the whole route that can be flown only in the direction MTD-ABB-BNE-DEVAL.

Airway "UR975" in North Africa has more complicated directional restrictions within the list of airway waypoints AMANO, VAKOR, LIBRO, NELDA, DIRKA, GZO, KOSET, and SARKI:

- Starting from AMANO, the airway can be flown only to LIBRO.
- Starting from SARKI, the airway can be flown only to LIBRO.
- Between NELDA and GZO, the airway can be flown in either direction.

In the US, airways that are "one-way" for specified hours of operation are not uncommon. These airways are always bidirectional in the system database.

The system only allows correct airway sequences to be inserted. If the pilot subsequently inverts the flight plan, the system inverts the airway waypoint sequence and removes the airway header.

Adding an individual airway to a flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Scroll the list if necessary and touch a Waypoint Selection Button to display the 'Waypoint Options' Window.

3) Touch the **Load Airway** Button to display the 'Airway Selection' Screen.

4) Touch the **Sort A->Z** Button to select/deselect alphabetical sorting of the airway waypoints.

5) Scroll the list if necessary and touch an Airway Selection Button to select the airway and display the 'Select Exit' Window (if Sort A->Z is selected, the exit points are displayed in alphabetical order, not the order they appear in the airway).

6) Scroll the list if necessary and touch an Airway Exit Point Selection Button to select the airway exit point. The airway waypoint sequence is now show on the 'Airway Selection' Screen.

7) Touch the **Show on Map** Button to preview the airway on the active display pane.

8) Touch the **Load Airway** Button to insert the airway into the active or standby flight plan.



Figure 5-99 Adding an Airway to the Active Flight Plan

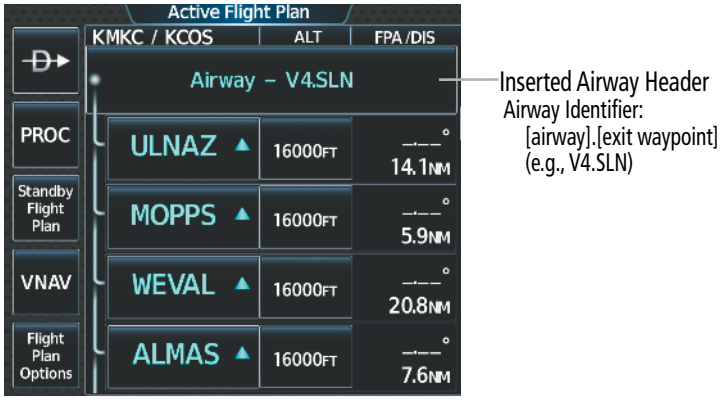


Figure 5-100 Active Flight Plan – V4 Airway Loaded

Removing an entire airway from the flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Scroll the list if necessary and touch an Airway Selection Button to display the 'Airway Options' Window.

3) Touch the **Remove Airway** Button.

4) Touch the **OK** Button in response to "Remove Airway – <airway name> from flight plan?". The airway is removed, but the starting and ending waypoints remain in the flight plan. To cancel the request, touch the **Cancel** Button.

Collapsing and Expanding Airways

The system allows airways to be displayed as collapsed or expanded within an active or standby flight plan. 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' Screen always keeps the following three waypoints visible: "From" waypoint, "To" waypoint, and the "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. By default, the system will expand all airways as they are loaded into the flight plan. If instead, it is preferred to have airways collapsed within the flight plan as they are loaded, this setting may be changed.



Figure 5-101 Expanded/Collapsed Airways

Collapsing/expanding the airways in the flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Scroll the list if necessary and touch an Airway Selection Button to display the 'Airway Options' Window.

3) Touch the corresponding button to collapse/expand an individual airway, or collapse/expand all airways.

4) Touch the **Back** Button to return to the flight plan.

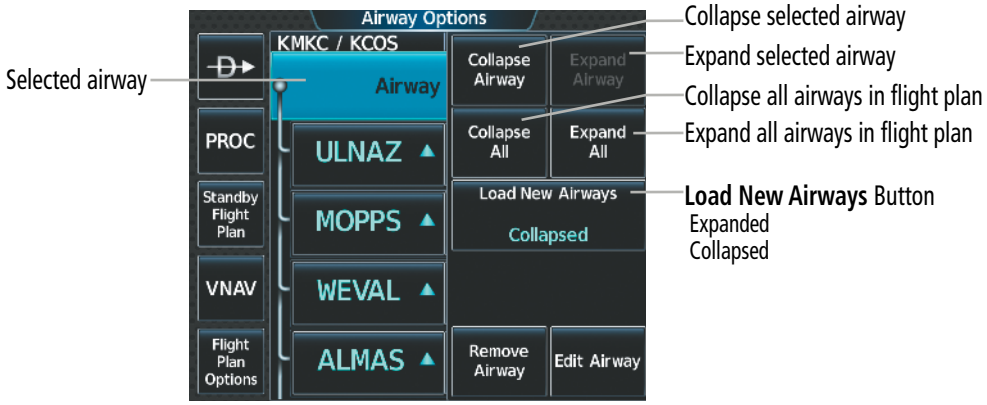


Figure 5-102 'Airway Options' Window

Changing Collapsed/Expanded settings for newly loaded airways:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

(Not available for stored flight plans)

2) Scroll the list if necessary and touch an Airway Selection Button to display the 'Airway Options' Window.

3) Touch the **Load New Airways** Button.

4) Touch the selection button for the desired setting.

ALTITUDE CONSTRAINTS

NOTE: *The system supports vertical path guidance and altitude constraints for the following leg types: AF, CD, CF, CI, CR, DF, FC, FD, HF, PI, RF, and TF.*

NOTE: *Manually specifying an FPA to the FAF, or manually creating an altitude constraint at the FAF inhibits the Transition to Approach (TTA) function.*

The system can use MSL or AGL altitude constraints associated with lateral waypoints to give guidance for vertical navigation. These altitudes are, depending on the specific instance, manually entered or retrieved from the published altitudes in the navigation database.

See the following figure for an example of how different Altitude Constraint Types are displayed in the active flight plan. When a procedure is loaded, the system will auto-designate (automatically enter and enable) altitude constraints to be used for vertical speed and deviation 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 touching the desired VNAV ALT button and entering the desired altitude. An altitude constraint may be manually designated only if it is selectable and available for vertical guidance. Altitudes that are not available for vertical guidance are shown in white text and are not selectable.

NOTE: *If the Final Approach Fix (FAF) is available for vertical guidance, the system will auto-designate the FAF altitude constraint when loading the procedure. If necessary, the FAF altitude constraint may be modified and set above or below the published FAF altitude.*

The system is capable of providing vertical navigation for any altitude constraint designated for use. Vertical navigation is provided to the AT portion of the AT or ABOVE / AT or BELOW constraint types. Vertical navigation will be provided to the lower altitude of a BETWEEN altitude constraint.

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

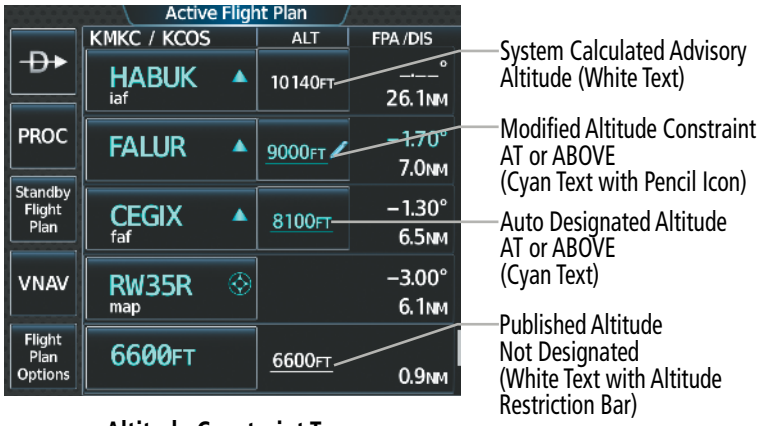
Altitudes that have been designated for use in vertical guidance can be “un-designated” by removing the altitude constraint. The altitude will not be used for vertical guidance and the text displayed will be shown in white. The system will recalculate advisory altitudes (white text) once any altitude 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 and runway waypoints. If an altitude constraint is created as an “AT or ABOVE” or “AT or BELOW” restriction, the "AT" portion of the restriction will be designated for vertical guidance.

NOTE: *After an approach procedure has been loaded into the flight plan, any altitude constraint programmed at the airport reference point (on the flight plan just ahead of the approach procedure) will be removed if the approach procedure is changed or removed.*

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

Altitude Constraints within a Flight Plan



Altitude Constraint Types

5000FT
Cross AT or ABOVE 5,000 ft

2300FT
Cross AT or BELOW 3,000 ft

2300FT
Cross AT 2,300 ft

5000FT
3000FT
Cross BETWEEN 3,000 ft & 5,000 ft

7898FT
Manual Input of Temperature Compensation

Figure 5-103 Active Flight Plan – Waypoint Altitude Constraints

White Text	Cyan Text
5000FT Advisory altitudes calculated by the system estimating the altitude of the aircraft as it passes the navigation point.	5000FT Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manual data entry.
5000FT Altitude retrieved from the navigation database. White line above and/or below indicates the type of constraint, as shown in the preceding figure. These altitudes are provided as a reference, and are not designated for vertical guidance.	5000FT The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.

Table 5-13 Altitude Constraint Color Coding

Entering or modifying an altitude constraint:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a stored flight plan button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Scroll the list, if necessary, and touch the desired VNAV ALT Button. If the desired altitude is already displayed, skip to Step 7 to designate the altitude constraint for vertical guidance.

3) If the 'Enter Altitude' Window is not automatically displayed, touch the VNAV Constraint Button to display it. Then, use the keypad to input the altitude.

4) If necessary, touch the **Flight Level** Button or the **MSL** Button to select the altitude mode.

5) Touch the **Enter** Button to accept the altitude entry and return to the 'VNAV Constraint' Window.

6) If necessary, touch the **Type** Button, then touch the **At**, **At or Above**, **At or Below** or **Between** Button. If the **Between** Button is selected, use the keypad and touch the **Enter** Button to enter the ceiling and floor altitudes.

7) Touch the **Create** or **Save** Button to designate the new altitude constraint. The altitude is now shown in cyan, indicating it is designated for vertical guidance.



Figure 5-104 Active Flight Plan – Adding an Altitude Constraint

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.

Removing/undesignating an altitude constraint:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

   b) Scroll the list if needed and touch a stored flight plan button to display the 'Catalog Options' Window.

   c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Scroll the list, if necessary, and touch the desired VNAV ALT Button.

3) Touch the **Remove Constraint** Button. A 'Remove Altitude Constraint?' window is displayed.

4) Touch the **OK** Button. The altitude is now shown in white (or possibly as white dashes if there are no other constraints in the flight plan), indicating it is not usable for vertical guidance. To cancel the request, touch the **Cancel** Button.

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

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

   b) Scroll the list if needed and touch a stored flight plan button to display the 'Catalog Options' Window.

   c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Scroll the list, if necessary, and touch the desired VNAV ALT Button.

3) Touch the **Remove Constraint** Button. A 'Remove or Revert to published VNAV altitude of nnnnnFT?' confirmation window is displayed.

4) Touch the **Revert** Button. The altitude is now the database altitude and is shown in cyan, indicating it is usable for vertical guidance.

Vertical Navigation Direct-To

The system allows a vertical navigation (VNAV) direct-to for any waypoint in the active flight plan with an altitude descent constraint designated (cyan text) for vertical guidance. Initiating the VNAV direct-to allows the flight plan to be flown, while vertical guidance based on the altitude constraint at the VNAV direct-to waypoint is provided. The altitude change begins on the current leg 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 TOD point is computed based on this altitude change; guidance for descent begins once the TOD is reached.

Once VNAV direct-to is activated, all VNAV altitude constraints before the VNAV direct-to waypoint are removed from the active flight plan. All VNAV altitude constraints following the VNAV direct-to waypoint are retained.

A lateral direct-to with an altitude constraint (activated by using the D▸ Key or Button) also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint.

Adjusting the active Vertical Speed Target and Flight Path Angle for the active VNAV waypoint is discussed later in this section.

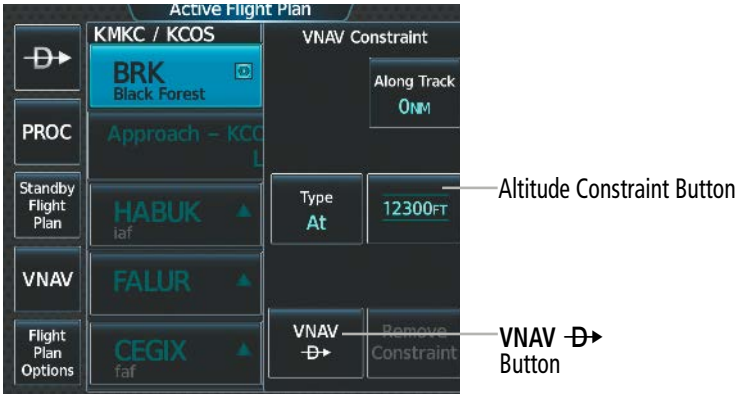


Figure 5-105 VNAV Constraint – Initiating a VNAV Direct-To



Figure 5-106 Active Flight Plan – VNAV Direct To Active

Activating a vertical navigation direct-to for an existing altitude constraint:

1) From MFW Home, touch **Flight Plan.**
2) Scroll the active flight plan list and touch the desired VNAV ALT Button.
3) Touch the **VNAV** D▸ <waypoint> Button to activate the vertical navigation direct-to. Vertical guidance begins to the altitude constraint for the selected waypoint.

   Or:

1) From MFW Home, touch **Flight Plan > VNAV.**
2) If necessary, touch the **Profile** Tab. Touch the **VNAV** Button to display the 'Select VNAV Direct To' Screen with a list of possible VNAV direct-to choices.
3) Scroll the list, if necessary, and touch a VNAV Waypoint Selection Button.
4) Touch the **OK** Button to activate the vertical navigation direct-to. Vertical guidance begins to the altitude constraint for the selected waypoint.
5) Touch the **Back** Button to exit and return to the previous screen.

Removing an altitude constraint when vertical navigation direct-to is active:

1) From MFW Home, touch **Flight Plan**.
2) Scroll the active flight plan list and touch the VNAV ALT Button for the waypoint receiving VNAV direct-to guidance.
3) Touch the **Remove Constraint** Button.
4) Touch the **OK** Button in response to the question "Remove Altitude Constraint?". Vertical navigation direct-to guidance for the altitude constraint is canceled, and the altitude constraint is removed from the flight plan.

VNAV ENABLEMENT

The system Vertical Navigation (VNAV) feature provides vertical guidance for the flight plan during the enroute and terminal phases of flight (does not affect final approach segment VNAV). Guidance is provided, based on specified altitude constraints in the active flight plan or for a VNAV direct-to. VNAV guidance is based on barometric altitudes, not on GPS altitude.

VNAV guidance may include the active VNAV waypoint identifier, altitude constraint, VS Required, FPA, Top of Descent (TOD), Bottom of Descent (BOD), and descent vertical deviation. The VNAV guidance to be displayed depends upon VNAV profile parameters (such as FPA), and aircraft location relative to the VNAV profile.

While in a descent, the descent VNAV guidance will be displayed as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with designated altitude constraints. Additionally, the desired path may be defined by specifying a Vertical Speed (VS) Target or Flight Path Angle (FPA) from the desired waypoint and designated altitude constraint.

VNAV guidance may be viewed on the PFW, Touchscreen Controller, and on the MFW within the 'Current VNAV Profile' Box (this box is displayed when an inset window is enabled on 'Navigation Map' Pane, and the MFW is in Full Mode).

The **VNAV Enabled** Button must be enabled (annunciator bar is green when enabled and gray when inhibited), to allow VNAV guidance to be displayed. VNAV can be enabled or disabled anytime. Disabling VNAV cancels active waypoint vertical guidance, and VNAV guidance is no longer displayed. VNAV remains disabled until manually enabled.

Refer to the AFCS Section for information on the display and use of VNAV guidance using the autopilot or flight director.

NOTE: *Adjusting the altimeter barometric setting creates discontinuities in VNAV vertical deviation, moving the path. For large adjustments, it may take several minutes for the aircraft to re-establish on the path. If the change is made while nearing a waypoint with a VNAV Target Altitude, the aircraft may not re-establish on the path in time to meet the vertical constraint.*

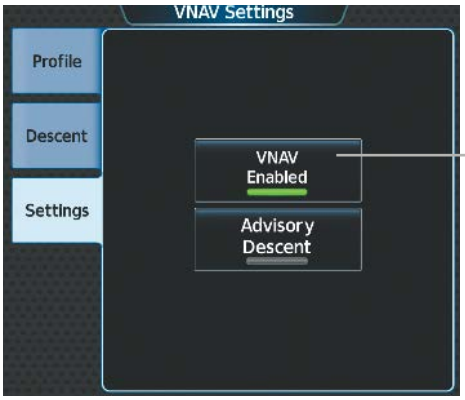


Figure 5-107 VNAV - Enabling/Disabling



Figure 5-108 Descent to Target Altitude for Active VNAV Waypoint – VNAV Enabled

Enabling/disabling VNAV guidance:

1) From MFW Home, touch **Flight Plan > VNAV.**
2) If necessary, touch the **Settings** Tab. Touch the **VNAV Enabled** Button to enable/disable vertical navigation.

ACTIVE FLIGHT PLAN VNAV PROFILE

The vertical speed target (VS Target) and flight path angle (FPA) for the active VNAV waypoint can be modified by directly entering either a VS Target or a FPA on the Touchscreen Controller.

The active VNAV waypoint is either the current VNAV waypoint for which VNAV direct-to guidance is being provided, or, when VNAV direct-to is not active, the system determines the next waypoint in the flight plan with a designated altitude constraint to be the active VNAV waypoint.

Flight Path Angle

The system can use descending flight path angle constraints associated with lateral waypoints to give guidance for navigation. These flight path angles are, depending on the specific instance, manually entered or computed by the FMS. In the later case, the FMS will use a default FPA value of 1.70 degrees, within the flight plan. The calculated FPA may be displayed in the column next to a designated VNAV descent altitude constraint.

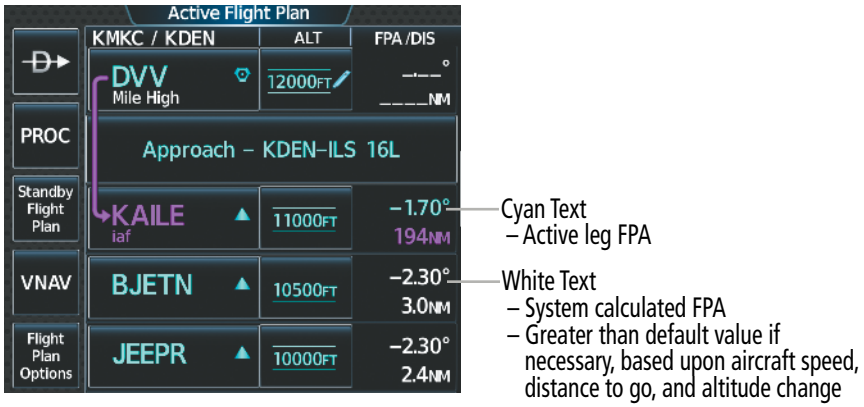


Figure 5-109 Active Flight Plan – Waypoint Flight Path Angle Constraints

The crew may optionally define a specific FPA for the next VNAV descent altitude constraint in the active flight plan. FPA constraints are displayed and entered to the nearest 0.01 degree. Manually entered FPA constraints can be deleted after having been added to the flight plan. These modifications will redefine the calculated vertical path and may result in movement of the Top of Descent (TOD).

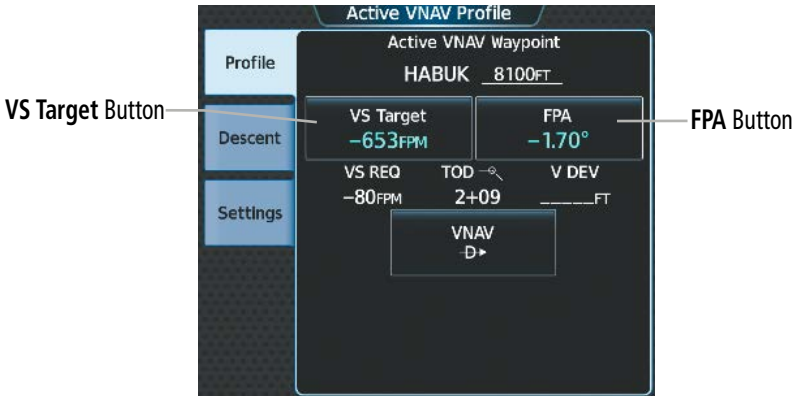


Figure 5-110 'VNAV Descent' Screen – Descent Schedule

Entering or modifying a flight path angle constraint in the active flight plan:

1) From MFW Home, touch **Flight Plan > VNAV**.
2) Touch the **Profile** Tab, if needed. Then touch the **FPA** Button to display the 'VNAV Flight Path Angle' Screen.
3) Use the keypad to select the angle. (FPA must be between -7.0 and -1.00)
4) Touch the **Enter** Button to accept the new FPA constraint.

Removing a flight path angle constraint in the active flight plan:

1) From MFW Home, touch **Flight Plan > VNAV**.
2) Touch the **Profile** Tab, if needed. Then touch the **FPA** Button to display the 'VNAV Flight Path Angle' Screen.
3) Touch the **Remove FPA** Button.
4) Touch the **OK** Button. The FPA reverts to the FMS computed value, or to dashes. To cancel the request, touch the **Cancel** Button.

Default Flight Path Angle:

The pre-defined FPA default value can be used or a pilot-defined FPA default value can be used for all flight plan descents.



Figure 5-111 Default Flight Path Angle Setting

Changing the flight plan descent FPA default:

1) From MFW Home, touch **Flight Plan > VNAV**.
2) Touch the **Descent** Tab.
3) Touch the **Default Flight Path Angle** Button to bring up the selection window.
4) To define a new descent FPA, touch the **Pilot-Defined Descent** Button. Then, use the keypad and the **Enter** Button to enter the FPA and return to the previous screen.

   Or:

   To use a pre-defined FPA, touch the desired descent button to select it and return to the previous screen.

Vertical Speed Target

The system can also use descending vertical speed target (VS Target) constraints associated with lateral waypoints to give guidance for navigation. These vertical speed would always be manually entered. Once manually entered, a new FPA will be calculated by the system. To remove the vertical speed target, the FPA constraint must be removed, as discussed previously.

Entering or modifying the VS Target in the active flight plan:

1) From MFW Home, touch **Flight Plan > VNAV.**
2) Touch the **VS Target** Button to display the 'VNAV VS Target' Screen.
3) Use the keypad to select the descent rate.
4) Touch the **Enter** Button to select the new vertical speed target and to display a new system-calculated FPA.

VERTICAL SITUATION DISPLAY

A Vertical Situation Display (VSD) can be displayed below the 'Navigation Map' Pane. The aircraft position, terrain, obstacles, vertical track vector, selected altitude, cruise altitude, and active flight plan information can be displayed on the VSD, depending on the selected mode. The flight planning mode will depict the vertical profile view of the flight plan to include the enroute altitude. Active flight plan information consists of waypoints, associated altitude constraints, the current VNAV profile, TOD/BOD, and destination runway). See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.

The VSD horizontal range is equal to the map 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 indicated range or the lowest range that displays all of the remaining active flight plan. The VSD altitude range automatically changes when the map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

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 subdued if the terrain is selected Off under Map Settings). Obstacles will be shown if the navigation map zoom is within the Map Obstacle Range settings. The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan between the aircraft present position and the end of the map range or active flight plan. The predefined width is determined by the flight phase.

The aircraft symbol is displayed on the left side of the VSD window. The position of the aircraft symbol on the vertical scale is at the bottom for climb-out, in the middle while enroute or if the phase is unknown, and close to the top during a descent.

Flight Plan Vertical Profile

The flight plan vertical profile is depicted on the VSD as a profile view of the flight plan path between waypoint constraint icons, and accompanying waypoint and altitude constraint labels. Waypoint altitude constraint values are displayed below the waypoint label, using the same color and format as on the 'Active Flight Plan' Screen. See the Altitude Constraints discussion earlier in this section for more information.

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 active-to waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Additionally, a constraint icon is displayed on the VSD along the vertical profile path for each flight plan waypoint altitude constraint. The tip of each constraint icon represents the AT portion of an AT-or-ABOVE / AT-or-BELOW constraint type, pointing up / down, respectively. Two opposing icons pointing to the same barometric altitude represent an AT constraint type. Two opposing icons pointing at different barometric altitudes represent a BETWEEN constraint type.

For enroute flight, the VSD will display the enroute altitude (shown as a horizontal line) as the highest of the current altitude, highest valid constraint in the flight plan, or selected altitude.

While enroute and flying to the first descent point, the VSD will display the horizontal line that intercepts the descent at the TOD. Normally, the aircraft will be displayed at the same altitude as the horizontal line and descend at the TOD.

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

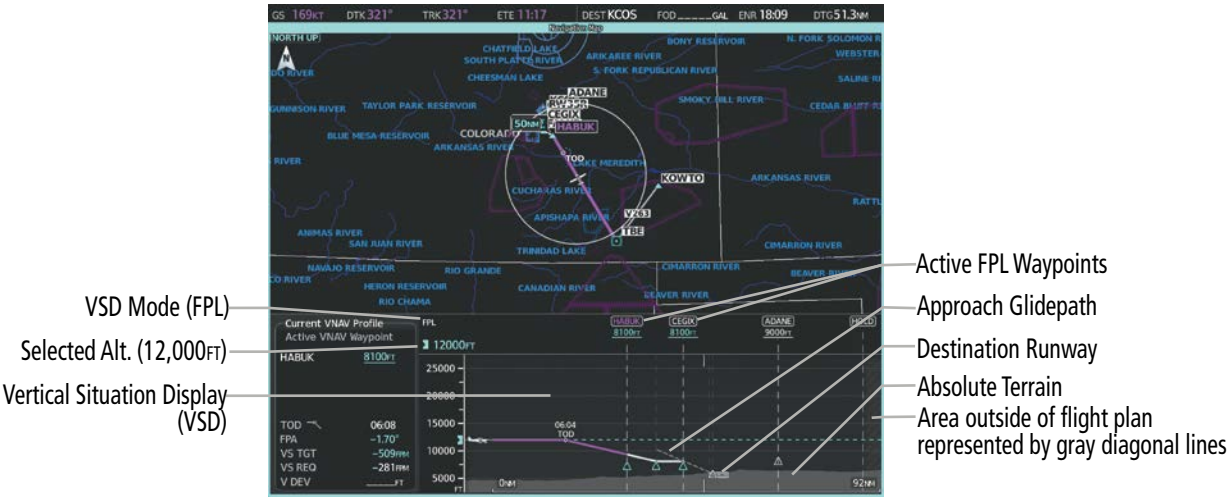


Figure 5-112 VSD Inset on 'Map - Navigation Map' Pane

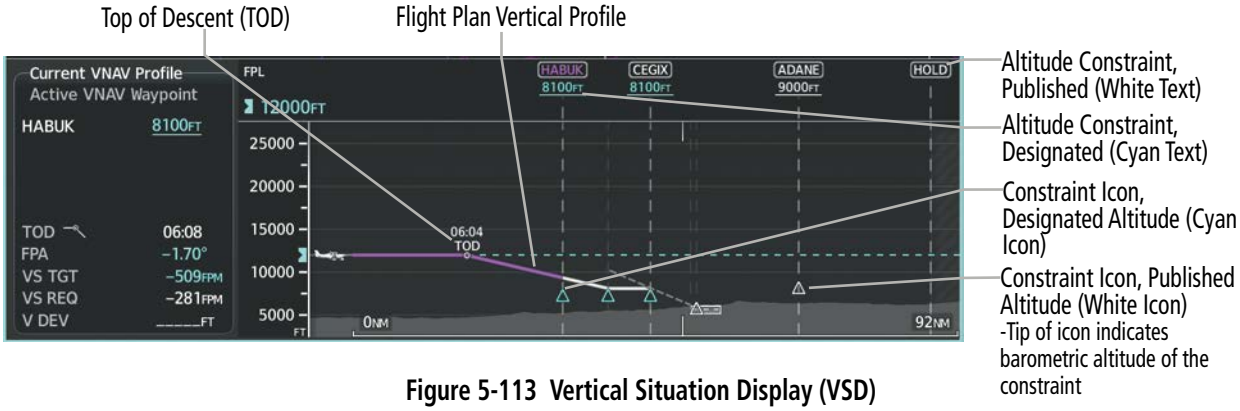


Figure 5-113 Vertical Situation Display (VSD)

Flight Phase	RNP Value	Width of Swath
Approach, Departure	0.3	0.6 nm
Terminal	1.0	2.0 nm
En Route	2.0	4.0 nm
Oceanic	4.0	4.0 nm

Table 5-14 Swath Width

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 [1]
	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 [1]
		Active FPL not available	Only shows message 'Flight Plan Not Available'
Track	TRK	NA	Terrain/obstacles along the current track, vertical track vector, and selected altitude

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

Table 5-15 VSD Mode Descriptions

Enabling/disabling the VSD:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) Touch the **Inset Window** Tab.
3) Touch the **VERT Situation Display** Button to enable/disable display of the VSD.

Changing the VSD Mode:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) Touch the **Inset Window** Tab.
3) Touch the VERT Situation Display **Settings** Button.
4) Touch the **Mode** Button to display the 'Mode Selection' Window.
5) Touch a Mode Selection Button to select it and return to the 'Vertical Situation Display Settings' Window.

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

Message	Description
'VSD Not Available'	At least one of the following is true: – Valid terrain database not available – Current barometric altitude not available – Current heading is not available – GPS position not available – An invalid range error has occurred

Table 5-16 VSD Messages

ADVISORY DESCENT

When enabled, this feature will display a location on the Navigation Map and VSD where a descent must be started in order to reach the destination airfield elevation using the default VNAV FPA. It does not have accompanying vertical guidance, and VNAV may be enabled or disabled. However, no active flight plan altitude constraint can exist for this feature to operate.

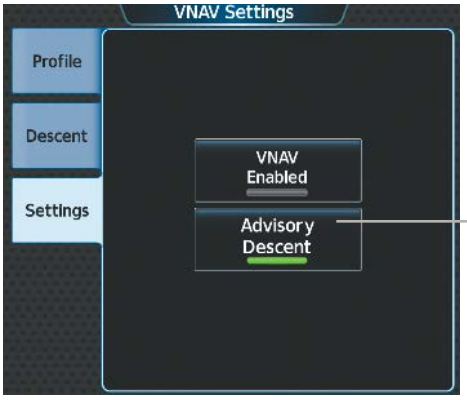


Figure 5-114 Advisory Descent - Enabling/Disabling

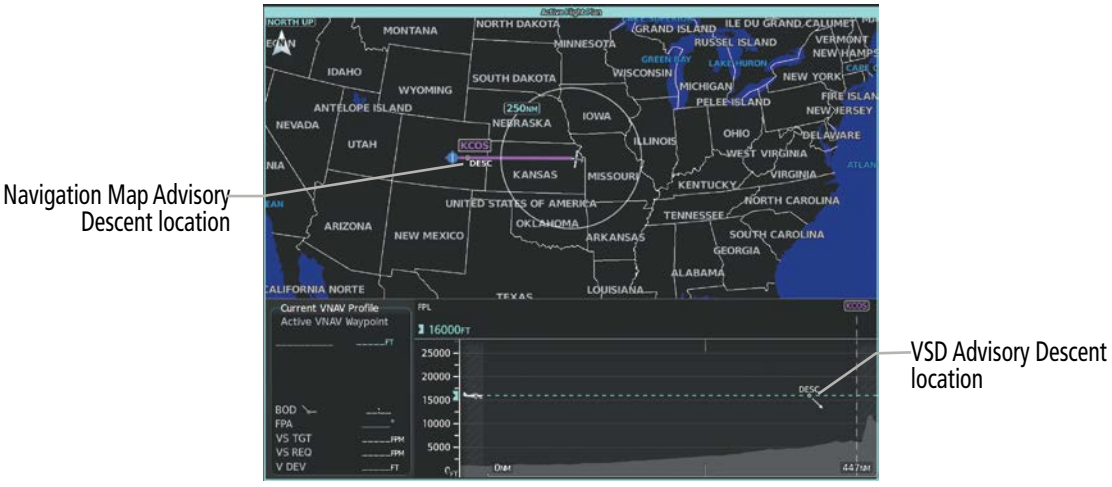


Figure 5-115 Advisory Descent to KCOS

Enabling/disabling the Advisory Descent:

1) From MFW Home, touch **Flight Plan > VNAV**.
2) Touch the **Settings** Tab.
3) Touch the **Advisory Descent** Button to enable/disable.

FLIGHT PLAN OPERATIONS

This section will discuss activating a flight plan leg, conducting enroute operations such as creating a parallel offset, along track offset, or user defined holds, inverting a flight plan, and utilizing the standby flight plan.

In-flight, the system automatically sequences through the active flight plan, with the exception of manually terminated legs (such as FM, HM, or VM) that can occur within procedures. For information on departures, arrivals, and approaches, refer to the Procedures Section later in the Flight Management Section. For information on OBS and SUSP Modes, refer to the Flight Instruments Section.

ACTIVATING A FLIGHT PLAN LEG

The system allows selection of a highlighted leg as the "active leg" (the flight plan leg which is currently used for navigation guidance). If necessary, the FMS will immediately provide a 45 degree intercept vector from the aircraft to the centerline.



Figure 5-116 Activating a Flight Plan Leg

Activating a flight plan leg:

1) From MFW Home, touch **Flight Plan**.
2) Scroll the list, if necessary, and touch the Waypoint Selection Button to select the destination waypoint for the desired leg. The 'Waypoint Options' Window is displayed.
3) Touch the **Activate Leg to Waypoint** Button.
4) Touch the **OK** Button in response to "Activate Leg?". The new active flight plan leg is activated. To cancel the request, touch the **Cancel** Button.

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.

Offset distance is calculated as a radial distance from the reference waypoint rather than a direct distance. The system will place the offset waypoint in the flight plan leg for which the radial distance intersects, regardless of distance between preceding flight plan legs. If the system is unable to find a point for which the radial offset distance intersects the flight path, the message 'Unable to place <offset waypoint and distance> on the existing Flight Plan' will be displayed.

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. Offset waypoints can span multiple flight plan legs, and multiple offset waypoints are allowed on each leg.

NOTE: *Initiating a Direct-to may remove the along track offset waypoint symbol from the map display if the along track offset waypoint is before the end of the direct-to segment. However, the along track offset waypoint will still remain in the flight plan. If it's desired to have the along track offset waypoint re-displayed on the map, recreate the along track offset waypoint.*

The system limits the along track offset distance so the along-track offset falls between the first and last waypoints in the flight plan. Assigning an along track offset to a leg with indeterminate length is not permitted. An along track offset is not allowed between the final approach fix and missed approach point of an approach.

An along track offset distance cannot be modified once entered. If the along track offset distance must be changed, the existing along track offset waypoint must be deleted and a new one created with the new offset distance.

Altitude constraints can also be entered for the along track offset waypoint within the flight plan or as part of a VNAV Direct-to. Altitude constraints and VNAV Direct-to are discussed previously in this section.

An along track offset waypoint can also be used for lateral navigation, such as the creation of a direct-to destination (discussed previously in this section), or as a part of a user-defined hold (discussed later in this section).

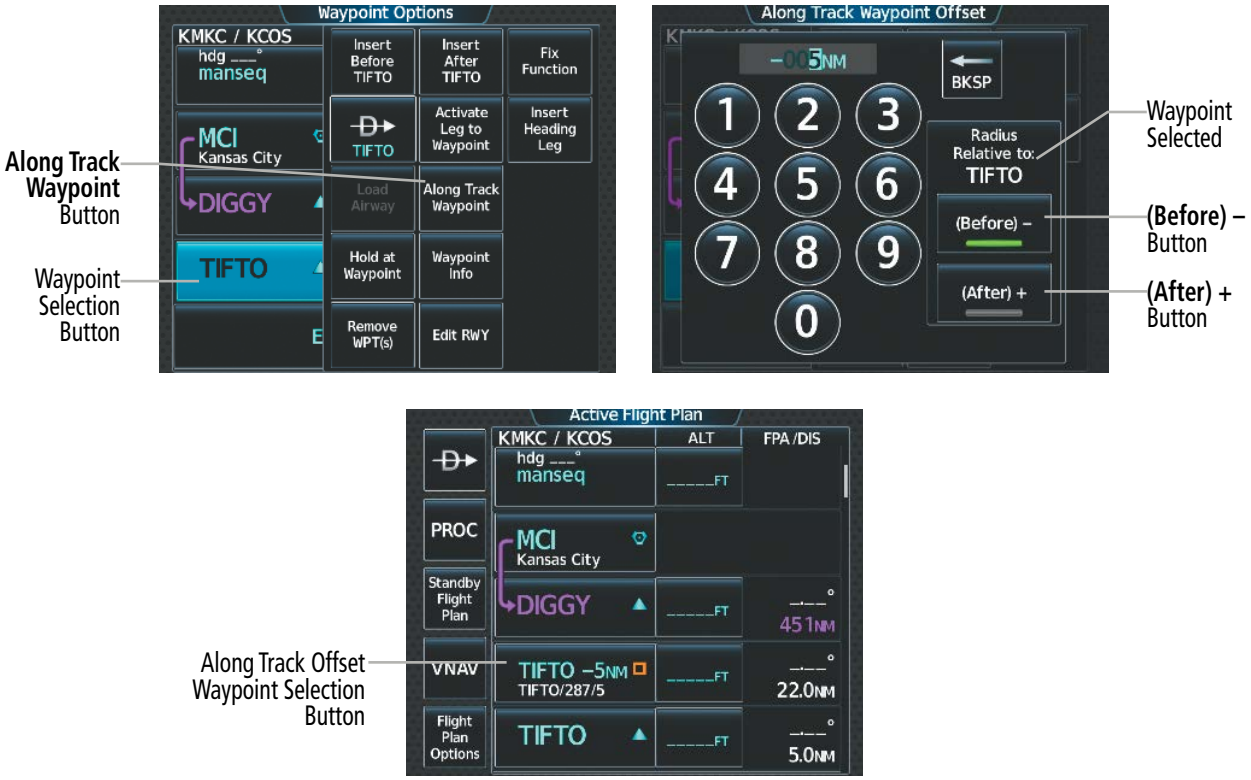


Figure 5-117 Inserting an Along Track Offset Waypoint

Inserting an along track offset waypoint into the active or standby flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

2) Touch a Waypoint Selection Button to display the 'Waypoint Options' Window.
3) Touch the **Along Track Waypoint** Button to bring up the 'Along Track Waypoint Offset' Window.
4) Enter a positive or negative offset distance in the range of ±1 to 999 nm (offset must fall between the first and last waypoint within the flight plan).
5) Touch the **(Before) –** Button or the **(After) +** Button to select the offset waypoint direction.
6) Touch the **Enter** Button to insert the offset waypoint into the flight plan.

Removing an along track offset waypoint from the active or standby flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

2) Touch the Along Track Offset Waypoint Selection Button to display the 'Waypoint Options' Window.
3) Touch the **Remove WPT(s)** Button.
4) Touch the **OK** Button to delete the waypoint from the flight plan.

PARALLEL OFFSET

The Parallel Offset feature allows creation of FMS-generated waypoints that parallel the course from 1 to 50 nm left or right of the current flight plan. When Parallel Offset is activated, the course line drawn on the map shows the parallel course, and waypoint names have a lower case "-p" placed after the identifier.

While flying a parallel offset:

» Initiating a direct-to will cancel the parallel offset and fly direct-to the selected waypoint.

» Initiating a hold at the present position will cancel the parallel offset and fly the holding pattern.

» Initiating a hold at a waypoint will result in the aircraft flying the parallel offset until a turn is required to fly to the hold waypoint. If the hold is removed before reaching the hold waypoint, the parallel offset will be resumed. Once the holding pattern is active, the parallel offset will not be resumed upon exiting the hold.

Parallel Offset is also canceled if a course change occurs greater than 120° or the parallel offsets overlap as a result of the course change. Deleting a portion of the active flight plan may also cancel a parallel track.

NOTE: *If a parallel track is created to an Off-Route Direct-To and the Direct-To waypoint is added to the flight plan, the Navigation Map will no longer display the parallel track.*



Figure 5-118 Active Flight Plan – Before Activating Parallel Offset

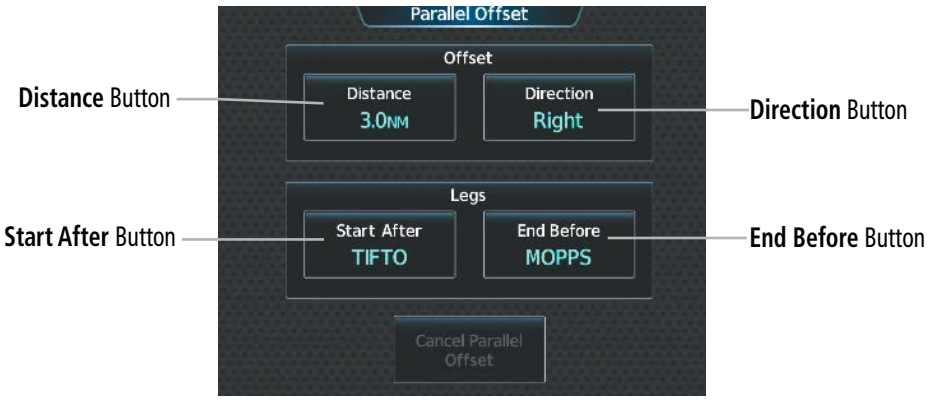


Figure 5-119 'Parallel Offset' Screen – Selecting Parallel Offset



Figure 5-120 Active Flight Plan – After Activating Parallel Offset

Activating parallel offset:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options** > **Parallel Offset**.
2) Touch the **Distance** Button to display the keypad.
3) Use the keypad to select the distance.
4) Touch the **Enter** Button to accept the distance, and return to the 'Parallel Offset' Screen.
5) If desired, touch the **Direction** Button to choose the offset direction.
6) Touch the **Start After** Button to display the flight plan waypoints.
7) Scroll if required and touch the desired flight point where the parallel offset will begin.
8) Touch the **End Before** Button to display the flight plan waypoints.
9) Scroll if required and touch the desired flight point where the parallel offset will end.
10) Touch the **Create** Button to accept the information and create the parallel offset, and return to the 'Active Flight Plan' Screen.

If the parallel offset, as defined by the offset direction and distance, is not allowed by the system, the activation prompt is displayed, but disabled. If a proposed parallel offset active leg does not a track between two fixes (TF) or a course to a fix (DF) leg or results in unreasonable route geometry, the 'Parallel Offset Unavailable Not Allowed for Active Leg' message will be displayed. Additionally, if an approach leg is active, the status indicates the system is unable to activate the parallel offset with the message 'Parallel Offset Unavailable Approach Leg Active'. In some cases, the system cannot calculate if a parallel offset can be activated until the **Activate Parallel Offset** Button is touched. For such cases, a window will appear stating, 'an active parallel offset cannot be maintained' after the button is touched.

Canceling parallel offset:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options > Parallel Offset**.
2) Touch the **Cancel Parallel Offset** Button to cancel the parallel offset function.

CLOSEST POINT OF FLIGHT PLAN

The Standby and Stored Flight Plans can identify a location along the flight plan that is the closest to another waypoint. The identified location will include the bearing and closest distance to the first upcoming flight plan leg that passes perpendicular to the selected reference waypoint. A new FMS-generated waypoint can be created along the flight plan, indicating the closest point. The default name of the new waypoint will be that of the selected reference waypoint followed by the numeral '1' (selecting KLBL for example will produce the name 'KLBL1'). Future closest point waypoints created from the same selected waypoint will produce a similar default name with an incremental numeric value (example: KLBL2).

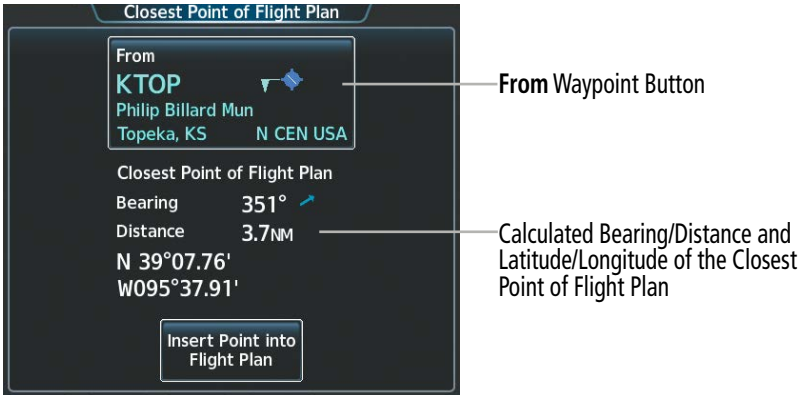


Figure 5-121 Closest Point of Flight Plan



Figure 5-122 Closest Point of Flight Plan inserted in the Flight Plan

Determining the closest point along the flight plan to a selected waypoint:

1) For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.

3) Touch the **Closest Point of Flight Plan** Button to display the 'Closest Point of Flight Plan' Screen.

4) Touch the **From** Waypoint Button to display the keypad.

5) Use the keypad and the **Enter** Button to select the "From" waypoint.

6) Touch the **Insert Point into Flight Plan** Button to add the calculated waypoint into the flight plan. The name for the new waypoint is derived from the identifier of the From waypoint.

USER-DEFINED HOLDING PATTERNS

A holding pattern can be defined at any active or standby flight plan waypoint, at the aircraft present position, or at a direct-to waypoint. Creating and editing user-defined holding patterns is allowed for the active and standby flight plan. A user-defined holding pattern at a flight plan waypoint is retained as part of the flight plan when storing the active or standby flight plan. The user-defined holding pattern can be removed from the active, standby, or stored flight plan.

The system automatically enters SUSP Mode and suspends waypoint sequencing of a flight plan when crossing the HOLD waypoint. Once the hold is active, the system will remain in SUSP Mode until the pilot disables SUSP Mode, at which point guidance along the hold to the inbound course is provided and automatic waypoint sequencing is resumed. For more information on SUSP Mode, see the Flight Instruments Section.

Creating or Editing a user-defined hold at an active or standby flight plan waypoint:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

2) Scroll the list, if necessary, to display the waypoint at which to define the holding or edit the existing holding:

a) To create holding, touch the Waypoint Selection Button to select the waypoint at which to define the holding pattern. The 'Waypoint Options' Window is displayed.

b) Touch the **Hold at Waypoint** Button. The 'Hold at Waypoint' Screen is displayed.

Or:

a) To edit, touch the Hold Waypoint Selection Button. The 'Waypoint Options' Window is displayed.

b) Touch the **Edit Hold** Button. The 'Hold at Waypoint' Screen is displayed.

3) Touch the **Turn** Button, and touch the **Right** Button or the **Left** Button to select the turn direction.

4) Touch the Course Direction (Inbound or Outbound) Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.

5) Touch the **Course** Button to display the keypad. Use the keypad and the **Enter** Button to select the inbound or outbound course.

6) Touch the Leg Length Mode Button, and touch the **Distance** Button or the **Time** Button to select the length mode.

7) Touch the **Leg Time** Button or the **Leg Distance** Button to display the keypad. Use the keypad and the **Enter** Button to select the length of the leg.

8) Touch the **Expect Further Clearance** Button to display the keypad. Use the keypad and the **Enter** Button to select the time for a reminder. A system message (HOLD EXPIRED Holding EFC time expired.) will be triggered at the selected time.

9) Touch the **Create** Button to create and add the hold into the flight plan.

Or:

Touch the **Save** Button to save the changes and return to the flight plan.

NOTE: *The HOLD EXPIRED message only remains active for approximately 30 seconds before being removed.*



Figure 5-123 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

Creating a user-defined hold at the aircraft present position:

1) From MFW Home, touch **Flight Plan > Flight Plan Options**.

2) Touch the **Hold at P. POS** Button. The 'Hold at Waypoint' Screen is displayed.

3) Touch the **Turn** Button, and touch the **Right** Button or the **Left** Button to select the turn direction.

4) Touch the Course Direction (Inbound or Outbound) Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.

5) Touch the **Course** Button to display the keypad. Use the keypad and the **Enter** Button to select the inbound or outbound course.

6) Touch the Leg Length Mode Button, and touch the **Distance** Button or the **Time** Button to select the length mode.

7) Touch the **Leg Time** Button or the **Leg Distance** Button to display the keypad. Use the keypad and the **Enter** Button to select the length of the leg.

8) Touch the **Expect Further Clearance** Button to display the keypad. Use the keypad and the **Enter** Button to select the time for a reminder.

9) Touch the **Create** Button to create an Offroute Direct-to hold waypoint at the aircraft present position.

10) If desired, to enter the hold into the flight plan, touch the PPOS-H Waypoint Selection Button to display the 'Direct To' Screen.

11) Touch the **Insert in Flight Plan** Button. The 'Insert PPOS-H Before?' Window is displayed.

12) Touch the desired Waypoint Selection Button, and the hold is inserted in the flight plan before the selected waypoint.

NOTE: *When a user-defined hold is created at the aircraft present position (shown as "Offroute", "→PPOS-H", at the top of the 'Active Flight Plan' Screen), the hold is the only part of the active flight plan shown on the map display. The hold must be canceled using the 'Removing a user-defined hold at the aircraft present position' procedure, which immediately removes the hold from the active flight plan, provides guidance to the active leg, and resumes automatic waypoint sequencing. The system will not follow the hold to the inbound course before resuming automatic waypoint sequencing. Following the steps in the procedure to insert the hold into the active flight plan will enable the* ***SUSP*** *Button and Softkey.*

NOTE: *If a user-defined hold has been created at the aircraft present position and then is edited, the preview shown on the map will reflect the new position of the holding pattern, but the PPOS-H waypoint (orange square) may not be accurately depicted. When the edited holding pattern is created, the PPOS-H waypoint is shown correctly.*

NOTE: *When a user-defined hold is created at the aircraft present position, the hold fix is placed slightly in front of the aircraft to allow the aircraft time to prepare for the upcoming turn.*

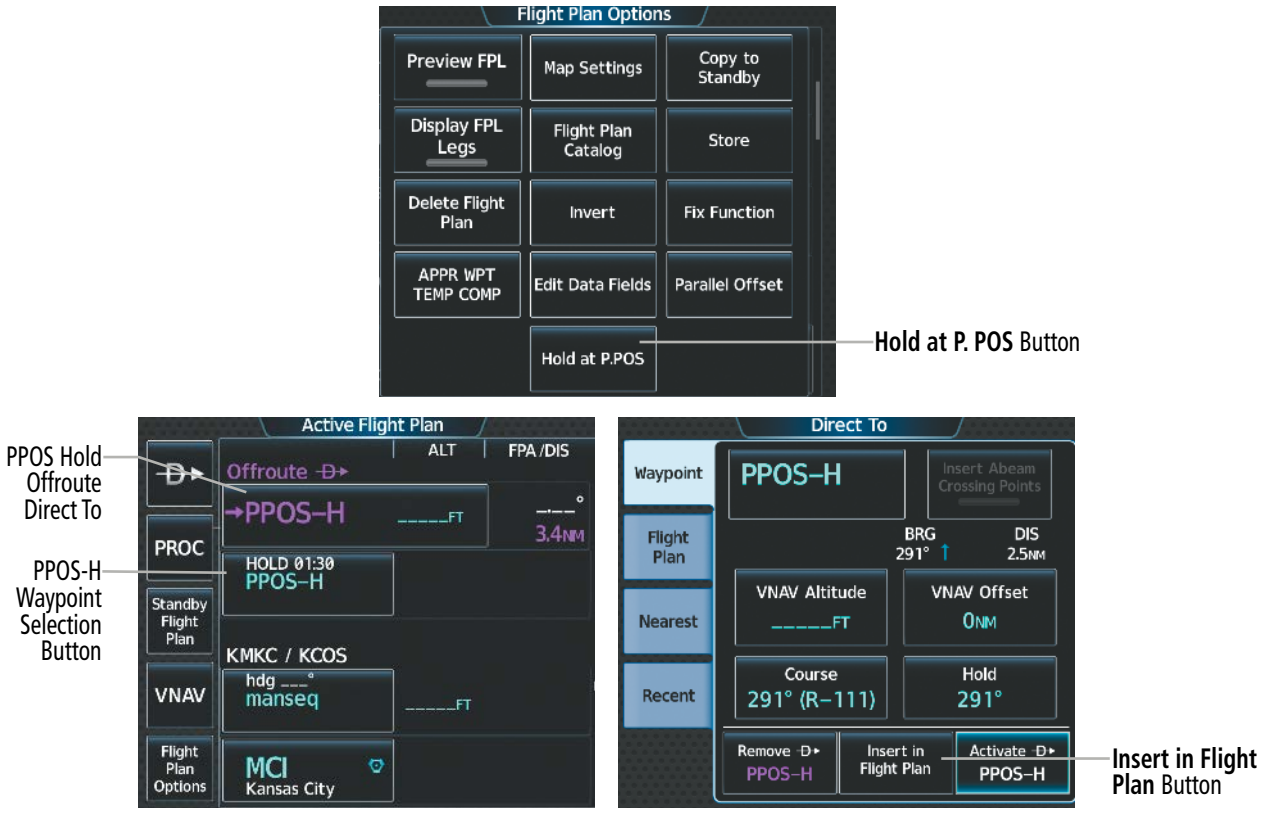


Figure 5-124 Creating a User Defined Holding Pattern at the Aircraft Present Position

Creating a user-defined hold at a direct-to waypoint:

1) From MFW Home, touch **Flight Plan**.
2) Touch the Direct To Button and set up the Direct To waypoint as desired.
3) Touch the **Hold** Button. The 'Direct To Hold' Screen is displayed.
4) Touch the **Turn** Button, and touch the **Right** Button or the **Left** Button to select the turn direction.
5) Touch the Course Direction (Inbound or Outbound) Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.
6) Touch the **Course** Button to display the keypad. Use the keypad and the **Enter** Button to select the inbound or outbound course.
7) Touch the Leg Length Mode Button, and touch the **Distance** Button or the **Time** Button to select the length mode.
8) Touch the **Leg Time** Button or the **Leg Distance** Button to display the keypad. Use the keypad and the **Enter** Button to select the length of the leg.
9) Touch the **Expect Further Clearance** Button to display the keypad. Use the keypad and the **Enter** Button to select the time for a reminder.
10) Touch the **Enter** Button to return to the 'Direct To' Screen.
11) Touch the **Activate** Direct To Button to activate the Direct To and add the hold into the flight plan.

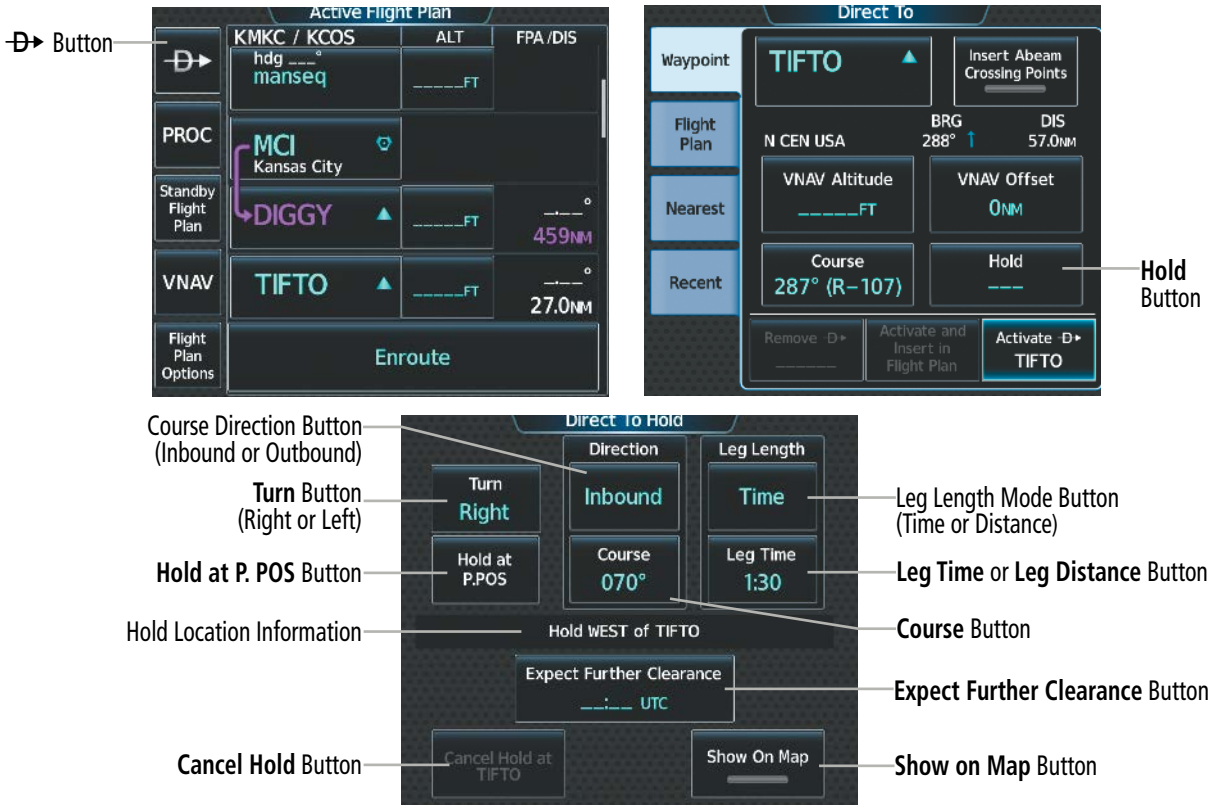


Figure 5-125 Creating a User Defined Holding Pattern at a Direct-To Waypoint

Removing a user-defined hold at an active flight plan waypoint or at a direct-to waypoint (hold not active):

1) From MFW Home, touch **Flight Plan**.
2) Scroll the list, if necessary, and touch the Hold Waypoint Selection Button. The 'Waypoint Options' Window is displayed.
3) Touch the **Remove Hold** Button.
4) To remove only the selected hold, touch the **OK** Button in response to 'Remove <waypoint name>?'. The hold is removed. To cancel the request, touch the **Cancel** Button.

   Or:

   To remove the hold along with a series of multiple waypoints:

   a) Touch the **Remove Multiple** Button to display the 'Remove From <hold waypoint> Through' Window.

   b) Touch a Waypoint Button that is sequenced before or after the previously selected hold waypoint. The confirmation window 'Remove <waypoint> Through <waypoint>?'is displayed.

   c) Touch the **OK** Button to confirm the removal of the two selected waypoints and all waypoints sequenced between them. To cancel the request, touch the **Cancel** Button.

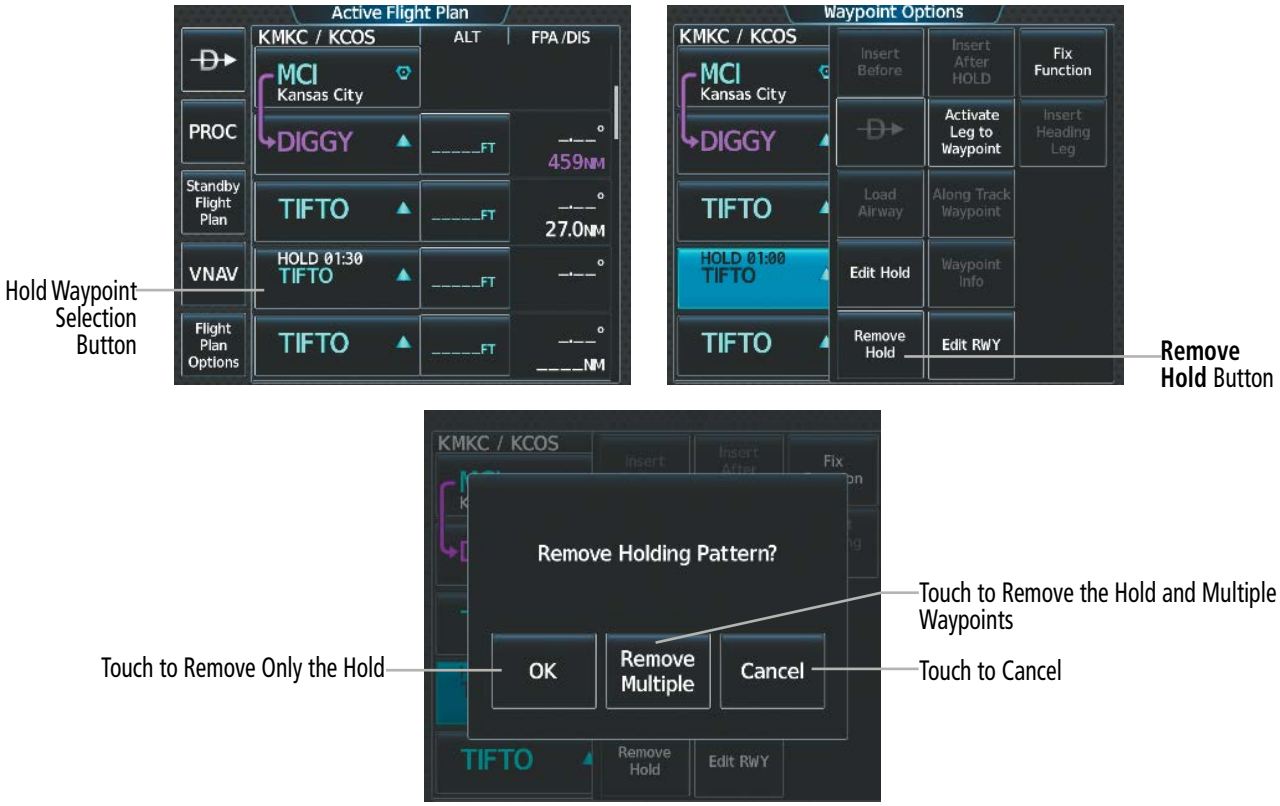


Figure 5-126 Removing a Hold at a Flight Plan Waypoint

Exiting a user-defined hold at an active flight plan waypoint or direct-to waypoint (hold active):

From PFW Home, touch the **SUSP** Button to return to automatic waypoint sequencing.

Or:

Press the **SUSP** Softkey to return to automatic waypoint sequencing.

NOTE: *Removing the hold from an active flight plan waypoint or canceling a hold for a direct-to waypoint will immediately remove the holding pattern from the flight plan, provide guidance to the active leg, and resume automatic waypoint sequencing.*

Removing a user-defined hold at the aircraft present position:

1) From MFW Home, touch **Flight Plan**.
2) Scroll the list, if necessary, and touch the PPOS-H Waypoint Selection Button, or touch the Direct To Button. The 'Direct To' Window is displayed.
3) Touch the **Remove PPOS-H** Button.
4) Touch the **OK** Button in response to "Remove PPOS-H?". The holding pattern is removed. To cancel the request, touch the **Cancel** Button.

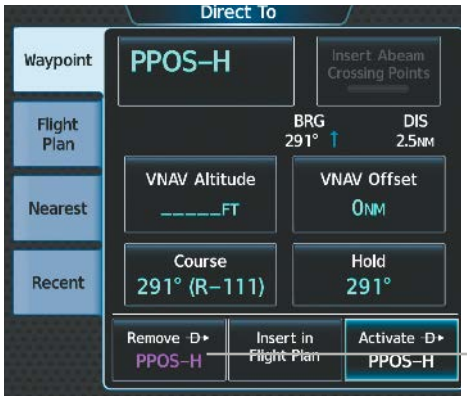


Figure 5-127 Removing a User Defined Holding Pattern at the Aircraft Present Position

INVERTING A FLIGHT PLAN

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

Inverting the active or standby flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

2) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
3) Touch the **Invert** Button.
4) Touch the **OK** Button in response to "Invert flight plan?". The flight plan is inverted. To cancel the request, touch the **Cancel** Button.

Inverting a stored flight plan:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
3) Scroll the list if necessary and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
4) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.
5) Touch the **Flight Plan Options** Button.
6) Touch the **Invert** Button. Touch the **OK** Button to continue. The flight plan and flight plan comment is inverted (all procedures are removed). Touch the **Back** Button to save the changes and return to the 'Flight Plan Catalog' Screen.

USING THE STANDBY FLIGHT PLAN

The standby flight plan is listed on the 'Standby Flight Plan' Screen on the Touchscreen Controller. The standby flight plan may be used for diversion planning purposes by linking the standby flight plan to the aircraft's present position (**Insert P. POS Link** Button). Once linked, the 'Standby Flight Plan' Screen will show a white arrow indicating the link from the aircraft present position to a specified waypoint in the standby flight plan. When the **Preview FPL** Button is chosen for the standby flight plan, the 'Standby Flight Plan' Pane will depict a white line between the aircraft present position and the standby flight plan waypoint for which it is currently linked to.

NOTE: *The **Insert P. POS** Button is for planning purposes only. It does not create any changes to the active flight plan, nor does it provide navigation guidance to the selected waypoint in the standby flight plan.*

As the aircraft continues navigating the active flight plan, the P. POS link between the aircraft present position and the standby flight plan will continuously update and sequence to the next waypoint, as necessary, to provide a best point of diversion from the active flight plan.

Two methods are available for loading and activating a standby flight plan. The **Load Standby** Button will load the standby flight plan to the active flight plan and display a confirmation window before replacing the active flight plan. An off-route direct-to leg for the previous active flight plan leg is entered to preserve active guidance. The **Load & Activate Standby** Button will load the standby flight plan to the active flight plan and create a new active direct-to leg from present position. The system will use the previous P. POS Link from the standby flight plan for the new active direct-to leg. If no P. POS Link is present in the standby flight plan, the system will automatically choose which leg to create a direct-to to instead and a confirmation window will be displayed to confirm the new active leg selection and flight plan activation.

The standby flight plan may also be stored for future use. See the Stored Flight Plan Functions discussion in this section.

Viewing the active and standby flight plan screen:

1) From MFW Home, touch **Flight Plan**.
2) Touch the **Standby Flight Plan** Button to display the 'Standby Flight Plan' Screen.
3) Touch the **Active Flight Plan** Button to return to the 'Active Flight Plan' Screen.



Figure 5-128 Switching between Active and Standby Flight Plan

Linking aircraft present position (Insert P. POS Link) to the standby flight plan:

1) From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.
2) Touch the desired Waypoint Selection Button to link the aircraft present position to a waypoint.
3) Touch the **Insert P. POS Link** Button.
4) A **P. POS** Button is added to the standby flight plan with a white arrow drawn to indicate the link created. To change the waypoint that P. POS is linked to, repeat Steps 2 through 4 for the desired waypoint.

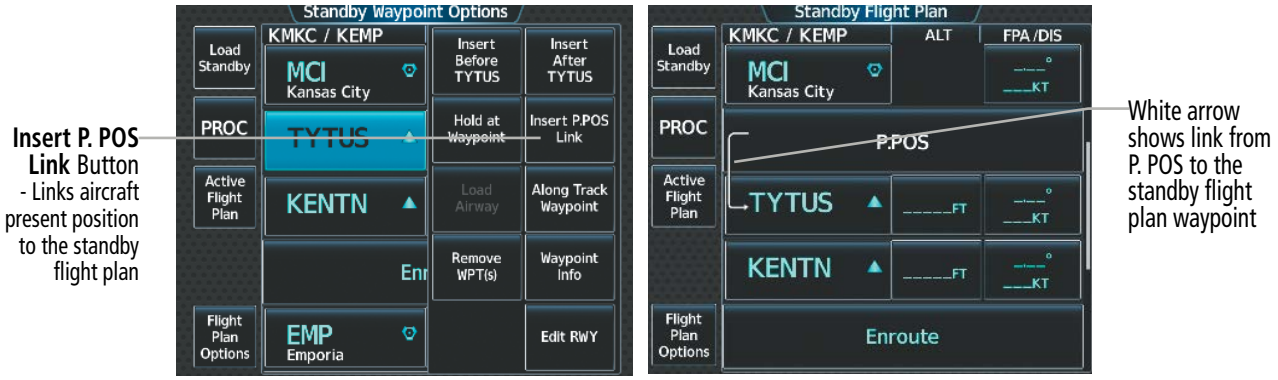


Figure 5-129 Standby Flight Plan – Insert P. POS Link

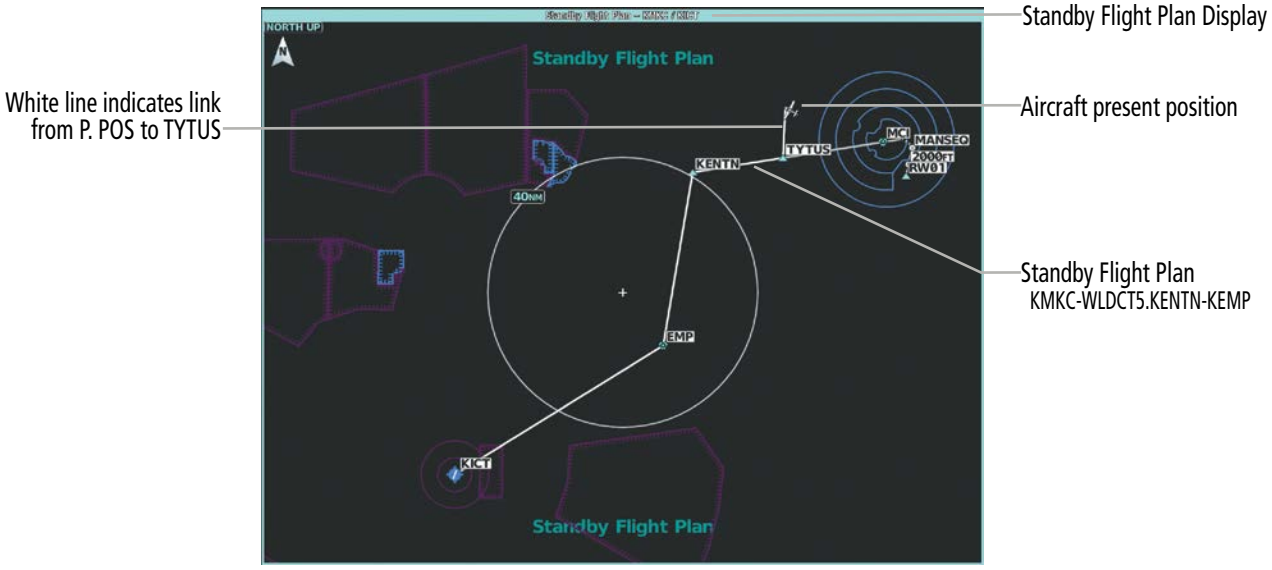


Figure 5-130 Standby Flight Plan – Inserted P. POS link active



Figure 5-131 P. POS link sequenced to next waypoint in standby flight plan

Removing P. POS link from the standby flight plan:

1) From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.
2) Touch the **P. POS** Button.
3) Touch the **Remove P.POS Link** Button.
4) Touch the **OK** Button in response to 'Remove link from P. POS?'. To cancel the request, touch the **Cancel** Button.

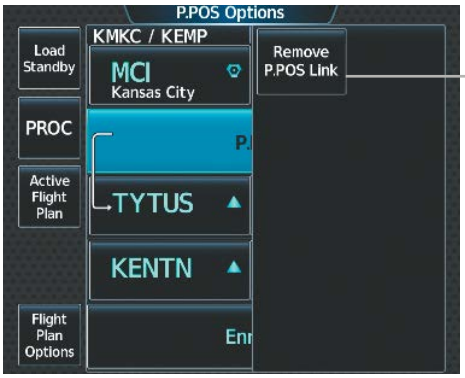


Figure 5-132 Standby Flight Plan – Remove link from P. POS

Loading and activating the standby flight plan:

1) From MFW Home, touch **Flight Plan** > **Standby Flight Plan.**
2) Load the Standby Flight Plan and preserve previous active leg guidance:
   a) Touch the **Load Standby** Button.

      Or:

      Touch **Flight Plan Options** > **Load Standby**.

   b) Touch the **OK** Button in response to the 'Load Standby Flight Plan and Replace Active Flight Plan.' prompt and return to the 'Flight Plan Plan' Screen. The standby flight plan is copied to the active flight plan, and an off-route direct-to leg is created for the previously active leg.

   Or:

   Load the Standby Flight Plan and create new direct-to leg guidance:

   a) Touch the **Flight Plan Options** Button.
   b) Touch **Load & Activate Standby** Button.
   c) Touch the **OK** Button in response to the 'Active Standby Flight Plan < flight plan leg >.' prompt and return to the 'Flight Plan Plan' Screen. The standby flight plan is copied to the active flight plan and new direct-to guidance is provided to the previously linked waypoint. If there was no P. POS link in the standby flight plan, the system chooses which waypoint to create a direct-to instead.

MANAGING FLIGHT PLANS

The pilot can manage flight plans by storing, copying, inverting, and deleting them, and flight plans can also be imported/exported using the SD Card or the optional Wireless Transceiver (Flight Stream 510). Also, the comment field (name) of each flight plan can be changed to something that is useful for identification and sorting.

NOTE: *The pilot/operator must review all portions of the flight plan following a flight plan import from any source.*

IMPORTING AND EXPORTING FLIGHT PLANS

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

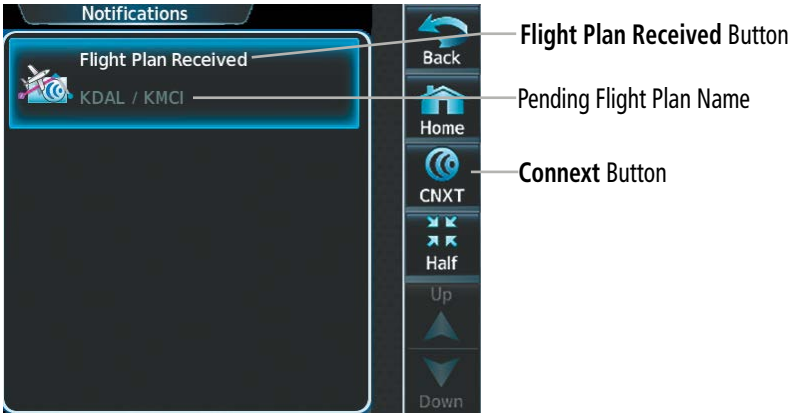


Figure 5-133 'Notifications' Screen - Pending Flight Plan Received

Ignoring a pending flight plan transfer from a wireless connection:

1) When a flight plan transfer has been initiated from a mobile device, the notification button will change to a flashing **Connext®** Button on the Touchscreen Controller, and a Connext annunciation appears on the PFW.
2) Touch the **Connext** Button to see the notification of the pending flight plan on the 'Notifications' Screen.
3) Touch the **Connext** Button again to ignore the pending flight plan and return to the previous screen. The pending flight plan is not loaded into the system, though the notification message will still remain on the 'Notifications' Screen under the **Connext** Tab for future use.

Touching the **Flight Plan Received** Button previews the pending flight plan while simultaneously adding it to the 'Standby Flight Plan' Screen. The pending flight plan is also automatically added to the 'Flight Plan Catalog' Screen for future use.

Viewing and activating a pending flight plan from a wireless connection:

1) When a flight plan transfer has been initiated from a mobile device, the notification button will change to a flashing **Connext** Button on the Touchscreen Controller, and a Connext annunciation appears on the PFW.
2) Touch the **Connext** Button to see the notification of the pending flight plan on the 'Notifications' Screen.

3) Touch the **Flight Plan Received** Button to preview and add the pending flight plan to the standby flight plan. If there is already a loaded standby flight plan, a pop up window will confirm 'Replace Standby Flight Plan?'. Touch **OK** to continue.

4) The 'Standby Flight Plan' Screen is now shown on the Touchscreen Controller containing the flight plan which was transferred from the mobile device.

5) Load the Standby Flight Plan, or Load and Activate the Standby Flight Plan:

   Touch the **Load Standby** Button. The Standby will replace the Active Flight Plan and vice versa.

   Or:

   Touch **Flight Plan Options** > **Load Standby**. The Standby will replace the Active Flight Plan and vice versa.

   Or:

   a) Touch **Flight Plan Options** > **Load & Activate Standby**. The Standby will replace the Active Flight Plan and vice versa.

   b) To activate, touch the **OK** Button in response to the 'Active Standby Flight Plan < flight plan leg >.' prompt and return to the 'Flight Plan Plan' Screen, or touch the **Cancel** Button.

Stored flight plans may be imported or exported to an SD card. Not all SD cards are compatible with the system. Use only 32 GB cards supplied by Garmin or the aircraft manufacturer.

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) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog > Create New Catalog Flight Plan > Flight Plan Options.**

3) Touch the **Import** Button to display the 'Import Flight Plan' Screen.

4) Touch a Stored Flight Plan Button to display the flight plan information and activate the **Import** Button.

5) Touch the **Import** Button.

6) Touch the **OK** Button to return to the 'Edit Stored Flight Plan' Screen.

If the import fails, a 'Flight Plan Import Failed' message will be displayed. Touch the **OK** Button to return to the 'Edit Stored Flight Plan' Screen.

NOTE: *The imported flight plan will not contain any procedures or airways, and will not have an origin or destination airport.*

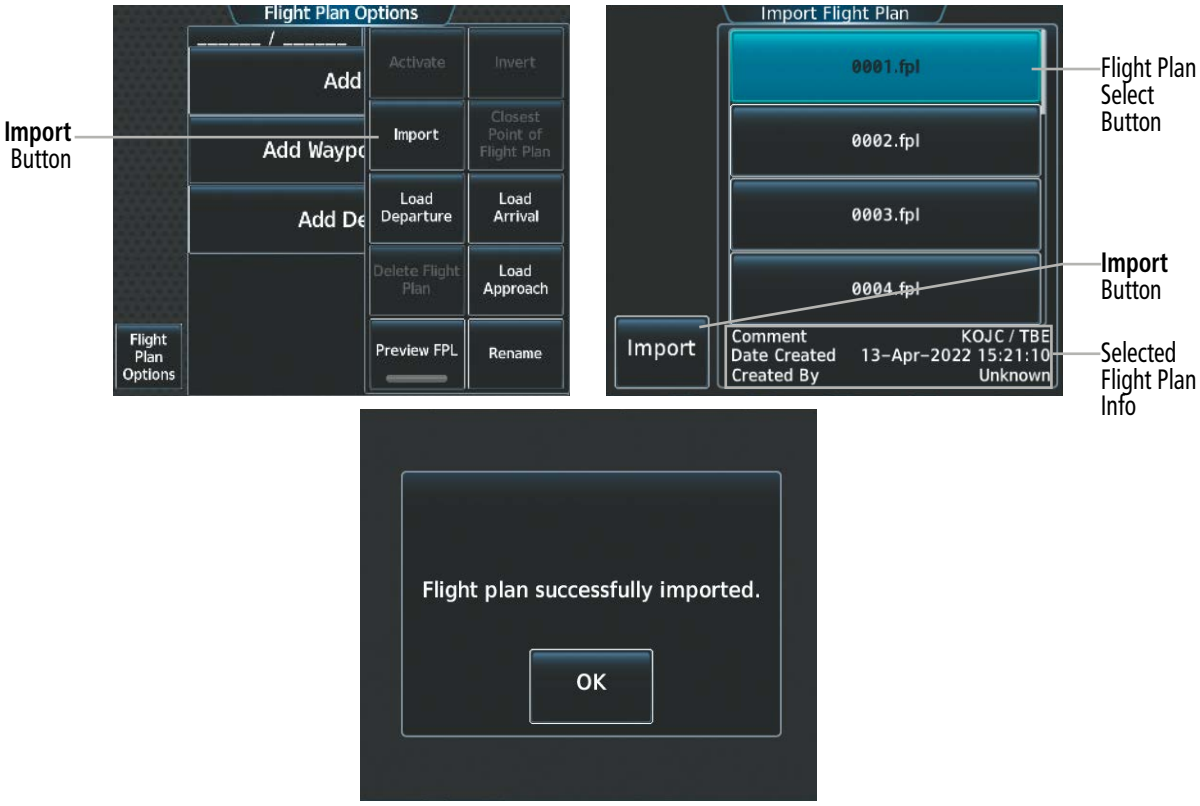


Figure 5-134 Flight Plan Import

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 stored Flight Plan to an SD Card:

1) Insert the SD card for storing the flight plan in the top card slot on the MFD.
2) From MFW Home, touch **Flight Plan > Flight Plan Options**.
3) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
4) Touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
5) Touch the **Export** Button to display the 'Export Flight Plan' Screen.
6) Touch the **File Name:** Button to rename the exported flight plan using the keypad or upper knobs, if necessary.
7) Touch the **Export** Button.
8) Touch the **OK** Button in response to the "Flight Plan Successfully Exported." prompt to return to the 'Flight Plan Options' Window.

NOTE: *The exported flight plan will not contain any procedures or airways. The flight plan origin/destination airport will be exported, but as the first and last waypoint, not the origin and destination.*

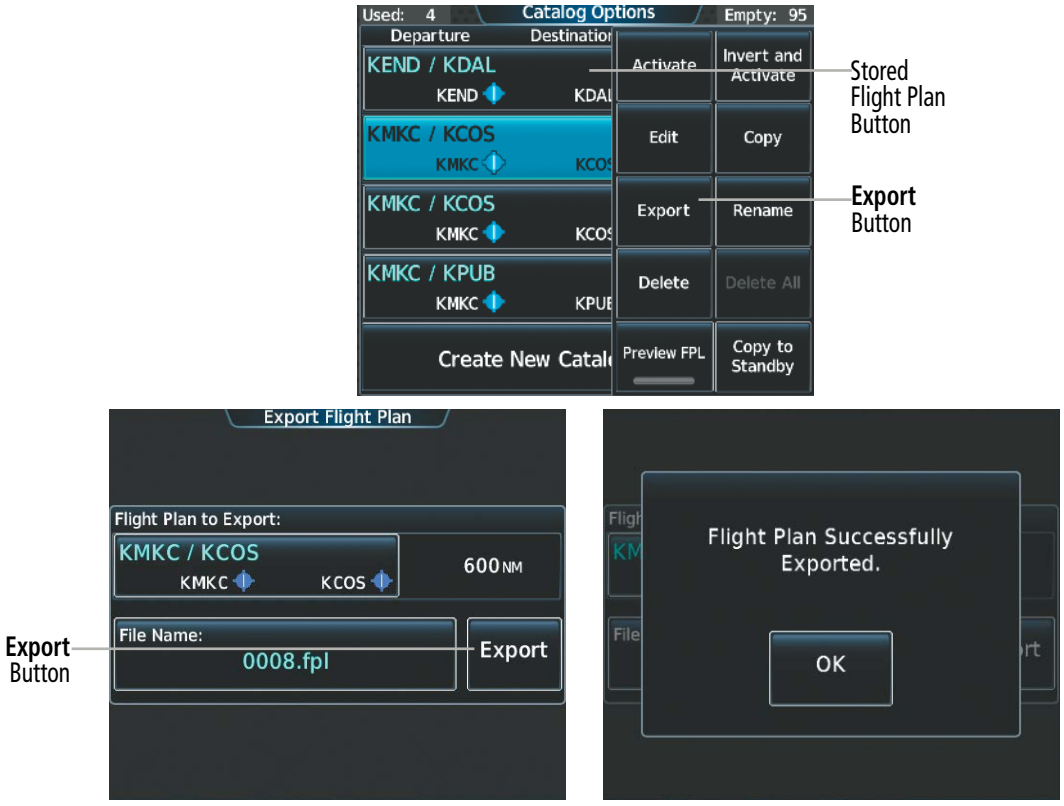


Figure 5-135 Flight Plan Export

If the export fails, a 'Flight Plan Export Failed' message will be displayed. Touch the **OK** Button to return to the 'Flight Plan Catalog' Screen.

In some circumstances, flight plan import or export messages may appear in a pop-up window in conjunction with others.

Flight Plan Import/Export Results	Description
'Flight plan successfully imported.'	A flight plan file stored on the SD card was successfully imported as a stored flight plan.
'File contained user waypoints only. User waypoints imported successfully. No stored flight plan data was modified.'	The file stored on the SD card did not contain a flight plan, only user waypoints. These waypoints have been saved to the system user waypoints. No flight plans stored in the system have been modified.
'No flight plan files found to import.'	The SD card contains no flight plan data.
'Flight plan import failed.'	Flight plan data was not successfully imported from the SD card.
'Flight plan partially imported.'	Some flight plan waypoints were successfully imported from the SD card, however others had errors and were not imported. A partial stored flight plan now exists in the system.
'File contained user waypoints only.'	The file stored on the SD card did not contain a flight plan, only user waypoints. In addition, one or more of these waypoints may not have imported successfully.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.

Flight Plan Import/Export Results	Description
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

Table 5-17 Flight Plan Import/Export Messages

DELETING THE ACTIVE OR STANDBY FLIGHT PLAN

The system allows deleting the active or standby flight plan. Deleting the active flight plan suspends navigation by the system. For information on deleting stored flight plans, see the Stored Flight Plan Functions discussion in this section.

Deleting the active or standby flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan** > **Flight Plan Options**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan** > **Flight Plan Options**.

2) Touch the **Delete Flight Plan** Button.

3) Touch the **OK** Button in response to "Delete all waypoints in flight plan?". The flight plan is deleted. To cancel the request, touch the **Cancel** Button.

STORED FLIGHT PLAN FUNCTIONS

Stored flight plans are listed on the 'Flight Plan Catalog' Screen. Each stored flight plan can be copied to the standby flight plan, and are available for activation (becomes the active flight plan). Up to 99 flight plans with up to 100 waypoints each can be created and stored in memory. If the flight plan memory is full and a flight plan is imported, it will overwrite the last flight plan in the catalog. Details about each stored flight plan can be viewed on the 'Flight Plan Catalog' Screen.

Viewing information about a stored flight plan:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.

2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen. The flight plan information is displayed showing departure, destination, and total distance information for the stored flight plans.

3) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

4) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen to view the waypoints in the stored flight plan.

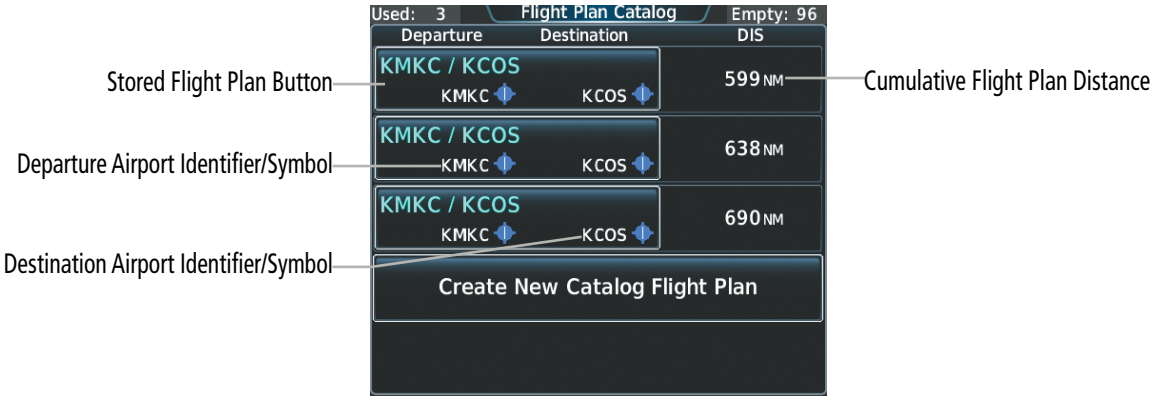


Figure 5-136 'Flight Plan Catalog' Screen

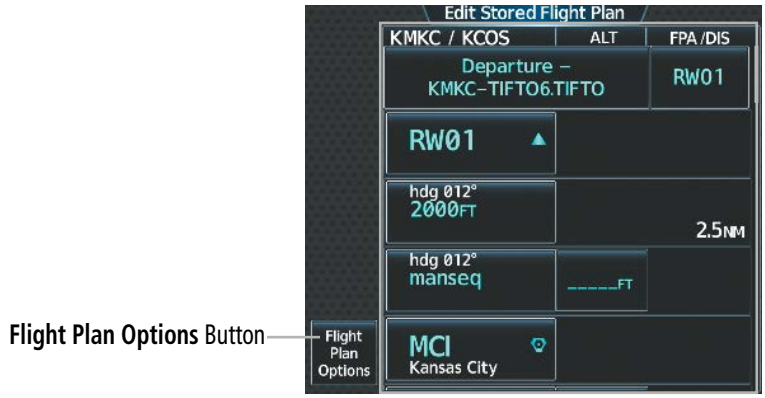


Figure 5-137 'Edit Stored Flight Plan' Screen

Storing a Flight Plan from the Active or Standby Flight Plan

Storing a flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan** > **Flight Plan Options**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan** > **Flight Plan Options**.

2) Touch the **Store** Button.

3) Touch the **OK** Button in response to the question "Store <origin>/<destination> into catalog?".

Activating a Stored Flight Plan

Activating a stored flight plan erases the active flight plan and replaces it with the flight plan being activated. Inverting and activating a stored flight plan reverses the waypoint order, erases the active flight plan, and replaces it with the flight plan being activated (the stored flight plan is not changed).

Activating a stored flight plan:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
3) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
4) Touch the **Activate** Button.
5) Touch the **OK** Button in response to "Activate Selected Flight Plan and Replace Current Active Route?". To cancel the request, touch the **Cancel** Button.

Inverting and activating a stored flight plan:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
3) Scroll the list if necessary and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
4) Touch the **Invert and Activate** Button.
5) Touch the **OK** Button in response to "Invert and Activate Selected Flight Plan and Replace Current Active Route?". The stored flight plan is inverted (all procedures are removed) and becomes the active flight plan. The stored flight plan is not modified. To cancel the request, touch the **Cancel** Button.

Copying a Stored Flight Plan

The system allows copying a stored 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. A stored flight plan can also be copied to the standby flight plan.

Copying a stored flight plan to another flight plan memory slot:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
3) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
4) Touch the **Copy** Button.
5) Touch the **OK** Button in response to "Copy Flight Plan <flight plan name>?". The copied flight plan is placed in the list of stored flight plans. To cancel the request, touch the **Cancel** Button.

Copying a stored flight plan to the standby flight plan:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
3) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
4) Touch the **Copy to Standby** Button. If the standby flight plan is empty, the selected flight plan is copied to the standby flight plan. If there is already a standby flight plan, then a confirmation message is displayed.
5) If necessary, touch the **OK** Button in response to "Copy Selected Flight Plan and Replace Current Standby Flight Plan?". The selected flight plan is copied to the standby flight plan. To cancel the request, touch the **Cancel** Button.

Deleting a Stored Flight Plan

Individual flight plans can be deleted from the system memory.

Deleting a stored flight plan:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
3) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
4) Touch the **Delete** Button.
5) Touch the **OK** Button in response to "Delete Flight Plan <flight plan name>?". The flight plan is deleted, and any flight plans following it in the list are shifted up. To cancel the request, touch the **Cancel** Button.

CHANGING FLIGHT PLAN COMMENTS (NAMES)

The 'Comment' Field (or name) of each flight plan can be changed to something that is useful for identification and sorting.

Storing the active flight plan and changing the comment:

1) For the standby flight plan: From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Store** Button.
3) Touch the **Rename** Button to display the keypad.
4) Use the keypad to select the comment.
5) Touch the **Enter** Button. The comment is changed for the active flight plan, and the 'Store <flight plan comment> into the catalog?' prompt is displayed.
6) Touch the **OK** Button to store the flight plan and return to the 'Active Flight Plan' Screen.

   Or:

   Touch the **Cancel** Button to return to the 'Active Flight Plan' Screen.

Changing a flight plan comment for the standby or stored flight plan:

1) For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan** > **Flight Plan Options**.

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
   b) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
   c) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
2) Touch the **Rename** Button to display the keypad.
3) Use the keypad to select the comment.
4) Touch the **Enter** Button to accept the comment, and return to the flight plan.

5.6 PROCEDURES

The system can access departures, arrivals, and approaches that are stored within the database using the Touchscreen Controller. Selected procedures can be added to the active, standby, or stored flight plan.

The process of loading procedures into the active flight plan and standby flight plan are similar. Waypoints are not required to be in the flight plan to load procedures. When a selected procedure is added to a flight plan, the airfield identifier for that procedure will fill the origin or destination field. If the origin or destination airport (or runway) is already loaded, the procedure selection screen defaults to the appropriate airport.

NOTE: *The origin airport/runway remains when removing a departure; the destination airport/runway remains if after deleting the procedure, there is no longer a procedure at the destination airport. A procedure replaces the respective destination/runway waypoint.*

Whenever an approach, departure, or arrival procedure is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan along with a header line describing the instrument procedure the pilot selected. The original enroute portion of the flight plan remains active (unless an instrument procedure is activated) when the procedure is loaded.

The system adds procedures to the flight plan based on the leg types coded within that procedure in the navigation database. Terminal procedures may contain unique characteristics, such as specifically coded leg segments like '2000FT', which indicates a leg that requires manual termination by the pilot when the specified altitude (2000 feet) has been exceeded. A heading leg in the flight plan displays 'hdg' or '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.

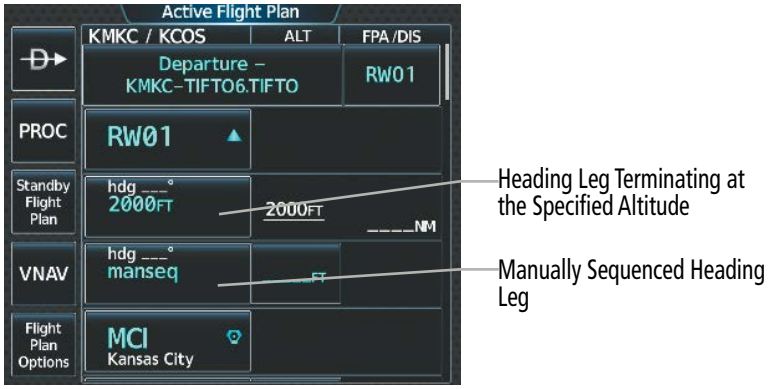


Figure 5-138 Procedure Leg Identifiers

The active flight plan origin and destination airfields and runways will automatically be loaded into the 'Takeoff Data' and 'Landing Data' Screens and Panes for the Takeoff and Landing Assistant (TOLA) feature. The system will prioritize the flight plan destination runway information, to be displayed in TOLA, in the following order (highest priority first):

- 'Approach Selection' Screen, **Landing RWY** Button,
- Approach runway
- Arrival runway.

For more information on takeoff and landing data, reference the TOLA portion of this section.

Viewing available procedures at an airport:

1) From MFW Home, touch **Waypoint Info** > **Airport**.
2) If necessary, touch the Airport Selection Button to display the keypad and use it to select the airport.
3) Touch **Proc** Tab to display the 'Airport Procedures' Screen.
4) Scroll the list if necessary and touch a Procedure Selection Button. The procedure selection screen is displayed on the Touchscreen Controller for the selected procedure.
5) Touch the **Preview** Button, then the **Show on Map** Button to show the procedure on the active display pane or touch the **Show Chart** Button to show the chart instead.
6) Touch the **Cancel** Button to return to the 'Airport Procedures' Screen to view another procedure.
7) Repeat Steps 4 through 6 as necessary.

Loading a procedure into the active flight plan from the 'Airport Information' Screen:

1) From MFW Home, touch **Waypoint Info** > **Airport**.
2) If necessary, touch the Airport Selection Button to display the keypad and use it to select the airport.
3) Touch the **Proc** Tab to display the 'Airport Procedures' Screen.
4) Scroll the list, if necessary, and touch a Procedure Selection Button. The procedure selection screen is displayed on the Touchscreen Controller for the selected procedure.
5) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the procedure on the active display pane or touch the **Show Chart** Button to show the procedure chart instead.
6) Select a different procedure, if desired.
7) Touch the **Load** Button to insert the procedure into the active flight plan.

Loading a procedure into the active flight plan from the 'Nearest Airport' Screen:

1) From MFW Home, touch **Nearest** > **Airport**.
2) If necessary, scroll the list to find the desired airport and touch the Airport Selection Button to display the 'Waypoint Options' Window for the selected airport.
3) Touch the **Airport Info** Button to display the 'Airport Information' Screen.
4) Touch the **Proc** Tab to display the 'Airport Procedures' Screen.
5) Scroll the list, if necessary, and touch a Procedure Selection Button. The procedure selection screen is displayed on the Touchscreen Controller for the selected procedure.
6) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the procedure on the active display pane or touch the **Show Chart** Button to show the procedure chart instead.
7) Select a different procedure, if desired.
8) Touch the **Load** Button to insert the procedure into the active flight plan.

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.*

Removing an entire procedure from a flight plan:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

   b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

   c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Scroll the list if necessary and touch the Departure, Arrival, or Approach Header Button to display the 'Departure Options', 'Arrival Options', or 'Approach Options' Window.

3) Touch the **Remove Departure** Button, the **Remove Arrival** Button, or the **Remove Approach** Button.

4) Touch the **OK** Button in response to "Remove <procedure> – <procedure name> from flight plan?". The procedure is removed. To cancel the request, touch the **Cancel** Button.

DEPARTURES

A Departure can be loaded at any airport that has one available. When loaded, a departure procedure is placed at the origin 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 flight plan, the new departure replaces the previous departure. The departure sequence is defined by selection of a departure, the runway, and transition waypoints.

Loading a departure into the flight plan:

1) For the active flight plan:

   a) From MFW Home, touch **PROC**.

   b) Touch the **Departure** Button to display the 'Departure Selection' Screen.

   Or:

   For the standby flight plan:

   a) From MFW Home, touch **Flight Plan** > **Standby Flight Plan > PROC**.

   b) Touch the **Departure** Button to display the 'Departure Selection' Screen.

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

   b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

   c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.

e) Touch the **Load Departure** Button to display the 'Departure Selection' Screen.

2) To access the 'Select Departure' Screen for the departure airport:

If the desired departure airport is already selected, touch the **Departure** Button. The 'Select Departure' Screen is displayed.

Or:

a) Touch the **Airport** Button.

b) Use the keypad and the **Enter** Button to select the departure airport. The 'Select Departure' Screen is displayed.

3) Scroll the list if needed and touch a Departure Selection Button to select a departure. The 'Select Transition' Screen may open.

4) Scroll the list if needed and available. Touch a Transition Selection Button to select the transition if necessary. The 'Select Runway' Screen will open.

5) Scroll the list if needed and touch a Runway Selection Button to select the runway and return to the 'Departure Selection' Screen.

6) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the departure on the active display pane or touch the **Show Chart** Button to show the departure chart instead.

7) Touch the **Load** Button to insert the departure into the flight plan.

The **Filter by** Button on the 'Departure Selection' Screen changes the selection order between Filter by Departure – selecting the departure first, then showing only the transitions and runways available for that departure; or Filter by Runway – selecting the runway first, then showing only the departures and transitions available for that runway. Any of the buttons can still be selected in any order.

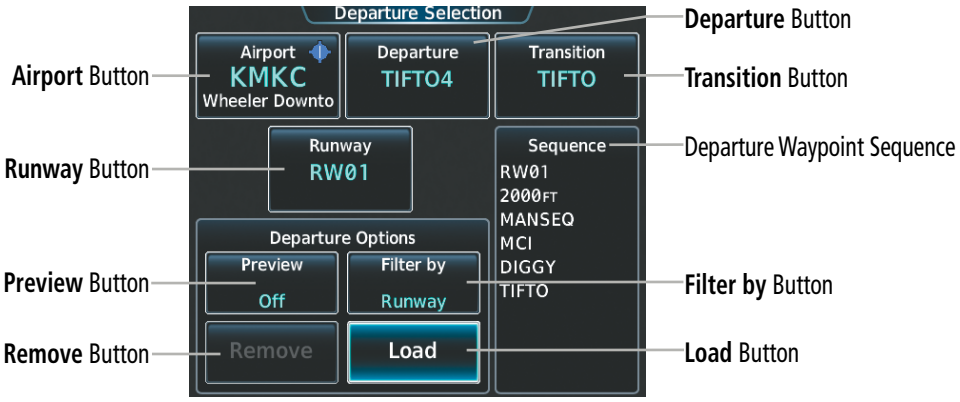


Figure 5-139 Departure Selection

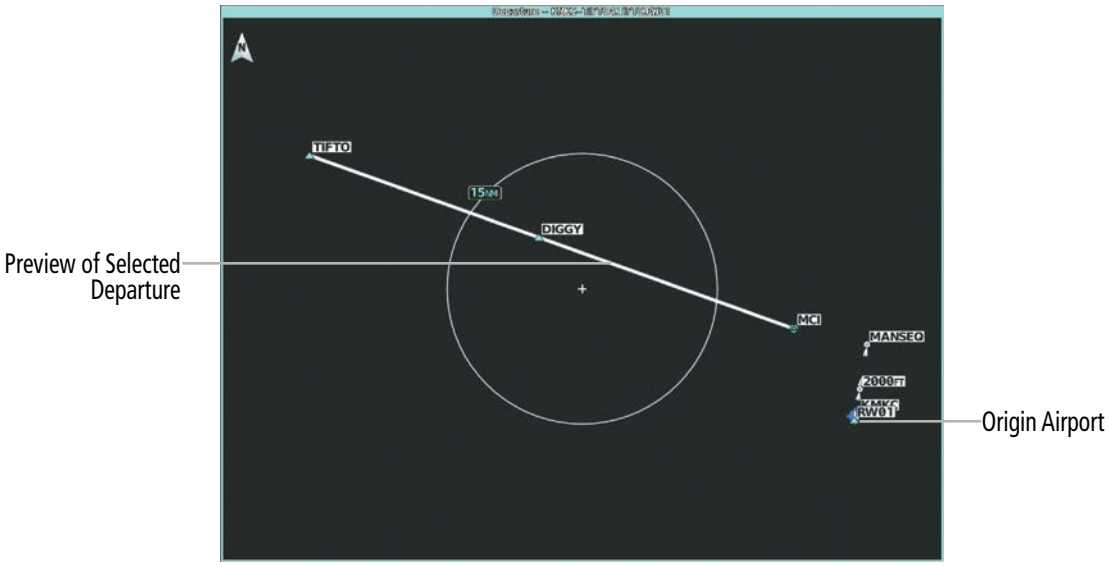


Figure 5-140 Preview of the Selected Departure



Figure 5-141 Loading a Procedure into a Stored Flight Plan – 'Flight Plan Options' Window

When plans change while flying IFR, departures can be easily removed from the flight plan.

Removing a departure from a flight plan:

1) For the active flight plan:

a) From MFW Home, touch **PROC**.

b) Touch the **Departure** Button to display the 'Departure Selection' Screen.

c) Touch the **Remove** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

Or:

a) From MFW Home, touch **Flight Plan**.

b) Touch the Departure Header Button to display the 'Departure Options' Window.

c) Touch the **Remove Departure** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

Or:

For the standby flight plan:

a) From MFW Home, touch **Flight Plan** > **Standby Flight Plan > PROC**.

b) Touch the **Departure** Button to display the 'Departure Selection' Screen.

c) Touch the **Remove** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

Or:

a) From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

b) Touch the Departure Header Button to display the 'Departure Options' Window.

c) Touch the **Remove Departure** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.

e) Touch the **Load Departure** Button to display the 'Departure Selection' Screen.

f) Touch the **Remove** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

2) Touch the **OK** Button. The departure is removed from the flight plan.

Additionally, when a published departure is in any flight plan, the Departure Runway Button will be displayed to simplify potential departure runway changes. Using the Departure Runway Button to change runways will automatically update the flight plan with the new departure procedure waypoints associated with the runway change.

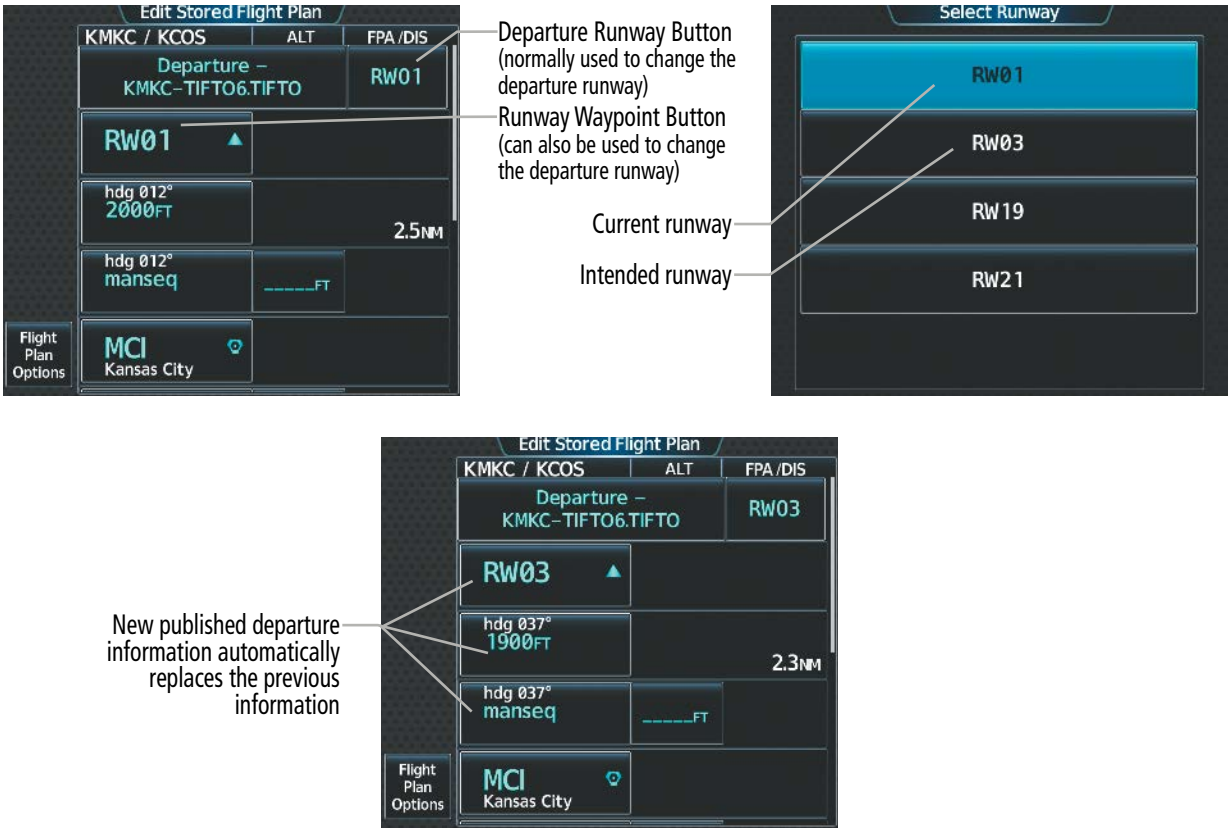


Figure 5-142 Departure Procedure Runway Change

WARNING: *Never touch the Edit Runway Button while holding at a waypoint within a departure or arrival procedure. Doing so will remove the holding pattern from the flight plan, and the aircraft will fly its current heading without flying the remainder of the flight plan.*

Changing the departure runway for a published departure procedure:

1) For the active flight plan:

From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan:

From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Open the 'Select Runway' Screen:

   Touch the Departure Runway Button.

   Or:

   a) Touch the Runway Waypoint Button to display the 'Waypoint Options' Window.

   b) Touch the **Edit RWY** Button to display the 'Select Runway' Screen.

3) Select the new departure runway.

ARRIVALS

A Standard Terminal Arrival can be loaded at any airport that has one available. When loaded, an arrival is placed at the destination airport in the flight plan. 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 flight plan, the new arrival replaces the previous arrival. The arrival sequence is defined by selection of an arrival, the transition waypoints, and a runway.

Loading an arrival into the flight plan:

1) For the active flight plan:

   a) From MFW Home, touch **PROC**.

   b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.

   Or:

   For the standby flight plan:

   a) From MFW Home, touch **Flight Plan** > **Standby Flight Plan > PROC**.

   b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.

   Or:

   For the stored flight plan:

   a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

   b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

   c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

   d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.

   e) Touch the **Load Arrival** Button to display the 'Arrival Selection' Screen.

2) To access the 'Select Arrival' Screen for the arrival airport:

   If the desired arrival airport is already selected, touch the **Arrival** Button. The 'Select Arrival' Screen is displayed.

   Or:

   a) Touch the **Airport** Button.

   b) Use the keypad and the **Enter** Button to select the arrival airport. The 'Select Arrival' Screen is displayed.

3) Scroll the list if needed and touch an Arrival Selection Button to select the arrival. The 'Select Transition' Screen may open.

4) Scroll the list if needed and available. Touch a Transition Selection Button to select the transition. The 'Select Runway' Screen will open.

5) Scroll the list if needed and touch a Runway Selection Button to select the runway and return to the 'Arrival Selection' Screen.

6) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the active display pane or touch the **Show Chart** Button to show the arrival chart instead.

7) Touch the **Load** Button to insert the arrival into the flight plan.

The **Filter by** Button on the 'Arrival Selection' Screen changes the selection order between Filter by Arrival – selecting the arrival first, then showing only the transitions and runways available for that arrival; or Filter by Runway – selecting the runway first, then showing only the arrivals and transitions available for that runway. Any of the buttons can still be selected in any order.

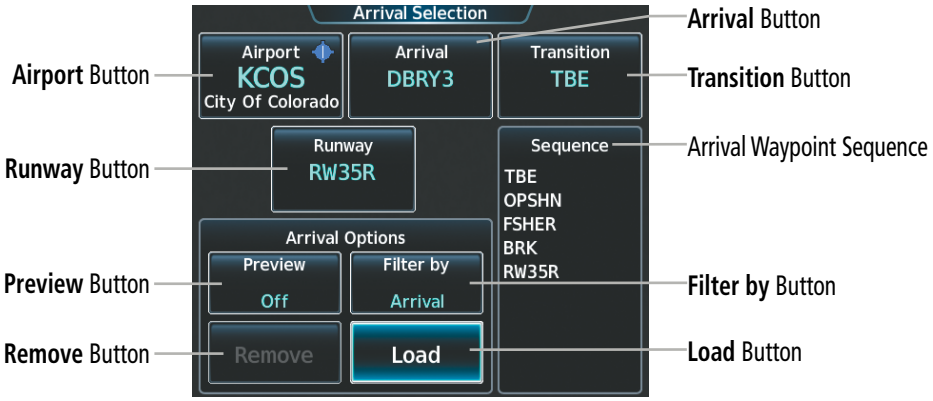


Figure 5-143 Arrival Selection

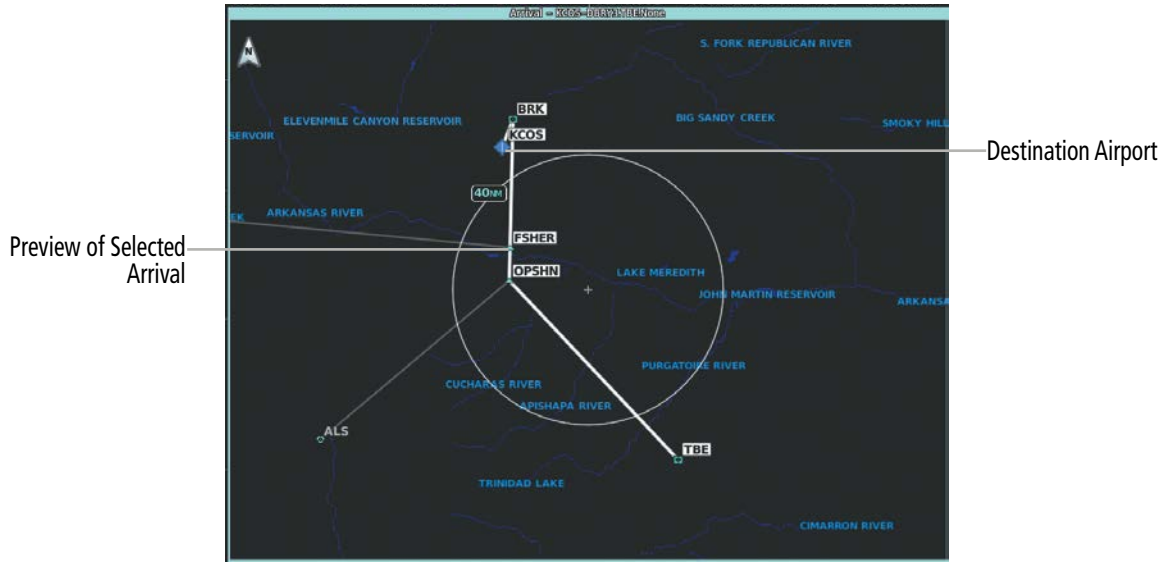


Figure 5-144 Arrival – Preview of the Selected Arrival

Removing an arrival from a flight plan using the Touchscreen Controller:

1) For the active flight plan:

a) From MFW Home, touch **PROC**.

b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.

c) Touch the **Remove** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

Or:

a) From MFW Home, touch **Flight Plan**.

b) Touch the Arrival Header Button to display the 'Arrival Options' Window.

c) Touch the **Remove Arrival** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

Or:

For the standby flight plan:

a) From MFW Home, touch **Flight Plan** > **Standby Flight Plan > PROC**.

b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.

c) Touch the **Remove** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

Or:

a) From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

b) Touch the Arrival Header Button to display the 'Arrival Options' Window.

c) Touch the **Remove Arrival** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.

e) Touch the **Load Arrival** Button to display the 'Arrival Selection' Screen.

f) Touch the **Remove** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

2) Touch the **OK** Button. The arrival is removed from the flight plan.

Additionally, when a published arrival is in any flight plan, the Arrival Runway Button will be displayed to simplify potential arrival runway changes. Using the Arrival Runway Button to change runways will automatically update the flight plan with the new arrival procedure waypoints associated with the runway change.

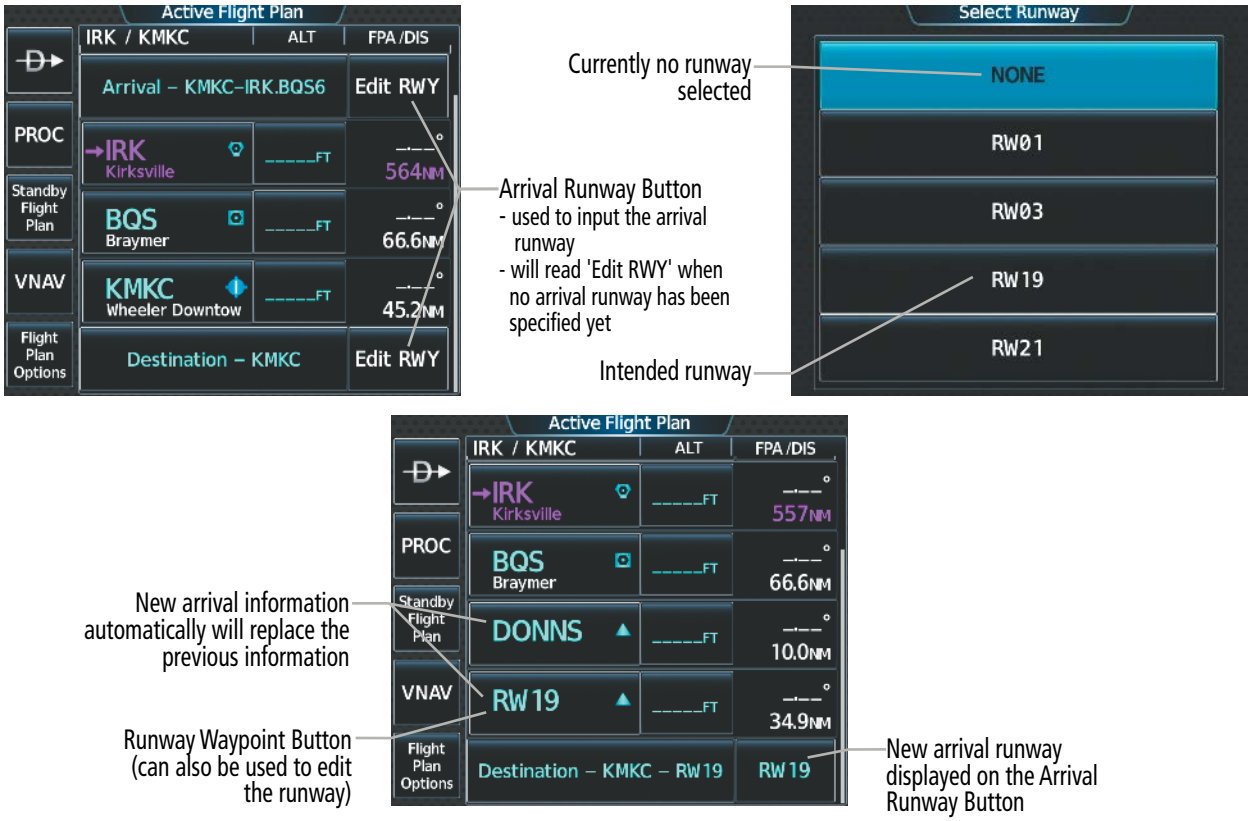


Figure 5-145 Arrival Procedure Runway Change

WARNING: *Never touch the* ***Edit Runway*** *Button while holding at a waypoint within a departure or arrival procedure. Doing so will remove the holding pattern from the flight plan, and the aircraft will fly its current heading without flying the remainder of the flight plan.*

Changing the arrival runway for a published arrival procedure:

1) For the active flight plan:

From MFW Home, touch **Flight Plan**.

Or:

For the standby flight plan:

From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

Or:

For the stored flight plan:

a) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.

2) Display the 'Select Runway' Screen:

Touch the Arrival Runway Button.

Or:

a) Touch the Runway Waypoint Button to display the 'Waypoint Options' Window.

b) Touch the **Edit RWY** Button to display the 'Select Runway' Screen.

3) Touch an arrival runway option.

If an approach was previously loaded that is not compatible with the arrival, the 'Arrival does not service loaded Approach. Edit Approach?' message will be displayed. Touch the **Yes** Button to change the approach. Otherwise, touch the **No** Button.

APPROACHES

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

INSTRUMENT APPROACHES

NOTE: *If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.*

The system provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.

NOTE: *The Baro-VNAV approach feature is a compensated Baro-VNAV system, which automatically uses the static air temperature (SAT) to adjust the approach glidepath. Temperature compensation values entered by the pilot will have no effect on the Baro-VNAV approach glidepath.*

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

Published Approaches using GPS

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

Just as the system supports navigating an airway using GPS, and using GPS instead of DME, the system also supports using GPS as an alternate means of navigation for NAVAID exclusive approaches (not including localizer based approaches).

Refer to the current, pertinent flight manual and regulations for information on alternatively using GPS navigation for NAVAID exclusive approaches.

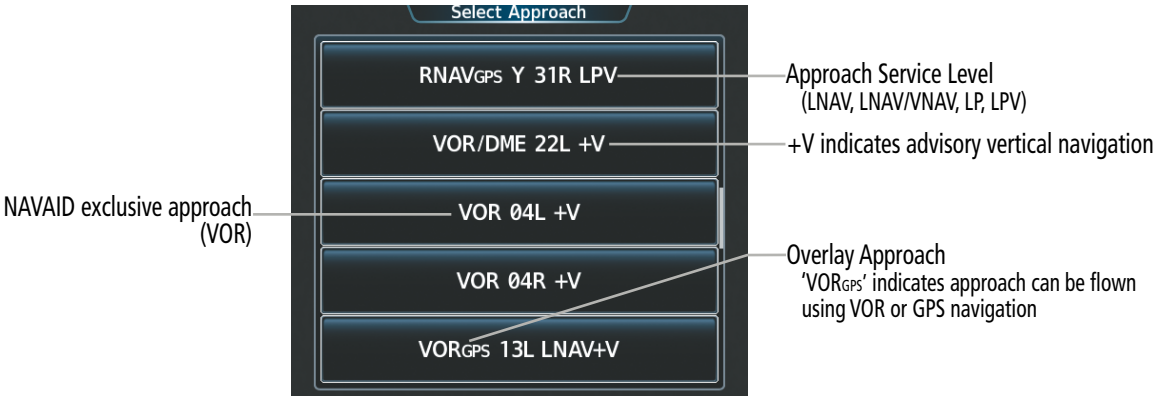


Figure 5-146 Example of Available Approaches with GPS Guidance

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

Approach Service Level
– LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV

Table 5-18 Approach Service Levels

NOTE: *The system requires 30 seconds of valid SBAS integrity monitoring before selecting an approach that requires SBAS vertical guidance.*

NOTE: *To ensure the system does not abort the GPS approach, both GPS receivers should have a VFOM less than 106 feet on the 'GPS Status' Pane before loading a GPS approach.*

The system GPS receivers will use Satellite Based Augmentation (SBAS) when available. Some approaches require the use of SBAS for lateral and/or vertical GPS navigation. However, the system will provide Barometric Vertical Navigation (Baro-VNAV) if SBAS is not available. For information on how lateral and vertical guidance is depicted on the PFD, see the Flight Instruments Section.

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

Approach Service Level	Lateral Navigation Source	Vertical Navigation Source
LNAV/VNAV	GPS	GPS [1] or Baro VNAV [2]
LP	GPS [1]	N/A
LP+V	GPS [1]	GPS [1] (advisory only)
LPV	GPS [1]	GPS [1]

[1] *SBAS required*
[2] *See Approach Downgrade Behavior Table*

Table 5-19 Source of Lateral and Vertical Navigation per Approach Service Level

User Approach Mode Selection

The system will allow modification to the active flight plan GPS approach service level without disabling SBAS. When the **Allow User Approach Mode Select** Button in the Avionics Settings is enabled, the **Approach Mode** Button will be displayed in the 'Approach Selection' Screen. When enabled, the lateral service level and vertical source can be modified. For example, a crew could choose to execute an approach marked LPV as though it were an LNAV+V approach. The service levels and vertical sources available in this selection are limited to those applicable to the approach, and invalid combinations (such as executing an LPV with Baro vertical guidance) are prevented. The Approach Mode default setting is 'Auto'. If the **Auto** Button is enabled, the optimal service level and vertical source will be displayed, as determined by the system for the selected published approach.

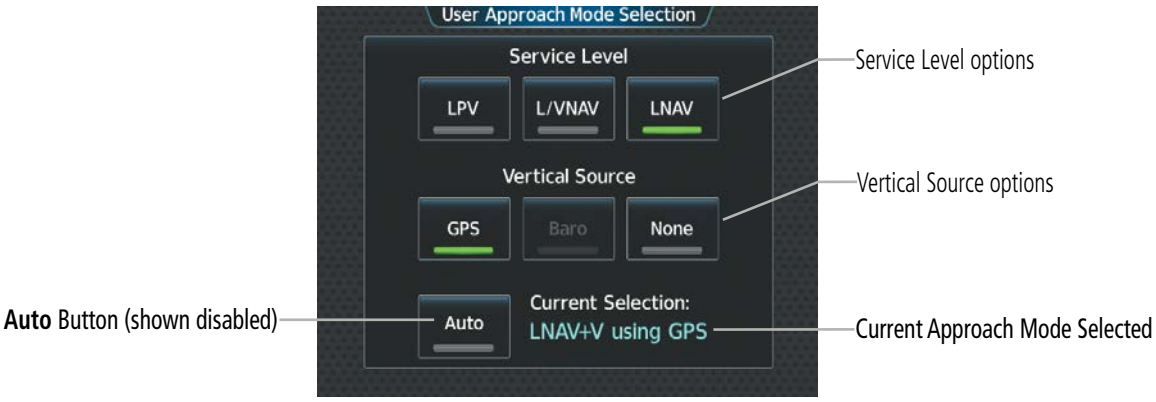


Figure 5-147 User Approach Mode Selection

Enabling/Disabling User Approach Mode Select:

1) From MFW Home, touch **Utilities > Setup > Avionics Settings**.
2) If necessary, touch the **System** Tab.
3) Scroll the list and touch the Allow User Approach Mode Select Button to enable/disable.

Modifying the active flight plan Approach Mode:

1) From MFW Home, touch **PROC > Approach > Approach Mode**.
2) Change the Approach Mode:

   Touch the **Auto** Button to enable automatic mode selection, if necessary. The button annunciator is green when automatic mode selection is enabled.

   Or:

   a) Touch the **Auto** Button to disable automatic mode selection. The button annunciator is gray when automatic mode selection is disabled, and the Service Level buttons and the Vertical Source buttons become selectable.

   b) Touch the desired 'Service Level' Button.

   c) Touch the desired 'Vertical Source' Button

3) Touch the **Enter** Button.

Loss of SBAS

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

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

Approach	SBAS Becomes Unavailable	Description	Action Required	Downgrade
LNAV LNAV+V	Approach phase not specified	SBAS not required. The approach is continued.	None	N/A
LNAV/ VNAV	Before the FAF	HSI displays approach service level in amber; VDI displays 'NO GP'. [2]	Acknowledge message to display Baro VNAV Glidepath	N/A
	At/after the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'.	None	LNAV [1]
LP	More than 1 min to the FAF	HSI displays approach service level in amber;	None	N/A
	Within 1 min to the FAF	HSI displays downgraded approach service level in magenta; CDI is removed. [2]	Acknowledge message to redisplay CDI with LNAV [1]	LNAV [1]
	At/after the FAF	CDI is removed. [2]	Acknowledge ABORT APR message to redisplay CDI	N/A

Approach	SBAS Becomes Unavailable	Description	Action Required	Downgrade
LP+V	More than 1 min to the FAF	HSI displays approach service level in amber; VDI displays 'NO GP'.	None	N/A
	Within 1 min to the FAF	HSI displays downgraded approach service level in amber; CDI is removed. VDI displays 'NO GP'. [2]	Acknowledge message to redisplay CDI with LNAV+V [1] and Baro VNAV Glidepath	LNAV+V [1]
	At/after the FAF	CDI is removed; VDI displays 'NO GP'. [2]	Acknowledge ABORT APR message to redisplay CDI	N/A
LPV	More than 1 min to the FAF	HSI displays approach service level in amber.	None	N/A
	Within 1 min to the FAF	HSI displays downgraded approach service level in amber; VDI displays 'NO GP'. [2]	Acknowledge message to display Baro VNAV Glidepath	LNAV/ VNAV [1]
	At/after the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'.	None	LNAV [1]

[1] *Some approaches may not publish minimums for the downgrade given as an example in this table. The system will select the appropriate downgrade, if available, for each published approach as it is derived from the database. If an appropriate downgrade is not available, the approach should be aborted.*

[2] *System message is generated.*

Table 5-20 Approach Degradation Behavior

Loss of GPS on a Published GPS Approach

If a total loss of GPS positioning occurs while on the final segment of a GPS approach, the approach service level on the HSI will turn amber, the annunciation 'UNABLE RNP' will be displayed on the PFD, and the 'Notifications' Screen will display a system message concerning the loss of GPS. If the aircraft is at or beyond the FAF when the condition occurs, a system message to abort the approach is given. The CDI deviation bar is removed from the HSI and cannot be restored when GPS positioning is unavailable.

Loss of Integrity

When the system is no longer receiving sufficient GPS integrity while on the final segment of a GPS approach, the approach service level on the HSI will turn amber, the annunciation 'GPS LOI' will be displayed on the PFD, and the 'Notifications' Screen will display a system message concerning the loss of GPS. If the aircraft is at or beyond the FAF when the condition occurs, a system message to abort the approach is given and the CDI deviation bar is removed from the HSI. The CDI deviation bar will reappear after acknowledging the system message to abort the approach.

VISUAL APPROACHES

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 transition options, the straight in transition (STRAIGHT) or the Vectors-to-Final transition (VECTORS). An initial waypoint and a final waypoint will be created by the system. The initial waypoint will be 3 nm before the final waypoint, and the final waypoint will default to 5 nm from the selected runway threshold. This distance to the threshold is called the Final Approach Distance, and it can be modified from 1 to 9 nautical miles.

NOTE: *When flying direct-to the final waypoint, the system will suspend (SUSP) leg sequencing if the approach intercept angle exceeds 45 degrees. For visual approaches only, if leg sequencing is subsequently unsuspended, turn anticipation from the final waypoint will be provided.*

NOTE: *When loading a visual approach for a parallel runway, verify the correct approach is selected and loaded into the flight plan. The initial and final waypoints shall correspond to the selected approach, but the appropriate parallel runway identifier is not listed in the waypoint name.*

For visual approaches, the pilot is responsible for avoiding terrain, obstacles and traffic. Therefore, when a visual approach is selected, a window will display, "Advisory Guidance Only", "Obstacle clearance is not provided", and the associated glidepath angle and threshold crossing height. This must be acknowledged before the visual approach can be loaded into the flight plan.



Figure 5-148 Loading a Visual Approach

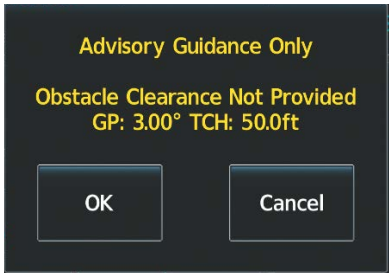


Figure 5-149 Visual Approach Advisory

LOADING AND ACTIVATING AN APPROACH

Whenever an approach is selected, the choice to either 'Load' or 'Activate' is given. 'Load' adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation using 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.

If an approach is loaded, touching the 'Activate Vectors To Final' button will display an extended centerline for the approach segment before the FAF. See the AFCS Section for information on FMS Mode approach guidance.

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

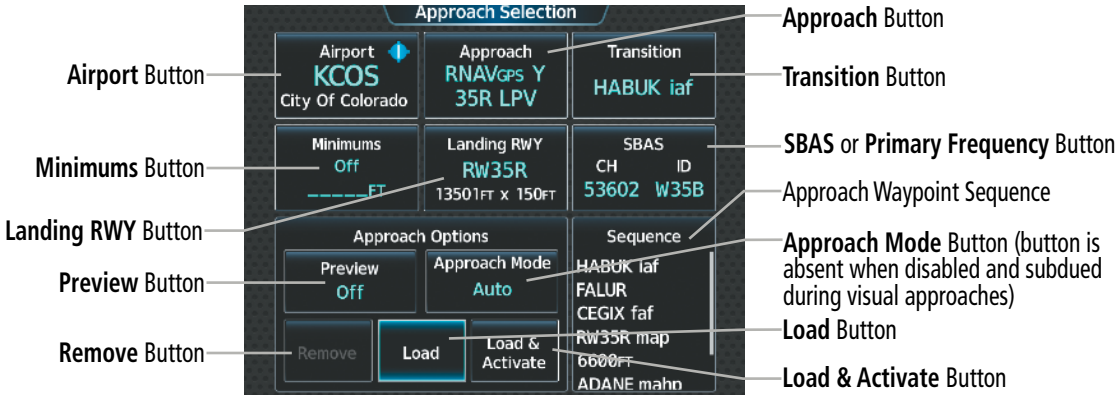


Figure 5-150 Approach Selection

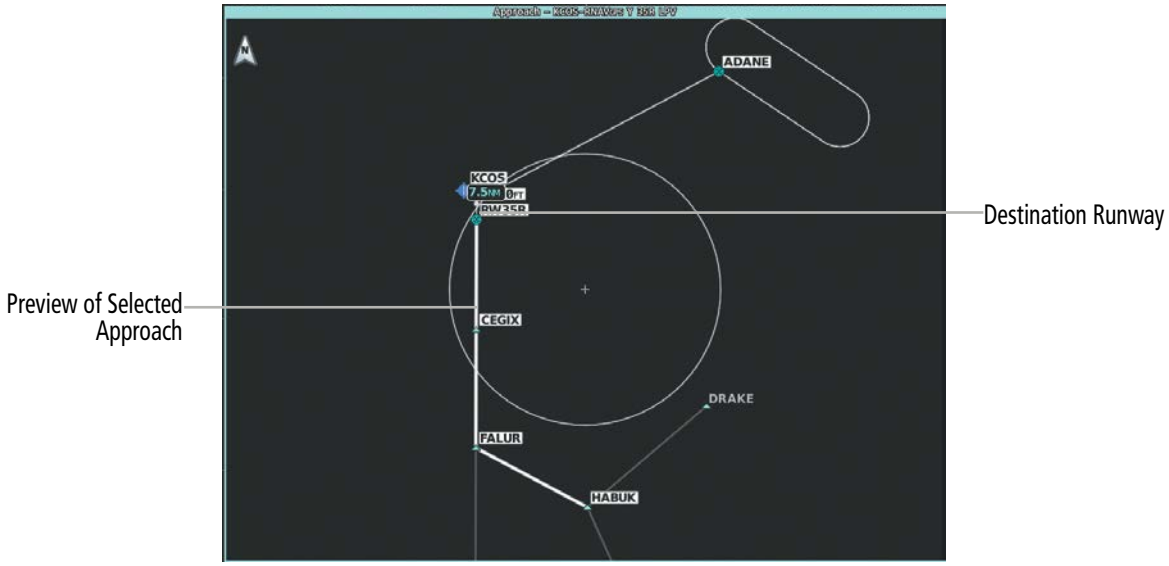


Figure 5-151 Approach – Preview of the Selected Approach



Figure 5-152 Loading an Approach – Setting Minimums

Loading an approach into the active/standby flight plan:

1) For the active flight plan: From MFW Home, touch **PROC**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan** > **PROC**.

2) Touch the **Approach** Button to display the 'Approach Selection' Screen.

3) To select the approach:

   a) If the desired approach airport is already selected, touch the **Approach** Button. The 'Select Approach' Screen is displayed.

   b) Scroll the list, if needed, and touch the desired Approach Selection Button.

   c) The 'Select Transition' Screen is automatically displayed after selecting an approach from the 'Select Approach' Screen. Touch the desired Transition Selection Button to select the transition.

   Or:

   a) Touch the **Airport** Button.

   b) Use the keypad and the **Enter** Button to select the approach airport. The 'Select Approach' Screen is displayed.

   c) Scroll the list, if needed, and touch the desired Approach Selection Button.

   d) The 'Select Transition' Screen is automatically displayed after selecting an approach from the 'Select Approach' Screen. Touch the desired Transition Selection Button to select the transition.

   e) If a visual approach was selected, to change the Final Approach Distance, touch the **Final Approach Distance** Button, then touch the numeric button for the desired distance.

   Or:

   a) If the **SBAS** Button is available, touch the **SBAS** Button to display the keypad and use it to select the SBAS channel number (The SBAS channel Button is only available when an RNAV, GPS, or no approach is selected).

   If the **SBAS** Button is not available, touch the **Approach** Button to display the 'Select Approach' Screen. Scroll as needed and touch the **Select by SBAS Channel** Button to display the keypad, and use it to select the SBAS channel number.

b) Touch the **Enter** Button to accept the SBAS channel and return to the 'Approach Selection' Screen with the airport and approach selected.

c) Touch the **Transition** Button to display the 'Select Transition' Screen.

4) Scroll the list, if needed, and touch a Transition Selection Button to select the transition.

5) To set the minimums, touch the **Minimums** Button to display the 'Minimums' Screen.

a) If Baro is desired, touch the **Minimums** Button to display the 'Minimums Source' Window.

b) Touch the **Baro** Button to select barometric minimums and return to the 'Minimums' Screen.

c) Use the keypad to select the minimums altitude.

d) Touch the **Enter** Button to accept the barometric minimum altitude and return to the 'Approach Selection' Screen.

Or:

a) If temperature compensated minimum is desired, touch the **Minimums** Button to display the 'Minimums Source' Window.

b) Touch the **Temp Comp** Button. The first time temperature compensation is enabled, the 'Destination Temp' Screen is displayed. Use the keypad and the **Enter** Button to select the temperature at the airport. If temperature compensation was previously enabled, the previous entry for destination temperature is automatically entered.

c) Use the keypad to select the minimums altitude.

d) Touch the **Enter** Button to accept the temperature compensated minimums and return to the 'Approach Selection' Screen.

6) To set the landing runway, touch the **Landing RWY** Button to display the 'Select Landing Runway' Screen and touch the desired runway.

7) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the approach on the active display pane or touch the **Show Chart** Button to show the approach chart instead.

8) Select the Approach Mode:

If an RNAV approach was selected and User Approach Mode Selection is enabled, touch the **Approach Mode** Button and change the mode to the desired settings.

9) Touch the **Load** Button to insert the approach into the flight plan.

If a visual approach was selected, an advisory message will appear stating that obstacle clearance is not provided and the approach glidepath and threshold crossing height will also be displayed. Touch the **OK** Button to continue.

NOTE: *If the desired IAF is also an entry waypoint to a hold in lieu of procedure turn, and the option to load the course reversal is accepted, the altitude constraint for this IAF may not be loaded.*

An Approach Procedure can be loaded into a stored flight plan. Only one approach can be loaded at a time in a stored flight plan.

Loading an approach procedure into a stored flight plan:

1) From MFW Home, touch **Flight Plan** > **Flight Plan Options**.
2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
3) Touch a Stored Flight Plan Button to display the 'Catalog Options' Screen.
4) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.
5) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
6) Touch the **Load Approach** Button to display the 'Approach Selection' Screen.
7) Select the airport and approach:
   a) If needed, touch the **Airport** Button to display the keypad and use it to select the approach airport.
   b) Touch the **Enter** Button to accept the approach airport.
   c) If needed, touch the **Approach** Button to display the 'Select Approach' Screen with a list of available approaches.
   d) Scroll the list if needed and touch an Approach Selection Button to select the approach and display the 'Select Transition' Screen.
   e) Scroll the list if needed and touch a Transition Selection Button to select the transition and return to the 'Approach Selection' Screen.
   f) If a visual approach was selected, and it is necessary to change the Final Approach Distance, touch the **Final Approach Distance** Button, then touch the numeric button for the desired distance.

   Or:

   a) If the **SBAS** Button is available , touch the **SBAS** Button to display the keypad and use it to select the SBAS channel number (The **SBAS** channel Button is only available when an RNAV or GPS based approach is selected, or no approach is selected).

   Or:

   If the **SBAS** Button is not available , touch the **Approach** Button to display the 'Select Approach' Screen. Scroll as needed and touch the **Select by SBAS Channel** Button to display the keypad, and use it to select the SBAS channel number.

   b) Touch the **Enter** Button to accept the SBAS channel and return to the 'Approach Selection' Screen with the airport and approach selected.
   c) Touch the **Transition** Button to display the 'Select Transition' Screen with a list of available transitions.
   d) Scroll the list if needed and touch a Transition Selection Button to select the transition and return to the 'Approach Selection' Screen.
8) To set the landing runway, touch the **Landing RWY** Button to display the 'Select Landing Runway' Screen and touch the desired runway.
9) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the approach on the active display pane or touch the **Show Chart** Button to show the approach chart instead.
10) Touch the **Load** Button to insert the approach into the stored flight plan.

*NOTE: The **SBAS** button may change its name and functionality to read 'Primary Frequency' and no longer function as a button. This depends upon the type of approach selected. When displaying as a primary frequency, it is advisory only, and not necessarily what is loaded into the system.*



Figure 5-153 Stored Flight Plan – Approach Inserted

"Activate Approach" creates a direct path to the first approach waypoint. The approach mode will not become active until the first leg of the approach becomes active. A previously loaded approach can be activated from the 'Procedures' Screen or the 'Active Flight Plan' Screen on the Touchscreen Controller.

Activating a previously loaded approach:

1) From MFW Home, touch **PROC**.
2) Touch the **Activate Approach** Button to activate the approach.

Or:

1) From MFW Home, touch **Flight Plan**.
2) Touch the Approach Header Button to display the 'Approach Options' Window.
3) Touch the **Activate Approach** Button to activate the approach.

In many cases, it may be easiest to "load" the full approach while still some distance away, enroute to the destination airport. Later, if vectored to final, activate Vectors To Final, which makes the inbound course to the FAF waypoint active.

Activating a previously loaded approach with vectors to final:

1) From MFW Home, touch **PROC**.
2) Touch the **Activate Vectors To Final** Button to activate vectors to final.

Or:

1) From MFW Home, touch **Flight Plan**.
2) Touch the Approach Header Button to display the 'Approach Options' Window.
3) Touch the **Activate Vectors To Final** Button to activate vectors to final.

REMOVING AN APPROACH

Removing an approach from the active/standby flight plan:

1) For the active flight plan: From MFW Home, touch **PROC**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan** > **PROC**.

2) Touch the **Approach** Button to display the 'Approach Selection' Screen.
3) Touch the **Remove** Button. A 'Remove approach <approach> from flight plan?' Window is displayed.
4) Touch the **OK** Button. The approach is removed from the active flight plan. To cancel the request, touch the **Cancel** Button.

   Or:

1) For the active flight plan: From MFW Home, touch **Flight Plan**.

   Or:

   For the standby flight plan: From MFW Home, touch **Flight Plan** > **Standby Flight Plan**.

2) Touch the Approach Header Button to display the 'Approach Options' Screen.
3) Touch the **Remove Approach** Button. A 'Remove Approach – <approach> from flight plan?' Window is displayed.
4) Touch the **OK** Button. The approach is removed from the active flight plan. To cancel the request, touch the **Cancel** Button.

Removing an approach from a stored flight plan:

1) From MFW Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.
2) Scroll the list if needed and touch a Stored Flight Plan Button to display the 'Catalog Options' Window.
3) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.
4) Select the approach to remove:
   a) Touch the Approach Header Button to display the 'Approach Options' Window.
   b) Touch the **Remove Approach** Button. A 'Remove Approach – <approach identifier> from flight plan?' Window is displayed.

      Or:

   a) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
   b) Touch the **Load Approach** Button to display the 'Approach Selection' Screen.
   c) Touch the **Remove** Button. A 'Remove Approach – <approach identifier> from flight plan?' Window is displayed.
5) Touch the **OK** Button. The approach is removed from the stored flight plan. To cancel the request, touch the **Cancel** Button.

MISSED APPROACH

NOTE: *When flying an approach leg to the FAF and the missed approach has been activated, manually changing any portion of the flight plan may deactivate the missed approach.*

The system is capable of providing guidance for the approach as well as the missed approach. Once the missed approach is activated, RNP 0.3 will be displayed on the HSI next to the CDI. If the missed approach is activated before the Missed Approach Point (MAP), waypoint sequencing will continue along the approach to the missed approach. If the missed approach is not activated before the MAP, the system will enter SUSP Mode once the aircraft crosses the MAP until the missed approach is activated or SUSP Mode is disabled. See the Flight Instruments, Course Deviation Indicator Section for more information on SUSP Mode.

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



Figure 5-154 Activating a Missed Approach on the Touchscreen Controller

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



Figure 5-155 Course to Altitude

Activating a missed approach in the active flight plan:

Press the Go-Around Button. The system begins automatic sequencing through the missed approach waypoints to the MAHP. See the AFCS Section for more details.

Or:

Fly past the MAP and touch the **SUSP** Button on the PFW Home Screen or press the **SUSP** Softkey on the PFW.

Or:

1) From MFW Home, touch **PROC**.
2) Touch the **Activate Missed Approach** Button to activate the missed approach. The system begins automatic sequencing through the missed approach waypoints to the MAHP. (The **Activate Missed Approach** Button is available after the leg to the FAF becomes active and GPS is the active NAV source on the PFW.)

Or:

1) From MFW Home, touch **Flight Plan**.
2) Touch the Approach Header Button to display the 'Approach Options' Window.
3) Touch the **Activate Missed Approach** Button to activate the missed approach. The system begins automatic sequencing through the missed approach waypoints to the MAHP. (The **Activate Missed Approach** Button is available after the leg to the FAF becomes active and GPS is the active NAV source on the PFW.)

TRANSITION TO APPROACH FUNCTION

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

TEMPERATURE COMPENSATION

Temperature Compensation for approach altitudes

If desired, the system can calculate temperature compensation for waypoint crossing altitudes loaded as part of an approach procedure. The pilot must manually enable temperature compensation and then enter the destination airport temperature. The system adjusts the altitudes accordingly, and the snowflake icon is displayed next to those altitudes. By default, these altitudes are displayed in MSL values. When a temperature compensated approach altitude (shown in MSL) is higher than the Transition Level but is not shown in FL, a system message is generated.

NOTE: *The use of temperature compensated altitudes outside the final approach segment will be coordinated with ATC.*

Manually enabling/disabling temperature compensation for approach waypoint altitudes:

1) From MFW Home, touch **Flight Plan > Flight Plan Options**.
2) Touch the **APPR WPT TEMP COMP** Button to display the 'Temp Compensation' Screen.
3) Touch the **Temp Compensation** Annunciator Button to enable/disable temperature compensation.

4) The first time temperature compensation is enabled, the 'Destination Temp' Screen is displayed. Use the keypad and the **Enter** Button to select the temperature at the airport. Touch the **Back** Button to return to the 'Temp Compensation' Screen. If temperature compensation was previously enabled, the previous entry for destination temperature is automatically entered.

5) To edit the airport temperature, touch the **Temp at Dest** Button and use the keypad and the **Enter** Button to select the temperature at the airport.

NOTE: *Activating/canceling temperature compensation for the loaded approach altitudes does not select/deselect temperature compensated minimums (MDA/DH), nor does selecting/deselecting temperature compensated minimums activate/cancel temperature compensated approach altitudes.*

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

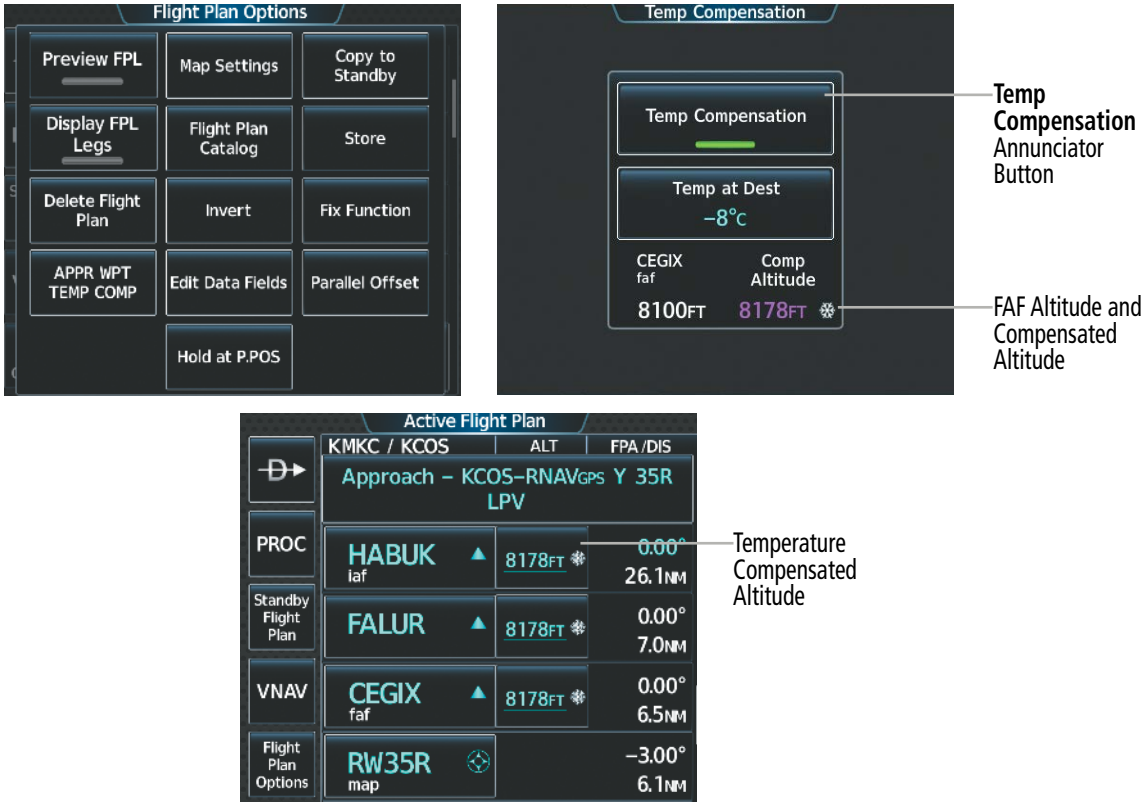


Figure 5-156 Temperature Compensation for Approach Waypoints

Temperature Compensation for Approach Minimums

Temperature compensated minimums can be entered for the approach. Once this is entered on the touchscreen controller, the altitude is also displayed on the PFW.

Entering a temperature compensated minimum into an approach:

1) From MFW Home, touch **PROC** > **Approach** to display the 'Approach Selection' Screen.

   Or:

   a) From MFW Home, touch **Flight Plan**.

   b) Touch the Approach Header Button to display the 'Approach Options' Window.

   c) Touch the **Edit Approach** Button to display the 'Approach Selection' Screen.

2) Touch the **Minimums** Button to display the 'Minimums' Screen.

3) Touch the **Minimums** Button to display the 'Minimums Source' Window.

4) Touch the **Temp Comp** Button. If necessary, use the keypad and touch the **ENT** Button to enter the destination airport temperature. If temperature compensation was previously enabled, the previous entry for destination temperature is automatically entered.

5) If not already entered, use the keypad to select the minimums altitude.

6) Touch the **Enter** Button to return to the 'Approach Selection' Screen.



Touchscreen Controller – 'Approach Selection' Screen

PFW – COMP MIN Shown

Figure 5-157 Entering Temp Comp Minimums on the Touchscreen Controller

5.7 WEIGHT AND BALANCE

WEIGHT AND BALANCE PLANNING

The system includes a weight and balance planning function. The weight and balance planning function allows the pilot to enter operating weight, aircraft loading, and fuel data, which is used with the active flight plan to estimate takeoff weight and current weight. Furthermore, the system provides a graphical representation of weight and balance data on the MFD.

The 'Station vs Weight' Box displays a visual representation of the aircraft's center of gravity (CG) from takeoff plus the remaining fuel burn. The takeoff CG icon is represented as a triangle, current CG as a diamond, and fuel burn as a graphical line. All that lie within the white bordered polygon, are considered to be within the weight balance parameters and, therefore, are colored green.

Weight and balance data may be retained across power cycles when defined within a crew profile. For more information on crew profiles, see the System Overview Section.

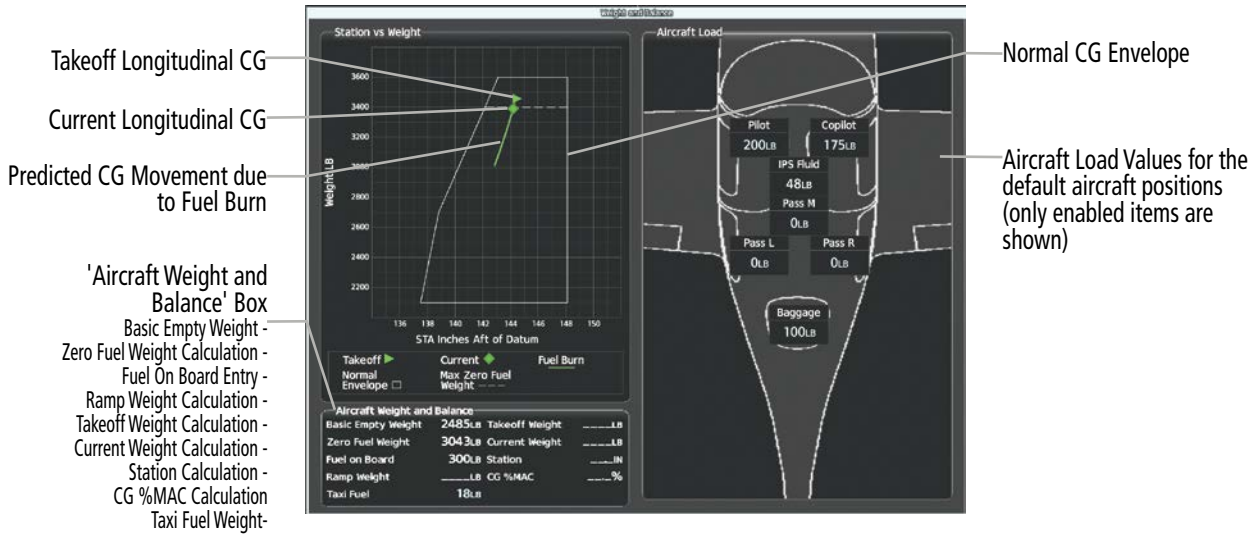


Figure 5-158 'Weight & Balance' Pane in Full Mode

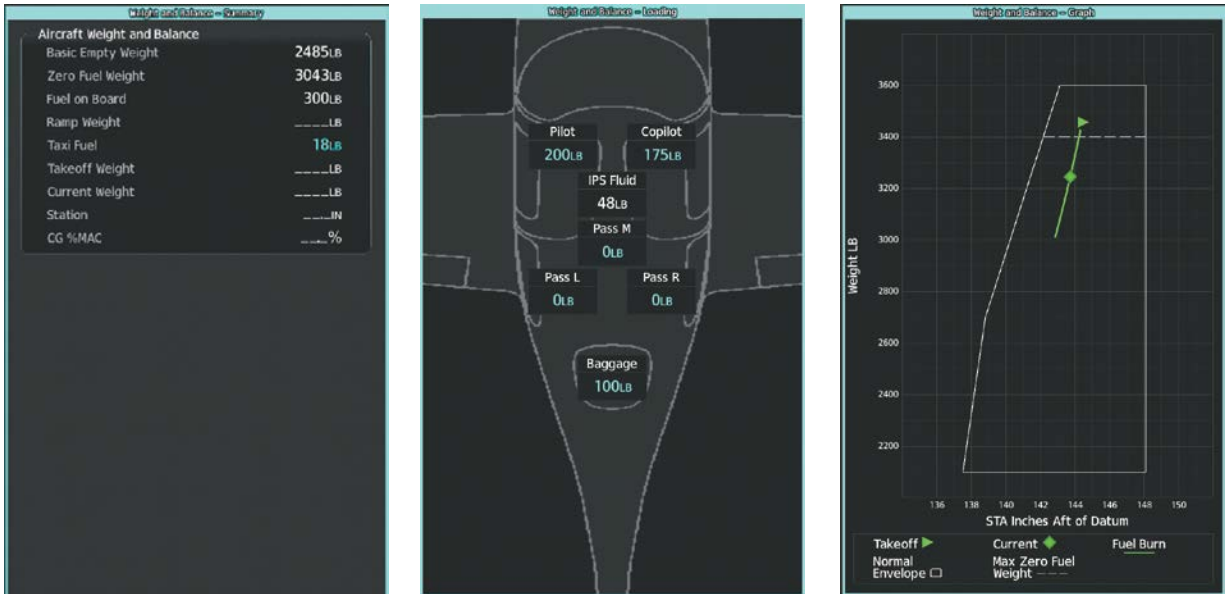


Figure 5-159 'Weight and Balance Pane' - Display Types in Half Mode

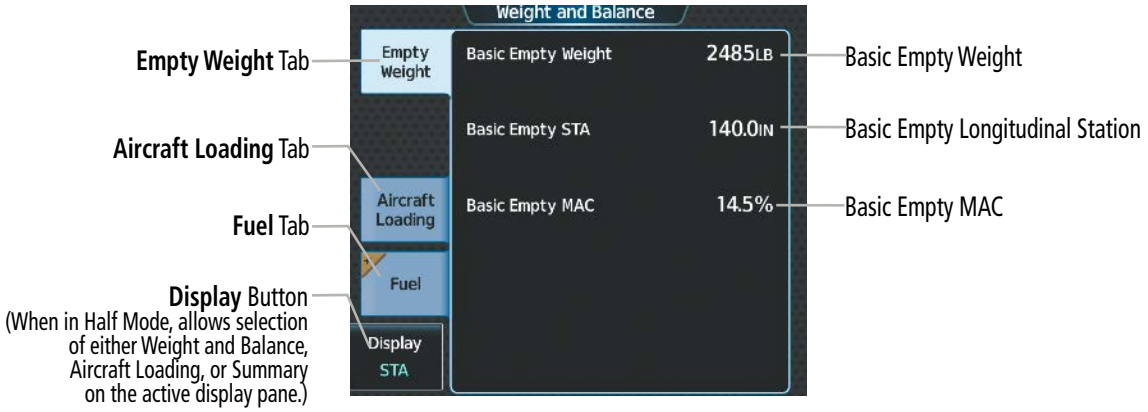


Figure 5-160 Weight and Balance - Empty Weight Tab

Selecting the Weight and Balance Display Type:

1) From MFW Home, touch **PERF** > **Weight and Balance**.
2) Display the full pane or the desired half pane:

   To view the full pan, if necessary, touch the **Full** Button to display a full sized display pane showing the Station vs. Weight Box, 'Aircraft Weight and Balance' Box, and 'Aircraft Load' Box.

   Or:

   a) To view a half pane, touch the **Half** Button on the Button Bar, if required.

   b) Touch the **Display** Button to display the 'Select Display Type' Window.

   c) Touch the button corresponding to the desired display type.

CALCULATIONS

The 'Aircraft Weight and Balance' Box contains several calculations calculations using the following formulas:

- 'Basic Empty Weight' is calculated by summing the weights of the airframe/engine, fixed equipment, unusable fuel, full oil and other items necessary for flight.
- 'Operating Empty Weight' (not shown in the system) is calculated by summing the Basic Empty weight, crew, crew baggage, items used by the crew, and the Icing Protection System fluid.
- 'Zero Fuel Weight' = Operating Empty Weight + Aircraft Load (Passengers + Baggage)
- 'Fuel on Board' = Weight in pounds using the **FOB SYNC** Button (current fuel remaining) or by manually entering the initial fuel on board using the **Initial Fuel** Button on the 'Initial Fuel' Screen.
- 'Ramp Weight' = Zero fuel weight + Fuel on Board weight
- 'Takeoff Weight' = Ramp Weight - 9 lbs
- 'Gross Weight' (Current Weight) = Zero Fuel Weight + Fuel on Board (synchronized with fuel burn throughout flight)
- 'Taxi Fuel' = User allotted taxi fuel allowance (lbs).

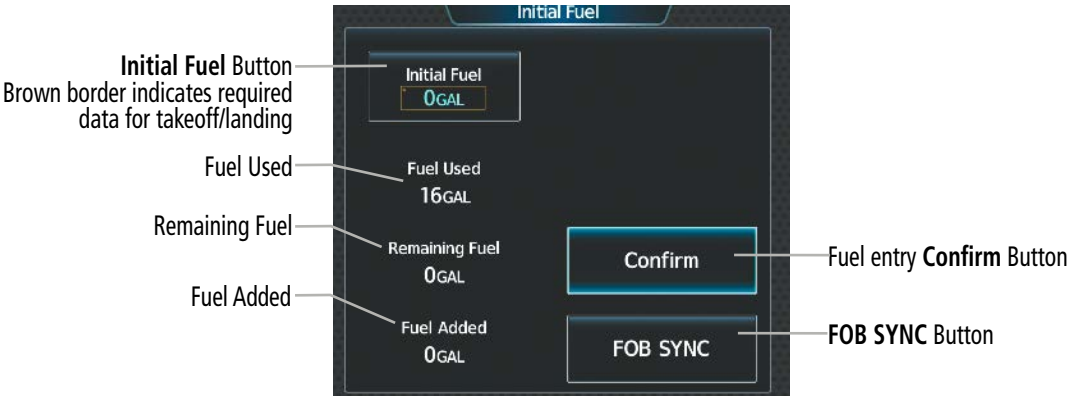


Figure 5-161 Weight and Balance - Fuel Entry

LOAD AND FUEL

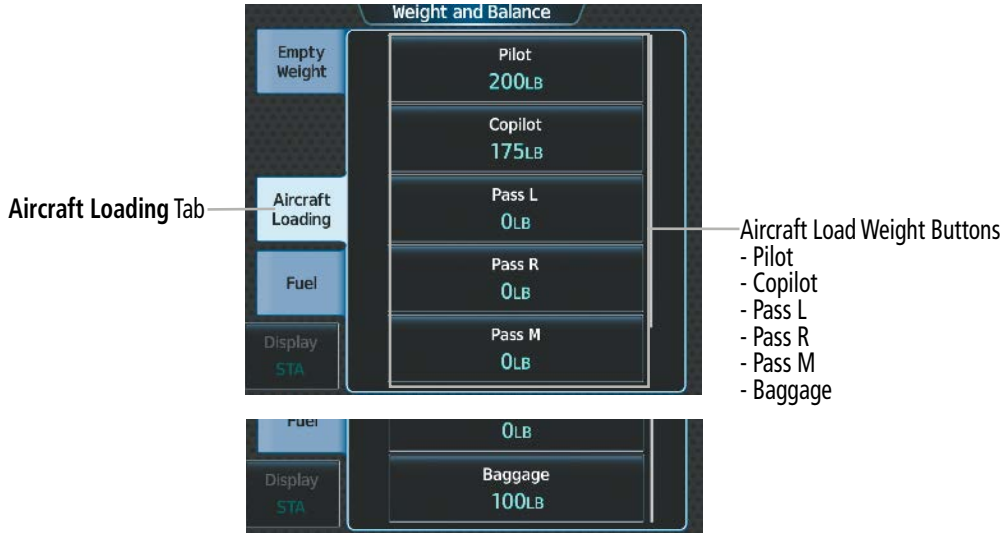


Figure 5-162 Weight and Balance - Aircraft Loading Tab

Entering the aircraft load weights:

1) From MFW Home, touch **PERF** > **Weight and Balance**.
2) Touch the **Aircraft Loading** Tab to display the aircraft load weight buttons.
3) Touch an aircraft load weight button to display the keypad.
4) Use the keypad to enter the item weight.
5) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Balance' Screen.
6) Repeat steps 3 - 5 as necessary.

Both the fuel on board and current weight shown on the 'Weight and Balance - Summary' Pan decrease as fuel is burned.

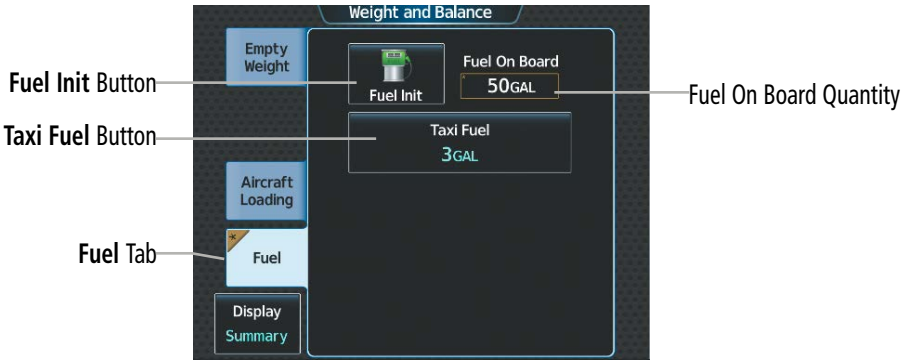


Figure 5-163 Weight and Balance - Fuel Tab

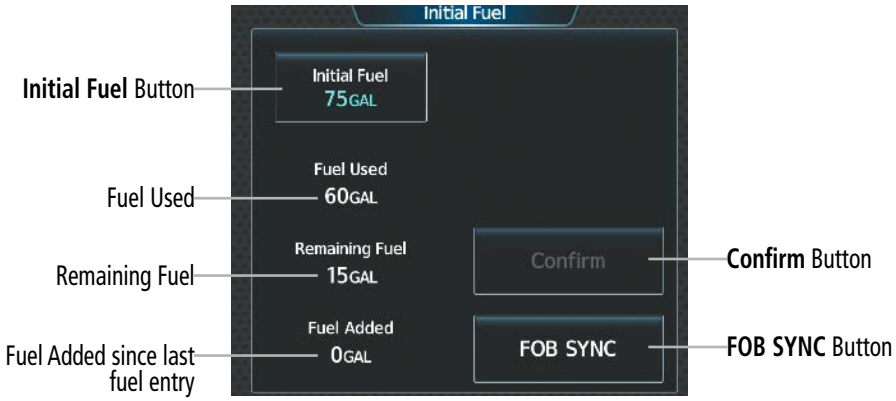


Figure 5-164 Initial Fuel

Entering the fuel on board quantity:

1) From MFW Home, touch **PERF** > **Weight and Balance**.
2) Touch the **Fuel** Tab to display the fuel entry buttons.
3) Touch the **Fuel Init** Button to display the 'Initial Fuel' Screen.
4) Touch the **Initial Fuel** Button to display the 'Set Initial Gallons' Screen.
5) Use the keypad to enter the item quantity.
6) Touch the **Enter** Button to accept the entry, and return to the 'Initial Fuel' Screen.
7) Touch the **Confirm** Button to use the value for fuel calculations.

Or:

1) From MFW Home, touch **PERF** > **Weight and Balance**.
2) Touch the **Fuel** Tab to display the fuel entry buttons.
3) Touch the **Fuel Init** Button to display the 'Initial Fuel' Screen.
4) Touch the **FOB SYNC** Button. The fuel on board quantity is set to the current measured fuel.
5) Touch the **Confirm** Button to use the value for fuel calculations.

Entering the taxi fuel quantity:

1) From MFW Home, touch **PERF** > **Weight and Balance**.
2) Touch the **Fuel** Tab to display the fuel entry buttons.
3) Touch the **Taxi Fuel** Button to display the entry keypad.
4) Use keypad to enter desired fuel allotment for taxi.

WEIGHT AND BALANCE CAUTION AND WARNING CONDITIONS

If the Zero Fuel Weight, Current Weight, Station, or CG %MAC is outside limitations, then the respective value will be displayed in amber.

If the Station value is outside the specified envelope, then the value is displayed in amber and 'CURRENT LOADING OUTSIDE DISPLAY AREA' is displayed on the weight and balance graph.

5.8 GENERAL PERFORMANCE AND TRIP PLANNING

This section shall discuss general performance data, selecting a wind and temperature datalink weather source, and using the Trip Planning feature. Flight plan constraints, VNAV guidance, flight planning, weight and balance planning are discussed previously in this Flight Management Section. Speed bugs are discussed previously in the Flight Instrument Section.

General performance data such as endurance, estimated time enroute, and fuel over destination (shown in the MFW Navigation Data Bar and Flight Plan Data Fields) is estimated based on flight plan information, weight, fuel data, and wind/temperature data.

DATALINK WEATHER FOR PERFORMANCE ESTIMATES

General performance data will take wind and temperature data into account when predicting time and fuel. If available, observed wind and temperature values for flight plan waypoints may be derived from the selected datalink weather source.

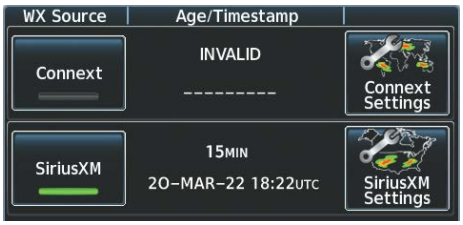


Figure 5-165 Performance Wind and Temperature Datalink Source

Changing the datalink wind and temperature source setting for general performance data:

1) From MFW Home, touch **PERF > Datalink WX PERF.**
2) A window is displayed showing the available datalink wind and temperature sources. Touch the button for the desired datalink source.

TRIP PLANNING

The trip planning function allows the pilot to view trip statistics, fuel statistics, and other statistics for a specified flight plan or for a flight plan leg. The statistics can be based on automatic data, or based on manually entered data. A brown asterisk with a brown bordered field indicates the minimum required manual input required to calculate trip planning statistics.

All of the input of data needed for calculation and viewing of the statistics is done on the 'Trip Planning' Screen on the Touchscreen Controller.



Figure 5-166 'Trip Planning' Screen – Automatic Mode



Figure 5-167 'Trip Planning' Screen – Minimum required information for Manual Entry

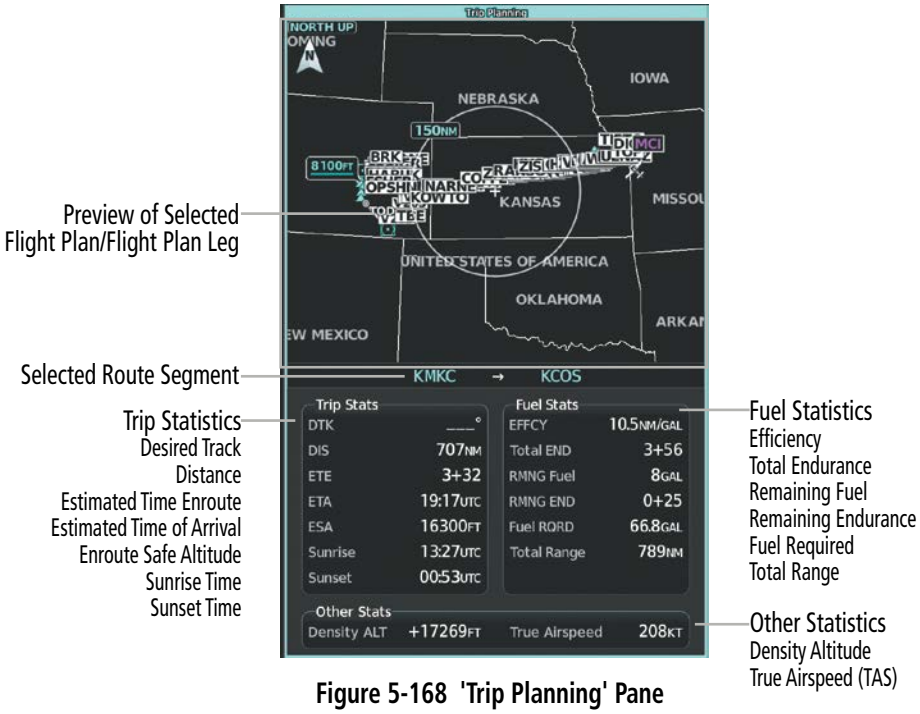


Figure 5-168 'Trip Planning' Pane

The trip planning inputs are based on sensor inputs (automatic mode) or on pilot inputs (manual entry mode). Some additional explanation of the sources for some of the inputs is as follows:

- Departure time (Depart 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 (Cal Airspeed) – The primary source is from the air data system, and the secondary source of information is GPS ground speed.
- Indicated altitude (Indicated Alt) – 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 trip route selected and the trip planning inputs.

Trip Route Mode	Trip Route Button	Description
Stored Flight Plan – Cumulative Mode		Waypoints are the starting and ending waypoints of the selected flight plan.
Stored Flight Plan – Leg Mode		Waypoints are the endpoints of the selected leg.
Active Flight Plan – Remaining Mode		The 'from' waypoint is the present position of the aircraft or a selected waypoint, and the 'to' waypoint is the endpoint of the active flight plan.
Active Flight Plan – Leg Mode		The 'from' waypoint is the present position of the aircraft or a selected waypoint, and the 'to' waypoint is the endpoint of the selected leg
Waypoint Mode		Manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

Table 5-21 Trip Route Button Functionality

Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

» Desired Track (DTK) – DTK is shown as nnn° and is the desired track between the selected waypoints. It is dashed unless only a single leg is selected.

» Distance (DIS) – 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 stored flight plan is selected it shows the ETA by adding to the departure time all of the ETEs of the legs up to 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)

» Destination sunrise and sunset times – 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 (EFFCY) – This value is calculated by dividing the current ground speed by the current fuel flow.

» Time of fuel endurance (Total END) – 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 (RMNG 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 (RMNG END) – 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 RQRD) – 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 (Density ALT)
» True airspeed

Selecting the Stored Flight Plan – Cumulative trip route mode:

1) From MFW Home, touch **Utilities > Trip Planning.**
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Screen.
4) Scroll the list, if necessary, and touch a stored flight plan button to display the 'Select Flight Plan Leg' Screen.
5) Touch the **Cumulative Flight Plan** Button to select the mode and return to the 'Trip Planning' Screen.

Selecting the Stored Flight Plan – Leg trip route mode:

1) From MFW Home, touch **Utilities > Trip Planning.**
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Screen.
4) Scroll the list, if necessary, and touch a stored flight plan button to display the 'Select Flight Plan Leg' Screen.
5) Scroll the list, if necessary, and touch a flight plan leg selection button to select the mode and return to the 'Trip Planning' Screen.

Selecting the Active Flight Plan – Remaining trip route mode:

1) From MFW Home, touch **Utilities > Trip Planning.**
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Screen.
4) Scroll the list, if necessary, and touch the active flight plan button to display the 'Select Flight Plan Leg' Screen.
5) Touch the **Remaining Flight Plan** Button to select the mode and return to the 'Trip Planning' Screen.

Selecting the Active Flight Plan – Leg trip route mode:

1) From MFW Home, touch **Utilities > Trip Planning.**
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Screen.

4) Scroll the list, if necessary, and touch the active flight plan button to display the 'Select Flight Plan Leg' Screen.

5) Scroll the list, if necessary, and touch a flight plan leg selection button to select the mode and return to the 'Trip Planning' Screen.

Selecting the waypoints trip route mode:

1) From MFW Home, touch **Utilities > Trip Planning.**

2) Touch the **Trip Route** Button to display the 'Input Selection' Window.

3) Touch the **Select Starting and Ending Waypoints** Button to display the 'Select Starting and Ending Locations' Window.

4) Touch the starting waypoint button to display the 'Select Starting Location' Window.

5) Touch the **Present Position** Button to use the present position of the aircraft and return to the 'Select Starting and Ending Locations' Window.

   Or:

   Touch the **Waypoint** Button to select a waypoint using the keypad and return to the 'Select Starting and Ending Locations' Window.

6) Touch the ending waypoint button to select a waypoint using the keypad and return to the 'Select Starting and Ending Locations' Window.

7) Touch the **Accept** Button to select the mode and return to the 'Trip Planning' Screen.

When the manual entry mode is selected, the other eight trip input data fields must be entered by the pilot, in addition to flight plan and leg selection.

Entering manual data for trip statistics calculations:

1) From MFW Home, touch **Utilities > Trip Planning.**

2) Touch the **Manual Entry** Button to enable the manual entry data field buttons.

3) Touch an input data field button and use the keypad to select the value.

4) Touch the **Enter** Button to accept the value and return to the 'Trip Planning' Screen.

5) Repeat Steps 3 and 4 for each of the data fields.

5.9 TAKEOFF AND LANDING ASSISTANT (TOLA)

The Takeoff and Landing Assistant (TOLA) function assists the pilot by allowing entry and review of planned takeoff and landing data. Data may be manually entered or modified by the pilot, unless otherwise indicated.

The cyan pencil icon indicates a value has been manually entered or modified for buttons that do not originally have a brown border.

Fields shown as dashes on the 'Takeoff Data' Screen or the 'Landing Data' Screen indicate missing or invalid data. If a field is required for takeoff or landing information, the field is bordered by a brown box until filled. Any tab having at least one field required will display a brown * symbol on the tab until all required fields on that tab are filled in.

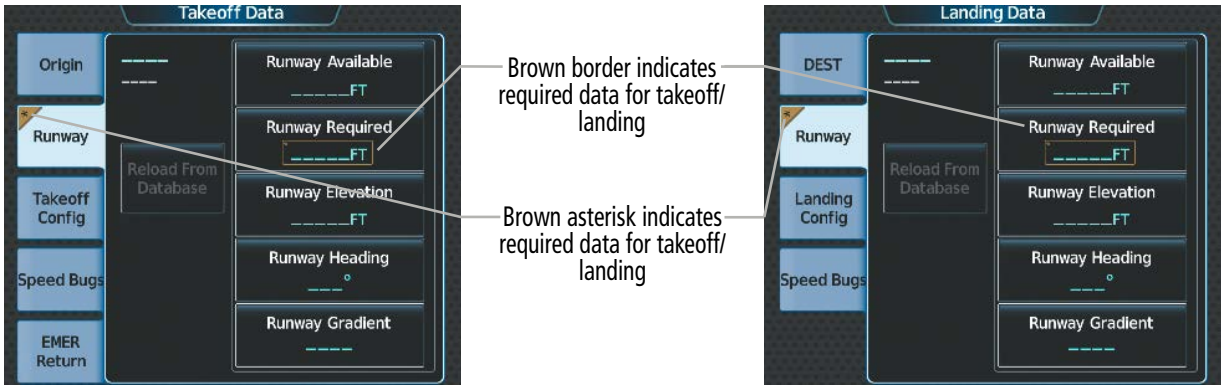


Figure 5-169 Incomplete Fields Required for Takeoff and Landing Runway Tabs

TOLA compares the takeoff and landing runway required to the runway available. An amber value on the 'Takeoff Data' Screen or 'Landing Data' Screen, and respective MFW Pane, indicates the value entered is outside allowable parameters.

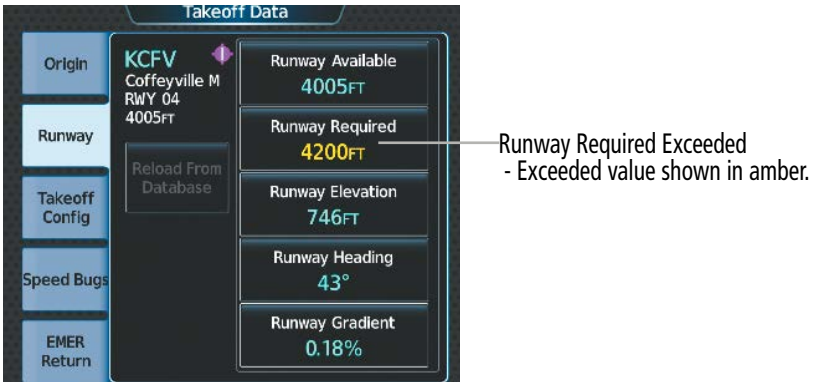


Figure 5-170 Takeoff Data – 'Runway Required' Length Exceeded

The system will also compare the flight plan origin and destination runways with the TOLA airfield and runway information and provide messages for any inconsistencies.

ACCESSING TOLA

After applying power to the system, the 'Initialization' Screen allows Takeoff Data entry. Access to the 'Takeoff Data' Screen and the 'Landing Data' Screen is accomplished from the 'PERF' Screen.

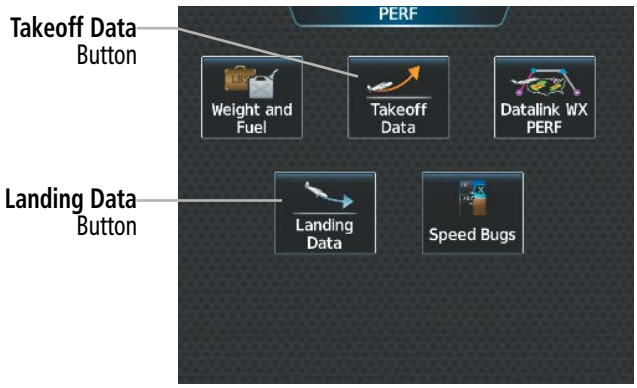


Figure 5-171 Accessing Takeoff and Landing Data from the 'PERF' Screen

Accessing the 'Takeoff Data' Screen:

From MFW Home, touch **PERF** > **Takeoff Data**.

Accessing the 'Landing Data' Screen:

From MFW Home, touch **PERF** > **Landing Data**.

TAKEOFF DATA

When the active flight plan origin airport or departure runway is modified, the TOLA Takeoff Data airport and runway will be updated automatically. See the Flight Planning portion of this section for more information on the prioritization of active flight plan inputs with respect to TOLA.

ORIGIN TAB

All **Origin** Tab information can be entered manually, and all information can be auto filled from the active flight plan. The **Flight Plan** Button is available for quick access to the 'Active Flight Plan' Screen.



Figure 5-172 Takeoff Data – Origin Tab

Manually selecting an origin airport and runway on the 'Takeoff Data' Screen:

1) From MFW Home, touch **PERF** > **Takeoff Data** to display the **Origin** Tab.
2) Touch the Origin Airport Button (may be displayed as six cyan dashes if empty) to display the keypad.
3) Use the keypad to enter the origin airport.

4) Touch the **Enter** Button to accept the entry, and return to the 'Takeoff Data' Screen.

5) Touch the **Runway** Button to display the 'Select Runway' Screen.

6) Touch the desired Runway Selection Button, and return to the 'Takeoff Data' Screen.

RUNWAY TAB

Most **Runway** Tab data will default to information derived from the Navigation Database. However, the 'Runway Required' Button must be filled manually.

NOTE: *Refer to the current pertinent flight manual for calculating the Runway Required distance.*

When the database contains an Accelerate-Stop Distance Available and a Takeoff Run Available, the system defaults to displaying the lesser of the two on the **Runway Available** Button. Optionally, these runway values may be manually adjusted. To revert to database again, touch the **Reload From Database** Button. Alternatively, returning to the **Origin** Tab and selecting a different runway will also restore runway data from the Navigation Database.

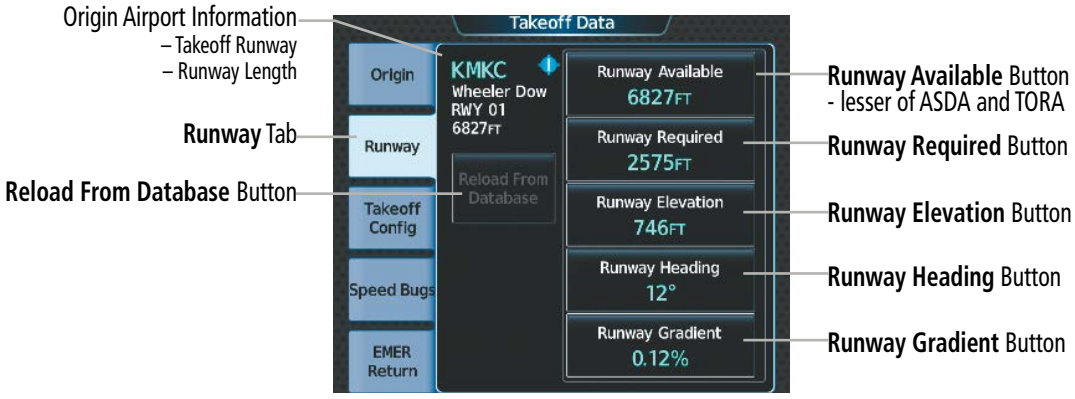


Figure 5-173 Takeoff Data – Runway Tab

The runway available distance can be manually reduced, specifically at the approach and/or departure end.



Figure 5-174 Takeoff Run Available – No Origin Selected



Figure 5-175 Takeoff Run Available – Normal



Figure 5-176 Takeoff Run Available – Corrected

Entering takeoff run available:

1) From MFW Home, touch **PERF** > **Takeoff Data**.
2) Touch the **Runway** Tab.
3) Touch the **Runway Available** Button to display the 'Takeoff Run Available' Screen.
4) Enter or change the takeoff run available distance:
   - **a)** Touch the **Shorten DEP End** Button to display the keypad.
   - **b)** Use the keypad to enter the reduction distance from the departure end of the runway.
   - **c)** Touch the **Enter** Button to accept the entry.

   Or:

   - **a)** Touch the **Takeoff Run Available** Button to display the keypad.
   - **b)** Use the keypad to enter the takeoff run available distance.
   - **c)** If an Origin runway had been selected, touch the **DEP** Button or **APPR** Button to shorten the distance from the approach or departure end.
   - **d)** Touch the **Enter** Button to accept the entry.

   Or:

a) Touch the **Shorten APPR End** Button to display the keypad.

b) Use the keypad to enter the reduction distance from the approach end of the runway.

c) Touch the **Enter** Button to accept the entry.

5) Repeat Step 4 until the takeoff run data is displayed correctly.

6) Touch the **Save** Button to make the changes and return to the 'Takeoff Data' Screen.

Entering the takeoff Runway Required distance:

1) From MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **Runway** Tab.

3) Touch the **Runway Required** Button to display the keypad.

4) Use the keypad to enter the takeoff runway distance required.

5) Touch the **Enter** Button to accept the entry, and return to the **Runway** Tab.

Manually entering takeoff runway elevation, heading, or gradient:

1) From MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **Runway** Tab.

3) Touch the **Runway Elevation** Button, **Runway Heading** Button, or the **Runway Gradient** Button to display the keypad.

4) Use the keypad to enter the value.

5) Touch the **Enter** Button to accept the entry, and return to the **Runway** Tab.

6) Repeat Steps 3 through 5 until all runway values are entered as desired.

Reload runway data from database:

1) From MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **Runway** Tab to display the runway data.

3) Touch the **Reload from Database** Button. The cyan pencil icon is removed from each of the manual entries, and the values are replaced with data derived from the Navigation Database.

TAKEOFF CONFIG TAB

The **Takeoff Config** Tab on the 'Takeoff Data' Screen will contain flap setting information.

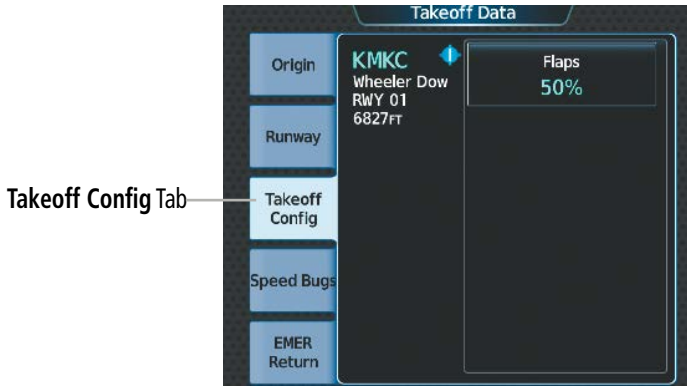


Figure 5-177 Takeoff Data – Takeoff Config Tab

Selecting the flaps position on the 'Takeoff Data' Screen:

1) From MFW Home, touch **PERF** > **Takeoff Data**.
2) Touch the **Takeoff Config** Tab.
3) Touch the **Flaps** Button.
4) Touch the desired flap setting button and return to the **Takeoff Config** Tab.

SPEED BUGS TAB

The **Speed Bugs** Tab provides controls to enable, disable, or modify Vspeed reference values. Speed bugs that are enabled shall be displayed on the airspeed tape. See the Flight Instruments Section for more information on PFD indications for speed bugs.

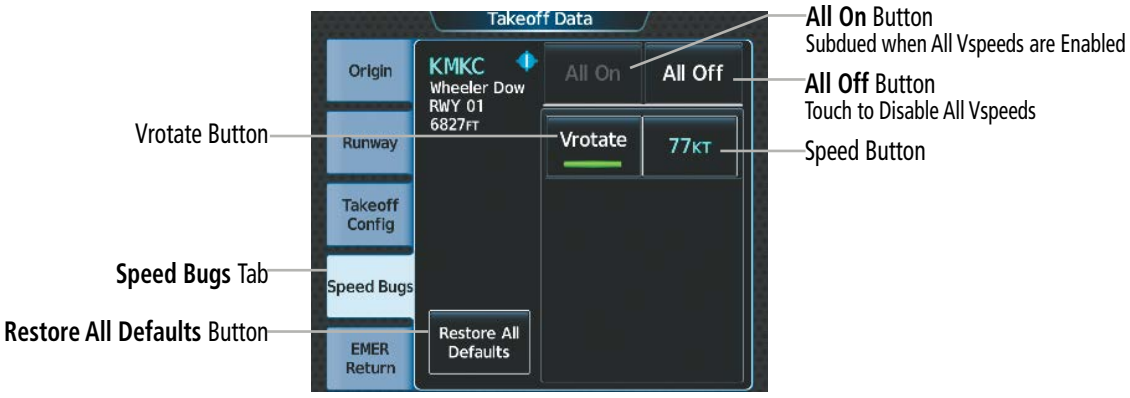


Figure 5-178 Takeoff Data – Speed Bugs Tab

Enabling/disabling takeoff Vspeed bugs:

1) From MFW Home, touch **PERF** > **Takeoff Data**.
2) Touch the **Speed Bugs** Tab.
3) Enable/disable takeoff Vspeed bugs:

   Touch the button for the desired Vspeed bug to enable or disable it. The annunciator bar is green when enabled.

   Or:

   Touch the **All On** Button to enable all Vspeed bugs.

   Or:

   Touch the **All Off** Button to disable all Vspeed bugs.

Manually entering takeoff Vspeed values:

1) MFW Home, touch **PERF** > **Takeoff Data**.
2) Touch the **Speed Bugs** Tab.
3) Touch the desired Speed Button to display the keypad.
4) Use the keypad to enter the new speed value.

5) Touch the **Enter** Button to accept the entry and return to the 'Takeoff Data' Screen.

6) Repeat Steps 3 through 5 until all values are entered as desired.

Restoring all takeoff Vspeed values:

1) MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **Speed Bugs** Tab.

3) Touch the **Restore All Defaults** Button. The system restores all default takeoff Vspeed values and disables all takeoff Vspeed bugs.

EMER RETURN TAB

The **EMER Return** Tab provides data for a return to land scenario. TOLA automatically will retrieve the origin airport and runway from the active flight plan departure information. The Runway Available will default to information derived from the Navigation Database.

Runway values may be manually adjusted for all emergency return runway buttons. To repopulate the data from the database again, touch the **Reload From Database** Button. Alternatively, returning to the 'Active Flight Plan' Screen and selecting a different runway will also update runway data from the Navigation Database.

The pilot must manually enter the distance for the **Runway Required** Button.

NOTE: *Refer to the current pertinent flight manual for calculating the Runway Required distance.*

The **Load Emergency Return** Button is located on the **DEST** Tab of the 'Landing Data' Screen and is discussed later in this section.

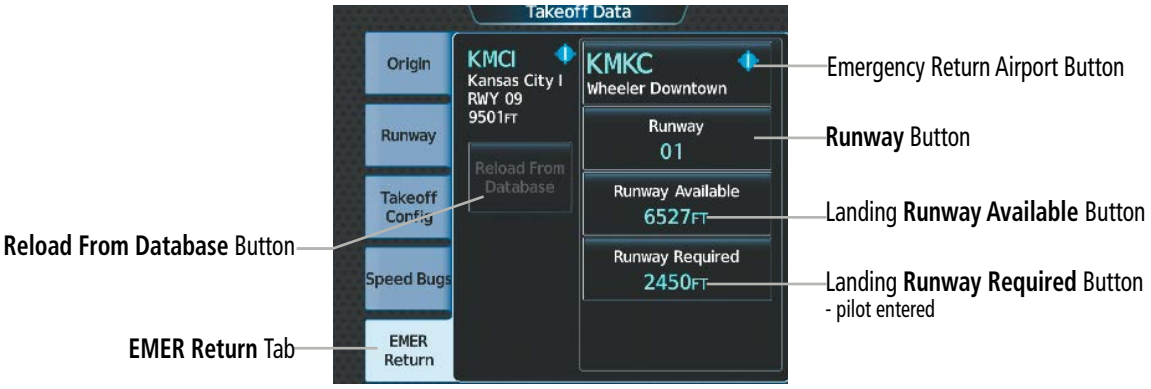


Figure 5-179 Takeoff Data – EMER Return Tab

Manually selecting the emergency return airport and runway:

1) From MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **EMER Return** Tab.

3) Touch the Emergency Return Airport Button to display the keypad.

4) Use the keypad to enter the emergency return airport.

5) Touch the **Enter** Button to accept the entry, and return to the 'Takeoff Data' Screen.

6) Touch the **Runway** Button to display the 'Select Runway' Screen.

7) Touch the desired Runway Selection Button to select it, and return to the 'Takeoff Data' Screen.

The landing distance available can be manually reduced, specifically at the approach and/or departure end. Refer to the 'Landing Data' Screen, **Runway** Tab for more details on manually reducing the runway available.

Modifying the Runway Available for the emergency return runway:

1) From MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **EMER Return** Tab.

3) Touch the **Runway Available** Button to display the 'Landing Distance Available' Screen.

4) Enter or change the landing distance available:

   a) Touch the **Shorten DEP End** Button to display the keypad.

   b) Use the keypad to enter the reduction distance from the departure end of the runway.

   c) Touch the **Enter** Button to accept the entry.

   Or:

   a) Touch the **Landing Distance Available** Button to display the keypad.

   b) Use the keypad to enter the shortened landing distance available.

   c) If a Departure runway had been selected, touch the **DEP** Button or **APPR** Button to shorten the distance from the approach or departure end.

   d) Touch the **Enter** Button to accept the entry.

   Or:

   a) Touch the **Shorten APPR End** Button to display the keypad.

   b) Use the keypad to enter the reduction distance from the approach end of the runway.

   c) Touch the **Enter** Button to accept the entry.

5) Repeat Step 4 until the landing distance data is displayed correctly.

6) Touch the **Save** Button to make the changes and return to the **EMER Return** Tab.

Reload runway data from database for the emergency return runway:

1) From MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **EMER Return** Tab to display the runway data.

3) Touch the **Reload from Database** Button.

Entering the Runway Required distance for emergency return:

1) From MFW Home, touch **PERF** > **Takeoff Data**.

2) Touch the **EMER Return** Tab.

3) Touch the **Runway Required** Button to display the keypad.

4) Use the keypad to enter the required landing distance.

5) Touch the **Enter** Button to accept the entry, and return to the **EMER Return** Tab.

TAKEOFF DATA PANE

When the 'Takeoff Data' Screen is displayed on the Touchscreen Controller, a corresponding 'Takeoff Data' Pane is shown on the active display pane. Takeoff runway data, configuration, takeoff speed, and emergency return runway data will normally be displayed.

Additionally, information that is inconsistent with TOLA inputs will also be shown as an amber message in the 'Configuration Monitor' Box. Runway Required values that exceed the Runway Available will also be shown in amber.

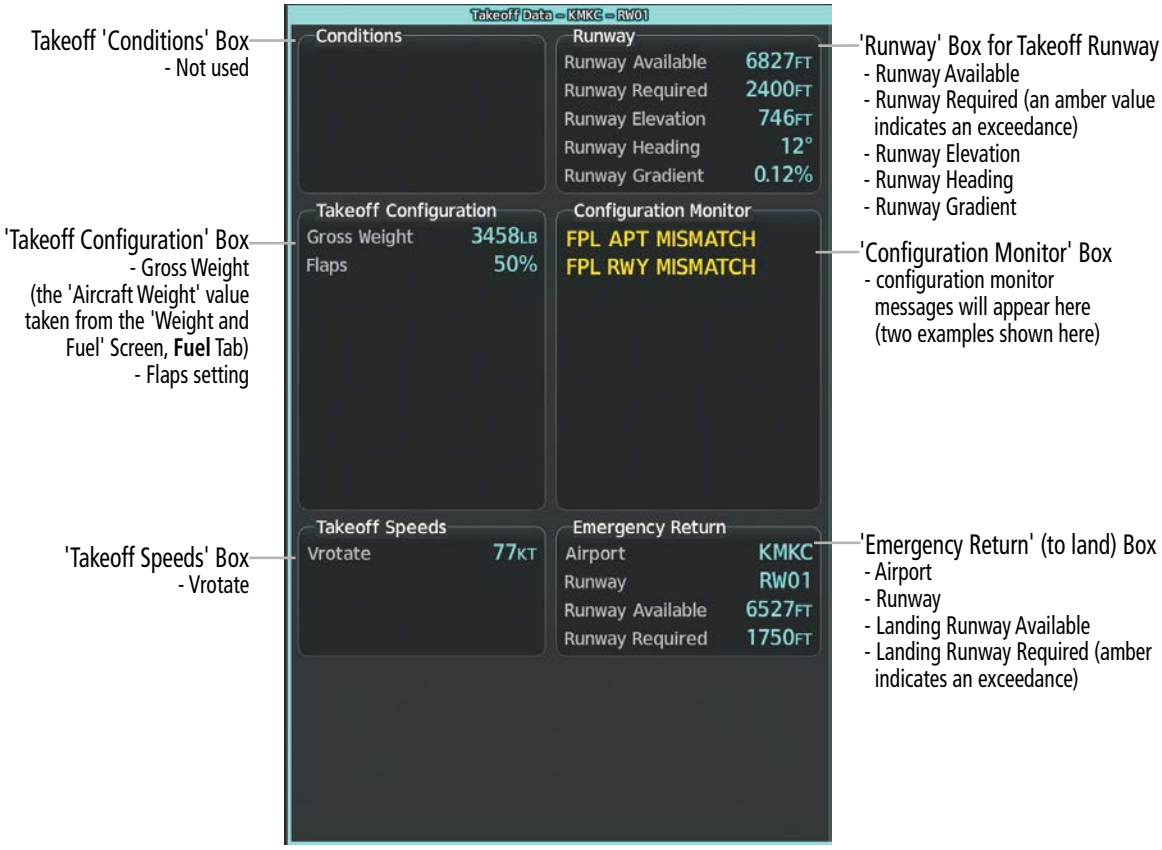


Figure 5-180 'Takeoff Data' Pane

TAKEOFF CONFIGURATION MONITOR MESSAGES

The 'Configuration Monitor' Box on the 'Takeoff Data' Pane will display an amber message (example: 'FPL APT MISMATCH') for each item that is currently set differently than its planned takeoff setting.

Message	Condition
FLAPS MISMATCH	When in the takeoff phase, the flaps setting selected in TOLA for takeoff differs from the current flaps setting as detected by the flight deck.
FPL APT MISMATCH	The departure airport in the active flight plan is not the same as the departure airport on the **Origin** Tab.
FPL RWY MISMATCH	The departure runway in the active flight plan is not the same as the departure runway on the **Origin** Tab.

Table 5-22 Takeoff Configuration Monitor Messages

LANDING DATA

When the active flight plan destination airport or landing runway is modified, the TOLA Landing Data airport and runway will be updated automatically. See the Flight Planning portion of this section for more information on the prioritization of active flight plan inputs with respect to TOLA.

DEST TAB

All **DEST** Tab information can be entered manually, and all information can be auto filled from the active flight plan. The **Flight Plan** Button is available for quick access to the 'Active Flight Plan' Screen.

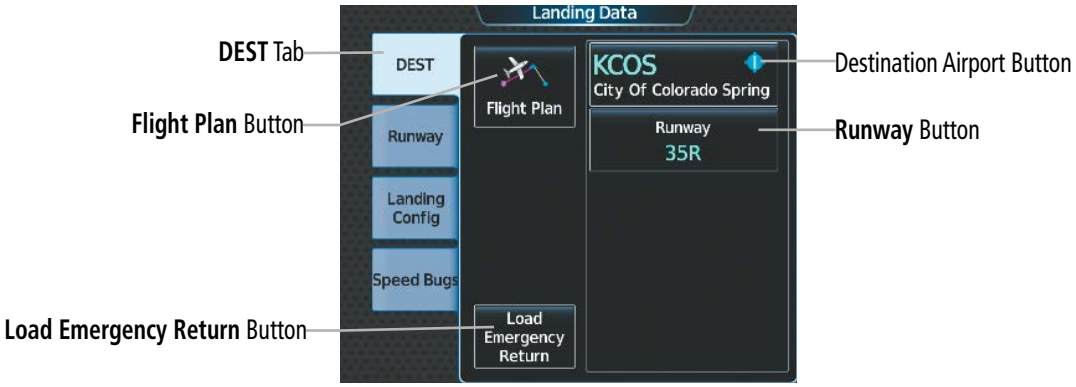


Figure 5-181 Landing Data – Destination Tab

Manually selecting an destination airport and runway on the 'Landing Data' Screen:

1) From MFW Home, touch **PERF** > **Landing Data** to display the **DEST** Tab.
2) Touch the Destination Airport Button (may be displayed as six cyan dashes if empty) to display the keypad.
3) Use the keypad to enter the destination airport.
4) Touch the **Enter** Button to accept the entry, and return to the 'Landing Data' Screen.
5) Touch the **Runway** Button to display the 'Select Runway' Screen.
6) Touch the desired Runway Selection Button, and return to the 'Landing Data' Screen.

Accessing the 'Weight and Fuel' Screen from the DEST Tab:

1) From MFW Home, touch **PERF** > **Landing Data** to display the **DEST** Tab.
2) Touch the **Weight and Fuel** Button to display the 'Weight and Fuel' Screen.

EMERGENCY RETURN

The **Load Emergency Return** Button can be used to quickly load data for a return to land scenario. Touching the **Load Emergency Return** Button will copy the airport, runway, and landing distance available, from the **EMER Return** Tab on the 'Takeoff Data' Screen to the 'Landing Data' Screen. The pilot must manually enter the landing distance required and flap setting.

Loading data for emergency return:

1) From MFW Home, touch **PERF** > **Landing Data**.
2) Touch the **Load Emergency Return** Button. 'Load emergency return data for landing?' is displayed.
3) Touch the **OK** Button to copy the data for emergency return to the 'Landing Data' Screen.

RUNWAY TAB

Most **Runway** Tab data will default to information derived from the Navigation Database. However, the required runway distance must be filled manually.

Optionally, these runway values may be manually adjusted. To repopulate the data from the database again, touch the **Reload From Database** Button. Alternatively, returning to the 'Active Flight Plan' Screen and selecting a different runway will also update runway data from the Navigation Database.

NOTE: *Refer to the current pertinent flight manual for calculating the Runway Required distance.*

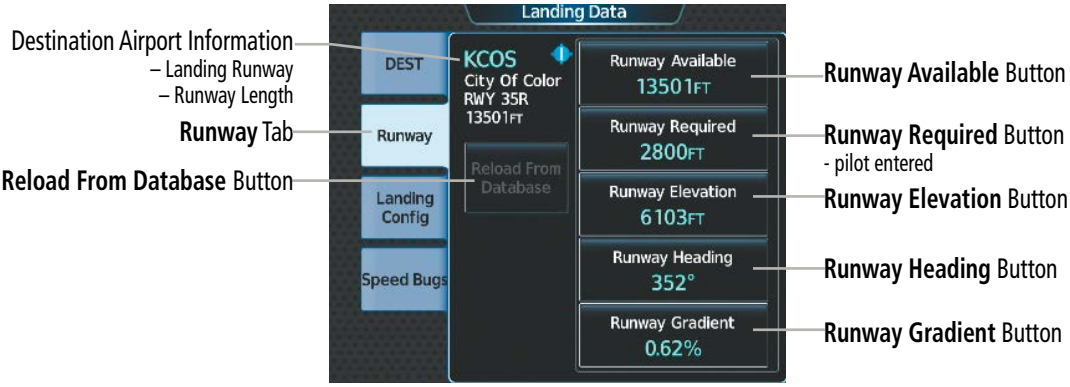


Figure 5-182 Landing Data – Runway Tab

The runway available distance can be manually reduced, specifically at the approach and/or departure end.

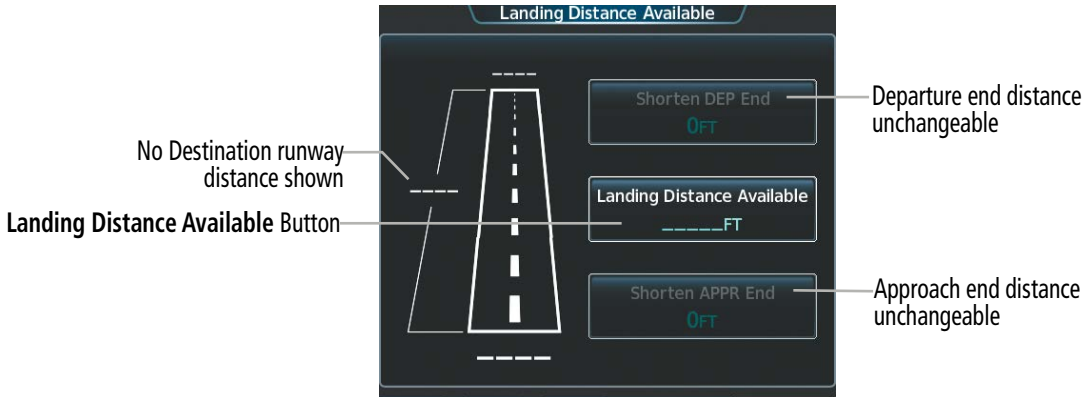


Figure 5-183 Landing Distance Available – No Destination Selected



Figure 5-184 Landing Distance Available – Normal



Figure 5-185 Landing Distance Available – Shortened Approach End

Manually entering landing runway available distance:

1) From MFW Home, touch **PERF** > **Landing Data**.
2) Touch the **Runway** Tab.
3) Touch the **Runway Available** Button to display the 'Landing Distance Available' Screen.
4) Enter or change the landing runway available distance:
   - **a)** Touch the **Land and Hold Short** Button to display a list of intersections and LAHSO buttons. Each button displays the name of the intersecting runway and LAHSO designation (if available), and the landing distance available before that intersection/LAHSO point.
   - **b)** Scroll the list if necessary and touch the button for the desired intersection or LAHSO point.

   Or:

   - **a)** Touch the **Intersection Exit** Button to display a list of intersections. Each Intersection Button displays the name of the intersecting runway or taxiway, and the landing distance available before that intersection.
   - **b)** Scroll the list if necessary and touch the button for the desired intersection takeoff.

   Or:

   - **a)** Touch the **Shorten DEP End** Button to display the keypad.
   - **b)** Use the keypad to enter the reduction distance from the departure end of the runway.
   - **c)** Touch the **Enter** Button to accept the entry.

   Or:

   - **a)** Touch the **Landing Distance Available** Button to display the keypad.
   - **b)** Use the keypad to enter the shortened landing distance available.
   - **c)** If a Departure runway had been selected, touch the **DEP** Button or **APPR** Button to shorten the distance from the approach or departure end.
   - **d)** Touch the **Enter** Button to accept the entry.

   Or:

a) Touch the **Shorten APPR End** Button to display the keypad.

b) Use the keypad to enter the reduction distance from the approach end of the runway.

c) Touch the **Enter** Button to accept the entry.

5) Repeat Step 4 until the landing runway available distance data is displayed correctly.

6) Touch the **Save** Button to make the changes and return to the 'Landing Data' Screen.

Entering the landing Runway Required distance:

1) From MFW Home, touch **PERF** > **Landing Data**.

2) Touch the **Runway** Tab.

3) Touch the **Runway Required** Button to display the keypad.

4) Use the keypad to enter the landing runway distance required.

5) Touch the **Enter** Button to accept the entry, and return to the **Runway** Tab.

Manually entering landing runway elevation, heading, or gradient:

1) From MFW Home, touch **PERF** > **Landing Data**.

2) Touch the **Runway** Tab.

3) Touch the **Runway Elevation** Button, **Runway Heading** Button, or the **Runway Gradient** Button to display the keypad.

4) Use the keypad to enter the value.

5) Touch the **Enter** Button to accept the entry, and return to the 'Landing Data' Screen.

6) Repeat Steps 3 through 5 until all runway values are entered as desired.

Reload runway data from database:

1) From MFW Home, touch **PERF** > **Landing Data**.

2) Touch the **Runway** Tab to display the runway data.

3) Touch the **Reload from Database** Button. The cyan pencil icon is removed from each of the manual entries, and the values are replaced with data derived from the Navigation Database.

LANDING CONFIG TAB

The **Landing Config** Tab on the 'Landing Data' Screen will contain flap setting information.

The **Inhibits** Button provides quick access to the **Alerts** Tab on the 'Avionics Settings' Screen for SurfaceWatch™ inhibit settings. See the Additional Features Section for information on how to inhibit alerts.

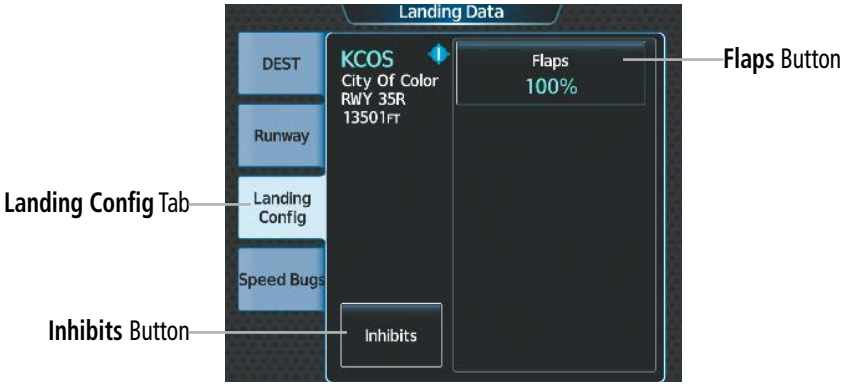


Figure 5-186 Landing Data – Landing Config Tab

Selecting the flaps position on the 'Landing Data' Screen:

1) From MFW Home, touch **PERF** > **Landing Data**.
2) Touch the **Landing Config** Tab.
3) Touch the **Flaps** Button.
4) Touch the desired flap setting button and return to the **Takeoff Config** Tab.

SPEED BUGS TAB

The **Speed Bugs** Tab will contain no landing speed bug information.

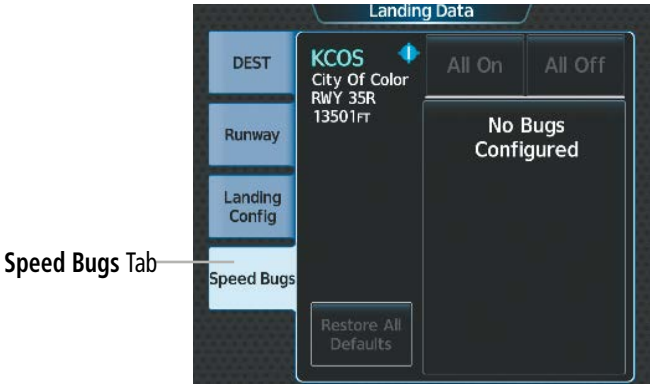


Figure 5-187 Landing Data – Speed Bugs Tab

LANDING DATA PANE

When the 'Landing Data' Screen is displayed on the Touchscreen Controller, a corresponding 'Landing Data' Pane is shown on the active display pane. Landing runway data and aircraft configuration will normally be displayed.

Additionally, information that is inconsistent with TOLA inputs will also be shown as an amber message in the 'Configuration Monitor' Box. Runway Required values that exceed the Runway Available will also be shown in amber.

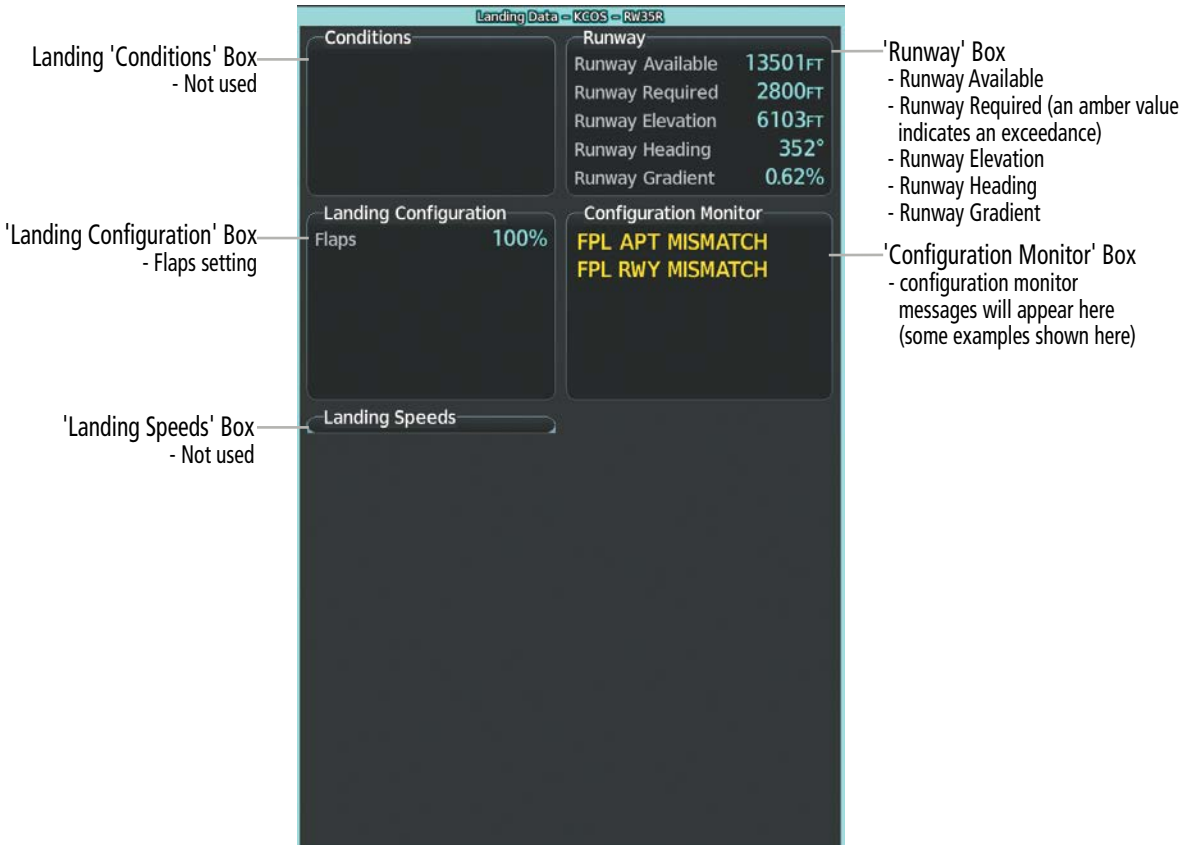


Figure 5-188 'Landing Data' Pane

Landing Configuration Monitor Messages

The 'Configuration Monitor' Box on the 'Landing Data' Pane will display an amber message (example: 'FPL RWY MISMATCH') for each item that is currently set differently than its planned landing setting.

Message	Condition
FLAPS MISMATCH	When in the landing phase, the actual flaps setting is not the same as the flaps setting on the **Landing Config** Tab.
FPL APT MISMATCH	The destination airport in the active flight plan is not the same as the destination airport on the **DEST** Tab.
FPL RWY MISMATCH	The destination runway in the active flight plan is not the same as the destination runway on the **DEST** Tab.

Table 5-23 Landing Configuration Monitor Messages

5.10 ABNORMAL OPERATION

This portion of the guide discusses enroute and terminal Flight Management System (FMS) degradation and Dead Reckoning (DR). For information on final approach degradation behavior, see the Procedures portion given earlier in this section.

FMS DEGRADATION

NOTE: *Once inhibited, sensors will not be monitored or used by the system, and the system will not uninhibit those sensors in the event of a failure. The system will revert to Dead Reckoning or no position until an uninhibited sensor with a valid position is available.*

The FMS will operate in either the GPS or the DR position fixing mode, depending on the available sensors. If enabled and available for use, GPS1/GPS2 will have priority, and SBAS will be used if available. If one GPS sensor fails, the system will automatically transition to the other GPS sensor.

If GPS is lost and the system is unable to recover a signal, or if both GPS sensors fail, the "GPS LOI" (Loss of Integrity) annunciation is displayed in amber on the PFW. Also, a system message concerning the loss of GPS will appear on the Touchscreen Controller.

DEAD RECKONING NAVIGATION

The system will revert to Dead Reckoning (DR) mode if the system is no longer fully using any GPS sensor for position fixing, even if airspeed and heading data are unavailable. In DR Mode, the system will use 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 will become increasingly unreliable and must not be used as a sole means of navigation.

DR mode is inherently less accurate than the standard GPS/SBAS mode due to the lack of satellite measurements needed to find 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 position data is restored.

DR mode will be indicated on the system by the appearance of the letters "DR" displayed in amber on the HSI, and on top of the aircraft symbol on map displays. The CDI deviation bar will be displayed in amber, and the "UNABLE RNP" annunciation will also be displayed on the PFW. The autopilot can be coupled in DR mode, as long as the lateral deviation guidance is available.

NOTE: *GPS derived information will remain displayed in magenta (not amber) on the Flight Plan Text and Flight Plan Progress inset when operating in Dead Reckoning mode. However, this information shall still be considered as degraded navigation source information.*

As a result of operating in DR mode, all data that is dependent upon GPS is displayed as amber text to denote degraded navigation source information. If the VSD Inset is enabled, 'VSD Not Available' will be displayed. Airspace alerts continue to function, but with degraded accuracy. Also, while the system is in DR mode, SVT and forward looking terrain alerting functions are disabled.

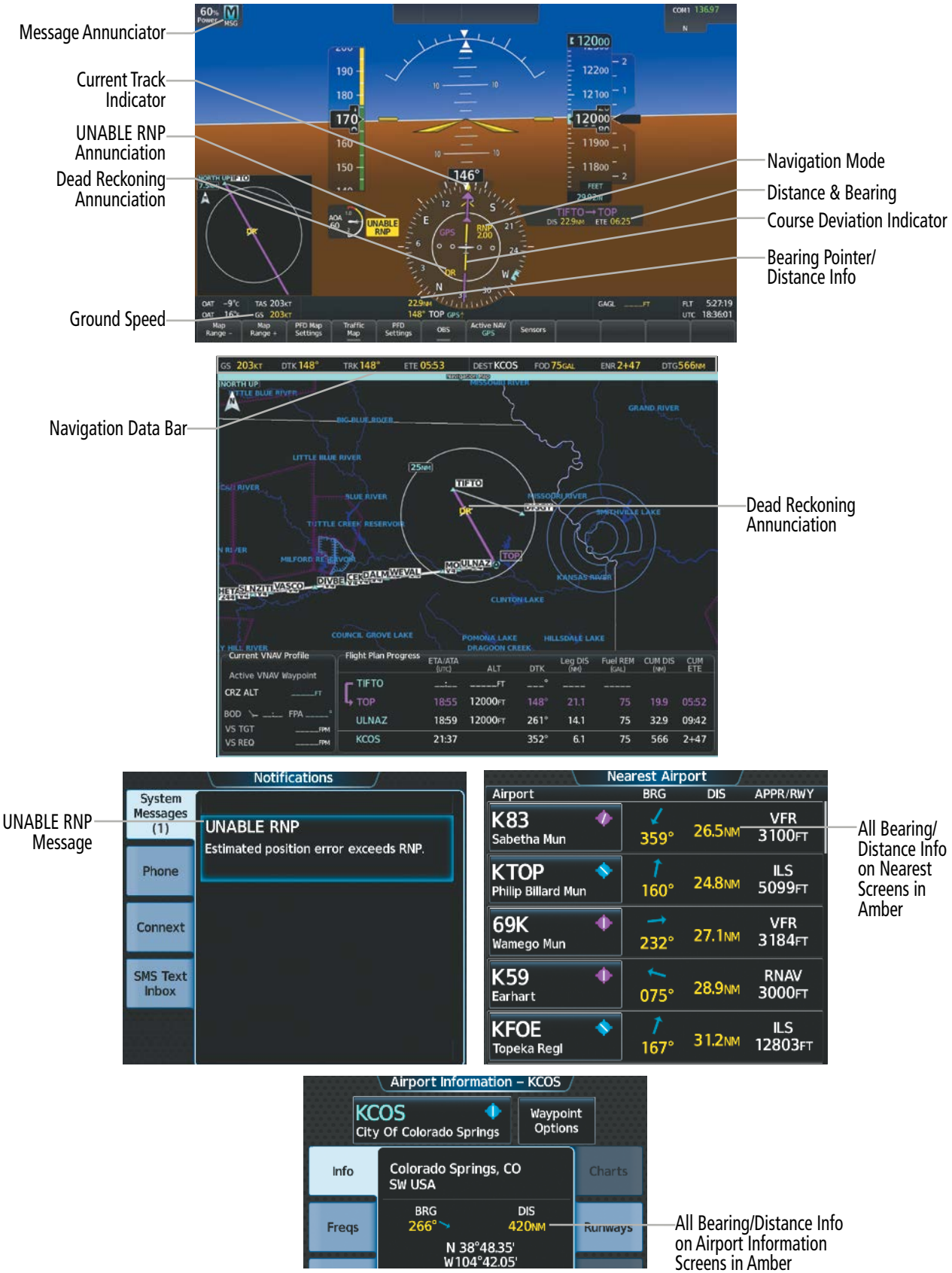


Figure 5-189 Dead Reckoning Mode – GPS Derived Data Shown in Amber

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SECTION 6 HAZARD AVOIDANCE

Hazard Avoidance features available for the Cirrus Perspective+™ 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 SXM SiriusXM Weather (Subscription Optional).
  - GSR 56 Garmin Connext® Weather (Optional).
  - Flight Information Services-Broadcast (Optional).
  - L-3 Stormscope® WX-500 Lightning Detection System (Optional).
- **Terrain Avoidance**
  - Terrain-SVT™ (Optional).
  - Terrain Awareness and Warning System Class-B (TAWS-B) (Optional).
- **Traffic**
  - Garmin GTS™ 800 Traffic Advisory System (TAS) (Optional).
  - Garmin GTX™ 345R Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic (Optional).

6.1 DATA LINK WEATHER

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

WARNING: *Do not use the indicated data link weather product age to ascertain 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) Weather. 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 optional Garmin GDL 69 SXM SiriusXM Datalink Receiver and an active service subscription, updates its weather data periodically and automatically, and transmits this information to the aircraft's receiver by 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 optional Garmin GSR 56 Iridium 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

Before SiriusXM Weather and SiriusXM Satellite Radio can be used, the services must be activated by providing SiriusXM's customer service the coded IDs unique to the installed data link receiver. SiriusXM Satellite Radio (audio) and SiriusXM Weather (data) services each have coded IDs, which may be identical. The Data and Audio Radio IDs must be provided to activate the weather and entertainment subscriptions, respectively. These IDs are in the following locations:

- The 'SiriusXM Info' Screen on Touchscreen Controllers.
- The XM Satellite Radio Activation Instructions included with the unit.
- The label on the front of the data link receiver.

SiriusXM uses the coded IDs to send an activation signal to enable the system to receive weather data and/or audio entertainment programming.

Establishing a SiriusXM Weather Data account:

1) From MFW Home, touch **Utilities > Setup** > **SiriusXM Info**.
2) Note the ID shown in the 'Data Radio' Window.
3) Contact SiriusXM customer service. Follow the instructions provided by SiriusXM customer service.

Activating SiriusXM Weather services:

1) Position the aircraft so the GDL 69A SXM antenna has an unobstructed view of the sky, away from buildings.
2) Connect aircraft to external power source if available.
3) Power on the avionics and allow the system to energize in normal mode.
4) For the GDL 69A SXM, service activation is performed automatically by the system.
5) To verify the correct subscription package, from MFD Home, touch **Utilities > Setup** > **SiriusXM Info**.
6) On the 'SiriusXM Info' Screen, verify the correct subscription package is displayed in the 'Service Class' Window.
7) In the 'Weather Products' Window, scroll as needed to view available weather products. Available weather products appear as white text (data has not been received); A green check indicates the weather product data has been received and is available for use, unavailable weather products appear in subdued (gray) text. It may take 45 - 60 minutes before activation is complete and all subscribed-to weather products become available.

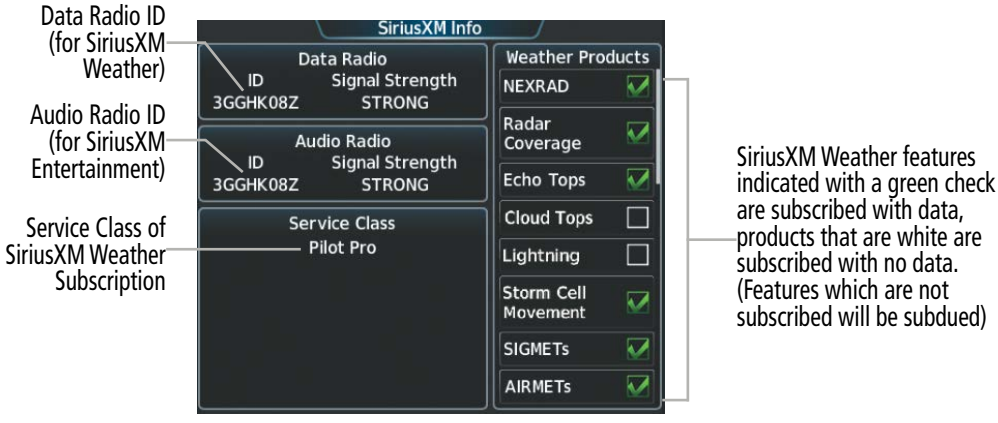


Figure 6-1 'SiriusXM Info' Screen After Activation

NOTE: *Not all weather products offered by SiriusXM are supported for display on this system. This pilot's guide only discusses supported weather products.*

After SiriusXM has been contacted, it may take approximately 15 minutes until the activation occurs.

REGISTERING THE SYSTEM FOR GARMIN CONNEXT SERVICES

When an account is established, Garmin Aviation Product Support provides an Access Code which must be entered and transmitted to Garmin in order to receive Garmin Connext weather data.

Registering the system to receive Garmin Connext Weather:

1) Ensure the aircraft is outside and has a clear view of the sky (if connecting through the Iridium network).
2) From MFW Home, touch **Utilities > Setup > Connext Settings**. If the Registration Information Window indicates 'Not Registered', continue with this procedure.
3) Touch the **Register** Tab.
4) Scroll as necessary and touch the **Register** Button
5) Use the keypad or large and small upper knobs to supply the access code provided from Garmin Connext customer service.
6) Touch the **Enter** Button or push the upper knob. The system contacts the Garmin Connext Weather service. Registration is complete when the Registration Information Window displays the name of the airframe, tail number, and the serial numbers for the airframe and Iridium unit.



Figure 6-2 'Connext Registration' Screen Before Registration



Figure 6-3 Enter Access Code Provided by Garmin Aviation Product Support

ACCESSING FIS-B WEATHER INFORMATION

NOTE: *Service activation is not applicable to the FIS-B Weather service.*

The 'FIS-B Weather' Pane is the principal map display for viewing FIS-B Weather information. This is the only map display capable of showing information for all available FIS-B Weather products, with the exception of Terminal Aerodrome Forecasts (TAFs), discussed later in this section.

Viewing the 'FIS-B Weather' Pane:

From MFW Home, touch **Weather > Weather Selection > FIS-B Weather**.

On the 'FIS-B Weather' Settings Screen, the pilot can enable/disable FIS-B weather data reception of the service. If FIS-B weather service reception is disabled, the overlays buttons for FIS-B weather products for navigation maps will be subdued and cannot be selected until FIS-B weather is enabled; however, the buttons to enable/disable overlays are not subdued on the 'FIS-B Weather Settings' Screen. While the pilot can still enable/disable the overlays on the 'FIS-B Weather Settings' Screen, the FIS-B weather data will not be shown until the pilot enables FIS-B weather data reception.

Enabling/disabling the FIS-B weather data reception:

1) From MFW Home, touch **Weather > Weather Selection > FIS-B Weather > FIS-B Settings**.
2) Touch the **Enable FIS-B** or **Disable FIS-B Button**.

The 'FIS-B Data Status' window on the 'FIS-B Weather Settings' Screen provides the number of minutes since the last successful ground uplink of FIS-B Weather data, or dashes if no completed uplink has been received. The window also displays the names of FIS-B weather products currently experiencing a data outage as determined by the FIS-B weather service, or 'None' if there are no known outages, or 'Data not available' if outage information is currently unavailable or has not been received.

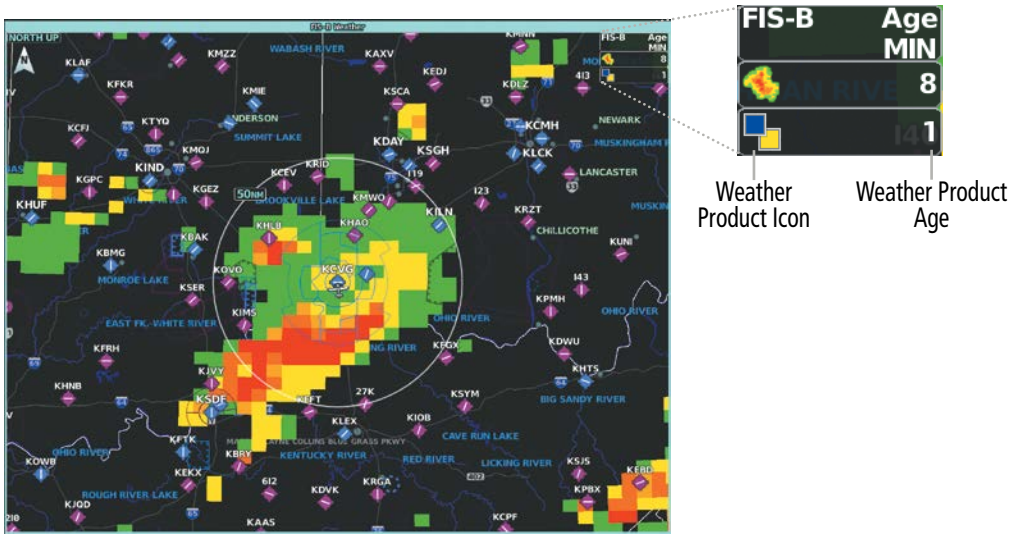


Figure 6-4 'FIS-B Weather' Pane with PIREPs and CONUS NEXRAD Enabled

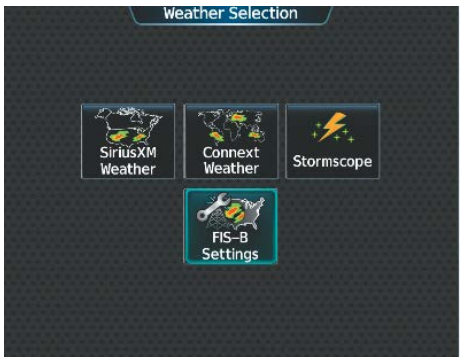


Figure 6-5 'Weather Selection' Screen

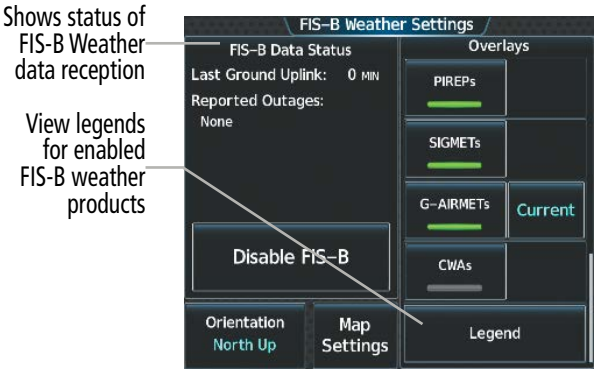


Figure 6-6 'FIS-B Weather Settings' Screen

WEATHER PRODUCT AGE

Unlike real-time weather information collected directly from weather sensors on-board an aircraft, such as an airborne lightning detection system, data link weather by contrast relies on service providers to collect, process, and transmit weather information to the aircraft. This information can come from a variety of sources such as government agencies. Due to the time it takes to collect, process, and distribute data link weather information, it is imperative for pilots to understand that data link weather information is not real-time information and may not accurately depict the current conditions.

For each data link weather product which can be displayed as a map overlay, such as METARs, the system can also show a weather product age. This age represents the elapsed time, in minutes, since the weather service provider compiled the weather product and the current time. It does not represent the age of the information contained within the weather product itself. For example, a single mosaic of radar precipitation is comprised of data from multiple radar sites providing data at differing scan rates or intervals. The weather service provider periodically compiles this data to create a single composite image, and assigns one time to this image which becomes the basis of the product age. The service provider then makes this weather product available for data link transmission at the next scheduled update time. The actual age of the weather data contained within the mosaic is therefore older than its weather product age and should never be considered current. The pilot can optionally enable or disable this information on the Inset Map or HSI Map.

SiriusXM and FIS-B weather products are broadcast automatically on a repeating cycle without pilot intervention. The Garmin Connext weather service requires the pilot to select a manual or automatic (recurring) weather data request in order to receive weather data updates.

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 weather product information on the Inset Navigation Map and HSI Map:

1) From PFW Home, touch **PFD Map Settings**.
2) Touch the **Layout** Button. If not selected, touch either the **HSI Map** or **Inset Map** Buttons.
3) Touch the **Weather Legend** Button.

Or:

1) With the PFD Inset Map or HSI Map shown, press the **PFD Map Settings** Softkey.
2) Press the **Weather Legend** Softkey.

Tables 6-1 and 6-2 show the weather product symbols, the expiration times and the broadcast rates where applicable, 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)	SiriusXM Weather Product	Product Symbol	Expiration Time (Minutes)
Next-generation Radar (NEXRAD)		30	Winds Aloft		90
Cloud Tops		60	County Warnings		60
Echo Tops		30	Cyclone (Hurricane) Warnings		60
SiriusXM Lightning		30	Icing Potential (CIP and SLD)		90
Storm Cell Movement		30	Pilot Weather Report (PIREPs)		90
SIGMETs		60	Air Report (AIREPs)		90
AIRMETs		60	Turbulence		180
METARs		90	No Radar Coverage	No product symbol	30
City Forecast		90	Temporary Flight Restrictions (TFRs)		60
Surface Analysis		60	Terminal Aerodrome Reports (TAFs)	No product symbol	60
Freezing Levels		120	Temps Aloft		90
Surface Visibility		30	Center Weather Advisories		120

Table 6-1 SiriusXM Weather Product Symbols and Data Timing

FIS-B Weather Product	Product Symbol	Expiration Time (Minutes)	FIS-B Weather Product	Product Symbol	Expiration Time (Minutes)
NEXRAD Composite (US)		30	Temporary Flight Restriction (TFR)		60
NEXRAD Composite (Regional)		30	Pilot Weather Report (PIREP)		90
Cloud Tops		120	SIGMETs		60
METARs		90	Graphical AIRMETs		60
Lightning		30	Center Weather Advisories		60
Winds Aloft		90 [1]	Terminal Aerodrome Forecast (TAF)	No product image	60
Turbulence		120	No Radar Coverage	No product image	30
Icing Forecast		30			

[1] *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, the expiration times and the refresh rates. The refresh 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. The pilot chooses how often to contact the Garmin Connext weather service in order to retrieve weather data through the Connext Data Request.

NOTE: *The availability of specific Garmin Connext Weather products varies by region and by subscription type. For Garmin Connext weather product coverage information, refer to flygarmin.com.*

Garmin Connext Weather Product	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

Table 6-3 Garmin Connext Weather Product Symbols and Data Timing

WARNING: *Do not use the indicated data link weather product age to ascertain 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.*

DISPLAYING DATA LINK WEATHER PRODUCTS

WEATHER DATA LINK PANE

The Weather Data Link (SiriusXM/Connext/FIS-B) Pane is the principal map pane for viewing data link weather information.

This pane provides the capability for displaying the most data link weather products of any map on the system. The Weather Data Link Pane also provides system-wide controls for selecting the data link weather source, if more than one source has been installed. The pane title indicates the selected data link weather source (e.g., "SiriusXM", "Connext" or "FIS-B").

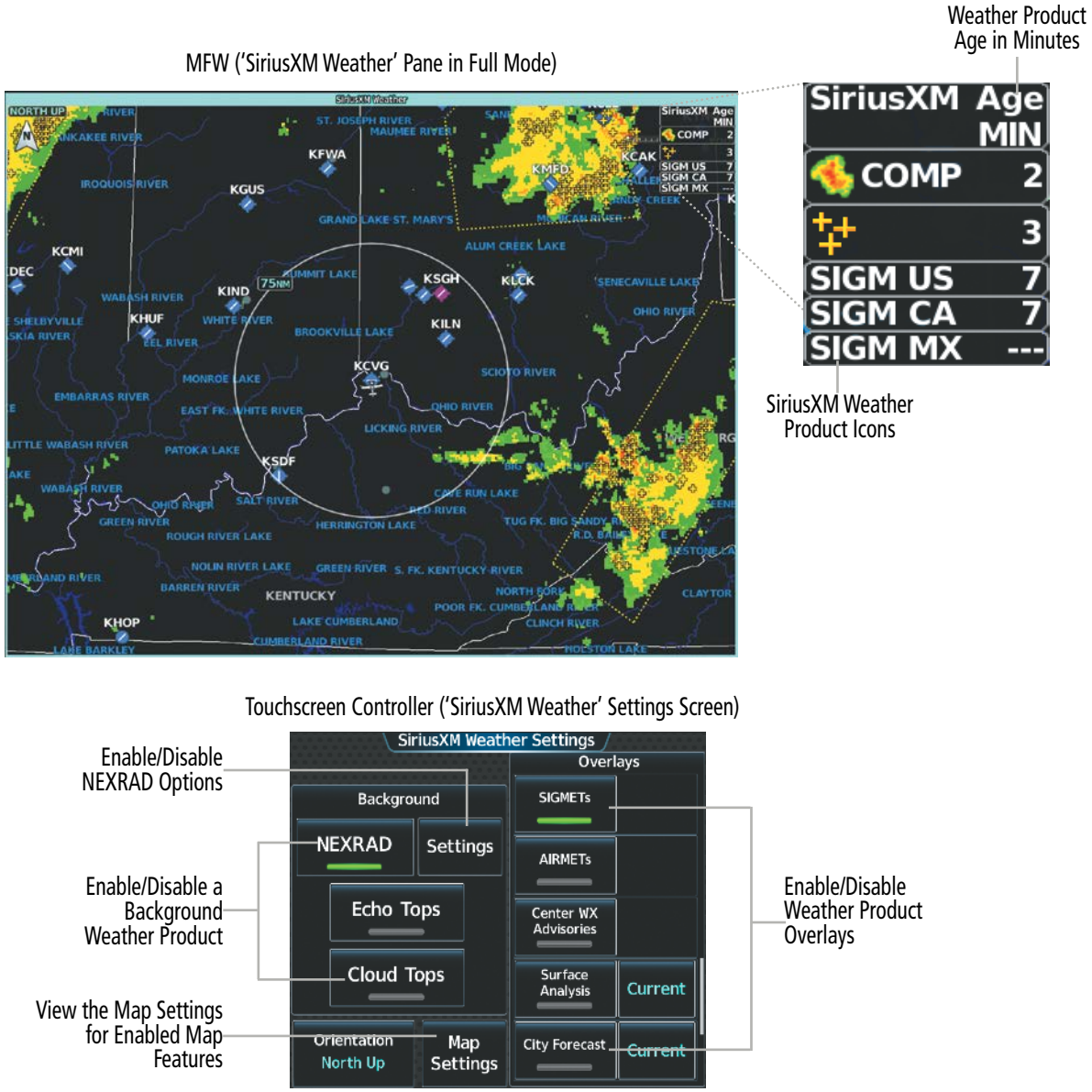


Figure 6-7 'SiriusXM Weather' Pane with Product Icons and Age Information

Viewing the Weather Data Link Pane and changing the data link weather source, if applicable:

1) From MFW Home, touch the **Weather** Button. Button is highlighted and becomes **Weather Selection** Button. Selected display pane shows a weather pane. If a weather pane other than 'Data Link Weather' is shown (such as 'Weather Radar' in the pane title), continue with the procedure to view the desired Weather Pane. (SiriusXM, FIS-B, or Connext).
2) Touch the **Weather Selection** Button. The 'Weather Selection' Screen appears.
3) Touch either **SiriusXM Weather, Connext Weather or FIS-B Weather** Button. Touched button is highlighted and becomes the settings Button. For example, if the **SiriusXM Weather** Button is touched it becomes the **SiriusXM Settings** Button.
4) If not selected, touch either the **SiriusXM, Connext, or FIS-B Settings** Button to access controls for the selected weather pane.

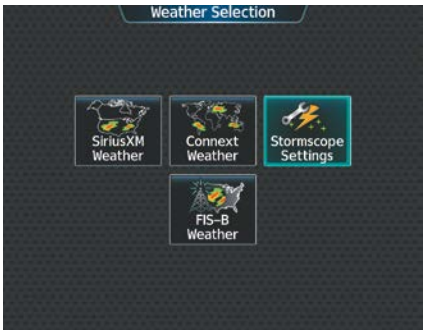


Figure 6-8 'Weather Selection' Screen

If more than one weather data link weather source has been installed (such as Garmin Connext Weather or FIS-B), the system provides the option to select a source of weather information for each Navigation Map Pane.

Selecting a Data Link Weather Source for Navigation Map Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll if necessary to view the **WX Source** Button. Cyan text on the button indicates currently selected weather data link weather source.
4) Touch the **WX Source** Button.
5) Touch the button for the data link weather source to be used (such as **SiriusXM, FIS-B,** or **Connext**, if installed).

Navigation Maps displaying data link weather products show the name of the selected source ('SiriusXM' or 'Connext WX') in the upper-right corner of the Inset map or lower right of the HSI map while data link weather products are enabled for display.

Selecting a Data Link Weather Source for PFD Maps (Inset Map, HSI Map):

1) From PFW Home, touch the **PFD Map Settings** Button.
2) Scroll as needed and touch the **WX Source** Button. The button will change to reflect desired source (**SiriusXM**, **FIS-B,** or **Connext**).

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Data Link Settings** Softkey.
3) Press the **Data Link** Softkey. Each selection of the softkey changes the source, which is displayed in cyan on the softkey.

The 'Data Link' Weather Settings Screen controls the enabling/disabling of weather products on the 'Data Link' Weather Pane. The 'Map Settings' Screen controls the enabling/disabling of weather products on navigation maps.

Setting up and customizing 'Data Link' Weather Products on navigation maps:

1) From MFW Home, touch **Map > Map Selection > Map Settings.**
2) If not selected, touch the **Sensor** Tab.
3) Scroll through the list to view the available weather products.
4) Touch a weather product annunciator button to enable/disable the selected weather product. Button annunciator is green when a weather product is enabled, or gray when disabled.
5) If not selected, touch a range button next to the corresponding weather product, then touch to select the maximum map range at which the system will display the selected weather product.

WEATHER PRODUCT MAP OVERLAYS

Table 6-4 shows which Data Link Weather products can be displayed (indicated with a '+' symbol) on specific maps.

Data Link Weather Product	PFD Inset or HSI Map	'Navigation Map' Pane	Weather Data Link Pane
NEXRAD/Radar Precipitation	+	+	+
Cloud Tops			+
Echo Tops			+
Infrared Satellite			+
Data Link Lightning	+	+	+
Cell Movement	+	+	+
SIGMETs/AIRMETs			+
Graphical AIRMETs			+
METARs	+	+	+
City Forecast			+
Surface Analysis			+
Surface Visibility			+
Freezing Levels			+
Winds Aloft		+[1]	+
County Warnings			+
Cyclone Warnings			+
Icing			+
PIREPs			+
AIREPs			+
Temperatures Aloft			+
Turbulence			+
No Radar Coverage	+	+	+
TFRs	+	+	+
TAFs			+
Center Weather Advisories			+

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

Table 6-4 Weather Product Display Maps

NOTE: *In configurations with multiple datalink weather sources, it is possible the HSI map not display weather data, or may display weather data from the incorrect source. This can occur either immediately following initialization or activation of a crew profile. When this occurs, it can be remedied by deselecting then reselecting the source on the GTC HSI Map Settings page.*

For each enabled 'Data Link' Weather product shown on a map, the system displays a weather product icon or name and the product age. The product age is the elapsed time (in minutes) since the weather data provider compiled the weather product. The product age display does not indicate the age of the information contained within the weather product, which can be significantly older than the displayed weather product age. This information appears automatically when a weather product is enabled on the 'Data Link' Weather Pane or 'Navigation Map' Pane. The pilot can optionally enable or disable this information on the Inset Map or HSI Map.

Softkeys control which weather products are shown on the PFD Inset or HSI Map Navigation Maps. The Touchscreen Controller controls the display of weather information on other map display panes such as the Navigation Map and Data Link Weather Panes. When most weather products are enabled for display, the corresponding button annunciator or softkey annunciator changes from gray (disabled) to green (enabled). For the NEXRAD weather product, pressing the 'Source' Softkey cycles through the various coverage sources (USA, Canada, or Off), indicated by cyan text on the Softkey.

The Data Link Weather Settings Screen controls the enabling/disabling of weather products for the Data Link Weather Pane The 'Map Settings' Screen controls the enabling/disabling of weather products for the 'Navigation Map' Panes.

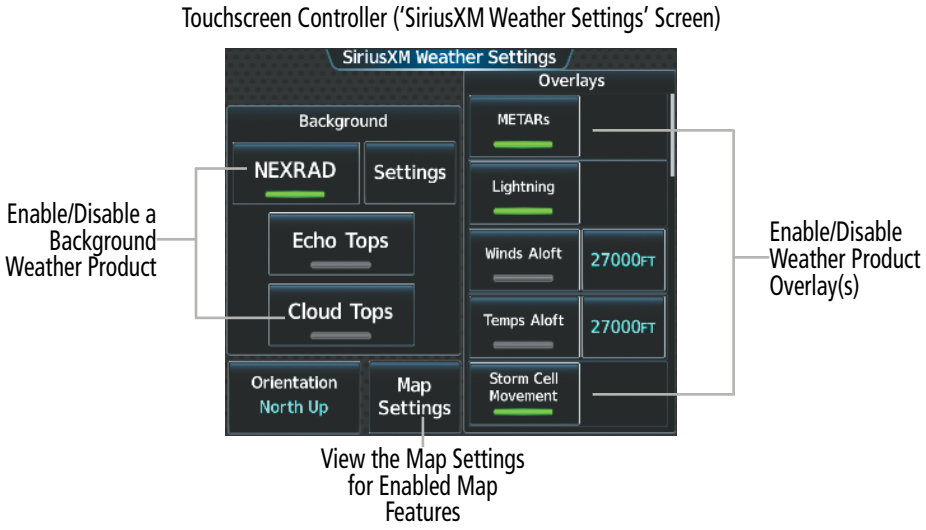


Figure 6-9 'SiriusXM Weather Settings' Screen

For Navigation Maps (including the Inset Map and HSI Map), the flight crew can select the maximum map range to display each Data Link Weather product. The 'Map Settings' Screen on the Touchscreen Controller controls the maximum map range at which the system displays a weather product on a map; selecting a map range higher than this range will declutter the weather product from the map. The selected maximum map ranges apply to all onside navigation maps, regardless of which screen was used to make the maximum map range selections.

Selecting Maximum Navigation Map Range for Data link Weather Products:

1) From MFW Home, touch **Map > Map Selection > Map Settings.**
2) If not selected, touch the **Sensor** Tab.
3) Scroll through the list to view the available weather products.
4) Touch a range button next to the corresponding weather product, then touch to select the maximum navigation map range at which the system will display the selected weather product.

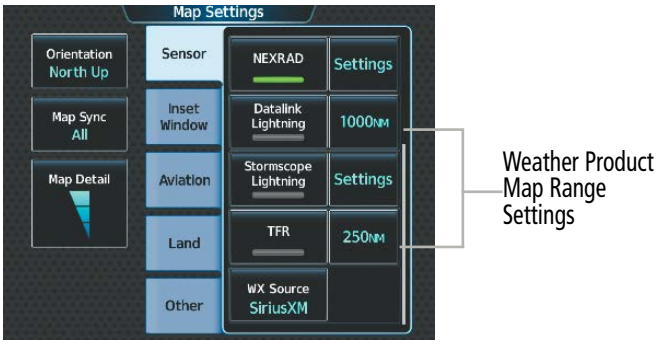


Figure 6-10 'Map Settings' Screen (Sensor Tab Selected)

The Data Link Weather Settings Screen on the Touchscreen Controller can display a legend for each weather product currently enabled on the Data Link Weather Pane.

NOTE: *When viewing the 'Navigation Map' Pane, with a data link weather overlay information enabled, displaying a different map and returning to the original map will ensure the most current weather overlay information is displayed.*

Viewing legends for weather products enabled on the 'Data Link' (SiriusXM, Connext, or FIS-B) Weather Pane:

1) From MFW Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**
2) Scroll as needed in the 'Overlays' Window and touch the **Legend** Button. The 'Weather Legends' Window appears on the Touchscreen Controller.
3) Scroll as needed to view the weather legends in the 'Weather Legends' window.
4) To remove the 'Weather Legends' Window, touch **Back** or **Home.**

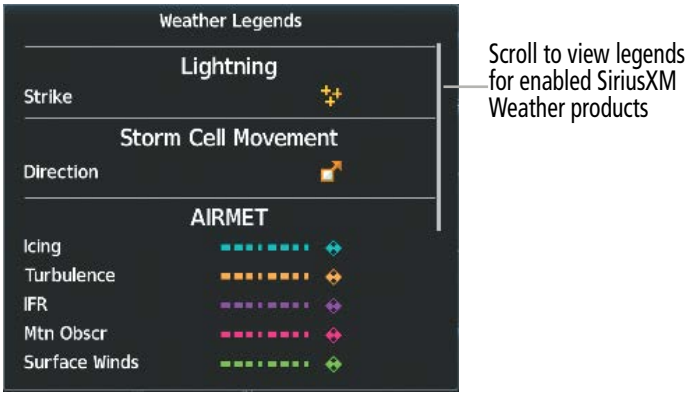


Figure 6-11 'Weather Legends' Window (SiriusXM)

The system displays additional information about the following weather products by panning over the product on the map with the Map Pointer.

- Echo Tops (SiriusXM)
- Storm Cell Movement (SiriusXM)
- SIGMETs
- AIRMETs
- METARs
- County Warnings (SiriusXM)
- Center Weather Advisories
- Graphical AIRMETs
- TFRs
- PIREPs
- AIREPs
- Infrared (IR) Satellite (Connext)

The lower knob adjusts the map range. Pushing the lower knob enables map panning. Once panning is enabled, pushing either the upper knobs or lower knob disables map panning. To move the Map Pointer while panning is enabled, turn the large and small upper knobs or use the **Touchpad**. If the map range is adjusted while panning is enabled, the map is re-positioned on the Map Pointer.

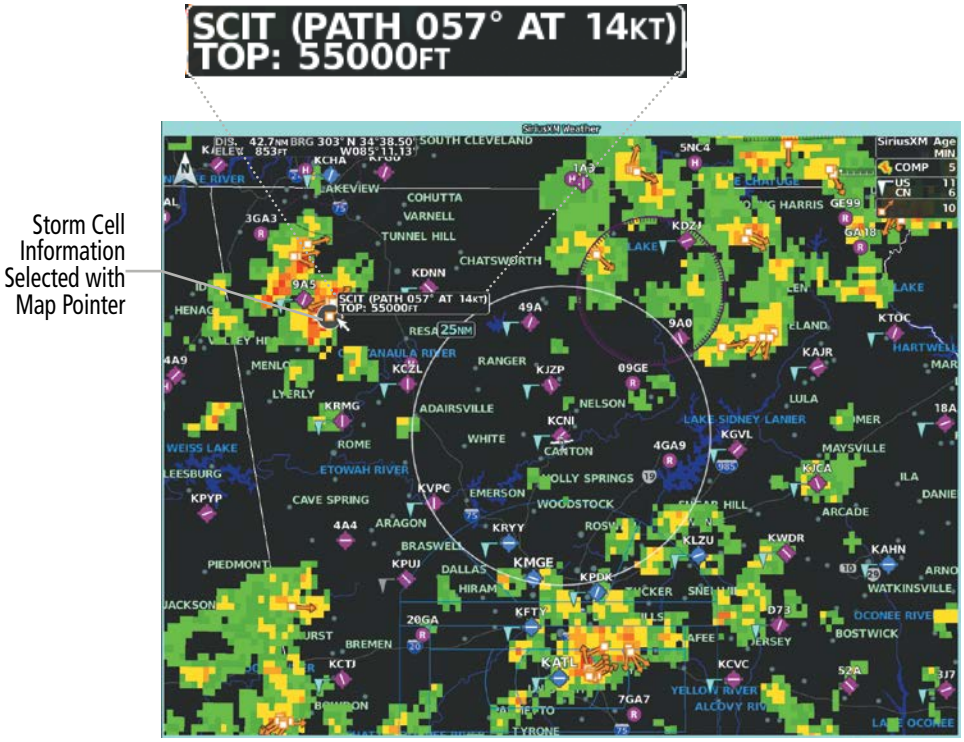


Figure 6-12 Panning on the 'SiriusXM Weather' Pane

The system provides the ability to select a map orientation for the Data Link Weather Pane for the selected display pane location. In addition to the Heading Up, Track Up, and North Up display options, the system can also synchronize the Data Link Weather Pane orientation to the 'Navigation Map' Pane orientation.

Selecting a map orientation for the Data Link (SiriusXM, Connext, or FIS-B) Weather Pane:

1) From MFW Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
2) Touch the **Orientation** Button to change the selected map orientation (displayed in cyan).
3) Touch the desired map orientation button (**Heading Up, Track Up, North Up, Sync to Nav Map**).

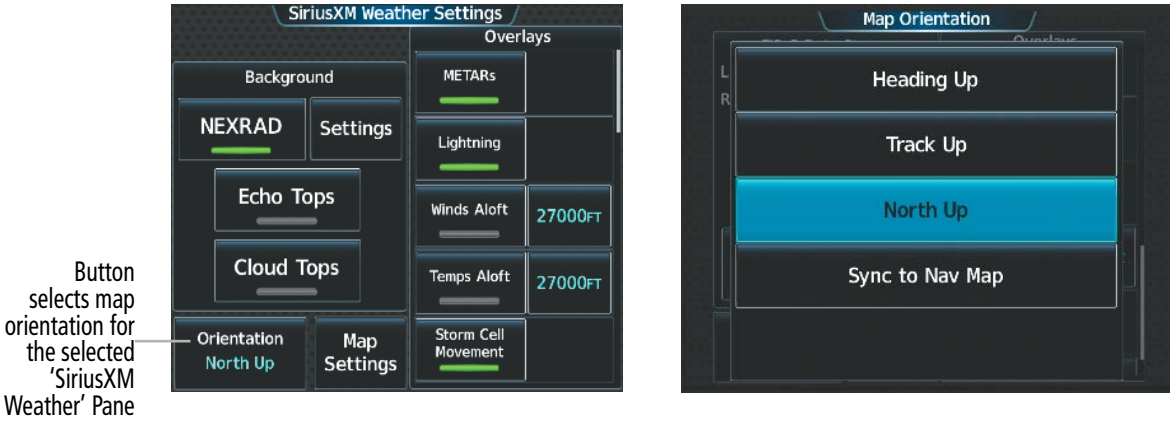


Figure 6-13 Selecting a Map Orientation for the 'SiriusXM Weather' Pane

The weather product age and availability information appears automatically when a weather product is shown on the Data Link Weather Pane. The pilot can manually enable/disable the display of this information on the PFD Inset/HSI Map.

Displaying/Removing Weather Product Age Information on the (PFD Inset Map or HSI Map):

1) From PFW Home, touch the **PFD Map Settings** Button.
2) Scroll as needed and touch the **Weather Legend** Button.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Weather Legend** Softkey to enable/disable the weather product age information.

In addition to the displaying Data Link Weather on the 'Navigation Map' Pane, the system can overlay Data Link Weather NEXRAD data on IFR/VFR Navigation Charts. When the NEXRAD data is selected to be overlaid on IFR/VFR charts, the opacity levels of the NEXRAD data can be controlled on the GTC. The opacity levels of the NEXRAD data can be set from of 37 to 100% in order to not obscure critical navigation data on the selected charts. For a further discussion about IFR/VFR Charts, please refer to the Additional Features section.

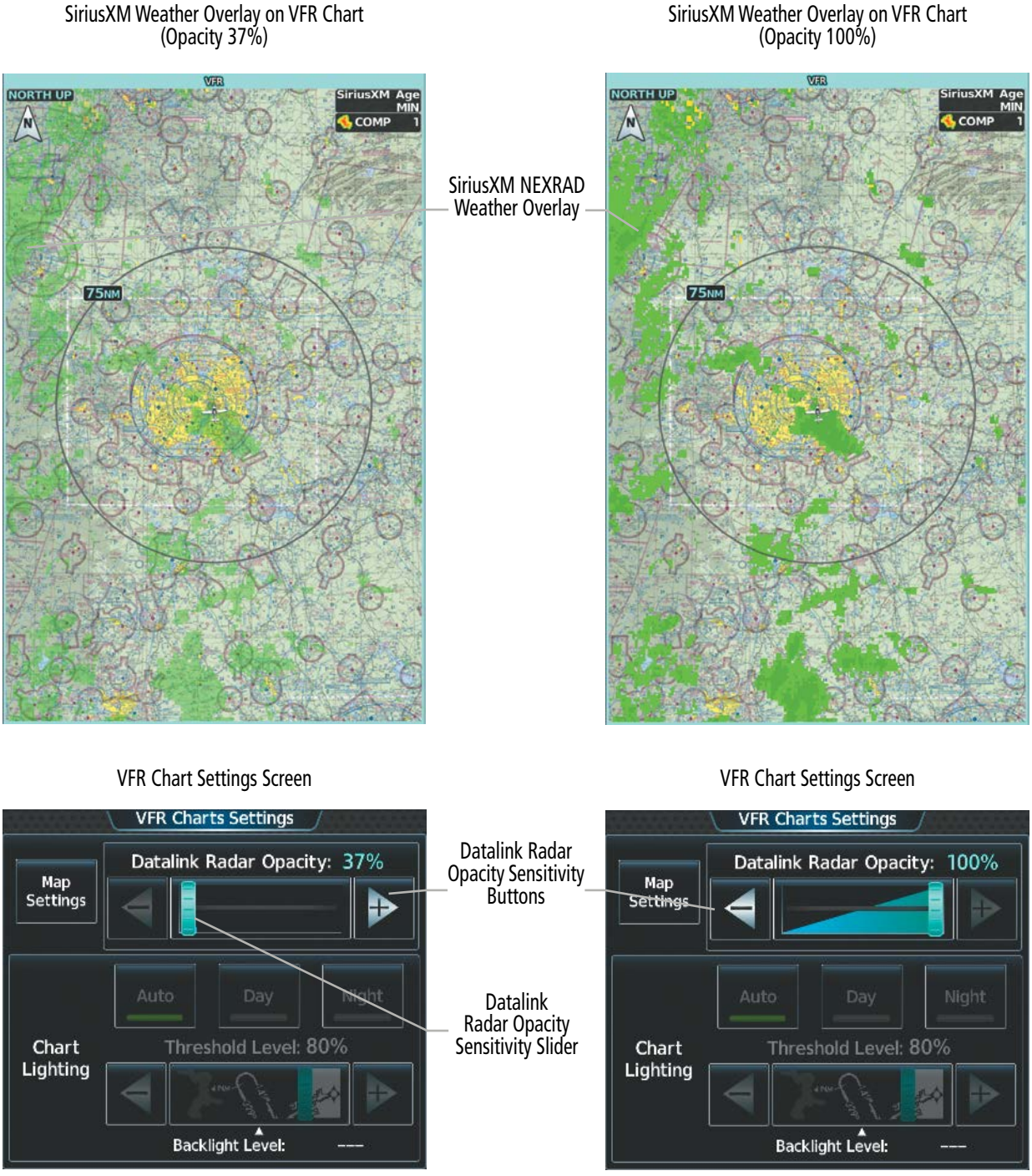


Figure 6-14 SiriusXM Weather Overlay on VFR Charts

Setting Data Link Radar Opacity on VFR/IFR Charts :

1) From MFW Home, touch **Map > Map Selection > Map Settings.**
2) Touch the **VFR** Button **> VFR Settings** Button.

Or:

1) From MFW Home, touch **Map > Map Selection > Map Settings.**
2) Touch the **IFR Low** Button **> IFR Low Settings** Button.

Or:

1) From MFW Home, touch **Map > Map Selection > Map Settings.**
2) Touch the **IFR High** Button **> IFR High Settings** Button.
3) To increase or decrease the Data link Radar Opacity touch **-/+** Button or move the slider left or right to the desire setting. Setting the Data link Radar Opacity percentage to the same percentage shown as the MFD Backlight Level will cause the Day/Night view to switch at the current backlight setting. Adjusting the Data link Radar Opacity setting greater than the MFD Backlight Level will cause the display to remain in Night Mode longer. Adjusting the Data link Radar Opacity setting lower than the MFD Backlight Level will cause the display to change to Day Mode sooner.

CONNEXT WEATHER DATA REQUESTS

The 'Data Request' Window on the 'Connext Weather Settings' Screen provides the flight crew with the options to define weather data request coverage areas, select automatic weather data request intervals, and provides the ability to send an manual data request immediately. The Data Request Window also displays the status of the Connext Data Request process.

Before the system can retrieve weather information, a valid coverage area must be defined from which all available Garmin Connext Weather products will be retrieved (regardless of which weather products are currently enabled for display). The flight crew may define the coverage area by enabling/disabling one or more of the following buttons at any time:

- **P.POS** (Present Position)
- **Destination** (as part of the active flight plan)
- **Flight Plan** (active)
- **Waypoint**

It is not necessary to provide the system with the destination, flight plan, or waypoint before enabling these buttons. However, if none of this information is supplied, the present position must be included in the Connext Data Request. Otherwise, the 'Data Request' Window indicates 'INVALID COVERAGE AREA' when performing a data request, because the system has insufficient information to define the coverage area.

Defining Weather Data Request Coverage Area:

1) From MFW Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings**.
2) Touch the **Define Coverage** Button.
3) To change the diameter and route width of the weather data request coverage area, touch the **Diameter/ Width** Button. Scroll as needed and touch the desired distance button in the selection window.
4) To include/remove the present position in the weather data request, touch the **P.POS** Button.
5) To include/remove the destination of the active flight plan in the weather data request, touch the **Destination** Button.
6) To include/remove any portion of the active flight plan route in the weather data request, touch the **Flight Plan** Button.
7) To change distance of the flight plan to be used in the data request, touch the Flight Plan Distance Button. Scroll as needed and touch the desired distance of the flight plan to be used ('Remaining FPL' uses the remainder of the flight plan, or select a specified look-ahead distance from the list.)
8) To include/remove a specific waypoint to be used in the weather data request, touch the **Waypoint** Button.
   a) Touch the waypoint entry Button (to the right of the **Waypoint** Button).
   b) Use Touchscreen Controller keypad or large and small upper knobs to enter a waypoint to include in the weather data request, then touch the **Enter** Button or press the small upper knob.
9) When finished, touch the **Back** Button to return to the 'Connext Weather Settings' Screen, or touch the **Home** Button.

Sending/Canceling an Immediate Weather Data Request:

1) From MFW Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings**.
2) Touch the **Send Immediate Request** Button. The system contacts Garmin Connext services and displays the status in the 'Data Request' Window. System displays 'Completed' when finished.
3) If desired, touch the **Cancel Immediate Request** Button while a request is occurring. 'Data Request' Window displays 'Canceled'.

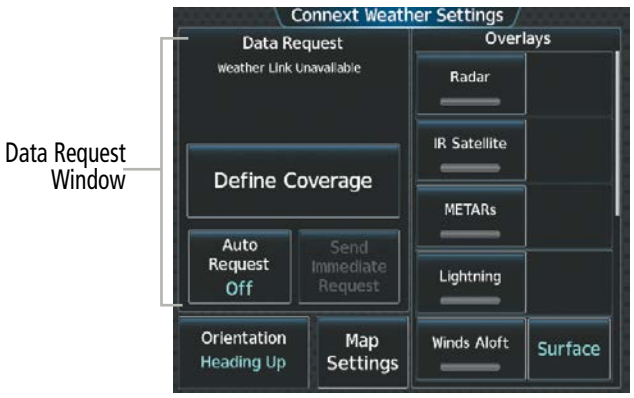


Figure 6-15 'Connext Weather Settings' Screen

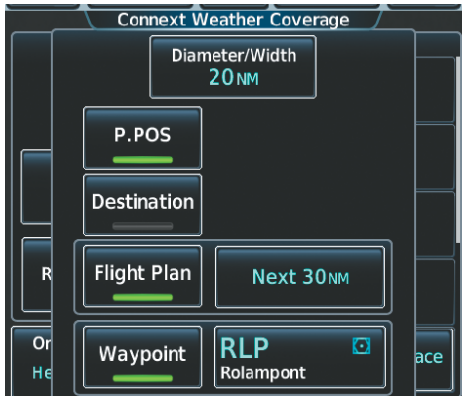
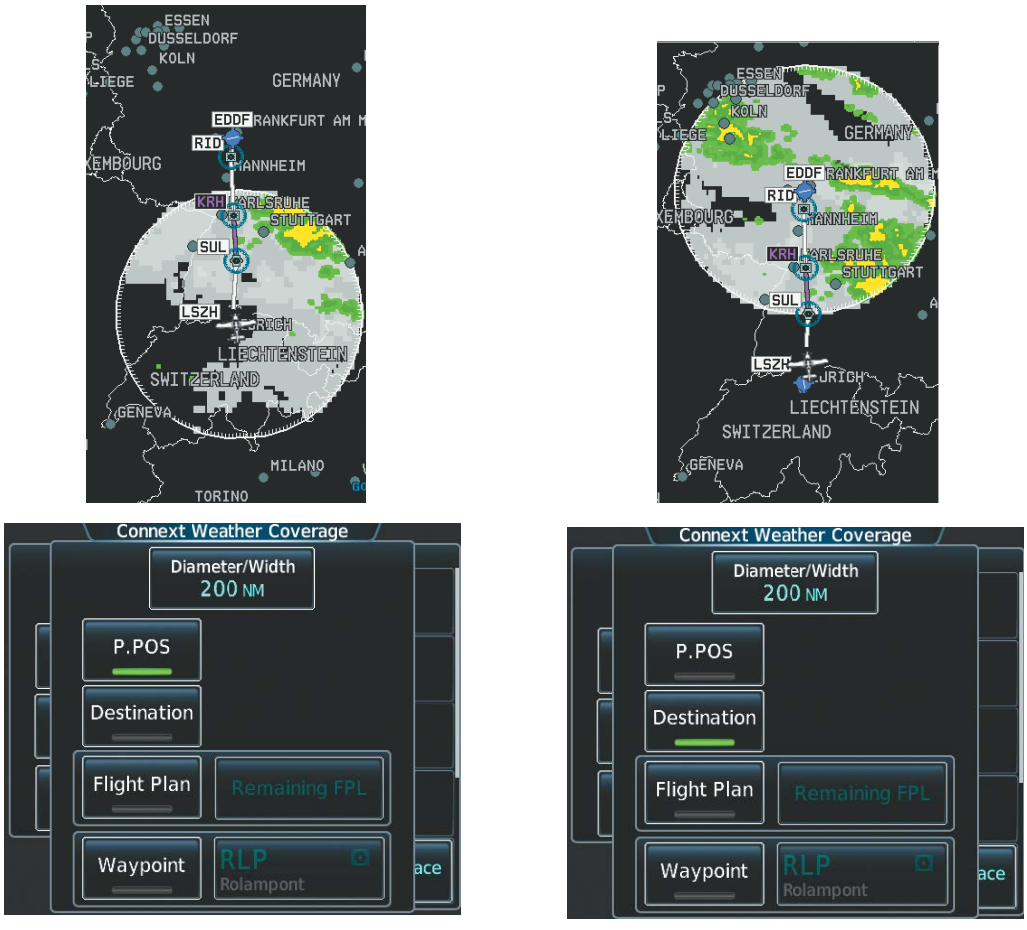


Figure 6-16 Selecting coverage area for Connext Data Request

During a weather data request, the 'Data Request' Window initially displays "Contacting Connext...". Once a connection is established, the 'Data Request' Window displays "Receiving Wx Data... Time Remaining:" with an estimated data transfer time (either minutes or seconds). Connext Data Requests typically take between one to four minutes to complete depending on the size of the selected weather coverage area and the data link signal strength. If the system cannot complete the data request, the 'Data Request' Window displays an error; see the Abnormal Operations discussion later in this section for more information.

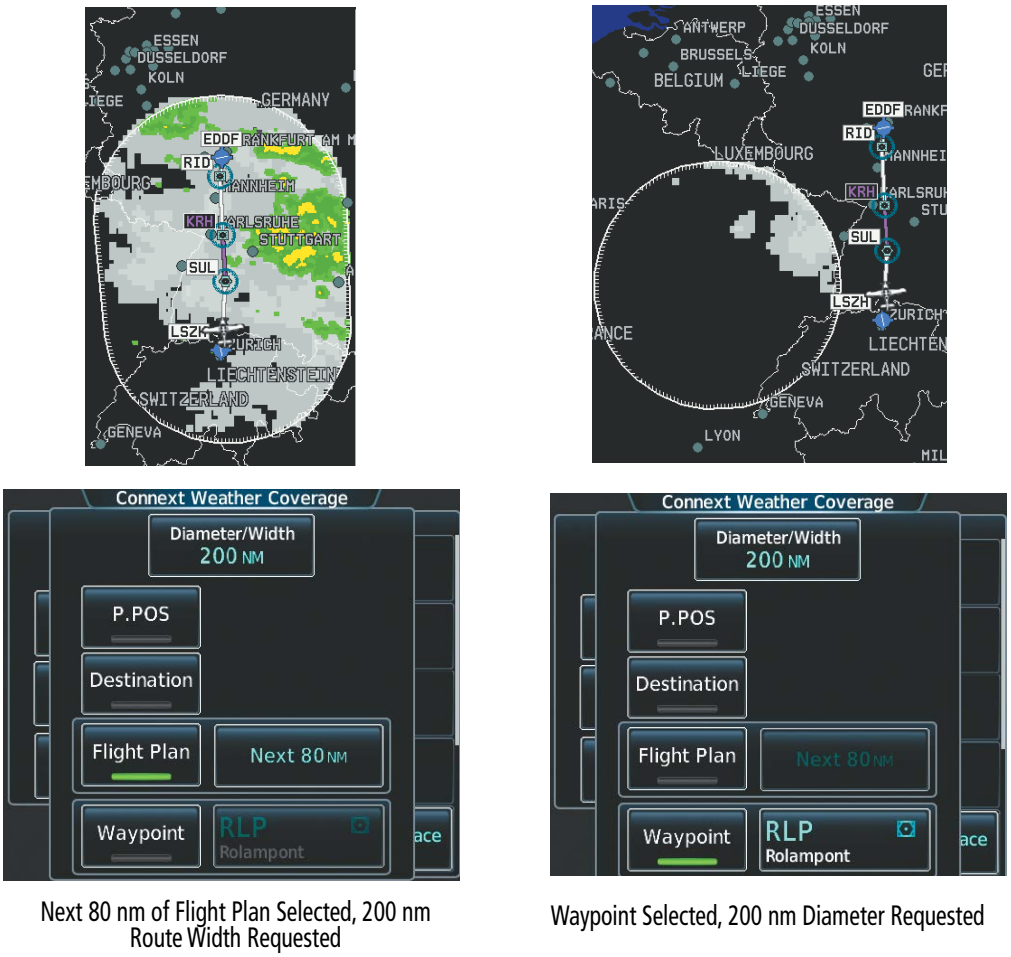
The system retrieves all available Connext Weather products within the selected coverage area during an initial weather data request, regardless of which products (if any) are currently enabled for display. On subsequent weather data requests, previously retrieved textual products (such as METARs and TAFs) are retained if not expired, while new textual weather data matching the current coverage area and all graphical weather data is downloaded during every data request.



Present Position Selected, 200 nm Diameter Requested

Destination Selected, 200 nm Diameter Requested

Figure 6-17 Connext Weather Coverage Options for Present Position and Destination



Next 80 nm of Flight Plan Selected, 200 nm Route Width Requested

Waypoint Selected, 200 nm Diameter Requested

Figure 6-18 Connext Weather Coverage Options based on Flight Plan and Waypoint Selections

The flight crew can schedule Connext Data Requests to recur automatically. Automatic requests remain enabled until the flight crew disables them, or the system power is cycled. The 'Data Request' Window will indicate a countdown timer until the next automatic Connext Data Request occurs. Performing an immediate data request resets the timer until the next Automatic data request occurs.

Enabling/disabling automatic Connext Data Requests:

1) From MFW Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings**.
2) Touch the **Auto Request** Button.
3) From the selection window, touch an Auto Update Request Rate Button to select the desired weather request update interval in minutes or touch the **Off** Button to disable automatic Connext Data Requests.

WEATHER PRODUCT OVERVIEW

The following is an overview of data link weather products the system can display.

NEXRAD (SIRIUSXM)

WARNING: *Do not use the indicated data link weather product age to ascertain 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.*

NOTE: *The NEXRAD weather product cannot be displayed at the same time as terrain, echo tops, turbulence, or icing data.*

NOTE: SiriusXM NEXRAD composite reflectivity is only available for radar sites within the United States. For sites outside of the United States, SiriusXM NEXRAD base reflectivity data will be displayed.

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 160 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 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.

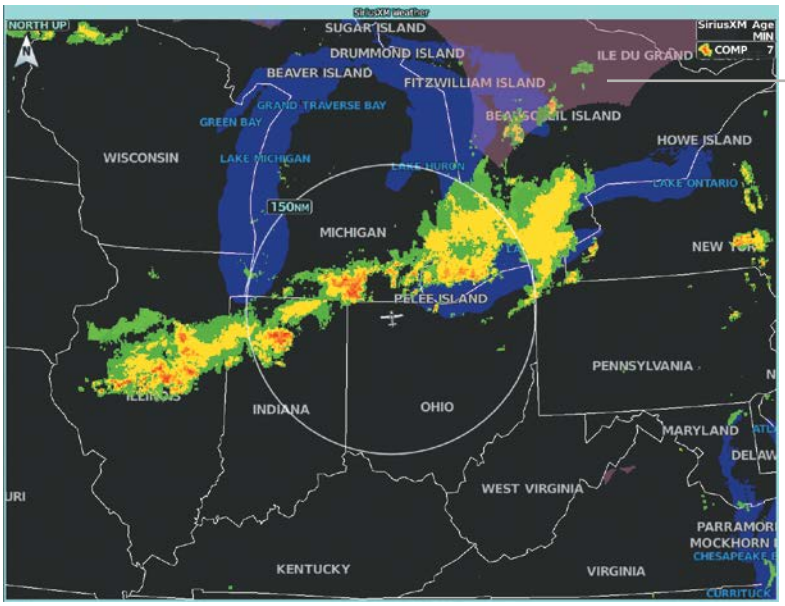


Figure 6-19 NEXRAD Data on the 'SiriusXM Weather' Pane

Displaying NEXRAD weather information on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings.**
2) Touch the **NEXRAD** Button in the 'Background' Window to enable/disable the display of NEXRAD information.

Changing the NEXRAD coverage area on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings.**
2) Touch the NEXRAD **Settings** Button. The 'NEXRAD Options' Window appears.
3) Touch the **NEXRAD Type** Button.
4) Touch the **Composite Reflectivity CONUS** or **Base Reflectivity All Regions** Button, or touch **Back** or **Home** to exit without changing the coverage area.

NOTE: *The* NEXRAD composite reflectivity is only available for radar sites in the United States. For sites outside of the United States, NEXRAD base reflectivity data will be used.

Displaying NEXRAD weather information on the 'Navigation Map' Panes:

1) From MFW Home, touch **Map** > **Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the **NEXRAD** Button in the 'Overlays' Window to enable/disable the display of the NEXRAD weather product on the 'Navigation Map' Pane.

Changing the NEXRAD coverage area on the 'Navigation Map' Panes:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the NEXRAD **Settings** Button.
4) Touch the **NEXRAD Type** coverage Button (displaying either 'Composite Reflectivity' or 'Base Reflectivity' in cyan).
5) Touch the **Composite Reflectivity CONUS** or **Base Reflectivity All Regions** Button, or touch **Back** or **Home** to exit without changing the coverage area.

Displaying SiriusXM NEXRAD weather information (PFD Inset Map or HSI Map):

1) If necessary, enable the Inset Map or HSI Map.
2) From PFW Home, touch **PFD Map Settings.**
3) Scroll in the **Overlays** Tab and touch the **NEXRAD** Button.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **WX Overlay** Softkey until SiriusXM is displayed in cyan. Each press cycles through an available option, displayed in cyan. When 'SiriusXM' is displayed, SiriusXM NEXRAD is enabled. When 'Off' is displayed, SiriusXM NEXRAD data is disabled.

Changing the SiriusXM NEXRAD coverage area (PFD Inset Map or HSI Map):

1) From PFW Home, touch the **PFD Map Settings** Button.
2) Scroll in the Overlays Tab, and touch the NEXRAD **Settings** Button.
3) Touch the **NEXRAD Type** Button.
4) Touch the **Composite Reflectivity CONUS** or **Base Reflectivity All Regions** Button, or touch **Back** or **Home** to exit without changing the coverage area.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Data Link Settings** Softkey.
3) Press the **NEXRAD** Softkey. Each selection of the softkey changes the source 'COMP' or 'Base', which is displayed in cyan on the softkey.

All weather product legends can be viewed on the Touchscreen Controllers. For the NEXRAD legend, scroll as needed and touch the **Legend** Button on the 'SiriusXM Weather Settings' Screen when NEXRAD is enabled for display.

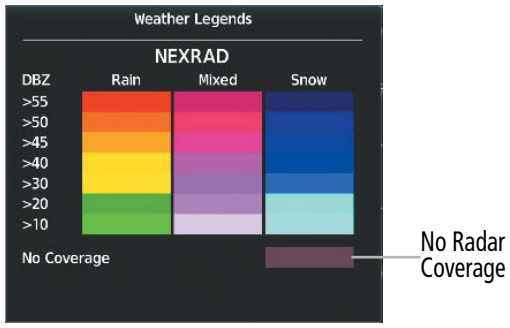


Figure 6-20 SiriusXM NEXRAD Legend

The system can animate a loop of NEXRAD information on the 'SiriusXM Weather' Pane, navigation maps, and Inset Map. Animation begins after the system has received at least two NEXRAD images. When animation is enabled, a timeline appears to the left of the NEXRAD weather product age display. The large square on the timeline indicates the relative position of the displayed frame of animation, from oldest to newest.

The NEXRAD weather product age corresponds to the displayed frame. The system can show up to six frames of NEXRAD animation when the USA coverage option is selected, and up to three frames of animation when Canada is selected.

Displaying Time-Lapse NEXRAD Animation on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) If not selected, touch the **NEXRAD** Button in the 'Background' Window to enable the display of NEXRAD.
3) Touch the NEXRAD **Settings** Button.
4) Touch the **Animation** Button to enable/disable the animation.
5) When finished, touch **Back** or **Home**.

Displaying Time-Lapse NEXRAD Animation on the 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll if necessary and touch the NEXRAD **Settings** Button.
4) Touch the **NEXRAD Animation** Button to enable/disable the animated NEXRAD information.
5) When finished, touch **Back** or **Home**.

Displaying Time-Lapse NEXRAD Animation on the PFD Inset Map:

1) If necessary, enable the Inset Map.
2) From PFW Home, touch the **PFD Map Settings** Button.
3) Scroll and touch the NEXRAD **Settings** Button.
4) Touch the **NEXRAD Animation** Button to enable/disable the animated NEXRAD information on the Inset Map

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Data Link Settings** Softkey.
3) Press the **NEXRAD Animation** Softkey.

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

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:

- NEXRAD base reflectivity does not provide sufficient information to ascertain cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- NEXRAD base reflectivity is sampled at the minimum antenna elevation angle. An individual NEXRAD 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. The intensity level reflected by each square represents the *highest* level of NEXRAD data sampled within the area.
- 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 NEXRAD radar images:

- Ground clutter.
- Spurious radar data.
- Sun strobes (when the radar antenna points directly at the sun).
- Interference from buildings or mountains, which may cause shadows.
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans.

NEXRAD Limitations (Canada)

- Radar coverage extends to 55°N.
- Any precipitation displayed between 52°N and 55°N is displayed as mixed regardless of actual precipitation type.

NEXRAD (FIS-B)

NOTE: *The NEXRAD weather product cannot be displayed at the same time as relative terrain.*

NOTE: *Pilots are encouraged to check additional NOTAM sources to supplement FIS-B NOTAMs. NOTAMs older than 30 minutes will not be displayed by FIS-B. For additional information refer to InFO 18008 and AC 00-63.*

NOTE: *The ceiling for FIS-B is 24,000ft (FL240), however it is expected that users can receive the FIS-B service above that altitude. Some FIS-B products will only include data up to or near FL240, however Winds and Temps Aloft will extend up to FL390.*

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.

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.

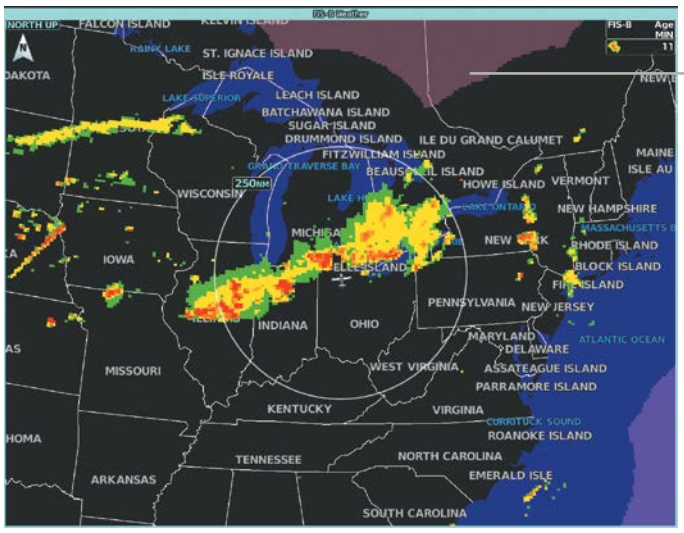


Figure 6-21 CONUS NEXRAD Weather Product on the 'FIS-B Weather' Pane

The Regional 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). The pilot can choose which type of NEXRAD weather product is displayed.

Enabling/Disabling FIS-B weather information on the 'FIS-B Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > FIS-B Weather > FIS-B Settings.**
2) Touch the **Enable FIS-B** Button in the 'FIS-B Data Status' Window to enable/disable the display of FIS-B Weather information.

Displaying the NEXRAD weather product on the 'FIS-B Weather; Pane (CONUS or Regional):

1) From MFW Home, touch **Weather > Weather Selection > FIS-B Weather > FIS-B Settings.**
2) Touch the **CONUS NEXRAD** or **Regional NEXRAD** Buttons in the 'Overlays' Window.

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 hatched 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.

Both types of NEXRAD may be enabled on the map simultaneously. When this occurs, the Regional NEXRAD display takes precedence when the CONUS and Regional NEXRAD coverage overlaps.

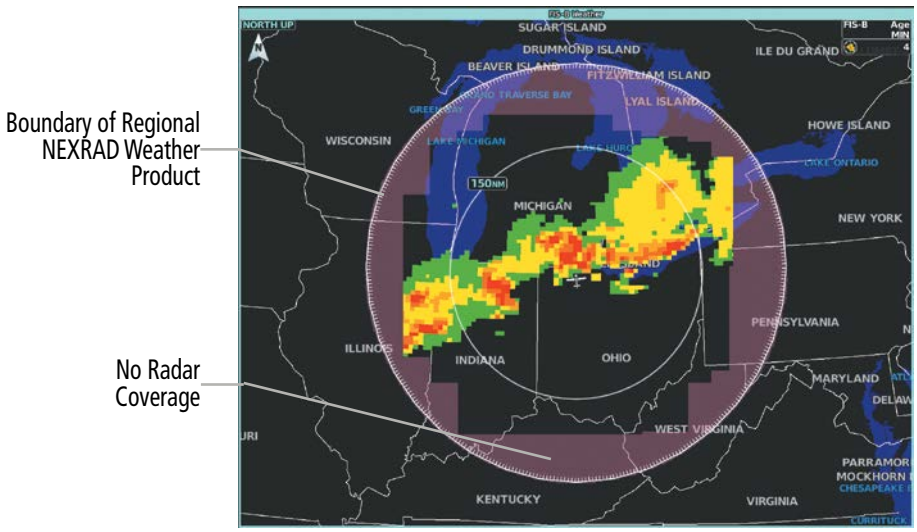


Figure 6-22 Regional NEXRAD Weather Product on the 'FIS-B Weather' Pane

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.

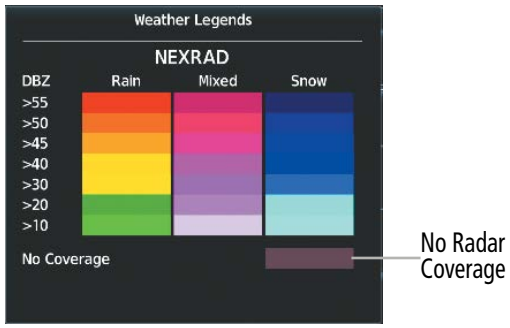


Figure 6-23 FIS-B NEXRAD Legend

When NEXRAD is enabled, areas where radar data is not currently available, has not yet been received, or is not being collected are indicated in a gray shade of purple.

Displaying FIS-B NEXRAD weather information on the 'Navigation Map' Panes:

1) From MFW Home, touch **Map** > **Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the **NEXRAD** Button.
4) Touch the **CONUS**, **Regional,** or **Combined** Button to enable/disable the display of the NEXRAD weather product on the 'Navigation Map' Pane.

Displaying FIS-B NEXRAD weather information (PFD Inset Map or HSI Map):

1) If necessary, enable the Inset Map or HSI Map.
2) From PFW Home, touch **PFD Map Settings.**
3) Scroll in the **Overlays** Tab and touch the **NEXRAD** Button.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **WX Overlay** Softkey until FIS-B is displayed in cyan. Each press cycles through an available option, displayed in cyan. When 'FIS-B' is displayed, FIS-B NEXRAD is enabled. When 'Off' is displayed, FIS-B NEXRAD data is disabled.

Changing the FIS-B NEXRAD coverage area (PFD Inset Map or HSI Map):

1) From PFW Home, touch the **PFD Map Settings** Button.
2) Scroll in the Overlays Tab, and touch the **NEXRAD** Button.
3) Touch the either **CONUS**, **Regional**, or **Combined** Button for the desired FIS-B NEXRAD coverage data.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Data Link Settings** Softkey.
3) Press the **NEXRAD** Softkey to select between 'CONUS', 'Regional', or 'Combined' FIS-B NEXRAD Coverage data.

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 a map range of 30 nm or less, individual blocks of NEXRAD weather data are viewable. For the regional version of the NEXRAD weather product, each block is 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 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.
- 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 Garmin Connext Radar weather product, where available, shows a mosaic of weather radar images compiled from individual radar sites. Images may arrive at ground-based collection systems at different rates and times.

Periodically, the Garmin Connext Weather service collects these images, and assigns a single time to indicate when it created the image. This composite image becomes the Garmin Connext Radar product. Images from individual radar sites differ in age, and are always older than the displayed Precipitation weather product age.

Because of the time required to detect, assemble, and distribute this 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. Information from the Garmin Connext Radar 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.

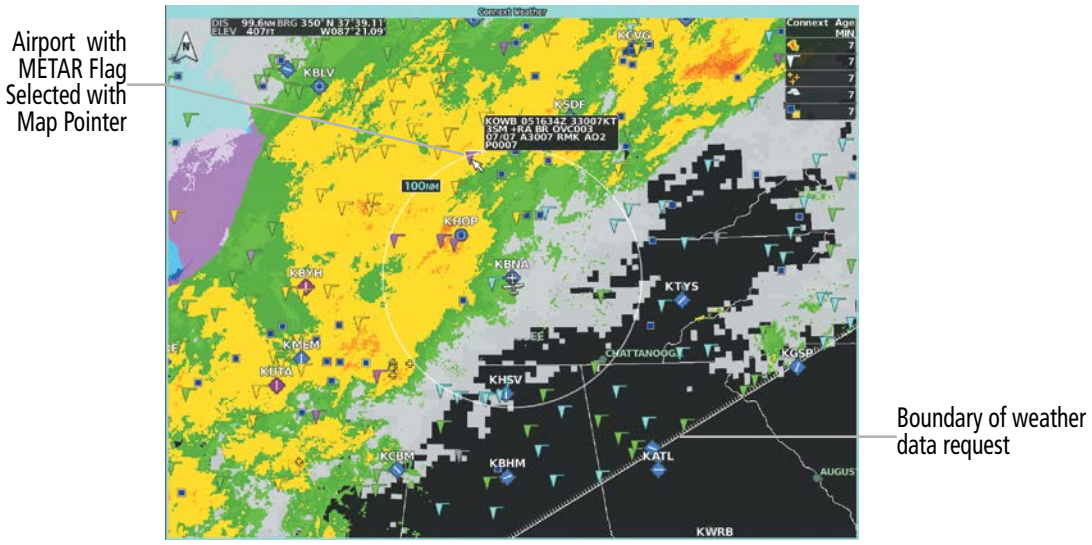


Figure 6-24 'Connext Weather' Pane with Connext Radar Enabled

Displaying Garmin Connext Radar information on the 'Connext Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings.**
2) Touch the **Radar** Button in the 'Overlays' Window.

Connext Weather Radar data shown represents lowest level, base reflectivity, of radar returns. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the 'Connext Weather' Pane. For the Connext Radar legend, touch the **Legend** Button on the 'Connext Weather Settings' Screen when Connext Weather is enabled for display.

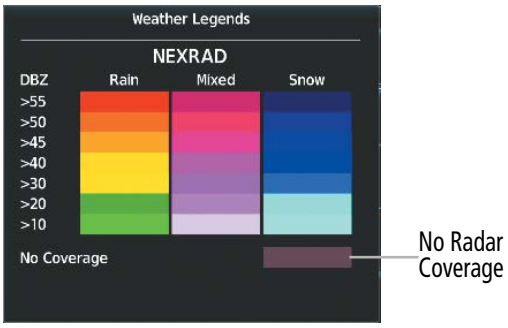


Figure 6-25 Connext Weather Radar Legend

The display of no radar coverage is enabled when Garmin Connext Radar is enabled for display. Areas where radar coverage is not currently available or is not being collected are indicated in a gray shade of purple. A white boundary line with white tick marks depicts the selected coverage area of the Connext Data Request (as defined in the 'Data Request' Window). This boundary encloses the precipitation data when this weather product is displayed. This boundary assists the flight crew in differentiating an area without precipitation from an area outside of the Connext Data Request coverage area.

Displaying Garmin Connext Radar information on the 'Navigation Map' Panes:

1) From MFW Home, Touch **Map** > **Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** tab.
3) Scroll if needed and touch the **Connext Radar** Button

Displaying Connext Radar weather information (PFD Inset Map or HSI Map):

1) If necessary, enable the Inset Map or HSI Map.
2) From PFW Home, touch **PFD Map Settings.**
3) Scroll in the **Overlays** Tab and touch the **Connext Radar** Button.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **WX Overlay** Softkey until Connext is displayed in cyan. Each press cycles through an available option, displayed in cyan. When 'Connext' is displayed, Connext Radar is enabled. When 'Off' is displayed, Connext Radar is disabled.

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the Precipitation display directly correlate 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 radar echo intensities are measured in decibels (dB) relative to reflectivity (Z). Weather radars measure the 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.

Radar Limitations

Radar images may have certain limitations:

- Radar base reflectivity does not provide sufficient information to ascertain 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.
- 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.

DATA LINK WEATHER PRODUCT OVERLAYS

If equipped, the following optional data link weather products will be available to the flight crew.

ECHO TOPS (SIRIUSXM)

NOTE: *When the Echo Tops weather product is enabled on the 'SiriusXM Weather' Pane, the system disables the NEXRAD and Cloud Tops weather products.*

The Echo Tops weather product shows the location and elevation of the highest radar echo. The highest radar echo does not indicate the actual top of a storm or clouds. It indicates the highest altitude at a which NEXRAD radar was able to detect precipitation. Note this Echo Tops altitude may be significantly higher than the highest altitude airborne weather radar was able to detect precipitation, particularly at longer ranges from the airborne weather radar antenna. See the Airborne Color Weather Radar discussion later in this section for more information on airborne weather radar. The Echo Tops weather product, like all data link weather products, does not provide real-time weather information.

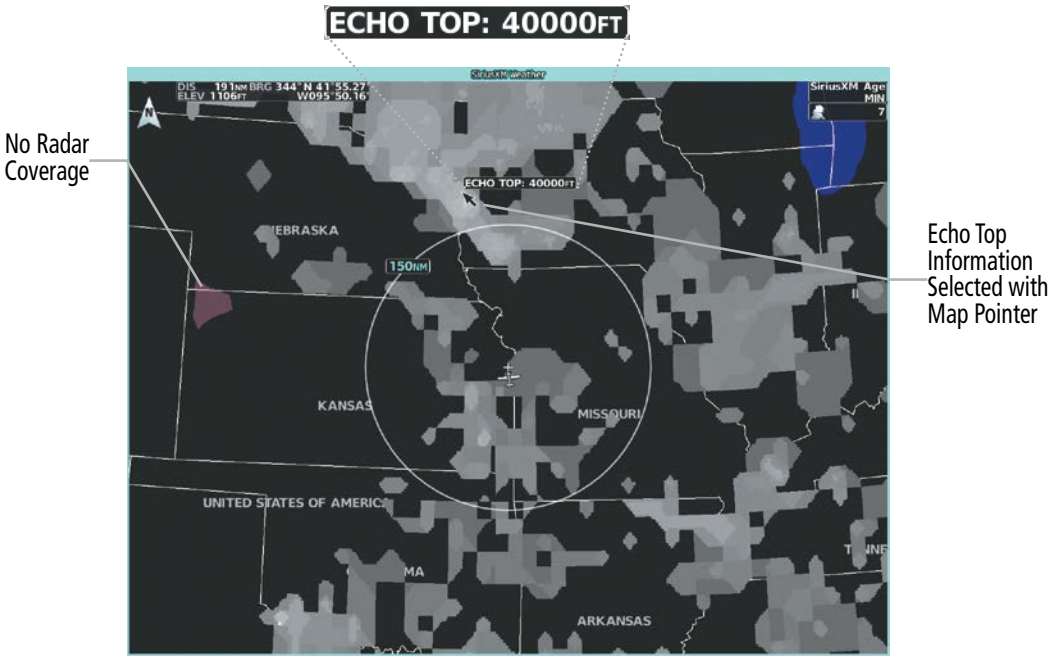


Figure 6-26 Echo Tops Weather Product

Enabling/Disabling Echo Tops information:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Touch the **Echo Tops** Button in the 'Background' window.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'SiriusXM Weather' Settings Screen to display the 'Echo Tops' legend when 'Echo Tops' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**. Since Echo Tops and Cloud Tops use the same color scaling to represent altitude, only one of these products may be displayed at a time. When Echo Tops is enabled, the system disables NEXRAD and Cloud Tops information.

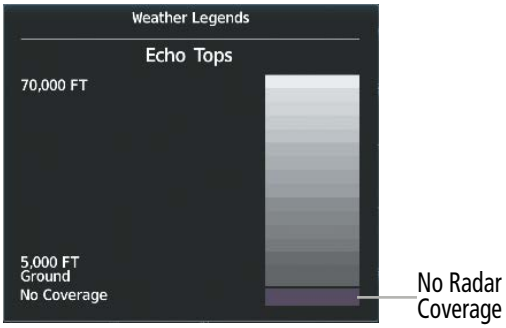


Figure 6-27 Echo Tops Legend

The display of No Radar Coverage is always active when either Echo Tops or NEXRAD is enabled. Areas where NEXRAD radar coverage and Echo Tops information is not available, or is not being collected are indicated in gray shade of purple.

CLOUD TOPS (SIRIUSXM/FIS-B)

NOTE: *When the Cloud Tops weather product is enabled on the 'SiriusXM Weather' Pane, the system disables the Echo Tops weather product.*

The Cloud Tops weather product depicts cloud top altitudes as determined from satellite imagery. When the Cloud Tops weather product is enabled, the system removes the Echo Tops weather product. When the Map Pointer is activated, the system displays the altitude of the selected Cloud Tops.

The FIS-B Cloud Tops weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

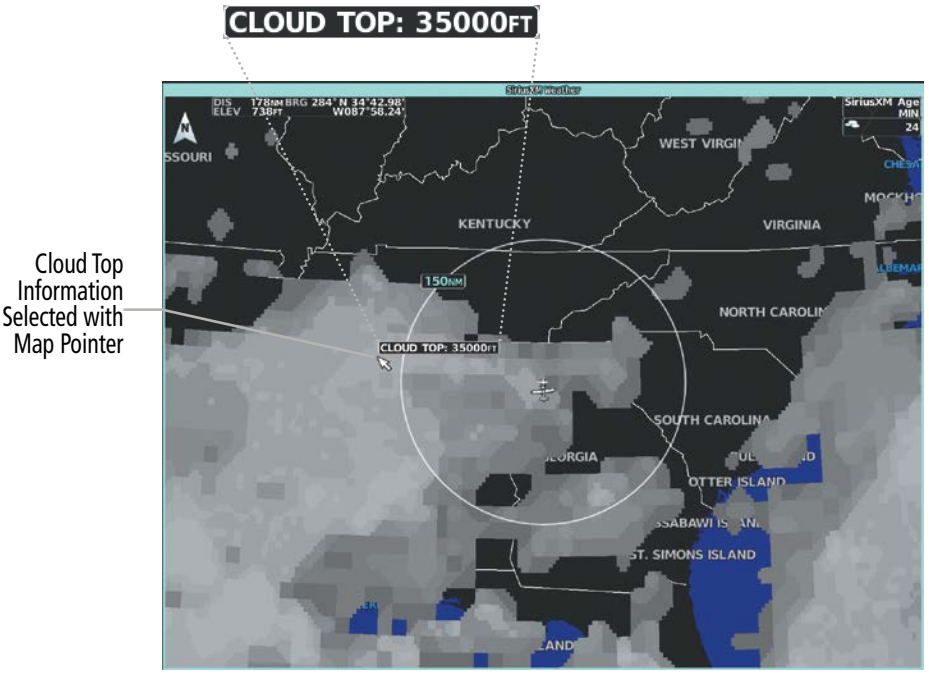


Figure 6-28 Cloud Tops Weather Product

Enabling/Disabling Cloud Tops information on the 'Data Link Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
2) Touch the **Cloud Tops** Button in the 'Background' Window (SiriusXM) or 'Overlays' Window (FIS-B).

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'SiriusXM Weather' Settings Screen to display the 'Cloud Tops' legend when 'Cloud Tops' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.

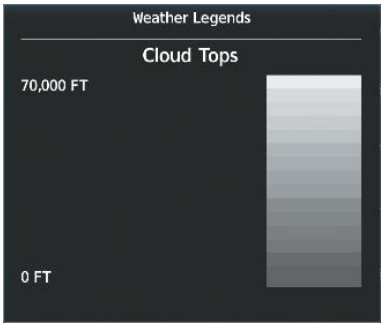


Figure 6-29 Cloud Tops Legend

INFRARED SATELLITE (GARMIN CONNEXT)

The Infrared (IR) Satellite weather product depicts cloud top temperatures, as determined from infrared satellite imagery. Darker colors indicate warmer cloud tops typically associated with lower altitudes; lighter colors indicate cooler cloud tops typically associated with higher altitudes. When panning over a Cloud Top with the Map Pointer, the system displays an estimated temperature range for the selected Cloud Top.

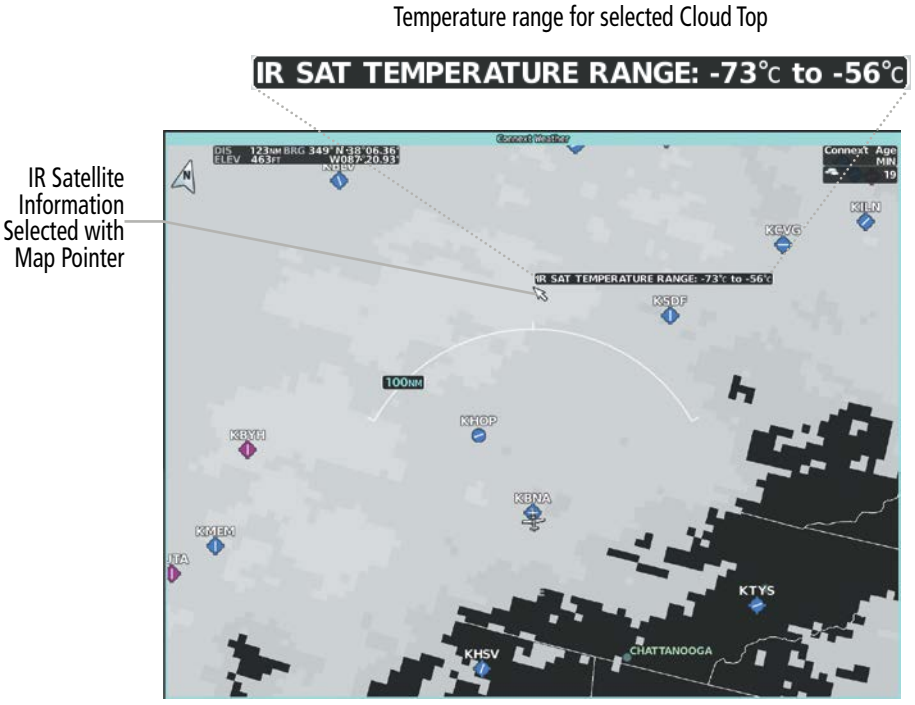


Figure 6-30 Infrared Satellite Weather Product on 'Connext Weather' Pane

Displaying Infrared Satellite information on the 'Connext Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings.**
2) Touch the **IR Satellite** Button in the 'Overlays' Window.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Connext Weather Settings' Screen to display the 'IR Satellite' legend when 'IR Satellite' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.

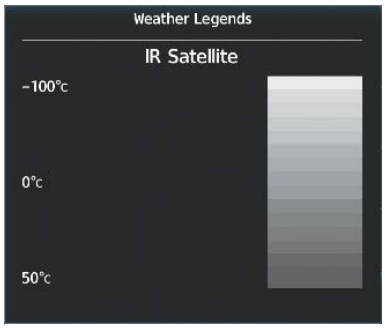


Figure 6-31 Infrared Satellite Legend

METARS AND TAFS

METARs typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud base 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 which have a requested METAR available.

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.

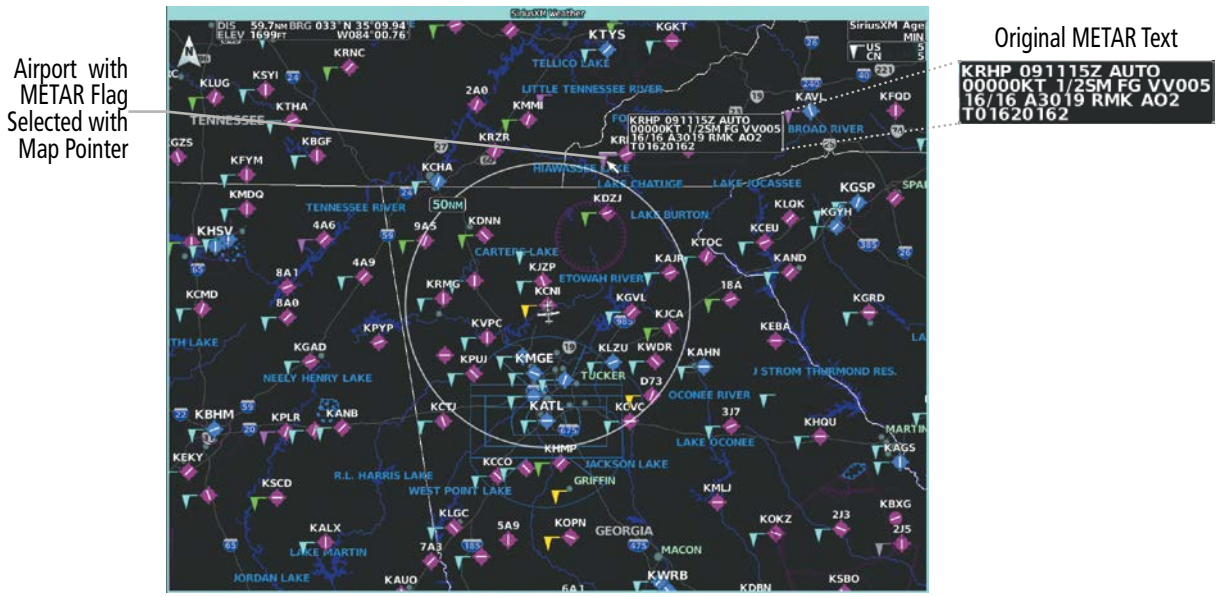


Figure 6-32 Displaying METARS on the 'SiriusXM Weather' Pane

Displaying METAR text on the 'Data Link Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
2) Touch the **METARs** Button in the 'Overlays' Window. The system displays graphical METAR flags at available reporting stations when METARs are enabled (button annunciator is green).
3) To view METAR text, press the lower knob and move the map pointer with the large and small upper knobs or **Touchpad** over a METAR flag. The system displays the original METAR text near the METAR flag. If the display has not yet received the METAR text associated with the selected flag, it displays "Waiting for METAR text." until it receives this information.

The graphical METAR flag color shown on the maps is determined by the information within the METAR. The system displays a gray METAR flag when the system does not have enough information to categorize the METAR.

Displaying Graphical METAR information on 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the **Graphical METARs** Button. The system displays METAR flags at available reporting stations when METARs are enabled (button annunciator is green).
4) To view METAR text, press the lower knob and move the map pointer with the large and small upper knobs or **Touchpad** over a METAR flag. The system displays the original METAR text near the METAR flag. If the display has not yet received the METAR text associated with the selected flag, it displays "Waiting for METAR text." until it receives this information.

Original METAR text can be viewed on the Inset Map by panning the Map Pointer over a graphical METAR flag. The HSI Map also shows the graphical METAR flags, but cannot display the text contained within the METAR.

Displaying METAR information (PFD Inset Map):

1) From PFW Home, touch **PFD Map Settings**.
2) Scroll and touch the **Graphical METARs** Button. METAR flags appear on the map.

Or:

1) Press the **PFD Map Settings**.
2) Press the **METAR** Softkey.
3) If the PFD Inset Map is shown, use the upper and lower knobs on the Touchscreen Controller to pan the Map Pointer over the desired METAR flag to view the original METAR text. Note: METAR text is not available on the HSI map.

Textual METAR/TAF information is available on the Airport Information Screen on the Touchscreen Controller for airports with a requested METAR available. This textual METAR/TAF information may come from any data link weather source available to the system (such as SiriusXM, or Garmin Connext), if more than one source is installed. In this case, the system automatically displays the newest available METAR. If the METAR age is identical from 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.

The textual display of METAR information on the Touchscreen Controllers begins with the decoded version, followed by the original METAR text. Note the original METAR text may contain additional information not present in the decoded version. The TAF, if available for the selected airport, appears below the original METAR text. The system displays the data link weather source of the displayed METAR/TAF at the end of the report.

Viewing textual METAR/TAF information on the Airport Information Screen:

1) From MFW Home, touch **Waypoint Info > Airport**.
2) If the desired airport identifier and name already appears in the airport button near the top of the screen, go to step 5.
3) Touch the airport button.
4) Enter the airport identifier using the keypad or the large and small upper knobs, then touch the **Enter** Button or push the upper knob.
5) Touch the **Weather** Tab.
6) Touch a button for an available weather product (**METAR Raw**, **METAR Decoded**, **TAF Raw**, **TAF Decoded**). If a button is subdued, that weather product is currently unavailable for the selected airport.
7) Scroll as necessary to view the weather text. Note raw weather products may provide additional information not present in the decoded version.

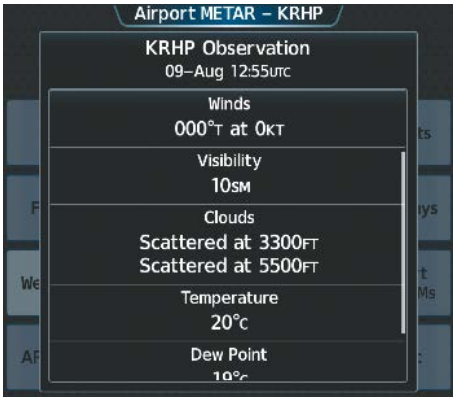


Figure 6-33 Decoded METAR information on the Airport Weather Screen

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.



Figure 6-34 METAR Legend

DATA LINK LIGHTNING

The Lightning weather product shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike has occurred within a two-kilometer region. The exact location of the lightning strike is not displayed.

The FIS-B Lightning weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

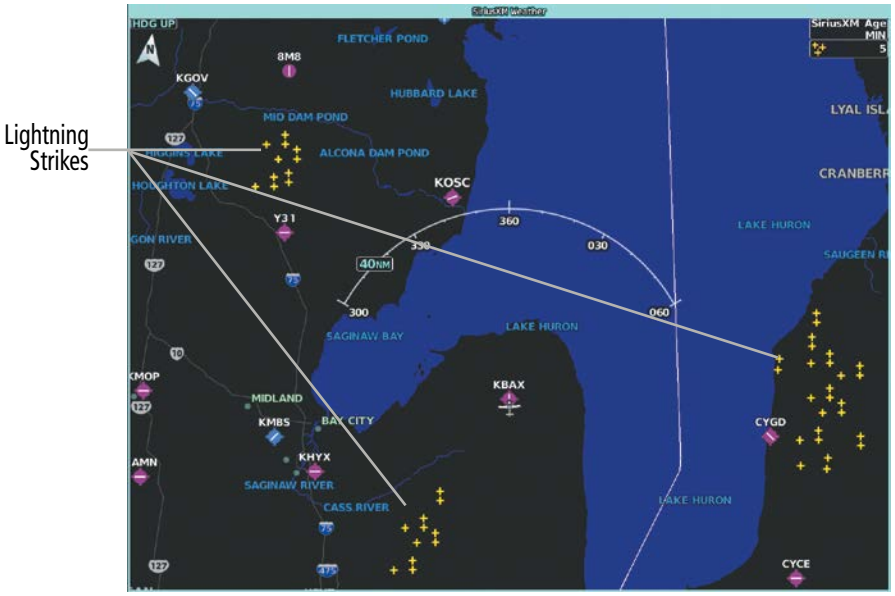


Figure 6-35 SiriusXM Lightning Weather Product

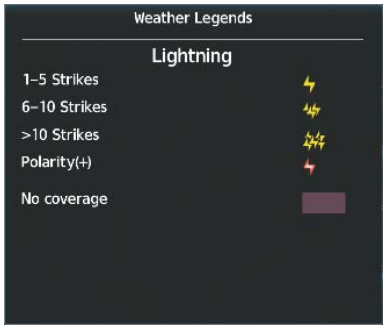
Enabling/Disabling 'Data Link' Lightning information:

1) From MFW Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
2) Touch the **Lightning** Button in the 'Overlays' Window.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.



SiriusXM/Connext Data Link Lightning Legend



FIS-B Data Link Lightning Legend

Figure 6-36 Data Link Lightning Legends

Displaying 'Data Link' Lightning information on 'Navigation Map' Panes:

1) From MFW Home, touch **Map** > **Map Selection** > **Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the **'Data Link' Lightning** Button.

Displaying 'Data Link' Lightning information on PFD maps:

1) From PFW Home, touch **PFD Map Settings**.
2) If not selected, touch either the **HSI Map** or **PFD Inset Map** Button to access overlays buttons.
3) Scroll if necessary in the **Overlays** Tab, and touch the **'Data Link' Lightning** Button.

Or:

1) If necessary, enable the HSI Map or PFD Inset Map to access 'Data Link' softkeys.
2) Press the **PFD Map Settings** Softkey.
3) Press the **Datalink Lightning** Softkey.

WINDS ALOFT

The Winds Aloft weather product shows the predicted wind speed and direction at the surface and at selected altitudes. SiriusXM and Connext Winds Aloft data can be displayed in 3,000-foot increments from the surface up to 42,000 feet MSL.

FIS-B Winds Aloft data can be displayed in 3000-foot increments beginning at the 3000 feet up to 53,000 feet MSL. FIS-B Weather additionally allows flight crews to select winds aloft data at lower altitudes in 500-foot increments beginning at 1000 feet through 2000 feet MSL.

Displaying Winds Aloft data:

1) From MFW Home, touch **Weather** > **Weather Selection** > **Data Link Weather** > **Data Link Weather Settings**.
2) Scroll as needed in the 'Overlays' Window and touch the **Winds Aloft** Button.
3) To change the selected winds aloft altitude, touch the Winds Aloft altitude button and select the desired winds aloft altitude from the pop-up window.

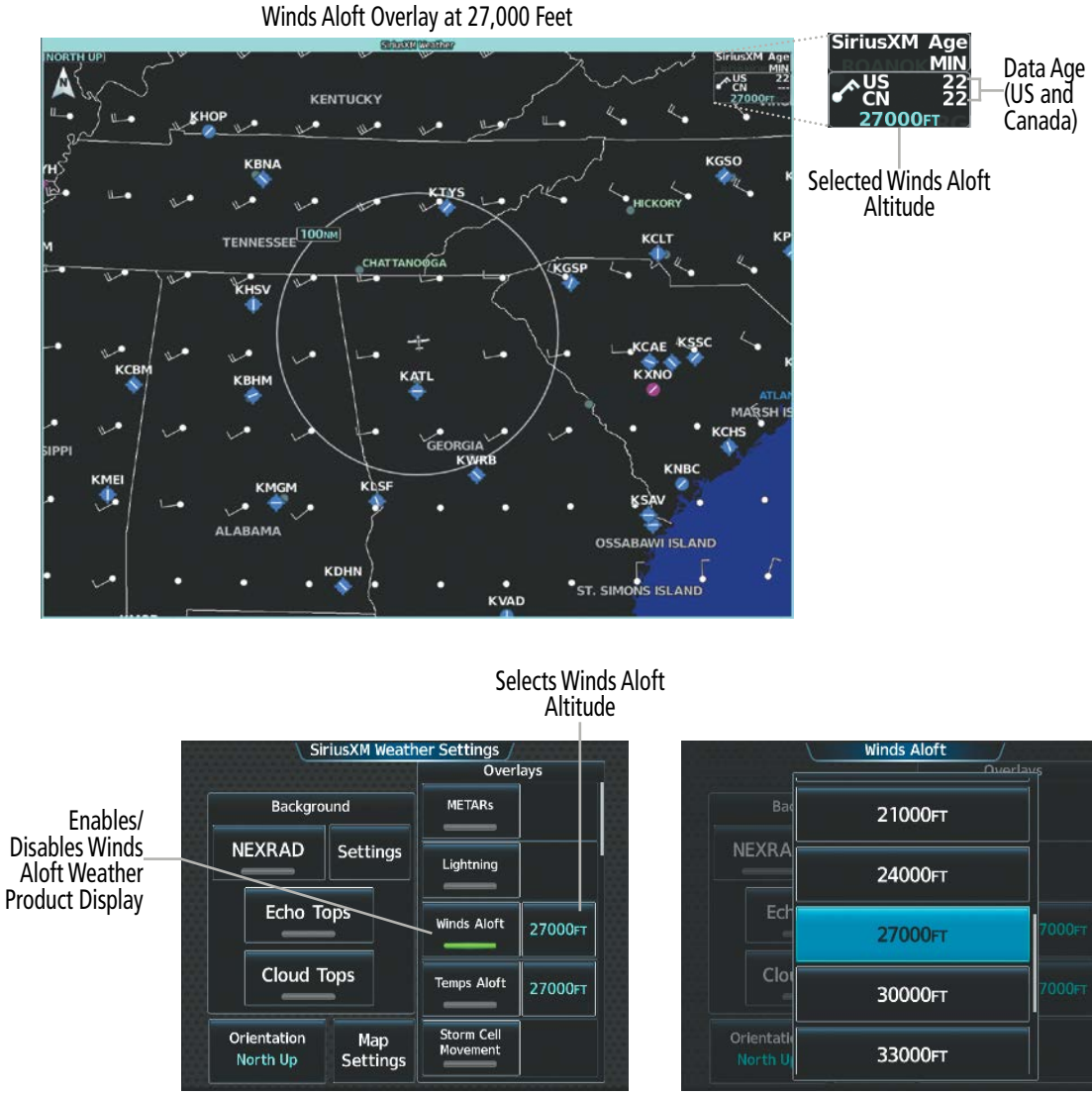


Figure 6-37 Selecting a Winds Aloft Altitude on the 'SiriusXM Weather Settings' Screen

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display the 'Winds Aloft' legend when 'Winds Aloft' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.



Figure 6-38 Winds Aloft Data Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) Inset Window on the 'Navigation Map' Pane. The displayed wind components are relative to current aircraft altitude and track or flight plan, depending on the selected VSD Mode, but not relative to aircraft speed.

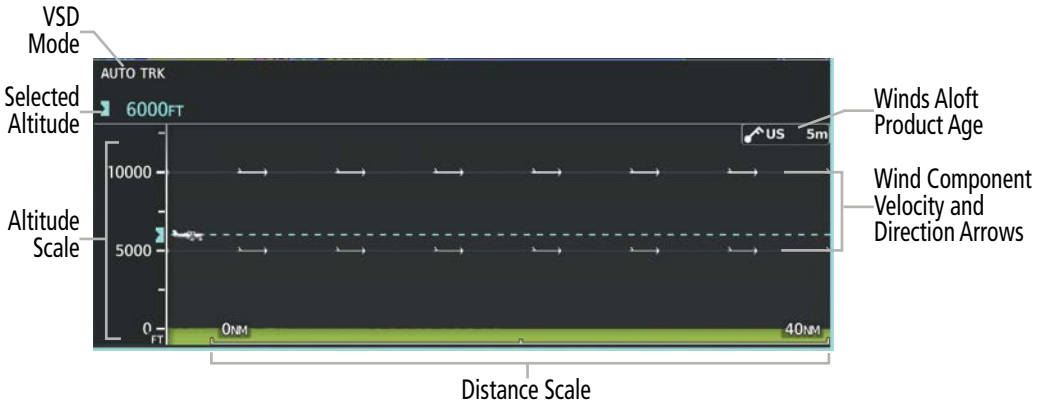


Figure 6-39 VSD Inset Window with Winds Aloft Information

NOTE: *Winds Aloft information will not be available on the VSD Inset Window if FIS-B is the active data link weather source.*

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in the following table.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-5 Profile View Headwind/Tailwind Component Symbols

Enabling/Disabling VSD (containing winds aloft data):

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Inset Window** Tab.
3) Touch the **VERT Situation Display** Button to enable/disable the VSD Inset Window. If the winds aloft weather product icon does not appear in the inset window, continue with this procedure to enable winds aloft information.
4) Touch the VERT Situation Display **Settings** Button.
5) Touch the **Winds** Button. When enabled, the system displays the winds aloft weather product inside the Vertical Situation Display.

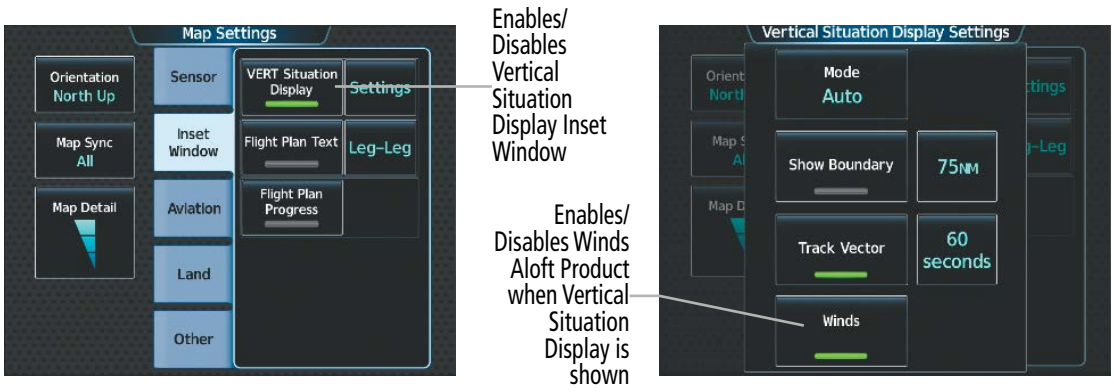


Figure 6-40 Controlling the display of Winds Aloft information for VSD Inset Window

TEMPERATURES ALOFT (SIRIUSXM)

The SiriusXM Temperatures Aloft weather product depicts air temperature data as a grid with each point in the grid displaying observed and forecasted temperatures aloft. When enabled the Temperatures Aloft product utilizes eight, 3-hour forecast periods in order to give continued 24 hours data coverage.

The Temperatures Aloft data can be displayed in 3,000-foot increments from 3,000 feet up to 42,000 feet MSL.

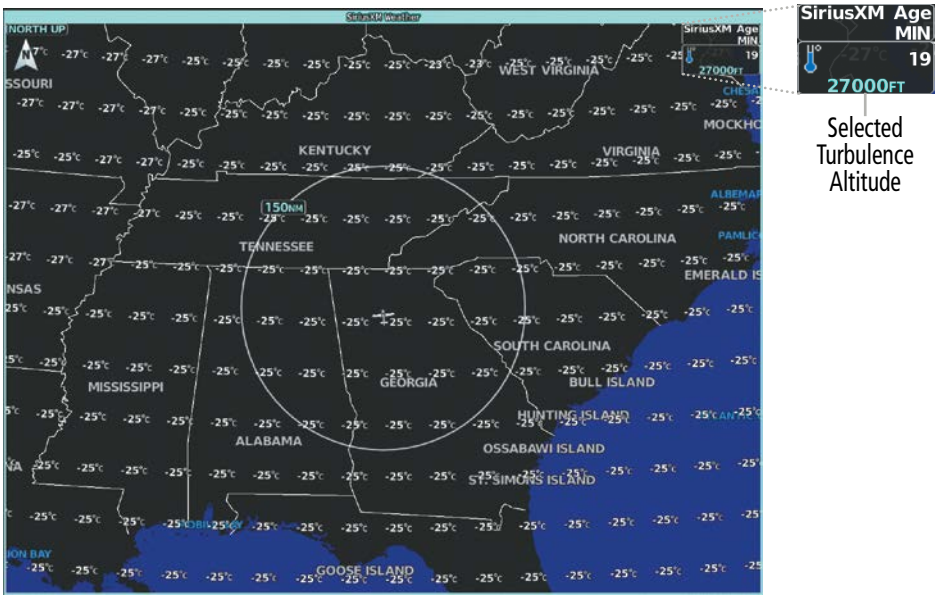


Figure 6-41 Temperatures Aloft Weather Product at 27,000 Feet

Displaying Temperatures Aloft data on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Scroll in the 'Overlays' Window and touch the **Temps Aloft** Button.
3) Touch the Temperatures Aloft altitude button (to the right of the **Temps Aloft** annunciator button) and touch the desired altitude from which to display temperature aloft data.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'SiriusXM Weather' Settings Screen to display the 'Temperatures Aloft' legend when 'Temperatures Aloft' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.

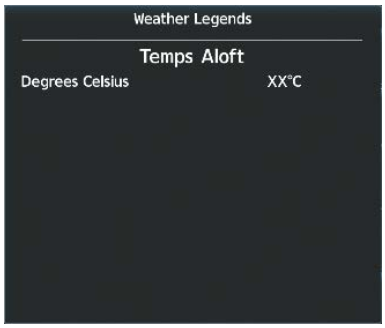


Figure 6-42 Temperatures Aloft Legend

STORM CELL MOVEMENT (SIRIUSXM)

The Cell Movement weather product, also known as SCIT (Storm Cell Identification and Tracking), shows the location and movement of storm cells as identified by the ground-based system. Orange squares represent cells, with arrows indicating the direction of cell movement. When the Map Pointer is panned over a Storm Cell, the system displays the path, speed, and altitude range of the Storm Cell, as determined by the NEXRAD system.

NOTE: *The Storm Cell base height is not available if a GDL 69A SiriusXM Datalink Receiver is installed. In this case, the Storm Cell base height is displayed as 0 feet when the map pointer selects a storm cell.*

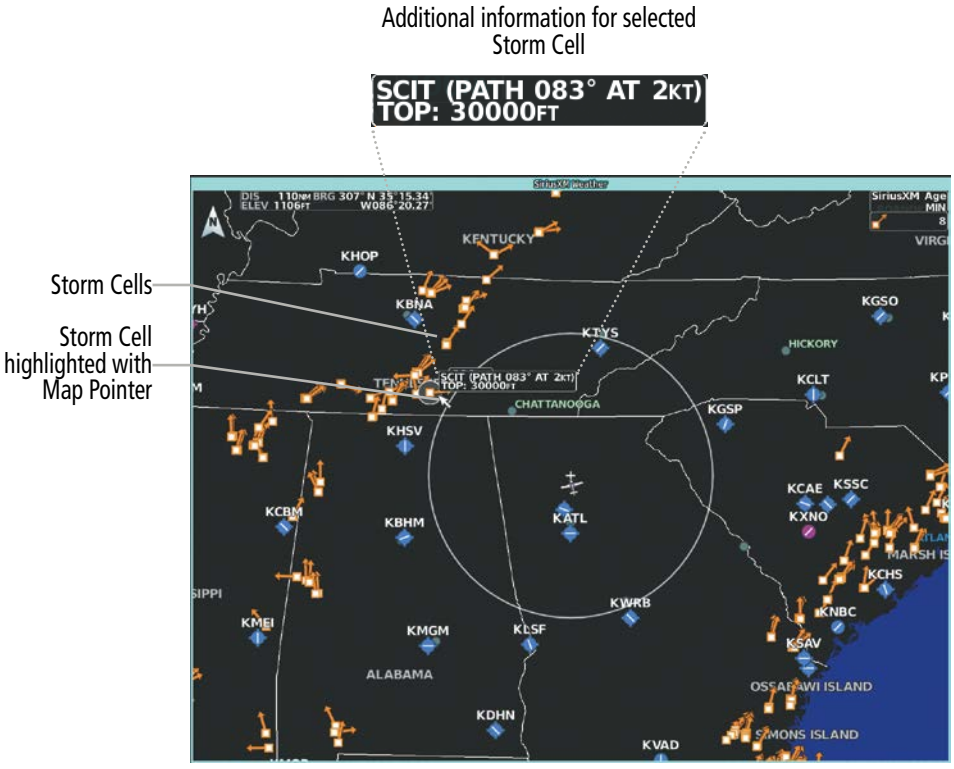


Figure 6-43 Storm Cell Movement Weather Product

Enabling/Disabling Storm Cell Movement Information on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Touch the **Storm Cell Movement** Button in the 'Overlays' Window.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'SiriusXM Weather' Settings Screen to display the 'Storm Cell Movement' legend when 'Storm Cell Movement' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.



Figure 6-44 Cell Movement Legend

Displaying Storm Cell Movement Information on 'Navigation Map' Panes:

1) From MFW Home, touch **Map** > **Map Selection > Map Settings.**
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the NEXRAD **Settings** Button.
4) Touch the **Storm Cell Movement** Button. When button annunciator is green, the system shows Storm Cell Movement with the NEXRAD weather product on navigation map panes. When button annunciator is gray, system will not show the Storm Cell Movement weather product on navigation map panes.

Displaying Storm Cell Movement with NEXRAD information (PFD Inset and HSI Map):

1) From PFW Home, touch **PFD Map Settings.**
2) If not selected, touch either the **HSI Map** or **Inset Map** Button to access overlays buttons.
3) Touch the NEXRAD **Settings** Button.
4) Touch the **Storm Cell Movement** Button.
5) When finished, touch **Back** or **Home**.

Or:

1) With the Inset Map or HSI Map shown, press the **PFD Map Settings** Softkey.
2) Press the **Data Link Settings** Softkey.
3) Press the **Storm Cell Movement** Softkey.
4) When finished, press the **Back** Softkey.

TURBULENCE (SIRIUSXM/FIS-B)

NOTE: *The Turbulence weather product cannot be displayed at the same time as NEXRAD weather product.*

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 (SiriusXM). The FIS-B Turbulence weather product displays forecast turbulence every 2,000 feet starting 2000 feet msl to 24,000 feet msl. Turbulence data is intended to supplement AIRMETs and SIGMETs.

The FIS-B Turbulence weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

Displaying Turbulence data on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > Data Link Weather > Data Link Weather Settings**.
2) Scroll in the 'Overlays' Window and touch the **Turbulence** Button.
3) Touch the Turbulence altitude button (to the right of the **Turbulence** annunciator button) and touch to select an altitude from which to display turbulence data.

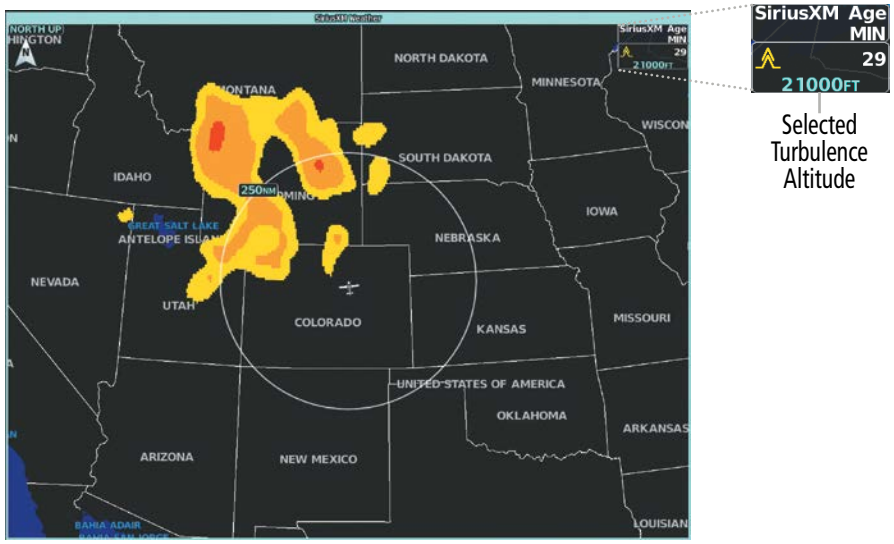


Figure 6-45 Turbulence Weather Product at 21,000 Feet

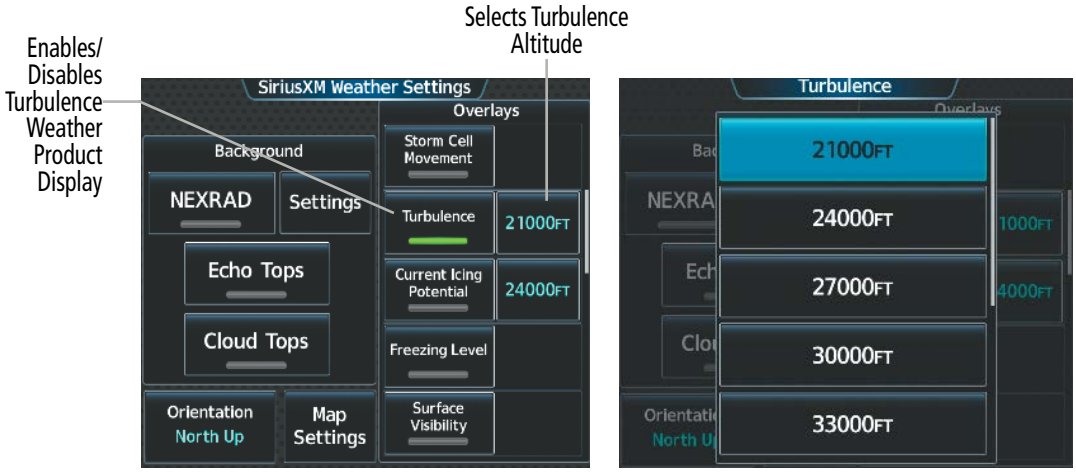


Figure 6-46 Selecting a Turbulence Altitude on the 'SiriusXM Weather Settings' Screen

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.

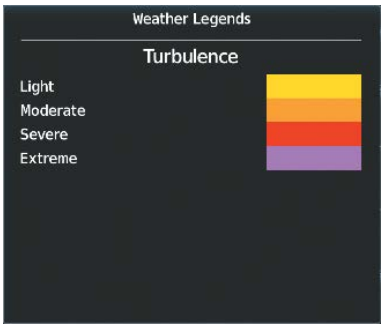


Figure 6-47 SiriusXM Turbulence Legend

ICING (CIP & SLD) (SIRIUSXM/FIS-B)

NOTE: *Icing data cannot be displayed at the same time as NEXRAD data.*

The Current Icing Potential (CIP) (SiriusXM) weather product shows a graphical view of the icing environment. Icing severity is displayed in four categories: trace, light, moderate, and heavy (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.

The Icing Forecast (FIS-B) weather product displays a graphical view of the icing probability forecast. Icing Forecast data is supplied by the National Weather Service (NWS) utilizing the Forecast Icing Potential model. The FIS-B Icing Forecast is available from 2,000 feet msl to 24,000 feet msl at 2,000 feet intervals. Additionally, the FIS-B Icing Forecast weather product is only available in the continental United States.

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.

The FIS-B Icing Forecast weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

Displaying Icing data:

1) From MFW Home, touch **Weather > Weather Selection > Data Link Weather > Data Link Weather Settings**.
2) Scroll as needed in the 'Overlays' Window and touch the **Current Icing Potential** (SiriusXM) or **Icing Forecast** (FIS-B) Button to enable/disable icing information.
3) Touch the altitude button (to the right of the **Current Icing Potential** or **Icing Forecast** annunciator Button) and scroll to and touch the desired altitude Button (from 1,000 feet up to 30,000 feet (SiriusXM) or 2,000 feet up to 24,000 feet (FIS-B)).

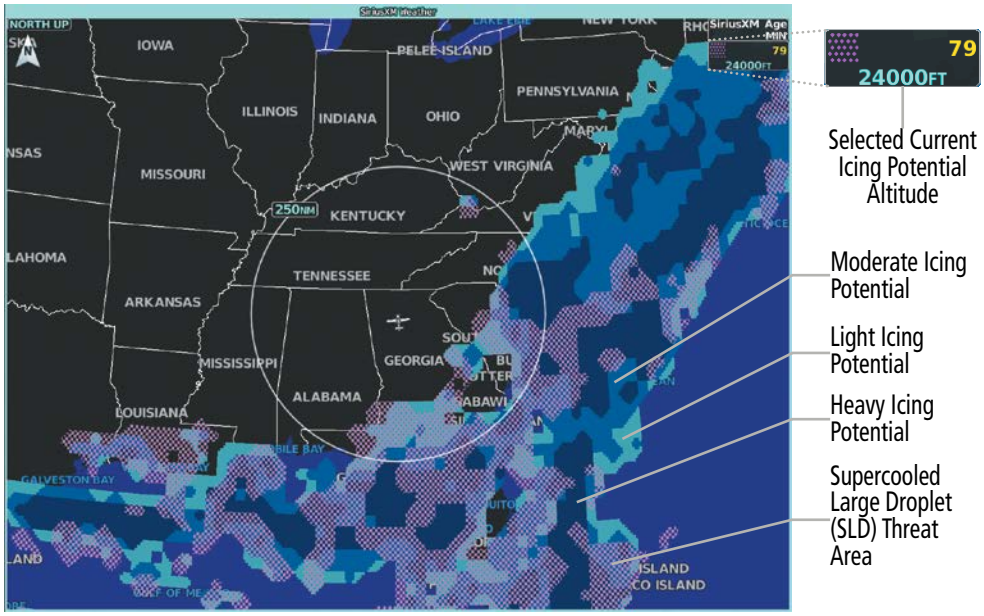


Figure 6-48 Current Icing Potential Overlay at 24,000 Feet

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.

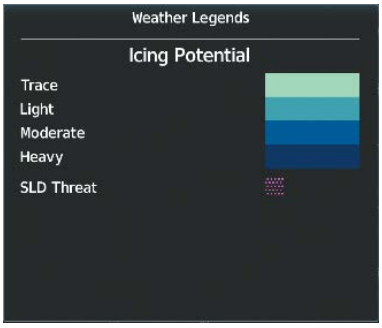


Figure 6-49 Icing Legend

FREEZING LEVEL (SIRIUSXM)

Freezing Level data 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.

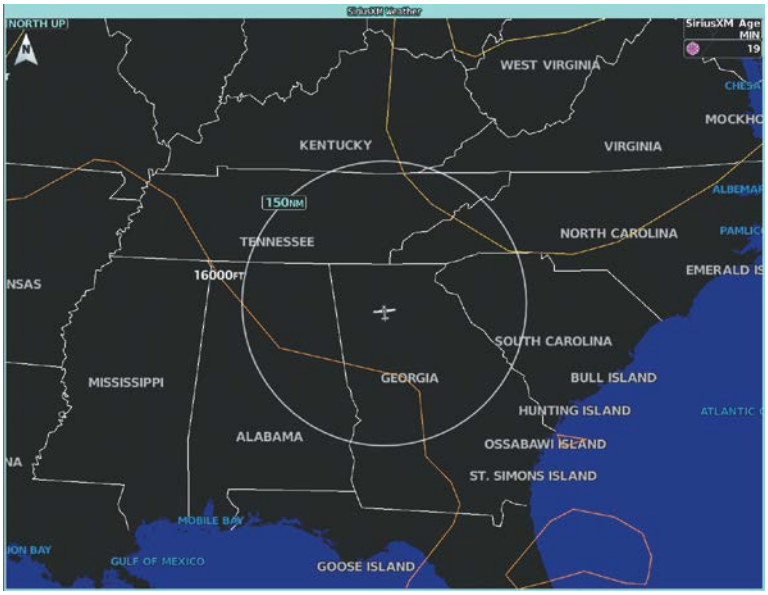


Figure 6-50 Freezing Level Weather Product

Displaying Freezing Level information on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Scroll as needed in the 'Overlays' Window and touch the **Freezing Level** Button.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'SiriusXM Weather' Settings Screen to display the 'Freezing Levels' legend when 'Freezing Levels' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.

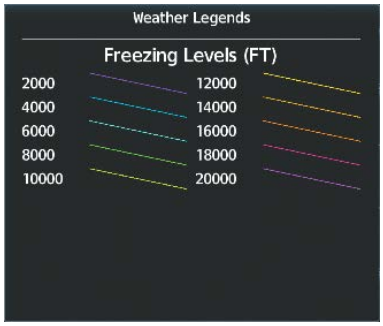


Figure 6-51 Freezing Level Legend

TEMPORARY FLIGHT RESTRICTIONS (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.*

The Federal Aviation Administration (FAA) issues TFRs to designate areas where flight is restricted. TFRs are issued to restrict flight for a variety of reasons including national security, law enforcement, fire suppression efforts, airshows, and large sporting events. TFRs may be issued at any time, and TFR data displayed on the system is only intended to supplement TFR information obtained from official sources including Flight Service Stations (FSS), and air traffic control.

If the TFR product is not available or has expired, the system displays 'TFR N/A' in the upper-right corner of maps on which the display of TFRs is enabled.

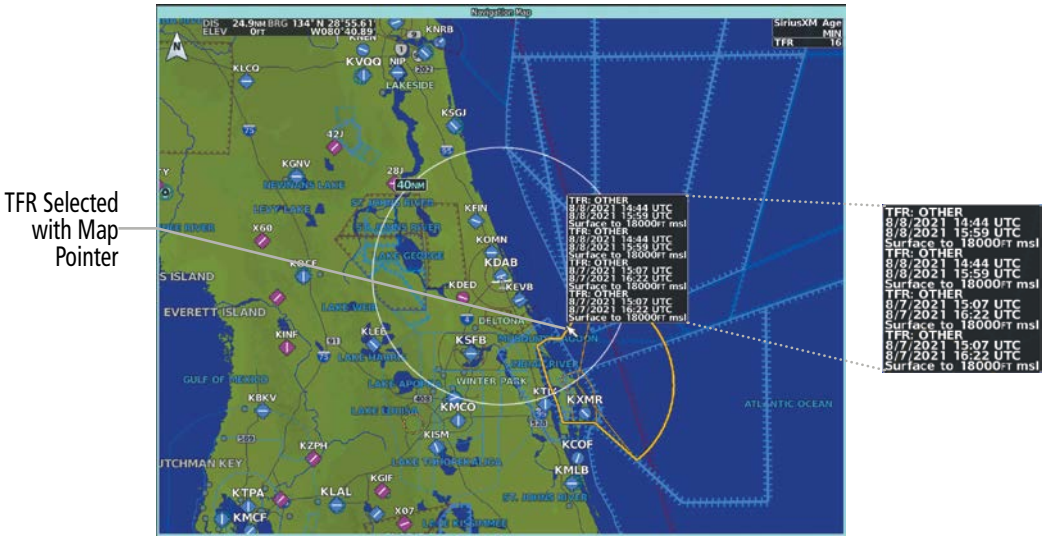


Figure 6-52 TFR Text for TFR Selected with Map Pointer

Enabling/disabling TFR information ('Data Link' Weather Pane):

1) From MFW Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
2) Scroll in the 'Overlays' Window as needed and touch the **TFRs** Button.
3) To view TFR text, push the lower knob to activate the map pointer and move the pointer with the large and small upper knobs or **Touchpad** until the selected TFR is highlighted. The TFR text appears near the map pointer for the selected TFR.
4) When finished, push either knob, or touch the **Back** Button or the **Home** Button.

The 'Map Settings' Screen provides controls for enabling/disabling the display of TFR information on navigation maps, in addition to selecting the maximum map range for the system to display TFR information. If the crew selects a map range above this setting, the system declutters TFR information from the selected pane.

Enabling/disabling TFR information on 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll and touch the **TFR** Button.

Maps other than the 'Navigation Map' Pane use settings based on those selected on the 'Map Settings' Screen.

Selecting the maximum map range to display TFR information:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the TFR Range Button.
4) Scroll as necessary and touch the maximum navigation map range to display TFR information.



Figure 6-53 Customizing TFR display settings for Navigation Maps

PIREPS AND AIREPS

Pilot Weather Reports (PIREPs) provide 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, windshear, 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.

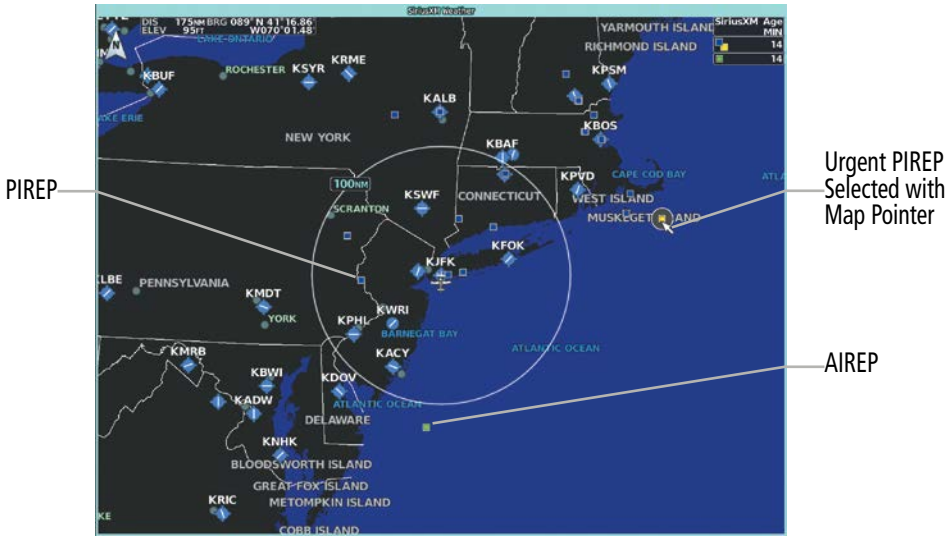


Figure 6-54 AIREPs and PIREPs on the 'SiriusXM Weather' Pane

Displaying PIREP or AIREP information:

1) From MFW Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
2) Scroll in the 'Overlays' Window as needed and touch the **AIREPs** (SiriusXM only) or **PIREPs** Buttons.
3) To view PIREP/AIREP text, push the lower knob to activate the map pointer and use the large and small upper knobs or **Touchpad** to highlight a PIREP or AIREP symbol, then touch the **Info** Button.
4) Scroll as needed through the report text, then touch the **Back** Button or the **Home** Button.

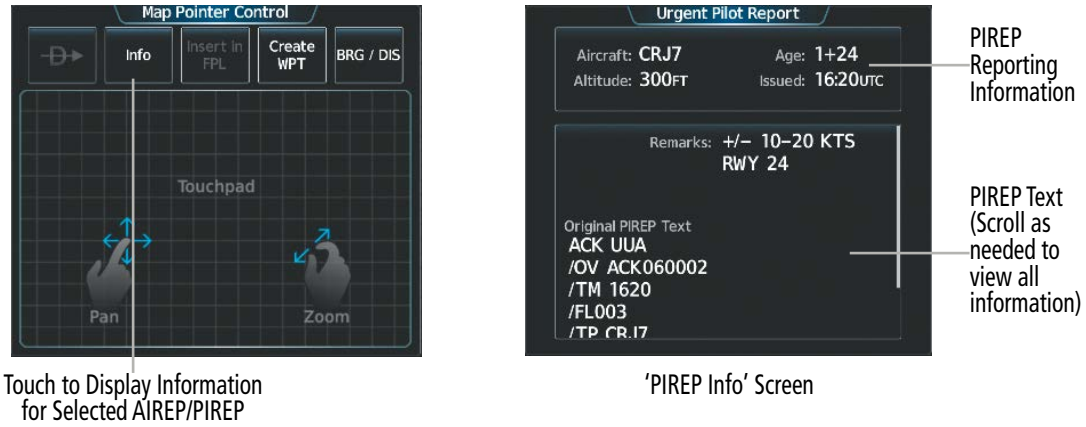


Figure 6-55 Displaying PIREPS/AIREPs on the Touchscreen Controller

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.

The PIREP color is determined by the type (routine or urgent).



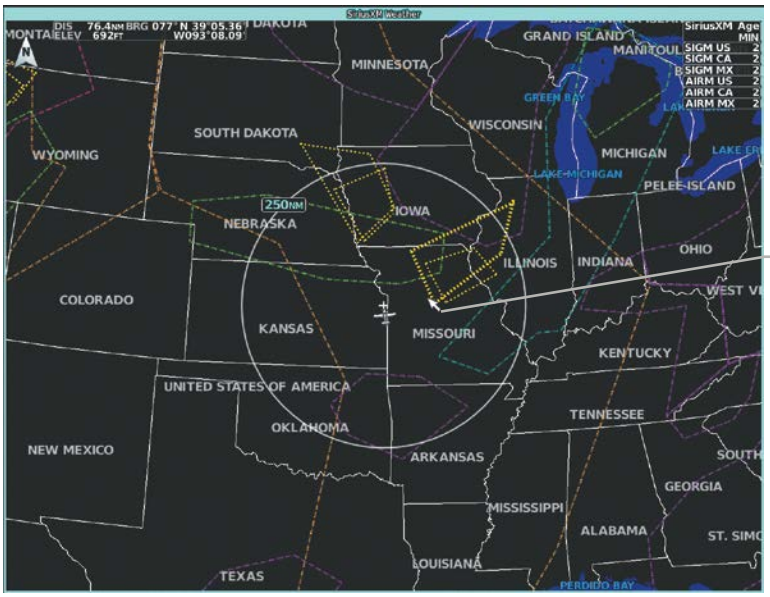
Figure 6-56 AIREPs & PIREPs Legend

SIGMETS AND AIRMETS

The National Weather Service issues SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) for potentially hazardous weather. Convective SIGMETs are issued for hazardous convective weather.

SIGMETs and AIRMETs are represented on the 'Data Link' Weather Pane by dashed lines when they are issued for a wide geographic area, or a diamond shape when conditions are confined to a localized area. The color of the line or diamond correlates to the conditions shown in the SIGMET or AIRMET legend, as applicable.

NOTE: *If a GDL 69A SXM receiver is installed, then 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.*



SIGMET highlighted with Map Pointer

Figure 6-57 AIRMET and SIGMET Weather Products

Enabling/Disabling AIRMET and SIGMET information:

1) From MFW Home, touch **Weather > Weather Selection > Data Link Weather > Data Link Settings**.
2) Scroll as needed and touch the **AIRMETs** (SiriusXM) and/or **SIGMETs** Buttons in the 'Overlays' Window.
3) To view the text of a AIRMET or SIGMET, push the **Joystick** and move the map pointer with the **Joystick** over the SIGMET or AIRMET border or icon until it is highlighted.
4) Touch the **Info** Button to show the AIRMET / SIGMET Information Screen with the selected AIRMET or SIGMET.
5) Scroll as needed to view full text of the report, then touch the **Back** Button or the **Home** Button.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.

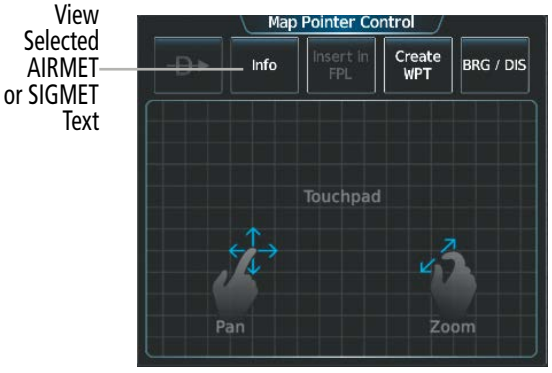


Figure 6-58 'Map Pointer Control' Screen

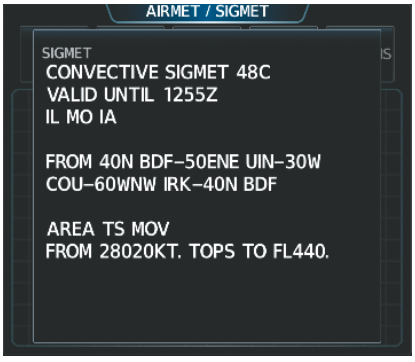


Figure 6-59 'AIRMET/SIGMET' Screen



Figure 6-60 SIGMET/AIRMET Legend

GRAPHICAL AIRMETS (FIS-B)

The FIS-B Graphical METAR weather product, when enabled, displays a graphical depiction of meteorological weather information for conditions that may be hazardous to aircraft. The Graphical METARs are issued by the Aviation Weather Center at 0245, 0845, 1445, and 2045 UTC.

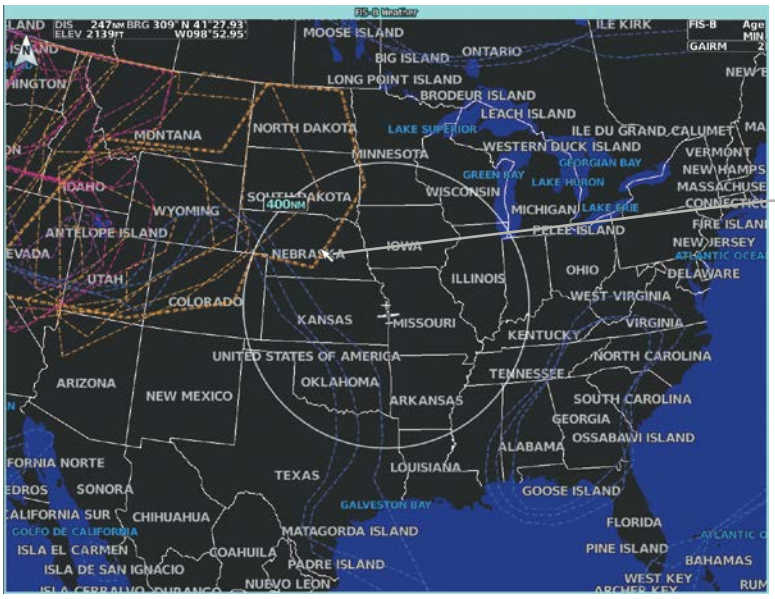


Figure 6-61 Graphical AIRMET Weather Product

Enabling/Disabling Graphical AIRMET information:

1) From MFW Home, touch **Weather > Weather Selection > FIS-B Weather > FIS-B Settings**.
2) Scroll as needed and touch the **G-AIRMETs** Buttons in the 'Overlays' Window.
3) To select a Graphical AIRMET filter, touch the **Current** Button.
4) On the 'G-AIRMETs Filter' Screen, touch either the **Current** or **All** Buttons.
   - **Current**: Displays all currently active G-AIRMETs.
   - **All**: Displays all current and future G-AIRMETs.
5) To view the text of a Graphical AIRMET push the **Joystick** and move the map pointer with the **Joystick** over the G-AIRMET border or icon until it is highlighted.
6) Touch the **Info** Button to show the 'G-AIRMET Info' Screen with the selected G-AIRMET.
7) Scroll as needed to view full text of the report, then touch the **Back** Button or the **Home** Button.

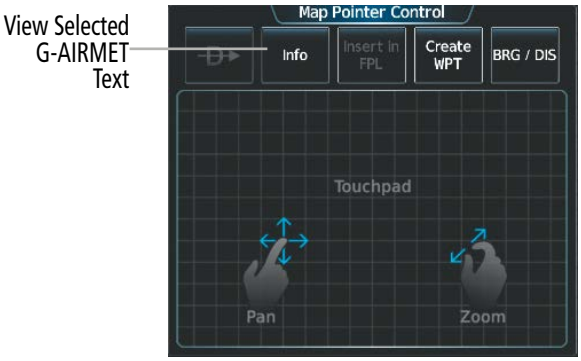


Figure 6-62 'Map Pointer Control' Screen



Figure 6-63 'G-AIRMET Info' Screen

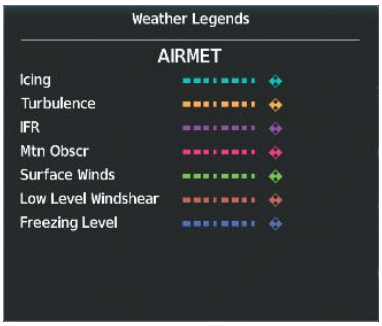


Figure 6-64 Graphical AIRMET Legend

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'FIS-B Weather Settings' Screen to display the 'G-AIRMETs' legend when 'G-AIRMETs' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.

CENTER WEATHER ADVISORIES (SIRIUSXM/FIS-B)

The National Weather Service issues Center Weather Advisories (CWA) when conditions exists meeting or approaching the national in-flight advisory (AIRMET, SIGMET, or Convective SIGMET) criteria. CWAs are unscheduled weather advisories which are valid for up to 2 hours and may include forecast conditions that are expected to begin within 2 hours of the issuance. If meteorological conditions are expected to continue beyond the advisories valid period a statement to this effect will be included in the advisory.

The CWA will describe the location of the phenomenon using ARTCC relevant points of reference, such as VORs, and will include the height, extent, intensity, and movement of the phenomenon. Each CWA will have a phenomenon number.

The format of the CWA communications header is: (ARTCC designator)(phenomenon number) CWA (date/time issued in UTC)/(ARTCC designator) CWA (issuance number) VALID UNTIL (date/time in UTC)/(FROM) (affected area)/(text).

CWAs can be issued for any of the following meteorological events:

» Conditions meeting convective SIGMET criteria.
» Conditions at or approaching Low IFR.
» Freezing precipitation.
» Heavy precipitation.
» Icing - moderate or greater.
» Low Level Windshear (surface - 2,000 feet).
» Surface winds/gusts >30 knots.
» Turbulence - moderate or greater.
» Volcanic ash, dust storms, or sandstorms.

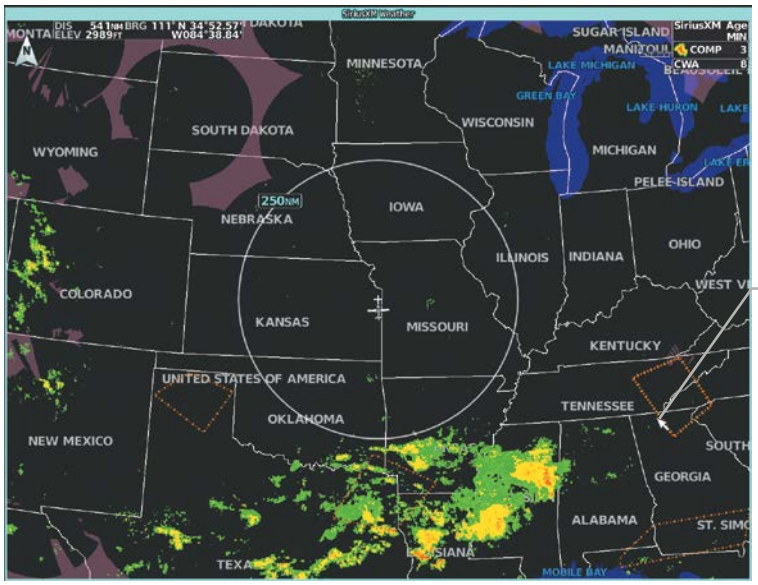


Figure 6-65 Center Weather Advisories on the 'SiriusXM Weather' Pane

View Selected Center Weather Advisory Text

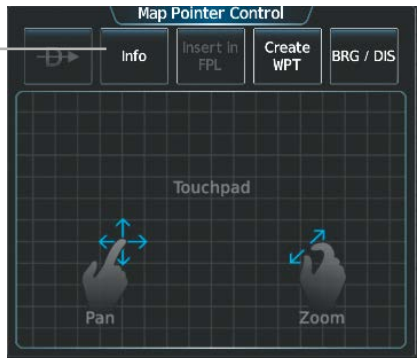


Figure 6-66 'Map Pointer Control' Screen

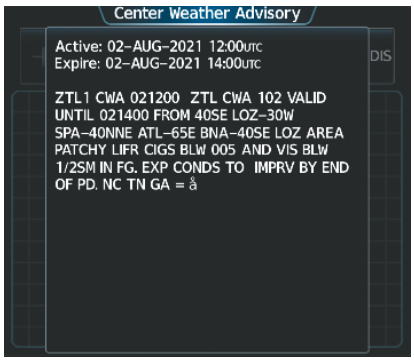


Figure 6-67 'Center Weather Advisory' Screen

Enabling/Disabling Center Weather Advisory information:

1) From MFW Home, touch **Weather > Weather Selection > Data Link Weather > Data Link Settings**.
2) Scroll as needed and touch the **Center WX Advisories (SiriusXM)** or **CWAs (FIS-B)** Buttons in the 'Overlays' Window.
3) To view the text of a Center Weather Advisory, push the **Joystick** and move the map pointer with the **Joystick** over the Center Weather Advisory border until it is highlighted.
4) Touch the **Info** Button to show the 'Center Weather Advisory' Screen for the selected Center Weather Advisory.
5) Scroll as needed to view full text of the report, then touch the **Back** Button or the **Home** Button.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'Data Link Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.



Figure 6-68 Center Weather Advisories Legend

SURFACE ANALYSIS AND CITY FORECAST (SIRIUSXM)

The Surface Analysis and City Forecast weather products are available for current and forecast weather conditions. Forecasts are available for intervals of 12, 24, 36, and 48 hours.

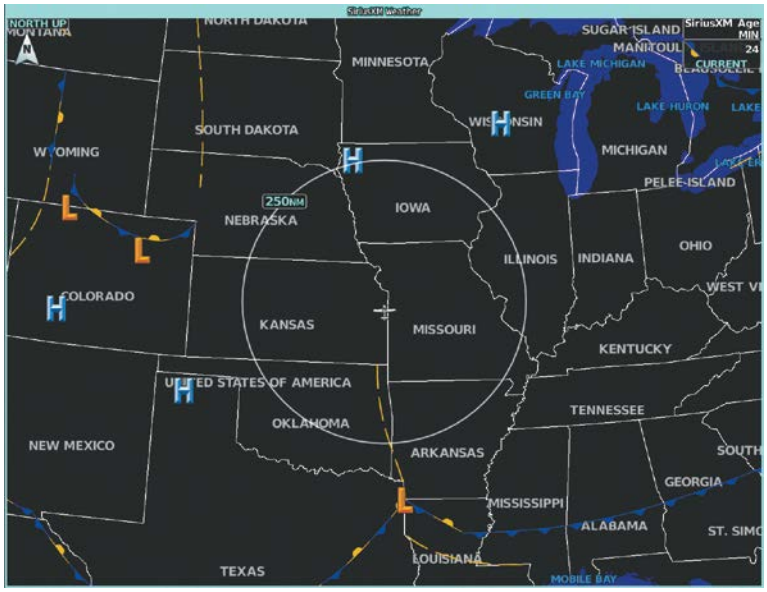


Figure 6-69 Current Surface Analysis Weather Product

Displaying Surface Analysis and City Forecast information on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Scroll as needed in the 'Overlays' Window and touch the **Surface Analysis** or **City Forecast** Buttons.
3) If needed, touch the Surface Conditions forecast period button (to the right of the **Surface Analysis** or **City Forecast** Buttons) and select from **Current**, **12 Hours**, **24 Hours**, **36 Hours**, or **48 Hours** forecast periods from the selection window.

Touch the **Legend** Button on the 'SiriusXM Weather Settings' Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch **Back** or **Home**.

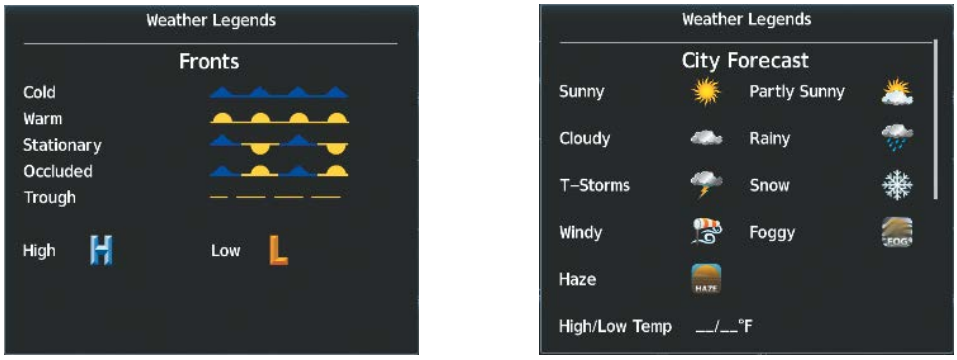


Figure 6-70 Surface Analysis and City Forecast Legend

CYCLONE WARNINGS (SIRIUSXM)

The Cyclone weather product shows the current location of cyclones (hurricanes), tropical storms, and their projected tracks. The track consists of a two digit date, followed by the estimated time of arrival.

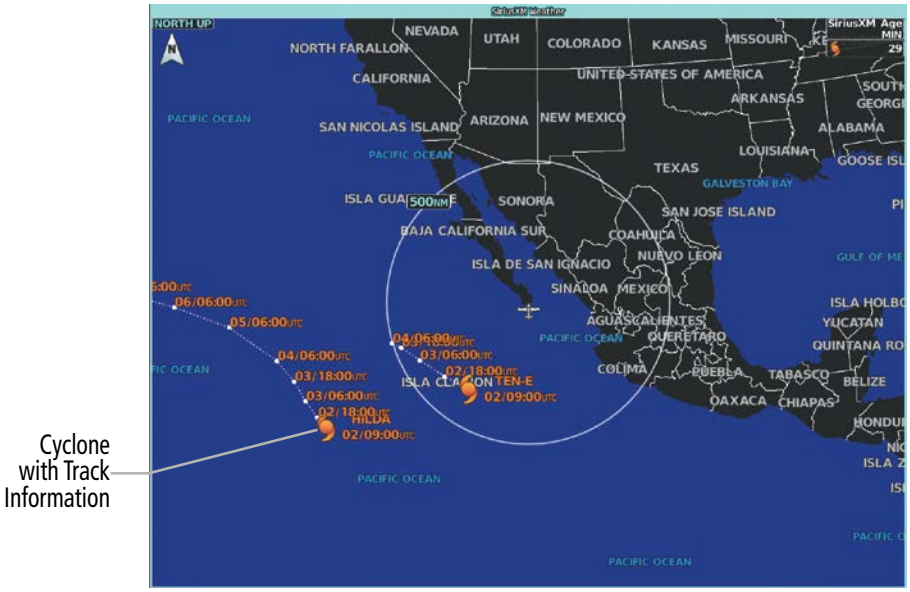


Figure 6-71 Cyclone (Hurricane) Weather Product

Enabling/Disabling cyclone (hurricane) weather product on the 'SiriusXM Weather' Pane:

1) From MFW Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Scroll as needed in the 'Overlays' Window and touch the **Cyclone Warnings** Button.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'SiriusXM Weather' Settings Screen to display the 'Cyclone' legend when 'Cyclone' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.



Figure 6-72 Cyclone Legend

COUNTY WARNINGS (SIRIUSXM)

County data provides specific public awareness and protection weather warnings from the National Weather Service (NWS). This can include information on severe thunderstorms, tornadoes, and flood conditions.

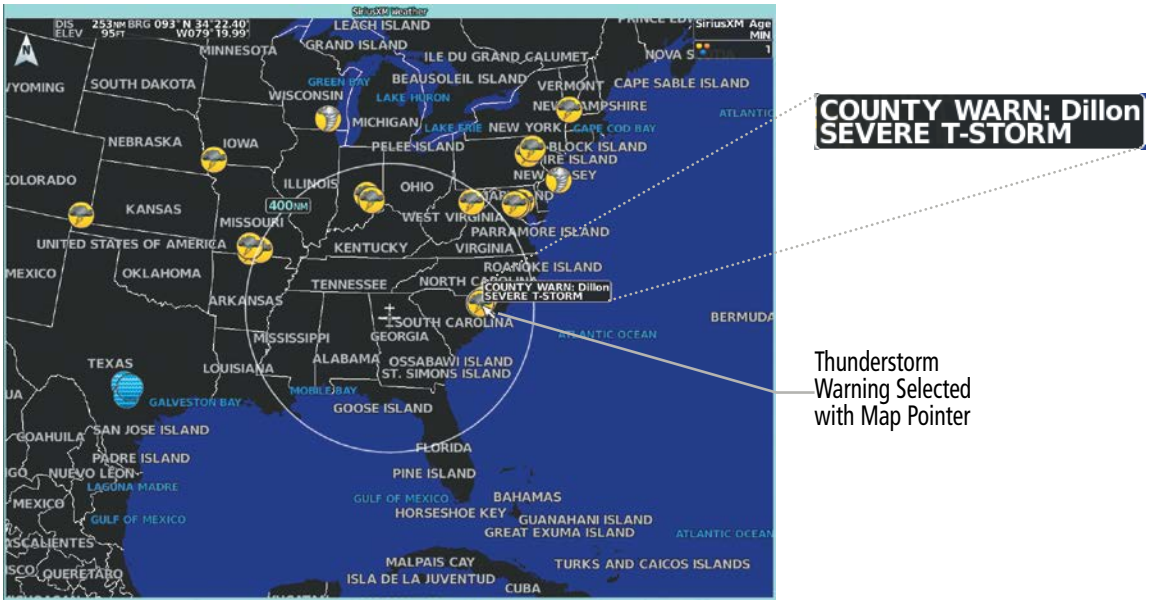


Figure 6-73 County Warnings Weather Product

Displaying County Warning information on the 'SiriusXM Weather' Pane:

1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Scroll as needed in the 'Overlays' Window and touch the **County Warnings** Button.
3) To view additional information (such as county name), press the lower knob to activate the map pointer and turn the large and small upper knobs or use the **Touchpad** to select a County Warning. County Warning information appears in a box near the map pointer.
4) When finished, press either knob to deactivate the map pointer.

Scroll to the bottom of the 'Overlays' Window and touch the **Legend** Button on the 'SiriusXM Weather' Settings Screen to display the 'County Warnings' legend when 'County Warnings' weather product is enabled. Scroll as necessary to view the information, then touch **Back** or **Home**.



Figure 6-74 County Warnings Legend

FIS-B WEATHER ABNORMAL OPERATIONS

Additional information about the status of FIS-B Data Status is available on the 'FIS-B Weather Settings' Screen of the Touchscreen Controller.

FIS-B Weather Status Banner Annunciation	Description
FIS–B WEATHER UNAVAILABLE	Current aircraft position is outside the FIS-B Coverage area.
NOT RECEIVING WEATHER DATA	GTX™ 345R is currently off-line or not receiving FIS-B Weather data from the antenna.

Table 6-6 FIS-B Weather Status Annunciation

CONNEXT WEATHER ABNORMAL OPERATIONS

If the system cannot complete a weather data request, one or more messages will appear in the 'Data Request' 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 [2]	A communications error has occurred with the GIA. The system should be serviced.
Connext Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or the GIA is off-line.
Connext Comm Error [5]	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. If 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 Connext Data Request.
Connext Comm Error [8]	A server error has occurred or invalid data received.
Connext Login Invalid	There is a problem with the Garmin Connext registration. Contact Garmin Aviation Product Support using the information at flygarmin.com.
Connext Server Temporarily 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 Connext Data Request does not sufficiently define a coverage area on which to retrieve weather data. Verify the selections in the Connext Weather Coverage Window, then issue another Connext Data Request.
No Connext Subscription	The system is not currently subscribed to the Garmin Connext Weather service, or the access code is incorrect. Verify the access code. Contact Garmin Aviation Product Support using the information at flygarmin.com.
Reduce Request Area	The weather data request area exceeds size limits. Reduce weather coverage area and re-send data request.
Request Canceled	The user has canceled a weather data request.
Request Failed - Try Again	The weather data request timed-out. Re-send data request.
Transfer Preempted	The data link is busy. Retry request later.

Table 6-7 Abnormal Weather Data Request Status Messages

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®' Pane, 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.

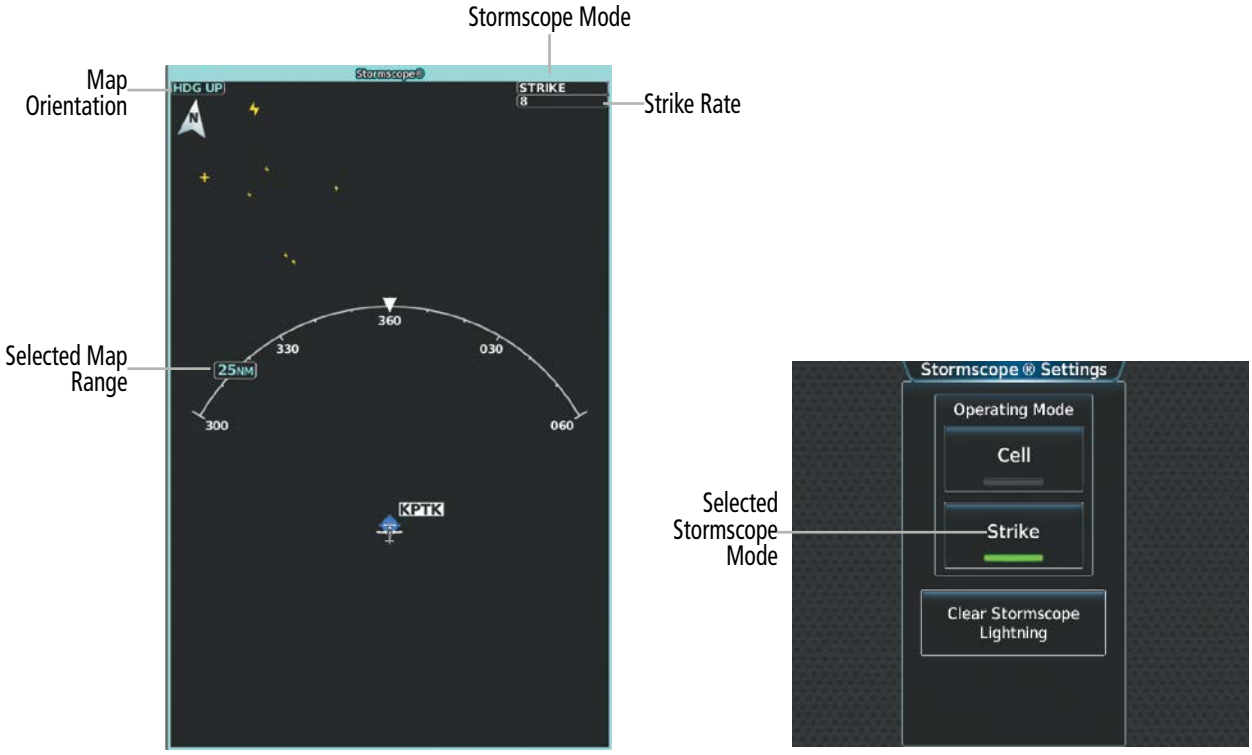
Lightning Age	Symbol
Strike is less than 6 seconds old	
Strike is between 6 and 60 seconds old	
Strike is between 1 and 2 minutes old	
Strike is between 2 and 3 minutes old	

Table 6-8 Lightning Age and Symbols

The Stormscope operates in either Cell Mode or Strike Mode. When operating in Cell Mode, the system displays clusters or cells of electrical activity. When operating in Strike Mode, the system displays the approximate location of individual lightning strikes.

USING THE STORMSCOPE PANE

The 'Stormscope' Pane shows lightning information in relation to the aircraft's current location, with simplified map details to reduce clutter and to allow for easier identification of lightning cells and strikes. It is the principal map pane for viewing Stormscope lightning information. The 'Stormscope' Pane map orientation is heading up, with an arrow pointing North, unless there is no valid heading. The 'Stormscope' Pane displays the selected Stormscope operating mode and lightning strike rate in the upper right corner of the pane. The selected map range appears in cyan a box on the range arc. The 'Stormscope' Pane also displays the active flight plan, when one exists.



'Stormscope' Pane Operating in Strike Mode

'Stormscope Settings' Screen

Figure 6-75 Displaying Stormscope Lighting on the 'Stormscope' Pane

Displaying the 'Stormscope' Pane:

From MFW Home, touch **Weather > Weather Selection > Stormscope** > **Stormscope Settings.**

The knob on the lower right of the Touchscreen Controller controls the map range shown on the 'Stormscope' Pane. Turn the knob clockwise to increase the map range shown, or counter-clockwise to decrease the map range. Map ranges of 25 nm to 200 nm are available.

Selecting a Stormscope Operating Mode on the 'Stormscope' Pane:

1) From MFW Home, touch **Weather > Weather Selection > Stormscope > Stormscope Settings.**
2) Touch either the **Cell** Button or the **Strike** Button. Button annunciator is green for currently selected mode.

Clearing the 'Stormscope' Pane removes any previously displayed cell or lightning strike information from the 'Stormscope' Pane.

Clearing Stormscope Information on the 'Stormscope' Pane:

1) From MFW Home, touch **Weather > Weather Selection > Stormscope > Stormscope Settings**.
2) Touch the **Clear Stormscope Lightning** Button.

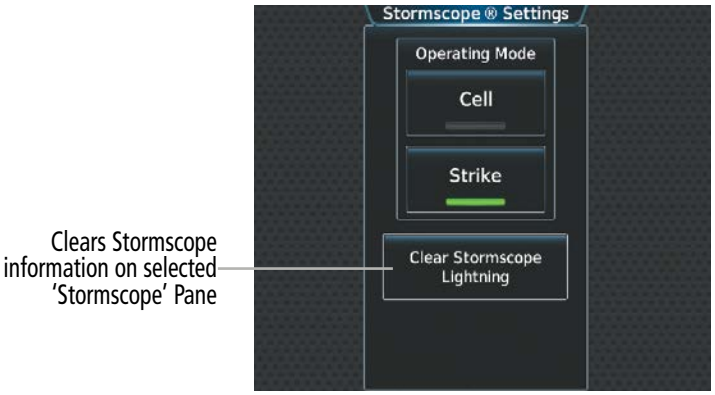


Figure 6-76 Clearing Stormscope Lightning for the 'Stormscope' Pane

STORMSCOPE INFORMATION ON NAVIGATION MAPS

Stormscope lightning information is available as an overlay on navigation maps.

Enabling/Disabling Stormscope Lightning Information on the PFD maps:

1) From PFW Home, touch **PFD Map Settings**.
2) If not selected, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
3) Scroll if necessary, and touch the **Stormscope Lightning** button to enable/disable Stormscope information.

Or:

1) With either the Inset Map or HSI Map shown, press the **PFD Map Settings** Softkey.
2) Press the **Stormscope** Softkey.

Selecting a Stormscope operating mode (PFD maps):

1) From PFW Home, touch **PFD Map Settings**.
2) If not selected, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
3) Touch the Stormscope Lightning **Settings** Button.
4) Touch either the **Cell** or **Strike** Buttons.

Clearing Stormscope Lightning (PFD maps):

1) From PFW Home, touch the **PFD Map Settings** Button.
2) If not selected, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
3) Touch the Stormscope Lightning **Settings** Button.
4) Touch the **Clear Stormscope Lightning** Button.

Selecting a maximum Stormscope map range for the PFD maps:

1) From PFW Home, touch **PFD Map Settings**.
2) If not selected, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
4) Touch the **Stormscope** Button (current range setting displayed in cyan).
5) Scroll as needed and touch a desired map range setting from the list.

Enabling/disabling Stormscope information on 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the **Stormscope Lightning** Button.

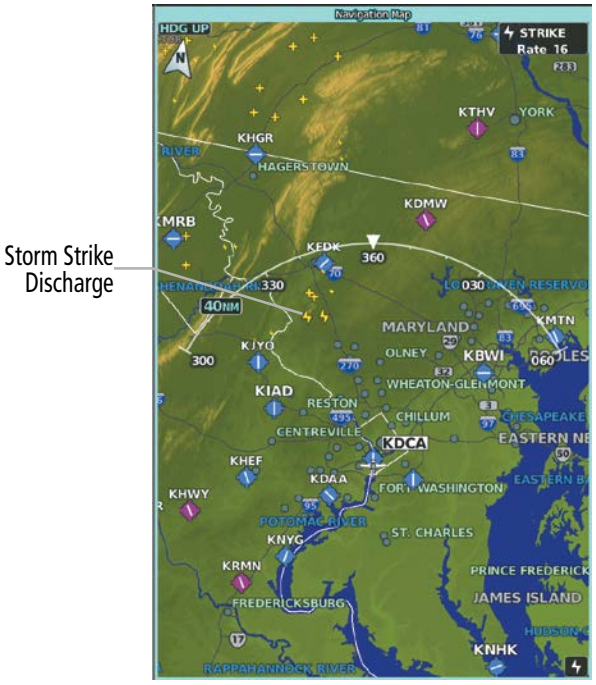


Figure 6-77 Stormscope Information on the 'Navigation Map' Pane (Strike Mode Selected)

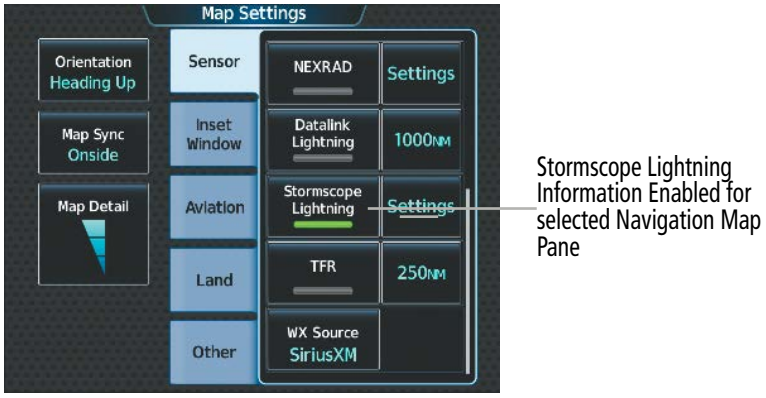


Figure 6-78 Enabling Stormscope Information for the 'Navigation Map' Pane

Selecting a Stormscope mode for 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
4) Touch either the **Cell** Button or the **Strike** Button. Button annunciator is green for currently selected mode.
5) When finished, touch **Back** or **Home**.

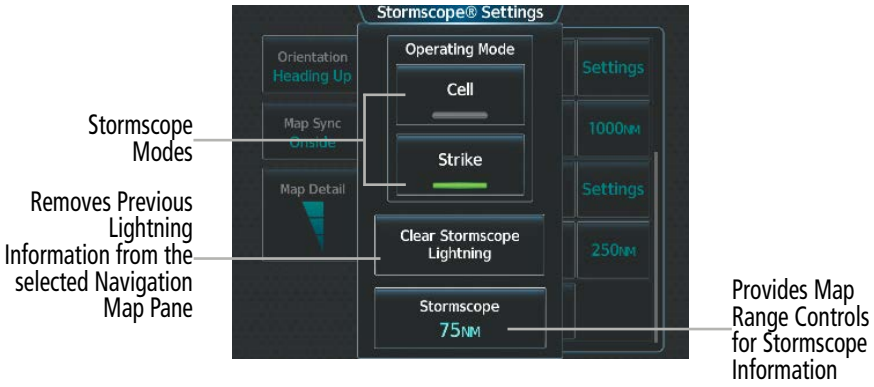


Figure 6-79 Stormscope Settings for the 'Navigation Map' Pane

Clearing the 'Stormscope' Pane removes any previously displayed cell or lightning strike information from the navigation maps.

Clearing Stormscope information on 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
4) Touch the **Clear Stormscope Lightning** Button.
5) When finished, touch **Back** or **Home**.

Selecting a maximum Stormscope map range on 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
4) Touch the **Stormscope** Button (current range setting displayed in cyan).
5) Scroll as needed and touch a desired map range setting from the list.



Access controls for changing maximum Navigation Map Range for Stormscope Information

Touch to select maximum map range for Stormscope information to be displayed on selected Navigation Map Pane

Figure 6-80 Selecting maximum 'Navigation Map' Pane range to display Stormscope Lightning information

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 the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft. Refer to the previous procedures 'Clearing Stormscope information on the 'Navigation Map' Pane' or 'Clearing Stormscope Information on the 'Stormscope' Pane' to clear Stormscope information from the selected map.

6.3 VERTICAL SITUATION DISPLAY TERRAIN

The system offers a Vertical Situation Display (VSD), which includes a profile of terrain and obstacles in an inset window. Although the VSD does not display Terrain SVT or 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 Terrain SVT or TAWS discussions for more information about relative terrain and obstacle color correlation and symbols.

VSD INSET WINDOW

NOTE: *Wire obstacles are not available for display inside the VSD Inset Window.*

NOTE: *Only one inset window may be shown per display pane. If another inset window is selected, it replaces the previously selected inset window.*

NOTE: *Individual obstacles may be depicted more than once on the VSD. This can occur, for example, during turns as the projected path in front of the aircraft changes.*

The VSD Inset Window appears along the bottom of the 'Navigation Map' Pane. Aircraft altitude appears along a vertical scale, with an aircraft icon positioned at the current altitude. Distance is represented horizontally along the bottom of the VSD Inset Window, and increases from left (present position) to right.

The VSD horizontal distance is the same as the 'Navigation Map' Pane Range distance displayed on the map range arc or circle, down to one nautical mile. At 'Navigation Map' Pane ranges below this distance, the VSD horizontal distance remains at one nautical mile. Adjusting the 'Navigation Map' Pane range also adjusts the VSD horizontal and vertical distance in proportionally. If the GPS position is unavailable, the system displays "VSD Not Available" inside the VSD Inset Window.

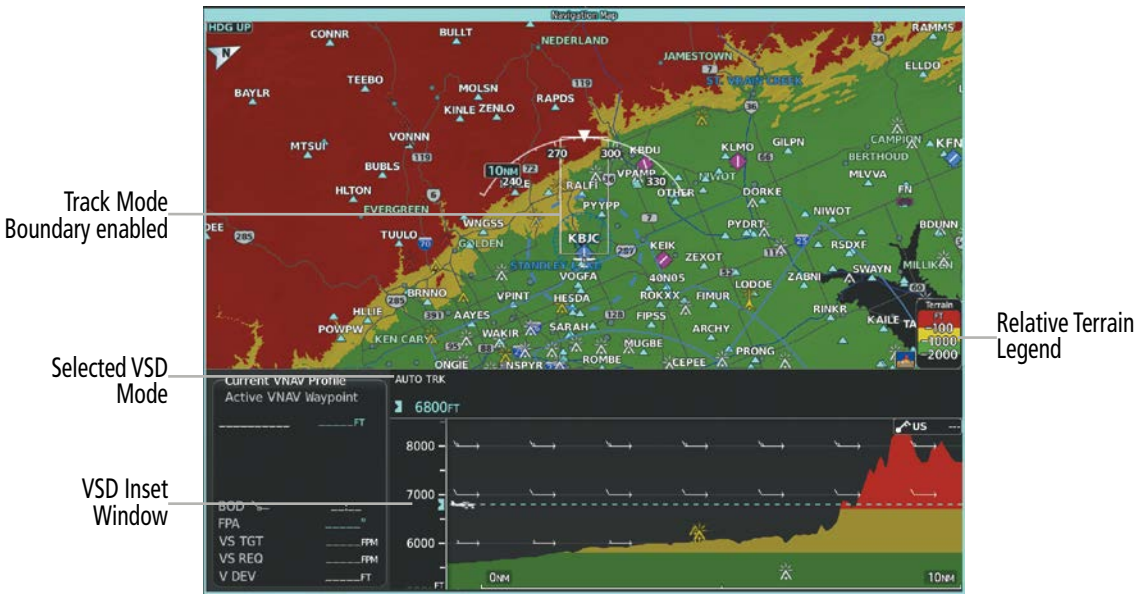


Figure 6-81 'Navigation Map' Pane with VSD Inset Window and Relative Terrain Enabled

Note the VSD Inset Window uses the color gray to depict relative terrain more than 2000' below the current aircraft altitude when relative terrain is enabled. When terrain is selected 'Off' for the 'Navigation Map' Pane, the VSD Inset Window uses the color gray to depicts absolute terrain.

Enabling/Disabling VSD Inset Window:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Inset Window** Tab.
3) Touch the **VERT Situation Display** Button to enable/disable the VSD Inset Window.

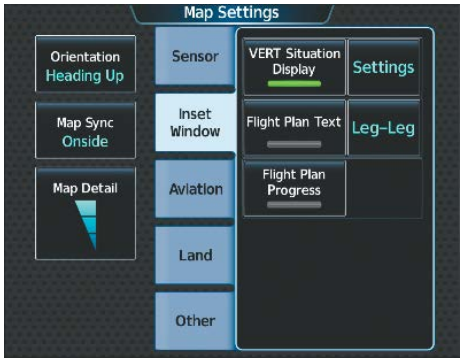


Figure 6-82 Enabling Vertical Situation Display Inset Window on the 'Map Settings' Screen

The same controls which enable/disable the display of terrain and point obstacles on the 'Navigation Map' Pane also control the display of this information in the VSD.

Enabling/disabling Relative Terrain information in the VSD and 'Navigation Map' Pane:

1) From MFW Home, touch **Map > Map Selection > Map Settings.**
2) If not selected, touch the **Sensor** Tab.
3) Touch the **Terrain** Button.
4) Touch either the **Absolute, Relative, or Absolute + Relative** Button to enable the display of Terrain information on the 'Navigation Map' Pane and VSD, or touch the **Off** Button to remove this information.



Figure 6-83 Enabling Relative Terrain for the Profile View Inset Window and 'Navigation Map' Pane

Enabling/disabling Point Obstacle information in the VSD and 'Navigation Map' Pane:

1) From MFW Home, touch **Map > Map Selection > Map Settings.**
2) If not selected, touch the **Land** Tab.
3) Touch the **Point Obstacle** Button to enable/disable the display of Point Obstacle information on the 'Navigation Map' Pane and VSD.

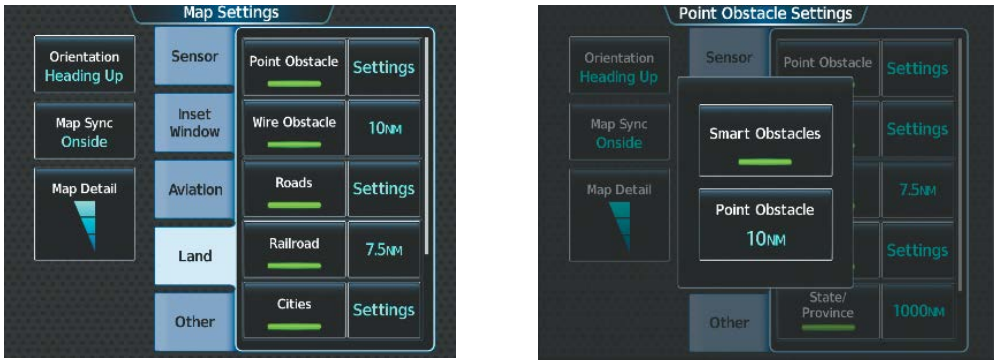


Figure 6-84 Enabling Obstacle information for the VSD and 'Navigation Map' Pane

Selecting a Point Obstacle information range in the VSD and 'Navigation Map' Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Land** Tab.
3) Touch the Point Obstacle **Settings** Button.
4) Touch the **Point Obstacles** Button (current range setting displayed in cyan).
5) Scroll as needed and touch a desired map range setting from the list.

When enabled, terrain and obstacles on 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 terrain is selected 'Off' on the 'Navigation Map' Pane). 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 or aircraft track (depending on the mode selected by the flight crew) 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. Approach and Departure flight phases are .6 NM. Terminal flight phase is 2 NM. Enroute and Oceanic flight phases are 4 NM.

The forward looking swath of terrain is based on the selected VSD Mode, annunciated in the top-left corner of the VSD. In Flight Plan Mode, the contour follows the active flight plan with the 'FPL' annunciation, 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 with the 'TRK' annunciation. In Auto Mode, the contour is based on the active flight plan, when available, otherwise, it is based on the ground track. Auto Mode annunciations are 'AUTO FPL' or 'AUTO TRK' when applicable.

Changing the Vertical Situation Display Mode:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) Touch the **Inset Window** Tab.
3) Touch the VERT Situation Display **Settings** Button.
4) Touch the **Mode** Button.
5) Touch one of the following buttons to select a mode:
   - **Auto:** VSD shows terrain along the active flight plan route, or current track if there is no active flight plan.
   - **Flight Plan:** VSD shows terrain along the active flight plan route. VSD is unavailable if there is no active flight plan.
   - **Track:** VSD shows terrain along the current track.
6) When finished, touch the **Back** Button or the **Home** Button.

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, a vertical line appears below the obstacle symbol in order to depict the top of the obstacle symbol at its height AGL, as shown in the following figure.

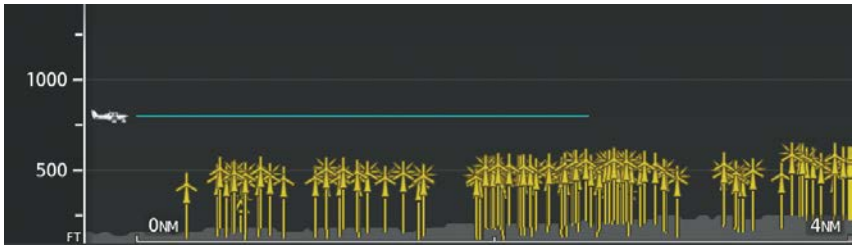


Figure 6-85 Lines raise obstacle symbols to their heights AGL along the altitude scale, if necessary

TRACK MODE BOUNDARY

The Track Mode Boundary displays the horizontal and lateral boundaries of the information shown in the VSD. The boundary is a white rectangle on the 'Navigation Map' Pane and is only available when the VSD is operating in Track Mode. The two white range references inside the boundary rectangle match the range references along the distance scale inside the VSD whenever the profile range is at least five nm.

The Track Mode Boundary rectangle may be enabled or disabled, and the 'Navigation Map' Pane range at which the Track Mode Boundary rectangle is removed from Navigation Map Pane can be changed.



Figure 6-86 Customizing the Track Mode Boundary Navigation Maximum Map Range

Enabling/disabling the Track Mode Boundary:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) Touch the I**nset Window** Tab.
3) Touch the VERT Situation Display **Settings** Button.
4) If the **Track Mode Boundary** Button is subdued, it will be necessary to change the Mode to either Auto or Track before continuing to the next step; refer to the procedure 'Changing the VSD Mode' for more information.
5) Touch the **Track Mode Boundary** Button to enable/disable the display of the boundary on the 'Navigation Map' Pane.
6) Touch the Track Mode Boundary range button.
7) Scroll as needed and touch a button for the desired maximum 'Navigation Map' Pane range for the system to display the Profile Boundary (above this selection, the system will remove the Profile Boundary from the pane.)
8) When finished, touch the **Back** Button or the **Home** Button.

6.4 TERRAIN DISPLAYS

WARNING: *Do not use terrain avoidance displays as the sole source of information for maintaining separation from terrain and obstacles. Garmin obtains terrain and obstacle data from third party sources and cannot independently verify the accuracy of the information.*

NOTE: *Terrain data is not displayed when the aircraft is outside of the installed terrain database coverage area.*

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

NOTE: *Terrain and obstacle alerting requires the Terrain-SVT or TAWS-B option.*

The terrain system increases situational awareness and aids in reducing controlled flight into terrain (CFIT) and obstacles.

One of the following terrain systems is installed on this aircraft:

- Terrain-SVT (included with the Garmin SVT option when the Terrain Awareness and Warning System Class-B (TAWS-B) is not installed; refer to the Flight Instruments section for more information about Garmin SVT.)
- TAWS-B (optional).

The installed terrain system provides color indications on map displays when terrain or obstacles, including certain power lines, are within a certain altitude threshold from the aircraft. Terrain-SVT and TAWS-B furthermore provide advisory visual annunciations and voice alerts to indicate the presence of threatening terrain or obstacles relevant to the projected flight path. Compared to Terrain-SVT alerting, TAWS-B uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles. The TAWS-B system includes more alerting capabilities than the Terrain-SVT system.

The terrain system requires the following for proper operation:

- Valid 3-D GPS position.
- Valid terrain and obstacle databases.

The terrain system uses terrain and obstacle information supplied by government and other sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions, such as towers or power lines, may be shown if available in the database. Garmin verifies the data to confirm accuracy of the content. However, the displayed information should never be understood as being all-inclusive and data may still contain inaccuracies.

The terrain system uses information provided from the GPS receiver to provide a horizontal position and altitude. GPS altitude is derived from satellite measurements. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level (MSL) calculated geometrically. The system uses GSL altitude to find the alerts for the Terrain-SVT and TAWS-B systems. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to find the MSL altitude. It is a widely-used MSL altitude source. Therefore, GSL altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

The terrain and obstacle databases used by the terrain system are referenced to MSL. Using the GPS position and GSL altitude, terrain system displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, for the Terrain-SVT or TAWS-B systems, the system uses the GPS position and GSL altitude to calculate and "predict" the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, the Terrain-SVT or TAWS-B systems can provide advanced alerts of predicted dangerous terrain conditions.

Baro-corrected altitude (or indicated altitude) is derived by adjusting the altimeter setting for local atmospheric conditions. The most accurate baro-corrected altitude can be achieved by frequently updating the altimeter setting to the nearest reporting station along the flight path. However, because actual atmospheric conditions seldom match the standard conditions defined by the International Standard Atmosphere (ISA) model (where pressure, temperature, and lapse rates have fixed values), it is common for the baro-corrected altitude (as read from the altimeter) to differ from the GSL altitude. This variation results in the aircraft's GSL altitude differing from the baro-corrected altitude.

RELATIVE TERRAIN SYMBOLOGY

The terrain system uses colors and symbols to represent terrain and point obstacles (with heights greater than 200 feet above ground level, AGL) present in the databases relative to aircraft altitude. The system dynamically adjusts these colors as the aircraft altitude changes, and after takeoff and landing.

While the aircraft is on the ground, the system displays relative terrain 400 feet or more above the aircraft altitude using red, and terrain at less than 400 feet above aircraft altitude using black, as shown on the On-Ground Legend. When the aircraft is in the air, the system displays relative terrain information using red, yellow, green, and black, as shown on the In-Air Legend. As the aircraft transitions from on-ground to in-air, or from in-air to on-ground, the display of relative terrain momentarily fades into the corresponding colors. For Terrain-SVT or TAWS-B systems, if an alert occurs, the relative terrain colors transition to the In-Air Legend if the On-Ground Legend was shown in order to provide the pilot with the most information possible.

On-Ground Legend



In-Air Legend



Figure 6-87 Relative Terrain Legend

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

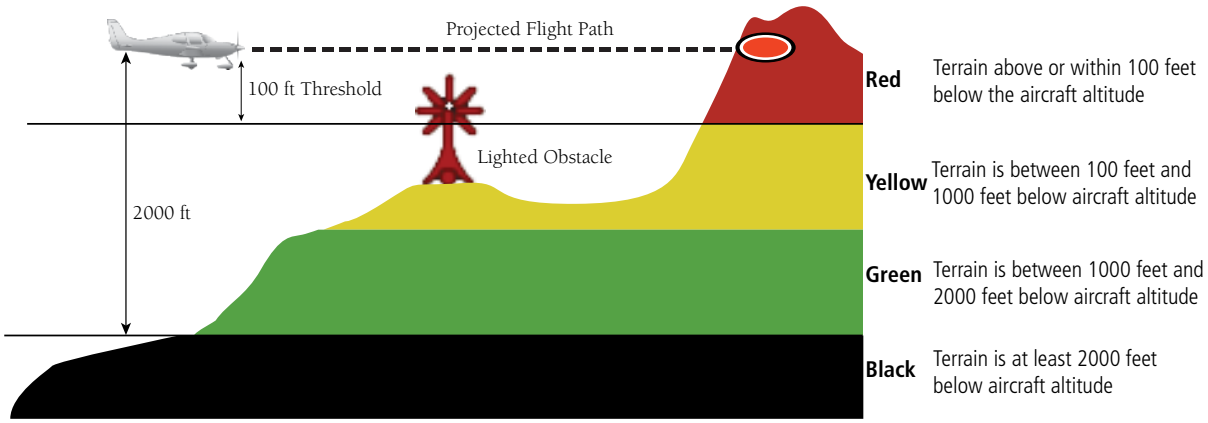


Figure 6-88 Terrain Altitude/Color Correlation for Terrain-SVT or TWAS B Systems

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude.
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude.
				White obstacle is more than 1000 ft below aircraft altitude.

Table 6-9 Terrain SVT Relative Point Obstacle Symbols and Colors

Wire Obstacle	Wire Obstacle Location
	Red wire obstacle is at or above the aircraft altitude.
	Yellow wire obstacle is between the aircraft altitude to within 250 feet below the aircraft altitude.
	White wire obstacle is more than 250 ft below the aircraft altitude.

Table 6-10 Relative Wire Obstacles 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 6-11 Wind Turbine Obstacles and Colors

The Terrain-SVT and TAWS-B systems show potential impacts areas for terrain and obstacles using yellow and red as shown in the following table.

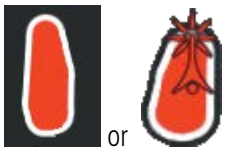
Potential Impact Area Examples	Alert Type	Example Annunciation
	Warning	TAWS-B Warning PULL UP Terrain-SVT Warning TERRAIN
	Caution	TERRAIN

Table 6-12 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

DISPLAYING RELATIVE TERRAIN INFORMATION

The Terrain-SVT/TAWS Pane is the principal map pane for viewing relative terrain information. Aviation data (airports, VORs, and other NAVAIDs) can be enabled for reference. Relative Terrain information is also available for display on navigation maps.

TERRAIN PANE

The Terrain-SVT/TAWS Pane is specialized to show terrain, obstacle, and potential impact area information in relation to the aircraft's current altitude, without clutter from the basemap. For Terrain-SVT and TAWS-B systems only, this pane also shows potential impact areas. If terrain or obstacles and the projected flight path of the aircraft intersect, the system automatically adjusts the map range if necessary to emphasize the display of the potential impact area(s).

Aircraft orientation on this map is always heading up unless there is no valid heading, in which case the orientation is track up. Map range is adjustable with the **Lower Knob** from 250 feet to 1000 nm, which is indicated on the map range arc.

The Terrain-SVT/TAWS Pane also displays annunciations in the lower-left corner of the pane, in addition to banner annunciations in the center of the pane.

Showing the Terrain Pane:

From MFW Home, touch the [Terrain] Button. [Terrain] can be **Terrain-SVT**, or **TAWS**.

The Terrain Pane can also show airports, VORs, NDBs, and intersections for additional reference, using the map settings chosen for the 'Navigation Map' Pane.

Enabling/disabling aviation information on the Terrain Pane:

1) From MFW Home, touch the [Terrain] Button. [Terrain] can be **Terrain-SVT**, or **TAWS**.
2) Touch the **Show Aviation Data** Button to enable/disable aviation information (airports, VORs, NDBs, Intersections) for the terrain pane.

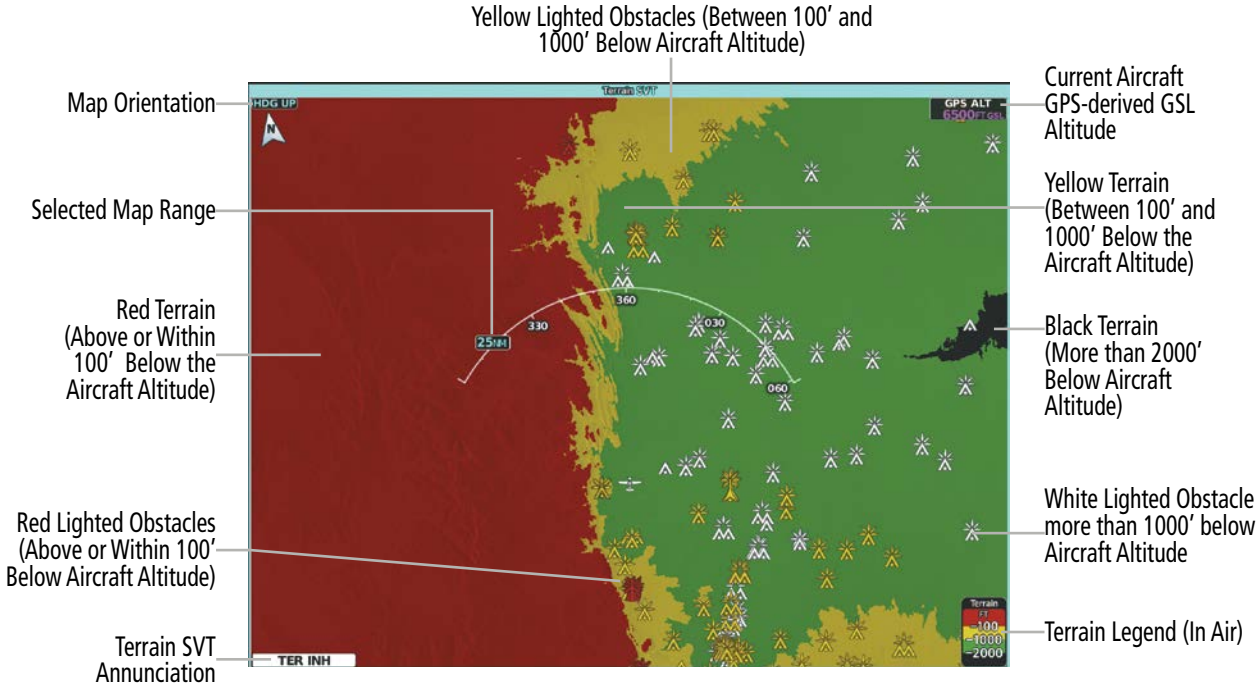


Figure 6-89 'Terrain SVT' Pane with Aircraft in the Air



Figure 6-90 Terrain SVT Settings Screen

RELATIVE TERRAIN ON THE NAVIGATION MAPS

The Terrain-SVT/TAWS Pane is the principal map pane for viewing terrain information. Relative terrain information is also available for display on navigation maps.. This includes the display of relative terrain, obstacles, and potential impact areas. When relative terrain information is enabled on a navigation map, the system displays a terrain icon and legend. If terrain data is not available or has failed, a white 'X' appears over the terrain Icon. If the system calculates a potential impact area, it appears on any navigation map, regardless of whether relative terrain information is enabled/disabled.

Controlling Relative Terrain Information (Navigation Map Panes):

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the **Terrain** Button.
4) Touch the **Relative** Button to enable Relative Terrain, or **Off** to remove terrain information.

Controlling Relative Terrain Information (Inset and HSI Map):

1) From PFW Home, touch **PFD Map Settings**.
2) If the Inset Map or HSI Map is not presently shown on the PFD, do the following:
   a) Touch the **Layout** Button.
   b) Touch the **Inset Map** Button to display the Inset Map, or touch the **HSI Map** Button to display the HSI Map.
3) Touch the **Terrain** Button.
4) Touch the **Relative** Button to enable Relative Terrain, or **Off** to remove terrain information.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Terrain Settings** Softkey.
3) Press the **Relative** Softkey.

When relative terrain information is enabled on the 'Navigation Map' Pane or dedicated terrain pane, a relative terrain legend appears. A relative terrain overlay enabled icon also appears on navigation maps with the exception of the HSI Map.

The 'Map Settings' Screen provides a means for enabling/disabling the display of relative terrain, point obstacles (such as towers), and wire obstacles (such as power lines). The 'Map Settings' Screen 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.

The pilot can display relative terrain information independently of point or wire obstacle information; however, obstacles for which Terrain-SVT or TAWS-B 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 terrain pane use settings based on those selected for the 'Navigation Map' Pane. The maximum display ranges for obstacles on each map are dependent on the range setting made for the 'Navigation Map' Pane.

Customizing terrain and obstacle display on the 'Navigation Map' Pane:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the Terrain **Settings** Button.
4) Touch the **Map Settings** Button.
5) The **Terrain** Button displays the maximum navigation map range to show relative terrain information in cyan. To change this value, touch the **Terrain** Button.
6) Scroll as needed, and touch a maximum navigation map range to display relative terrain information.
7) Touch the **Back** Button three times to return to the 'Map Settings' Screen.
8) Touch the **Land** Tab.
9) Touch the **Point Obstacle** Button to enable/disable the display of point obstacles on navigation maps.
10) Touch the Point Obstacle **Settings** Button.
11) Touch the **Point Obstacle** Button.
12) The Point Obstacle Button displays the maximum map range to show point obstacles in cyan. Touch this button to change the value.
13) Scroll as needed, and touch a maximum navigation map range to display point obstacle information.
14) When finished, touch the **Back** Button or the **Home** Button.

Enabling/disabling Smart Obstacles Information on (Navigation Maps):

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Land** Tab.
3) Touch the Point Obstacle **Settings** Button.
4) Touch the **Smart Obstacles** Button.

On the 'Navigation Map' Pane, the pilot can view the obstacle heights AGL and MSL by panning with the Map Pointer over an obstacle or point obstacle icon. The map panning feature is enabled by pushing the **Lower Knob**. The map range is adjusted by turning the **Lower Knob**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.

RELATIVE + ABSOLUTE TERRAIN MAP OVERLAYS

In addition to the relative terrain information that can displayed on navigation map as previously discussed. The system offers the ability for the flight crew to overlay relative terrain data that is used on the Terrain-SVT/ TAWS Pane with that of the absolute terrain data used on the navigation maps.

For a further discussion on Absolute Terrain feature, please refer to Flight Management section.

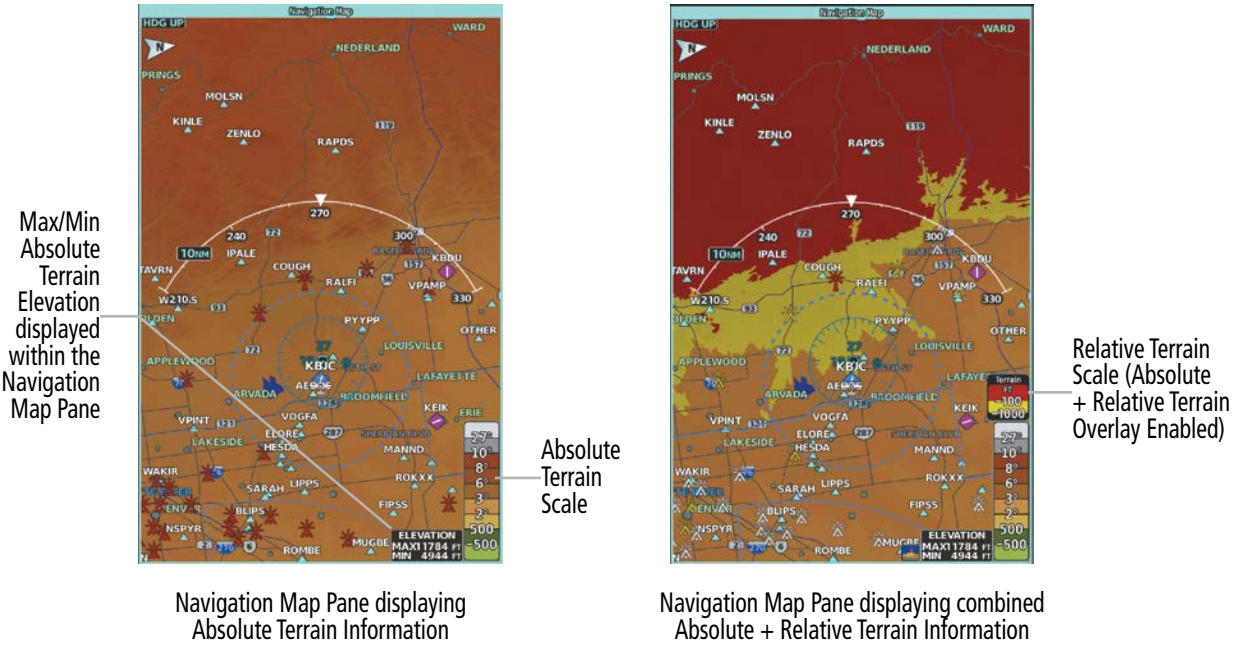


Figure 6-91 'Navigation Map' Pane displaying Terrain Information

Controlling Absolute Terrain + Relative Terrain Information on the Navigation Map Pane:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the **Terrain** Button.
4) Touch the **Absolute + Relative** Button to enable Absolute + Relative Terrain feature, or **Off** to remove terrain information.

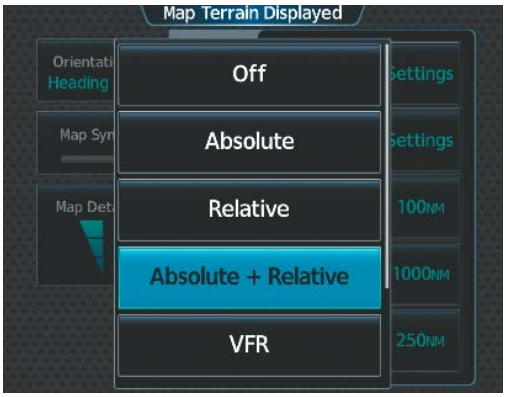


Figure 6-92 Enabling Absolute + Relative Terrain Information on the 'Map Settings' Screen

Enabling/disabling Absolute Terrain + Relative Terrain Information on the Inset Navigation Map and HSI Map:

1) From PFW Home, touch **PFD Map Settings** Button.
2) If the HSI Map is not presently shown on the PFD, do the following:
   a) Touch the **Layout** Button.
   b) Touch the **HSI Map** Button to display the HSI Map.
3) Touch the **Terrain** Button.
4) Touch the **Absolute + Relative** Button to enable Absolute + Relative Terrain feature, or **Off** to remove terrain information.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Terrain Settings** Softkey.
3) Press the **Absolute + Relative** Softkey.

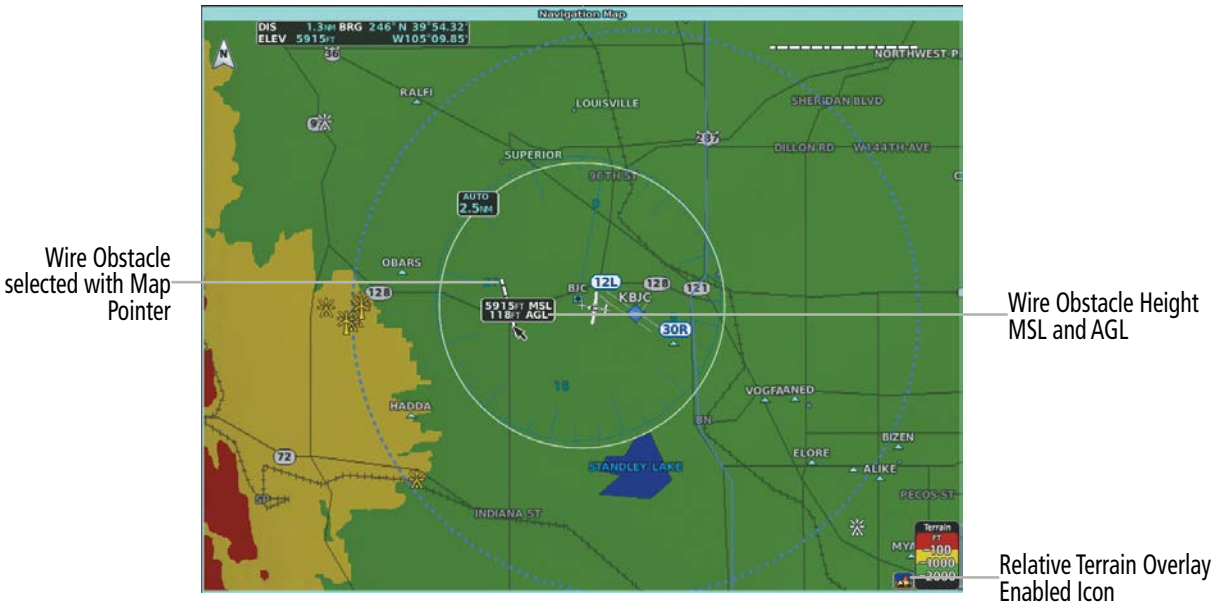


Figure 6-93 Using the Map Pointer to get Wire Obstacle Height 'Navigation Map' Pane

WIRE OBSTACLE INFORMATION AND ALERTING

For additional safety, the terrain system incorporates Garmin's WireAware™ wire obstacle information. For wire obstacles such as power lines present in the obstacle database, the system shows these on the maps as well as the Synthetic Vision display; see the Flight Instruments section for more information about Synthetic Vision displays of power lines. For the Terrain-SVT and TAWS-B only, this system can also issue cautions or warnings for potential impact with wire obstacles.

WireAware database information mainly includes Hazardous Obstacle Transmission (HOT) power lines which are typically high voltage transmission lines depicted on VFR Sectional charts, and are considered of special interest to fixed-wing pilots. These include power lines which may span rivers, valleys, canyons, or be in close proximity to airports/heliports.

It is important to note the obstacle database does not contain all power lines. In fact, WireAware database coverage is mostly limited to HOT power lines, such as the especially tall transmission lines and their associated support structures. It does not typically have information for the more prevalent smaller utility poles or lines, such as those found in residential areas. Furthermore, WireAware obstacle database coverage exists mainly in the United States; with limited coverage in portions of Canada and Mexico. In addition, the height of the wire obstacles is commonly estimated and should not be relied upon for maneuvering decisions.

NOTE: *Wire obstacles are not available for display inside the VSD Inset Window.*

TERRAIN-SVT AND TAWS-B TERRAIN AND OBSTACLE ALERTS

The system issues alerts when flight conditions meet parameters that are set within Terrain-SVT or TAWS-B software algorithms. The system issues terrain/obstacle alerts as a caution or warning severity level. Alerts include visual annunciations and voice alerts.

When the system issues an alert, annunciations appear on the PFWs, the 'Terrain-SVT' Pane or 'TAWS' Pane, and on the Touchscreen Controllers. The PFW shows the annunciation to the left of the altitude tape. The Terrain-SVT or TAWS Pane shows the annunciation in the lower-left corner of the pane. In addition, a pop-up alert appears on each Touchscreen Controller. To respond to the pop-up alert, do one of the following on either Touchscreen Controller:

Acknowledging Terrain Alerts:

1) **Touch the Terrain-SVT or TAWS Button to display the terrain pane and terrain settings screen.**
2) **Touch the OK Button to remove the pop-up alert.**

   Or:

   Touch the Terrain Inhibit or TAWS Inhibit Button to inhibit the terrain system from issuing alerts.

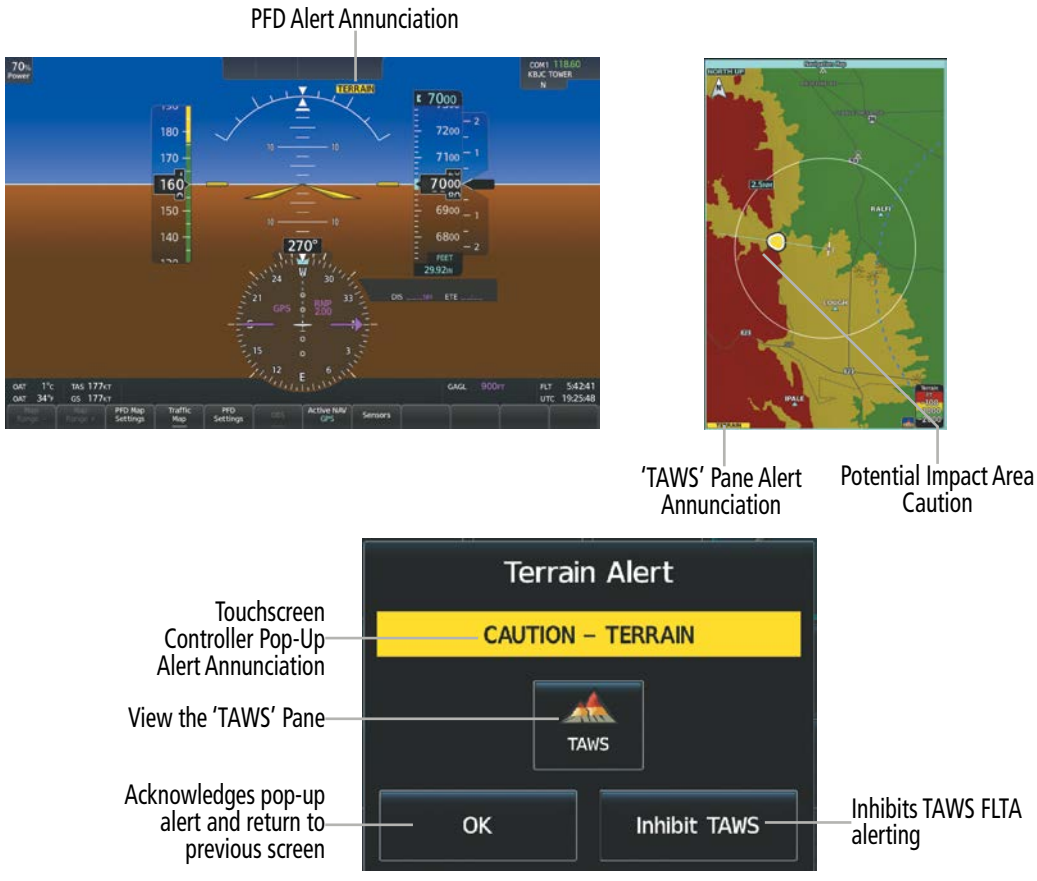


Figure 6-94 TAWS-B Alert Annunciations

The following table lists the possible Terrain-SVT alerts.

Alert Type	PFD/'Map - Terrain- SVT' Page Alert	Touchscreen Controller Pop-Up Alert	Voice Alert
Reduced Required Terrain Clearance Warning (RTC)	TERRAIN	WARNING – TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Line Clearance (RLC) Warning	TERRAIN	WARNING – WIRE	"Warning; Wire, Wire"
Imminent Terrain Impact Warning (ITI)	TERRAIN	WARNING – TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Obstacle Clearance Warning (ROC)	TERRAIN	WARNING – OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Obstacle Impact Warning (IOI)	TERRAIN	WARNING – OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Line Impact Warning (ILI)	TERRAIN	WARNING – WIRE	"Warning; Wire, Wire"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN	"Caution; Terrain, Terrain"
Imminent Line Impact Caution (ILI)	TERRAIN	CAUTION – WIRE	"Caution; Wire, Wire"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN	"Caution; Terrain, Terrain"
Reduced Required Line Clearance Caution (RLC)	TERRAIN	CAUTION – WIRE	"Caution; Wire, Wire"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE	"Caution; Obstacle, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE	"Caution; Obstacle, Obstacle"

Table 6-13 Terrain SVT Alerts Summary

The following table lists the TAWS-B alerts.

Alert Type	PFD/'Map - TAWS-B' Page Alert Annunciation	Touchscreen Controller Pop-Up Alert	Voice Alert
Excessive Descent Rate Warning (EDR)	PULL UP	PULL–UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN – PULL–UP	"Terrain, Terrain; Pull Up, Pull Up"
Imminent Line Impact Warning (ILI)	PULL UP	WIRE AHEAD – PULL–UP	"Wire Ahead; Pull Up, Pull Up"
Reduced Required Line Clearance Warning (RLC)	PULL UP	WARNING – WIRE	"Wire, Wire; Pull Up, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN AHEAD – PULL–UP	"Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE – PULL–UP	"Obstacle, Obstacle; Pull Up, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE AHEAD – PULL–UP	"Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN	"Caution, Terrain; Caution, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	TERRAIN – AHEAD	"Terrain Ahead; Terrain Ahead"
Required Reduced Line Clearance Impact Caution (RLC)	TERRAIN	CAUTION – WIRE	"Caution, Wire; Caution, Wire"
Imminent Line Clearance Impact Caution (ILI)	TERRAIN	WIRE AHEAD	"Wire Ahead; Wire Ahead"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE	"Caution, Obstacle; Caution, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	OBSTACLE AHEAD	"Obstacle Ahead; Obstacle Ahead"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW – TERRAIN	"Too Low, Terrain"
Touchdown Callout (VCO) "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DONT SINK	"Don't Sink"

Table 6-14 TAWS-B Alerts Summary

FORWARD LOOKING TERRAIN AVOIDANCE (FLTA)

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVT or TAWS-B compares the projected flight path as derived from GPS data with terrain features and obstacles from the terrain and obstacle databases. The system issues FLTA alerts when the projected flight path conflicts with terrain or obstacles.

The projected flight path is a calculated area ahead of, to the sides, and below the aircraft. The size of the projected flight path varies based on factors including ground speed (the path ahead is larger when the ground speed is higher), whether the aircraft is level, turning, or descending, and the proximity to the nearest usable runway along the current track. As the aircraft approaches the runway, the projected flight path becomes narrower until the system automatically disables FLTA alerts or the flight crew manually inhibits them.

There are two types of FLTA alerts, Reduced Required Terrain/Obstacle Clearance (RTC or ROC respectively) and Imminent Terrain/Obstacle Impact (ITI or IOI respectively).

The system issues **Reduced Required Terrain Clearance (RTC)** and **Reduced Required Obstacle Clearance (ROC)** alerts when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values. When an RTC alert is issued, the system displays a potential impact area on navigation maps and the 'Terrain SVT' Pane or the 'TAWS' Pane.

Imminent Terrain Impact (ITI) and **Imminent Obstacle Impact (IOI)** alerts occur when the aircraft is below the elevation of a terrain or obstacle in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact area on navigation maps and the 'Terrain SVT' Pane or the 'TAWS' Pane. The alert occurs when the projected vertical flight path is calculated to come within minimum clearance altitudes.

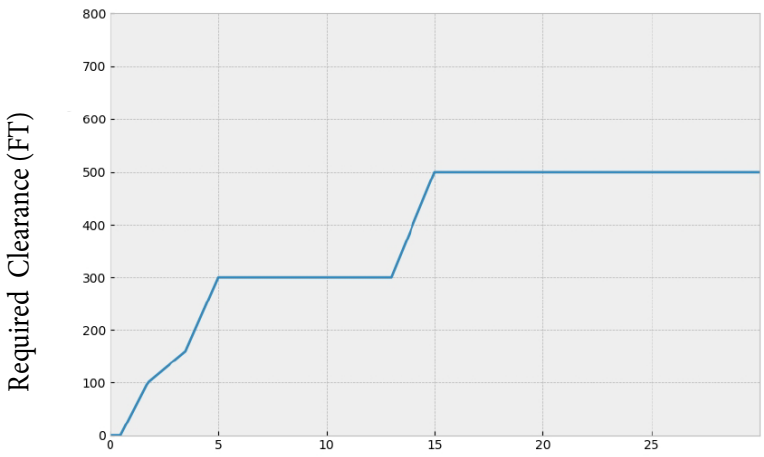


Figure 6-95 FLTA Alert Minimum Terrain and Obstacle Clearance Values

The system automatically inhibits FLTA alerts when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway or the aircraft is between runway ends.

INHIBITING FLTA AND PDA ALERTS

The flight crew can manually inhibit FLTA and PDA visual annunciations and voice alerts. Discretion should be used when inhibiting alerts and the system should be enabled when appropriate. When PDA and FLTA alerts are inhibited, the system status annunciation 'TER INH' or 'TAWS INH' appears on the 'Terrain SVT' Pane or 'TAWS' Pane and on the PFD.

NOTE: *Inhibiting Terrain alerts inhibits FLTA and PDA alerts only. EDR and VCO alerts remain enabled even when TAWS is inhibited.*



Figure 6-96 Alerting is Inhibited when Annunciation is displayed

Inhibiting/enabling Terrain SVT alerting:

1) From MFW Home, touch **Terrain SVT** > **Terrain SVT Settings**.

   Or:

   a) From MFW Home, touch **Map > Map Selection > Map Settings**.

   b) If not selected, touch the **Sensor** Tab.

   c) Touch the Terrain **Settings** Button.

   Or:

   a) From PFW Home, touch **PFD Map Settings**.

   b) If not selected, touch the **HSI Map** or **Inset Map** button to enable the Overlays buttons.

   c) Touch the Terrain **Settings** Button.

2) Touch the **Terrain Inhibit** Button. When the annunciator on the button is green, Terrain SVT alerting is inhibited. When the annunciator is gray, Terrain SVT alerting is enabled.

Inhibiting Terrain SVT alerting while an alert is occurring:

Touch the **Terrain Inhibit** Button on the Terrain SVT pop-up window.

Inhibiting/enabling TAWS-B FLTA and PDA alerting:

1) From MFW Home, touch **TAWS > TAWS Settings**.

2) Touch the **TAWS Inhibit** Button. When the annunciator on the button is green, TAWS-B alerting is inhibited. When the button annunciator is gray, TAWS-B alerting is enabled.

   Or:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.

2) If not selected, touch the **Sensor** Tab.

3) Touch the Terrain **Settings** Button.

4) Touch the **TAWS Inhibit** Button. TAWS-B alerting is inhibited when the button annunciator is green, enabled when gray.

   Or:

1) From PFW Home, touch **PFD Map Settings**.
2) Touch the Terrain **Settings** Button in the 'Overlays' Window.
3) Touch the **TAWS Inhibit** Button.

Inhibiting TAWS-B alerting while an alert is occurring:

1) Touch the **TAWS Inhibit** Button on the Terrain Alert pop-up window on the Touchscreen Controller.
2) Touch the **OK** Button to confirm and inhibit TAWS or touch the **Cancel** Button to return to the previous screen or Terrain Alert pop-up window.

While Terrain alerting is manually inhibited (or the TAWS system is not available or has failed), the system may display a 'LOW ALT' annunciation on the PFD next to the altitude tape if the following conditions are met:

» The aircraft is on an SBAS approach.
» The Final Approach Fix is the active waypoint.
» The aircraft is at least 164 feet below the prescribed altitude at the Final Approach Fix.

See the Flight Instruments Section for more details about the 'LOW ALT' annunciation.

ADDITIONAL TAWS-B ALERTING

In addition to the FLTA alerting discussed previously, TAWS-B provides the following additional types of alerts.

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide notification when the aircraft is determined to be closing (descending) upon terrain a rate that is calculated to be excessive relative to height above terrain.

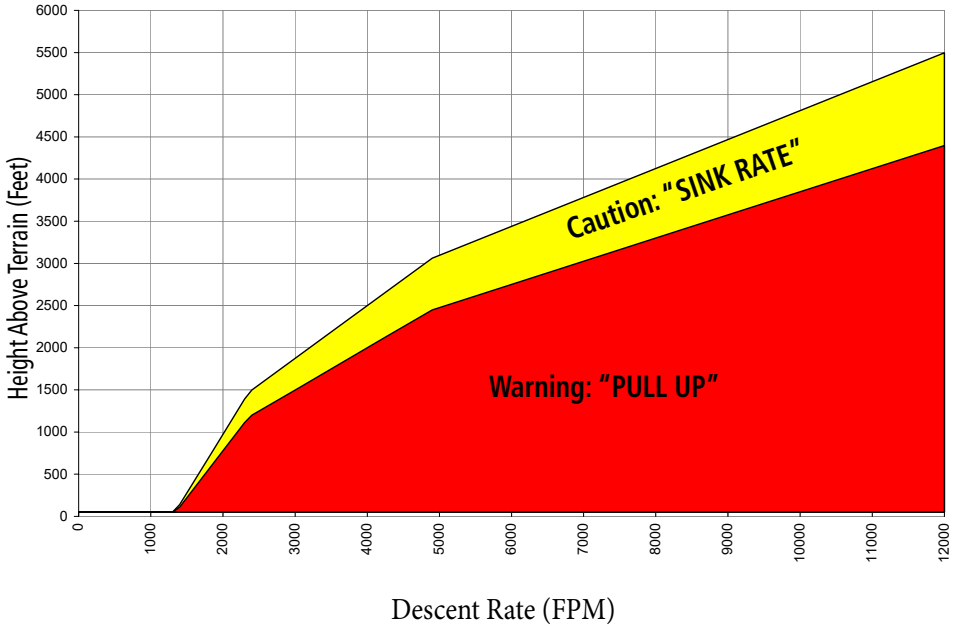


Figure 6-97 Excessive Descent Rate Alert Criteria

PREMATURE DESCENT ALERTING

A **Premature Descent Alert (PDA)** is issued when the system detects 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.

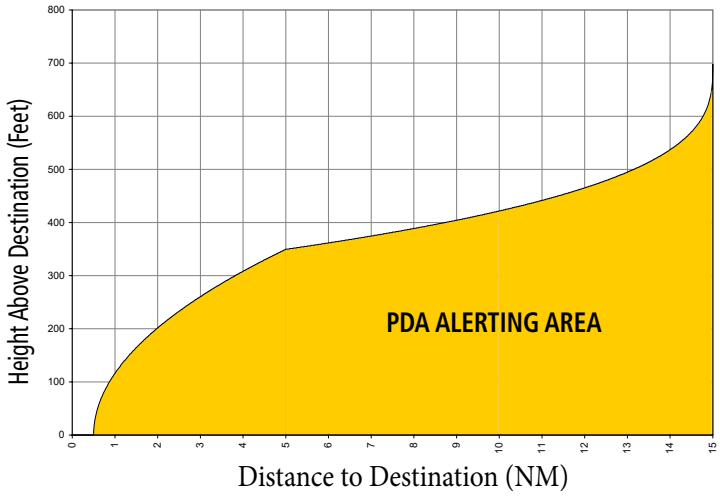


Figure 6-98 PDA Alerting Threshold

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT (NCR)

The **Negative Climb Rate (NCR) After Takeoff** alert (also referred to as "Altitude Loss After Takeoff") provides alerts when the system determines the aircraft is losing altitude (closing upon terrain) after takeoff. The voice alert **"Don't Sink"** is given for NCR alerts, accompanied by visual annunciations. NCR alerting is only active when departing from an airport and when the following conditions are met:

» Height above the terrain is less than 700 feet.

» Distance from the departure airport is 5 nm or less.

» Heading change from the departure heading is less than 110 degrees.

» NCR alerts can be triggered by either altitude loss or sink rate.

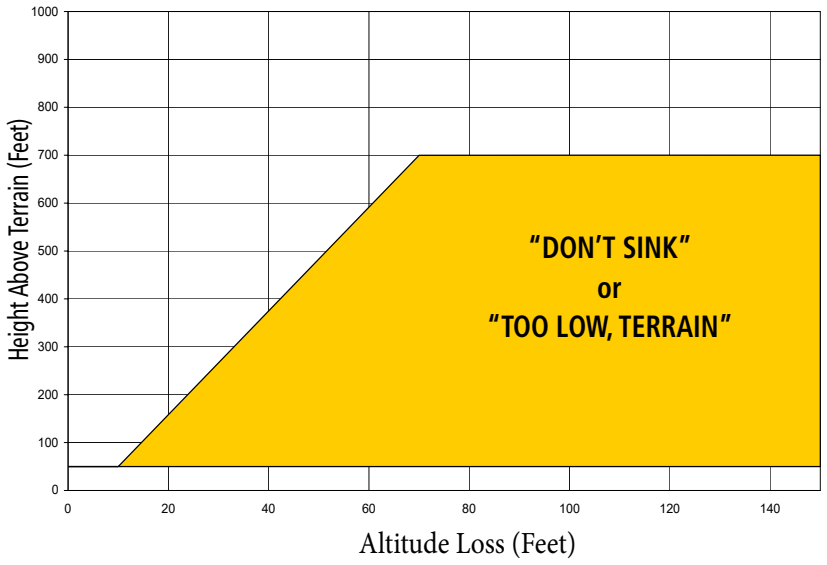


Figure 6-99 Negative Climb Rate (NCR) Altitude Loss

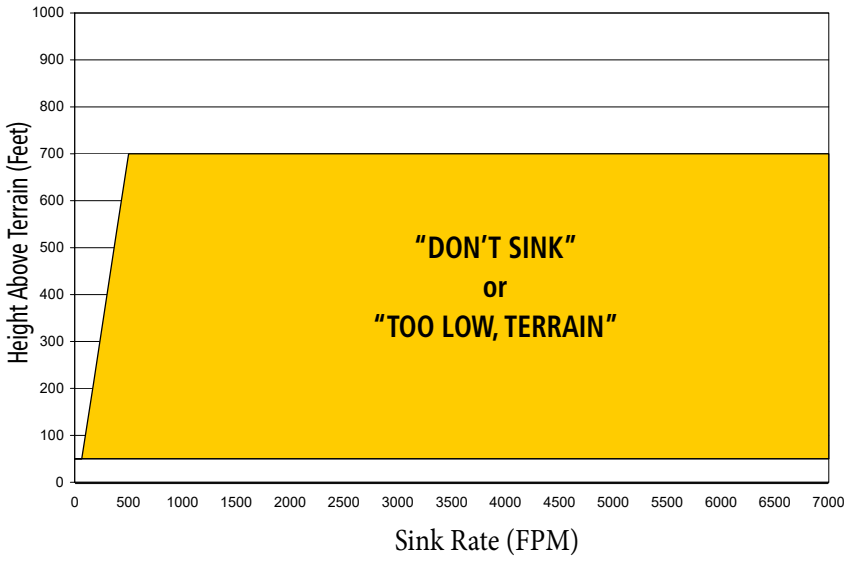


Figure 6-100 Negative Climb Rate (NCR) Sink Rate

ALTITUDE VOICE CALLOUT (VCO)

The purpose of the TAWS-B **"Five-hundred"** voice alert is to provide an advisory alert of when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within 5 nm of an airport, the **"Five Hundred"** voice alert is based on the nearest runway threshold elevation. When the aircraft is more than 5 nm of the nearest airport, the **"Five Hundred"** voice alert is based on the height above terrain (as determined by the GPS altitude and Terrain Database).

There are no display annunciations or pop-up alerts that accompany the VCO alert. This voice alert cannot be inhibited.

SYSTEM STATUS

TERRAIN-SVT

At the beginning of an avionics power cycle, Terrain-SVT conducts a self-test of its visual annunciations and voice alerts. A voice alert is issued at test completion.

Terrain-SVT continually monitors several system-critical items such as database validity, hardware status, and FMS (GPS) status. If the terrain/obstacle database is not available, the system issues the voice alert **"Terrain System Failure"** along with the 'TER FAIL' alert annunciation.

Terrain-SVT requires a 3-D FMS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation 'TER N/A' appears on the PFDs and on the 'Terrain-SVT' Pane. The voice alert **"Terrain System Not Available"** is generated. When sufficient GPS signal is returns and the aircraft is within the database coverage area, the voice alert "**Terrain System Available**" is generated.

Alert Type	PFD/Terrain SVT Display Annunciation	Terrain SVT Display Center Banner Annunciation	Voice Alert
System Test in Progress.	TER TEST	TERRAIN TEST	None
System Test Pass.	None	None	"Terrain System Test OK"
Terrain Alerting Inhibited.	TER INH	None	None
No GPS position.	TER N/A	NO GPS POSITION	"Terrain System Not Available"[1]
Excessively degraded GPS signal; or Out of database coverage area.	TER N/A	None	"Terrain System Not Available"[1]
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault.	TER FAIL	TERRAIN FAIL	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain SVT operating with PFD Terrain or Obstacle databases.	None	TERRAIN DATABASE FAILURE	None

[1] *"Terrain System Available" will be heard when sufficient GPS signal is received, or terrain database coverage area re-entered.*

Table 6-15 Terrain SVT System Status Annunciations

TAWS-B

At the beginning of the avionics power cycle, TAWS-B conducts a self-test of its visual annunciations and voice alerts. A voice alert is issued at test completion. The pilot can also manually select a TAWS-B system test. The system test option is unavailable when the ground speed exceeds 30 knots.

Manually testing the TAWS System:

1) From MFW Home, touch **Aircraft Systems > System Tests**.
2) Touch the **TAWS** Button.

TAWS-B continually monitors several system-critical items such as database validity, hardware status, and FMS (GPS) status. If the terrain/obstacle database is not available, the voice alert *"TAWS System Failure"* is generated along with the 'TAWS FAIL' alert annunciation.

TAWS-B requires a 3-D FMS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the system displays the 'TAWS N/A' annunciation, and issues the *"TAWS Not Available"* voice alert. When the GPS signal integrity returns and the aircraft is within the database coverage area, the system issues the voice alert, *"TAWS Available"*.

Alert Type	'TAWS' Pane Annunciation	'TAWS' Pane 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"
TAWS Available.	None	None	"TAWS Available"
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

Table 6-16 TAWS-B System Test Status Annunciations

TAWS-B ABNORMAL OPERATIONS

TAWS-B continually monitors several system-critical items such as database validity 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-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' appears on the TAWS Pane and the PFD. The voice alert *"TAWS Not Available"* is also generated if airborne. When the GPS signal is re-established and the aircraft is within the database coverage area, the system issues a "TAWS Available" voice alert.

Alert Cause	'TAWS' Pane Annunciation(s)	TAWS Alert Types Not Available
TAWS System Test Fail; Terrain, Airport Terrain or Obstacle database unavailable or invalid on all displays; software mismatch among displays; TAWS audio fault.	TAWS FAIL and TAWS FAIL	FLTA, PDA
MFW Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases.	TERRAIN DATABASE FAILURE	
No GPS position.	TAWS N/A and NO GPS POSITION	FLTA, PDA, VCO
Excessively degraded GPS signal, or out of database coverage area.	TAWS N/A	FLTA, PDA

Table 6-17 TAWS-B Abnormal Status Alerts

6.5 TAS TRAFFIC

WARNING: *Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.*

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

NOTE: *Pilots should be aware of TAS system limitations. TAS systems require transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due to phenomena such as antenna shading or marginal transponder performance, traffic may be displayed intermittently, or not at all. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication. Pilots should remain vigilant for traffic at all times.*

NOTE: *If a Garmin GTX 345R transponder is installed with this traffic system, refer to the ADS-B traffic discussion for more information about ADS-B traffic displays.*

The optional Garmin GTS 800 is a Traffic Advisory System (TAS). The system enhances flight crew situational awareness by displaying traffic information for detected transponder-equipped aircraft. The system also provides visual annunciations and voice traffic alerts to assist the pilot in visually acquiring traffic.

The GTS 800 is capable of tracking a total of 45 intruding aircraft equipped with Mode A, C, or S transponders. The system can display a maximum of 30 aircraft with the highest threat potential simultaneously. The system provides no surveillance information 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 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 335R 1090 MHz ES (Extended Squitter) transponders, 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 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 surveillance range, in addition to broadcasts from traffic outside of the TAS 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.

NOTE: *The Garmin traffic system does not display traffic determined to be on the ground, including Mode C transponder equipped aircraft operating below 300' AGL that is not climbing. However, if own aircraft has ADS-B In capability, and is receiving traffic information from an ADS-B source (including ADS-R, ADS-B, TIS-B), the system does display this traffic while operating in SURF Mode. Refer to the ADS-B Traffic Section for more information.*

TRAFFIC DISPLAY SYMBOLOGY

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 6-18 TAS Traffic Symbology

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 6-19 TAS Traffic with ADS-B Symbology (GTX 335 Transponder)

Symbol	Description
	Traffic Advisory with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory with ADS-B directional information is beyond the selected display range. Displayed at outer range ring at proper bearing. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with ADS-B directional information. Arrow points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with ADS-B directional information. Arrow points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic with ADS-B directional information. Pointed end indicates direction of travel. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-20 TAS Traffic with ADS-B Traffic Symbology (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.

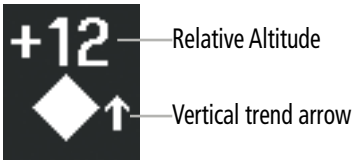


Figure 6-101 Intruder Altitude and Vertical Trend Arrow

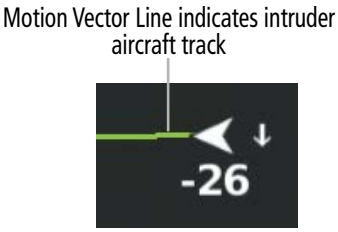


Figure 6-102 Intruder Traffic with ADS-B Directional Information and Motion Vector

TA ALERTING CONDITIONS

The traffic system automatically reduces its TA sensitivity level to reduce the likelihood of nuisance TA alerting during certain flight conditions. Level A (reduced) TA sensitivity normally applies when the aircraft is less than 2,000 feet above ground level. If the system cannot determine this height, then Level A TA sensitivity applies when the groundspeed is less than 120 knots. In all other conditions, the system uses Level B (increased) sensitivity in order to find the 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 6-21 TA Sensitivity Level and TA Alerting Criteria

TRAFFIC ALERTS

When the traffic system detects a new TA, the following occur:

- The system issues a single **"Traffic!"** voice alert, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that caused the TA. The voice alert "**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 is in Full Mode, and an Inset Navigation Map or HSI Map was already displayed, the traffic appears on the map with its overlay setting enabled. If the PFD is in Full Mode, and an Inset Map or HSI map was not already displayed, the Traffic Inset Map appears. If the PFD is in Half Mode, no map automatically appears.
- 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 and the bottom of the HSI 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.

The system displays a TA traffic symbol and traffic annunciation for at least eight seconds, even if the alerting condition(s) that initially triggered the TA are no longer present.

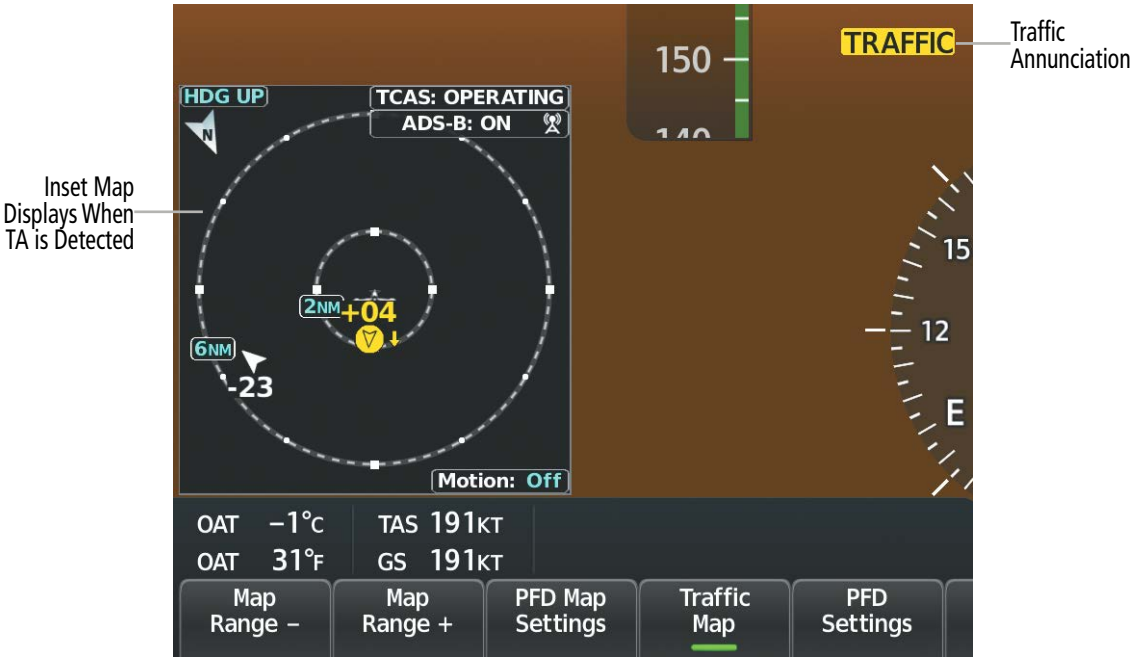


Figure 6-103 Traffic Annunciation (PFD)

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 6-22 TA Descriptive Voice Announcements

NOTE: *If a GTX 345 transponder is installed, and TA occurs within 0.25 nautical miles from own aircraft, or multiple TAs occur simultaneously, then relative altitude is omitted from the voice alert(s).*

SYSTEM TEST

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 the TAS system is operating normally. The test takes approximately ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols is displayed on the traffic maps.

If the aircraft has ADS-B In capability, the system announces *"Traffic System Test"*, and the test pattern corresponds to the current aircraft heading. A climbing TA is shown to the west, level Other Non-Threat traffic is shown to the northwest, and a descending Proximity Advisory is in the northeast, relative to own aircraft. If the system test passes, the traffic system enters standby mode, and no traffic failure annunciations are displayed on the traffic maps.

If the aircraft does not have ADS-B In capability, the test pattern is fixed and does not correspond to the aircraft heading. If the system test passes, the system announces, *"TAS System Test Passed"* Otherwise the system announces, *"TAS System Test Failed."* When the system test is complete, the traffic system enters Standby Mode.

The voice alert indicates the traffic system test is complete, and the system enters Standby Mode.

Traffic System	Voice Alert
GTS 800 (TAS)	"TAS System Test Passed."
	"TAS System Test Failed."

Table 6-23 System Test Voice Alerts GTX 335R

Traffic System	Voice Alert
GTS 800 (TAS)	"Traffic System Test Passed."
	"Traffic System Test Failed."

Table 6-24 System Test Voice Alerts GTX 345R

Testing the Traffic System:

1) From MFW Home, touch **Traffic > Traffic Settings**.
2) Turn the lower knob on the GTC to adjust the map range to 2 NM for the inner range ring, and 6 NM for the outer range ring. This ensures the full traffic test pattern is depicted on the map.
3) If the traffic system is in Operating Mode, touch the **Standby** Button and the **ADS-B Display** Button.
4) Touch the **Home** Button to return to the MFW Home screen.
5) From MFW Home, touch **Aircraft Systems > System Test**.
6) Touch the **ADS-B** Button.



Figure 6-104 System Test in Progress with Test Pattern

OPERATION

'TRAFFIC MAP' PANE

The 'Traffic Map' Pane shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. It is the principal map pane for viewing traffic information. Aircraft orientation is always heading up unless there is no valid heading. Range rings indicate map ranges. Turn the lower knob on the Touchscreen Controller clockwise to increase the range (up to 40 nm) and counter-clockwise to decrease the range.

The traffic operating mode and altitude display mode appear in the upper right corner of the 'Traffic Map' Pane.

Displaying the 'Traffic Map' Pane:

From MFW Home on the Touchscreen Controller, touch **Traffic > Traffic Settings**.

Or:

If the PFW is in Split Mode, press the **Traffic** Softkey or touch the **Traffic Map** Button from **PFW Home** on the Touchscreen Controller.

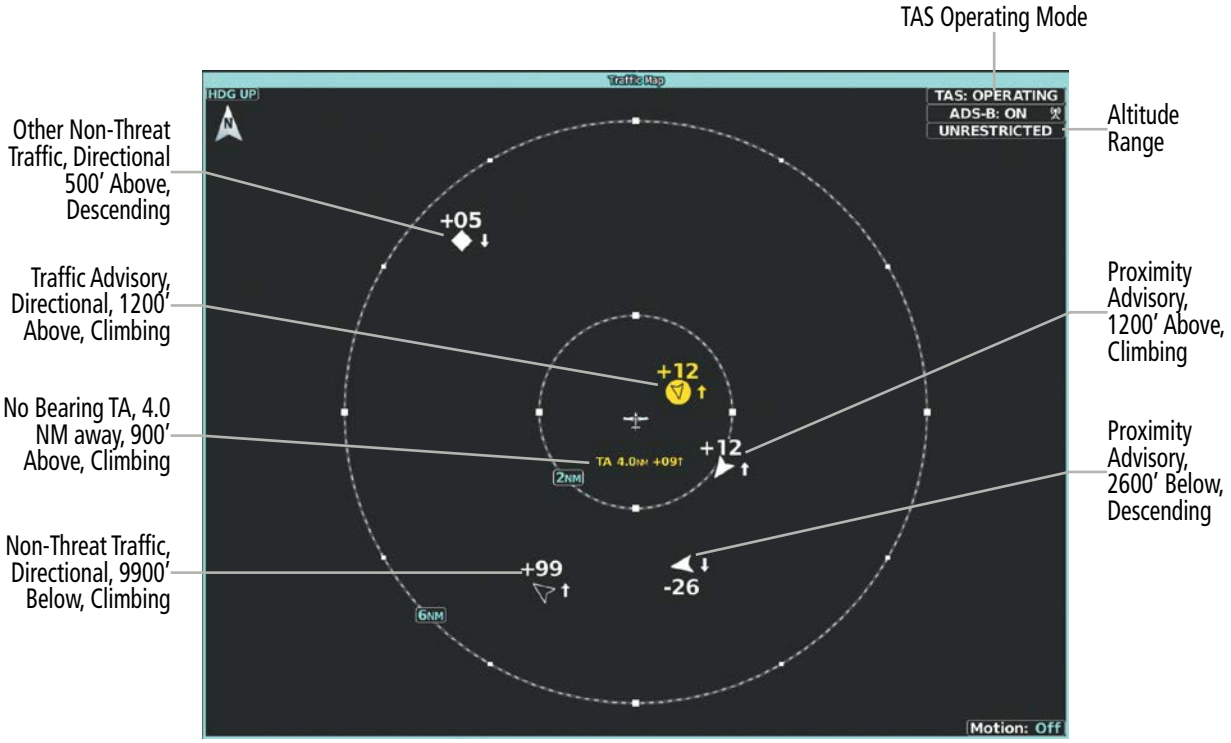


Figure 6-105 'Traffic Map' Pane with TAS and ADS-B Traffic Display Enabled

Selecting an operating mode:

1) From MFW Home, touch **Traffic > Traffic Settings**.

   Or:

   a) From MFW Home, touch **Map > Map Selection > Map Settings**.

   b) If not selected, touch the **Sensor** Tab.

   c) Touch the Traffic **Settings** Button.

2) In the **TCAS Mode** Window, touch one of the following buttons:

   • **Operate:** System interrogates other aircraft transponders and displays traffic.

   • **Standby:** Traffic system does not interrogate other aircraft transponders or display traffic.

ALTITUDE RANGE

The flight crew can select the volume of airspace in which non-threat and proximity traffic is displayed. Note the system will still show TAs occurring outside of these limits regardless of the altitude mode chosen.

Changing the altitude range:

From MFW Home, touch **Traffic > Traffic Settings**.

Or:

1) From MFW Home, touch **Map > Map Selection > Map Settings >** Traffic **Settings** Button.
2) Touch the **Altitude Range** Button:
3) Touch one of the following buttons from the list:
   - **Unrestricted:** All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.
   - **Above:** Displays non-threat and proximity traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
   - **Normal:** Displays 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 non-threat and proximity traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.

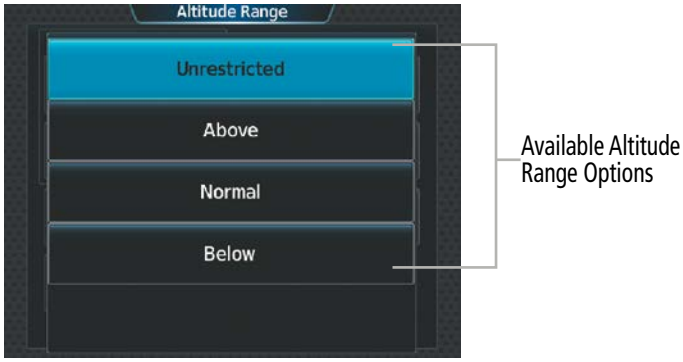


Figure 6-106 Selecting an Altitude Mode on the Traffic Settings Screen

NOTE: *Refer to the ADS-B Traffic Section for more information for controlling the display of ADS-B traffic information.*

ADDITIONAL TRAFFIC DISPLAYS

The system can overlay traffic information on the 'Navigation Map' Pane. Traffic information is also available on the PFD when the Synthetic Vision Technology (SVT) terrain display is enabled. See the Flight Instruments section for details about SVT traffic.

Enabling/disabling display of traffic information on Navigation Map Panes:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the **Traffic** Button.

Enabling/disabling the display of traffic information (HSI Map or Inset Map):

1) From PFW Home, touch **PFD Map Settings**.
2) Touch the **Layout** Button. If not selected, touch the **HSI Map** Button or **Inset Map** Button to access the Overlays settings.
3) Touch the **Traffic** Button in the 'Overlays' Window to enable/disable the display of traffic on the HSI Map or Inset Map.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Traffic** Softkey.

When the display of traffic is enabled on navigation maps, the system shows a traffic status icon and altitude mode in the lower right corner of the map.

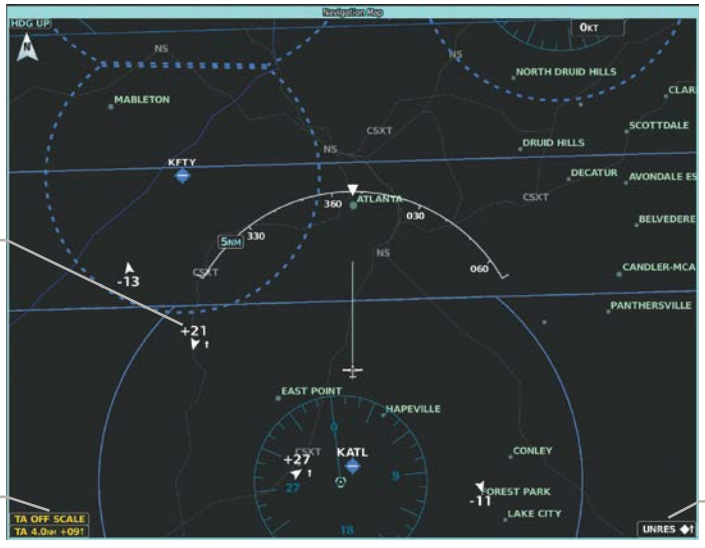


Figure 6-107 Displaying Traffic on the 'Navigation Map' Pane

The system provides controls to customize the display of traffic information on navigation maps. Traffic symbols and labels (such as up or down arrows and relative altitudes) can be decluttered from the display when the map range exceeds a specified distance. In addition, traffic labels may also be enabled or disabled, regardless of map range.

Customizing traffic display on the navigation maps:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the Traffic **Settings** Button.
4) Touch the **Map Settings** Button.
5) Touch the **Labels** button to enable/disable the display of traffic labels on navigation maps.
6) To change the map range above which the system removes traffic symbols from the display, touch the **Symbols** Button, then scroll to and touch to select a map range above which the system will remove the traffic symbols.
7) To change the map range at which the system removes traffic labels from the display (such as, touch the Labels range button, then scroll to and touch to select a map range above which the system removes traffic labels from the display.

Or:

1) From PFW Home, touch **PFD Map Settings**.
2) In the **Overlays** Tab, touch the Traffic **Settings** Button.
3) Touch the **Map Settings** Button.
4) Touch the **Labels** button to enable/disable the display of traffic labels on navigation maps.
5) To change the map maximum navigation map range to show traffic symbols, touch the **Symbols** Button, then scroll as needed and touch a button for the desired range.
6) To change the map maximum navigation map range to show traffic labels, touch the **Labels** Button, then scroll as needed and touch a button for the desired range.

When the PFD is operating in Full Mode, a Traffic Inset Map is available for display on the PFD.

Enabling/disabling the Traffic Inset Map on the PFD:

With the PFW in Full Mode, press the **Traffic Map** Softkey

Or:

From PFW Home, touch **Traffic Map** Button.

The HSI can also present a version of the Traffic Map. Traffic operating mode information is not present on this map. Refer to the Flight Instruments section for more information about displaying maps on the HSI.

Showing the HSI Traffic Map:

1) From PFW Home, touch **PFD Map Settings**.
2) Touch the **Layout** Button.
3) Touch the **HSI Traffic** Button.

Or:

1) On the PFW, press the **PFD Map Settings** Softkey.
2) Press the **Map Layout** Softkey.
3) Press the **HSI Traffic** Softkey.



Figure 6-108 HSI Traffic Map

Enabling/disabling traffic overlay on PFD navigation maps:

1) With the Inset Map or HSI Map displayed, press the **Map/HSI** Softkey.
2) Press the **Traffic** Softkey to enable/disable the traffic overlay.
3) Press the **Back** Softkey to return to the top-level PFD softkeys.

SYSTEM STATUS

The traffic system mode appears in the upper right corner of the 'Traffic Map' Pane.

Traffic System Mode	Traffic Map Mode Annunciation	Traffic Overlay Status Icon
Operating	TAS: OPERATING	
Standby	TAS: STANDBY (also shown in white in center of 'Traffic Map' Pane)	
Failed [1]	TAS: FAILED	

[1] *See Table 6-27 for additional failure annunciations.*

Table 6-25 TAS Modes

If the traffic unit fails, the system shows an annunciation as to the cause of the failure in the center of the 'Traffic Map' Pane. During a failure condition, the Operating Mode is not available.

'Traffic Map' Pane Center Annunciation	Description
NO DATA	System is not receiving any data from the traffic unit.
DATA FAILED	System is receiving data from the traffic unit, but the unit is reporting a failure.
FAILED	The traffic unit is sending invalid data to the system.

Table 6-26 TAS Failure Annunciations

Traffic Status annunciations appear in banners at the lower left corner of 'Navigation Map' Panes.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range. [1] Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory. [2] Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	The traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data). [2]
NO TRFC DATA	Data is not being received from the traffic unit.

[1] *Shown as symbol on 'Traffic Map' Pane.*
[2] *Shown in center of 'Traffic Map' Pane.*

Table 6-27 TAS Traffic Status Annunciations

6.6 ADS-B TRAFFIC

WARNING: *Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.*

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

ADS-B SYSTEM OVERVIEW

Automatic Dependent Surveillance-Broadcast (ADS-B) is a core technology in the FAA NextGen air traffic control system. It offers improved surveillance services, both air-to-air and air-to-ground, especially in areas where radar coverage is ineffective due to terrain, or where it is impractical or cost prohibitive. ADS-B is comprised of three segments for the purposes of providing traffic information: ADS-B (Broadcast), ADS-R (Rebroadcast), and Traffic Information Service-Broadcast (TIS-B).

ADS-B includes the automatic broadcast of position reports by aircraft, surface vehicles, and transmitters on fixed objects. These broadcasts contain information such as GPS position, identity (Flight ID, Call Sign, Tail Number, ICAO registration number, etc.), ground track, ground speed, pressure altitude, and emergency status.

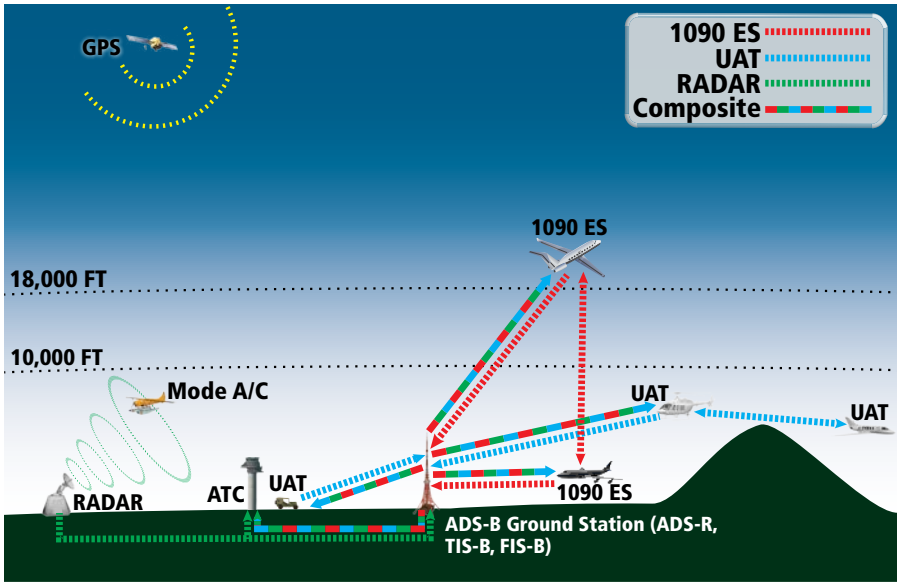


Figure 6-109 ADS-B System

For the purpose of distinguishing between levels of ADS-B service, there are three classifications of aircraft or system capability: ADS-B In, ADS-B Out, and ADS-B participating. ADS-B In refers to the capability to receive ADS-B information. ADS-B Out refers to the capability to transmit ADS-B information. ADS-B participating refers to the capability to both send and receive ADS-B information. Aircraft lacking either ADS-In, ADS-B Out, or both ADS-B capabilities may also be referred to as ADS-B nonparticipating aircraft.

The ADS-B system operates on two frequencies: 1090 MHz and 978 MHz. Both frequencies provide the same traffic information. An aircraft may be ADS-B In, Out, or participating on one or both frequencies, depending on the installed equipment. The 1090 MHz frequency portion of ADS-B is known as 1090 Extended Squitter (1090 ES). The 978 MHz portion of ADS-B is known as Universal Access Transceiver (UAT).

The optional Garmin GTX 335 transponder provides ADS-B Out functions using the 1090 ES data link. When the GTS 800 TAS is installed with a GTX 335, the GTS 800 receives ADS-B In traffic data from the 1090 ES data link.

The Garmin GTX 345R transponder provides ADS-B Out functions using the 1090 ES data link. It also performs ADS-B In functions using the UAT data link. For the GTX 345, this includes the reception of Flight Information Services-Broadcast (FIS-B) data link weather service, provided when the aircraft is receiving data from a participating ground station; refer to the Data Link Weather section for more information about FIS-B Weather.

AUTOMATIC DEPENDENT SURVEILLANCE-REBROADCAST (ADS-R)

Because it is not required that ADS-B In capable aircraft be able to receive ADS-B data on both the 1090 MHz and 978 MHz data links, a method exists to get data from one data link to the other. ADS-R is the rebroadcast of ADS-B data by FAA ground stations, which provide this service by taking traffic data from one link and rebroadcasting it on the other. For example, if two aircraft are in the service volume for a ground station, and one is transmitting on 1090 MHz and the other is transmitting on 978 MHz, the ground station retransmits the data from each aircraft on the other link to ensure the two aircraft can "see" each other as traffic.

For example, if another aircraft can only receive 978 MHz UAT information, it cannot directly 'see' another aircraft sending only 1090 ES information aircraft unless an ADS-R ground station in the vicinity rebroadcasts the 1090 ES data over the 978 MHz UAT frequency. This is also true for an aircraft when can only receive 1090 ES data; it would need an ADS-R ground station to 'see' another aircraft operating on the UAT frequency.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

TIS-B provides a link between the secondary surveillance radar (SSR)-based system ATC uses and the ADS-B-based system. When an ADS-B In or Out capable aircraft is within the service volume of an FAA ADS-B ground station, the ground station broadcasts a portion of the ATC radar data to the aircraft. This aircraft is then included in the list of aircraft being provided TIS-B service and is then considered a "TIS-B participant."

TIS-B coverage is available when the aircraft is within ground station and SSR coverage, and the other aircraft is also in SSR coverage, and is transmitting its altitude.

The ground station provides ATC radar information for other aircraft within ±3,500 feet and 15 NM of the participant, to include altitude, position, ground speed, and ground track. TIS-B broadcasts occur once every three to thirteen seconds, depending on the characteristics of the ground station providing the TIS-B service.

The following table provides examples of when own aircraft may be able to detect traffic based on equipment installed in other aircraft.

Other Aircraft Equipment	Viewable by a GTX 335 Equipped Aircraft	Viewable by GTX 345R Equipped Aircraft
1090ES Out Equipped	Yes	Yes
UAT Receive Only Equipped	No	No
UAT Transmit Only Equipped	No, unless ATC is providing the traffic through a TIS-B ground uplink	Yes
No Transponder, No ADS-B	No	No
Non ADS-B Equipped, but has a Mode C or S Transponder	May be viewable if a TAS System is also installed, or ATC is providing the traffic through a TIS-B ground uplink.	

Table 6-28 Aircraft Available for Viewing by an ADS-B Equipped Own Aircraft

ADS-B WITH TAS

When an optional active traffic system, such as a Traffic Advisory System (TAS) is installed and operating with an optional GTX 345R transponder, the transponder receives traffic from the active traffic system and attempts to match (or "correlate") this traffic with ADS-B traffic the transponder is tracking. When a correlation is made, the only the traffic with the most accurate information is displayed to the flight crew. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This correlation of traffic by the transponder improves the accuracy of the traffic displayed, while reducing the occurrence of the same aircraft being displayed twice.

NOTE: *In certain situations, a single aircraft may be depicted as two aircraft on the display if the system is unable to correlate the traffic. This may occur, for example, when operating on the edges of ATC radar coverage, or the traffic system is receiving intermittent data. This may also occur if TIS-B traffic data does not closely match the traffic data from other sources, especially while the traffic tracked by ATC radar is turning.*

ADS-B TRAFFIC ADVISORY SYSTEM (ATAS)

ADS-B Traffic Advisory System (ATAS) is an alerting algorithm which provides ADS-B traffic alerts to the flight crew which are similar in nature to the TAS Traffic system discussed previously.

When a TA occurs, the system displays an amber 'TRAFFIC' annunciation and provides a voice alert "Traffic", followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that caused the TA. The own aircraft altitude above terrain determines the sensitivity of the ATAS algorithm to minimize nuisance alerts to the flight crew.

NOTE: *The system mutes TA voice alerts from ADS-B sources when own aircraft is below 400 feet AGL.*

NOTE: *The optional TAS system issues alerts for traffic it is tracking using TAS alerting criteria. The ADS-B system issues alerts for traffic it is tracking using the ADS-B Traffic Advisory System (ATAS) criteria.*

Sensitivity Level	Height Above Airport Reference Point (Feet)	Radar Altitude (Feet)	Height Above Terrain (HAT)	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (Feet)	Protected Volume (NM)
4	< = 1500 and within 5 NM of airport reference point	Any	Any	Any	30	400	0.20
4	Unavailable	< = 1500	Any	Any	30	400	0.20
4	Unavailable	Unavailable	< = 1500	Any	30	400	0.20
5	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	< = 5000	35	700	0.35
6	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 5000 < = 10,000	40	700	0.55
7	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 10,000 < = 20,000	45	700	0.80
8	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 20,000	48	700	1.10

Table 6-29 ATAS 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. 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 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 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 a factor.

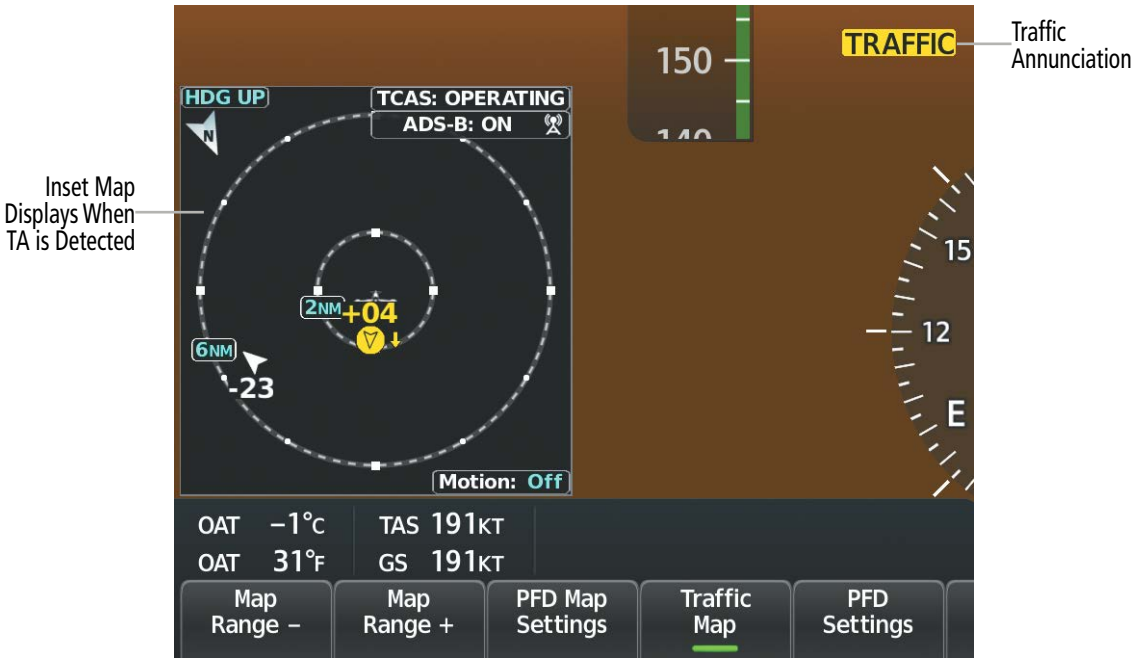


Figure 6-110 Traffic Annunciation (PFD)

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 6-30 TA Descriptive Voice Announcements

AIRBORNE AND SURFACE APPLICATIONS

ADS-B traffic can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five nautical miles and 1,500 feet above the nearest airport. When the AIRB application is active, the system only displays traffic which is airborne.

The SURF application is on when the aircraft is within five nautical miles 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 Pane range of one nautical mile 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 find the runway alignment of traffic, especially when runways are in close proximity to each other.*

Due to the varying precision of the data received through 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 ADS-B Status Screen, discussed later in this section.



Figure 6-111 'Traffic Map' Pane with SURF Mode On

NOTE: *Refer to the TAS Traffic section for a table of ADS-B and TAS traffic symbols the system can display.*

AIRBORNE AND SURFACE APPLICATIONS

ADS-B traffic can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five nautical miles and 1,500 feet above the nearest airport. When the AIRB application is active, the system only displays traffic which is airborne.

The SURF application is on when the aircraft is within five nautical miles 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' Pane range of one nautical mile 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 solely on the traffic display to ascertain the runway alignment of traffic, especially when runways are in close proximity to each other.*

Due to the varying precision of the data received through 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 'ADS-B Status' Screen, discussed later in this section.

NOTE: *Refer to the TAS Traffic section for a table of ADS-B and TAS traffic symbols the system can display.*

OPERATION

'TRAFFIC MAP' PANE

The 'Traffic Map' Pane 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 lower knob. Rings denote the map range.

The traffic mode and altitude mode are annunciated in the upper right corner of the pane.

NOTE: *Refer to the TAS Traffic Section for information about testing the traffic system(s).*



Figure 6-112 'Traffic Map' Pane with ADS-B Traffic Enabled

Enabling/disabling the display of ADS-B traffic:

1) From MFW Home, touch **Traffic > Traffic Settings**.

   Or:

   a) From MFW Home, touch **Map > Map Selection > Map Settings**.

   b) Touch the **Traffic Settings** Button on the **Sensor** Tab.

   Or:

   a) From PFW Home, touch **PFD Map Settings**.

   b) Touch the Traffic **Settings** Button.

2) Touch the **ADS-B Display** Button.

NOTE: *If a TAS system is installed, and the TAS mode changes from Standby to Operating, the display of ADS-B traffic is automatically enabled, unless the pilot has manually disabled the* ***ADS-B Display*** *Button while the TAS was in Standby Mode.*

DISPLAYING MOTION VECTORS

When Absolute Motion Vectors are selected, the vectors extending from the traffic symbols depict the traffic's reported track and speed over the ground. When Relative Motion Vectors are selected, the vectors extending from the traffic symbols display how the traffic is moving relative to own aircraft. These vectors are calculated using the traffic's track and ground speed and own aircraft's track and ground speed. These two values are combined to depict where the traffic is moving purely with respect to own aircraft, and provide a forecast of where the traffic will be, relative to own aircraft, in the near future. If the system does not have sufficient information to calculate motion vectors, they are not shown.



Absolute Motion Vector Enabled

Relative Motion Vector Enabled

Figure 6-113 'Traffic Map' Pane with Motion Vectors Enabled

Selecting a Motion Vector display:

1) From MFW Home, touch **Traffic > Traffic Settings**.
2) Touch the **Motion Vector** Button.
3) Touch a button to select the desired Motion Vector display mode: **Off**, **Absolute**, or **Relative**.
4) To change the duration of time used to forecast motion vectors, touch the **Vector Duration** Button.
5) Touch a button for the desired duration: **30SEC**, **1MIN**, **2MIN**, or **5MIN**.

ADDITIONAL TRAFFIC DISPLAYS

The 'Traffic Map' Pane 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, ground-speed, and other information.

Showing additional traffic information:

1) From MFW Home, touch **Traffic > Traffic Settings**.
2) Touch the **Target Selection** Button.
3) Turn the upper knob. A cyan border appears on the first selected traffic symbol. Additional information appears in a window in the lower-left corner of the 'Traffic Map' Pane.
4) To select a different aircraft symbol, turn the upper knob.
5) When finished, touch the **Target Selection** Button again to disable the button.

NOTE: *ADS-B traffic can be displayed as an overlay to navigation maps. Refer to the previous TCAS discussion for information about these additional traffic displays.*

Customizing traffic display on the navigation maps:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not selected, touch the **Sensor** Tab.
3) Touch the Traffic **Settings** Button.
4) Touch the **Map Settings** Button.
5) Touch the **Labels** button to enable/disable the display of traffic labels on navigation maps.
6) To change the map range above which the system removes traffic symbols from the display, touch the **Symbols** Button, then scroll to and touch to select a map range above which the system will remove the traffic symbols.
7) To change the map range at which the system removes traffic labels from the display (such as, touch the **Labels** range button, then scroll to and touch to select a map range above which the system removes traffic labels from the display.

Or:

1) From PFW Home, touch **PFD Map Settings**.
2) In the **Overlays** Tab, touch the Traffic **Settings** Button.
3) Touch the **Map Settings** Button.
4) Touch the **Labels** button to enable/disable the display of traffic labels on navigation maps.
5) To change the map maximum navigation map range to show traffic symbols, touch the **Symbols** Button, then scroll as needed and touch a button for the desired range.
6) To change the map maximum navigation map range to show traffic labels, touch the **Labels** Button, then scroll as needed and touch a button for the desired range.

TRAFFIC MAP DISPLAY RANGE

The flight crew can adjust the range of traffic displayed on the 'Traffic Map' Pane can be changed at any time. Map range is adjustable with the **Joystick**, as indicated by the map range rings.

Selecting the 'Traffic Map' Pane display range:

1) From MFW Home, touch the **Traffic > Traffic Settings** Button.
2) Turn the lower knob clockwise to increase map range, or counter-clockwise to decrease map range.
3) 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 and 2 nm.
   - 2 and 6 nm.
   - 6 and 12 nm.
   - 12 and 24 nm.
   - 24 and 40 nm.

ADS-B SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the 'Traffic Map' Pane.

ADS-B Mode	Traffic Mode Annunciation (Traffic Map Pane)	Traffic Map Pane Center Banner Annunciation	Traffic Display Status Icon (Other Maps)
ADS-B Operating in Airborne Mode	ADS–B: ON	None	
ADS-B Operating in Surface Mode	ADS–B: ON + SURF	None	
ABS-B Traffic Off	ADS–B: OFF	ADS–B TRFC OFF	
ABS-B System Test Initiated	ADS–B TEST	TEST MODE	
ADS-B Traffic Not Available	ADS–B: N/A	NO TRK/HDG	
ADS-B Failed [1]	ADS–B: FAIL	NO TRK/HDG	

[1] *See Table 6-33 for additional failure annunciations.*

Table 6-31 ADS-B Modes

The 'Traffic Map' Pane displays a white antenna icon to indicate the successful reception of ADS-B traffic services from a ground station. If the system has no TAS/TCAS installed, a white-X over this icon indicates there is a potential incomplete traffic picture surrounding the aircraft at this time and reception of ADS-B services is unavailable. For systems with an installed and operating TAS/TCAS, a white-X over this icon indicates the status of the TIS-B/ADS-R coverage is irrelevant and not required.

ADS-B Ground Station Reception Status	Traffic Map Pane Icon
Receiving ADS-B traffic services from a ground station	
Not receiving ADS-B traffic services from a ground station	

Table 6-32 ADS-B Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the 'Traffic Map' Pane. During a failure condition, the Operating Mode cannot be selected.

'Traffic Map' Pane 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 6-33 Traffic Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range. [1] Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory. [2] Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
NO TRFC DATA	Data is not being received from the traffic unit.

[1] *Shown as symbol on 'Traffic Map' Pane*
[2] *Shown in center of 'Traffic Map' Pane.*

Table 6-34 Traffic Status Annunciations

Additional information about the status of ADS-B traffic products is available on the ADS-B Status Screen.

Viewing ADS-B Traffic Status:

1) From MFD Home, touch **Utilities > Setup > ADS-B Status**.
2) View the status of the traffic applications, then touch the **Back** Button or the **Home** Button when finished.



Figure 6-114 Viewing ADS-B Traffic Status on the ADS-B Status Screen

ADS-B Status Screen Item	Status Message	Description
Airborne (AIRB), Surface (SURF), Airborne Alerts (ATAS)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) find 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.

Table 6-35 ADS-B Status Screen Messages for ADS-B Traffic

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 OVERVIEW

NOTE: *The current version of the pertinent flight manual always supersedes the information in this Pilot's Guide.*

The Garmin Automatic Flight Control System (AFCS) is 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™ 1450W Flight Display (2)
  Or
- GDU™ 1250W Flight Display (2)
- GIA 64W Integrated Avionics Unit (2)
- GMC 707 AFCS Controller (1)
- GSA 87 Servo Actuators (2) (pitch and roll)
  - GSA 87 Servo Actuator (1) (yaw optional)
- GTA 82 Pitch Trim Adapter (1)

The AFCS can be divided into these main operating functions:

- **Flight Director (FD) —** This aircraft is equipped with dual flight directors, each operating within a GIA and referred to as pilot-side and copilot-side. The flight director provides:
  - Vertical/lateral mode selection and processing.
  - Command bars showing pitch/roll guidance.
  - Pitch and roll commands to the autopilot.
- **Autopilot (AP) —** Autopilot operation occurs within the pitch, roll, and pitch-trim servo adapters. 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**) (Optional) — 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. Yaw damper is optional on the SR22T/22T and not available on the SR20.
- **Manual Electric Pitch Trim (MEPT) —** The pitch-trim servo provides manual electric pitch trim capability when the autopilot is not engaged.

BASIC AUTOPILOT OPERATION

This section provides an overview for autopilot engagement and disengagement. A more detailed description follows in the Autopilot and (Optional) Yaw Damper Operation Section.

- **Autopilot Engagement —** The autopilot may be engaged by pressing the **AP** Key on the AFCS Controller. Annunciations regarding the engagement are indicated on the PFW. Engaging the autopilot also engages the optional yaw damper.
- **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 flight director command bars. The prior flight director modes remain unchanged.

- **Autopilot Disengagement —** The most common way to disconnect the autopilot is to press and release the **AP DISC** Switch, which is located on the control stick. When disengaged an autopilot disconnect tone will be heard and annunciated on the PFW. Other ways to disconnect the autopilot include:
  - » Pressing the **AP** Key on the AFCS Controller.
  - » Pressing the **TO/GA** Switch, if on the ground and the autopilot is engaged.
  - » Pulling the autopilot circuit breaker.

  In the event of unexpected autopilot behavior, pressing and holding the **AP DISC** Switch will disconnect the autopilot and remove all power to the servos.

AFCS PREFLIGHT TEST (PFT)

The AFCS Preflight Test is initiated upon system startup. Evidence of this test is indicated by a white 'PFT' annunciation.

NOTE: *During system PFT an "Autopilot" aural alert may be observed with the autopilot servos circuit breaker pulled.*

7.2 AFCS CONTROLS

AFCS CONTROLLER

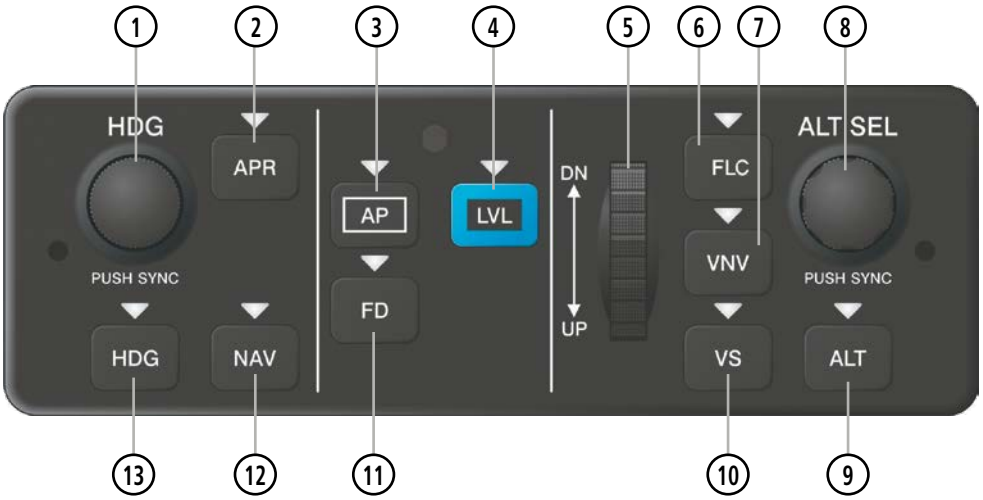


Figure 7-1 GMC 707 AFCS Controller

The AFCS Controller has the following controls:

1	**HDG** Knob	Adjusts the Selected Heading and bug in 1° increments on the HSI - Push to synchronize the Selected Heading to the current heading
2	**APR** Key	Selects/deselects Approach Mode
3	**AP** Key	Engages/disengages the autopilot and the (optional) yaw damper
4	**LVL** Key	Engages the autopilot (if the autopilot is disengaged and the aircraft is within the autopilot engagement limitations) and selects level vertical and lateral modes on the flight director
5	**UP/DN** Wheel	Adjusts the reference in Pitch Hold, Vertical Speed, Flight Level Change (IAS Reference), and Altitude Hold modes (see Flight Director Vertical Modes Table) for change increments in each mode)
6	**FLC** Key	Selects/deselects Flight Level Change Mode
7	**VNV** Key	Selects/deselects Vertical Navigation flight control
8	**ALT SEL** Knob	Controls the Selected Altitude in 100-ft increments - Push to synchronize the Selected Altitude to the current altitude
9	**ALT** Key	Selects/deselects Altitude Hold Mode
10	**VS** Key	Selects/deselects Vertical Speed Mode
11	**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
12	**NAV** Key	Selects/deselects Navigation Mode
13	**HDG** Key	Selects/deselects Heading Select Mode

ADDITIONAL AFCS CONTROLS

The following AFCS controls are located separately from the AFCS Controller:

AP DISC Switch (Autopilot Disconnect)	Disengages the autopilot, flight director, yaw damper (if installed) and interrupts trim operation - An **AP DISC** Switch is located on each control stick. - This switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.
TO/GA Switch (Go Around)	Selects Flight Director Takeoff Mode (on ground) or Go Around Mode (in air). AFCS stays engaged through Go Around. - If an approach procedure is loaded, this switch also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned. - The **TO/GA** Switch is located on the power lever.
MEPT Switch (Manual Electric Trim)	Used to command manual electric pitch trim - A **MEPT** Switch is located on the pilot and copilot control stick. - Press **DN** (forward) and **UP** (rearward) for manual electric trim.

7.3 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFW. With the flight director active, the aircraft can be hand-flown to follow the pitch and roll guidance shown by the command bars. Maximum commanded pitch (-15°, +20°) and roll (30°) angles, vertical acceleration, and roll rate are limited to values established during AFCS certification. The flight director also provides commands to the autopilot.

ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in the following table (when the flight director is not active) activates the flight director in the listed modes. The flight director may be turned off and the command bars removed from the display by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
TO/GA Switch	Takeoff (on ground) Go Around (in air)	TO GA	Takeoff (on ground) Go Around (in air)	TO GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
FLC Key	Roll Hold (default)	ROL	Flight Level Change	FLC
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key	Roll Hold (default)	ROL	Vertical Path Tracking[1]	VPTH
NAV Key	Navigation[2]	GPS VOR LOC BC	Pitch Hold (default)	PIT
APR Key	Approach[2]	GPS VAPP LOC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT
LVL Key	Level	LVL	Level	LVL

[1] *Valid VNAV flight plan must be entered before **VNV** Key press activates flight director. When the **VNV** Key is pressed in conjunction with another mode selection, a 'V' is displayed with the selected mode annunciation.*

[2] *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course before* **NAV** *or* **APR** *Key press activates flight director.*

Table 7-1 Flight Director Activation

AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFW when the flight director is active. The autopilot status and yaw damper status (if installed) 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.

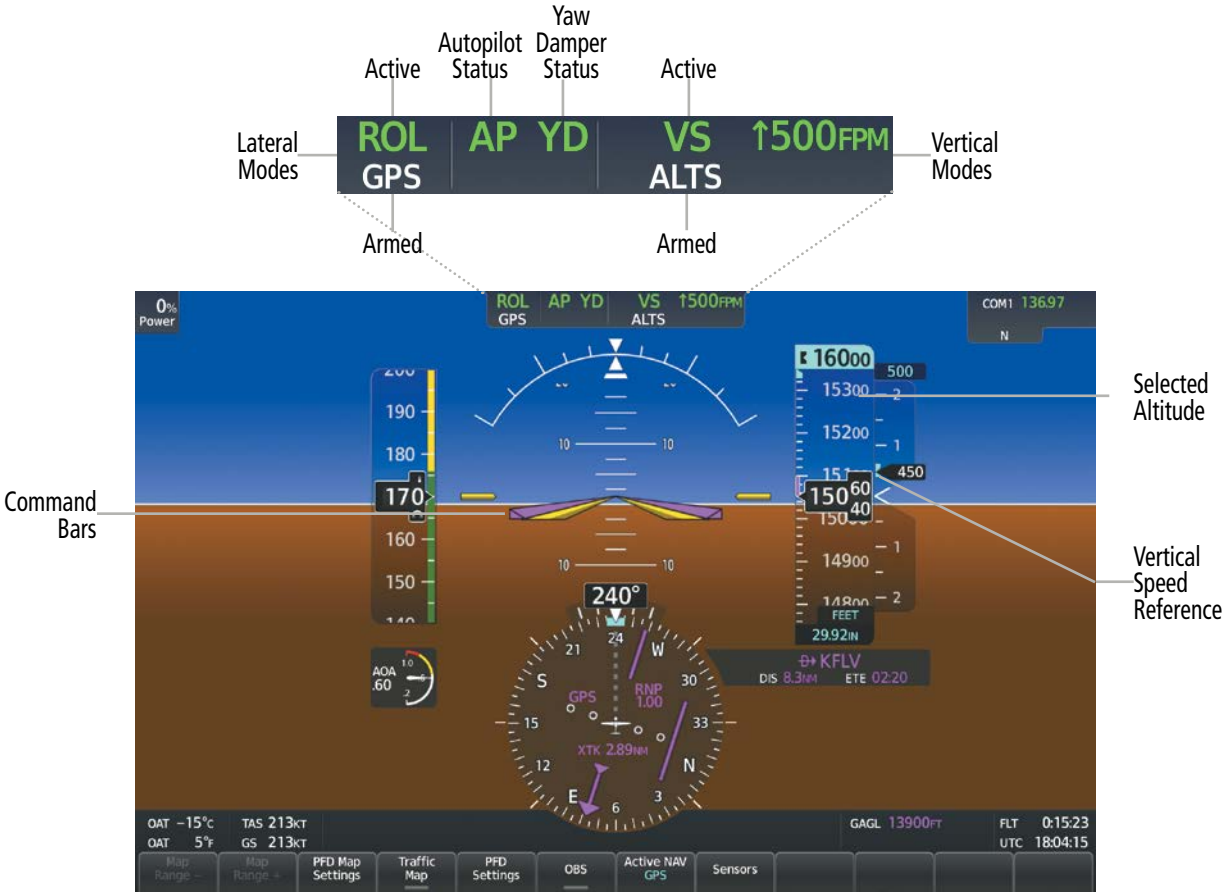


Figure 7-2 PFW AFCS Display

FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the flight director reverts to the default pitch and/or roll mode.

Under normal operation when the flight director is activated by pressing the **FD** Button, the flight director activates 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 indicates loss of sensor (ADC) or navigation data (VOR, LOC, FMS) required to compute commands. When such a loss occurs, the command bars give guidance to roll the wings level, and then depending on the affected axis, either enters Roll Hold Mode or maintains the pitch angle (enters Pitch Hold Mode). The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.



Figure 7-3 Loss of VOR Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

COMMAND BARS

Upon activation of the flight director, command bars are displayed in magenta on the PFW as a single cue. The Aircraft Symbol is indicated in amber. The single-cue command bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.

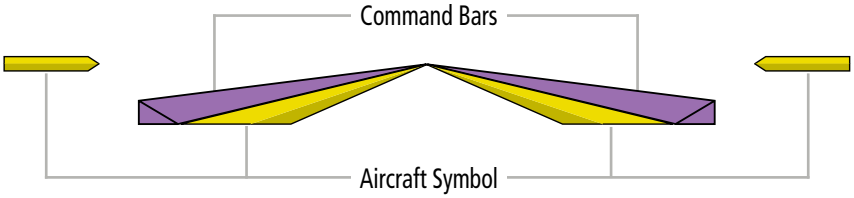


Figure 7-4 Single-cue Command Bars

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 that do not operate in conjunction with a lateral mode with their corresponding controls and annunciations. The mode reference (e.g., altitude, vertical speed, airspeed) is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **UP/DN** Wheel can be scrolled to adjust the corresponding reference change increment while operating in Pitch Hold, Vertical Speed, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the **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	[1]	ALTS			
Altitude Hold	Holds the current Altitude Reference	**ALT** Key	ALT	nnnnn FT		
Vertical Speed	Holds the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**VS** Key	VS	nnnn FPM	-3000 to +1500 fpm	100 fpm
Flight Level Change	Holds the current aircraft airspeed while the aircraft is climbing/ descending to the Selected Altitude	**FLC** Key	FLC	nnn KT	80 to 181 kts (SR20) 80 to 185 kts (SR22/SR22T)	1 kt

[1] *ALTS is armed automatically when the Selected Altitude is to be captured instead of the VNAV Target Altitude.*

[2] *While in ALT Hold Mode, the **UP/DN** Wheel will change the altitude ref in 10 ft increments up to a maximum of 180 ft from the initial reference.*

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the flight director is activated (i.e., the **FD** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active pitch mode by the green annunciation 'PIT.' 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 called 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 scrolling the **UP/DN** Wheel.



Figure 7-5 Pitch Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change
- Takeoff/ Go Around
- Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNAV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed (see previous figure). 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 (see following figure). This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude (shown as the Altitude Reference). As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.

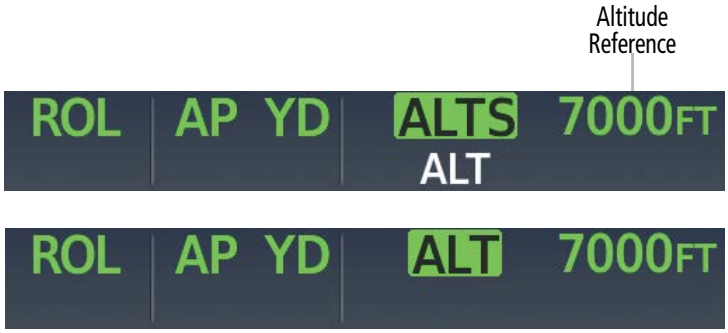


Figure 7-6 Automatic Mode Transitions During Altitude Capture

Changing the Selected Altitude

NOTE: *While ALTS is active, the reference altitude cannot be changed by using FLC, VS, or VNAV Modes. Change to another Selected Altitude by deactivating ALTS, then re-activate the desired vertical 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)

When Altitude Hold Mode is 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 either of the following modes:

» Selected Altitude Capture

» VNAV Target Altitude Capture

The transition to Altitude Hold Mode begins when at 50 feet from the Selected Altitude. In this case, the Selected Altitude or VNAV Target Altitude becomes the flight director's Altitude Reference. The active mode annunciation 'ALT' appears if the transition was made from VNAV Target Altitude Capture Mode.

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.*



Figure 7-7 Pitch Hold Mode

VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference (shown above the Vertical Speed Indicator). 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 used in conjunction with VNAV (V VS) for a descent, VNAV Target Altitude Capture is also enabled.

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 above the Vertical Speed Indicator) may be changed by scrolling the **UP/DN** Wheel.



Figure 7-8 Vertical Speed Mode

FLIGHT LEVEL CHANGE MODE (FLC)

NOTE: *The Selected Altitude should be set before selecting Flight Level Change Mode.*

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the flight director continuously monitors Selected Altitude, airspeed, and altitude. When Flight Level Change Mode is used in conjunction with VNAV (V FLC) for a descent, VNAV Target Altitude Capture is also enabled.

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 green Airspeed Reference in the AFCS Status Box. The Airspeed Reference is also displayed in cyan directly above the Airspeed Indicator, along with a cyan 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.

In level flight with FLC Mode selected, if the Selected Altitude is above the current altitude, the system will maintain zero vertical speed until the Airspeed Reference is lowered or power is added to allow a climb. Similarly, if the Selected Altitude is below the current altitude, FLC Mode will maintain zero vertical speed until the Airspeed Reference is increased or power is reduced to allow the descent.



Figure 7-9 Flight Level Change Mode

Changing the Airspeed Reference

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by scrolling the **UP/DN** Wheel.

LATERAL MODES

The following table relates each Garmin AFCS lateral mode to its respective control and annunciation. Refer to the combination modes section for information regarding Go Around and Takeoff modes.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude	(default)	ROL	25°
Heading Select	Captures and tracks the Selected Heading	**HDG** Key	HDG	25°
Navigation Mode				
GPS Arm/Capture/ Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	30° Capture 10° Track
VOR Enroute Arm/ Capture/Track			VOR	25° Capture 10° Track
LOC Arm/Capture/ Track (No Glideslope)			LOC	25° Capture 10° Track

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, 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 conditions listed in the following table.



Figure 7-10 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

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. The Selected Heading is only shown in the box to the upper left of the HSI for three seconds after the Selected Heading is changed or the **HDG** Knob is pushed.

Changing the Selected Heading

The Selected Heading is adjusted turning the **HDG** Knob. Pushing the **HDG** Knob synchronizes the Selected Heading to the current heading. When the **HDG** Knob is pushed while the aircraft is in a turn, the Heading Bug moves to the current heading at that moment.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

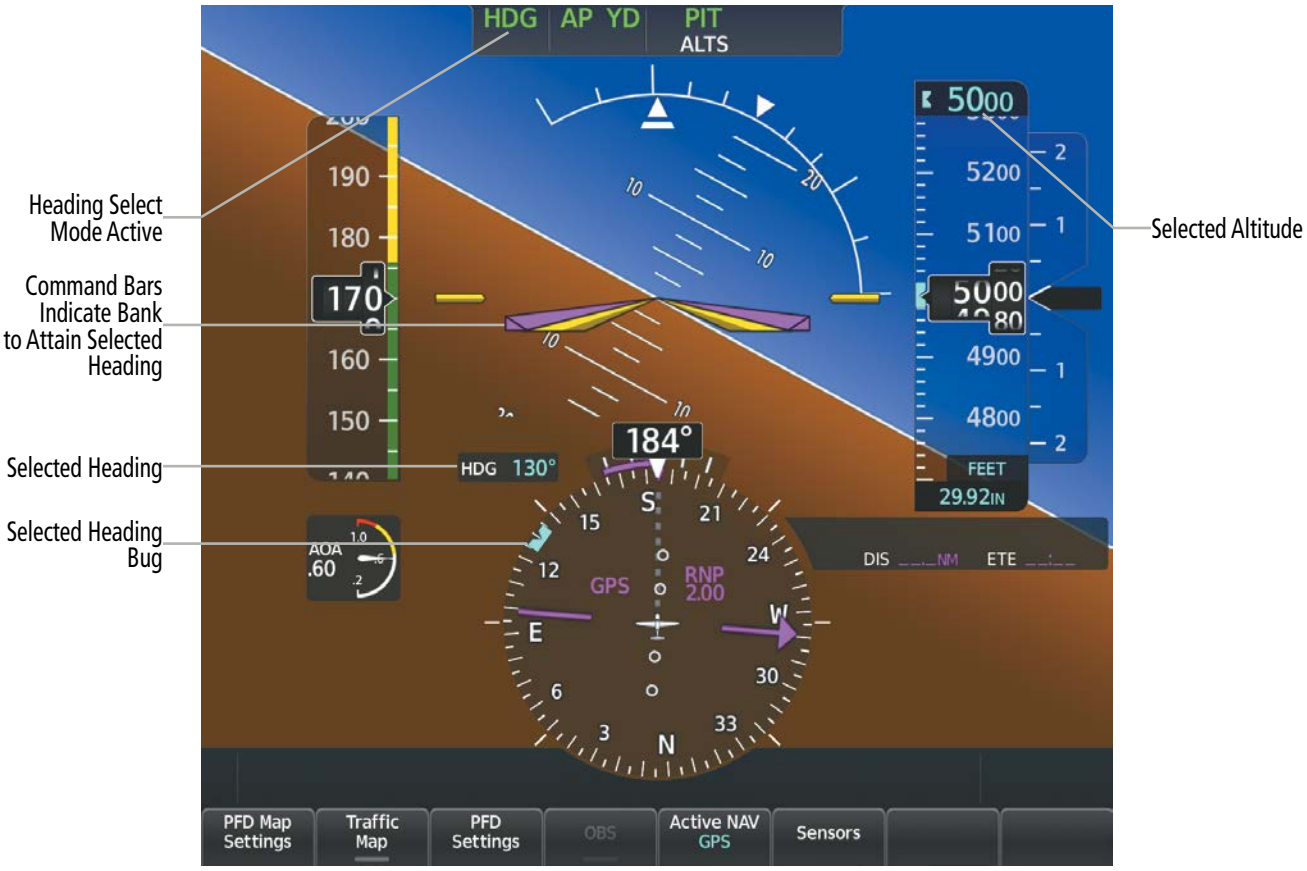


Figure 7-11 Heading Select Mode

NOTE: *A 'Heading mode active for extended period' Alert will show in the Alerts Window when HDG mode is active and the heading bug has not been changed for 10 minutes.*

Heading Sync Mode

Heading Sync Mode is activated when the AP/FD is laterally coupled to the Navigation Mode (NAV), and the pilot pushes the **HDG** Knob. When activated, 'SYNC MODE' will be displayed below the Selected Heading. The HDG bug will remain continuously synchronized to aircraft current heading as the airplane changes heading, eliminating the need to sync the heading bug during the turn. Heading Sync Mode is canceled if any of the following occur:

- NAV is no longer the active lateral mode
- A different heading is selected by turning the **HDG** Knob
- The **HDG** Knob is pushed again



Figure 7-12 Heading Sync Mode

The Heading Sync Mode will also be briefly applied, although not annunciated, if the **HDG** Knob is pushed while Heading Select Mode is the active coupled mode and the aircraft is not level. This allows for a smooth roll out onto the new heading, rather than an S-turn back to a heading that has been turned past.

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: *When intercepting a flight plan leg, the flight director gives commands to capture the active leg at approximately a 45° angle to the track between the waypoints defining the active leg. The flight director does not give commands fly to the starting waypoint of the active leg.*

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 half dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI is less than one half dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white below the active roll mode.



Figure 7-13 GPS Navigation Mode Armed

When the CDI has automatically switched from GPS to LOC during a LOC/ILS approach, GPS Navigation Mode remains active, providing GPS steering guidance until the localizer signal is captured. If the **APR** Key is pressed before the automatic navigation source switch, LOC Navigation Mode is armed.

If 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 **Active NAV** 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.

COMBINATION MODES

The following table lists the modes that operate by using both Vertical and Lateral Modes with their corresponding controls and annunciations.

Mode	Description	Control	Annunciation	Maximum Roll Command Limit	Reference Range
Vertical Navigation Modes					
Vertical Path Tracking	Captures and tracks descent legs of an active vertical profile	**VNV** Key	V PATH		
VNV Target Altitude Capture	Captures the Vertical Navigation Target Altitude	[1]	ALTV		
VOR Approach Mode					
VOR Arm/Capture/Track	Captures and tracks VOR navigation source	**APR** Key	VAPP	25° Capture 10° Track	
GPS Approach Mode					
GPS Arm/Capture/Track	Captures and tracks GPS navigation source	**APR** Key	GPS	25° Capture 10° Track	
Glidepath	Captures and tracks the SBAS glidepath on approach		GP		
LOC Approach Mode					
LOC Arm/Capture/Track	Captures and tracks the LOC navigation source	**APR** Key	LOC	25° Capture 10° Track	
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Backcourse Arm/Capture/Track	Captures and tracks the LOC source for backcourse approaches	**NAV** Key	BC	25° Capture 10° Track	
Additional Modes					
Takeoff	Commands a constant pitch angle on the ground in preparation for takeoff	**TO/GA** Switch	TO		7°
Go Around	Commands a constant pitch angle and wings level in the air		GA		7°
Level	Commands straight and level flight	**LVL** Key [2]	LVL		

[1] *ALTV is armed automatically under V PATH when the VNAV Target Altitude is to be captured instead of Selected Altitude.*

[2] *Level Mode can also 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 MODE (V)

Enhanced Descent-Only Vertical Navigation is a standard feature on this aircraft; target altitudes will not be captured during climbs.

NOTE: *VNAV is disabled when parallel track or dead reckoning mode is active.*

NOTE: *The Selected Altitude takes precedence over any other vertical constraints.*

Vertical Navigation (VNV) flight control is available for enroute/terminal cruise and descent operations when VNV flight planning is available. Refer to the Flight Management Section for more information on VNV flight plans.

Flight director Vertical Navigation Mode can be armed by the pilot at any time. However, VNAV may not become active until certain conditions for VNAV availability are satisfied. The following conditions will cause VNAV to be armed and not change to active:

» VNAV not enabled on the Touchscreen Controller
» No waypoints with altitude constraints in the active flight plan
» With PATH descent ahead, Selected Altitude is at or above current altitude
» NAV source not GPS
» GS or GP is the active FD vertical mode
» OBS Mode active
» Dead Reckoning Mode active
» NAV source switched to LOC for capture of ILS final approach segment (ILS approach is part of the FMS flight plan)
» Cross-track deviation > 10 nm
» Track Angle Error > 75 degrees
» Parallel offset active
» PATH mode has reverted to PIT (i.e., vertical deviation has exceeded 200 feet due to AFCS overspeed protection activation decreasing the descent rate)
» The VNV Target Altitude of the active waypoint is not more than 250 ft above the current aircraft altitude.

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.

Pressing the **VNV** Key will display either a white 'V' in the lower field (indicating VNV is armed) or a green 'V' in the upper field indicating VNAV is active and it will sequence armed flight director modes as appropriate. The VNAV indication may change between armed and active indications depending on the conditions for VNAV availability.

When VNAV is on but cannot arm the flight director mode, the green 'V' on the active line is removed and a white "V" is displayed to the left of the vertical armed fields. As an example, this will occur if PATH is the next mode, but the altitude selector is set to the current altitude. Refer to the criteria above for the complete list of conditions that will cause VNAV to go to the armed state. Any vertical flight director mode can be active with VNAV on.

When a vertical mode is armed it will become the active mode with no further pilot action. If a pilot action is required to arm the mode, the mode will not display as armed until that action is taken (e.g., move the Selected Altitude from the current altitude to a lower altitude to arm PATH). The following figures show examples of armed and active VNV annunciations.

NOTE: *The GPS VNAV function operates independently of the AFCS. With the VNAV AFCS function off, VNAV may still be active in the FMS, providing alerting (e.g., TOD, BOC alerts), and if applicable, vertical deviation for descent.*



The white 'V' indicates that vertical navigation is armed and requires further pilot action before it can go active.



The green 'V' indicates that vertical navigation is active and no further pilot action is required.

Figure 7-14 VNAV Annunciations

Crew Acknowledgment of VNV Departure From Level Flight

When within one minute of 'Top of Descent' (TOD), a "One Minute to TOD" message is displayed in the NAV message box. The crew acknowledges and enables the VNV departure by setting the Selected Altitude appropriately.

If VNV is active and the altitude selector is at the current altitude, then at one minute to TOD a white CAS Message ('ARM VNAV DESCENT') is displayed to prompt the crew to adjust the selected altitude lower.

VNAV Path Descent Mode (V PATH)

NOTE: *If another vertical mode key is pressed while VNAV Path Descent Mode is active, Vertical Path Descent Mode reverts to armed.*

When a VNAV flight plan is active and the **VNV** Key is pressed, VNAV Path Descent Mode is armed in preparation for descent path capture. If the system is not set up to continue the upcoming descent, a white "V" will appear when the **VNV** Key is pressed.

When descending, the appropriate altitude capture mode is armed for capture of the next VNAV Target Altitude (ALTV) or the Selected Altitude (ALTS). If the next target altitude has an "AT or BELOW" constraint, no level off is required, therefore, no target altitude is to be captured. ALTS is then armed and the Selected Altitude is captured. If an "AT-or-BELOW" altitude is used to define bottom-of descent, it will be treated as an "AT" altitude (arming ALTV). Intermediate "AT-or-BELOW" altitudes in the descent do not arm ALTV.

Descending with V FLC Mode:

1) Ensure a flight plan or direct-to waypoint with a vertical constraint is loaded into the system.
2) Activate the flight plan leg or waypoint.
3) Press the **FLC** Key on the AFCS Controller.
4) Press the **VNV** Key on the AFCS Controller.
5) Set the Selected Altitude below the current altitude.
6) Ensure vertical navigation is active (green 'V').

Before descent path interception, the Selected Altitude must be set below the current aircraft altitude. In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the Navigation Status Box and the "Vertical Track" voice message, VNAV indications (VNAV Target Altitude, Vertical Deviation Indicator, Vertical Speed Required Indicator, and a white or (green 'V') in the AFCS status box) appear on the PFD (see following image).



Figure 7-15 Indications at TOD Within 1 Minute

While the airplane is descending, if a level-off is required to meet a VNAV altitude constraint, ALTV Mode is armed to affect the level-off. If the airplane is set up to start the descent with no further pilot action before 1 minute, then the (green 'V') will be displayed. If further pilot action is required (e.g., changing the Selected Altitude) then the white 'V' will be displayed.

In a descent, VNAV will cause a level-off at "At-or-Above", "At" or the lower altitude of a "Between" constraint.

A descent can also be initiated manually at a point earlier or later than the TOD by setting the Selected Altitude to a lower altitude and selecting PIT, FLC or VS Mode. In that case, VNAV will automatically arm both PATH Mode (to capture the defined vertical path) and ALTV to capture the next VNAV altitude constraint.

When there is a sequence of altitude constraints at flight plan waypoints, the VNAV function will create a descent profile that crosses all the waypoints at appropriate altitudes without any unnecessary level-offs.

The Selected Altitude must be set appropriately (below the current altitude) to allow the descent to start or resume. Until the Selected Altitude is reset, VNAV (V) Mode is shown as armed in white. When the Selected Altitude is reset, VNAV (V) mode goes to active (green) and PATH is armed. If the Selected Altitude has not been reset by the time the airplane is within one minute of TOD (or the point where the descent must continue in FLC), a system message is displayed.

With the Selected Altitude set to a lower altitude, the armed PATH mode becomes active (green) as the airplane approaches the TOD.

If the airplane passed the TOD and the Selected Altitude did not permit the descent to start or resume automatically, the crew can start or resume the descent at their discretion by resetting the Selected Altitude and selecting the desired descending vertical mode (typically with VS Mode). In this case VNAV Mode goes active (green) as soon as the Selected Altitude is reset. PATH and ALTV modes remain armed until the planned descent profile is re-joined.

When descending, the airplane never levels off at an "At-or-Below" altitude nor the upper altitude of a "Between" constraint. However, if the current descent gradient is not sufficient to make the required altitude at the waypoint, a system message will be shown.

While on an approach and transitioning from FMS navigation to short range navigation, Enroute VNAV guidance and PATH Mode continue to be available until the Final Approach Fix (FAF). At the FAF, this vertical guidance is removed.



Figure 7-16 VNAV PATH Descent Mode

If the Altimeter's 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 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.

Advisory Descent

The Advisory Descent feature is intended to provide information that will inform the crew when to consider beginning the descent to ensure the default descent angle is met. This feature is intended to work in situations when the crew has a destination loaded but does not yet have descent constraints loaded into the flight plan. The crew can turn the Advisory Descent feature on/off in the VNAV settings menu (From MFW Home touch **Flight Plan > VNAV > Settings**).

The Advisory Descent feature provides the following indications. These indications are only shown when there are no descent VNAV constraints loaded into the flight plan.

- **Advisory DESC Point** – An indication on the 2D map and vertical situation display (VSD) of the point at which the aircraft should begin descending to reach the ground at the desired destination along the active lateral path.

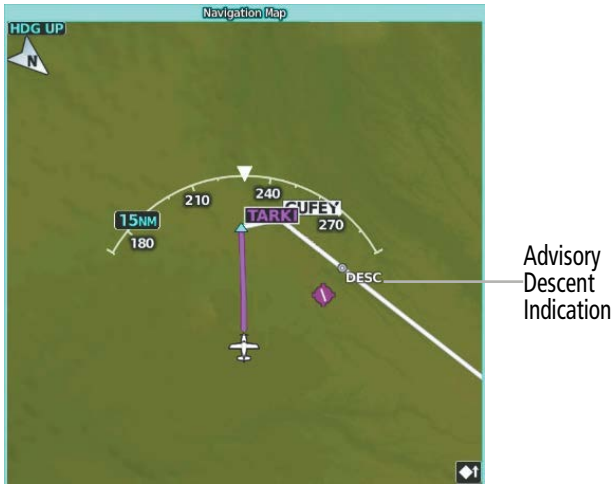


Figure 7-17 Advisory Descent

- **Advisory Vertical Speed Required (VSR)** – Computed to the same destination waypoint and elevation. The Advisory VSR is viewable on the vertical speed tape as a gray chevron and the GDU™ status bars. The Advisory VSR is not displayed on the VNAV profile pages to avoid confusion with active VNAV guidance data.

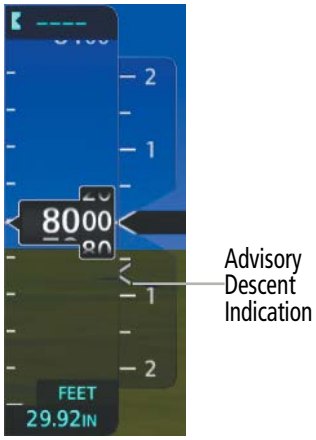


Figure 7-18 Advisory Vertical Speed Requirement (VSR)

No visual or aural alerting is provided. Additionally, there is no specific FMS or AFCS behavior associated with these indications.

VNAV Descend Now

The Descend Now feature calculates a vertical path descent that begins at the aircraft position that meets all VNAV altitude constraints in the flight plan without changing them. Descend Now can be activated by selecting vertical direct-to on the active VNAV point and selecting the complex constraint option.

Executing a Descent Now:

1) From MFW Home, touch Flight Plan and ensure a flight plan with a vertical constraint is loaded.
2) On the 'Active Flight Plan' Page, touch the altitude constraint button for the desired waypoint.
3) Press the **VNAV Direct To** Button. The TOD is recalculated to be just in front of the aircraft and the descent can begin.



Figure 7-19 VNAV Direct Button Displayed

Or:

1) From MFW Home, touch **Flight Plan > VNAV**.
2) Touch the VNAV Direct To Button and the 'Select VNAV Direct To' Page is displayed.
3) From the list, select the desired descent. In the example below, the **FL200 at ININN** Button is selected.



Figure 7-20 VNAV Descend Now Options

VNAV Target Altitude Capture Mode

VNAV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNAV Target Altitude is to be intercepted before the Selected Altitude. PIT, VS, FLC, and PATH can all arm ALTV if VNAV is active. The annunciation 'ALTV' indicates the VNAV Target Altitude is to be captured. VNAV 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 FMS Navigation section for details).

A VNAV Target Altitude can be specified in one of several different ways as shown in the following table.

VNAV Target Altitude Type	VNAV Target Altitude Indication	Descent Behavior
"AT"	22000	Arms ALTV
"AT or BELOW"	22000	Does not arm ALTV[1,2]
"AT or ABOVE"	22000	Arms ALTV
"BETWEEN"	22000 21000	Arms ALTV using the lower altitude

[1] *Even if ALTV is not armed, the 'UNABLE VNAV ALTITUDE' system message will be shown if the airplane's vertical speed is not sufficient to meet the targeted altitude before crossing the waypoint.*

[2] *Normally, "AT-or-BELOW" altitudes are not used to define the bottom-of-descent. However, if an "AT-or-BELOW" altitude is used in this way, it will be treated as an "AT" altitude (arming ALTV). Intermediate "AT-or-BELOW" altitudes in the descent do not arm ALTV.*

Table 7-6 VNAV Target Altitude Behavior

At the same time as "TOD within 1 minute" or "BOD within 1 minute" is annunciated in the Navigation Status Box when VNAV is active, the active VNAV Target Altitude is displayed above the Vertical Speed Indicator.

As the aircraft nears the VNAV Target Altitude, the flight director automatically transitions to VNAV 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 (before changing to solid green) and the appearance of the white 'ALT' annunciation. When ALTV is active, ALT becomes an armed vertical FD mode (in PATH descents, FLC can also be armed as well). The VNAV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RVSI) is removed once VNAV Target Altitude Capture Mode becomes active.

At 50 feet from the VNAV Target Altitude, the flight director automatically transitions from VNAV 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 (before changing to solid green) to indicate the automatic transition. The flight director automatically arms VNAV Path Descent, allowing upcoming descent legs to be captured and subsequently tracked.



Figure 7-21 Automatic Mode Transitions During Altitude Capture

Changing the VNAV Target Altitude

VNAV target altitudes can be changed while editing the active flight plan (see Flight Management for details).

VNAV Guidance For Non-Precision Approaches

Advisory vertical navigation guidance is provided for legacy non-precision approaches including: (non-GPS/RNAV) approaches (e.g., VOR, NDB, etc.). The vertical guidance will be provided by GPS. For VOR and NDB approaches, the system will provide vertical guidance when a published glidepath angle is resident in the navigation databases. These approaches will be flown with GPS selected using GPS lateral and vertical guidance. VOR deviation is provided in an overlay on the CDI/HSI, and the crew will set up a bearing pointer to monitor the NDB.

Approach selection will now include +V in the selection title, as shown in the following figure. This text indicates to the crew when advisory vertical guidance is available, though is it not required to complete the approach.

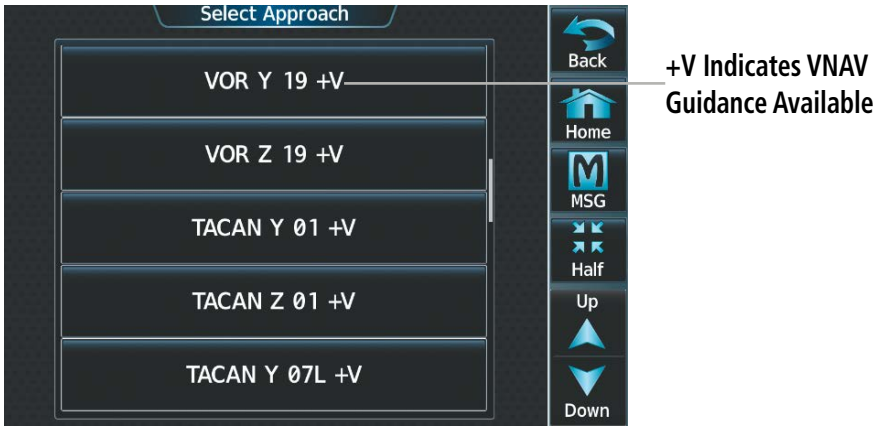


Figure 7-22 Non-Precision Approach with VNAV Guidance

To satisfy the requirement to monitor the NAVAID for VOR approaches, the preview is displayed on the CDI. The CDI will automatically preview the display of deviation from the VOR/NDB final approach course. The NDB bearing pointer must be manually selected for display. Information about the preview (NAVAID tuned, decoded identifier, and selected course) will be displayed (similar to ILS approaches). An example of the CDI preview is shown in the following figure.

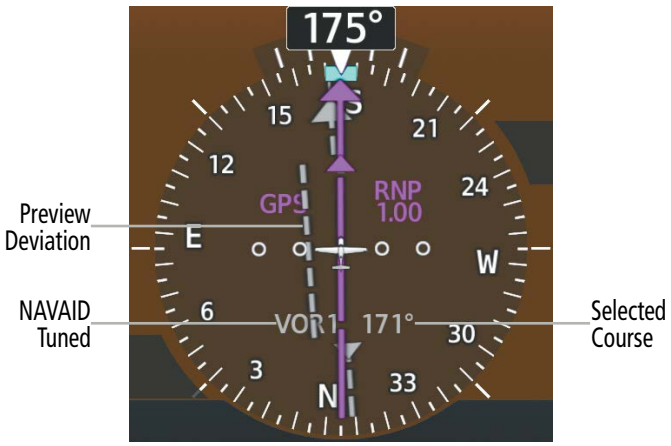


Figure 7-23 VOR Final Course Preview

APPROACH MODE

NOTE: *The selected navigation receiver must have a valid VOR or LOC signal or active FMS course for the flight director to enter Approach Mode.*

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (GPS, VOR, or LOC), depending on loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. If the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

- Different VOR/LOC tuned while in VOR/ILS Navigation Mode (VOR/LOC Navigation Mode reverts to armed)
- Approach Mode is active and a Vectors-To-Final is activated
- Approach Mode is active and Navigation source is manually switched
- During a LOC/ILS approach, FMS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from FMS to LOC

VOR Approach Mode (VAPP)

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode. When the navigation source is VOR and the **APR** Key is pressed, the system will capture the VOR course when:

- The CDI is less than one dot, and
- The tuned VOR frequency was not changed in the last ten seconds.

Selecting VOR Approach Mode:

1) Ensure a valid VOR frequency is tuned.
2) Ensure that VOR is the selected navigation source (press the **Active NAV** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.



Figure 7-24 Navigation/Approach Mode Armed

GPS Approach Mode

NOTE: *Some RNAV (GPS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV+V or LP+V should comply with step down altitude constraints and be flown to an MDA, until visual with the landing surface, even though vertical glidepath (GP) information may be provided.*

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).

When the navigation source is GPS and the **APR** Key is pressed, the system will capture the GPS course when the CDI is less than one half dot.

Selecting GPS Approach Mode without a Glidepath:

1) Ensure an RNAV 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 (press the **Active NAV** Softkey to cycle through navigation sources if necessary).
3) Press the **NAV** Key.



Figure 7-25 GPS Mode Armed

GLIDEPATH MODE (GP)

WARNING: *Do not rely on the autopilot to level the aircraft at the MDA/DH when flying a coupled approach with GP or GS modes active. The autopilot will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.*

Glidepath Mode is used to track the WAAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting GPS Approach Mode with a Glidepath:

1) Ensure an RNAV 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 (press the **Active NAV** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.



Figure 7-26 GPS and Glidepath Modes Armed

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 7-27 Glidepath Mode Active

Localizer Approach Mode

Localizer Approach Mode is annunciated as 'LOC' in green when active and 'LOC' in white when armed as the lateral flight director mode.

When the navigation source is LOC and the **APR** Key is pressed, the system will capture the LOC course when the CDI is less than one dot.

Selecting LOC Approach Mode without a Glideslope:

1) Ensure a valid localizer frequency is tuned.
2) Ensure that LOC is the selected navigation source (press the **Active NAV** Softkey to cycle through navigation sources if necessary).
3) Press the **NAV** Key.

Or:

1) Ensure that GPS is the selected navigation source (press the **Active NAV** 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 **NAV** Key.



Figure 7-28 LOC Approach Mode Without Glideslope

Glideslope Mode (GS)

WARNING: *Do not rely on the autopilot to level the aircraft at the MDA/DH when flying a coupled approach with GP or GS modes active. The autopilot will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.*

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. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode with a Glideslope (ILS):

1) Ensure a valid ILS frequency is tuned.
2) Ensure that LOC is the selected navigation source (press the **Active NAV** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

Or:

1) Ensure that GPS is the selected navigation source (press the **Active NAV** Softkey to cycle through navigation sources if necessary).
2) Ensure an ILS approach is loaded into the active flight plan.
3) Ensure the corresponding LOC frequency is tuned.
4) Press the **APR** Key.



Figure 7-29 Glideslope Mode Armed

Once the following conditions have been met, the glideslope can be captured:

- An ILS approach with vertical guidance is loaded into the active flight plan
- A valid ILS frequency is tuned on the NAV radio
- A glideslope signal is being received
- 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)

Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope while simultaneously tracking the localizer in the active lateral mode.



Figure 7-30 Glideslope Mode Active

Backcourse Mode (BC)

NOTE: *In order to Arm a LOC Backcourse, the aircraft heading must be within 75 degrees of the LOC Backcourse.*

NOTE: *When making a backcourse approach, set the Selected Course to the localizer front course.*

NOTE: *The* ***NAV*** *Key must be used to arm Backcourse Mode; the* ***APR*** *Key will not arm the approach.*

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. When making a backcourse approach, set the Selected Course to the localizer front course. The flight director creates roll steering commands from the Selected Course and deviation.

Selecting Backcourse Mode:

1) Ensure a valid localizer backcourse frequency is tuned.
2) Ensure that LOC is the selected navigation source (press the **Active NAV** Softkey to cycle through navigation sources if necessary).
3) Set the Selected Course to the localizer front course.
4) Press the **NAV** Key.



Figure 7-31 Backcourse Mode Active

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 before 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

In Takeoff and Go Around modes, the flight director commands a constant set pitch attitude. The **TO/GA** Switch located on the power lever is used to select both modes. The mode entered by the flight director depends on whether the aircraft is on the ground or airborne. 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 provides a climb reference after takeoff. This mode can be selected only while on the ground by pushing the **TO/GA** Switch. The flight director Command Bars assume a wings-level, pitch-up attitude. FLC mode may be armed and NAV or HDG modes may be armed as well. Selected Altitude Capture mode is armed after selected altitude is set.

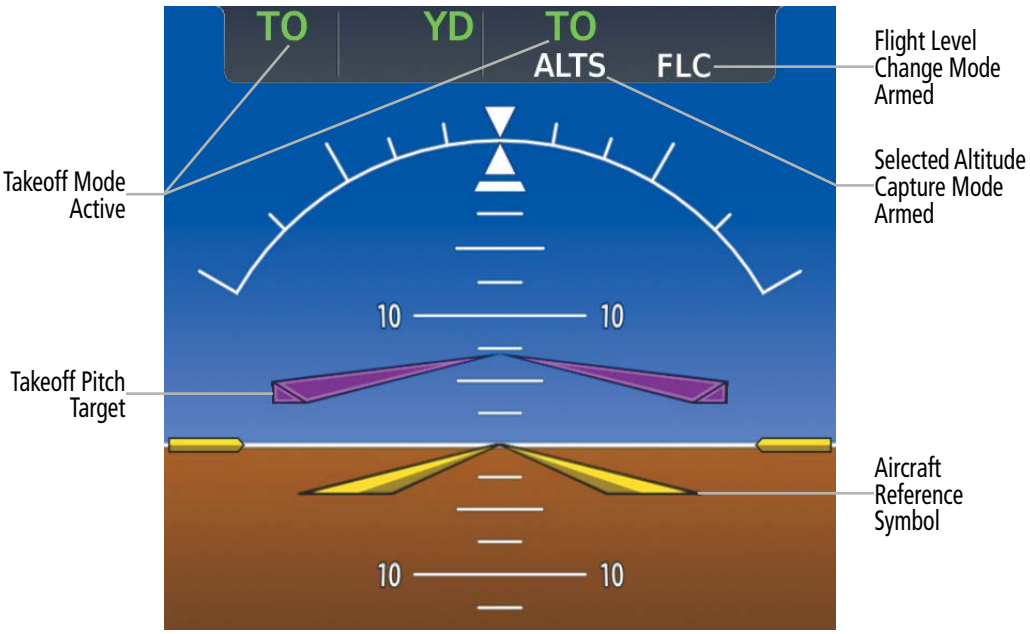


Figure 7-32 Takeoff Mode Selected on the Ground

At rotation speed, the pilot may begin to pitch the aircraft to achieve the climb reference. At 400 feet AGL, the flight director will automatically transition from TO Mode to the armed vertical and/or lateral modes. In the preceding example, the FLC mode annunciation will become active and the speed reference at transition is synced to the current speed.

If autopilot is then engaged (as shown in the following figure), engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired climb profile while maintaining the Airspeed Reference. The Airspeed Reference (shown above the Airspeed Indicator and as an AFCS annunciation) may be adjusted by scrolling the **UP/DN** Wheel.



Figure 7-33 Takeoff Mode with Autopilot Engaged

Go Around Mode (GA)

Pressing the **TO/GA** Switch while in the air activates the flight director in a wings-level, pitch-up attitude, allowing the execution of a missed approach or a go around. Attempts to modify the aircraft attitude (i.e., with the **UP/DN** Wheel) result in reversion to Pitch Hold Mode.

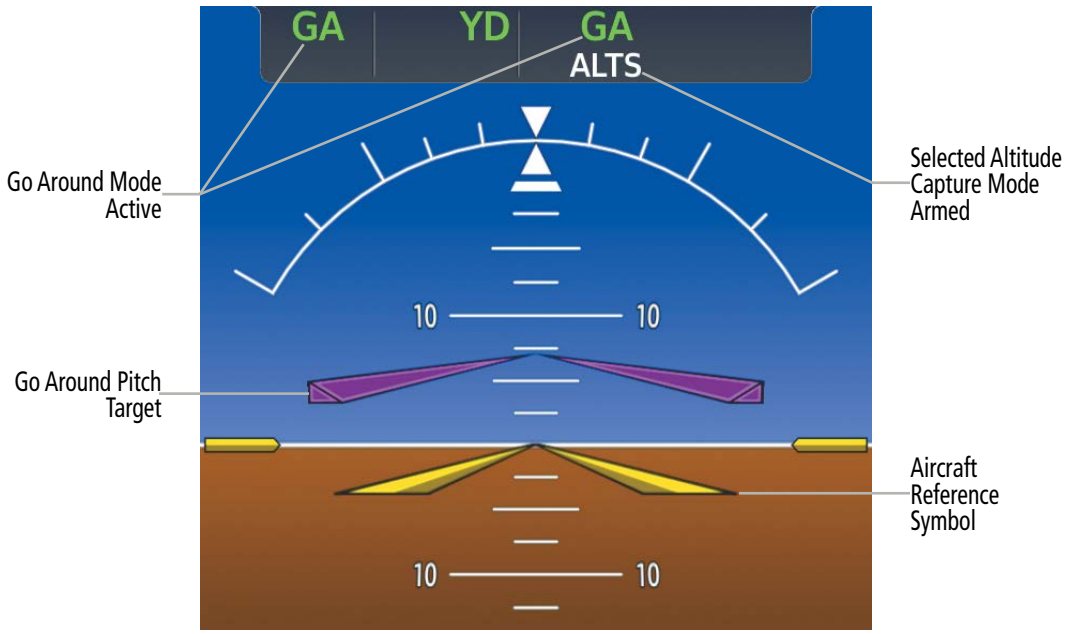


Figure 7-34 Go Around Modes

LEVEL MODE

Level Mode is a coupled pitch and roll mode and is annunciated as both the vertical and lateral modes when active. Pressing the **LVL** Key engages the autopilot (if the autopilot is disengaged and the aircraft is within the autopilot engagement limitations) in level vertical and lateral modes. While Level Mode does not track altitude or heading, it will adjust the pitch angle to maintain zero vertical speed. When the **LVL** Key is pressed, all armed and active modes are canceled and the autopilot and flight director revert to Level Mode for pitch and roll. While in level mode, all other modes are available by pressing the corresponding button.

Level mode also becomes active as a function of Electronic Stability and Protection (ESP™). Refer to the Additional Features section for a detailed discussion of the ESP feature.

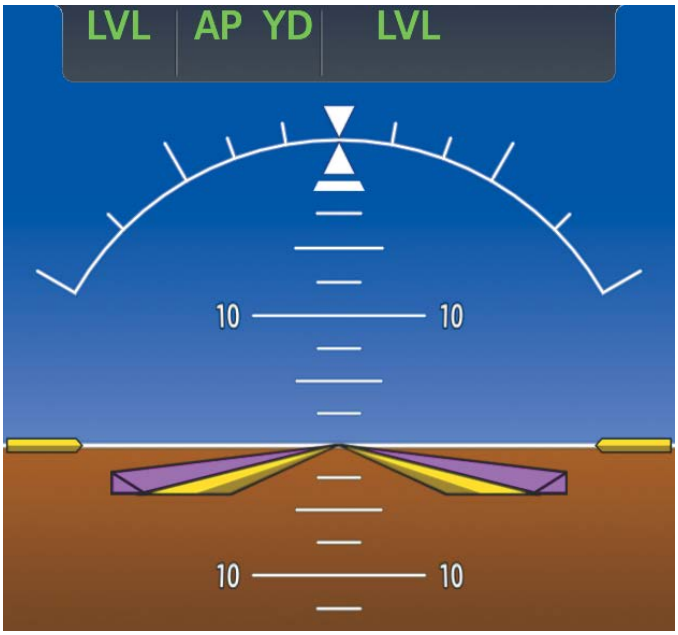


Figure 7-35 Level Mode

7.5 AUTOPILOT AND (OPTIONAL) 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. Yaw damper is optional on the SR22T/22T and not available on the SR20. 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 adapter to drive the pitch trim motor 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 is 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 servos are equipped to monitor the torque and can be overridden once the torque limit is exceeded.

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 adapter to drive the pitch trim motor. The pitch-trim adapter commands the motor to reduce the average pitch servo effort.

When the autopilot is not engaged, the pitch-trim adapter may be used to provide Manual Electric Pitch Trim (MEPT). This allows the aircraft to be trimmed using a control stick switch. Trim speeds are scheduled with airspeed to provide more consistent response.

ROLL AXIS

The autopilot roll axis uses roll rate to stabilize aircraft roll attitude during flight director maneuvers. The flight director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

YAW AXIS

The optional 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. Yaw damper operation is independent of autopilot engagement.

The system automatically engages the yaw damper independent of the autopilot. When the **AP** key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated and the annunciator lights on the AFCS controller for the autopilot are illuminated. The flight director engages in Pitch and Roll Hold Modes when initially activated.

ENGAGING THE AUTOPILOT AND (OPTIONAL) YAW DAMPER

When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated and the annunciator light on the AFCS controller for the autopilot is illuminated and 'AP' and 'YD' are shown on the AFCS Status Box. The flight director engages in Pitch and Roll Hold modes when initially activated.



Figure 7-36 Autopilot and Yaw Damper Engaged

The yaw damper will engage automatically when the aircraft climbs through 200' AGL and disengages when the aircraft descends through 200' AGL. The yaw damper will always engage when the autopilot is engaged. Disabling ESP on the 'Avionics Settings' Page will disable the automatic yaw damper engagement (From MFW Home, touch **Utilities > Setup > Avionics Settings**. On the **System** Tab, scroll down to view the **Stability & Protection** Button).

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.

DISENGAGING THE AUTOPILOT AND YAW DAMPER

MANUAL DISENGAGEMENT

The autopilot may be manually disengaged by pushing the **AP DISC** Switch or pressing the **AP** Key on the AFCS Controller. Manual disengagement is indicated by a five-second flashing amber 'AP' annunciation and a three-second autopilot disconnect aural alert. The **AP DISC** Switch may be used to cancel the aural alert.



Figure 7-37 Manual AP Disengagement

The **AP DISC** Switch can be used to manually disengage the yaw damper. The 'YD' and 'AP' annunciations turn amber and flash for 5 seconds upon disengagement.



Figure 7-38 Manual Yaw Damper Disengagement

AUTOMATIC DISENGAGEMENT

Automatic autopilot disengagement is indicated by a flashing red and white 'AP' annunciation and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the **AP DISC** Switch. Automatic autopilot disengagement occurs due to:

- System failure.
- Invalid sensor data.
- Stall warning.
- Inability to compute default flight director modes (FD also disengages automatically).

Automatic yaw damper disengagement is indicated by a five-second flashing yellow '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 7-39 Automatic Disengagement

7.6 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The annunciations in the following table can appear on the PFW above the Airspeed and Attitude indicators. Only one annunciation may occur at a time, and messages are prioritized by criticality.

Condition	Annunciation	Description
Pitch Failure	PTCH	Pitch axis control failure; autopilot inoperative
Roll Failure	ROLL	Roll axis control failure; autopilot inoperative
Pitch Trim Failure (or stuck **MEPT** Switch)	PTRM	If autopilot is engaged, take control of the aircraft and disengage autopilot If autopilot is disengaged, move **MEPT** switches separately to unstick
Yaw Damper Failure	YAW	Yaw damper control failure
System Failure	AFCS	Autopilot and MEPT are unavailable; Flight director may still be available
Elevator Mistrim Down	↓ELE	Pitch servo providing sustained force in the indicated direction - May indicate a failure of the pitch-trim adapter or trim system
Elevator Mistrim Up	↑ELE	
Aileron Mistrim Right	AIL→	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	←AIL	
Rudder Mistrim Right	RUD→	Yaw servo providing sustained force in the indicated direction. - Aircraft rudder pilot adjustment after substantial pitch and power changes required
Rudder Mistrim Left	←RUD	
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion - Do not press the **AP DISC** Switch during servo power-on and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-on tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test failed; aural alert sounds at failure
Hypoxia Recognition System is Activated	EDM	Activated only by the Hypoxia Recognition System

Table 7-7 AFCS Status Alerts

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 (see pertinent flight manual for airspeeds which are dependent upon flap setting, and anti-ice system on-board), a flashing amber 'MINSPD' annunciation will appear above the airspeed indicator.

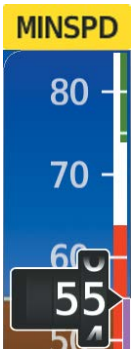


Figure 7-40 MINSPD Annunciation

When the airspeed trend vector reaches the predetermined airspeed, a single aural "AIRSPEED" will sound, alerting the pilot to the impending underspeed condition.

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)

NOTE: *Flight Level Change (FLC) Mode is only considered an altitude-critical mode when utilizing the zero vertical speed submode (e.g., if attempting to climb with a power setting too low for the speed bug selected).*

When the aircraft decelerates to stall warning, the lateral and vertical flight director modes will change from active to armed, and the autopilot will provide input causing the aircraft to pitch down and the wings to level.



Figure 7-41 Lateral and Vertical Modes Armed

An aural "AIRSPEED" alert will sound every five seconds and a red "UNDERSPEED PROTECT ACTIVE" annunciation will appear to the right of the Vertical Speed Indicator. The pitch down force will continue until the aircraft reaches a pitch attitude at which IAS equals the IAS at which stall warning turns off, plus two knots.



Figure 7-42 Underspeed Protect Active Annunciation

When airspeed increases (as a result of adding power/thrust) to above the IAS at which stall warning turns off, plus two knots, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference and the vertical and lateral flight director modes will change from armed to active.

NON-ALTITUDE CRITICAL MODES (PIT, VS, VNAV, FLC)

When the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed, a red "UNDERSPEED PROTECT ACTIVE" annunciation will appear to the right of the Vertical Speed Indicator. The vertical flight director mode will change from active to armed, and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed. When the airspeed trend vector reaches an IAS below the minimum commandable autopilot airspeed, a single aural "AIRSPEED" will sound, alerting the pilot to the impending underspeed condition.



Figure 7-43 Vertical Mode Armed

When airspeed increases (as a result of adding power/thrust) to an IAS above the minimum commandable autopilot airspeed, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference and the vertical flight director mode will change from armed to active.

OVERSPEED PROTECTION

NOTE: *Overspeed protection is not active in Altitude Hold, Glideslope or Glidepath modes.*

While Pitch Hold, Vertical Speed, Flight Level Change, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Pitch commands are not changed until overspeed protection becomes active. Overspeed protection is provided in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding VNE.

When an autopilot overspeed condition occurs, the Airspeed Reference appears in a box above the Airspeed Indicator, flashing a yellow 'MAXSPD' annunciation. The flight director reacts to overspeed conditions by commanding pitch-up guidance to decrease airspeed to a target reference speed. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.

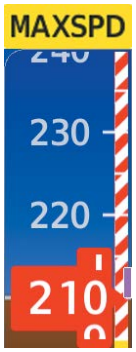


Figure 7-44 Overspeed Annunciation

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 stick.
2) Press and hold the **AP DISC** Switch. The autopilot will disconnect and power is removed from the trim motor. Power is also removed from all primary servo motors and engaged solenoids. Note the visual and aural alerting indicating autopilot disconnect.
3) Reconfigure the aircraft as needed. Substantial trim adjustment may be needed.
4) Pull the appropriate circuit breaker(s) to electrically isolate the servo and solenoid components.
5) Release the **AP DISC** Switch.

OVERPOWERING AUTOPILOT SERVOS

In the context of this discussion, "overpowering" refers to any pressure or force applied to the pitch controls when the autopilot is engaged. A small amount of pressure or force on the pitch controls can cause the autopilot automatic trim to run to an out-of-trim condition. Therefore, any application of pressure or force to the controls should be avoided when the autopilot is engaged.

Overpowering the autopilot during flight will cause the autopilot's automatic trim to run, resulting in an out-of-trim condition or cause the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the autopilot is disengaged.

Checking autopilot servos during 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 servos.

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SECTION 8 ADDITIONAL FEATURES

8.1 OVERVIEW

NOTE: *Regardless of 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 Integrated Avionics System include the following:

- SafeTaxi®
- SurfaceWatch™ (Optional)
- Electronic Charts
  - ChartView™ (Optional)
  - FliteCharts® (Optional)
  - IFR/VFR Charts
- Satellite Telephone & Datalink Services (Optional)
- Position Reporting (Optional)
- Connext® (Optional)
- SiriusXM® Satellite Radio (Optional)
- Flight Data Logging
- Electronic Checklists
- Electronic Documents
- Auxiliary Video (EVS)
- Stabilized Approach
- Autonomí®
  - Electronic Stability & Protection (ESP™)
- Hypoxia Recognition and Automatic Descent Mode
- Database Management

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 1,400 airports in North America, South America, and Europe. 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 SurfaceWatch feature provides voice and visual annunciations to aid in maintaining situational awareness and avoid potential runway incursions during ground and air operations in the airport environment.

ChartView (optional) and FliteCharts (optional) provide on-board electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information. IFR/VFR Charts provide electronic low altitude IFR charts, high altitude IFR charts, and VFR charts for navigation.

The optional Iridium Transceiver provides an airborne low speed datalink, Iridium Satellite Telephone service, and Short Message Service (SMS).

The optional Position Reporting feature allows the system to send position reporting information to a provider, such as FlightAware.com.

The optional Connext feature 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 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 Flight Data Logging feature automatically stores critical flight and engine data on an SD data card. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

The Electronic Checklists feature helps to quickly find the proper checklist procedure on the ground or during flight.

The Electronic Documents feature allows viewing of electronic documents on selected GDU™ displays.

The Auxiliary Video feature provides a control and display interface for an auxiliary video system.

The Stabilized Approach feature provides aural and visual annunciations to notify the flight crew of unstable conditions during an approach.

Autonomí® Autonomous Safety-Enhancing Technology is a family of solutions that are designed to help make flying safer. The Autonomí product for this aircraft is Electronic Stability and Protection (ESP).

Electronic Stability and Protection (ESP) is a feature that is intended to discourage the exceedance of attitude, established airspeed, and angle of attack parameters. Availability of this feature is reflected on the screen shown at initialization.

The Hypoxia Recognition System with Automatic Descent Mode provides protection to aircraft occupants from succumbing to the debilitating affects of hypoxia.

The database management feature provides a comprehensive means to view and manage all databases installed on the system.

8.2 SAFETAXI

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.*

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range on the 'Navigation Map' Page or the Inset Map on the PFW. 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 aircraft's current position is within the SafeTaxi view, the airplane symbol on the airport provides enhanced position awareness.

NOTE: *To view the SafeTaxi feature, 'Airports' must be enabled on the 'Map Settings' Page through the* ***Aviation*** *Tab on the Touchscreen Controller and Garmin SVT™ must be active.*

NOTE: *When obstacles are displayed on the 'Navigation Map' Page in the vicinity of an airport being viewed with SafeTaxi, the obstacle symbols may be obscured by SafeTaxi feature labels.*

HOT SPOTS

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.

NOTE: *For 3D SafeTaxi to function, the SafeTaxi2 database must be utilized.*

3D SAFETAXI

3D SafeTaxi provides a three dimensional depiction of the airport environment which assists the pilot with ground maneuvers and airport identification. Information displayed includes 3D building footprints (e.g., hangars, terminals, and towers), taxiways, aprons, signs, and other markings. This taxi view is only available in SVT Auto Mode.

Enabling SVT Auto Mode:

1) From PFW Home, touch **PFD Settings**.
2) With the PFD Tab selected, touch the **Synthetic Vision** Button.
3) Touch the **Auto** Button.

3D SafeTaxi features a new frame of reference that is above and behind the aircraft body and is therefore not attitude aligned. A 3D aircraft model is depicted aligned with the aircraft's own body frame. The model is rotated to show the heading of the aircraft within SVT. Aircraft surroundings during on-ground taxi maneuvers are emphasized. Reference Flight Instruments for further discussion on SVT.



Figure 8-1 3D SafeTaxi

OPERATION

Any map display that shows the navigation view can also show the SafeTaxi airport layout within the maximum configured range. The following is a list of displays where the SafeTaxi feature can be seen:

- 'Navigation Map' Page
- Inset Map
- Various Weather pages
- 'Trip Planning' Pane
- Various 'Nearest' Pages (with 'Show On Map' enabled)
- Various 'Flight Plan' Pages (with 'Preview FPL' enabled)

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the following example, the aircraft is on the active runway approaching a designated Airport Hot Spot boundary. 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.

Enabling/disabling SafeTaxi:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not already selected, touch the **Aviation** Tab.
3) If necessary, scroll to display the **SafeTaxi** Annunciator Button.
4) Touch the **SafeTaxi** Button to enable or disable SafeTaxi on the Navigation and inset maps. A green annunciator on the button indicates SafeTaxi is enabled.

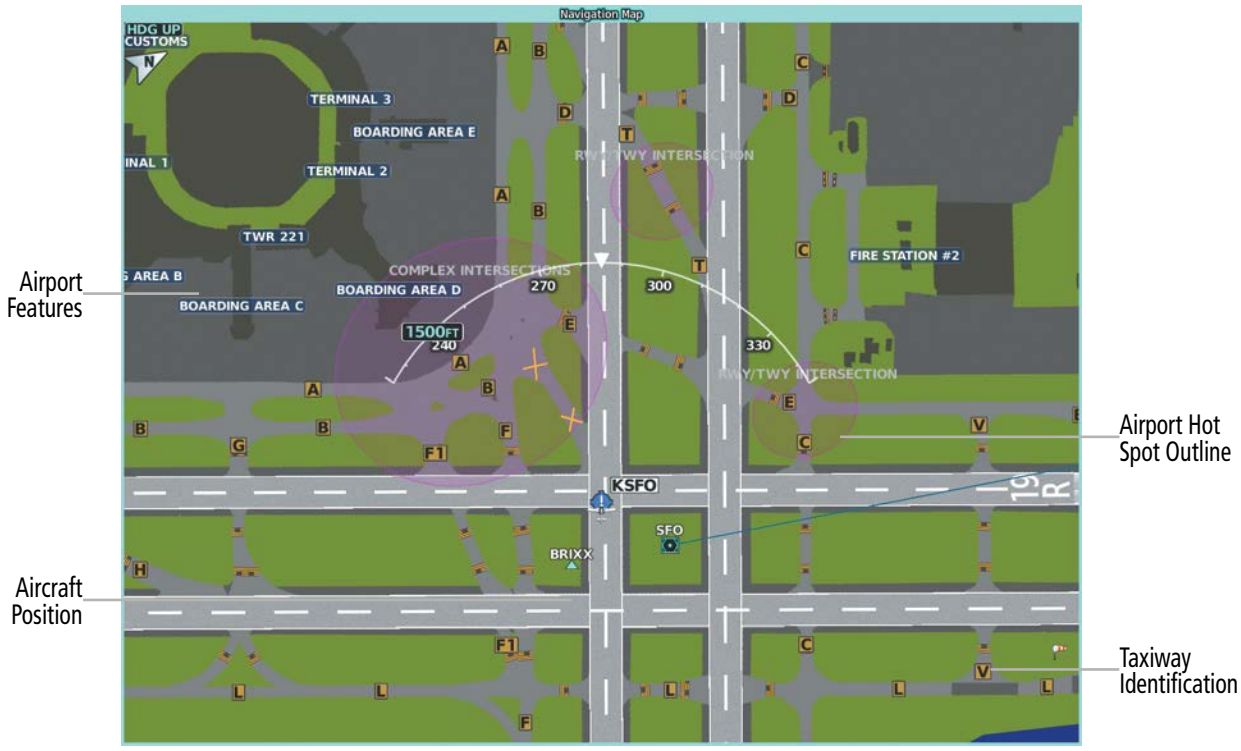


Figure 8-2 SafeTaxi Depiction on the 'Navigation Map' Display

Configuring SafeTaxi range:

1) From MFW Home, touch **Map > Map Selection > Map Settings**.
2) If not already selected, touch the **Aviation** Tab.
3) If necessary, scroll to display the **SafeTaxi** Range Button.
4) Touch the **SafeTaxi** Range Button. A selection of ranges are displayed.
5) Touch the desired range. In the following figure, 1.5 NM has been selected. With this setting, SafeTaxi will be displayed on the 'Navigation Map' Page for range settings up to and including 1.5 NM.

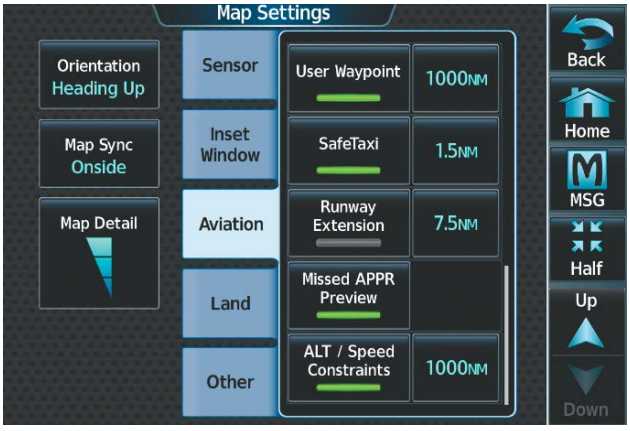


Figure 8-3 SafeTaxi Map Settings

8.3 SURFACEWATCH (OPTIONAL)

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: *The SafeTaxi database must be available to provide information regarding taxiways, aprons and other objects in the airport environment.*

The SurfaceWatch feature provides visual annunciations to help the pilot maintain situational awareness and avoid potential runway incursions during ground and air operations in the airport environment. The full SurfaceWatch feature is not available in Reversionary Mode. The SurfaceWatch feature is comprised of the following key components:

- Alert Annunciations such as: Taxiway Takeoff, Runway Too Short (during takeoff or landing), Check Runway (during takeoff or landing), and Taxiway Landing
- Information on the PFW about runway and taxiway information that changes as the aircraft moves through the airport environment



Figure 8-4 SurfaceWatch Information on the PFW

Enabling/disabling SurfaceWatch:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Settings.**
2) If not already selected, touch the **Alerts** Tab and scroll to view the **SurfaceWatch Inhibit** Button.
3) Touch the **SurfaceWatch Inhibit** Button to enable or disable SurfaceWatch. A green annunciator indicates SurfaceWatch is inhibited, or disabled. The system message 'SFC WATCH INHIB' is also displayed in the 'CAS' Window indicating SurfaceWatch is inhibited. The inhibit setting will be canceled after a power cycle.

INFORMATION DISPLAY

The SurfaceWatch Information Box is displayed on the PFW to the left of the HSI. 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 as shown in the following figure. These components are Currently Occupied, Approaching, and Crossing Runways.

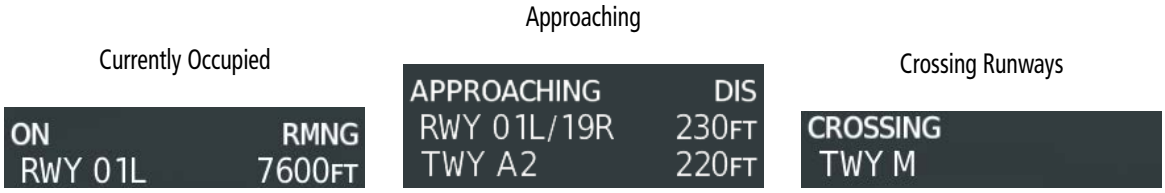


Figure 8-5 Information Types Displayed in the Information Box

CURRENTLY OCCUPIED

This component indicates the aircraft is 'ON' the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently 'ON' RWY 01L. 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 is displayed only for objects labeled on the SafeTaxi diagram.

APPROACHING COMPONENT

This component indicates the aircraft is 'APPROACHING' the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently 'APPROACHING' RWY 01L/19R and TWY A2. The distance to each is also shown.

NOTE: *When approaching a runway, the distance displayed does not take into account the position of the Hold Line for the runway. Do not cross the Hold Line until authorized.*

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 COMPONENT

This component lists the runways or taxiways, from closest to furthest, the aircraft is crossing, as seen in the previous figure. The distance to each runway or taxiway is also shown in order of closest distance. Runways or taxiways behind the aircraft are not depicted.

The Crossing component is shown in conjunction with the Currently Occupied component of the Information Box.

SCENARIOS

Additionally, different scenarios are presented to convey how the Information Box is depicted under different circumstances.

On Apron

When the aircraft is situated on a labeled apron (i.e., any non-maneuvering area not controlled by ATC Tower that is identified in the SafeTaxi Database), the apron label name will be shown in the 'Currently Occupied' component of the Information Box. Additionally, the 'Approaching' component may show the object name and distance to the nearest edge of the object.



Figure 8-6 'On Apron' Scenario Examples

On Taxiway

When the aircraft is situated on a taxiway, the taxiway name will be shown in the 'Currently Occupied' component of the SurfaceWatch Information Box. If the aircraft heading is such that another geometric object (e.g., taxiway, runway, labeled apron) is encountered, the 'Approaching' component will show the object name and distance to the nearest edge of the object. When approaching an intersection of multiple taxiways, the taxiways will be listed in order of proximity in the 'Approaching' component. If the aircraft is within the intersection of multiple taxiways, the 'Crossing Taxiways/Runways' component title will display 'CROSSING' and the taxiway being crossed will be displayed with no distance shown.

ALERTS

The SurfaceWatch alert annunciations are displayed in the central portion of the PFW. The alert annunciations are accompanied by a corresponding voice alert. Other associated information is presented in the SurfaceWatch Information Box.

The following is a descriptive list of the SurfaceWatch alerts.

Alert Annunciation	Associated Voice Alert	Description
TWY TAKEOFF TWY LANDING	"Taxiway"	Issued when the aircraft is taking off from or landing on 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 calculated by the system. - The Runway Too Short Alert may be issued for any runway from which the aircraft is taking off from, or landing on, even if the runway is not the one entered by crew.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from or landing on a runway different than that entered into the system.

Table 8-1 SurfaceWatch Alert Annunciations

TAKEOFF ALERTS

The takeoff phase-of-flight, as determined by the system, must be valid in order for the system to issue Takeoff Alerts. Nominally, the aircraft will be in the SurfaceWatch 'Takeoff Phase-of-Flight' when the aircraft starts its takeoff maneuver (e.g., the power lever is pushed forward).

Taxiway Takeoff

The Taxiway Takeoff Alert is issued when the aircraft attempts to takeoff from a non-runway (e.g., a taxiway). The system determines this when the takeoff phase-of-flight is valid and the aircraft is not aligned with the runway.

In addition to the visual and voice alert, 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.

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 system determines this when the takeoff phase-of-flight is valid while the aircraft is aligned with a runway and the remaining runway length is less than the required takeoff distance calculated by PERF.



***NOTE:** 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 PERF.*

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.

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 into the system. Because it is somewhat common for ATC to redirect an aircraft to a different runway, this alert is a caution (amber) alert level as opposed to a warning (red) alert level.

In addition to the visual and voice alert, the Information Box contains a textual description of the currently occupied runway.

LANDING ALERTS

The On-Final phase-of-flight, as determined by the system, must be valid in order for the system to issue Landing Alerts. Nominally, the aircraft will be in the SurfaceWatch 'On-Final Phase-of-Flight' when the aircraft is on approach and nearing the airport to land (generally within a couple of nautical miles of the runway threshold).

Taxiway Landing

The Taxiway Landing alert is issued when the aircraft attempts to land on a non-runway (e.g., a taxiway). The system determines this when the On-Final phase-of-flight is valid and 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.

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 as calculated by the PERF function. The system determines this when the On-Final phase-of-flight is valid and the aircraft is aligned with a runway the PERF function has calculated to be too short.

***NOTE:** While the Runway Too Short alert may be issued for any runway with which the aircraft is aligned, the system will always calculate the runway length for the specific runway entered in PERF.*

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text "APPROACHING" above the runway designation and the text "RMNG" above the indicated remaining runway length.

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 PERF function. The system determines this when the On-Final phase-of-flight is valid and the aircraft is aligned with a runway that is not the landing runway entered in the PERF function or the active flight plan. Because it is somewhat common for ATC to redirect an aircraft to a parallel runway, this alert is a caution (amber) alert level as opposed to a warning (red) alert level.

Additionally, the Information Box will display the destination airport identifier, the runway with which the aircraft is aligned, and the distance to the runway.

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 PFW.

SurfaceWatch setup can be accomplished through flight plan origin and destination information or by using the PERF Takeoff Data and Landing Data Page.

Entering origin/destination airport when no flight plan has been entered:

1) From MFW Home, touch **Flight Plan > Add Origin** or **Add Destination** as appropriate.
2) Use the keypad to enter the Airport Identifier and touch **Enter**.

Selecting origin runway:

1) From MFW Home, touch **Flight Plan > Origin**.
2) On the 'Select Runway' Screen, scroll down as required and select the appropriate runway.

Selecting destination runway:

1) From MFW Home, touch **Flight Plan > Destination > Select Arrival Runway**.
2) On the 'Select Runway' Screen, scroll down as required and select the appropriate runway.

See the FMS Section for information on how to adjust the PERF Takeoff and Landing Data (from MFW Home, touch **PERF > Takeoff Data** or **PERF / Landing Data**. The **Runway Required** Button located on the **Runway** Tabs are used to adjust the length of the runway due to NOTAMs.

Selecting required takeoff / landing distance using the 'PERF' Page:

1) From MFW Home, touch **PERF > Takeoff Data.**
2) Touch the **Origin** Tab.
3) If not already selected, touch the **Runway** Button and select the takeoff runway.
4) Touch the **Runway** Tab. The 'Runway Available' Distance is automatically populated for runways supported with PERF data.
5) Touch the **Runway Required** Button and adjust the required takeoff distance as required.

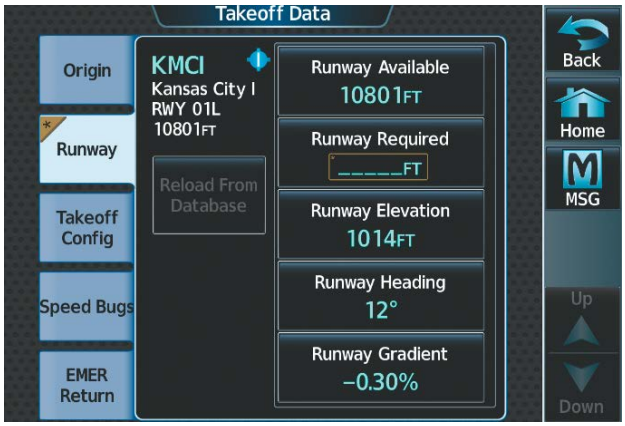


Figure 8-7 Adjusting Takeoff Runway Required

Selecting required landing distance:

1) From MFW Home, touch the **PERF > Landing Data.**
2) Touch the **DEST** Tab (if not already selected).
3) Touch the **Runway** Button and select the landing runway.
4) Touch the **Runway** Tab. 'The Runway Available' is automatically populated for runways supported with PERF data.
5) Touch **Runway Required** Button and adjust the required landing distance as required.

OPERATIONAL STATES

SurfaceWatch has four distinct operational states: Normal, Fail, Inhibited, and Disabled. These states and their annunciations will populate the 'Notifications' Page when applicable.

NOTE: *While a missing or invalid SafeTaxi Database will reduce functionality, SurfaceWatch will remain operational. All SurfaceWatch alerting is based on the Navigation Database. The SurfaceWatch Information Box will show only 'On' or 'Approaching' runway information if the SafeTaxi Database is missing or invalid or if the airport does not have SafeTaxi diagrams.*

Alert	Description
SURFACEWATCH FAIL (One or more inputs invalid)	The GPS or WAAS position could be invalid, or is insufficient due to RAIM position warning, loss of integrity, or the GPS horizontal protection level exceeds the LNAV/VNAV horizontal alert limit (556.0 meters). Heading Input could be invalid.
SURFACEWATCH INHIBITED (SurfaceWatch inhibited)	SurfaceWatch has been inhibited by the pilot. Aural and visual alerts are inhibited. Functionality will automatically reset on a system restart.
SURFACEWATCH DISABLED (Too far north/south)	Issued when the aircraft is positioned north of N 87° latitude or south of S 87° latitude.
NO RUNWAY POSITION DATA (Inhibit SurfaceWatch. No runway position data.)	If the runway entered in PERF or other pilot entry page does not have complete position information, SurfaceWatch will display this message indicating that SurfaceWatch should be inhibited by the pilot (see above procedure). Some airports within the Navigation database do not have surveyed runway position data for all runways at the airport (e.g., soft surface runways, turf, gravel, etc.). In these cases, SurfaceWatch may either issue alerts, or may not provide alerts, or may not be able to display complete Information Box data at that airport.

Table 8-2 SurfaceWatch Alerts

8.4 ELECTRONIC CHARTS

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 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.*

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

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

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 MFW.

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 'Charts Options' Screen under Preferred Source.

Selecting the preferred charts source:

1) From MFW Home, touch **Charts > Chart Selection** > **Charts Options.**
2) Ensure the desired chart source is available (indicated by a green check mark in the 'Dual Charts Status' Window). When the database age is beyond the disable date, an amber exclamation mark is displayed.
3) Touch the **Preferred Source** Button.
4) Touch either **ChartView** or **FliteCharts** to set as the preferred chart source. The current selection is then displayed on the **Preferred Source** Button.

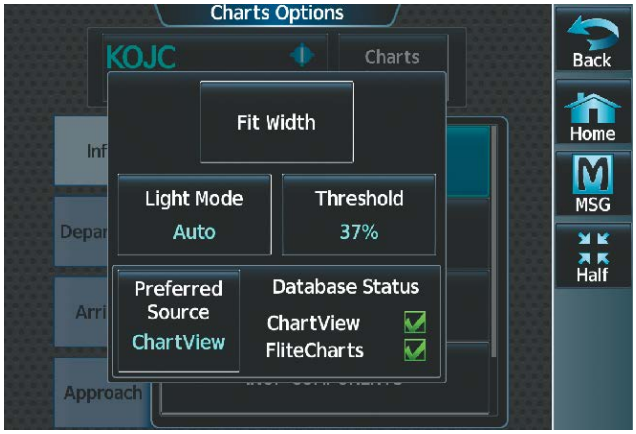


Figure 8-8 Charts Options Preferred Source Button

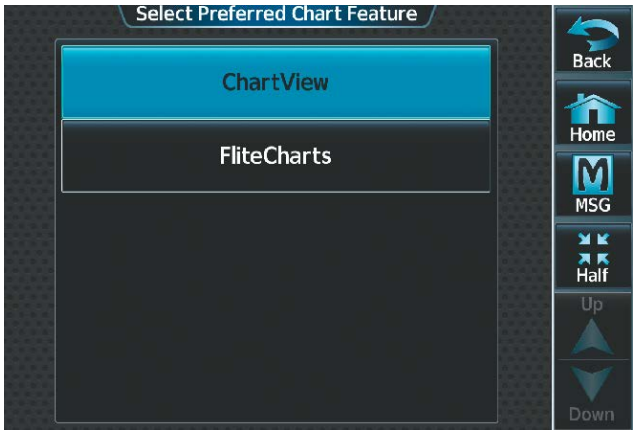


Figure 8-9 'Select Preferred Chart Feature' Screen

CHARTVIEW (OPTIONAL)

ChartView Electronic Charts resemble the paper version of Jeppesen Terminal Procedures Charts and can be viewed on the MFW. The charts are displayed in full color with high-resolution. The display pane depiction shows the aircraft position on the moving map in the plan view of approach charts and on airport diagrams.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the gray shading. Note, the gray shading is for illustrative purposes only and will not appear on the published chart or display pane. 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.

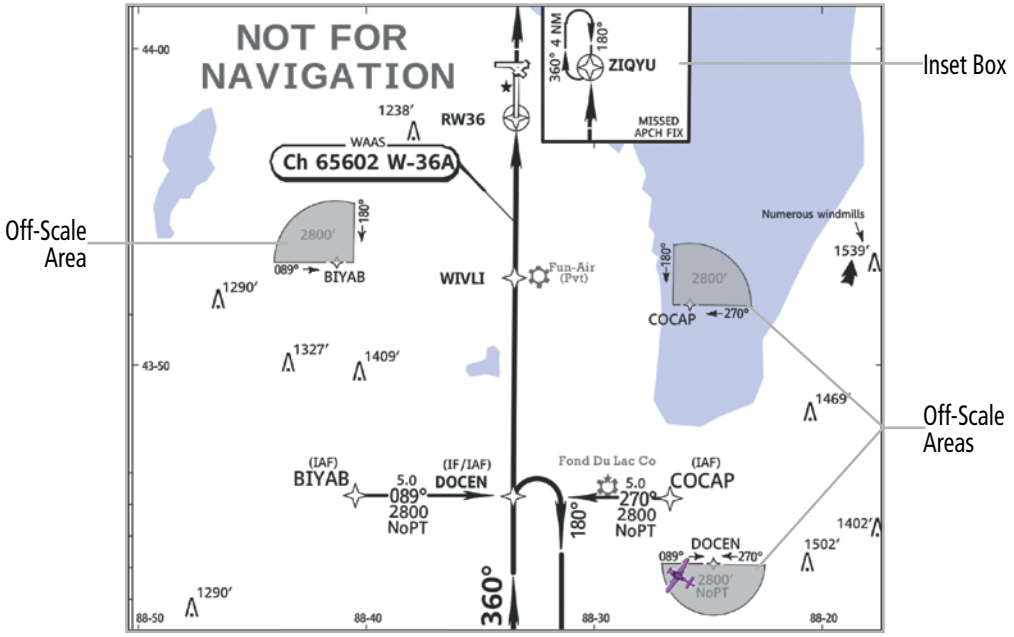


Figure 8-10 Sample Chart Indicating Off-Scale Areas

NOTE: *Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.*

The ChartView database subscription is available from Jeppesen, Inc. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams
- Chart NOTAMs

CHART SELECTION

When the aircraft is on the ground, the airport surface chart for the nearest airport will be selected. If the airport surface chart is not available, but a Takeoff Minimums chart is available, that chart will be selected.

When the aircraft is airborne and a direct-to is activated, the airport surface chart for that airport is selected. If airborne and the active leg of the flight plan is part of a procedure, the chart linked to that procedure is selected. If a procedure exists past the active leg of the flight plan, then the chart linked to the next procedure in the flight plan is selected. If a procedure is not being utilized, the last waypoint in the active flight plan is an airport, then the airport surface chart for that airport is selected. Finally, if none of the previously airborne scenarios are applicable, the airport surface chart for the nearest airport is selected.

Additionally, pressing the **SYNC POF** Button on the 'Charts' Page will cause the chart for the current phase of flight (POF) to be displayed.

Selecting charts using the 'Charts' Screen:

1) From MFW Home, touch **Charts > Chart Selection**.
2) The airport for which charts will be displayed is shown at the top of the 'Charts' Screen. Touch the **Airport** Button to enter another airport.
3) Touch the **Info** Tab to display the airport information selection buttons for the selected airport.
   a) Touch the **Departure** Tab to display a list of possible departures for the selected airport.
   b) Touch the **Arrival** Tab to display a list of possible arrivals for the selected airport.
   c) Touch the **Approach** Tab to display a list of possible approaches for the selected airport.
4) Touch the desired information button in any of these lists to display the applicable chart on the selected display pane.

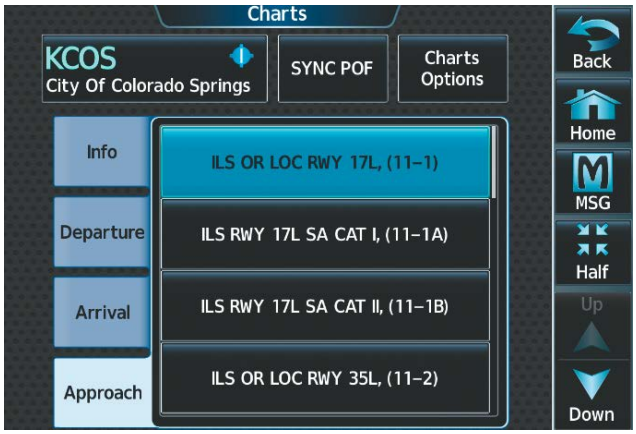


Figure 8-11 Airport Approach Selection

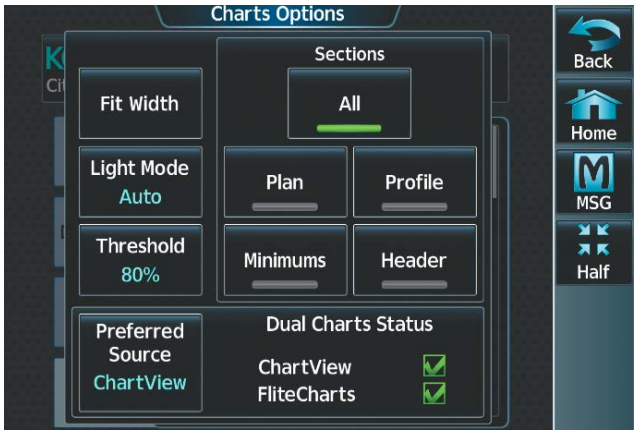


Figure 8-12 'Charts Options' Screen

5) Touch the **Charts Options** Button to select the desired display option for the selected chart (see previous figure).

6) Touch **All** to display the complete Airport Diagram. **Fit Width** displays the full width of the Airport Diagram. **Plan** displays only the diagram portion of the chart. **Minimums** displays only the approach minimums on an approach chart. **Profile** displays only the descent profile on the approach chart. **Header** displays the chart header. Only appropriate views are available for the selected chart.

7) Touch the **Back** Button to return to the 'Charts' Screen.

Zooming-in, zooming-out, rotating, and panning the displayed chart:

1) From MFW Home, touch **Charts > Chart Selection**.

2) Select the desired chart for display in the selected pane.

3) Push the lower knob. The 'Charts Pan/Zoom Control' Screen is displayed on the Touchscreen Controller as shown in the following figure.

4) Turn the lower knob, or use the pinch-and-zoom feature on the Touchpad to adjust the chart zoom.

5) Move a finger along the Touchpad, or turn the upper knobs to pan the displayed chart.

6) Touch the **Rotate** buttons to rotate the chart clockwise or counter-clockwise, as indicated on the button. Each touch of the button rotates the chart 90 degrees in the designated direction.

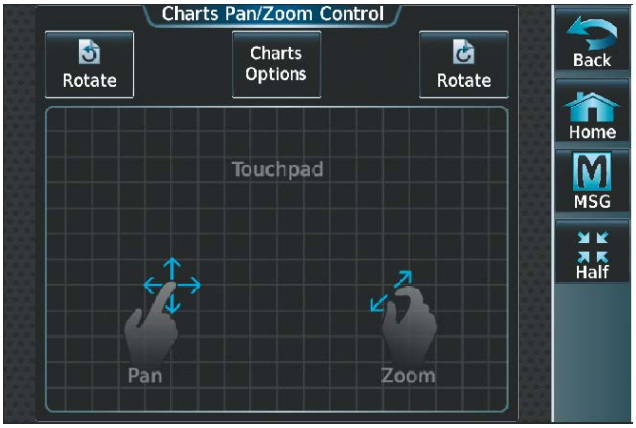


Figure 8-13 Pan and Zoom Touchpad

Selecting airport diagrams from the 'Nearest Airports' Screen:

1) From MFW Home, touch **Nearest** > **Airport**.
2) Touch the desired airport button. KCOS is selected in this example. The **Waypoint Options** buttons are displayed as shown in the following figure.

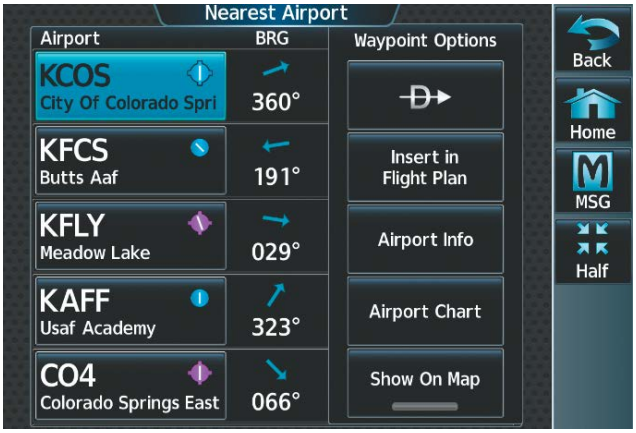


Figure 8-14 Airport Diagram Selection

3) Touch the **Airport Chart** Button. The **Info** Tab selections are displayed on the Touchscreen Controller and the Airport Diagram is displayed on the selected display pane.

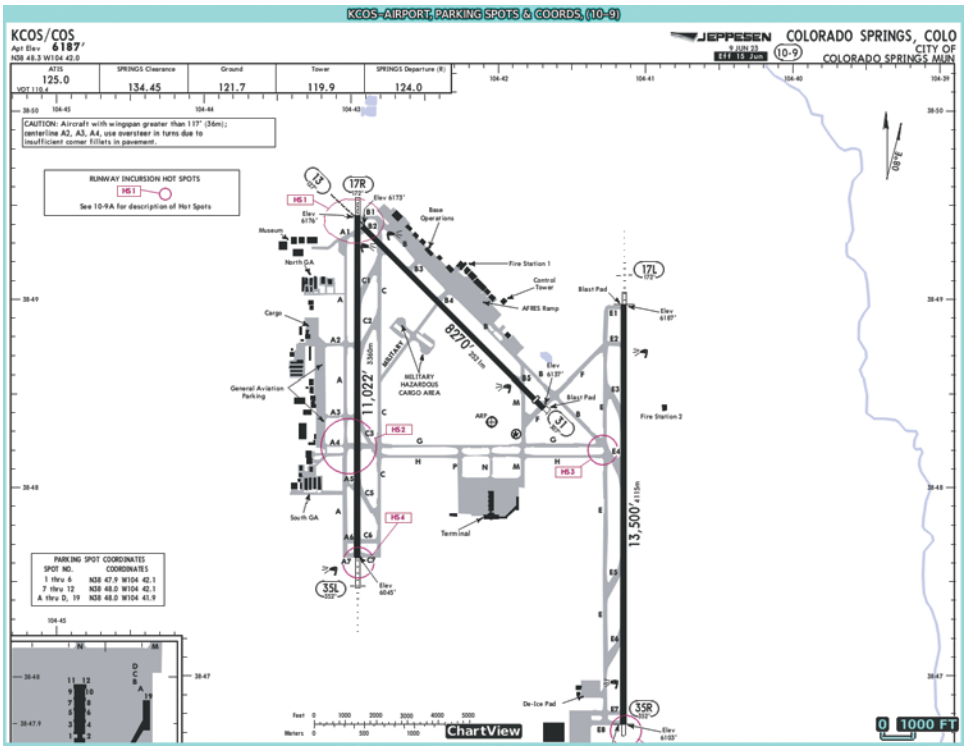


Figure 8-15 Airport Chart for Selected Airport

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.

When no terminal procedure chart is available for the nearest airport or the selected airport, the banner 'No Available Charts' appears on the screen. The 'No Available Charts' banner does not refer to the Jeppesen subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.



Figure 8-16 No Available Charts Banner

If there is a problem in rendering the data (e.g., a data error or a failure of an individual chart), the banner 'Unable To Display Chart' is then displayed.



Figure 8-17 Unable To Display Chart Banner

Phase of Flight Matching

The charts feature provides quick access to charts matching the current phase-of-flight (e.g., the departure, arrival, and approach phases).

Syncing charts to current phase of flight:

1) From MFW Home, touch **Charts > Chart Selection**.
2) From the 'Charts' Page, press the **SYNC POF** Button to cause the chart applicable to the current phase of flight to be displayed.



Figure 8-18 Phase of Flight Chart Syncing

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.

Selecting night, day, or auto view:

1) From MFW Home, touch **Charts** > **Chart Selection** > **Charts Options**.
2) Touch the **Light Mode** Button.
3) Touch the **Night**, **Day**, or **Auto** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

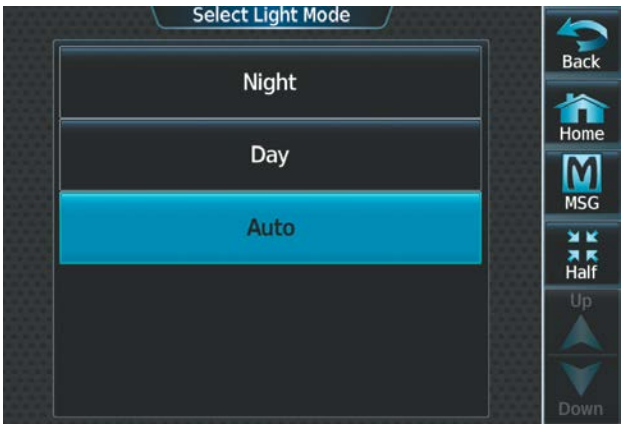


Figure 8-19 Selecting Day, Night, or Auto View

4) With 'Auto' selected, touch the **Threshold** Button. The 'Auto Light Mode Threshold' Window is displayed.



'Charts Options' Page

Adjust Threshold Setting

Figure 8-20 Setting Day/Night Switching Threshold

5) Move the slider left or right to set the desired threshold. Setting the Threshold Level percentage to the same percentage shown as the Current MFD Backlight Level will cause the Day/Night view to switch at the current backlight setting. Adjusting the Threshold Level setting larger than the Current MFD Backlight Level will cause the display to remain in Night Mode longer. Adjusting the Threshold Level setting smaller than the Current MFD Backlight Level will cause the display to change to Day Mode sooner.

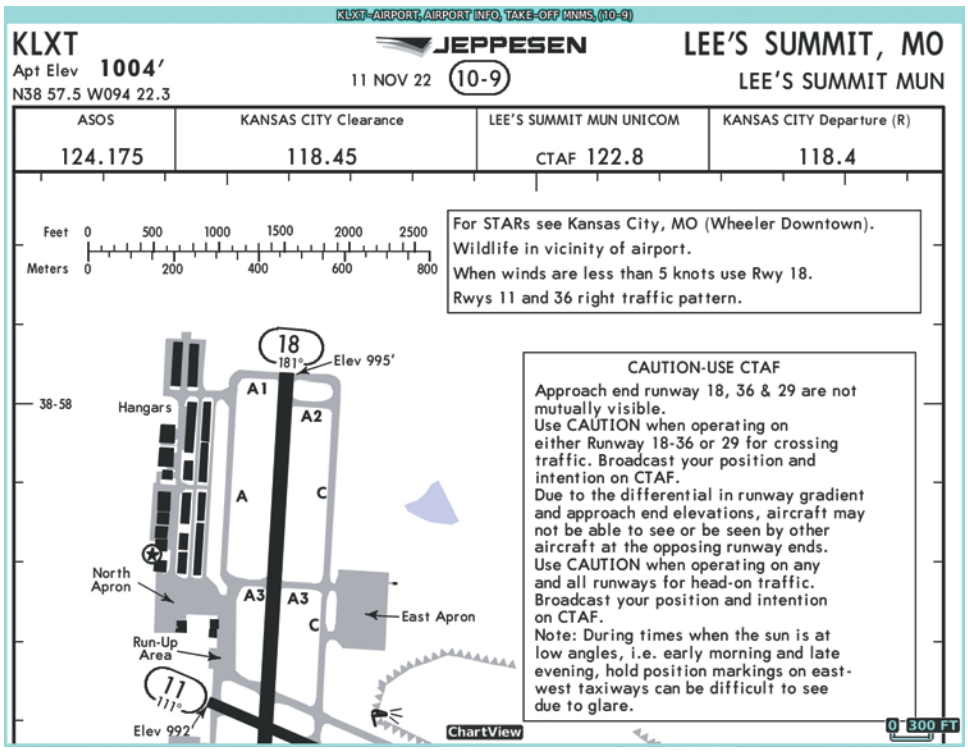


Figure 8-21 Airport Diagram, Day View

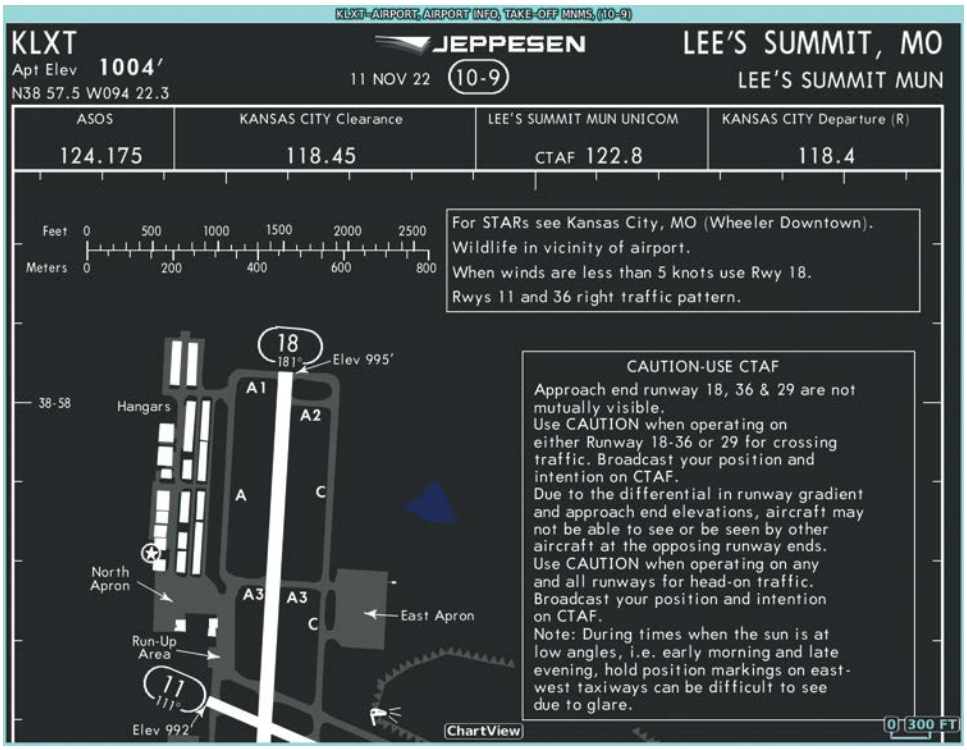


Figure 8-22 Airport Diagram, Night View

FLITECHARTS (OPTIONAL)

FliteCharts are electronic charts that resemble the paper version of AeroNav Services Terminal Procedures Charts. The charts are displayed with high-resolution and in color for applicable charts. The display pane depiction shows the aircraft position on the moving map and on airport diagrams.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. When the aircraft is not within the chart boundaries, the 'Aircraft Not Shown' Icon is displayed in the lower right corner of the MFD.



Figure 8-23 Aircraft Not Shown Icon

The following figure shows examples of off-scale areas, indicated by the gray shading. Note, the gray shading is for illustrative purposes only and will not appear on the published chart or display pane. 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.

NOTE: *Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.*

The FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams

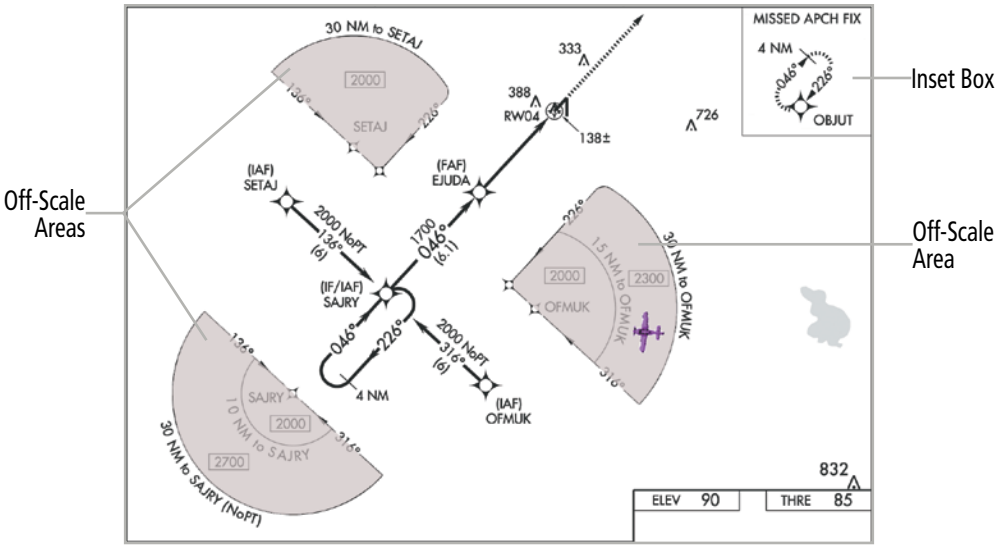


Figure 8-24 Sample Chart Indicating Off-Scale Areas

CHART SELECTION

When the aircraft is on the ground, the airport surface chart for the nearest airport will be selected. If the airport surface chart is not available, but a Takeoff Minimums chart is available, that chart will be selected.

When the aircraft is airborne and a direct-to is activated, the airport surface chart for that airport is selected. If airborne and the active leg of the flight plan is part of a procedure, the chart linked to that procedure is selected. If a procedure exists past the active leg of the flight plan, then the chart linked to the next procedure in the flight plan is selected. If a procedure is not being utilized, the last waypoint in the active flight plan is an airport, then the airport surface chart for that airport is selected. Finally, if none of the previously airborne scenarios are applicable, the airport surface chart for the nearest airport is selected.

Additionally, pressing the **SYNC POF** Button on the 'Charts' Page will cause the chart for the current phase of flight (POF) to be displayed.

Selecting charts using the 'Charts' Screen:

1) From MFW Home, touch **Charts > Chart Selection**.
2) The airport for which charts will be displayed is shown at the top of the 'Charts' Screen. Touch the **Airport** Button to enter another airport.
3) Touch the **Info** Tab to display the airport information selection buttons for the selected airport (see following figure).
   a) Touch the **Departure** Tab to display a list of possible departures for the selected airport.
   b) Touch the **Arrival** Tab to display a list of possible arrivals for the selected airport.
   c) Touch the **Approach** Tab to display a list of possible approaches for the selected airport.
4) Touch the desired information button in any of these lists to display the applicable chart on the selected display pane.



Figure 8-25 Airport Info Selection

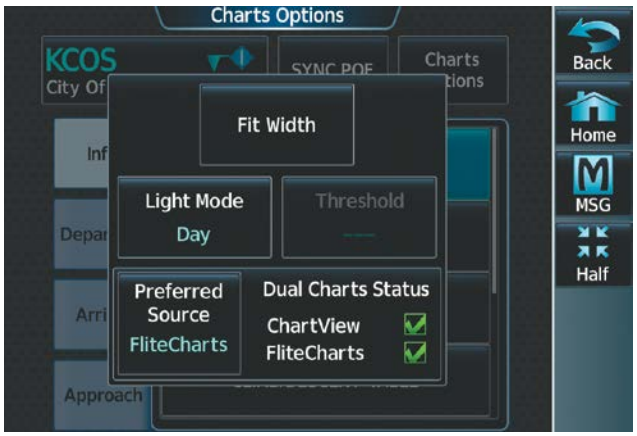


Figure 8-26 'Charts Options' Screen

5) Touch the **Charts Options** Button to select the desired display option for the selected chart.

6) Touch **Fit Width** to display the full width of the chart.

7) Touch the **Back** Button to return to the 'Charts' Screen.

Zooming-in, zooming-out, rotating, and panning the displayed chart:

1) From MFW Home, touch **Charts > Chart Selection**.

2) Select the desired chart for display in the selected pane.

3) Push the lower knob on the Touchscreen Controller. The 'Charts Pan/Zoom Control' Screen is displayed as shown in the following figure.

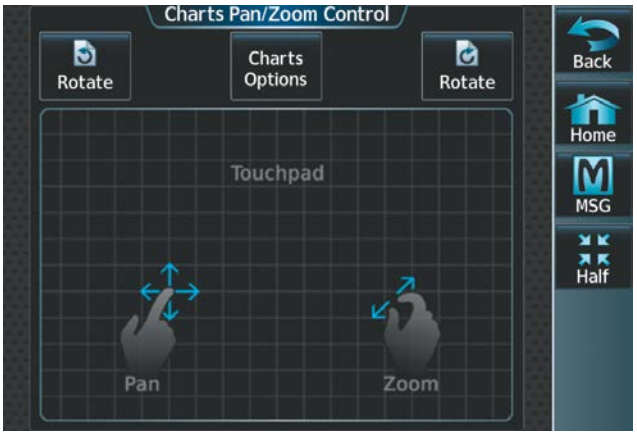


Figure 8-27 Touchpad Pan and Zoom

4) Turn the lower knob, or use the pinch-and-zoom feature on the Touchpad to adjust the chart zoom.

5) Move a finger along the Touchpad, or turn the upper knobs to pan the displayed chart.

6) Touch the **Rotate** buttons to rotate the chart clockwise or counter-clockwise, as indicated on the button. Each touch of the button rotates the chart 90 degrees in the designated direction.

Selecting airport diagrams from the 'Nearest Airports' Screen:

1) From MFW Home, touch **Nearest** > **Airport**.

2) Touch the desired airport button. KCOS is selected in this example. The **Waypoint Options** buttons are displayed as shown in the following figure.



Figure 8-28 Airport Diagram Selection

3) Touch the **Airport Chart** Button. The **Info** Tab selections are displayed on the Touchscreen Controller and the Airport Diagram is displayed on the selected display pane.

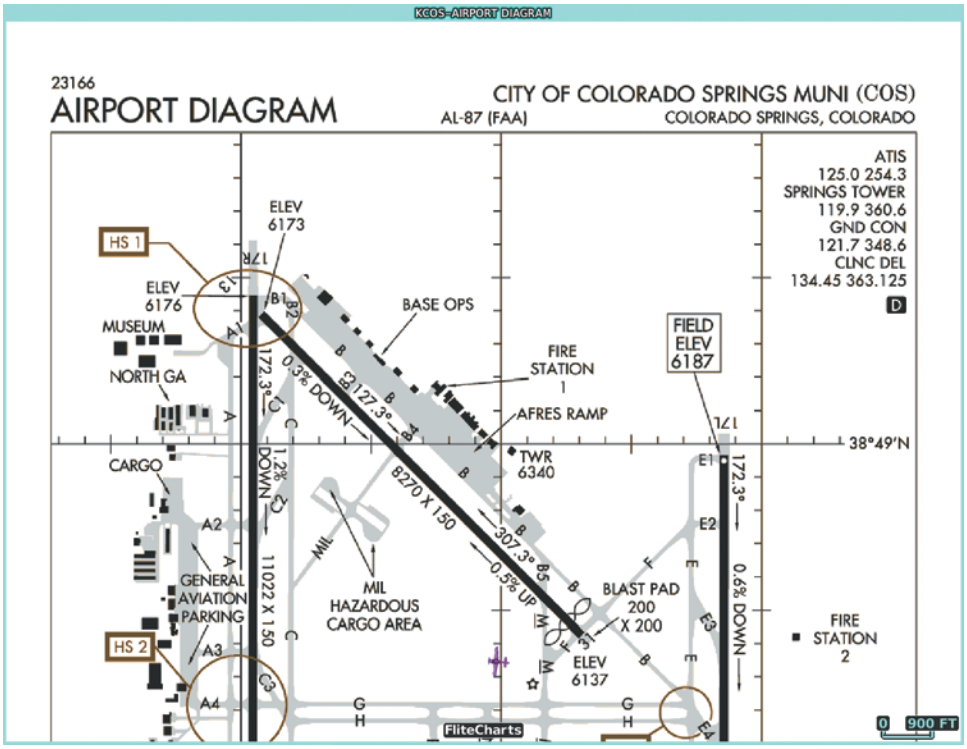


Figure 8-29 Airport Diagram for Selected Airport

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.

When no terminal procedure chart is available for the nearest airport or the selected airport, the banner 'No Available Charts' appears on the screen. The 'No Available Charts' banner refers the availability of a particular airport chart selection or procedure for a selected airport.



Figure 8-30 No Available Charts Banner

If there is a problem in rendering the data (e.g., a data error or a failure of an individual chart), the banner 'Unable To Display Chart' is then displayed.



Figure 8-31 Unable To Display Chart Banner

Phase of Flight Matching

The charts feature provides quick access to charts matching the current phase-of-flight (e.g., the departure, arrival, and approach phases).

Syncing charts to current phase of flight:

1) From MFW Home, touch **Charts > Chart Selection**.
2) From the 'Charts' Page, press the **SYNC POF** Button to cause the chart applicable to the current phase of flight to be displayed.



Figure 8-32 Phase of Flight Chart Syncing

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.

Selecting Night, Day, or Auto view:

1) From MFW Home, touch **Charts** > **Chart Selection** > **Charts Options**.
2) Touch the **Light Mode** Button.
3) Touch the **Night**, **Day**, or **Auto** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

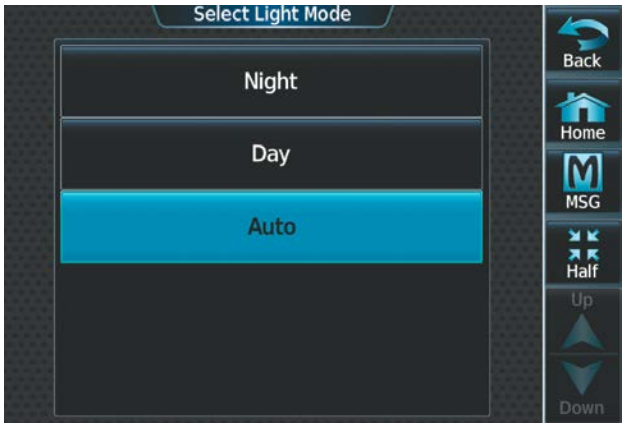
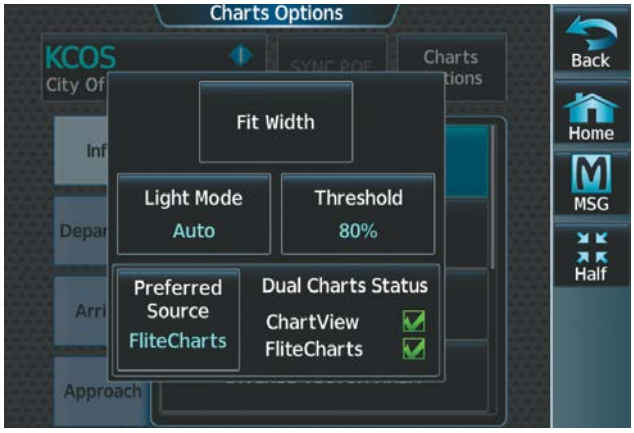
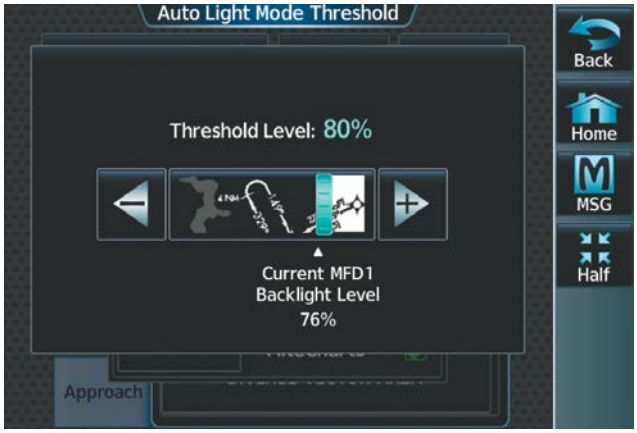


Figure 8-33 Selecting Day, Night, or Auto View

4) With 'Auto' selected, touch the **Threshold** Button. The 'Auto Light Mode Threshold' Window is displayed.



'Charts Options' Page



Adjust Threshold Setting

Figure 8-34 Setting Day/Night Switching Threshold

5) Move the slider left or right to set the desired threshold. Setting the Threshold Level percentage to the same percentage shown as the Current MFD Backlight Level will cause the Day/Night view to switch at the current backlight setting. Adjusting the Threshold Level setting larger than the Current MFD Backlight Level will cause the display to remain in Night Mode longer. Adjusting the Threshold Level setting smaller than the Current MFD Backlight Level will cause the display to change to Day Mode sooner.

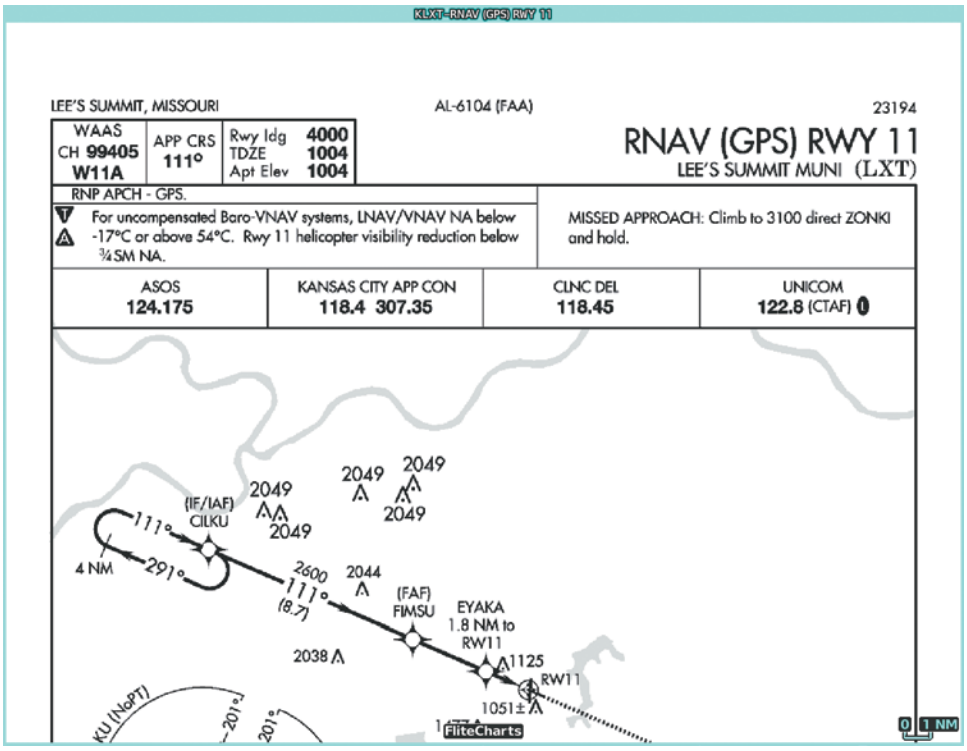


Figure 8-35 Approach Chart, Day View



Figure 8-36 Approach Chart, Night View

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 2.5 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 greater than 7.5 nm or more will show the Sectional chart. Once the range is decreased to 7.5 nm or below, the system will automatically change the displayed chart from the Sectional to the TAC.

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

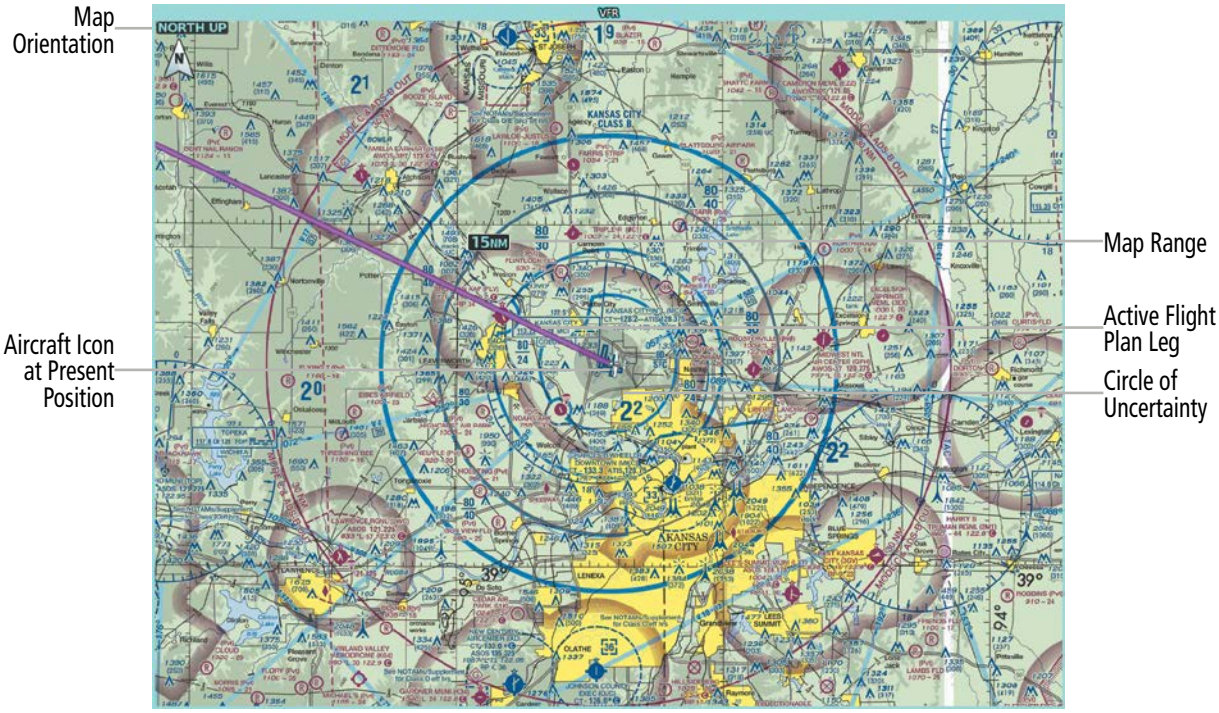


Figure 8-37 GPS Navigation Information on the VFR Chart

Selecting the chart to display:

1) From MFW Home, touch **Map > Map Selection**.
2) Touch the desired Chart Button (**VFR**, **IFR Low**, or **IFR High**).

Modifying the VFR, IFR Low, and IFR High chart settings:

1) From MFW Home, touch **Map > Map Selection**.
2) Touch the desired Chart Button. The selected chart is displayed on the active display pane, and the button on the Touchscreen Controller becomes the Chart Settings Button (**VFR Settings** Button**, IFR Low Settings** Button, or **IFR High Settings** Button).
3) Touch the Chart Settings Button to display the applicable settings screen ('VFR Charts Settings' Page or 'IFR Charts Settings' Page.

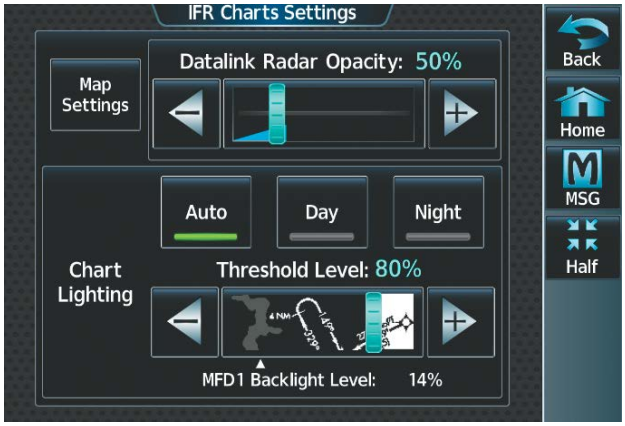


Figure 8-38 'IFR Charts Settings' Page

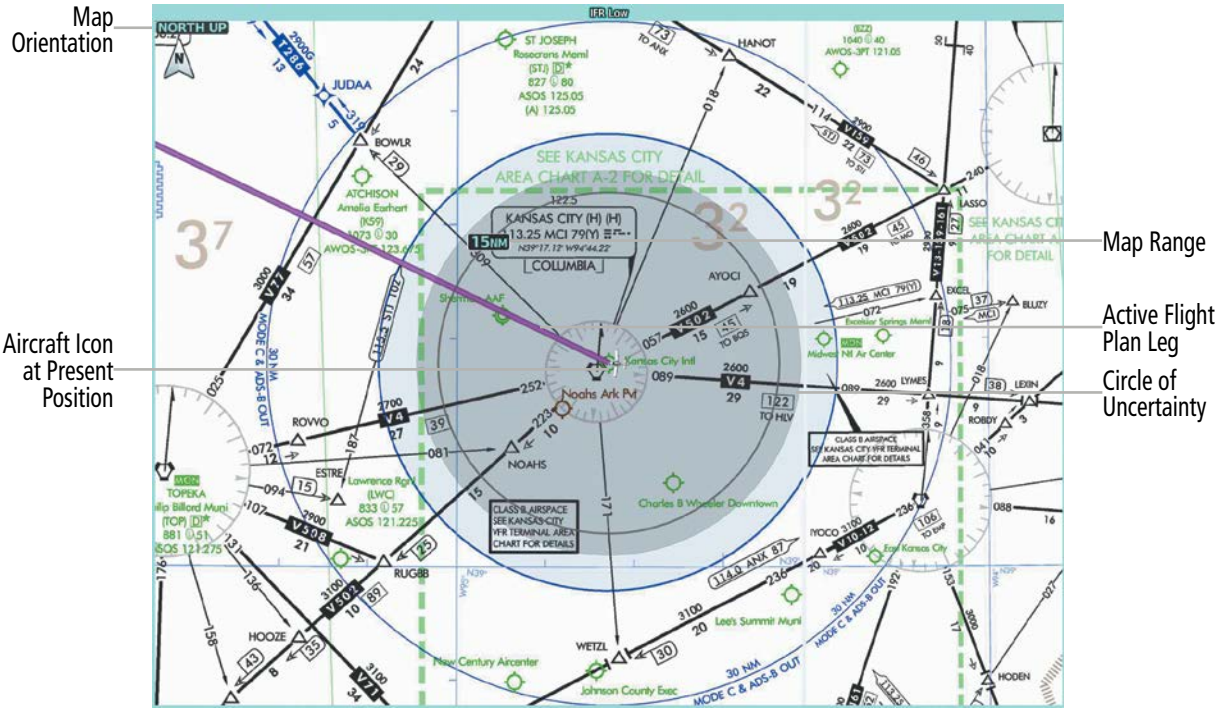


Figure 8-39 IFR Low Altitude Chart

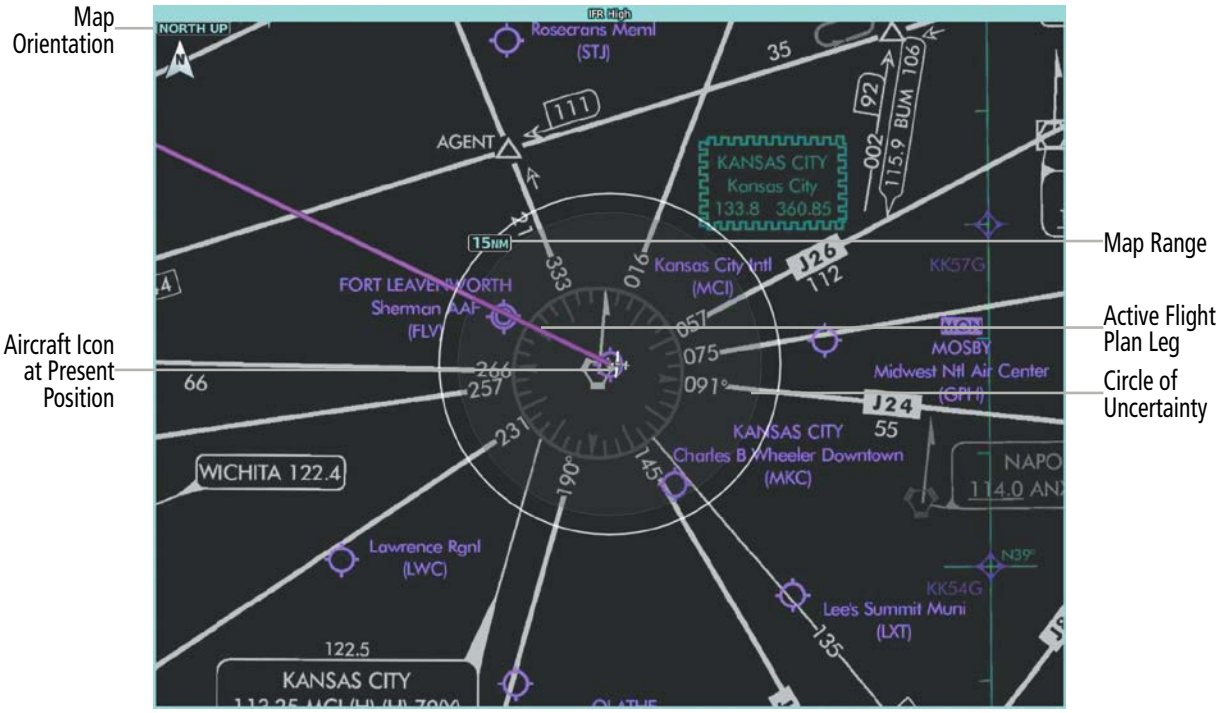


Figure 8-40 IFR Night High Altitude Chart

DAY/NIGHT VIEW

IFR Charts 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.

Selecting Day, Night, or Auto View:

1) From MFW Home, touch **Map > Map Selection > VFR, IFR Low,** or **IFR High**.
2) Touch the applicable settings button: **VFR Settings, IFR Low Settings,** or **IFR High Settings**.
3) Touch the **Light Mode** Button.
4) Touch the **Day**, **Night**, or **Auto** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

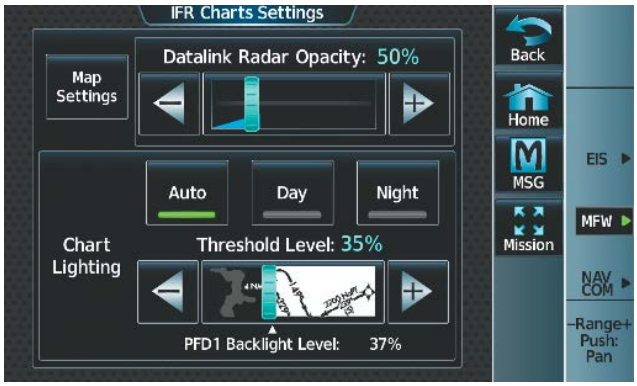


Figure 8-41 Selecting Day, Night, or Auto View

5) With 'Auto' selected, the **Threshold** Slider is no longer grayed out.

6) Move the slider left or right to set the desired threshold. Setting the Threshold Level percentage to the same percentage shown as the Current PFD1 Backlight Level will cause the Day/Night view to switch at the current backlight setting. Adjusting the Threshold Level setting larger than the Current PFD1 Backlight Level will cause the display to remain in Night Mode longer. Adjusting the Threshold Level setting smaller than the Current PFD1 Backlight Level will cause the display to change to Day Mode sooner.

TRAFFIC AND WEATHER OVERLAYS

Traffic symbols and labels as well as weather can be configured and overlaid onto IFR/VFR charts.

Viewing traffic on the IFR Low, IFR High, or VFR chart:

1) From MFW Home, touch **Map > Map Selection** > **Map Settings**.

2) Touch the 'Sensor' Tab. Touch the **Traffic** Button to enable the traffic overlay. A green annunciator indicates the feature is enabled.

Configuring traffic overlay settings:

1) From MFW Home, touch **Map > Map Selection** > **Map Settings**.

2) Touch the 'Sensor' Tab. Touch the Traffic **Settings** Button, then touch the **Map Settings** Button.



Figure 8-42 'Traffic Settings' Screen

3) Touch the **Symbols** Button. Choose the range at which traffic symbols will be displayed and below (e.g., 100 nm and below).

4) Touch the Labels Button to enable the feature.

5) Touch the **Labels** Button with the nautical mile range below. Choose the range at which traffic labels will be displayed and below (e.g., 100 nm and below).

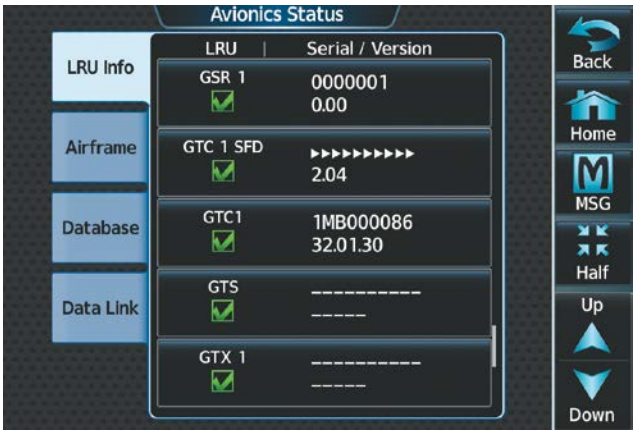


Figure 8-43 Traffic Overlay on IFR Low Chart

Viewing weather on the IFR Low, IFR High, or VFR chart:

1) From MFW Home, touch **Map > Map Selection** > **Map Settings**.

2) Touch the 'Sensor' Tab. Touch the **Graphical METARs** Button, the **NEXRAD** Button, the **Datalink Lightning** Button, the **Stormscope Lightning** Button, or the **TFR** Button.

The WX Source Button is used to select the source of weather information: **SiriusXM**, **Connext**, or **FIS-B** Weather.

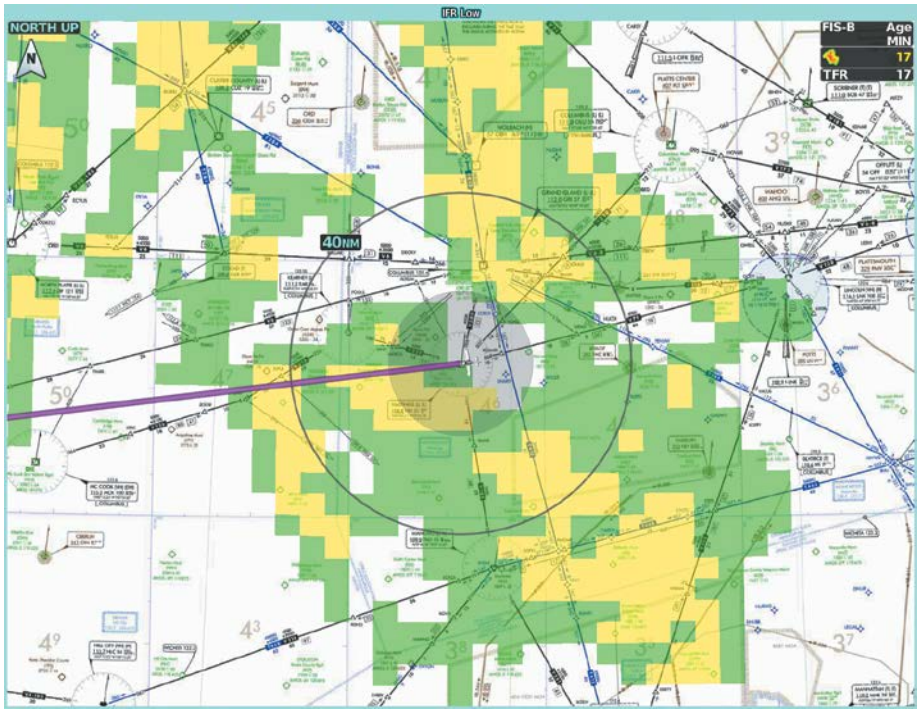


Figure 8-44 FIS-B Weather Displayed on the IFR High Chart

8.5 SATELLITE TELEPHONE & DATALINK SERVICES (OPTIONAL)

NOTE: *Do not rely solely upon datalink 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: *Separate accounts must be established to access the Iridium Satellite Network for voice and Garmin Connext for data transmission of maintenance reports.*

The optional Iridium Transceiver (GSR 56) provides an airborne low speed datalink, Iridium Satellite Telephone service and SMS text messaging. The telephone is available to the flight crew through the audio panel and headsets.

If installed, the Wireless Transceiver (Flight Stream 510) provides a Bluetooth connection to the aircraft which allows a Portable Electronic Device (PED) running the Garmin Pilot app to control telephone calls and text messages from the PED. See the Garmin Pilot for iOS Manual or the Garmin Pilot for Android Manual for detailed discussion of these features involving a PED.

The GMA™ 36B Audio Controller also provides a Bluetooth connection to the aircraft for audio which allows a PED to make and receive telephone calls and utilize PED contacts on the Touchscreen Controller.

CONNEXT REGISTRATION

A subscriber account must be established before using the Iridium Satellite System. Before setting up an Iridium account, obtain the System ID and serial number of the Iridium Transceiver (GSR1) by performing the following procedure. Contact Garmin Connext at flyGarmin.com®.

Registering the system for datalink services:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Status**.
2) If necessary, touch the **Airframe** Tab. Note the System ID. This number will be needed when contacting Garmin Connext to establish the account.



Figure 8-45 System ID Number

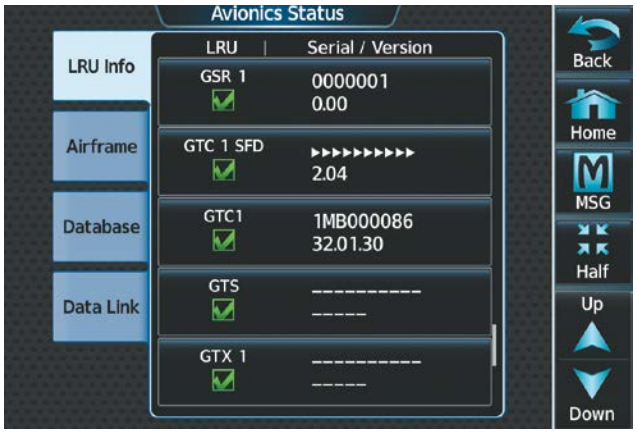


Figure 8-46 Iridium Transceiver Serial Number (GSR1)

3) Touch the **LRU Info** Tab. Scroll to view 'GSR1.' Note the serial number of each will also be needed when contacting Garmin Connext.

4) Contact Garmin Connext to establish an account and receive an access code.

5) From MFW Home, touch **Services > Connext Setup >**, then touch the **REG** Tab.

6) Press the **Register** Button.

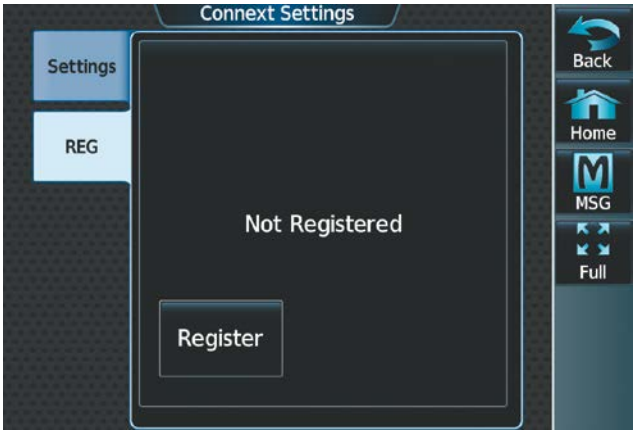


Figure 8-47 'Connext Settings' Page



Figure 8-48 Entering the Access Code

7) Enter the access code.

8) Touch the **Enter** Button.

BLUETOOTH ENHANCEMENTS

When the GMA 36B Audio Controller is installed, the system supports a Bluetooth link for audio to a Portable Electronic Device (PED) (e.g., a personal cell phone, Garmin VIRB®, etc.). See the Connext Section in Additional Features for PED pairing instructions. This link enables a two-way telephone call between the system and the PED. This arrangement allows the flight crew to talk on a PED cell phone call through the aviation headset. The system also supports exchange of telephone related data and control commands between the PED and the Garmin Integrated Flight Deck (GIFD). These controls allow the flight crew to manage incoming and outgoing cell phone calls without requiring access to the PED based menu.

When a PED Bluetooth link is connected to the system, the system provides the following capability through the Touchscreen controller based user interface. This menu is located on the 'Services' Page. With a Bluetooth audio connection you can:

- Answer, ignore, hold, or end a call.
- View a calling number and name as reported by the connected PED.
- Initiate a call from the Touchscreen Controller using avionics contacts, Bluetooth contacts, or the dial pad
- See the signal strength graphic for the connected cell phone.
- Isolate the call to the pilot/copilot (using the **Isolate** Button).

The flight crew can manually add contacts to the contacts list ('Stored' Contacts). Alternately, the system can import contacts directly from the PED ('Pilot Bluetooth' Contacts). The flight crew can browse these imported contacts and initiate a cell phone call. The system automatically syncs PED contacts after the Bluetooth connection is made.

NOTE: *For Android devices, you must allow your device to share your contacts when the connection is established. For Apple devices, you must first establish the Bluetooth connection. Then on your PED, go into Bluetooth settings for the connected device and allow contacts to sync.*

CONTACTS

Names, telephone numbers, and email addresses may be entered and stored. These contacts may be used to place telephone calls or send email and text messages.

Creating a new stored contact:

1) From MFW Home, touch **Services** > **Contacts**. Touch the **Stored** Tab if not already selected.
2) The 'Contacts' Screen is displayed.



Figure 8-49 'Services' Page



Figure 8-50 'Contacts' List

3) Touch the **Create New** Button.
4) Touch the **Name** Button. The 'Contact Name' Entry Screen is displayed.



Figure 8-51 Enter New Contact Information



Figure 8-52 Enter Name

5) Enter the name of the new contact.
6) Touch the **Enter** Button.
7) If desired, touch the **Favorite** Button to designate the new contact as a favorite. A green annunciator indicates the contact is now designated as a favorite.
8) Touch the **Telephone Number** Button. The 'Phone Number' Entry Screen is displayed.



Figure 8-53 Select Telephone Number



Figure 8-54 Enter Telephone Number

9) Enter the telephone number of the new contact.

10) Touch the **Enter** Button.

11) Touch the **Email Address** Button (scroll down as required). The 'Email Address' Entry Screen is displayed.



Figure 8-55 Select Email Address



Figure 8-56 Enter Email Address

12) Enter the email address of the new contact.

13) Touch the **Enter** Button.

14) Touch the **Create** Button. The new contact is created and appears in the list of contacts. If the contact was selected as a 'Favorite,' a star symbol will display on the right side of the contact button to indicate this selection.

NOTE: *Refer to the Connext Chapter for instructions on connecting a Bluetooth device to the system.*

Viewing contacts from a Bluetooth connected PED:

1) From MFW Home, touch **Services** > **Contacts**.

2) Touch the **Pilot Bluetooth** Tab. Once a PED is connected to the system, contacts in this tab will automatically populate.



Figure 8-57 'Contacts' List

Editing a contact:

1) From MFW Home, touch **Services** > **Contacts**. Touch the **Stored** Tab if not already selected.
2) Touch the contact you desire to edit.
3) Touch the information field that you would like to edit.
4) When changes are complete, touch the **Save** Button.

Deleting a contact:

1) From MFW Home, touch **Services** > **Contacts**.
2) Touch the contact you desire to delete.
3) Touch **Delete**.
4) Touch **OK**.

Deleting all contacts:

1) From MFW Home, touch **Services** > **Contacts**.
2) Touch **Options**.
3) Touch **Delete All Contacts**.
4) Touch **OK**.

TELEPHONE COMMUNICATION

NOTE: *Iridium transceiver setup may differ based on aircraft configuration.*

The pilot or copilot can place and answer calls on the Iridium Satellite Network or through a Bluetooth connected PED using the GMA 36B Audio Controller. Ensure telephone audio is enabled for the pilot and/or copilot when using the satellite telephone feature. Reference the Audio & CNS Section for information regarding enabling and disabling telephone audio.

Viewing the 'Telephone' Screen:

1) From MFW Home, touch **Services** > **Satellite Phone**.
2) The 'Satellite Phone' Screen is displayed.



Figure 8-58 'Services' Screen

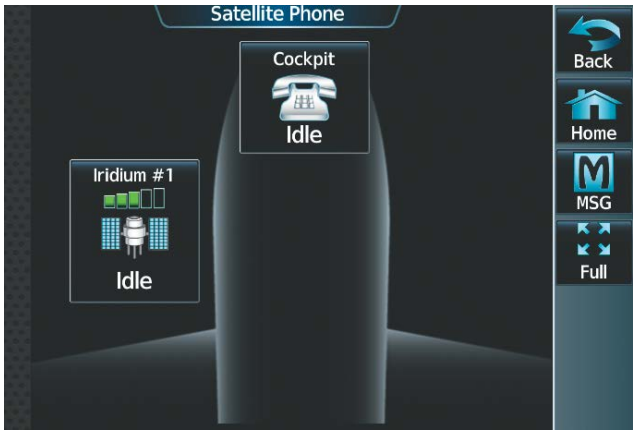


Figure 8-59 'Satellite Phone' Screen

The 'Satellite Phone' Screen gives a graphical representation of the current disposition of voice 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

Internal Phone	External Phone	Description
		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

ENABLING/DISABLING THE IRIDIUM TELEPHONE SYSTEM

The Iridium Satellite Telephone System may be disabled by the flight crew. When disabled, incoming calls will not be received and outgoing calls will not be possible from the cockpit.

Enabling/disabling the Iridium Telephone System:

1) From MFW Home, touch **Services** > **Satellite Phone**.
2) Touch the **Iridium #1** Button to display the 'Satellite Phone - Iridium #1 Transceiver' Screen.
3) Touch the **Disable Iridium Transmission** Button to disable the transceiver. A green annunciator indicates Iridium transmission is disabled. Touch the button again to enable the transceiver. A gray annunciator indicates Iridium transmission is enabled.



Figure 8-60 Iridium Transceiver Enabled



Figure 8-61 Iridium Transceiver Disabled

INCOMING CALLS

Incoming voice calls from an external telephone through the Iridium Satellite Network or through a Bluetooth connected PED using the GMA 36B Audio Controller are annunciated by a ring tone and flashing **PHONE** Button on the Touchscreen Controller Button Bar, as well as a flashing annunciation in the upper left corner of the PFW.

Answering a call:

1) Touch the flashing **PHONE** Button. The 'Notifications' Screen is displayed.
2) Touch the **Answer** Button. The call is now connected as indicated. Touching the **Ignore** Button extinguishes the new call annunciation and the call remains disconnected.



Figure 8-62 Incoming Call Notification

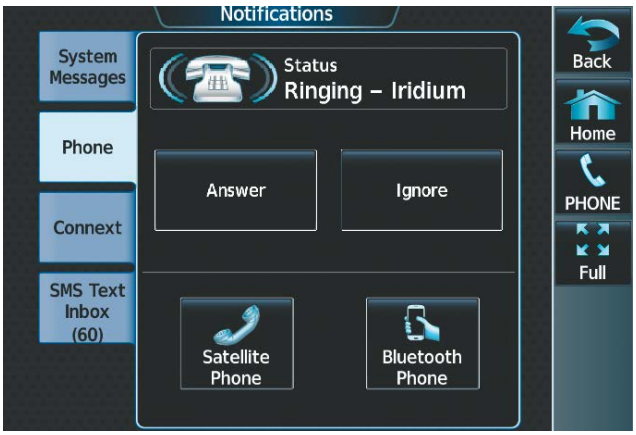


Figure 8-63 'Phone' Tab Selected

3) When the call is finished, touch the **End Call** Button to disconnect the call.



Figure 8-64 Iridium Call Answered



Figure 8-65 PED Over Bluetooth Call Answered

OUTGOING CALLS

Voice calls can be made from the cockpit to an external telephone through the Iridium Satellite Network or through a Bluetooth connected PED using the GMA 36B Audio Controller.

Making an external call using a telephone number:

1) From MFW Home, touch **Services** > **Satellite Phone**.
2) Touch the **Cockpit** Phone Button. The 'Satellite Phone - Cockpit' Screen is displayed.
3) Touch the **Dial** Button. The phone number entry screen is displayed.



Figure 8-66 'Satellite Phone - Cockpit' Screen



Figure 8-67 Telephone Number Entry

4) Using the number keys, enter the phone number.

The International dialing sequence is necessary to place a call from the cockpit to an external phone: Country Code + City/Area Code (if any) + Telephone Number. The following country codes may be used when calling other satellite telephone systems.

Satellite System	Country Code
Inmarsat	870
ICO	8810 or 8811
Ellipso	8812 or 8813
Iridium	8816 or 8817
Globalstar	8818 or 8819

Table 8-4 International Calling Codes

5) Touch the **Send** Button. The system now begins establishing a connection. The system indicates a completed connection when the telephone is answered.

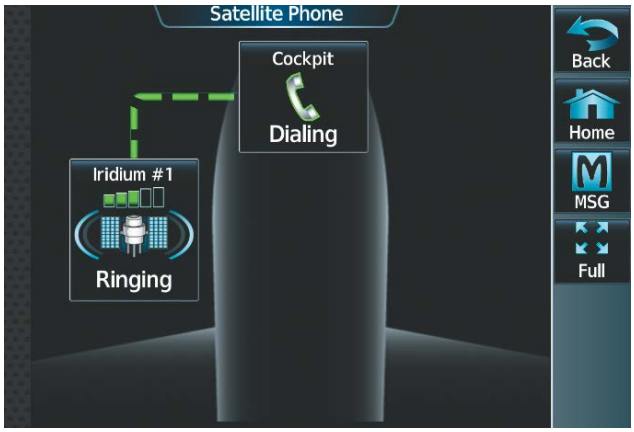


Figure 8-68 Establishing a Connection

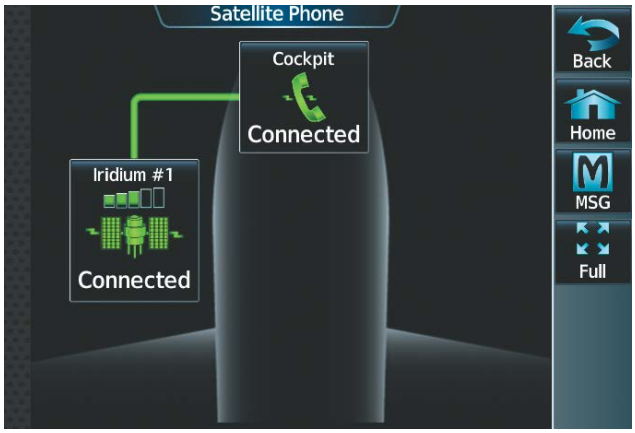


Figure 8-69 Telephone Connected

Making an external call by selecting a contact:

1) From MFW Home, touch **Services > Contacts**. Touch the **Stored** Tab (if not already selected).
2) Touch the button corresponding to the desired contact. The selected contact is displayed.



Figure 8-70 'Contacts' List



Figure 8-71 Contact Chosen

3) Touch the **Call or Send Text** Button. A selection screen is displayed.

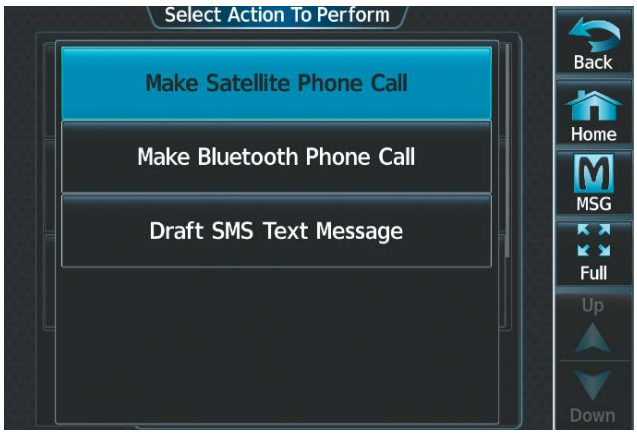


Figure 8-72 Select Action To Perform

4) Touch the **Make Satellite Phone Call** Button.

   Or:

   Touch the **Make Bluetooth Phone Call** Button. The system initiates the call. The system indicates a completed connection when the telephone is answered.

Making a call using a contact from a Bluetooth connected PED:

1) From MFW Home, touch **Services** > **Contacts**. Touch the **Pilot Bluetooth** Tab.
2) Touch the button corresponding to the desired contact. The selected contact is displayed.

   Touch the **Copy To Stored Contacts** Button to save the contact in the **Stored** Tab on the Touchscreen Controller.

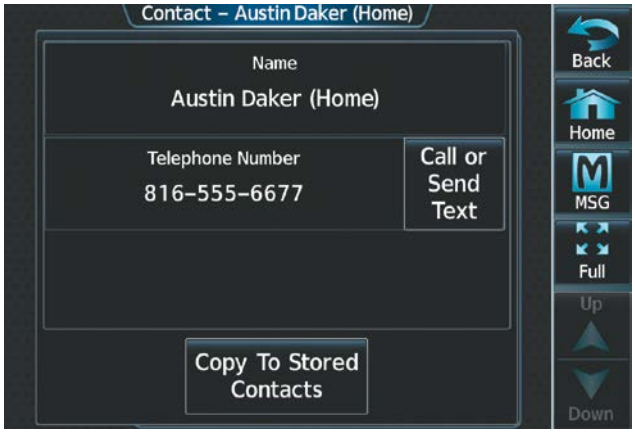


Figure 8-73 Bluetooth Contact Selected

3) Touch the **Call or Send Text** Button. A selection screen is displayed.

4) Touch the **Make Bluetooth Phone Call** Button. The system initiates the call using the connected PED. The system indicates a completed connection when the telephone is answered.



Figure 8-74 Dialing Using a PED with Bluetooth



Figure 8-75 Connected PED Call Over Bluetooth

When numeric entries are required during a call, such as selecting menu items like "dial zero to get an operator", a phone keypad is available to access the numeric softkeys.

Entering numbers during an Iridium call:

1) From MFW Home, touch **Services** > **Satellite Phone**.

2) With a call already connected, touch the **Cockpit** Phone Button. The 'Satellite Phone - Cockpit' Screen is displayed.

3) Touch the **Open Keypad** Button. The 'Phone Keypad' Screen is displayed.

4) Utilize the keypad as necessary.



Figure 8-76 Open Keypad Button



Figure 8-77 Phone Keypad

If a call is connected and a third party attempts a call, the 'Notifications' Screen will display a 'Call Waiting' Message.

Placing a call on hold:

From the **Phone** Tab on the 'Notification's Screen, press the **Hold Active Call And Answer** Button.

Or:

Press the **Ignore** Button.



Figure 8-78 Call Waiting

Or:

When a call is connected over Bluetooth, touch the **Hold Active Call** Button.



Figure 8-79 Placing a Bluetooth Call on Hold

Ending a call:

1) From MFW Home, touch **Services** > **Satellite Phone**.
2) Touch the **Cockpit** Phone Button. The 'Cockpit Phone' Screen is displayed.
3) Touch the **End Call** Button.



Figure 8-80 Ending the Call

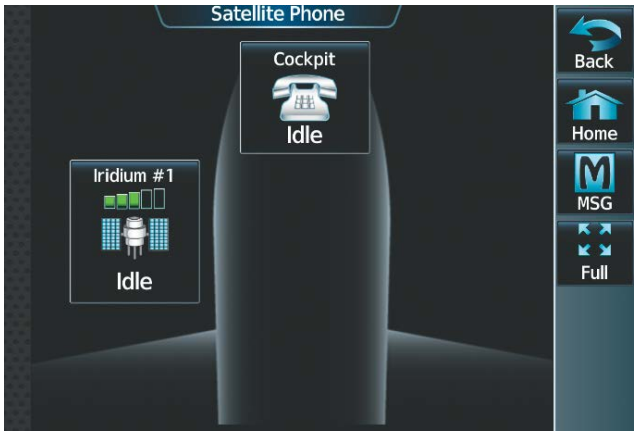


Figure 8-81 System is Idle After Ending Call

MANAGING TELEPHONE AUDIO

NOTE: *The **Push-to-Talk** Switch is not utilized for telephone communication. The microphone is active whenever a call is connected and telephone audio is enabled.*

NOTE: *A call must be connected in order to view the cockpit phone options.*

When an incoming call is received or an outgoing call is made, telephone audio (which includes headset and microphone) is automatically enabled for either the pilot or copilot, depending on which Touchscreen Controller was used to make or answer the call. If the pilot or copilot wishes to join an existing call, the telephone audio must be enabled manually on the Touchscreen Controller. When the call is ended, telephone audio is automatically disabled. The green **Pilot Audio** Annunciator Button indicates pilot audio is enabled on the pilot-side Touchscreen Controller. The copilot-side controller will, likewise, indicate a green **Copilot Audio** Annunciator Button. Pilot and copilot telephone audio can be enabled and disabled manually by performing the steps in the following procedure.

Additionally, the pilot or copilot may choose to silence their radios during a call. After silencing the radios, the pilot or copilot radio audio is muted for the duration of the call and the annunciation "Pilot Radios Muted - Pilot radios are muted" or "Copilot Radios Muted - Copilot radios are muted" is provided on the Touchscreen Controller as a system message. Once the call is complete, radio audio will automatically unmute.

Enabling/disabling telephone audio and adjusting volume:

1) After a call is connected, from MFW Home, touch **Services** > **Satellite Phone**.
2) Touch the **Cockpit** Phone Button. The 'Satellite Phone - Cockpit' Screen is displayed.



Figure 8-82 Managing Telephone Audio

3) Touch the **Pilot Audio** or **Copilot Audio** Annunciator Button to disable telephone audio, including microphone (gray annunciator).
4) Touch the Annunciator Button again to enable telephone audio, including microphone (green annunciator).
5) Touch and move the **Volume** Slider on the appropriate Touchscreen Controller to adjust the telephone volume.

TEXT MESSAGING (SMS)

The pilot or copilot can send and receive short message service (SMS) 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.

Incoming SMS messages are annunciated by a flashing **SMS** Button on the Touchscreen Controller Button Bar, as well as a flashing 'SMS' annunciation in the upper left corner of the PFW display.

Viewing the 'SMS Text Messaging' Screen:

From MFW Home, touch **Services** > **Satellite SMS Text.**

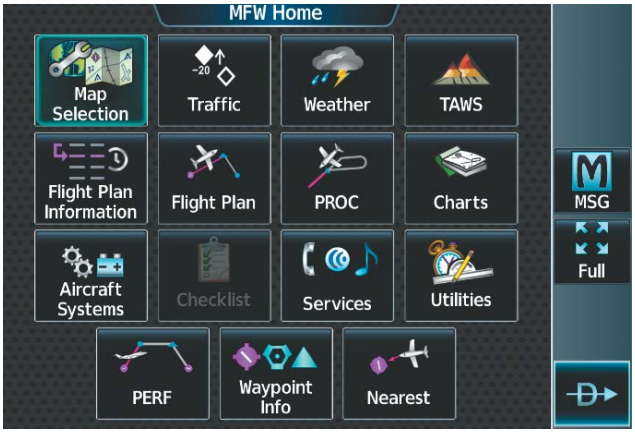


Figure 8-83 MFW Home



Figure 8-84 'Satellite SMS Text Messaging' Screen

Sending a text message:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.



Figure 8-85 'Satellite SMS Text Messaging' Screen

2) Touch the **Draft New** Button. The 'SMS Text Message Draft' Screen is displayed. The **Draft New Message** Button is also available from within the **Drafts** and **Outbox** Tabs.

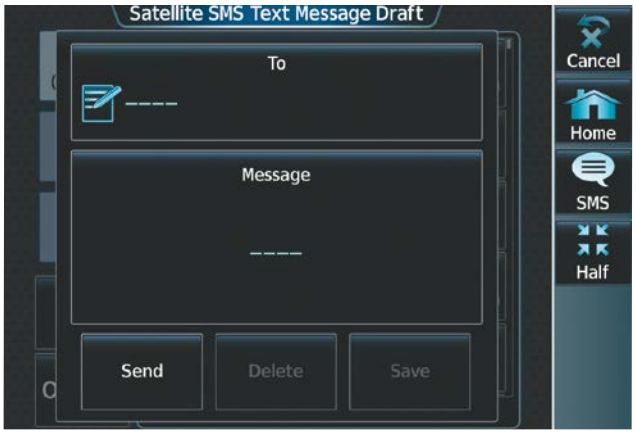


Figure 8-86 Touch 'To' Window

3) Touch the **To** Window. A selection screen is displayed. If the text message is to be sent to an SMS compatible telephone, touch the **Phone** Button. If the message is to be sent to an email address, touch the **Email** Button.

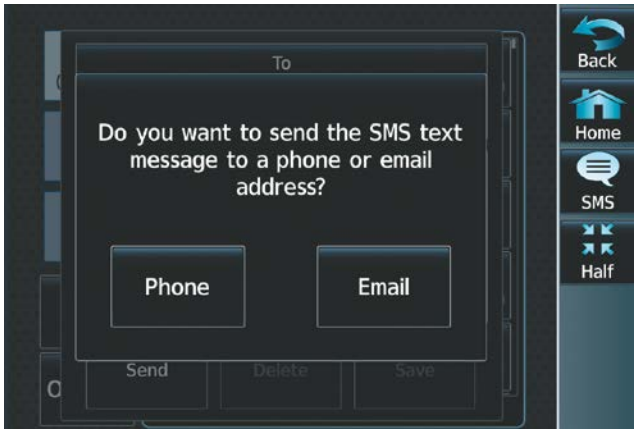


Figure 8-87 Select Message Destination



Figure 8-88 Enter Number or Address

4) Enter the telephone number or email address. The number or address may be obtained from stored Contacts by touching the **Find** Button.

5) If a phone number or address was entered manually, touch the **Enter** Button. The number or address is now displayed.

6) Touch the **Message** Window. The alphanumeric buttons are displayed.

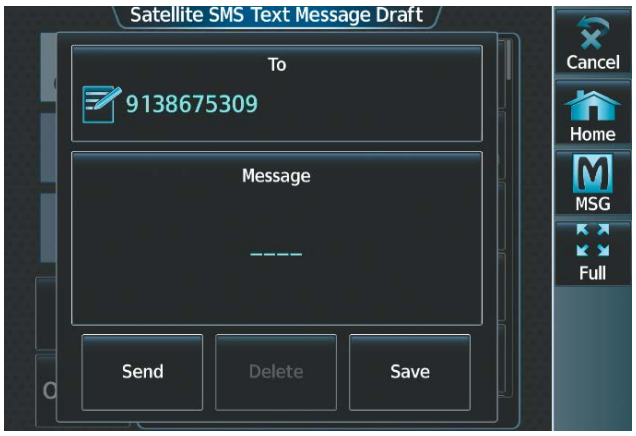


Figure 8-89 Touch the 'Message' Window



Figure 8-90 Reply Message

7) Enter the message text. The large upper knob on the Touchscreen Controller may be used to move the cursor within the message text in order to select the location for adding new text, or delete existing text.

8) Touch the **Enter** Button. The message text is displayed in the **Message** Window.

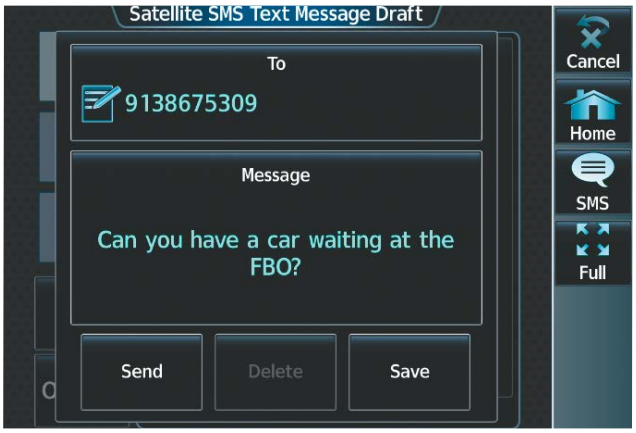


Figure 8-91 Message Ready to Send

9) Touch the **Send** Button.

Sending a new text message to a saved contact:

1) From MFW Home, touch **Services > Contacts**.

2) Scroll down as required to find a contact. Touch the contact's name on the Touchscreen Controller.

3) Touch the **Call or Send Text** Button.



Figure 8-92 Touch the Call or Send Text Button

Viewing a text message when received:

1) Touch the flashing **SMS** Button on the Touchscreen Controller. The **SMS Text Inbox** Tab is automatically selected and the newly received text message is shown at the top of the Notifications List.



Figure 8-93 New SMS Text Message Annunciation

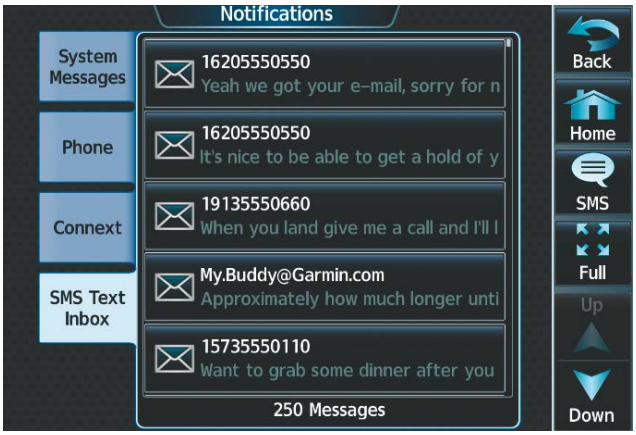


Figure 8-94 New Text Message at Top of List

2) Touch the desired message to display its contents.



Figure 8-95 New Text Message Contents

3) If desired, touch the **Reply** Button to create a reply to the message.

4) Touch the **Delete** Button to delete the message from the list.

5) Touching the **Save Contact** Button saves the contact information in the system contact list.

Replying to a text message:

While viewing the text message content, touch the **Reply** Button.

Or:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.



Figure 8-96 SMS Text Services Selection



Figure 8-97 Touch Desired Message

2) If necessary, scroll to the desired message. Touch the desired text message in the Inbox list. The text message is displayed.

3) Touch the **Reply** Button. The 'Opened Satellite SMS Text Message' Screen is displayed.

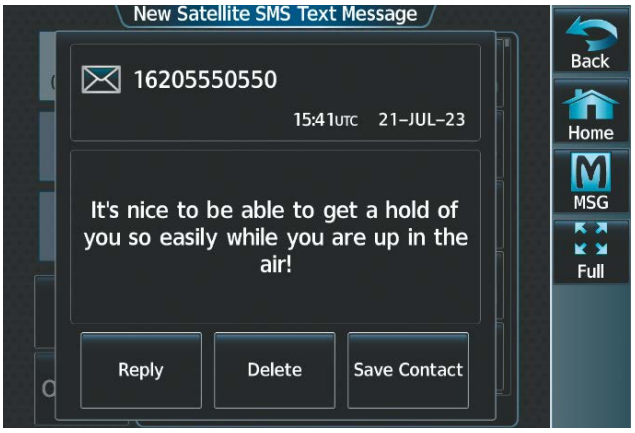


Figure 8-98 Message Content



Figure 8-99 Reply to the Message

4) Touch the **Message** Window to display the alphanumeric buttons.



Figure 8-100 Message Content

5) Enter the reply text. The large upper knob on the Touchscreen Controller may be used to move the cursor within the message text in order to select the location for adding new text, or delete existing text.

6) Touch the **Enter** Button. The reply message is displayed.

7) Touch the **Send** Button. The 'Satellite SMS Text Message Replied To' Screen is displayed.



Figure 8-101 Reply Message



Figure 8-102 Reply Message Sent

8) If desired, touch the **Reply Again** Button to send another reply.

9) Touch the **Delete** Button to delete the message from the list.

10) Touching the **Save Contact** Button saves the contact information in the system contact list.

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.

Viewing Inbox messages:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.

2) Touch the **Inbox** Tab. A list of received messages is displayed. The **Inbox** Tab is selected by default when accessing the 'Satellite SMS Text Messaging' Screen.



Figure 8-103 SMS Text Inbox

Viewing Draft messages:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.
2) Touch the **Drafts** Tab. A list of draft messages is displayed; provided messages have been previously saved.
3) Touch a message to access the **Send** or **Delete** Buttons.



Figure 8-104 SMS Text Drafts

Viewing Outbox messages:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.
2) Touch the **Outbox** Tab. A list of sent or unsent messages is displayed.
3) Touch a message to access the **Resend**, **Delete,** and **Save Contact** buttons.



Figure 8-105 SMS Text Outbox

MANAGING TEXT MESSAGES

The following table illustrates the various message status icons.

Message Symbol	Description
	Received text message that has not been opened
	Received text message that has been opened
	A reply has been sent for this text message
	Saved text message, draft not sent
	System is sending text message
	Text message has been sent
	System failed to send text message

Table 8-5 Text Message Symbols

The viewed messages in the Inbox, Outbox, or Drafts may be listed according to the date/time the message was sent or received or by message address.

Viewing messages sorted by message date/time:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.
2) Touch the **Options** Button. The 'Sort Messages By' selections are displayed.

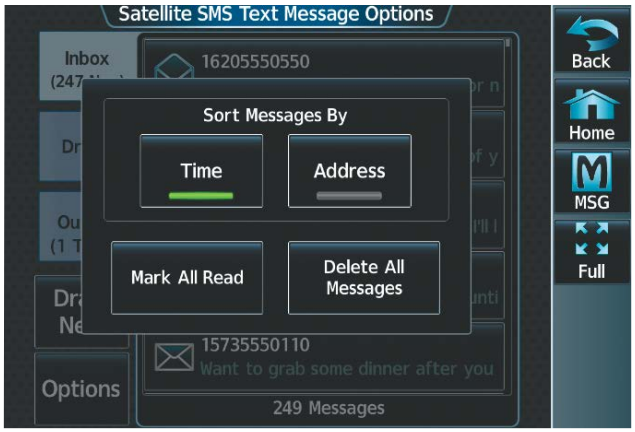


Figure 8-106 Message Sort Options

3) Touch the **Time** Button. A green annunciator indicates an active selection.
4) Touch the **Back** Button to return to the previously selected message box.

Viewing messages sorted by address:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.
2) Touch the **Options** Button. The 'Sort Messages By' selections are displayed.
3) Touch the **Address** Button. A green annunciator indicates an active selection.
4) Touch the **Back** Button to return to the previously selected message box.

Marking all messages as read:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.
2) Touch the **Options** Button. The selection buttons are displayed.
3) Touch the **Mark All Read** Button. All messages in the Inbox now indicate they have been opened.
4) Touch the **Back** Button to return to the Inbox.

Deleting all messages:

1) From MFW Home, touch **Services** > **Satellite SMS Text**.
2) Touch the **Options** Button. The selection buttons are displayed.
3) Touch the **Delete All Messages** Button. A confirmation screen is displayed.
4) Touch the **OK** Button.

   Or:

   Touch the **Cancel** Button to return to the Inbox.



Figure 8-107 Confirm Deletion of Messages

8.6 POSITION REPORTING (OPTIONAL)

NOTE: *An account must be established with Garmin Connext to make full use of the Position Reporting feature.*

The Position Reporting feature allows the system to send position reporting information to a provider, such as FlightAware.com.

The position reports can be enabled or disabled by the pilot. The interval between each report can be set from 2 to 60 minutes. While active, the position reports are transmitted over the Iridium Short Burst Datalink periodically at a pilot specified interval or by touching the **Send Report** Button. During voice communications and data transfers, the Iridium Datalink is occupied and position reports will not be sent. During this period the reports will buffer and be sent as a package as soon as the link is available. The position reports are received by Garmin Connext and forwarded to select flight tracking provider(s).

To reduce excess usage, position reports are only transmitted while the aircraft is in the air. The following are position reports contents:

- Tail Number
- Date and Time
- Latitude/Longitude
- Ground Speed
- Ground Track
- Heading
- Barometric Altitude
- True Airspeed
- Outside Air Temperature
- Destination
- Estimated Time Enroute (ETE)
- Airborne Status
  - The 'Airborne Status' Field is the indication the aircraft is on the ground or in the air at the time the position report was generated. The avionics generate a position report when the 'Airborne Status' Field changes state.
- Passengers Onboard
  - Passengers Onboard indicates passengers are on the aircraft at the time the position report was generated. A position report is generated when the 'Passengers Onboard' Field changes state.

Enabling/disabling position reporting:

1) From MFW Home, touch **Services** > **Position Reports**.
2) Touch the **Automatic Reporting** Button to enable or disable automatic transmission of position reports. A green annunciator indicates automatic reporting is enabled.



Figure 8-108 Automatic Reporting Disabled

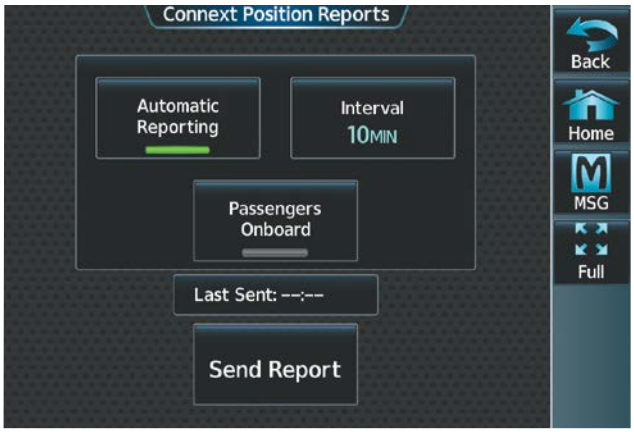


Figure 8-109 Automatic Reporting Enabled

Setting up automatic position reporting:

1) From MFW Home, touch **Services** > **Position Reports**.
2) Touch the **Automatic Reporting** Button to enable automatic transmission of position reports. A green annunciator indicates automatic reporting is enabled.
3) Touch the **Interval** Button. The 'Interval Entry' Screen is shown.
4) Use the keypad to enter the time (2 - 60 minutes) between automatic reports, and touch the **Enter** Button to return to the 'Connext Position Reports' Screen.



Figure 8-110 Enter an Interval Value

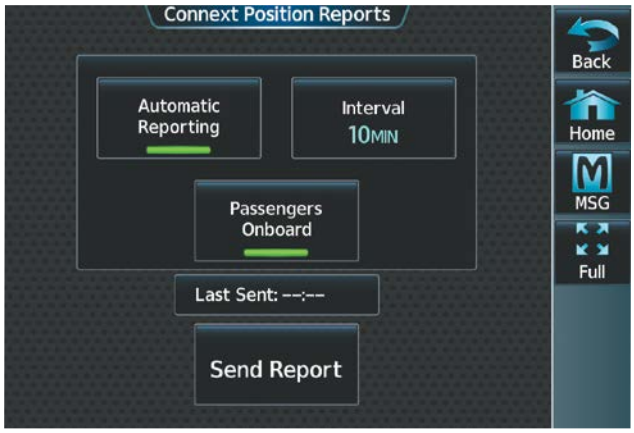


Figure 8-111 'Passengers Onboard' Enabled

5) Touch the **Passengers Onboard** Button to indicate passengers are or are not on the aircraft. A green annunciator indicates passengers are on the aircraft.

Sending a position report manually:

1) From MFW Home, touch **Services** > **Position Reports**.
2) Touch the **Send Report** Button to send a report as soon as the link is available.

8.7 CONNEXT (OPTIONAL)

Connext seamlessly brings together people, flight information, and hardware to create a connected environment. This section will discuss how to setup the optional Wireless Transceiver (Flight Stream 510) with a mobile device running the Garmin Pilot application. Data shared is dependent upon the hardware installed on your aircraft and whether you are operating Garmin Pilot on an iOS System or an Android System.

The following section will be presented from the flight deck point of view. See the Garmin Pilot for iOS Manual or the Garmin Pilot for Android Manual for discussion in detail on how to use the below features from the Garmin Pilot application point of view.

Upon successful connection, the Garmin Pilot application and the wireless transceiver enable an array of features:

- **Database Concierge**: enables wireless transfer of databases to select avionics
- **Flight Plan Transfer**: supports two-way flight plan transmission
- **Bluetooth Interface:** When the GMA™ 36B Audio Controller is installed, supports Bluetooth volume control and selection of Bluetooth source on the Touchscreen Controller.
- **Garmin Pilot Interface:**
  - **Iridium Communications (optional)**: provides satellite voice and SMS message capability
    - » Requires Iridium Transceiver (GSR 56) and an Iridium subscription
  - **SiriusXM Music (optional)**: delivers remote audio control of SiriusXM audio entertainment
    - » Requires SiriusXM Datalink Receiver (GDL® 69A) and a SiriusXM subscription
- **Flight Deck Data Streaming to Mobile Device:**
  - **Attitude & Heading Reference System (AHRS)**: displays attitude information including roll, pitch, and yaw
  - **Traffic**: displays traffic targets
  - **GPS Information**: shares position, velocity, and time with Garmin Pilot
  - **SiriusXM Weather**: displays SiriusXM aviation weather for the U.S. and Canada
    - » Requires SiriusXM Datalink Receiver (GDL 69A) and a SiriusXM subscription
  - **Flight Data Logging**: streamed in real time to Garmin Pilot and saved as a log for each flight in Garmin Pilot on your portable electronic device
  - **Garmin Pilot Watch Connectivity**: The MARQ® Aviator, tactix® 7 series, and D2™ series aviation watches offer further connectivity in flight by providing global navigational capability in a wearable package.

The Flight Stream 510 must be installed in the lower slot of either GDU. If inserted while the system is already running, a power cycle may be required.

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 'Internal Network Settings' Screen. The system is 'discoverable' whenever this screen 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.

WIRELESS TRANSCEIVER/PED COMPATIBILITY

The Wireless Transceiver (Flight Stream 510) is compatible with the following PEDs, operating system (OS) versions, and Apps:

- iPhone® 5 and newer, running iOS version 8.1 and above
- iPad® 3 and newer, running iOS version 8.1 and above
- iPad Air® and newer, running iOS version 8.1 and above
- iPad mini® with Retina Display and newer, running iOS version 8.1 and above
- iPad Pro® and newer, running iOS version 8.1 and above
- Google Nexus™, running Android OS version 4.4 (KitKat) and above
- Samsung Galaxy™, running Android OS version 4.4 (KitKat) and above
- Garmin Pilot for iPhone/iPad version 8.4 and above, running on a supported iPhone/iPad model listed above
- Garmin Pilot for Android version 5.4 and above, running on a supported Android OS device listed above
- ForeFlight® Mobile version 7.3 and above, running on a supported iPhone/iPad model listed above
- FltPlan® Go version 4.6.4 and above, running on a supported iPhone/iPad model listed above

NOTE: *If the 'Wireless Settings' Screen displays the Flight Stream 510 as 'offline,' ensure the Flight Stream 510 is inserted into the lower slot of either GDU and cycle the power to the system.*

NOTIFICATIONS

The following aircraft messages and alerts are sent to Flight Stream devices when they become active in the flight deck:

- CAS alerts (warnings, cautions, and advisories)
- System messages
- Text messages
- Incoming satellite telephone calls

LINK MANAGEMENT

Configuration and management of the Bluetooth and Wi-Fi links with mobile devices is handled through the 'Connext Setup' Page and also through Garmin Pilot on a mobile device.

Streaming data over a Wi-Fi connection is possible only while the aircraft is on the ground. Data transfer while airborne is accomplished through a Bluetooth connection.

NOTE: *For the Flight Stream 510, only one Wi-Fi device can be connected at a time, and only one protocol (e.g., Bluetooth or Wi-Fi) is connected at a time.*

WIRELESS PAIRING

The mobile device must be 'paired' with the system in order to use the various functions. A mobile device is paired by using a Bluetooth connection. The pilot is prompted when a Wi-Fi connection is preferred for database transfers.

The following discussion assumes that your mobile device is setup. This includes downloading and logging into Garmin Pilot on your mobile device. For detailed Garmin Pilot instructions see the Garmin Pilot for iOS Manual or the Garmin Pilot for Android Manual.

Bluetooth Pairing

Bluetooth pairing is accomplished by first placing the system in pairing mode by displaying the 'Connext Setup' Screen. The system is 'discoverable' whenever this screen is displayed. The pairing operation is completed from the mobile device and the Garmin Pilot application.

Viewing the 'Networks & Pairing' Screen:

From MFW Home, touch **Services > Networks & Pairing**.



Figure 8-112 'Wireless Settings' Page

Changing Bluetooth device name:

1) From the 'Networks & Pairing' Screen, touch the Bluetooth **Settings** Button.

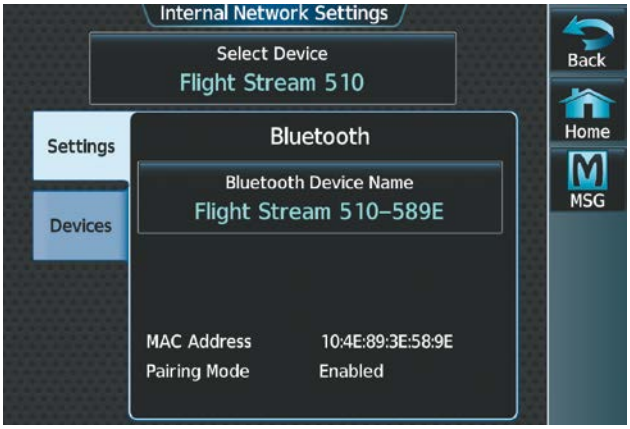


Figure 8-113 'Bluetooth Settings' Tab

2) Touch the **Bluetooth Device Name** Button. This is the name of the Bluetooth device you will connect to from your PED.

3) If desired, change the name of the Bluetooth Device by entering a new name using the alpha-numeric keypad on the 'BT Name' Screen.



Figure 8-114 'BT Name' Screen

4) Touch the **Enter** Button when complete.

Connecting a PED to the aircraft's Bluetooth System:

1) After obtaining the system's Bluetooth Name from the previous procedure, on your PED, initiate a Bluetooth connection to this device. In the previous image, the system's Bluetooth Name is 'Flight Stream 510-589E.' Connect to this device on your PED.

NOTE: *The flight crew shall reject a Bluetooth pairing request if the PINs on the PED and Garmin display are not identical or the request originates from any unknown or suspicious device.*

2) The system will prompt with a message: "Accept Bluetooth pairing with device "<PED Name>"? Passkey: <######>."

3) After verifying the passkey provided by the system matches that on your PED, touch the **Yes** Button to pair the device. Also complete any pairing steps on your PED.

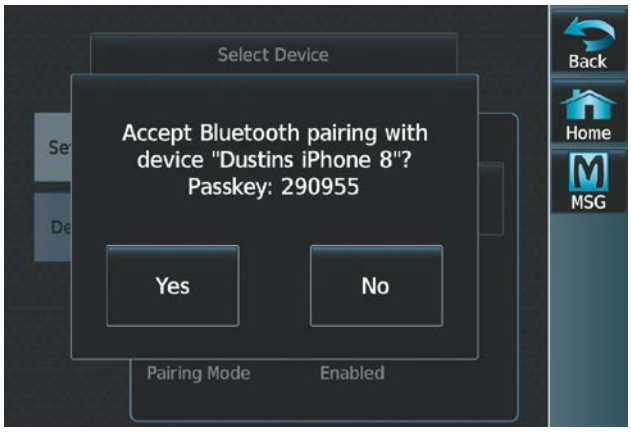


Figure 8-115 Touch 'Yes' to Complete Pairing

4) From the 'Internal Network Settings' Screen, touch the **Devices** Tab. Your device is now 'Connected' to the system over Bluetooth.



Figure 8-116 Viewing the 'Devices' Tab

Viewing the 'Connext Settings' Screen:

From MFW Home, touch **Services > Connext Setup**. The **Settings** Tab is displayed by default.



Figure 8-117 'Connext Setup' Screen

Selecting crew position for Garmin Pilot control of Connext Bluetooth volume:

1) From the 'Connext Setup' Page and with the **Settings** Tab selected, touch the PED Volume **Settings** Button.
2) Touch the **Pilot**, **Copilot**, or **Pass** Button (indicated by a green annunciator) to enable SiriusXM remote volume control on a mobile device running Garmin Pilot. In the following figure, the **Pass** (Passenger) Button has been selected. A mobile device running Garmin Pilot can now control the passenger's SiriusXM volume.



Figure 8-118 Garmin Pilot App Volume Control

Enabling/disabling Flight Plan Importing from Garmin Pilot:

NOTE: *Before activating a flight plan that has been transferred/uploaded from outside the avionics system, the flight crew shall validate the flight plan is correct.*

1) From MFW Home, touch **Services > Connext Setup**.
2) On the **Settings** Tab, a green annunciator below the **PED Flight Plan Imports** Button indicates PED flight plan importing is enabled. Pressing the **PED Flight Plan Imports** Button cycles this function either 'on' or 'off.'



Figure 8-119 'Connext Setup' Screen

Enabling/Disabling Wi-Fi Database Importing from Garmin Pilot:

1) From MFW Home, touch **Services > Connext Setup**.
2) On the **Settings** Tab, a green annunciator below the **Database Imports** Button indicates Wi-Fi Database Importing is enabled. Pressing the **Database Imports** Button cycles this function either 'on' or 'off.'

Removing a specific paired device from the list of paired devices:

1) From MFW Home, touch **Services > Networks & Pairing.**
2) Touch the Bluetooth **Settings** Button.
3) While viewing the 'Internal Network Settings' Screen, touch **Devices** Tab.

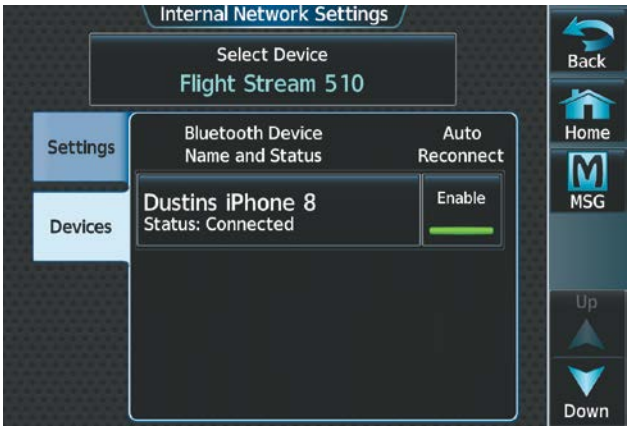


Figure 8-120 Viewing the 'Devices' Tab

4) Touch the Bluetooth device name to be removed.
5) A confirmation screen is displayed asking to remove the paired Bluetooth device.
6) Touch **OK** to remove the device from the list of paired devices (see following figure).



Figure 8-121 Device Removal Confirmation

RECORDING MODE

Recording Mode will allow monitored audio to be recorded on a device capable of recording audio over Bluetooth (e.g., Garmin VIRB®). The GMA will send audio from the flight crew headset to a device connected to GMA-1 for recording. Any Garmin recording device will be enabled by default upon successful pairing.

NOTE: *For monitored audio to be recorded, the device must be connected to GMA-1 over a Bluetooth connection.*

Enabling a Bluetooth Device as a recording device:

1) From MFW Home, touch **Services > Networks & Pairing.**
2) While viewing the 'Networks & Pairing' Screen, touch the Bluetooth **Settings** Button.
3) On the 'Internal Network Settings' Page, touch the **Select Device** Button.

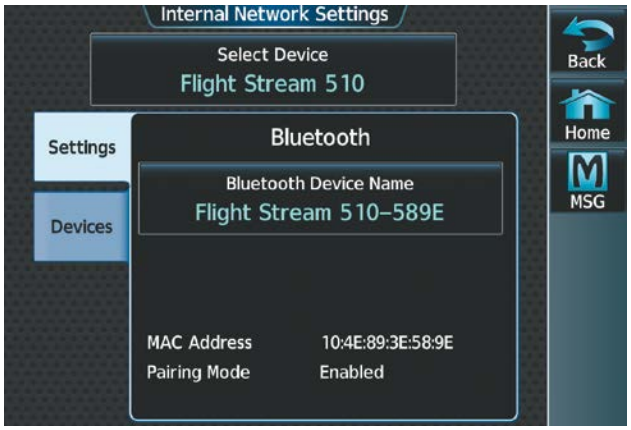


Figure 8-122 'Internal Network Settings' Page



Figure 8-123 'Device Selection List'

4) From the 'Device Selection List' touch the **GMA 1** Button.
5) With GMA 1 selected, touch **Devices** Tab on the 'Internal Network Settings' Page.
6) Follow the 'Connecting a PED to the aircraft's Bluetooth System' Procedure and connect the PED to GMA 1.

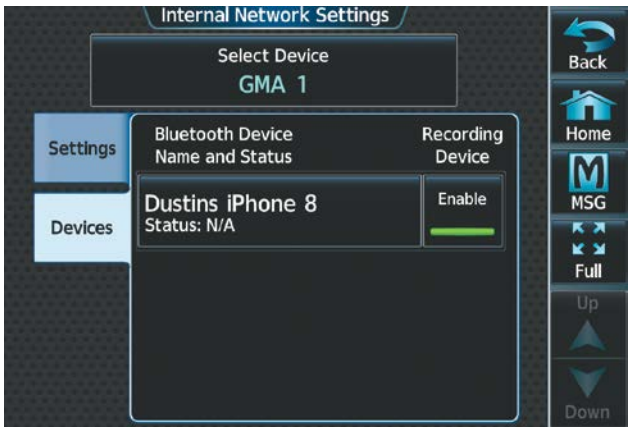


Figure 8-124 'Internal Network Settings' Page

7) Toggle the Recording Device **Enable** Button next to the device in the 'Bluetooth Device Name and Status' List to allow headset audio to be recorded over the GMA-1 Bluetooth connection to the PED.
8) A green annunciator indicates the device has been enabled for recording.

8.8 SIRIUSXM SATELLITE RADIO (OPTIONAL)

***NOTE:** Refer to the Hazard Avoidance Section for information and activation of SiriusXM Weather Products.*

The SiriusXM Satellite Radio entertainment feature of the SiriusXM Datalink Receiver (GDL® 69A) provides audio entertainment for passengers and crew. The SiriusXM Datalink Receiver can receive SiriusXM Satellite Radio entertainment services at any altitude throughout the Continental United States.

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.

For added convenience, when paired with a Wireless Transceiver (Flight Stream 510), SiriusXM audio can be remotely controlled using a compatible iOS or Android device running the Garmin Pilot™ App. Additional information is available at flyGarmin.com®.

ACTIVATING SIRIUSXM SATELLITE SERVICES

The SiriusXM Radio services are activated by first establishing an account with SiriusXM Satellite Radio. The Audio Radio ID and/or Data Radio ID must be provided to SiriusXM Satellite Radio to activate the entertainment subscription.

SiriusXM Satellite Radio uses the coded radio ID to send an activation signal that, when received by the SiriusXM Datalink Receiver, allows it to play entertainment programming.

These radio IDs are located:

- On the label on the back of the Datalink Receiver.
- On the 'SiriusXM Info' Screen on the Touchscreen Controller (see following figure).

Contact the installer if the radio ID cannot be located.

Establishing a SiriusXM Satellite Radio account:

1) From MFW Home, touch **Utilities > Setup** > **SiriusXM Info**.
2) Note the Data Radio ID and the Audio Radio ID as seen in the following figure.
3) Contact SiriusXM Satellite Radio. Follow the instructions provided by SiriusXM Satellite Radio services.



Figure 8-125 'SiriusXM Info' Display

Activating SiriusXM satellite services:

1) Position the aircraft so the GDL 69A SXM antenna has an unobstructed view of the sky, away from buildings.
2) Connect aircraft to external power source if available.
3) Power on the avionics and allow the system to start in normal mode.
4) For the GDL 69A SXM, service activation is performed automatically by the system.
5) To verify the correct subscription package, from MFW Home, touch **Utilities > Setup > SiriusXM Info**.
6) On the 'SiriusXM Info' Screen, verify the correct subscription package is displayed in the 'Service Class' Window (see previous figure).
7) In the 'Weather Products' Window, available weather products appear as white text (data has not been received); A green check indicates the weather product data has been received and is available for use, unavailable weather products appear in subdued (gray) text.

***NOTE:** It may take 45 - 60 minutes before activation is complete and all subscribed-to weather products become available.*

USING SIRIUSXM RADIO

The 'Music' Screen provides information and control of the audio entertainment features of the SiriusXM Satellite Radio.

Viewing the 'Music' Screen:

From MFW Home, touch **Services > Music.**

Or:

From NAV / COM Home, touch the **Pilot Music 1** Button.



Figure 8-126 SiriusXM Satellite Radio Controls

SELECTING CHANNELS

The channel list on the 'Music' Screen shows the available channels for the selected audio entertainment category. The 'Now Playing' Field shows information for the currently active channel.

Selecting a channel from the channel list:

1) From MFW Home, touch **Services > Music** to access the 'Music' Screen as in the previous figure.
2) Touch the desired channel in the channel list. The selected channel is now shown in the 'Now Playing' Field.

Selecting a channel directly:

1) From MFW Home, touch **Services > Music** > **Channel**.
2) The numeric keypad is displayed. Enter the desired channel number.
3) Press the **Enter** Button. The selected channel is now shown in the 'Now Playing' Field.

ENTERTAINMENT CATEGORIES

The 'Category' Field on the 'Music' Screen shows the currently selected entertainment category. Categories of audio entertainment (e.g., Pop, Rock, R&B, etc.) can be selected to list the available channels for a type of music or other contents.

Selecting a category:

1) From MFW Home, touch **Services > Music** > **Category**.
2) The list of categories is displayed.

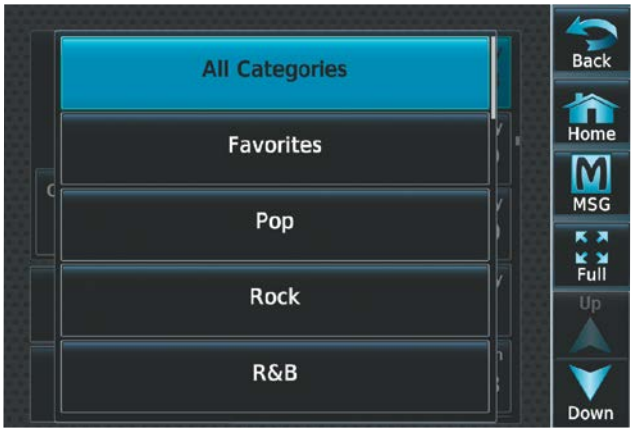


Figure 8-127 Channel Categories

3) Scroll to view the available categories.
4) Touch the desired category to select. The selected category is displayed on the **Category** Button and the channel list displays channels available for the selected category.

FAVORITES

Channels can be saved to a list of favorites and recalled for listening later.

Saving a channel to favorites list:

1) From MFW Home, touch **Services > Music** to access the 'Music' Screen.
2) Select a desired channel. It will be shown as the 'Now Playing' Channel.
3) Touch the **Favorite** Annunciator Button. The current channel is placed in the favorites list. Note, a green annunciator indicates a favorite channel is 'Now Playing.'

Selecting a favorite channel for listening:

1) From MFW Home, touch **Services > Music** > **Category**.
2) The list of categories is displayed as shown in the previous figure.
3) If necessary, scroll to view the **Favorites** Button.
4) Touch the **Favorites** Button to view the 'Favorites' Channel List.
5) Touch the desired channel in the list. The channel is now displayed in the 'Now Playing' Field.

ADJUSTING VOLUME

SiriusXM audio volume is shown in the 'Volume' Field (see following figure) as a percentage of full volume. Volume can be muted manually, or muting may be initiated automatically when other audio, such as radio, intercom, or aural alerts, are present. Entertainment audio adjustment may also be accessed by touching the **Pilot Music 1** Button on the 'NAV / COM Home' Screen.

Adjusting SiriusXM pilot volume:

1) From MFW Home, touch **Services > Music** > **Volume**.
2) The **Volume** Slider is displayed.
3) Touch and drag the slider to the right or left to adjust the volume. Dragging to the right increases volume. Dragging to the left to decrease the volume.

Or:

Turn the **Volume** Knob on the Touchscreen Controller.

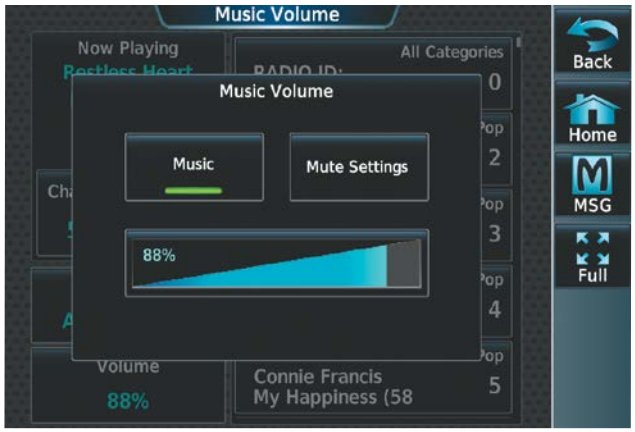


Figure 8-128 Adjusting Volume

Muting or unmuting the volume:

1) From MFW Home, touch **Services > Music** > **Volume**.
2) Touch the **Music** Annunciator Button to mute or unmute the volume. Muted volume is indicated by a gray annunciator. Unmuted volume is indicated by a green annunciator.
3) Touch the **Back** Button to return to the 'Music' Screen. When the volume is muted, 'Muted' is displayed in the 'Music Volume' Field.

Or:

1) From NAV / COM Home, touch the **Audio & Radios** Button, then touch the **Pilot**, **Copilot**, or **Pass** Tab.
2) Scroll down and press the **Music** Button. A gray annunciation under the **Music** Button indicates SiriusXM volume is muted.

Soft Muting

When soft muting is enabled, the system will decrease music volume to a very low level (soft mute) when the following occur:

- **Push-To-Talk** Button is pressed for COM radio transmission
- COM radio audio is received
- Intercom is active
- Cockpit music will always be soft muted during aural and voice alerts

Enabling/disabling soft mute settings:

1) From MFW Home, touch **Services > Music** > **Volume** > **Mute Settings**.
2) Touch the **Intercom** Annunciator Button to select/deselect automatic soft muting of entertainment audio when intercom audio is present. This function is active when the annunciator is green.

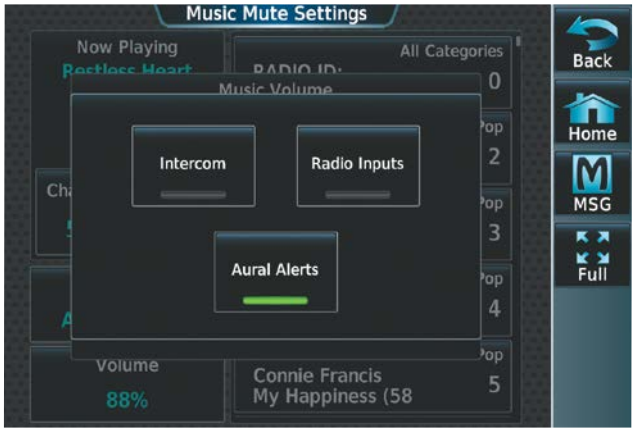


Figure 8-129 Mute Settings

3) Touch the **Radio Inputs** Annunciator Button to allow automatic soft muting of entertainment audio when COM, NAV, ADF, etc. audio is present. This function is active when the annunciator is green.
4) Touch the **Aural Alerts** Annunciator Button to allow automatic soft muting of entertainment audio when alert audio is present. This function is active when the annunciator is green.
5) Touch the **Back** Button to return to the 'Music' Screen.

8.9 FLIGHT DATA LOGGING

NOTE: *Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.*

NOTE: *When a Wireless Transceiver (Flight Stream 510) is installed, Flight Data Logging parameters can be streamed to a mobile device running the Garmin Pilot™ application and the log file is available in Garmin Pilot.*

The Flight Data Logging feature will automatically store critical flight and engine data on a SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 600 flight hours can be recorded for each 1GB of available space on the card. The data recorded by the Flight Data Logging feature is separate from data recorded by the Central Maintenance Computer (CMC).

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 .csv file may be viewed with Microsoft Excel® or other spreadsheet applications.

When a Wireless Transceiver (Flight Stream 510) is installed, logged data from the current flight plan and from past flights can be streamed through a Bluetooth connection. This requires a wireless transceiver to be inserted in the bottom slot of the GDU™, and a the Garmin Pilot application running on a mobile device.

Once the data has been transferred to Garmin Pilot, the App. can transfer the flight log to the pilot's flyGarmin.com® account for archiving and analysis once the mobile device connects to the Internet.

The following is a list of data parameters the system is capable of logging.

- Local Date / Time
- UTC Offset
- Active Waypoint
- Latitude / Longitude
- Indicated Barometric Altitude
- Selected Barometric Px Setting
- GPS Altitude Relative to MSL
- Outside Air Temperature
- Indicated Airspeed
- Ground Speed
- Vertical Speed
- Attitude Pitch / Roll Angle
- Lateral (Y) Acceleration (g)
- Vertical (Z) Acceleration (g)
- Heading
- Track
- Battery #1 & #2 Volts
- Battery #1 Amps
- Fuel Quantity L & R
- Engine #1&2 Fuel Flow
- Engine #1 Oil Temperature
- Engine #1 Oil Pressure
- Engine #1&2 Manifold Pressure
- Engine #1&2 RPM
- Engine #1 Power Percent
- Engine #1, Cylinder Head Temp. (#1-6)
- Engine #1, EGT (#1-6)
- Engine #1, Turbine #1&2 Inlet Temperature
- Engine #1&2 Torque
- Engine #1&2 RPM % Generator Turbine (Compressor Turbine)
- Engine #1&2 ITT
- WGS84 GPS Altitude
- True Airspeed
- HSI Source (e.g., NAV1, NAV2, GPS)
- Selected Course
- #1&2 Nav. Radio Frequency
- #1&2 COM Radio Frequency
- Horizontal / Vertical CDI
- Wind Speed / Direction
- Distance / Bearing to Next Waypoint
- Magnetic Variation
- Autopilot Engagement
- AP Pitch / Roll Mode
- AP Pitch / Roll Command
- GPS Vertical Speed
- GPS Fix
- GPS Horizontal / Vertical Alert Limit
- WAAS GPS Horizontal / Vertical Protection Level
- GPS Horizontal Protection Level
- GPS Horizontal / Vertical Alert Limit (source 2)
- WAAS GPS Horizontal / Vertical Protection Level (source 2)
- GPS Horizontal Protection Level (source 2)
- Position Fix Mode
- Aircraft Weight

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.

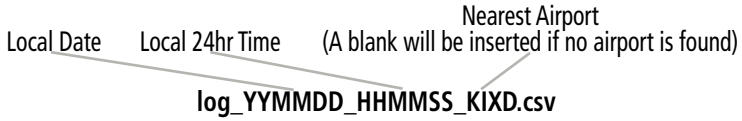


Figure 8-130 Flight Data Log File Format

8.10 ELECTRONIC CHECKLISTS

NOTE: *The checklists shown in the following figures are examples only.*

NOTE: *Garmin is not responsible for the content of checklists. Checklists are created by the aircraft manufacturer. Modifications or updates to the checklists are coordinated through the aircraft manufacturer.*

The Electronic Checklists feature allows the pilot to view and interact with aircraft checklists on the ground and during each phase of flight. Checklist contents are displayed on the PFW and the MFW. Checklist controls are provided on the Touchscreen Controller. The crew can upload a checklist file to the system by placing it on a Secure Digital (SD) card hosted in the top card slot or bottom slot of each GDU™. Once the checklist file is synced across the system, the SD card with the checklist file is no longer required.

CHECKLIST FEATURES

FONTS AND COLORS

Electronic Checklists allow the pilot to view checklist information in various font sizes and colors. The following table displays the color scheme for various elements.

Item	Color
'Checked' Checklist Item	Green
'Unchecked' Checklist Item	White
Plain Text	Silver
Notes	Silver
Cursor Box on Selected Item	Cyan
Warning Statements	Amber
Hyperlinks	Cyan
Subtitle	White
Caution Statements	White

Table 8-6 Default Color Scheme

HYPERLINK-BASED NAVIGATION

Checklist files support navigation using hyperlinks. These hyperlinks allow the pilot to select the link and navigate to the associated checklist.

BRANCHED QUESTIONING

Many checklists involve a decision-making process that depends on operational conditions. Branched questioning allows the checklist to provide two or more options. Each option can have a sub checklist associated with it. The pilot can pick the appropriate option and complete the associated checklist. Only one of the sub checklists needs to be filled out in order to satisfy the "Checklist Complete" criteria.

When the pilot is complete with all items on a branched checklist, the bottom of the page will display 'Back to Previous?' which will return the pilot back to the main checklist.



Figure 8-131 Branched Questioning

CREW ALERTING SYSTEM (CAS) MESSAGE LINKING

With CAS Message Linking, the system automatically nominates a checklist based on activation of a crew alerting message.

An alerting message often requires the flight crew to work through an associated checklist. The CAS Linking feature allows a link between a Crew Alerting System (CAS) message and the applicable checklist.

The Checklist function features a new group dedicated to CAS linked checklists. When a CAS message is active, the CAS Linking feature uses that group to list the checklist linked to the message. The flight crew has to manually select the required checklist. CAS linking is more efficient than searching for a checklist from the full set of lists. The flight crew has the option to disregard the nominated checklists and access other checklist groups, if required.

Utilizing a nominated checklist:

1) After the flight crew has been alerted to a CAS Message that is linked to a checklist, from MFW Home, touch **Checklist.**

2) Touch the 'CAS' Tab to view the checklist linked to that specific CAS message.



Figure 8-132 Touch the 'Checklist' Button

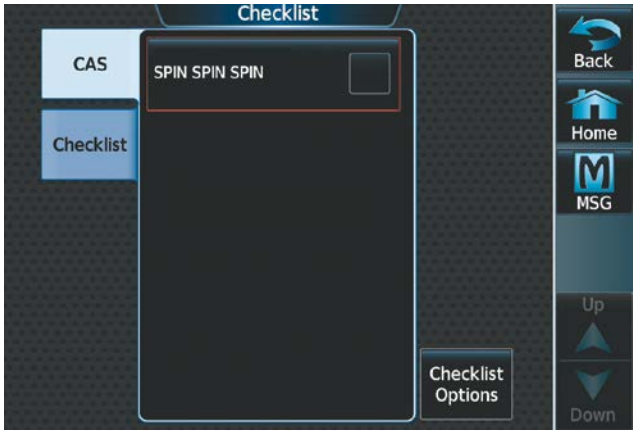


Figure 8-133 Viewing the Nominated Checklist

3) Touch the nominated checklist to view the checklist on the MFW/PFW.

CHECKLIST IMAGES

Checklists can display an image as a part of the checklist. The image can be setup as a challenge item with an associated check box or as a reference item without a check box. The images are included in the checklist file uploaded to the system.

Accessing and navigating checklists:

1) From MFW Home, touch the **Checklist** Button. The checklist structure is displayed.



Figure 8-134 Touch the Checklist Button



Figure 8-135 List of Checklists

2) Touch the desired checklist from the list. If necessary, scroll through the list to see all the available checklists for the selected group. In the previous figure, the **Taxi** checklist is selected and is displayed in the previously selected display pane. The first checklist item is selected as indicated by the white text surrounded by a cyan box.

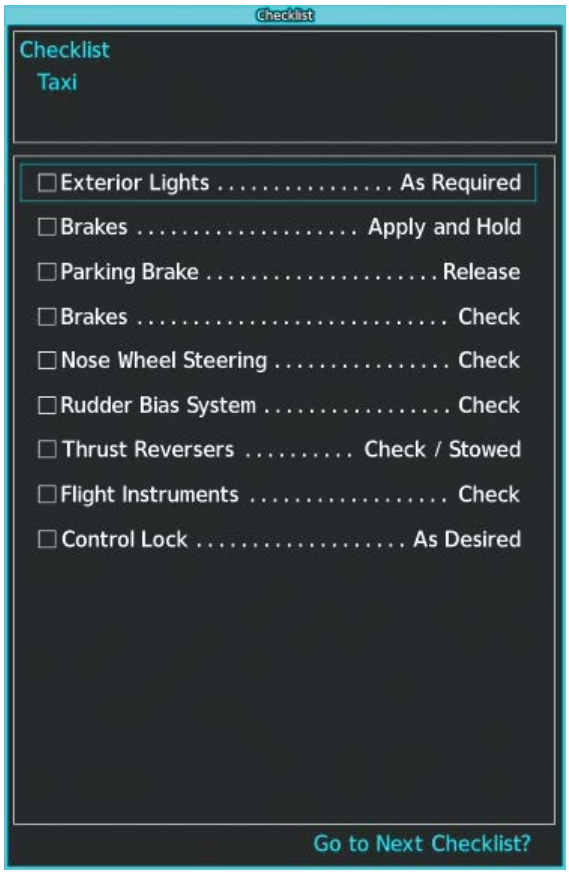


Figure 8-136 First Checklist Item Selected

3) Press the lower knob on the Touchscreen Controller or the **Checklist Advance** Button to check the selected checklist item. The line item turns green and a check mark is placed in the associated box as shown in the following figure. The next line item is automatically selected for checking.



Figure 8-137 First Checklist Item Completed and Checked

Turn the lower knob on the Touchscreen Controller to scroll through the checklist and select the desired checklist item.

Selecting a checked item and pressing the lower knob on the Touchscreen Controller or the **Checklist Advance** Button will return the item to the unchecked state.

Or:

Press the dedicated checklist button. The line item turns green and a check mark is placed in the associated box. The next line item is automatically selected for checking.

4) When all checklist items have been checked, '* Checklist Finished *' is displayed in green text at the bottom left of the checklist window and 'Go to Next Checklist?' is highlighted as in the following figure. If 'Go to Next Checklist?' is selected before checking all the checklist items, '* Checklist Not Finished *' will be displayed in amber text.



Figure 8-138 Checklist Finished

5) While the 'Go to Next Checklist?' text is highlighted, press the lower knob on the Touchscreen Controller.

   Or:

   Press the **Checklist Advance** Button to display the next checklist in the group.

   Or:

   Choose another Checklist by touching the desired checklist on the Touchscreen Controller.

Resetting a specific checklist:

1) From MFW Home, touch **Checklist**.
2) Touch the desired checklist to reset. The **TAXI** checklist is selected in the following figure.
3) Touch the **Checklist Options** Button.
4) Touch the **Reset Checklist** Button.

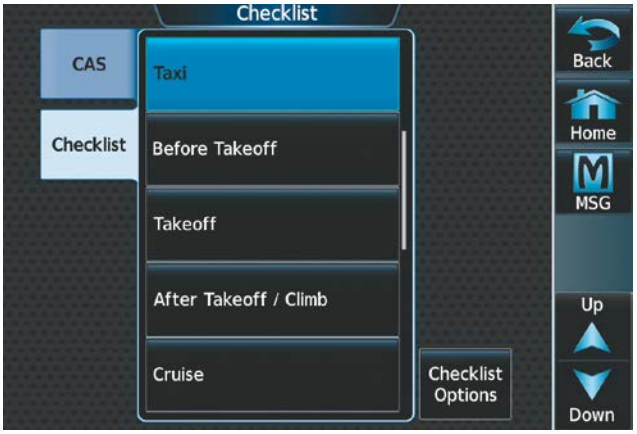


Figure 8-139 Touch the Checklist Options Button

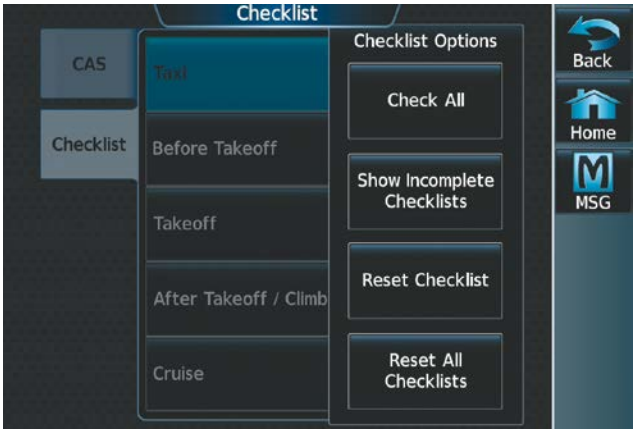


Figure 8-140 'Checklist Options' Pane

Resetting all checklists:

1) From MFW Home, touch the **Checklist** Button.
2) Touch the **Checklist Options** Button.
3) Touch the **Reset All Checklists** Button as seen in the previous figure.

8.11 ELECTRONIC DOCUMENTS

The Electronic Document function allows viewing of electronic documents on the selected display pane. The system allows the display of electronic documents from two sources. These sources are Installed Documents and User Documents.

INSTALLED DOCUMENTS

'Installed' Documents are typically provided by the aircraft manufacturer. These documents are stored on the Supplemental Data Cards, along with the databases, located in the bottom SD Card slot of each GDU. Each Supplemental Data Card contains identical document files.

USER DOCUMENTS

User Documents are those loaded by the crew. User Documents must be in .pdf format and reside on an SD Card no larger than 16GB. The Maximum document file size is 1.5GB. The maximum number of pages per document is limited to 9,999. Pages that contain large and/or numerous images may exceed RAM memory limits and therefore may not be displayed correctly or may not be displayed at all. The name of the file is limited to 35 characters. If this length is exceeded, the file may not be able to be viewed.

An SD card must be inserted into the top card slot of each display on which it is desired to view the user documents. Each display can only access electronic documents on the SD Cards that are inserted in that display.

User Documents are unique to the display on which they are viewed.

SUPPORTED PDF FEATURES

User Documents must be in .pdf format. The following .pdf features are not supported. If a file contains any of these features, the system will ignore the feature and display the document.

- Embedded files (attachments)
- Alternate images (using a different image for display and printing)
- Page labels (alternate page numbers; e.g., i, ii, iii, iv for Table of Contents)
- Additional annotations, including file attachment annotation, sound annotation, movie annotation, widget annotation, and trap network annotation
- Digital signatures
- JavaScript
- Logical structure (structuring documents into chapters, paragraphs, headings, footnotes)
- Web capture information (annotations for search engines)
- Prepress support (annotations for newspapers, etc.)

SD CARD FILE STRUCTURE FOR USER DOCUMENTS

User document files must reside on the SD card in a directory named 'Documents.' The list of available User Documents is limited to 100 documents and are shown in alphabetical order based on filename.

VIEWING ELECTRONIC DOCUMENTS

Selecting a document:

1) From MFW Home, touch **Utilities > Documents**. The 'Document Viewer' Screen is now displayed.

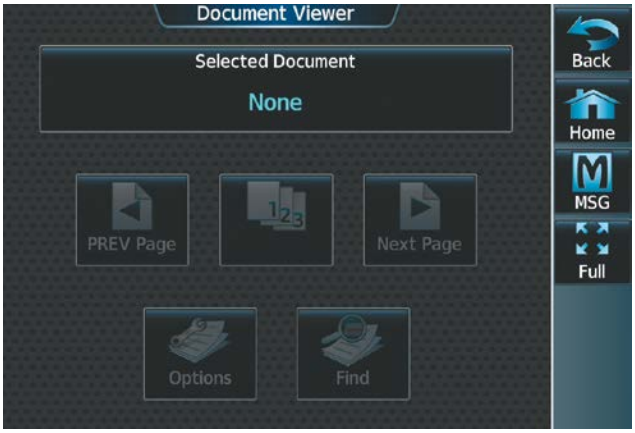


Figure 8-141 Electronic Document Viewer

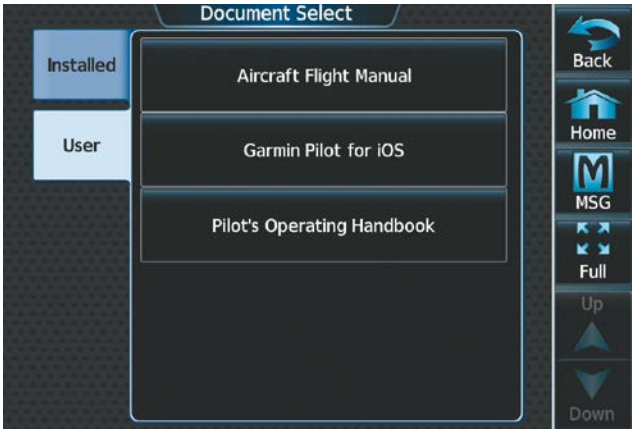


Figure 8-142 Document Selection

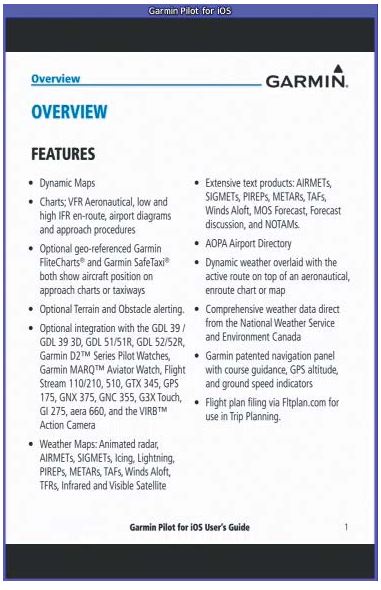
2) Touch the **Selected Document** Button.

3) Touch the **Installed** or **User** Tab to select the desired document source. In the above example, the **User** Tab is selected. Documents must be installed by the manufacturer for them to show in the 'Installed' Tab.

4) Touch the desired document button. The selected document name is displayed in the **Selected Document** Button. The document is displayed in the selected pane.



Figure 8-143 Selected Document Indicated


Garmin Pilot for iOS

Overview

GARMIN

OVERVIEW

FEATURES

- Dynamic Maps
- Charts; VFR Aeronautical, low and high IFR en-route, airport diagrams and approach procedures
- Optional geo-referenced Garmin FliteCharts® and Garmin SafeTaxi® both show aircraft position on approach charts or taxiways
- Optional Terrain and Obstacle alerting.
- Optional integration with the GDL 39 / GDL 39 3D, GDL 51/51R, GDL 52/52R, Garmin D2™ Series Pilot Watches, Garmin MARQ™ Aviator Watch, Flight Stream 110/210, 510, GTX 345, GPS 175, GNX 375, GNC 355, G3X Touch, GI 275, aera 660, and the VIRB™ Action Camera
- Weather Maps: Animated radar, AIRMETs, SIGMETs, Icing, Lightning, PIREPs, METARs, TAFs, Winds Aloft, TFRs, Infrared and Visible Satellite
- Extensive text products: AIRMETs, SIGMETs, PIREPs, METARs, TAFs, Winds Aloft, MOS Forecast, Forecast discussion, and NOTAMs.
- AOPA Airport Directory
- Dynamic weather overlaid with the active route on top of an aeronautical, enroute chart or map
- Comprehensive weather data direct from the National Weather Service and Environment Canada
- Garmin patented navigation panel with course guidance, GPS altitude, and ground speed indicators
- Flight plan filing via Fltplan.com for use in Trip Planning.

Garmin Pilot for iOS User's Guide 1

Figure 8-144 Document Viewed on Selected Display Pane

Changing Document Viewer options:

1) From MFW Home, touch **Utilities > Documents > Options.** The 'Document Viewer Options' Screen is displayed.
2) Touch the **Document Info** Button to view information pertaining to the document, such as the document name, the file size, and the creation date.



Figure 8-145 Document Viewer Options

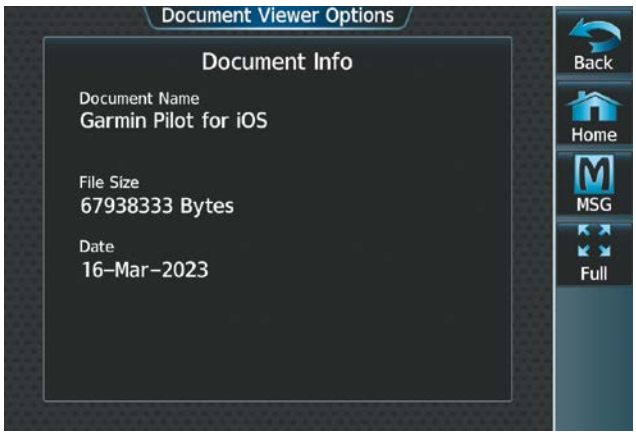


Figure 8-146 Document Information

3) After touching the **Back** Button, touch the **Fit Page** Button to view the complete page in the selected pane.
4) Touch the **Fit Width** Button to enlarge the displayed page to fill the width of the selected pane.
5) Touching the **Rotate Page** buttons will turn the displayed page 90 degrees to the right or left within the selected pane. Each subsequent touch will turn the page another 90 degrees.
6) Touch the **Brightness** Slider to adjust the brightness of the displayed page.

   Or:

   Touch the **+** Button to increase brightness, or the **-** Button to decrease brightness. Each touch increases or decreases the brightness by approximately five percent.

Browsing the document:

1) After selecting the desired document, touch the **PREV Page** and **Next Page** buttons to increment and decrement one page with each touch.



Figure 8-147 Document Browsing Options

2) The Page Select Button shows the number of pages contained in the document and the page currently being displayed. Touch the Page Select Button to jump to a specific page number. The 'Enter Page Number' Screen is displayed, as in the following figure.



Figure 8-148 Enter Document Page Number

3) From the 'Document Viewer' Screen, touch the **Find** Button to display the 'Document Viewer Find' Screen.

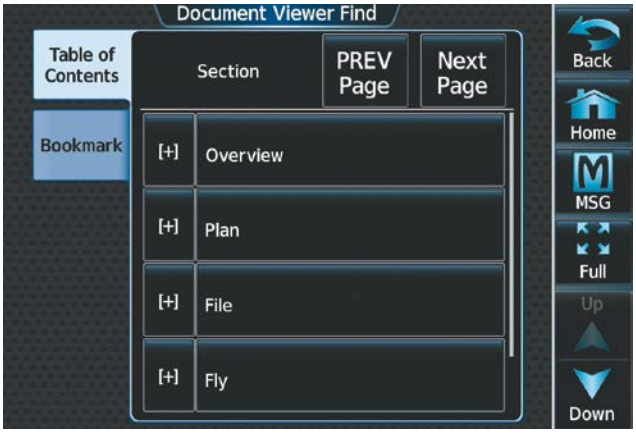


Figure 8-149 Table of Contents

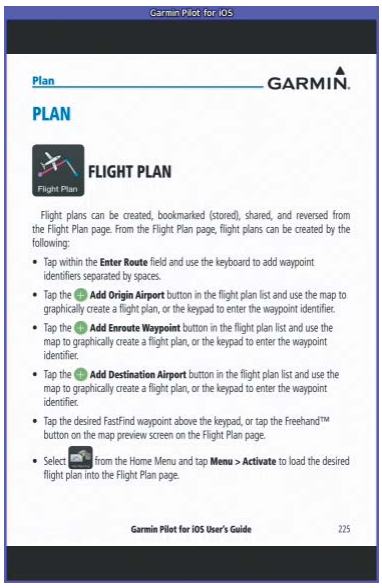


Figure 8-150 Flight Plan Section Displayed

4) If necessary, touch the **Table of Contents** Tab.

5) Touch the **[+]** Button to expand a topic. Touch the **[–]** Button to return to the collapsed view of the topic.

6) Touch the desired topic to jump to that portion of the document. In this example, the Flight Plan Section is selected (see previous figure).

Zooming in and out on a document page:

1) With the document displayed, push the lower knob. The 'Document Pointer Options' Screen is now displayed on the Touchscreen Controller as shown in the following figure. Also, a flashing pointer is shown on the document display.
2) Turn the lower knob, or use the pinch-and-zoom feature on the Touchpad to zoom in or zoom out on the document page display.
3) Turn the upper knobs, or move a finger across the Touchpad to move the pointer within the document. When the pointer reaches the edge of the display, the display will scroll to show more of the document page.

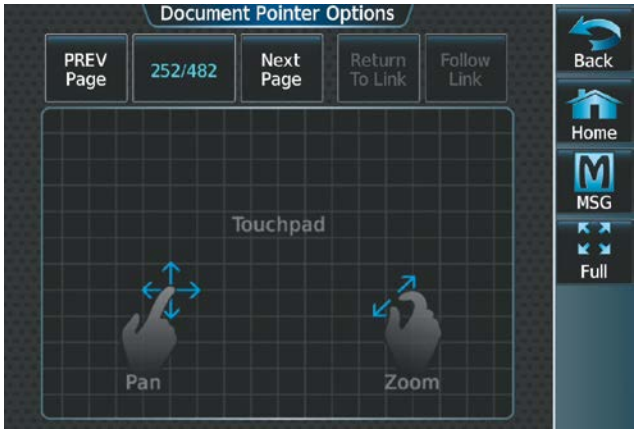


Figure 8-151 Touchpad

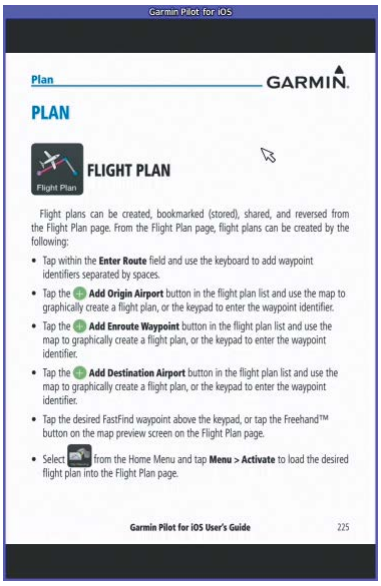


Figure 8-152 Pointer Now Visible

Navigating links within the document:

1) With the document displayed, push the lower knob. The 'Document Pointer Options' Screen is now displayed on the Touchscreen Controller as shown in the following figure. Also, a flashing pointer is shown on the document display as in the previous figure.
2) Turn the upper knobs, or move a finger across the Touchpad to move the pointer to the desired document link as in the following figure.

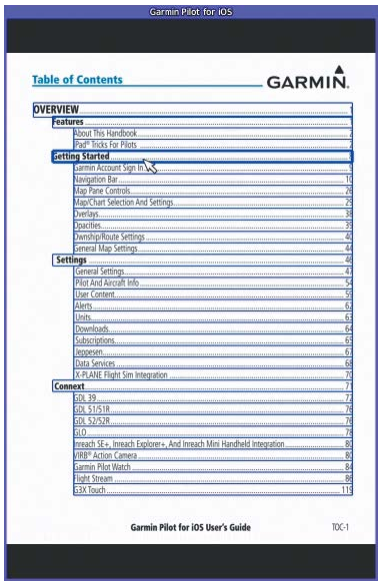


Figure 8-153 Link Selected

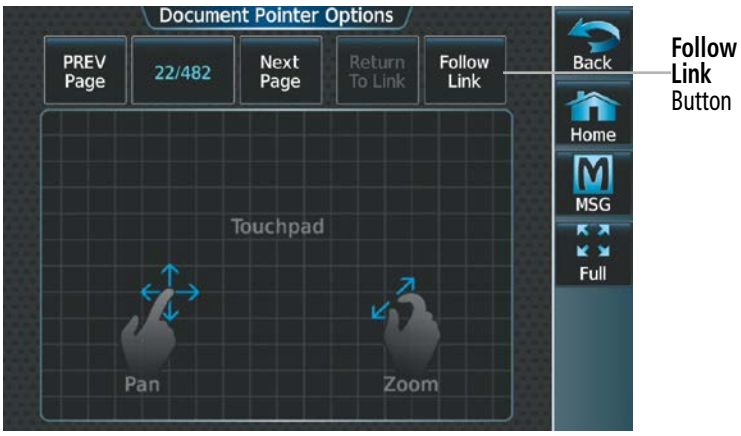


Figure 8-154 Follow Link

3) With the link highlighted, touch the **Follow Link** Button shown in the previous figure. The selected link destination is now displayed in the selected pane.

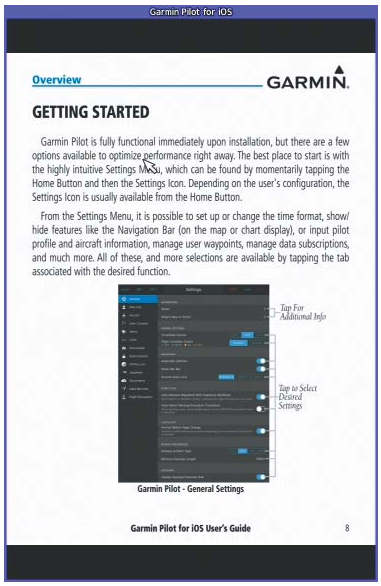


Figure 8-155 Link Selected is Displayed

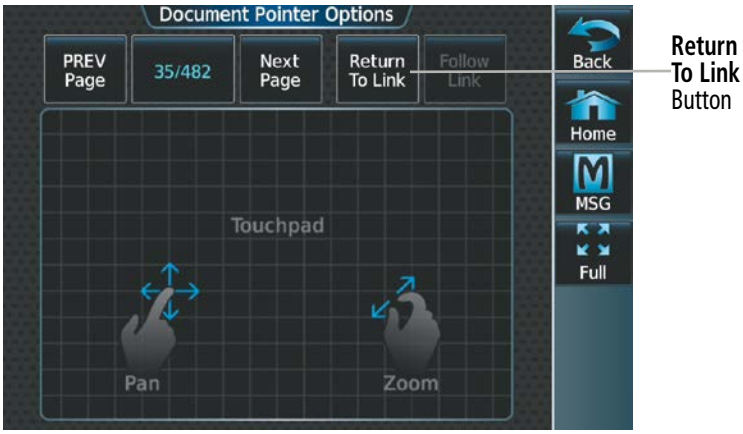


Figure 8-156 Return to Link

4) Touch the **Return To Link** Button (see previous figure) to return to the link origin.

5) Touch the **Back** Button, push the upper knob, or press the lower knob to remove the pointer from the display.

Creating bookmarks in the document:

1) While viewing the page to bookmark, touch the **Find** Button on the 'Document Viewer Find' Screen.

2) Touch the **Bookmark** Tab.

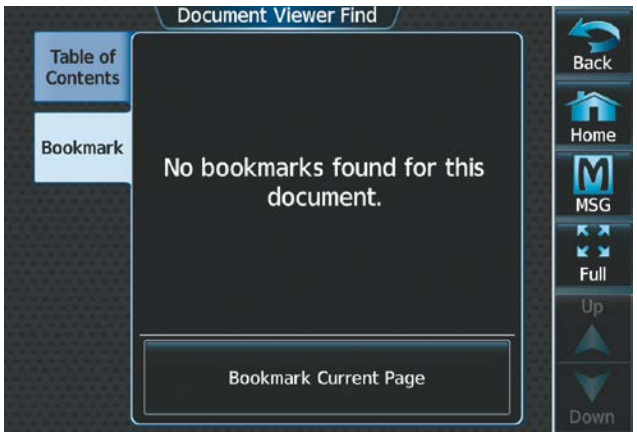


Figure 8-157 Select Bookmark Tab

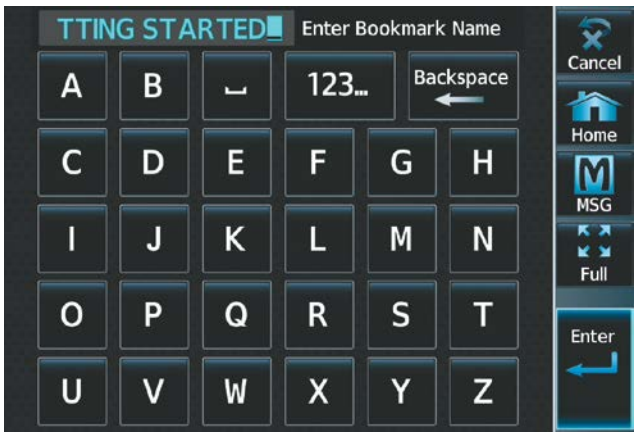


Figure 8-158 Enter Bookmark Name

3) Touch the **Bookmark Current Page** Button. The 'Enter Bookmark Name' Screen is displayed.

4) After naming the bookmark, touch the **Enter** Button. A confirmation screen is displayed.

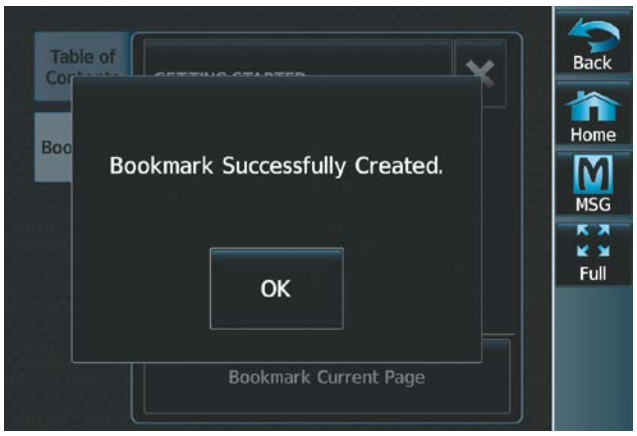


Figure 8-159 Confirmation Screen

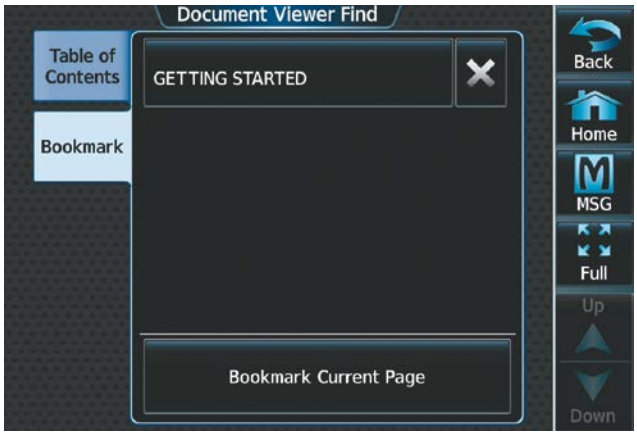


Figure 8-160 Bookmark Created

5) Touch the **OK** Button. The newly created bookmark is displayed as in the previous figure.

Deleting document bookmarks:

1) With the desired document displayed, touch the **Find** Button to display the 'Document Viewer Find' Screen.

2) Touch the **Bookmark** Tab.

3) Touch the **X** Button next to the bookmark to be deleted.

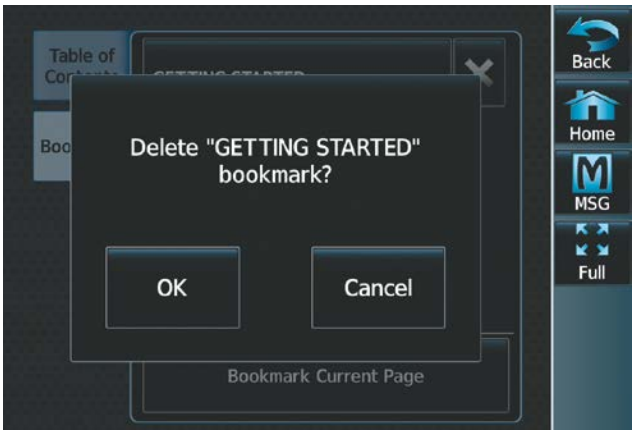


Figure 8-161 Delete Bookmark

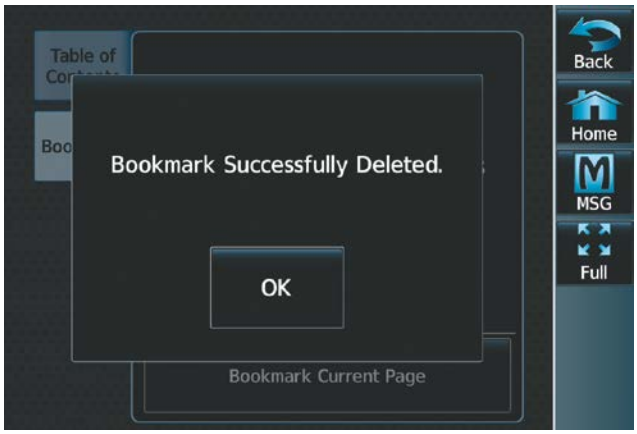


Figure 8-162 Bookmark Deleted

4) Touch the **OK** Button on the confirmation screen.

5) To acknowledge deletion of the bookmark, touch the **OK** Button.

8.12 AUXILIARY VIDEO (EVS)

The display of auxiliary video information enhances situational awareness, provides entertainment, and if applicable, allows for visual monitoring of the inside or outside of the airplane. The display of auxiliary video is crew-selectable. This feature is capable of interfacing to a composite video source (HD-SDI, SD-SDI).

NOTE: *Auxiliary Video can only be displayed on the MFD.*

Displaying auxiliary video:

From MFW Home, touch **Aircraft Systems > Video**. The 'Video Settings' Screen is displayed on the Touchscreen Controller and Auxiliary Video is displayed on the selected display pane.



Figure 8-163 'Aircraft Systems' Screen

MODES

There are four modes of operation of the auxiliary video display: Full-Screen, Full-Screen with Digital Zoom, Split-Screen, and Split-Screen with Digital Zoom.

FULL-SCREEN

Video is displayed in the entire usable area of the MFD when full screen is enabled on the Touchscreen Controller. The Navigation Map is hidden and the Touchscreen Controller displays the video source.

Switching between full-screen and split-screen:

1) From MFW Home, touch **Aircraft Systems > Video**.
2) On the Touchscreen controller, touch the **Half** or **Full** Button on the Button Bar.

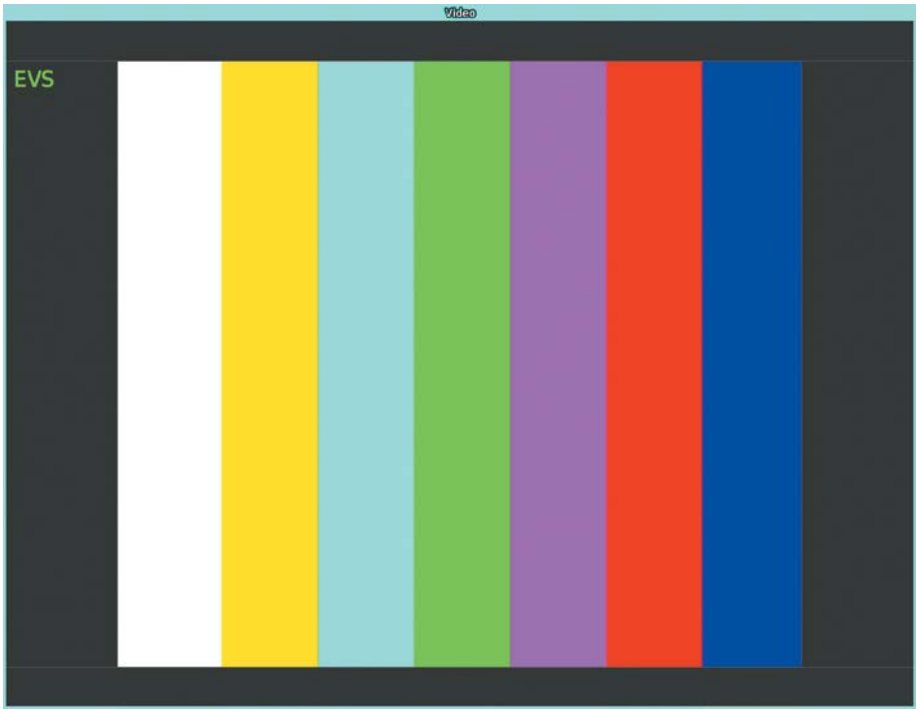


Figure 8-164 Full-Screen Video Display

FULL-SCREEN WITH DIGITAL ZOOM

The zoomed portion of the auxiliary video image is displayed on the entire usable area available on the MFD. The zoomed auxiliary video image can be panned to view other parts of the full image.

Zooming in and out:

1) From MFW Home, touch **Aircraft Systems > Video**.
2) Turn the lower right knob on the Touchscreen Controller to zoom in and out. Note the 'ZOOM: 4x' or 'ZOOM: 1x' notification on the 'Video' Screen after zooming in or out.

SPLIT-SCREEN

The auxiliary video can be displayed on the left or right portion of the MFD while another page is also displayed. The window size of the full auxiliary video image is dependent on the pixel resolution of the original image.



Figure 8-165 Split-Screen With Map

SPLIT-SCREEN WITH DIGITAL ZOOM

The full auxiliary video image is displayed on the left or right portion of the MFD while a different page is also displayed. The zoomed portion of the auxiliary video image displayed can be panned to view other parts of the full image.

VIDEO SETTINGS

The auxiliary video settings can be changed on the 'Video Settings' Page on the Touchscreen Controller. Multiple windows may display the 'Video' Page at the same time.

Auxiliary video brightness, contrast, and saturation can be adjusted. The **Default Settings** Button reverts the brightness, contrast, and saturation to 50%.

Adjusting video settings:

1) From MFW Home, touch **Aircraft Systems > Video**.
2) To adjust the brightness, contrast, or saturation, touch and slide the applicable slider.

   Or:

   Touch the **+** pointer to increase or the **-** pointer to decrease the setting.
3) Touch the **Default Settings** Button to return the video settings to the factory settings.

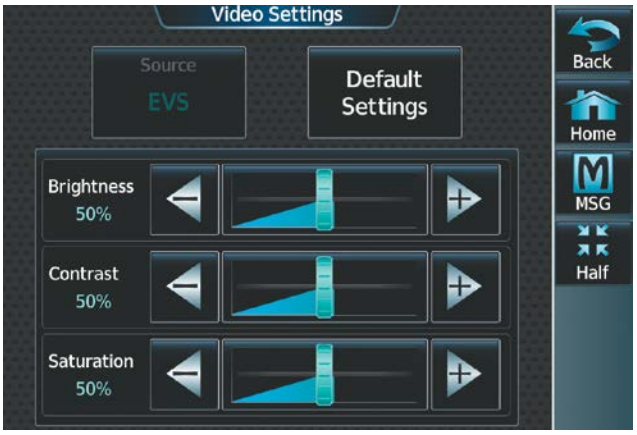


Figure 8-166 'Video Settings' Page

8.13 STABILIZED APPROACH

The Stabilized Approach functionality provides aural and visual annunciations to the flight crew of potentially unstable conditions during an approach and assist in recognition of factors that can lead to loss of control. Stabilized Approach uses airframe, weather and position data, heading, track, groundspeed and altitude, and requires either an instrument or visual approach to be active in order to function. Some Stabilized Approach Alerts require an instrument approach procedure to be active before the alert can be annunciated.

The Stabilized Approach feature is intended to monitor certain parameters to ensure the aircraft is operated in a 'stabilized approach' envelope. Typically, the copilot would monitor these parameters and alert the pilot flying that stabilized approach criteria are not met, which may necessitate a go-around. This feature automates this monitoring and provides real-time guidance to crew members that corrections need to be made to bring the aircraft back into the stabilized approach envelope.

Visual alerts are presented in the central portion of the PFW, to the right of the altitude tape and are removed when conditions that triggered the message no longer exist. These alerts are intended to convey a high level of urgency. Aural alerts are issued at the same time as the visual alerts are displayed.



Figure 8-167 Visual Alert PFW Location

ALERT TYPES

BAROMETRIC/GPS ALTITUDE MISMATCH ALERT

NOTE: *The barometric altitude is temperature compensated based on the current landing airport. Consequently, the airframe must provide a static air temperature input for this alert to be functional.*

The difference between the barometric altitude (temperature compensated for the landing airport) and the GPS altitude is greater than 150 ft.

CROSSWIND ALERT

NOTE: *The Crosswind Alert is suppressed if the optional SiriusXM Datalink (GDL 69A) is not installed and operating with a valid SiriusXM subscription.*

The landing runway crosswind is greater than 20 kts. Nominally, the source of the wind data is the most recent valid SiriusXM METAR data from the Stabilized Approach Landing Airport. If this METAR data is invalid, another airport's METAR may be used. This alert will not be issued if the system cannot obtain METAR data at or within 20 NM of the destination airport.

FLAPS NOT IN LANDING CONFIGURATION ALERT

The flaps are not in a landing configuration during the approach.

LATERAL DEVIATION ALERT

HSI lateral deviation is greater than 1.5 dots.

TAILWIND ALERT

NOTE: *The Tailwind Alert is suppressed if the optional SiriusXM Datalink (GDL 69A) is not installed and operating with a valid SiriusXM subscription.*

The landing runway tailwind is greater than 10 kts. Nominally, the source of the wind data is the most recent valid SiriusXM METAR data from the Stabilized Approach Landing Airport. If this METAR data is invalid, another airport's METAR may be used. This alert will not be issued if the system cannot obtain METAR data at or within 20 NM of the destination airport.

GPS VERTICAL DEVIATION ALERT

During a precision GPS approach, glidepath deviation is greater than 1.5 dots.

NON-GPS VERTICAL DEVIATION ALERT

During an ILS approach, glideslope deviation is greater than 1.5 dots.

Stabilized Approach Alert Annunciation	Voice Alert	Description	Type
BARO	"Baro"	Barometric/GPS Altitude Mismatch Alert	IFR
GLIDEPATH	"Glidepath"	GPS Vertical Deviation Alert	IFR
GLIDESLOPE	"Glideslope"	Non-GPS Vertical Deviation Alert	IFR
COURSE	"Course"	Lateral Deviation Alert	IFR
FLAPS	"Flaps"	Flaps Not in Landing Configuration Alert	IFR / VFR
CROSSWIND	"Crosswind"	Crosswind Alert	IFR / VFR
TAILWIND	"Tailwind"	Tailwind Alert	IFR / VFR

Note: Alerts in this table are prioritized by criticality, in the event where more than one alert may be applicable, only the single most critical alert will be annunciated.

Table 8-7 Stabilized Approach Annunciations

NOTE: *Upon system restart, all alerts are made available regardless of previous selections.*

Inhibiting all stabilized approach alerts:

1) From MFW Home, touch **Utilities > Setup > Avionics Settings.**
2) Touch the **Alerts** Tab.
3) Touch the **Stabilized APPR Inhibit** Button to enable or disable Stabilized Approach Alerts. A green annunciation in the button indicates Stabilized Approach Alerts are inhibited.

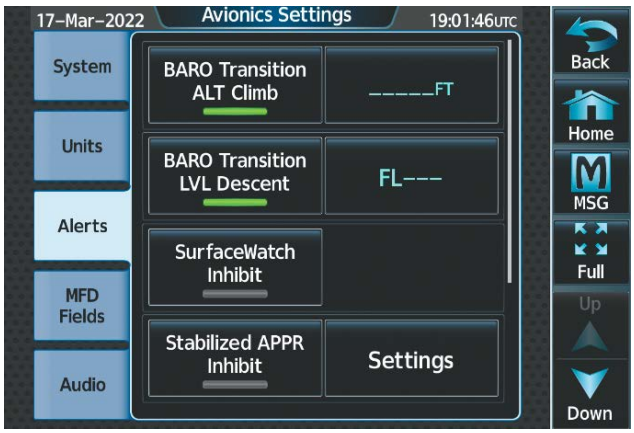


Figure 8-168 Stabilized Approach Alerts

Configuring Stabilized Approach settings:

1) From MFW Home, touch **Utilities > Setup > Avionics Settings.**
2) Touch the **Alerts** Tab.
3) Scroll down to view the **Stabilized APPR Inhibit** Button and touch the adjacent **Settings** Button.

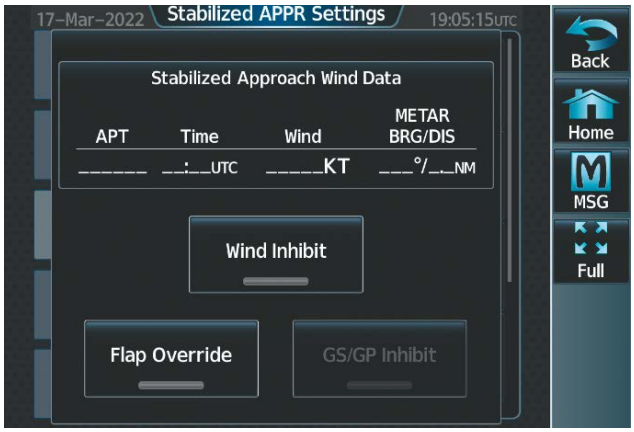


Figure 8-169 Stabilized Approach Settings

4) Touch the **Flap Override** Button to override the 'Flaps Not in Landing Configuration' Alert.

   Or:

   Touch the **Wind Inhibit** Button to prevent the Crosswind Alert and the Tailwind Alert from being displayed.

   Or:

   Touch the **GS/GP Inhibit** Button inhibit the Vertical Deviation Alerts.

8.14 ELECTRONIC STABILITY & PROTECTION (ESP)

Electronic Stability and Protection (ESP) is a feature that is part of the Garmin Autonomí® family of autonomous safety-enhancing technologies. This feature 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, VNE, 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.

The ESP feature will only function when the aircraft meets the following conditions:

- The aircraft is in flight. The system infers this by speed. If the aircraft GPS ground speed is over 30 knots, or True Airspeed is over 50 Knots.
- The aircraft is above 200 feet AGL (GPS Altitude), if GPS altitude is available.
- The autopilot is not engaged, meaning the pilot is "hand flying."
- The Aircraft is within the maximum engagement limit range defined as Pitch (±50°) and Bank (±75°).

ESP is automatically enabled above 200 ft AGL using GPS altitude. If a Loss of GPS Integrity (LOI) Occurs ESP will default to enabled, however low speed ESP functions will be disabled.

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 24 seconds (cumulative; not necessarily consecutive seconds) of a 120-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 the Autopilot Disconnect (**AP DISC**) Switch. Upon releasing the **AP DISC** 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 'Avionics Settings' Screen on the MFW Touchscreen Controller.

Enabling/disabling ESP:

1) From MFW Home, touch **Utilities** > **Setup** > **Avionics Settings**.
2) On the **System** Tab, scroll to display the **Stability & Protection** Button.
3) Touch the **Stability & Protection** Button to enable or disable ESP. A green annunciator on the button indicates ESP is enabled.

ESP is automatically enabled when power is applied to the system.



Figure 8-170 ESP Enabled

ROLL ENGAGEMENT

Roll Limit Indicators are displayed on the roll scale at 45° right and left, indicating where ESP will engage (see following figure). As roll attitude exceeds 45°, ESP will engage and the on-side Roll Limit Indicator will move to 30°. The Roll Limit Indicator is now showing where ESP will disengage as roll attitude decreases.

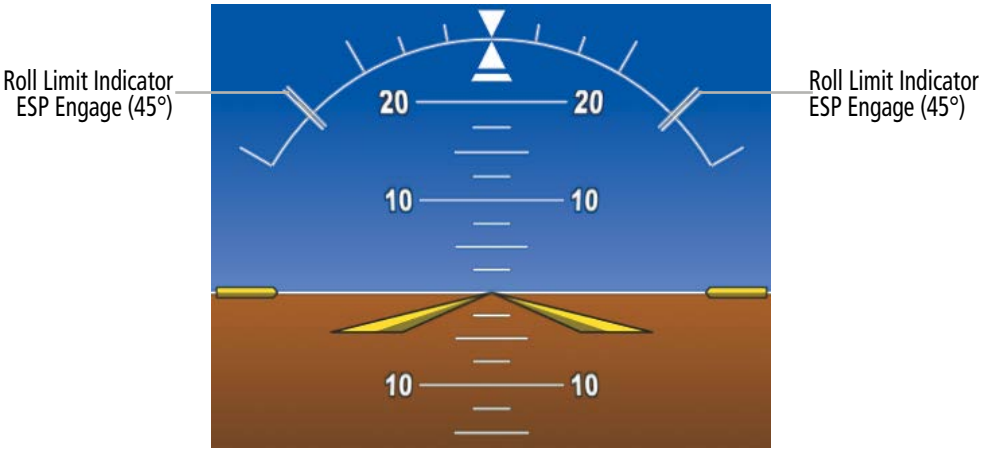


Figure 8-171 ESP Roll Engagement Indication (ESP NOT Engaged)

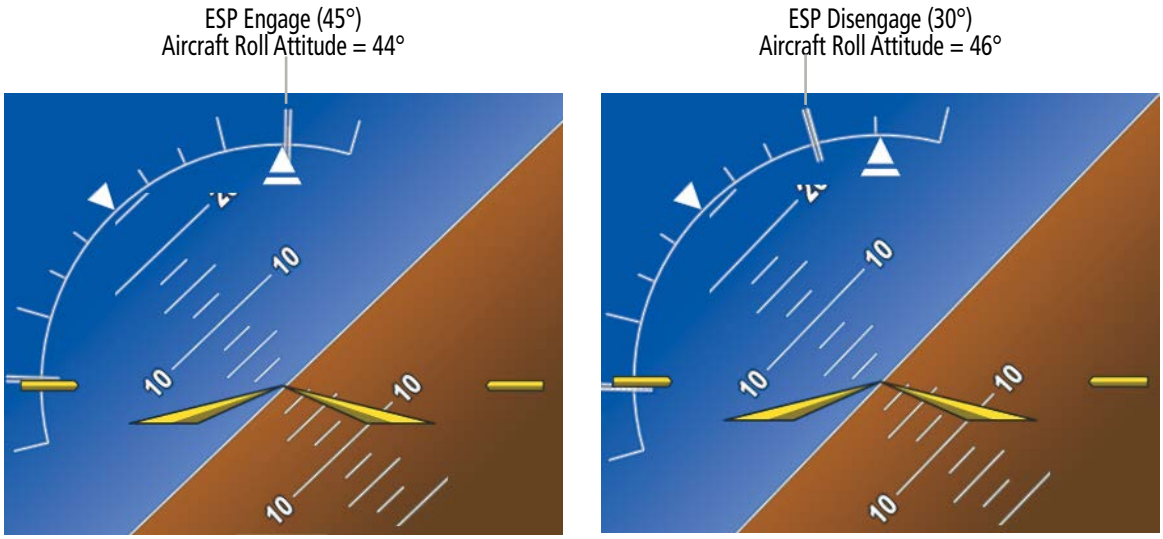


Figure 8-172 Roll Increasing to ESP Engagement

Once engaged, ESP force will be applied between 30° and 75°, as illustrated in the following figure. The force increases as roll attitude increases and decreases as roll attitude decreases. The applied force is intended to encourage pilot input that returns the airplane to a more normal roll attitude. As roll attitude decreases, ESP will disengage at 30°.

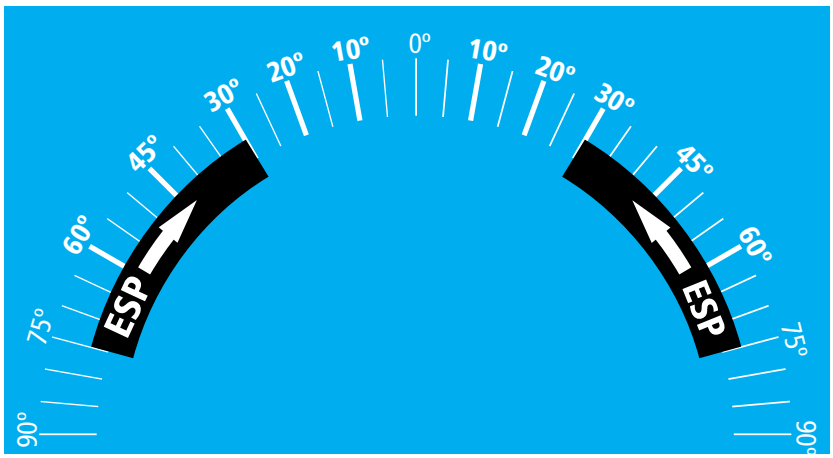


Figure 8-173 ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)

ESP is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75° (see following figure).

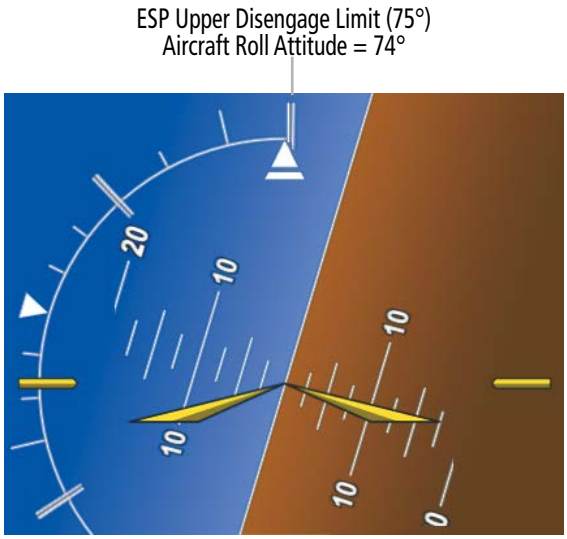


Figure 8-174 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP engages at 16° nose-up and 17° nose-down. Once ESP is engaged, it will apply opposing force between 16° and 50° nose-up and between 17° and 50° nose-down, as indicated in the following figure. Maximum opposing force is applied between 25° and 50° nose-up and between 22° and 50° nose-down.

The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft.

There are no indications marking the pitch ESP engage and disengage limits in these nose-up/nose-down conditions.

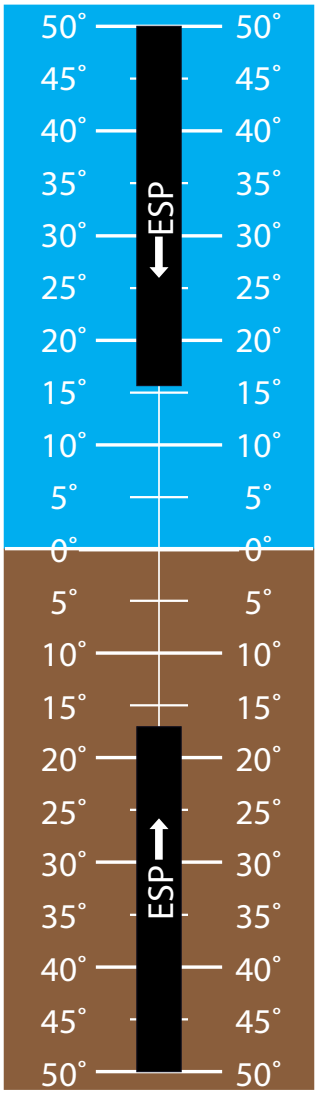


Figure 8-175 ESP Pitch Operating Range When Engaged
(Force Increases as Pitch Increases & Decreases as Pitch Decreases)

ANGLE OF ATTACK PROTECTION

Angle of attack protection is provided as part of the ESP feature. ESP force is applied when the Stall Warning and Protection System determines a stall warning condition is present or imminent. In this condition, the Pitch Limit Indicator will be initially displayed 4° below this computed pitch attitude (see following figure). 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.

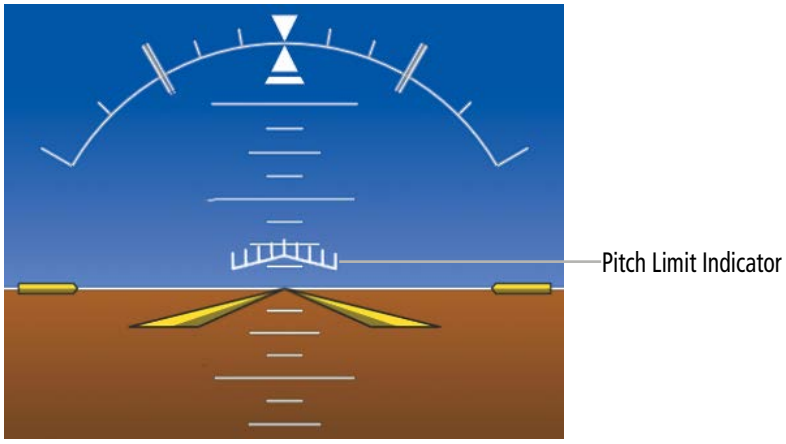


Figure 8-176 Pitch Limit Indicator

LOW AIRSPEED PROTECTION

Low airspeed protection utilizes configurable airspeed limits to protect against an underspeed condition. Low speed protection is provided as part of the ESP feature. When the stall warning system determines a stall condition is imminent, ESP will engage, applying force in the direction necessary to lower the nose of the aircraft.

HIGH AIRSPEED PROTECTION

High airspeed protection utilizes configurable airspeed limits to protect against an overspeed condition. Exceeding VNE 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.

8.15 HYPOXIA RECOGNITION & AUTOMATIC DESCENT MODE

The Hypoxia Recognition detects pilot incapacitation due to the affects of hypoxia or other physical conditions. This is accomplished by monitoring pilot interaction with the system. If the system determines the pilot is not responding, Automatic Descent Mode is activated placing the aircraft in a descent to a lower altitude to provide the pilot and passengers an opportunity to recover from the effects of hypoxia.

The system is operative when the aircraft altitude is above 14,900' Pressure Altitude (PA) and the Garmin AFCS Autopilot is engaged. Pilot interaction with the system is monitored by detecting key presses (turn knobs and the push-to-talk button excluded). If a period of inactivity (time dependent on altitude, see following figure) is detected, Hypoxia Recognition initiates an automatic descent.

NOTE: *Turning any knob does not reset pilot-to-aircraft interaction. Additionally, the push-to-talk button will not reset pilot-to-aircraft interaction.*

Upon activation, there are three sequential phases employed by the system: Determining Pilot Alertness, Descent to 14,000' MSL, and Descent to 12,500' MSL.

DETERMINING PILOT ALERTNESS

When the system detects a sufficient period of inactivity the Advisory Annunciation 'Are you alert?' is displayed. Pressing the **MSG** Button on the Touchscreen Controller will acknowledge the message and reset the system. Pressing any other softkey or button on the GDU or the AFCS Controller (GMC-707) will also reset the system.

When no pilot interaction is detected for an additional 60 seconds, the Caution Annunciation 'HYPOXIA ALERT' is displayed. Again, selecting the **MSG** Button will acknowledge the message and reset the system. Pressing any other softkey, or button will also reset the system.

When no pilot interaction is detected for an additional 60 seconds, the Warning Annunciation 'AUTO DESCENT' is displayed in the Annunciation Window and 'Automatic descent to 14,000FT in 60 seconds' is displayed in the Messages Window. Once again, selecting the **MSG** Button will acknowledge the message and reset the system. Pressing any other softkey, or button will also reset the system. When no interaction is detected for another 60 seconds, the system will automatically proceed with the descent.

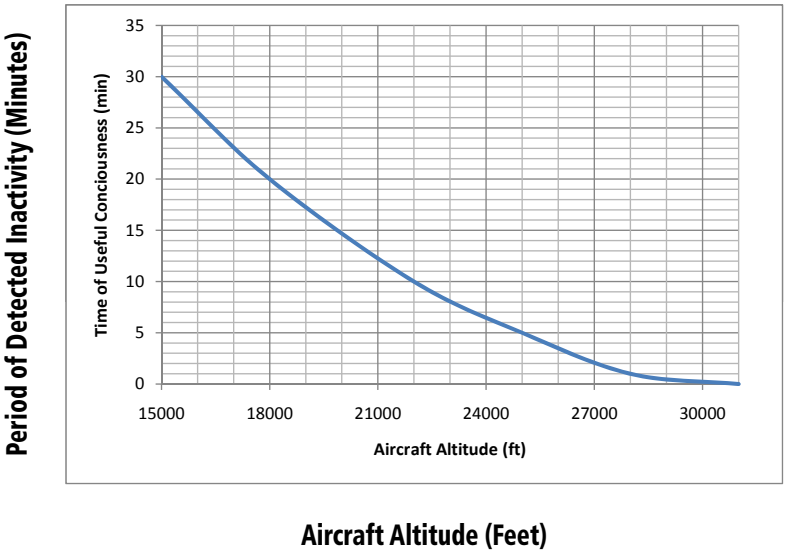


Figure 8-177 Hypoxia Recognition Activation Times

AUTOMATIC DESCENT MODE (ADM)

NOTE: *Automatic Descent Mode does not account for terrain elevation.*

As the system prepares for descent, the Selected Altitude is set to 14,000' and the AFCS enters FLC Mode with the Airspeed Reference set to the maximum allowable airspeed setting for the specific aircraft model. 'FLC' is displayed in the AFCS Status Box along with the target airspeed. Refer to the 'Flight Director Vertical Modes' discussion in Chapter Section 7: Automatic Flight Control System. AFCS lateral mode settings are not affected.

As the descent begins, an 'AUTO DESCENT' warning is displayed in the annunciation window. 'AUTO DESCENT - Aircraft Descending to 14,000FT' is displayed in the messages window. 'EDM' is shown as an AFCS Status Annunciation indicating the system has entered Automatic Descent Mode. 'EDM' (Emergency Descent Mode) is the AFCS mode that is activated when Hypoxia Recognition initiates an automatic descent. A continuous repeating chime will be heard as long as Automatic Descent Mode is active. After the descent begins, Automatic Descent Mode can only be canceled by disconnecting the autopilot.

As the aircraft reaches 14,000' the system sets the AFCS to Altitude Hold Mode. The AFCS will also remain in Automatic Descent Mode as indicated by 'EDM' continuing to be displayed as an AFCS Status Annunciation. The system again begins monitoring for pilot interaction.

If no pilot interaction is detected for four minutes, the system initiates the second descent. As the system prepares for this descent, the Selected Altitude is set to 12,500' and the AFCS again enters FLC Mode with the Airspeed Reference set to the maximum allowable airspeed for the specific aircraft model.

As the descent begins, an 'AUTO DESCENT' warning is displayed in the annunciation window. 'AUTO DESCENT - Aircraft Descending to 12,500FT' is displayed in the messages window. 'EDM' is shown as an AFCS Status Annunciation. Also, the continuous repeating chime is heard.

As the aircraft reaches 12,500' the system sets the AFCS to Altitude Hold Mode. The AFCS will also remain in Automatic Descent Mode as indicated by 'EDM' continuing to be displayed as an AFCS Status Annunciation as well as the continuing presence of the repeating chime. At this point, the AFCS must be disconnected to cancel Automatic Descent Mode.

8.16 DATABASE MANAGEMENT

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: *To improve database security, the following databases are digitally signed and must pass digital signature verification before the system will accept an upload through an SD card or through the Wireless Transceiver (Flight Stream 510): Airport Directories, Basemap, Navigation, Obstacles, SafeTaxi, Terrain, ChartView, FliteCharts, and IFR/VFR.*

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

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

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

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

CYCLE NUMBER AND REVISION

Databases that may be available include Terrain, Obstacle, Navigation, Basemap, SafeTaxi, Checklist, Airport Directory, IFR/VFR Charts, ChartView, and FliteCharts. Data is revised and expiration dates vary. The **Database** Tab on the 'Avionics Status' Page displays the current status of the databases. As an example, see the table below for the various displays and the definition of each. The expiration date and disables date varies for each database.

The 'Effective' date is the beginning date for this database cycle. The 'Effective' date appears in amber when the current date is before the effective date. The 'Expires' date is the revision date for the next database cycle. The 'Expires' date appears in amber when expired. 'Not Available' indicates the database is not available on the database card or no database card is inserted.

An expired SafeTaxi and Airport Directory database is not disabled and will continue to function indefinitely. Charts are still viewable during a period that extends from the cycle expiration date to the disables date. ChartView is disabled 70 days after the expiration date and is no longer available for viewing. Also, the **Charts** Button on the home screen appears subdued and is disabled until a new issue of ChartView is installed.

Database Condition	SafeTaxi	FliteCharts	Airport Directory
Current date is before Effective Date	Safetaxi Region US Version 2.71 Cycle YYTI Effective DD-MMM-YYYY Expires DD-MMM-YYYY GARMIN LTD. AND ITS SUBSIDIARIES	Not Applicable	Airport Directory Region WORLDWIDE Version 1.01 Cycle YYTI Effective DD-MMM-YYYY Expires DD-MMM-YYYY Copyright YYYY AC-U-KWIK® – Penton Media, Inc
Database is current	Safetaxi Region US Version 2.71 Cycle YYTI Effective DD-MMM-YYYY Expires DD-MMM-YYYY GARMIN LTD. AND ITS SUBSIDIARIES	Chart Chart FliteCharts Region US Cycle YYII Expires DD-MMM-YYYY Disables DD-MMM-YYYY Copyright YYYY Garmin Ltd. or its subsidiaries	Airport Directory Region WORLDWIDE Version 1.01 Cycle YYTI Effective DD-MMM-YYYY Expires DD-MMM-YYYY Copyright YYYY AC-U-KWIK® – Penton Media, Inc
Database has expired	Safetaxi Region US Version 2.71 Cycle YYTI Effective DD-MMM-YYYY Expires DD-MMM-YYYY GARMIN LTD. AND ITS SUBSIDIARIES	Chart Chart FliteCharts Region US Cycle YYII Expires DD-MMM-YYYY Disables DD-MMM-YYYY Copyright YYYY Garmin Ltd. or its subsidiaries	Airport Directory Region WORLDWIDE Version 1.01 Cycle YYTI Effective DD-MMM-YYYY Expires DD-MMM-YYYY Copyright YYYY AC-U-KWIK® – Penton Media, Inc
Database is disabled	Not Applicable	Chart Chart FliteCharts Region US Cycle YYII Expires DD-MMM-YYYY Disables DD-MMM-YYYY Copyright YYYY Garmin Ltd. or its subsidiaries	Not Applicable
Database is not installed	Safetaxi Region NOT AVAILABLE Version Cycle Effective Expires GARMIN LTD. AND ITS SUBSIDIARIES	Chart Chart NOT AVAILABLE Region Cycle Expires Disables Copyright	Airport Directory Region NOT AVAILABLE Version Cycle Effective Expires Copyright YYYY AC-U-KWIK® – Penton Media, Inc

Table 8-8 Database Status Examples

Viewing database information:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Status**.
2) Touch the **Database** Tab.
3) Touch the button corresponding to the display (**MFD1, PFD1, GTC1,** or **GTC2**) for which the database information will be viewed.
4) Scroll to display the appropriate database information.

   Or:

   From MFW Home, touch **Utilities > Setup > Database Status.**

Refer to the Database Management Section in Appendix 'B' for instructions on revising databases. Database cycle numbers are in a format such as YYXI or YYII, which are deciphered as follows:

YYXI

» YY – Indicates the last two digits of the year (e.g., 23 represents 2023)

» X – Indicates the database type (e.g., 'S' is for SafeTaxi, 'D' is for Airport Directory, etc., as seen in the following table)

» I – Indicates the numerical issue of the database for the year (e.g., 05 is the fifth issue of the year)

YYII

» YY – Indicates the last two digits of the year (e.g., 23 represents 2023)

» II – Indicates the numerical issue of the database for the year (e.g., 05 is the fifth issue of the year)

Database	Database Cycle Number Format	Revision Cycle
Navigation	YYII	28 days
Basemap	YYMI	Not Applicable
Terrain	YYTI	Not Applicable
Obstacle	YYBI	56 days
SafeTaxi	YYSI	56 days
Airport Directory	YYDI	56 days
ChartView	YYII	14 days
FliteCharts	YYII	28 days
IFR/VFR Charts	YYII	28 days

Table 8-9 Database Cycle Number Format and Revision Cycle

8.17 ABNORMAL OPERATION

DATALINK TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the 'Avionics Status' Page for Iridium Receiver (GSR 56) (optional) or the SiriusXM Datalink Receiver (GDL 69A) (optional) status, serial number, and software version number. If a failure has been detected in the GDL 69A the status is marked with a red 'X'.

Viewing the 'Avionics Status' Screen:

1) From MFW Home, touch **Utilities > Setup** > **Avionics Status**.
2) Touch the **LRU Info** Tab.
3) Scroll to display the appropriate database information.
4) Touch an LRU to view further information.

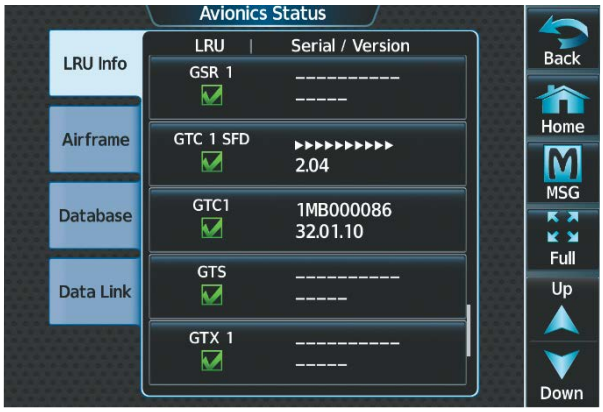


Figure 8-178 'Avionics Status' Screen



Figure 8-179 GSR 56 Status

QUICK TROUBLESHOOTING

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

» Ensure the installed hardware has an active subscription or account (e.g., Iridium subscription, XM subscription)

» Perform a quick check of the circuit breakers to ensure that power is applied to the applicable hardware

» If a failure still exists, the following messages may provide insight as to the possible problem:

Message	Message Location	Description
CHECK ANTENNA	'XM Information' Screen (Touchscreen Controller)	Datalink Receiver antenna error; service required
UPDATING	'XM Information' Screen (Touchscreen Controller)	Datalink Receiver updating encryption code
NO SIGNAL	'XM Information' Screen (Touchscreen Controller) Weather Datalink Display (selected display pane)	Loss of signal; signal strength too low for receiver
LOADING	'Music' Screen (Touchscreen Controller)	Acquiring channel audio or information
OFF AIR	'Music' Screen (Touchscreen Controller)	Channel not in service
---	'Music' Screen (Touchscreen Controller)	Missing channel information
ACTIVATION REQUIRED	'XM Information' Screen (Touchscreen Controller) Weather Datalink Display (selected display pane)	SiriusXM subscription is not activated

Table 8-10 SiriusXM Datalink Receiver Messages

ANNUNCIATIONS AND ALERTS

NOTE: The current version of the pertinent flight manual supersedes information found in this document. Refer to the current version of the pertinent flight manual for recommended pilot actions.

CREW ALERTING SYSTEM (CAS) MESSAGES

The CAS Window displays abbreviated Crew Alerting System (CAS) annunciation text. Text color is based on alert levels described in the following section. When the system issues a CAS message, a CAS window appears to the right (or beneath in Split Mode) of the Altimeter and Vertical Speed Indicator on the PFD, and a Warning or Caution (**WARN** or **CAUT**) Annunciation appears in the upper left corner of the PFD. The **WARNING**, **CAUTION**, or **ALERTS** Softkey will also flash on the PFD. On the Touchscreen Controllers, a flashing **WARN** or **CAUT** Button appears in place of the **MSG** Button, matching the annunciation on the PFD. A white horizontal line separates annunciations that are acknowledged from annunciations that are not yet acknowledged. Higher priority annunciations are displayed towards the top of the window. The CAS messages, softkey annunciation, and Touchscreen controller button flash until the messages are acknowledged by touching the button or softkey. CAS messages that are auto-acknowledged by the system will not flash, and will not trigger the **WARN** or **CAUT** Button, softkey and Annunciation to appear.

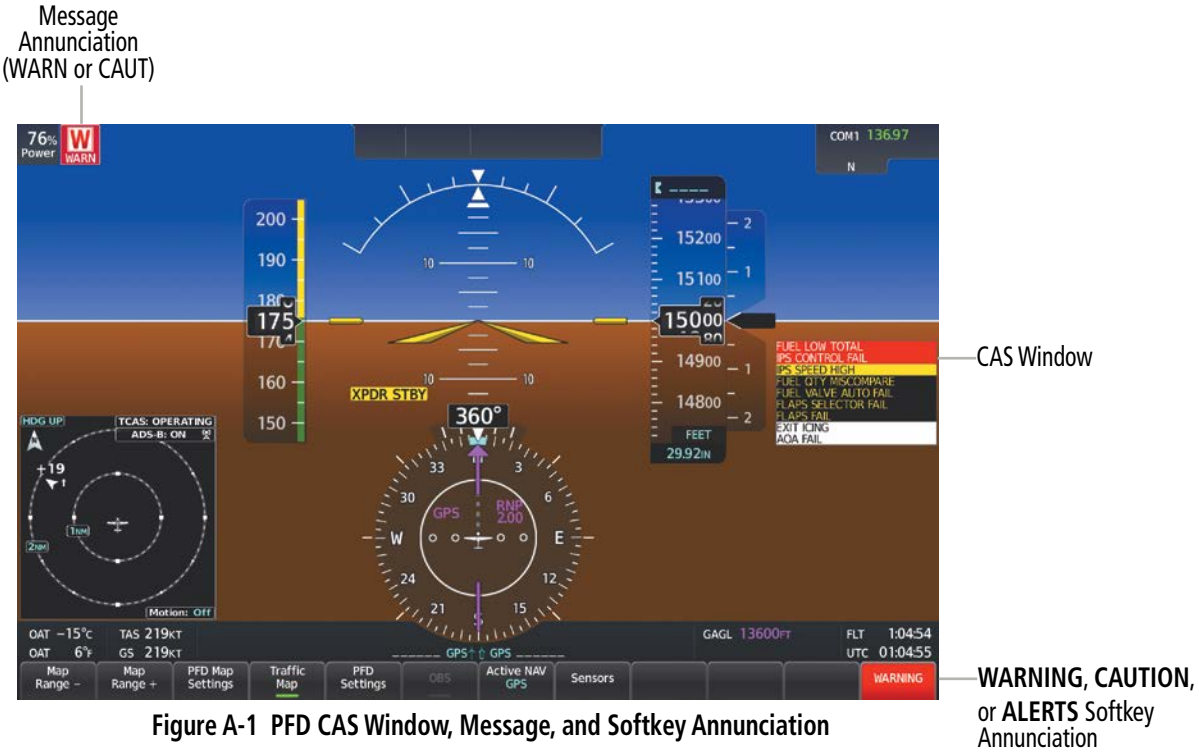


Figure A-1 PFD CAS Window, Message, and Softkey Annunciation

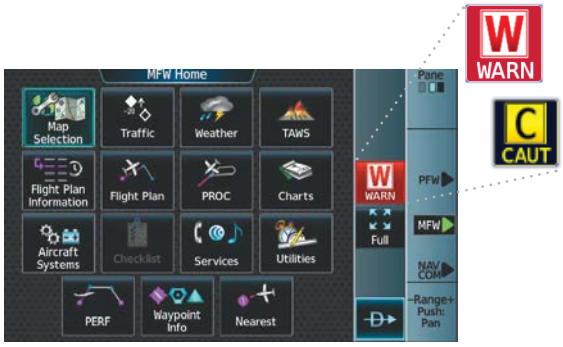


Figure A-2 Touchscreen Controller Warning/Caution Button

Any active CAS message can be viewed on the Touchscreen Controller by touching the **WARNING**, **CAUTION**, or **MSG** Button on the Button Bar, then touching the **Up** or **Down** Buttons to scroll through the displayed messages on the 'Notifications Screen.



Figure A-3 Scrolling - 'Notifications' Window

CAS MESSAGE PRIORITIZATION

CAS messages are grouped by criticality (Warning, Caution, Alerts) and sorted within each group in order of appearance (most recent messages on top). The color of the message is based on its urgency and on required action.

» **Warning** (red) – Immediate crew awareness and action required. The system displays a Warning message in the CAS Window of the PFD and may issue an aural chime. A Warning message may be accompanied by a red **WARN** Button and Annunciation on the Touchscreen Controllers and in the upper left corner of the PFD respectively, as well as the **WARNING** Softkey annunciation. Touching the **WARN** Button on the Touchscreen Controller or the **WARNING** Softkey on the PFD acknowledges the presence of the Warning message, stops any aural chime and removes the **WARN** Button, annunciation and flashing softkey.

» **Caution** (amber) – Immediate crew awareness and possible future corrective action required. The system displays a Caution message in the CAS Window and may issue an aural chime. A Caution message may be accompanied by an amber **CAUT** Button and annunciation on the Touchscreen Controller and in the upper left corner of the PFD respectively, as well as the **CAUTION** Softkey Annunciation. Touching the **CAUT** Button on the Touchscreen Controller or the **CAUTION** Softkey on the PFD acknowledges the presence of the Caution message, stops any aural chime, and removes the **CAUT** Button, annunciation and flashing **CAUTION** softkey.

» **Alerts** (white) – Crew awareness and subsequent action may be required. Alerts CAS messages do not flash. An **ALERTS** Softkey annunciation will display on the PFD. Pressing the **ALERTS** Softkey on the PFD acknowledges the presence of the Alerts message, and removes the flashing **ALERTS** Softkey.

After the acknowledgment, a message remains displayed at the top of its respective priority group in the CAS Window until either a newer message of the same priority appears or the condition(s) that caused the alert to display no longer exist.



Figure A-4 WARNING, CAUTION, and ALERTS PFD Softkey Annunciations

WARNING MESSAGES

NOTE: The ice protection system (optional) must be operated in accordance with the current version of the pertinent flight manual. This option is only available on the SR22 and SR22T models.

CAS Message Title	'Notifications' Window Text
AOA OVERHEAT[2]	AOA probe is overheated.
APPROACH SPEED	Approach Speed is too high.
AUTO DESCENT	Automatic descent to 14,000FT in 60 seconds.
AUTO DESCENT	Aircraft descending to 14,000FT.
AUTO DESCENT	Aircraft descending to 12,500FT.
AUTO DESCENT	Aircraft descended due to pilot incapacitation.
CHT	Cylinder head temperature is high.
CO LVL HIGH	Carbon monoxide level is too high.
ESSENTIAL BUS VOLTS	Check essential power bus voltage.
FLAPS ICE[2]	Full flaps prohibited in icing conditions.
FUEL FLOW	Check fuel flow.
FUEL IMBALANCE	Fuel quantity imbalance has been detected.
FUEL LOW LEFT	Left fuel tank is nearly empty.
FUEL LOW RIGHT	Right fuel tank is nearly empty.
FUEL LOW TOTAL	Total fuel quantity is low.
IPS CONTROL FAIL	IPS valves cannot be closed.
IPS FLUID LOW	IPS fluid quantity is low.
IPS QUANTITY FAIL	Left and right IPS fluid quantities are unknown.
MAIN BUS 1 VOLTS	Check main power bus 1 voltage.
MAIN BUS 2 VOLTS	Check main power bus 2 voltage.
MANIFOLD PRESSURE	Check manifold pressure.
OIL PRESSURE	Oil pressure is out of range.
OIL TEMP	Oil temperature is high.
OXYGEN FAULT[1]	Oxygen system fault.
OXYGEN QTY LOW[1]	Oxygen quantity is low.
OXYGEN REQUIRED[1]	Oxygen usage is required.
RPM	Check engine RPM.
SPIN SPIN SPIN	Spin entry detected - initiate recovery.
STALL	Stall warning.
STALL WARNING FAIL	Stall warning is inoperative.
STARTER ENGAGED	Starter is engaged.
TIT[3]	Turbine inlet temperature is high.

[1] *Optional*
[2] *TKS FIKI (optional)*
[3] *SR22T only*

CAUTION MESSAGES

CAS Message Title	'Notifications' Window Text
ALT AIR OPEN[2]	Alternate air door is open.
ALTERNATOR 1 CURRENT	Check alternator 1 current.
ALTERNATOR 2 CURRENT	Check alternator 2 current.
AOA HEAT FAIL [3]	Autopilot is unavailable due to miscompare.
AP MISCOMPARE	Autopilot is unavailable due to miscompare.
AP/PFD DIF ADC	Autopilot and PFD are using different ADCs.
AP/PFD DIF AHRS	Autopilot and PFD are using different AHRSs.
BATTERY 1 CURRENT	Check battery 1 current.
BATTERY 1 FAIL	Battery 1 service is required.
BATTERY 1 FAULT	Battery 1 fault detected.
BATTERY 1 LOW	Battery 1 state of charge is low.
CHT	Cylinder head temperature is high.
FLAPS AIRSPEED INHIBIT	Flaps motion inhibited.
FLAPS DISAGREE	Flaps not in commanded position.
FLAPS FAIL	Flaps not in commanded position.
FLAPS SELECTOR FAIL	Flaps not in commanded position.
FUEL IMBALANCE	Fuel quantity imbalance has been detected.
FUEL LOW TOTAL	Total fuel quantity is low.
FUEL PUMP OFF	Fuel pump is turned off.
FUEL QTY MISCOMP	Sensed and totalized fuel quantity disagreement.
FUEL VALVE AUTO FAIL	Automatic fuel tank selection is unavailable.
HYPOXIA ALERT	Hypoxia caution alert.
IPS FLUID LOW[3]	IPS fluid quantity is low.
IPS IMBALANCE[3]	IPS fluid quantity imbalance has been detected.
IPS PRESSURE HIGH[3]	IPS pressure is high.
IPS PRESSURE LOW [3]	IPS tail pressure is low.
IPS QUANTITY FAIL [3]	Left IPS fluid quantity is unreliable.
IPS QUANTITY FAIL [3]	Right IPS fluid quantity is unreliable.
IPS SPEED HIGH [3]	Airspeed is too high for ice protection.
IPS SPEED LOW [3]	Airspeed is too low for ice protection.
IPS TEMP LOW [3]	Temperature is too low for ice protection.
MAIN BUS 1 VOLTS	Check main power bus 1 voltage.
MAIN BUS 2 VOLTS	Check main power bus 2 voltage.
MANIFOLD PRESSURE	Check manifold pressure.
NO ADC MODES	Autopilot air data modes are not available.

[1] *Optional*
[2] *SR22T*
[3] *TKS FIKI (optional)*

CAS Message Title	'Notifications' Window Text
NO VERT MODES	Autopilot vertical modes are not available.
OIL PRESSURE	Oil pressure is out of range.
OIL TEMP	Oil temperature is high.
OXYGEN QTY LOW[1]	Oxygen quantity is low.
OXYGEN REQUIRED[1]	Oxygen usage is required.
PARK BRAKE	Parking break is set.
PITOT HEAT FAIL	Pitot heat failure.
PROBE HEAT OFF	Probe heat is required.
SFD ALT MISCOMPARE	SFD altitude miscompare.
SFD IAS MISCOMPARE	SFD airspeed miscompare.
SFD PITCH MISCOMPARE	SFD pitch miscompare.
SFD ROLL MISCOMPARE	SFD roll miscompare.
STALL WARNING FAIL	AOA/stall warning input invalid.
STARTER ENGAGED	Starter is engaged.
TAKEOFF FLAPS	Flaps not in takeoff configuration.

[1] *Optional*
[2] *SR22T*
[3] *TKS FIKI (optional)*

ALERTS MESSAGES

NOTE: *The ice protection system (optional) must be operated in accordance with the current version of the pertinent flight manual limitations. This option is only available on SR22 and SR22T models.*

CAS Message Title	'Notifications' Window Text
ALTITUDE SEL	Climbing away from selected altitude.
ALTITUDE SEL	Descending away from selected altitude.
AOA FAIL[2]	Dynamic stall speed band is unavailable.
ARE YOU ALERT?	Are you alert?
CHECK OXYGEN[1]	Check oxygen system status.
COURSE SELECT[1]	Current track will not intercept selected course.
ECS RECIRC ON	ECS recirculation mode is prohibited in flight.
ESP CONFIG	ESP config error. Config service req'd.
EXIT ICING[2] [1]	Exit icing conditions.
FAILED PATH	An autopilot servo data path has failed.
FLAPS CLIMB	Flaps not set for enroute climb.
FUEL IMBALANCE	Fuel quantity imbalance has been detected.
FUEL PUMP OFF	Fuel pump is turned off.
FUEL VALVE OFF	Fuel valve is in the off position.

[1] *Optional*
[2] *TKS FIKI (optional)*

CAS Message Title	'Notifications' Window Text
HDG MODE	Heading mode active for extended period.
IPS FLUID LOW[2]	IPS fluid quantity is low.
IPS PUMP BACKUP[3]	IPS backup pump mode has been selected.
OXYGEN ON[1]	Oxygen system is left on after shutdown.
OXYGEN QTY LOW[1]	Oxygen quantity is low.
ROL MODE	Roll mode is active.
SFC WATCH FAIL	SurfaceWatch failed.
SFC WATCH INHIB	SurfaceWatch inhibited.
SFD NO COMPARE	SFD comparison data missing.
VNAV ALT SEL	VNAV needs lower ALT SEL to capture VPATH.
VNAV NOT ARMED	Press VNV to arm VPATH capture.

[1] *Optional*
[2] *TKS FIKI (optional)*

VOICE ALERTS

Refer to applicable sections throughout this Pilot's Guide for more information on Voice Alerts.

SYSTEM ANNUNCIATIONS

When the system issues a message, the **MSG** Annunciator flashes on the PFD and a **MSG** Button flashes on the Touchscreen Controllers to alert the pilot of a new message. The annunciator and button continue to flash until acknowledged by touching the **MSG** Button on any Touchscreen Controller. Active messages are displayed on the Touchscreen Controllers in white text. Messages that have become inactive change to gray text. The **MSG** Annunciator and **MSG** Button flash if the state of a displayed alert changes or a new message is displayed.

When an LRU or an LRU function fails, a large red or amber 'X' (depending on the LRU or function) is typically displayed on items associated with the failed 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 powering of the system, certain windows remain invalid as the equipment begins to initialize. All windows should be operational within one minute of power application. If any window continues to remain flagged, the system should be serviced by a Garmin-authorized repair facility.*

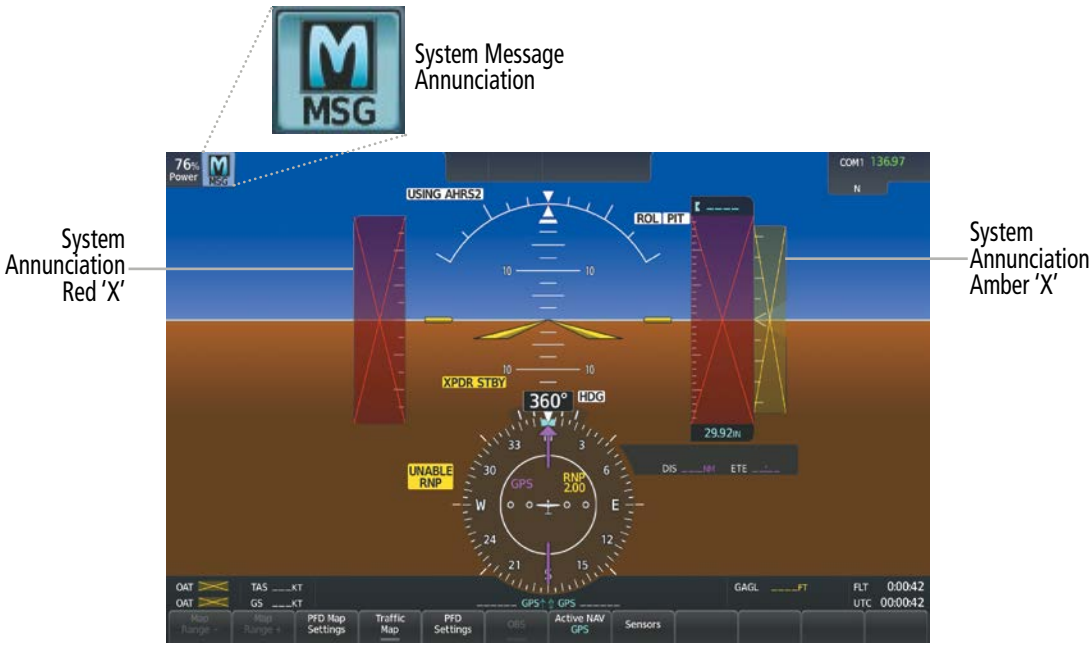


Figure A-4 System Annunciations (PFD)



Figure A-5 System Messages Annunciation (Touchscreen Controller)

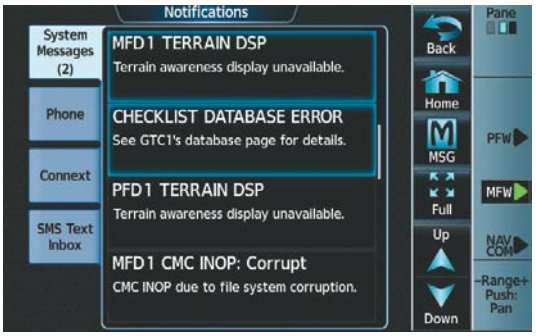


Figure A-6 'Notifications' Screen After MSG Button Touched (Touchscreen Controller)

SYSTEM MESSAGES

NOTE: *This Section provides information regarding system messages 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.*

This section describes various system messages. Certain messages are issued due to an LRU or LRU function failure. Such messages are normally accompanied by a corresponding red or amber 'X' annunciation as shown previously in the System Annunciations section.

System Message	Comments
ABORT APPR – Loss of GPS navigation. Abort approach.	Abort approach due to loss of GPS navigation.
ADC 1 COMM – Check ADC 1 and GIA1 wiring	The ADC unit is inoperative due to a loss of communication path to a GIA.
ADC 1 COMM – Check ADC 1 and GIA2 wiring	The ADC unit is inoperative due to a loss of communication path to a GIA.
ADC 1 FAULT – ADC Failure	The AFCS is unavailable due to invalid data from the ADC unit.
ADC 1 POWER – ADC 1 power loss. Check power.	The ADC unit is inoperative due to a loss of communication path to a GIA.
ADC 2 COMM – Check ADC 2 and GIA1 wiring	The ADC unit is inoperative due to a loss of power.
ADC 2 COMM – Check ADC 2 and GIA2 wiring	The ADC unit is inoperative due to a loss of power.
ADC 2 FAULT – ADC Failure	The AFCS is unavailable due to invalid data from the ADC unit.
ADC 2 POWER – ADC 2 power loss. Check power.	The ADC unit is inoperative due to a loss of power.
ADC1 ALT EC – ADC altitude error correction is unavailable.	ADC1 / GDC1 is reporting the altitude error correction is unavailable.
ADC1 AS EC – ADC airspeed error correction is unavailable.	ADC1 / GDC1 is reporting the airspeed error correction is unavailable.
ADC1 SERVICE – ADC needs service. Return unit for repair.	A failure has been detected in the ADC1 / GDC1. The system should be serviced.
ADC2 ALT EC – ADC altitude error correction is unavailable.	ADC2 / GDC2 is reporting the altitude error correction is unavailable.
ADC2 AS EC – ADC airspeed error correction is unavailable.	ADC2 / GDC2 is reporting the airspeed error correction is unavailable.
ADC2 SERVICE – ADC needs service. Return unit for repair.	A failure has been detected in the ADC2 / GDC2. The system should be serviced.
AFCS [1-2] INOP: PFT FAIL – Pre-Flight Test Failure	AFCS 1 and/or 2 pre-flight test failure.
AFCS INOP: GIA1 SERVOS COMM – Check GIA1 485 bus wiring to servos	The GSA servos are inoperative due to a loss of communication path to a GIA.

System Message	Comments
AFCS INOP: GIA2 SERVOS COMM – Check GIA2 485 bus wiring to servos	The GSA servos are inoperative due to a loss of communication path to a GIA.
AFCS INOP: PIT SERVO FAULT – PIT Servo failure	The GSA servo is inoperative due to an internal servo fault. The system should be serviced.
AFCS INOP: PIT SERVO PFT – AFCS [1-2] Pre-Flight Test Fail: PIT Servo	The GSA servo is inoperative due to an AFCS 1 and/or 2 pre-flight test failure. The system should be serviced.
AFCS INOP: PIT SERVO POWER – PIT Servo power loss. Check power.	The GSA servo is inoperative due to a loss of power. The system should be serviced.
AFCS INOP: PIT SERVO POWER – PIT Servo power loss. Check power.	The GSA servo is inoperative due to a loss of power. The system should be serviced.
AFCS INOP: PIT TRM SERVO – AFCS [1-2] Pre-Flight Test Fail: PIT Trim Servo.	The GSA servo is inoperative due to an AFCS 1 and/or 2 pre-flight test failure. The system should be serviced.
AFCS INOP: PIT TRIM SVO FAULT – PIT Trim Servo failure	The GSA servo is inoperative due to an internal servo fault. The system should be serviced.
AFCS INOP: ROL SERVO FAULT – ROL Servo failure	The GSA servo is inoperative due to an internal servo fault. The system should be serviced.
AFCS INOP: ROL SERVO PFT – AFCS [1-2] Pre-Flight Test Fail: ROL Servo	The GSA servo is inoperative due to an AFCS 1 and/or 2 pre-flight test failure. The system should be serviced.
AFCS INOP: ROL SERVO POWER – ROL Servo power loss. Check power.	The GSA servo is inoperative due to a loss of power. The system should be serviced.
AFCS INOP: YAW SERVO FAULT – YAW Servo failure	The GSA servo is inoperative due to an internal servo fault. The system should be serviced.
AFCS INOP: YAW SERVO PFT – AFCS [1-2] Pre-Flight Test Fail: YAW Servo	The GSA servo is inoperative due to an AFCS 1 and/or 2 pre-flight test failure. The system should be serviced.
AFCS INOP: YAW SERVO POWER – YAW Servo power loss. Check power.	The GSA servo is inoperative due to a loss of power. The system should be serviced.
AHRS 1 COMM – Check AHRS 1 and GIA1 wiring	The AHRS unit is inoperative due to a loss of communication path to a GIA.
AHRS 1 COMM – Check AHRS 1 and GIA2 wiring	The AHRS unit is inoperative due to a loss of communication path to a GIA.
AHRS 1 FAULT – AHRS Failure	The AFCS is unavailable due to invalid data from the AHRS unit.
AHRS MAG DB – AHRS magnetic model database version mismatch.	AHRS1 and AHRS2 magnetic model database versions do not match.
AHRS1 CAL – AHRS1 calibration version error. SRVC REQD.	AHRS1 calibration version error. The system should be serviced.
AHRS1 CONFIG – AHRS1 config error. Config service REQD.	AHRS1 configuration settings do not match those of backup configuration memory. The system should be serviced.

System Message	Comments
AHRS1 GPS – AHRS1 not receiving any GPS information.	AHRS1 is not receiving any or any useful GPS information. Check the current version of the pertinent flight manual for limitations. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	AHRS1 is not receiving backup GPS information. The system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	AHRS1 is operating exclusively in no-GPS mode. The system should be serviced.
AHRS1 GPS – AHRS1 using backup GPS source.	AHRS1 is using the backup GPS path. Primary GPS path has failed. The system should be serviced when practical.
AHRS 1 POWER – AHRS 1 power loss. Check power.	The AHRS unit is inoperative due to a loss of power.
AHRS1 SERVICE – AHRS1 needs service. Return unit for repair.	A failure has been detected in AHRS1. The system should be serviced.
AHRS 2 COMM – Check AHRS 2 and GIA1 wiring	The AHRS unit is inoperative due to a loss of communication path to a GIA.
AHRS 2 COMM – Check AHRS 2 and GIA2 wiring	The AHRS unit is inoperative due to a loss of communication path to a GIA.
AHRS 2 POWER – AHRS 2 power loss. Check power.	The AHRS unit is inoperative due to a loss of power.
AHRS1 SRVC – AHRS1 Magnetic-field model needs update.	AHRS1 earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS1 TAS – AHRS1 not receiving valid airspeed.	AHRS1 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 REQD.	AHRS2 calibration version error. The system should be serviced.
AHRS2 CONFIG – AHRS2 config error. Config service REQD.	AHRS2 configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS 2 FAULT – AHRS Failure	The AFCS is unavailable due to invalid data from the AHRS unit.
AHRS2 GPS – AHRS2 not receiving any GPS information.	AHRS2 is not receiving any or any useful GPS information. Check the current version of the pertinent flight manual for limitations. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving backup GPS information.	AHRS2 is not receiving backup GPS information. The system should be serviced.
AHRS2 GPS – AHRS2 operating exclusively in no-GPS mode.	AHRS2 is operating exclusively in no-GPS mode. The system should be serviced.
AHRS2 GPS – AHRS2 using backup GPS source.	AHRS2 is using the backup GPS path. Primary GPS path has failed. The system should be serviced when practical.
AHRS2 SERVICE – AHRS2 needs service. Return unit for repair.	A failure has been detected in AHRS2. The system should be serviced.
AHRS2 SRVC – AHRS2 Magnetic-field model needs update.	AHRS2 earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS2 TAS – AHRS2 not receiving valid airspeed.	AHRS2 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.
AP DISC: AP ENGAGE TIMEOUT	Failed to engage AP due to activation timeout of required resources.
AP DISC: GFC POWER LOSS	Abnormal AP disconnect due to loss of GFC power.
AP DISC: GIA REVERSION	Abnormal AP disconnect while switching to alternate GIA.

System Message	Comments
AP DISC: HSDB CONNECTIVITY	Abnormal AP disconnect due to loss of data bus connectivity.
AP DISC: INVALID DATA – PIT servo	Abnormal AP disconnect due to invalid data in pitch servo.
AP DISC: INVALID DATA – ROL servo	Abnormal AP disconnect due to invalid data in roll servo.
AP DISC: INVALID DATA – Servo PFT	Abnormal AP disconnect due to failed servo pre-flight test.
AP DISC: INVALID DATA – PFD	Abnormal AP disconnect due to loss of primary flight display.
AP DISC: INVALID DATA – ADC	Abnormal AP disconnect due to servo receiving invalid ADC data.
AP DISC: INVALID DATA – SWPS	Abnormal AP disconnect due to stall warning activated.
AP DISC: INVALID DATA – AHRS	Abnormal AP disconnect due to invalid AHRS data.
AP DISC: INVALID DATA – Cross-side GIA	Abnormal AP disconnect due to cross-side GIA commanding an AP disconnect.
AP DISC: INVALID DATA – Flight Director parameters	Abnormal AP disconnect due to flight director receiving invalid required parameter.
AP DISC: INVALID DATA – Servo comm failure	Abnormal AP disconnect due to loss of servo communication.
AP DISC: MET ACTIVE	Abnormal AP disconnect due to use of manual electric trim.
AP DISC: PRIMARY TRIM – Primary Trim not Selected.	Abnormal AP disconnect due to incorrect trim card selection
AP DISC: SENSOR MISCOMPARE – ADC	Abnormal AP disconnect due to miscompared ADC sensor readings.
AP DISC: SENSOR MISCOMPARE – AHRS	Abnormal AP disconnect due to miscompared AHRS sensor readings.
AP DISC: SOFTWARE	Abnormal AP disconnect due to software fault.
AP DISC: X-SIDE DISCONNECT – Cross-side disconnect	Abnormal AP disconnect due to cross-side GIA commanding an AP disconnect.
AP DISC: YD NOT AVAILABLE	Abnormal AP disconnect due to loss of yaw damper.
APPR ADVISORY – SBAS VNAV not available. Using Baro VNAV.	SBAS not available. The system is calculating the VNAV profile using BARO VNAV.
APPR ADVISORY – GPS VNAV not available. Using Baro VNAV.	GPS not available. The system is calculating the VNAV profile using BARO VNAV.
APPR DOWNGRADED – <Approach Downgraded>	Vertical guidance generated by SBAS is unavailable. Use Baro LNAV/VNAV or LNAV minimums.
APR INACTV – Approach is not active.	The system notifies the pilot 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 airspace within 10 minutes.
ARSPC NEAR – Airspace near – less than 2 nm.	Special use airspace is within 2 nm of the aircraft position.
ARSPC NEAR – Airspace near and ahead.	Special use airspace is near and ahead of the aircraft position.
ARM VNAV DESCENT – Reset altitude preselect to arm descent.	Adjust altitude preselect value to enable VNAV descent.

System Message	Comments
AUDIO MANIFEST – Audio software mismatch, communication halted.	The GIA has incorrect software installed. The system should be serviced.
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.
CHECK NAV – Approach ID mismatch / <LOC>	Selected course for LOC2 differs from published localizer course by more than 10 degrees.
CHECKLIST DATABASE ERROR – See GTC1's database page for details.	The GTC database has an error.
CHECKLIST DATABASE ERROR – See GTC2's database page for details.	The GTC database has an error.
CNFG MODULE – PFD1 configuration module is inoperative.	The specified GDU configuration module backup memory has failed. The system should be serviced.
COM #1 INOP: CAL – Factory COM Calibration Lost or Corrupted.	COM 1 calibration version error. Check COM calibration.
COM #1 INOP: CRNT – Check COM Current.	COM 1 current is low. Check COM current.
COM #1 INOP: INTRL – COM Internal Fault.	COM 1 has an internal fault.
COM #1 INOP - SYNTH – COM Synthesizer Lock Fault.	COM 1 has a synthesizer lock fault.
COM #1 INOP - VOLT – Check COM Voltage.	COM 1 has low voltage.
COM #2 INOP: CAL – Factory COM Calibration Lost or Corrupted.	COM 2 calibration version error. Check COM calibration.
COM #1 REDUCED TX POWER – Reduced COM transmit power.	COM 1 has a reduced transmission power.
COM #2 INOP: CRNT – Check COM Current.	COM 2 current is low. Check COM current.
COM #2 INOP: INTRL – COM Internal Fault.	COM 2 has an internal fault.
COM #2 INOP: SYNTH – COM Synthesizer Lock Fault.	COM 2 has a synthesizer lock fault.
COM #2 INOP: VOLT – Check COM Voltage.	COM 2 has low voltage.
COM #2 REDUCED TX POWER – Reduced COM transmit power.	COM 2 has a reduced transmission power.
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.

System Message	Comments
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.
COPILOT PTT STUCK – GMA 1 Copilot Push-to-Talk is Stuck	The GMA 1 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.
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 & PFDs with preferred settings, if desired.
DATABASE CHANGE – 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 a navigation database update. Verify use of airways in stored flight plans and reload airways as needed.
DATABASE CHANGE – Verify user modified procedures.	This occurs when a stored flight plan contains procedures that have been manually edited. This alert is issued only after a navigation database update. Verify the user-modified procedures in stored flight plans are correct and current.
DATABASES DOWNLOADING – See databases page for more information.	Databases are downloading to the system. Go to the 'Database Status' Screen to monitor status.
DATABASES EXPIRED – Restart avionics to activate standby databases.	The databases in the system have expired. Restart the system to 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 to move the standby databases to active status.
DB ERR – Database error exists.	Database verification error. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
DB MISMATCH – Navigation database mismatch. Xtalk is off.	The GDUs have different navigation database versions or regions installed. Crossfill is off. Check the 'Avionics Status' Screen to ascertain versions or regions. Also, check the 'Avionics Status' Screen for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Obstacle database mismatch.	The GDUs have different obstacle database versions or regions installed. Check the 'Avionics Status' Screen to ascertain versions or regions. Also, check the 'Avionics Status' Screen for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Terrain database mismatch.	The GDUs have different terrain database versions or regions installed. Check the 'Avionics Status' Screen to ascertain versions or regions. Also, check the 'Avionics Status' Screen for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB UPDATE IN PROGRESS – See Database Page for more information.	Databases are updating. See the "Database Status' Screen on the Touchscreen Controller.
DIG GMA1 MANIFEST – DIG GMA 1 software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.

System Message	Comments
DISABLE GP TO ARM CLIMB – Press NAV to enable VNAV track change.	Disable AFCS APPR mode to enable VNAV.
DISABLE GS TO ARM CLIMB – Press NAV to enable VNAV track change.	Disable AFCS APPR mode to enable VNAV.
DOC VIEWER MISMATCH – See Document Viewer Page for detailed info.	The documents on the database cards do not match. Ensure the aircraft manufacturer installed documents on the bottom card of each display match.
FAILED PATH – [xxxx].	A data path connected to the GDU or the GIA has failed.
FLIGHT PLAN CATALOG – Last plan in catalog was overwritten by an import.	Flight plan storage full. Last plan in the flight plan storage was overwritten by an imported flight plan.
FPL TRUNC – Flight plan has been truncated.	This occurs when a newly installed navigation database eliminates an obsolete approach or arrival used by a stored flight plan. The obsolete procedure is removed from the flight plan. Update flight plan with current arrival or approach.
FPL WPT LOCK – Flight plan waypoint is locked.	Upon power-on, The system detects that a stored flight plan waypoint is locked. This occurs when an aviation 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 flight plans that are deleted. Remove the waypoint from the flight plan if it no longer exists in any database, or update the waypoint name/identifier to reflect the new information.
FPL WPT MOVE – Flight plan waypoint moved.	The system has detected that a waypoint coordinate has changed due to a new navigation database update. Verify that stored flight plans contain correct waypoint locations.
FS 510 MANIFEST – FS 510 software mismatch.	Incorrect software version. The system should be serviced.
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.
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 69A SXM. The receiver is unavailable. The system should be serviced.
GDL69 MANIFEST – GDL69 software mismatch, communication halted.	The 69A SXM has incorrect software installed. The system should be serviced.
GEA # 1 INOP: CNFG – Check GEA software and configuration.	There is a problem with the GEA 1 software configuration. Check the configuration. If the problem persists, the system should be serviced.
GEA # 1 INOP: INTRL – GEA internal fault.	GEA 1 has an internal fault. The system should be serviced.
GEA # 1 INOP: POWER – Check GEA power.	GEA 1 power is low. Check GEA power. If the problem persists, the system should be serviced.
GEA # 1 INOP: SENS CNFG – Check GEA software and configuration.	There is an error in the GEA 1 software and configuration. Check the software and configuration. If the problem persists, the system should be serviced.

System Message	Comments
GEA # 1 INOP: TEMP – Check GEA cooling arrangement.	GEA 1 has insufficient cooling. If the problem persists, the system should be serviced.
GEA # 1 INOP: VOLT – Check GEA voltages.	GEA 1 voltage is low. Check GEA voltages.
GEA # 1 INOP: VOLT EXCIT – Check GEA Transducer Power Outputs.	GEA 1 transducer power is low. Check GEA transducer power.
GEA1 CONFIG – GEA1 config error. Config service REQ'D.	The #1 GEA 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.
GEO LIMITS – AHRS1 too far north/south, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is annunciated as invalid.
GEO LIMITS – AHRS2 too far North/South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.
GFC MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
GIA #1 FAN FAIL – Fan fault, check GIA temperature.	GIA #1 fan failure. Monitor GIA #1 temperature.
GIA #1 INOP - CRNT – Check GIA Current.	GIA 1 current is low. The current should be checked.
GIA #1 INOP: SERL – Internal GIA Serial Communication Fault.	GIA 1 serial communication fault. Check GIA serial communication.
GIA #1 INOP: VOLT – Check GIA Voltage.	GIA 1 low voltage. Check voltage.
GIA #1 OVER TEMP – Check GIA Temperature.	GIA 1 is reporting an over-temperature condition.
GIA #2 FAN FAIL – Fan fault, check GIA temperature.	GIA #2 fan failure. Monitor GIA #2 temperature.
GIA #2 INOP - CRNT – Check GIA Current.	GIA 2 current is low. The current should be checked.
GIA #2 INOP: SERL – Internal GIA Serial Communication Fault.	GIA 2 serial communication fault. Check GIA serial communication.
GIA #2 INOP: VOLT – Check GIA Voltage.	GIA 2 low voltage. Check voltage.
GIA #2 OVER TEMP – Check GIA Temperature.	GIA 2 is reporting an over-temperature condition.
GLIDE/ASSIST RING ASSIST – Unavailable above [#}.	Glide assist / glide ring unavailable above specified altitude.
GLIDESLOPE #1 INOP: INTRL – Glideslope Internal Fault	The Glideslope sub-system of the GIA is inoperative due to an internal fault.
GLIDESLOPE #2 INOP: INTRL – Glideslope Internal Fault	The Glideslope sub-system of the GIA is inoperative due to an internal fault.

System Message	Comments
GMA 1 INOP: COMM – GMA Communication Fault.	There is a problem with the GMA 1 config module connection. Check the connection.
GMA 1 INOP: INTRL – GMA Internal Fault.	GMA 1 has an internal fault. The system should be serviced.
GMA 1 INOP: SOFTWARE – GMA CRC Fault.	The GMA is inoperative due to a CRC fault.
GMA 1 INOP: VOLTAGE – Voltage outside standard range.	The GMA is inoperative due to a voltage fault.
GMA 1 STUCK KEY – Front Panel Key is Stuck	The Front Panel key for the GMA is stuck.
GMA1 FAIL – GMA1 is inoperative.	The audio controller has detected a failure. The audio controller is unavailable. The system should be serviced.
GMA1 INSPECTION REQUIRED – Redundant power supply is not present.	GMA1 backup power source is not connected. The system should be serviced.
GMA1 MANIFEST – DIG GMA 1 software mismatch, communication halted.	The audio controller has incorrect software installed. The system should be serviced.
GMA1 SERVICE – GMA1 needs service. Return unit for repair.	The audio controller self-test has detected a problem in the unit. Certain audio functions may still be available, and the audio controller may still be usable. The system should be serviced when practical.
GMC1 CONFIG – GMC Config error. Config service REQ'D.	Error in the configuration of GMC1.
GMC1 FAIL – GMC is inoperative.	A failure has been detected in GMC1. GMC1 is unavailable.
GMC1 KEYSTK – GMC [key name] key is stuck.	A key is stuck on the GMC1 bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
GMC1 MANIFEST – GMC software mismatch. Communication halted.	GMC1 has incorrect software installed. The system should be serviced.
GPS #1 INOP - CAL – Factory GPS Calibration Lost Or Corrupted.	GPS 1 factory calibration lost or corrupted. Check GPS calibration. Check GPS calibration.
GPS #1 BATT LOW – GPS 1 Batt Check Recommended.	GPS 1 Battery is low. The battery should be checked.
GPS #2 INOP - CAL – Factory GPS Calibration Lost Or Corrupted.	GPS 2 factory calibration lost or corrupted. Check GPS calibration. Check GPS calibration.
GPS #1 BATT LOW – GPS 2 Batt Check Recommended.	GPS 2 Battery is low. The battery should be checked.
GPS NAV LOST – Loss of GPS navigation. Enable GPS sensors.	Loss of GPS navigation due to GPS being disabled
GPS NAV LOST – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.
GPS NAV LOST – Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.

System Message	Comments
GPS1 CHECK POSITION – Position difference. Check position sensors.	Check GPS1. From the 'Sensors' Screen on the Touchscreen Controller, disable then enable GPS1 to clear the alert. If the alert persists, the system should be serviced.
GPS2 CHECK POSITION – Position difference. Check position sensors.	Check GPS2. From the 'Sensors' Screen on the Touchscreen Controller, disable then enable GPS2 to clear the alert. If the alert persists, the system should be serviced.
GRS-GMU1 RS232 COMM FAIL – GMU Software Loading Inoperable	The RS-232 communication path between the GRS and GMU has failed. The system should be serviced.
GRS-GMU2 RS232 COMM FAIL – GMU Software Loading Inoperable	The RS-232 communication path between the GRS and GMU has failed. The system should be serviced.
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	AHRS1 has incorrect software installed. The system should be serviced.
GRS2 MANIFEST – GRS2 software mismatch, communication halted.	AHRS2 has incorrect software installed. The system should be serviced.
GSR1 FAIL – GSR1 has failed.	A failure has been detected in GSR1. The system should be serviced.
GTC1 CARD1 ERR – GTC1 card 1 is invalid.	The internal SD card in the Touchscreen Controller contains invalid data. The system should be serviced.
GTC1 CARD1 REM – GTC1 card 1 was removed. Reinsert card.	The internal SD card in the Touchscreen Controller was removed. The system should be serviced.
GTC1 CHK REQD: FAN FAIL – Monitor GTC Temperature	GTC1 fan failure. Monitor GTC temperature.
GTC1 CONFIG – GTC1 config error. Config service REQ'D.	Touchscreen Controller configuration settings do not match those of backup configuration memory. The system should be serviced.
GTC1 DB ERR – GTC1 [XXXX] database errors exist.	The Touchscreen Controller detected a failure in one or more databases. Ensure the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
GTC1 INOP: OVERTEMP – Temperature outside operational range	GTC1 is outside of operational temperature range. The system should be serviced.
GTC1 INOP: VOLTAGE – Voltage outside standard range	GTC1 is outside of operational temperature range. The system should be serviced.
GTC1 MANIFEST – GTC1 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC1 MEM ERROR – Internal Memory Error	The GTC is inoperative due to an internal memory fault. If problem persists, remove and replace the GTC per Line Maintenance Manual procedures. If problem has been resolved, return the aircraft to normal operations.
GTC1 KEYSTK – GTC1 [key name] key is stuck.	A knob or key is stuck on the GTC bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
GTC1 OVERTEMP – Reduced Backlight Level	Reduced backlight level.
GTC1 RESET – Corrective Reset Performed	The GTC1 performed a corrective restart to repair an Single Event Upset. There is no maintenance action required. The GTC1 is capable of resuming normal operation after the corrective restart.

System Message	Comments
GTC2 CARD1 ERR – GTC2 card 1 is invalid.	The internal SD card in the Touchscreen Controller contains invalid data. The system should be serviced.
GTC2 CARD1 REM – GTC2 card 1 was removed. Reinsert card.	The internal SD card in the Touchscreen Controller was removed. The system should be serviced.
GTC2 CHK REQD: FAN FAIL – Monitor GTC Temperature	GTC1 fan failure. Monitor GTC temperature.
GTC2 CONFIG – GTC2 config error. Config service REQ'D.	Touchscreen Controller configuration settings do not match those of backup configuration memory. The system should be serviced.
GTC2 DB ERR – GTC2 [XXXX] database errors exist.	The Touchscreen Controller detected a failure in one or more databases. Ensure the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
GTC 2 MEM ERROR – Internal Memory Error	The GTC is inoperative due to an internal memory fault. If problem persists, remove and replace the GTC per Line Maintenance Manual procedures. If problem has been resolved, return the aircraft to normal operations.
GTC2 INOP: OVERTEMP – Temperature outside operational range	GTC2 is outside of operational temperature range. The system should be serviced.
GTC2 INOP: VOLTAGE – Voltage outside standard range	GTC2 is outside of operational temperature range. The system should be serviced.
GTC2 KEYSTK – GTC2 [key name] key is stuck.	A knob or key is stuck on the GTC bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
GTC2 MANIFEST – GTC2 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC2 OVERTEMP – Reduced Backlight Level	Reduced backlight level.
GTC2 RESET – Corrective Reset Performed	The GTC2 performed a corrective restart to repair an Single Event Upset. There is no maintenance action required. The GTC2 is capable of resuming normal operation after the corrective restart.
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.
GTX 3X5 1 MANIFEST – GTX software mismatch.	The GTX has incorrect software installed. The system should be serviced.
GTX 3X5 1 ADS-B 1090 – Datalink: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
GTX 3X5 1 ADS-B IN – Datalink: ADS-B in has failed.	The transponder is unable to receive ADS-B IN information.
GTX 3X5 1 ADS-B NO POS – GTX not receiving ADS-B position data	The transponder is not able to receive position information.
GTX 3X5 1 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.
GTX 3X5 1 ADS-B TRFC – Datalink: Traffic failed.	The Transponder is incapable of processing traffic information.

System Message	Comments
GTX 3X5 1 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
GTX 3X5 1 CONFIG – GTX config error. Config service REQ'D.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
GTX 3X5 1 FAIL – GTX is inoperative.	There is no communication with the #1 transponder.
GTX 3X5 1 FIS-B WX – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
GTX 3X5 1 GND TEST – <XPDR OR DLK 1>: Ground test mode active.	Transponder / datalink ground test active.
GTX 3X5 1 OVER TEMP – <XPDR OR DLK 1>: Over temperature.	The system has detected an over temperature condition in GTX 1 / datalink 1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
GTX 3X5 1 PRES ALT – GTX not receiving ADS-B press alt data	Unable to provide pressure altitude information.
GTX 3X5 1 SERVICE – GTX needs service. Return unit for repair.	GTX 1 should be serviced when possible.
GTX 3X5 1 TEST MODE – Transponder: Test mode active.	Transponder test mode active.
GTX 3X5 1 UNDER TEMP – <XPDR OR DLK 1>: Under temperature.	The system has detected an under temperature condition in GTX 1 / datalink. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
HDG FAULT – AHRS1 magnetometer fault has occurred.	A fault has occurred in the #1 GMU. 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. 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.
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
LOI – GPS integrity lost. Crosscheck with other NAVS.	GPS integrity is insufficient for the current phase of flight.
LOSS OF GPS NAVIGATION – Insufficient Satellite Reception.	Loss of GPS navigation due to insufficient satellite reception.
LOW BANK ACTIVE – Disengage for approach.	Low Bank mode is active. Disengage to continue approach.
LOW BANK ACTIVE – Disengage for RNP less than 1.0.	Low Bank mode active, disengage Low Bank Mode to continue the approach.
LRG MAG VAR – Verify all course angles.	The GDU internal model cannot ascertain 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°.
LRU REPLACEMENT – [LRU name].	The system has detected an LRU replacement. Perform LRU replacement software or full configuration loading procedure.
MANIFEST – Software mismatch, communication halted.	The GSR1 has incorrect software installed. The system should be serviced.

System Message	Comments
MFD FAN FAIL – The cooling fan for the PFD is inoperative.	The cooing fan in the MFD has failed. The system should be serviced.
MFD1 CARD 1 ERR – MFD1 card 1 is invalid.	The SD card in the top card slot of the MFD contains invalid data.
MFD1 CARD 1 REM – MFD1 card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the MFD. The SD card needs to be reinserted.
MFD1 CARD 2 ERR – MFD1 card 2 is invalid.	The SD card in the bottom card slot of the MFD contains invalid data.
MFD1 CARD 2 REM – MFD1 card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the MFD. The SD card needs to be reinserted.
MFD1 CHK REQD: BTM SD – Bottom SD card error.	The GDU bottom SD card is inoperative.
MFD1 CHK REQD: INT SD – Internal SD card error.	The GDU internal SD card is inoperative.
MFD1 CHK REQD: TOP SD – Top SD card error.	The GDU top SD card is inoperative.
MFD1 CMC INOP: Config – CMC system inop due to invalid config.	The CMC system logging capability is inoperative due to file invalid configuration.
MFD1 CMC INOP: Corrupt – CMC INOP due to file system corruption.	The CMC system logging capability is inoperative due to file system corruption.
MFD1 CMC INOP: MEM Full – Internal SD card full.	The CMC system logging capability is inoperative due to insufficient memory.
MFD1 CONFIG – MFD1 config error. Config service REQ'D.	The MFD configuration settings do not match backup configuration memory. The system should be serviced.
MFD1 DB ERR – MFD 1 [XXXX] database errors exist.	The MFD detected database errors. 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. Ensure that data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 HEAT TIME EXTD – Heater taking extended time to warm up.	The specified GDU heater is taking an extended time to warm up. The system should be serviced.
MFD1 INOP: DISABLE DSPL – Check Disable Display Input Wiring	The specified GDU has insufficient voltage. The system should be serviced.
MFD1 INOP: LED FAULT – Reduced backlight level: needs repair.	The specified GDU has reduced backlight levels. The system should be serviced.
MFD1 KEYSTK – MFD1 [key name] is stuck.	A key is stuck on the MFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
MFD1 MANIFEST – MFD1 software mismatch.	The MFD has incorrect software installed. The system should be serviced.
MFD1 MEM ERROR – Internal Memory Error	The MFD is inoperative due to an internal memory error. If problem persists, remove and replace the MFD per Line Maintenance Manual procedures. If problem has been resolved, return the aircraft to normal operations.

System Message	Comments
MFD1 OVER TEMP – Check MFD1 temperature.	The specified GDU is over-temperature. The system should be serviced.
MFD1 RESET – Corrective Reset Performed	The GDU performed a corrective restart to repair a Single Event Upset. There is no maintenance action required. The GDU is capable of resuming normal operation after the corrective restart.
MFD1 SERVICE – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
MFD1 TERRAIN DSP – MFD1 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in the MFD is missing or invalid.
MODEL MISMATCH – Model mismatch for GDU or GTC. Service required.	The GTC or GDU modes are not compatible. The system should be serviced.
NAV #1 INOP: CAL – Factory NAV Calibration Lost or Corrupted.	NAV 1 calibration version error. Check COM calibration.
NAV #1 INOP: CONFIG – Check NAV Software and Config.	There is a problem with the NAV 1 software configuration. Check the configuration. If the problem persists, the system should be serviced.
NAV #1 INOP: INTRL – NAV Internal Fault.	NAV 1 has an internal fault.
NAV #1 INOP: SERL – Internal NAV Serial Communication Fault.	NAV 1 serial communication fault. Check NAV serial communication.
NAV #1 INOP: SYNTH – NAV Synthesizer Lock Fault.	NAV 1 has a synthesizer lock fault.
NAV #2 INOP: CAL – Factory NAV Calibration Lost or Corrupted.	NAV 2 calibration version error. Check COM calibration.
NAV #2 INOP: CONFIG – Check NAV software and config.	There is a problem with the NAV 2 software configuration. Check the configuration. If the problem persists, the system should be serviced.
NAV #2 INOP: INTRL – NAV Internal Fault.	NAV 2 has an internal fault.
NAV #2 INOP: SERL – Internal NAV Serial Communication Fault.	NAV 2 serial communication fault. Check NAV serial communication.
NAV #2 INOP: SYNTH – NAV Synthesizer Lock Fault.	NAV 2 has a synthesizer lock fault.
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.
NAV2 RMT XFR – NAV1 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.
NO RUNWAY POSITION DATA – Inhibit SurfaceWatch. No runway position data.	Inhibit SurfaceWatch.
NON-MAGNETIC UNITS – Non-MAG NAV angle display units are active.	Navigation angle is not set to Non-MAG NAV at power-on.

System Message	Comments
NON WGS84 WPT – Do not use GPS for navigation to [xxxx]	The position of the selected waypoint [xxxxx] 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.
PFD FAN FAIL – The cooling fan for the PFD is inoperative.	The cooing fan in the PFD has failed. 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 ANNUNC INOP – PFD Annunciation Failure	PFD 1 annunciations are inoperative due to an internal error.
PFD1 CARD 1 ERR – PFD1 card 1 is invalid.	The SD card in the top card slot of the PFD contains invalid data.
PFD1 CARD 1 REM – PFD1 card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the PFD. The SD card needs to be reinserted.
PFD1 CARD 2 ERR – PFD1 card 2 is invalid.	The SD card in the bottom card slot of the PFD contains invalid data.
PFD1 CARD 2 REM – PFD1 card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the PFD. The SD card needs to be reinserted.
PFD1 CHK REQD: BTM SD – Bottom SD card error.	The GDU bottom SD card is inoperative.
PFD1 CHK REQD: INT SD – Internal SD card error.	The GDU internal SD card is inoperative.
PFD1 CHK REQD: TOP SD – Top SD card error.	The GDU top SD card is inoperative.
PFD1 CMC INOP: Config – CMC system inop due to invalid config.	The CMC system logging capability is inoperative due to file invalid configuration.
PFD1 CMC INOP: Corrupt – CMC INOP due to file system corruption.	The CMC system logging capability is inoperative due to file system corruption.
PFD1 CMC INOP: MEM Full – Internal SD card full.	The CMC system logging capability is inoperative due to insufficient memory.
PFD1 CONFIG – PFD1 config error. Config service REQ'D.	The PFD configuration settings do not match backup configuration memory. The system should be serviced.
PFD1 DB ERR – PFD1 [XXXX] database errors exist.	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 missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
PFD1 HEAT TIME EXTD – Heater taking extended time to warm up.	The specified GDU heater is taking an extended time to warm up. The system should be serviced.
PFD1 INOP: DISABLE DSPL – Check Disable Display Input Wiring	The specified GDU has insufficient voltage. The system should be serviced.
PFD1 INOP: LED FAULT – Reduced backlight level: needs repair.	The specified GDU has reduced backlight levels. The system should be serviced.

System Message	Comments
PFD1 KEYSTK – PFD1 [key name] is stuck.	A key is stuck on the PFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
PFD1 MEM ERROR – Internal Memory Error	The PFD is inoperative due to an internal memory error. If problem persists, remove and replace the MFD per Line Maintenance Manual procedures. If problem has been resolved, return the aircraft to normal operations.
PFD1 MANIFEST – PFD1 software mismatch.	The PFD has incorrect software installed. The system should be serviced.
PFD1 OVER TEMP – Check PFD1 temperature.	The specified GDU is over-temperature. The system should be serviced.
PFD1 RESET – Corrective Reset Performed	The GDU performed a corrective restart to repair a Single Event Upset. There is no maintenance action required. The GDU is capable of resuming normal operation after the corrective restart.
PFD1 SERVICE – PFD1 needs service. Return unit for repair.	The PFD self-test has detected a problem. The system should be serviced.
PFD1 TERRAIN DSP – PFD1 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in the PFD is missing or invalid.
PILOT PTT STUCK – GMA 1 Pilot Push-to-Talk is Stuck	The GMA 1 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.
PIT SERVO COMM – Check PIT servo wiring to GIA1	The GSA servo is inoperative due to a loss of communication path to a GIA. The system should be serviced.
PIT SERVO COMM – Check PIT servo wiring to GIA2	The GSA servo is inoperative due to a loss of communication path to a GIA. The system should be serviced.
PIT TRIM INOP – Data Miscompare	The system has detected conflicting sensor readings from the trim monitors.
PIT TRIM INOP – Uncommanded Movement	The system has detected uncommanded trim surface movement and stopped operation.
PIT TRIM INOP – Runaway Trim	The system has detected a runaway trim situation and stopped operation.
PIT TRIM INOP – Wrong direction detected	The system has determined the trim is moving in the wrong direction compared to what was commanded.
PIT TRIM INOP – Servo Fault	The system has detected a trim servo fault.
PIT TRIM INOP – Flap configuration trim inoperative	The system has detected that the flap configuration trim is inoperative.
PIT TRIM INOP – Primary trim failure	The system has detected a failure of the primary trim system.
PIT TRIM INOP – Manual electric trim fault	The system has detected a fault in the manual electric trim system
PIT TRIM INOP – Trim response fault	The system has detected an improper response to trim commands.
REGISTER CONNEXT – Data services inop, register w/ Connext.	The system is not registered with Garmin Connext, or its current registration data has failed authentication.
ROL SERVO COMM – Check ROL servo wiring to GIA1	The GSA servo is inoperative due to a loss of communication path to a GIA. The system should be serviced.

System Message	Comments
ROL SERVO COMM – Check ROL servo wiring to GIA2	The GSA servo is inoperative due to a loss of communication path to a GIA. The system should be serviced.
SCHEDULER [#] – <message>.	Message criteria entered by the user.
SLCT ARR RWY – Select appropriate runway for arrival procedure.	The system notifies the pilot to load the appropriate approach runway for the arrival procedure.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT MAG – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the 'Avionics Settings' Screen to Magnetic.
SLCT NAV – Select NAV on CDI for approach.	The system notifies the pilot to set the CDI to the correct NAV receiver. Set the CDI to the correct NAV receiver.
SLCT NON-MAG – Select alternate NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the 'Avionics Settings' Screen to True.
SMS TEXT MSG MEM LIMIT – Oldest MSG will be deleted when MSG received.	The memory limit for SMS text messaging has been reached. The oldest text message will automatically be deleted when a new SMS text message is received.
STEEP TURN – Steep turn ahead.	The computed bank angle needed to execute the turn ahead may exceed the current bank angle limit.
STRMSCP FAIL – Stormscope has failed.	Stormscope has failed. The system should be serviced.
SURFACEWATCH DISABLED – Too far north/south.	The SurfaceWatch system has been disabled.
SURFACEWATCH FAIL – Invalid audio configuration.	The SurfaceWatch system has failed due to an invalid audio configuration.
SURFACEWATCH FAIL – Invalid configurable alerts.	The SurfaceWatch system has failed due to invalid configurable alerts.
SURFACEWATCH FAIL – One or more inputs invalid.	The SurfaceWatch system has failed due to one or more invalid inputs.
SURFACEWATCH INHIBITED – SurfaceWatch inhibited.	The SurfaceWatch system has been inhibited.
SVT DISABLED – Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.
SVT DISABLED – Terrain DB resolution too low.	Synthetic Vision is disabled because a terrain database of sufficient resolution (9 arc-second or better) is not currently installed.
SYSTEM INOP: AIRCRAFT ID – Aircraft-specific config lost / corrupted.	The system configuration has changed unexpectedly. The system should be serviced.
SYSTEM INOP: FLEET ID – System configuration lost or corrupted.	The system configuration has changed unexpectedly. The system should be serviced.
TCAS FAIL – TCAS system is inoperative.	The TCAS system has failed. The system should be serviced.
TEMP COMP – APPR ALT Constraint above Transition Level	Temperature compensated approach altitude is higher than the Transition Level.

System Message	Comments
TIMER EXPIRD – Timer has expired.	The system notifies the pilot the timer has expired.
TRAFFIC FAIL – Traffic device has failed.	The system is no longer receiving data from the traffic system. The traffic device should be serviced.
TERRAIN AUD CFG – Trn Awareness audio config error. Service REQD.	TAWS is disabled because the audio configuration is invalid. The system should be serviced.
TRN AUD FAIL – Trn Awareness audio source unavailable.	TAWS is disabled because an aural alert audio source is unavailable.
UNABLE RNP – Estimated position error exceeds RNP.	The estimated GPS position error exceeds the RNP limits. Check GPS signal.
UNABLE RNP APR – GPS integrity lost. Check GPS sensors.	The GPS integrity level is insufficient for the RNP AR approach
UNABLE VNAV ALTITUDE – Cannot meet VNAV altitude constraint.	The current vertical speed is insufficient to make the active flight plan altitude constraint before crossing the 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.
VNAV DISCONTINUITY AHEAD – Discontinuity after [waypoint].	A vertical discontinuity exists ahead of the aircraft in the flight plan.
VNAV CONFIG – VNAV config error Config service REQD.	VNAV configuration error. The system should be serviced.
VOR1 APPR DEV NOT AVAIL – APPR NAVAID deviation not available.	VOR-based deviation is not available.
VOR2 APPR DEV NOT AVAIL – APPR NAVAID deviation not available.	VOR-based deviation is not available.
WPT ARRIVAL – Arriving at waypoint - [xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
XTALK ERROR – Flight display crosstalk error has occurred.	The GDUs and/or GTCs are not communicating with each other. The system should be serviced.
YAW SERVO COMM – Check YAW servo wiring to GIA1	The GSA servo is inoperative due to a loss of communication path to a GIA. The system should be serviced.
YAW SERVO COMM – Check YAW servo wiring to GIA2	The GSA servo is inoperative due to a loss of communication path to a GIA. The system should be serviced.

AIRFRAME SYSTEM MESSAGES

Message Title	Window Text
AOA SENSOR FAIL	The AOA 2 signal is out of range.
ECS RECIRC ON	ECS recirculation mode is prohibited in flight.
ESP CONFIG	ESP config error. Config service req'd.
ESP DEGRADE	ESP IAS mode is inoperative.
ESP FAIL	ESP is inoperative.
ESP OFF	ESP selected off.
MIXTURE POSITION SERVICE REQD	Mixture position sensor requires service.
THROTTLE POSITION SERVICE REQD	Throttle position sensor requires service.

DATABASE MANAGEMENT

Two options are available for updating databases:

- Garmin Pilot™ in combination with a Portable Electronic Device (PED) which transfers databases to the system through the FS 510 Wireless Transceiver
- A 32 GB Supplemental Data (SD) card (or FS 510 card as a storage device) and an SD Card reader to download databases from a personal computer

See descriptions and procedures in this Appendix for more information.

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.

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.*

NOTE: *Loading a database in the system prior to its effective date will result in the expiration date on the Power-on Display and the effective date on the 'Database Status' Screen being displayed in amber.*

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 flygarmin.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 flygarmin.com by selecting 'Database Exclusions List.'*

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

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

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

DATABASES AND CYCLES

The cycles, dates and regions for both standby and active databases are displayed on the 'Database Status' Screen and the 'Standby Database Catalog' on the Touchscreen Controller. Any active databases with expiration dates in the past will be highlighted with amber text.

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. Navigation databases are available for multiple regions. Refer to flygarmin.com for a list of navigation databases available.

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 basemap database is only available in a 'Worldwide' version.

The terrain database contains the terrain mapping data. These databases are updated periodically and have no expiration date. The terrain database is only available in a 'Worldwide' version.

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. The obstacle database is only available in a 'US/Canada/Europe' version.

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. A 'Worldwide' Airport Directory database is available as well as Airport Directory databases for multiple regions. Refer to flygarmin.com for a list of Airport Directory databases available.

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. A 'Full Coverage' SafeTaxi database is available as well as SafeTaxi databases for multiple regions. Refer to flygarmin.com for a list of SafeTaxi databases available.

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 ChartView database is available for multiple regions. Refer to jeppesen.com for a list of ChartView databases available.

The IFR/VFR charts database contains VFR and IFR raster charts. The VFR Charts are digital representations of the Sectional Aeronautical Charts and Terminal Area Charts. The IFR Charts include both IFR High (designed for navigation at or above 18,000 ft) and IFR Low (designed for navigation below 18,000 ft). IFR/VFR Charts are updated every 28 days except for Canadian IFR/VFR Charts which are updated every 56 days. The IFR/VFR charts database is available for multiple regions. Refer to flygarmin.com for a list of IFR/VFR charts databases available.

The Checklist database is a custom configured database. Refer to the Additional Features Section for details.

STANDBY DATABASE CATALOG

The Standby Database Catalog supports multiple regions for the same database, allowing the crew to quickly change regions while on ground. A system power cycle is required to change database regions. The Standby Database Catalog can store standby and active databases for the internally stored display (GDU™) databases, SD Card databases, and databases on a connected PED. Databases in the Standby Database Catalog can be active databases from a region that is not currently selected, or standby databases stored until reaching the activation date. When an SD card is inserted in the bottom slot of the MFD, it will take priority over any other databases recognized by the system.

Changing the Database Region:

1) From MFW Home, touch **Utilities > Setup > Database Status.**
2) Scroll if necessary and select the button(s) for the desired database(s) in the 'Standby' Column.
3) Select the button for the desired database(s) on the 'Standby Database Catalog' Screen. The selected database(s) will sync to 'Standby'.

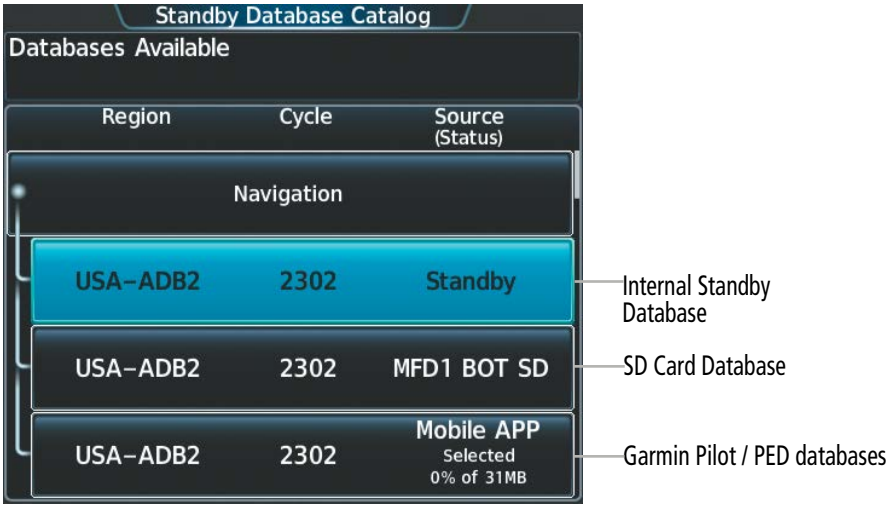


Figure B-1 'Standby Database Catalog' Screen

4) To monitor the database(s) transfer:
   a) From MFW Home, touch **Utilities > Setup > Database Status.**
   b) Scroll if necessary and select the button for the desired database in the 'Standby' Column.
   c) The database update status will appear in the status window at the top of the screen. Monitor the database transfer. Synchronization is complete when 'Databases Transfer Complete' is displayed in the progress window.

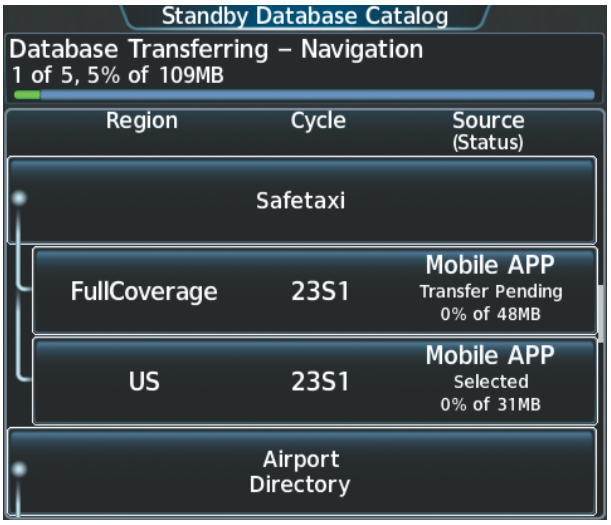


Figure B-2 'Standby Database Catalog' Screen Transfer Starting

5) Databases selected to load will be indicated by a cyan single-arrow. For any new databases not selected to load with a cyan arrow, touch the arrow in the 'Load' Column next to the specific database**.** The arrow will change to cyan in color.

6) From MFW Home, touch **Utilities > Setup > Database Status > Database Options > Restart Displays.**

Or:

From MFW Home, touch **Utilities > Initialization > Database Status > Database Options > Restart Displays.**

7) Press the right-most softkey on the MFD to acknowledge the power-on screen.

8) From MFW Home, touch **Utilities > Initialization > Database Status**.

Or:

From MFW Home, touch **Utilities > Setup > Database Status.**

9) Verify the standby databases transferred and are now in the 'Active' Column.

DATABASE AUTO SWAP

When an expired, active database has a standby database that is ready to become effective, a cyan arrow will be displayed between the database cycles. When this arrow is visible, it indicates the standby and active databases in that row will be switched on the next power cycle, activating the current standby database. The auto swap process may be inhibited if desired by touching the **Inhibit Auto Swap** Button.

Inhibiting / Enabling database auto swap:

1) From MFW Home, touch **Utilities > Initialization > Database Status.**

Or:

From MFW Home, touch **Utilities > Setup > Database Status.**

2) Scroll down and touch **Database Options > Inhibit Auto Swap.**

SD CARD REQUIREMENTS

A 32 GB SD (or FS 510 card as a storage device) card can be used to perform database updates. Only cards provided by Garmin or the OEM should be used. In the event there is a file corruption problem with the SD card, it may be necessary to reformat the card. This can cause an issue when formatting using Mac OS, where the newly formatted device will not be recognized by the avionics system. When using a Macintosh computer to format the SD card, Garmin recommends using the SD Memory Card Formatter application made available by the SD Association as a download from sdcard.org. When running the application, use the Quick Format option.

NOTE: *Use of SD cards that are not Garmin or OEM provided may cause system malfunctions when left in the MFD after the databases are loaded.*

All databases can be updated through a single SD card in the bottom slot of the MFD. Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (flygarmin.com). Once the updated files have been downloaded from the website, a personal computer equipped with an appropriate card reader is used to unpack and program the new databases onto an existing card. When database files are loaded to the card, any previously loaded database files of the same type residing on the card will be overwritten. This includes loading a database of a different coverage area or data cycle than the currently residing on the card. Equipment required to perform the update is as follows:

- PC with Window Vista or later/Mac with OS X 10.9 or later
- SD card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent.
- Updated databases obtained from the Garmin website.
- Garmin or OEM provided 32 GB SD card

SEAMLESS DATABASE ACTIVATION

When new databases are available on an SD card inserted in the bottom slot of the MFD, the Seamless Database Activation process allows any new Navigation, Obstacle, Airport Directory, and SafeTaxi databases to be synchronized and activated across the avionics system at power-on. FliteCharts, ChartView, and IFR/VFR Charts databases will be synchronized and activated in the background after power-on. All aforementioned databases will be activated and displayed in the 'Active' Column of the 'Database Status' Screen; no restart of system is required. However, when new Basemap and Terrain databases are available, a restart of the system will be necessary for those databases to be activated.

Monitoring Seamless Database Activation:

1) Download and install the databases on the SD card.

2) Insert an SD card in the bottom slot of the MFD.

3) Apply power to the system.

4) The Touchscreen Controllers and Display Units will display update status for any new databases available. The system will complete the power-on process when the updates are complete.



Figure B-3 Database Updates During Power-On

5) After the system is powered on, the Navigation, Obstacle, Airport Directory, and SafeTaxi will display in the Active column if updates were available for those databases. FliteCharts, ChartView, and IFR/VFR Charts will begin synchronizing. The synchronization can be monitored in the 'Database Status' Screen progress window. Touch **Utilities > Setup > Database Status.** A cyan 'Delayed Access' Symbol will appear in the 'Load' Column for any database that is synchronizing. Associated charts will not be available for use on the system when the symbol is present.

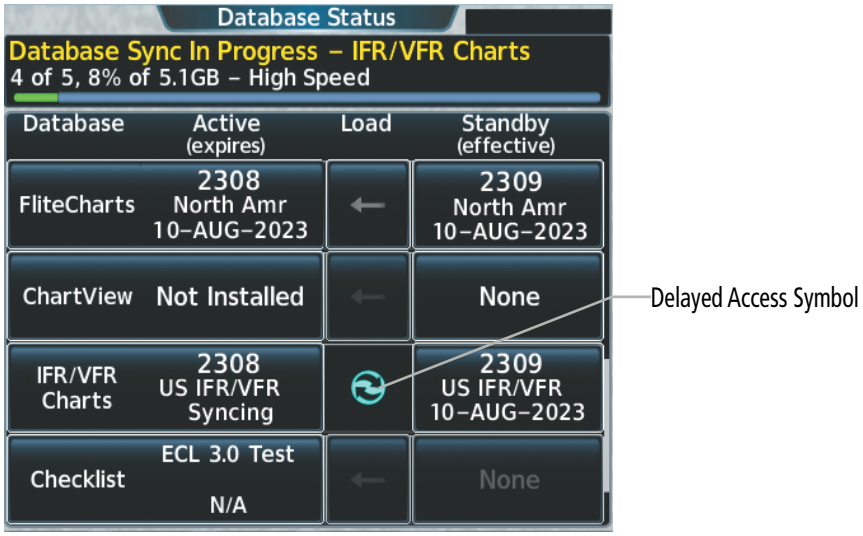


Figure B-4 Charts Databases Update after Power-on

6) To cancel the charts update, touch **Utilities > Setup > Database Status > Database Options** > **Cancel Chart DB Update.**

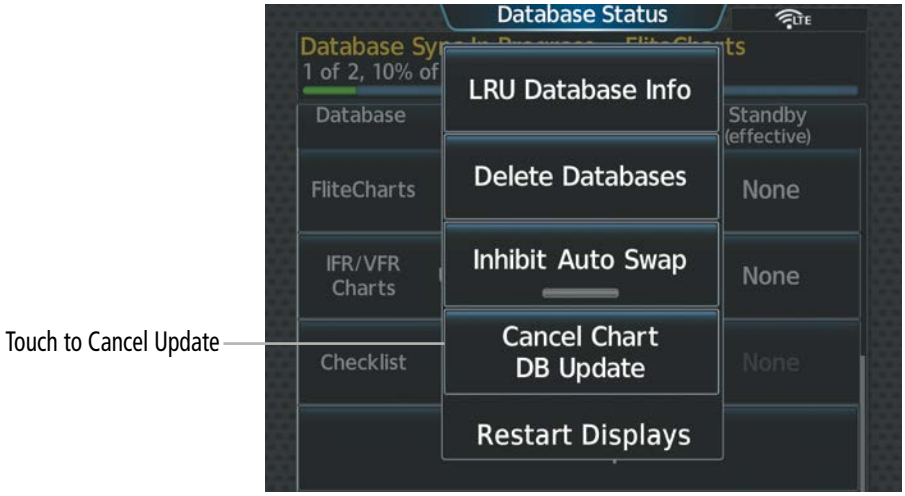


Figure B-5 Cancel Chart Database Update

7) The 'Delayed Access' Symbol will display on any 'MFW Home' Screen Buttons, the **Database Status** Button and on the 'Initialization' Screen to show the affected screens are not accessible.



Figure B-6 'Delayed Access' Symbol on 'MFW Home' Screen.

8) When there are new Basemap and Terrain databases to be activated, the system will display the message 'Activate databases with on ground restart' in the progress window. Cyan arrows will appear in the 'Load" Column beside the Basemap and Terrain databases.



Figure B-7 'Database Status' Screen before Activation of Basemap and Terrain Databases

9) From MFW Home, touch **Utilities > Setup > Database Status > Database Options > Restart Displays.**

Or:

From MFW Home, touch **Utilities > Initialization > Database Status > Database Options > Restart Displays.**

10) Press the right most softkey on the MFD to acknowledge the power-on screen.

11) From Home, touch **Utilities > Initialization > Database Status.**

Or:

From Home, touch **Utilities > Setup > Database Status.**

12) Verify the standby Basemap and Terrain databases transferred and are now in the 'Active' Column.

UPDATING DATABASES WHEN THE SYSTEM IS POWERED ON

The following instructions cover updating databases after system power-on for using an SD Card. (For instructions to update databases after system power-on using Garmin Pilot and a PED, see 'Updating Databases Using Garmin Pilot'). Databases will update automatically after power-on when enabled on the system. Databases will begin to update automatically when an SD card is inserted in the bottom slot of the MFD after system power-on

Updating databases using an SD card:

1) When using databases from an SD card:

a) Download and install the databases on the SD card.

b) Insert an SD card in the bottom slot of the MFD.

2) From MFW Home, touch **Utilities > Initialization > Database Status.**

Or:

From MFW Home, touch **Utilities > Setup > Database Status.**

3) Monitor the Sync Status on the 'Database Status' Screen. Wait for the databases to complete syncing, indicated by 'Sync Complete' being displayed briefly.

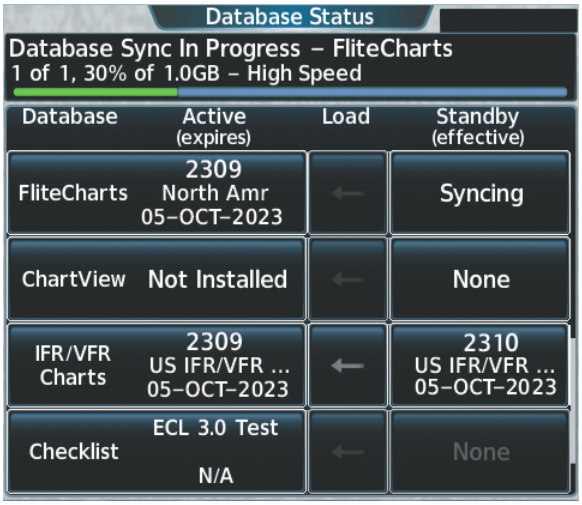


Figure B-8 'Database Status' Screen Synchronization in Progress

4) The database update status will appear in the status window at the top of the screen. Synchronization is complete when 'Databases Ready' is displayed in the progress window.

5) Databases selected to load will be indicated by a cyan single-arrow. For any new databases not selected to load with a cyan arrow (or if Inhibit Automatic Swap is selected), touch the arrow in the 'Load' Column next to the specific database**.** The arrow will change to cyan in color.

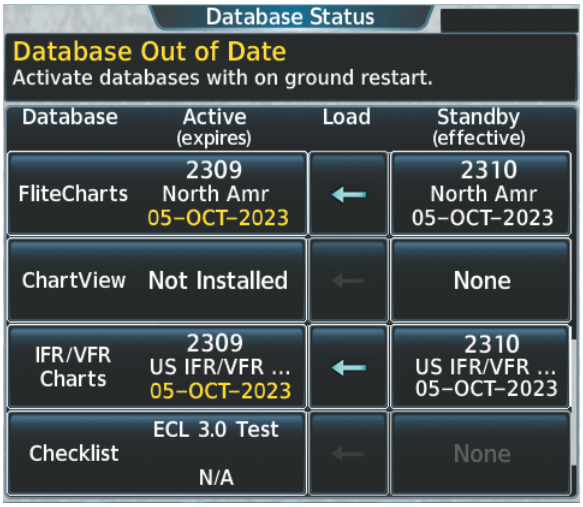


Figure B-9 'Database Status' Screen before Activation of Basemap and Terrain Databases

6) From MFW Home, touch **Utilities > Setup > Database Status > Database Options > Restart Displays.**

Or:

From MFW Home, touch **Utilities > Initialization > Database Status > Database Options > Restart Displays.**

7) Remove the SD card from the applicable display if desired.

8) Press the right most softkey on the MFD to acknowledge the power-on screen.

9) From MFW Home, touch **Utilities > Initialization > Database Status.**

Or:

From MFW Home, touch **Utilities > Setup > Database Status**.

10) Verify the standby databases transferred and are now in the 'Active' Column.

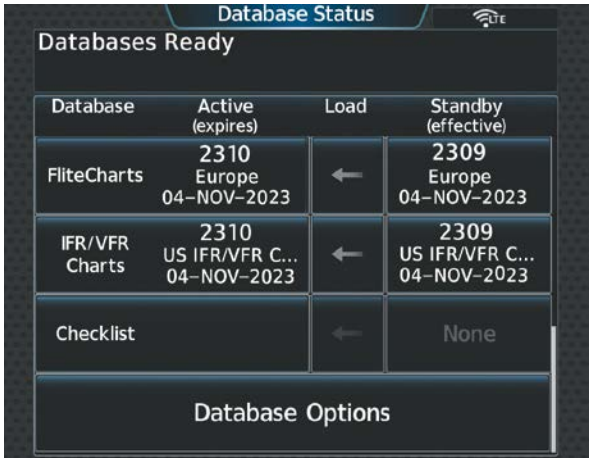


Figure B-10 'Database Status' Screen after Activation of Standby Databases

UPDATING DATABASES WITH GARMIN PILOT

Databases can be updated using a PED with Garmin Pilot in combination with the Wireless Transceiver. A PED with Garmin Pilot™ must be paired with the Wireless Transceiver over Bluetooth. The system preferred PED may be selected on the Touchscreen Controller 'Database Status' Screen from a menu list of devices that have been paired to the system. When the system is enabled it will automatically connect to the preferred device. If the preferred device has not been selected or is not available, the system will automatically connect to the first of any available, paired devices.

Once a Bluetooth connection to the paired PED is made, Garmin Pilot™ makes available databases that can be transferred with Wi-Fi to the Wireless Transceiver. If any of these databases is more recent than the respective standby database on the system, (or if there is no standby database on the system) those databases will be automatically selected to load. The database updates may be initiated from the 'Database Status' Screen on either Touchscreen Controller.

NOTE: *The system will only provide a Wi-Fi 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 Wi-Fi signal.*

NOTE: *If the PED has previously connected to the Wireless Transceiver, and is not connected to another Wi-Fi source (i.e. hangar Wi-Fi), the PED should connect automatically to the Wireless Transceiver. If the PED is connected to another Wi-Fi source or has not previously connected to the Wireless Transceiver, then the Wireless Transceiver will not connect automatically.*

SELECTING THE PREFERRED DEVICE

Select the Preferred Device.

1) From MFW Home on the Touchscreen Controller, touch **Utilities > Initialization > Database Status**.

Or:

From MFW Home on the Touchscreen Controller, touch **Utilities > Setup > Database Status**.

2) Touch the **Select Preferred Device** Button.

3) Touch the button for the desired PED from the list.

UPDATING DATABASES

Updating databases using Garmin Pilot:

1) Turn the system on.
2) Press the right-most softkey on the MFD to acknowledge the power-on screen.
3) From MFW Home, touch **Services > Connext Setup > Settings** Tab.
4) Ensure the **Database Import** Button is selected.

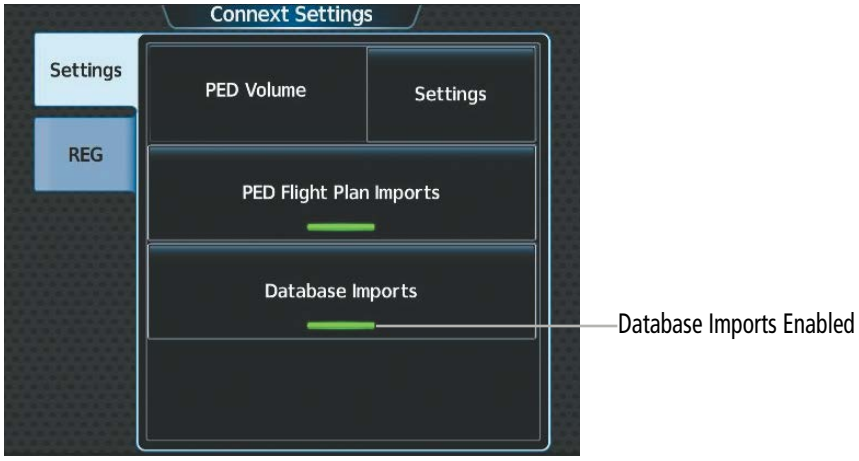


Figure B-11 Connext Settings - Database Imports

5) From MFW Home, touch **Services > Networks & Pairing >** Bluetooth **Settings** and ensure pairing mode is enabled on the 'Bluetooth Settings' Screen.

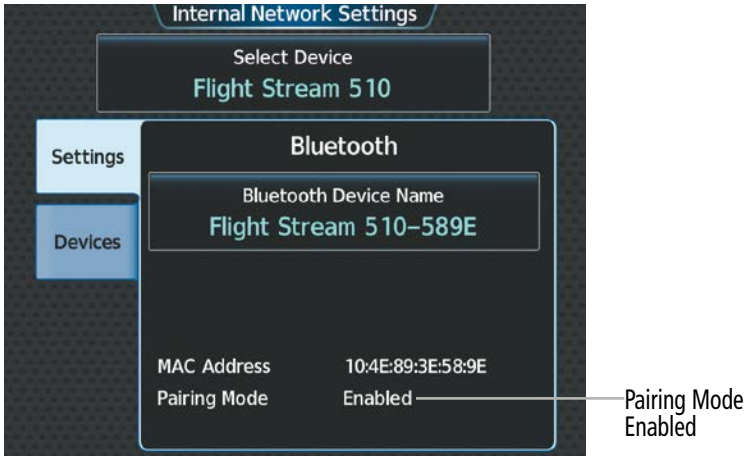


Figure B-12 Bluetooth Settings - Pairing Mode Enabled

6) On the PED, start Garmin Pilot™ and touch **Home** > **Connext** > **Database Concierge**.
7) On the PED, connect with Bluetooth to the Wireless Transceiver. (Refer to the Additional Features section for more information on connecting to Bluetooth)

8) From MFW Home on the Touchscreen Controller, touch **Utilities > Initialization > Database Status > Mobile App Databases**.

Or:

From MFW Home on the Touchscreen Controller, touch **Utilities > Setup > Database Status > Mobile App Databases**.

9) The 'Database Status' Screen will show the databases connected to the PED in place of the active databases on the system. Databases selected to load will be indicated by a cyan single-arrow. For any new databases not selected to load with a cyan arrow (or if Inhibit Automatic Swap is selected), touch the arrow in the 'Load' Column next to the specific database**.** The arrow will change to cyan in color.



Figure B-13 'Database Status' Screen Transfer Starting

10) From MFW Home, touch **Utilities** > **Setup** > **Utilities > Services > Networks & Pairing >** (Internal WiFi) **Settings.**

11) On the PED, connect to the indicated SSID Wi-Fi network shown on **Utilities > Services > Networks & Pairing >** (Internal WiFi) **Settings** on the Touchscreen Controller**.**

Or:

If using a PED that has not been previously paired with the system, a password prompt will appear on the PED. Enter the password shown on connect to the indicated SSID Wi-Fi network shown on **Utilities > Services > Networks & Pairing >** (Internal WiFi) **Settings** on the Touchscreen Controller**.**



Figure B-14 Bluetooth Settings - Pairing Mode Enabled

13) Touch the **Start Transfer** Button on the 'Database Status' Screen.

14) 'Databases Ready' and 'Transfer starting' will appear in the progress window of the 'Database Status' Screen, followed by, 'Database Transfer in Progress.' Monitor the Sync Status on the 'Database Status' Screen. Wait for all databases to complete transferring. 'Transfer Complete' will be shown briefly in the progress window and for each individual database. To cancel, touch the Cancel Transfer Button.



Figure B-15 Database Transfer Starting

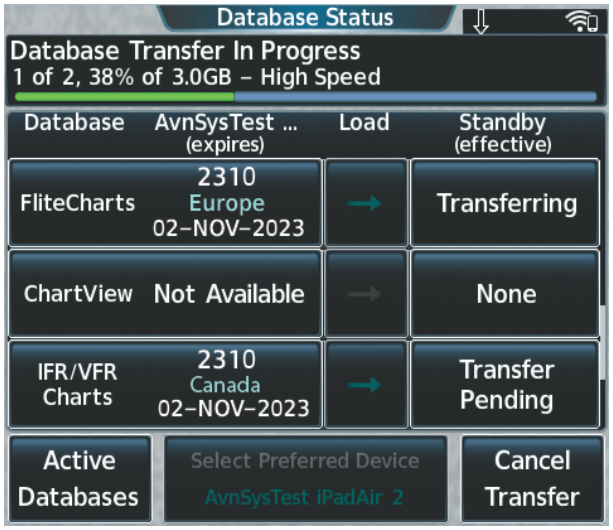


Figure B-16 Database Transfer in Progress

15) Touch the **Active Databases** Button. The database update status will appear in the status window at the top of the screen. The load is complete when 'Databases Ready' and 'Activate database with on ground restart' is displayed.

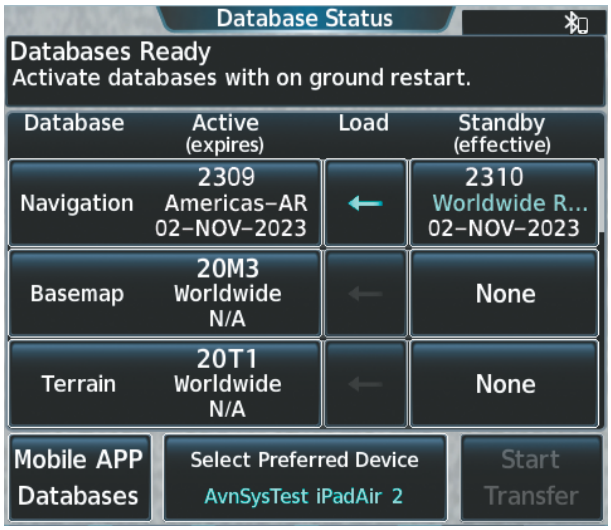


Figure B-17 Databases Ready - Restart Avionics

16) From MFW Home, touch **Utilities > Setup > Database Status > Database Options > Restart Displays.**

Or:

From MFW Home, touch **Utilities > Initialization > Database Status > Database Options > Restart Displays.**

17) Press the right-most softkey on the MFD to acknowledge the power-on screen.

18) From MFW Home, touch **Utilities > Initialization > Database Status**.

Or:

From MFW Home, touch **Utilities > Setup > Database Status.**

19) Verify the standby databases transferred and are now in the 'Active' Column.

DELETING DATABASES

If databases are not properly loading or functioning, it may be necessary to delete the databases from the system. All databases may be deleted at once or individual databases may be selected for deletion.

Deleting Active, Standby, and / or 'All SD' databases:

1) From MFW Home, touch **Utilities > Initialization > Database Status**.

Or:

From MFW Home, touch **Utilities > Setup > Database Status**.

2) Scroll down and touch **Database Options > Delete Databases**.

3) The following prompt will appear. Touch the **OK** Button.

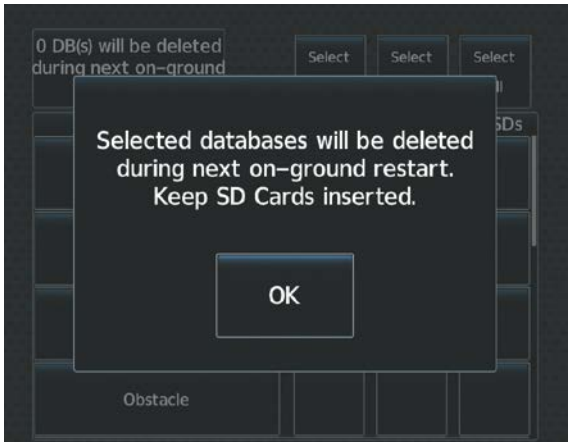


Figure B-18 Delete Databases Initial Prompt

4) To delete Active, Standby, and / or SD card databases:

a) Touch the **Select All** Button in the 'Active', 'SDBY', and / or 'All SDs', column(s) to delete all databases for one or all database sources.

Or:

Touch the desired database button in the 'Active', 'SDBY', and / or 'All SDs' column to delete specific databases.



Figure B-19 'Delete Databases' Screen

b) A message will appear to notify how many databases will be deleted during on-ground restart.

c) From MFW Home, touch **Utilities > Setup > Database Status > Database Options > Restart Displays.**

Or:

From MFW Home, touch **Utilities > Initialization > Database Status > Database Options > Restart Displays.**

d) Press the right most softkey on the MFD display to acknowledge the power-on screen.

e) From MFW Home, touch **Utilities > Initialization > Database Status.**

Or:

From MFW Home, touch **Utilities > Setup > Database Status.**

f) Confirm that all or selected databases have been deleted from the system.

MAGNETIC FIELD VARIATION DATABASE UPDATE

The Magnetic Field Variation Database is loaded as part of the navigation database, but is copied to, and resides within each AHRS (GRS1 and GRS2). When applying power, the system compares the MV DB within the navigation database to that presently residing in each AHRS (GRS1 and GRS2). When a new navigation database is loaded, the system may ascertain the newly loaded MV DB within the navigation database is newer than that residing in each AHRS. In this case, the system will prompt for an update. This prompt is displayed on the Touchscreen Controller (GTC), Note, in this 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-20 GRS1 Magnetic Field Variation Database Update Prompt (Touchscreen Controller)

Loading the Magnetic Field Variation Database update:

1) With the MV DB prompt displayed, touch the **OK** Button. A progress monitor is displayed



Figure B-21 Uploading Database to GRS1

2) When the upload is complete, the prompt for the next GRS upload is displayed. A database mismatch message indicates the second GRS has not yet been updated.



Figure B-22 GRS2 Magnetic Field Variation Database Update Prompt

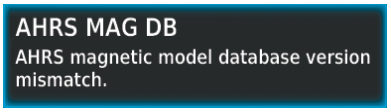


Figure B-23 Database Mismatch Message is Annunciated Before Second GRS is Updated

3) Touch the **OK** Button. A progress monitor for the next GRS is displayed. When the upload is complete, the system is ready for use.

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AVIATION ABBREVIATIONS, TERMS, AND ACRONYMS

A	Amps, Amperes
ABN	Abnormal
AC	Advisory Circular, Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
ACC	Accuracy
ACFT	Aircraft
ACK	Acknowledge
ACT, ACTV	Active, Activate, Altitude Compensated Tilt
ADAHRS	Air Data, Attitude and Heading Reference System
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Direction Indicator
ADIZ	Air Defense Identification Zone
ADM	Administrative Domain
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
ADS-R	Automatic Dependent Surveillance-Rebroadcast
AEA	Aircraft Electronic Association
AF	Arc to Fix Leg
AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AFN	ATS Facilities Notification
AFRM	Airframe
AFTN	Aeronautical Fixed Telecommunication Network
A/G	Air-to-Ground
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
AIM	Aeronautical Information Manual
AIRB	Airborne
AIRMET, AIRM	Airman's Meteorological Information
AIRREP	Air Reports
ALRT	Alert, Alerting
ALT	Altitude
ALT, ALTN	Alternator, Alternate
ALTM	Altimeter
ALTS	Altitude Select, Selected Altitude Capture Mode
ALTV	VNAV Altitude Capture Mode
AM	Amplitude Modulation
AMP	Amplifier, Ampere
AMPS	Amperes
ANN/ANNUNC	Annunciation/Annunciator
ANSP	Air Navigation Service Provider
ANT	Antenna
AOA	Angle of Attack, ACARS Over AVLC
AOC	Aeronautical Operational Control
AOG	Aircraft On Ground
AOPA	Aircraft Owners and Pilots Association
AP	Autopilot
AP DISC	Autopilot Disconnect
APPR, APR	Approach, Approach Control
APT	Airport, Aerodrome, Automatic Pitch Trim
APTSIGNS	Airport Signs
APU	Auxiliary Power Unit
APV	Approaches with Vertical Guidance
ARINC	Aeronautical Radio Incorporated
ARM	Arm, Armed
ARR,ARV	Arrival
ARSPC	Airspace
ARTCC	Air Route Traffic Control Center
AS	Airspeed
ASB	Aviation Support Branch
ASDA	Accelerate-Stop Distance Available
ASI	Airspeed Indicator
ASOS	Automated Surface Observing System
AT	Auto Throttle
ATAS	ADS-B Traffic Advisory System
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon System
ATD	Along-Track Distance
ATE	Along-Track Error, Automatic Test Equipment
ATIS	Automatic Terminal Information Service

ATK	Along Track
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
ATT	Attitude
ATZ	Aerodrome Traffic Zone
AUD	Audio
AUTO	Automatic
AUTOSEQ	Automatic Sequence
AUX	Auxiliary
AVAIL	Available
AVG	Average
AVLC	Aviation VHF Link Control
AWOS	Automated Weather Observing System
AWY	Airway
AZ	Azimuth
B	Both Runways
B ALT	Barometric Altitude
BC, B/C	Back Course
BARO	Barometer, Barometric Setting
BATT	Battery
Bearing	The compass direction from the present position to a destination waypoint.
BFO	Beat Frequency Oscillator
BKLT	Backlight
BKSP	Backspace
BKUP	Backup
BLKHD	Bulkhead
Bluetooth	Wireless standard for data exchange over short distances
BOC	Bottom of Climb
BOD	Bottom of Descent
BRG	see also Bearing
BRK	Brake
BTM	Bottom
°C	Degrees Celsius
C	Center Runway
CA	Course to Altitude Leg
CAL	Calibrated, Calibration
CALC	Calculator
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
CAS	Crew Alerting System
CAT	Clear Air Turbulence
CAVS	CDTI Assisted Visual Separation
CLB	Climb
CB	Circuit Breaker
CCG	Current Climb Gradient
CD	Course to DME Distance Leg
CDA	Current Data Authority
CDI	Course Deviation Indicator
CDU	Control Display Unit
CDTI	Cockpit Display of Traffic Information
CF	Course to Fix Leg
CFG	Configuration
CFIT	Controlled Flight into Terrain
CG	Center of Gravity
CH, CHNL	Channel
CHK	Check
CHKLIST	Checklist
CHRG	Charge
CHT	Cylinder Head Temperature
CI	Course to Intercept Leg
CIP	Current Icing Potential
CL	Class, Centerline
CLB	Climb
CLD	Cloud
CLG	Ceiling
CLR	Clear
CLS	Close
CLTR	Clutter
CM	Centimeter, Context Management, Configuration Module
CMC	Central Maintenance Computer
CMPRTR	Comparator
CN	Canada
CNCL	Cancel
CNFM	Confirm
CNI	Communication, Navigation, & Identification
CNS	Communication, Navigation, & Surveillance
CNXT	Connext

CO	Carbon Monoxide
COM	Communication Radio
COMP	Compensated, Compensation
CONFIG	Configuration
CONUS	Continental United States
COOL	Coolant
COPLT	Copilot
CORR	Correct, Corrected, Correction
Course	The line between two points to be followed by the aircraft.
Course to Steer	The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.
CP	Copilot, Control Panel
CPDLC	Controller Pilot Datalink Communications
CPL	Couple
CR	Course to Radial Leg
CRC	Cyclic Redundancy Check
CRG	Cockpit Reference Guide
CRNT	Current
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.
CRS	see also Course, Course to Steer
CRSR	Cursor
CRU, CRZ	Cruise
CSA	Conflict Situational Awareness
CSC	Current Speed Control
CSTR	Constraint
CTA	Control Area
CTAF	Common Traffic Advisory Frequency
CTR	Center, Controlled Traffic Region
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
CVS	Combined Vision System
CWS	Control Wheel Steering
CYC CTR	Cyclic Centering
CYL	Cylinder
CZ	Control Zone
D->, ⊣D▸	Direct-To
D/A	Digital to Analog Converter
D ALT	Density Altitude
D-ATIS	Digital Automatic Terminal Info Service
DA	Decision Altitude, Drift Angle
DB, DBASE	Database
DBZ	Decibels 'Z' (Radar Return)
DCL	Departure Clearance
DCLTR, DECLTR	Declutter
DEC	Declination
DEC FUEL	Decrease Fuel
DEG	Degree
DEIC, DEICE	De-icing
DEL	Delete
DEP	Departure, Departure Control
DESC	Descent
Desired Track	The desired course between the active "from" and "to" waypoints.
DEST, DES	Destination, Destination Airport Identifier
DET	Detect, Detected, Detection, Detector
DEV	Deviation
DF	Direction Finder, Direct to Fix Leg
DFLT	Default
DG	Directional Gyro
DGPS	Differential GPS
DGRD	Degrade
DH	Decision Height
DIFF	Differential
DIG	Digital
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
DISC	Disconnect
DISENG	Disengage
DISP, DSPL	Display

Distance	The 'great circle' distance from the present position to a destination waypoint.
DIV	Divert, Diversion
DL LTNG	Datalink Lightning
DLS	Data Link System
DME	Distance Measuring Equipment
DN	Down
DNALT	Density Altitude
DNGR	Danger
DNLK	Downlink
DOD	Department of Defense
DOP	see also Dilution of Precision
DOPP	Doppler
DP	Departure Procedure, Differential Pressure
DPRT	Departure
DQR	Data Quality Requirements
DR	Dead Reckoning
DSBL	Disabled
DSP	Display, Datalink Service Provider, Digital Signal Processor
DTG	Distance To Go, Remaining distance to last active FPL waypoint
DTK	see also Desired Track
DWNGRADE	Downgrade
E	Empty, East
EAS	Engine and Airframe Systems
EC	Error Correction
ECC	Error Correcting Code
ECL	Electronic Checklist
ECR	Excessive Closure Rate
ECS	Environmental Control System
ECU	Engine Control Unit
EDM	Emergency Descent Mode
EDR	Excessive Descent Rate
EEP	Expanded Envelope Protection
EFB	Electronic Flight Bag
EFC	Expected Further Clearance
EFVS	Enhanced Flight Vision System
EGNOS	European Geostationary Navigation Overlay Service
EGT	Exhaust Gas Temperature
EHS	Enhanced Surveillance
EICAS	Engine Indication and Crew Alerting System
EIS	Engine Indication System
ELEC	Electrical
ELEV	Elevation, Elevator
ELT	Emergency Locator Transmitter
EMER, EMERG, EMERGCY	Emergency
EMI	Electromagnetic Interference
END, ENDUR	Endurance
Endurance	Flight endurance, or total possible flight time based on available fuel on board.
ENG	Engine
ENGA	Engage
ENGD	Engaged
ENR	Enroute; ETE to Final Destination
Enroute Safe Altitude (ESA)	Uses Grid MORAs to find a safe altitude within ten miles left or right of the desired course on an active flight plan or direct-to.
ENT	Enter
EP	Envelope Protection
EPE	see also Estimated Position Error
EPU	Estimated Position Uncertainty
ERR	Error
ES	Extended Squitter
ESA	Emergency Safe Altitude, see also Enroute Safe Altitude
ESOSP	Electronic Stability Overspeed Protection
ESP	Electronic Stability and Protection
Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.
Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
ET	Elapsed Time
ETA	see also Estimated Time of Arrival
ETD	Estimated Time of Departure
ETE	see also Estimated Time Enroute

EVS	Enhanced Vision Sensor
EXCIT	Excitation
EXP	Expand
EXPIRD	Expired
EXT	External
EXTD	Extend, Extended
EXTING	Extinguish, Extinguisher
EXTR	Extract, Extraction
°F	Degrees Fahrenheit
FA	Course From Fix to Altitude Leg
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAIL	Failure
FANS	Future Air Navigation System
FAP	Final Approach Point
FAPP	Final Approach
FAR	Federal Aviation Regulations
FBO	Fixed Base Operator
F/C	Flight Crew
FC	Course From Fix to Distance Leg
FCC	Federal Communication Commission
FCE	Flight Control Equipment
FCST	Forecast
FCTN	Function
FD	Flight Director, Course From Fix to DME Distance Leg
FDE	Fault Detection and Exclusion
FDR	Flight Data Recorder
FF, FFLOW	see also Fuel Flow
FIS-B	Flight Information Services-Broadcast
FISDL	Flight Information Service Data Link
FIT	Flight Into Terrain
FL	Flight Level
FLC, FLCH	Flight Level Change
FLT	Flight, Flight Timer
FLTA	Forward Looking Terrain Avoidance
FLW	Follow, Following
FM	Course From Fix to Manual Termination Leg
FMS	Flight Management System
FOB	see also Fuel On Board
FOD	see also Fuel Over Destination
FPA	Flight Path Angle
FPBFD	Flight Path Based Flight Director
FPL	Flight Plan
FPM	Feet Per Minute, Flight Path Marker
FR	From
FREQ	Frequency
FRMT	Format
FRT	Front
FRZ	Freezing
FS	Flight Stream
FSD	Full-Scale Deflection
FSM	Flight System Messages
FSS	Flight Service Station
FT	Foot/Feet
Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.
Fuel On Board	The total amount of usable fuel on board the aircraft.
Fuel Over Destination	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.
FWD	Forward
G/A	Ground to Air
G/S	Glideslope
GA	Go-Around
GAGAN	GPS Aided GEO Augmented Navigation
GAGL	GPS AGL Altitude
GAL, GL	Gallon(s)
GBAS	Ground Based Augmentation System
GBOX	Gearbox
GBT	Ground Based Transceiver
GCS	Ground Clutter Suppression
GCSS	Garmin Connext Satellite Services
GCU	Garmin Control Unit
GDC	Garmin Air Data Computer
GDL	Garmin Satellite Data Link
GDR	Garmin Data Radio
GDU	Garmin Display Unit
GEA	Garmin Engine/Airframe Unit
GEAR	Landing Gear

GEN	Generator
GEO	Geographic
GFC	Garmin Flight Control
GHD	Garmin Head Up Display
GHZ	Gigahertz
GIA	Garmin Integrated Avionics Unit
GIFD	Garmin Integrated Flight Deck
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
GNSS	Global Navigation Satellite System
GOLD	Global Operational Data Link
GP	Glidepath
GPH	Gallons per Hour
GPN	Garmin Part Number
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GRA	Garmin Radar Altimeter
GRC	Garmin Remote Control
Grid MORA (Minimum Off-Route Altitude)	One degree latitude by one degree longitude in size and clears the highest elevation reference point in the grid by: a) 1,000 feet where the highest elevation is <5001MSL or b) 2,000 feet where the highest elevation is >5000MSL
Ground Track	See Track
Groundspeed	The velocity the aircraft is traveling relative to a ground position.
GRP	Geographic/Ground Reference Point
GRS	Garmin Reference System
GRT	Garmin Radio Transceiver
GS	Ground Speed, Glideslope
GSA	Garmin Servo Adapter
GSD	Glideslope/Glidepath Deviation, Garmin Data Concentrator
GSL	Geometric/Geodetic Sea Level
GSR	Garmin Satellite Radio
GSU	Garmin Sensor Unit
GTC	Garmin Touchscreen Controller
GTS	Garmin Traffic System
GTX	Garmin Transponder
GW	Gross Weight
GWX	Garmin Weather Radar
H	Hours
H+MM	Hours and Minutes
HA	Hold Terminating at Altitude Leg
HAL	Horizontal Alert Limit
HAT	Height Above Threshold
HDD	Head Down Display
HDG	see also Heading
HDOP	Horizontal Dilution of Precision
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
HF	High Frequency, Hold Terminating at Fix Leg
HFOM	see also Horizontal Figure of Merit
HG	Mercury
HI	High
HI SENS	High Sensitivity
HLD	Hold, Holding, Holding Pattern
HM	Hold with Manual Termination Leg
HNS	Hybrid Navigation Sensor
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
HOV	Hover
HOV-P	Hover Prediction
HP	High Pressure, Horsepower
HPA	Hectopascal
HPI	Hover Power Indicator
HPL	Horizontal Protection Level
HR	Hour
HRZN HDG	Horizon Heading
HSC	High Speed Cruise
HSDB	High-Speed Data Bus
HSI	Horizontal Situation Indicator
HT	Heat, Height
HTR	Heater

HUD	Head Up Display
HUL	Horizontal Uncertainty Level
HWND	Headwind
HYD	Hydraulic
HZ	Hertz (cycles per second)
HZN	Horizon
I	Inner Marker
IAF	Initial Approach Fix
IAP	Instrument Approach Procedure
IAS	Indicated Air Speed
IAT	Indicated Air Temperature
IATA	International Air Transport Association
IAU	Integrated Avionics Unit
IBD, INBD	Inboard
ICAO	International Civil Aviation Organization
ICE	Icing
ICS	Intercom System
ID	Identification/Morse Code Identifier
IDENT, IDNT	Identification
IEEE	Institute of Electrical & Electronics Engineers
IF	Initial Fix
IFR	Instrument Flight Rules
IG	Imperial Gallon
IGE	In Ground Effect
IGW	Increased Gross Weight
ILI	Imminent Line Impact
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
IN	Inch
IN HG, "HG	Inches of Mercury
INACTV	Inactive
INBD	Inboard
INBND	Inbound
INC FUEL	Increase Fuel
IND	Indicator, Indicated
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
INDX	Index
INFO	Information
INH, INHIB	Inhibit
INIT	Initialization
INOP	Inoperative
INS	Inertial Navigation System
INSTR	Instrument
INT	Intersection(s), Internal
INTEG	Integrity (RAIM unavailable)
INTERN, INTRL	Internal
INV	Invalid
IOI	Imminent Obstacle Impact
IR	Infrared
IrDA, IRDA	Infrared Data Association
IRST	Infrared Surveillance and Tracking
ISA	International Standard Atmosphere; ISA Relative Temperature
ISO	International Standards Organization
ISOL	Isolation
ITI	Imminent Terrain Impact
ITT	Inter-Turbine Temperature, Interstage Turbine Temperature
KEYSTK	Key Stuck
KG	Kilogram
KHZ	Kilohertz
KIAS	Knots Indicated Airspeed
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, Localizer Type Directional Aid
LDG	Landing, ETA at Final Destination
LED	Light Emitting Diode
Leg	The portion of a flight plan between two waypoints.
LEN	Length
LGND	Legend

LIFR	Low Instrument Flight Rules
LI-ION	Lithium Ion
LIM	Limit
LMM	Locator Middle Marker
LNAV	Lateral Navigation
LO	Low
LOA	Letter of Authorization
LOC	Localizer
LOI	Loss of Integrity (GPS)
LOM	Locator Outer Marker
LON, LONG	Longitude, Longitudinal
LP	Localizer Performance, Low Pressure
LPV	Localizer Performance with Vertical Guidance
LRC	Long Range Cruise
LRG	Large
LRU	Line Replaceable Unit
LSB V	Lower Sideband Voice
LT	Left, Light
LTNG	Lightning
LVL	Level
M	Meter, Middle Marker, Mach
Mach Number	Mach number is the ratio of the true airspeed to the speed of sound.
MAG	Magnetic
MAG VAR	Magnetic Variation
MAHP	Missed Approach Hold Point
MAINT	Maintain
MAL	Malfunction
MAN	Manual
MAN IN	Manifold Pressure (inches Hg)
MAN SQ	Manual Squelch
MANSEQ	Manual Sequence
MAP	Missed Approach Point
MAPROC	Missed Approach Procedure
MASQ	Master Avionics Squelch
MAX	Maximum
MAXSPD	Maximum Speed (overspeed)
MB	Marker Beacon, Millibar(s)
MCDU	Multifunction Control and Display Unit
MCLB	Maximum Climb Thrust
MCP	Maximum Continuous Power
MCRZ	Maximum Cruise Thrust
MCT	Maximum Continuous Thrust
MDA	Barometric Minimum Descent Altitude
MEA	Minimum Enroute Altitude
MEM	Memory
MEPT	Manual Electric Pitch Trim
MET	Manual Electric Trim
METAR	Aviation Routine Weather Report
METRO	Metropolitan
MFI	Multi-Function Instrument
MFD	Multi Function Display
MFW	Multi Function Window
MGRS	Military Grid Reference System
MGT	Measured Gas Temperature
MHz	Megahertz
MIC	Microphone
MID	Middle
MIN	Minimum, Minute
MKR	Marker Beacon
MM	Middle Marker
MMO (VMO)	Maximum Speed
MOA	Military Operations Area
MOD	Modification, Modify
MON	Monitor, Monitored, Monitoring
MORA	Minimum Off-Route Altitude
MOV	Movement
MPEL	Maximum Permissible Exposure Level
MPM	Meters per Minute
MSA	Minimum Safe Altitude
MSAS	Multi-functional Satellite Augmentation System
MSG	Message
MSL	Mean Sea Level
MT, M	Meter
MTG	Mounting
MTN	Mountain
MTOGW	Maximum Takeoff Gross Weight
MTOW	Maximum Takeoff Weight
MV	Millivolt(s)
MVFR	Marginal Visual Flight Rules

N	North
NATS	North Atlantic Tracks System
NAV	Navigation
NAVAID	Navigation Aid
NCR	Negative Climb Rate
NDA	Next Data Authority
NDB	Non-Directional Beacon
NEG	Negative
NEXRAD	Next Generation Radar
NG	Gas Producer Rotation Speed
NM	Nautical Mile(s)
NMPG	Nautical Miles per Gallon
NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
NORM	Normal
NOTAM	Notice To Air Missions
NP	Power Turbine Speed
NPA	Non-Precision Approach
NR	Rotor Speed
NRST	Nearest
NWHL	Nose wheel
NWS	National Weather Service, Nose wheel Steering
O	Outer Marker
OAT	Outside Air Temperature
OBD, OUTBD	Outboard
OBS	Omni Bearing Selector, Observation, Observe, Observed
OBSCR	Obscuration
OCL	Oceanic Clearance
OEM	Original Equipment Manufacturer
OFST	Offset
OGE	Out of Ground Effect
OM	Outer Marker
OOOI	Out of the gate, Off the ground, On the ground, and In the gate
OROCA	Off Route Obstacle Clearance Altitude
OSP	Overspeed Protection
OUTBD	Outboard
OUTBND	Outbound
OVBD	Overboard
OVFL	Overflow
OVFLY	Overfly, Overflying
OVHD	Overhead
OVHT	Overheat
OVLIM	Overlimit
OVLD	Overload
OVPR	Overpressure
OVR, OVRD	Override
OVRN	Overrun
OVSPD	Overspeed
OVTMP	Overtemperature
OXY	Oxygen
P ALT	Pressure Altitude
P-ATT	Pitch Attitude
PA	Precision Approach, Passenger Address, Proximity Advisory
PB	Push Button
PASS, PAX	Passenger(s)
PC	Personal Computer
PCL	Pilot Controlled Lighting
PDA	Premature Descent Alerting
PDC	Pre-Departure Clearance
PED	Portable Electronic Device
PERF	Performance
PFD	Primary Flight Display
PFT	Preflight Test
PFW	Primary Flight Window
PG	Pilot's Guide
PI	Procedure Turn to Course Intercept Leg
PIREP	Pilot Report
PIT, PTCH	Pitch
PLT	Pilot
PNR	Prior Notice Required
POA	Plain Old ACARS
POB	Persons (Souls) on Board
POF	Phase of Flight
POH	Pilot's Operating Handbook
POHS	Pilot's Operating Handbook Supplement
POS, POSN	Position
POSS	Possible
PPH	Pounds per Hour

PPM	Parts per Million
PPOS, P. POS	Present Position
PREFLT	Preflight
PRES, PRESS, P	Pressure
PREV	Previous
PRI, PRIM	Primary
PRL	Parallel
PRN	Pseudo Random Noise
PROC	Procedure(s), Procedure Turn
PROP	Propeller
PROX	Proximity
PSI	Pounds per Square Inch, Power Situation Indicator
PT	Procedure Turn, Part Time
PTK	Parallel Track
PTT	Push-to-Talk
PWR	Power
Q	Engine Torque
QFE	Field Elevation Pressure
QNE	Pressure Altitude
QNH	Sea Level Pressure
QTY	Quantity
R	Right, Right Runway
RA	Resolution Advisory, Radio Altimeter, Radar Altimeter
RAD	Radial
RAD ALT	Radio Altimeter, Radar Altimeter
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RAT	Ram Air Temperature
RCVR	Receiver
R/D	Radial/Distance
RDR	Radar
REC	Record, Recorder
RECIRC	Recirculate/Recirculating
REF	Reference
REGL	Regulator
REM	Remaining (fuel remaining), Reminder, Removed, Remote
REQ	Request
REQD, REQ'D	Required
RES	Reserve (fuel reserve entered by pilot)
REST	Restricted, Restriction
RET	Return
REV	Reverse, Revision, Revise
RF	Radio Frequency, Constant Radius Turn to Fix Leg
RFM	Rotorcraft Flight Manual
RLC	Required Line Clearance
RMI	Radio Magnetic Indicator
RMT	Remote
RNAV	Area Navigation
RNG	Range
RNP	Required Navigation Performance
RNWY, RWY	Runway
ROA	Runway Occupancy Awareness
ROAAS	Runway Overrun Awareness and Alerting System
ROC	Required Obstacle Clearance, Rate of Climb
ROD	Rate of Descent
ROL	Roll
ROM	Read Only Memory
ROT	Rotary
RPM	Revolutions Per Minute
RQRD	Required
RST FUEL	Reset Fuel
RSV	Reserve (fuel reserve entered by pilot)
RT	Right
RTC	Required Terrain Clearance
RTE	Route
RTR	Router
RUDICS	Router-Based Unrestricted Digital Interworking Connectivity Solution
RVRSNRY	Reversionary
RVSI	Required Vertical Speed Indicator
RVSM	Reduced Vertical Separation Minimums
RX	Receive
S	South
SA	Selective Availability
SAIB	Special Airworthiness Information Bulletin
SAR	Search and Rescue

SAT	Static Air Temperature
SATCOM	Satellite Communication
SBAS	Satellite-Based Augmentation System
S-CLB	Step Climb
SC	Short Circuit
SCIT	Storm Cell Identification and Tracking
S-DES	Step Descent
SD	Secure Digital
SDF	Simplified Directional Facility
SEC	Second(s), Secondary
SECT	Section
SEG	Segment
SEL, SLCT	Select
SELCAL	Selective Calling
SENS	Sense, Sensitivity, Sensor
SEQ	Sequence, Sequencing
SERL	Serial
SERV	Service, Servicing, Served
SET	Setup
SFC	Surface
SHT	Short
SIAP	Standard Instrument Approach Procedures
SID	Standard Instrument Departure
SIG	Signal
SIG/AIR	SIGMET/AIRMET
SIGM	SIGMET
SIGMET	Significant Meteorological Information
SIM	Simulator
SITA	Societe Internationale de Telecommunications
SLD	Supercooled Large Droplet
SLP/SKD	Slip/Skid
SLW	Slow
SM	Statute Mile
SMBL	Symbol
SMK	Smoke
SMS	Short Message System
SNGL	Single
SOB	Souls on Board
SPBK	Speed Brake
SPC	Space
SPD	Speed
SPI	Special Position Identification
SPKR	Speaker
SQ, SQL	Squelch
SRVC, SVC	Service
SSEC	Static Source Error Correction
SSID	Wireless Service Set Identifier
SSR	Secondary Surveillance Radar
STAB	Stabilization
STAL	Stall
STAR	Standard Terminal Arrival Route
STAT	Status
STATS	Statistics
STBY	Standby
STC	Sensitivity Time Constant, Supplemental Type Certificate
STD	Standard
STN	Station
STR	Strip
STRMSCP	Stormscope
SUA	Special Use Airspace
SUB	Substitute
SUPPRESS	Suppression
SURF	Surface
SUSP	Suspend
SVBL	Serviceable
SVO	Servo
SVT	Synthetic Vision Technology
SW	Software
SWPS	Stall Warning Protection System
SYN TERR	Synthetic Terrain
SYN VIS	Synthetic Vision
SYNC	Synchronize
SYNTH	Synthesizer
SYS	System
T	True
T HDG	True Heading
T/R	Thrust Reverser
TA	Traffic Advisory, Transition Altitude
TAC	Tactical, Terminal Area Chart
TACAN, TCN	Tactical Air Navigation System

TAF	Terminal Aerodrome Forecast
TAS	True Airspeed, Traffic Advisory System
TAT	Total Air Temperature
TAWS	Terrain Awareness and Warning System
TC	Table of Contents
TCA	Terminal Control Area
TCAS	Traffic Alert Collision Avoidance System
TCH	Threshold Crossing Height
TD	Touchdown
TEL	Telephone
TEMP, TMP	Temperature
TERM	Terminal
TERR	Terrain
T/F	To/From
TF	Track Between Two Fixes Leg
TFR	Temporary Flight Restriction
TGT	Target
TH	True Heading
THLD	Threshold
THR	Thrust
TIS	Traffic Information Service
TIS-B	Traffic Information Service-Broadcast
TIT	Turbine Inlet Temperature
TIZ	Traffic Information Zone
TKE	see also Track Angle Error
TL	Transition Level
TLA	Throttle Lever Angle, Thrust Lever Angle
TMA	Terminal Maneuvering Area
TMR/REF	Timer/Reference
TNK	Tank
TO	To, Takeoff
TOC	Top of Climb, Table of Contents
TOD	Top of Descent, Time to TOD
TOGA, TO/GA	Take-Off, Go-Around
TOLA	Takeoff and Landing Assistant
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
TRM	Trim
TRN	Terrain
TRSA	Terminal Radar Service Area
TRUNC	Truncated
TSO	Technical Standard Order
TST	Test
TTA	Time-to-Alert
TTK	True Track
TTL	Total
TTS	Text to Speech
TUR	Turbine
TURB	Turbulence
TURN	Procedure Turn
TWND	Tailwind
TWIP	Terminal Weather Information for Pilots
TWR	Tower
TWY	Taxiway
TX	Transmit
UA	Routine PIREP
UAT	Universal Access Transceiver
UAV	Unmanned Airborne Vehicle
UHF	Ultra-High Frequency
UNABL	Unable
UNAVAIL	Unavailable
UNLIM	Unlimited
UPLK	Uplink
US	United States
USB V	Upper Sideband Voice
USP	Underspeed Protection
USR	User
UTC	Coordinated Universal Time
UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid
UUA	Urgent PIREP
V	Volts, Vertical

V DEV	Vertical Deviation
V, Vspeed	Velocity (airspeed)
V_1	Takeoff Decision Speed
V_2	Takeoff Safety Speed
V_A	Maneuvering Speed
VA	Heading Vector to Altitude Leg
VAC	Volts Alternating Current
VAL	Vertical Alert Limit
VAPP	VOR Approach Mode
V_{APP} , V_{AC}	Approach Climb Speed
VAR	Variable, Variation
VCO	Voice Call Out
VD	Heading Vector to DME Distance Leg
VDC	Volts Direct Current
VDI	Vertical Deviation Indicator
VDL	VHF Datalink
V_E, V_{ENR}	Enroute Climb Speed
VECT	Vector
VERT	Vertical
Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.
Vertical Speed Required	The vertical speed necessary to descend/climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.
V_{FE}	Maximum Flap Extended Speed
VFOM	see also Vertical Figure of Merit
VFR	Visual Flight Rules
VHF	Very High Frequency
VI	Heading Vector to Intercept Leg
VIB	Vibration
V_{LE}	Maximum Landing Gear Extended Speed
V_{LNDx}	Approach Speed (Flaps at x°)
V_{LO}	Maximum Landing Gear Operating Speed
VLD	Valid
VLOC, VOR/L	VOR/Localizer Receiver
VM	Heading Vector to Manual Termination Leg
V_{MC}	Minimum Control Speed
VMC	Visual Meteorological Conditions
V_{MO} (M_{MO})	Maximum Operating Speed
VNAV, VNV	Vertical Navigation
V_{NE}	Never-Exceed Speed
VOL	Volume
VOLT	Voltage
VOR	VHF Omnidirectional Range
VOR/D	VOR/DME
VOR/I	VOR/ILS
VORTAC	VHF Omnidirectional Range Station and Tactical Air Navigation
VPATH, VPTH	Vertical Path
VPL	Vertical Protection Level
VPROF	VNAV Profile, Vertical Profile
V_R	Takeoff Rotate Speed
VR	Heading Vector to Radial Leg
V_{REF}	Landing Approach Speed, Reference Landing Speed
VRP	Visual Reporting Point
VS	Vertical Speed
V_{SB}	Maximum Speedbrake Speed
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
VSM	Vertical Separation Minima
V_{SR}	Stall Speed
VSR, VS REQ	see also Vertical Speed Required
V_T	Takeoff Flap Retraction Speed
VTE	Vertical Track Error
VTF	Vector to Final
VTK	Vertical Track
V_{TIRE}	Maximum Tire Speed
V_X	Best Angle of Climb Speed
V_Y	Best Rate of Climb Speed
V_{YSE}	Best Single-Engine Rate of Climb Speed
W	Watt(s), West
WAAS	Wide Area Augmentation System
WARN	Warning
WATCH	Weather Attenuated Color Highlight
WB	Weight & Balance
WDIR	Wind Direction
WEP	Wired Equivalent Privacy
WSPD	Wind Speed
WGS-84	World Geodetic System - 1984

WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
WILCO	Will Comply
WNDSHR, WSHEAR	Windshear
WL	Wings Level
WOG	Weight on Gear
WOW	Weight on Wheels
WPA	Wi-Fi Protected Access
WPT	Waypoint(s)
WT	Weight
WUXGA	Widescreen Ultra Extended Graphics Array
W/V	Wind Velocity
WW	World Wide
WX	Weather
WXR	Weather Radar
XFD	Crossfeed
XFER, XFR	Transfer
XFLOW	Crossflow
XM LTNG	SiriusXM Lightning
XMIT	Transmit
XMSN	Transmission
XPDR	Transponder
XTALK	Cross-Talk
XTE	Crosstrack Error
XTK	Cross-Track, Crosstrack Error
YD	Yaw Damper
Z	Reflectivity Factor
ZPL	Zero Pitch Line

FREQUENTLY ASKED QUESTIONS

If a particular aspect of the Cirrus Perspective Touch+™ 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. The GPS aided GEO augmented navigation (GAGAN) offers covers mainly India.

How does SBAS affect approach operations?

LNAV/VNAV and LPV RNAV approaches use the accuracy of SBAS to include vertical (glide path) guidance capability. The additional accuracy and vertical guidance capability allows improved instrument approaches to an expanded number of airports throughout the U.S.

The implementation of RNAV LP and LPV approaches further improves approach capabilities. RNAV LPV approaches are designed to make full use of the improved GPS signal from the SBAS. This approach combines localizer precision lateral guidance with vertical guidance similar to the typical Instrument Landing System (ILS). RNAV LPV approaches allow lower approach minimums.

What is RAIM and how does it affect approach operations?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:

- Monitors and verifies integrity and geometry of tracked GPS satellites
- Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight
- Predicts satellite coverage of a destination area to determine whether the number of available satellites is sufficient to satisfy requirements

NOTE: *If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the GPS 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). 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.

Why might there be no 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 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 enroute 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 when the current aircraft position is different from the origin of the active flight plan, the active flight plan is erased when the system is turned off. Also, the active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, a departure, or an arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information, provided the procedure has not been modified. Should an approach, departure, or arrival procedure no longer be available, the flight plan becomes locked until the procedure is deleted from the flight plan.

What does the OBS Button/Softkey do?

The **OBS** Button/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 canceled, 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

Why might the System not automatically sequence to the next waypoint?

The system only sequences flight plan waypoints when automatic sequencing is enabled (i.e., no 'OBS' or 'SUSP' annunciation on the HSI). For automatic sequencing to occur, the aircraft must also cross the *bisector* of the turn being navigated. The bisector is a line passing through the waypoint common to two flight plan legs at an equal angle from each leg.

How can a waypoint be skipped in an approach, a departure, or an arrival?

The system allows the pilot to manually select any approach, departure, or arrival leg as the active leg of the flight plan. This procedure is performed from the Touchscreen Controller 'Active Flight Plan' Screen by touching the desired waypoint button, followed by the Activate Leg To Waypoint Button. After confirming the activation, 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 27°) 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 the midpoint of the turn has been crossed.

When does the CDI scale change?

Once a departure is activated, the system 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 service level 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 active waypoint 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 Button or TOGA Button on the left throttle is pressed *after* crossing the MAP. All published missed approach procedures must be followed, as indicated on the approach plate.

Execute missed approach procedures per the current version of the pertinent flight manual.

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 touching the **PROC** Button on the Home Screen, followed by the **Activate Approach** or **Activate Vectors to Final** Button. 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 touching the **PROC** Button, then touch the **Approach** Button to access the Approach Selection Screen. Then touch the **Approach** Button. The Touchscreen Controller displays a list of approaches as buttons. Scroll as needed and touch the desired approach button, then touch a transition button. The Touchscreen Controller returns to the Approach Selection Screen. To activate the selected approach, touch the **Load & Activate** Button.

To activate a new approach to a different airport, touch the **Direct To** Button to access the Direct To Screen. Then touch the waypoint point and enter the desired airport using the keypad or large and small upper knobs. Touch the **Enter** Button or push the **Upper Knob** to accept the selected airport, then follow the steps in the preceding paragraph to select an approach for the new airport.

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